Boffa Miskell

Burnham 2020 Limited

Burnham Quarry | Application for Resource Consent and Assessment of Environmental Effects

Prepared for Fletcher Concrete and infrastructure Limited (Trading as Winstone Aggregates)

7 September 2023



Boffa Miskell is proudly a
Toitū carbonzero® consultancy

Document Quality Assurance

Bibliographic reference for citation:

Boffa Miskell Limited 2023. *Burnham Farm Limited Renewal of Water Permit – CRC222536: Application for Resource Consent and Assessment of Environmental Effects*. Report prepared by Boffa Miskell Limited for Burnham Farm Limited.

Prepared by:	Claire Kelly Planner / Principal Boffa Miskell Limited	
Reviewed by:	Catherine Clarke Planner / Partner Boffa Miskell Limited	
Status: [FINAL]		Issue date: 7 September 2023

Use and Reliance

This report has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Boffa Miskell does not accept any liability or responsibility in relation to the use of this report contrary to the above, or to any person other than the Client. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Template revision: 20210629 0000

File ref: BM19954

Cover photograph: Burnham Farm Limited, View from Grange Road, 2020.

CONTENTS

Executive Summary 2

The Site and its surroundings 2

Zoning 3

The Proposal 3

Activity status 4

Environmental Effects 6

Objectives and Policies 9

Notification 10

1.0 Burnham 2020 Limited 11

2.0 Description of the Site and the Surrounding Environment 13

2.1 The Site 13

2.2 Zoning 14

2.3 Surrounding Land Uses 15

2.4 Sensitive Activities 16

2.5 Meteorological Conditions 17

2.6 Cultural Context 20

3.0 The Proposal 21

3.1 Overview 21

3.2 Site selection 23

3.3 Design of the Proposal 23

3.4 Proposed activities 24

4.0 Resource Consents Held and Utilised by Burnham 2020 Limited 39

5.0 Statutory Matters 41

5.1 Resource Management Act 1991 (RMA) 41

5.2 National Environmental Standards for Freshwater 41

5.3 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS) 41

5.4 Operative Selwyn District Plan 42
5.5 Partially Operative Selwyn District Plan 46
5.6 Weighting of the SDP and the POSDP 49
5.7 Canterbury Land and Water Regional Plan (CLAWRP) 50
5.8 Canterbury Air Regional Plan ('CARP') 52
5.9 Summary 55
5a NES-CS Statutory Assessment 57
5b SDC Statutory Assessment 60
5c POSDC Statutory Assessment 81
5d CLAWRP Statutory Assessment 94
5e CARP Statutory Assessment 105
6.0 Assessment of Environmental Effects 111
6.1 Section 104(2) Permitted Baseline 111
6.2 Effects Assessment 116
6.3 Conditions 143
6.4 Conclusion of Assessment of Environmental Effects 143
7.0 Assessment of Objectives and Policies 145
7.1 National Policy Statements 145
7.2 Regional and District Plans 152
7.3 Iwi Management Plans 175
7.4 Conclusion on Statutory Considerations 178
8.0 Consultation Record 179
8.1 Iwi engagement 179
8.2 Key Stakeholders 179
9.0 Record of pre-application meetings with Councils 183
9.1 Canterbury Regional Council (Environment Canterbury) 183
9.2 Selwyn District Council 183
10.0 Notification 184
10.1 Public Notification 184

11.0 Term of Consent Sought 185

12.0 Conclusion 189

Appendices

Appendix 1: Application Forms

Appendix 2: Record of Title

Appendix 3: Site Plan

Appendix 4: Map of Surrounding Land Uses

Appendix 5: Plan set
- Landscape Strategy.
- Edge Treatment Details.
- Quarry Entrance details.
- Quarry Staging.
- Contour Plan.

Appendix 6: Draft Quarry Management Plan

Appendix 7: Draft Dust Management Plan

Appendix 8: Landscape Effects Assessment

Appendix 8a: Landscape Graphic Supplement

Appendix 9: Acoustic Assessment

Appendix 10: Transport Assessment

Appendix 11: Preliminary Site Investigation (PSI)

Appendix 11a: Addendum to the PSI

Appendix 12: Ecological Assessment

Appendix 13: Assessment of Soil Related Effects

Appendix 13a: Draft Soil Management Plan

Appendix 14: Hydrogeology Assessment

Appendix 15: Air Quality Assessment

Appendix 16: Archaeological Assessment

Appendix 17: Economic Assessment

Appendix 18: Objectives and Policies

Tables

Table 1: Location of receptors close to the proposed quarry.

Table 2: Wind Speed Frequency Distribution for the Site.

Table 3: Local Road Daily Traffic Columns (vehicles per day).

Table 4: Heavy Vehicle Traffic Generation Forecasts from the Transport Assessment.

Table 5: Distribution of truck movements.

Figures

Figure 1: The Site taken from GoogleEarth.

Figure 2: Location of Sensitive Receptors.

Figure 3: Location of Proposed Dust Monitors.

Figure 4: Percentage of dry days by month.

Completed application forms are enclosed as **Appendix 1**. The summary details relating to the applicant and subject Site are as follows:

To:	Selwyn District Council ('SDC') Canterbury Regional Council ('ECan')
Applicant's Name:	Burnham 2020 Limited (refer to **Section 1**)
	Boffa Miskell Ltd PO Box 91250, Auckland 1142 Attn: Catherine Clarke Phone: 09 359 5306 Email: catherine.clarke@boffamiskell.co.nz
Address for Service:	Fletcher Concrete and Infrastructure Limited PO Box 17-195 Greenlane Auckland 1546 Attn: Dan McGregor – Senior Project & Resource Advisor Phone: +64 (21) 405 040 Email: Dan.McGregor@winstoneaggregates.co.nz
Address for Fees:	As above.
Site Address:	Grange Road and Aylesbury Road, Burnham
Legal Description:	Rural Section 19387 and Rural Section 25412 Rural Section 27776 and Rural Section 27777 Rural Section 27724 (refer Records of Title in **Appendix 2**).
Owner/Occupier Name and Address:	Burnham 2020 Limited PO Box 17 195 Greenlane Auckland.
Site Area:	361.9 hectares
Operative Selwyn District Plan	Rural: Outer Plains There is a fault line that runs across the northern portion of the Site. The Site is not subject to any overlays or designations.
Proposed Selwyn District Plan	General Rural Zone. Greendale Fault Overlay and Fault Awareness Overlay. Plains Flood Management Overlay.
Canterbury Regional Land and water Plan	Aquifer: Semi confined or unconfined aquifer. Selwyn-Waimakariri Groundwater and Surface Allocation Zone. Selwyn-Waihora Nutrient Allocation Zones.

Executive Summary

This application by Burnham 2020 Limited (a wholly owned subsidiary of Fletcher Concrete and Infrastructure Ltd, who will operate the Burnham Quarry through one of its divisions, Winstone Aggregates) seeks to establish and operate an aggregate quarry within a Site located at the junction of Aylesbury Road and Grange Road, Burnham. Please refer to the Site Plan in **Appendix 3**.

Burnham 2020 Limited (hereafter referred to as Burnham 2020) seeks:

- a land use consent in perpetuity from Selwyn District Council.
- a 35-year term on the regional council consents sought from ECan.

The Site and its surroundings

The Site was chosen because:

- it is of sufficient size to contain all quarrying activities, largely internalises adverse effects and provide a secure aggregate resource over a long period of time, minimising the need to develop additional sites in the future; and
- it is located in proximity to markets for the resource and State Highway 1 and Aylesbury Road (an arterial road) which means less carbon emissions from transporting product and no need to utilise local roads; and
- of its distance from large-scale residential populations such as Rolleston, Templeton and Christchurch City.

The Site is located on the Canterbury Plains and lies approximately 8.4km from Rolleston town centre and approximately 18.4km from the outskirts of Christchurch. It is generally accessed from State Highway 1 via Aylesbury Road. It is approximately 362 hectares in area and triangular in shape with a generally flat topography that slopes gently to the south-east. The Site is currently operated as a dairy finishing farm with some cropping and is irrigated by three centre pivot irrigators. The irrigation water has been supplied from the Central Plains Water Scheme (CPWS) stage 2 scheme since October 2018, with groundwater also available. Its exotic pastures but may be used as a breeding site by South Island pied oystercatcher (an At Risk species) and for forging by Black-fronted tern, black-billed gull and red-billed gull, paradise shelduck and mallard duck. Spur-winged plover chicks (indigenous but not threatened) have also been seen at the Site.

The Site is surrounded by primary production activities including equestrian facilities, scattered residential dwellings with a cluster located at the junction of Aylesbury and Two Chain Roads to the southeast. To the south is Burnham Camp, a New Zealand Defence Force base which supports a diverse range of activities. Approximately 3.5km to the east lies the Road Metals Quarry on Wards Road, and Rolleston Prison and Youth Justice (Te Puna Wai o Tuhinapo) are located between State Highway 1 and Two Chain Road.

The closest sensitive activities/receptors (defined in the Canterbury Regional Air Plan as a location where people or surroundings may be particularly sensitive to the effects of air pollution) are 168 Aylesbury Road, 159 and 273 Grange Road, 176 Kivers Road and 535 and 716 Wards Road.

Zoning

The Site is located within the Outer Plains Zone in the Selwyn District Plan (SDP), which is a rural zone that supports a range of activities. It is characterised by a predominance of vegetation cover over buildings, with a low overall density of built development, where residents should expect to tolerate mild effects associated with 'day-to-day' farming activities and temporary effects associated with seasonal activities such as harvesting or topdressing. It is also identified as an appropriate location for rural-based industrial activities such as the processing of aggregate, due to the availability of larger allotment sizes and lower population densities.

The rules in the Partially Operative Selwyn District Plan (POSDP) had legal effect from 19th August 2023 and are therefore considered in full in this application. The Site is zoned as General Rural, which provides for primary production activities (including quarrying and the processing of aggregate) and other compatible activities. The Zone recognises that many activities including rural production may have associated effects such as noise, dust and odour.

The Proposal

It is proposed to extract aggregate from the Site alongside undertaking primary production on the land prior to quarrying and post rehabilitation. The active quarry area will be a maximum of 40 hectares and will comprise three zones:

Zone	Hectares
Fixed processing plant, other processing, stockpiling, unsealed customer loadout.	18
Silt processing and storage.	7
Excavation and active rehabilitation (excluding rehabilitated areas), including conveyance and unsealed accessways.	15

The majority of quarrying activities will be undertaken during the hours of 7am to 8pm (Monday to Saturday excluding public holidays) with rehabilitation and site pre-startup including operational warmup of on-site plant occurring from 6am to 7pm on the same days. On up to 30 days (Monday to Saturday) per annum and 15 Sundays (excluding public holidays) between 5am and 7am, it is proposed to load trucks with aggregate in the stockyard and to despatch that material to concrete batching facilities.

The Site will be accessed from Aylesbury Road via a vehicle crossing that will enable trucks to enter and leave the Site without cutting up the edge of the carriageway. Aylesbury Road between the site access and Two Chain Road will be widened to 8 metres. The boundary with Aylesbury Road (from the site site) will be bunded to 3 metres in height, except in proximity to the properties along Two Chain Road where quarrying activities will be setback 100 metres into the Site. Likewise in proximity to residential properties on Grange Road, quarrying activities will be setback 100 metres into the Site. These setbacks will be planted with indigenous vegetation as will the permanent bund along Aylesbury Road.

A mobile crushing plant will be installed in the initial stockpile/extraction area near the site entrance during the first part of the Construction Phase (when the stockyard, plant processing areas and the site administration facility are established) and will then be moved to the stockyard. However, most of the aggregate processing will be undertaken towards the centre of the Site, at least 500 metres from any site boundary.

Quarrying will be undertaken in phases circulating around the Site as shown on the Quarry Staging plan in **Appendix 5**. The removal of overburden will generally only occur during the earthwork season (typically October to April) and will be stored in temporary stockpiles along site boundaries as shown on the Edge Treatment Plan in **Appendix 5**. These temporary stockpiles will be located within the 17.5 metre setback from site boundaries, will be 3 metres in height with a 1:1 batter slope that will be grassed. They will be constructed prior to extraction occurring within 250 metres of the site boundary and extend along the length of the area to be extracted and will remain in place until the area within 250 metres of the boundary has been rehabilitated (except for the final batter). The final act of rehabilitation will be to regrade the batter slope and use the overburden within the stockpile to cover the final batter with a minimum of 200 millimetres of subsoil and 200 millimetres of topsoil ready for planting.

Any excess overburden will be stockpiled in windrows along the western boundary of the first extraction area. The internal stockpiles will be used for rehabilitation as extraction moves from the long-term processing and stockpile areas into the general extraction.

Dust will be managed by monitoring weather forecasts and weather conditions, and mitigation measures such as watering surfaces, processing aggregate when wet, minimising the amount of vegetation, overburden and soil removed, controlling vehicle speeds to 30 km/h on unconsolidated surfaces, and mulching, grassing and / or planting bare areas and bunds.

Most of the water used at the quarry will be for processing aggregate, which will either fall on the ground, or drain to silt settlement ponds, before discharging back to the aquifer. The silts within the ponds may need to be cleaned out on occasion, and this will be spread out within the Site. Stormwater from the roofs of buildings will discharge directly to ground as it will essentially be clean.

Other water such as from cleaning trucks will discharge to a sump and an oil-water interceptor, with the discharge water directed to a vegetated swale and then a soak pit. All water from sumps and soak pits will discharge to the underlying aquifer. Office wastewater will pass through an on-site wastewater treatment system prior to discharge to a subsurface dripline system placed in the landscaped and bunded areas at original ground level.

The quarry will not generate more than 250 heavy vehicle movements per day (on any one day) until the intersection of Aylesbury Road and State Highway 1 has been upgraded to a roundabout or equivalent. After that has occurred, the quarry may generate a maximum of 750 truck movements per day. Early morning truck movements between 5am and 7am will be limited to 10 truck movements per hour on up to 30 days (Monday to Saturday) and 15 Sundays per annum (excluding public holidays). It is unlikely that any trucks will return to the Site during these hours given the distance to markets.

Activity status

The Proposal requires resource consent as follows:

- Under the SDP as overall a **Discretionary Activity** for:

- earthworks,
- planting of shelter belts,
- the formation of an accessway onto Aylesbury Road that exceeds the standard in the SDP,
- signs not separated by 80 metres,
- a non-rural activity (quarrying),
- a rural-based industrial activity (aggregate processing),
- exceeding the noise standard between 7am and 7.30am on Monday to Saturday (excluding public holidays), and,
- generating more than 30 car equivalent movements per day.

- Under the POSDP as overall a **Discretionary Activity** for:
  - mineral extraction,
  - quarrying activity that will generate more than 40 vehicle movements per day,
  - more than 60 equivalent vehicle movements per day averaged over any, one-week period,
  - a quarry that will generate 50 vehicles per peak hour (at its busiest) at Year 2030 and 112 at Year 2035, and therefore will exceed the basic ITA threshold, and
  - two signs at the site access that will not be set back 20m from the road.

- Under the NES-CS as overall a **Discretionary Activity** as a Detailed Site Investigation has not been prepared.

- Under the CLWRP as overall a **Discretionary Activity** for:
  - the discharge of liquid waste and sludge waste that will exceed $10m^3$ per day and the rate of discharge may exceed 5mm per day,
  - The discharge of any wastewater from an industrial or trade process, into or onto land, within the Selwyn Te Waihora sub-region;
  - the discharge of stormwater from buildings, car parks, internal roads, quarried areas, processing areas and stockpiles into or onto contaminated land that will be partly associated with rural activities and partly an industrial activity;
  - the uncontrolled discharge of water through cleanfill, and
  - the deposition of more than $50m^3$ of material in any consecutive 12-month period onto land which will have been excavated to a depth in excess of 5m below the natural land surface.

- Under the CARP as overall a **Discretionary Activity** for:
    - the discharge of contaminants into air from the handling of bulk solid materials,
    - The discharge of contaminants into air from the disposal of cleanfill.

Environmental Effects

Burnham 2020 commissioned a series of expert assessments to inform the design of the Proposal and assist in understanding the potential adverse effects of the Proposal including any potential mitigation measures as follows:

- Landscape Effects Assessment (LEA), prepared by Boffa Miskell for Burnham 2020 Limited, 6 September 2023.
- Burnham Quarry Landscape and Visual Assessment Graphic Supplement (LVEA) Graphics), prepared by Boffa Miskell for Burnham 2020 Limited, 21 August 2023.
- The economic significance of the proposed new quarry at Burnham in Canterbury, prepared for Burnham 2020 Limited, by New Zealand Institute Economic Research (NZIER) NZIER, 24 July 2023.
- An Archaeological Assessment, prepared by Underground Overground Archaeology (Underground-Overground) for Burnham 2020 Limited, July 2023.
- Preliminary Site Investigation, prepared by Pattle Delamore Partners (PDP) for Burnham 2020 Limited, July 2023.
- Land Contamination – Additional Clarification of Risk, prepared by PDP for Burnham 2020 Ltd, 24 July 2023.
- Burnham Quarry Assessment of Noise Effects, Rp 001 20211322, prepared by Marshall Day Acoustics (Marshall Day) for Burnham 2020 Limited, 28 August 2023.
- Burnham Quarry Transport Assessment Report, prepared by Stantec for Burnham 2020 Limited, August 2023.
- Burnham Quarry Ecological Impact Assessment (EcIA), prepared by Boffa Miskell for Burnham 2020 Limited, 2 August 2023.
- Assessment of Soil Related Effects for Burnham Quarry (Soil Assessment), prepared by PDP for Burnham 2020 Limited, July 2023.
- Hydrology Assessment for Proposed Burnham Quarry (Hydro Assessment), prepared by PDP for Burnham 2020 Limited, July 2023.
- Proposed Burnham Quarry – Air Quality (Air Quality Assessment), prepared by PDP for Burnham 2020 Limited, August 2023.

The potential and actual adverse effects are summarised below:

Landscape - The Site will remain well integrated into the broader landscape, recognising the existing and proposed planting and that most activity will occur up to 10 metres below the existing ground level. Effects on landscape character will be more than minor during the operation of the quarry,

gradually reducing through successive phases of aggregate extraction and rehabilitation, resulting in less than minor effects on landscape values at completion.

Visual amenity (public viewpoints) - The greatest visual effect will be at the Site entrance along Aylesbury Road at the commencement of the project, albeit becoming increasingly screened by planting and the relocation of processing areas to the floor of the quarry. Furthermore, the existing shelterbelt, proposed long-term bund, temporary stockpiles, and proposed areas of planting will ensure that visual effects from public viewpoints will remain effectively mitigated, and will be less than minor.

Visual amenity (private viewpoints) – Views from private properties will largely remain unchanged as they will be truncated or entirely curtailed by the existing shelterbelt planting, long-term bund and intervening areas of planting including proposed native vegetation along the tops of rehabilitated slopes of the quarry, resulting in less than minor adverse effects.

Noise from activities within the Site - Noise related to the operation of the quarry will be contained within the boundaries of the Site and will meet the noise standards in both the SDP and the POSDP, except for activities between 7am and 7.30am on Monday to Saturday (excluding public holidays), which will exceed the night-time noise limit in the SDP.

Noise from truck movements - whilst excluded from consideration under the noise standards, it is recognised that the truck movements to and from the quarry will increase noise relative to the status quo, most noticeably on the limited number of occasions per year that trucks are operating between 5am and 7am. This is a potential effect on amenity values. However, with the agreement of the two closest residential properties, being 168 and 146 Aylesbury Road, it would be practicable to install acoustic mitigation measures to reduce any adverse noise effects arising from truck movements.

Transport - The Site is well located on an arterial road that provides connections to State Highway1, Main South Road and State Highway 73 West Coast Road. This enables most travel to and from the quarry to occur on the state highway and arterial road network. Therefore, with local modifications proposed at the site access and to the route connecting the Site to State Highway 1 and the planned modifications to the State Highway 1 / Aylesbury Road intersection, it has been assessed that additional quarry traffic can be safely and efficiently accommodated within the transport network, and effects on the network will be less than minor.

Contaminated land – HAIL activities have been identified on the Site, but broader sampling of soil surfaces outside of HAIL activity areas shows that likely indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) are at background levels. However, recognising that farming will continue across most of the Site with further potential risk for contamination from the storage of farm equipment and materials, it is proposed that identified HAIL areas are subject to targeted detailed site investigations (DSI's) as quarrying progresses across the Site. As such, potential adverse effects will be managed through an on-going process.

Ecology - There is the potential for works to damage or disturb a small number of indigenous bird nests, if construction or extraction occurs during the breeding season, which could lead to nest failure. However, due to the small number of nests potentially affected (if any) effects on local populations are unlikely and the magnitude of this effect, at worst, will be less than minor. That said, most indigenous bird species (excluding spur-winged plover) are either absolutely or partially protected under the Wildlife Act (1953), therefore pre-construction nesting bird surveys will be undertaken.

The removal, management and replacement of soils – Activities relating to soil will be undertaken in accordance with a Soil Management Plan, which includes measures designed to ensure appropriate soil rehabilitation will be implemented at each phase of quarry extraction. This means that the Site will be rehabilitated, so it can be used for agricultural activities, ensure completed areas have adequate drainage and water infiltration for irrigated pasture farming, and minimise disturbance to farming operations including irrigation of pasture.

Water quality - The major use of water at the quarry is for processing aggregate, which drains back to the aquifer when it falls on the ground, or discharges to settling ponds, where this water then generally also returns to the underlying aquifer. As this water has primarily only been in contact with uncontaminated natural strata, it is not expected to cause any adverse effects on the existing water quality in the underlying groundwater.

The annual loss of nitrate into the groundwater from continued farming use will reduce slightly while quarrying occurs on the Site, although the nitrate will reach the water table sooner in the post-quarry farming activity.

Discharges to air –It is proposed to apply a number of mitigation measures that will minimise dust emissions to within 100 metres of the source and therefore within the Site. Effects relating to discharges to air will be less than minor.

Archaeology - It is considered unlikely that pre-1900 archaeological material will be uncovered during quarrying activities. However, it is proposed to avoid damage to any archaeological site discovered during quarrying activities by applying an Archaeological Discovery Protocol. The result will be no adverse effects on archaeological values.

Cultural values - There are no known waahi tapu sites or other known sites of significance on the Site. However, through consultation with Mahaanui Kurataiao Ltd (MKT), a key cultural concern is managing potential adverse effects on groundwater quality. It has been determined that any potential adverse effects on groundwater quality will be minimised with no excavation to take place within 1 metre of the lowest recorded high ground water levels at the Site. Burnham 2020 will seek to continue engagement with MKT and Taumutu Rūnanga and Ngāi Tūāhuriri Rūnanga following lodgement of the application, as requested by MKT.

Shading of the road - The proposed additional planting will not result in greater shading of the adjoining roads that would adversely affect the safety of road users. Neither will any trees encroach any sightlines at any road intersection. Furthermore, the planting will provide visual screening of the proposed quarry and protect adjoining sites from dust generated within the Site.

Signage - The proposed signs will not adversely affect the safety of motorists, pedestrians or cyclists using Aylesbury Road and neither will the signs affect traffic speeds, manoeuvring or the general flow of traffic by becoming a visual obstruction or distraction. They will be viewed in the context of the formed site access to a quarry and therefore, adverse effects on visual amenity will be less than minor and the rural character of the Site will largely be retained.

Positive effects - The quarry will have a positive effect on the economy of the district by ensuring a steady supply of aggregate in proximity to demand, which will assist in maintaining the price of aggregate and thereby the cost and timeliness of new infrastructure. It will also provide employment opportunities, especially for those working on quarries that have ceased or are about to cease extractive activities.

Objectives and Policies

The objectives and policies of the CRPS, CARP, CLAWRP, SDP and the POSDP have been grouped by subject in the assessment of the Proposal against the relevant objectives and policies in the plans. This approach has been adopted as the CARP, CLAWRP, SDP and POSDP must give effect to the CRPS.

The following national policy statements of relevance to this Proposal have also been addressed:

- National Policy Statement for Freshwater Management 2021 (NPS-FM).
- National Policy Statement for Highly Productive Land 2022 (NPS-HPL).
- National Policy Statement for Indigenous Biodiversity 2022 (NPS-IB).

The proposal has been also assessed against the provisions in the Mahaanui Iwi Management Plan 2013 (MIMP).

The objective and policies in Part 2 of the NPS-FM have been assessed, and overall, it is considered that the Proposal is not contrary to the objective and relevant policies of the NPS-FM and is therefore generally consistent with the concept of Te Mana o te Wai.

The NPS-HPL is not applicable as the Site is LUC 4s7 and therefore not highly productive.

The NPS-IB is only applicable in that South Island pied oystercatcher have been observed foraging in pasture and recently cultivated loamfield within the Site, and black-fronted tern, black-billed gull and red-billed gull may use the Site infrequently and irregularly for foraging. The Site may also be used by a small number of indigenous birds such as the South Island pied oystercatcher and pied stilt for nesting. However, any risk to nesting bird species will be managed by undertaking pre-construction nesting bird surveys during the breeding season (August to February).

It is also proposed to undertake extensive areas of indigenous planting around the Grange Road access and in the southeast corner of the Site, and along the rehabilitated batters adjacent to the site boundaries resulting in approximately 30 hectares of indigenous planting. This could provide new habitats for indigenous species and form part of a future ecological corridor across the Canterbury Plains.

Overall, the Proposal will not be contrary to the objectives and policies in the NPS-FM, CRPS, CLAWRP, CARP, SDP, POSDP and the MIMP because:

- The Site will be managed to minimise effects on the physical and natural environment.
- The quarrying activities will be undertaken in manner to minimise impacts on people's health and wellbeing.
- It will enable the extraction of a valuable natural resource that is vital to the economy of the Selwyn District and Christchurch City.
- The Site will be rehabilitated, and topsoil will be removed, stored, and replaced to enable the land to be used for primary production.
- By the time of closure, there will be approximately 30 hectares of indigenous vegetation established within the Site.

Notification

Burnham 2020 requests that these applications be publicly notified by Selwyn District Council and Environment Canterbury, in accordance with section 95A(3)(a).

1.0 Burnham 2020 Limited

The applicant for this consent and the existing application CRC222635 to renew the take and use consents for groundwater is Burnham 2020 Limited (Burnham 2020). Burnham 2020 is a wholly owned subsidiary of Fletcher Concrete and Infrastructure Ltd. This parent company will operate the Burnham Quarry through one of its operating businesses, Winstone Aggregates (Winstone Aggregates is a trading name of Fletcher Concrete and Infrastructure Limited and is one of the businesses in Fletcher Building's Concrete Division). Fletcher Concrete and Infrastructure Limited is a wholly owned subsidiary of Fletcher Building (a NZX listed entity).

Winstone Aggregates extracts hard-rock, sand and gravel from around 12 sites across the country. This resource produces aggregate and sand that is used as roading aggregate, for erosion control and drainage as well as cement based basecourse, and in cement and asphalt manufacture across NZ.

Winstone Aggregates strives to manage operations to achieve sustainable economic development while effectively avoiding or managing adverse effects on the environment. The company has:

- A robust Environmental Management System (EMS). This flexible EMS ensures accountability for environmental performance, providing a management framework that encourages openness and environmental improvement at all operational sites.
- A comprehensive Environment Policy gives direction to the EMS and includes commitments by senior management to continual improvement and pollution prevention to effect enhanced core business operations and improved environmental performance.
- A commitment to achieving a 30% reduction in Scope 1 (direct) and Scope 2 (indirect) carbon emissions by 2030.
- As part of the wider Fletcher Building Concrete Division a commitment to achieving positive biodiversity outcomes by 2023
- A database and consent management system that facilitates the allocation of responsibilities, compliance analysis and mandatory reporting as well as regular audits and assessments to ensure regulations are met or exceeded.
- A quarry/site management plan for each quarry that is tailored to the specific requirements and environmental concerns at each site.
- Employees that are trained and expected to consider how their work impacts their surroundings and how they can do better, such as calling in the water truck when roads get dusty or slowing down when driving around homes – simple, common-sense ideas that make a big difference.
- Regular inspections and environmental monitoring to verify the impacts and success of mitigation measures.

Winstone Aggregates understands the need to quarry, and process aggregate in a responsible and sustainable manner, recognising that it is also important that aggregates are extracted, processed, and transported as efficiently, economically and unobtrusively as possible. Winstone Aggregates also acknowledges that quarrying is a temporary activity and that the land will either be restored to its former use or converted to support some other activity which best meets the needs of the local

community. Winstone Aggregates has put thought and investment into ensuring that this restoration will be carried out to the highest possible standards.

2.0 Description of the Site and the Surrounding Environment

2.1 The Site

The Site is located on the Canterbury Plains and lies approximately 8.4km from Rolleston town centre and approximately 18.4km from the outskirts of Christchurch. It is generally accessed from State Highway 1 via Aylesbury Road. Refer to the Site Plan contained in **Appendix 3**.

It is owned by Burnham 2020 Limited and borders Aylesbury Road and Grange Road, at Burnham in the Selwyn District. It comprises 5 parcels of land: RS27724, RS25412, RS19387, RS27776 and RS27777.

RS25412 and RS19387 are held together in one record of title and RS27776 and RS27777 are held together in one record of title.



Figure 1: the Site taken from Google Earth

The Site is approximately 362 hectares in area and triangular in shape. Currently access to the Site is from Grange Road via a wide gravel access track. It has a generally flat topography with a gentle slope to the south-east, reflective of the ancient, braided river channels which created the broader Canterbury Plains.

The Site was converted from forestry to grazing in 2005 – 2006.

Currently the Site is operated as a dairy finishing farm with some cropping. The Site is fully irrigated by three centre pivot irrigators. There are three 515m centre pivots (270 ha), four single span towable pivots (65 ha) and set sprinklers. Irrigation water has been provided by groundwater abstraction since 2007 and the Site has also used water from the Central Plains Water Scheme (CPWS) stage 2 scheme for irrigation use since October 2018. The farm undertakes monitoring of soil moisture and adopts good management practices for irrigation.

The character of the Site is representative of the surrounding area, supporting primary production within an enclosure of linear exotic shelterbelts. It also contains infrastructure associated with the irrigation of pasture and crops with buildings (portacom office, large storage shed, shipping containers, and silos) located towards the centre of the block and a pump station on the eastern boundary. The infrastructure including the irrigation systems represent a significant financial investment in the Site. Enabling future use of the Site for primary production will ensure the efficient use of this existing investment.

The property has a Farm Environment Plan (FEP) and is regularly audited. For the year ending 2020, nutrient loss was 31 kg N/ha/yr (Overseer v 6.4.3).

Depth to groundwater fluctuates over a depth range of around 8 – 20m below ground level in the south-east of the Site and 15 – 32m in the north-west of the Site. There are at least four deep irrigation bores within the Site (>140m): M36/7710, M36/7711, M36/7712 and M36/7713.

The boundaries of the Site with Aylesbury Road and Grange Road have been planted with evergreen pine trees that are approximately 5-6 metres in height. The western boundary has also been planted in evergreen trees that provide substantial screening of the Site. The Landscape Effects Assessment in **Appendix 8** provides detailed description of the existing vegetation on the Site.

The Site has been assessed as having low ecological values with no evidence of indigenous vegetation as described in the Ecological Effects Assessment in **Appendix 12**.

2.2 Zoning

2.2.1 Operative Selwyn District Plan

The Site is located within the Outer Plains Zone in the Selwyn District Plan (SDP). The SDP recognises that the Rural zone is principally a business area that supports a range of activities that need to be able to operate efficiently and with few restrictions as practical. The Zone is characterised by a predominance of vegetation cover over buildings, with a low overall density of built development.

Residential activities occur in the Rural zone, both ancillary to farming and other business activities, and as the principal use of a site. The Plan provisions combine to maintain a pleasant living environment. However, residents should expect to tolerate mild effects associated with ‘day-to-day’ farming activities and temporary effects associated with seasonal activities such as harvesting or topdressing. Longer-lasting noise effects should be managed to not disturb residents on adjoining properties when they are indoors.

With regard to rural-based industrial activities such as the processing of aggregate, the Plan specifically states if potential adverse effects related to those activities are of a size and scale beyond that permitted by the District Plan, they should locate within a Business 2 Zone or in the Rural (Outer Plains) Zone. The latter zone has larger allotment sizes and lower population densities providing

greater opportunity for internalising adverse effects. Accordingly, the quarry and associated processing of aggregate is proposed to be located in the Outer Plains Zone.

2.2.2 Partially Operative Selwyn District Plan

The Site is located within the General Rural zone in the Partially Operative Selwyn District Plan (POSDP). It is noted that the majority of the Selwyn District is zoned as General Rural Zone, with its primary purpose being to provide for primary production activities (which includes quarrying and the processing of aggregate) and other compatible activities.

The character and amenity of the zone is one of a landscape dominated by openness and vegetation, with significant visual separation between neighbouring residential buildings. The POSDP also recognises that many activities including rural production may have associated levels of noise, dust and odour.

Residential activities are provided for but should not compromise the ability of the Zone to be used for primary production (reverse sensitivity). To control residential density, the Zone has been separated into areas. The Site is located in the East Plains/ Te Waihora ki Waimakariri[1] overlay and has a residential density of 20 hectares per residential unit.

The proposed quarry and associated activities including the processing of aggregate will therefore be appropriately located within the General Rural Zone.

2.3 Surrounding Land Uses

The activities in the area surrounding the Site reflects its rural zoning. Refer to the Map of Surrounding Land Uses in **Appendix 4.**

Immediately to the south of the Site is Grange Road are at least two equestrian facilities:

- Brugs Nicholls Dressage at 646 Grange Road.
- Mark Jones Harness Racing Stables at Overport Lodge, 259 Grange Road.

Further south, Burnham Camp, a New Zealand Defence Force base occupies a large area of land that supports a diverse range of activities. The main base is located between SH1/the railway line and Burdons Road and is defined by tree lined boundaries and security fencing. It supports activities including housing, educational facilities, shops, petrol station, military accommodation, offices and facilities. To the north of Burdons Road, and on the opposite side of Aylesbury Road are exercise facilities and shooting ranges. The Aylesbury Range is located to the west of the main camp at Burnham. The Burnham Golf Course is located around the Aylesbury Range.

The land to the west of the Site, between its northern boundary and Kivers Road, is characterised by primary production activities, with approximately 7 residential dwellings.

To the east, the land is characterised by primary production and scattered dwellings, which is indicative of the land uses in the wider area to the north and west of the Site. Further to the east (approximately 3.5km), lies the Road Metals Quarry on Wards Road. Along Two Chain Road there are a significant number of rural lifestyle blocks with the majority containing a dwelling. Rolleston Prison and Youth Justice (Te Puna Wai o Tuhinapo) are located between SH1 and Two Chain Road.

[1] Te Reo Meaning: Refers to Lake Ellesmere and surrounds, heading towards the Waimakariri River.

The location of these activities aligns with the current urban edge of Rolleston on the opposite side of State Highway 1 (SH1). The remaining area to the west of Rolleston is characterised by primary production, scattered dwellings and the Pines Wastewater Treatment Plant lies to the west.

Further to the east extending to the boundary of Christchurch and north to West Melton, land use is dominated by rural lifestyle blocks.

To the southwest of the Site are South Pacific Meats on Two Chain Road and Owens Farm at 908 Two Chain Road (a poultry breeder farm for Tegel). approximately 6.5 km north of the Selwyn / Waikirikiri River and 12.5 km south of the Waimakariri River.

2.4 Sensitive Activities

The term 'sensitive activities' is defined in the Canterbury Regional Air Plan as a location where people or surroundings may be particularly sensitive to the effects of air pollution, and includes:

- Residential properties;
- Hospitals;
- Schools;
- Libraries; and
- Public outdoor locations (e.g. parks, reserves, beaches, sport fields).

The nearest sensitive receptors are summarised in **Table 1** below and **Figure 4** (taken from the Air Quality Assessment in **Appendix 15**) shows these graphically. It is noted that that not all sensitive receptors have been identified but a discrete selection based on wind direction, i.e. they would be representative of other more distant dwellings along the same wind direction, but still in proximity to the proposed quarry.

Table 1: Location of receptors close to the proposed quarry.

Receptor Name	**Address**	**Closest Distance to Quarry Activity (m)**	**Direction Relative to the Quarry**
R1	168 Aylesbury Road	120	East northeast
R2	159 Grange Road	170	South
R3	273 Grange Road	350	South
R4	176 Kivers Road	330	Northwest
R5	535 Wards Road	1,100	North northwest
R6	716 Wards Road	1,450	East northeast
Notes: Distance is measured from the closest proposed quarrying activity.			

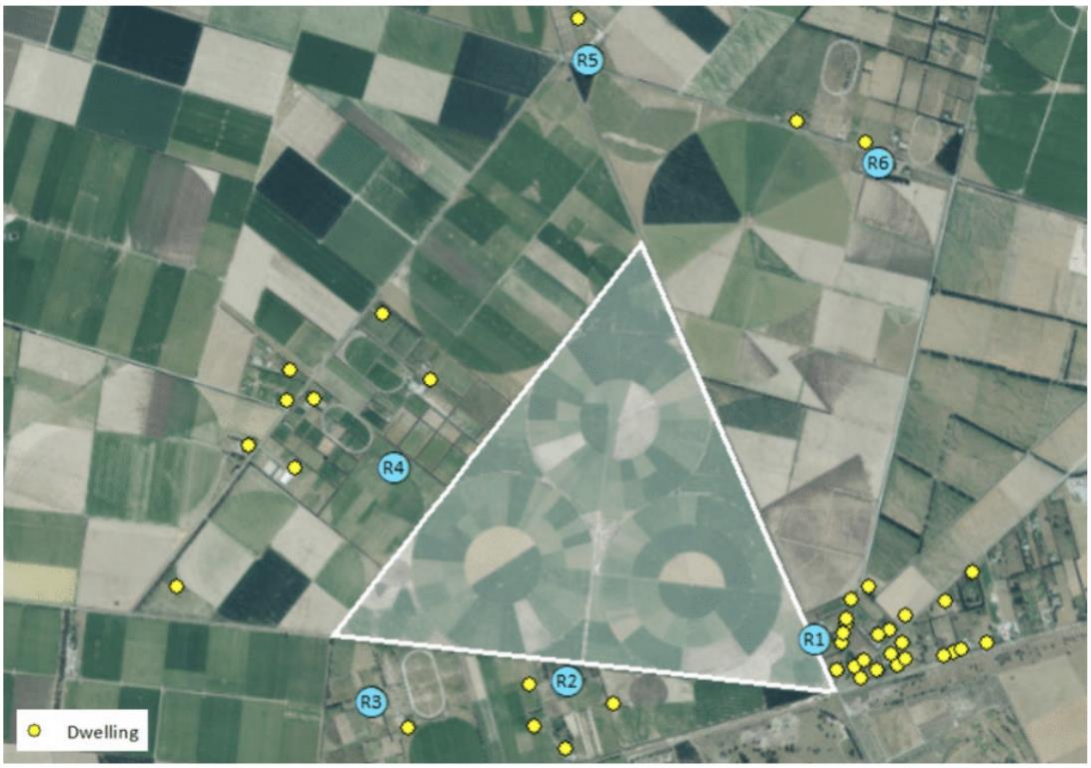


Figure 2: Location of Sensitive Receptors

The closest dwelling relative to the Site is approximately 25 metres to the east northeast of the site boundary, however it is not proposed to undertake gravel extraction within 100 metres of a dwelling. Other than residential dwellings, the only other locations that might be sensitive to air quality impacts in the vicinity of the proposed quarry are Coronation Park and the Golf Club which are 250 metres and 700 metres respectively to the southwest.

2.5 Meteorological Conditions

2.5.1 Rainfall

The percentage of dry days by month has been calculated based on the nearby Lincoln monitoring site for the years 2020 to 2022 and is presented in the figure below. The driest months of the year are generally January and April. Over the three-year period, the number of days where evaporation rates exceed rainfall in a 24-hour period (or 'dry days') was 888 days, which corresponds to 81 percent of the time.

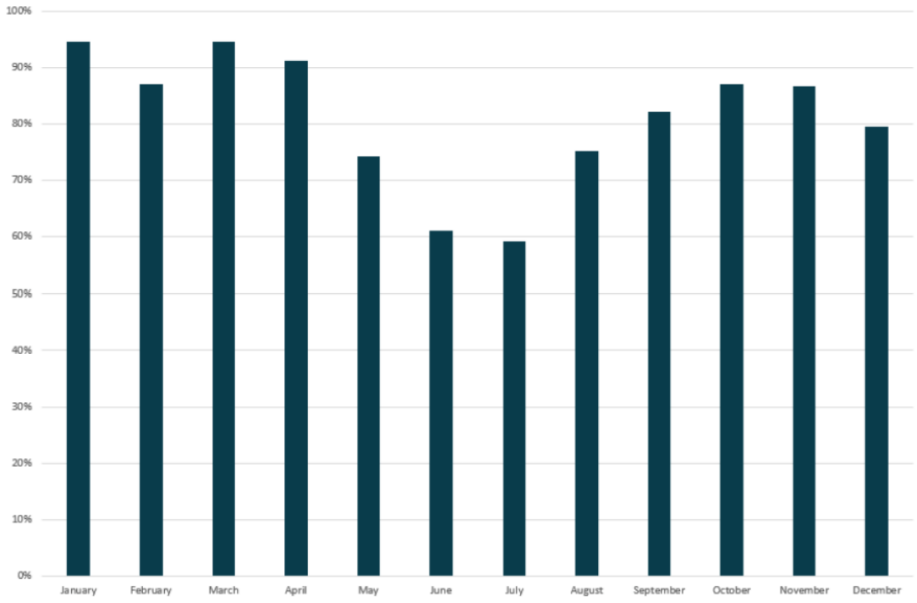


Figure 4: Percentage of dry days by month Source – Figure 6 in the Air Quality Report (Appendix 15)

2.5.2 Climate

The long-term average rainfall for the Site is 681 mm/year, with an average temperature of 11.8ºC and annual potential evapotranspiration of 916mm/year. Climate data for the Site has been sourced from OverseerFM's climate station tool (Overseer version 6.4.3) for the nitrogen losses.

2.5.3 Wind

The Site has its own Automatic Weather Station (AWS); however, this has only been in operation since 16th August 2022 and therefore does not cover a full range of meteorological conditions. The nearest publicly available meteorological weather stations relative to the Site are at Christchurch Airport approximately 21 km to the northeast, Darfield approximately 15 km to the northwest and Lincoln approximately 13 km to the east. However, the data from these sites would not represent the likely wind conditions at the Site.

Given the lack of suitable meteorological data, PDP has used a three-dimensional meteorological dataset developed using the Weather Research and Forecasting model (WRF[2]). The WRF dataset covered the area of the Site at 1km resolution for the years 2019-2020. Both the data collected at the Site and the WRF meteorological dataset for the same months (September to December) show dominant winds from both the northeast and northwest. However, the WRF dataset appears to be overpredicting north-westerly winds and overall predicts stronger winds but using the WRF dataset will add conservatism to the air quality assessment.

Table 2 from the Air Quality report in **Appendix 15** (page 13) below presents the predicted distribution frequency of wind speed, which shows the predominant higher speed winds (greater than 5 metres per second (m/s)) originate from the northwest.

[2] https://www.mmm.ucar.edu/weather-research-and-forecasting-model

Table 2: Wind Speed Frequency Distribution for the Site

Direction	Wind Speed (m/s)		Total (%)
	0-5	>5	
North	5.2	0.8	6.0
North Northeast	7.4	0.8	8.1
Northeast	12.2	5.2	17.5
East Northeast	3.8	3.6	7.4
East	1.0	0.0	1.0
East Southeast	0.8	0.0	0.8
Southeast	1.9	0.1	2.0
South Southeast	2.6	0.9	3.5
South	2.6	1.1	3.7
South Southwest	2.9	1.5	4.4
Southwest	3.4	1.8	5.2
West Southwest	4.5	1.7	6.2
West	5.4	0.8	6.2
West Northwest	5.1	2.8	7.8
Northwest	5.0	7.1	12.1
North Northwest	3.9	3.3	7.1
Calms			0.8

When wind speeds at the ground level reach 5 m/s they have the highest potential to transport dust off-site. In the case of the Site, winds from the north northwest to the south have the potential to transport dust to the closest receptors along the southern boundary and southeast corner of the Site, and these winds have speeds in excess of 5 m/s between 0 and 5.2 percent of the time. These predicted wind speeds are based on winds at 10 metres high and therefore will overpredict strong winds at ground level.

2.6 Cultural Context

The Site is located within the rohe of Te Taumutu Rūnanga: one of the 18 papatipu rūnanga of Ngāi Tahu. It does not contain any sites of significance to Te Taumutu Rūnanga as far as the Applicant is aware.

It is recognised that whilst some distance away, any potential risk to water quality in Te Waihora should be considered. This Lake is a treasured source of mahinga kai and subject to on-going restoration of its values.

3.0 The Proposal

3.1 Overview

Burnham 2020 proposes to develop an aggregate quarry within a Site located at the junction of Aylesbury Road and Grange Road, Burnham. Please refer to the Site Plan in **Appendix 3**.

Quarrying activities will be undertaken whilst enabling on-going use of the majority of the Site for primary production. Simultaneous on-going rehabilitation of the quarried land will also occur as quarrying of each portion ceases.

3.1.1 Guiding Principles

Burnham 2020 has developed guiding principles that have driven the design of this Proposal. These are, in no particular order:

- Internalisation of potential adverse effects arising from proposed quarry activities to the extent practicable.
- Retention of the existing rural outlook and character when viewed from surrounding sites and public roads. This will be done by ensuring all boundaries retain planted screening as well as by the construction of a permanent boundary bund alongside Aylesbury Road and temporary overburden stockpiles prior to extraction occurring. Both the permanent bund and overburden stockpiles will be 3 metres in height and be located inside the screening vegetation. Furthermore, substantial additional planting is proposed within the southeast corner of the Site, providing a 100m buffer between extraction areas and Aylesbury Road in proximity to adjoining residential properties. It is intended that plants will be eco-sourced and representative of the original Canterbury Plains species, where feasible.
- Minimisation of the volume of water used by recycling water and maximise the return of any non-recycled water cleanly to the aquifer.
- Achievement of a goal of a 30% reduction in direct and indirect carbon emissions by 2030. This requires flexibility in the type of machinery and plant that is used on the Site, with a general move away from diesel powered to electric or green hydrogen, and potentially the use of conveyors. It is noted that:
    - whilst the activity of depositing cleanfill (as defined in the Canterbury Land and Water Plan) forms part of this application, it will **only** use virgin and processed materials that have been extracted from within the Site and is essentially earthworks.
    - the take and use of groundwater do **not** form part of this application. An application to renew CRC222536 and CRC221642 – water permits to take and use water (CRC222635) was lodged with ECan under s124 of the RMA on 26th November 2021. This application is on-hold under s91 of the RMA pending receipt of applications to undertake quarrying i.e. discharges to land and air, extraction and cleanfilling.

3.1.2 Duration of the proposed activity

The quarry will have a life expectancy of at least 60 years based on current demand.

The application for resource consent seeks to provide as much certainty about the Proposal over the anticipated life expectancy of the quarry, as is practicable and feasible at this time. Land use consent is sought without the restriction of any term to allow for the extraction of aggregate to respond to market needs over time.

3.1.3 Reason for the Proposal

Aggregate is a vital material that is essential in the development of buildings, roads and infrastructure. New Zealand uses 9-10 tonnes of aggregate every year for each adult and child. (Aggregate & Quarrying Association - https://aqa.org.nz/fact-files/).

In Canterbury, this demand may be slightly higher due to population growth, Christchurch is still rebuilding after the earthquakes of 2010 and 2011, and the proposed stadium is under construction. Selwyn is also the fastest growing district in New Zealand with Rolleston being the main area of growth for both residential and commercial development.

Existing quarries in Canterbury are vertically constrained to an approximate depth of 10 metres due to underlying aquifer systems, so tend to expand horizontally. In turn, the expansion of existing quarries is often constrained by surrounding activities and land uses, and issues of reverse sensitivity.

It is also understood that (at this time) all the braided rivers, where gravel can be extracted, (for example the Waimakariri and the Rakaia) are overallocated in terms of consented gravel extraction volumes.

Fletcher Concrete and Infrastructure Limited is actively investigating alternative aggregate sources such as recycled concrete to meet New Zealand's aggregate demand. Currently there are barriers in place to wide-scale use of alternative aggregate sources. The barriers are complex and encompass existing policy frameworks, customer perception, technical constraints and economic factors. As a consequence, these alternative products will likely only form a small percentage of the market for the foreseeable future.[3]

Fletcher Concrete and Infrastructure Limited (trading as Winstone Aggregates) currently owns and operates the Wheatsheaf Quarry in Broadfield and previously owned and operated the Yaldhurst Quarry on West Coast Road.

Extraction activities have ceased at Yaldhurst Quarry as there is no adjoining land onto which it can readily expand, and the depth of extraction cannot be increased due to the sensitivity of the underlying Christchurch West Melton Aquifer. Only cleanfilling and rehabilitation activities are occurring at the former quarry, which is now owned by another company.

Wheatsheaf Quarry has a projected lifespan of approximately 6 years. Land use and discharge consents granted on 28th June 2022 provide for an expansion of 6.8 hectares for quarrying activities. Any further expansion of Wheatsheaf Quarry is constrained by setbacks required from adjoining residential properties for amenity and rural character. Therefore, this quarry could only currently

[3] WSP/ Opus Recycled aggregates on New Zealand Roads: Barriers to update and drivers for change.2018.www/.nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Resource-efficiency/Research-projects/FINAL-Recycled-aggregates-on-NZ-roads.pdf.https??:

expand into a small area of available land to the southeast that is constrained by setbacks that would be required from Robinsons Road.

Given these constraints to expansion of existing quarries and current barriers to the use of alternative aggregate sources, Burnham 2020 seeks to develop a new quarry to meet projected demand and provide a long term, secure supply of aggregate to the Canterbury region.

The projected demand is detailed in the New Zealand Institute of Economic Research report in **Appendix 17.** The report describes the importance of quarrying, and the projected demand for aggregate resource in the Canterbury region. In summary, aggregate extraction is a regionally significant industry due to its underpinning role in the development and maintenance of infrastructure. Without continuing secure access to aggregate sources close to demand, infrastructure costs would rise, and its affordability would decrease. This would have impacts for all the region's industries that rely on that infrastructure, both directly (infrastructure providers) and indirectly (infrastructure users, such as transport operators).

3.2 Site selection

Burnham 2020 undertook a detailed process of site selection. In summary the factors which influenced the site selection process were:

- Size is sufficient to contain all quarrying activities, internalise adverse effects to the extent practicable and provide a secure aggregate resource over a long period of time in order to minimise the need to develop additional sites in the future.
- Proximity to markets for the resource and State Highway 1. Aggregate is expensive to transport. This dictates the distance that the site can be located from identified markets and key transport networks. Locating near markets also ensures that any reduction in carbon emissions achieved by the quarry operations is not offset by high (carbon) emissions from trucks travelling long distances.
- Distance from large-scale residential populations such as Rolleston, Templeton or Christchurch City. The Site is in a rural area, recognising rural residential properties either adjoin or are near the Site. There are approximately 70 rural lifestyle properties located to the southeast along Two Chain Road heading back towards Rolleston. The Burnham Military Camp is also located to the south.

3.3 Design of the Proposal

Burnham 2020 commissioned a series of expert assessments to assist in understanding the potential adverse effects of the proposal and inform the design of the proposal including any potential mitigation measures.

These expert assessments are listed below, including how they are referenced in this AEE.

- Landscape Effects Assessment (LEA), prepared by Boffa Miskell for Burnham 2020 Limited, 6 September 2023.
- Burnham Quarry Landscape and Visual Assessment Graphic Supplement (LVEA) Graphics), prepared by Boffa Miskell for Burnham 2020 Limited, 21 August 2023.

- The economic significance of the proposed new quarry at Burnham in Canterbury, prepared for Burnham 2020 Limited, by New Zealand Institute Economic Research (NZIER) NZIER, 24 July 2023.
- An Archaeological Assessment, prepared by Underground Overground Archaeology (Underground-Overground) for Burnham 2020 Limited, July 2023.
- Preliminary Site Investigation, prepared by Pattle Delamore Partners (PDP) for Burnham 2020 Limited, July 2023.
- Land Contamination – Additional Clarification of Risk, prepared by PDP for Burnham 2020 Ltd, 24 July 2023.
- Burnham Quarry Assessment of Noise Effects, Rp 001 20211322, prepared by Marshall Day Acoustics (Marshall Day) for Burnham 2020 Limited, 28 August 2023.
- Burnham Quarry Transport Assessment Report, prepared by Stantec for Burnham 2020 Limited, August 2023.
- Burnham Quarry Ecological Impact Assessment (EcIA), prepared by Boffa Miskell for Burnham 2020 Limited, 2 August 2023.
- Assessment of Soil Related Effects for Burnham Quarry (Soil Assessment), prepared by PDP for Burnham 2020 Limited, July 2023.
- Hydrology Assessment for Proposed Burnham Quarry (Hydro Assessment), prepared by PDP for Burnham 2020 Limited, July 2023.
- Proposed Burnham Quarry – Air Quality (Air Quality Assessment), prepared by PDP for Burnham 2020 Limited, August 2023.

3.4 Proposed activities

This section describes the quarrying activities including site preparation, aggregate extraction, processing of aggregate and rehabilitation, proposed by Burnham 2020 at the Site.

The proposed quarrying activities will be undertaken in a series of phases as set out in the Quarry Staging plan in **Appendix 5.** These phases and the indicative timings are the Construction Phase being 0 to 5 years when works such as constructing the vehicle crossing and access, the buildings, the permanent bund along Aylesbury Road and the stockpile are undertaken, Extraction Phase being 6 to (approximately) 60 years and Completion and Final Rehabilitation at year 60. The timing is only approximate, having been developed based on current demand projections for the quarry.

3.4.1 General matters

3.4.1.1 Layout of the site

The proposed quarrying activities will be located on the Site in accordance with the Plans in **Appendix 5**.

3.4.1.2 Active Quarry Area

The active quarry area will be a maximum of 40 hectares and comprises a number of zones.

The area of each zone will generally be as listed below (although some flexibility is required). However, the total active area will not exceed 40 hectares.

Purpose of the Active Quarry Zone	Area of the Zone (hectares)
Fixed processing plant, other processing, stockpiling, unsealed customer loadout.	18
Silt processing and storage.	7
Excavation and active rehabilitation (excluding rehabilitated areas), including conveyance and unsealed accessways.	15
Total	**40**

3.4.1.3 Hours of Operation

The proposed hours of operation will be as follows:

Hours of Operation			Activities
AT ALL TIMES			Environmental mitigations (including dust control), light vehicle movements into and on site, operation of site office, site security and light maintenance.
MORNING	Monday - Sat (excluding public holidays)	6am to 7am	Rehabilitation and movement of vehicles within site associated with that activity. Site pre-startup including operational warmup of on-site plant.
DAYTIME	Monday - Sat (excluding public holidays)	7am to 8pm	Full range of production activities within current operational area and/or primary and secondary stockyard.
EARLY MORNING	Monday to Saturday on up to a maximum of 30 days per annum (excluding public holidays)	5am to 7am	Loadout and access / egress of trucks operated by the quarry operator.
	Sundays on up to a maximum of 15 days per annum (excluding public holidays)	5am to 7am	

3.4.1.4 Staff numbers

The Site will employ approximately 15 full time people.

3.4.1.5 Lighting

Lighting is proposed as the Site will need to be accessed at times of darkness, particularly in winter. A "flag light" will be located at the Site entrance to highlight the location and position of access features. Internal lighting is also proposed and will be directed downwards, away from site boundaries so that light spill will not exceed 3-lux spill onto any part of an adjoining property or road.

3.4.1.6 Signage

Signage displaying the name of the quarry will be located at the vehicle entrance on Aylesbury Road. There will be one sign on either side of the entrance. The signage will be located within the Site, setback from the road boundary and may be lit as the Site will be accessed at night.

3.4.2 Construction Phases

3.4.2.1 Construction and design of vehicle crossing.

Development of the Site will commence with the construction of the vehicle crossing for both light and heavy vehicles from Aylesbury Road. The vehicle crossing will be formed to the Waka Kotahi commercial vehicle access standard including widening the eastern side of the road and entry side of the access. This exceeds the design standard for vehicle crossings for commercial and heavy vehicles for all roads in the Selwyn District Plan. The vehicle crossing will be constructed to a high pavement and drainage standard to ensure that the pavement achieves a long service life without cracking or potential water damage.

The internal access road will be approximately 9 metres in width (7m wide sealed asphalt surface with 1m unsealed shoulder either side) and sealed for 150 metres into the Site to the weighbridge/initial stockyard area. There will also be a 1.5 metre bund constructed on either side of the access road.

After the Construction Phase (refer to Phasing Plan in **Appendix 5**), the access road will be sealed for a further 150 metres from the weighbridge to the permanent stockyard. This will result in a total of 300 metres of sealed road with a 6.7% gradient from the unsealed stockyard to Aylesbury Road.

The Aylesbury Road accessway will curve into the Site with bunding to prevent direct line-of-sight to quarry activities from the road frontage. The bunding and screening of the operational area will remain in place for the life of the quarry.

Works are also proposed to widen Aylesbury Road between the site access and Two Chain Road to form an 8-metre-wide sealed carriageway to provide for the volume of trucks that will result from the quarrying activity and turn into and from the Site. These works will require approximately 1 metre of widening on each side of the road over a length of approximately 1.5 kilometres. These works will be carried out to satisfy the 7.5 metre width required by Table E10.5 in the Selwyn District Plan. However, it is acknowledged that the agreement of SDC will be required to undertake these works. It is also understood that SDC already has plans to upgrade this road in its Long-Term Plan (2021 to 2031) as part of its Safe Network Programme Safety Improvement under the Ministry of Transport's Road to Zero strategy, and it may be that Burnham 2020 can work with SDC to expediate this work.

The existing vehicle crossing off Grange Road will remain as access for farm vehicles only, keeping the farming and quarrying activities separate and avoiding possible conflict between stock and quarry trucks. However, an internal road with a grade of 6.7% will need to be constructed from Grange Road to access rehabilitated land used for primary production. It will have planting on its batters that reflects the wider quarry internal batter planting.

3.4.2.2 Site facilities

The site office, staff amenities, parking and weighbridge areas will be established in proximity to Aylesbury Road. The buildings will be no more than 5 metres in height and will be set back at least 30 metres from Aylesbury Road.

The weighbridge installation and sealing of 150 metres of access road between site boundary and the weighbridge will be completed as part of the construction phases to establish the quarry and prior to any extraction activities.

A wheel wash will be established at the base of the exit ramp. All road going vehicles leaving the Site will be required to pass through the wheel wash, which will be over 150 metres from the exit onto Aylesbury Road.

The Site will be fully fenced with an appropriate farm fence and gated, and the gates will be locked when the quarry is not operating. Areas of the Site which are actively farmed, or otherwise used for an alternative use will also be fully fenced and have an independent access way, providing clear delineation between quarrying and other activities. There will be signage advising access is prohibited, cameras and buildings and plant will be alarmed/monitored.

3.4.2.2.1 Services

Services including potable water, power, electricity, and telecommunications will be installed.

An upgrade is proposed to the transmission infrastructure. These works will be carried out by Orion and do not form part of this application.

3.4.2.2.2 Mobile plant

A mobile crushing plant will be installed in the initial stockpile/extraction area near the site entrance in the first part of the Construction Phase and then moved to the stockyard.

3.4.2.3 Stripping of overburden

Overburden is the topsoil and subsoil layers that lie above the aggregate that must be stripped and removed prior to aggregate extraction. It is estimated the overburden is generally 0.35 metres in depth at the Site.

Site preparation works will require the stripping of overburden within the part of the Site where the stockyard, plant processing areas and the site administration facility are proposed to be located.

The overburden will be used to create a permanent bund along Aylesbury Road, which will remain in place for the life of the Quarry. The material will also be used for the rehabilitation of the stockyard area. Where practicable, subsoil and topsoil layers used to form bunds will be kept separate to enhance utilisation of this material for future rehabilitation works.

3.4.2.4 Bunds

During the Construction Phase, a permanent bund will be established from the site access for 1 kilometre south along Aylesbury Road. This permanent bund will be constructed entirely from overburden stripped from the processing and stockyard areas and will remain in place throughout the life of the quarry. The bund will be 3 metres in height, with a 1:2 batter slope with a 1 metre wide crest along the top to ensure stability and to facilitate maintenance access. The permanent bund will be planted and grassed.

3.4.2.5 Landscaping

The site boundaries along Aylesbury Road, Grange Road, and the boundaries of properties adjacent to Kivers Road are generally fully screened by an established evergreen shelterbelt approximately 5 metre in height by 3.5 metre in width. Where there are gaps in this existing shelter belt, these will be planted with the same species of tree. This shelter belt will be retained for the operational life of the quarry except where it is required to construct the new vehicle access crossing to the Site off Aylesbury Road. Any trees in the shelter belt that are lost due to weather events or disease will be replaced to ensure the Site remains effectively screened.

In the southeast corner of the Site, planting of native species will be completed within the 100 metre set back from the road boundary at the time Phase 3 is commenced. When Phase 5 extraction commences, additional indigenous planting will also be undertaken within the 100 metre set back from Grange Road as shown on the Landscape Strategy in **Appendix 5**. This will result in a combined total of 8 hectares of native planting.

3.4.3 Extraction Phases

It is estimated that the Site contains 26 to 36 million banked cubic metres (BCM) of aggregate that equates to approximately 60 years supply of resource based on the current projected demand for aggregate. However, the length of time required to extract the aggregate resource on Site will depend primarily on demand. Total resource extracted each month will be on average 500,000 BCM but will fluctuate with market demand and economic conditions.

3.4.3.1 Removal of overburden

The removal of overburden will generally only occur during the earthwork season (typically October to April).

Overburden will be stripped by machinery, loaded directly into trucks and transported to the Site boundary and formed into temporary stockpiles around the Site as shown on the Edge Treatment Plan in **Appendix 5** or immediately used to rehabilitate already quarried areas. Any excess overburden will be stockpiled in windrows along the western boundary of the first extraction area in the southeast centre-pivot area.

3.4.3.2 Stockpiles

At the time of constructing stockpiles, extraction activities will be occurring at least 8-10 metres below ground level, as extraction will push out from within the quarry towards the site boundaries.

The stockpiles will be 3 metres in height, with a 1:1 batter slope that will be grassed. The temporary stockpiles will be located within the 17.5 metre setback from site boundaries and will be constructed

prior to extraction occurring within 250 metres of the site boundary. The stockpiles will extend along the length of the area to be extracted and will remain in place until the area within 250 metres of the boundary has been rehabilitated (except for the final batter). The final act of rehabilitation will be to regrade the batter slope and use the overburden within the stockpile to cover the final batter with a minimum of 200 millimetres of subsoil and 200 millimetres of topsoil ready for planting.

3.4.3.3 Plant Processing and Stockyard Area

The first area of extraction will create the plant processing and stockyard areas towards the centre of the Site, approximately 500 metres from Aylesbury Road. Extraction will use a top-down method using excavators, wheel loaders, and trucks. The material will either be processed immediately with mobile crushing equipment into saleable material or stockpiled in a future extraction area (once overburden has been removed) for later processing. Any stockpile of material will be less than 4 metres in height (when measured above the original ground level of the quarry).

Once the plant processing and stockyard areas have been extracted to full depth, the extraction methodology will change to extraction from the pit floor, which is expected to be approximately 10 metres below the original ground level. The extraction area will advance by removing material from the toe of the active quarry face. It is estimated that it will take approximately 5-6 years to extract and process the plant processing and stockyard areas.

3.4.3.4 Remaining extraction area

It is proposed to undertake extraction with minimal disturbance to existing farm infrastructure (water lines, irrigators, power, buildings), and retain a separation distance of at least 500 metres from adjoining residential properties for as long as possible.

Extraction will progress in phases focusing within one specific centre pivot irrigated area at a time starting with Southeast, then Southwest and finally the Northern centre-pivot area. Each centre pivot irrigation area will be divided into wedges for extraction to minimise disruption to the existing irrigated farmland. From Phase 3, the quarry is projected to extract approximately 500,000 BCM of resource per year. After approximately 10 years, the extraction and rehabilitation will be in equilibrium with 25 hectares of active quarrying area equivalent to approximately a 5-year cycle from extraction to rehabilitation.

The 5-year cycle of extraction to rehabilitation includes:

- Year 1 - Active Extraction.
- Year 2 - Use for access to working area.
- Year 3 - Deposit silt and aggregate.
- Year 4 - Allow silts to dry and consolidate.
- Year 5 – Level silts, add topsoil and seed/plant = End of ‘Active Quarry’ zone.

The maximum depth of extraction will vary across the Site but is estimated to be an approximately 10 metre depth to ensure that extractive activities occur 1 metre above the highest level of groundwater recorded for the Site. Extraction machinery will be fitted with telemetered grade control to ensure that machinery cannot extract below the designed floor level and provide a record of actual extraction machinery activity.

It is proposed that the extraction of aggregate will be undertaken in increments of 25 hectares, commencing in proximity to the Site entrance and facilities area.

It is proposed that the areas of extraction will generally be set back approximately:

- 24.5 metres from Aylesbury Road, extending to 100 metres along approximately 0.6km of the southwestern corner of the Site in proximity to the adjoining residential properties, and
- 17.5 metres from Grange Road, adjoining rural zoned land and residential properties to the west extending to 100 metres in proximity to the Site entrance and adjoining residential properties on Grange Road.

3.4.3.5 Method of extraction

Extraction of the aggregate resource will start with the use of standard quarrying machinery such as excavators, wheel loaders, dump trucks, and bucket wheel excavators. It is not proposed to undertake any blasting.

As the expected life of the quarry is approximately 60 years, it is likely the equipment used for extraction will change as technology advances in terms of energy efficiencies and reductions in carbon dioxide emissions. As new technologies develop, Burnham 2020 will seek to utilise more sustainable equipment and plant in accordance with the overall sustainability objectives of Fletcher Concrete and Infrastructure Limited.

Once the aggregate resource has been extracted, material will be transported to the processing plant by truck along the haul road.

In the future, material may be transported to the processing plant by way of covered overland conveyors. Overland conveyors provide an efficient, cost-effective way of moving material using renewable energy sources. Overland conveyors will minimise dust generation, especially when compared to typical load and cart operations using dump trucks and haul roads. A temporary access road would be required to maintain the overland conveyor and provide access to the active extraction area for equipment and transportation of rehabilitation materials.

Stockpiles of extracted aggregate will be located on the floor of the extraction areas and will be no greater in height than the height of the closest earth bund, fencing or landscaping. Therefore, stockpiles of aggregate will be fully screened from any public views.

3.4.4 Stockyard

Extracted and processed material will be stockpiled in the stockyard. Activities in the stockyard will include:

- Final sizing into various products.
- Blending and combining product.
- Road truck access and movements.
- Loading road trucks with wheel loaders, overhead bins, and conveyors.

3.4.5 Processing of aggregate

The quarry will use a combination of fixed and mobile processing plants. However, most processing will occur inside the main processing plant, towards of the centre of the Site identified on the Quarry Staging Plan (Figure 4b) in **Appendix 5**. The boundaries of the processing area will be at least 500 metres from any site boundary.

3.4.5.1 Mobile processing plant

Mobile processing plants will also be used in the early establishment of the processing and stockyard areas and, as and when required to supplement the fixed plant production capacity in meeting peak demand. The mobile processing plants will be located at least 250 metres from site boundaries.

3.4.5.2 Fixed processing plant

Fixed processing plant will be located in the plant processing area and will include fixed plant of 5 to 8 crushers. There will be a mix of dry and wet processing, as aggregate will be crushed, screened and washed. Wash water will be captured and cleaned, which will possibly include the use of clarifying silos and filter presses, or otherwise will involve pumping wash water to settling ponds.

3.4.6 Dust

3.4.6.1 Generation of dust

The extraction and processing of aggregate and the movement of vehicles within the quarry site will generate dust. This aspect of the proposal is described in detail in the Air Quality Assessment in **Appendix 15**. In summary, the most significant source of dust will be from the movement of vehicles along unpaved roads, stripping of overburden and the creation of bunds during dry weather.

3.4.6.2 Dust suppression activities

3.4.6.2.1 Overburden Placement

During overburden removal and placement, the following mitigation measures will be implemented to mitigate the potential dust effects:

- watering the surface prior to disturbing it during dry weather conditions, if required;
- minimising the amount of vegetation, overburden and soil removal to a practicable level;
- controlling vehicle speeds to 30 km/h on unconsolidated surfaces;
- dampening of haul roads; and,
- mulching, grassing and / or planting of bare areas and bunds shall be undertaken as soon as reasonably practicable.

When it is impracticable to avoid overburden disposal during particularly dry weather, watercarts or fixed sprinklers will be used to ensure that adequate dust suppression occurs to avoid generating off-site dust effects.

3.4.6.2.2 Aggregate Extraction and Truck Loading

For the majority of the time the rock extraction and truck loading will take place below existing ground level which will greatly reduce off-Site dust emissions. In addition, or when extraction and works are undertaken around or at the current ground level such as enabling works, there are three possible techniques that are commonly used at quarries to control dust from excavation and truck loading activities. These include wetting the material on the ground prior to the commencement of loading, the use of a fine water spray whilst loading is occurring, and / or the use of windbreaks to reduce wind velocities in the vicinity of the quarry.

3.4.6.2.3 Aggregate Processing

The majority of the aggregates will be processed wet, which will result in little potential for dust emissions from the processing plant. Additionally, it is proposed to undertake the following mitigation:

- All dry screens will have either fixed line fogging installed or will be enclosed.
- All crushers will have fixed line fogging installed around the infeed and outfeed, with additional fogging on the first few metres on the discharge conveyor.
- All transfer points for unwashed or dry material will have fixed line foggers installed.
- Conveyors transferring unwashed dry products less than 5 mm will be covered.
- Fogging canons will be available to control residual emissions as required.
- Locate the processing plant near the centre of the site (over 1,000 metres from the closest dwelling) and approximately 10 metres below the existing ground level.

3.4.6.2.4 Stockpiles and Exposed Areas, Truck Loading and Transportation

The following mitigation measures will be the main techniques to control dust emissions from stockpiles, exposed areas, truck loading and transportation:

- Minimise, at all times, the area from which dust particles can be eroded.
- Vegetate the surface. However, ground cover can take some time to establish, particularly if required during a slow growing period. Therefore, other measures, such as polymer stabilisation, are often required whilst vegetation is becoming established.
- Periodic irrigation of exposed land and unpaved roads by water carts to control dust emissions. In more permanent unsealed sections of road that are regularly used, Burnham 2020 will consider using fixed sprinklers to apply water.
- During truck load out the most practical dust mitigation for this activity will be limited to the drop height of the material. Additional measures can be adopted such as applying water if the material is particularly dry and installing wind break screens if load-out activities are undertaken in exposed areas.
- Apply a speed restriction of 30 km/h on all internal roads.
- Replacing road metal prior to it becoming a potential dust source on internal roads.
- Installing sealed road surfaces in high-risk areas such as from the site entrance to the weighbridge. However, as with unsealed roads, applying water will control dust from these

surfaces and sweeping will be undertaken. Additionally, a wheel wash and a flood wash will be installed to remove dirt from trucks leaving the Site.

3.4.6.2.5 Silt Management

The following mitigation measures will be the main techniques to control dust emissions from silt management:

- No specific dust controls will be required on the ponds themselves, if the silt ponds remain slurried or have a top surface with a high moisture content.
- If a protective 'crust' forms and is not subject to vehicle tracking, then no specific dust controls will be required.
- If the protective crust does produce emissions, then controls such as wetting the surface or applying polymer or other approved suppressants will be used.
- Silt stockpiles will be treated with a polymer or other approved suppressant or vegetated.

3.4.6.2.6 Monitoring

The following visual monitoring programme as set out in the Air Quality Assessment (**Appendix 15**) will be undertaken to ensure that dust is being managed at the Site.

Monitoring Activity	**Frequency**
Inspect land adjacent to the site where possible, site exits and adjoining roads for the presence of dust deposition.	Twice daily
Check weather forecasts for strong winds and rainfall to plan appropriate work schedule and dust management response.	Daily
Observe weather conditions including wind and rain via observations and data outputs from weather stations.	Daily and as conditions change
Inspect all exposed surfaces for dampness and to ensure that the exposed un-stabilised area is minimised.	Daily and as conditions change
Inspect any stockpiles to ensure that they are not subject to wind erosions. Minimise as far as practical the height of stockpiles containing unprocessed or unwashed material.	Daily and as conditions change
Inspect dust generating activities to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced

Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas.	Weekly

In addition, continuous dust monitoring with telemetry will be undertaken at three locations around the Burnham Quarry as identified on **Figure 3** below.



Figure 3: Location of Proposed Dust Monitors (Air Quality Assessment, Refer Appendix 15)

Dust will be controlled using the following triggers and these triggers will be incorporated into site management plans.

- Trigger Level 1 - (120 µg/m³ as a 1-hour average) - To identify that dust concentrations have reached a point where dust nuisance is likely to occur if action is not taken to implement mitigation measures. It would not be expected that dust concentrations would reach this level unless there are adverse weather conditions in conjunction with a failure of mitigation.
- Trigger Level 2 – (150 µg/m³ as a 1-hour average) - If this trigger is exceeded it indicates that dust concentrations have reached a level which is unacceptable, and dust nuisance will occur. All activities that have the potential to generate dust on site, apart from dust mitigation, must cease until such time as dust concentrations drop below Trigger Level 1.

If an investigation identifies that activities on the Site are not responsible for the high dust concentrations, the activities may resume prior to concentrations dropping to below Trigger Level 1.

Wind monitoring will also be undertaken with real-time meteorological data, which will be used to alert of potential dust generating winds. Alerts will be sent out to quarry staff when wind speeds exceed 5 m/s and 10 m/s (during two consecutive 10-minute periods) so appropriate dust management and mitigation measures can be put in place.

3.4.7 Water management

Most of the water used at the quarry will be for processing aggregate. However, most of this water will either fall on the ground, or drain to silt settlement ponds, before discharging back to the aquifer. The silt settlement ponds also will take water and suspended silt derived from the natural strata. The water will be discharged through the base and sides of the ponds, and the sediments and silts will remain in the ponds. It may be necessary to clean out the ponds as silt and sediment builds up, and these materials will be spread out within the site. Given that the water and suspended sediment are derived from the natural strata within and beneath the Site, this activity is not expected to cause any adverse effects.

Truck washing will occur within fully bunded concrete pads. Truck decks will be cleaned using clean water with no detergents, therefore resulting wash water will primarily only contain fine sediment which will discharge to a sump, with overflow occurring to a soak pit. Body cleaning may involve biodegradable detergents and degreasers and could potentially pick up hydrocarbons. Therefore, this wash water will discharge to a sump and an oil-water interceptor, with the discharge water directed to a vegetated swale and then a soak pit. All water from sumps and soak pits will discharge to the underlying aquifer.

Water used for dust suppression will be sprayed at a rate to help bind surface sediments, and as it is used during dry, windy weather, it will primarily evaporate. It is not expected that this water will drain back to the underlying aquifer.

Stormwater from the roofs of buildings will discharge directly to ground as it will essentially be clean. Water from the internal sealed road will flow to roadside swales where it will be subject to first flush treatment prior to discharging to ground.

Office wastewater will pass through an on-site wastewater treatment system prior to discharge to a subsurface dripline system placed in the landscaped and bunded areas at original ground level. The discharge will occur in close vicinity of the office buildings.

Potable water for staff facilities will be supplied from groundwater as the application lodged to renew the consents for the take and use of groundwater from Environment Canterbury in November 2021 sought to enable the use of water for quarrying activities. This application relied on the definition of Quarrying activities as defined in the National Planning Standards[4] being: ‘the extraction, processing (including crushing, screening, washing, and blending), transport, storage, sale and recycling of aggregates (clay, silt, rock, sand), the deposition of overburden material, rehabilitation, landscaping and cleanfilling of the quarry, and the use of land and accessory buildings for offices, workshops and car parking areas associated with the operation of the quarry.’

3.4.8 Storage of hazardous substances

The storage of hazardous substance on the Site will be limited to plant and machinery fuel (diesel, unleaded petrol, bio-ethanol mix, hydrogen, ad-blue etc.), lubrication (oils and greases), and small quantities of laboratory chemicals for use in aggregates compliance testing.

Fuel will be kept in double skinned tanks of up to 30,000 litres and up to 1,000kgs of oil and greases will be stored in specially designed areas within the workshop.

[4] National Planning Standards, Ministry for the Environment, November 2019.

A hazardous substance risk register, and management plan will be developed for the Site and will comply with all relevant legislation for the use and storage of hazardous substances.

3.4.9 Traffic

Trucks will enter and leave the Site by way of the vehicle entrance on Aylesbury Road. The majority will head south towards State Highway 1. The maximum number of trucks entering and exiting the Site will be 750 per day. It is not expected that the quarry will achieve this maximum quantity of movements until the latter phases of its life. The maximum number of truck movements has been calculated based on the combination of the existing Yaldhurst and Wheatsheaf quarry weighbridge data. However, until the intersection of Aylesbury Road and State Highway 1 has been upgraded to a roundabout, the quarry will not generate more than 250 heavy vehicle movements per day (on any one day).

Early morning truck movements between 5am and 7am will be limited to 10 truck movements per hour:

- Monday to Saturday (excluding public holidays) on up to 30 days per annum and,
- Sundays excluding public holidays) on up to 15 days per annum.

It is unlikely that any trucks will return to the Site during these hours given the distance to markets.

3.4.10 Rehabilitation

3.4.10.1 Rehabilitation Management Plans

The quarry has a long-projected lifetime of 60+ years. It is therefore difficult to determine what future productive uses will look like. Consequently, a detailed landscape rehabilitation management plan will be prepared for each phase of extraction activity and prior to commencing each subsequent quarrying phase in accordance with an overall landscape strategy (refer Landscape Effects Assessment, **Appendix 8**). These landscape rehabilitation management plans shall ensure on-going extraction activities facilitate a progressive staged rehabilitation of the Site.

Each landscape rehabilitation management plan will identify:

- The final form of batters proposed to accommodate revegetation (average 1:2 slope), to assimilate changes in level within the Site through revegetation and ensure proposed revegetation will thrive;
- The final volumes of subsoil and topsoil required to rehabilitate batters and facilitate ongoing rural land use;
- Plant establishment and maintenance, including the following specifications:
    i. Establish a minimum 400mm depth of subsoil and topsoil supporting successful establishment of all planted areas;
    ii. The specifications and schedules of planting;
    iii. Means to ensure plants will be irrigated for at least two years after planting until established; and

iv. Pest protection to include the installation of combi-guards and/or predator proof fencing around areas of new planting for two years after establishment and ongoing means of monitoring plant success including pest eradication as necessary.

3.4.10.2 Soils Rehabilitation

Rehabilitation of the Site will require the reinstatement of at least 200mm depth of subsoil and 200mm of topsoil, comprising fine matrix soil materials, free of stones over 150mm and other coarse materials. The topsoil will contain up to 10% organic matter, nutrients, and fine matrix soil materials, being relatively free of large rocks to minimise barriers to plant roots. The placement of the soil on the shaped land surface is important and will be undertaken using light track-driven machinery or lighter quarry machines to achieve an approximately uniform stable thickness. If there is insufficient soil, then extracted/processed aggregate will be used.

The reinstated soils will be low in carbon and fertiliser will be required before and during pasture establishment, as well as dampening immediately after placement to minimise the risk of wind erosion. In addition, permanent or temporary irrigation will be reinstated on the rehabilitated areas and pasture established as soon as possible. The fine roots of pasture create soil structure by growing into new subsoil and coating cracks and pores. It is considered that after three years, with careful stock management, the soil will be suitable for a range of agricultural uses.

3.4.11 Farming activities whilst the quarry is active

As described in the Assessment of Soil Related Effects report (**Appendix 13**), the current farming operation grazes 1650 heifer calves from 1st Dec to 31st April, and 1650 yearling heifers from 1st May to 1st May. The farm also grazes 80 Jersey bull calves from 1st Dec through to heifer mating the following spring. The total stocking rate in the year end 2020 was 12,044 SU and 32.11 SU per productive hectare.

Each year between 2018/19 and 2020/21 35 ha of kale and 22 ha of annual forage ryegrass was grown for intensive winter feed and grazed between 1 May and 30 September. Between 2013 and 2017 fodder beet was also grown and the total area of forage crops was the same. Under the National Environmental Standards for Freshwater (NES-F) controls on the expansion of the area of land used for intensive winter grazing came into force from 1 May 2021. The maximum area of intensive winter grazing (kale and annual ryegrass) was 57 ha or 14.7% of the total farm area in the reference period of 1 July 2014 to 30 June 2019.

The current farming operation is not part of this proposal, but forms part of the existing environment within which the application will occur if approved. In the short term, the farm will continue to operate a similar stocking policy and stocking rate per grazed hectare. When the gravel extraction is underway, total stock numbers will be adjusted to allow for the loss of productive land, but the maximum area of intensive winter grazing will not increase.

3.4.12 Management plans

The following draft management plans are provided with this application and will be finalised and provided to the relevant council for certification, in accordance with the proposed conditions of consent:

- Draft Quarry Management Plan, August 2023 (refer **Appendix 6)**.
- Draft Dust Management Plan prepared by PDP, August 2023 (refer **Appendix 7**).
- Draft Soil Management Plan prepared by PDP, July 2023 (refer **Appendix 13a**).

4.0 Resource Consents Held and Utilised by Burnham 2020 Limited

Burnham 2020 Limited previously held the following regional consents from Environment Canterbury.

Consent Number	Authorised Activity	
CRC222536 (Consent 1)	To take and use groundwater.	Expired 28 February 2022
CRC084252	Discharge of domestic sewage to ground.	Certificate of Compliance
CRC221642 (Consent 2)	To use groundwater (for quarrying activities)	Expired 28 February 2022

Consent 1(CRC222536)

In summary, Water Consent CRC222536 enables groundwater abstraction not exceeding 1,937,000 cubic metres between 1 July and the following 30 June in any year, to be taken at a rate of 210 litres per second from:

(a) Bore M36/7710, 300 millimetres diameter and a proposed depth of 100 metres, at or about map reference NZMS 260 M36:5204-3406; and

(b) Bore M36/7711, 300 millimetres diameter and a proposed depth of 100 metres, at or about map reference NZMS 260 M36:5268-3507; and

(c) Bore M36/7712, 300 millimetres diameter and a proposed depth of 100 metres, at or about map reference NZMS 260 M36:5272-3455; and

(d) Bore M36/7713, 300 millimetres diameter and 154 metres deep, at or about map reference NZMS 260 M36:5368-3410.

Water Consent CRC222536 permits any water taken to be used to irrigate the Site.

Consent 2 (CRC221642)

In summary, Water Consent CRC221642 enables groundwater abstracted under CRC222536 (or any subsequent replacement consent) to be used for quarrying activities. Quarrying activities are defined in Consent 2 as including (but not limited to): washing of aggregate, dust suppression (including high pressure water sprays and fogs fitted to processing plant); truck washing and site mitigation, rehabilitation and restoration (including irrigation of native tree and shrub plantings established for amenity screening).

The Applicant is required to keep records of water taken as follows:

i. the permit holder must keep records that provide a measurement of the water used under the permit

ii. the records must specify if the water was used for consumptive or non- consumptive (e.g. taken and discharged back to ground) purposes

iii. the records must comprise measurements in cubic metres of the volume of water used on each day.

Due to the expiry of Consent Numbers CRC222536 and CRC221642, Burnham 2020 Limited has lodged applications with Environment Canterbury to renew the following consents in accordance with s124 of the RMA.

Consent Number	Activity for which consent has been sought	
CRC222635	To renew CRC222536 and CRC221642 – water permits to take and use water.	Application is on-hold under section 91, RMA pending receipt of applications to undertake quarrying i.e. discharges to land and air, extraction and cleanfilling.

Burnham 2020 Limited utilises the following consents:

Consent Number	Authorised Activity	Expiry Date
CRC165686 held by Central Plains Water Trust, which licences the Applicant to use that consent consistent with conditions 1,2,3,4,7,8,9, 10,11 and 12.	To discharge nitrogen to ground.	25 July 2047.
CRC165680 held by Central Plains Water Limited, which licences the Applicant to use water in a manner that is consistent with the conditions of consent.	To take and use surface water from the Rakaia River and Waimakariri River.	25 July 2047.

5.0 Statutory Matters

5.1 Resource Management Act 1991 (RMA)

Although the Natural and Built Environments Bill has now been passed, this application has been made prior to the Canterbury Region's NBEA date. It will therefore continue to be processed and determined under the RMA[5].

The following section sets out the relevant matters under the RMA that apply to this application.

5.1.1 Consideration of applications under the RMA

In considering an application for a resource consent, consent authorities must have regard to the following sections of the Act:

- s104 Consideration of applications; and
- s104B Determination of applications for discretionary or non-complying activities; and
- s107 Restriction on grant of certain discharge permits; and
- s108 Conditions of resource consents; and
- s15 Discharge of contaminants into environment.

5.2 National Environmental Standards for Freshwater

The Freshwater NES (NES-F) set requirements for carrying out certain activities that pose risks to freshwater and freshwater ecosystems. Anyone carrying out these activities will need to comply with the standards. The standards are designed, amongst other matters, to set minimum requirements for feedlots and other stockholding areas, improve the practice of intensive winter grazing of forage crops and restrict further agricultural intensification until the end of 2024.

This application will reduce stock numbers on the property, and the maximum area of intensive winter grazing will not increase, therefore no additional consent is needed under the temporary intensification provisions in the NES-F.

5.3 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES-CS)

The National environmental standard for assessing and managing contaminants in soil to protect human health (NES-CS) is a nationally consistent set of planning controls and soil contaminant values. It ensures that land affected by contaminants in soil is appropriately identified and assessed before it is developed - and if necessary, the land is remediated, or the contaminants contained to make the land safe for human use.

[5] NBEA, 1st Sched, cl 17 and 18.

A Preliminary Site Investigation has been undertaken by PDP (**Appendix 11**), which identified a number of potentially contaminating activities occurring or that have occurred within the Site. PDP has also prepared an addendum report clarifying risk associated with potential contaminated areas within the Site (**Appendix 11a**), which included identification of the following HAIL activities: an above ground diesel tank in the yard of the former forestry block (anecdotal), two above ground fuel storage tanks, storage of bulk fertilisers and other materials such as fence posts, tyres and waste pits/infill pits.

It is proposed that potentially contaminated land is managed by undertaking targeted detailed site investigations of each HAIL area as the quarrying activity progresses to ensure that any contamination sources associated with the on-going use of the Site for primary production are captured in the assessments. Any remedial works will be identified in a Site Management Plan prepared for the Site.

Consequently, consent is required as a **Discretionary Activity** under Clause 11 of the NES-CS as no DSI has been prepared. A full statutory assessment can be found in **Section 5a**.

5.4 Operative Selwyn District Plan

The Operative Selwyn District Plan was made operative in 2016. The SDP controls the use of land and physical resources across the Selwyn District and manages the adverse effects of activities on the environment and people.

5.4.1 Zoning and Overlays

The Site is zoned as Rural Outer Plains and there is a fault line that runs across the northern portion of the Site. It is not within the Cultural Landscape/Values Management Area and is not subject to any overlays or designations (refer to map in the **Appendix 5**).

Aylesbury Road is an arterial road (Strategic) and Grange Road is a local road.

5.4.2 Definitions

It is necessary to determine how quarrying and aggregate processing are defined in the Selwyn District Plan.

Part D of the District Plan sets out the following definitions:

Definition	Discussion
Industrial Activity - means any activity involving the manufacturing, production, processing, assembly, disassembly, packaging, servicing, testing, repair and/or warehousing of any materials, goods, products, machinery or vehicles, but excludes mining, mineral exploration and quarrying.	The definition of industrial activity specifically excludes quarrying. The definition of 'Rural Based Industrial Activity' applies to the processing of raw materials i.e. aggregate that is quarried in the rural environment and crushed to produce a commercial product.

Rural Based Industrial Activity - means an Industrial Activity that involves the use of raw materials or primary products which are derived directly from the rural environment, including agricultural, pastoral, horticultural, forestry, viticultural and crops.	
Quarrying - to take, mine or extract, by whatever means, any rock, stone, gravel or sand existing in its natural state in land. "To quarry" has a corresponding meaning.	The definition of quarrying can be applied to the proposed extraction of aggregate. However, no rules in the District Plan use the term 'quarrying' and therefore, this definition cannot be applied to determine the status of a quarrying activity. Neither does this definition include crushing extracted material, the stripping and placement of overburden and other associated quarrying activities.
Rural Activity – the use of land or building(s) for the purpose of growing or rearing crops or livestock including forestry, viticulture, and horticulture and livestock production and may include a dwelling.	The definition of 'Rural Activity' in the District Plan does not include quarrying. This is inconsistent with the definition in the Regional Policy Statement which includes quarrying within the definition of 'Rural Activity'. The definitions of 'Industrial activity' and 'Rural Based Industrial Activity' in the District Plan, also do not provide for quarrying (extraction).
Earthworks: include any disturbance, to, or excavation, removal or deposition of, soil, earth or any other mineral derived from the ground. For the purpose of Rule 1, Earthworks, do not include disturbing soil associated with the following activities: digging post-holes, cultivation, tending or landscaping gardens, planting trees or removing dead or diseased trees. It does include disturbance of earth associated with harvesting trees.	The definition of 'earthworks' does provide for the excavation and removal of minerals from the ground. As such, the quarrying of aggregate is included within the definition of 'earthworks' in the District Plan.

Quarrying is not defined as a rural activity in the Operative Selwyn District Plan, despite the fact that it relies on a resource that is mostly extracted within the rural zone. This is due to the need for large areas of land that is remote from substantial areas of population as quarries often generate high volumes of traffic and can generate effects such as dust. Therefore, for the purposes of this application, the extraction of aggregate is defined as earthworks and a non-rural activity.

The processing of aggregate is defined as a Rural-Based Industrial Activity.

5.4.3 Rules

C1 Earthworks, C2 Tree planting, C3 Buildings, C4 Roading, C6 Signs and Noticeboards, C7 Hazardous Substances, C8 Waste and C9 Activities are of relevance to this application.

A full assessment against the relevant rules in the District Plan is contained in **Section 5b.** In summary, consent is required for the following activities:

Matter	Reason	Activity status
1.7.6: Earthworks	Exceeds 5000m^3 per project. A vertical cut face where more than 5% of the total vertical cut is over 2m.	Discretionary.
2.1.1.5: Shelterbelts and Amenity Planting	Planting trees that shade: (a) Any part of the carriageway of any road between 1000 and 1400 hours (inclusive) on the shortest day of any calendar year; and (b) Any property under different ownership between 1000 and 1400 hours (inclusive) on the shortest day of any calendar year;	Restricted Discretionary.
3.9.2.1: Buildings and Access	Legal access will be to a formed and maintained legal road that is Aylesbury Road, which is a strategic road.	Restricted Discretionary.
4.5.1.2 and 9.12.1: Vehicle Access	The vehicle accessway will not be formed to the relevant design and formation standards set out in Appendix E10.2.	Discretionary.
4.5.1.6 and 9.12.1: Vehicle Access	There is legal access to Grange Road (local road) but this to be retained for vehicles associated with primary production on the Site. Access to the quarry will be Aylesbury Road, which is an arterial road. The vehicle accessway or vehicle crossing will not comply with the performance criteria given in Appendix E10.2.2.	Restricted Discretionary.
4.5.1.8 and 9.12.1: Vehicle Access	There is legal access to Grange Road (local road) but this to be retained for vehicles associated with primary production on the Site. Access to the quarry will be Aylesbury Road, which is an arterial road.	Discretionary.

6.4.2 Outdoor Signs and Strategic Roads	The proposed signs at the site access will not be separated by 80m.	Restricted Discretionary.
7.1.2: Hazardous Substances	The storage of hazardous substances will exceed the limits in Appendix E15, being 5,000 litres of diesel and 10kg of oils and greases. It is proposed to store up to 30,000 litres of diesel and up to 1,000kg of oils and greases.	Discretionary.
9.4.2: Non-Rural Activity	The maximum area of the quarry site covered by building(s), loading, storage and waste areas used for extraction activities will exceed 100m^2 and more than two full-time equivalent persons will be employed on the quarry site.	Discretionary.
9.5.3 Rural Based Industrial Activity	The maximum area of the quarry site associated with the processing of aggregate will exceed 100m^2 and more than two full-time equivalent persons will be employed on the quarry site.	Discretionary as the Site is in the Outer Plains.
9.16.2: Activities and Noise	Quarry activities will commence at 0700 hrs and noise emissions from the Site will not comply with the permitted activity night-time noise standards for the 30-minute period until 0730 hrs when the daytime noise limits apply.	Discretionary.
9.13.2: Vehicle Movements	The number of vehicle movements on generated by the proposal will exceed 30 equivalent car movements per day averaged over any, one-week period.	Discretionary.

5.4.4 Activity Status - Land use consent

The proposed quarry will require land use consent in accordance with the following rules of the Operative District Plan:

- 1.7.6 (Earthworks).
- 2.1.1.5 (Shelterbelts and Amenity Planting).
- 3.9.2.1 (Buildings).
- 4.5.1.2, 4.5.1.6, 4.5.1.8 and 9.12.1 (Vehicle Access).
- 6.4.2 (Outdoor Signs and Strategic Roads).
- 7.1.2 (Hazardous Substances).

- 9.4.2 (Non-Rural Activity).
- 9.5.3 (Rural Based Industrial Activity).
- 9.16.2 (Noise).
- 9.13.2 (Vehicle Movements).

It is overall a **Discretionary Activity**.

5.5 Partially Operative Selwyn District Plan

Decisions on submissions to the Partially Operative Selwyn District Plan (POSDP) were notified on 19th August 2023. Consequently, all rules in the POSDP have legal effect and those of relevance to this Proposal are addressed below. The POSDP controls the use of land and physical resources across the Selwyn District and manages the adverse effects of activities on the environment and people.

5.5.1 Zoning and Overlays

The Site is zoned as General Rural and there is a fault line that runs across the northern portion of the Site, which is mapped as Greendale Fault Overlay and Fault Awareness Overlay. It is not within an Outstanding Natural Landscape or a Visual Amenity Landscape. However, the Site lies within the Plains Flood Management Overlay (refer to map in the **Appendix 5**).

Aylesbury Road is an arterial road and Grange Road is a local road.

5.5.2 Definitions

It is necessary to determine how quarrying and aggregate processing are defined in the POSDP.

Part 1 – Introduction and General Provisions / Interpretation / Definitions of the POSDP sets out the following definitions:

Definition	Discussion
Primary Production means: a. any aquaculture, agricultural, pastoral, horticultural, mining, quarrying or forestry activities; and b. includes initial processing, as an ancillary activity, of commodities that result from the listed activities in a); c. includes any land and buildings used for the production of the commodities from a) and used for the initial processing of the commodities in b); but	Quarrying is defined as Primary Production and therefore is anticipated to occur in the General Rural Zone. It also includes the processing of aggregate by way of reference to 'initial processing' of a quarried product as well as the use of buildings and land for extraction and the processing of aggregate.

d. excludes further processing of those commodities into a different product.	
Mineral Extraction - Any mining or quarrying activity.	Quarrying activities are specifically defined and provided for within the POSDP and cover a broad spectrum of activities. Therefore, there is no requirement to consider separate rules for earthworks (extraction), processing of aggregate, buildings and cleanfilling. The temporary bunds are included in the definition as they are essentially storage areas.
Quarry - means a location or area used for the permanent removal and extraction of aggregates (clay, silt, rock or sand). It includes the area of aggregate resource and surrounding land associated with the operation of a quarry and which is used for quarrying activities.	
Quarrying Activities - means the extraction, processing (including crushing, screening, washing, and blending), transport, storage, sale and recycling of aggregates (clay, silt, rock, sand), the deposition of overburden material, rehabilitation, landscaping and cleanfilling of the quarry, and the use of land and accessory buildings for offices, workshops and car parking areas associated with the operation of the quarry.	
Principal Building - Any building or buildings which is/are used as part of the primary activity or activities on the site. Principal buildings include residential units, but do not include: a. accessory buildings; b. containers in the PORTZ.	This definition is relevant to the Natural Hazard provisions. Principal Building includes the site office, laboratory and workshops.

Quarrying is defined as Primary Production activity in the POSDP, recognising the fact that it relies on a resource that is mostly extracted within the rural zone. However, the activity of quarrying is specifically defined as a broad range of activities that enables it to be considered holistically.

Therefore, for the purposes of this application, the extraction and process of aggregate, transport, storage, the deposition of overburden material, rehabilitation, landscaping and cleanfilling of the quarry, and the use of land and accessory buildings for offices, workshops and car parking areas associated with the operation of the quarry are defined as Quarrying Activities.

5.5.3 Rules

General Rural, Transport, Natural Hazards, Hazardous Substances, Light, Noise and Signs are of relevance to this application.

A full assessment against the relevant rules in the POSDP is contained in **Section 5c.** In summary, consent is required for the following activities:

Matter	Reason	Activity status
GRUZ-R21-3: Mineral Extraction.	The excavation of aggregate will not be setback 200m from the notional boundaries of lawfully established residential activities.	Discretionary.
Rule TRAN-R4.2: Vehicle Crossings.	The vehicle crossing will be a quarrying activity that will generate more than 40 vehicle movements per day.	Restricted Discretionary.
TRAN-R7-2: Rural Vehicle Movements and Associated parking.	The number of vehicle movements generated by the proposal will exceed 60 equivalent vehicle movements per day averaged over any, one-week period.	Restricted Discretionary.
TRAN-R8-3 High Trip Generating Activities.	The quarry will generate 50 vehicles per peak hour (at its busiest) at Year 2030 and 112 at Year 2035, and therefore will exceed the basic ITA threshold.	Restricted Discretionary.
SIGN-R4.2. Signs Adjacent to State Highways or Arterial Roads.	The two signs at the site access will not be setback 20m from the road (the setback required for a building from the road boundary).	Restricted Discretionary.

5.5.4 Activity Status - Land use consent

The proposed quarry will require land use consent in accordance with the following rules of the POSDP:

- GRUZ-R21 (Mineral Extraction).
- TRAN-R4 (Vehicle Crossings).
- TRAN-R7 (Rural Vehicle Movements and Associated parking).
- TRAN-R8 (High Trip Generating Activities).
- SIGN-R2 (Signs Adjacent to State Highways or Arterial Roads).

It is overall a **Discretionary Activity**.

5.6 Weighting of the SDP and the POSDP

Burnham 2020 has sought legal advice on the weight that should be given to each of the respective district plans: the SDP and the POSDP. This is set below and is intended to provide guidance, rather than formal legal advice, to the decision makers.

The Decisions Version of the Partially Operative Selwyn District Plan (POSDP) was publicly notified on 19 August 2023. Pursuant to s 86B of the RMA, the rules in the POSDP now have legal effect, alongside the rules of the Operative Selwyn District Plan (SDP).

The rules in the POSDP will replace the SDP rules as soon as they are either "treated as" being operative or Selwyn District Council formally makes them operative:

a) Under section 86F of the RMA rules in the POSDP must be treated as operative once the appeal period has expired without any appeals lodged in relation to the rule, or all appeals on the relevant rule have been resolved. As a consequence, any equivalent rules in the SDP must be treated as inoperative from that point.

b) Once the POSDP's provisions are beyond challenge, Selwyn District Council will approve the SDP, or parts thereof, and then publicly notify an operative date. On that date the POSDP, whether in whole or in part, will formally become operative and render either the whole or part of the SDP inoperative.

Until the POSDP's rules are treated as operative, the rules in the SDP and POSDP both apply when considering a resource consent application; that is, consent must be granted under both plans. As soon as the POSDP's rules are treated as operative, the SDP's equivalent rules must be treated as inoperative.

The progress of the POSDP cannot render the activity status of the proposal more stringent than when the application was lodged. However, in cases where the SDP classifies the proposal more leniently, at the point the POSDP rules are treated as operative (and the SDP rules inoperative), the applicant is entitled to any benefit.

As s 86F only applies to rules, the non-rule provisions of the SDP such as its objectives and policies will continue to be operative until the POSDP's operative date.

There is no statutory guidance as to the weight to be accorded to operative and proposed plan provisions during the transition time when both plans have legal effect. However, the High Court has endorsed the following guidance:

a) The weight to attach to a proposed plan is a factual enquiry to be considered on its own merits and particular facts.

b) The importance of the proposed plan will depend on the extent to which it has proceeded through the objection and appeal process. "The closer the proposed plan comes to its final content the more regard is had to it". The likelihood of success of any appeal is also relevant consideration, with some bearing on the likelihood of the proposed provision becoming operative.

c) Where there has been a significant shift in Council policy and the new provisions are in accordance with Part II of the RMA, the proposed plan may be accorded more weight.

d) The extent to which the provisions of a proposed plan are relevant should be considered on a case by case basis and might include:

   i) the extent (if any) to which the proposed measure might have been exposed to testing and independent decision-making;

   ii) circumstances of injustice;

   iii) the extent to which a new measure, or the absence of one, might implement a coherent pattern of objectives and policies in a plan.

The POSDP has been through the public submission and council hearing processes, and therefore deserves some weight on that basis alone. Where it also better aligns with national or regional policy, or relies on more up to date standards, there are reasons for according it greater weight. Once the appeal period for Selwyn District Council's decision on the POSDP passes, the question of weight will have to be reappraised bearing in mind which parts of the POSDP are challenged, and which are unchallenged.

5.7 Canterbury Land and Water Regional Plan (CLAWRP)

The CLAWRP was made operative in 2018. It identifies the resource management outcomes or goals (objectives) for sustainably managing land and water resources in Canterbury and the policies and rules needed to achieve the objectives.

The Site is located in the Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone. The taking and use of water is addressed in application CRC222635 that seeks to renew CRC222536 and CRC221642 – Water permits for the taking and using of water, so those activities are not covered by this application.

The CLAWRP activities for which consent is sought under this application are set out below.

5.7.1 Definitions

Definition	Discussion
Cleanfill: means material that, when buried, will have no adverse effects on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of: 1. combustible, putrescible, degradable or leachable components; 2. hazardous substances; 3. products or materials derived from hazardous waste treatment, hazardous	There is clearly an overlap between the definitions of 'cleanfill and 'earthworks' in terms of filling a site with soil and rock. However, the rules in the CLWRP apply to the "excavation" and the "deposition" of material. The rules do not assign a particular status to earthworks or cleanfill. Any deposition must be limited to cleanfill material in order for it to enjoy controlled activity status. Therefore, the filling of the quarry with material is defined as deposition, using cleanfill material.

waste stabilisation, or hazardous waste disposal practices; 4. materials that may present a risk to human or animal health, such as medical and veterinary waste, asbestos, or radioactive substances; or 5. liquid waste.	
Earthworks: means the excavation of, and/or filling with topsoil, subsoil, sediments, rock and/or other underlying materials on which the soil is formed. Earthworks include, but are not limited to, the construction and maintenance of roads, tracks, firebreaks and landings, and ground shaping (recontouring), root raking and blading. Earthworks excludes: (a) cultivation of the soil for the establishment of, or harvesting of, crops or pasture; or (b) digging of postholes for the construction of fences; (c) works for research and monitoring such as coring, water bores and the use of piezometers; (d) ripping in of water pipes or cables; (e) establishment, maintenance and/or enhancement of wetlands, domestic gardens or amenity planting; (f) harvesting of horticultural crops.	

5.7.2 Rules

On-Site wastewater, greywater, dust suppressants, industrial and trade wastes, stormwater, earthworks over aquifers and hazardous substances are of relevance to this application.

A full assessment against the relevant rules in the District Plan is contained in **Section 5d**. In summary, consent is required for the following activities:

Rule	Assessment	Activity Status
5.92	The discharge of liquid waste and sludge waste will exceed 10m^3 per day and the rate of discharge may exceed 5mm per day.	Discretionary.

Rule	Assessment	Activity Status
11.5.28	The discharge of any wastewater from an industrial or trade process, into or onto land, within the Selwyn Te Waihora sub-region that meets the conditions under Rule 11.5.28.	Discretionary.
5.97	The discharge of stormwater from buildings, car parks, internal roads, quarried areas, processing areas and stockpiles into or onto contaminated land that will be partly associated with rural activities and partly an industrial activity.	Discretionary.
5.100	The discharge of water through cleanfill is not controlled and therefore cannot meet Condition 1 (volume and rate of application) and Condition 6 (does not occur when the soil moisture exceeds field capacity) of Rule 5.98.	Discretionary.
5.177	It is proposed to deposit more than 50m^3 of material in any consecutive 12-month period onto land which will have been excavated to a depth in excess of 5m below the natural land surface, and discharge contaminants onto or into land where it may enter water, that meets the conditions of Rule 5.177.	Controlled.

5.7.3 Activity Status

The proposed quarry will require consent to discharge to land in accordance with Rules:

- 5.6 (discharge of water through cleanfill).
- Rules 5.92 and 11.5.28 (discharge of any liquid waste or sludge waste from an industrial or trade process).
- Rule 5.97 (discharge of stormwater).
- Rule 5.100 (discharge of water from the silt ponds).
- Rule 5.177 (deposition of, and discharge of water through cleanfill).

of the CLAWRP and is overall a **Discretionary Activity**.

5.8 Canterbury Air Regional Plan ('CARP')

The CARP was made operative in 2017 and manages activities that could adversely affect air quality across the Canterbury region. The Site is not located in a Clean Air Zone as mapped in Section 9 of the CARP.

5.8.1 Definitions

Definition	Discussion
Bulk solid materials: means materials consisting of, or including, fragments that could be discharged as dust or particulate. These materials include but are not limited to: gravel, quarried rock, fertiliser, coal, cement, flour, rock aggregate, grains, compost and woodchip.	The aggregate to be extracted, processed, stockpiled and conveyed within and transported off the Site will consist of fragments that could be discharged as dust or particulate. The definition also specifically refers to gravel, quarried rock and rock aggregate and so applies to this proposal. It is noted that this definition is used within the rules that manage stockpiling.
Cleanfill: means material that, when buried, will have no adverse effects on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of: a. combustible, putrescible, degradable or leachable components; b. hazardous substances; c. products or materials derived from hazardous waste treatment, hazardous waste stabilisation, or hazardous waste disposal practices; d. materials that may present a risk to human or animal health, such as medical and veterinary waste, asbestos, or radioactive substances; or e. liquid waste.	Cleanfill under the CARP includes virgin natural materials such as soil and clay, and presumably silt would also be included within this term. The definition also includes inert materials such as concrete, and presumably crushed glass. Unlike the CLAWRP, there is no definition or reference to earthworks in the CARP, therefore the soil and silt to be deposited on the Site is defined as cleanfill.
Handling: means extraction, quarrying, mining, processing, screening, conveying, blasting, or crushing of any material.	Rules in the CARP refer to the 'handling' of material, rather than the specific activities of extraction, processing or conveying etc of aggregate.
Industrial or trade process (RMA): includes every part of a process from the receipt of raw material to the dispatch or use in another process or disposal of any product or waste material, and any intervening storage of the	The proposal includes receipt of aggregate (raw material) within the Site, processing of the aggregate, storage and dispatch. This is defined as an industrial or trade premise under the CARP and makes the Site an industrial or trade premises. We also

raw material, partly processed matter, or product. **Industrial or trade premises (RMA)**: means: a. any premises used for any industrial or trade purposes; or b. any premises used for the storage, transfer, treatment, or disposal of waste materials or for other waste-management purposes, or used for composting organic materials; or c. any other premises from which a contaminant is discharged in connection with any industrial or trade process; but does not include any production land.	understand from previous applications, that this is the approach taken by ECan.
Sensitive activity: means an activity undertaken in: a. the area within 20m of the façade of an occupied dwelling; or b. a residential area or zone as defined in a district plan; or c. a public amenity area, including those parts of any building and associated outdoor areas normally available for use by the general public, excluding any areas used for services or access areas; or d. a place, outside of the Coastal Marine Area, of public assembly for recreation, education, worship, culture or deliberation purposes.	A sensitive activity is defined as 'the area within 20m of the façade of an occupied dwelling' rather than the dwelling itself. This equates to the concept of 'notional boundary' which is often used in district plans in relation to noise. It is intended to protect the amenity anticipated within residential properties but outside dwellings and protects the level of amenity anticipated in outdoor living areas. There are a number of residential properties in the vicinity of the Site and applicable rules that trigger a setback from sensitive activities, making this definition relevant to this proposal.

Therefore, for the purposes of this application, the Site is defined as an Industrial and Trade premise as aggregate is processed and stored within its boundaries.

The extraction and processing of aggregate is defined as handling and extracted material (when stockpiled) is defined as bulk solid material. Soil and silt (to be deposited within the Site) is defined as cleanfill.

5.8.2 Rules

Rules applying to all activities and industrial, trade or commercial premises are relevant to this application.

A full assessment against the relevant rules in the CARP is contained in **Section 5e**. In summary, consent is required for the following activities:

Rule	Assessment	Activity Status
7.64	The discharge of contaminants into air from the handling of bulk solid materials.	Discretionary.
7.63	The discharge of contaminants into air from the disposal of cleanfill.	Discretionary.

5.8.3 Activity Status

The proposed quarry will require air discharge permits in accordance with Rules:

- 7.64 (discharge of contaminants into air from the handling of bulk solid materials).
- 7.63 (discharge of contaminants into air from the disposal of cleanfill).

of the CARP and is overall a **Discretionary Activity**.

5.9 Summary

In summary, the following consents are being sought:

Plan	Activity Status	Activity
SDP	Restricted Discretionary.	Access off Aylesbury Road (Strategic/Arterial Road).
	Discretionary.	Earthworks. Vehicle access. Vehicle movements. Signs. Noise. Storage of hazardous substances. Quarrying and processing of aggregate.
POSDP	Restricted Discretionary	Vehicle Crossings.
		Rural Vehicle Movements and Associated parking.
		High Trip Generating Activities.
		Signs Adjacent to State Highways or Arterial Roads.

	Discretionary.	Mineral Extraction.
CLWRP	Controlled.	Deposition of cleanfill.
	Discretionary.	The discharge of liquid waste from an industrial or trade process. The discharge of any wastewater from an industrial or trade process, into or onto land, within the Selwyn Te Waihora sub-region that meets the conditions under Rule 11.5.28. The discharge of stormwater. The discharge of water through cleanfill to ground.
CARP	Discretionary.	The discharge of contaminants into air from the handling of bulk solid materials. The discharge of contaminants into air from the disposal of cleanfill.

Overall, the proposal requires under the:

- SDP as a **Discretionary Activity**;
- POSDP as a **Discretionary Activity**;
- CLWRP as a **Discretionary Activity**;
- CARP as a **Discretionary Activity**; and
- NES-CS as a **Discretionary Activity**.

5a NES-CS Statutory Assessment

The National Environment Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES) states that the NES applies when a person wants to sample the soil on a piece of land, disturb the soil of the piece of land, or change the use of the piece of land, which means changing it to a use that is reasonably likely to harm human health, if the piece of land (Clause 5(7)):

- has an activity or industry described in the Hazardous Activities and Industries List (HAIL) being undertaken on it, or
- an activity or industry described in the HAIL has been undertaken on it, or
- it is more likely than not that an activity or industry described in the HAIL is being or has been undertaken on it.

The following activities, of relevance, are listed in HAIL:

A Chemical manufacture, application and bulk storage

1. Agrichemicals including commercial premises used by spray contractors for filling, storing or washing out tanks for agrichemical application.
6. Fertiliser manufacture or bulk storage.
8. Livestock dip or spray race operations.
10. Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds
17. Storage tanks or drums for fuel, chemicals or liquid waste.

Firstly, it needs to be determined if a HAIL activity is occurring, has or is likely to have, occurred within the Site.

A Preliminary Site Investigation has been undertaken by PDP (**Appendix 11**), which identified a number of potentially contaminating activities occurring or that have occurred within the Site. Preliminary soil sampling was undertaken under Clause 5(3), but this was confined to the areas away from the farm's known operational areas to provide a general characterisation of any past broad-acre contamination. No indicators of contamination were identified in the surface soils with concentrations similar to background levels for the area. No soil sampling was undertaken in the current operational yard area or known pit locations as these areas will continue to be used for primary production for some time.

Clause 5(8) states that if a piece of land described in Clause 5(7) is production land, these regulations apply if the person wants to—

Activity	Comment
(a)remove a fuel storage system from the piece of land or replace a fuel storage system in or on the piece of land:	It is not proposed to remove a fuel storage system.
(b)sample or disturb— (i)soil under existing residential buildings on the piece of land: (ii)soil used for the farmhouse garden or other residential purposes in the immediate vicinity of existing residential	There was previously a residential building in the southeast corner of the Site but there are no existing residential or proposed residential units.

buildings: (iii)soil that would be under proposed residential buildings on the piece of land: (iv)soil that would be used for the farmhouse garden or other residential purposes in the immediate vicinity of proposed residential buildings:	
(c)subdivide land in a way that causes the piece of land to stop being production land:	It is not proposed to subdivide the Site.
(d)change the use of the piece of land in a way that causes the piece of land to **stop** being production land.	The land will stop being production land for a period of time whilst quarrying is undertaken.

Clause 8 (4) provides for subdividing or changing the use of a piece of land as a permitted activity while the following requirements are met:

Requirement	Comment
(a)a preliminary site investigation of the land or piece of land must exist.	A Preliminary Site Investigation has been undertaken by PDP (**Appendix 11**).
(b)the report on the preliminary site investigation must state that it is highly unlikely that there will be a risk to human health if the activity is done to the piece of land.	The PSI identified several areas where activities listed in the Hazardous Activities and Industries List (HAIL) are likely to have been undertaken. The PSI also involved broad sampling of soil surfaces outside of HAIL activity areas. The sampling results showed that likely indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) are at background levels. PDP also prepared an addendum report clarifying risk associated with potential contaminated areas within the Site (**Appendix 11a**), which included identification of the following HAIL activities: • an above ground diesel tank in the yard of the former forestry block (anecdotal); • two above ground fuel storage tanks; • storage of bulk fertilisers; and • other materials such as fence posts and tyres and waste pits/infill pits.
(c)the report must be accompanied by a relevant site plan to which the report is referenced.	The full PSI can be found in **Appendix 11** and is provided as part this application.
(d)the consent authority must have the report and the plan.	

However, the PSI recognises that farming will continue across most of the Site with further potential risk for contamination from the storage of farm equipment and materials. As such, it is proposed that identified HAIL areas will be subject to targeted detailed site investigations (DSI's) as quarrying progresses across the Site. This will ensure that any ongoing activities are captured by the assessments, and any remedial actions applied accordingly.

Remedial actions will vary according to the nature and extent of contamination found during any DSI, but waste material is likely to require sorting and/or offsite disposal. In other areas, the contamination from normal farming operations is not expected to result in the need for large scale remedial works. However, these matters will be addressed in any Site Management Plan prepared following the DSI phase.

Consequently, consent is required as a **Discretionary Activity** under Clause 11 of the NES-CS as no DSI has been prepared.

5b SDC Statutory Assessment

EARTHWORKS AND CONTAMINATED LAND

Permitted Activities — Earthworks and Contaminated Land

1.2.1 Any earthworks which meet the following condition shall be a permitted activity:

1.2.1.1 Any soil or earth to be removed from the site is not contaminated.

Restricted Discretionary Activities — Earthworks and Contaminated Land

1.2.2 The removal of contaminated soil or earth from a site shall be a restricted discretionary activity.

1.2.3 Under Rule 1.2.2, the Council shall restrict its discretion to the consideration of:

1.2.3.1 Where the contaminated soil will be disposed to and how; and

1.2.3.2 Any monitoring conditions.

1.7 EARTHWORKS AND SETBACKS, VOLUME AND SITE REHABILITATION

Any earthworks which meet the following conditions shall be a permitted activity:

1.7.1.1 The earthworks are set back at least 20m from the edge of any waterbody (excluding aquifers):

(a) unless the earthworks are those undertaken within a road reserve and are for the purpose of installing underground network utility infrastructure; or

(b) except that for rivers the following earthworks are subject to a reduced setback of 5m:

(i) $100m^2$ (area) per 1000 metres in any continuous 5 year period; and

(ii) $40m^3$ (volume) per 1000 metres in any continuous 5 year period; or

(iii) any earthworks which has been granted resource consent for a discretionary or non- complying activity from the Canterbury Regional Council; or

1.7.1.2 The earthworks do not exceed:

(a) A vertical cut face where no more than 5% of the total vertical cut is over 2m; and

(b) A maximum volume of $5000m^3$ per project.

1.7.1.4 Any stockpiling of earth, soil or other material within 100m of any dwelling, other than a dwelling erected on the same property as the earthworks, is to be kept moist and consolidated.

Restricted Discretionary Activities — Earthworks and Setbacks, Volume and Site Rehabilitation

1.7.2 Any earthworks which do not comply with Rule 1.7.1.4 shall be a restricted discretionary activity.

1.7.3 Under Rule 1.7.2, the Council shall restrict its discretion to consideration of:

1.7.3.1 Any potential dust nuisance caused by the stockpiled material;

1.7.3.2 The effectiveness of any proposed mitigation measures; and

1.7.3.3 The need for monitoring and review conditions on the consent.

1.7.6 Discretionary Activities — Earthworks and Setbacks, Volume and Site Rehabilitation

Any earthworks which do not comply with Rules 1.7.1.1, 1.7.1.2 or 1.7.1.3 shall be a discretionary activity.

ASSESSMENT

The land is contaminated in small areas but there are no waterways in the vicinity of the Site.

The earthworks will exceed a:

- vertical cut face where more than 5% of the total vertical cut is over 2m; and
- maximum volume of 5000m^3.

Therefore, earthworks (including the extraction of aggregate) require consent as a **Discretionary Activity**.

2.1 SHELTERBELTS AND AMENITY PLANTING

Permitted Activities — Shelterbelts & Amenity Planting

2.1.1 The planting of any trees for amenity planting, shelterbelts shall be a permitted activity if all of the following conditions are met:

2.1.1.5 No tree shades:

(a) Any part of the carriageway of any road between 1000 and 1400 hours (inclusive) on the shortest day of any calendar year; and

(b) Any property under different ownership between 1000 and 1400 hours (inclusive) on the shortest day of any calendar year;

2.1.1.6 No tree is planted so that on maturity it encroaches within the line of sight for any railway crossing or road intersection, as shown in Appendix 11.

Restricted Discretionary Activities — Shelterbelts & Amenity Planting

2.1.6 Any tree planting which does not comply with Rule 2.1.1.5 shall be a restricted discretionary activity.

2.1.7 Under Rule 2.1.6 the Council shall restrict its discretion to consideration of:

2.1.7.1 The effects of the proposed shelterbelt on restricting views of the Upper Waimakariri Basin from SH 73 or the Midland Railway including (but not limited to);

(a) Whether expansive views either side of the shelterbelt would remain;

(b) Whether the shelterbelt will screen the view of any lake, Silent File area, Wāhi Taonga Site, Wāhi Taonga Management Area, Mahinga Kai Site, or any area of Outstanding Landscape.

2.1.7.2 The length of the shelterbelt;

2.1.7.3 The need to provide effective stock or crop shelter; and

2.1.7.4 Any positive effects which may offset any adverse effects.

ASSESSMENT

There are no waterbodies within or in proximity to the Site, and all planting will be setback 100m from the intersection of Aylesbury, Grange and Two Chain Roads.

However, trees planted adjacent to Aylesbury Road and Grange Road may shade the road carriageway between 1000 and 1400 hours (inclusive) on the shortest day of any calendar year.

Therefore, the planting of trees requires consent as a **Restricted Discretionary Activity**.

3 RURAL RULES – BUILDINGS

3.9 BUILDINGS AND ACCESS AND PARKING

Permitted Activities — Buildings and Access and Parking

3.9.1 Erecting any building or any additions or alterations to, or modification or demolition of any building shall be a permitted activity if the following conditions are met:

3.9.1.1 Any dwelling or other principal building:

(a) Is erected on a site which has legal access to a formed and maintained legal road other than a road listed as a Strategic Road in Appendix 9; and

(b) does not have its only access to a legal formed road by crossing a railway line.

Notes:

Any access to an allotment shall comply with Rule 4.5.1.

Any carparking for activities associated with the building shall comply with Rule 4.6.1-4.6.5.

Restricted Discretionary Activities — Buildings and Access to Parking

3.9.2 Any dwelling or other principal building which does not comply with Rule 3.9.1.1(a) shall be a restricted discretionary activity if it complies with the following standards and terms:

3.9.2.1 The site has legal access to a legal road (whether a Strategic Road or an unformed or unmaintained road) and that access is not obtained by crossing a railway line.

3.9.2.2 Under Rule 3.9.2.1, the Council shall restrict its discretion to all of the following matters:

For all Sites:

Whether the site can have legal access to a formed and maintained legal road other than a Strategic Road;

For Sites with Access on to Strategic Roads:

(b) The design and location of the vehicle crossing;

(c) The number and type of vehicles, pedestrian or stock using the access;

(d) Any adverse effects, including cumulative effects, on traffic safety or flow on the Strategic Road;

For Sites with Access on to an Unformed or Unmaintained Legal Road

(e) The party who will be responsible for any forming or maintaining of the road.

Non-Complying Activities — Buildings and Access to Parking

3.9.3 Any activity which does not comply with Rule 3.9.1.1(b) or 3.9.2.1 shall be a non-complying activity.

ASSESSMENT

Aylesbury Road is a strategic road, and the Site will be accessed from this road but will not require crossing a railway line. The proposal is therefore a **Restricted Discretionary Activity**.

3.11 BUILDINGS AND SITE COVERAGE

Permitted Activities — Buildings and Site Coverage

3.11.1 Erecting any building or any additions or alterations to, or modification or demolition of, any building shall be a permitted activity if all of the following conditions are met:

3.11.1.1 The maximum area of any allotment covered by buildings shall be:

(a) 35% or 500m^2 whichever is the lesser, for allotments less than 1ha in area.

(b) 5% for all other allotments.

Discretionary Activities — Buildings and Site Coverage

3.11.2 Any building which does not comply with Rule 3.11.1 shall be a discretionary activity.

ASSESSMENT

The maximum area of any allotment covered by buildings will be 5% or 181,000m^2. Therefore, building coverage meets Rule 3.11.1.1 and is a **Permitted Activity**.

3.12 BUILDINGS AND BUILDING HEIGHT

Permitted Activities — Buildings and Building Height

3.12.1 Erecting any building or any additions or alterations to, or modification or demolition of, any building shall be a permitted activity if all of the following conditions are met:

3.12.1.1 That, except where Rule 3.7.1 specifies a lower height, the maximum height of any building does not exceed:

(a) 8m for any building designed or used for human occupation; or

(b) 12m for any other building, except grain silos, where height shall not exceed 25m.

Discretionary Activities — Buildings and Building Height

3.12.2 Any building or part of any building which does not comply with Rule 3.12.1 shall be a **Discretionary Activity**

ASSESSMENT

The buildings and structures on the Site will not exceed 12m in height and are therefore **Permitted Activities**.

3.13 BUILDINGS AND BUILDING POSITION

Permitted Activities — Buildings and Building Position

3.13.1 Erecting any building or any additions or alterations to, or modification or demolition of, any building shall be a permitted activity if all of the following conditions are met:

3.13.1.1 Any building complies with the relevant setbacks from property boundaries and road boundaries as shown in Table C3.2:

Table C3.2 — Setbacks from Boundaries

		Setbacks		
Property Size	**Building Type**	**Property Boundary**	**Arterial Road or Strategic Road**	**Other Road**
Greater than 1ha (>1ha)	Garage or Accessory	5m	10m	10m
	Dwelling or Principal Building	5m	20m	10m
Any Size	Building housing Animals	30m	30m	30m

3.13.1.3 Any building is positioned so that it complies, at the property boundaries, with the relevant recession plane angles in Appendix 16.

3.13.1.4 Any building is setback a minimum distance of:

(a) 100m from the edge of any lake or any wetland which adjoins a lake; and

(b) 20m from the edge of any waterbody listed in Appendix 17 other than a lake; and

(c) 10m from the edge of any other waterbody (excluding aquifers).

Discretionary Activities — Buildings and Building Position

3.13.6 Any building or part of any building, other than a garage or accessory building, which does not comply with Rule 3.13.1.1 shall be a discretionary activity. (Clause 16).

3.13.7 Any building which does not comply with Rule 3.13.1.2 or 3.13.1.3 shall be a discretionary activity.

3.13.8 Except as provided in Rule 3.13.7, any building other than a dwelling or other principal building which does not comply with Rule 3.13.1.4 shall be a discretionary activity.

Non-Complying Activities — Buildings and Building Position

3.13.9 Any dwelling or other principal building which does not comply with Rule 3.13.1.4 shall be a non-complying activity.

ASSESSMENT

All buildings will be located more than 5m from any property boundary and 10m from any road boundary. Therefore, the proposal will meet Rule 3.13.1.1 and is a **Permitted Activity**.

3.14 BUILDINGS AND NIGHT LIGHTING

Permitted Activities — Buildings and Night Lighting

3.14.1 Erecting any building or any additions or alterations to, or modification or demolition of, any building shall be a permitted activity if any outdoor lighting on any building complies with Rule 9.18.

ASSESSMENT

See Rule 9.18.

4 RURAL RULES - ROADS AND TRANSPORT

4.4 ROAD AND ENGINEERING STANDARDS

Permitted Activities — Road and Engineering Standards

4.4.1 The forming, installation, upgrading, maintenance or replacement of any road shall be a permitted activity if the following standards are met:

4.4.1.1 Any part of any road does not have a gradient greater than:

(a) 1:6 vertical; or

(b) 1:20 horizontal.

4.4.1.2 Any road is formed to the relevant standards set out in Appendix E10.3, except that E10.3.1 shall not apply to works to existing roads undertaken by Council pursuant to the Local Government Act.

Discretionary Activities — Road and Engineering Standards

4.4.2 Any activity which does not comply with Rule 4.4.1 shall be a Discretionary Activity.

ASSESSMENT

It is proposed to widen Aylesbury Road to 8m, which essentially requires approximately 1m of widening on each side of the road over a length of approximately 1.5km. This improvement will be carried out to satisfy the 7.5m wide required by Table E10.5 and as such is a **Permitted Activity**.

4.5 VEHICLE ACCESSWAYS AND VEHICLE CROSSINGS

Permitted Activities — Vehicle Accessways and Vehicle Crossings.

4.5.1 The forming, installation, upgrading, maintenance or replacement of any vehicle accessway or vehicle crossing shall be a permitted activity if the following conditions are met:

4.5.1.1 Any part of any vehicle accessway does not have a gradient greater than:

(a) 1:6 vertical; or

(b) 1:20 horizontal.

Note: Rule 4.5.1.1 does not apply to private roads, vehicle accessways or tracks which are intended to be used solely by persons owning or occupying the property and are not located in the road reserve. The rules do apply to vehicle accessways or private roads which are shared between properties, or which are used to provide public access (with landholder's consent).

4.5.1.2 Any vehicle accessway is formed to the relevant design and formation standards set out in Appendix E10.2.

4.5.1.3 Any vehicle accessway complies with the relevant separation and sight distance standards set out in Appendix E10.2.

4.5.1.4 Any vehicle crossing which has a gate positioned across the vehicle crossing, has the gate either opening inwards towards the property and away from the road; or setback a minimum distance of 10 metres from the road boundary;

4.5.1.5 Any vehicle crossing providing vehicle access to a sealed road is sealed:

(a) The full length of the vehicle crossing (from the edge of the sealed carriageway to the road boundary of the property), or;

(b) For the first 10 metres from the sealed carriageway.

4.5.1.6 Any access to a State Highway or Arterial Road complies with the following:

(a) No legal access is available from another lower classification road;

(b) For State Highways only, the traffic generated through the access to the State Highway is less than 100 ecm/d;

(c) The vehicle accessway or vehicle crossing complies with the performance criteria given in Appendix E10.2.2, 10.2.3 and E10.2.4;

(d) Provision is made for manoeuvring on site, so that reverse manoeuvring onto the State Highway or Arterial Road is not required.

4.5.1.8 Any site with more than one road frontage to a road that is formed and maintained by Council, shall have access to the formed and maintained (and legal) road with the lowest classification.

Note: For example, where a site has frontage to both an arterial road and a local road access shall be to the local road.

Restricted Discretionary Activities — Vehicle Accessways and Vehicle Crossings

4.5.2 Any activity which does not comply with Rule 4.5.1.6 shall be a restricted discretionary activity.

4.5.3 The Council shall restrict its discretion to the exercise of:

4.5.3.1 Whether the crossing is sufficiently removed from an intersection having regard to traffic volumes on the roads, and any other factors that will prevent conflict and confusion between vehicles turning at the crossing or at the intersection;

4.5.3.2 The adequacy of available sight distances having regard to the 85th percentile operating speed of vehicles on the road;

4.5.3.3 Whether there is a need to separate entry and exit in order to reduce potential traffic confusion and conflict;

4.5.3.4 Whether the physical form of the road will minimise the adverse effects of access (e.g. whether the road offers good visibility; whether a solid median barrier will stop unsafe right turns or a flush median will assist right hand turns etc);

4.5.3.5 Whether particular mitigation measures such as a deceleration or turning lane are required due to speed or volume of vehicles on the road;

4.5.3.6 The design of the crossing to enable traffic exiting the site to safely enter the traffic

stream;

4.5.3.7 The location and design of the crossing in relation to pedestrian and cycle safety;

4.5.3.8 Whether there is adequate queuing and parking space on site so that vehicles do not queue over vehicle crossings or on the State Highway or Arterial Road;

4.5.3.9 Any potential cumulative effects of extra access points on the function of the State Highway or Arterial Road;

4.5.3.10 Any relevant accident history of the State Highway in the vicinity of the site; and

4.5.3.11 The particular traffic characteristics of an existing or proposed activity, including expected traffic generation, types of vehicles etc

Discretionary Activities — Vehicle Accessways and Vehicle Crossings

4.5.4 Any activity which does not comply with Rules 4.5.1.1, 4.5.1.2, 4.5.1.3, 4.5.1.5(a), 4.5.1.7 or 4.5.1.8 shall be a discretionary activity.

Note: The Council may refer to its Engineering Code of Practice to assist it in deciding on any resource consent application made under Rule 4.5.4, where appropriate.

Non-Complying Activities — Vehicle Accessways and Vehicle Crossings

4.5.5 Any activity which does not comply with Rules 4.5.1.5(b) or 4.5.1.6 shall be a non-complying activity.

ASSESSMENT

The vehicle accessways will have gradients less than 1:6 vertical or 1:20 horizontal, being located at original ground level within the Site.

The proposed vehicle accessway on Aylesbury Road will be located at least 1km from the two road intersections to the east and west. Furthermore, Aylesbury Road is straight and will readily meet the required sight distance of 282m.

The proposed access will be formed to a standard that is consistent with that of a commercial vehicle access onto or from a state highway, which exceeds the relevant design and formation standards set out in Appendix E10.2.

The quarry will be gated for security reasons and will either open inwards or be setback a minimum distance of 10 metres from the road boundary.

The proposed vehicle crossing will be sealed for the full length of the vehicle crossing (from the edge of the sealed carriageway to the road boundary of the property), and for 150m into the Site.

There is legal access to Grange Road (a local road) but this to be retained for vehicles associated with primary production on the Site. Access to the quarry will be from Aylesbury Road (arterial road), and sufficient space will be provided within the Site so that reverse manoeuvring onto Aylesbury Road is not required. In fact, the access road and vehicle crossing will be wide enough to accommodate vehicles entering and exiting the Site.

The two non-compliances are that the Site has more than one road frontage to roads that are formed and maintained by Council, however it is proposed to access the Site from the road with the highest classification, and the vehicle crossing will not comply with the performance criteria given in Appendix E10.2. This infringes two rules: Rule 4.5.1.6 and Rule 4.5.1.8.

The Plan provides for non-compliance with Rule 4.5.1.6 as being both a Restricted Discretionary (Rule 4.5.2) and Non-Complying Activity (4.5.5). It is our understanding from discussions with SDC

on previous applications, that non-compliance is intended to be a **Restricted Discretionary Activity** under Rule 4.5.2. It is also understood that this was how the rules were applied to the application by Fulton Hogan to establish and operate Roydon Quarry (RC185627) (refer to s42a officers report prepared by Andrew Henderson dated 2 September 2019, Paragraphs 21 and 22).

Non-compliance with Rules 4.5.1.2 and 4.5.1.8 is a **Discretionary Activity** under Rule 4.5.4.

4.6 VEHICLE PARKING AND CYCLE PARKING

Permitted Activities — Vehicle Parking and Cycle Parking

4.6.1 Any activity in the Rural Zone which provides car parking in accordance with the following standards shall be a permitted activity.

4.6.1.3 For any other activity:

(a) all car parking associated with an activity must be located either on-site or on land adjoining the site and not on the road reserve; and

(b) all loading (including unloading) associated with an activity must be undertaken on-site or on land adjoining the site and not within the road reserve; and

4.6.1.4 All carparking and loading areas shall comply with all standards set out in Appendix E10.1.

4.6.2 Any activity on a site which has a vehicle manoeuvring area of sufficient size to enable any vehicle to turn on the site and not have to reverse onto the road shall be a permitted activity if:

4.6.2.1 The site is used for any activity other than residential activities; or

4.6.2.2 The site has access to a State Highway or an arterial road listed in Appendix 9.

Note: Refer to the Council's most recent Code of Practice for the design standards required for the manoeuvring of vehicles.

4.6.3 Any activity which involves the provision of goods or services to the general public shall be a permitted activity if the following conditions are met:

4.6.3.1 One disabled carpark is provided with the first 10 carparking spaces; and one additional disabled carpark space for every additional 50 carparking spaces provided.

4.6.3.2 The disabled carparks are:

(a) Located as close to the entrance to the building or the site of the activity as practical;

(b) Sited on a level surface; and

(c) Clearly marked as being for mobility-impaired persons.

Controlled Activities – Vehicle Parking and Cycle Parking

4.6.4 Any development of a parking area with a total of 40 or more parking spaces shall be a controlled activity, in respect to safety, circulation and access for pedestrians within the site

and moving past vehicle crossings.

Restricted Discretionary Activities — Vehicle Parking and Cycle Parking

4.6.5 Any activity which does not comply with Rule 4.6.3 shall be a restricted discretionary activity.

4.6.6 The Council shall restrict its discretion to consideration of:

4.6.6.1 Whether there is likely to be a demand for parking for mobility impaired person, given the nature of the activities being undertaken on the site;

4.6.6.2 Whether there is any need to provide specific carparking for mobility impaired persons on the site, given the size and nature of the carparking area and the location of the activity relative to the carparking area; and

4.6.6.3 Any monitoring or review conditions.

Discretionary Activities — Vehicle Parking and Cycle Parking

4.6.7 Any activity which does not comply with Rule 4.6.1 shall be a discretionary activity.

Non-Complying Activities — Vehicle Parking and Cycle Parking

4.6.8 Any activity which does not comply with Rule 4.6.2 shall be a non-complying activity.

ASSESSMENT

All car parking associated with the Proposal will be located within the Site and all loading (including unloading) associated with the Proposal will also be undertaken within the Site.

All carparking and loading areas will comply with all the standards set out in Appendix E10.1.

The Site will be used for quarrying activities and has access to an arterial road and will have a vehicle manoeuvring area of sufficient size to enable any vehicle to turn on the site and not have to reverse onto the road.

The Site will not retail to the public.

Therefore, the Proposal will meet the relevant parts of Rule 4.6 and is a **Permitted Activity**.

6 RURAL RULES - OUTDOOR SIGNS AND NOTICEBOARDS

6.1 OUTDOOR SIGNS – GENERAL

Permitted Activities — Outdoor Signs – General

6.1.1 Erecting any outdoor sign shall be a permitted activity if all of the following conditions are met:

6.1.1.1 The sign, unless it is a temporary sign, is located entirely within the site to which it relates, and is not located on, or overhangs onto, any road reserve;

6.1.1.2 The sign is positioned so that it does not obstruct or impair the view for any motorist or pedestrian of any traffic signal, intersection, vehicle crossing, bend or corner;

6.1.1.3 The sign does not have any of the following features:

(a) Flashing or revolving lights;

(b) Sound effects;

(c) Balloons or blimps; or

(d) Moving parts;

6.1.1.4 The sign is designed so that it does not resemble a traffic sign or signal;

6.1.1.5 The light spill from any illuminated sign onto any adjoining property or the road reserve is not more than 3-lux spill;

6.1.1.6 The height of the sign is not more than:

(a) The height of the building to which it is attached; or

(b) 6m above the ground if the sign is not attached to a building;

6.1.1.7 The size of the sign, including any sign attached to a building, is not more than $3m^2$ and the total area of signage on the site does not exceed $6m^2$.

6.1.1.8 Any sign which is attached to a building and exceeds $3m^2$ in area does not protrude beyond the framework of the building.

6.1.1.9 The maximum number of signs on any one property, including any temporary signs, is in accordance with Table C6.1

Table C6.1 — Maximum Number of Signs

No.	Sign Type	Maximum Number per Property
1	Any directional sign having: A maximum height of 1m; and A maximum size of $0.6m^2$; and Any message limited to 'entry' or 'exit' or arrows.	No maximum
2	Any sign required under other legislation or to provide for people's health or safety.	No maximum
3	Any sign advertising a property for sale if the sign is removed within one calendar month or the property being sold.	No maximum
4	Any sign denoting a place name or road name.	No maximum
5	Any sign denoting private property, wandering stock, fire restrictions and public access.	No maximum
6	Any sign which relates to products and services sold on-site at a shop or a service station.	No maximum
7	Any other sign.	Three

Discretionary Activities — Outdoor Signs – General

6.1.2 Erecting any outdoor sign which does not comply with Rule 6.1.1 shall be a discretionary activity.

ASSESSMENT

It is proposed to display the name of the quarry on either side of the vehicle entrance on Aylesbury Road. The signs will be located within the Site and setback from the road boundary. They will not obstruct or impair the view for any motorist or pedestrian of any traffic signal, intersection, vehicle crossing, bend or corner, as there are none in the vicinity of the vehicle crossing to the Site.

The signs will not have flashing or revolving lights, sound effects, balloons or blimps; or moving part and will not resemble a traffic sign or signal.

Should the signage at the entrance to the Site be illuminated, the light spill onto any adjoining property or the road reserve will not exceed 3-lux spill.

The height of the signs will not be more than 6m above the ground if the sign and will not be attached to a building.

The size of each sign will not be more than $2m^2$ and the total area of signage will not exceed $4m^2$.

The maximum number of signs (other than signs for operational warning, health or safety reasons) will be 2.

The proposed signage is therefore a **Permitted Activity** under Rule 6.1.1.

6.4 OUTDOOR SIGNS AND STRATEGIC ROADS

Permitted Activities — Outdoor Signs and Strategic Roads

6.4.1 Erecting any outdoor sign on a site adjoining a road which is listed in Appendix 9 as a Strategic Road shall be a permitted activity if all of the following conditions are met:

6.4.1.1 The sign has a maximum number of 5 words or a maximum combined number of 6 words and symbols;

6.4.1.2 there is a minimum separation distance between any 2 outdoor signs of:

(a) 70m, where the speed limit is 80km/hr; or

(b) 80m, where the speed limit is 100km/hr;

6.4.1.3 The sign is visible from a distance of:

(a) 175m, where the speed limit is 80km/hr; or

(b) 250m where the speed limit is 100km/hr;

6.4.1.4 The sign has a minimum height for any letter which complies with the values set out in Table C6.2.

Table 6.2 — Minimum Letter Sizes - Strategic Roads

Speed Limit	Main Message	Secondary Message
80 km/hr	250mm	125mm
100 km/hr	300mm	150mm

6.4.1.5 The sign is illuminated only when the premises are open for business; and

6.4.1.6 The sign is positioned at right angles to the road frontage of the site but angled off the direction of traffic by 5°.

Restricted Discretionary Activities — Outdoor Signs and Strategic Roads

6.4.2 Any sign which does not comply with Rule 6.4.1 shall be a restricted discretionary activity.

6.4.3 Under Rule 6.4.2, the Council shall restrict its discretion to consideration of:

6.4.3.1 Any adverse effects, singularly or cumulatively, of the proposed sign on the safety of motorists, pedestrians or cyclists;

6.4.3.2 Any effects on reduced visibility for people moving into and out of properties along the Strategic Road;

6.4.3.3 Any potential effects on traffic speed, manoeuvring or general flow of traffic along the Strategic Road;

6.4.3.4 Any positive effects which may offset any adverse effects; and

6.4.3.5 Any monitoring or review conditions.

ASSESSMENT

The proposed signs at the site access will only have two or three words, being the name of the quarry. However, being either side of the site access, they will not be separated by 80m, but will be visible for 250 metres. The lettering will comply with the letter size of 300mm and will only be lit (if at all) when the quarry is open. The signs will be angled off the direction of traffic by 5°.

The proposed signage is therefore a **Restricted Discretionary Activity** under Rule 6.4.2.

6.7 OUTDOOR SIGNS AND HEALTH AND SAFETY

Permitted Activities — Outdoor Signs and Health and Safety

6.7.1 Any outdoor sign required for operational warning, health or safety reasons shall be a permitted activity provided that the sign advertises only the name of the organisation carrying out the work or activity, and any relevant safety information.

ASSESSMENT

The quarry will be required to display operational warning, health or safety signs, which will only display the name of the organisation carrying out the work or activity, and any relevant safety information.

This is a **Permitted Activity** under Rule 6.7.1.

7 RURAL RULES — HAZARDOUS SUBSTANCES

STORAGE OF HAZARDOUS SUBSTANCES

Permitted Activities — Storage of Hazardous Substances

7.1.1 The storage of any hazardous substance shall be a permitted activity if all of the following conditions are met.

7.1.1.1 For all hazardous substances (except agrichemicals, fumigants and vertebrate toxic agents) the quantity of each subclass of hazardous substances listed in Appendix 15 Table E15.2 complies with the maximum storage quantities set out in Appendix 15 Table E15.2.

7.1.1.2 For agrichemicals, fumigants and vertebrate toxic agents:…

7.1.1.3 Any area used to store the hazardous substance or goods treated with the hazardous substance except for Liquefied Petroleum Gas (LPG) has an impervious surface which:

(a) Is separated from the bare ground;

(b) Is designed to contain any runoff of the substance or water contaminated with the substance;

(c) Has a minimum area able to be used to contain the hazardous substance amounting to no less than 110% of the total volume of any stored hazardous substance where the area is roofed; or

(d) Has a minimum area able to be used to contain the hazardous substance amounting to no less than 120% of the total volume of any stored hazardous substance where the area is unroofed.

7.1.1.4 The hazardous substance is stored in a sealed container which:

(a) Is made of a sound material that will not be weakened or corroded by the hazardous substance being stored in it;

(b) Is permanently labelled with the name of the contents; and

(c) Contains only one type of hazardous substance;

7.1.1.5 The hazardous substance is not stored:

(a) Within 20m of any waterbody (excluding aquifers), and

(b) In any area shown on the Planning Maps as a Silent File Area, Wāhi Taonga Site, Wāhi Taonga Management Area, or Mahinga Kai Site.

Note: Rule 7.1.1.5 shall apply only to hazardous substances that are:

(i) substances other than those that are listed in Policy 1(a)(ii) of Chapter 17 of the Canterbury Regional Policy Statement (RPS); and

(ii) substances that are listed in Policy 1(a)(ii) of Chapter 17 of the Canterbury Regional Policy Statement (RPS) and are transported by means other than through a pipe.

The substances listed in Policy 1(a)(ii) of the RPS are:

(a) Pesticides.

(b) Chlorinated solvents

(c) Timber preservatives

(d) Petroleum products

(e) Substances containing the following chemicals: arsenic, cadmium, chromium, cyanide, lead, mercury, nickel or selenium.

Discretionary Activities — Storage of Hazardous Substances

7.1.2 Any storage of hazardous substances which does not comply with Rule 7.1.1 shall be a discretionary activity.

ASSESSMENT

Appendix E15 Table E15.2 permits the storage of 5,000 litres of diesel and 10kg of oils and greases. It is proposed to store up to 30,000 litres of oil in double skinned tanks and up to 1,000kg of oils and greases in special designed areas within the roofed workshop.

The area used to store the hazardous substances will have an impervious surface which will be:

- separated from the bare ground;
- designed to contain any runoff of the substance or water contaminated with the substance;
- the minimum area able to be used to contain the hazardous substance amounting to no less than 110% of the total volume of any stored hazardous substance.

The hazardous substances will be stored in sealed containers which:

- are made of a sound material that will not be weakened or corroded by the hazardous substance being stored in it;
- are permanently labelled with the name of the contents; and
- each contains only one type of hazardous substance;

No hazardous substance will be stored within 20m of any waterbody (excluding aquifers), and in any area shown on the Planning Maps as a Silent File Area, Wāhi Taonga Site, Wāhi Taonga Management Area, or Mahinga Kai Site.

The storage of hazardous substances that exceed the quantity limits in Appendix E15 requires consent as a **Discretionary Activity** under Rule 7.1.2.

9 RURAL RULES – ACTIVITIES

9.1 ACTIVITIES — GENERAL

Permitted Activities — Activities – General

9.1.1 Any activity shall be a permitted activity if all of the following conditions are met:

9.1.1.1 The activity complies with all other rules of the Plan (Rules 1 to 8 or Rule 10);

9.1.1.2 The activity is not listed as a discretionary activity in Rule 9.2.1.

9.1.1.3 The activity is not listed as a non-complying activity in Rule 9.2.2.

Other Activities — Activities – General

9.1.2 Any activity which does not comply with Rule 9.1.1.1 shall have the status of the rule with which it does not comply.

9.2 ACTIVITIES – LISTED ACTIVITIES

Discretionary Activities — Listed Activities

9.2.1 All of the following activities shall be discretionary activities irrespective of whether they comply with all other rules in the Plan for permitted activities:

9.2.1.1 Any activity which requires an Offensive Trade Licence under the Health Act 1956;

9.2.1.2 Any activity which involves the composting of organic material, where that material is brought on to the site except where additional material such as saw dust or straw is required as part of the process of composting pigs;

9.2.1.3 Any activity which involves the manufacture of fertiliser from organic material, where

that material is brought on to the site;

9.2.1.4 Prisons or detention centres; and

9.2.1.5 Camping ground facilities.

Non-Complying Activities — Listed Activities

9.2.2 All of the following activities shall be non-complying activities irrespective of whether they comply with all other rules in the Plan for permitted activities:

9.2.2.1 Any other industrial activity, except for another industrial activity being a home-based occupation.

ASSESSMENT

The proposed activities (extraction, processing of aggregate and cleanfilling) are not listed as Discretionary or Non-Complying Activities. Furthermore, the definition of industrial activity in the SDP excludes quarrying. Rule 9.1.2 means that the application has the activity status afforded by other rules, i.e. discretionary.

9.4 SCALE OF NON-RESIDENTIAL AND NON-RURAL ACTIVITIES

Permitted Activities — Scale of Activities

9.4.1 Any activity which is not a rural activity or a residential activity shall be a permitted activity if the following conditions are met:

9.4.1.1 The maximum area of any site covered by building(s), loading, storage and waste areas used for any other activity on the site does not exceed 100m^2 and no more than two full-time equivalent persons are employed in undertaking any other activity on the site; or

9.4.1.2 The activity is undertaken by either an approved tertiary education provider (as defined in the Education Act 1989) or a Crown Research Institute involving the use of land or buildings for the purpose of growing or rearing of crops or livestock and associated monitoring of the environment for research and education purposes but excluding conferencing, accommodation, recreation and retail activities.

Note: Rule 9.4.1 does not apply to any temporary activity or any activity within the Porters Ski and Recreation Area, Rural Based Industrial Activity or any Other Industrial Activity (where Rule 9.5.1 and Rule 9.2.2 apply), or Utilities (where rules in Part C Rule 5 Utilities apply).

Discretionary Activities — Scale of Activities

9.4.2 Any activity which does not comply with Rule 9.4.1 shall be a discretionary activity.

ASSESSMENT

The maximum area of the quarry site covered by building(s), loading, storage and waste areas used for extraction activities will exceed 100m^2 and more than two full-time equivalent persons will be employed on the quarry site. This requires consent as a **Discretionary Activity** under Rule 9.4.2.

9.5 RURAL BASED INDUSTRIAL ACTIVITIES

Permitted Activities — Rural Based Industrial Activities

9.5.1 Any rural based industrial activity shall be a permitted activity if the following conditions are met:

9.5.1.1 The maximum area of any site covered by any building(s), loading, storage and waste areas used for any rural based industrial activity on the site shall be 100m².

9.5.1.2 No more than two full-time equivalent persons are employed in undertaking the activity on the site.

Note: Rule 9.5.1 does not apply to any temporary activity.

Discretionary Activities — Rural Based Industrial Activities

9.5.2 Any activity which does not comply with Rule 9.5.1 shall be a discretionary activity if one of the following standards and terms are met:

9.5.2.1 The site is located within the Outer Plains, as shown on the Planning Maps; or

9.5.2.2 Any building and/or operations expansion or addition associated with the poultry processing plant of Brinks South Island, 1310–1312 Main South Road, Weedons that occurs within land parcels Lot 1 and/or Lot 2 DP 20292; or

9.5.2.3 Any upgrading of the existing on-site irrigation waste disposal associated with the poultry processing plant of Brinks South Island, Main South Road, Weedons that occurs within land parcels Lot 4 DP 22430 and/or Lot 2 DP 83245; or

9.5.2.4 Any building and/or operations expansion or addition associated with the feedmill of Feedco Canterbury, 162 Selwyn Road, Broadfield that occurs within land parcel Lot 2 DP 61860.

.

Non-Complying Activities — Rural Based Industrial Activities

9.5.3 Any activity which does not comply with Rule 9.5.2 shall be a non-complying activity.

ASSESSMENT

The processing of aggregate is defined as a Rural Industrial Activity. The maximum area of the quarry site associated with the processing of aggregate will exceed 100m^2 and more than two full-time equivalent persons will be employed on the quarry site. However, the Site is located in the Outer Plains. The activity is therefore a **Discretionary Activity** under Rule 9.5.2.

9.12 ACTIVITIES AND CARPARKING, VEHICLE CROSSINGS, ACCESS AND EGRESS

Permitted Activities — Carparking, Vehicle Crossings, Access and Egress

9.12.1 The activity shall comply with the rules for carparking, vehicle crossings, vehicle access and egress set out in Rule 4, and Appendix 10 for specific provisions applying to State Highways to be a permitted activity.

Default Activity — Carparking, Vehicle Crossings, Access and Egress

9.12.2 Any activity which does not comply with Rule 9.12.1 shall have the status set out in Rules 4.4 to 4.6 for the rules(s) with which it does not comply.

ASSESSMENT

As above.

9.13 ACTIVITIES AND VEHICLE MOVEMENTS

Permitted Activities — Activities and Vehicle Movements

9.13.1 Any activity which does not exceed the following maximum number of vehicle movements shall be a permitted activity:

9.13.1.1 Road Unformed and, or not maintained by Council:

(a) For any commercial or industrial related activity where access is required off an unformed and un-maintained road, excluding normal farming activities: Nil.

(b) For any individual property access off an unformed and un-maintained road: 15 equivalent car movements per day (ecm/d) per site.

9.13.1.2 Road Formed, Sealed and maintained by Council:

(a) State Highway and Arterial Roads (as identified in Appendix 9): 30 ecm/d per site averaged over any one week period).

(b) Local and Collector Roads: 60 ecm/d per site (averaged over any one week period).

9.13.1.3 Road Formed, Unsealed and maintained by Council:

(a) 60 ecm/d per site (averaged over any one week period).

Note:

7 Guidance for the preparation of a Traffic Management Plan can be found in New Zealand Transport Agencies Code of Practice for Temporrary Traffic Mangement (COPTTM).

8 The Selwyn District Council Traffic and Parking Bylaw 2009 (and subsequent versions) applies to both permanent and temporary activities and may require the preparation of a Traffic Management Plan in certain circumstances. Please refer to the Bylaw for further details.

Discretionary Activities — Activities and Vehicle Movements

9.13.2 Any activity which does not comply with Rule 9.13.1 shall be a discretionary activity. The Council's discretion may include but shall not be limited to:

9.13.2.1 Any works required to the road to upgrade it to the standards set out in the Council's Engineering Code of Practice;

9.13.2.2 Any potential adverse effects of traffic on the amenity values of surrounding residents and on other uses of the road, including (but not limited to) stock droving;

9.13.2.3 In respect to the integration of land use and transport, the appropriateness of the location within the existing and planned road network.

9.13.2.4 The position and design of any vehicle crossing or vehicle access and egress;

9.13.2.5 Any positive effects which may offset any adverse effects; and

9.13.2.6 Any other relevant matters including relevant objectives and policies.

9.13.2.7 Any monitoring or review conditions.

ASSESSMENT

The number of vehicle movements generated by the proposal will exceed 30 ecm/d per site averaged over any, one-week period. The activity is therefore a **Discretionary Activity** under Rule 9.13.2.

9.16 ACTIVITIES AND NOISE

Permitted Activities — Activities and Noise

9.16.1 Except as provided in 9.16.3 below, any activity shall be conducted so as to comply with the noise limits and within the time frames stated in the following tables in order to be a permitted activity:

Table C9.3 – Noise limits assessed at the notional boundary of any dwelling, rest home, hospital, or classroom in any educational facility except where that dwelling, rest home, hospital or classroom is located within a Living zone.

Hours	**Noise Limit**
7.30am – 8.00pm	60 dBA L_{10} 85 dBA L_{max}
8.01pm – 7.29am	45 dBA L_{10} 70 dBA L_{max}

General Exemptions

9.16.3 Noise limits in any part of the Plan shall not apply:

9.16.3.1 In any area to activities of a limited duration required by normal primary production activities including agriculture, horticulture, aquaculture, forestry and fishing, provided that the activity shall comply with the requirements of Section 16 of the Resource Management Act 1991. For the purposes of Rule 9.16.3.1, “activities of a limited duration” means: Activities which are temporary and/or intermittent in nature, such as crop harvesting, crop irrigation, general use of farm machinery or crop protection devices (other than audible bird scarers). Such uses may occur on a limited number of days in a year, a limited number of hours in a day or a limited number of days in a week or month.

9.16.3.2 In any part of the District where the noise source is a warning device used by emergency services.

9.16.3.3 In any part of the district used for residential activities of a normal domestic nature including recreational activities, such as sporting events, that do not involve powered motor sport, powered aviation, gunfire or amplified music.

9.16.3.4 Where any residential activity exists on the same site, or a site owned by the same owner, as a noise source being assessed.

9.16.3.5 Where the activity is a temporary military training activity and complies with the following provisions:

Permitted Activities — Other Exemptions

9.16.6: Rule 9.16.1 does not apply to the following activities:

9.16.6.1: Noise from any motor vehicle or any mobile machinery (including farm machinery and stationary equipment not fixed to the ground).

Discretionary Activities — Activities and Noise

9.16.2 Any activity which does not comply with Rule 9.16.1 shall be a discretionary activity.

ASSESSMENT

Operational activities within the Site will comply with the permitted activity standards at the notional boundaries of all surrounding dwellings, except for 30 minutes between 0700 hrs (when quarry operations commence, and the night-time noise limits apply) and 0730hrs when ODP daytime noise limits apply.

As shown on Figure 16 of the Acoustic Assessment (**Appendix 9**), noise arising from load out activities occurring during the hours of 5am to 7am, will also meet the night-time noise limit at the notional boundaries of 168 and 146 Aylesbury Road being the closest residential dwellings. This is given the distance of the activity from the dwellings, the proposed bunding along Aylesbury Road and that the stockyard will be located below existing ground level.

Noise from construction activities, including the formation of bunds and site facilities, will comfortably comply with the applicable New Zealand Standards and District Plan permitted activity limits.

It is noted that under Rule 9.16.6.1, the noise limits do not apply to noise generated by any motor vehicle i.e. truck movements along Aylesbury Road.

The Proposal is therefore a **Discretionary Activity** under Rule 9.16.2.

9.18 ACTIVITIES AND GLARE

Permitted Activities — Activities and Glare

9.18.1 Except in the area shown on the Planning Maps as the West Melton Observatory Lighting Area, any activity which involves lighting shall be a permitted activity provided that the activity has a maximum light spill not exceeding:

9.18.1.1 10-lux spill on to any part of any adjoining property which is located in a Business zone and which does not contain a dwelling; and

9.18.1.2 3-lux spill on to any part of any other adjoining property or any road reserve.

Discretionary Activities — Activities and Glare

9.18.3 Any activity which does not comply with Rule 9.18.1 or Rule 9.18.2 shall be a discretionary activity.

ASSESSMENT

The quarry will have a maximum light spill not exceeding 3-lux spill on to any part of any other adjoining property or any road reserve. Therefore, the proposal is a **Permitted Activity** in terms of Rule 9.18.1.

9.19 ACTIVITIES AND DUST

Permitted Activities — Activities and Dust

9.19.1 Any stockpilling activity shall be a permitted activity provided that stockpiling of any soil, coal, sawdust, powdered fertiliser or any other unconsolidated material outdoors within 100m of a dwelling (other than a dwelling on the same property as the stockpiled material), is either:

9.19.1.1 Covered; or 9.19.1.2 Consolidated; or 9.19.1.3 Otherwise secured to mitigate windblown dust on to adjoining properties.
Discretionary Activities — Activities and Dust 9.19.2 Any stockpiling of material which does not comply with Rule 9.19.1 shall be a discretionary activity.
ASSESSMENT It is not proposed to stockpile soil or any other unconsolidated material outdoors within 100m of a dwelling on an adjoining property. Therefore, the Proposal is a **Permitted Activity** in terms of Rule 9.19.1.

5c POSDC Statutory Assessment

GRUZ-R21 MINERAL EXTRACTION

Activity Status: RDIS

1. The establishment or expansion of any mining or quarrying activity; or

A. The establishment or expansion of a farm quarry that exceeds an area of extraction of 1,500m^2.

B. Associated activities to the principal use as a mining or quarrying activity that involve the recovery of aggregate products.

Where:

a. The activity is set back from the notional boundary of any lawfully established residential activity or visitor accommodation, or the site boundary of any lawfully established community or educational facility, except where those sensitive activities are located on the same site by:
   i. 200m for any excavation associated with mining, or extracting or winning aggregate; and
   ii. 500m for any activity involving blasting; and
   iii. 500m for any processing or aggregate recovery.
b. The activity is set back from the boundary of any residential zone by 500m.

Activity status when compliance not achieved:

3. Activity status when compliance with any of GRUZ-R21.1 is not achieved: DIS

ASSESSMENT

All processing of aggregate will be set back 500m from the notional boundary of any lawfully established residential activity in the surrounding area.

However, the excavation of aggregate will not be setback 200m from the notional boundary of the lawfully established residential activity at 186 Aylesbury Road, 146 Aylesbury Road, 159 Grange Road and 181 Grange Road.

Therefore, the extraction of aggregate requires consent as a **Discretionary Activity** under Rule GRUZ-R21-3.

GRUZ-R25 SHELTERBELT

Activity Status: PER

1. The establishment of a new, or expansion of an existing shelterbelt.

Where this activity complies with the following rule requirements:

GRUZ-REQ16 Springfield Airfield Height Restriction.

EI-REQ23 West Melton Aerodrome Height Restriction.

EI-REQ24 Planting Setbacks Restriction near Significant Electricity Distribution Line.

NH-REQ7 Wildfire Setbacks.

Activity status when compliance not achieved:

2. When compliance with any rule requirement listed in this rule is not achieved: Refer to relevant

rule requirements.

NH-REQ7 Wildfire Setbacks

1. Any new woodlot or shelterbelt shall comply with the following separation distances, measured from the outside extent of the canopy:
   a. 30m from any residential unit or other principal building on an adjoining property; and
   b. 30m from any zone that is not a rural zone; and
   c. 5m from any adjoining legally established accessway to a residential unit or other principal building.

Activity status when compliance not achieved:

2. When compliance with any of NH-REQ7.1. is not achieved: RDIS

Matters for discretion:

3. The exercise of discretion in relation to NH-REQ7.2. is restricted to the following matters:
   a. NH-MAT5.A Wildfire

Notification:

4. Any application arising from NH-REQ7.2. shall not be subject to public notification.

ASSESSMENT

It is proposed to plant gaps in an existing shelterbelt, so in effect the length of the shelterbelt will increase. The shelterbelt will not be new, so the wildfire setback does not apply.

Therefore, the proposed shelterbelt planting is a **Permitted Activity** under Rule GRUZ-R25

TRAN-R4 VEHICLE CROSSINGS

Activity status: PER

1. The establishment of a vehicle crossing

Where:
   a. The vehicle crossing is located no closer to an intersection with a State Highway or arterial road than:
      i. 60m to the departure side of any intersection; and
      ii. 30m to the approach side of any intersection; and
   b. The vehicle crossing does not service any:
      i. Service station; or
      ii. Truck stop; or
      iii. Activity that generates more than 40vm/d or, in PREC11 - Rural Services Precinct, 250vm/d.

And this activity complies with the following rule requirements:

TRAN-REQ2 Access restrictions

TRAN-REQ3 Number of vehicle crossings

TRAN-REQ4 Siting of vehicle crossings

TRAN-REQ5 Vehicle crossing design and construction

TRAN-REQ6 Vehicle crossing surface

Activity status when compliance not achieved:

2. When compliance with any of TRAN-R4.1 is not achieved: RDIS

3. When compliance with any rule requirement listed in this rule is not achieved: Refer to TRAN-Rule Requirements

Matters for discretion:

4. The exercise of discretion in relation to TRAN-R4.2 is restricted to the following matters:
   a. TRAN-MAT2 Vehicle crossings

ASSESSMENT

The vehicle crossing cannot meet TRAN4.1b.iii as it will service an activity that will generate more than 40 vehicle movements per day.

Therefore, the vehicle crossing is a **Restricted Discretionary Activity** under Rule TRAN-R4.2.

TRAN-MAT2 Vehicle crossings and accessways

1. Any effects on the ease and safety of vehicle manoeuvring.

2. Whether the boundaries of a site support the formation of the vehicle crossing or accessway.

3. Whether the site can gain access from another road that is not a State Highway or Arterial Road listed in APP2 – State Highway, Arterial and Collector Road Classifications List.

4. The design and location of the vehicle crossing or accessway.

5. The anticipated number and type of vehicles, cycles, pedestrians or stock movements.

6. Any visual effects on road design and amenity values from not forming the vehicle crossing or accessway to the specified standards.

TRAN-R6 PARKING, MANOEUVRING AND LOADING AREAS

Activity Status: PER

3. Any parking, manoeuvring and loading areas associated with any activity that is not a residential activity.

Where the activity complies with the following rule requirements:

TRAN-REQ8 Location of parking spaces

TRAN-REQ9 On-site parking – Does not apply to the GRUZ Zone.

TRAN-REQ10 Mobility parks.

TRAN-REQ11 Cycle parks and facilities - Does not apply to the GRUZ Zone.

TRAN-REQ12 Vehicle loading areas - Does not apply to the GRUZ Zone.

TRAN-REQ13 Parking and loading gradients.

TRAN-REQ14 Access gradients.

TRAN-REQ15 Queuing spaces - Does not apply to the GRUZ Zone.

TRAN-REQ16 Vehicle manoeuvring.

TRAN-REQ17 Surface of parking and loading areas.

TRAN-REQ28 Landscape Strip for Parking Areas - Does not apply to the GRUZ Zone.

Activity status when compliance not achieved:

4. When compliance with any rule requirement listed in this rule is not achieved: Refer to TRAN-Rule Requirements.

TRAN-REQ8 Location of parking spaces

7. All car parking associated with any activity shall be wholly on the same site where the activity operates, or on an adjoining site.

Activity status where compliance is not achieved:

8. When compliance with any of TRAN-REQ9.7 is not achieved: RDIS

TRAN-REQ10 Mobility parks

1. All activities shall provide the following number of mobility parking spaces:
   a. One mobility parking space is provided with the first 20 vehicle parking spaces;
   b. Not less than two mobility parking spaces is provided for up to 49 vehicle parking spaces; and
   c. One additional mobility park space for every additional 50 parking spaces is provided.

2. All mobility parks shall comply with the design requirements listed in TRAN-TABLE10 - Minimum parking area dimensions and illustrated in (DIAGRAM13) - Parking area formation dimensions.

Activity status where compliance is not achieved:

3. When compliance with any of TRAN-REQ10.1 or TRAN-REQ10.2 are not achieved: RDIS

TRAN-REQ13 Parking and loading gradients

1. The gradient for any on-site parking or loading area surface for any non-residential activity is no more than:
   a. 1:16 (6.25%) at 90º to the angle of the vehicle park; and
   b. 1:20 (5%) when parallel to the angle of the vehicle park.

Activity status where compliance is not achieved:
2. When compliance with any of TRAN-REQ13.1 is not achieved: RDIS

TRAN-REQ14 Access gradients

1. The maximum gradient for any access to a parking area is no more than:
   a. 1:4 (25%) on any straight section up to 20m in length;
   b. 1:5 (20%) where longer than 20m in length; and
   c. 1:6 (16.7%) around curves when measured on the inside line of the curve.

2. The maximum change in gradient without a transition is no greater than 1:8 (12.5%).

3. Changes of grade of more than 1:8 (12.5%) are separated by a minimum transition length of 2m.

Activity status where compliance is not achieved:
4. When compliance with any of TRAN-REQ14.1, TRAN-REQ14.2 or TRAN-REQ14.3 are not achieved: RDIS

TRAN-REQ16 Vehicle manoeuvring

1. All activities shall provide sufficient on-site manoeuvring to ensure that vehicles do not reverse either onto or off a site which has access:
   a. To a State Highway or arterial road; or
   b. To a collector road where three or more vehicle parking spaces are provided; or
   c. To an accessway that serves a site with six or more vehicle parking spaces.

2. Parking and loading areas are formed so that vehicle operators do not need to undertake more than one reverse manoeuvre to exit the parking space or loading area.

Note: Two vehicle parking spaces may be provided in tandem where on-site manoeuvring is provided to ensure that vehicles do not reverse either onto or off the site.

Activity status when compliance is not achieved:

3. When compliance with TRAN-REQ16.1.a is not achieved: NC

3A When compliance with TRAN-REQ16.1.b or TRAN-REQ16.1.c is not achieved: RDIS

4. When compliance with TRAN-REQ16.2 is not achieved: RDIS

TRAN-REQ17 Surface of parking and loading areas

6. Any vehicle parking or loading areas expected to be used by vehicles accessing the educational facility or activity involving the retailing of goods and services to the public shall be either metalled or sealed.

ASSESSMENT

All car parking required for quarry staff and visitors and trucks waiting be loaded or doing paperwork will be located within the Site.

There will be 30 car parks within the Site, therefore two mobility parking spaces will be provided and will be designed in accordance with the design requirements listed in TRAN-TABLE10 - Minimum parking area dimensions, having a stall width of 3.6m and a stall depth of 6.1m.

The area where the on-site parking will be located will be relatively flat and will therefore meet the required gradients of:
a. 1:16 (6.25%) at 90o to the angle of the vehicle park; and
b. 1:20 (5%) when parallel to the angle of the vehicle park.

The access to the parking area will be more than 20m in length, curved but with little gradient. It will not exceed 1:5 (20%) or 1:6 (16.7%) around curves.

There is sufficient space for private vehicles to manoeuvre within the Site and not reverse onto Aylesbury Road. Likewise heavy trucks will either turn round within the quarry itself or within the turning circle provided close to the access. Given the space available within the Site, no vehicle will need to undertake more than one reverse manoeuvre to exit a parking space or loading area. The

Site will not support an educational facility or retail to the public; therefore TRAN-REQ-17 is not relevant.

Therefore, the parking, manoeuvring and loading areas are a **Permitted Activity** under Rule TRAN-R6.

TRAN-R8 HIGH TRIP GENERATING ACTIVITIES

Activity Status: PER

1. The establishment of a new, or expansion of an existing activity listed in (TRAN-TABLE2) - HTGA thresholds and ITA requirements.

TRAN-TABLE2 HGTA thresholds and ITA requirements

Activity	Basic ITA	Full ITA
Mixed or other activities not otherwise listed in this Table	50 vehicles per peak hour	120 vehicles per peak hour

Where:

a. The activity does not exceed the basic ITA threshold in (TRAN-TABLE2) - HTGA thresholds and ITA requirements; or
b. The activity does exceed the basic ITA threshold in (TRAN-TABLE2) - HTGA thresholds and ITA requirements but an ITA has already been approved for the site as part of a granted resource consent and the activity is within the scope of that ITA and in accordance with the resource consent, unless the resource consent has lapsed.

Advisory Note: Further guidance is available from New Zealand Transport Agency Research Report No.422 'Integrated Transport Assessment Guidelines', Abley et al, November 2010

Activity status when compliance not achieved:

2. When compliance with any of TRAN-R8.1 is not achieved: RDIS

Matters for discretion:

3. Where the Basic ITA (but not Full ITA) threshold in (TRAN-TABLE2) - HTGA thresholds and ITA requirements is exceeded, the exercise of discretion in relation to TRAN-R8.2 is restricted to the following matters:

a. TRAN-MAT8 High Trip Generating Activities – Basic

4. Where the Full ITA threshold in (TRAN-TABLE2) - HTGA thresholds and ITA requirements is exceeded, the exercise of discretion in relation to TRAN-R8.2 is restricted to the following matters:

a. TRAN-MAT8A High Trip Generating Activities - Full

ASSESSMENT

As set out in Table 10-2 Heavy Vehicle Generation for Intersection assessment in the Stantec Transport Assessment (**Appendix 10**), the quarry will generate 50 vehicles per peak hour (at its busiest) at Year 2030 and 112 at Year 2035. As such, the quarry will exceed the basic ITA threshold, but not the full ITA threshold.

Therefore, consent is required as **Restricted Discretionary Activity** under Rule TRAN-R8.3.

However, a full ITA has been prepared by Stantec (**Appendix 10**) that addresses safety and efficiency, design and layout, network effects and heavy vehicles.

Matters of discretion

TRAN-MAT8 High Trip Generating Activities - Basic

1. Whether the provision of access and on-site manoeuvring areas associated with the activity, including vehicle loading and servicing deliveries. affects the safety, efficiency, accessibility (including for people whose mobility is restricted) of the site, and the land transport network (including considering the network classification of the frontage road).

2. Whether the design and layout of the proposed activity promotes opportunities for travel other than private cars, including by providing safe and convenient access for travel using more active modes.

3. Whether the ITA has been prepared by a suitably qualified and experienced transport specialist.

4. Need for an ITA - Any characteristics of a proposed activity or site that are out of scope of an existing ITA but where expected traffic generation and access to existing multi modal connections mean requiring an ITA, in a manner set out in this rule, is unnecessary.

NH-R2 NEW BUILDINGS AND STRUCTURES IN NATURAL HAZARD OVERLAYS

Activity Status: PER

3. The establishment of any new residential unit or other principal building.

Where:

a. The building is not located in a high hazard area; and
b. The building is not located between any surface water body and any stopbank designed to contain floodwater from that surface water body; and
c. The building finished floor level is equal to or higher than the minimum floor level stated in a Flood Assessment Certificate issued in accordance with NH-SCHED1 Flood Assessment Certificates.

Activity status when compliance not achieved:

4. When compliance with any of NH-R2.3.a. or NH-R2.3.b. is not achieved: NC
5. When compliance with any of NH-R2.3.c. is not achieved: RDIS

Matters for discretion:

6. The exercise of discretion in relation to NH-R2.5. is restricted to the following matters:
   a. NH-MAT1 Natural Hazards Generally

ASSESSMENT

The principal buildings on the Site are the site office, laboratory and workshops.

The buildings will not be located in a high hazard area.

The buildings will be not located between any surface water body and any stopbank designed to contain floodwater from that surface water body; and

The buildings will have a finished floor level equal to or higher than the minimum floor level stated in a Flood Assessment Certificate issued in accordance with NH-SCHED1 Flood Assessment Certificates.

Therefore, the principal buildings on the Site will be **Permitted Activities** under Rule NH-R2.3

NH-SCHED1 Flood Assessment Certificates.

A Flood Assessment Certificate will be issued by the Selwyn District Council (that is valid for 2 years from the date of issues) which specifies:

1. whether or not the site or activity is located on land that is within a High Hazard Area; and
2. whether or not the site or activity is likely to be subject to inundation in a 200-year Average Recurrence Interval (ARI) flood event and;
3. where the site or activity is not located on land that is within a High Hazard Area but is likely to be subject to inundation in a 200-year ARI flood event, a minimum finished floor level for any new building or structure (or part thereof) that is 300mm above the 200-year ARI flood level.

The minimum finished floor level will be determined with reference to:

a. the most up to date models and maps held by Selwyn District Council or Canterbury Regional Council;
b. any relevant field information; and
c. any site-specific flood assessment prepared by a suitably and experienced person

Advice Note:

Information showing the modelled flood characteristics within specific parts of the district is publicly available online via Canterbury Maps. This information is indicative only and will be updated to reflect the best information as it becomes available. A party may provide the Council with a site-specific flood assessment prepared by a suitably qualified and experienced person, to support the identification of minimum finished floor levels.

HAZS-R1 USE AND/OR STORAGE OF HAZARDOUS SUBSTANCES, EXCLUDNG A MAJOR HAZARD FACILITY

Activity Status: PER

1. Use and/or storage of hazardous substances, excluding a major hazard facility.

ASSESSMENT

The quarry will not be a major hazard facility and is therefore a **Permitted Activity** under Rule HAZS-R1.

LIGHT-R1 ARTIFICAL OUTDOOR LIGHTING

Activity Status: PER

1. Artificial outdoor lighting for any activity not otherwise provided for in LIGHT-R2, LIGHT-R3, LIGHT-R4 and LIGHT-R5

Where this activity complies with the following rule requirements:

LIGHT-REQ1 Light Spill

LIGHT-REQ2 Glare

LIGHT-REQ3 Sky Glow

Activity status when compliance not achieved:

2. When compliance with any rule requirement listed in this rule is not achieved: Refer to LIGHT-Rule Requirements.

LIGHT-REQ1 Light Spill

1. The maximum level of light spill from artificial outdoor lighting shall not exceed the horizontal or vertical illuminance levels outlined in LIGHT-TABLE1 below on an adjoining site, including roads.

Advisory notes:

1. *LIGHT-REQ1 shall not apply to light spill from road lighting within roads.*
2. *Measurement of light spill is to be undertaken in accordance with AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.*

2200 to 0600: 1 lux

Hours of darkness from 0600 to 2200: 5 lux

Activity status when compliance not achieved:

2. When compliance with any of LIGHT-REQ1.1. is not achieved: RDIS

LIGHT-REQ2 Glare

1. Artificial outdoor lighting is directed away from and/or screened from adjoining properties and roads.

Activity status when compliance not achieved:

2. When compliance with any of LIGHT-REQ2.1. is not achieved: RDIS

LIGHT-REQ3 Sky Glow

1. All artificial outdoor lighting shall be directed downward and shielded from above to ensure that all light shines below the horizontal.

Activity status when compliance not achieved:

2. When compliance with any of LIGHT- REQ3.1. is not achieved: RDIS

ASSESSMENT

The quarry will have a maximum light spill (if any) not exceeding 3-lux spill onto any adjoining property or any road reserve during hours of darkness.

Lighting will be designed to shine into the Site and if related to the extraction of aggregate will generally be located below existing ground level.

All outdoor lighting will be directed downward and shielded from above to ensure that all light shines below the horizontal, retaining views of the night sky.

Therefore, the lighting required within the quarry is a **Permitted Activity** under Rule LIGHT R1.1

NOISE-RI ACTIVITIES NOT OTHERWISE SPECIFIED

Activity Status: PER
1. Any land use activity not listed elsewhere in NOISE-R1 that generates noise, unless any of NOISE-R2 - NOISE-R16 applies.

Where this activity complies with the following rule requirements:
NOISE-REQ1 Zone Noise Limits

Activity Status when compliance not achieved:
2. When compliance with any rule requirement listed in this rule is not achieved: Refer to NOISE – Rule requirements

Activity status: PER

3. Traffic and rail noise generated within a land transport corridor. This does not apply to the testing (when stationary), maintenance, loading, or unloading of trains.

NOISE REQ1 Zone Noise Limits

1. Any activity that generates noise shall meet the noise limits of the zone of the site receiving noise from an activity, as set out in NOISE-TABLE5 - Zone Noise Limits.

Zone Noise Limits			
Zone of site generating noise	**Zone of the site receiving noise**	**Assessment Location**	**Hours and Limits**
GRUZ	GRUZ	At the notional boundary of any noise sensitive activity within any site receiving noise.	0700 to 2200: 55 dB L_{Aeq} (15min) 2200 to 0700: 45 dB L_{Aeq} (15min) / 70 L_{AFmax}

Activity status when compliance not achieved:

2. When compliance with any of NOISE-REQ1 is not achieved: RDIS

3. The exercise of discretion is restricted to the following matters:
   a. NOISE-MAT1

Advisory note:
1. The noise limits do not apply to assessment locations within the same site as the activity.
2. Where the noise limits are assessed at any point within any site receiving noise, if the site boundary is a boundary with a road or railway network the noise standards shall apply at the furthest boundary of the road or railway network.
3. Where a site is divided by a zone boundary then each part of the site divided by the zone boundary shall be treated as a separate site.

ASSESSMENT

Marshall Day has undertaken an acoustic assessment of the Proposal (**Appendix 9**) and concludes that the activities within the Site will comply with the noise standards in NOISE-TABLE5 including noise arising from load out activities occurring during the hours of 5am to 7am. As shown on Figure 16 of the Acoustic Assessment, the night-time noise limit at the notional boundaries of 168 and 146 Aylesbury Road being the closest residential dwellings will be met. This is due to the distance of the activity from the dwellings, the proposed bunding along Aylesbury Road and the stockyard's location below existing ground level.

Noise generated by the trucks within the land transport corridor is specifically provided for as a permitted activity.

Therefore, the generation of noise is a **Permitted Activity** under NOISE-R1 and R1.3.

NOISE-R2 CONSTRUCTION ACTIVITIES

Activity Status: PER

1. Any construction activity

Where:

a. Any noise created by the use of explosives for construction activity does not exceed a peak sound pressure level of 120 dB Lzpeak measured 1m from the façade of any building containing a habitable room.

And this activity complies with the following rule requirements:

NOISE-REQ2 Construction Noise Limits

Activity status when compliance not achieved:

2. When compliance with any rule NOISE-R2.1 is not achieved: DIS

3. When compliance with any rule requirement listed in this rule is not achieved: Refer to NOISE – Rule requirements.

NOISE-REQ2 Construction Noise Limits

1. Any activity that generates construction noise and any temporary military training activity where there is a mobile noise source shall meet the construction noise limits in NOISE-TABLE6 - Construction Noise Limits.

NOISE-TABLE6 Construction Noise Limits

Zone	Time of week	Time period	Duration of work		
			Typical duration (Dba)	Short-term duration (Dba)	Long-term duration (Dba)
GRUZ	Weekdays	0630-0730	60 L_{eq} / 75 L_{max}	65 L_{eq} / 75 L_{max}	55 L_{eq} / 75 L_{max}
		0730-1800	75 L_{eq} / 90 L_{max}	80 L_{eq} / 95 L_{max}	70 L_{eq} / 85 L_{max}
		1800-2000	70 L_{eq} / 85 L_{max}	75 L_{eq} / 90L_{max}	65 L_{eq} / 80 L_{max}
		2000-0630	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}
	Saturdays	0630-0730	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}
		0730-1800	75 L_{eq} / 90 L_{max}	80 L_{eq} / 95 L_{max}	70 L_{eq} / 85L_{max}
		1800-2000	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}
		2000-0630	45 L_{eq} / 75	45 L_{eq} / 75	45 L_{eq} / 75

			L_{max}	L_{max}	L_{max}
	Sundays and public holidays	0630-0730	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}
		0730-1800	55 L_{eq} / 85 L_{max}	55 L_{eq} / 85 L_{max}	55 L_{eq} / 85 L_{max}
		1800-2000	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}
		2000-0630	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}	45 L_{eq} / 75 L_{max}

ASSESSMENT

It is expected that the 'construction works' will meet the long-term duration limits.

Therefore, the generation of construction noise is a **Permitted Activity** under Rules NOISE-R2.

SIGN-R1 GENERAL SIGNS

Activity Status: PER

1. Any sign:

c. That is an official sign;

Official sign means all signs required or provided for under any statute or regulation or are otherwise related to aspects of public safety.

Activity status when compliance not achieved:

N/A

ASSESSMENT

All signage related to health and safety on the Site is a **Permitted Activity** under Rule SIGN-R1.

SIGN-R4 SIGNS ADJACENT TO STATE HIGHWAYS OR ARTERIAL ROADS

Activity Status: PER

1. Other than a sign listed in SIGN-R1.1 or SIGN-R3 any sign located on a site adjacent to a State Highway or Arterial Road listed in APP2 – Roading Hierarchy which has a speed limit of more than 60km per hour.

Where:

a. The road boundary setback rules for a building in the zone in which the sign is located are met; and
b. Is located more than 100m in front of any official traffic sign or signal (excluding street naming signs and NZTA brown tourist signs) in all zones other than in the General Rural Zone, or more than 200m in front of such signs in the General Rural Zone.

And this activity complies with the following rule requirements:

SIGN-REQ1 Free standing signs.

SIGN-REQ2 Built form - signs attached to buildings.

SIGN-REQ3 Built form - signs mounted and affixed to verandahs or overhanging road reserve.

SIGN-REQ4 Built form - signs projecting from the face of a building.

SIGN-REQ6 Distracting features.

SIGN-REQ7 Traffic safety

Activity status when compliance not achieved:

2. When compliance with any of SIGN-R4.1 is not achieved: RDIS

3. When compliance with any rule requirement listed in this rule is not achieved: Refer to SIGN-Rule requirements

ASSESSMENT

The two signs that will display the name of the quarry at the site entrance will not be setback 20m from the road (the setback required for a building from the road boundary).

Therefore, the proposed signs are a **Restricted Discretionary Activity** under Rule SIGN-R4.2.

Matters for discretion:

3. The exercise of discretion in relation to SIGN-R4.2 is restricted to the following matters:
   a. SIGN-MAT1 All Signs and Support Structures.

The scale, design, colour, and location of the sign, accounting for:
   a. impacts on the architectural integrity, amenity values, character values, or visual coherence of:
      i. The building or site on which the sign is displayed and its ability to accommodate the sign;
      ii. The surrounding area (including anticipated changes in the area);
      iii. Heritage buildings or settings, open spaces, protected trees, or areas possessing significant natural or landscape values.
   b. The amount and nature of existing signs on the building and/or site, and whether the proposed sign will result in visual clutter;
   c. The level of visibility of the sign;
   d. The provision of landscaping or other mitigating features;
   e. The length of the road frontage;
   f. The extent to which the sign adds visual interest or screens unsightly activities.
   g. Whether there are any special circumstances or functional needs relating to the activity, building, site or surroundings, which affect the signs requirements including operational, safety, directional, and functional requirements, and
   h. The potential of the sign to cause distraction, or confusion to motorists and/or adversely affect traffic safety due to its location, visibility, and/or content including size of lettering, symbols, or other graphics.

5d CLAWRP Statutory Assessment

5.8

The discharge of wastewater from a new, modified or upgraded on-site wastewater treatment system onto or into land in circumstances where a contaminant may enter water is a permitted activity, provided the following conditions are met:

1. The discharge volume does not exceed $2m^3$ per day; and
2. The discharge is onto or into a site that is equal to or greater than 4 hectares in area; and

2a. The discharge is not located within an area where residential density exceeds 1.5 dwellings per hectare and the total population is greater than 1000 persons; and

3. The discharge is not onto or into land:

   (a) where there is an available sewerage network; or

   (b) that is contaminated or potentially contaminated; or

   (c) that is listed as an archaeological site; or

   (d) in circumstances where the discharge would enter any surface waterbody; or

   (e) within 20 m of any surface waterbody or the Coastal Marine Area; or (f) within 50 m of a bore used for water abstraction; or (g) within a Community Drinking-water Protection Zone as set out in Schedule 1; or (h) where there is, at any time, less than 1 m of vertical separation between the discharge point and groundwater; and

4. The treatment and disposal system is designed and installed in accordance with Sections 5 and 6 of New Zealand Standard AS/NZS 1547:2012 – On-site Domestic Wastewater Management; and
5. The treatment and disposal system is operated and maintained in accordance with the system's design specification for maintenance or, if there is no design specification for maintenance, Section 6.3 of New Zealand Standard AS/NZS 1547:2012 – On-site Domestic Wastewater Management; and
6. The discharge does not result in wastewater being visible on the ground surface; and
7. The discharge does not contain any hazardous substance.

5.9 The discharge of wastewater from:

(a) an existing on-site wastewater treatment system onto or into land in circumstances where a contaminant may enter water that does not meet one or more of the conditions of Rule 5.7; or

(b) a new, modified or upgraded on-site wastewater treatment system onto or into land in circumstances where a contaminant may enter water that does not meet one or more of the conditions of Rule 5.8; is a restricted discretionary activity.

The exercise of discretion is restricted to the following matters:

1. The actual and potential environmental effects of not meeting the condition or conditions of Rule 5.7 for an existing system; and

2. The actual and potential direct and cumulative environmental effects of not meeting the

condition or conditions of Rule 5.8 for a new, modified or upgraded system; and

3. The actual and potential environmental effects of the discharge on the quality and safety of human and animal drinking-water; and

4. The effect of on-site wastewater treatment system density in the local area including known on-site wastewater treatment system failures, the material health status of the community, groundwater quality, the nature of effects of current sewage disposal methods, treatment options available and affordability.

ASSESSMENT

Wastewater includes sewage and water from the staff kitchen and bathrooms.

The discharge of wastewater will be from a new on-site wastewater treatment system onto or into land in circumstances where a contaminant may enter water. The discharge volume will exceed not $2m^3$ per day and will be onto a Site that is greater than 4 hectares in area.

The discharge will not be located within an area where residential density exceeds 1.5 dwellings per hectare and the total population is greater than 1000 persons.

The discharge will not be onto or into land:

- where there is an available sewerage network; or
- that is listed as an archaeological site; or
- within 20 m of any surface waterbody or the Coastal Marine Area; or
- within 50 m of a bore used for water abstraction; or
- within a Community Drinking-water Protection Zone as set out in Schedule 1;
- where there is, at any time, less than 1m of vertical separation between the discharge point and groundwater.

The area where it is proposed to discharge wastewater has not been identified as contaminated in the Preliminary Site Investigation (PSI) or addendum prepared by PDP (**Appendices 11 and 11a**). Broad sampling of soil surfaces outside of HAIL activity areas showed that likely indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) are at background levels. Therefore, the discharge of wastewater will not be onto land that is contaminated or potentially contaminated.

The treatment and disposal system will be designed and installed in accordance with Sections 5 and 6 of New Zealand Standard AS/NZS 1547:2012 – On-site Domestic Wastewater Management; and

The treatment and disposal system will be operated and maintained in accordance with the system's design specification for maintenance or, if there is no design specification for maintenance, Section 6.3 of New Zealand Standard AS/NZS 1547:2012 – On-site Domestic Wastewater Management; and

The discharge will not result in wastewater being visible on the ground surface.

The discharge will not contain any hazardous substance as it will be from staff facilities.

Therefore, the discharge of wastewater is a **Permitted Activity** under Rule 5.9.

5.18

The discharge of a dust suppressant onto or into land in circumstances where a contaminant may enter water is a permitted activity, provided either of the following conditions is met:

1. The discharge is only of vegetable oil, or of new light fuel or lubricating oil and is:

(a) applied in a manner that does not result in pooling or runoff, with a maximum application rate not exceeding 2 litres/m^2 per day and 4 litres/m^2 per annum; and

(b) not within 20 m of a surface water body, the Coastal Marine Area, a bore or soakhole; or

2. The dust suppressant is approved under the Hazardous Substances and New Organisms Act 1996 and the use and discharge of the dust suppressant is in accordance with all conditions of the approval.

ASSESSMENT

Any dust suppressant used on the Site will be approved under the Hazardous Substances and New Organisms Act 1996 and the use and discharge will be in accordance with all conditions of the approval. As such, the use of dust suppressants is a **Permitted Activity** under Rule 5.18.

5.91

The discharge of any liquid waste or sludge waste from an industrial or trade process, including livestock processing, excluding wastewater, into or onto land, or into or onto land in circumstances where a contaminant may enter water is a permitted activity, provided the following conditions are met:

1. The volume of the discharge does not exceed 10m^3 per day; and

2. The discharge is at a rate not exceeding 5mm per day; and

3. The discharge does not contain any hazardous substance; and

4. The discharge is not:

(a) directly to a surface water body, or within 50m of a surface water body, a bore used for water abstraction, a dwelling house, school, community facility or the Coastal Marine Area; and

(b) within a Community Drinking-water Protection Zone as set out in Schedule 1; and

(c) within the Christchurch Groundwater Protection Zone as shown on the Planning Maps; and

(d) onto or into land over an unconfined or semi-confined aquifer, where the land has less than 0.3 m depth of soil; and

(e) within any area or zone identified in a proposed or operative district plan for residential or commercial purposes; and

(f) within a Nutrient Allocation Zone identified as “At Risk” (Orange) or “Water Outcomes Not Met” (Red) on the Planning Maps, unless the discharge contains no nitrogen or phosphorus, or otherwise causes a limit in Schedule 8 to be exceeded; and

(g) onto or into contaminated or potentially contaminated land.

5.92

The discharge of any liquid waste or sludge waste from an industrial or trade process, including

livestock processing, excluding wastewater, into or onto land, or into or onto land in circumstances where a contaminant may enter water that does not meet one or more of the conditions in Rule 5.91 is a discretionary activity.

ASSESSMENT

Industrial or trade process is not defined in the CLAWRP, however in the CRPS the term 'industrial' in Greater Christchurch is defined as 'the manufacturing, assembly, packaging, wholesaling or storage of products or the processing of raw materials and other ancillary activities.'

It is proposed to process 'raw' aggregate and stockpile raw and processed aggregate on the Site, which falls within the definition of 'industrial'. This will result in the discharge of 'liquid waste', generally being water that may contain silts from the silt ponds and the silt (sludge waste) from the ponds being used as cleanfill.

The volume of discharge will exceed $10m^3$ per day and the rate of discharge may exceed 5mm per day. The discharge will not contain any hazardous substance; and will not be:

- directly to a surface water body, or
- within 50m of a surface water body, a bore used for water abstraction, a dwelling house, school, community facility or the Coastal Marine Area; or
- within a Community Drinking-water Protection Zone as set out in Schedule 1; or
- within the Christchurch Groundwater Protection Zone as shown on the Planning Maps; or
- within any area or zone identified in a proposed or operative district plan for residential or commercial purposes.

Whilst the discharge will be within a within a Nutrient Allocation Zone identified as "Water Outcomes Not Met" (Red) on the Planning Maps, the discharge will not contain nitrogen or phosphorus, or otherwise cause a limit in Schedule 8 to be exceeded.

The area where it is proposed to discharge liquid waste from an industrial process has not been identified as contaminated in the Preliminary Site Investigation (PSI) or addendum prepared by PDP (**Appendices 11 and 11a**). Broad sampling of soil surfaces outside of HAIL activity areas showed that likely indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) are at background levels.

The discharge of waste sludge will not be into or onto contaminated land - whilst there are areas of contaminated land across the Site, these will be remediated prior to any discharge occurring. However, the discharge of sludge will be onto land over an unconfined or semi-confined aquifer, where the land has less than 0.3 m depth of soil (soil is defined as loose material on the earth's surface in which terrestrial plants grow and includes sand, silts, clays and any intermixed organic material).

The discharge of liquid waste and sludge waste is a **Discretionary Activity** under Rule 5.92 because the volume will exceed $10m^3$ per day, the rate of discharge may exceed 5mm per day and will be onto land that has less than 0.3 m depth of soil.

11.5.28

Despite Rules 11.5.6 to 11.5.17, within the Selwyn Te Waihora sub-region the discharge of any wastewater, liquid waste or sludge waste from an industrial or trade process, including livestock processing, excluding sewage, into or onto land, or into or onto land in circumstances where a contaminant may enter water is a discretionary activity where the following conditions are met:

1. The discharge, in combination with all lawfully established existing discharges, does not exceed the nitrogen load limit in Table 11(i) for industrial or trade processes; or

2. The nitrogen loss from the discharge, in combination with any other activity, including farming, occurring on the land, is less than any authorised nitrogen loss from the activity that is being replaced; and

3. For all discharges, the best practicable option is used for the treatment and discharge.

11.5.29

Within the Selwyn Te Waihora sub-region, the discharge of any wastewater, liquid waste or sludge waste from an industrial or trade process, including livestock processing, excluding sewage, into or onto land, or into or onto land in circumstances where a contaminant may enter water that does not meet one or more of the conditions in Rule 11.5.28 is a non-complying activity.

ASSESSMENT

The quarry is an industrial process because raw materials will be processed on the Site (Industrial or trade process as defined in the CRPS). The discharge of water potentially containing silt (liquid waste) from the quarry will not contain nitrogen, therefore the discharge will not exceed the nitrogen load limit in Table 11(i) for industrial or trade processes.

The nitrogen loss from the discharge, in combination with any other activity, including farming, occurring on the land, will be less than any authorised nitrogen loss from the activity that is being replaced (farming).

The best practicable option is used for the treatment and discharge.

The discharge of water potentially containing silt (liquid waste) is a **Discretionary Activity** under Rule 11.5.28 as it will meet the conditions set out in the rule.

5.96

The discharge of stormwater, other than into or from a reticulated stormwater system, onto or into land where contaminants may enter groundwater is a permitted activity, provided the following conditions are met:

1. The discharge is not from, into or onto contaminated or potentially contaminated land; and

2. The discharge:

   (a) does not cause stormwater from up to and including a 24 hour duration 10% Annual Exceedance Probability rainfall event to enter any other property; and

   (b) does not result in the ponding of stormwater on the ground for more than 48 hours, unless the pond is part of the stormwater treatment system; and

   (c) is located at least 1 m above the highest groundwater level at the time the discharge system is constructed; and

   (d) is only from land used for residential, educational or rural activities; and

   (e) does not occur where there is an available reticulated stormwater system, except where incidental to a discharge to that system; and

   (f) is not from a system that collects and discharges stormwater from more than five sites.

5.97

The discharge of stormwater, other than from a reticulated stormwater system, into a river, lake, wetland or artificial watercourse or onto or into land in circumstances where a contaminant may enter water that does not meet one or more of the conditions of Rule 5.95 or Rule 5.96; and the discharge of stormwater or construction-phase stormwater into a reticulated stormwater system that does not meet the condition of Rule 5.93A; is a discretionary activity except that within the boundaries of Christchurch City it is a non-complying activity.

ASSESSMENT

Stormwater means runoff water and entrained contaminants arising from precipitation on the external surface of any structure or any land modified by human action, and that has been channelled, diverted, intensified or accelerated by human intervention. It excludes construction-phase stormwater, sediment-laden water and drainage water which are separately defined.

Stormwater within the Site will be runoff water from the buildings, car parks, internal roads, quarried areas, processing areas and stockpiles.

The discharge of stormwater will not be into or onto contaminated land - whilst there are areas of contaminated land across the Site, these will be remediated prior to any discharge and works occurring. The discharge will not cause stormwater from up to and including a 24 hour duration 10% Annual Exceedance Probability rainfall event to enter any other property.

There will be no ponding of stormwater on the ground for more than 48 hours, and the discharge will be at least 1m above the highest groundwater level.

The discharge will not only be from a rural activity as it will be from the part of the Site used for an industrial activity. This is a breach of standard 5.96(e).

There is not an available reticulated stormwater system, nor will there be a system servicing more than 5 sites.

Because of the breach of standard 5.96(e) the discharge of stormwater is a **Discretionary Activity** under Rule 5.97.

5.98

Any discharge of water or contaminants onto or into land in circumstances where a contaminant may enter groundwater that is not classified by any of the above rules, is a permitted activity, provided the following conditions are met:

1. The volume of the discharge does not exceed $10m^3$ per day and the application rate does not exceed 10mm per day; and
2. The discharge is not directly into groundwater; and
3. The discharge does not result in any overflow or runoff into any surface water body or onto neighbouring site; an
4. The discharge does not, in groundwater, render fresh water unsuitable or unpalatable for consumption by animals or humans; and
5. The discharge does not contain any hazardous substance, hazardous waste or added radioactive isotope; and
6. The discharge does not occur when the soil moisture exceeds field capacity; and
7. The discharge is not from or into contaminated or potentially contaminated land; and

8. The discharge is not within

   (a) 50 m of a bore used for water abstraction; or

   (b) within a Community Drinking-water Protection Zone as set out in Schedule 1; and

9. Where the discharge is from the use of live ammunition associated with military training under the Defence Act 1990, conditions 1 to 8 do not apply.

5.100

Any discharge that is not permitted by either Rule 5.98 or 5.99 and is not classified by any other rule in this Plan is a discretionary activity.

ASSESSMENT

The discharge of water though cleanfill is uncontrolled and may exceed $10m^3$ per day. There will be no direct discharge into groundwater, but the water will reach groundwater eventually, thus triggering rule 5.98.

The discharge will not result in any overflow or runoff into any surface water body or onto neighbouring site.

The discharge will be filtered through at least 1m of undisturbed gravel prior to discharging to groundwater. The report prepared by PDP states that the effects on groundwater quality will be low and not render fresh water unsuitable or unpalatable for consumption by animals or humans. The discharge will not contain any hazardous substance, hazardous waste or added radioactive isotope.

The discharge is not controlled and may naturally occur when the soil moisture exceeds field capacity. The discharge will not be from or into contaminated or potentially contaminated land - whilst there are areas of contaminated land across the Site, these will be remediated prior to any discharge occurring.

The discharge will not be within 50m of a bore used for water abstraction; nor within a Community Drinking-water Protection Zone as set out in Schedule 1. Condition 9 is not relevant.

The non-compliances with conditions 1 and 6 trigger a consent requirement for a **Discretionary Activity** under Rule 5.100.

5.175

The use of land to excavate material is a permitted activity, provided the following conditions are met:

….

Over an unconfined or semi-confined aquifer:

a. the volume of material excavated is less than $100m^3$; or

b. the volume of material excavated is more than $100m^3$ and:

i. there is more than 1m of undisturbed material between the deepest part of the excavation and the highest groundwater level; and

ii. the excavation does not occur within 50m of any surface waterbody.

5.176

The use of land to excavate material that does not comply with one or more of the conditions of Rule 5.175 is a restricted discretionary activity.

The exercise of discretion is restricted to the following matters:

1. The actual and potential adverse environmental effects on the quality of water in aquifers, rivers, lakes, wetlands; and
2. Any need for remediation or long-term treatment of the excavation; and
3. The protection of the confining layer and maintaining levels and groundwater pressures in any confined aquifer, including any alternative methods or locations for the excavation; and
4. The management of any exposed groundwater; and
5. Any adverse effects on Ngāi Tahu values or on sites of significance to Ngāi Tahu, including wāhi tapu and wāhi taonga.

ASSESSMENT

It is proposed to extract more than 100m^3 of material but there will be more than 1m of undisturbed material between the deepest part of the excavation and the highest groundwater level recorded for the Site.

The excavation is therefore a **Permitted Activity**.

5.177

The use of land for the deposition of more than 50m^3 of material in any consecutive 12 month period onto land which is excavated to a depth in excess of 5m below the natural land surface and is located over an unconfined or semi-confined aquifer, where the highest groundwater level is less than 5m below the deepest point in the excavation, and the associated discharge of contaminants onto or into land where it may enter water, is a controlled activity, provided the following conditions are met:

1. The material is only cleanfill; and
2. The volume of vegetative matter in any cubic metre of material deposited does not exceed 3%; and
3. The material is not deposited into groundwater placed in the land at least 1 m above the highest groundwater level at the site; and
4. The material is not concrete slurry, coal tar or hydro-excavated waste; and
5. The material is not deposited onto or into land that is listed as an archaeological site; and
6. A management plan has been prepared in accordance with Section 8.1 and Appendix B of "A Guide to the Management of Cleanfills", Ministry for the Environment, January 2002; and
7. A site rehabilitation plan has been prepared for the site and is submitted with the application for resource consent.

The CRC reserves control over the following matters:

1. The potential for adverse effects on the quality of water in aquifers, rivers, lakes, wetlands and mitigation measures; and

2. The content and adequacy of the management plan prepared in accordance with Section 8.1 and Appendix B of "A Guide to the Management of Cleanfills", Ministry for the Environment, January 2002; and

3. The content and adequacy of the site rehabilitation plan to address any adverse effects after the deposition of material is completed.

ASSESSMENT

It is proposed to deposit more than 50m^3 of material in any consecutive 12-month period onto land which will have been excavated to a depth in excess of 5m below the natural land surface. The land is located over an unconfined or semi-confined aquifer and the highest groundwater level is less than 5m below the deepest point of the excavation.

The material will only be cleanfill (virgin materials (unprocessed and processed) extracted from the Site) and will not contain any vegetative matter, concrete slurry, coal tar or hydro-excavated waste. All material will be deposited at least 1m above the highest level of groundwater and no material will be deposited onto or into land that is listed as an archaeological site. A management plan has been prepared in accordance with Section 8.1 and Appendix B of "A Guide to the Management of Cleanfills", Ministry for the Environment, January 2002, and a site rehabilitation plan has been prepared for the Site, which can be found in **Appendix 8** and is described in the Proposal section of this application.

Therefore, the deposition of cleanfill is a **Controlled Activity**.

5.179

The use of land for the storage in a portable container and use of a hazardous substance listed in Part A of Schedule 4 is a permitted activity, provided the following conditions are met:

1. The substance is approved under the Hazardous Substances and New Organisms Act 1996 and the storage and use of the substance is in accordance with all conditions of the approval; and

2. The container(s) are not located within:

(a) 20 m of a surface water body or a bore; or

(b) a Community Drinking-water Protection Zone as set out in Schedule 1.

5.180

The use of land for the storage in a portable container and use of a hazardous substance listed in Part A of Schedule 4 that does not meet one or more of the conditions in Rule 5.179 is a restricted discretionary activity.

The exercise of discretion is restricted to the following matters:

1. Measures to avoid:

(a) the entry of the substances or associated contaminants into groundwater, surface water, supplies of drinking-water and aquatic ecosystems; and

(b) any actual or potential adverse environmental effects on the current or future use of the water resource, as a result of leakage or spillage of the substance, or a release of the substance as a result of a natural event; and

2. Measures to prevent or contain spills or leaks, including site layout and drainage, waste management, emergency management and leak detection; and

3. Maintenance and monitoring of the storage or use system including containment measures.

ASSESSMENT

It is proposed to store and use up to 1,000kg of greases in special designed areas within the workshop. The substances will be approved under the Hazardous Substances and New Organisms Act 1996, and the storage and use of the substance will be in accordance with all conditions of the approval. The container(s) will not be located within 20m of a surface water body or a bore; or a Community Drinking-water Protection Zone as set out in Schedule 1.

The use of land for the storage in a portable container and use of a hazardous substance is a **Permitted Activity** under Rule 5.179.

5.181

The use of land for the storage, other than in a portable container, and use of a hazardous substance listed in Part A of Schedule 4 is a permitted activity, provided the following conditions are met:

1. The substance is approved under the Hazardous Substances and New Organisms Act 1996, and the storage and use of the substance is in accordance with all conditions of the approval; and

2. A current inventory of all hazardous substances on the site is maintained, and a copy of the inventory shall be made available to the CRC or emergency services on request; and

3. For hazardous substances stored or held on or over land, all areas or installations used to store or hold hazardous substances are inspected at least once per month or annually if the site is outside of any area or zone identified in a proposed or operative district plan for residential, commercial or industrial purposes and is unstaffed, and repaired or maintained if any defects are found that may compromise the containment of the hazardous substance; and

4. For hazardous substances stored or held in a container located in or under land:

   (a) if there has been any physical loss of product, then the Canterbury Regional Council shall be notified within 24 hours of confirmation of the loss; and

   (b) records of stock reconciliations over the past 12 months shall be made available to the CRC upon request. If requested, a copy of the stock reconciliation and the most recent certification of the container shall be provided to the CRC within five working days; and

5. For substances stored within a Community Drinking-water Protection Zone as set out in Schedule 1:

   (a) all hazardous substances on a site are stored under cover in a facility which is designed, constructed and managed to contain a leak or spill and allow the leaked or spilled substance to either be collected or lawfully disposed of; and

   (b) spill kits to contain or absorb a spilled substance are located with the storage facility and use areas at all times and

6. Except where the storage was lawfully established before 4 July 2004 and the maximum quantity stored has not increased since that date, or the storage relates to transformers and other equipment associated with electricity infrastructure, the substances shall not be stored

within:

(a) 20 m of a surface waterbody or a bore used for water abstraction; or

(b) 250m of a known active fault that has a recurrence period of less than 10,000 years, and the land is:

(i) over an unconfined or semi-confined aquifer; or

(ii) within 50 m of a permanently or intermittently flowing river or a lake.

5.182

The use of land for the storage, other than in a portable container, and use of a hazardous substance listed in Part A of Schedule 4 that does not meet one or more of the conditions in Rule 5.181 is a discretionary activity.

ASSESSMENT

It is proposed to store and use 30,000 litres of oil in double-skinned containers on the Site. Oil is a substance that is approved under the Hazardous Substances and New Organisms Act 1996, and the storage and use of the substance will be in accordance with all conditions of the approval.

A current inventory of all hazardous substances on the Site will be maintained, and a copy of the inventory shall be made available to the CRC or emergency services on request.

The storage area will be inspected at least once per month and will be repaired or maintained if any defects are found that may compromise the containment of the hazardous substance.

If there has been any physical loss of product, then the Canterbury Regional Council shall be notified within 24 hours of confirmation of the loss; and records of stock reconciliations over the past 12 months shall be made available to the CRC upon request. If requested, a copy of the stock reconciliation and the most recent certification of the container will be provided to the CRC within five working days.

No substances will be stored within:

- a Community Drinking-water Protection Zone as set out in Schedule 1,
- 20m of a surface waterbody or a bore used for water abstraction; or
- within 50 m of a permanently or intermittently flowing river or a lake;or
- within 250m of the fault that runs across the western part of the Site.

The use of land for the storage (other than in a portable container) and use of a hazardous substance is a **Permitted Activity** under Rule 5.181.

5e CARP Statutory Assessment

7.32 The discharge of dust to air beyond the boundary of the property of origin from the construction of buildings, land development activities, unsealed surfaces or unconsolidated land, is a permitted activity provided the following conditions, where applicable, are met: 1. The building to be constructed is less than 3 stories in height, or where the building is greater than 3 stories in height, a dust management plan is prepared in accordance with Schedule 2 and implemented by the person responsible for the discharge into air; and 2. The area of unsealed surface or unconsolidated land is less than 1000m^2, or where the area of unsealed surface or unconsolidated land is greater than 1000m^2 a dust management plan is prepared in accordance with Schedule 2 and implemented by the person responsible for the discharge into air; and 3. The discharge does not cause an offensive or objectionable effect beyond the boundary of the property of origin, when assessed in accordance with Schedule 2.
7.33 The discharge of dust, beyond the boundary of the property of origin, from the construction of buildings, land development activities, unsealed surfaces or unconsolidated land that does not meet condition 1 or 2 of Rule 7.32 is a restricted discretionary activity. The exercise of discretion is restricted to the following matters: 1. The content of the management plan to be implemented; and 2. The frequency of the effects of the discharge; and 3. The intensity of the effects of the discharge; and 4. The duration of the effects of the discharge; and 5. The offensiveness of the discharge; and 6. The location of the effects of the discharge; and 7. The matters set out in Rule 7.2; and 8. Any effect on the environment of not meeting the condition or conditions of the particular rule contravened; and 9. Whether the conditions of the rule, when considered as a package, remain effective; and 10. Mitigation methods available to minimise any actual or potential environmental effects on the efficacy of the package of conditions.
7.34 The discharge of dust into air beyond the boundary of the property of origin, from the construction of buildings, land development activities, unsealed land or unconsolidated surfaces that does not meet condition 3 of Rule 7.32 is a non-complying activity.
ASSESSMENT The area of unsealed surface or unconsolidated land will be more than 1000m^{2,} but any discharge will not cause an offensive or objectionable effect beyond the boundary of the Site, as confirmed in

the Air Quality Assessment prepared by PDP (**Appendix 15**) section 6.2.6. Furthermore, a dust management plan will be prepared in accordance with Schedule 2. Therefore, the Proposal is a **Permitted Activity** as it will meet the conditions of Rule 7.32.

7.35 The discharge of contaminants into air from the handling of bulk solid materials is a permitted activity provided the following conditions are met: 1. The discharge of dust does not cause an offensive or objectionable effect beyond the boundary of the property of origin, when assessed in accordance with Schedule 2; and 2. The handling occurs indoors, or where the handling occurs outdoors the rate of handling does not exceed 100t per hour; or 3. Where handling occurs outdoors on less than 21 days per calendar year, the rate of handling does not exceed 250t per hour; and 4. Where the handling occurs outdoors and the rate of handling exceeds 20t per hour, a dust management plan is prepared in accordance with Schedule 2 and implemented by the person responsible for the discharge into air; and 5. The dust management plan is supplied to the CRC on request; and 6. The discharge does not occur within 200m of a sensitive activity, wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan; and 7. Notwithstanding condition 6, where the discharge is from production blasting at a quarry site the discharge does not occur within 500m of a sensitive activity wāhi tapu, wāhi taonga or a place of significance to Ngāi Tahu that is identified in an Iwi Management Plan.
7.63 The discharge of contaminants into air: 1. that does not comply with one or more of the conditions of Rules 7.47 to 7.62, excluding condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62; or 2. that is from an industrial or trade premise and is not managed by Rules 7.47-7.62; and is not a prohibited activity, is a discretionary activity.
ASSESSMENT The handling of bulk solid materials refers to the processing and loading of aggregate onto trucks, and the removal and replacement of overburden within the Site. 1. The discharge of dust will not cause an offensive or objectionable effect beyond the boundary of the Site, as confirmed in the Air Quality Assessment prepared by PDP (**Appendix 15**) section 6.2.6. 2. The handling will not occur indoors. The handling will occur outdoors, but the rate of handling will not exceed 100t per hour, so Rule 7.35.2 is not applicable. 3. The handling will occur outdoors on more than 21 days per calendar year, so Rule 7.35.3 is not applicable. 4. The rate of handling will likely exceed 20 tonnes per hour, therefore a dust management plan

will be prepared in accordance with Schedule 2 and will be implemented by Burnham 2020.

5. The dust management plan will be supplied to the CRC on request.
6. The discharge of dust will occur within 200m of a sensitive activity but not any wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan.
7. There will be no production blasting at the Site.

The Proposal is therefore a **Discretionary Activity** under Rule 7.63 as a quarry where aggregate is processed is defined as an industrial or trade premise and it is not managed by the specified rules.

7.36

The discharge of contaminants into air from the outdoor storage of bulk solid materials is a permitted activity provided the following conditions are met:

1. The discharge of dust does not cause an offensive or objectionable effect beyond the boundary of the property of origin, when assessed in accordance with Schedule 2; and
2. The amount of material stored does not exceed 1000t when it has an average particle size of less than 3.5mm; and
3. Where the storage exceeds 200t, a dust management plan is prepared in accordance with Schedule and implemented by the person responsible for the discharge into air; and
4. The dust management plan is supplied to the CRC on request; and
5. The discharge does not occur within 100m of a sensitive activity, wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan.

7.63

The discharge of contaminants into air:

1. that does not comply with one or more of the conditions of Rules 7.47 to 7.62, excluding condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62; or
2. that is from an industrial or trade premise and is not managed by Rules 7.47 -7.62; and is not

a prohibited activity, is a discretionary activity.

7.64

The discharge of contaminants into air that does not comply with condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62 is a non-complying activity.

ASSESSMENT

The outdoor storage of bulk solid materials includes the stockpiling of aggregate and overburden.

1. The discharge of dust will not cause an offensive or objectionable effect beyond the boundary of the Site, as confirmed in the Air Quality Assessment prepared by PDP (**Appendix 15**) section 6.2.6.
2. The amount of material stored may exceed 1000t and the average particle size will be less than 3.5mm.

3. The storage may exceed 200t, so a dust management plan will be prepared in accordance with Schedule 2 and will be implemented by Burnham 2020.
4. The dust management plan will be supplied to the CRC on request.
5. The discharge to air of dust will not occur within 100m of a sensitive activity, wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan.

The Proposal is therefore a **Permitted Activity** under Rule 7.36.

7.49

The discharge of contaminants into air from the disposal of cleanfill is a permitted activity provided the following conditions are met:

1. The discharge of dust does not cause an offensive or objectionable effect beyond the boundary of the property of origin when assessed in accordance with Schedule 2; and
2. The discharge does not occur within 200m of a sensitive activity on another property, or within 100m of a wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan; and
3. The amount of material stored does not exceed 1000t when it has an average particle size of less than 3.5mm; and
4. If there is a discharge of dust beyond the boundary of the property of origin, a dust management plan is prepared in accordance with Schedule 2 and implemented by the person responsible for the discharge into air; and
5. The dust management plan is supplied to the CRC on request.

7.63

The discharge of contaminants into air:

1. that does not comply with one or more of the conditions of Rules 7.47 to 7.62, excluding condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62; or
2. that is from an industrial or trade premise and is not managed by Rules 7.47-7.62; and is not

a prohibited activity, is a discretionary activity.

7.64

The discharge of contaminants into air that does not comply with condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62 is a non-complying activity.

ASSESSMENT

1. The discharge of dust from cleanfilling will not cause an offensive or objectionable effect beyond the boundary of the Site, as confirmed in the Air Quality Assessment prepared by PDP (**Appendix 15**) section 6.2.6.
2. The discharge of dust will occur within 200m of a sensitive activity on another property, but not within 100m of a wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan.
3. The amount of material stored may exceed 1000t and the average particle size will be less than

3.5mm.

4. A dust management plan will be prepared for the Site and implemented by Burnham 2020.

5. The dust management plan will be supplied to the CRC on request.

The Proposal is therefore a **Discretionary Activity** under Rule 7.63 as a quarry where aggregate is processed is defined as an industrial or trade premise and it is not managed by the specified rules.

7.50

The discharge of contaminants into air from the treatment and disposal of less than $50m^3$ per day of human sewage effluent averaged over a calendar month is a permitted activity provided the following conditions are met:

1. The discharge of odour does not cause an offensive or objectionable effect beyond the boundary of the property of origin, when assessed in accordance with Schedule 2; and

2. If there is a discharge of odour beyond the boundary of the property of origin, an odour management plan is prepared in accordance with Schedule 2 and implemented by the person responsible for the discharge into air; and

3. The odour management plan is supplied to the CRC on request; and

4. Except where the discharge is from a single dwelling or other source discharging less than $2m^3$ per day averaged over a calendar month, the treatment system and any surface irrigation of effluent is at least 20m from the boundary of the property of origin; and

5. There is no uncovered storage of screened solids or uncovered drying and storage of sludge; and

6. Spray irrigation, and storage of effluent in uncovered vessels, including oxidation ponds, occurs at least 50m from the boundary of the property of origin and at least 150m from any sensitive activity or wāhi tapu, wāhi taonga or place of significance to Ngāi Tahu that is identified in an Iwi Management Plan.

7.63

The discharge of contaminants into air:

1. that does not comply with one or more of the conditions of Rules 7.47 to 7.62, excluding condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62; or

2. that is from an industrial or trade premise and is not managed by Rules 7.47-7.62; and is not

a prohibited activity, is a discretionary activity.

7.64

The discharge of contaminants into air that does not comply with condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62 is a non-complying activity.

ASSESSMENT

The Site will not generate more than $50m^3$ per day of human sewage effluent averaged over a calendar month.

1. The discharge of odour will not cause an offensive or objectionable effect beyond the boundary of the property of origin, based on understanding wind direction, strength and the likelihood of

dust discharging onto adjoining properties from the Air Quality Assessment prepared by PDP (**Appendix 15**) section 6.2.6.

2. Therefore, there is no requirement to prepare and implement an odour management plan.
3. Is not relevant as no odour management plan is required.
4. The treatment system and any surface irrigation of effluent will be over 50m from the boundary of the Site, and
5. There will be no uncovered storage of screened solids or uncovered drying and storage of sludge.
6. There will be no spray irrigation or oxidation ponds as wastewater will discharge via a subsurface dripline system placed in the landscaped and bunded areas at original ground level. The discharge will occur in close vicinity of the office buildings.

The Proposal is therefore a **Permitted Activity** under Rule 7.50.

7.53

The discharge of contaminants into air, including vapour ventilation and displacement, from the storage or transfer of petroleum products (including liquefied petroleum gas), is a permitted activity provided the following conditions are met:

1. The total volume of petroleum product stored on the site is less than 1,000l; or
2. The total volume of petroleum product stored on the site is 1,000l or more, and if there is a discharge of odour or dust beyond the boundary of the property of origin, an odour management plan is prepared in accordance with Schedule 2, implemented by the persons responsible for the discharge into air, and supplied to the CRC on request.

7.63

The discharge of contaminants into air:

1. that does not comply with one or more of the conditions of Rules 7.47 to 7.62, excluding condition 1 of Rules 7.47, 7.48, 7.49, 7.50 7.51, 7.55, 7.59 and 7.62; or
2. that is from an industrial or trade premise and is not managed by Rules 7.47 -7.62; and is not

a prohibited activity, is a discretionary activity.

ASSESSMENT

It is proposed to store 30,000 litres of petroleum products on the Site in a double skinned tank at least 500m from any adjoining sensitive activity or public road. As such, it is not anticipated that there will be a discharge of odour beyond the boundary of the Site.

The rule states, '**if** there is a discharge of odour or dust…'and none is anticipated to occur in association with the storage and use of hazardous substances. As such, it is not proposed to prepare an odour management plan and the storage of petroleum products is a **Permitted Activity** under Rule 7.53.

6.0 Assessment of Environmental Effects

This section sets out the receiving environment, the potential and actual effects of the proposal and how these will be managed through mitigation measures.

6.1 Section 104(2) Permitted Baseline

6.1.1 Selwyn District Plan

The Operative Selwyn District Plan (the District Plan) permits, as relevant to this Site:

- Maximum of 5,000m^3 of earthworks on uncontaminated land, where these works are setback 20 metres from the edge of any water body.
- Any activity which is not a rural activity provided the maximum area of any site covered by building(s), loading, storage and waste areas used for any other activity on the site does not exceed 100m^2 and no more than two full-time equivalent persons are employed in undertaking any other activity on the site.
- Any rural based industrial activity provided that the maximum area of any site covered by any building(s), loading, storage and waste areas used for any rural based industrial activity on the site shall be 100m² and no more than two full-time equivalent persons are employed in undertaking the activity on the site.
- The storage and use of hazardous substances that meets quantity limits, storage area requirements, and the hazardous substance is not stored within 20 metres of any waterbody (excluding aquifers), and in any area shown on the Planning Maps as a Silent File Area, Wāhi Taonga Site, Wāhi Taonga Management Area, or Mahinga Kai Site.
- Traffic movements generated by the Site onto a road that is formed, sealed and maintained by Council is a maximum of 30 ecm/d[6] per site (averaged over any one-week period) onto a State Highway and Arterial Roads.

By way of example, the District Plan permits 5,000m^3 of quarrying (such as a farm quarry) as a non-rural activity on the Site along with 100m^2 of buildings and storage area and no more than two full-time equivalent persons employed in the activity. Processing of the rock is also permitted as a rural industrial activity provided that building(s), loading, storage and waste areas do not exceed 100m² and no more than two full-time equivalent persons are employed in this activity. The storage and use of hazardous substances is permitted to a maximum of 5,000 litres of diesel and 10kg of oils and greases.

All activities on the Site are permitted to generate a maximum of total of 30 ecm/d per site (averaged over any one-week period) if access is onto Aylesbury Road, and 60 ecm/d per site (averaged over any one week period) if access is onto Grange Road.

Given the scale of activity being proposed, this permitted baseline is considered to be of limited relevance and has not been relied upon in the assessment of potential and actual effects of this Proposal.

[6] Equivalent Car Movements Per Day as defined in the Operative Selwyn District Plan.

The Selwyn District Plan also permits, as relevant to this Site:

- Shelterbelts that do not shade the road during specified times, do not encroach within the line of sight for any railway crossing or road intersection and/or height restrictions for West Melton Airfield or Hororata Domain, and do not involve the planting of certain species.
- Buildings outside hazard areas (unless certain standards are met), not on contaminated land, on a site that has legal access to a formed and maintained legal road, that cover up to 5% of the Site, are no greater than 12m in height, and are setback 5m from a property boundary, 20m from an arterial road or 10m from any other road.
- Access ways that have a gradient greater than 1:6 vertical; or 1:20 horizontal and standards related to design and formation, sightlines, position of a gate, sealing and sites with two road frontages, and accessing the road with the lowest classification.
- Unlimited signs required under legislation or to provide for people's health or safety.
- Three signs related to the activity on the Site, which cannot exceed the height of the building they ae attached to, or if not attached to a building, be more than 6m in height. Signs can also not be more than $3m^2$ and the total area of signage on the site cannot exceed $6m^2$.
- Activities that meet the following noise limits at the notional boundary of any dwelling, rest home, hospital, or classroom in any educational facility except where that dwelling, rest home, hospital or classroom is located within a Living zone:

Hours	Noise limits
7.30am – 8.00pm	60 dBA L_{10} 85 dBA L_{max}
8.01pm – 7.29am	45 dBA L_{10} 70 dBA L_{max}

- Noise from any motor vehicle or any mobile machinery (including farm machinery and stationary equipment not fixed to the ground) is exempt from the noise standards.

These permitted activities and standards are considered to be of greater relevance to the Proposal as the number or extent of shelterbelts are not limited by the District Plan and only the shading of the road is sought to be managed.

The permitted activity standards also provide for buildings on the Site (being no more than 5% of the site coverage, a maximum of 12 metres in height and setback 20m from an arterial road). The buildings proposed on the Site will meet the site coverage, maximum height and boundary setbacks for buildings in the OSDP.

The accessway standards, signage limits and noise standards all set a permitted baseline against which the Proposal has been assessed under ss95D, 95E and 104(1)(a) of the RMA.

6.1.2 Partially Operative Selwyn District Plan

The Partially Operative Selwyn District Plan (the POSDP) permits, as relevant to this Site:

- Traffic movements generated by the Site onto a road that is formed, sealed and maintained by Council is a maximum of 60 ecm/d[7] per site (averaged over any one-week period).
- The establishment of a vehicle crossing that does not service an activity that generates more than 40 vehicle movements per day.

Given the scale of activity being proposed, this permitted baseline is considered to be of limited relevance and has not been relied upon in the assessment of potential and actual effects of this Proposal.

The Partially Operative Selwyn District Plan also permits, as relevant to this Site:

- Rural Production (Any aquaculture, agricultural, pastoral, horticultural, or forestry activities, including farm quarrying and includes initial processing, as an ancillary activity, of commodities that result from the listed activities above, and includes any land and buildings used for the production of the commodities from a) and used for the initial processing of commodities.
- The establishment of a new, or expansion of an existing shelterbelt, that complies with the Springfield Airfield Height Restriction, the West Melton Aerodrome Height Restriction, the Planting Setbacks Restriction near Significant Electricity Distribution Line and the Wildfire Setbacks.
- The erection of a new, or relocation, or alteration, or expansion of an existing structure not used as either a residential unit or a minor residential unit that meets the following standards:
    - building coverage of a maximum of 35% or 500m^2, whichever is lesser for sites less than 1ha; or 5% for all other sites greater than 1ha.
    - 12 metre height limit, and
    - 20 metre setback from an arterial road and 10m from any other road.
- The establishment of any new principal building that is not located in a high hazard area; not located between any surface water body and any stopbank designed to contain floodwater from that surface water body; and the finished floor level is equal to or higher than the minimum floor level stated in a Flood Assessment Certificate issued in accordance with NH-SCHED1 Flood Assessment Certificates.
- Car parking for an activity that:
    - is all located within the site,
    - provides sufficient mobility parks that are designed in accordance with the design requirements listed in TRAN-TABLE10 - Minimum parking area dimensions, having a stall width of 3.6m and a stall depth of 6.1m.
    - meets the required gradients of:
        - 1:16 (6.25%) at 90o to the angle of the vehicle park; and
        - 1:20 (5%) when parallel to the angle of the vehicle park.
    - is accessed via a road that meets the gradient requirements.

[7] Equivalent Car Movements Per Day as defined in the Operative Selwyn District Plan.

    - has sufficient space for vehicles to manoeuvre within the Site and not reverse onto an arterial road.
- Use and/or storage of hazardous substances, excluding a major hazard facility.
- Signs located on a site adjacent to an Arterial Road with a speed limit of more than 60km per hour, where the road boundary setback rules for a building in the Rural Zone are met; and the sign is located more than 200m in front of any official traffic sign or signal (excluding street naming signs and NZTA brown tourist signs) in the General Rural Zone.
- Artificial outdoor lighting that complies with the rule requirements for light spill, glare and sky glow.
- Activities that meet the following noise limits at the notional boundary of any noise sensitive activity within any site receiving noise:

Hours	Noise limits
0700 to 2200	55 dB L_{Aeq}
2200 to 0700	45 dB L_{Aeq} 70 L_{AFmax}

- Traffic noise generated within a land transport corridor.

These permitted activities and standards are considered to be of greater relevance to the Proposal as the number or extent of shelterbelts are not limited by the District Plan and only effects on specified airfields, significant electricity distribution lines and the risk of wildfire area sought to be managed.

The permitted activity standards also provide for buildings on the Site (being no more than 5% of the site coverage, a maximum of 12 metres in height and setback 20m from an arterial road). The buildings proposed on the Site will meet the site coverage, maximum height and boundary setbacks for buildings in the POSDP.

The accessway standards, signage limits, lighting and noise standards all set a permitted baseline against which the Proposal has been assessed under ss95D, 95E and 104(1)(a) of the RMA.

6.1.3 Canterbury Land and Water Regional Plan

Under the CLAWRP, the following activities, as relevant to this Proposal, are permitted:

- The discharge of wastewater from a new on-site wastewater treatment system onto or into land where a contaminant may enter water, provided that the discharge volume does not exceed 2m^3 per day, subject to conditions.
- The discharge of a dust suppressant approved under the Hazardous Substances and New Organisms Act 1996, and the use and discharge of the dust suppressant is in accordance with all conditions of the approval onto or into land.
- The discharge of stormwater, other than into or from a reticulated stormwater system, onto or into land in circumstances where contaminants may enter groundwater and subject to conditions including that the discharge is located at least 1 metre above the highest groundwater level at the time the discharge system is constructed.

- The discharge of 10m^3 of water or contaminants where the application rate does not exceed 10 mm per day onto or into land in circumstances where a contaminant may enter groundwater that is not classified by any other rule, subject to conditions.
- The excavation of more than 100m^3 where there is more than 1m of undisturbed material between the deepest part of the excavation and the highest groundwater level, and it does not occur within 50 metres of any surface waterbody.
- The storage in a portable container and use of a hazardous substance listed in Part A of Schedule 4 of the CLAWRP and approved under the Hazardous Substances and New Organisms Act 1996, subject to conditions.
- The storage, other than in a portable container, and use of a hazardous substance listed in Part A of Schedule 4 and approved under the Hazardous Substances and New Organisms Act 1996, subject to conditions.

The CLAWRP permits a small volume (not exceeding 2m^3 per day) of the discharge of wastewater as a permitted activity, which this Proposal will just exceed.

The discharge of stormwater is not constrained by a volume control and therefore the permitted baseline is considered relevant.

The permitted baseline for the discharge of dust suppressants and the storage of hazardous substances are also considered relevant to this Proposal.

The discharge of water or contaminants onto or into land, not managed under any other rule, is limited by a volume of 10m^3, which is of little relevance to this Proposal.

There is no limit on the volume of earthworks that can be undertaken provided there is more than 1 metre of undisturbed material between the deepest part of the excavation and the highest recorded groundwater level. This permitted baseline for earthworks is directly applicable to the Proposal.

As such, the permitted baseline has been applied to:

- The discharge of a dust suppressant approved under the Hazardous Substances and New Organisms Act 1996.
- The discharge of stormwater.
- Aggregate extraction.
- The storage and use of hazardous substances.

6.1.4 Canterbury Air Regional Plan

The CARP permits the following relevant activities:

- The discharge of dust to air beyond the boundary of the Site from the construction of buildings, unsealed surfaces or unconsolidated land, subject to conditions.
- The discharge of contaminants into air from the handling of bulk solid materials, subject to conditions.
- The discharge of contaminants into air from the outdoor storage of bulk solid materials, subject to conditions.

- The discharge of contaminants into air from the disposal of cleanfill, subject to conditions.
- The discharge of contaminants into air, including vapour ventilation and displacement, from the storage or transfer of petroleum products (including liquefied petroleum gas), subject to conditions.

These permitted activity standards form a permitted baseline for discharges from activities within the Site including dust from aggregate extraction activities, haul roads and processing activities.

6.2 Effects Assessment

The effects assessment addresses actual and potential effects on or from the following matters, arising from the Proposal being establishment of a quarry, the extraction and processing of aggregate and the rehabilitation of the Site:

- Landscape values and visual amenity.
- Noise.
- Transport and the roading network.
- Contaminated land.
- Ecological values.
- Productivity of the soil.
- Groundwater quality.
- Air Quality.
- Archaeology values.
- Economy of the district.

6.2.1 Landscape Values and Visual Amenity

The following section assesses the potential landscape and visual effects of the Proposal and has been informed by the Landscape and Visual Effects Assessment prepared by Boffa Miskell (**Appendix 8**).

6.2.1.1 Landscape, Rural Character and Amenity Values

Landscape

The Site forms part of the lower eastern area of the Canterbury Plains (Kā Pākihi-whakatekateka-a-Waitaha), which extends between the foothills of the Southern Alps and Banks Peninsula and between the Waimakariri River to the north and the Waikirikiri / Selwyn River to the south. The plains are made up of a series of gently sloping fans that contain greywacke gravels produced during successive glaciations of the mountainous regions to the west. These gravels are up to 500 metres deep in some places.

The Site and its surroundings have not been identified as part of any outstanding natural landscape or significant amenity landscape at the regional or district scale.

Rural character

Large-scale land use changes including primary production have led to widespread irrigation with large pivot irrigators being a common structure in wide, open paddocks. Linear roads and fencing with dispersed agricultural sheds and dwellings are also common physical influences encountered throughout this working rural landscape context. The Road Metals Quarry on Wards Road and Burnham Golf Club on Aylesbury Road also typify the types of activities that are found in rural areas and contribute to its character.

Indigenous vegetation present on the plains is less than 0.5% of the total landcover, and has been reduced to small, isolated and scattered remnants.

Visual amenity

The vastness and openness of this landscape allows for uninterrupted views of the Southern Alps to the west and Banks Peninsula to the east. Views of the Site from both public and private viewpoints are restricted by the flat topography coupled with the existing shelter planting around the perimeter of the Site, although there are intermittent views between gaps in the existing shelter planting from Aylesbury Road (a primary collector road), and Grange Road, with long distance views of the western boundary of the Site available from Kivers Road. Views of the Site from neighbouring dwellings are typically restricted due to intervening shelter planting within the Site and reinforced with planting introduced along neighbouring property boundaries.

A detailed description of the visual catchment can be found in section 2.5 of the LVEA and the Graphic Supplement. In brief, views from most public viewpoints on Aylesbury Road, Two Chain Road, Sandy Knolls Road and Grange Road are curtailed by existing vegetation on the boundaries of the Site. There are no restrictions on views into the Site near 159 and 139 Grange Road, but these would generally be experienced only obliquely and for a transient moment as drivers and passengers pass the Site on the open road.

6.2.1.2 Effects on Landscape, Rural Character and Visual Amenity Values

The proposed quarry will result in gradual and progressive modification to the existing landform, and exposure of bare earth during the extraction of aggregate. These effects will gradually move across the Site through successive phases of construction and extraction, however, will be contained within a framework of vegetation with bunding, temporary stockpiles and additional planting along batter slopes following rehabilitation. It is considered that effects on landscape character will be more than minor (moderate adverse) during the operation of the quarry and will gradually reduce through successive phases of aggregate extraction and rehabilitation.

While the landform within the Site will change, it will remain predominantly in productive rural land use prior to, and following, each phase of extraction. Therefore, the Site will remain rural in character albeit in the context of a modified landform rehabilitated with substantial planting. During the life of the Project, a mosaic of patches and corridors of native planting equating to approximately 30 hectares will be established. This will ensure that the Site remains well integrated into the broader landscape, resulting in no more than low (less than minor) adverse effects on landscape values at completion.

6.2.1.3 Effects from Public Viewpoints

Initially, there will be limited to filtered views from Aylesbury Road to the east through the established shelterbelts along the boundary of the Site. However, these views will diminish as the entrance way is planted, the long term bund is constructed, and the stockyards are located below existing ground

level. Adverse visual effects from public viewpoints on Aylesbury Road will therefore be low adverse (less than minor).

Views from Grange Road of the southern portion of the Site will be curtailed by the existing pine shelterbelts which extend along the majority of the Site boundary and will be retained throughout the life of the quarry. Some more transient, long-distance views of above ground activity during Phases 1-3 may be obtained through a gap in the boundary planting, however, these will generally be limited by the internal shelterbelt (SB26) (refer to LVEA Graphic Supplement **Appendix 8**) and the temporary stockpiling and planting that will occur within this gap during Phase 5. These views will remain restricted as the proposed farm access is realigned and intervening planting becomes established. Therefore, adverse visual effects from public viewpoints on Grange Road will be very low (less than minor) and reduce to neutral on the implementation and establishment of the planting near the existing farm entry.

Long-distance, glimpsed views of the Site will be available from Kivers Road, through gaps in the existing shelterbelt. However, beyond this, any views into the Site will be curtailed by the intervening shelterbelt on the western boundary of the Site combined with planting on intervening private properties. Accordingly, any visual effects experienced from public viewpoints on Kivers Road are assessed as neutral during extraction and on completion.

Overall, the established shelterbelt, proposed reinforcement planting, rehabilitation planting and bunding will limit views into the Site from the surrounding area. As such, visual effects from public viewpoints will be no greater than low adverse (less than minor) and will further reduce as proposed native vegetation planted along the perimeter of the Site and at the entrance becomes established over time.

6.2.1.4 Effects on Private Properties

There are approximately 51 private properties (identified on Figure 3 of the Landscape and Visual Assessment Graphic Supplement in **Appendix 8**), and additional dwellings within the Burnham Military Camp base, within the vicinity of the Site.

Visual effects on private properties were assessed during a site visit (from the nearest public vantage points as no properties were visited), and a desktop analysis was undertaken to understand proximity to the Site; the apparent orientation of the house (it appears that most are orientated to the north or north-west) and the nature of the view, including any existing or proposed vegetation that might provide full or partial screening of views.

A summary of the assessment is set out below:

Houses	Level of Effect	Summary of Assessment
Houses 1 to 25 – to the east.	Less than minor (No greater than very low adverse).	During Phase 1, there may be glimpsed and transitory views of the construction of the long-term bund and planting in the south-eastern corner of the Site. However, these views will generally be curtailed by the existing shelterbelt along the eastern boundary of the Site. Views of future processing and extraction areas will be concealed by an established pine

		shelterbelt, the long-term bund to the north and the 100-metre planted setback in the south-eastern corner of the Site.
Houses 26 to 37 - south of the Site and predominantly accessed from Grange Road and Two Chain Road.	Less than minor (No greater than very low adverse).	Views from these dwellings will remain truncated or completely curtailed by intervening vegetation, including the existing shelterbelt along the southern boundary of the Site, proposed internal planting around the Site entrance and along the tops of rehabilitated batters.
Houses 38 to 46	Less than minor (No greater than very low adverse).	Views into the Site will largely be curtailed by the existing boundary vegetation. Even during Phases 7 to 11 (the phases closest to these houses) any glimpsed, transitory views through the existing shelterbelt of machinery operating within the quarry will be curtailed by the construction of a temporary stockpile and final rehabilitation of the battered slope with native vegetation.
North of the Site are Houses 47 to 51 - accessed from Wards Road and are closest to the final stages of extraction (Phases 11-14).	Neutral.	Views from these properties will be curtailed by intervening shelterbelt planting, the orientation of the dwellings, and intervening vegetation within the wider landscape.
Burnham Military Camp to the south of the Site	Neutral.	Views towards the Site are already curtailed by intervening vegetation within the wider landscape and the exotic shelterbelt on the Site boundary.

6.2.1.5 Summary of effects

The Site will remain well integrated into the broader landscape, recognising the existing and proposed planting and that most activity will occur up to 10 metres below the existing ground level. Effects on landscape character will be more than minor (moderate adverse) during the operation of the quarry and will gradually reduce through successive phases of aggregate extraction and rehabilitation, resulting in less than minor (no more than low adverse) effects on landscape values at completion.

The greatest visual effect will be from public viewpoints at the Site entrance along Aylesbury Road at the commencement of the project, albeit becoming increasingly screened by planting and the relocation of processing areas to the floor of the quarry. Furthermore, the existing shelterbelt, proposed long-term bund, temporary stockpiles, and areas of planting established prior to extraction and following rehabilitation of each phase, will ensure that visual effects from public viewpoints will remain effectively mitigated, and will be less than minor (no greater than low adverse).

Views from private viewpoints will largely remain unchanged as they will be truncated or entirely curtailed by the existing shelterbelt planting, long-term bund and intervening areas of planting including additional native vegetation introduced along the tops of rehabilitated slopes of the quarry, resulting in less than minor (very low) adverse effects.

The Landscape Effects Assessment recommends that the following landscape mitigation measures are included as conditions of consent:

- A landscape plan is prepared prior to commencing development that addresses:
    - the maintenance of the existing shelterbelts, and
    - infill planting of existing shelterbelts where necessary, and
    - additional planting including on the long-term bunds and in the south-east corner and on the southern boundary of the site, and
    - measures to reduce the risk of fire, and
    - the planting associated with the Aylesbury Road Site entrance.
- A detailed landscape rehabilitation management plan prepared for each stage of extraction activity, and prior to commencing each subsequent phase in accordance with the overall landscape strategy. These plans should provide sufficient flexibility to enable suitable future end uses, once known, whilst facilitating measures to ensure the health and longevity of proposed native vegetation incorporated within the Site. Plant trials and environmental monitoring including ecological input (where necessary) should also form an integral component of the rehabilitation works so that planting and ongoing management is optimised throughout the life of the quarry.

6.2.2 Noise

The following section assesses the potential noise effects of the Proposal and has been informed by the Assessment of Noise Effects prepared by Marshall Day (**Appendix 9**).

6.2.2.1 Existing Noise Environment

In May 2022, Marshall Day was engaged by Burnham 2020 to measure ambient noise levels at 6 different locations in the vicinity of the Site with the aim of establishing existing noise levels at and near the Site. The locations are described in Figure 5 of the Marshall Day Assessment contained in **Appendix 9**. It is noted that road construction was occurring on Aylesbury Road south of the Grange Road intersection but that the survey positions were not generally significantly affected by this. However, there may have been reduced traffic volumes and therefore lower ambient noise levels overall.

At the long duration logging locations, local traffic movements were the dominant noise source along with natural environment sounds including wind generated leaf rustle and birdsong. Distant traffic on SH1 was also audible.

Short duration noise levels logged at:

- Grange Road are 47 dB L_{Aeq} on average but vary over the course of the day. Passing traffic increases the noise levels by 10 dB between 0500 and 0800 hrs when a noise level of 49 dB

L_{Aeq} is achieved before reducing to low 40s dB during the early afternoon. A second traffic noise peak of around 50 dB L_{Aeq} is achieved at 1700 hrs. Noise levels reduce steadily to around 40 dB L_{Aeq} at 2200 hrs.

- Aylesbury Road are 49 dB L_{Aeq} on average but show less variability during the daytime period. Noise levels increase from 0500 to a high of 50 dB L_{Aeq} at 0800 and 1700 hrs. During the early afternoon, noise levels are in the mid to high 40s dB L_{Aeq}.
- Opposite 146 Aylesbury Road, the Aylesbury & Wards Rd intersection and at two locations on Kivers Road are similar to those on Grange and Ayslebury Roads in that passing vehicles dominate the noise environment with 'natural environment' sounds audible in the lulls between traffic. However, on Kivers Road wind generated foliage noise was responsible for significant environmental noise levels and was not significantly affected by occasional passing traffic. Noise emissions on Kivers Road included local traffic and farm machinery in adjacent fields.

In relation to the residential properties located on Aylesbury Road, which will be the main transport route from the Site:

- 168 Aylesbury Road: The average daytime noise level at the dwelling is in the low 60s dB $L_{Aeq(1hr)}$. At night the average noise level is approximately 40 dB $L_{Aeq(1hr)}$.
- 146 Aylesbury Road: The average daytime noise level at the dwelling is approximately 50 dB $L_{Aeq(1hr}$. At night the average noise level is approximately 40 dB $L_{Aeq(1hr)}$.
- Burnham Camp: During the day, the average noise level is in the order of 55 dB L_{Aeq} at the Camp. At night, the average noise level is approximately 45 dB L_{Aeq}.

6.2.2.2 Potential Noise Effects

The operation of the quarry including extractive activities, processing of aggregate, the associated use of machinery and vehicle movements both within and to and from the Site, all generate noise, which needs to be managed to minimise impacts on the surrounding environment especially residential properties.

Modelling undertaken by Marshall Day and set out in Table 12 on Page 29 of the Assessment of Noise Effects (**Appendix 9**) clearly illustrates that all activities on the Site including the construction of bunds and stockpiles on the site boundary will meet the noise standards in the SDP, except for 30 minutes between 0700 hrs (when the night-time noise limit applies) and 0730hrs when the daytime noise limit applies.

Furthermore, noise generated by any motor vehicle or any mobile machinery (including farm machinery and stationary equipment not fixed to the ground) is excluded from complying with the Noise Limits under Rule 9.16.1 and the POSDP provides for traffic noise generated within a land transport corridor as a permitted activity under Rule NOISE-R3. However, Marshall Day considers that as a discretionary activity, it is appropriate to assess the potential noise effects from trucks using the surrounding road network. In effect, a precautionary approach has been taken.

Therefore, recognising the relatively low ambient noise environment, Marshall Day has recommended the following noise limits for the Proposal that will apply within the notional boundary of a dwelling:

	Hours	Noise limits
Day	0700 to 2200	55 dB $L_{Aeq(15mins)}$
Night	2200 to 0700	45 dB $L_{Aeq(15\ mins)}$ and 70 dB L_{AFmax}

These noise limits have formed the basis of the noise assessment and Marshall Day concludes that all activities within the Site will always meet these standards. In fact, noise levels are likely to be well within the proposed limits and therefore no adverse noise effects will arise from activities undertaken within the Site.

Some properties could be affected by the noise from trucks travelling to and from the Site along Aylesbury Road to State Highway 1 particularly:

- 168 Aylesbury Road.
- 146 Aylesbury Road.
- Burnham Camp.

6.2.2.2.1 Daytime noise levels

Marshall Day has assessed the likely noise effects on an hourly basis at each of the representative locations for these average and maximum values of 30 and 112 movements per hour and using truck noise source level of 84 dB L_{AE} at a distance of 10 metres.

<u>168 Aylesbury Road</u>

The average daytime noise level at the dwelling is in the low 60s dB $L_{Aeq(1hr)}$, which exceeds the 55dB L_{Aeq} project daytime noise limit and the daytime noise limit in the POSDP. An additional 30 truck movements (average) per hour along Aylesbury Road will result in noise levels increasing to 61 dB $L_{Aeq(1hr)}$: a barely noticeable change in the noise level experienced at this dwelling. However, 112 truck movements (maximum) per hour will likely result in a 7 to 10dB increase in the noise level to 67 dB $L_{Aeq(1hr)}$ at this dwelling, which will result in a significant effect. However, this level of effect could be mitigated by the construction of an acoustic fence, which would reduce truck noise by 5 to 10dB.

<u>146 Aylesbury Road</u>

The average daytime noise level at the dwelling is approximately 50 dB $L_{Aeq(1hr)}$ and 30 truck movements (average) per hour along Aylesbury Road will result in a noise level of 54 dB $L_{Aeq(1hr)}$: a slight change in the noise level experienced at this dwelling. However, 112 truck movements (maximum) per hour will likely result in a 10dB increase in the noise level at this dwelling to 60 dB $L_{Aeq(1hr)}$: which will result in a significant effect. However, the absolute noise level of 55 dB $L_{Aeq(1hr)}$ for the 'average' number of truck movements, will ensure a level of residential daytime noise amenity anticipated by the residents.

<u>Burnham Camp</u>

During the day, the average noise level is in the order of 55 dB L_{Aeq} at the Camp. Marshall Day's assessment concludes that the proposed average and maximum truck movements along Aylesbury Road will have negligible to moderate noise effects at the closest buildings within Burnham Camp.

Marshall Day's assessment concludes that construction activities, such as the implementation of noise control bunds, will comply with the applicable noise limits from New Zealand Standard NZS 6803: 1999 Acoustics - Construction Noise.

There will also be no significant sources of vibration on site and vibration effects will be negligible.

6.2.2.2.2 Early morning noise levels

5am to 7am is considered to be night-time in both the SDP and POSDP and the weekly hourly traffic volumes on Aylesbury Road, north of Two Chain Road, on Two Chain Road east of Aylesbury Road and on Aylesbury Road from Burdons Road to State Highway 1 (Figures 19, 20 and 21 in the Acoustic Assessment in **Appendix 9**) show that there are notable traffic movements during these hours.

If Burnham quarry generates 10 vehicle movements per hour during these times, it will result in the following change in noise levels at the closest residential properties:

Location	10 movements per hour Truck noise level, dB L_{Aeq}(1hr)	Relative change, dB
168 Aylesbury Road	56	5 to 10
146 Aylesbury Road	49	3 to 5
Burnham Camp	49	0 to 3

The truck movements will result in the greatest change at 168 Aylesbury Road but if acoustic fencing or other appropriate noise control measures are implemented, as described above for day-time noise, this would reduce truck noise by 5 to 10dB. The level of noise received at this property would then become similar to that anticipated in a rural location adjacent to an arterial road. It is also important to note that truck movements from 5am to 7am will only occur on Mondays to Saturdays on up to 30 days and on Sundays for up to 15 days of every calendar year (excluding public holidays).

Acoustic attenuation measures would also reduce any impacts on 146 Aylesbury Road. Whereas for Burnham Camp, noise from traffic movements is already elevated in the early morning and therefore, any impact on the Camp will be minimal.

Burnham 2020 proposes to continue discussions with the owners/occupiers of 168 and 146 Aylesbury Road to seek to achieve an acceptable outcome in relation to noise mitigation.

Overall, noise related to the operation of the quarry can be contained within the boundaries of the Site and will comply with the noise standards in the District Plans, with the exception of operational activities occurring from 7am to 7.30am under the SDP.

With regard to truck noise on roads, whilst excluded from consideration under the noise standards in both the SDP and POSDP, it is recognised that it will affect the level of amenity anticipated at two affected dwellings, most noticeably when trucks use Aylesbury Road between 5am and 7am. That said, in this rural area vehicle movements related to primary production are likely to commence early in the morning, as are other activities such as milking, harvesting etc and therefore residents may be less sensitive to noise early in the morning than late at night. Furthermore, both the SDP and the

POSDP recognise that there can be periods of noise related to temporary activities such as harvesting. Whilst the movement of trucks does not meet the definition of 'temporary activity' in the SDP or POSDP, it will be an infrequent activity that occurs on a limited number of days. It is also practicable to install acoustic mitigation measures, should they be desired, at the two closest residential properties, being 168 and 146 Aylesbury Road, to reduce the adverse effects arising from the movement of trucks to and from the quarry. Overall, the effects on the owners and occupiers of 168 and 146 Aylesbury Road will be more than minor, without mitigation.

6.2.2.3 Recommendations

In addition to the proposed noise and early morning truck movement limits, Marshall Day recommends the following form conditions of consent:

- Construction activities including erection of structures and buildings, formation of site access roads, bund construction and site rehabilitation, shall be conducted in accordance with NZS 6803: 1999 "Acoustics - Construction Noise", and shall comply with the "long term duration" noise limits contained within Table 2 of that Standard.
- Should vehicle reversing alarms be required in vehicles owned by the site operator, only broadband noise alarms are to be used. Tonal reversing alarms are not permitted.

6.2.3 Transport

The following section assesses the potential transport effects of the Proposal and has been informed by the Traffic Assessment Report prepared by Stantec (**Appendix 10**). The Site is located on Aylesbury Road, an arterial road, and Grange Road, a local road. All the surrounding roads have a range of carriageway widths.

Traffic data

Stantec has relied on annual daily traffic volumes recorded by Waka Kotahi to understand the traffic flows along State Highway 1, data from Selwyn District Council and its own traffic counts.

- State Highway 1

Notable weekday evening peaks can be observed at approximately 1,200vph, whereas in the morning there is a lower peak of 1,000vph. Friday peak traffic volume is approximately 1,500vph between 3pm and 4pm as a result of higher than typical volumes both towards and away from Christchurch. A similarly high peak period occurs on a Sunday afternoon associated with travel towards Christchurch.

- Local road traffic data

Aylesbury Road connecting to State Highway 1 is the busiest section of road in the Selwyn District carrying approximately 3,700 vehicles per day on a weekday, reflecting the contribution that the Burnham Military Camp makes to traffic generation in the area. However, where it passes the Site, Aylesbury Road carries low traffic volumes of approximately 500 vehicles per day (vpd) past. Peak hour traffic volumes are not reported but could typically be expected to be approximately 10% of the daily traffic volumes.

The State Highway 1 / Aylesbury Road intersection has some peak period congestion on the side roads, with the northern approach from Aylesbury Road experiencing long queues in the afternoon

peak period. There has been a previous history of serious crashes at the intersection leading to implementation of a lower speed limit that is activated by vehicles turning at the intersection.

Overall, there are no capacity related issues on the surrounding District Council road network, while the crash history indicates that there have been some vehicle turning/crossing crashes at intersections, and loss of control and turning crashes at locations between intersections.

Most serious and fatal crashes have been reported on the State Highway, representative of the high traffic volumes.

6.2.3.1 Effects on the Transport Network and Capacity

The operation of a quarry at Burnham will result in the generation of vehicle movements associated with staff (private cars) and the transport of aggregate (heavy vehicle movements). It is the latter that has the greatest potential to generate effects on the safe and efficient operation of the surrounding road network and is the focus of the assessment.

6.2.3.1.1 Heavy vehicle generation

Consent is being sought for a maximum of 750 heavy vehicle movements per day, split into approximately 375 movements into the Site and approximately 375 movements from the Site. However, based on data from the Yaldhurst Quarry (previously operated by Winstone), Stantec expects that day-to-day operations will result in a significantly lower trip generation. That data indicates that when fully operational, average traffic generation is more likely to be approximately 40% of the maximum, which equates to an average of 300 heavy vehicle movements per day.

6.2.3.1.2 Travel patterns

The traffic distribution patterns for the proposed quarry have been assessed by Stantec under two scenarios:

- Scenario 1: Christchurch City focus, is based on projected trip patterns, with the proposed quarry being heavily weighted towards servicing Christchurch.
- Scenario 2: Selwyn District focus, is that the quarry will have a focus on servicing the Selwyn District, recognising other major quarries are located in Christchurch and the eastern edge of the Selwyn District. Although, it is recognised it is likely that a change in quarry strategy would be required for this to occur.

6.2.3.1.3 Traffic Effects

<u>Changes in traffic volumes</u>

It is anticipated that changes in traffic volume will be most noticeable on the local road network and at the intersection of Aylesbury Road and State Highway 1. The Christchurch City focus scenario will result in much higher traffic volumes on Aylesbury Road south of the Site and utilising the intersection with SH1, whereas the Selwyn District focus scenario will result in higher volumes of traffic on local roads. Stantec has determined the potential range of traffic volumes on an average day between the medium and long term, and also the long-term peak volume (Table 10-1 in **Appendix 10**). The main influences on traffic volumes are where the extracted material is being used (the destination), and the level of production (with long term volumes higher than short/medium term). Under the Christchurch City scenario, Aylesbury Road will carry the bulk of the heavy vehicle movements. Under the Selwyn/local road scenario, Wards Road appears likely to receive a greater volume of heavy truck

movements. That said, this may change depending on route choices, time of day and perceptions of the most desirable route.

The effects of potential changes in traffic patterns are:

State Highway 1 and Aylesbury Road intersection

A key issue is the intersection at State Highway 1 / Aylesbury Road, which is already at capacity at peak times and queuing can occur. Therefore, the addition of vehicles associated with the proposed quarry is likely to exacerbate queuing, especially if quarry traffic coincides with the morning and evening peak period of traffic entering and exiting the Burnham Military Camp. Whilst Waka Kotahi has indicated it will be upgrading the intersection to a single lane roundabout as part of their transport network safety improvements, this is not expected to occur until 2024-2027. Stantec therefore recommend a heavy vehicle movement limit for the Site of 250 heavy vehicle movements per day until the intersection has been upgraded. This will ensure that the effects of the Proposal on the safe and efficient operation of this intersection remain acceptable before the upgrade occurs. Burnham 2020 has so limited its application.

Once constructed by Waka Kotahi, the roundabout will perform well with moderate delays possible on side road approaches during peak periods in the 2035 scenario, with typical and peak quarry traffic generation contributing to those delays resulting in a minor effect on the efficiency of the roading network. The level of delay is unlikely to generate safety issues.

Site access and Aylesbury Road

Aylesbury Road is an arterial road, and the location of the purpose-built site entrance will minimise turns at local intersections.

The site access will be designed to the Waka Kotahi Planning Policy Manual “Diagram E” standard for a 100km/h speed limit road. This standard is suitable for a high vehicle generating commercial vehicle access on a lower volume arterial road and exceeds the Selwyn District Plan requirement (Operative District Plan Rural Volume Diagram E10.D and Proposed District Plan TRAN-Diagram 7). It will have concrete kerbing, drainage design, and flag lighting to highlight the access during hours of darkness. It will also easily comply with relevant District Plan standards with respect to proximity to intersections, and there are only two accesses to dwellings in the immediate vicinity.

To ensure debris will not be transferred onto Aylesbury Road, the site access road will have a sealed shoulder 1.0m wide for at least the first 100 metres of the road. There will also be truck waiting areas on entry and exit within the Site, to a minimise the risk of trucks parking on Aylesbury Road and damaging the edge of the carriageway or creating a hazard to other road users.

Aylesbury Road between the site access and Two Chain Road is a narrow road (currently 5.8m wide sealed width) but with excellent sightlines due to its straight alignment. Currently there are low traffic volumes that will allow exiting traffic to select large gaps and accelerate away from the Site with minimal interaction with, or effect on, through traffic.

However, it is considered that an increase in heavy vehicles will result in increased damage to the edge of the road, contributing to an increased rate of pavement deterioration. Therefore, the Applicant proposes to widen Aylesbury Road to 8 metres (based on industry standards) to enable safe two-way heavy vehicle movement that will minimise effects on the road pavement performance. In addition, localised or full route edge line markings on the widened section of road, and markings to highlight the

Site access would improve road safety. It is acknowledged that these works will require the agreement of the Selwyn District Council.

The constrained nature of the Aylesbury Road / Wards Road intersection means that, quarry related heavy vehicle turning movements will be limited to one additional heavy vehicle movement per hour until such time as kerb adjustments have been completed. The same will apply until the kerbing between Aylesbury Road (north) and Two Chain Road (east) has been adjusted. These upgrades will also require the agreement of Selwyn District Council. With the agreement of the Council, these works will avoid any adverse effects on the traffic environment of Aylesbury Road.

Overall, the safe and efficient operation of Aylesbury Road can be maintained, subject to the works discussed above.

Local roads

There is expected to be very low use of roads to the north of the Site, or of Two Chain Road, and even in the unlikely scenario of the quarry only servicing Selwyn District, traffic volumes will not be inconsistent with the function of these roads.

It has been assessed that local road intersections, including those servicing Burnham Military Camp, and accesses on Aylesbury Road will continue to operate, in the long term, at a very good level of service even on the busiest operational days at the quarry.

To avoid any potential effects on local roads, Stantec recommends developing and implementing a Transportation Route Management Plan as set out below under 7.2.3.4. This will ensure that any potential adverse effects on local roads are less than minor.

6.2.3.2 Recommendations

Stantec recommends, and Burnham 2020 accepts to undertake the following works and/or adopt the following limitations to ensure that the safe and efficient operation of the surrounding road environment is maintained:

- The quarry will not generate more than 250 heavy vehicle movements per day (on any one day) prior to the SH1 / Aylesbury Road intersection being upgraded to a roundabout.
- After the SH1 / Aylesbury Road intersection has been upgraded, the volume of daily heavy traffic will increase to a maximum of 750 heavy vehicle movements per day, on any one day;
- Implementation of a Transportation Route Management Plan that achieves as far as practicable:
    - Minimisation of additional congestion at the Aylesbury Road and Stage Highway intersection.
    - No use of unsealed sections of Kerrs Road or Sandy Knolls Road between Aylesbury Road/Two Chain Road and Wards Road (as per proposed condition of consent).
    - Use of Aylesbury Road as preferred route to connect to/from SH1.
    - Minimise use of Two Chain Road to no more than 45vpd unless upgraded to a standard expected to accommodate heavy vehicles. A further limitation of no more than 10 heavy vehicle movements per day turning between Aylesbury Road (north) and Two Chain Road (east) until kerb adjustments are made to support the left turn from Aylesbury Road (north).

- Minimise use of Wards Road / Aylesbury Road intersection to no more than 10 truck and trailer movements per day unless upgraded to support the right turn from Aylesbury Road south into Wards Road east.

6.2.3.3 Summary of effects

Overall, the Site is well located on an arterial road that provides connections to State Highway 1, Main South Road and State Highway 73 (West Coast Road). This enables most travel to and from the quarry to occur on the state highway and arterial road network which will result in changes in traffic volumes mainly being focussed on Aylesbury Road.

With the local modifications proposed at the site access and to the route connecting the Site to SH1, the implementation of the recommendations above, and the planned modifications to the SH1 / Aylesbury Road intersection, it has been assessed that additional quarry traffic can be safely and efficiently accommodated within the transport network, and effects on the existing transport network will be less than minor.

6.2.4 Contaminated Land

A search of the Land Use Register on the ECan website revealed that the Site has not been identified as contaminated.

Nevertheless, PDP prepared a Preliminary Site investigation (PSI) (**Appendix 11**). The PSI identified several areas where activities listed in the Hazardous Activities and Industries List (HAIL) are likely to have been undertaken. PDP also prepared an addendum report clarifying risk associated with potential contaminated areas within the Site (**Appendix 11a**), which included identification of the following HAIL activities: an above ground diesel tank in the yard of the former forestry block (anecdotal), two above ground fuel storage tanks, storage of bulk fertilisers and other materials such as fence posts and tyres and waste pits/infill pits. The PSI also involved broad sampling of soil surfaces outside of HAIL activity areas. The sampling results showed that likely indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) are at background levels. It is also noted that the HAIL activities will continue on the Site until such time as primary production ceases and is replaced by quarrying activities.

However, the PSI recognises that farming will continue across most of the Site with further potential risk for contamination from the storage of farm equipment and materials. As such, it is proposed that identified HAIL areas are subject to targeted detailed site investigations (DSI's) as quarrying progresses across the Site. This will ensure that any ongoing activities are captured by the assessments, and any remedial actions applied accordingly.

Remedial actions will vary according to the nature and extent of contamination found during any DSI, but waste material is likely to require sorting and/or offsite disposal. In other areas, the contamination from normal farming operations is not expected to result in the need for large scale remedial works. However, these matters will be addressed in any Site Management Plan prepared following the DSI phase.

6.2.5 Ecology

The following section assesses the potential ecological effects of the Proposal and has been informed by the Ecological impact Assessment Report prepared by Boffa Miskell Limited (**Appendix 12**). The Ecological Impact Assessment assesses the potential effects of the Proposal on vegetation and birds, as no wetlands, waterways or waterbodies, or lizard habitat were identified by field investigation within the Site.

6.2.5.1 Ecological values

The proposed quarry is within the Low Plains Ecological District (ED) in the Canterbury Plains Ecological Region (McEwen, 1987). The original vegetation of the Low Plains ED has been substantially depleted by human induced fire and land clearance for agriculture and settlement.

The four main vegetation and habitats within the Site are:

- Exotic grassland (perennial ryegrass grassland);
- Fodder crops;
- Cultivated loamfield; and
- Shelterbelts (radiata pine treeland).

There are no indigenous vegetation communities or habitats within the Site, being intensively managed farmland comprising exotic grassland, loamfield, fodder crops and exotic shelterbelts. The location and extent of exotic grassland, fodder crops and cultivated loamfield changes depending on farm management activities. For example, at times, exotic grassland is ploughed and temporarily left as bare soil (loamfield) until it is replanted in pasture or fodder crops. However, all of the vegetation and habitats on the Site are exotic. There is no naturally occurring indigenous vegetation on the Site. Therefore, the clearance of any vegetation has been assessed as not requiring management or mitigation measures.

The existing exotic shelterbelts within the Site may have a minor role as ecological corridors assisting the movement and dispersal of indigenous fauna, including common indigenous forest bird species (such as South Island fantail, grey warbler and silvereye), across this part of the Canterbury Plains, they are not considered ecologically significant in this context.

There are no wetlands within the Site and there are no waterways or permanent water bodies. The intensively farmed, cultivated, grazed and cropped exotic habitats do not provide suitable habitat for lizards, therefore effects on lizards have not been considered in this application.

Only one At Risk species, South Island pied oystercatcher, was recorded on the Site. This species was observed foraging in pasture and recently cultivated loamfield and is likely to be using similar habitat in the wider area for feeding. No evidence of South Island pied oystercatcher breeding on the Site (breeding behaviour, nests or chicks) was recorded during a site visit in October, but it is possible this species could breed within improved pasture or cultivated loamfield within the Site.

The following species may forage on the Site, but it does not provide suitable habitat including for breeding: Black-fronted tern, black-billed gull and red-billed gull, paradise shelduck and mallard duck. Spur-winged plover chicks (indigenous but not threatened) were observed on the Site, confirming this species breeds within the improved pasture or loamfield on the Site.

Overall, given the modified nature of the Site, it is not ecologically significant under any of the criteria for determining ecological significance in Appendix 3 of the CRPS.

6.2.5.2 Effects on ecological values

The construction and operation of the quarry will result in the loss of existing habitat for birds, although rehabilitation to enable farming activities to occur in the future will mean that the Site will continue to provide the same or similar habitat for birds. The Site does not provide important habitat for Nationally Threatened and At-Risk species, but South Island pied oystercatcher have been observed foraging in pasture and recently cultivated loamfield within the Site, and black-fronted tern, black-billed gull and red-billed gull may use the Site infrequently and irregularly for foraging. Due to similar intensively managed farmland habitats being widespread in the surrounding area, and across the Canterbury Plains, the magnitude of the loss and modification of such habitat on birds is Negligible and the Level of effect is assessed as less than minor (Very Low).

Further, because the proposal is to progressively excavate in stages, disturbance effects will be limited to a relatively small portion of the Site. In this context, the magnitude of the effect of disturbance due to quarry construction noise and activity and the level of effect is assessed as less than minor (Very Low).

It is noted there is a risk to nesting bird species if works for quarry establishment or expansion for extraction occurs during the breeding season (generally September to February). This could arise either through works to clear new ground damaging nests or by disruption of nesting behaviours due to noise and other disturbance. It was confirmed during the October 2022 site visit that Spur-winged plover breed on the Site. However, no evidence of South Island pied oystercatcher breeding (breeding behaviour, nests or chicks) was recorded during that visit, although it is possible this species could nest within improved pasture or cultivated loamfield. There is also no evidence of pied stilt breeding on the Site, but this species could nest in shallow depressions that are subject to rain-derived water pooling or pooling from irrigation.

This means that there is the potential for works to damage or disturb a small number of nests, if construction or extraction is undertaken during the breeding season, which could lead to nest failure. However, due to the small number of nests potentially affected (if any) effects on the local populations of these species are unlikely and the magnitude of this effect, at worst, would be less than minor (Low). That said, most indigenous bird species (excluding spur-winged plover) are either absolutely or partially protected under the Wildlife Act (1953), therefore it is unlawful to disturb the nesting of these species. Consequently, Burnham 2020 accepts the recommendation of the ecological expert to manage effects on any nesting indigenous bird species during construction and extraction phases, by undertaking pre-construction nesting bird surveys.

6.2.6 Soils

The following section assesses the potential effects relating to soil management by the Proposal and has been informed by the Assessment of Soil Related Effects for Burnham Quarry prepared by Pattle Delamore Partners Limited (PDP) (**Appendix 13**).

6.2.6.1 Description of Underlying Geology and Soils on the Site

The geology of the broader area consists of successive alluvial deposits comprising gravel, sand, silt and clay derived from the Southern Alps and deposited during the Quaternary period. The

permeability of the strata is influenced by the age, depth of burial and depositional environment. The aquifers in the region are generally semi-confined.

PDP undertook a site investigation in December 2019 with forty-two test pits, logged and sampled to a target depth of 10m below ground level (bgl) and backfilled back to ground level. These test pits logs have been used to determine the depth of topsoil and subsoil. A test pit location plan is presented in Appendix A, Figure 4 of the Assessment of Soil Related Effects report in Appendix 13.

The average topsoil thickness was between 300mm and 400mm across the three phases of test pits. Shallow soils are 20 – 45 cm deep to gravel or bedrock, therefore these soils are classified as shallow silt soils over gravel for drainage modelling.

The topsoil (A horizon) was identified as a dark brown sandy gravelly silt, dry well graded, rounded to subrounded slightly weathered greywacke with organics, roots, and wood fragments.

The Site is Land Use Classification 4s7 (NZLRI Land Use Capability 2021) and is therefore not defined as highly productive under the National Policy Statement for Highly Productive Land.

6.2.6.2 Soil Management Effects

Quarrying requires the removal of soil to enable the underlying aggregate to be extracted. This will be undertaken in stages to minimise the time and the volume of soil required to be stockpiled. The removal and storage of topsoil will be undertaken with care to minimise effects on its structure, and ability to support vegetation. Any soil disturbance (as part of proposed quarrying activities) is likely to result in disruption to soil properties such as soil compaction, loss of soil structure and degradation of soil aggregates during removal, transport and storage, and compaction of the soil material during placement. This can lead to impeded soil drainage (reducing air and water flow pathways in the soil), reduced soil water storage capacity, and reduced soil pores for biological activity. Therefore, soil removal, management and replacement of soils as well as managing potential adverse effects on the surrounding environment will be undertaken in accordance with a Soil Management Plan (a draft has been prepared by PDP and can be found in **Appendix 13a**).

The replacement of the soil and the use of the Site for primary production may result in effects on water quality, soil productivity and the generation of dust. These effects are discussed below.

<u>Nitrogen loss to groundwater</u>

The Assessment of Soil Related Effects prepared by PDP (**Appendix 13**) states that the thickness of the soils and gravels above the highest water table level (permanently unsaturated zone) will be reduced from the current minimum depth range of 8 – 12 metres across the farm to a minimum depth of 1 metre. Furthermore, whilst the intermittently saturated zone, within which the water table fluctuates, will remain unchanged, the depth of strata will reduce from 8 to 22 metres of strata above the water table to a depth of 1 – 11 metres, depending on the groundwater level at any time.

This assessment of effects is only concerned with the potential effect of soil changes wrought by quarrying on the land's nitrate loss characteristics. Whilst any nitrate discharge associated with future use of the remediated quarry floor would reach the groundwater sooner, this is not expected to change the mass of nitrate reaching the water table as no significant attenuation occurs in this zone. During quarrying activities, the reduction in farmed area will reduce nitrate discharges, relative to the land's existing use. Furthermore, on completion of the quarrying activities and resumption of agricultural land use, annual losses of nitrate to groundwater will be lower than current losses

(assuming the same agricultural land use practices continue) due to some of the Site being planted in native vegetation.

Phosphorus loss to water

Phosphate fertiliser will be used to raise the Olsen P levels in replaced topsoil to levels similar to those occurring, prior to the commencement of quarrying activities. The amount applied will be based on individual paddock soil testing and designed to meet pasture demand as determined by the nutrient budgeting software OverseerFM for most macro-nutrients (particularly phosphorus and potassium).

Phosphorus (P) leaching can occur after phosphate fertiliser is applied to pasture and crops and whilst the P leaching vulnerability for Lismore soils is yet to be determined, the following good management practices will be employed to reduce the risk of P loss:

- There will be a soil testing and monitoring programme to ensure phosphate fertiliser is applied at optimal rates to minimise leaching.
- Irrigation will only occur to meet the moisture needs of the plant and avoiding drainage. Varying the depth of irrigation on a daily basis can minimise the quantity of drainage, which is minimised further by adjusting applications according to weather forecasts. Compared to uniform rate irrigation, the use of variable depth has been shown to decrease P losses by up to 80% (McDowell, 2017).
- The timing of fertiliser or effluent P application to soil can influence P loss, mainly because of the effect soil moisture can have on P leaching. P fertiliser will therefore not be applied to soil at, or close to, field capacity or if heavy rain is predicted, or in the months of May to September inclusive.
- Lower water-soluble P fertilisers will be used if higher rates of phosphate fertiliser are required.

The proposed activity will therefore have a less than minor effect on the loss of nutrients as the farming activity will not change and there will be a small reduction in the farmed area.

Pathogen loss to water

The ongoing use of the Site by one and two-year old dairy heifer replacements creates a source of E. coli and other pathogens that can migrate down to the underlying groundwater system, particularly during heavy rainfall events. However, during this migration from the ground surface through the sub-surface environment, E. coli numbers are reduced by filtration, desiccation, dispersion, dilution, and natural die-off over time. So, while there will be less reduction of the E. coli concentrations through the unsaturated zone between the surface soil profile and the groundwater table in the post-quarry farming activity, modelling assessment of potential flow paths shows that there will still be sufficient removal of E.Coli concentrations to avoid adverse water quality effects in neighbouring bores.

Consequently, stripping the topsoil and placing it over the quarried areas, with an additional silty subsoil layer, will aid in the removal of E.coli in the event that stock are grazed on the remediated land. Furthermore, crops will be planted to help develop the soil structure and it is expected that 1 – 2 years after the completion of quarrying, the topsoil will have the same, or better bacterial removal rates than currently exist.

Nutrient loss to surface water

As the Proposal is located on the Canterbury Plains, approximately 6.5 kilometres from the Selwyn/Waikirikiri River and 12.5 kilometres from the Waimakariri River, it is assessed there will be no overland flow from the farming operation to surface water.

Soil loss to water

There will be no overland flow from the farming operation on this Site to surface water as there no rivers or waterbodies within or in proximity to the Site. Furthermore, the bunds and stockpiles created around the boundary of the Site will be covered or vegetated with grass to reduce soil damage and loss caused by wind and rain.

The depth of topsoil is not expected to change; therefore, it is expected that rainwater will drain through the profile to the groundwater rather than pond. Areas of obviously impeded drainage, which show by way of surface ponding, will be examined to establish if any moisture restricting layer exists and appropriate ripping or subsurface aeration undertaken to shatter such compacted layers.

Soil Productivity

Re-vegetation to pasture will be undertaken as soon as practicable after topsoil placement to minimise possible deterioration of soil structure and development of erosion problems on bare cultivated soils.

As the pasture establishes over the first year, soil properties will improve due to the positive impacts of the pasture cover: these will include development of soil aggregates and soil biological activity. A management system will be enacted that:

- initially limits any grazing of light weight stock such as sheep and calves/1-year cattle.
- prevents any grazing in July and August in the first year after sowing the new pastures.
- promotes grass harvesting (hay and/or silage) over the first two years after rehabilitation.
- manages wet soil to avoid degradation of soil structure, especially managing stock movement when the soil is saturated and susceptible to pugging and compaction.

If carefully managed, in the long term, the land will be capable of supporting at least the same range of land uses as the current soil resource and the life supporting capacity of the soil will be retained.

Dust

The storage and transport of topsoil will be managed by way of a dust management plan (draft provided in **Appendix 7**). With regard to replaced topsoil, irrigation will be re-established to establish pasture, thereby reducing the risk of dust problems.

The existing shelter belts will also be retained, and any gaps will be planted and there will be a 100m setback, planted in native vegetation, from neighbouring dwellings to the southeast that will further mitigate any dust effects.

Soil monitoring

Changes in land use or land management can markedly alter many physical, biological and, to a lesser degree, chemical soil properties of soil, which show up as visual characteristics. A ‘miniVisual Soil Assessment’ (VSA) has been adapted for New Zealand farmers from the Soil Quality Management Assessment (SQMS) developed by Plant & Food Research, the Visual Soil Assessment produced by the Soil Management Initiative (UK) and Manaaki Whenua - Landcare Research visual

soil assessment field guide. It is based on the visual assessment of key soil 'state' and plant 'performance' indicators of soil quality, presented on a score card.

Annual monitoring will be undertaken using miniVSA in the areas rehabilitated within the last three years from the start of Phase 2 (i.e. years 7 -10). A control site on an undisturbed site will be included in ongoing soil monitoring to differentiate between the effects of contemporary land use management and effects associated with the re-establishment of the soil.

If the Soil Quality Assessment in the VSA is ranked as poor three years after rehabilitation, a plan will be developed and implemented to improve the soil quality. Furthermore, additional soil testing to inform farm management and nutrient management will be carried out and this will be included in the Soil Management Plan (draft Soil Management Plan in **Appendix 13a**).

Summary of effects

The removal, management and replacement of soils arising from the proposed quarrying activities will be undertaken in accordance with a Soil Management Plan (draft **Appendix 13a**). The proposed soil management measures to be adopted as part of the Proposal, are designed to ensure appropriate soil rehabilitation will be implemented at each phase of quarry extraction.

This soil management strategy will achieve the progressive rehabilitation of the site, stabilisation of quarry faces and restored extraction areas, areas where works are completed are left stable, the site is rehabilitated to enable agricultural activities such as pastural farming to occur in the future, ensure completed areas have adequate drainage and water infiltration for irrigated pasture farming, and minimise disturbance to farming operations including irrigation of pasture.

Overall, it is assessed that there will be appropriate mitigation of any potential adverse effects arising from soil removal, replacement and management arising from the Proposal.

6.2.7 Groundwater

PDP has prepared a Hydrogeology Assessment for Proposed Burnham Quarry (**Appendix 14**) which describes the hydrogeological setting for the area and assesses the way in which the proposed quarrying activities will interact with the hydrogeology. The findings of the report have informed this assessment and are summarised below.

6.2.7.1 Existing Level and Quality of Groundwater

Level of Groundwater

The driller's logs for the water supply bores on the Site indicate that the strata generally consist of gravels with varying sand and clay content. Near the bottom of the bores, water-bearing sandy gravels were generally encountered.

An assessment of long-term groundwater level records in the area indicates that the level of the water table is expected to fluctuate over a depth range of around 8-19.5m bgl in the south-east of the Site and around 16.5 -28m bgl in the north-west of the Site. Lowest groundwater levels generally occur in late summer and autumn and highest groundwater in spring.

Groundwater Quality

The groundwater quality of the area is typical of the central Canterbury Plains with shallow bores in particular showing the effects of the overlying agricultural land use resulting in elevated concentrations of nitrate-Nitrogen and occasional detections of E. coli.

Groundwater quality data in the vicinity of the Site (obtained from ECan) are largely historical samples collected between 1975 and 1995. However, one pair of bores (M36/4151 and M36/8187)[8] provide a long-term and up-to-date record of nitrate-N concentrations, and data from these bores indicates that concentrations of nitrate-N are steadily increasing over time, with values around the MAV or 11.3 g/m^3 recorded in 2020 and 2021. This pair of bores also record 2 exceedances of the E.coli MAV (<1 MPN/100 mL) from 41 samples taken between January 2006 and November 2022. These exceedances occurred during July 2013 and September 2017 and recorded values of 1 MPN/100mL.

One shallow bore (M36/5785, screened from 24.7 – 27.7 m deep) and one deep bore (M36/7711, screened from 118.4 – 148.4 m deep) were sampled in late May/ early June 2022 to provide an indication of groundwater quality beneath the Site. The results show that the shallow groundwater has generally low concentrations for most parameters although nitrate-N is elevated at 7.5 g/m^3. Total coliforms were detected at 9 MPN/100mL, indicating a pathway for near surface bacteria to reach this shallow groundwater, although none of these were E.coli which is the drinking-water standards indicator of a health risk.

Similar, or slightly lower concentrations were recorded in the deep groundwater (bore M36/7711) with the notable differences being nitrate-N at 4.8 g/m^3 and no detections of total coliforms.

6.2.7.2 Effects on Groundwater Levels and Quality

Aggregate Extraction

The removal of the soil during quarrying activities and the exposure of the underlying gravels will promote the infiltration of both rainwater and water used within the quarry, to the underlying groundwater and will remove the sources of nitrates and E. coli that currently occur from the agricultural land use. These changes will result in a positive change to the underlying shallow groundwater resource.

Flood water entering a quarried area from surrounding agricultural land could be a source of poor quality water containing E.coli and nitrates. However, this is assessed as low risk given the perimeter landscaping, bunds and stockpiles, which will prevent overland flow from other properties unless there is an extreme event. Flooding of the Site will also be avoided by constructing diversion bunds around areas being quarried or that are in the process of being rehabilitated.

Quarry Water Use

The major use of water at the quarry is for processing aggregate. This mostly drains back to the aquifer when it falls on the ground, or discharges to settling ponds, where this water then generally returns to the underlying aquifer. As this water has primarily only been in contact with uncontaminated natural strata, it is not expected to cause any adverse effects on the existing water quality in the underlying groundwater.

[8] In 2005 bore M36/4151 (35 m deep) was replaced by bore M36/8187, 48 m deep located approximately 25m northeast of where the unused M36/4151 was located.

The washing of truck decks will only use water and will occur within fully bunded concrete pads. The resulting washwater will primarily contain only fine sediment which will discharge to a sump, with overflow occurring to a soakpit.

Body cleaning may involve biodegradable detergents and degreasers and washwater may contain hydrocarbons. Therefore, this washwater will be discharged to a sump and an oil-water interceptor, with the resulting discharge water directed to a vegetated swale and then a soak pit.

Water from the silt settlement basins will be discharged through the base and sides of the basins, and the sediments and silts (derived from the natural strata) will remain in the basins. It may be necessary to clean out any build-up of silt and sediment, which will be spread out within the Site. Water and suspended sediment from the silt settlement basins will be derived from the natural strata within and beneath the Site, so will not cause any adverse effects on water quality.

Water used for dust suppression will be sprayed to help bind surface sediments. This will be undertaken dry, windy weather and therefore will primarily evaporate, so is not expected to drain back to the underlying groundwater.

Office wastewater will pass through an on-site wastewater treatment system prior to discharging to a subsurface dripline system through landscaped and bunded areas located at, or near to, the original ground level in the general vicinity of the office buildings.

Overall, these discharges will promote the return of the water to the underlying groundwater resource in a manner that avoids adverse effects on water quality.

Storage and Use of Hazardous Substances

Storage of hazardous substance on the Site will be limited to plant and machinery fuel (diesel, unleaded petrol, bioethanol mix, hydrogen, ad-blue, etc.), lubrication (oils and greases), and small quantities of laboratory chemical for use in aggregates compliance testing. Fuel will be kept in double skinned tanks of up to 30,000L. Oil and greases will be stored in specially designed areas within the workshop area of up to 1,000kgs.

A hazardous substance risk register, and management plan will be developed for the Site and comply with all relevant legislation. This will ensure that storage and handling of these hazardous substances occurs well above the base of the excavation and in appropriately bunded areas so as to contain any potential spills.

Continuation of farming land use on the rehabilitated quarry land

The rehabilitation of the Site and any recommencement of farming activities will be at a lower elevation i.e. closer to the water table than is currently the case. This has been addressed above and in the Assessment of Effects on Soil report (**Appendix 13**) in terms of the effects of removing aggregate and replacing the topsoil at a lower level within the Site.

From a hydrogeology perspective, the annual loss of nitrate into the groundwater from continued farming use will remain largely the same as currently occurs, although the nitrate will reach the water table sooner in the post-quarry farming activity.

Conclusion

Overall, quarrying activities within the Site and future use of the land for farming can be effectively managed to maintain the current quality of groundwater.

6.2.8 Air Quality

PDP has prepared an Air Quality Assessment (**Appendix 15**) in accordance with the Ministry for the Environment (MfE) guidance for assessing and managing the environmental effects of dust emissions (MfE GPG Dust) and a qualitative assessment to predict the effects from the proposed quarrying operations using the FIDOL assessment tool (Frequency, Intensity, Duration, Offensiveness and Location).

6.2.8.1 Existing Air Quality

The western and southern dust monitors recorded similar daily average PM_{10} concentrations of 3.5 and 3.6 µg/m³ respectively, whereas the eastern monitor had a higher daily average concentration of 5.8 µg/m³. The eastern dust monitor recorded several days in mid-October where daily average concentrations were elevated and approaching the National Environmental Standard for PM_{10} (being 50 µg/m³). The main source of PM_{10} appears to be northwest of the dust monitor and occurs during very strong windspeeds (>10 m/s). While the source of the dust is not clear, it may have been from activities such as field cultivation that could have been some distance away.

The 1-hour average PM_{10} recorded at the three dust monitoring locations are typically well below the MfE dust nuisance trigger value of 150 µg/m³, however, there have been a few occasions when background concentrations at the eastern dust monitor were elevated and above the guideline value.

Ambient respirable crystalline silica (RCS) monitoring has also been undertaken at the eastern dust monitor site between 15 July 2022 and 3 January 2023. The average RCS concentration was 0.3 µg/m³ and a maximum concentration of 0.44 µg/m³ collected over a two-to-four-week period.

Comparing the six-month average monitored concentration (0.3 µg/m³) to the RCS guideline (3 µg/m³) shows that on average over a year, concentrations are likely to be 10% of the guideline value. Even if the maximum monitored RSC concentration value of 0.44 µg/m³ was assumed to occur every month of the year, this would equate to an annual concentration of 0.44 µg/m³ which is well below (15%) the guideline value of 3 µg/m³.

It can also be seen that 24-hour average PM_{10} concentrations would also be well below the appropriate short-term health assessment criterion of 24 µg/m³.

6.2.8.2 Effects on Air Quality

The potential for air quality effects at the proposed Burnham Quarry relate almost exclusively to the potential for dust emissions. While there is the potential for a number of vehicles operating on the Site, the combustion emissions from the vehicles are considered to be insignificant and they are unlikely to result in any noticeable changes in air quality.

The proposed quarry has the potential to generate dust from:

- Initial enabling works, including the construction of the haul roads and work platforms, removal of overburden, construction of erosion and sediment controls, and the formation of bunds.
- Extraction of aggregate.
- Operation of vehicles on the haul roads.
- Wind erosion of working areas.

- Rehabilitation of the completed areas.

6.2.8.2.1 FIDOL assessment

The potential for dust generation is affected by the size and density of the particles, wind speed and direction, height of release and the distance between the discharge point and the receptors. PDP has applied a distance of 400 metres to conservatively indicate the distance within which some level of dust effects could be experienced if no form of mitigation were to be applied. Properties to the north (535 and 716 Wards Road) are greater than 400 metres away from the Site therefore effects to these receptors are expected to be minimal with respect to dust nuisance.

Frequency

Typically, nuisance dust has a diameter between 30 and 100 µm and would need winds greater than 5 m/s to travel beyond the site boundary. At Burnham, wind greater than 5 m/s occurs 31.6 percent of the time from all directions, but high wind speeds in the direction of receptors 168 Aylesbury Road and 159 Grange Road are frequent, 273 Grange Road is moderately frequent and 176 Kivers Road is infrequent.

However, for dust nuisance to occur, dust producing activities will need to coincide with the right winds and during dry conditions. Therefore, the chances of dust nuisance occurring are smaller than the predicted wind frequencies in Table 2 on page of 12 of the Air Quality Assessment (**Appendix 15**) and are less likely to occur. This, in combination with the proposed mitigation and monitoring, means that the frequency of any effects associated with the quarrying activities will be low.

Intensity

Dust intensity is a result of a concentration at the source, location of the dust source, windspeed and the pathway between the source and the receiving properties.

The receptors at 168 Aylesbury Road and 159 Grange Road are between 120 and 170 metres, and 273 Grange Road and 176 Kivers Road are over 330 metres, from the closest quarrying activity and consequently, most activities within the quarry will occur at much greater distances from these properties as it moves within the Site. For example, the processing plant will be at least 1 kilometre from any receptor, and at this distance, it is very unlikely dust from this source will have any noticeable effect on intensity at receptor locations.

In addition, the existing 5-6 metre shelterbelts along the road boundaries with Aylesbury Road and Grange Road and the western boundary means the pathway for dust, especially generated by activities at current ground level, is not directly open and the trees will help to reduce dust intensity in certain metrological conditions. Once the pit is established, extraction will work from the centre outwards and from the toe of the pit, which means there will always be a pit wall between the activity and the receptors. The pit wall will have the same effect on the dust pathway as the shelterbelt, which will result in containing most dust effects.

Therefore, dust intensity effects at nearby receptors will be low.

Duration

Duration relates to the length of time that dust discharges are likely to occur, which in this case relates to the time taken to mitigate dust discharges, should they arise. Based on the visual monitoring programme, if an event were to occur, at worst, the duration will be limited to a period of no more than

2 to 4 hours at any one time. However, with the use of continuous monitoring of dust and wind conditions using the alerts, the duration of dust emissions can possibly be reduced to 30 minutes.

Furthermore, the scale of the Site means that quarrying activities near the receptors will be for a much shorter duration due to the proposed quarrying sequence and the scale of the Site.

Offensiveness

Dust emissions are unlikely to result in any off-site offensive or objectionable effects, based on the activities proposed to be undertaken and the extraction methodology, distance to the sensitive receptor and mitigation measures that will be implemented. Furthermore, any dust from the Burnham Quarry will be of a similar nature to that already generated in the surrounding area, and therefore will be less likely to be considered offensive.

Location

The Site was chosen because it is away from populated areas to avoid any potential effects on a larger number of receptors, but still within a viable distance of its main markets.

It is proposed to establish a 100 metre buffer distance to any dwelling. Likewise, the location of the processing plant in the centre of the Site will minimise noise and dust effects.

In addition, most of the quarrying activities relative to the receptors are either at a sufficient distance or have intervening features such as wind breaks and bunds that will restrict the transportation of dust towards these locations, and therefore the potential for nuisance dust will be low.

Furthermore, the surrounding area experiences a number of rural activities, and it is not unusual to experience a degree of dust from working the land or unsealed roads.

Overall, it is considered that there is a low potential that any sensitive receptors will be affected by activities within the Site. While some quarrying activities will get close to a few nearby sensitive receptors, given the mitigation and monitoring that will be undertaken, the potential for nuisance dust effects will be less than minor.

6.2.8.2.2 Assessment of Health Dust Effects

PM_{10} and $PM_{2.5}$

The potential human health impacts are driven primarily by the smaller size fraction of particulate (PM_{10} and smaller). Given the sources and type of dust which will be discharged from the proposed Burnham Quarry, it is considered that impacts on human health will be low because:

- PM_{10} and particularly $PM_{2.5}$ are not a significant components of the dust generated from quarry activities, and therefore dust emitted is not generally in the inhalable fraction; and
- given low background PM_{10} concentrations of the rural environment, with the small contribution to PM_{10} from quarry activities, total cumulative concentrations of PM_{10} will be maintained well below the NESAQ criteria of 50 µg /m^3 as a 24-hour average and the AAQG criteria of 20 µg/m^3 as an annual average, and;
- suppression of dust also suppresses PM_{10}.

Data from the monitoring commissioned by Environment Canterbury between 22 December 2017 and 21 April 2018 around the Yaldhurst quarry area has been used to inform the potential level of PM_{10} concentrations from quarrying activities. While the data is from a different location, it is of high quality,

comprehensive and collected from a site that is larger than the proposed Burnham Quarry. This data set provides robust information to inform a conservative (worst case) health impact assessment for the proposed Burnham Quarry.

6.2.8.2.3 Cumulative Effects

There are a number of potential dust sources already located in the area such as horse training tracks, fields that are cultivated and an army vehicle training facility, but nothing that has the potential to generate significant nuisance dust concentrations other than the Road Metals Quarry 2.5 kilometres to the northeast of the Site.

For a receptor to be affected by cumulative effects from the proposed Burnham Quarry and Road Metals Quarry, both these activities must be generating dust within 400 metres of a receptor at the same time when winds are blowing towards the receptor. Given that the distance between these two quarries is 2.5 kilometres, it is highly unlikely that the proposed Burnham Quarry will result in cumulative nuisance dust effects including for RSC.

6.2.8.2.4 Conclusion

If no mitigation measures were undertaken, there is some potential for air discharges from the proposed Burnham Quarry to cause off-site effects. However, it is proposed to apply a number of mitigation measures that will minimise dust emissions to within 100 metres of the source. Therefore, off-site dust effects at nearby receptor locations will be less than minor based on the following:

- Most receptors are too far away to be affected by dust from the proposed quarry and there are only a small number of receptors that are close enough that could be affected if no mitigation was implemented.
- There is a low probability of high emission rates occurring at the same time as dust transporting wind speeds blowing in the direction of receptors.
- The frequency of dust emissions will be further reduced as Burnham 2020 will be continuously monitoring wind speed and direction and dust concentration to ensure that the appropriate mitigation will be undertaken especially during wind conditions that might impact nearby receptors.
- The existing shelterbelts, bunding and temporary stockpiles on the site boundaries, will assist in managing dust effects on the receptors.
- There is no additional risk for people currently living near to the Site to experience health related effects as a result of dust from quarrying activities.
- The proposed quarry will not result in cumulative effects as the closest source of potential nuisance dust is located approximately 2.5 kilometres away and therefore it is unlikely both sources will interact.

6.2.9 Archaeology

Underground Overground Archaeology has prepared an archaeological assessment (**Appendix 16)** that details the history of the Site including setting its context in the cultural landscape and the later period of settler activity, through to today. The assessment concludes the property is located within a wider area of known Māori occupation and European pastoral pursuits. However, there is no recorded

evidence that the Site had any specific use prior to 1900 that would be likely to result in the presence of archaeological remains. In summary, the Site is assessed as unlikely to contain any archaeological material.

As such, it is considered unlikely that pre-1900 archaeological material will be uncovered during quarrying activities.

The Assessment recommends, and Burnham 2020 accepts the following:

1. As a first principle, every practical effort should be made to avoid damage to any archaeological site discovered during quarrying activities.
2. An Archaeological Discovery Protocol should be applied to the Site and this will form a condition on the land use consent. Any archaeological material encountered during the works should be reported to an archaeologist and Heritage New Zealand Pouhere Taonga. Local iwi should be consulted in the first instance if Māori material is encountered.

6.2.10 Positive Effects

Aggregate quarrying is a regionally significant industry that supports a diversity of other industries including construction and the development and maintenance of infrastructure. In fact, it is a fundamental input to these industries, which rely on a reliable source of aggregate that is located within proximity of where it is needed. Otherwise, the high cost of transporting aggregate means that the cost of infrastructure also rises, with consequent effects on affordability and the cost of living. This may only become more relevant as international agreements on curbing climate change aimed at reducing net emissions of greenhouse gases to the atmosphere are also likely to increase the cost of transport that relies on fossil fuelled propulsion.

There are few cost-effective substitutes for the range of uses of aggregate in roading, building and civil construction but the number of appropriate locations to establish new quarries is decreasing. A number of existing quarries are reaching the end of their consented life, and some are unable to expand as residential development has encroached onto the land around them.

The addition of another quarry is vital to the supply of aggregate in this part of Canterbury given the rate of residential development in the Selwyn District and the on-going rebuild of Christchurch. Burnham 2020 will also increase competition between suppliers and choice for consumers, with lower economic cost of supplies and environmental effects associated with transporting aggregate compared to sourcing aggregates outside the region or at greater distances from the area of demand.

Furthermore, the rural location of the proposed quarry, few close neighbours and lack of restrictive overlays and designations means that the effects arising from the development of the quarry can be managed through mitigations including conditions of consent that will not undermine the economic viability of the quarry. Conversely, neither will it adversely affect the economic wellbeing of an adjoining property owner or activity by limiting its ongoing operation or ability to expand.

Overall, the Proposal will make a positive economic contribution by ensuring a steady supply of much needed aggregate in proximity to demand, which will assist in avoiding costs that would arise if quarried materials were less available, affecting the cost and timeliness of new infrastructure. This could result in:

- Congestion of infrastructure of fixed capacity, such as roads, pipelines, interchanges

- Delay in the alleviation of costs and risks borne by the community, such as protections against natural hazards like flooding and repairs of landslips.
- Delay in treating environmental degradation, which increases the cost of remediation and reduces the well-being for communities waiting for the remedial work.

The Proposal will also provide employment opportunities, especially for those working on quarries that have ceased or are about to cease extractive activities. Overall, it will likely have a positive effect on economy of the Canterbury region.

6.2.11 Effects on Cultural Values

There are no known waahi tapu sites or other known sites of significance on the Site. Furthermore, there is no disturbance of significant indigenous flora and fauna, and no identified areas of ecological significance on the Site. It is recognised through consultation with Mahaanui Kurataiao Ltd (MKT), that a key cultural concern is managing potential adverse effects on groundwater quality. As discussed in Section 7.2.7 above, any potential adverse effects on groundwater quality will be minimised with no excavation to take place within 1 metre of the lowest recorded high ground water levels at the Site. The mitigation measures are also proposed for the storage and use of hazardous substances, and compliance with cleanfill standards. It has been concluded that quarrying activities within the Site and future use of the land for farming can be effectively managed to maintain the current quality of groundwater.

Burnham 2020 will seek to continue engagement with MKT and Taumutu Rūnanga and Ngāi Tūāhuriri Rūnanga following lodgement of the application, as requested by MKT.

6.2.12 Shading of the road

It is proposed to plant gaps in the existing shelterbelts along the road boundaries with Aylesbury and Grange Road. The existing shelterbelts are likely to currently cause shading over these roads at certain times of the day, and the additional planting is highly unlikely to contribute significantly to additional or greater shading that would adversely affect the safety of road users. Neither will it encroach any sightlines at any road intersection.

Furthermore, the planting will provide visual screening of the proposed quarry and protect adjoining sites from dust generated within the Site. Although, this is considered to be a low risk.

6.2.13 Signage

It is proposed to erect two signs at the access to the Site: one on either side of the formed vehicle crossing that will display the name of the quarry.

The signs will only contain two clear words: Burnham Quarry in 0.3 metre high lettering, so they will be easy to read at a distance of 250 metres by vehicles travelling in either direction on Aylesbury Road. The signs may be lit but only during the hours when the quarry is operating. This is intended to emphasise the site access and prevent late braking and vehicles turning around within the road.

The signs will be setback at least 5 to 6 metres from the formed road (carriageway) at the edge of the grassed berm that lies between the site boundary and the carriageway. However, the signs will only be separated by the width of the vehicle crossing as it enters the Site being 8 to 10 metres. Where it

crosses the berm, the vehicle crossing is flared, to provide for turning trucks and this will enable the signs to be angled towards the flow of traffic. The location of the signs means that they will not adversely affect the safety of motorists, pedestrians or cyclists using Aylesbury Road and neither will the signs affect traffic speeds, manoeuvring or the general flow of traffic by becoming a visual obstruction or distraction.

The rural location of the Site means that the signs will be simple in design. They will be viewed in the context of the formed site access to a quarry with its gates and proposed indigenous planting either side of the accessway into the Site. As such, adverse effects on visual amenity will be less than minor and the rural character of the Site will largely be retained as described in the Landscape Effects Assessment (**Appendix 8**). There are no heritage buildings or settings, open spaces, or protected trees within the Site and the Site is not within an area possessing significant natural or landscape values.

Furthermore, there are no existing signs on the Site or on any other property in proximity to the site access, therefore, the proposed signs will not result in visual clutter. Given the location, and the length of the subject site boundary, the proposed signs will likely remain the only signs in this location for some time.

Overall, the proposed signs will result in less than minor effects on the visual amenity of the surrounding area and people's health and wellbeing by maintaining the safe and efficient operation of Aylesbury Road.

6.3 Conditions

Section 104B of the RMA states that, where considering an application for a discretionary activity, the consent authority may grant or refuse the application. If the activity is granted, the consent authority may impose conditions pursuant to Section 108.

Suggested conditions of consent have not been provided as part of this application. It is considered more appropriate that suggested conditions be provided to the Councils following receipt of any submissions arising from the public notification of the application.

6.4 Conclusion of Assessment of Environmental Effects

The Site is located on Aylesbury Road (an arterial road) in a relatively unpopulated area with residential properties scattered around the Site and a cluster located to the southwest, with Burnham Camp located to the south.

Aylesbury Road has a straight alignment that will enable trucks to readily access State Highway 1, with limited modifications required to widen the road between the site access and Two Chain Road. The intersection with State Highway1 has some capacity issues and therefore until it is upgraded by Waka Kotahi, vehicle generation from the quarry will be limited to 250 vehicles per day. Noise from trucks using the local road network will be managed through limitations on the number of early morning truck movements (5am and 7am) and, if agreed to by the owners of the closest properties (146 and 168 Aylesbury Road), the application of mitigation measures such as an acoustic fence along their road boundaries.

The establishment of a formed site access will provide for turning trucks without causing damage to the edge of the road and places for trucks to park will be provided within the Site, preventing vehicles parking on Aylesbury Road and potentially affecting the safety of other road users.

The Site itself is large and has low ecological values having been used for primary production activities, although pre-construction checks will be undertaken for nesting birds. It has established shelterbelts along its site boundaries that form a screen that will assist in maintaining visual amenity values and managing potential dust effects. This will be reinforced by a bund that will be retained for the life of the quarry along most of the boundary with Aylesbury Road and 100m wide planting of indigenous vegetation in the southeast corner of the Site. In effect, views from private viewpoints will largely remain unchanged and from public viewpoints there will be temporary adverse effects until such time as the proposed exotic and native vegetation planted along the perimeter of the Site and at the entrance becomes established.

Furthermore, activities that generate dust and noise can be centrally located within the Site away from site boundaries and therefore residential properties. Temporary stockpiles will provide visual screening and dust and noise mitigation for extraction activities when in proximity to site boundaries. As such, quarry activities will meet the operational noise limits in the SDP and construction activities, such as the implementation of noise control bunds, will comply with the applicable noise limits from New Zealand Standard NZS 6803: 1999 Acoustics - Construction Noise.

The Site will be progressively rehabilitated using material sourced within the Site, being processed materials, silt and at least 200mm of topsoil. It will then be returned to primary production uses.

Overall, the quarry can be established and operated without adversely affecting amenity values on neighbouring properties, water quality, and the productivity of the soil, and future primary production can also be undertaken without affecting water quality.

The quarry will have a positive effect on the economic contribution to the district by ensuring a steady supply of aggregate in proximity to demand, which will assist in avoiding costs that would arise if quarried materials were less available, affecting the cost and timeliness of new infrastructure. It will also provide employment opportunities, especially for those working on quarries that have ceased or are about to cease extractive activities.

7.0 Assessment of Objectives and Policies

In accordance with Section 104(1) of the Resource Management Act 1991 ('RMA'), this part of the report addresses the statutory documents which are relevant to the assessment of this Proposal.

The objectives and policies of the CRPS, CARP, CLAWRP, SDP and the POSDP have been grouped by subject in the assessment of the Proposal against the relevant objectives and policies in the plans. This approach has been adopted as the CARP, CLAWRP, SDP and POSDP must give effect to the CRPS.

7.1 National Policy Statements

The following national policy statements of relevance to this Proposal have been addressed below:

- National Policy Statement for Freshwater Management 2021.
- National Policy Statement for Highly Productive Land 2022.
- National Policy Statement for Indigenous Biodiversity 2022.

7.1.1 National Policy Statement for Freshwater Management (NPS-FM)

The NPS-FM must be given effect to through ECan's policies and plans. However, as ECan has not yet had the opportunity to review its planning documents to implement the NPS-FM, an assessment of the proposal has been made against the objective and relevant policies of the NPS-FM in accordance with s 104(1)(b)(iii).

2.1 Objective

(1) The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises:

(a) first, the health and well-being of water bodies and freshwater ecosystems.

(b) second, the health needs of people (such as drinking water).

(c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

The proposed quarry is not located near any surface waterbodies, nor are there any located within the Site. The only freshwater that may be affected by the Proposal is groundwater in the aquifer underlying the Site. However, as determined through the Effects on Soil Assessment (**Appendix 13**) and the Hydrogeology Assessment (**Appendix 14**), effects on water quality arising from quarrying activities and primary production can be managed to minimise any adverse effects on water quality. A brief summary of the key matters is set out below.

- All discharges will be to land and not directly to groundwater.
- Water falling on the excavated quarry floor will filter through at least 1 metre of aggregate before discharging to the aquifer. This water will be clean as there will be no contaminants on the floor of the quarry, and the removal of the topsoil also removes a potential source of E.coli.

- All hazardous substances will be stored outside the quarry floor and used according to HSNO requirements and spills managed according to a management plan.
- Wastewater from the staff facilities and processing water will be treated prior to discharging to land outside the quarry floor.
- All cleanfill will be sourced from within the Site and therefore any stormwater discharging through this into the aquifer will result in no different or greater effect than currently occurs. The stormwater will not contain any contaminants due to the careful management of hazardous substances within the Site, and it will be filtered through at least 1 metre of in situ material and 0.3 - 0.4 metres of cleanfill comprising at least 0.2 metres of topsoil.

In essence, the quarry has been designed and will be operated, along with the primary production activities to prioritise the health and wellbeing of the aquifer. The water in the underlying aquifer will therefore be able to be used for drinking and stock water. Furthermore, discharging to land (and indirectly into the aquifer) will enable the community to provide for its direct economic needs through employment at the quarry. In addition, making aggregate available for the construction of infrastructure and construction for the region will provide social benefits. The maintenance of water quality will also ensure that there are no downstream effects on other water bodies such as Te Waihora, which is recognised as having significance to the local rūnanga.

Policy 1: *Freshwater is managed in a way that gives effect to Te Mana o te Wai.*

Based on the assessment of the hierarchy above, it is considered discharges to land that could potentially affect freshwater will be managed in a way that gives effect to Te Mana o te Wai.

Policy 2: *Tangata whenua are actively involved in freshwater management (including decision making processes), and Māori freshwater values are identified and provided for.*

The Proposal has been assessed against the relevant iwi management plan and assessed as consistent with the objectives and policies of that plan as set out in Section 7.3.1 below.

Policy 3: *Freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.*

Policy 4: *Freshwater is managed as part of New Zealand's integrated response to climate change.*

Policy 5: *Freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved*.

Policies 3, 4 and 5 relate to integration, whole of catchment management, NZ's integrated climate change response and the National Objectives Framework. These policies are directed at a higher level than is relevant to this proposal and are given effect through the CLAWRP and ECan management. Again, the Proposal is consistent with these policies by ensuring protection of freshwater values and by being in keeping with the approach for the wider catchment established through existing planning documents. As stated above, discharges to land that may enter groundwater will not adversely affect the health and well-being of the aquifer nor its ability to provide for the health needs of people.

Policy 6: *There is no further loss of extent of natural inland wetlands, their values are protected, and their restoration is promoted.*

There is no natural inland wetland affected in any way by this Proposal.

Policy 7: *The loss of river extent and values is avoided to the extent practicable.*

This policy is not relevant as no river will be affected by this Proposal.

Policy 8: T*he significant values of outstanding water bodies are protected.*

There are no outstanding water bodies within or adjacent to the Site, so this policy is not relevant.

Policy 9: *The habitats of indigenous freshwater species are protected.*

Policy 10: *The habitat of trout and salmon is protected insofar as this is consistent with Policy 9.*

These policies are not relevant to this Proposal given it is related to an aquifer. Freshwater resources are remote from the Site, and unaffected by proposed discharges to land that may enter groundwater sought in this application.

Policy 11: *Freshwater is allocated and used efficiently, all existing over-allocation is phased out, and future over-allocation is avoided.*

Policy 11 is not relevant as the take and use of groundwater is not sought by this application.

Policy 12: *The national target (as set out in Appendix 3) for water quality improvement is achieved.*

As discussed above, the Proposal will not result in adverse effects on water quality and will not contribute to any decline in water quality or adversely impact on any ability to improve water quality.

Policy 13: *The condition of water bodies and freshwater ecosystems is systematically monitored over time, and action is taken where freshwater is degraded, and to reverse deteriorating trends.*

Policy 14: *Information (including monitoring data) about the state of water bodies and freshwater ecosystems, and the challenges to their health and well-being, is regularly reported on and published.*

Policies 13 and 14 relate to work that is required to be undertaken by ECan. However, it is proposed to undertake on-going monitoring of water quality beneath the Site and of discharges, to ensure that water quality standards are being met. This information will be provided/available to ECan to inform its own monitoring and reporting programmes.

Policy 15: *Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.*

Discharges to land are a necessary activity that will enable Burnham Quarry to operate. By enabling the discharges, the quarry will generate employment and economic activity that will benefit the local, regional and national economy. Quarrying is a necessary precursor to construction as aggregate is needed to supply residential development, infrastructure and road building in Christchurch and its surrounds.

The objective and policies in Part 2 of the NPS-FM have been assessed, and overall, it is considered that the proposal achieves the objective and relevant policies of the NPS-FM and is therefore generally consistent with the concept of Te Mana o te Wai.

Part 3 is not considered relevant as it relates to implementation of the NPS-FM by the regional council rather than whether an individual application gives effect to or is aligned with, the intent of the NPS-FM.

7.1.2 National Policy Statement for Highly Productive Land 2022 (NPS-HPL)

The NPS-HPL must be given effect to through ECan's policies and plans. However, as the Council has not yet had the opportunity to review its planning documents to implement the NPS-HPL, an assessment of the Proposal has been made against the objective and relevant policies.

The NPS-HPL seeks to protect highly productive land to enable its use for land-based primary production, both now and for future generations. It recognises the finite characteristics and long-term values of such land, and that its protection may lead to reduced (or least no greater) use of agri-chemicals by reducing the use of marginal land.

In general, the NPS-HPL applies to Land Use Capability Classifications 1, 2 and 3. Regional councils may also map land that is in a general rural zone or a rural production zone that is not LUC 1, 2, or 3 land, as highly productive land if the land is, or has the potential to be (based on current uses of similar land in the region), highly productive for land-based primary production in that region, having regard to the soil type, physical characteristics of the land and soil, and climate of the area. This work has not been undertaken by ECan.

The LUC mapping unit is in three parts:

<u>LUC class</u>

The LUC class is the broadest grouping in the classification, identifying the general degree of limitation to arable use. It comprises eight classes. Classes 1 to 4 are classified on their suitability for cultivation for cropping, with Class 1 being the most versatile with few limitations to use, through to Class 4 which has limitations so it is marginal for cultivation for cropping. The Site is LUC 4 due to the shallow topsoil over gravels which limits cultivation options.

<u>LUC subclass</u>

The LUC class is subdivided into one of four subclasses, depending on the major physical limitation to use. There are four limitations; erodibility (e), wetness (w), soil (s), and climate (c). They are denoted by the small letter e, w, s, or c after the LUC class number. The Site is suitable for pastoral farming but limited by moderate soil (s) limitations.

<u>LUC unit</u>

The third and most detailed level of classification is the LUC unit. The unit groups areas that require the same kind of management, the same kind and intensity of soil conservation treatment, and are

suited to the same kinds of crops, pasture or forestry species which require specific conservation measures and management practices to achieve similar yields.

The Site is LUC4s 7 and is described as terraces and plains with shallow and stony soils of medium to low fertility in seasonally moisture-deficient districts. These soils are often irrigated to overcome the moisture deficits, and are suitable for occasional cropping, pasture farming, tree crops and may be suitable for viticulture and berry fruit.

The Site is Land Use Classification 4s7 (NZLRI Land Use Capability 2021), therefore the NPS-HPL is not applicable. It is noted that the Site is surrounded by LUC 4s7 (same classification) and 3s5 (more productive/versatile) land.

7.1.3 National Policy Statement for Indigenous Biodiversity 2022 (NPS-IB).

The NPS-IB must be given effect to through ECan's and Selwyn's policies and plans. However, as the Councils have not yet had the opportunity to review their planning documents to implement the NPS-IB, an assessment of the proposal has been made against the objective and relevant policies, noting that the Site does not support indigenous vegetation.

The objective of this National Policy Statement is to protect, maintain, and restore indigenous biodiversity in a way that:

(a) recognises tangata whenua as kaitiaki, and people and communities as stewards, of indigenous biodiversity; and

(b) provides for the social, economic, and cultural wellbeing of people and communities now and in the future.

There are no indigenous vegetation communities or habitats within the Site as it has been used for primary production for several decades. However, South Island pied oystercatcher have been observed foraging in pasture and recently cultivated loamfield within the Site, and black-fronted tern, black-billed gull and red-billed gull may use the Site infrequently and irregularly for foraging. The Site may also be used by a small number of indigenous birds such as the South Island pied oystercatcher and pied stilt for nesting.

The establishment of the quarry may temporarily disrupt this feeding and nesting location. However, there is no shortage of similar habitat available locally, and the on-going use of the Site for, and staged rehabilitation to enable the Site to be used for, primary production will mean that the Site will continue to provide the same or similar habitat for birds. Further, because the Proposal is to progressively excavate in stages, disturbance effects will be limited to a relatively small portion of the Site at any one time. Any risk to nesting bird species will be managed by undertaking pre-construction nesting bird surveys during the breeding season (August to February).

It is also proposed to undertake extensive areas of indigenous planting around the Grange Road access and in the southeast corner of the Site, and along the rehabilitated batters adjacent to the site boundaries resulting in approximately 30 hectares of indigenous planting. This could provide new habitats for indigenous species and form part of a future ecological corridor across the Canterbury Plains. This will restore indigenous biodiversity while recognising the role of tangata whenua as kaitiaki and providing for the wellbeing of people and communities by providing much needed aggregate for the Region.

Policy 1: Indigenous biodiversity is managed in a way that gives effect to Te Rito o te Harakeke.

Based on the above, it is considered that indigenous biodiversity will be managed in a way that gives effect to Te Rito o te Harakeke, given the lack of indigenous vegetation and habitats within the Site, pre-construction nesting bird surveys and the proposed area of indigenous planting.

Policy 2: Tangata whenua are recognised as kaitiaki, and enabled to exercise kaitiakitanga for indigenous biodiversity in their rohe, including through:

(a) enabling tangata whenua to manage indigenous biodiversity on their land; and

(b) the identification and protection of indigenous species, populations and ecosystems that are taonga.

The Site is not owned by tangata whenua nor have any taonga bird species been observed at the Site. However, given the area of indigenous planting proposed, Burnham 2020 will engage with tangata whenua in selecting species and undertaking on-site works to enable them to exercise their kaitiakitanga.

Policy 3: A precautionary approach is adopted when considering adverse effects on indigenous biodiversity.

A precautionary approach has been taken, as whilst only a small number of nesting indigenous birds such as the South Island pied oystercatcher and pied stilt may be affected, it is proposed to undertake pre-construction nesting bird surveys, if the removal of vegetation occurs in August to February. This recognises that most indigenous bird species (excluding spur-winged plover) are either absolutely or partially protected under the Wildlife Act (1953), therefore it is unlawful to disturb the nesting of these species.

Policy 4: Indigenous biodiversity is resilient to the effects of climate change.

This Proposal is contributing to the resilience of indigenous biodiversity by planting indigenous vegetation within the Site that could provide new habitats for indigenous species and form part of a future ecological corridor across the Canterbury Plains.

Policy 5: Indigenous biodiversity is managed in an integrated way, within and across administrative boundaries.

Policy 5 is a matter than the relevant Councils need to address but cross-boundary management is probably not relevant to this Site as it is centrally located within the Selwyn District.

Policy 6: Significant indigenous vegetation and significant habitats of indigenous fauna are identified as significant natural areas (SNAs) using a consistent approach.

Policy 7: SNAs are protected by avoiding and managing adverse effects from new subdivision, use and development.

The Site is not a significant indigenous vegetation or a significant habitat of indigenous fauna, so Policies 6 and 7 are not relevant.

Policy 8: The importance of maintaining indigenous biodiversity outside SNAs is recognised and provided for.

As discussed above, the Site supports very little (if any) indigenous biodiversity, but this may be substantially enhanced through the planting of 30 hectares of indigenous vegetation.

Policy 9: Certain existing activities are provided for within and outside SNAs.

This Policy is not relevant as this Proposal is for a new activity on the Site.

Policy 10: Activities that contribute to New Zealand's social, economic, cultural, and environmental well-being are recognised and provided for.

The Proposal will support activities such as infrastructure, construction and flood management that support people's economic and social wellbeing. Furthermore, enabling the quarry to establish and operate, will result in a significant area of indigenous vegetation being planted to support indigenous biodiversity and the outcomes sought by the NPS-IB.

Policy 11: Geothermal SNAs are protected at a level that reflects their vulnerability, or in accordance with any pre-existing underlying geothermal system classification.

The Site does not lie in an area that has geothermal activity; therefore, this Policy is not relevant.

Policy 12: Indigenous biodiversity is managed within plantation forestry.

The Site does not contain plantation forestry; therefore, this Policy is not relevant.

Policy 13: Restoration of indigenous biodiversity is promoted and provided for.

It is proposed to undertake extensive areas of indigenous planting: at the commencement of quarrying activities around the Grange Road access and in the southeast corner of the Site, and along the rehabilitated batters adjacent to the site boundaries as part of site rehabilitation. This will result in approximately 30 hectares of indigenous planting.

Policy 14: Increased indigenous vegetation cover is promoted in both urban and non-urban environments.

It is proposed to undertake 30 hectares of indigenous planting on the Canterbury Plains that could form part of a future ecological corridor and contribute to achieving Policy 14.

Policy 15: Areas outside SNAs that support specified highly mobile fauna are identified and managed to maintain their populations across their natural range, and information and awareness of specified highly mobile fauna is improved.

Policy 16: Regional biodiversity strategies are developed and implemented to maintain and restore indigenous biodiversity at a landscape scale.

Policy 17: There is improved information and regular monitoring of indigenous biodiversity.

These Policies relate to work that needs to be undertaken by ECan at a regional level and cannot be appropriately considered as part of a consenting process.

Overall, it is considered that the Proposal generally achieves the objective and relevant policies of the NPS-IB and is consistent with the concept of Te Rito o te Harakeke.

7.2 Regional and District Plans

This section assesses the proposal against the relevant objectives and policies in the following plans:

- Canterbury Regional Policy Statement (CRPS).
- Canterbury Land and Water Regional Plan (CLAWRP).
- Canterbury Air Regional Plan (CARP).
- Selwyn District Plan (SDP).
- Partially Operative Selwyn District Plan (POSDP).

7.2.1 Land Use and Infrastructure

Document	Provisions	Summary
CRPS	Chapter 5 – Obj 5.2.1. Pols 5.3.2, 5.3,7, 5.3.8 and 5.3.12.	The Site is located outside Greater Christchurch and the objective and policies seek to ensure that future development will achieve consolidated, well designed and sustainable growth in and around existing urban areas. Development should be avoided, remedied or mitigated, including where these would compromise or foreclose the productivity of the region's soil resources, without regard to the need to make appropriate use of soil which is valued for existing or foreseeable future primary production, or through further fragmentation of rural land, and significant natural and physical resources. Development should also avoid or mitigate reverse sensitivity effects and conflicts between incompatible activities, including identified mineral extraction areas; and integrate with transport networks to provide for the

		sustainable and efficient movement of goods and services, and a logical, permeable and safe transport system. The policies also seek to maintain and enhance natural and physical resources contributing to Canterbury's overall rural productive economy in areas which are valued for existing or foreseeable future primary production, by: 1. avoiding development, and/or fragmentation which; a. forecloses the ability to make appropriate use of that land for primary production; and/or b. results in reverse sensitivity effects that limit or precludes primary production.

Discussion

Development is not defined in the CRPS, and primary production is defined as 'the production (but not processing) of primary products including agricultural, horticultural, pastoral, aquacultural, and forestry products and includes the use of land and auxiliary buildings for these purposes.'[9] Whilst the definition does not specifically include quarrying or mineral extraction, Burnham 2020 considers aggregate to be a primary product.

The processing of aggregate is specifically excluded from the definition of 'primary production'. However, the processing of aggregate cannot be defined as 'development' as implied by the use of the term in the CRPS. This is illustrated in the objectives and policies in the Land Use and Infrastructure, which clearly apply to residential or other forms of 'built development'.

Addressing the use of the Site for aggerate extraction (primary production), the Proposal will not foreclose the ability of the Site to be used for other forms of primary production such as agriculture. Pastoral and agricultural activities will continue while quarrying occurs, as this latter activity will be staged. Rehabilitation of the Site will also enable the continued use of the Site for agriculture. Thus, there will be no fragmentation of rural productive land or adverse effects on this important physical resource, noting that the aggregate is also an important physical resource.

The processing of the aggregate is directly associated with the use of the land for primary production (aggregate extraction) and will commence at the same time as, operate alongside, and cease shortly after, the extraction activities. As such, it also will not foreclose the ability of the Site to be used for other forms of primary production such as agriculture.

Furthermore, the Site is remote to large-scale residential populations, although it is acknowledged that there is a pocket of development to the South-East of the Site. The scale of the Site will enable activities that generate noise and dust to be centrally located, and the existing shelterbelt and the proposed bunding and stockpiling will ensure that potential effects on surrounding roads and properties are effectively mitigated.

[9] Glossary and Definitions, CRPS 2013.

The quarrying operation will not be sensitive to any surrounding primary production activities, so it will not cause reverse sensitivity effects.

The Site integrates with the existing transport network as it is located on an arterial road that connects to State Highway 1, limiting the need for trucks to use local roads that may not have constructed to support large volumes of heavy trucks. It is acknowledged that Aylesbury Road will need to be widened to manage effects arising from trucks damaging the edge of the road and the intersection of Aylesbury Road and SH1 needs to be upgraded but not because of the quarry. However, until that intersection is upgraded, the number of truck movements generated by the quarry will be limited to 250 per day to enable the safe and efficient operation of the road network.

Overall, the Proposal will generally achieve the outcomes sought by the objectives and will be generally consistent with the policies of Chapter 5 of the CRPS.

7.2.2 Mineral Extraction and cleanfilling

Document	Provisions	Summary
CRPS	Obj 15.2.1 and Pol 15.3.1	Soils are to be maintained and enhanced to safeguard their mauri, their life supporting capacity, their health and their productive capacity. This is to be achieved by ensuring that land-uses and land management practices avoid significant long-term adverse effects on soil quality, and remedy or mitigate significant soil degradation where it has occurred or is occurring; and promote land-use practices that maintain and improve soil quality.
CLAWRP	Pols 4.18, 4.19 and 4.22	These more general policies seek that the discharge of contaminants to groundwater from earthworks, excavation or disposal sites and contaminated land is avoided or minimised by ensuring that activities are sited, designed and managed to avoid the contamination of groundwater including from sedimentation; and contaminated land is monitored where appropriate. Note that Policy 4.94 below specifically addresses the effect of gravel extraction on groundwater.
	Pols 4.93 and 4.94.	These gravel extraction-specific policies recognise the importance of gravel extraction for the construction and maintenance of infrastructure, economic activity and the re-build of Christchurch. 4.93 Recognise the value of gravel extraction for construction and maintenance of infrastructure, for economic activity, for flood management purposes and for the re-build of Christchurch. 4.94 Enable the extraction of gravel from land, provided adverse effects on groundwater quality are minimised

		and remediation is undertaken to minimise any ongoing risk of groundwater contamination.
SDP	Objs B1.1.1, 1.1.2 and 1.1.3 Pols B1.1.1, B1.1.2, B1.1.3, B1.1.6 and B1.1.1.7	The objectives seek to manage the adverse effects of activities on land and soil resources, ensure people and property are not affected by contaminated or unstable soil and promote the sustainable management of the soil resource. This is achieved by appropriate management of contaminated land and hazardous substances to avoid adverse effects on people and the mitigation or remediation of adverse effects on the environment. Policies B1.1.6 and B1.1.7 seek to manage damage to soils by encouraging initiatives by landowners to reduce the adverse effects of activities on soil structure and erosion and avoid removing large quantities of topsoil from sites unless the site will be covered in hardstanding or the topsoil replaced and the site replanted once the activity ceases.
POSDP	Obj 01 Pols EW-P3 and P4.	The objectives and policies seek to manage potential adverse effects resulting from earthworks to limit erosion, inundation or siltation so that it does not impede the functioning of natural biological and physical processes, and minimise any adverse visual effects, loss of privacy, dust nuisance, or shading adverse effects during or on completion of earthworks.
	GRUZ-P4	Policy GRUZ-P4 seeks to provide for the economic development potential of the rural area, by enabling a range of activities that have a direct relationship with primary production (noting the definition of Primary Production in the OPSDP includes quarrying activities) have a functional or operational need to locate in the rural area, represent an efficient use of natural and physical resources, and maintain or enhance the character and amenity values of the surrounding area.
	GRUZ P8	Policy GRUZ-P8 enables mineral extraction in the General Rural Zone while managing the spatial extent and effects of mineral extraction activities in order to maintain the amenity values of sensitive activities and residential activities; internalising adverse environmental effects as far as practicable, including by using industry best practice and management plans; and avoiding mineral extraction on highly productive land unless there is a functional or operational need to locate it on that land and in

		the case of aggregate extraction provides a significant national or regional public benefit..
	GRUZ P9	This Policy requires the rehabilitation of mineral extraction sites, so that they can be used for permitted or consented activities that have an economic, environmental, social or cultural benefit. The final landform must maintain or enhance the amenity values in the surrounding area.

Discussion

The proposed quarry is important for the Selwyn District and wider Canterbury Region, as it will provide a steady supply of aggregate in proximity to its markets. This is important as aggregate is expensive to transport but is vital to the construction of infrastructure and buildings. This is recognised in Policy 4.93 of the CLAWRP.

Policy GRUZ-P8 of the PSDP seeks to enable mineral extraction in the General Rural Zone provided that the spatial extent and effects of the activity are managed to maintain amenity values of sensitive activities and residential activities, internalises adverse environmental effects as far as is practicable, including by using industry best practise and management plans, and avoiding mineral extraction on highly productive land.

Burnham 2020 chose the Site at Aylesbury Road and Grange Road, Burnham because it is rural in character and the General Rural Zone seeks to enable activities such as quarrying (mineral extraction). The Site is some distance from a large residential population such as Rolleston or Christchurch, but within reasonable distance of its markets. The greatest population density in proximity to the Site is located along Two Chain Road and at the Burnham Camp.

The Site is large and can readily contain all associated processing activities and provide a secure resource over a long period of time, to minimise the need to find further sites in the future: providing certainty to the local community. Its size also means that it can internalise most adverse effects such as construction and operational noise, with processing activities being centrally located within the Site. The existing shelterbelt around the Site, additional planting, the long-term bund along Aylesbury Road and the temporary stockpiles will screen views from adjoining private properties and public road, as well as provide some mitigation for dust.

Policies B1.1.6 and B1.1.7 of the SDP seek to manage damage to soils by reducing the adverse effects of activities on soil structure and avoiding the removal of large quantities of topsoil from sites unless the topsoil will be replaced and replanted once the activity ceases. The activity of quarrying requires the removal of large areas of topsoil; however, this will be undertaken in phases to limit the amount of time the soil is stockpiled, which could affect its structure. These works will be undertaken in accordance with a Soil Management Plan (**Appendix 13a**).

The extraction activity itself will be managed in accordance with the Quarry Management Plan (**Appendix 6**), a Dust Management Plan (**Appendix 7**) and a range of both design and mitigation measures to manage potential adverse effects on noise, air and water quality.

Water quality in the underlying aquifer will not be adversely affected during extraction as the use and storage of hazardous substances will be carefully controlled and spills will be quickly cleaned up. Any identified HAIL activities within the Site will be managed by way of a DSI to be prepared and implemented as quarrying occurs in the proceeding phase, and water falling as precipitation or

discharged through the settling ponds will be filtered through underlying aggregate, in a manner no different to that currently occurring at the Site.

Existing air quality will be maintained by continuously monitoring wind speed and direction and dust concentration to ensure that the appropriate mitigation is undertaken especially during wind conditions that might impact nearby residential properties such that offsite dust effects at nearby receptor locations will be no more than minor.

The generation of potential noise effects has been considered in the spatial design of the Proposal, with the processing plant located towards the centre of the Site. Bunds and stockpiles will be used at the site perimeter to further mitigate quarry noise effects on identified sensitive receivers and residences. Noise criteria have been developed by acoustic experts, Marshall Day, which reflect the POSDP noise standards and are considered appropriate for the protection of residential amenity in a rural zone. Noise modelling confirms operational quarrying activities will comply with these proposed noise limits, and the noise effects are considered reasonable in the context of the receiving environment in the General Rural Zone. It is therefore considered that proposed quarrying activities will maintain the acoustic amenity of sensitive activities and residential activities.

With respect to truck movements, it has been assessed that without mitigation, acoustic amenity will not be maintained, and adverse noise effects will be generated, particularly at the residences at 168 and 146 Aylesbury Road. Significant traffic noise effects are unlikely during the day and limited in frequency during the early morning period. However, the implementation of acoustic mitigation measures such as acoustic fencing will reduce the level of any adverse noise effects resulting from truck movements during the daytime and in the early morning between 5am and 7am. Furthermore, the quarry is located in a rural area, where early morning activities associated with Burnham Camp and primary production are anticipated.

The Proposal has avoided locating on highly productive land as identified in the National Policy Statement for Highly Productive Land.

GRUZ P9 requires the rehabilitation of mineral extraction sites, so that they can be used for permitted or consented activities that have an economic, environmental, social or cultural benefit. The final landform must maintain or enhance the amenity values in the surrounding area. It is proposed to rehabilitate the land as each phase of extraction is completed, by cleanfilling with 200mm of overburden, subsoil or waste aggregate and 200mm of topsoil, which will be planted in pasture, irrigated and lightly stocked. Cleanfill for the Site will only be sourced from within the quarry and will be free of contaminants, thus minimising any further risk to water quality in the underlying aquifer. Stockpiles will be pushed into the quarry and the slopes graded to an average slope of 1 in 2 and planted with indigenous vegetation. The plants will be irrigated for at least two years after planting until established; and pest protection implemented and maintained for two years after establishment. Therefore, the Proposal accords with Policies B1.1.6 and B1.1.7 of the SDP, which seek that topsoil is replaced and replanted once quarrying has ceased.

Whilst the Site will not be rehabilitated back to existing ground level due to the lack of certainty over access to suitable cleanfill, it will likely be used for primary production. However, it could also be used for other purposes and the planting of at least 30 hectares of indigenous vegetation will have an ecological benefit. So, the final landform will at least maintain, if not enhance, the amenity values in the surrounding area.

Overall, the proposed on-site quarrying activities (both construction and operational) will generally accord with the outcomes sought by the relevant objectives and will be generally consistent with the policies in the CRPS, CLAWRP, the SDP and the POSDP that seek to enable well managed mineral extraction activities in the General Rural Zone of the OPSP and OPSDP. However, it is acknowledged that without mitigation, adverse effects from off-site traffic noise effects ranging from slight to significant could be generated on the existing residences at 168 and 146 Aylesbury Road, albeit infrequently. It is therefore proposed to implement mitigation measures to minimise adverse truck noise effects, but this is subject to agreement by the properties' owners. As such, existing acoustic amenity at these sensitive receivers will not be fully maintained.

7.2.3 Landscapes and Rural Character

Document	Provisions	Summary
CRPS	Obj 12.2.2. Pols 12.3.3.	The CRPS requires identification and management of other important landscapes that are not outstanding natural landscapes. Other important landscapes may include natural character, amenity and historic and cultural heritage.
OSDP	Obj B1.4.1. Pols B1.4.2	The objective and policies only relate to Outstanding Natural Features and Landscapes.
POSDP	GRUZ-O1	The objective provides for development in the rural areas provided that it supports, maintains or enhances the function and form, character and amenity value of the rural areas, prioritises primary production over other activities, allows primary production and activities that directly support primary production and have a functional or operational need to locate in the General Rural Zone to operate without being compromised by reverse sensitivity effects, retains the contrast in character to the urban areas and protects highly productive land.
	GRUZ-P1	The policy seeks to maintain or enhance the amenity values of rural areas by retaining a low overall building density, enabling primary production which includes quarrying activities while managing adverse effects of mineral extractive industries, managing the density and location of residential development, retaining a clear delineation and contrast between the district's rural areas and urban areas, and recognising that primary production produces noise, dust, odour and traffic that is noticeable to residents and visitors to the General Rural Zone.

Discussion

The landscape within which the Site is located has not been identified as having outstanding natural character or amenity values identified as a historic or cultural landscape and has no natural features or landscape of significance as identified in the SDP and POSDP. Therefore, the objectives and policies in the Landscape sections of the SDP and POSDP are not considered relevant.

The Landscape Effects Assessment (**Appendix 8**) has considered effects on landscape values (in its broadest sense) and concludes that whilst there will be an adverse effect on landscape character during the operation of the quarry, this will reduce over time as native planting becomes established, ensuring the Site remains well integrated into the broader landscape.

Of importance, is that GRUZ-P1 specifically seeks to provide primary production including quarrying activities, that this is an appropriate activity in the context of the Site and these activities should be enabled subject to managing adverse effects on rural character and amenity values.

The Site will remain predominantly in productive rural land use prior to, and following, each phase of extraction, thus it will retain its rural character albeit in the context of a modified landform rehabilitated with substantial planting. The quarry will result in a low overall building density, and a predominance of vegetation cover due to ongoing and future primary production within the Site. Overall, the Site will retain its rural character thus maintaining the contrast in character to the urban areas.

In conclusion, the Proposal will generally accord with the outcomes sought by the objectives and will be generally consistent with the policies that apply to landscapes and rural character in the CRPS, SDP and the POSDP.

7.2.4 Amenity Values

Document	Provisions	Summary
SDP	Objs B3.4.1 and B3.4.2 Pols B3.4.1, B3.4.3 and B3.4.4.	The Plan seeks that the district's rural area is a pleasant place to live and work and that a variety of activities are provided for. However, these need to avoid, remedy or mitigate significant adverse effects on amenity values, avoid reverse sensitivity effects and maintain low levels of building density in the Rural zone and the predominance of vegetation cover. The Plan also seeks that the adverse effects of non-rural based industrial activities are avoided, remedied or mitigated to the extent that they are no more than minor.
	Pol B3.4.11	Activities should avoid shining light at night into houses, other than a house located on the same site as the activity, or from vehicles using roads in the District.
	Pol B3.4.13	Continuous or regular noise is at a level which does not disturb people indoors on adjoining properties.

	Pol B3.4.16	Mitigate effects from dust including nuisance effects on adjoining dwellings caused by dust from earthworks or stockpiled material.
	Pol B3.4.17	Buildings and trees do not excessively shade adjoining properties.
POSDP	GRUZ-O1	The objective provides for development in the rural areas provided that it supports, maintains or enhances the function and form, character and amenity value of the rural areas, prioritises primary production over other activities, allows primary production and activities that directly support primary production and have a functional or operational need to locate in the General Rural Zone to operate without being compromised by reverse sensitivity effects, retains the contrast in character to the urban areas and protects highly productive land.
	GRUZ-P1	The policy seeks to maintain or enhance the amenity values of rural areas by retaining a low overall building density, enabling primary production which includes quarrying activities while managing adverse effects of mineral extractive industries, managing the density and location of residential development, retaining a clear delineation and contrast between the district's rural areas and urban areas, and recognising that primary production produce noise, dust, odour and traffic that is noticeable to residents and visitors to the General Rural Zone.
	Obj: NOISE—O1 Pol: NOISE-P1 and P8.	The objectives seek that the health and wellbeing of people and communities and their amenity values are protected from noise effects consistent with the anticipated outcomes for the receiving environment. Policy P1 seeks to manage noise effects by setting maximum noise limits, limits on the location, frequency and duration of activities and a vibration standard. Policy P8 seeks to manage the frequency and duration of temporary activities.
	Obj: LIGHT-O1 Pol: LIGHT-P1, P2 and P3.	The objective provides for artificial outdoor lighting that enables activities to occur beyond daylight hours while maintaining the health, safety and amenity values of people, and protecting the District's natural darkness and natural features. The policy directives seek to manage new artificial outdoor lighting by minimising light spill, glare onto adjoining sites and glare onto roads to provide for the health and safety of people

		and the safe and efficient operation of the land transport network. Policy P2A also recognises that artificial lighting may be required to support the operational needs of activities. Policy P3 directs that sky glow should also be minimised to • maintain people's ability to view the night sky; and • maintain the distinct character and amenity values of the district's night sky; and • protect the health and well-being of people and ecosystems.

Discussion

The POSDP recognises that the primary purpose of the General Rural Zone is to provide for primary production activities which includes quarrying activities, and other compatible activities. Furthermore, the POSDP recognises rural landscapes include mineral extraction and associated structures and buildings, and that these activities may have associated levels of noise, dust and odour. Whilst residential activities are part of the General Rural Zone, they should not compromise the ability of the Zone to be used for primary production.

Whilst the SDP includes Policy B3.4.3 (Avoid, remedy or mitigate significant adverse effects of activities on the amenity values of the rural area), it is clearly stated that the Policy should not be used as a catch-all to oppose changes to land uses. '*Changes in land uses do not necessarily detract from the amenity values of an area and may enhance them. Where an activity will detract from the amenity values of an area, Policy B3.4.3 requires those effects be mitigated.*

The requirement to mitigate adverse effects of activities in Policy B3.4.3 of this section does not replace more specific duties to protect areas and avoid adverse effects, in other policies in the Plan.'[10]

The SDP does not define the amenity values anticipated in the Rural Zone however it can be inferred from the policy framework as relatively low levels of noise and light at night, a low density of built form, and low levels of traffic on local roads with higher volumes including trucks on arterial roads and during activities such as harvesting.

Building density

Buildings associated with primary production will be clustered towards the centre of the Site away from property boundaries. Those related to the quarry will be clustered in proximity to the site access off Aylesbury Road and will be limited in number to 4 being the site office, workshops and laboratory. These will be screened from Aylesbury Road by a long-term bund and established and proposed planting. Overall, the density of buildings within the Site will be low given the size of the Site.

Reverse sensitivity

With respect to Policy GRUZ-O1(3), the proposed quarry will not be sensitive to any actual potential or perceived environmental effects generated by established primary production activities. Therefore,

[10] Selwyn District Plan, Rural Volume, Objectives and Policies, B3 Health Safety Values, Policy B3.4.3 Explanation and Reasons.

the quarry will be consistent with this Policy, as the establishment of a new quarry will not generate any reverse sensitivity effects or compromise any of the existing primary production activities.

Predominance of vegetation

The Site is currently in pasture and crops with no indigenous vegetation, with the site boundaries being planted with pines. It is proposed that the Site will continue to be used for primary production alongside staged quarry activities thus retaining a predominance of vegetation and through rehabilitation, the Site will be grassed and returned to primary production. The bunds along Aylesbury Road will be planted, the rehabilitated batter slopes, an area in the southeast corner of the Site and around the access from Grange Road will also be planted in indigenous vegetation to be retained in perpetuity. So, when viewed externally, there will be a predominance of vegetation.

Lighting

Lighting in the Rural Zone is often required for harvesting, shearing and other seasonal activities and there are no restrictions on outdoor lighting provided it does not shine directly onto another property.

Any lighting located within the Site will generally be directed away from site boundaries, and often below the surrounding ground level if associated with extraction or stockpiling. Furthermore, lighting will shine into the Site, be screened by the bund and temporary stockpiles, and will not spill onto the road or adjoining properties thereby reducing the risk of nuisance effects and glare for motorists. Lighting will shine downwards, maintaining people's ability to view the night sky.

Noise

Many people consider that rural areas should be relatively quiet especially at night with low ambient noise levels. However, the sound of machinery operating in fields and in farmyards or heavy trucks using local roads is not uncommon, with greater levels of noise associated with seasonal activities such as harvesting particularly in the early morning.

Construction and operational noise related to aggregate extraction and processing can be contained within the Site and will meet both the operative and proposed noise standards at the notional boundaries of adjoining residential dwellings. However, there is the potential for a significant increase in traffic noise to be experienced at the closest property at 168 Aylesbury Road on limited occasions. It is therefore proposed to implement mitigation measures such as acoustic fencing to reduce the level of this effect and limit both the number and frequency of truck movements in the early morning between 5am and 7am.

Dust

It is anticipated that dust will be managed to minimise dust emissions to within 100 metres of the source. This will be achieved through continuously monitoring wind speed and direction and dust concentration, retaining the existing shelterbelts, establishing bunding and temporary stockpiles on the site boundaries. A dust management plan will also be prepared and implemented to ensure that dust does not result in adverse effects on adjoining properties.

Shading by trees

The existing shelterbelts are likely to already cause shading over Aylesbury and Grange Roads at certain times of the day, and the additional planting is highly unlikely to contribute significantly to additional or greater shading that would adversely affect the safety of road users.

Overall, the Proposal will generally achieve the outcomes sought by the objectives and policies in the SDP and the POSDP that seek to maintain and / or enhance amenity values in the General Rural Zone. However, as discussed above, the Proposal will not maintain amenity values in relation to noise at 168 and 146 Aylesbury Road. It is therefore proposed to implement mitigation measures to minimise adverse truck noise effects, but this is subject to agreement by the properties' owners. As such, existing acoustic amenity at these sensitive receivers will not be fully maintained.

7.2.5 Transport

Document	Provisions	Summary
CRPS	Obj 6.2.4 Pol 6.3.4	The CRPS seeks that transport infrastructure facilitates the movement of people and goods and the provision of services in Greater Christchurch, while reducing emission of contaminants to air and energy use, optimising use of existing capacity within the network; and enhancing transport safety. This is to be achieved through avoiding development that will overload strategic freight routes; providing patterns of development that optimise use of existing network capacity, providing opportunities for travel demand management; requiring integrated transport assessment for substantial developments; and improving road user safety.
SDP	Obj B2.1.1 Pol B2.1.2, B2.1.4(a), B2.1.13 and B2.1.14	The objective seeks an integrated approach to land use and transport planning to ensure the safe and efficient operation of the district's roads, pathways, railway lines and airfields is not compromised by adverse effects from activities on surrounding land or by residential growth. The policies seek to manage the effects of activities on the existing road network as increased volumes of traffic can affect the classification of a road and require upgrades. As such it is important to ensure that all sites have legal access to a legal road which is formed to the standard necessary, considering the number and type of vehicle movements generated by the activity; the road classification and function; and any pedestrian, cycle, public transport or other access required by the activity.
POSDP	Objs: TRAN-O1, TRAN-02, . Pols: TRAN-P3, TRAN-P4, TRAN-	The objectives seek to ensure people and places are connected through safe, efficient, and effective land transport corridors and land transport infrastructure for all transport modes which are well integrated with land use activities and subdivision development. Further that land transport corridors and land transport infrastructure need to be protected from incompatible land use activities and subdivision development.

	P7 and TRAN-P11.	The Plan requires high trip generating activities to prepare Integrated Transport Assessments to maintain the safety and efficiency of the land transport corridor by ensuring there is sufficient capacity in land transport corridors and establish whether the high trip generating activity can be supported by active transport modes including accessibility to safe and convenient walking and cycling connections and access to public transport and public transport facilities. Policy TRAN-P4 seeks that the adverse effects of activities within the General Rural Zone that exceed the maximum number of vehicle movements for each site are managed. The policies also seek to recognise and protect the function of the District's land transport network and systems by managing the safe and efficient movement of people and goods by (i) avoiding significant adverse effects and minimising other adverse effects from activities on the safe, efficient and effective operation of land transport corridors and land transport infrastructure, (ii) ensuring transport corridors and land transport infrastructure can efficiently and effectively provide for the volume and type of transport movements based on the network road classifications, and (iii) and requiring the design, positioning, and maintenance of accessways, corner splays, vehicle crossings, intersections, footpaths, plantings, and signs to ensure appropriate sightline visibility is provided to road users to support safe and efficient vehicle, pedestrian, and cycle movements.

Discussion

The Site will be located on an arterial road that provides connections to SH1 Main South Road and SH73 West Coast Road. This enables most travel to and from the quarry to occur on the state highway and arterial road network and minimise the risk of trucks using local roads that have not been designed to support large numbers of heavy trucks.

The POSDP requires high trip generating activities to prepare Integrated Transport Assessments to assist in ensuring there is sufficient capacity in land transport corridors. Although the quarry does not reach the high trip generating activity threshold, essentially a full integrated traffic assessment has been undertaken by Stantec and the Assessment is provided in **Appendix 10**.

The number of truck movements generated by the quarry will be limited to 250 per day until such time as the SH1/Aylesbury Road intersection has been upgraded, ensuring the development of the quarry integrates with funded improvements to the network. In the interim, truck movements generated by the quarry will not overload the current capacity of the roading network.

The site access will be formed to a higher standard than required by the SDP to ensure turning trucks will not impact on the edge of the road and parking spaces are provided to reduce the risk of trucks parking on Aylesbury Road and becoming a limitation on visibility for other road users or a hazard for cyclists and pedestrians.

Aylesbury Road has a straight alignment and good sightlines that will not be affected by the Proposal. The road will be widened between the site access and Two Chain Road to enable two trucks to pass and then turn into the Site without adversely impacting on the edge of the road causing its condition to deteriorate.

As discussed in **Section 6.2.3**, with the modifications proposed to the roading network, the limit on the number and frequency of truck movements in the early morning between 5am and 7am, and the planned modifications to the SH1 / Aylesbury Road intersection with traffic generated by the quarry limited to 250 heavy vehicles per day until that occurs, the additional quarry traffic can be accommodated within the existing land transport corridors and land transport infrastructure network without adversely affecting its safe, efficient and effective operation.

Overall, the Proposal will generally achieve the outcomes sought by the Transport objectives and will be generally consistent with the policies in the CRPS, SDP and the POSDP.

7.2.6 Ecosystems and Indigenous Biodiversity

Document	Provisions	Summary
CRPS	Objs: 9.21 and 9.2.3	The objectives seek to halt the decline in the quality and quantity of Canterbury's ecosystems and indigenous biodiversity, and that areas of significant indigenous vegetation and significant habitats of indigenous fauna are identified, and their values and ecosystem functions protected.
SDP	Obj: B1.2.1 and B1.2.4. Pol: B1.2.6.	The objectives seek to recognise and protect significant areas of indigenous vegetation and habitats of indigenous fauna and encourage the enhancement of areas of indigenous vegetation. The policies seek to avoid, remedy or mitigate adverse effects on indigenous ecosystems, vegetation and habitat, where these areas are important for maintaining the indigenous biodiversity and ecosystem functions and natural character of the District.
POSDP	Obj: ECO-O1 and ECO-O2. Pol: ECO-P11 and P12.	The objectives seek to manage indigenous biodiversity within the district through the exercise of kaitiakitanga and stewardship and recognise and provide for the relationship of Ngāi Tahu whānui, and their customs and traditions, with indigenous biodiversity. The policies direct that the planting of pest tree and plant species listed in ECO-SCHI Potential Plant Species, or the Canterbury Regional Pest Management Plan are avoided and that indigenous vegetation cover in extensive dryland pastoral systems are maintained.

Discussion

The Site does not contain any significant areas of indigenous vegetation or significant habitats of indigenous fauna and therefore the objectives and policies listed above are not relevant.

ECO-P11 seeks to avoid the planting of pest tree and plant species identified as pest species. The gaps in the existing shelterbelt will be planted with non-wilding pine species that are not identified pest plant species.

It is also proposed to undertake the planting of 30 hectares with indigenous vegetation, along the site boundaries and in areas adjacent to the access on Grange Road and in the southeast corner of the Site. This will significantly enhance the existing indigenous vegetation cover on the Site and assist in halting the decline in the quality and quantity of Canterbury's ecosystems and indigenous biodiversity and therefore achieves Objective 9.21 of the CRPS.

Overall, the Proposal will be entirely consistent with the direction set out in the ecosystems and indigenous biodiversity objective and policy directives in the CRPS, SDP and the POSDP.

7.2.7 Hazardous Substances

Document	Provisions	Summary
CRPS	Obj 18.2.1 and 18.2.2. Pols 18.3.1 and 18.3.2	The objectives and policies seek to manage the adverse effects of storing and using of hazardous substances and that new contamination of land is avoided. In particular, the use, storage or disposal of hazardous substances in high hazard areas must be avoided and managed in areas of unconfined or semi-confined aquifer, where the depth to groundwater is such that there is a risk of contamination of that groundwater, and generally on the environment.
CLAWRP	Pols 4.25 and 4.27.	Policy 4.25 provides for the use of hazardous substances that are not approved under the Hazardous Substances and New Organisms Act.
SDP	Objs 3.2.1 and B3.2.2 Pols B3.2.1 (a) and (b)	The Plan seeks to avoid, remedy or mitigate the adverse effects on human health and the environment including farm animals, waterbodies and ecosystems of manufacturing and storing of hazardous substances. Hazardous substances are to be stored in a manner to reduce the risk of leaks and spills to land and water, and to enable the storage of quantities and classes of hazardous substances in the rural areas that are commensurate with the types of activities provided for in the SDP. The quantities stored are often sufficient to contaminate land and soil with significant adverse effects, therefore, storage needs to be subject to conditions to protect the environment. There are also threshold limits to distinguish between small-scale activities where effects are likely to be minor, and larger scale activities that require resource consent.

POSDP	Obj HAZS-O1. Pol HAZS-P1	The objective and policy seek to recognise the benefits associated with activities involving the use, storage, disposal, and transportation of hazardous substances are recognised, while ensuring that risks to the environment and human health are minimised to acceptable levels.

Discussion

All the hazardous substances proposed to be stored and used within the Site have been approved under the Hazardous Substances and New Organisms Act.

Fuel will be kept in double skinned tanks and oil and greases will be stored in specially designed areas within the workshop, outside the quarry floor.

A hazardous substance risk register, and spill management plan will be developed for the Site and will comply with all relevant legislation.

Overall, the storage and use of hazardous substances will achieve the outcomes sought by the objectives and policies set out above.

7.2.8 Contaminated Land

Document	Provisions	Summary
POSDP	Obj CL-O1. Pols CL-P1	The objectives and policies seek to ensure that human health and the environment are protected from adverse effects on the use of contaminated land and require any proposal for development to apply a best practise approach to investigate risks and remediate the contamination or manage activities on contaminated land to protect people and their environment.

Discussion

A search of the Land Use Register on the ECan website revealed that the Site has not been identified as contaminated.

Nevertheless, Preliminary Site investigation (PSI) has been prepared which identified several areas where activities listed in the Hazardous Activities and Industries List (HAIL) are likely to have been undertaken.

A best practise approach to investigate any risks and remediate any contamination or manage activities on contaminated land to protect people and their environment has been proposed as part of the Proposal.

It is proposed that identified HAIL areas are subject to targeted detailed site investigations (DSI's) as quarrying progresses across the Site. This will ensure that any ongoing activities are captured by the assessments, and any remedial actions applied accordingly. Remedial actions will vary according to the nature and extent of contamination found during any DSI.

Overall, the proposed management of any potentially contaminated land on the Site will be consistent with the objectives and policies managing contaminated land, set out above.

7.2.9 Freshwater - Quality

Document	Provisions	Summary
CRPS	Obj 7.2.3.	The objective seeks to maintain or improve the overall quality of freshwater in the region and protect the life supporting capacity, ecosystem processes and indigenous species and their associated freshwater ecosystems are safeguarded.
CLAWRP	Objs 3.1, 3.2, 3.5, 3.8, 3.8A, 3.11, 3.13 and 3.24. Pols 4.1, 4.2, 4.4 and 4.7, 4.8A, 4.11, 4.12, 4.13, 4.14. 4.14B, 4.17, 4.23, 4.23A and 4.94. 11.4.1, 11.4.11, 11.4.12 and 11.4.38.	Put simply, the objectives seek to ensure the integrated management of water and land, as well as taking a mountain to the sea approach. Water quality is sought to be managed to protect the life supporting capacity of ecosystems, and to ensure that high-quality groundwater is available for abstraction. Aquifers are required to meet freshwater outcomes set out in the Plan, and overall water quality must not decline. Direct discharges to groundwater are controlled and cannot include untreated wastewater or industrial or trade waste. Furthermore, discharges to land that may enter groundwater are managed according to a hierarchy of avoid production of the contaminant, secondly reuse, recover or recycle and thirdly, use a land-based treatment, a wetland, where practical. Discharges should not exceed the natural capacity of the soil to treat or remove the contaminant, or the water storage capacity of the soil. However, Policy 4.14 recognises that this is not always possible and sets out other matters that need to be addressed: making the contaminant plume as small as practicable, separating the discharge from other discharges and drinking water supplies; not result in the accumulation of pathogens or persistent toxins and not raise groundwater to a level that would impede ground drainage. Stormwater needs to be managed to ensure that it does not cause or exacerbate the risk of inundation or damage to property or infrastructure downstream, or risks to the safety of people. Policy 4.23 specifically seek to protect sources of drinking water by ensuring that discharges do not adversely affect the taste, clarity and smell of drinking water and community drinking water supplies meet the CWMS drinking water targets and the New Zealand Drinking Water Standard. Policy 4.94 specifically enables the extraction of gravel from land, where adverse effects on groundwater quality are

		minimised and remediation is undertaken to minimise any ongoing risk of contamination. The Selwyn Te Waihora sub section contains additional policies of relevance that require discharges of wastewater to land to be in accordance with the best practicable option and not exceed the nitrogen load limits set in the Plan, except where the loss of nitrogen from both the discharge and the farming activity does not exceed the authorised discharge of nitrogen that was occurring prior to the discharge.
SDP	Obj B1.3.1.	The objective seeks the contamination of groundwater is avoided or mitigated, and that degraded water quality is improved, generally by changes to land use practices or controls on land uses.

Discussion

It is noted that Policy 4.94 of the CLAWRP specifically enables the extraction of gravel from land, where adverse effects on groundwater quality are minimised and remediation is undertaken to minimise any ongoing risk of contamination.

Sections 6.2.6 and 6.2.7 clearly set out the effects of the establishment and operation of the proposed quarry, and the on-going and future use of the Site for primary production. In summary,

- There will be no direct discharges of water or contaminants to the aquifer.
- The removal of the soil during quarrying activities and the exposure of the underlying gravels will promote the infiltration of both rainwater and water used within the quarry for washing aggregate, to the underlying groundwater and will remove sources of nitrates and E. coli that currently arise from the agricultural land use.
- A hazardous substance risk register, and management plan will be developed for the Site that will comply with all relevant legislation. The storage and use of hazardous substances will occur outside the quarry floor and in appropriately bunded areas to contain any potential spills.
- Wastewater from the staff facilities will be treated prior to discharging to land.
- Stormwater may pond during extreme weather events but essentially will be clean water and no excavation will occur within ponded water on the quarry floor.
- The annual loss of nitrate into the groundwater will remain largely the same as currently occurs, although the nitrate will reach the water table sooner than under the pre-quarry scenario, with no consequent effects on water quality.
- Assuming current farming practices are resumed on the rehabilitated land, there will be less reduction of the E. coli concentrations through the unsaturated zone between the surface soil profile and the groundwater table than is currently the case, but removal will be sufficient to avoid adverse water quality effects in neighbouring bores.

Overall, the Proposal will generally achieve the outcomes sought by the objectives and policies in relation to water quality in the CRPS, and the SDP.

7.2.10 Air Quality

Document	Provisions	Summary
CRPS	Obj 14.2.1, 14.2.2 Pols 14.3.1, 14.3.3 and 14.3.5	The objectives and policies seek to maintain or improve existing air quality whilst enabling the discharge of contaminants. However, there should be no significant localised adverse effects on social, cultural and amenity values, flora and fauna, and other natural and physical resources. Of particular relevance Policy 14.3.5 seeks those new activities which require resource consents to discharge contaminants into air located away from sensitive land uses and receiving environments unless the adverse effects of the discharge can be avoided or mitigated.
CARP	Objs 5.1-5.7 and 5.9-5.10 Pols 6.1,6.2, 6.3, 6.5, 6.6, 6.8, 6.9, 6.10, 6.11, 6.12, 6.13, 6.15, 6.17, 6.22, 6.25, 6.26 and 6.28	The objectives reflect the importance of air quality to the health and wellbeing of the community and the competing needs that can affect it. There is a focus on maintaining acceptable, and improving degraded, ambient air quality. This is to be achieved by maintaining the amenity values of the receiving environment, considering the effects of new discharges on adjacent land uses and sensitive activities, avoiding offensive and objectionable effects and noxious or dangerous effects, and using technology. The policies seek that any discharge does not adversely impact on people's health and wellbeing, biodiversity, visibility or property as well as wāhi tapu, wāhi taonga, and places of significance to Ngāi Tahu. The policies also acknowledge that some activities have locational constraints that should be considered when imposing terms and conditions, and that where activities locate appropriately to mitigate adverse effects on air quality a longer consent duration may be available to provide on-going operational certainty. Discharges should apply good environmental practices and the best practicable option, recognising that changes in technology may allow for improvements in the quality of a discharge over the term of the consent and provide for this by imposing management and review conditions on new and replacement resource consents. Alternatively, where a discharge causes effects that are unpredictable because of

		scientific uncertainty or an absence of information, adopt a precautionary approach to assessing the effects. Applications for resource consent for discharges into air from industrial or trade activities classified as discretionary must address (as relevant to this application): • localised effects of the proposed discharge and the location of sensitive receptors; and • available mitigation and emission control options; and • the duration of consent being sought and the practicability for the effects of the discharge to be reduced over time. Of particular relevance to this application is the management of dust by ensuring that activities likely to discharge to air are appropriately located.

Discussion

It is proposed to develop a new aggregate quarry in a rural zone, away from residential areas, albeit there are several dwellings located within 250m of the quarry site. The potential for air quality effects relate almost exclusively to the potential for dust emissions, which could arise from extraction, vehicle movements, aggregate processing, stockpiling and rehabilitation activities.

As discussed under Section 6, an air discharge assessment has been carried out by PDP (**Appendix 15**) and the quarry will operate in accordance with a Dust Management Plan (**Appendix 7**). The effect of any discharges to air will be less than minor due to on-going monitoring that enables dust generating activities and any discharges to be managed quickly and efficiently. Furthermore, mitigation measures such as using water to dampen loose surfaces, limiting the speed limit of vehicles within the quarry, the planting of vegetation on batter slopes and establishing pasture on the rehabilitated quarry floor will effectively manage dust emissions, and therefore maintain the current air quality.

The application includes discharges to air from the processing of aggregate (defined as an industrial or trade activity in the CARP). Therefore, the Air Quality Assessment has addressed localised effects of the proposed discharge being as discussed above, identified the location of sensitive receptors in Figure 10 of the Air Quality Assessment; and identified mitigation measures, as discussed above. Overall, any potential adverse effects are certain, can be effectively managed and there is no need to apply the precautionary principal.

The ability to reduce effects of the discharge over time is limited and unnecessary in this instance, given that it is proposed to minimise dust emissions to within 100 metres of the source, which will mean that dust is generally retained within the Site and there will be very low potential for health effects.

Overall, the Proposal will generally achieve the outcomes sought by the objectives and will generally be consistent with the policies related to air quality in the CRPS and the CARP.

7.2.11 Reverse sensitivity

Document	Provisions	Summary
SDP	Pol B3.4.20	Mitigate reverse sensitivity by locating and managing new activities, which may have adverse effects on surrounding properties.
POSDP	GRUZ-P7	Avoid reverse sensitivity effects on: 1. lawfully authorised or established primary production activities; 2. activities that have a direct relationship with, or are dependent, on primary production; and 3. important infrastructure.

Discussion

The POSDP defines reverse sensitivity as follows: the potential for an approved (whether by consent or designation), lawfully established existing or permitted activity to be compromised, constrained, or curtailed by the more recent establishment, intensification, or alteration of another activity that may be sensitive to the actual, potential or perceived adverse environmental effects generated by the approved, lawfully established existing or permitted activity.

Burnham 2020 carefully chose the Site for its distance from large areas of population, and being in the Rural zone where primary production including quarrying activities are anticipated and provided for. It is recognised that there are lawfully authorised and established primary production activities located in close proximity to the Site of the Proposal.

The proposed quarry will not be sensitive to any actual, potential or perceived environmental effects generated by these established primary production activities, and therefore it will be consistent with this Policy. The establishment of new quarry will also avoid generating any reverse sensitivity effects on these existing primary production activities.

Overall, the Proposal will be entirely consistent with the policies that address reverse sensitivity in the SDP and POSDP.

7.2.12 Natural Hazards

Document	Provisions	Summary
CRPS	Obj 11.2.1 and 11.2.3 Pols 11.3.1, 11.3.2, 11.3.3, 113.5, 11.3.8 and 11.3.9	The objectives and policies seek to avoid the creation of new hazards as well as not increasing the risk to people and property from existing hazards, whilst recognising the effects of climate change. When considering natural hazards, and in determining if new subdivision, use or development is appropriate and sustainable, local authorities shall have particular regard to the effects of climate change.

SDP	Objs: B3.1.1 and B3.1.2 Pols: B3.1.7 and 3.1.8.	The objectives and policies seek that activities do not cause or exacerbate natural hazards, and mitigation measures do not cause or exacerbate adverse effects on the environment.
POSDP	Objs: NH-O1, NH-O3 and NH-04. Pols: NH-P1, NH-P2, NH-P3, NH-P4 and NH-P5. Flood Hazards: NH-P10 and NH-P12. Geotechnical Hazards: NH-P15 and NH-P17.	The objectives and policy directives addressing natural hazards, seek to avoid new use and development in areas where the risks from natural hazards to people, property and infrastructure are assessed as being unacceptable; and in all other areas, is undertaken in a manner that ensures that the risks of natural hazards to people, property and infrastructure are appropriately mitigated. Any risk assessment must include consideration of climate change and its influence on the frequency and severity of natural hazards. Further, methods to mitigate natural hazards must not create or exacerbate adverse effects on other people, property, infrastructure, or the environment. The policy directives of particular relevance to this Proposal seek to: In areas within the Plains Flood Management Overlay that are not a high hazard area, any new use and development is only enabled where every principal building has an appropriate floor level above the 200 year Average Return Interval (ARI) design flood level. Mange earthworks undertaken in the Plains Flood Management Overlay to ensure that they do not exacerbate flooding on any other property by displacing or diverting floodwater on surrounding land. Within the Greendale Fault Avoidance Overlay, avoid the development or use of land, buildings or structures for any, community facility, important infrastructure, land transport infrastructure of Major Hazard Facility. Within the Fault Awareness Overlay, restrict the development of important infrastructure; or land transport infrastructure; or Major Hazard Facility unless the adverse effects can be mitigated so as to ensure that there is no greater risk to human health during or after any earthquake.

Discussion

The Site is subject to flooding in a 1 in 200 and 1 in 500 ARI rainfall event but is not generally identified as a High Hazard area.

The flow of water across the Site is from North West/West to the South/South east, with the likely maximum depth of water being 1 metre during both ARI (Average Reoccurrence Interval) events but over most of the affected areas of the Site, the maximum depth will be 0.5 metres, except for one tiny area in the centre of the Site where the maximum depth will be more than 1.5 metres due to a previous excavation (high hazard in 1 in 500 year ARI event). The 500 year ARI rainfall hazard – Maximum of Depth (m) and Depth (m) x Velocity (m/s) will be less than 0.8m except for the same area in the centre of the Site which will have a maximum depth of 1-1.2 metres (high hazard).

The Site is not subject to flooding from the Waimakariri or Selwyn Rivers.

The establishment and operation of the quarry will not exacerbate the effects of flooding as the Site is of sufficient size that water will be retained within the Site and not flood onto adjoining roads or properties. This matter will also be addressed in the Quarry Management Plan.

The quarry can be readily evacuated in a flood event, with only a small number of people working in the quarry and hazardous substances will be stored in buildings that are located on land that will remain at the height of the existing ground level. The buildings will also be constructed to have a floor level above the 200 year Average Return Interval (ARI) design flood level.

It is recognised that part of the Site is located in the Greendale Fault Avoidance Overlay and the Fault Awareness Overlay. (Refer **Appendix 3**). However, it is not proposed to construct a community facility; or important infrastructure; or land transport infrastructure; or a Major Hazard Facility.

Overall, the Proposal will generally achieve the outcomes sought by the natural hazard objectives and policies in the CRPS, SDP and the POSDP.

7.2.13 Signs

Document	Provisions	Summary
SDP	Pols: B3.4.9 and B3.4.10.	The policies seek to manage the effects of signage on the amenity of the rural zone, and the health and safety of people. This is achieved by requiring signs and noticeboards to be located on the site to which the sign or notice board relates and managing the design and position of signs.
POSDP	Obj: SIGN-O1 Pols: SIGN-P1 and SIGN-P2.	The objective recognises that signs contribute to the District's economic and community wellbeing, and transport safety. Of relevance to this Proposal, the policy directives seek to enable signs that are an integral component of industrial and commercial activities, while managing the size, design, location, and number of signs to maintain transport safety, and the character and amenity values of the surrounding environment.

Discussion

It is proposed to display the name of the quarry either side of the vehicle entrance on Aylesbury Road. The two signs will be simple in design (two or three words naming the quarry), located within the Site

and setback from the road boundary. Consequently, the proposed signs will not obstruct or impair the view of any traffic signal, intersection, vehicle crossing, bend or corner and will maintain traffic safety.

The signs will not have flashing or revolving lights, sound effects, balloons or blimps; or moving parts and will not resemble a traffic sign or signal. Should the signage at the entrance to the Site be illuminated, the light spill onto any adjoining property or the road reserve will not exceed 3-lux spill.

The proposed signage will trigger Rule 6.4.2 (Restricted Discretionary) of the SDP as they will not be separated by 80 metres, and Rule SIGN-R4.2 (Restricted Discretionary) in the POSDP as they are not proposed to be setback 20 metres from the road. The assessment of effects has assessed the effects of these infringements as being less than minor and the rural character of the Site will largely be retained as described in the Landscape Effects Assessment (**Appendix 8**).

Overall, the Proposal will achieve the outcomes sought by the objectives and will be consistent with the policies related to signs in the SDP and the POSDP.

7.3 Iwi Management Plans

The only iwi management plan of relevance to this application is the Mahaanui Iwi Management Plan 2013 (MIMP).

7.3.1 MIMP

MIMP is the manawhenua planning document reflecting the collective efforts of six Papatipu Rūnanga that represent the hapū who hold manawhenua rights over lands and waters within the takiwā from the Hurunui River to the Hakatere River and inland to Kā Tiritiri o Te Moana. The Site is within the Papatipu Rūnanga of Te Taumutu.

The plan provides a values-based, plain language policy framework for the protection and enhancement of Ngāi Tahu values, and for achieving outcomes that provide for the relationship of Ngāi Tahu with natural resources. The plan has the mandate of the six Papatipu Rūnanga, and is endorsed by Te Rūnanga o Ngāi Tahu, as the iwi authority. It is applicable to policy and planning processes under the RMA, in this case by providing context to the matters over which discretion is reserved under rule 11.5.33 of the CLAWRP.

Section 5.3 Wai Māori states that surface and groundwater resources are over-allocated in many catchments and water quality is degraded as a result of urban and rural land uses. This has significant effects on the relationship of Ngāi Tahu to water, particularly with regard to mauri, mahinga kai, cultural well-being and indigenous biodiversity. There are clear objectives that seek to ensure:

- Water quality in groundwater and surface water resources in the takiwā enables customary use mō tātou, ā, mō kā uri ā muri ake nei.
- Water and land are managed as interrelated resources embracing the practice of Ki Uta Ki Tai, which recognises the connection between land, groundwater, surface water and coastal waters.
- Water quality is such that future generations will not have to drink treated water.

The Te Waihora region-specific objectives include the following:

- Land and water use in the catchment respect the boundaries, availability and limits of our freshwater resources and the need to protect soil and water resources for future generations.
- The relationship between land use, groundwater, surface water and Te Waihora is recognised and provided for according to the principle of Ki Uta Ki Tai.

The MIMP also contains Policies P13.2 and P13.3 that specifically address the quarrying component of the Proposal including giving consideration to the location of the quarry, the type of quarry proposed, avoiding and mitigating adverse effects, the preparation of quarry management plans and site rehabilitation plans.

Discussion

These objectives, which predate the CLAWRP, have clearly informed its content, as the thrust of both documents is consistent. Many of the comments made above in evaluating this application against the objectives and policies of the CLAWRP are relevant also to assessment against the framework of the MIMP.

Specifically, this assessment has taken into consideration the need to address Ngāi Tahu values by ensuring all discharges are to land and not directly to water, maintaining existing water quality in the aquifer, managing discharges to air and rehabilitating the land including planting the regraded batter slopes that will form the site boundaries with indigenous vegetation. It is also proposed to plant an area in the South East corner of the Site and in proximity to the Grange Road access with indigenous vegetation. Eventually, 30 hectares of indigenous planting will be established within the Site.

It is also proposed to undertake pre-construction nesting bird surveys to minimise impacts on indigenous bird species.

In addition, there are no Statutory Acknowledgements or Silent File Areas within 1km of the Site. There is also no significant indigenous biodiversity (including remnant native bush, waterways, wetlands or waipuna) on the Site, or nearby, nor are there any sites of significance on or near the Site. There is a very low risk of accidental discoveries.

The table below addresses Policies P13.2 and P13.3 that seek to manage the impacts of quarrying / mineral extraction.

Matter	Discussion
<u>Location of the activity</u> • What is the general sensitivity of the site to the proposed activity? • How well does the proposed activity 'fit' with the existing landscape? • Is there significant indigenous biodiversity on the site, including remnant native bush? • What waterways, wetlands or waipuna exist on the site?	The Site is not sensitive to the proposed quarry activities as it is devoid of indigenous vegetation and is not part of a Statutory Acknowledgements or Silent File Area. The Landscape Effects Assessment concludes that whilst there will be an initial moderate effect on landscape values, this will reduce as the proposed planting becomes established, the long-term bund along Aylesbury Road and the temporary stockpiles are formed and the gaps in the shelterbelt are planted.

• Are there sites of significance on or near the site? • What is the risk of accidental discoveries? • What is the wider cultural landscape context within which the site is located?	There is no significant indigenous biodiversity on the Site, including remnant native bush as the Site has been used for dairy finishing and fodder crops. This has resulted in the domination of pasture associated with grazing and irrigation. No waterways, wetlands or waipuna exist on the Site. There no sites of significance on or near the Site. There is a very low risk of accidental discoveries. There are no Statutory Acknowledgements or Silent File Areas within 1km of the Site, and the Site sits outside any cultural overlay identified in the POSDP.
<u>Type of quarrying</u> • What resource is being extracted, what will it be used for, and is it sustainable?	It is proposed to extract, and process aggregate to support the construction industry and infrastructure projects in Christchurch and its surrounds.
<u>Avoiding and mitigating adverse effects</u> • What provisions are in place to address sediment and erosion control? • What provisions are in place for stormwater management? • What provisions are in place for waterway protection? • How will the site be restored once closed?	Activities within the Site will be undertaken in accordance with a Quarry Management Plan and a Dust Management Plan. Stormwater will discharge to land as currently occurs. It will be clean as hazardous substances will be carefully stored and used within the Site and any spills will be managed in accordance with a Spill Management Plan. There are no waterways within or in close proximity to the Site. The Site will be rehabilitated as each phase of extraction is completed. It is proposed to place 200mm of overburden, aggregate, silt or other material sourced from within the Site over the excavated quarry floor and cover with 200mm of topsoil, also sourced from within the Site including from temporary stockpiles along the site boundaries. This will then be planted in pasture and irrigated.

	The sides of the quarry will be battered to approximately 1 in 2 and planted in indigenous vegetation.
Management plans Quarry management plans for earthworks, erosion and sediment control, waterway protection, on site stormwater treatment and disposal and provisions for visual screening / barriers that include indigenous vegetation; and	A Quarry Management Plan is provided with this application. (**Appendix 6**).
Rehabilitation Site rehabilitation plans that include restoration of the site using indigenous species.	As discussed above.

Overall, it is considered that the Proposal will generally accord with the outcomes sought by the MIMP as the quarry will be established and operated to minimise adverse effects on the environment whilst also establishing approximately 30 hectares of indigenous vegetation.

7.4 Conclusion on Statutory Considerations

Overall, the Proposal will generally accord with the outcomes sought by the objectives and policies in the NPS-FM, CRPS, CLAWRP, CARP, SDP, POSDP and the MIMP because:

- The Site will be managed to minimise effects on the physical and natural environment.
- The quarrying activities will be undertaken in manner to minimise impacts on people's health and wellbeing.
- It will enable the extraction of a valuable natural resource that is vital to the economy of the Selwyn District and Christchurch City.
- The Site will be rehabilitated, and topsoil can be removed, stored, and replaced to enable the land to be used for primary production.
- By the time of closure, there will be approximately 30 hectares of indigenous vegetation established within the Site.

8.0 Consultation Record

Burnham 2020 has undertaken a range of consultation including open days, iwi engagement and general communication with neighbouring properties. Consultation undertaken to date, is summarised below. Consultation will also continue following lodgement of the application.

8.1 Iwi engagement

There are two Runanga with rohe over the area within which the Site is located: Te Taumutu Runanga and Te Ngai Tuahuriri Runanga. Both Runanga are represented by Mahaanui Kurataiao Ltd (MKT).

Burnham 2020 met with MKT on 27 February 2023. The main issues raised by MKT were:

- Would like to see indigenous, locally plants sourced for rehabilitation, ideally from DOC.
- Preference would be that the post-rehabilitated land would not be used for dairy support, due to the scale of dairy support in the region and effects on nitrate level.
- MKT have no policy opposing quarrying, but groundwater quality was a major issue, particularly in relation to stopping contaminants such as heavy metals and hydrocarbons from entering groundwater (discussion of spill control etc).
- MKT would like to review current farming nitrogen discharge levels onsite.
- Queried whether Burnham 2020 would consider being involved in offsite rehabilitation / restoration projects such as wetlands or Te Ara Kakariki. Burnham 2020 advised that they would be happy to discuss any proposals.

In terms of future meetings, MKT advised that their preference was to not meet in person pre-lodgement but rather work through the application as lodged, once received from Canterbury Regional Council and Selwyn District Council.

8.2 Key Stakeholders

8.2.1 Waka Kotahi

Stantec has had several discussions with Waka Kotahi transport safety engineers to understand plans for State Highway 1 in the vicinity of Aylesbury Road, in the context and understanding that a large-scale quarry is proposed on Aylesbury Road. Stantec advised that a transport assessment was being carried out, which would include consideration of access connections via the road network to State Highway 1. This consultation has directly informed the Transport Assessment in **Appendix 10** and a summary is set out below:

<u>April 2022</u>

Waka Kotahi advised that a feasibility assessment for the State Highway 1 / Aylesbury Road intersection had been completed as part of the Speed and Infrastructure Programme which included a project for the intersection and adjacent section of the highway. The preferred option was described as a single lane roundabout, with separation from the railway maintaining a distance of approximately

30 metres between limit lines. From these discussions, Stantec expected a design that would enable the full range of traffic movements at the intersection in a safe and efficient manner. However, it was recognised that consultation on the proposal had not commenced, property would need to be purchased, but it is likely that construction would be included in the next NLTF programme 2024-2027.

May 30 to 19 December 2022

On-going communication with Waka Kotahi regarding the concept design / layout of the SH1 / Aylesbury Road intersection. However, this was still being progressed during the second half of 2022 and was unavailable to Stantec.

16 March 2023

Waka Kotahi advised that they have developed a working concept/feasibility stage intersection design. It was understood that the design will be a single lane roundabout, which will be part of the Road to Zero package (State Highway 1 Templeton to Selwyn). The intersection is a safety project, independent of the Rolleston Access Upgrade package, with detailed design to be completed in the next year, and implementation funding to be included in 2024-27 budget.

23 May 2023

Waka Kotahi advised that the detailed design of the State Highway 1 / Aylesbury Road intersection had commenced, but that they still need to work through property and consenting. The “inscribed diameter” of the roundabout is proposed to be 50m (single lane). No specific traffic modelling of the roundabout has been undertaken as its primary function is as a safe access and u-turning location.

6 July 2023

Stantec requested a meeting to discuss the transport assessment but was advised that internal discussions were required to understand the sensitivity of information about the State Highway 1/Aylesbury upgrades as the Waka Kotahi communication team were about to commence some community engagement.

20 July 2023

Aurecon (Waka Kotahi’s consultant engineers) asked to meet with Stantec to understand the quarry project as it relates to the State Highway 1 / Aylesbury Road intersection.

3 August 2023

Stantec and Winstone had an online meeting with Aurecon to describe the quarry proposal and matters that may be of relevance to the roundabout project, including analysis carried out by Stantec, and matters relating to integration of the roundabout with the railway line. Aurecon set out the current design plans for the intersection.

21-29 August 2023

A discussion was held between Stantec and WSP who are also part of the Waka Kotahi design team to discuss the quarry project parameters and the analysis undertaken. Stantec agreed to supply collated traffic data, the transport assessment report, and intersection analysis models. Those have been provided to WSP and a link also made available to the Waka Kotahi safety engineer and planner.

8.2.2 KiwiRail

Burnham 2020 met with KiwiRail to discuss the project in May 2022.

8.2.3 Department of Corrections

The Department of Corrections responded to an invitation in November 2022 to attend public open days advising that their interest would likely be restricted to proposed transport routes.

Burnham 2020 has provided the Department of Corrections with a copy the Transport Assessment prepared by Stantec and proposes to meet with them following lodgement of the application.

8.2.4 Ministry of Defence (Burnham Camp)

Burnham 2020 made initial contact with the Ministry of Defence (MOD) in February 2020 who advised that its main concerns were likely to be air quality and traffic. MOD also noted that Burnham Camp was in effect a small town, and the MOD encouraged the individual residents of the Camp to lodge their own submissions if they had concerns.

Burnham 2020 presented a draft proposal to staff at Burnham Camp on 12 April 2023. The main issues raised included the following:

- The State Highway 1 / Aylesbury intersection is unsafe and not suitable for increased heavy vehicle movements. Alternative routes were queried and how Burnham 2020 would control any traffic routes that may be specified in future consent conditions.
- Several of the Camp residents are mana whenua, and Burnham 2020 was asked about the potential for future collaboration. Options for future social procurement, training and possible employment were raised. Burnham 2020 advised that they would be open to discussions on this point.
- Water quality at the Camp is excellent, and that any impacts on it from the Proposal needed to be carefully assessed.
- Potential air quality impacts, particularly as there is a school located within the Camp.

8.2.5 Neighbouring Properties

In September 2021, representatives of Burnham 2020 visited nearby residents on Wards Road, Kivers Road, Grange Road, Two Chain Road, Aylesbury Road and Sandy Knolls Road. The purpose of the visits was to advise residents that Burnham 2020 had purchased the Site and proposed to develop a quarry there. In October 2021 visits were made to those not at home during the earlier visits.

The above visits were followed by letters sent to the same properties in February 2022, advising on the status of the project and providing a point of contact for any queries.

8.2.6 Public Open Day

From 1-3 December 2022, representatives for Burnham 2020 held a series of open days at a marquee on the Burnham Site with display boards setting out the draft proposal. Invitations to the

open day were sent out in November 2022 by letter drops to local residents and emailed to other stakeholders including MOD / Burnham Camp, Department of Corrections / Rolleston Prison, and local councils (including relevant individual Councillors). The invitation was also extended to mana whenua via Mahaanui Kurataiao Ltd.

The event was well attended with the main issue raised being traffic effects on the local roading network.

9.0 Record of pre-application meetings with Councils

9.1 Canterbury Regional Council (Environment Canterbury)

Burnham 2020 initially met with Environment Canterbury (ECan) to discuss the Proposal on 11 May 2022. This was a general discussion to introduce the draft quarry concept to ECan and gather some initial thoughts and guidance.

This was followed by a formal pre-application meeting held on 11 May 2023. One of the key matters discussed was whether the silts and soil used to rehabilitate the Site will be defined as earthworks or cleanfill. ECan staff advised that in their opinion, it would be defined as 'cleanfill'. Further Council staff did not raise concerns about using material from the Site to refill the Site. However, ECan did note that whilst the Land and Water Plan refers to the 2002 MfE Cleanfill Guidelines, MfE has now adopted the WasteMinz 2022 Guidelines. ECan advised they are obviously seeking best practice; however Burnham 2020 can choose to use the 2002 MfE Guidelines or preferably use the WasteMinz 2022 Guidelines.

9.2 Selwyn District Council

Burnham 2020 initially met with Selwyn District Council to discuss the Proposal on 25 May 2022. This was followed by a formal pre-application meeting on 22 March 2023 at which the key issue discussed was traffic including:

- The design and timing of the construction of a roundabout at the State Highway 1 / Aylesbury Road intersection.
- the operation and safety of the 5-point Two Chain / Aylesbury intersection.
- SDC led improvements to the section of Aylesbury Road that runs past the Camp and the Site. This would likely be coupled with a reduction in the existing speed limit, possibly down to 50km/h.
- Use of the local roading network beyond Aylesbury Road, including Two Chain Road.

10.0 Notification

This section of the report provides discussion on whether this application for resource consent needs to be notified in accordance with Sections 95 to 95G of the RMA.

10.1 Public Notification

Sections 95 to 95F of the RMA sets out the requirements in relation to public and limited notification of applications for resource consent. The steps in Section 95A relate to whether application should be publicly notified.

Burnham 2020 requests that these applications be publicly notified by Selwyn District Council and Environment Canterbury, in accordance with section 95A(3)(a). Therefore, pursuant to section 95A(2)(a), both consent authorities are required to **publicly notify** the applications.

11.0 Term of Consent Sought

Burnham 2020 seek:

- a land use consent in perpetuity from Selwyn District Council.
- 35-year term from ECan on the regional council consents.

If consent is granted, the relevant factors to be considered by a decision maker in determining the appropriate term of consent are well traversed in case law. Most of these matters have been addressed in the sections above but to assist ECan and SDC are summarised below:

Matter	Consideration
Providing security of term for the Applicant, insofar as it is consistent with sustainable management.	Burnham 2020 will make a considerable investment in establishing and operating a quarry and securing a reliable, long term consent duration is important.
The level of adverse effects from the activities on the environment.	The assessment of effects undertaken under section 6 concludes that adverse effects on the environment will be less than minor or avoided, except for those related to traffic noise on 146 and 168 Aylesbury Road and any residential or other sensitive activities in the Burnham Camp adjacent to Aylesbury Road and initial adverse effects on landscape effects being more than minor, reducing over time as planting and bunding is established. Neither of these effects is a matter controlled by the Regional Council. It is understood that an appropriate term of consent is to be considered on a case-by-case basis. However, as set out in Sections 6 and 7, ECan can take comfort from the fact that all effects are known, so there is no need to apply the precautionary principal, can be avoided or mitigated and will not result in significant adverse effects on the environment or people. Furthermore, Burnham 2020 has taken a long-term approach to identifying and managing potential adverse effects. These factors support a longer term of consent.

Matter	Consideration
Consideration of alternatives.	Burnham 2020 considered several other sites before purchasing the Site on Aylesbury and Grange Roads. While sites for aggregate extraction are ideally located close to its markets but away from large populations, even in rural areas, scattered residential properties and even pockets of residential development are likely to occur. When also considering the availability of sites, their location, access to water for dust suppression, size to provide certainty over supply and to reduce the need for many small quarries with consequent effects and uncertainty for the community, and to be able to contain potential adverse effects, the number of alternative sites becomes limited. The low likelihood of significantly better sites becoming available in the future favours a lengthy term of consent.
The site's history and current zoning.	The Site is zoned as Rural in the Selwyn District Plan and General Rural in the Partially Operative District Plan and therefore the proposed uses are in accordance with the purpose of those Zones. In particular, the Partially Operative Plan specifically provides for mineral extraction including quarrying as an appropriate activity within the General Rural Zone. The unlikelihood of a major zoning change to the Site or immediate surrounds supports a longer term of consent.
The level of uncertainty about the effectiveness of conditions to protect the environment, including regard to the applicant's past record of compliance with consent conditions.	The proposed land use effects on the environment can be effectively managed by way of conditions of consent, given the low level of any potential adverse effects. There is little uncertainty about their effectiveness, supporting a lengthier term of consent. It is recognised that the Applicant will need to apply to renew the regional discharge and

Matter	Consideration
	cleanfill consents, which will enable any environmental effects that have arisen to be addressed at that time. Fletcher Concrete and Infrastructure Ltd (Burnham 2020 is a wholly owned subsidiary) is an experienced quarry operator with a good compliance record.
The ability of the Council to review conditions, and whether review conditions can sufficiently avoid or remedy any adverse effects.	ECan can review the conditions of consent, under s125. However, the Proposal will appropriately manage any adverse effects on the environment, therefore no such review would be needed in the foreseeable future.
Whether there has been any public objection / disquiet regarding the activity.	As far as Burnham 2020 is aware there has been no public objection/disquiet to the Proposal, and they have held public open days and consulted with adjoining neighbours, providing them with the opportunity to discuss the Proposal at any time.
The economic life of an operation and the prospect of further and continued investment.	The Site will operate as a quarry for 60 years (at current demand) and it is proposed to invest in continually improving operations such as using electric vehicles, conveyors to minimise the number of truck movements. Burnham 2020 will also be open to utilising new technologies to manage discharges to air and land. As such, there will be an initial, long-term and continued investment in the land. Therefore, to secure long-term consents for quarrying activities is imperative.
The potential availability of new information about methods of mitigation, or new environmental standards, during the term of the consent.	It is acknowledged the RMA 1991 will eventually be replaced with the Natural and Built Environment Act with a subsequent focus on environmental bottom lines. However, the timing of this is uncertain and it could be 10 or more years before the Act applies in Canterbury. However, if such changes occur during the term of the

Matter	Consideration
	consent, they can be addressed through a review of the consent conditions.

Burnham 2020 considers that there is sufficient certainty regarding potential and actual adverse effects on the environment and people, and for the reasons set out above, that should consent be granted it can be for the following terms:

- land use consent in perpetuity.
- 35-year term on all the regional council consents.

12.0 Conclusion

Burnham 2020 has lodged this application for resource consent to provide for the establishment and operation of an aggregate quarry within a Site located at the junction of Aylesbury Road and Grange Road, Burnham. The quarry is required to meet the current high demand for aggregate resource in Christchurch and its immediate environs.

The Site is located in the Selwyn-Waimakariri Combined Surface and Groundwater Allocation Zone (Allocation Zone). In the SDP, the Site is zoned as Rural Outer Plains and there is a fault line that runs across the northern portion of the Site. The Site is zoned as General Rural in the POSDP, and the fault line is mapped as Greendale Fault Overlay and Fault Awareness Overlay. The Site also lies within the Plains Flood Management Overlay.

Aylesbury Road is an arterial road and Grange Road is a local road under both the SDP and the POSDP.

The proposed quarrying activities will be undertaken in a series of phases as set out in the Quarry Staging plan in **Appendix 5**. The timing is only approximate, having been developed based on current demand projections for the quarry.

The active quarry area will be a maximum of 40 hectares and will comprise the fixed processing plant, other processing, stockpiling, unsealed customer loadout, silt processing and storage, excavation and active rehabilitation (excluding rehabilitated areas), including conveyance and unsealed accessways. Primary production will be undertaken on the yet to be quarried and rehabilitated areas.

A range of technical experts engaged by Burnham 2020 have both informed the design and assessment of the potential and actual effects of developing and operating the quarry.

The application is a Discretionary Activity under the SDP, the POSDP, the CLAWRP, the CARP and the NES-CS.

This assessment of environmental effects has determined that:

- effects on landscape character will be more than minor during the operation of the quarry and will gradually reduce to less than minor through successive phases of aggregate extraction and rehabilitation.
- visual effects experienced from public viewpoints will be less than minor and will further reduce as proposed native vegetation planted along the perimeter of the Site and at the entrance becomes established over time.
- views from private viewpoints will largely remain unchanged as they will be truncated or entirely curtailed by the existing shelterbelt planting, long-term bund and intervening areas of planting including additional native vegetation introduced along the tops of rehabilitated slopes of the quarry, resulting in less than minor adverse effects.
- activities within the Site will meet the POSDP and SDP noise limits, except for 30 minutes between 0700 hrs (when the night-time noise limit applies) and 0730hrs when the daytime noise limit in the SDP applies.
- truck movements along Aylesbury Road during daytime hours will result in adverse noise effects on 168 Aylesbury Road without mitigation. Burnham 2020 proposes to engage with the property owner/occupier to address this matter. At 146 Aylesbury Road, the absolute

noise level of 55 dB LAeq(1hr) for the 'average' number of truck movements, will ensure a level of residential daytime noise amenity anticipated by the residents.

- truck movements in the early morning will be limited to between 5am and 7am and confined to a limited number of days per year, but on such occasions, there is potential for a significant effect relative to the existing amenity at 168 Aylesbury Road unless acoustic mitigation measures are implemented. As above, Burnham 2020 proposes to engage with the property owner/occupier to address this matter.
- the safe and efficient operation of the road network can be maintained if the quarry does not generate more than 250 heavy vehicle movements per day (on any one day) prior to the State Highway 1 / Aylesbury Road intersection being upgraded to a roundabout, and a Transportation Route Management Plan is prepared and implemented.
- the identified areas where HAIL activities have occurred can be appropriately managed through targeted detailed site investigations (DSI's) as quarrying progresses across the Site. This will ensure that any ongoing activities are captured by the assessments, and any remedial actions applied accordingly.
- any potential effects on any nesting indigenous bird species during construction and extraction phases can be managed by undertaking pre-construction nesting bird surveys.
- the removal, management and replacement of soils arising from the proposed quarrying activities will be undertaken in accordance with a Soil Management Plan, which will minimise the risk of potential adverse effects on the soil.
- quarrying activities within the Site and future use of the land for farming can be effectively managed to maintain the current quality of groundwater.
- the application of mitigation measures will minimise dust emissions to within 100 metres of the source and, therefore, off-site dust effects at nearby receptor locations will be less than minor.
- the Site is unlikely to contain any archaeological material.
- the quarry will make a positive economic contribution by ensuring a steady supply of much needed aggregate in proximity to demand, thereby managing transport costs and avoiding affecting the cost and timeliness of new infrastructure, if quarried materials were less available.
- the quarry will provide employment opportunities, especially for those working in quarries that have ceased or are about to cease extractive activities.

An assessment of the relevant objective and policy provisions in the NPS-FM, NPS-HPL, the NPS-IB, CRPS, CLAWP, CARP, the SDP and the POSDP has been undertaken. Overall, the proposed quarry and associated activities:

- accord with concept of Te Mana o te Wai as set out in the NPS-FM and the concept of Te Rito o te Harakeke under the NPS-IB.
- do not require consideration under the NPS-HPL as the Site does not contain land defined as LUC 1, 2 or 3.

- will generally be consistent with the policy direction in the CRPS as the proposal will not foreclose the ability of the Site to be used for other forms of primary production such as agriculture, the containment of most potential adverse effects within the Site, and the use of an arterial road and State Highway 1 to transport aggregate.
- will generally achieve the direction in the CLAWRP to improve and/or maintain water quality including managing the effects of land uses as the Proposal will ensure that adverse effects on groundwater quality are minimised and remediation is undertaken to minimise any ongoing risk of contamination.
- will generally achieve the direction in the CARP to maintain and/or improve air quality by minimising dust emissions to within 100 metres of the source, which will mean that dust is generally retained within the Site and there will be very low potential for health effects.
- will generally accord with the objectives and generally be consistent with the policies in the SDP and the POSDP that seek to manage soil and land, water, quality of the environment, noise and vibration, dust and reverse sensitivity. However, GRUZ-P4 in the POSDP seeks that the character and amenity values of the surrounding area are maintained or enhanced. It is acknowledged that without mitigation, adverse effects from off-site traffic noise effects ranging from slight to significant could be generated at the existing residences at 146 and 168 Aylesbury Road. It is proposed to implement mitigation measures to minimise adverse truck noise effects but existing acoustic amenity at these sensitive receivers will not be fully maintained.

Overall, it is considered that the proposed expansion of extraction activities generally achieves the objectives and will generally be consistent with the policies in the identified statutory planning documents as set out above and, that granting of this land use consent would give effect to Part 2 of the Act.

The application must be processed on a publicly notified basis pursuant to Section 95 of the RMA as requested by Burnham 2020.

ADDENDUM to "Burnham 2020 Limited, Burnham Quarry, Application and Assessment of Environmental Effects, Prepared for Fletcher Concrete and Infrastructure Limited (Trading as Winstone Aggregates). Dated 7 September 2023".

Dated 11th October 2023

Earthworks within 50m of a water race

Executive Summary

Activity status

The Proposal requires resource consent as follows:

- Under the CLWRP as overall a **Discretionary Activity** for:
    - the discharge of liquid waste and sludge waste that will exceed 10m^3 per day and the rate of discharge may exceed 5mm per day,
    - The discharge of any wastewater from an industrial or trade process, into or onto land, within the Selwyn Te Waihora sub-region;
    - the discharge of stormwater from buildings, car parks, internal roads, quarried areas, processing areas and stockpiles into or onto contaminated land that will be partly associated with rural activities and partly an industrial activity;
    - the uncontrolled discharge of water through cleanfill, and
    - the deposition of more than 50m^3 of material in any consecutive 12-month period onto land which will have been excavated to a depth in excess of 5m below the natural land surface.
    - earthworks within 50 metres of a water race.

3.0 The Proposal

3.4 Proposed activities

3.4.13 Earthworks within 50m of a water race

Burnham 2020 proposes to develop an aggregate quarry within a Site located at the junction of Aylesbury Road and Grange Road, Burnham. As part of this proposal, it is proposed to undertake earthworks within 50m of a water race to the south of Grange Road. The water race is owned by Selwyn District Council. The earthworks include:

- stockpiling within the 17.5 metre setback from the site boundary and approximately 30-35 metres from the water race and,
- extractive activities (quarrying) and stockpiling within the setback 42 metres from the water race.

The water race is identified on **Figure 1** below.

Figure 1 – Indicative location of water race along Grange Road.



5.0 Statutory Matters

5.1 Canterbury Land and Water Regional Plan (CLWRP)

5.1.1 Definitions

Earthworks are defined in the Canterbury Land and Water Regional Plan (CLWRP) as '*the excavation of, and/or filling with topsoil, subsoil, sediments, rock and/or other underlying materials on which the soil is formed. Earthworks include, but are not limited to, the construction and maintenance of roads, tracks, firebreaks and landings, and ground shaping (recontouring), root raking and blading*.'

5.1.2 Rules

The rules in the CLWRP manage these activities as extraction and deposition as set out below.

Earthworks over Aquifers

5.175 The use of land to excavate material is a permitted activity, provided the following conditions are met: …

2. Over an unconfined or semi-confined aquifer:
   a. the volume of material excavated is less than 100m^3; or
   b. the volume of material excavated is more than 100m^3 and:
      (i) there is more than 1m of undisturbed material between the deepest part of the excavation and the highest groundwater level; and
      (ii) the excavation does not occur within 50m of any surface waterbody.

5.176 The use of land to excavate material that does not comply with one or more of the conditions of Rule 5.175 is a restricted discretionary activity.

The exercise of discretion is restricted to the following matters:

1. The actual and potential adverse environmental effects on the quality of water in aquifers, rivers, lakes, wetlands; and
2. Any need for remediation or long-term treatment of the excavation; and
3. The protection of the confining layer and maintaining levels and groundwater pressures in any confined aquifer, including any alternative methods or locations for the excavation; and
4. The management of any exposed groundwater; and
5. Any adverse effects on Ngāi Tahu values or on sites of significance to Ngāi Tahu, including wāhi tapu and wāhi taonga.

Assessment

'Surface waterbody' is defined in the CLAWRP to include 'water above the ground surface and within a lake, river, artificial watercourse or wetland, but does not include water in the sea, snow or rain or water vapour in the air.'

An 'Artificial watercourse' is defined in the CLAWRP as including water supply races.

It is proposed to undertake aggregate extraction and stockpiling of overburden that will be setback approximately 42 metres from the water race that runs along part of Grange Road as identified in Figure 1 above. Therefore, the Proposal requires consent as a **Restricted Discretionary Activity** under Rule 5.176 of the CLWRP.

Matter (1) over which discretion is restricted does not address actual or potential adverse environmental effects on the quality of water in water supply races. Matter 1 specifically refers to 'aquifers, rivers, lakes, wetlands' only.

Matter (2) regarding remediation has been addressed in the 'substantive AEE' [1] in particular in Section 3.4.10.1 - Rehabilitation Management Plans.

Matter (3) refers to the protection of the confining layer and maintaining levels and groundwater pressures in a confined aquifer[2]. The Site is identified in the CLAWRP as being within a semi-confined or unconfined aquifer. Therefore Matter 3 is not relevant.

Matter (4) refers to the management of any exposed groundwater. It is proposed that there is more than 1 metre of undisturbed material between the deepest part of the excavation and the highest groundwater level recorded for the Site at any time. Therefore Matter 4 regarding the management of exposed groundwater is not relevant.

Matter (5) regarding adverse effects on Ngāi Tahu values, is addressed in Section 6.2.11 – Effects on Cultural Values in the substantive AEE.

[1] **Substantive AEE** refers to the Document – "Burnham 2020 Limited, Burnham Quarry, Application and Assessment of Environmental Effects, Prepared for Fletcher Concrete and Infrastructure Limited (Trading as Winstone Aggregates). Dated 7 September 2023.''

[2] **Confined aquifer** means an aquifer overlain by a low permeability or impermeable layer where the water in the aquifer is under pressure, in the CLWRP.

6.0 Assessment of Environmental Effects

6.2 Effects Assessment

6.2.14 Earthworks within 50 metres of a water race

The substantive AEE has described proposed extractive activities and assessed the effects of these activities, in particular in the following sections:

Section 3: The Proposal

3.4.3 Extraction Phases.
3.4.6.2.4 Stockpiles and Exposed Areas, Truck Loading and Transportation.
3.4.6.2.6 Monitoring.
3.4.10.1 Rehabilitation

Section 6: Assessment of Effects

6.2.6 Soils.

Management Plans:

- Draft Quarry Management Plan.
- Draft Soil Management Plan.

Furthermore, the land within the 50 metre setback will be excavated from within the quarry. The Site is separated from the water race by Grange Road and there is a well-established pine shelterbelt along boundary the road boundary, separating the water race from Grange Road and the Site. There is also at least 42 metres between the water race and the closest proposed extraction activity, and approximately 34 metres between the water race and the stockpiles. It is considered that given these separation distances, there is minimal, if any, risk to the on-going effective functioning of the water race.

5.0 Objectives and Policies

The extraction activity including earthworks has been addressed in Section 5.0 of the substantive AEE particularly in the following sections:

1.2.2 Mineral Extraction and Cleanfilling, and

7.2.9 Freshwater – Quality (recognising Matter 1 – Matters of discretion for Rule 5.176 specifically excludes reference to any effect on the quality of water in water races).

It is not considered that any additional assessment of the relevant objectives and policies is required to address the resource consent sought under Rule 5.176 : setback of earthworks from a surface waterbody (water race) in accordance with the CLWRP.

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Guaranteed Search Copy issued under Section 60 of the Land Transfer Act 2017

R.W. Muir
Registrar-General of Land

Identifier	**CB31/285**
Land Registration District	**Canterbury**
Date Issued	16 February 1878

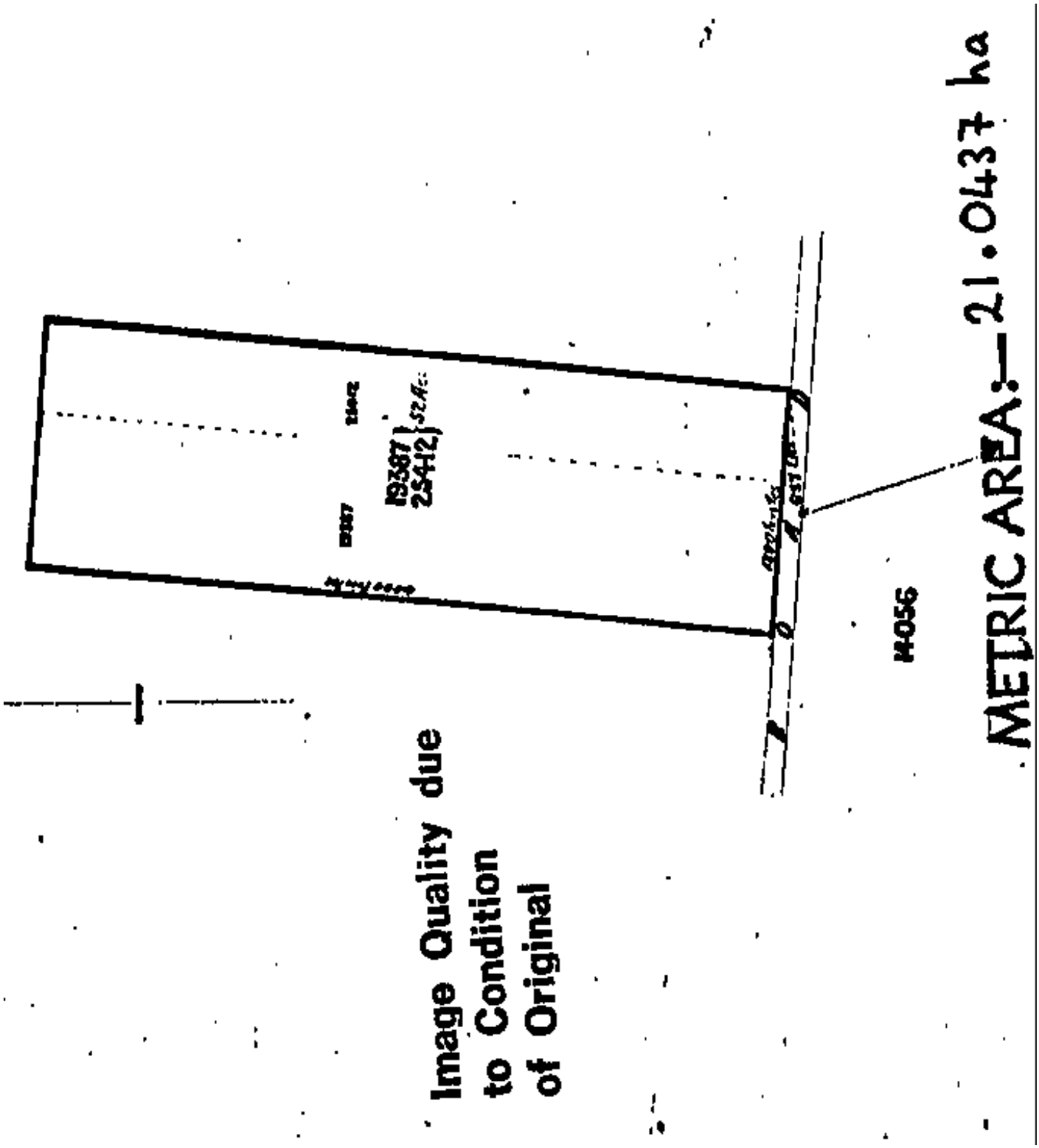
Estate	Fee Simple
Area	21.0437 hectares more or less
Legal Description	Rural Section 19387 and Rural Section 25412

Registered Owners

Burnham 2020 Limited

Interests

12119770.3 Mortgage to Camden Group Services Limited - 14.9.2021 at 3:28 pm


METRIC AREA:— 21.0437 ha
Image Quality due
to Condition
of Original
19387
25412
14056

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Guaranteed Search Copy issued under Section 60 of the Land Transfer Act 2017

R.W. Muir
Registrar-General of Land

Identifier	**CB137/244**
Land Registration District	**Canterbury**
Date Issued	09 May 1889

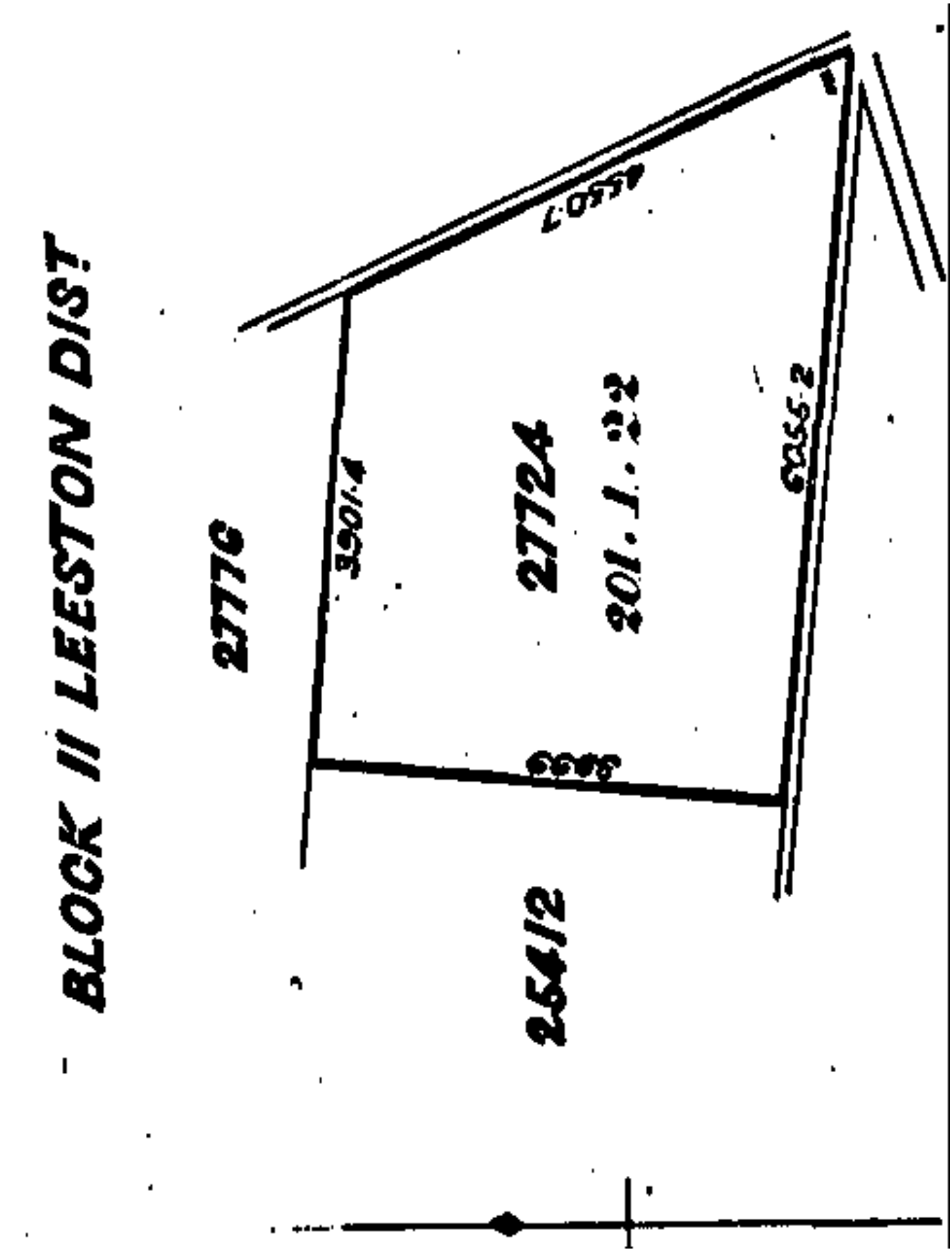
Prior References
CB120/123

Estate	Fee Simple
Area	81.4986 hectares more or less
Legal Description	Rural Section 27724
Registered Owners	

Burnham 2020 Limited

Interests

12119770.3 Mortgage to Camden Group Services Limited - 14.9.2021 at 3:28 pm


BLOCK II LEESTON DIST
27776
27724
201.1.22
25412
3901.4
6055.2
4550.7

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Guaranteed Search Copy issued under Section 60 of the Land Transfer Act 2017

R.W. Muir
Registrar-General of Land

Identifier	**CB82/294**
Land Registration District	**Canterbury**
Date Issued	07 August 1884

Estate	Fee Simple
Area	259.0899 hectares more or less
Legal Description	Rural Section 27776 and Rural Section 27777

Registered Owners

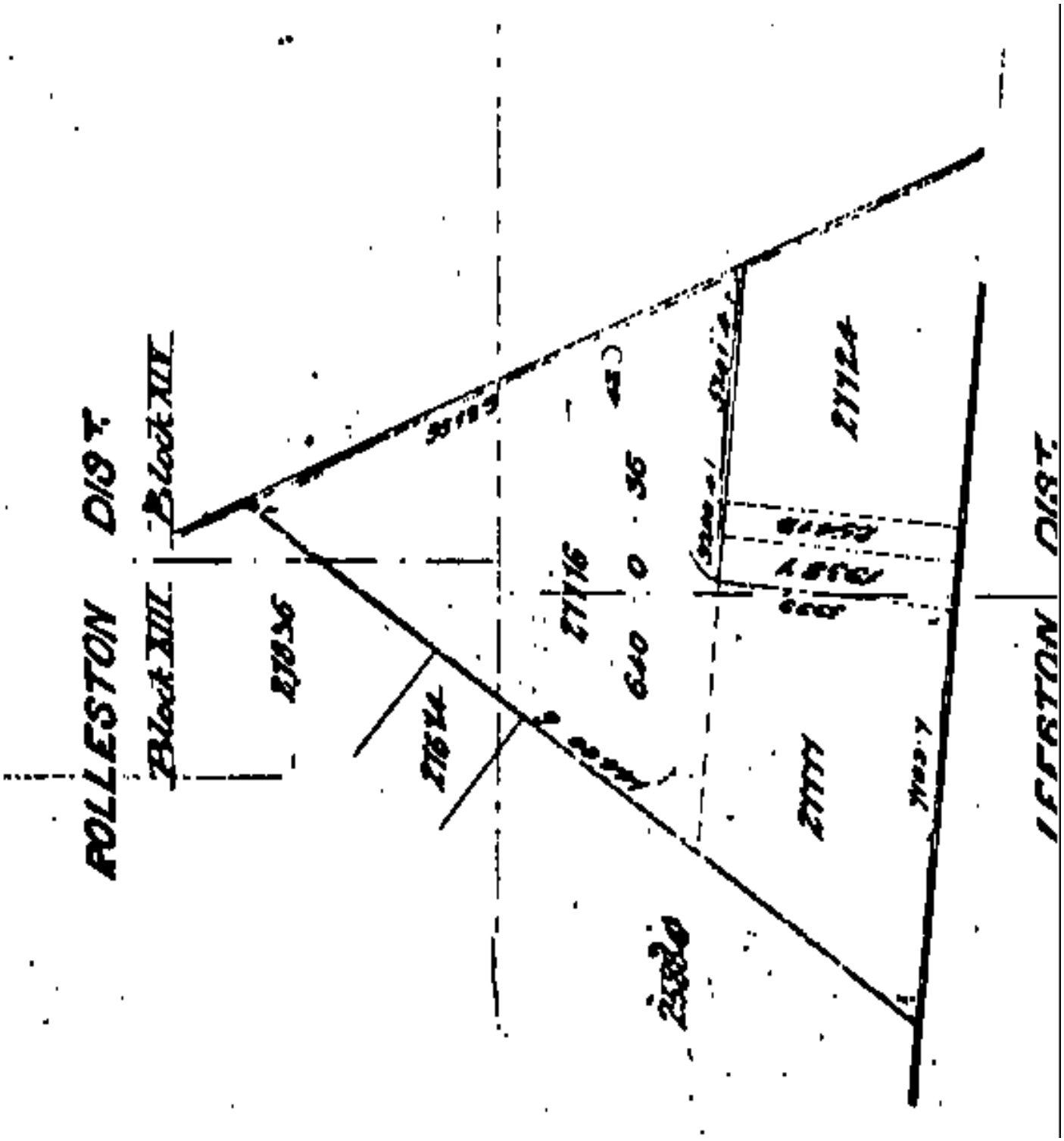
Burnham 2020 Limited

Interests

Subject to a right (in gross) to convey water, electricity and telecommunications over part RS 27776 marked Y & G on DP 534588 in favour of Central Plains Water Limited created by Easement Instrument 12120017.2 - 13.5.2021 at 9:20 am

12120017.3 Mortgage of Easement Instrument 12120017.2 to ANZ Bank New Zealand Limited - 13.5.2021 at 9:20 am

12119770.3 Mortgage to Camden Group Services Limited - 14.9.2021 at 3:28 pm


ROLLESTON DIST.
Block XIII
Block XIII
NOLESTON DIST.

File Ref: BM19954_003_A3P_SitePlan.mxd

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that

LEGEND

- Site Boundary
- Property Boundaries
- Railway Line

Wards Road
Kivers Road
Aylesbury Road
Sandy Knolls Road
Kerrs Road
Grange Road
Two Chain Road
Reynolds Road
Burdons Road
Queens Drive
Godley Road
Main South Road State Highway 1

RS 27776 Burnham Farm Limited

RS 19387 Burnham Farm Limited

RS 27777 Burnham Farm Limited

RS 25412 Burnham Farm Limited

RS 27724 Burnham Farm Limited

Boffa Miskell

www.boffamiskell.co.nz

0 600 m

1:15,000 @ A3

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Cadastre sourced from LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

POTENTIAL NEW QUARRY BURNHAM

Site Plan

Date: 23 August 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Catherine.Clarke@boffamiskell.co.nz | Drawn: SGa | Checked: AMo

File Ref: BM19954_006_A3P_Landuse.mxd

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that

LEGEND

- Site Boundary
- Property Boundaries

Landuse

- Cropping
- Forestry Block
- Grazing
- Ministry of Defence
- Quarry
- Racing Stables
- Residential/Lifestyle
- Railway Line

Wards Road
Kivers Road
Aylesbury Road
Sandy Knolls Road
Kerrs Road
Grange Road
Two Chain Road
Queens Drive
Godley Road
State Highway 1 Main South Road
Reynolds Road
Burdons Road

Boffa Miskell

www.boffamiskell.co.nz

0 600 m

1:15,000 @ A3

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Cadastre sourced from LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

POTENTIAL NEW QUARRY BURNHAM

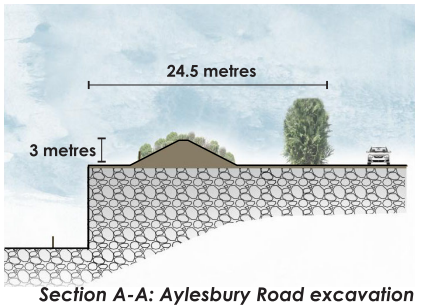
Surrounding Land Use

Date: 23 August 2023 | Revision: 0

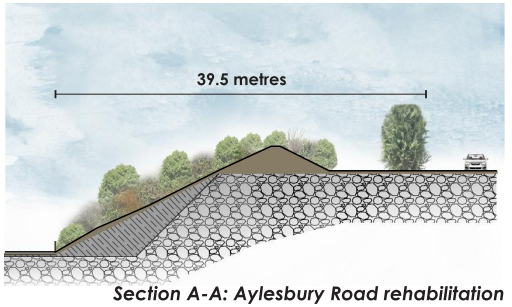
Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Catherine.Clarke@boffamiskell.co.nz | Drawn: SGa | Checked: AMo

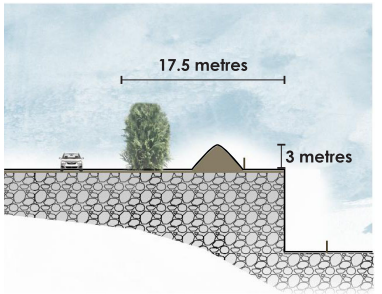




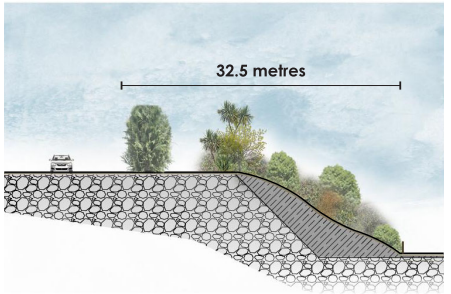
Section A-A: Aylesbury Road excavation



Section A-A: Aylesbury Road rehabilitation



Section B-B: Grange Road excavation



Section B-B: Grange Road rehabilitation

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 500 m

1:13,000 @ A3

LEGEND

- Finished level
- Long term bund
- Planted patches
- Rehabilitated Slope Planting
- Site Entrance
- Stockyards
- Processing Plant
- Shelter belt
- Silt Ponds
- Vehicle access

BURNHAM QUARRY

Landscape Strategy

Date: 04 July 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 1

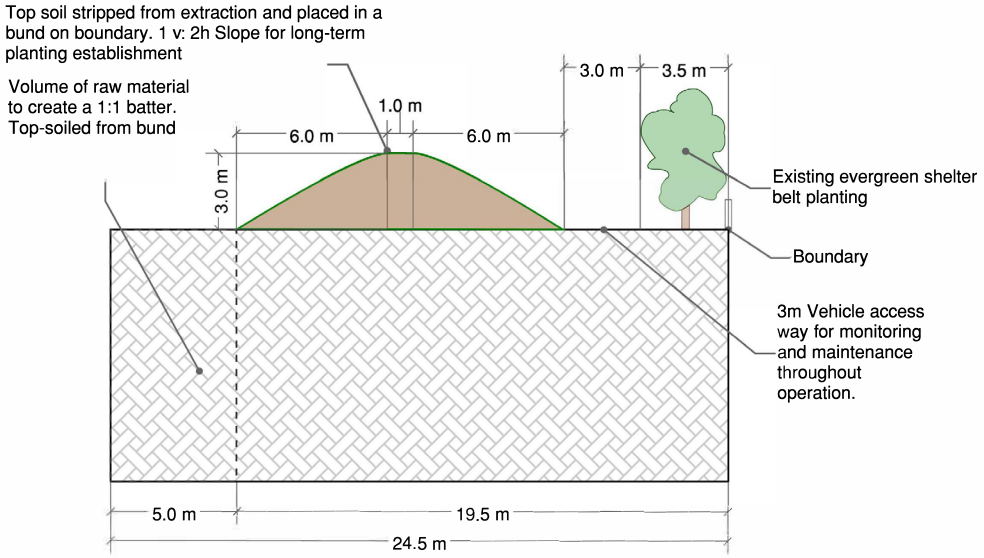


Fig A: Long-Term Edge Treatment

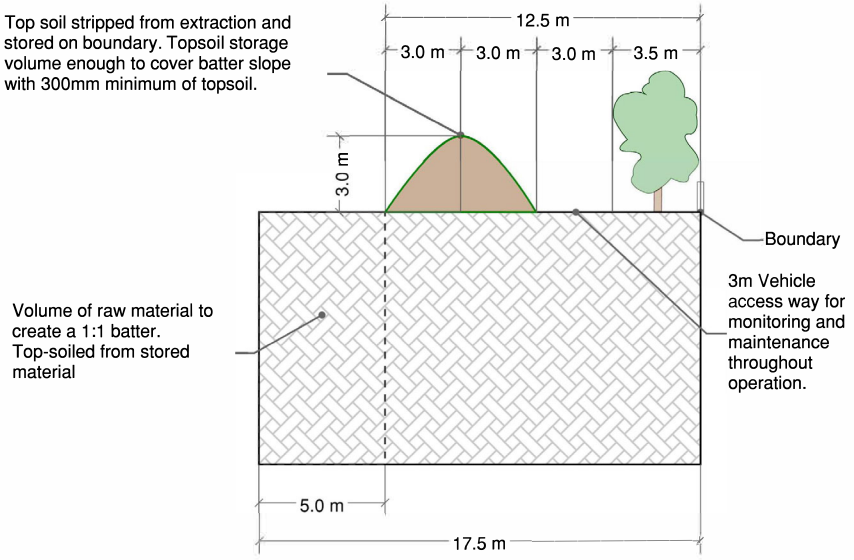


Fig B: Edge Treatment During Active Extraction

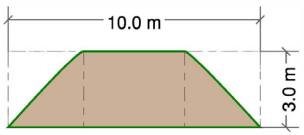
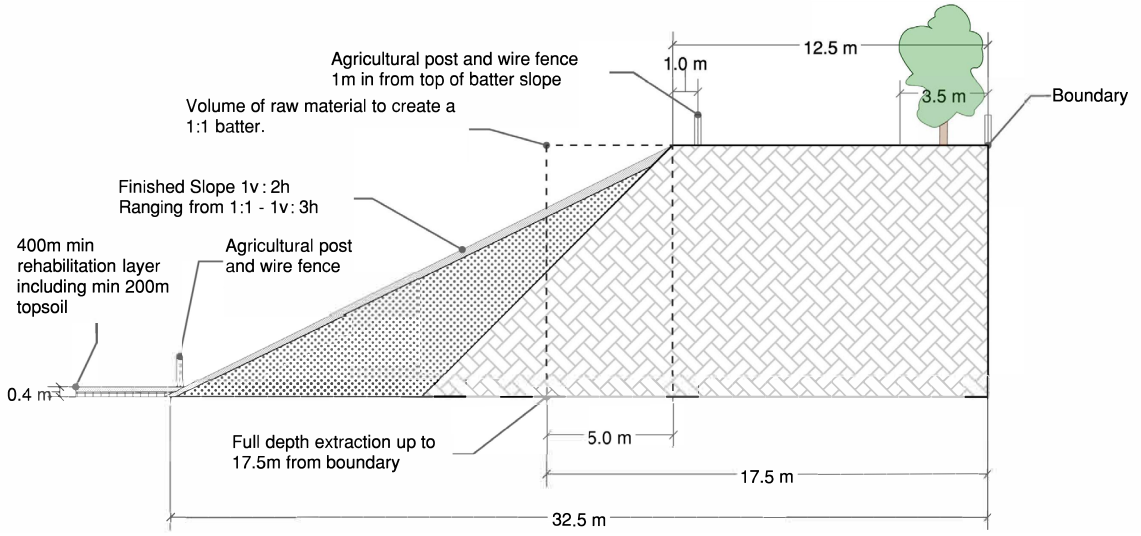


Fig C: Topsoil Stockpile inside quarry boundary



Pro-Manage

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

** Sections provided by Pro-Manage.*
1:200@A3. Dimensions not to scale and not for construction.

BURNHAM QUARRY

Edge Treatment Details

Date: 04 July 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 2



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

** Indicative location of buildings shown.*

BURNHAM QUARRY

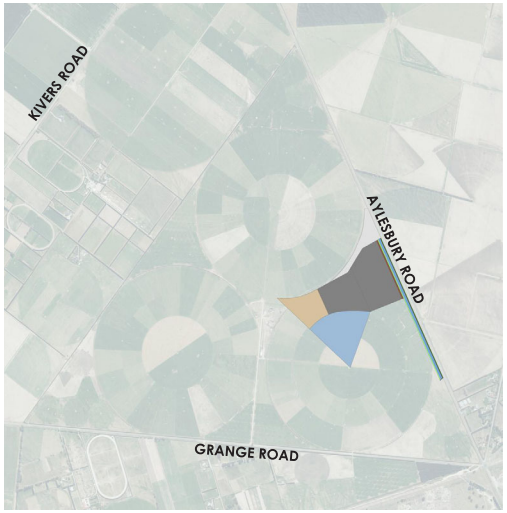
Quarry Entrance

Date: 04 July 2023 Revision: 0

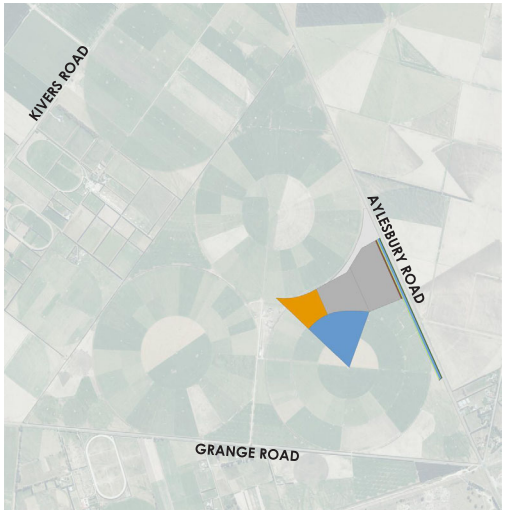
Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

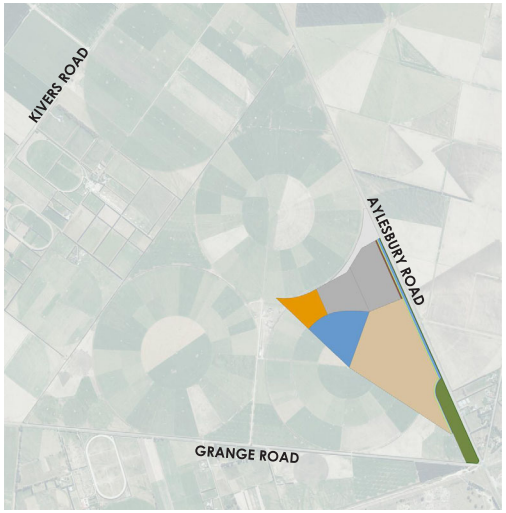
Figure 3



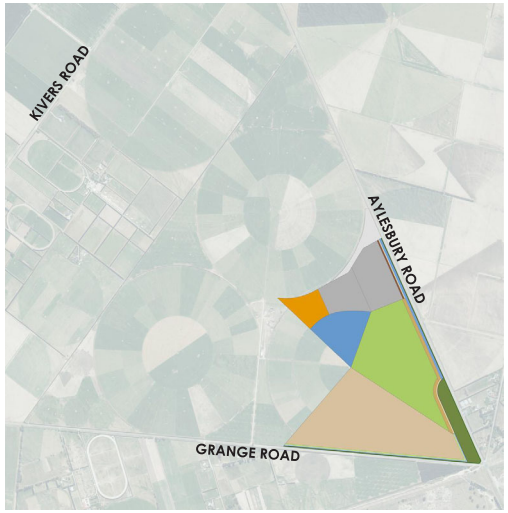
CONSTRUCTION (PHASE 1)



CONSTRUCTION (PHASE 2)



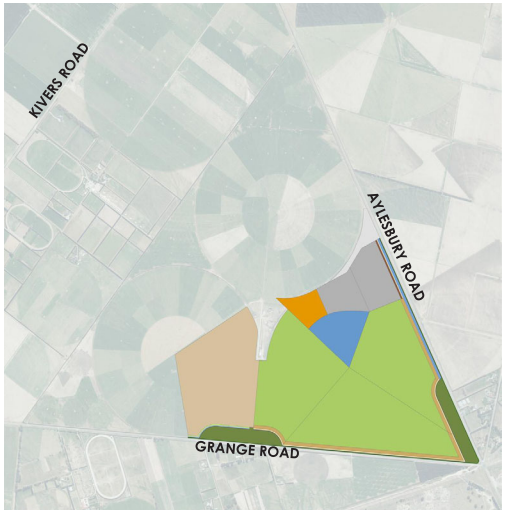
PHASE 3: EXTRACTION 6-10 YEARS



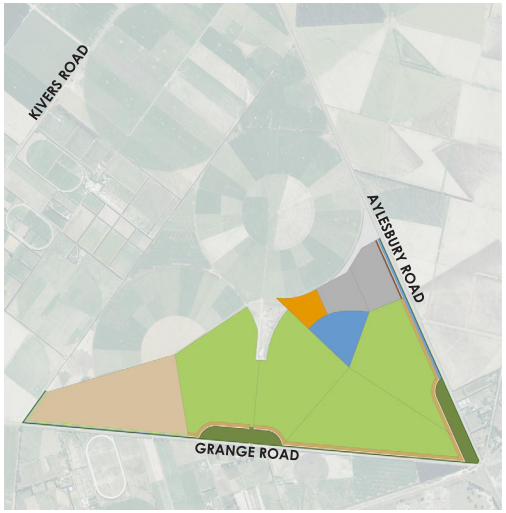
PHASE 4: EXTRACTION 11-15 YEARS



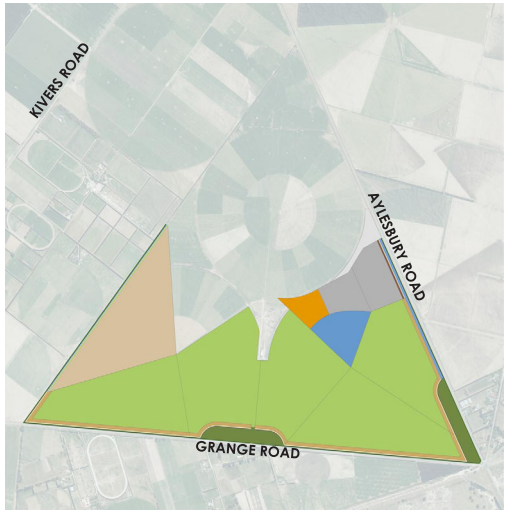
PHASE 5: EXTRACTION 16-20 YEARS



PHASE 6: EXTRACTION 21-25 YEARS



PHASE 7: EXTRACTION 26-30 YEARS



PHASE 8: EXTRACTION 31-35 YEARS

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

LEGEND

- Batter
- Crest
- Extraction
- Finished level
- Long term bund
- Planting
- Processing Plant
- Rehabilitated Slope Planting
- Rehabilitation material
- Rehabilitation
- Shelter belt
- Silt Ponds (*During construction*)
- Silt ponds
- Site Entrance
- Stockpile (*During construction*)
- Stockyards
- Vehicle access

BURNHAM QUARRY

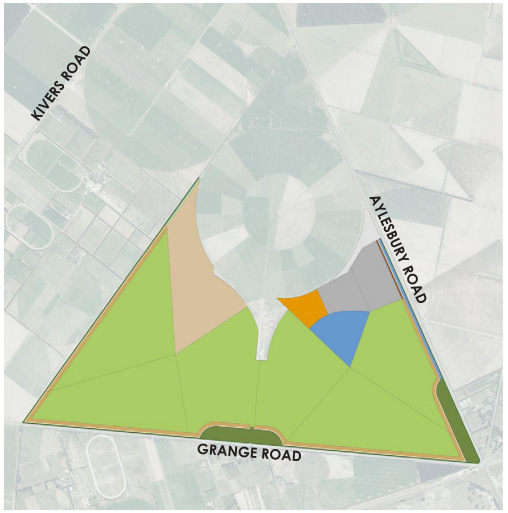
Quarry Staging

Date: 04 July 2023 Revision: 0

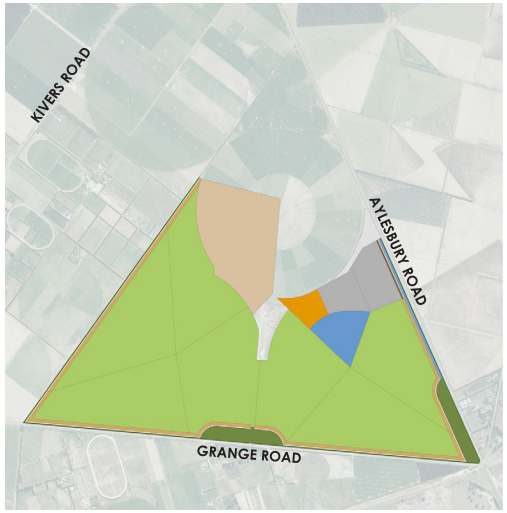
Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

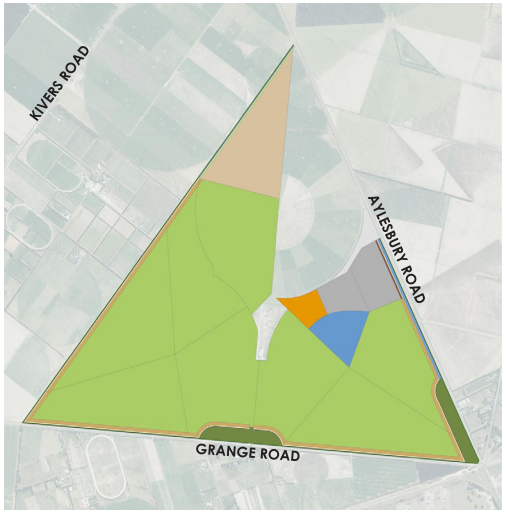
Figure 4a



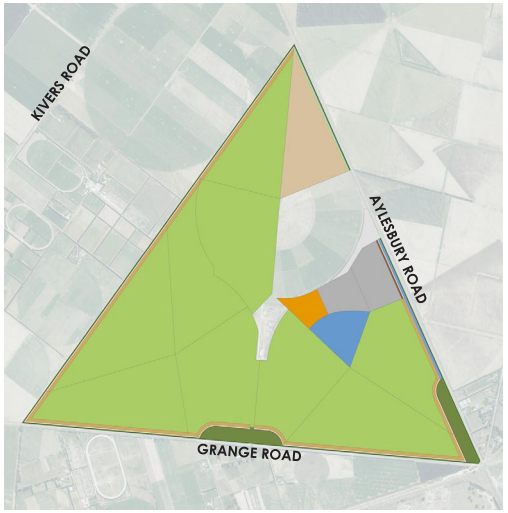
PHASE 9: EXTRACTION 36-40 YEARS



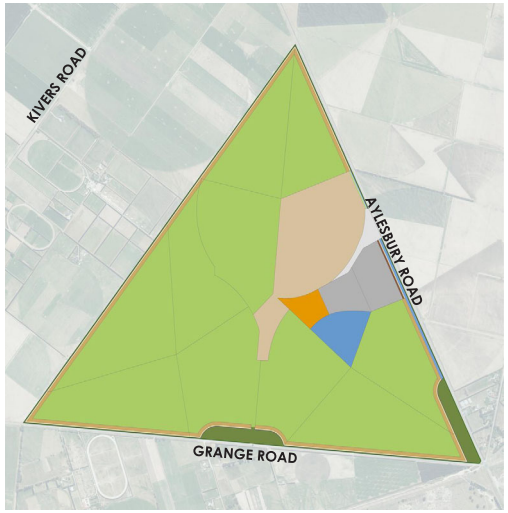
PHASE 10: EXTRACTION 41-45 YEARS



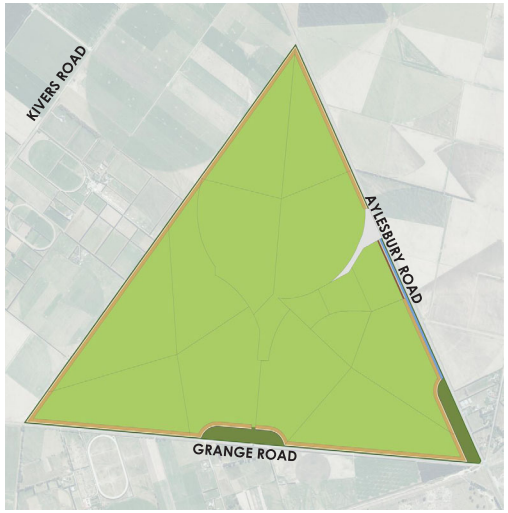
PHASE 11: EXTRACTION 46-50 YEARS



PHASE 12: EXTRACTION 51-55 YEARS



PHASE 13: EXTRACTION 56-60 YEARS



PHASE 14: COMPLETION + FINAL REHAB 60 YEARS

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

LEGEND

- Batter
- Crest
- Extraction
- Finished level
- Long term bund
- Planting
- Processing Plant
- Rehabilitated Slope Planting
- Rehabilitation material
- Rehabilitation
- Shelter belt
- Silt Ponds (*During construction*)
- Silt ponds
- Site Entrance
- Stockpile (*During construction*)
- Stockyards
- Vehicle access

BURNHAM QUARRY

Quarry Staging

Date: 04 July 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 4b

File Ref: BM19954_004_A3P_ContourPlan.mxd

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that

LEGEND

- Contour (10m)
- Site Boundary
- Property Boundaries
- Railway Line



Boffa Miskell

www.boffamiskell.co.nz

0 600 m

1:15,000 @ A3

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors, Cadastre sourced from LINZ

Projection: NZGD 2000 New Zealand Transverse Mercator

POTENTIAL NEW QUARRY BURNHAM

Contour Plan

Date: 23 August 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Catherine.Clarke@boffamiskell.co.nz | Drawn: SGa | Checked: AMo

WINSTONE AGGREGATES

BURNHAM QUARRY

QUARRY MANAGEMENT PLAN

DRAFT

Burnham Quarry

Aylesbury Road

Burnham

Rev.	Version	Summary of Revision
August 2023	1.0	Draft for comment



CONTENTS

1 CONTACT DETAILS 1

2 LEGAL DESCRIPTION & LOCATION 1

3 REQUIREMENT FOR QUARRY MANAGEMENT PLAN 1

4 QUARRY MANAGEMENT PLAN AIM 1

5 LINES OF RESPONSIBILITY 1

5.1 WINSTONE AGGREGATES 1

5.2 BURNHAM QUARRY STAFF & CONTRACTORS 2

5.3 TECHNICAL EXPERTS 2

6 HOURS OF OPERATION 2

7 TRAFFIC MANAGEMENT 2

7.1 SITE ACCESS, QUEUING, PARKING AND LOADING ARRANGEMENTS 2

7.2 SITE ACCESS, QUEUING, PARKING AND LOADING ARRANGEMENTS 3

7.3 MANAGING DEBRIS SPILLS ON ROADS 3

8 REHABILITATION 3

9 CULTURAL MATTERS 3

10 MANAGEMENT OF DUST 4

11 MANAGEMENT OF NOISE 4

11.1 NOISE EFFECTS 4

11.2 NOISE OBJECTIVE & MEASURES 4

11.3 NOISE PERFORMANCE STANDARDS – GENERAL OPERATIONS 4

12 SPILL CONTINGENCY 5

12.1 INVENTORY OF HAZARDOUS SUBSTANCES USED ON SITE 5

LUBRICANTS AND OILS 5

DIESEL 5

12.2 SAFETY 5

12.3 POTENTIAL SPILL SOURCES AND RISKS 5

12.4 PREVENTATIVE MEASURES IN PLACE 5

12.5 SPILL RESPONSE EQUIPMENT AVAILABLE ON SITE 6

LAND-BASED SPILLS 6

WATER-BASED SPILLS 6

12.6 EQUIPMENT AND OPERATORS AVAILABLE ELSEWHERE 6

13 QUARRY MANAGEMENT PLAN REVIEW 6

APPENDIX A – BURNHAM QUARRY SITE PLAN 8

APPENDIX B – BURNHAM QUARRY AIR QUALITY MANAGEMENT PLAN 9

1 CONTACT DETAILS

Burnham Quarry Manager - TBC

- [Mobile]
- [Email]
- [Postal Address]

2 LEGAL DESCRIPTION & LOCATION

- Legal Description: RS 27777, 27776, 19387, 25412, 27724 and 27725
- Location: Aylesbury Road, Burnham

3 REQUIREMENT FOR QUARRY MANAGEMENT PLAN

This Quarry Management Plan ("QMP") has been prepared in accordance with [ ].

4 QUARRY MANAGEMENT PLAN AIM

It is the aim of this QMP that all works be undertaken in a manner that ensures compliance with all regulatory and consenting requirements. The regulatory and consenting requirements have a common aim which is to avoid, remedy or mitigate adverse effects on the environment including effects on the health of people and ecosystems and amenity effects.

5 LINES OF RESPONSIBILITY

5.1 WINSTONE AGGREGATES

Overall management of the site is the responsibility of the General Manager of Winstone Aggregates (a division of Fletcher Concrete and Infrastructure Ltd) ("Winstone"). Operations on site are to be managed by Winstone, with the Burnham Quarry Manager (see Section 1 above) responsible for the specific operation and management of the quarry, rehabilitation and any associated activities.

Winstone, as the consent holder, has a general responsibility to implement all consent conditions, to abide by this QMP, as well as all other Management Plans relevant to the Burnham Quarry.

This responsibility includes ensuring that all contractors operating on site are familiar with the requirements of these documents and are undertaking their activities in accordance with those requirements.

5.2 BURNHAM QUARRY STAFF & CONTRACTORS

Every Winstone employee and contractor at the Burnham Quarry has a duty to avoid, remedy or mitigate any adverse environmental effects arising from an activity carried out by them or on their behalf. This includes, but is not limited to:

- Attending inductions and training relating to managing potential environmental effects such as the timing and duration of dust and noise.
- Observing and reporting environmental issues such as excessive dust or noise, whether or not these have led to off-site effects when noticed.
- Reporting all incidents relating to environmental issues such as excessive dust or noise
- Ensuring processes for managing environmental issues such as excessive dust or noise are understood and adhered to.

Every Winstone employee has a duty to adopt the best practicable option to ensure that any effects remain within consented levels.

All personnel will be required to be appropriately qualified and/or trained for their role. The following systems will be implemented to manage environmental matters on site:

- Inductions;
- Project briefing;
- Job safety and environmental training including site-specific dust and noise issues;
- On the job training; and
- Posters and information leaflets.

Staff training records will be maintained on-site. The records will include:

- Who was trained;
- When the person was trained; and
- General description of training content and whether follow up/refresher courses are required later.

5.3 TECHNICAL EXPERTS

Technical experts will from time to time provide advice and technical expertise on the operation. An understanding of consent conditions and this QMP as well as all other Burnham Quarry Management Plans relevant to the site, is required.

6 HOURS OF OPERATION

As per relevant conditions of consent.

7 TRAFFIC MANAGEMENT

7.1 SITE ACCESS, QUEUING, PARKING AND LOADING ARRANGEMENTS

Access to Burnham Quarry is via Aylesbury Road. The long access road inside the quarry means queueing of trucks on Aylesbury Road is not an issue at Burnham Quarry. Customer trucks are loaded in the quarry stockyard, located adjacent to the processing area (see Site Plan at **Appendix A**).

7.2 SITE ACCESS, QUEUING, PARKING AND LOADING ARRANGEMENTS

The site access off Aylesbury Road is level and has good sightlines on both directions. The access road within the quarry is sealed for the first 150m and includes speed humps and is maintained to a high standard. Burnham Quarry. All Winstone machinery and vehicles is regularly maintained to a high standard.

7.3 MANAGING DEBRIS SPILLS ON ROADS

All material spillage onto public roads originating from Burnham Quarry is removed immediately to the satisfaction of the Selwyn District Council Transport Manager.

8 REHABILITATION

A Landscape and Site Rehabilitation Management Plan will be developed and subject to certification by Selwyn District Council prior to the commencement of quarry operations.

9 CULTURAL MATTERS

Winstone will inform mana whenua prior to the commencements of overburden stripping works and offer them the opportunity to monitor these works.

Should archaeological remains or features be uncovered during quarry operations, the following procedure must be followed;

a. All works in the immediate vicinity of the discovery will cease immediately
b. Immediate steps will be taken to secure the area to ensure the archaeological material is not further disturbed
c. The consent holder or the consent holder's representative is to contact mana whenua and the Area Archaeologist of Heritage New Zealand (Heritage NZ). In the case of koiwi (human remains) the New Zealand Police must also be notified;
d. Mana whenua and Heritage NZ will jointly appoint/advise a qualified archaeologist who will confirm the nature of the accidental discovery material
e. If the material is confirmed as being archaeological, the consent holder will ensure an archaeological assessment is carried out by a qualified archaeologist, and if appropriate, an archaeological authority is obtained from Heritage NZ before work resumes (as per the Heritage New Zealand Pouhere Taonga Act 2014);
f. The consent holder will also consult with mana whenua on any matters of tikanga (protocol) that are required in relation to the discovery and prior to commencement of any investigation
g. If koiwi (human remains) are uncovered, in addition to the steps above, the area must be treated with utmost discretion and respect, and the koiwi dealt with according to both law and tikanga, as guided by mana whenua;

h. Works in the area shall not recommence in the immediate area until authorised by mana whenua, Heritage New Zealand (and the NZ Police in the case of koiwi) and any other authority with statutory responsibility, to ensure all statutory and cultural requirements are met;
i. All parties will work towards work recommencing in the shortest possible timeframe while ensuring that any archaeological sites discovered are protected until as much information as practicable is gained and a decision regarding their appropriate management is made, including obtaining an archaeological authority under the Heritage New Zealand Pouhere Taonga Act 2014 if necessary. Appropriate management may include recording or removal of archaeological material.

10 MANAGEMENT OF DUST

Please refer to the Burnham Quarry Air Quality Management Plan at Appendix B.

11 MANAGEMENT OF NOISE

11.1 NOISE EFFECTS

Noise is generated by several different activities carried out at the quarry including crushing, extraction, mobile plant, machinery, sales operations, and restoration activities. If noise is not controlled at the quarry there is the potential for noise to cause a nuisance to people who live near the quarry.

11.2 NOISE OBJECTIVE & MEASURES

Noise mitigation measures are intended to avoid, remedy, or mitigate adverse effects of noise generated by on-site activity on the residents of dwellings and on business activities in the vicinity of the quarry. Measures to assist in meeting this objective include:

- Managing the time and location of particularly noisy operations around the site to ensure compliance with the performance standards.
- Fixed processing plant, excluding conveyors are located in places that reduce the noise level at the boundary of the quarry.
- Machinery is regularly maintained to ensure that noise produced from machinery is kept to a practicable minimum.
- Bunds are constructed where appropriate to reduce the effects of noise beyond the boundary of the quarry.

11.3 NOISE PERFORMANCE STANDARDS – GENERAL OPERATIONS

Burnham Quarry is located in the Rural (Outer Plains) Zone of the Operative Selwyn District Plan. The permitted activity noise limits for the Rural Zone are reproduced in Table below, from Table C9.3 of Rule 9.16.1. These limits are assessed at "*the notional boundary1 of any dwelling, rest home, hospital, or classroom in any education facility except where that dwelling, rest home, hospital or classroom is located within a living zone*"

- Daytime 0730AM - 8.00PM 60 dB (L_{10})
  85 dB (L_{AMAX}
- Night 8.01PM - 0729AM 45 dB (L_{A10})
  70 dB (L_{AFMAX})

12 SPILL CONTINGENCY

12.1 INVENTORY OF HAZARDOUS SUBSTANCES USED ON SITE

LUBRICANTS AND OILS

Lubricants and oils are present in on-site storage tanks and various equipment including excavators, loaders and dump trucks. This includes greases as well as hydraulic, engine, and transmission oils.

DIESEL

Diesel fuel is present in all on-site machinery and is identified as a potential environmental contaminant.

12.2 SAFETY

The safety of people overrides all other considerations. In the event of spillage of flammable or explosive hydrocarbons, all sources of ignition must be shut down and the area checked for flammable vapours before deploying machinery in the area. Operations in conditions that endanger personnel must be suspended until conditions improve.

Personnel involved in a clean-up must be appropriately trained and issued with the appropriate protective clothing and safety equipment.

12.3 POTENTIAL SPILL SOURCES AND RISKS

The presence of diesel and other hazardous substances present on site are considered to have a low potential risk of environmental impact due to spills, as there is generally an opportunity to prevent the spill from getting into open water and ground water. The following are situations where there is potential for a spill of oil onto land:

- Re-fuelling (excavators) and servicing (excavators)
- Rupture (e.g. hydraulic line)
- Vandalism
- Equipment malfunction

Spill procedures set out below have taken into consideration all the different potential spill scenarios. It is not considered necessary to have different spill procedures for each scenario.

12.4 PREVENTATIVE MEASURES IN PLACE

When re-fuelling, the plant operator is required to remain in attendance in accordance with Winstone's standard operating procedure for re-fuelling.

Additional measures to prevent spills include:

- All mobile plant is locked overnight.
- Regular preventative maintenance is carried out on all mobile plant to ensure plant failure is minimised.
- There are weekly checks of all mobile plant, which are signed off by the Burnham Quarry manager.
- Plant operators are required to inspect their vehicles daily for any obvious signs of wear and tear.
- Any major equipment failures are reported to the Burnham Quarry manager as soon as possible.

12.5 SPILL RESPONSE EQUIPMENT AVAILABLE ON SITE

LAND-BASED SPILLS

The spill kits for land-based spills (e.g., engine oil or diesel) contain Spill-Sorb, a non-toxic, field proven, industrial absorbent. Spill-Sorb is spread over the affected area as quickly and evenly as possible to a sufficient depth to allow for immediate absorption. After use the absorbent/spill mix can be containerised for removal; either to be incinerated or sent to a land fill.

WATER-BASED SPILLS

Both Spill Sorb and floating booms will be used to contain any water-based spill (e.g., oil). Spill-Sorb is scattered across the surface of the water to a sufficient depth so as to ensure that full absorption will take place. Spill Sorb floats and the contaminated material will be contained using floating booms before being removed for disposal.

12.6 EQUIPMENT AND OPERATORS AVAILABLE ELSEWHERE

Environment Canterbury has equipment and resources to deal with spills that are considered more significant than Winstone can cope with itself. Environment Canterbury's Environmental Team manages incidents via a 24-hour, 7-day incident response service. To report an incident, phone the environmental protection team on 0800 765 588.

13 QUARRY MANAGEMENT PLAN REVIEW

This QMP will be reviewed annually, with review parameters including, but not limited to:

- Any internal and external audit reports;
- Reports of Council officers;
- Review of work practices against industry best practice;
- Environmental incident reports; and

- Complaints received.

APPENDIX A – BURNHAM QUARRY SITE PLAN

APPENDIX B – BURNHAM QUARRY AIR QUALITY MANAGEMENT PLAN

Dust Management and Monitoring Plan – Burnham Quarry

D
R
A
F
T

- Prepared for

Winstone Aggregates

- 2023

PATTLE DELAMORE PARTNERS LTD
Level 5, PDP House
235 Broadway, Newmarket, Auckland 1023
PO Box 9528, Auckland 1149, New Zealand

Office +64 9 **523 6900**
Website **http://www.pdp.co.nz**
Auckland Tauranga Hamilton Wellington
Christchurch Invercargill

solutions for your environment

Quality Control Sheet

TITLE	Dust Management and Monitoring Plan – Burnham Quarry
CLIENT	Winstone Aggregates
ISSUE DATE	2023
JOB REFERENCE	

Revision History

REV	Date	Status/Purpose	Prepared By	Reviewed by	Approved
			Full Name	Full Name	Full Name

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE

Jonathan Harland

Reviewed and Approved by

SIGNATURE

Andrew Curtis

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Winstone Aggregates and others (not directly contracted by PDP for the work), including Pro-Manage Consulting Limited. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Winstone Aggregate for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

D R A F T

DRAFT

Table of Contents

SECTION		PAGE
1.0	Introduction	1
1.1	Purpose	1
1.2	Background	1
1.3	Objectives	2
2.0	Consent Compliance and Key Performance Indicator	2
3.0	Site Activities	2
4.0	Sources, Management, and Mitigation Measures	3
4.1	Factors influencing dust discharge	3
4.2	Sources of Dust	4
4.3	Dust Control	4
4.4	Tiered Mitigation Measures	4
5.0	Monitoring	5
5.1	Instrumental Monitoring and Trigger Levels	6
6.0	Contingency measures	7
7.0	Roles and Responsibilities	8
7.1	Site Manager and Staff	8
7.2	Staff Training	8
8.0	DMP Review	9
9.0	Complaints	9
9.1	Receipt Procedure	10
9.2	Response Procedure	11
10.0	Emergency Contacts	11
11.0	References	11

Table of Figures

Figure 1: Site location and nearby receptors 2

Table of Tables

Table 2: Sources of Dust and Tiered Controls to be Employed 1

Table 2: Priority of Water Application for Dust Suppression 5

Table 3: Visual Dust Monitoring Programme 6

DRAFT

Table 4: Monitoring Trigger Levels 7

Table 4: Internal Environmental Emergency Contact Details 11

Table 5: External Environmental Emergency Contact Details 11

Appendices

Appendix A: Daily Log Form

Appendix B: Complaint Record

DRAFT

1.0 Introduction

This Dust Management Plan - Burnham Quarry (DMP) has been prepared by Pattle Delamore Partners Ltd (PDP) on behalf of Winstone Aggregates (Winstones) for the proposed quarry near Burnham.

This document is a draft DMP and provides a draft framework for managing dust emissions from the proposed quarry. Following the consent being granted, the DMP will be reviewed and updated to reflect any consent requirements.

1.1 Purpose

The purpose of the DMP is to provide a framework for managing dust emissions from the proposed quarry to avoid or mitigate potential dust effects and in particular to:

- facilitate the avoidance, remediation, and mitigation of any adverse effects of discharges of dust generated from the reclamation and construction works associated with the expansion, and;
- promote proactive solutions to the control of dust discharges from the site.

1.2 Background

The proposed Burnham Quarry will produce a wide variety of aggregates, including basecourse, concrete aggregates and sealing chip that will be used in civil infrastructure projects in the Canterbury region. The site activities will include, overburden removal and bund construction, gravel extraction, aggregate processing, stockpiling and reinstatement of quarried land.

An assessment of the sensitivity of the receiving environment and identification of the location of highly sensitive receptors is provided in Section 2.5 of the Air Quality Assessment of Environmental Effects (AEE), dated XXX 2023). The location of the proposed quarry and the location of the nearby sensitive receptors are shown in Figure 1.

D
R
A
F
T



Figure 1: Site location and nearby receptors

1.3 Objectives

The objectives of the DMP are to inform the quarry operations and site personnel of management and mitigation measures for quarry activities to minimise the adverse impacts of potential dust discharges on the receiving environment.

The DMP methods are designed to be practical for Winstones to implement, while the document is intended to be continuously improved to adapt mitigation where needed to ensure the required outcomes.

2.0 Consent Compliance and Key Performance Indicator

The environmental objective of the DMP is to ensure that the site will be managed to comply with the consent conditions related to the discharge of dust to air. The relevant performance indicator to ensure that the site activities will not result in dust that is objectionable to the extent that it causes an adverse effect beyond the boundary of the site.

Relevant consent condition(s) will be included here if applicable.

3.0 Site Activities

There are a number of activities that will be undertaken in the course of quarrying the proposed site, this includes the following:

D R A F T

- Site Establishment and Enabling Works – Overburden material is removed for the establishment of the quarry entrance, site office, amenities, parking and weigh bridge, production zone and stockyards. Overburden material from this activity will be used to form a permanent bund along sections of Aylesbury Road and Grange Road.
- Creation of the Pit - The first extraction of material will create the production zone and stockpiling areas. Extraction will use the top-down method utilising excavators, wheel loaders and trucks.
- Entrance and Site Access - The entrance and exit of the site will be located on Aylesbury Road. The entrance to the site will include offices, meeting rooms, amenities, light vehicle parking and the weigh bridge. From the entrance platform there will be a ramp leading down to the quarry floor which will include a wheel wash and a flood wash. The site entrance and the ramp down to the quarry floor will be sealed.
- Production Zone - The production zone will house the processing plant which will include fixed plant as well as mobile plant as required.
- Primary and Secondary Stockyards - The primary stockyard will contain those products which have a higher risk of dust emissions, whereas the secondary stockyard is intended to contain products with a lower risk of dust emissions, bulk volume base coarse products, or slow-moving products.
- Extraction Zone – Before accessing the resource overburden will be removed first during a stripping campaign, with this material being stored in temporary bunds along the border of the site. Extraction of the resource will be undertaken using excavator, front-end loaders or wheel bucket excavators. Extracted material will be transported to the Production Zone using either trucks or conveyors.
- Silt Management – That exact methodology is yet to be confirmed, however it is most likely to be in the form of mechanical settling.

4.0 Sources, Management, and Mitigation Measures

4.1 Factors influencing dust discharge

The key factors influencing the discharge of dust from the proposed Burnham Quarry are:

- The size and the density of the material being handled. Coarse aggregate material content is unlikely to give rise to dust emissions when compared to fine clay material that might be found in overburden;
- The moisture content of the material. A high moisture content will act to bind particles and control any dust emissions;

DRAFT

- Strong winds blowing across exposed surfaces on dry days resulting in entrainment of dust material; and
- The extent of exposed areas.

4.2 Sources of Dust

The Site's key dust sources are as follows:

- Development and remediation of the site;
- Excavation of gravel;
- Site access road and other unsealed surfaces;
- Disturbing stockpiles; and
- Stockpiling.

4.3 Dust Control

Water will be the primary mitigation tool that Winstones will implement to control dust. The use of water prevents (or suppresses) fine particulate from leaving the surface and becoming airborne through the action of mechanical disturbance or wind. In effect, the water acts to bind the small particles to the larger material, thus reducing the emission potential.

While it is still unknown exactly how the water will be applied, it is expected to be undertaken using a combination of methods such as water carts, fixed and mobile sprinklers, etc., with water being applied at a rate as required to suppress dust.

As a benchmark for dust suppression the Ministry for the Environment Good practice guide[1] on assessing and managing dust recommends a water application one litre/m^2/hr.

4.4 Tiered Mitigation Measures

The proposed dust prevention on site uses a two-tiered approach. Tier 1 controls are employed routinely, and Tier 2 controls are implemented additionally in the unlikely situation that the Tier 1 controls do not prove to be fully effective. These control measures are summarised in Table 2.

Application of water for dust suppression as described in the Tier 1 and Tier 2 controls should be prioritised as shown in Table 2.

[1] Ministry for the Environment. 2016. *Good Practice Guide for Assessing and Managing Dust.* Wellington: Ministry for the Environment.

D R A F T

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Unpaved surfaces such as site access roads	• Limit the area of exposed surfaces as much as practical. • Cover surfaces with coarse materials where practicable. • Compact all unconsolidated surfaces where practicable. • Trafficked unsealed surfaces will be watered on a regular basis using sprinklers and/or water cart system. • An onsite speed limit of 30 km/hr will be enforced.	• Increase water application rate to ensure that in-use unpaved roads are kept damp. • Use polymer additives or chemical stabilisation to assist in forming a surface crust on site access roads only in rare occasion all other options are insufficient. • Further reduce speed limits.
Vehicles	• Limit load sizes and ensure even loading to avoid spillages. • As far as practical minimise travel distances and/or maximise buffer distances between site access roads and site boundary through appropriate site layout and design. • Deep sided trucks (dump trucks) are used for transport within the site to reduce spills. • As above, an onsite speed limit of 30 km/hr will be enforced. • The main haul road into the site is sealed to prevent dust.	• Limit vehicle speeds on unsealed surfaces to 10 km/hr when traveling within 250 m of the site boundary or when vehicle generated dust plumes approach the boundary of the site. • Dry soil material in trucks will be covered or wetted.

D
R
A
F
T

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
	• Sweeping of the sealed road is undertaken as required. • Any spills of soil from vehicles are swept up and washed down on the same day as the spill. • All vehicles exiting the quarry will pass through the wheel before leaving the site.	
Disturbing all materials including the working faces	• The loading on to or removal of material from stockpiles will be only undertaken during low dust risk wind conditions (one hour average windspeed < 7.5 m/s). • Good practice machine operation will be implemented including minimizing drop heights and wetting dusty materials when needed (wind speeds above 5 m/s). • No materials will be disturbed when wind speeds are above 7.5 m/s.	• Adequate water suppression systems must be available at the site to dampen areas that are to be worked prior to any earthwork commencing and shall be used on the site until further earthworks in that area are not required.
Aggregate Processing	• Fitting water sprays and/or misters on the screens, crushers and conveyor transfer points. • Minimise drop heights from the loading of raw materials into the feed hopper and from stacking of stockpiles. • Locate mobile processing plant away from dwellings and below ground-level where possible (only applicable during the intimal phase if mobile plant is used).	• Dampen down raw material before entering the processing plant. • Reduce material throughput until any dust emissions can be controlled. • Use fog cannons as required.

DRAFT

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
	• Enclosing dry screens.	
Stockpiles (including placement and removal)	• Locate stockpiles as far away as practicable from identified sensitive receptors, with high-risk material stored within the primary stockpile area and lower risk material within the secondary stockpile area. • Orientate stockpiles to maximise wind sheltering as much as possible. • Maintain the height of gravel stockpiles to a practical height, but no more than 5 metres above the surround ground-level. • Maintain the height of bunds to a practical minimum of 3 metres. • Load and remove stockpiled material from site as soon as practical. • No materials will be disturbed when wind speeds are above 7.5 m/s.	• Use polymer additives or chemical stabilisation to assist in forming a surface crust on stockpiles only in rare occasion all other options are insufficient. • Further limit the height and slope of stockpiles to reduce wind entrainment. • Vegetation of long-term stockpiles and bunds. • Dampen stockpiles if they are producing visible dust emissions.
Bund removal and rehabilitation	• Areas are incrementally backfilled at regular intervals and re-grassed with suitable grass species as soon as practicable to limit potential for dust generation from exposed surfaces.	• Use polymer additives or chemical stabilisation to assist in forming a surface crust on soil surfaces if delays in vegetation. • Addition of nutrients (fertiliser) to increase fertility and promote and maintain even revegetation.

D R A F T

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
		• Soil moisture management via irrigation (if available) to promote and maintain even revegetation.
Miscellaneous	• Plan site layout so that mobile machinery and dust causing activities are located away from receptors as far as is practicable. • Ensure sufficient water is available on site. • Take account of daily forecast wind speed, wind direction and soil conditions before commencing an operation that has a high dust potential. • All site machinery should be regularly maintained to ensure optimal operation. • Targeted watering on areas within 250 m of sensitive receptors during high dust risk conditions.	• Targeted watering on areas identified as high-risk for dust discharge as a result of visual inspections.

DRAFT

Table 2: Priority of Water Application for Dust Suppression			
Water Priority	**Type of Source**	**Proximity to Boundary**	**Wind Direction**
1	Overburden removal and bund construction/deconstruction	Any	Any
2	Active Haul Roads and Site Access	Any	Any
3	Processing Plant and Stockpiles	Within 250 m of the site boundary	Towards closest boundary with nearby receptors.
4	Working Area	Any	Towards closest boundary with nearby receptors.

5.0 Monitoring

To ensure that dust mitigation measures are implemented and are effective at minimising dust emissions, presented in Table 3 is a monitoring plan developed for Winstones. The frequency of the monitoring is defined but it must be noted that in the instance of strong winds, dust emissions off-site, or a complaint, the monitoring programme should be undertaken more regularly.

DRAFT

Table 3: Visual Dust Monitoring Programme	
Monitoring Activity	**Frequency**
Check weather forecasts for strong winds and rainfall to plan appropriate work schedule and dust management response.	Daily
Inspect land adjacent to the site, site exits and adjoining roads for the presence of dust deposition.	At least daily and more frequently if the wind is blowing from a potentially dust operation towards the boundary or sensitive receptor and the TSP or meteorological monitoring conditions are triggered (See Table 4)
Ensure instrumental monitors are operating correctly.	Daily
Observe weather conditions including wind and rain via observations and data outputs from weather stations.	Daily and as conditions change
Inspect all exposed surfaces for dampness and to ensure that the exposed un-stabilised area is minimised.	Daily and as conditions change
Inspect dust generating activities to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced
Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas.	Weekly

5.1 Instrumental Monitoring and Trigger Levels

Winstones will continuously monitor meteorological conditions including wind speed, direction and rainfall as well as PM_{10}. The dust monitors will be located along each boundary near where sensitive receptors might be located. The monitors will be located in accordance with AS/NZS 3580.1.1:2007 “Methods for sampling and analysis of ambient air Part 1.1: Guide to siting air monitoring equipment”. The monitors will be maintained and calibrated by a suitably qualified person such as the instrument provider and in accordance with the manufacturer’s instructions.

The meteorological site will be co-located with the dust monitor located on the southern boundary and will be installed and maintained where practicable in accordance with AS/NZS 3580.14 Methods for sampling and analysis of ambient

DRAFT

air - Part 14: Meteorological monitoring for ambient air quality monitoring applications.

The instruments will provide continuous, real-time information on PM_{10} concentrations and wind conditions. Trigger values will be set for PM_{10} concentrations, wind speed and rainfall, and if reached will require additional dust mitigation measures as described in Section 4. There will be two dust trigger levels; a lower value which warns that dust concentrations are increasing above "normal" levels and an upper limit trigger level which should not be exceeded. The recommended trigger levels are shown in Table 4

The trigger level thresholds in Table 4 are preliminary values and may need to be adjusted depending on the monitor type and any subsequent feedback from neighbours. If there are any exceedances of the trigger level, Winstones will undertake an investigation to determine the reasons for the exceedance and identify any remedial measures that can be taken to prevent further exceedances.

Table 4: Monitoring Trigger Levels

Trigger		Value
TSP Trigger Levels	Warning	120 µg/m³ (1-hour average)
	Stop Work	150 µg/m³ (1-hour average)
Meteorological Trigger Levels	Wind speed	5 m/s (1 hour average)
	Rainfall	Less than 1 mm for previous 24 hours

D R A F T

6.0 Contingency measures

The following contingency measures have been identified to ensure the dust management is working as intended:

- Break-down or failure of water suppression systems: As this is a vital control method, all dust generating activities may need to be ceased until the system can be restored if an alternative way of watering the surface is not available.
- If dust impacts or there are a large number of complaints occur, Winstones will reduce the trigger levels presented in Table 4.
- If the monitoring equipment is offline either due to planned maintenance, equipment malfunction or power failures, Winstones will use the water cart on all potentially dusty surfaces within close proximity of the boundary or dwelling whether or not dust is being generated, unless raining. This will continue until the instrument is back online.

- Water supply for dust suppression. In the extremely unlikely situation of not having the required level of water for dust suppression during prolonged dry periods, all dust generating activities will be ceased until an alternative water supply can be obtained.
- Ensure vehicles moving on-site have undergone regular maintenance so that vehicle emissions are kept to a minimum.

7.0 Roles and Responsibilities

7.1 Site Manager and Staff

The Quarry Manager will have day-to-day responsibility for the implementation of the DMP. The Quarry Manager will have the following responsibilities in respect of the management of dust. They shall ensure:

- That the conditions of all relevant resource consents are complied with at all times;
- That the dust control and mitigation measures and procedures outlined in the DMP are implemented effectively;
- That there are adequate personnel and equipment on-site at all times to enable the prescribed dust control;
- That the meteorological and dust monitoring programmes are carried out as required, including recording of daily observations;
- There is sufficient water supply for dust management;
- That any complaints received are investigated and resolved as far as practicable; and
- That all records are kept and are available for the relevant regulatory authorities.

All personnel working on the site have responsibility for the requirements of the air discharge consent conditions and the DMP and reporting to the Site Manager on these issues.

7.2 Staff Training

Successful dust management depends on appropriate actions by site personnel in the day-to-day operations of the site. Environmental training for all staff will be undertaken as part of the site induction programme. The environmental induction will include the following information specific to this DMP:

- Information about the activities that may cause dust discharges within the site with the potential to impact neighbouring areas;
- Consent requirements;

D R A F T

- Dust mitigation procedures;
- Description of dust and meteorological monitoring for the site; and
- Complaints management procedures.

Staff training records will be maintained on-site. The records will include:

- Who was trained;
- When the person was trained; and
- General description of training content and whether follow-up/refresher courses are required at a later date.

8.0 DMP Review

The DMP will be reviewed once per year and updated, with the necessary approval from Environment Canterbury. Approval will be required for any relevant revisions of a material nature for the DMP. The review will take into consideration:

- Any significant changes to dust management activities or methods;
- Key changes to roles and responsibilities;
- Changes in industry best practice standards or recommended dust controls;
- Results of inspection and maintenance programmes, logs of incidents, corrective actions, internal or external assessments;
- The outcome of investigations into discharges of dust or other air pollutants; and
- Changes to site operations i.e. once the site starts undertaking container operations.

Reasons for making changes to the DMP will be documented. A copy of the original DMP document and subsequent versions will be kept for the project records and marked as obsolete. Each new/updated version of the DMP documentation will be issued with a version number and date.

9.0 Complaints

While the measures in the DMP are aimed at preventing dust emissions as a result of on-site activities, there may be occasions when an incident occurs and a complaint from the public is received. Any complaint made will be promptly investigated to resolve the source of the dust emission and implement appropriate actions to mitigate the effects.

DRAFT

The following outlines guidance for receiving and keeping records of any complaints made.

9.1 Receipt Procedure

It is important to ensure that any complaints are recorded and promptly investigated to identify and resolve the cause of the complaint. Requirements and procedures for complaints are detailed below.

The Quarry Manager has the responsibility to respond to and follow up on all complaints regarding dust, and to ensure that suitably trained personnel are available to respond to complaints at all times.

Actions to be taken as soon as possible, following the receipt of a complaint, by the Quarry Manager include:

- Undertake a site inspection. Note all dust-producing activities taking place and the mitigation methods being used, and take photographs for reference as appropriate. If the complaint was related to an event in the recent past, where possible, note any dust-producing activities taking place at that time;
- Initiate any remedial action necessary, which may include a stop work period;
- Note the time and date of the complaint/s and (unless the complainant refuses to provide them) the identity and contact details of the complainant. Ask the complainant to describe the discharge:
  - Is it constant or intermittent?
  - How long has it been going on for?
  - Is it worse at any time of day?
  - Does it come from an identifiable source?
- Meteorological data from the on-site station shall be downloaded;
- Note if the complaint has been referred to Environment Canterbury;
- As soon as possible (within 1 hour, where practicable), visit the area from where the complaint originated to ascertain if dust is still a problem;
- If it becomes apparent that there may be a source of dust other than the quarrying activities causing the complaint, it is important to verify this. Photograph the source and emissions;
- As soon as possible after initial investigations have been completed, contact the complainant to explain any problems found and remedial actions taken. Initiate a damage assessment if required; and

DRAFT

- If necessary, update any relevant procedures to prevent any recurrence of problems and record any remedial action taken.

9.2 Response Procedure

Following the receipt of the complaint, the following actions will be undertaken:

- Fill out the appropriate complaint form, attached as Appendix B to this DMP;
- Advise Environment Canterbury within 48 hours that a complaint has been received, what the findings of the investigation were, and any remedial action taken;
- Advise site personnel as soon as is practicable that a complaint has been received, what the findings of the investigation were, and any remedial action taken; and
- Call or visit the complainant to update them on the actions taken and to check that the issue has been resolved.

10.0 Emergency Contacts

Internal contacts for the site in the event of an emergency of other problems are provided in Table 4 and Table 5 below.

Table 5: Internal Environmental Emergency Contact Details

Role	Name	Organisation	Phone	Email
Quarry Manager	TBC	Winstones	TBC	TBC
After Hours Contact	TBC	TBC	TBC	TBC

Table 6: External Environmental Emergency Contact Details

Role	Name	Organisation	Phone	Email
Consents Compliance Team	TBC	Environment Canterbury	TBC	TBC

11.0 References

Institute of Air Quality Management (IAQM). (2016). *Guidance on the assessment of mineral dust impacts for planning.*

Ministry for the Environment. (2016). *Good Practice Guide for Assessing and Managing Dust*. Available at www.mfe.govt.nz.

DRAFT

Pattle Delamore Partners Ltd, *Air Quality Assessment – Burnham Quarry,* August 2023.

DRAFT

Appendix A: Daily Log Form

Daily Dust Inspection Log

Date: _____ Time: _____
Inspection by: _____
Current weather conditions (e.g., sunny, cloudy, rainy):_____
Wind speed and direction (e.g., light, moderate, strong):_____
Weather forecast for next 24 hours (e.g., rainy, windy):_____
Area(s) inspected: _____

Scope of Inspection	Circle Relevant Item	Comments
Is there visible dust from site work activities, stockpiles, earthworks areas or haul roads?	Y N N/A	
Are unsealed surfaces dry and need spraying with water cart?	Y N N/A	
Are any exposed earthworks visibly dry and need water spray?	Y N N/A	
Stockpiles covered/stabilised where needed?	Y N N/A	
Are there any signs of dust going off site as a result of site activities? [Inspect land adjacent to the site exits and adjoining roads for the presence of dust deposits.]	Y N N/A	
If wind speeds are strong or forecast to be strong (over 5 m/s) are additional inspections, activity restrictions and mitigation measures being put in place? (e.g., increase water application, restrictions on dusty activities)	Y N N/A	
Are watering systems (e.g., water carts, wheel wash) operating effectively to minimise dust?	Y N N/A	
Are trucks carrying loose (uncovered) material entering or leaving the site?	Y N N/A	

Scope of Inspection	Circle Relevant Item	Comments
How frequently has water sprinkling/spraying been used today (i.e., number of water carts, time, area watered)		
Note and dust control equipment malfunctions (and remedial actions taken as appropriate)		
Any unusual on-site activities today?		
Complaints received / community feedback		

Appendix B: Complaint Record

DUST COMPLAINT & ASSESSMENT FORM

PART A: Complaint Details

Date: Time:

Complaint Received By:

Name:

Address:

Contact phone numbers:

Possible source:

Anonymous: Y/N

Is dust occurring now?

Complaint details (include impacts/effects experienced by complainant:

PART B: Complainant Location Assessment

Date: Time:

Assessors Name:

Person spoken to at complaint location:

Reason for investigation: COMPLAINT/PROACTIVE

Complaint details (include impacts/effects experienced by complainant:

INITIAL IMPRESSIONS:

Type of dust

Time of the intial impression:

Any visible dust deposits: Y/N

Plume width (if known):

VISIBLE DUST DEPOSITS

Describe approximate quantites and extent

When was surface last cleaned?

Frequency of cleaning:

Describe the appearance of the deposits:

Colour

Shape

Size

Crystalline or powdery

Hard, soft

Any odour

Water soluble

Other

Weather Data (see over)

Wind direction:
Wind velocity:
Cloud cover:
Temperature:
Rainfall in past 24 hrs:

Photos Taken: Y/N Samples taken Y/N

Diagram/description of where photos were taken.

Diagram/description of where samples were taken:

Sample collection: Use a small paintbrush (clean) to sweep samples of the dust onto a sheet of paper and then into a clean plastic bag. At least half a teaspoonful will be required for analysis. Lesser amounts may be colected on strips of clear cellotape, which should then be stuck onto sheets of clear plastic to preserve the samples. Label all samples and record date, time, location, etc on a separate sheet of paper if required.

DRAFT

Based on your assessment on this occasion, which of the following applies:

- ☐ I did not find any dust
- ☐ I did find dust and consider it would not be objectionable at any location for any duration or frequency
- ☐ I did find dust and consider it would be objectionable if it became continuous
- ☐ I did find dust and consider it would be objectionable if it occurred on a regular or frequent basis
- ☐ I did detect dust and consider it to be objectionable even in periods of short duration.

FINAL CHECKLIST

- ☐ Upwind assessment completed. Record details below. If not, detail reason: _____
- ☐ Aerial photo/sketch showing location of assessment and upwind assessment attached
- ☐ Are there potential witness statements to obtain YES/NO

REMARKS

PART C: Off-site dust and 360° assessment

Assess the dust upwind of the suspected source and if possible conduct a 360° sweep around the source assessing the odour at different points

OTHER POTENTIAL SOURCES **Time:** _____

Check for road works, ploughing, construction activities, burn-offs, unsealed roads, unsealed sites

Site 1:

Wind direction: Wind strength: Wind stability: GPS Loc:
Visible dust: Desciption of dust
Comment:

Site 2:

Wind direction: Wind strength: Wind stability: GPS Loc:
Visible dust: Desciption of dust:
Comment:

Site 3:

Wind direction: Wind strength: Wind stability: GPS Loc:
Visible dust: Description of dust:
Comment:

Diagram of Suspected source, dust assessment sites and dust plume:

N

COMMENTS

PART D: Source On-site Investigation

If source of dust identified, visit site, identify yourself and show warrant. Explain the findings of your investigation to staff.

Date: Time: Source Identified:

Staff spoken to:: Position:

Staff contact phone number:

Current site operations:

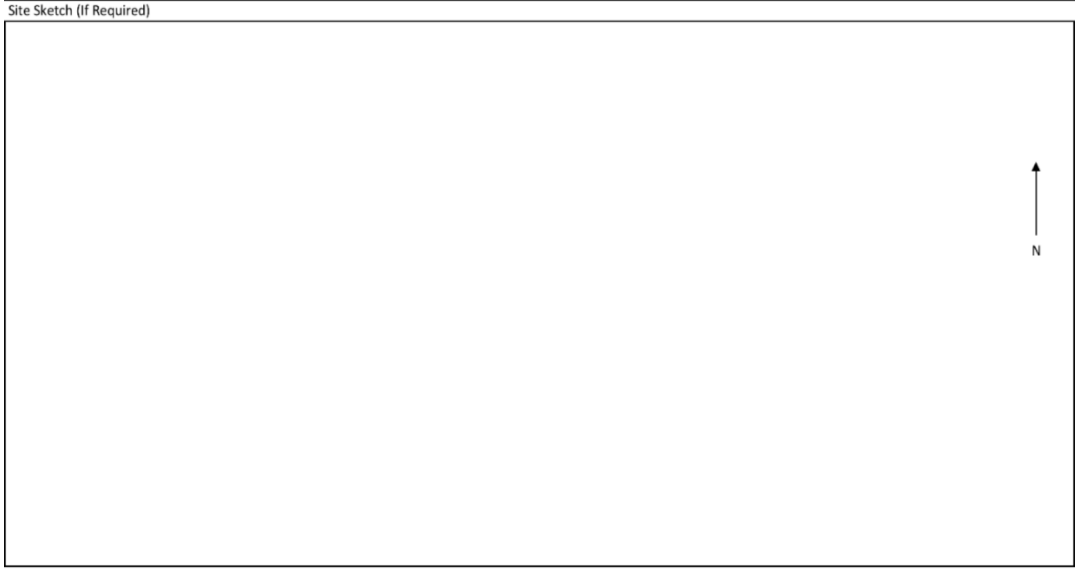
Reason/explanation given for dust

Other Comments

Monitoring results/samples/other records

D R A F T

Site Sketch (If Required)



SIGNED BY ASSESSOR _____ DATE: _____

PART E: Dust Reference Sheet

Definitions

Objectionable The term objectionable is the term used in consent conditions and is an ingredient of any subsequent enforcement action. It is a subjective term and is open to interpretation. There is guidance from case law which defines objectionable as: unpleasant or offensive or repugnant; open to objection or undesirable or disapproved of; noxious or dangerous. A test will be applied by the court that the term objectionable will be as it applies to "the minds of a significant cross section of reasonable people in the community". The assessor must bear this test in mind when completing their assessment.

Frequency How often an individual is exposed to dust nuisance events

Intensity As indicated by dust quantity/concentration and the degree of nuisance

Duration The length of the particular dust event

Character How objectionable the dust is, having regard to the nature of the dust

Land Beaufort Wind Scale

B. No.	Description	How to Recognise
0	Calm	Smoke rises straight up
1	Light Air	Smoke drifts
2	Light Breeze	Wind felt on face; leaves rustle
3	Gentle Breeze	Flags flap; twigs move all the time
4	Moderate Breeze	Papers blow; small branches move
5	Fresh Breeze	Small trees sway
6	Strong Breeze	Large branches move, wind whistles
7	Near Gale	Whole trees sway

Measuring Temperature

Use descriptions below or obtain local meterological data, especially temperature from websites such as www.metservice.govt.nz

Cold
Cool
Mild
Warm
Hot

Measuring Cloud Cover

Okta No.	Description
0	Clear Sky
1	Sunny
2	Mostly sunny
3	
4	Half the sky is covered in cloud
5	
6	Mostly cloudy
7	Considerable cloudiness
8	Overcast
F	Fog / Mist

During the day the sun is always shining, so the amount of sunshine reaching the ground depends on the amount and duration of any cloud cover. The amount of cloud cover is usually given in units called oktas. Each okta represents one eighth of the sky covered by cloud.

DRAFT

Boffa Miskell

Burnham Quarry

Landscape Effects Assessment
Prepared for Burnham 2020 Ltd

6 September 2023



Boffa Miskell is proudly a
Toitū net carbonzero certified consultancy

Document Quality Assurance

Bibliographic reference for citation: Boffa Miskell Limited 2023. *Burnham Quarry: Landscape Effects Assessment*. Report prepared by Boffa Miskell Limited for Burnham 2020 Ltd.		
Prepared by:	Rhys Girvan Senior Principal Landscape Planner Boffa Miskell Limited Hannah Wilson Landscape Architect Boffa Miskell Limited	
Reviewed by:	Rhys Girvan Senior Principal Landscape Planner Boffa Miskell Limited	
Status: [FINAL]	Revision / version: [6]	Issue date: 6 September 2023

Use and Reliance
This report has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Boffa Miskell does not accept any liability or responsibility in relation to the use of this report contrary to the above, or to any person other than the Client. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Executive Summary

Burnham 2020 Ltd is proposing to develop an existing dairy farm near Burnham, Canterbury for an aggregate quarry to be operated by Winstone Aggregates (a division of Fletcher Concrete and Infrastructure Ltd). The site and its surroundings form part of the Lower Canterbury Plains Landscape and do not contain any waterbodies or form part of any outstanding natural feature or landscape.

During operation, the quarry will extract aggregate in successive phases within a total area of 362 ha. comprising the site. This will be supported by temporary topsoil stockpiles and long-term topsoil bunds formed along the periphery of the Site and extraction areas to reinforce screening through existing shelter belts. During operation, native planting will be established along the long-term bund and resultant batter slopes following rehabilitation to assist with assimilating changes in landform within the Site. As each phase is completed it will be progressively rehabilitated and returned to pasture and native vegetation. Additional blocks of native planting are also proposed within the south-eastern corner and midway along the southern boundary of the Site. While each phase is extracted and rehabilitated, the remainder of the Site will continue to operate as a working farm.

Landscape effects

The character of the Site reflects part of a flat to gently sloping area of rural landscape which comprises remnant ancient, braided rivers that flowed through and shaped the broader Canterbury Plains. Intensive agricultural activity is now prevalent throughout this landscape including the Site. As a working dairy-finishing farm, the Site is currently managed as pasture with several pine shelterbelts and feed crops supported by farm infrastructure and machinery including three large centre pivot irrigators.

Key landscape effects of the proposed quarry will include the gradual and progressive modification to the existing landform. This activity will essentially entail the exposure of bare earth as a broad depression or pit is formed through the extraction of aggregate during each phase. Such effects will gradually shift across the Site through successive phases of development. Changes in land use commence with the establishment of the Site entrance along Aylesbury Road following which operational areas are located within the floor of the resultant quarry as extraction progresses in an anti-clockwise direction in 13 successive phases of activity.

Effects of the proposed quarry on landscape character are considered **moderate adverse** during the initial commencement of quarrying activity and will gradually and progressively reduce through successive phases of planting and associated rehabilitation. The Canterbury Plains have a strong agricultural character overlaid across a broad alluvial plain. The scale and disruption of the physical characteristic associated with the Site will be atypical of day-to-day farming practice. Nevertheless, the progressive nature of the proposal and high level of visual containment achieved through reinforcing the existing framework of vegetation with bunding, temporary stockpiling and progressive planting, including along resultant batter slopes following rehabilitation, will effectively reinforce the character and quality of this contained area of working rural landscape. As the Site is progressively returned to farmland with native planting reintegrating this proposed change in landform within its working rural context, longer-term adverse landscape effects are anticipated to be **low**.

Visual effects

The Site has limited public and private viewpoints due to the flat and gently sloping topography of the wider Canterbury Plains and established framework of shelterbelts. In this context, views are localised to roads and properties near the Site, primarily along Aylesbury and Grange Roads. From these areas, glimpsed views are predominantly limited to the proposed entrance to the Site along Aylesbury Road and into the existing entrance on Grange Road as well as smaller gaps and filtered views through existing

shelterbelts. Adverse visual effects from public viewpoints will be no greater than **low** and will remain limited as shelterbelts are maintained and proposed native vegetation implemented along the intervening perimeter of the quarry becomes established.

Private viewpoints are also limited by the nature of existing intervening shelterbelt vegetation and predominantly localised to transient views from properties in proximity of the Site. Prior to operation, glimpsed and transient views of onsite activity will be limited to glimpses through permeable sections of the pine shelter belt on the boundary of the Site for some properties. Such views will be reduced by the establishment of a permanent bund part way along Aylesbury Road and temporary stockpiles and planting which will reinforce existing screening as quarrying activity continues across the remainder of the Site boundary. As a consequence, visual effects from surrounding dwellings will be **very low**.

CONTENTS

Executive Summary i

1.0 Introduction 1

1.1 Scope of the report 1

1.2 Assessment Process 1

2.0 Existing Environment 2

2.1 Landscape Context 2

2.2 Canterbury Landscape Review 3

2.3 Selwyn District Landscape Study 4

2.4 Site Description 4

2.5 Visual Catchment 6

3.0 Relevant Statutory Provisions 7

3.1 Resource Management Act, 1991 7

3.2 Canterbury Regional Policy Statement 8

3.3 Operative Selwyn District Plan 8

3.4 Partially Operative Selwyn District Plan (Decisions Version) 8

4.0 Proposal Description 10

5.0 Assessment of Effects 11

5.1 Landscape Effects 12

5.2 Visual Effects 13

5.3 Effects in relation to Statutory Provisions 16

6.0 Recommendations 16

7.0 Conclusion 17

8.0 References 18

Appendix 1: Method Statement 19

Appendix 2: Summary Table of the Nature and Level of Visual Effects 22

1.0 Introduction

1.1 Scope of the report

Boffa Miskell Limited (BML) has been engaged by Winstone Aggregates (the applicant), a division of Fletcher Concrete and Infrastructure Ltd to undertake a Landscape Effects Assessment (LEA) for a proposed aggregate quarry near Burnham (otherwise referred to as The Site in this report). The Site is zoned Rural within the Outer Plains in the Operative Selwyn District Plan and General Rural in the Proposed Selwyn District Plan.

The following Landscape Effects Assessment assesses the landscape and visual effects of the proposed aggregate extraction activity on the immediate and surrounding environment including its rural character.

1.2 Assessment Process

This assessment has been undertaken with reference to Te Tangi a Te Manu, Aotearoa New Zealand Landscape Assessment Guidelines[1] and a corresponding method statement as set out in **Appendix 1**. In summary, the effects ratings are based upon a seven-point scale which ranges from very low to very high.



Figure 1: Seven-point scale from Te Tangi a te Manu: Aotearoa Landscape Assessment Guidelines.

This assessment entailed two Site visits. The first was undertaken on Wednesday 23rd March 2022 and focussed on understanding the Site context and establishing the views of the Site from public viewpoints. The second was undertaken on Thursday 19th May 2022 to appraise the Site, including understanding existing land use, and infrastructure.

The methodology used for the assessment involved a combination of fieldwork and visibility analysis including taking photographs from various publicly accessible viewpoints surrounding the Site.

In summary, the assessment process has comprised the following tasks:

- Site visit and familiarisation;

[1] Te Tangi a Te Manu, Aotearoa New Zealand Landscape Assessment Guidelines, New Zealand Institute of Landscape Architects (NZILA), 2022

- Analysis and appraisal of existing landscape and viewing audience, including fieldwork, reconnaissance and GIS data analysis including obtaining and analysis of UAV aerial photography;
- Review of planning documents, and other relevant material;
- Assessment of landscape, visual, and rural character effects;
- Recommendation of mitigation measures during operation and rehabilitation following completion of quarry operations;
- Consideration of development against relevant statutory considerations; and
- Peer Review.

2.0 Existing Environment

The Site forms a triangular wedge of land which adjoins Grange Road and Aylesbury Road to the north of Burnham military camp and approximately 4 kilometres west of Rolleston on the northern side of State Highway 1 (**Figure 1**). This area is characterised by rural and rural lifestyle properties encompassing grazing, dairy farms, and cropping within an established framework of shelter belts along field boundaries. Pivot irrigators and several horse stables and training facilities are also established in this rural area. Burnham Military Base, which includes army barracks, civilian housing, several small local shops, and extensive training grounds is located immediately south of the Site. Road Metals Quarry, an existing aggregate extraction activity is located approximately 3km from the Site boundary to the northeast. Rural dwellings nearby are typically enclosed by shelter and amenity planting located within their own property boundaries.

2.1 Landscape Context

2.1.1 Physical

The Site forms part of the lower eastern area of the Canterbury Plains which extends between the foothills of the Southern Alps and Banks Peninsula and between the Waimakariri River to the north and the Waikirikiri / Selwyn River to the south. The plains are made up of a series of gently sloping fans that contain greywacke gravels produced during successive glaciations of the mountainous regions to the west. These gravels are up to 500 metres deep in some places.

The Selwyn District's low altitude plains include several braided rivers, such as the Waimakariri, Waikirikiri / Selwyn, and Rakaia rivers. The larger rivers, Waimakariri and Rakaia have formed the outwash plains that characterise much of the Canterbury Plains.

Historically, vegetation within the low altitude plains included extensive podocarp forests, including species such as kahikatea, mataī, and tōtara. After the arrival of tangata whenua, fires cleared these forests and were replaced by tussock grassland, and species such as matagouri, kānuka, mānuka, kōwhai and taramea. After the arrival of Europeans, native vegetation was cleared further to accommodate pasture and cropping for farming. Today indigenous vegetation present on the plains is less than 0.5% of the total landcover, and has been reduced to small, isolated and scattered remnants as a result of large-scale land use changes.

Within this rural landscape, modern farming activity also supports large scale pivot irrigators which span across open paddocks, most typically associated with dairy farming. Linear roads and fencing with dispersed agricultural sheds and dwellings are also common physical influences encountered throughout this working rural landscape context.

The Site is classified as Land Use Classification 4s7 (NZLRI Land Use Capability 2021) reflecting shallow topsoil over gravels and is not recognised as highly productive land.

2.1.2 Perceptual

The Canterbury Plains remain expressive of their formative processes, containing ancient, braided river channels which form a broad sequence of outwash fans connecting the Southern Alps with Banks Peninsula. Overlaying this, the Canterbury Plains support a strong linear patchwork of rural land use with circular irrigation more frequent in some areas. Roadside shelter belts are common and often enclose and filter transient views. This working, productive rural landscape contrasts with the undeveloped backdrop of the Southern Alps. The vastness and openness of this landscape frequently allows for long distance views of the Southern Alps to the west, and Banks Peninsula to the east. A distinctive feature above the Canterbury Plains is the 'Nor-west arch' which is a distinctive cloud pattern common during the summer months and caused by hot dry winds.

2.1.3 Associative

The Canterbury Plains has a long history of human occupation and settlement.

Kā Pākihi-whakatekateka-a-Waitaha is the name given to reflect the adventures of Waitaha explorer Rākaihautū and his travelling party. The name translates to "the open plains where Waitaha walked proudly", after the travelling party were relieved that their travels north were not as difficult as those when traversing the Southern Alps. The rivers within the Canterbury Plains are of immense significance to mana whenua, with many being recorded as a kāinga mahinga kai. The Rakaia and Waimakariri Rivers were also a key travel route between the Canterbury Plains and West Coast. No recorded Māori cultural sites which are publicly available have been identified within the Site. Ngāi Tahu are the iwi and Ngai Tūāhuriri and Tauamutu are the rūnanga who have territorial rights over this area for which ongoing engagement is anticipated by the Project Team following lodging of this resource consent.

Since European settlement, the Canterbury Plains have become a prosperous agricultural landscape, particularly in the low altitude plains. The manicured patchwork of the plains spread beneath its vast open skies are distinctive characteristics of this landscape and has inspired both literature and paintings.

2.2 Canterbury Landscape Review

At the regional scale, the landscapes which include the Canterbury Plains were previously considered within the Canterbury Regional Landscape Review (2010)[2]. Within this study, the landscapes encompassing the Site were identified as part of the Lower Plains Landscape Type. This is characterised by a broad very low angle coalescing outwash fan and associated low terraces of the major rivers (Waimakariri, Rakaia, Rangitata, and the Waitaki Rivers),

[2] Canterbury Regional Landscape Study, 2010. Boffa Miskell Limited.

comprising Pleistocene glacial outwash gravels with variable loess cover, and extensive Holocene alluvium, coastal swamp deposits and minor inland dune belts.

Consistent with much of the Canterbury Plains, this area of landscape has been highly modified by a diverse array of land uses. Almost all of the indigenous vegetation has been replaced with farmland and productive land use. Dryland sheep farming is found on the stony shallow soils and cropping is mainly confined to the free draining deeper soils and along the riverbanks. On the lower plains, intensive dairy farm operations are becoming increasingly prevalent. On the outskirts of the major settlements such as Rolleston and Christchurch, numerous lifestyle farm properties have developed over the last 20 years.

The Site and its surrounding are not identified as part of any outstanding natural landscape or significant amenity landscape at the regional scale.

2.3 Selwyn District Landscape Study

The landscapes within Selwyn District were recently characterised as part of the Selwyn District Landscape Study (2017)[3]. Within this study, the Site was identified as part of the Low Altitude Plains Character Area (**Figure 2**), part of the central portion of Kā Pākihi Whakatekateka o Waitaha / the wider Canterbury Plains. This character area is defined by the foothills of the Malvern Hills in the north-west, by the Waimakariri River to the north-east, Te Waihora / Lake Ellesmere to the south-east and the Rakaia River to the south-west. This character area is defined by the flat, open and expansive plains which have little topographical relief. Elevation ranges from 0 to 150 metres above sea level.

This highly modified landscape is described as possessing a linearity, emphasised by shelterbelts, dissecting roads and broad scale agricultural land use. The central natural landscape feature of the area is the Waikirikiri / Selwyn River and its tributaries which flow from the Malvern Hills to Te Waihora / Lake Ellesmere. The Low Altitude Plains are dotted with a number of townships of varying scale which service the rural community. The number and size of these townships typically decrease with distance from Christchurch City.

The Selwyn District Landscape Study includes the following key landscape characteristics with relevance to the Site:

- *Flat, open and expansive plains which have little topographical relief.*
- *A largely linear landscape which is emphasised by the characteristic shelterbelts and dissecting roads, as well as the central spine of the Waikirikiri /Selwyn River.*
- *Broad scale, highly modified agricultural land use.*
- *Very little native vegetation.*
- *Distant backdrops of the Te Whata a Rama / Torlesse, Benmore and inland Craigieburn Ranges.*

The Site and its surrounding are not identified as part of any outstanding natural landscape or significant amenity landscape at the district scale.

2.4 Site Description

The character of the Site is typical of much of the surrounding rural landscape which represents a broad patchwork of intensive rural land use, typically enclosed by linear exotic shelterbelts along paddock and roadside boundaries. Natural systems operate; however rural activities, such as pastoral farming and cropping, typically prevail. The presence of built form including

[3] Selwyn District Landscape Study, 2018. Boffa Miskell Limited.

dispersed rural dwellings and farm buildings and the straight radial configuration of shelterbelts, roads and powerlines also influence the character of this local area of landscape.

The topography of the Site is generally flat with a gentle slope to the south-east (**Figure 3**) and reflective of ancient, braided river channels which created the broader Canterbury Plains. The Site is approximately 362 hectares in area and is currently managed as an operational dairy finishing farm with some cropping, irrigated via three large centre pivot irrigators, which distribute water supplied by the Central Plains Water (CPW) scheme. The Site is currently accessed from the south on Grange Road. At the centre of the Site is the farm base including a portacom office, large storage shed, shipping containers, and silos. The perimeter of the Site has been almost entirely planted in pine shelter belts, with interior shelter planting following the circumference of the centre pivots. Prior to being established as a dairy farm, the Site was established in plantation pine.

As part of this assessment, an aerial view of the Site was undertaken using UAV (unmanned aerial vehicle) (**Figure 4**), alongside several Site Appraisal Photographs which were taken within the Site boundary. These Site and aerial photographs were taken to understand the existing character of the Site, where existing infrastructure and vegetation is located, and the topography. The locations of **Site Appraisal Photographs A-F** have been labelled on **Figure 4**, in conjunction with the existing shelter belts (SBs) and tree groups (TGs) on the Site. Pine shelter belts (SB1 - SB28) have been trimmed to approximately 4 metres in height on Aylesbury Road and Grange Road, and between 4 and 8 metres on the western boundary of the Site.

At the centre of the Site is the existing farm base, as described above and demonstrated in **Site Appraisal Photograph A**. This area is located between the three large centre pivot irrigators which operate within the Site and has a pine shelter belt to the west to protect the farm base from nor-west winds. From this viewpoint there are open views towards the Southern Alps.

The existing main accessway to the Site is from Grange Road and consists of a wide gravel access track which extends to the centre of the northern centre pivot. As shown in **Site Appraisal Photograph B**, the track approaches the farm base from the south, and severs the two lower paddocks containing centre pivot irrigators, each having a radius of approximately 539 metres. From this viewpoint, the shelter planting surrounding the south-eastern pivot is visible and the storage sheds associated with the farm base.

Due to the flat underlying topography of the Canterbury Plains, there are open views from the Site to both Banks Peninsula and the Southern Alps. The view towards Banks Peninsula is demonstrated in **Site Appraisal Photograph C**, looking in a south-easterly direction. From this viewpoint the open rural landscape character of the Site is demonstrated. The area irrigated by each pivot is divided into several paddocks which contain a mixture of kale, stock, and improved pasture. Beyond this, pine shelter belts are maintained along Site boundaries and on the edges of the pivot circles.

From the northern corner of the Site, the Site's open character within the dense shelter planting on the eastern and western boundaries is evident as illustrated in **Site Appraisal Photograph D**. This viewpoint also illustrates the Site's connection to the wider Central Plains Water (CPW) scheme. The scheme's mainline extends from the northern corner of the Site to the south of the Site and supplies the three large pivot irrigators which operate throughout the Site.

Further south looking towards the eastern boundary of the Site, **Site Appraisal Photograph E** demonstrates an example of smaller irrigation schemes found throughout the Site. These areas are situated between each of the larger centre pivot irrigators and provide smaller scale irrigation to areas of pasture. In the distance, shelter planting on the eastern boundary of the Site is evident, and on the perimeter of the pivot irrigator circle.

The south-eastern corner of the Site adjoins the intersection of Grange Road, Aylesbury Road, Sandy Knolls Road and Two Chain Road. As shown in **Site Appraisal Photograph F,** the south-eastern corner of the Site is framed by pine shelter planting and is bounded by an area of exotic forestry associated with the Burnham Military Camp. This corner of the Site is also located near several rural lifestyle properties accessed from Aylesbury Road, Sandy Knolls Road, Kerrs Road, and Two Chain Road.

2.5 Visual Catchment

The underlying topography of the Site and broader context coupled with the existing shelter planting around the perimeter of the Site restricts views from both public and private viewpoints, creating a relatively contained viewing catchment. Public views of the Site are available intermittently between gaps in the existing shelter planting from Aylesbury Road (a primary collector road), and Grange Road, with long distance views of the western boundary of the Site available from Kivers Road. Views of the Site from neighbouring dwellings are typically restricted due to intervening shelter planting within the Site and reinforced with planting introduced along neighbouring property boundaries. Many of these neighbouring dwellings are clustered towards the intersection of Grange Road, Aylesbury Road, and Two Chain Road at the south-eastern corner of the Site.

The extent and degree to which the Site is visible from within the surrounding landscape was considered as part of the site visit. Under the methodology, a continuum of visibility has been considered, ranging from no view of the Site to full, open views. In this instance, the nature of available views is almost entirely truncated by intervening vegetation. For completeness, the potential public and private viewing audience surrounding the Site which has been identified is illustrated on **Figure 5,** adopting the following three categories:

- Truncated/Glimpsed views: a view towards the Site that is curtailed by a visual barrier;
- Partial View: a view of part of the Site between trees or structures, or a filtered view of the Site, or a distant view where the Site is perceived as a small part of the view; and
- Open view: a clear view of a significant proportion of the Site within the wider landscape.

To support the above assessment, a series of Site Context Photographs have been taken to illustrate the representative views from publicly accessible viewpoints. These photographs are found within the accompanying Graphic Supplement with their locations outlined on **Figure 5** and briefly described below.

Site Context Photograph 1 is taken near the intersection of Aylesbury Road, Two Chain Road, Sandy Knolls Road and Grange Road, and is orientated to the north-west towards the Site. From this viewpoint the existing planting on the boundary is visible, curtailing views into the Site. This viewpoint also shows some of the neighbouring dwellings clustered near the south-eastern corner of the Site. Most of these dwellings which neighbour the Site are accessed from Two Chain Road, Kerrs Road and Sandy Knolls Road.

Site Context Photograph 2 is taken to the south of the Site near 159 and 139 Grange Road and illustrates the existing site access from Grange Road. This viewpoint offers views of the existing pivot irrigators, stock, and farming activity within the Site. From this viewpoint, there are no restrictions on views into the Site. It would generally be experienced only obliquely and for a transient moment as drivers and passengers pass the Site on the open road.

Site Context Photograph 3 demonstrates the view from the south-western corner of the Site on Grange Road and is taken near 273 and 259 Grange Road. The existing shelter vegetation on the boundary of the Site truncates views from public viewpoints with the planting reaching approximately 4 metres in height. In the centre of the photograph, there is a small gap in existing shelter vegetation to allow for access into the Site from the road. There are other similar small gaps along the southern and eastern site boundary equivalent to that demonstrated in this photograph. This allows for transient and partial views into the Site when passing adjacent to the Site along Grange and Aylesbury Roads.

Site Context Photograph 4 demonstrates views from Kivers Road and is representative of long-distance views of the Site which are available from the west. From this viewpoint the western boundary of the Site is visible however due to existing shelter planting, views into the Site remain concealed.

Site Context Photograph 5 illustrates the view of the northern corner of the Site from Aylesbury Road, which connects between Burnham and State Highway 73 to the north-west. From this viewpoint, the Site remains enclosed by boundary vegetation along the western and eastern boundaries with the exception of glimpsed views associated with access to the Site. Any such views are limited to transient views when travelling along Aylesbury Road. The western boundary of the Site has a taller hedge which is evident when approaching the Site from the north.

Site Context Photograph 6 demonstrates the view near the proposed entry to the Site from Aylesbury Road. From this viewpoint views into the Site are currently glimpsed and transient views through gaps in boundary vegetation. This view also encompasses a small area of planting associated with a tank and pump shed seen in the centre of the photograph. Beyond such gaps, the internal shelter planting which surrounds the pivot irrigators in the Site are visible alongside smaller irrigation schemes which are found throughout the Site

3.0 Relevant Statutory Provisions

As part of this assessment, there are a number of planning provisions that are relevant to this project. Specifically, they include:

- *The Resource Management Act*, *1991*
- *The Canterbury Regional Policy Statement*
- *The Operative Selwyn District Plan*
- *The Partially Operative Selwyn District Plan*

3.1 Resource Management Act, 1991

The Site is not located within the coastal environment, nor does it contain any waterbodies. As identified above, it has not been identified within any outstanding natural feature or landscape overlays or visual amenity landscape overlays at either the regional or district scales. Therefore Section 6(a), and Section 6(b) of the Resource Management Act do not apply.

Sections of the Resource Management Act which are relevant and apply to this landscape and visual assessment include:

- Section 7(c) the maintenance and enhancement of amenity values.
- Section 7(f) maintenance and enhancement of the quality of the environment.

3.2 Canterbury Regional Policy Statement

Within the Canterbury Regional Policy Statement landscape matters are addressed within Chapter 12, with the purpose being to support the management and identification of other landscapes that may warrant protection or management for other reasons such as maintaining natural character, historic and cultural heritage or amenity, as well as outstanding natural features and landscape, none of which apply to the Site.

3.3 Operative Selwyn District Plan

Within the Operative Selwyn District Plan the Site is zoned Outer Plains (**Figure 6**). Objectives and policies of relevance to this assessment include the following:

Quality of the Environment — Objectives

Objective B3.4.1

The District's rural area is a pleasant place to live and work in.

Objective B3.4.2

A variety of activities are provided for in the rural area, while maintaining rural character and avoiding reverse sensitivity effects.

Quality of the Environment — Policies

Rural Character

Policy B3.4.1

Recognise the Rural zone as an area where a variety of activities occur and maintain environmental standards that allows for primary production and other business activities to operate.

Policy B3.4.3

Avoid, remedy or mitigate significant adverse effects of activities on the amenity values of the rural area.

3.4 Partially Operative Selwyn District Plan (Decisions Version)

Within the Partially Operative Selwyn District Plan (Decisions Version) the Site is zoned General Rural (**Figure 7**), with the primary purpose of the zone being *"…to provide for primary production activities and other compatible activities."*

The objectives and policies within the Partially Operative Selwyn District Plan include the following.

GRUZ-O1

Subdivision, use, and development in rural areas that:

1. supports, maintains, or enhances the function and form, character, and amenity value of rural areas;
2. prioritises primary production, over other activities to recognise its importance to the economy and wellbeing of the district;
3. allows primary production, those activities that directly support primary production and have a functional or operational need to locate with the General Rural Zone and important infrastructure, to operate without being compromised by incompatible sensitive activities and reverse sensitivity effects;
4. retains a contrast in character to urban areas; and
5. protects highly productive land.

GRUZ-P1

Maintain or enhance rural character and amenity values of rural areas by:

1. retaining a low overall building density, and predominance of vegetation cover;
2. enabling primary production while managing adverse effects of intensive primary production, and mineral extractive industries;
3. managing the density and location of residential development; and
4. retaining a clear delineation and contrast between the district's rural areas and urban areas; and
5. recognising that primary production activities can produce noise, dust, odour and traffic that may be noticeable to residents and visitors to the General Rural Zone.

GRUZ-P7

Avoid reverse sensitivity effects on lawfully established primary production activities.

GRUZ-P8

Enable mineral extraction in the General Rural Zone to meet the District's and region's supply needs, including by recognising the need for mineral extraction to locate where the mineral resource exists, while:

1. managing the spatial extent and effects of mineral extraction activities in order to maintain the amenity values of sensitive activities and residential activities; and
2. internalising adverse environmental effects as far as practicable, including by using industry best practice and management plans; and
3. avoiding mineral extraction on highly productive land unless there is a functional or operational need to locate it on that land and the mineral extraction provides either:
    a. a significant national public benefit; or
    b. in the case of aggregate extraction, a significant national or regional public benefit.

GRUZ-P9

Ensure that mineral extraction sites are progressively rehabilitated to:

1. mitigate erosion and subsidence risks; and
2. reinstate the land so that it is suitable for an alternative permitted or consented activity.

3.4.1 Quarry Rehabilitation Plan Guidance, Christchurch City Council

The Quarry Rehabilitation Plan Guidance (2018) prepared by Christchurch City Council provides relevant guidance for the design and rehabilitation of quarries within the local context of the Canterbury Plains and sets out recommendations to ensure effective long-term rehabilitation and mitigation.

4.0 Proposal Description

The proposal is to establish and operate an aggregate quarry over a 60-year period near Burnham, Canterbury. The proposal facilitates a gradual process of extraction which will occur progressively across the 362 ha. Site. Throughout the life of the quarry this encompasses several phases of excavation and rehabilitation of approximately 23 - 30 hectares with a maximum area of 40-hectares being operational at any one time. Each phase will be undertaken over approximately five-years moving clockwise around the Site (**Figure 8**). Consequently, the existing landform will become substantially modified forming a localised depression or pit within the broad flat character of the Canterbury Plains.

The proposed quarry will require initial construction (Phase 1) and extraction (Phase 2) to enable the setup of the site access, offices, amenities, stockyard ramp, and processing area (**Figure 9**). Access to the quarry will be located from Aylesbury Road near the mid-point of the eastern boundary and will introduce a cluster of utilitarian buildings which are proposed to remain embedded within reinforced amenity planting along this edge of the Site. Signage displaying the name of the quarry (each approximately $2m^2$) will be located either side of the entrance and may be lit as the Site will be accessed at night. As extraction activity continues during Phase 2, the processing areas, stockyards and silt ponds, will be relocated below existing ground level and nearer the centre of the Site where they will remain for the life of the quarry.

After Phase 1 and 2 are completed (1 - 6 years), the remaining 12 phases will be carried out in approximately 5-year increments depending on demand. Each phase will occur gradually and progressively, commencing with extraction of aggregate followed by rehabilitation as proposed extraction moves onto the next phase. The depth of the resultant pit will vary depending on depth above the water table, with an approximate depth of up to 10 metres below the existing ground level. During extraction, the existing farming operation will continue to be accessed from Grange Road. Prior to Stage 6, the existing farm access from Grange Road will be reconfigured through the modified landform to allow continued access to ongoing farming activity in response to the proposed changes in levels (see **Figure 11**).

During the initial stages of work, a long-term bund will be constructed from the proposed Aylesbury Site access to a point approximately 1km to the south along the boundary (**Figure 10, Section A-A**). This will be planted in native vegetation and remain present throughout the life of the quarry, encompassed within a 24.5m setback from the road boundary. For the remainder of the Site (southern, western, and north-eastern boundary), a 3m high temporary topsoil stockpile will be constructed within a 17.5m setback along each new area of extraction as it progresses around the Site (**Figure 10, Section B-B**). These stockpile areas will be formed when works within each respective phase commences within 250 metres of the Site boundary. This topsoil material will be reused as part of rehabilitation upon the completion of each extraction phase. In addition to existing planting retained along the boundary of the Site, a setback of 100 metres from neighbouring dwellings in the south and south-east are also proposed. These areas will be retired from farming and planted with native vegetation similar to vegetation to be established in larger trees and shrubs (**Figure 11**).

During the rehabilitation of each phase, the base of the pit will be resurfaced with at least 400 mm of material, comprised of a minimum of 200mm of subsoil material topped with at least 200mm of topsoil and sown with grass seed. The slopes of the pit edge will be regraded and combined with additional onsite material to achieve batters with an average gradient of 1(v):2(h) (**Figure 10, Section B-B:** Grange Road rehabilitation) and allowing for local variation between 1:1 and 1(v):3(h) within which areas of planting established along the boundaries of the Site boundary will increase. This represents average planted buffers of 39.5 metres after rehabilitation adjoining the long-term bund along Aylesbury Road (**Section A-A**), and 32.5 metres after rehabilitation for the remainder of the Site (**Section B-B**).

To support integration of the proposed permanent change in landform within the broader flat to gently undulating Canterbury Plains, planted patches and corridors of approximately 30 hectares of native planting will also be established in association with extraction activity. Such planting includes 8 hectares of representative native planting forming patches within setbacks at the south-eastern corner of the Site and the central southern boundary of the Site. Batter slopes which enclose the perimeter of the quarry will also be planted with native vegetation alongside rehabilitation of the base of the pit to allow for grass or crops to re-establish as part of supporting ongoing rural land use.

5.0 Assessment of Effects

Landscape and visual impacts result from natural or induced change in the components, character or quality of the landscape. Usually these are the result of landform or vegetation modification or the introduction of new structures, facilities or activities. All these impacts are assessed to determine their effects on character and quality, amenity as well as on public and private views.

In this study, the assessment of potential effects is based on a combination of the landscape's sensitivity and visibility together with the nature and scale of the development proposal.

Particular effects considered relate to the following:

- *Landscape / rural character effects;*
- *Visual amenity effects from public and private locations;*
- *Potential cumulative effects; and*
- *Effects in relation to statutory provisions.*

5.1 Landscape Effects

5.1.1 Landscape Character Effects

Landscape character is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects particular combinations of geology, landform, soils, vegetation, land use and features of human settlement. It creates the unique sense of place defining different areas of the landscape.

During operation, the character of the Site will gradually change as existing areas of pastoral activity are progressively excavated then rehabilitated at a lower ground level within this broader established working rural context. Earthworks activity and the ongoing operation of large machinery will permanently modify the existing landform and expose areas of bare ground and aggregate within the Site to an extent which is atypical of the scale of normal day to day farming activity that currently prevails. As activity continues, this will create a locally defined depression excavated within the existing broader flat rural context which remains characteristic of the Canterbury Plains. The proposed development will also support ongoing agricultural activity both prior to extraction and following rehabilitation, albeit the latter occurring approximately 10 metres below existing ground level.

Physical landscape effects of the proposal on the Site will occur gradually over the life of the quarry rather than everywhere all at once. As aggregate is gradually excavated over the life of the quarry, earthworks will subsequently be required near the perimeter of the Site following each defined phase to form and rehabilitate permanent batter slopes which work to integrate the permitter of the quarry within its wider setting. These batters will be formed at an average gradient of 1(v):2(h) allowing for some local variation between 1:1 to 1(v):3(h) and to facilitate revegetation. The resultant batters will be revegetated with native plants representative of the Canterbury Plains ecological district and appropriate for the conditions within the Site, including the addition of fire-resistant species along edges.

After Phase 1, processing areas, such as stockyards and silt ponds will be relocated below the existing ground level (Phase 2) where they will remain throughout the life of the quarry. Locating such activity centrally within the Site will ensure this remains set back from the road and surrounding properties and therefore minimises the potential for more intensive industrial influences within the surrounding rural landscape. At the end of the Project, extracted areas including the processing areas will be rehabilitated back to a pastoral landscape, albeit at a lower elevation and surrounded by more extensive corridors of representative native vegetation.

Prior to and during operation, a permanent bund and temporary topsoil stockpiles of up to 3m in height will be constructed along the boundary of future extraction areas. These areas will be located within the Site beyond existing boundary vegetation which limits the extent to which these remain visible from beyond the Site. Whilst such elements are uncharacteristic of the inherent flat overall character of the surrounding plains, any potential longer-term effects of such elements will remain limited as stockpiled material is progressively used to support subsequent rehabilitation.

During the life of the Project, a mosaic of patches and corridors of native planting equating to approximately 30 hectares will also be established. Such planting includes a combined 8 hectares of native planting introduced at the south-eastern corner and central southern boundary of the Site forming local buffers introduced between the nearest adjoining dwellings. This will connect with additional native planting reintroduced along rehabilitated batter slopes which enclose the perimeter of the quarry and adjoins grass or crops as part of supporting ongoing rural land use at the base of the pit. As proposed planting becomes established and

farmland is rehabilitated, this will further soften and contain the raw worked appearance of operational areas within the Site and assist with assimilating the proposed changes in landform within the broader Canterbury Plains landscape. The extent of such planting also provides a relatively unique opportunity to restore indigenous habitat opportunities within this heavily modified aspect of the Canterbury Plains.

Based on the locally contained and progressive nature of the Project combined with proposed mitigation, effects on landscape character will initially be **moderate adverse** during Phases 1 to 3 and will gradually reduce as the project shifts across the Site and increasing areas of rehabilitation following extraction become established. During all phases of the operation, the proposed activity within the Site will remain relatively well enclosed within existing boundary vegetation. This high level of containment will be progressively reinforced with native vegetation introduced along rehabilitated batters which will gradually increase throughout the life of the quarry.

The proposed change in landform will be gradual over the life of the quarry rather than simultaneous and all at once. While the form of Site will gradually change, the landscape character and prevailing land use will be similar to the existing environment, with the Site predominantly remaining in productive rural land use prior to and following each phase of extraction. Once established, the Site will remain rural in character albeit in the context of a modified landform rehabilitated with substantial planting. This will enhance opportunities for biodiversity and ensure that any apparent change in character will remain well integrated into the broader landscape, resulting in no more than **low adverse** effects at completion.

5.2 Visual Effects

Visual amenity effects are influenced by a number of factors including the nature of the proposal, the landscape absorption capability and the character of the Site and the surrounding area. Visual amenity effects are also dependent on distance between the viewer and the proposal, the complexity of the intervening landscape and the nature of the view.

5.2.1 Effects from public vantage points

Views from public viewpoints are effectively contained to the immediate context surrounding the Site. This is largely due to the flat topography of the wider Canterbury Plains landscape combined with established shelterbelt planting enclosing the immediate boundaries. Given this context, public vantage points are limited to transient views along parts of Aylesbury Road and Grange Road where these adjoin the Site as well as longer distance partial views of shelterbelts established along the western boundary from Kivers Road.

During operation, views into the Site from Aylesbury Road to the east will be limited to filtered views through established shelter belts along the boundary of the Site. Prior to extraction, such screening will be reinforced by a long-term bund with additional native planting maintaining a longer-term screen, including a 100-metre width of planting in the south-eastern corner. During the initial phases of the project, transient glimpsed views of the Site entrance and temporary stockyard area will be available. As the project continues, such views will gradually reduce as stockyards are located below existing ground level and planting at the site entrance becomes established. Views of access and associated signage at the Aylesbury Road Site entrance will include bunding and native vegetation which reinforces biodiversity opportunities in the context of the Canterbury Plains and remains compatible with surrounding rural based activity. Adverse visual effects from public viewpoints on Aylesbury Road are therefore considered **low adverse**.

Views from Grange Road to the south of the Site will remain curtailed due to existing pine shelter belts which extend along the majority of the Site boundary and are retained throughout the life of the quarry. Beyond this, some more transient, long-distance views of above ground activity during Phases 1-3 may occur but will remain largely curtailed by internal shelter belt (SB26) when viewed through a gap in roadside planting. Such views will remain curtailed as temporary stockpiling and planting is introduced within this gap during Phase 5 and prior to beginning excavation in adjoining areas (**Figure 8**). On completion of Phases 5 and 6, these views will remain restricted as the proposed farm access is realigned and intervening planting becomes established (**Figure 11**). Adverse visual effects from public viewpoints on Grange Road are therefore considered **very low** until the implementation of the planting near the existing farm entry. On establishment of this planting, visual effects will become **neutral**.

Long-distance, glimpsed views of the Site are also available from Kivers Road to the west of the Site, through gaps in the existing shelter belt to be retained. Beyond this, any views into the Site will remain curtailed by the intervening shelter belt on the western boundary of the Site combined with planting on intervening private properties. Accordingly, any visual effects from public viewpoints on Kivers Road are considered **neutral** during extraction and on completion.

5.2.2 Effects from private vantage points

While no access was obtained to assess the project from private properties, an assessment of visual effects on nearby dwellings was undertaken during the Site visit from the nearest public vantage points, principally the intervening road. A desktop analysis was also undertaken to understand the proximity to the Site; the apparent orientation of the house and the nature of the view, including any existing or proposed vegetation that might provide full or partial screening of views. The assessment is based on observations from public roads and use of aerial photos and is summarised in detail within **Appendix 2** of this report.

Private viewpoints from dwellings typically have a higher sensitivity due to the fixed nature of the view and the established association residents may have within their surrounding landscape context. The dwellings within the vicinity of the Site are largely orientated to the north or north-west with views towards the Southern Alps. The private viewing audience associated with this development includes 51 private properties, and additional dwellings within the Burnham Military Camp base (as shown in **Figure 5** of the Graphic Supplement).

Private viewing audiences to the east of the Site include Houses 1 – 25, with House 1 being the closest property to the Site. These properties are largely orientated to the north-west towards the Southern Alps and clustered near the intersection of Grange Road, Two Chain Road, Aylesbury Road, and Sandy Knolls Road. Houses 1-2 and 4-7 are orientated towards the Site and are accessed from Aylesbury and Sandy Knolls Road. During Phase 1, glimpsed and transitory views of the construction of the long-term bund and planting within the 100-metre buffer to the south-eastern corner of the Site will be available. These views will however be largely curtailed by the existing shelter belt which extends along the eastern boundary of the Site. Upon the extraction of Phase 4 (at approximately 10 years) planting introduced during Phase 3 will also begin to establish. Views of processing areas and ongoing extraction activity will therefore be concealed by an established pine shelter belt, the long-term bund to the north and a 100-metre planted setback from the Site boundary in the south-eastern corner of the Site. Visual effects from private properties to the east of the Site will therefore be no greater than **very low adverse**.

Houses 26-37 are located to the south of the Site and are predominantly accessed from Grange Road and Two Chain Road. These dwellings are located on larger lifestyle properties and are predominantly orientated to the north-west towards the Southern Alps. Houses 26-31 and 34

are orientated towards the Site, with the closest dwelling within this viewing catchment being House 27 which is located opposite the existing main entrance into the Site beyond intervening shelter planting established to the south of Grange Road. Views of the Project from dwellings in this area will remain truncated or completely curtailed by intervening vegetation. This includes the existing shelter belt along the southern boundary of the Site which will be retained and reinforced by internal planting surrounding the existing Site entrance and extended along the tops of rehabilitated batters. Once implemented, this planting will continue to establish throughout the life of the quarry to maintain an effective visual screen. Given this high level of visual containment, any adverse visual effects are considered no greater than **very low**.

Houses 38 to 46 are located to the west of the Site and are accessed from Kivers Road. These properties are also larger lifestyle properties and orientated to the north-west towards the Southern Alps and away from the Site. Visual effects of the proposal on properties to the west of the Site are no greater than **very low adverse** as activities will remain largely contained beyond the existing boundary vegetation. During the extraction of Phases 7 to 11 there will be glimpsed, transitory views through the existing shelter belt of machinery operating within the quarry. These will be curtailed by the construction of a temporary stockpiling and final rehabilitation of the battered slope with native vegetation following the extraction of these phases.

North of the Site are Houses 47-51. These properties are accessed from Wards Road and are closest to the final stages of extraction (Phases 11-14). These properties are also orientated to the north, away from the Site. Visual effects of the proposal on these dwellings are **neutral**. This is due to views from these properties being curtailed by the intervening shelter planting, orientation of the dwellings, and intervening vegetation within the wider landscape.

Burnham Military Camp to the south of the Site contains a mixture of civilian housing and army barracks. The camp is orientated to the north-west, parallel to State Highway 1, and towards the Southern Alps. Visual effects of the proposal on the Burnham Military Camp are considered **neutral**. Views towards the Site are already curtailed by intervening vegetation within the wider landscape and the exotic shelter belt on the Site boundary.

5.2.3 Summary of Visual Effects

Visual effects of the proposed quarry will be no greater than **low adverse** from public viewpoints, and **very low adverse** from private viewpoints. Views of the Site from public viewpoints will be largely curtailed by the existing pine shelter belt which extends along all boundaries of the Site and the existing and proposed entrances to the Site along Grange and Aylesbury Roads.

As the proposed long term bund, temporary stockpiles, and areas of planting are established prior to extraction and following rehabilitation of each phase, visual effects from public and private viewpoints will remain effectively mitigated. It is also recognised that as the extraction of each phase occurs the majority of activity will be occurring up to some 10 metres below the existing ground level in addition to the proposed reinforced planting along the Site boundary. The greatest visual effect will be from public viewpoints at the Site entrance along Aylesbury Road at the commencement of the project, albeit becoming increasingly screened by planting and the relocation of processing areas to the floor of the quarry as work continues.

Views from private viewpoints will largely remain unchanged and will be truncated or entirely curtailed by the existing shelter belt planting, the long-term bund and intervening areas of planting including additional native vegetation introduced along the tops of rehabilitated slopes of the quarry.

5.3 Effects in relation to Statutory Provisions

The Site is located within the Outer Plains Zone of the Operative Selwyn District Plan (**Figure 6**) and the General Rural Zone of the Partially Operative Selwyn District Plan (Decisions Version) (**Figure 7**). Both zones allow for rural activity while balancing the need for maintaining rural character. The Site is not classified as highly productive land.

The Site is not located within or near any Outstanding Natural Landscape, nor any other landscape overlays within the Operative or Partially Operative Selwyn District Plan. The Site is also not located within an identified Urban Growth Overlay associated with intensifying and developing new urban areas adjacent to existing townships (**Figure 7**). Therefore, any potential for reverse sensitivity effects on proposed urban development is very low.

As discussed in Section 5.1.1 above, the Site is characterised by an existing dairy farm and has a flat to gradually sloping topography towards the south-eastern corner of the Site.

Effects on rural character will continually change throughout the life of the quarry as each phase is excavated, exposing bare ground which is subsequently rehabilitated back to a rural land use at a lower elevation. While the existing rural character of the Site will be adversely affected by the proposal, the effects will be progressive and remain relatively well contained. Outside of areas undergoing quarrying activity, the Site will continue to operate as a dairy farm (or another rural farming use depending on future demand). Effects on rural character are also reduced by the rehabilitation of each previous phase during the extraction of the next phase, minimising potential for any longer-term or cumulative adverse effects on rural character.

On completion, the Site will remain part of a broader working rural landscape, with the key landscape changes being the planted batter slopes which follow the perimeter of the Site and ecological benefits of resultant native vegetation and associated enhanced opportunities for biodiversity.

6.0 Recommendations

In accordance with the landscape and visual assessment set out above, the following landscape mitigation measures are recommended to be included via consent conditions:

1. Prior to development commencing, prepare a landscape plan in accordance with the landscape strategy submitted with the application to identify the following:
    a. Existing shelterbelts to be retained along site boundaries to ensure an effective long-term screen. This shall also identify any areas of infill planting where necessary and include measures to ensure its ongoing screening benefit is maximised;
    b. Areas, species, and density of planting to establish the long-term bund, planting blocks in the south-east corner and southern boundary of the site, and rehabilitated batter slopes in accordance with the Low Plains Ecological District;
    c. Measures to reduce the risk of fire, including through the use of low flammability species along the edge of the Site;

d. Areas, species, and density of planting associated with the Aylesbury Road Site entrance to enhance the amenity values and soften and assimilate built form during Phase 1.

In addition to an overall landscape plan, to address rehabilitation areas and necessary screening from surrounding areas, staged rehabilitation plans should be prepared to provide certainty or rehabilitation implemented following extraction activity. These plans should provide sufficient flexibility to enable suitable future end uses, once known, whilst facilitating measures to ensure the health and longevity of proposed native vegetation incorporated within the Site. Plant trials and environmental monitoring including ecological input where necessary should also form an integral component of rehabilitation works so that planting and ongoing management is optimised throughout the lifetime of the operation. Landscape consent conditions should address the following:

2. A detailed landscape rehabilitation management plan should be prepared for each stage of extraction activity and prior to commencing each subsequent phase in accordance with the overall landscape strategy. Such plans shall ensure extraction facilitates a progressive staged rehabilitation process. Each plan shall identify the following:

    a. The final form of batters proposed to accommodate revegetation (average 1:2 slope), to assimilate changes in level within the Site through revegetation and ensure proposed revegetation will thrive;

    b. The final volumes of subsoil and topsoil required to rehabilitate batters and facilitate ongoing rural land use;

    c. Plant establishment and maintenance, including the following specifications:

        i. establish a minimum 200mm depth of topsoil supporting successful establishment of all planted areas;

        ii. The specifications and schedules of planting;

        iii. Means to ensure plants will be irrigated for at least two years after planting until established; and

        iv. Pest protection to include the installation of combi-guards and/or predator proof fencing around areas of new planting for two years after establishment and ongoing means of monitoring plant success including pest eradication as necessary.

7.0 Conclusion

The proposed aggregate quarry near Burnham in Canterbury will have relatively internalised effects on landscape and visual amenity. The quarry design ensures the effects of the proposal will be gradual and adverse effects will be addressed progressively over the life of the quarry, including the sequential extraction and rehabilitation of each phase. Whilst the landscape associated with the Site will change, the Project will remain relatively well contained within both existing boundary vegetation and reinforced native planting which also works to integrate the resultant change in landform within the wider landscape during rehabilitation. This outcome

works to minimise landscape impacts during operation and contributes to maintaining and enhancing the character and quality of the surrounding landscape in the longer term.

The key landscape features which contribute to the character of the Site and wider landscape values include the gently sloping topography of the remnant braided riverbed, linear shelter planting, and expansive areas of pasture facilitating productive rural land use. In this context, landscape effects are considered **moderate adverse** during the initial phases of extraction and will reduce to **low adverse** as rehabilitation continues following each phase. The progressive staging of extraction and the contribution of more substantial areas of native planting will ensure the magnitude of such impacts will be effectively managed and gradually reduce. While the landform within the Site will permanently change, the landscape will largely retain a rural character during operation and remain well integrated into the surrounding landscape at completion.

Visual amenity effects of the proposal are limited to **low adverse** from public viewpoints and **very low adverse** from private viewpoints. While glimpsed views will be available from the existing main entrance, proposed entrance, and in glimpses through established shelter belt planting, these views will become increasingly curtailed by the combination of localised areas of bunding and more substantial intervening vegetation introduced within the Site boundary as part of the progressive and ongoing proposed rehabilitation. The majority of quarrying activity will continue up to approximately 10 metres below ground level, further limiting adverse effects on visual amenity within surrounding areas.

Overall, the Project will respond well to its enclosed working rural environment and remain well integrated within the Canterbury Plains landscape.

8.0 References

Boffa Miskell Ltd. (2010). *Canterbury regional landscape study review: Final report* (Report No. C08016). Prepared by Boffa Miskell Ltd for Environment Canterbury.

Boffa Miskell Ltd. (2018). *Selwyn District Landscape Study: Landscape Characterisation and Evaluation.* (Report No. C15143F) Prepared by Boffa Miskell Ltd for Environment Canterbury.

Christchurch City Council. (2018). *Quarry Rehabilitation Plan Guidance*. Prepared by Christchurch City Council.

Appendix 1: Method Statement

This assessment method statement is consistent with the methodology (high-level system of concepts, principles, and approaches) of 'Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines', Tuia Pito Ora New Zealand Institute of Landscape Architects, July 2022. The assessment provides separate chapters to discuss landscape, visual and natural character effects where relevant, but is referred to throughout as a Landscape Effects Assessment in accordance with these Guidelines. Specifically, the assessment of effects has examined the following:

- *The existing landscape;*
- *The nature of effect;*
- *The level of effect; and*
- *The significance of effect.*

The Existing Landscape

The first step of assessment entails examining the existing landscape in which potential effects may occur. This aspect of the assessment describes and interprets the specific landscape character and values which may be impacted by the proposal alongside its natural character where relevant as set out further below. The existing landscape is assessed at a scale(s) commensurate with the potential nature of effects. It includes an understanding of the visual catchment and viewing audience relating to the proposal including key representative public views. This aspect of the assessment entails both desk-top review (including drawing upon area-based landscape assessments where available) and field work/site surveys to examine and describe the specific factors and interplay of relevant attributes or dimensions, as follows:

Physical –relevant natural and human features and processes;

Perceptual –direct human sensory experience and its broader interpretation; and

Associative – intangible meanings and associations that influence how places are perceived.

Engagement with tāngata whenua

As part of the analysis of the existing landscape, the assessment should seek to identify relevant mana whenua values (where possible) and describe the nature and extent of any engagement, informing an understanding of the existing landscape from a Te Ao Māori perspective.

Statutory and Non-Statutory Provisions

The relevant provisions facilitating change also influence the consequent nature and level of effects. Relevant provisions encompass objectives and policies drawn from a broader analysis of the statutory context and which may anticipate change and certain outcomes for identified landscape values.

The Nature of Effect

The nature of effect assesses the outcome of the proposal within the landscape. The nature of effect is considered in terms of whether effects are positive (beneficial) or negative (adverse) in the context within which they occur. Neutral effects may also occur where landscape or visual change is benign.

It should be emphasised that a change in a landscape (or view of a landscape) does not, of itself, necessarily constitute an adverse landscape effect. Landscapes are dynamic and are constantly changing in both subtle and more dramatic transformational ways; these changes are both natural and human induced. What is important when assessing and managing landscape change is that adverse effects are avoided or sufficiently mitigated to ameliorate adverse effects. The aim is to maintain or enhance the environment through appropriate design outcomes, recognising that both the nature and level of effects may change over time.

The Level of Effect

Where the nature of effect is assessed as **'adverse'**, the assessment quantifies the level (degree or magnitude) of adverse effect. Assessing the level of effect entails professional judgement based on expertise and experience provided with explanations and reasons. The identified level of adverse natural character, landscape and visual effects adopts a universal seven-point scale from **very low** to **very high** consistent with Te Tangi a te Manu Guidelines and reproduced below.



Landscape Effects

A landscape effect is an outcome for a landscape value. In essence, this takes account of the proposed change to a landscape's character and values (as identified across relevant landscape dimensions) and in the context of what change can be anticipated in that landscape as a result of relevant zoning and policy. The level of effect can also be influenced by the size or spatial scale, geographical extent, duration and reversibility of landscape effects within the specific context in which they occur.

Visual Effects

Visual effects are a subset of landscape effects. They are consequence of changes to landscape values as experienced in views. To assess where visual effects of the proposal may occur requires an identification of the area where it may be visible and the specific viewing audience(s) affected. Visual effects are assessed with respect to landscape character and values. This can be influenced by several factors such as distance, orientation of the view, duration, extent of view occupied, screening, backdrop etc. as well as potential change that could be anticipated in the view as a result of zone / policy provisions of relevant plans.

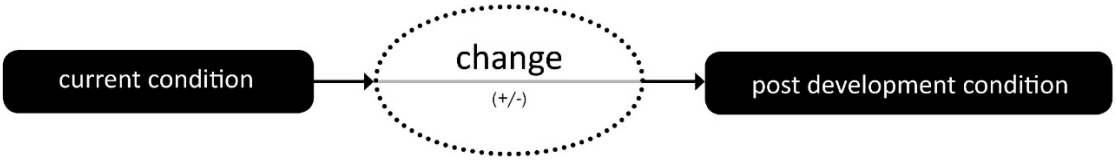
Natural Character Effects

Natural Character, under the RMA, specifically concerns *'the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development'*. Therefore, the assessment of natural character effects involves examining the proposed changes to natural elements, patterns and process which may occur in relevant landscape / seascape contexts only.

As with assessing landscape effects, the first step when assessing natural character effects involves identifying the relevant physical and experiential characteristics and qualities which occur and may be affected by a proposal at a commensurate scale. This can be supported through the input of technical disciplines such as geomorphology and marine, aquatic, and terrestrial ecology as well as input from tāngata whenua. Through this assessment, natural character also considers the level of naturalness and essentially reflects the current condition of the environment assessed in relation to the universal seven-point scale. A higher level of naturalness means the waterbody and/or margin is less modified and vice versa.

A natural character effect can be conceived of as a change to the current condition of parts of the environment where natural character occurs. Change can be negative or positive. The resultant level of natural character effects is influenced by the existing level of naturalness within which change is proposed; a greater level of effect will generally occur when the proposal reduces the naturalness of a less modified environment. In short, the process of assessing natural character effects can be summarised as follows:

- Identify the characteristics and qualities which contribute to natural character within a relevant context and defined spatial scale(s), including the existing level of naturalness;
- Describe the changes to identified characteristics and qualities and the consequent level of natural character anticipated (post construction); and
- Determine the overall level of effect based on the consequence of change.



The Significance of Effects

Assessing the significance of effects may be required in certain RMA situations. To support transparency in such circumstances, the assessment may qualify where the level of effect falls in terms of being 'minor'[4] or 'significant'[5]. This assessment has adopted the following scale applied to relevant RMA circumstances[6], acknowledging low and very low adverse effects generally equate to 'less than minor'.



[4] Whether the adverse effect on a person is less than minor (RMA, 95E); whether the adverse effect on the environment is no more than minor (RMA, 95D); or when assessing a non-complying activity whether the adverse effects of the activity on the environment will be 'minor' (RMA, 104D).

[5] Triggering requirement to consider: alternative sites, routes, and methods for Notices of Requirement (RMA s171(1)(b)), alternatives in AEEs (RMA s6(1)(a) of the 4th Schedule); or effects on natural features and landscapes within the coastal environment to be avoided (New Zealand Coastal Policy Statement (NZCPS) Policy 13 (1)(b) and 15(b)).

[6] Seven-point level of effect scale. Source: Te tangi a te Manu, Pg. 151

Appendix 2: Summary Table of the Nature and Level of Visual Effects

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
1	168 Aylesbury Road, Burnham	33	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Adverse	Very Low	Neutral	Views of the Site will be glimpsed and transient through the existing exotic shelter belt during the construction of the long-term bund and planting of the south-eastern block during Phase 1. The long-term bund, and 120 metre setback of established planting will curtail any views of the Phase 3 extraction activity. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
2	61 Sandy Knolls Road, Burnham	305	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.

[7] Locations where Proposed Development is Visible

[8] Extent of visibility: Full, Partial, Small Amount, Negligible

[9] Orientation of Views: Frontal, Oblique, Rear

[10] Significance of Effects: Very Low, Low, Moderate-Low, Moderate, Moderate-High, High, Very High

[11] Nature of Effect: Adverse, Neutral, Beneficial

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
3	43 Sandy Knolls Road, Burnham	235	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
4	41 Sandy Knolls Road, Burnham	220	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
5	35 Sandy Knolls Road, Burnham	180	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
6	27 Sandy Knolls Road, Burnham	160	Proposed planting to the south of the Site.	Negligible	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
											term bund and planted 120 metre setback. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
7	146 Aylesbury Road, Burnham	65	Proposed planting to the south of the Site.	Negligible	Frontal / Oblique	Fixed	Very Low	Adverse	Very Low	Neutral	Views of the Site will be glimpsed and transient through the existing exotic shelter belt during the construction of the long-term bund and planting of the south-eastern block during Phase 1. The long-term bund, and 120 metre setback of established planting will curtail any views of the Phase 3 extraction activity. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
8	68 Sandy Knolls Road, Burnham	430	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
9	49 Kerrs Road, Burnham	560	Proposed planting to the south of the Site.	Negligible	Rear/ Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
10	47 Kerrs Road, Burnham	445	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
11	37 Kerrs Road, Burnham	370	Proposed planting to	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form,

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
			the south of the Site.								vegetation, and the shelter belt on the Site boundary.
12	25 Kerrs Road, Burnham	230	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
13	7 Kerrs Road, Burnham	165	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback.
14	104 Kerrs Road, Burnham	1000	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
15	82 Kerrs Road, Burnham	800	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
16	46 Kerrs Road, Burnham	475	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
17	40 Kerrs Road, Burnham	395	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
18	522 Two Chain Road, Burnham	285	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
19	534 Two Chain Road, Burnham	175	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be truncated by the existing exotic shelter belt and intervening vegetation within the wider context. Any glimpsed views into the Site will be mitigated during Phase 1 on establishment of the long-term bund and planted 120 metre setback. As proposed planting

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
											becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
20	514 Two Chain Road, Burnham	410	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
21	500 Two Chain Road, Burnham	460	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
22	486 Two Chain Road, Burnham	675	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
23	478 Two Chain Road, Burnham	730	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
24	476 Two Chain Road, Burnham	790	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
25	462 Two Chain Road, Burnham	940	Proposed planting to the south of the Site.	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the Site boundary.
26	139 Grange Road, Burnham	215	Phase 4 -6	Small Amount	Frontal	Fixed	Very Low	Adverse	Very Low	Neutral	Views of the Site will be largely truncated by intervening vegetation within the wider landscape and the existing exotic shelter belt on the southern boundary of the Site. Any glimpsed views into the Site during Phases 1-3 will be further curtailed by intervening internal shelterbelts. As quarrying activity extends along the southern boundary of the Site during Phase 4-7 temporary stockpiles and southern block of planting (Grange Road Entrance) may be visible through gaps in intervening

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
											vegetation. Following rehabilitation and the introduction of further proposed planting along the tops of resultant batter slopes, glimpsed views of native vegetation may be visible above the intervening shelter belt from this property.
27	159 Grange Road, Burnham	85	Phase 4 -6	Small Amount	Frontal	Fixed	Very Low	Adverse	Very Low	Neutral	Views of the Site will be largely truncated by intervening vegetation within the wider landscape and the existing exotic shelter belt on the southern boundary of the Site. Any glimpsed views into the Site during Phases 1-3 will be further curtailed by intervening internal shelterbelts. As quarrying activity extends along the southern boundary of the Site during Phase 4-7 temporary stockpiles and southern block of planting (Grange Road Entrance) may be visible through gaps in intervening vegetation. As proposed planting becomes established, glimpsed views of native vegetation may be visible above the shelter belt from this property.
28	181 Grange Road, Burnham	150	Phase 5-7	Small Amount	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be largely truncated by intervening vegetation within the wider landscape and the existing exotic shelter belt on the southern boundary of the Site. Any glimpsed views into the Site during Phases 1-3 will be further curtailed by internal shelterbelts. As quarrying activity extends along the southern boundary of the Site during Phase 4-7 temporary stockpiles and southern block of planting (Grange Road Entrance) may be visible through gaps in intervening vegetation. As proposed planting becomes established, glimpsed views of native

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
											vegetation may be visible above the shelter belt from this property.
29	179 Grange Road, Burnham	400	Phase 5-7	Negligible	Frontal	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
30	177 Grange Road, Burnham	505	Phase 5-7	Negligible	Frontal	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
31	162 Burdons Road, Burnham	1300	Phase 4 -6	Negligible	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
32	808 Two Chain Road, Burnham	855	Phase 6 & 7	Negligible	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
33	816 Two Chain Road, Burnham	940	Phase 6 & 7	Negligible	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
34	259 Grange Road, Burnham	480	Phase 6 & 7	Negligible	Frontal	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the southern boundary of the Site.
35	273 Grange Road, Burnham	325	Phase 6 & 7	Negligible	Frontal	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the southern boundary of the Site.
36	860 Two Chain Road, Burnham	975	Phase 6 & 7	Negligible	Frontal	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
37	908 Two Chain Road, Burnham	1100	Phase 6 & 7	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.
38	42 Kivers Road, Burnham	1000	Phase 7 & 8	Negligible	Oblique	Fixed	Very Low	Adverse	Very Low	Neutral	Long distance, glimpsed views through the existing exotic shelter belt will be available into the Site prior to the extraction of Phase 7.

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
											These views will be curtailed by the proposed temporary stockpiles to be constructed prior to extraction of Phase 7, and long-term proposal to plant a native strip parallel to the Site boundary.
39	126 Kivers Road, Burnham	960	Phase 8	Negligible	Rear / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western of the Site.
40	121 Kivers Road, Burnham	1300	Phase 8	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the western boundary of the Site.
41	176 Kivers Road, Burnham	415	Phase 8	Negligible	Rear / Oblique	Fixed	Very Low	Adverse	Very Low	Neutral	Middle distance, glimpsed views will be available through the existing exotic shelter belt on the western boundary of the Site prior to the extraction of Phases 7 and 8. These views will become curtailed upon the establishment of the temporary stockpiles prior to the extraction of Phases 7 and 8, and long term proposal to plant a native strip parallel to the Site boundary.
42	164 Kivers Road, Burnham	1100	Phase 8	Negligible	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the western boundary of the Site.
43	151 Kivers Road, Burnham	1300	Phase 8	Negligible	Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the western boundary of the Site.
44	171 Kivers Road, Burnham	1150	Phase 8	Negligible	Rear / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the western boundary of the Site.
45	216 Kivers Road, Burnham	470	Phases 8 - 10	Negligible	Frontal / Oblique	Fixed	Very Low	Adverse	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western boundary of the Site.

House Number	Viewing Audience	Minimum Distance to Views (approx. metres)	Area Proposed Development is Visible[7]	Extent of visibility[8]	Orientation of Views[9]	Transient / Fixed	During Construction		Completion		Notes
							Level of Visual Effect[10]	Nature of Effect[11]	Level of Visual Effect	Nature of Effect	
46	228 Kivers Road, Burnham	920	Phases 8 - 11	Negligible	Frontal / Oblique	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the western boundary of the Site.
47	718 Wards Road, Burnham	1345	Phases 11 & 12	Negligible	Rear	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western boundary of the Site.
48	716 Wards Road, Burnham	1100	Phases 11 & 12	Negligible	Rear	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western boundary of the Site.
49	578 Wards Road, Burnham	1150	Phases 11-14	Negligible	Rear	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western boundary of the Site.
50	536 Wards Road, Burnham	1450	Phases 11-14	Negligible	Rear	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western boundary of the Site.
51	515 Wards Road, Burnham	1465	Phases 11-14	Negligible	Rear	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening vegetation, and the shelter belt on the western boundary of the Site.
n/a	Burnham Military Camp	540	Phases 11-14	Negligible	Frontal	Fixed	Very Low	Neutral	Very Low	Neutral	Views of the Site will be curtailed entirely by intervening built form, vegetation, and the shelter belt on the southern boundary of the Site.

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Whangarei, Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin, and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

Boffa Miskell

BURNHAM QUARRY

LANDSCAPE AND VISUAL ASSESSMENT GRAPHIC SUPPLEMENT

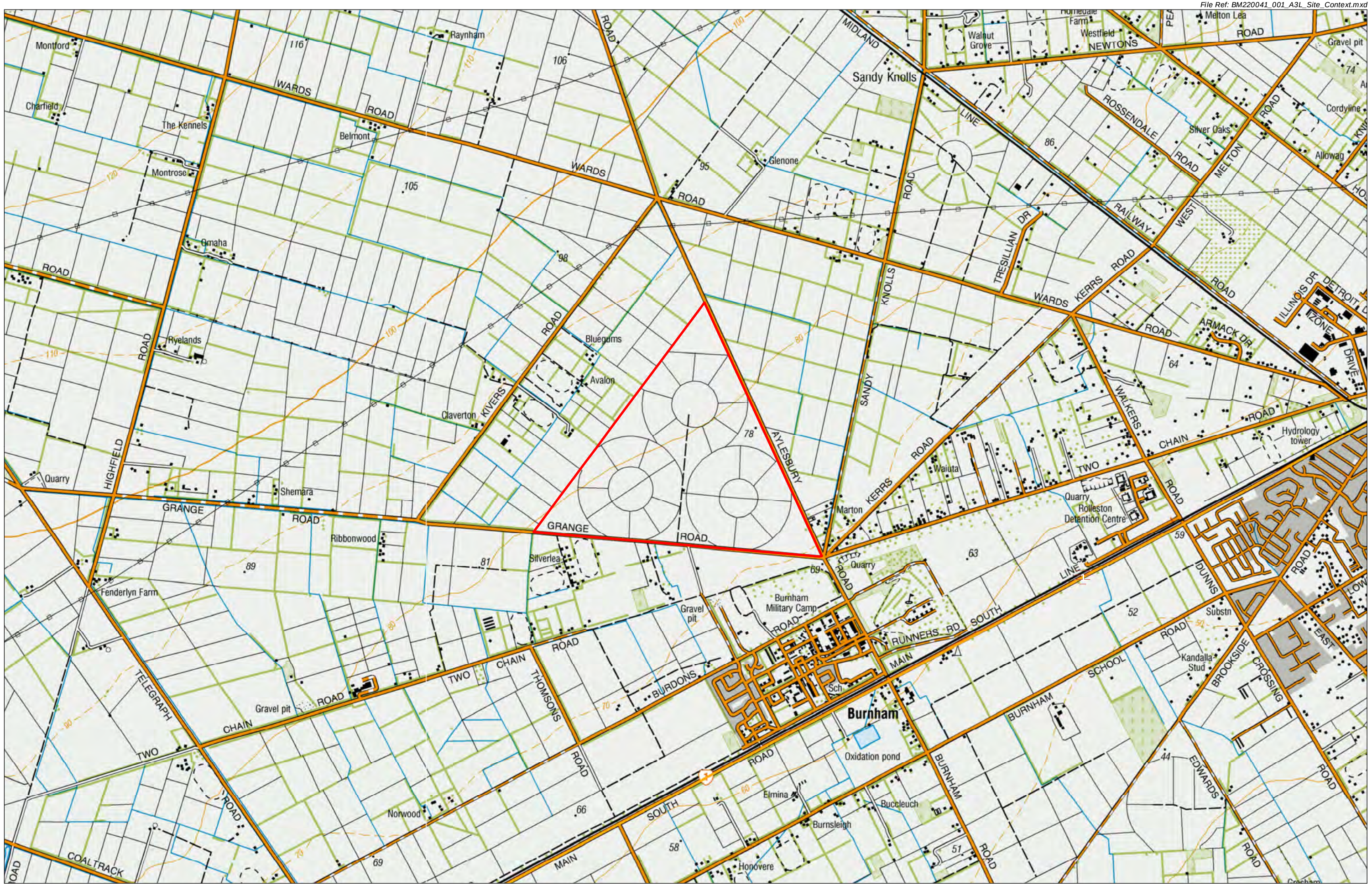
21 August 2023





CONTENTS

FIGURE 1: Site Context	1
FIGURE 2: Landscape Context	2
FIGURE 3: Elevation	3
FIGURE 4: Site Appraisal	4
FIGURE 5: Visual Appraisal	5
FIGURE 6: Operative District Plan Zoning	6
FIGURE 7: Partially Operative Selwyn District Plan (Decisions Version) Zoning	7
Site Appraisal Photographs A - B	8
Site Appraisal Photographs C - D	9
Site Appraisal Photographs E - F	10
Site Context Photographs 1 - 2	11
Site Context Photographs 3 - 4	12
Site Context Photographs 5 - 6	13
FIGURE 8a: Quarry Staging	14
FIGURE 8b: Quarry Staging	15
FIGURE 9: Quarry Entrance and Proposed Plant Palette	16
FIGURE 10: Landscape Strategy	17
FIGURE 11: Grange Road Farm Access	18



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 1,000 m

1:35,000 @ A3

Data Sources: LINZ Data Service, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

State Highway

Site Boundary

BURNHAM QUARRY

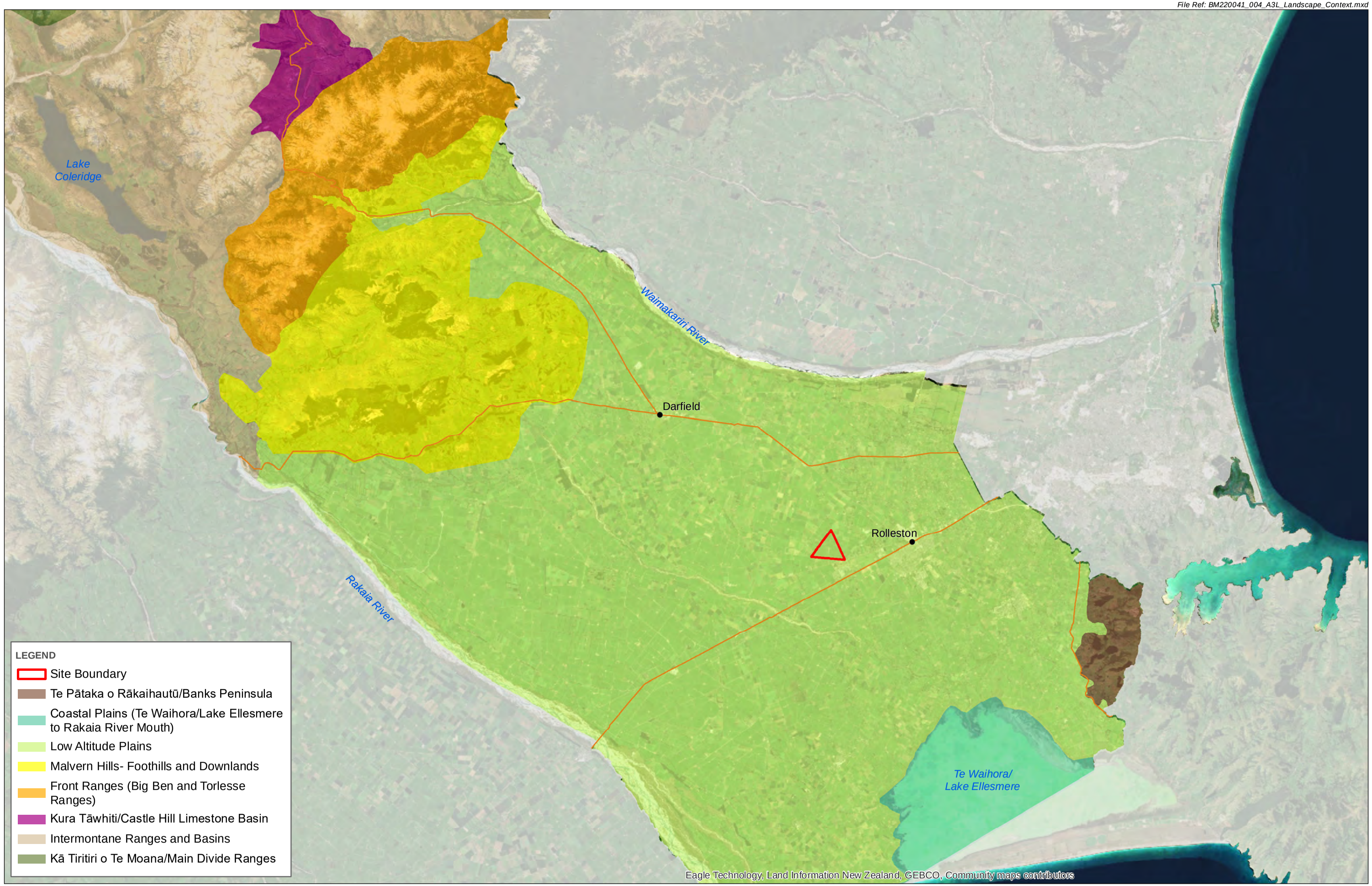
Site Context

Date: May 2022 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 1



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 10 km

1:300,000 @ A3

Data Sources: LINZ Data Service, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

BURNHAM QUARRY

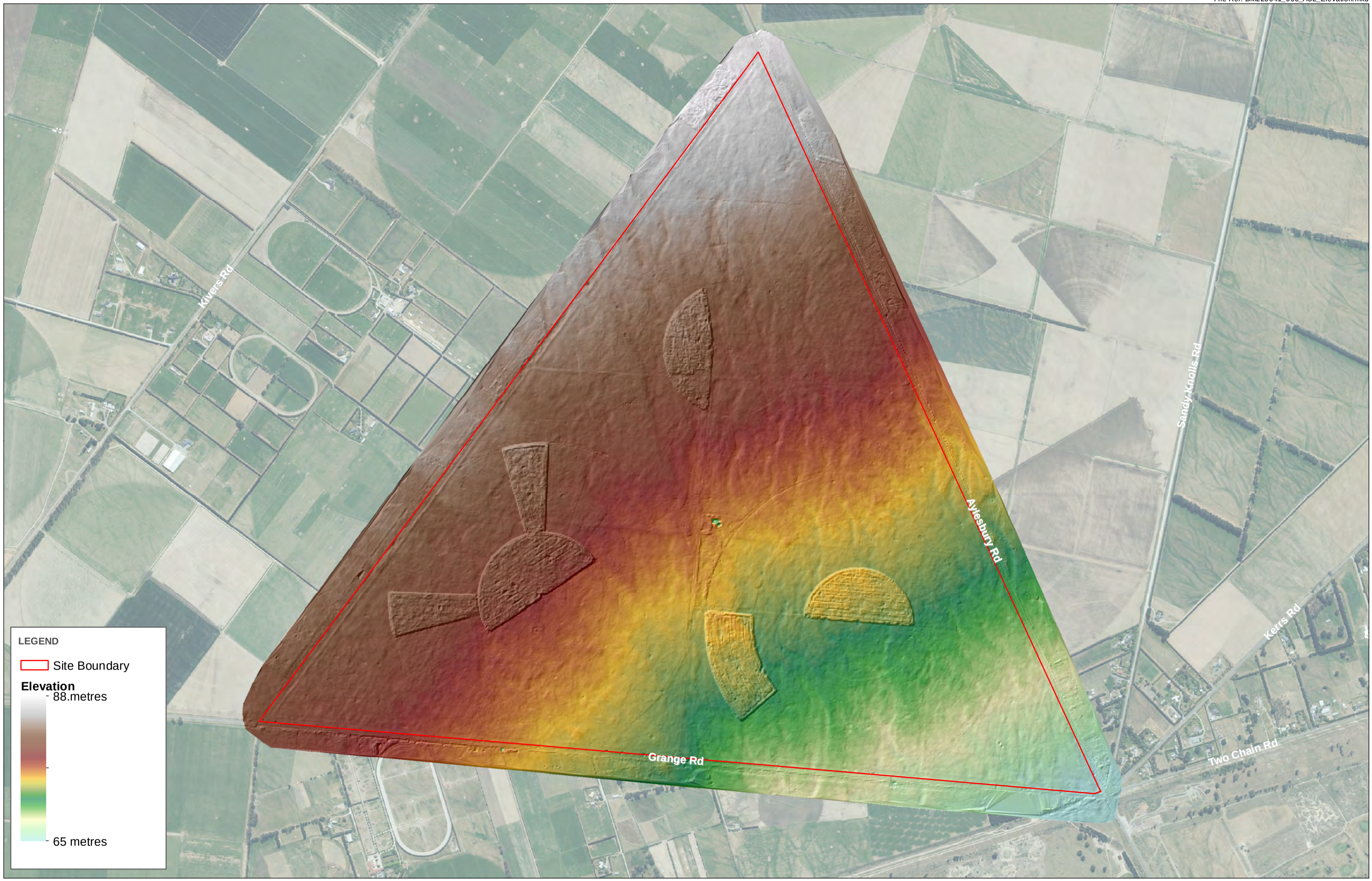
Landscape Context

Date: September 2022 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 2



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 500 m

1:12,000 @ A3

Data Sources: LINZ Data Service, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

Note: Digital Elevation Model obtained using UAV includes vegetation within the Site up to 300mm (e.g. kale crops).

BURNHAM QUARRY

Elevation

Date: 15 December 2022 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 3



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 500 m

1:12,000 @ A3

Data Sources: LINZ Data Service, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Site Boundary
- Site Appraisal Photographs A - F
- Shelter Belt (SB) 1 - 28
- Tree Group (TG) 1 & 2

BURNHAM QUARRY

Site Appraisal

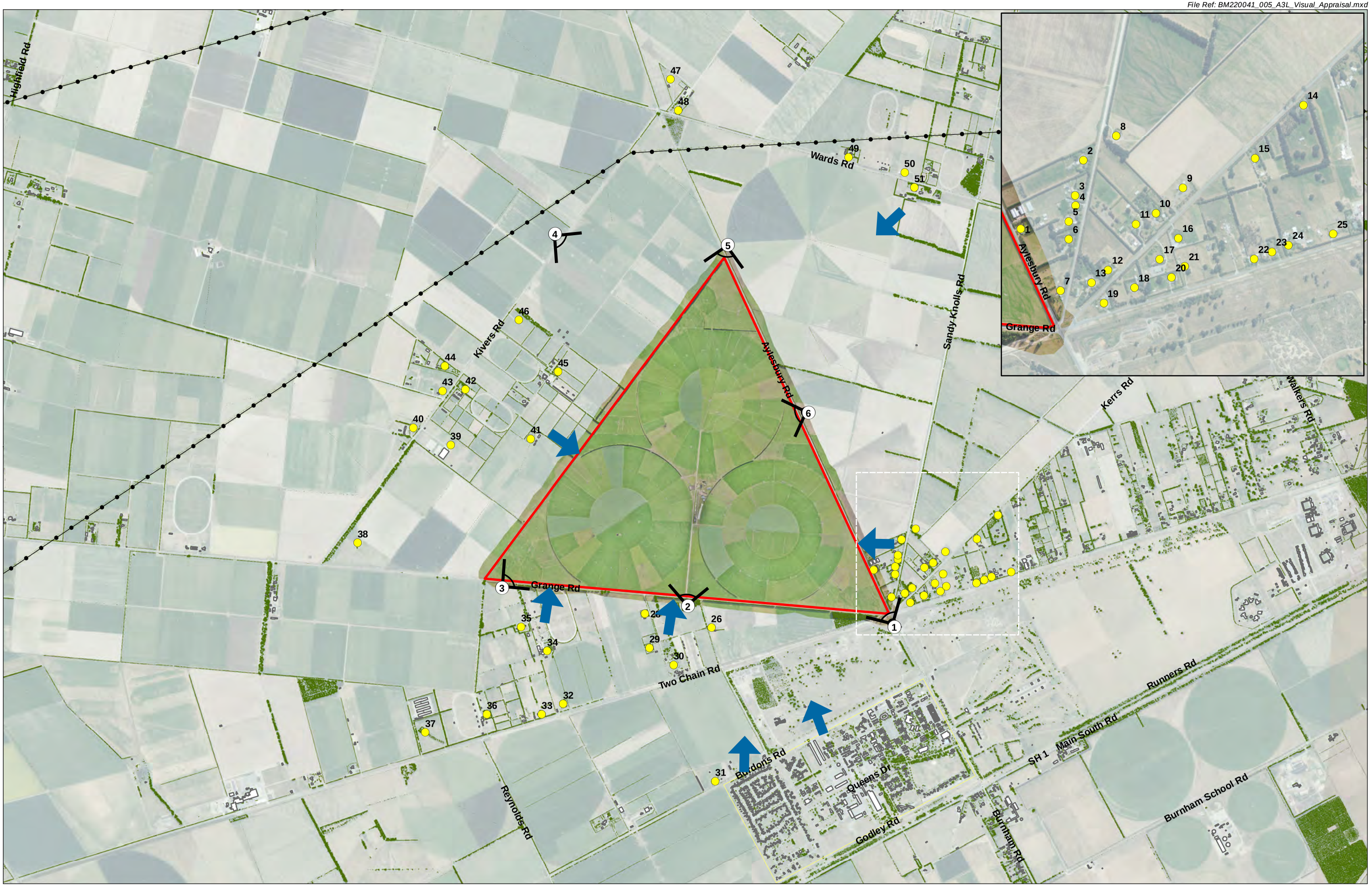
Date: 14 June 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 4

File Ref: BM220041_005_A3L_Visual_Appraisal.mxd



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 1,000 m

1:25,000 @ A3

Data Sources: LINZ Data Service, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Site Boundary
- Houses 1 - 51
- Burnham Military Camp
- Buildings
- Transmission Lines
- Vegetation (> 3m)
- Open View
- Partial View
- Truncated/No View

BURNHAM QUARRY

Visual Appraisal

Date: 08 February 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 5

LEGEND
- Site Boundary
- Designation

District Plan Zone
- Business 2
- Business 2A
- Inner Plains
- Outer Plains
- Living 1
- Living 1B
- Living 1C
- Living 2
- Living 3
- Living Z

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 1,000 m

1:35,000 @ A3

Data Sources: LINZ Data Service, Selwyn District Council, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

BURNHAM QUARRY

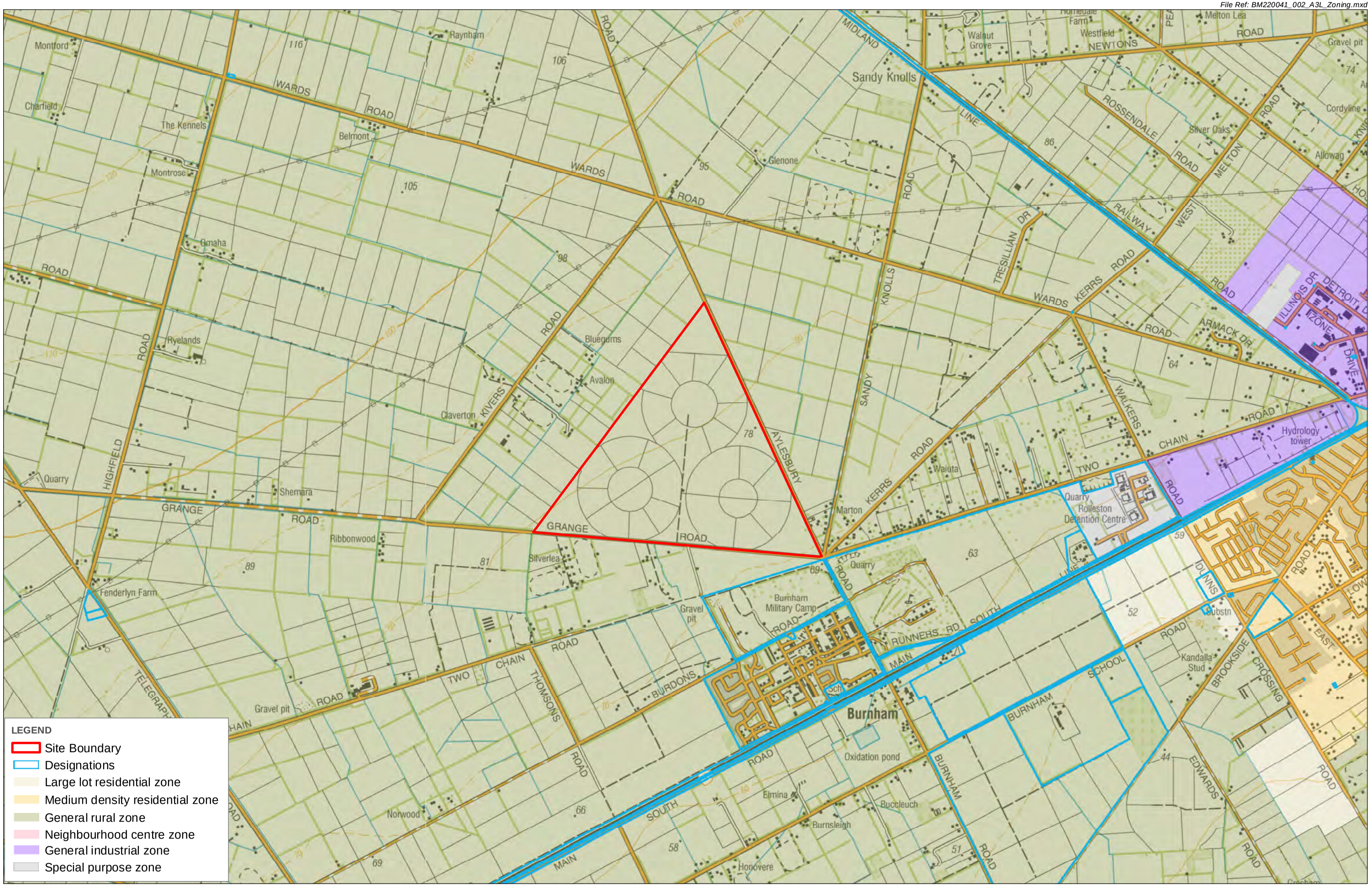
Operative Selwyn District Plan Zoning

Date: May 2022 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 6



Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 1,000 m

1:35,000 @ A3

Data Sources: LINZ Data Service, Selwyn District Council, and Eagle Technologies

Projection: NZGD 2000 New Zealand Transverse Mercator

BURNHAM QUARRY

Partially Operative Selwyn District Plan (Decisions Version) Zoning

Date: 21 August 2023 | Revision: 1

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 7



Site Appraisal Photograph A: View from the centre of the Site near the existing farm base looking north. This photograph demonstrates the existing structures within the Site including shipping containers, silos, and pivot irrigators.



Site Appraisal Photograph B: View from the main access road looking north-east towards the main farm base, and pivot shelter planting.

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Viewpoint Details

Horizontal Field of View	: 90°
Vertical Field of View	: 30°
Projection	: Rectilinear
Image Reading Distance @ A3 is	20 cm

BURNHAM QUARRY

Site Appraisal Photographs A & B

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi



Site Appraisal Photograph C: View looking south-east towards the western centre pivot from the western boundary of the Site.



Site Appraisal Photograph D: View from the northern corner of the Site looking south.

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Viewpoint Details

Horizontal Field of View	: 90°
Vertical Field of View	: 30°
Projection	: Rectilinear
Image Reading Distance @ A3 is 20 cm	

BURNHAM QUARRY

Site Appraisal Photographs C & D

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi



Site Appraisal Photograph E: View looking south-east towards the northern pivot irrigator and shelter planting.



Site Appraisal Photograph F: View of the south-eastern corner of the Site looking towards the intersection of Aylesbury Road, Grange Road, Two Chain Road, and Sandy Knolls Road.

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Viewpoint Details

Horizontal Field of View	: 90°
Vertical Field of View	: 30°
Projection	: Rectilinear
Image Reading Distance @ A3 is 20 cm	

BURNHAM QUARRY

Site Appraisal Photographs E & F

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi



Site Context Photograph 1: View from Two Chain Road looking north-west towards the Site, approximately 30 metres from the Site boundary.



Site Context Photograph 2: View of the existing entrance to the Site from Grange Road looking north-east towards thte Site, approximately 12 metres from the Site boundary.

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Viewpoint Details

Horizontal Field of View	: 90°
Vertical Field of View	: 30°
Projection	: Rectilinear
Image Reading Distance @ A3 is	20 cm

BURNHAM QUARRY

Site Context Photographs 1 & 2

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi



Site Context Photograph 3: View of the south-western corner of the Site from Grange Road looking north-east, approximately 13 metres from the Site boundary.



Site Context Photograph 4: View looking south-east towards the western boundary of the Site from Kivers Road, approximately 1 kilometre from the Site boundary.

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Viewpoint Details

Horizontal Field of View	: 90°
Vertical Field of View	: 30°
Projection	: Rectilinear
Image Reading Distance @ A3 is 20 cm	

BURNHAM QUARRY

Site Context Photographs 3 & 4

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi



Site Context Photograph 5: View taken from Aylesbury Road looking south-west towards the northern corner of the Site, approximately 25 metres from the Site boundary.



Site Context Photograph 6: View of the Site from Aylesbury Road looking north-west, approximately 10 metres from the Site boundary.

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Viewpoint Details

Horizontal Field of View	: 90°
Vertical Field of View	: 30°
Projection	: Rectilinear
Image Reading Distance @ A3 is 20 cm	

BURNHAM QUARRY

Site Context Photographs 5 & 6

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi



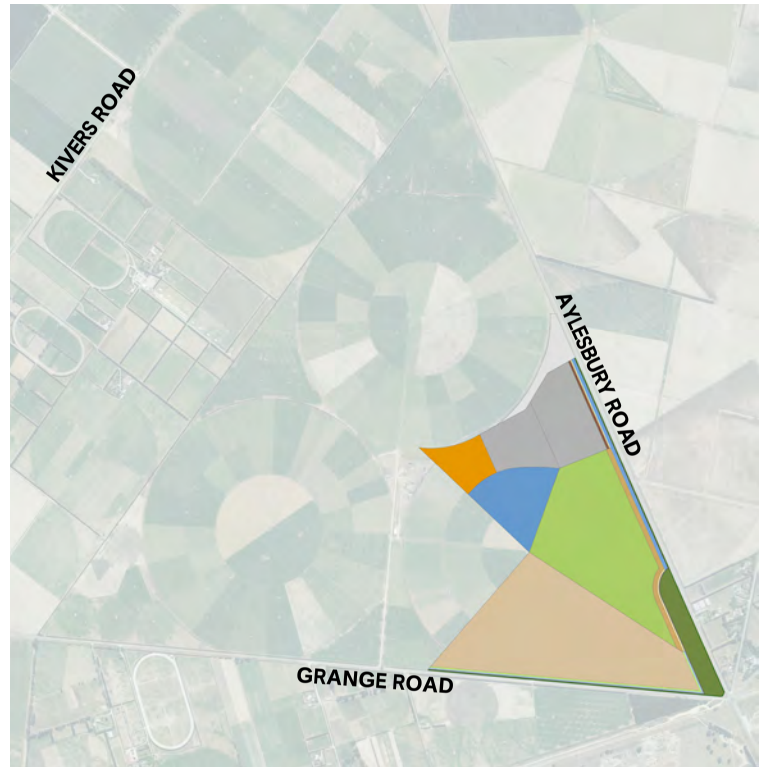
CONSTRUCTION (PHASE 1)



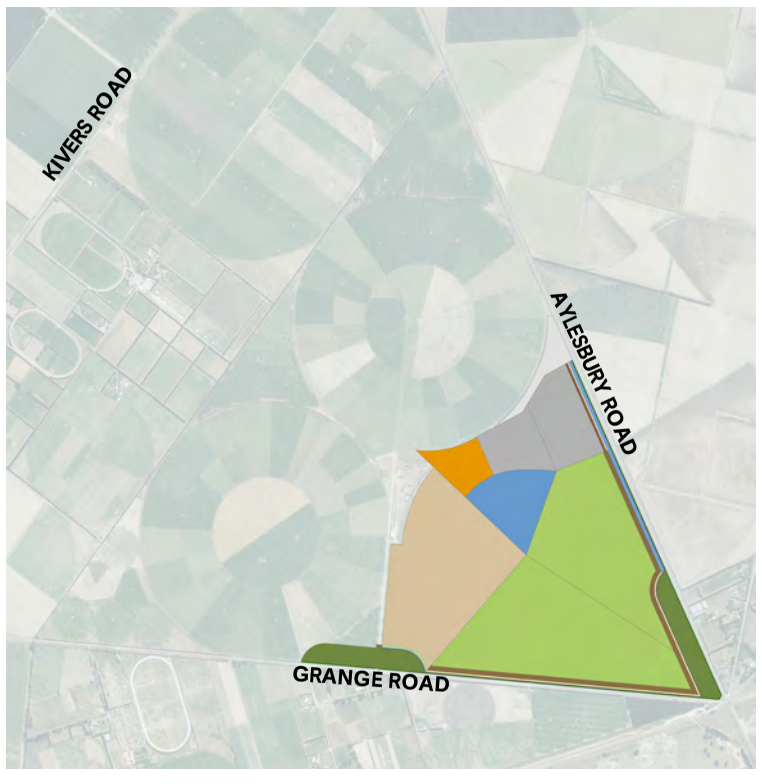
CONSTRUCTION (PHASE 2)



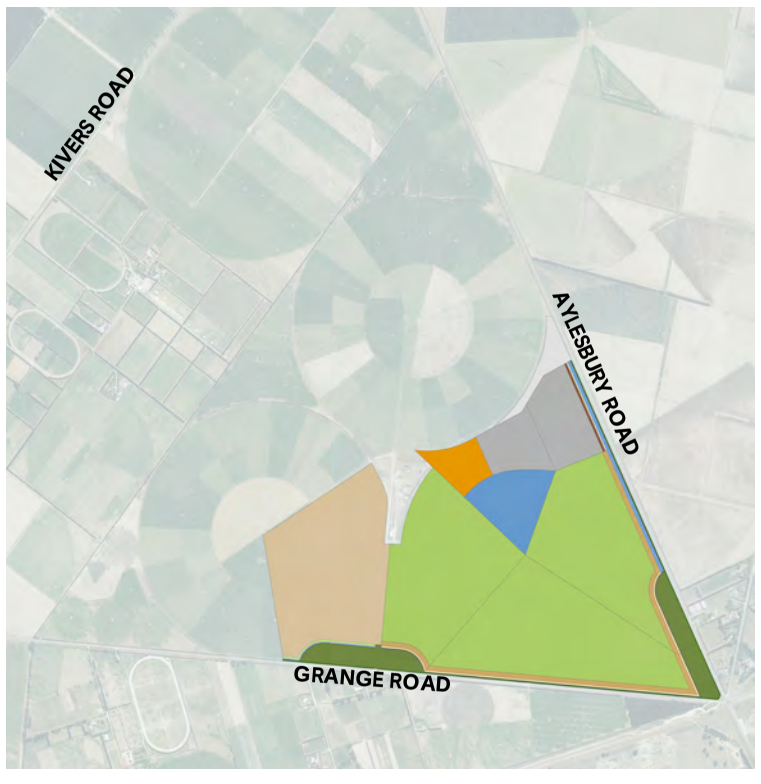
PHASE 3: EXTRACTION 6-10 YEARS



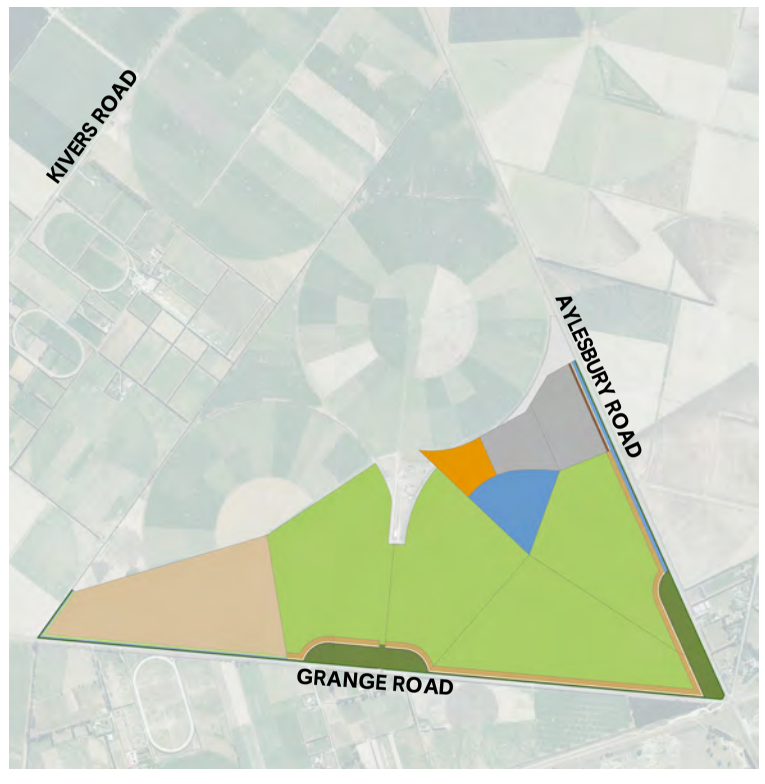
PHASE 4: EXTRACTION 11-15 YEARS



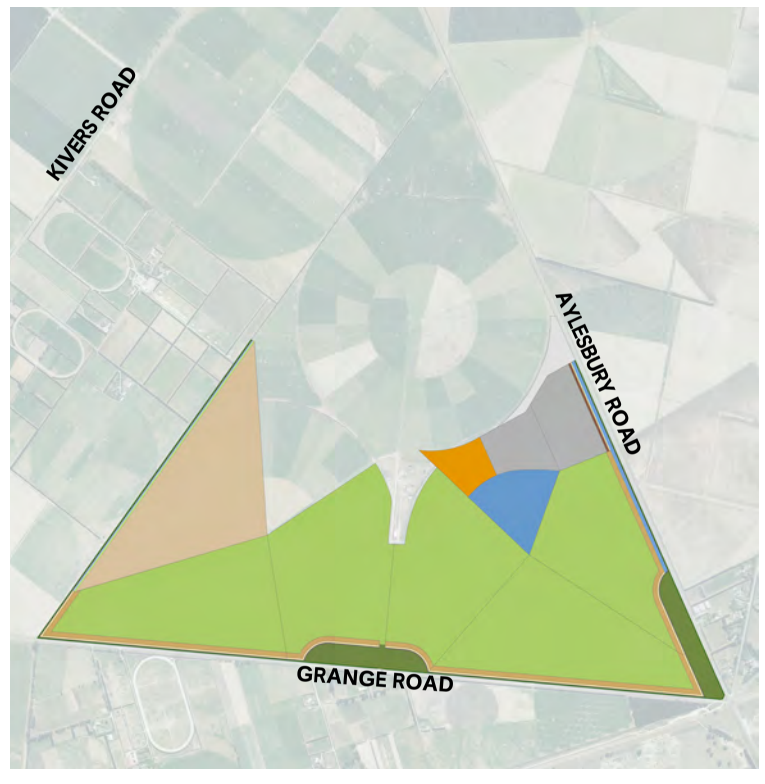
PHASE 5: EXTRACTION 16-20 YEARS



PHASE 6: EXTRACTION 21-25 YEARS



PHASE 7: EXTRACTION 26-30 YEARS



PHASE 8: EXTRACTION 31-35 YEARS

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

LEGEND

- Batter
- Crest
- Extraction
- Finished level
- Long term bund
- Planting
- Processing Plant
- Rehabilitated Slope Planting
- Rehabilitation material
- Rehabilitation
- Shelter belt
- Silt Ponds (*During construction*)
- Silt ponds
- Site Entrance
- Stockpile (*During construction*)
- Stockyards
- Vehicle access

BURNHAM QUARRY

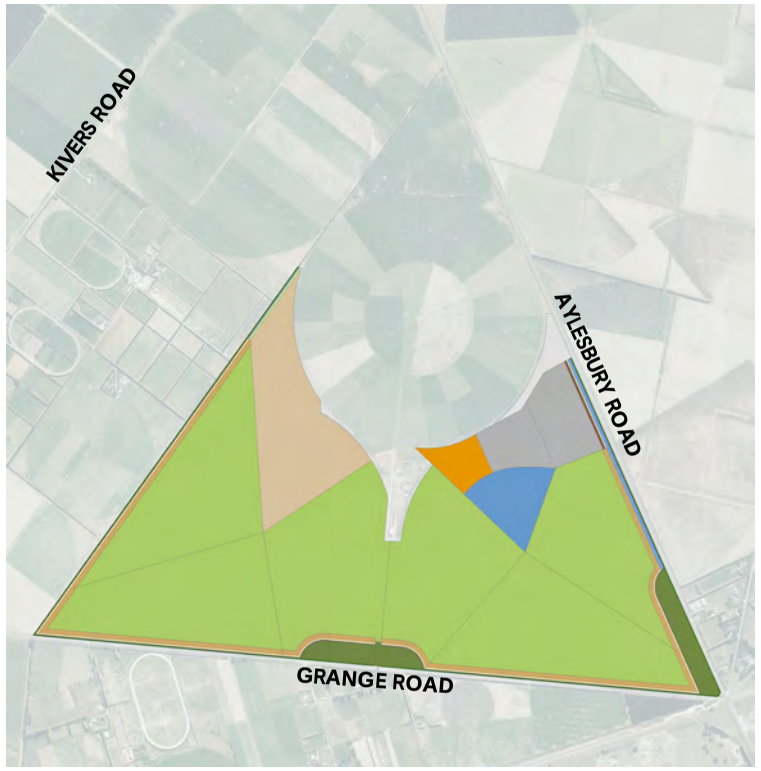
Quarry Staging

Date: 16 June 2023 Revision: 0

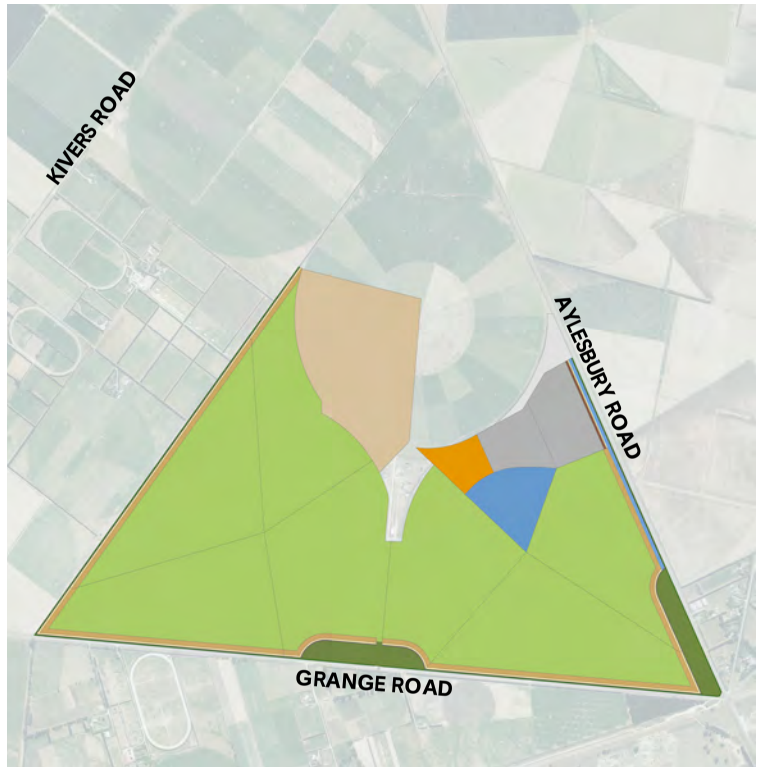
Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

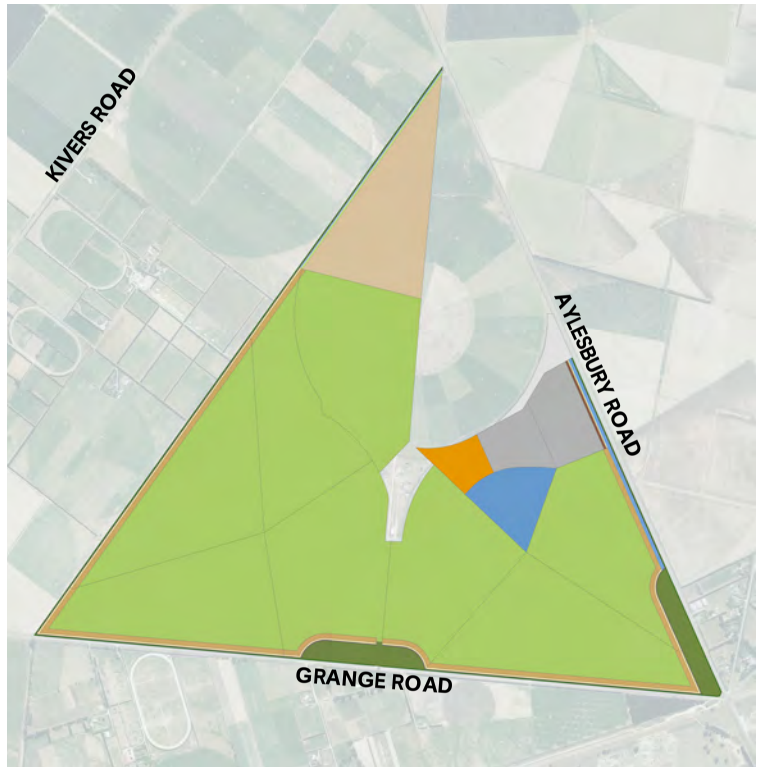
Figure 8a



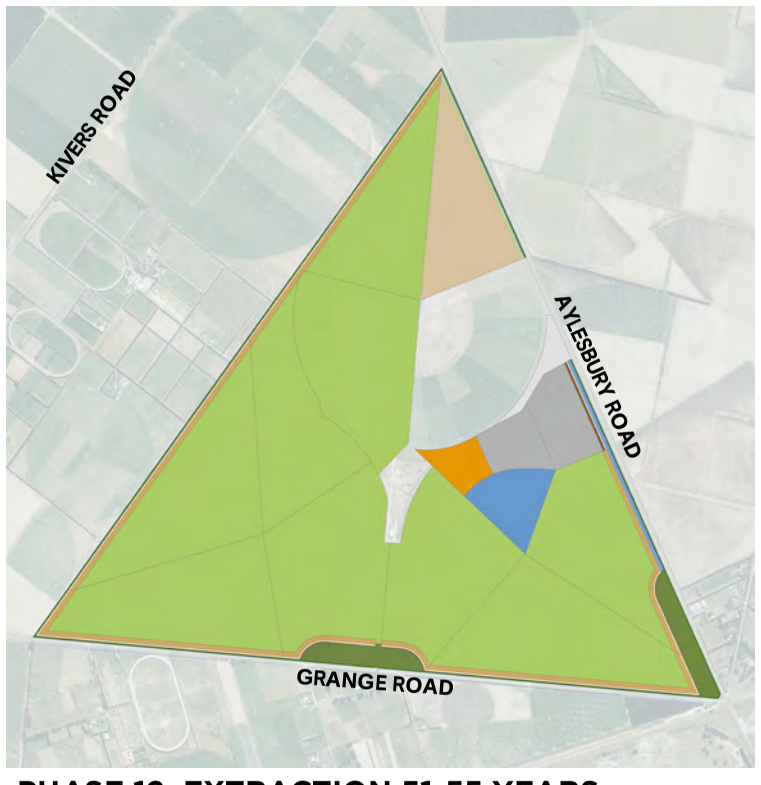
PHASE 9: EXTRACTION 36-40 YEARS



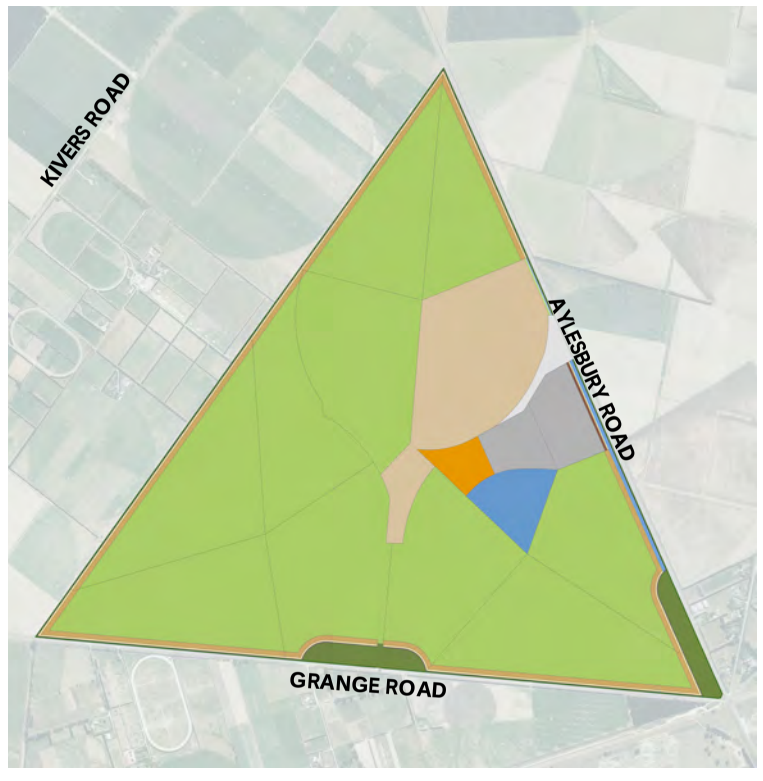
PHASE 10: EXTRACTION 41-45 YEARS



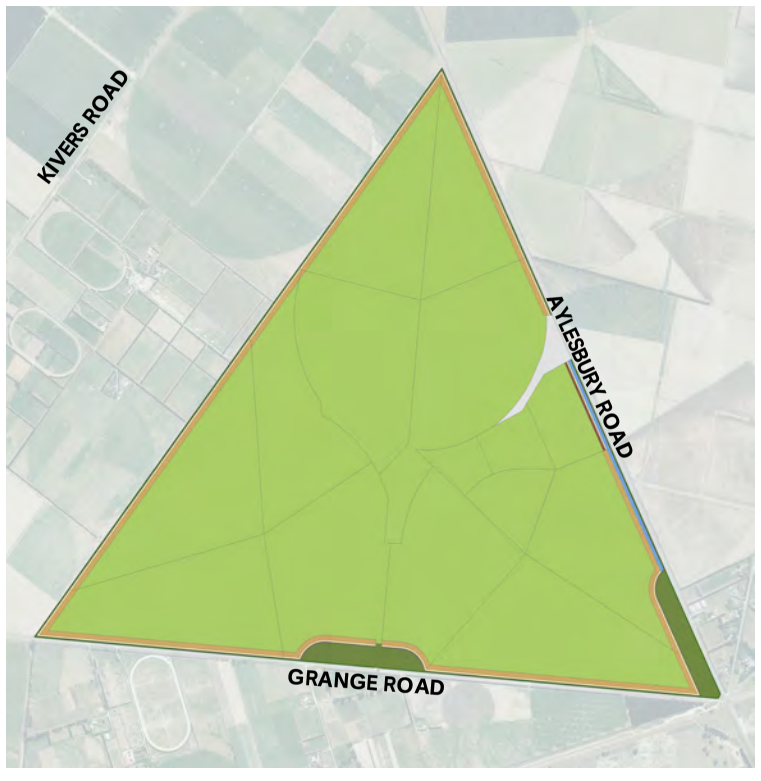
PHASE 11: EXTRACTION 46-50 YEARS



PHASE 12: EXTRACTION 51-55 YEARS



PHASE 13: EXTRACTION 56-60 YEARS



PHASE 14: COMPLETION + FINAL REHAB 60 YEARS

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

LEGEND

- Batter
- Crest
- Extraction
- Finished level
- Long term bund
- Planting
- Processing Plant
- Rehabilitated Slope Planting
- Rehabilitation material
- Rehabilitation
- Shelter belt
- Silt Ponds (*During construction*)
- Silt ponds
- Site Entrance
- Stockpile (*During construction*)
- Stockyards
- Vehicle access

BURNHAM QUARRY

Quarry Staging

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

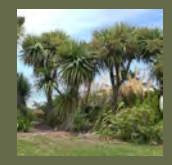
Figure 8b



MIX ONE: LARGER TREES AND SHRUBS



Austroderia richardii
South Island Toe Toe



Cordyline australis
Ti Kouka



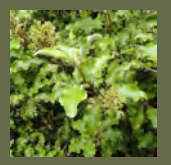
Griselinia littoralis
Kapuka



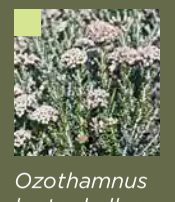
Hoheria angustifolia
Lacebark



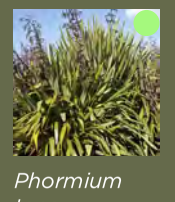
Myrsine australis
Mapou



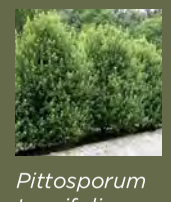
Olearia paniculata
Ahkiraho



Ozothamnus leptophyllus
Tauhinu



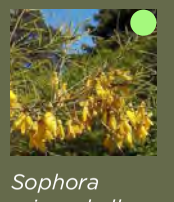
Phormium tenax
Harakeke



Pittosporum tenuifolium
Kohuhu



Plagianthus regius
Ribbonwood



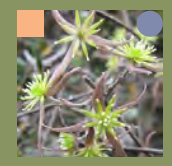
Sophora microphylla
S.I. Kowhai

** To be used in larger patches, and to screen views of the proposed plant.*

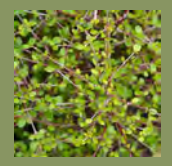
MIX TWO: EDGE PLANTING



Carmichaelia australis
NZ Broom



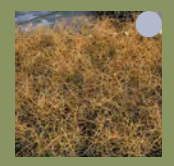
Clematis quad-ribracteolata
NZ Clematis



Coprosma crassifolia
Mingimingi



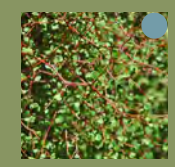
Coprosma propinqua
Mingimingi



Coprosma virescens
Mikimiki



Griselinia littoralis
Kapuka



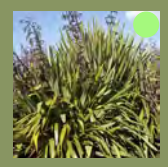
Muehlenbeckia astonii
Shrubby tororaro



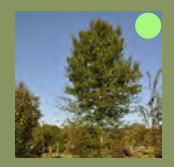
Myrsine australis
Mapou



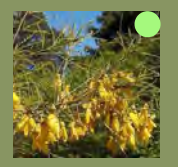
Ozothamnus leptophyllus
Tauhinu



Phormium tenax
Harakeke



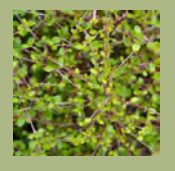
Plagianthus regius
Ribbonwood



Sophora microphylla
S.I Kowhai

** For corridors planted above the battered slope.*

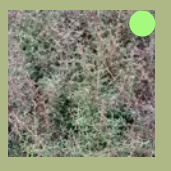
MIX 3: BUND/SCARP PLANTING



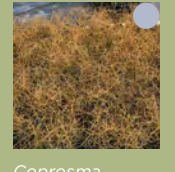
Coprosma crassifolia
Mingimingi



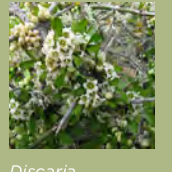
Coprosma intertexta



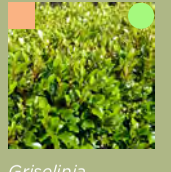
Coprosma propinqua
Mingimingi



Coprosma virescens
Mikimiki



Discaria toumatou
Matagouri



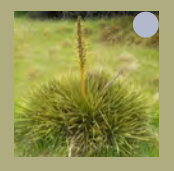
Griselinia littoralis
Kapuka



Melicytus alpinus
Porcupine shrub

** For battered slopes to create habitat which mimics a disturbed river scarp.*

MIX 4: TUSSOCKS AND SMALL SHRUBS



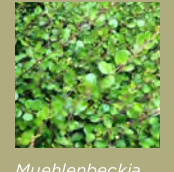
Aciphylla subflabellata
Spaniard



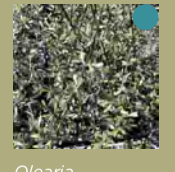
Festuca novae-zelandiae
Hard Tussock



Melicytus alpinus
Porcupine shrub



Muehlenbeckia complexa
Small-leaved Pohuehue



Olearia adenocarpa
Canterbury Plains tree daisy



Poa cita
Silver Tussock

** For use near accessways and roads.*

KEY

- Threatened - Nationally Vulnerable
- Threatened - Nationally Endangered
- Threatened - Nationally Critical
- Low Fire Risk
- At Risk - Naturally Uncommon
- At Risk - Declining
- Margins
- Infill

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

BURNHAM QUARRY

Quarry Entrance and Proposed Plant Palette

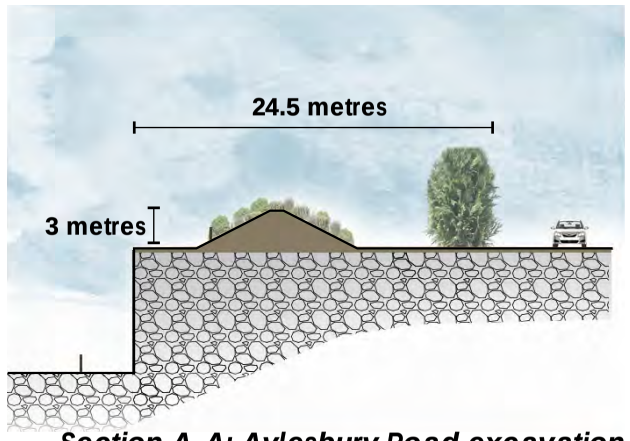
Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

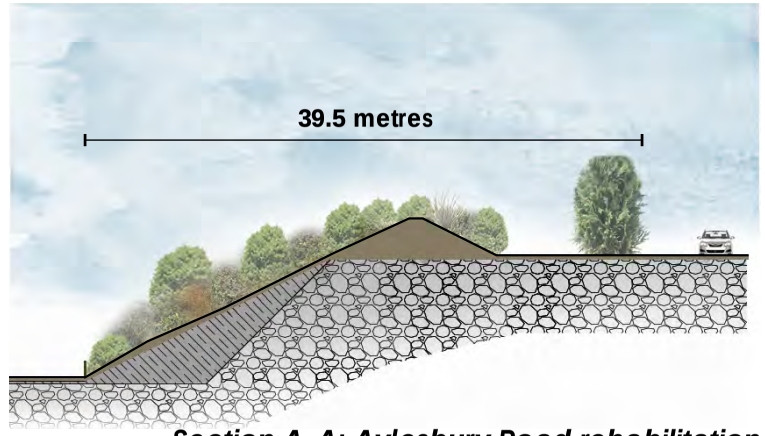
Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 9

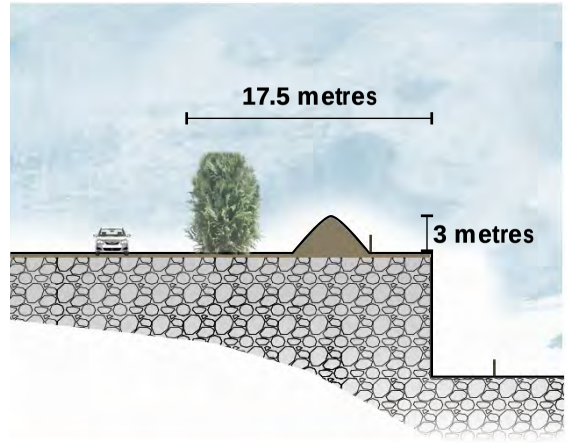




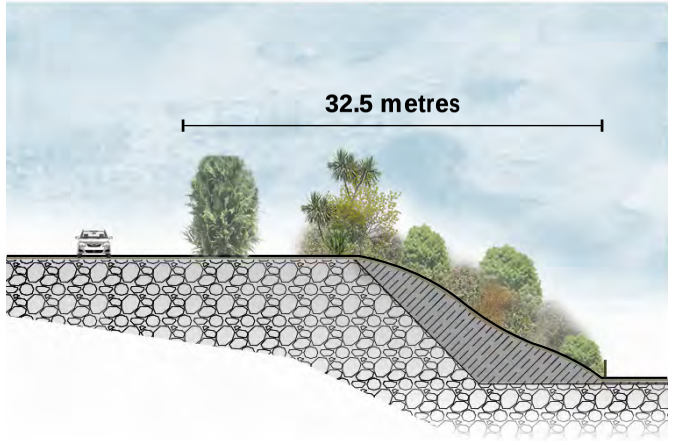
Section A-A: Aylesbury Road excavation



Section A-A: Aylesbury Road rehabilitation



Section B-B: Grange Road excavation



Section B-B: Grange Road rehabilitation

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

0 500 m

1:13,000 @ A3

LEGEND

- Finished level
- Long term bund
- Planted patches (refer to Figure 11)
- Rehabilitated Slope Planting
- Site Entrance
- Stockyards
- Processing Plant
- Shelter belt
- Silt Ponds
- Vehicle access

BURNHAM QUARRY

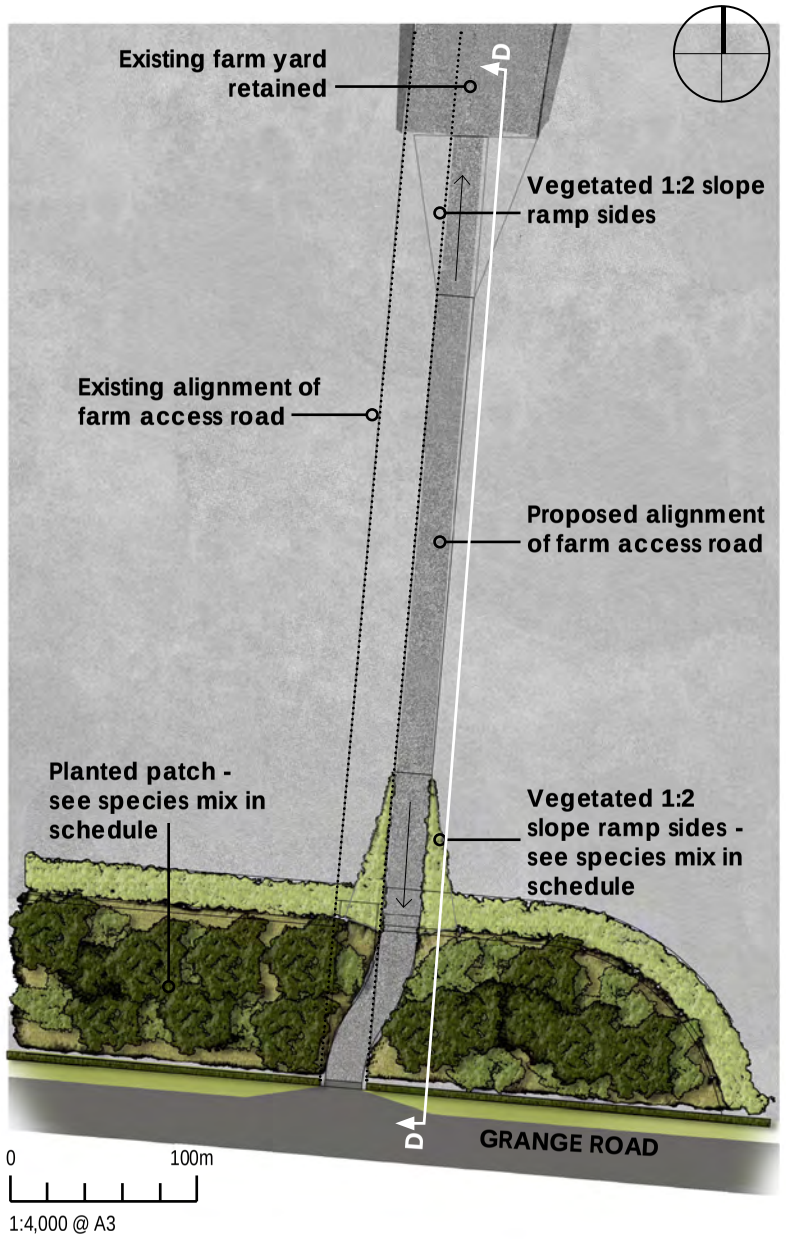
Landscape Strategy

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HWi | Checked: RGi

Figure 10



Landscape plan: Grange Road Farm access road



Festuca novae-zelandiae
Hard Tussock

Coprosma virescens
Mikimiki



Poa cita
Silver Tussock



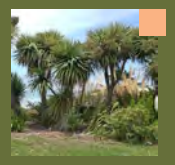
Muehlenbeckia astonii
Shrubby tororaro

** For sunny edges to create habitat and variance in overall height.*

PLANTED PATCHES MIX: LARGER TREES AND SHRUBS



Austroderia richardii
South Island Toe Toe



Cordyline australis
Ti Kouka



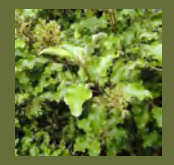
Griselinia littoralis
Kapuka



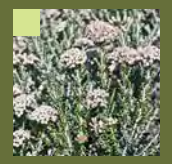
Hoheria angustifolia
Lacebark



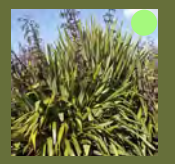
Myrsine australis
Mapou



Olearia paniculata
Ahkiraho



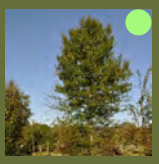
Ozothamnus leptophyllus
Tauhinu



Phormium tenax
Harakeke



Pittosporum tenuifolium
Kohuhu



Plagianthus regius
Ribbonwood

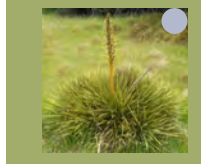


Sophora microphylla
S.I. Kowhai



Coprosma propinqua
Mingimingi

SCARPS / RAMP SIDES MIX: MIXED HEIGHT PLANTING



Aciphylla subflabellata
Spaniard



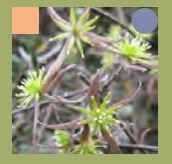
Festuca novae-zelandiae
Hard Tussock



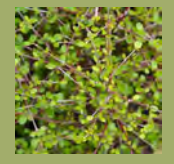
Melicytus alpinus
Porcupine shrub



Carmichaelia australis
NZ Broom



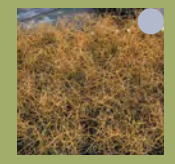
Clematis quad-ribracteolata
NZ Clematis



Coprosma crassifolia
Mingimingi



Coprosma propinqua
Mingimingi



Coprosma virescens
Mikimiki



Griselinia littoralis
Kapuka



Muehlenbeckia complexa
Small-leaved Pohuehue



Olearia adenocarpa
Canterbury Plains tree daisy



Poa cita
Silver Tussock



Muehlenbeckia astonii
Shrubby tororaro



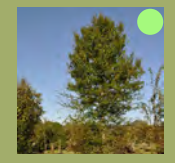
Myrsine australis
Mapou



Ozothamnus leptophyllus
Tauhinu



Phormium tenax
Harakeke



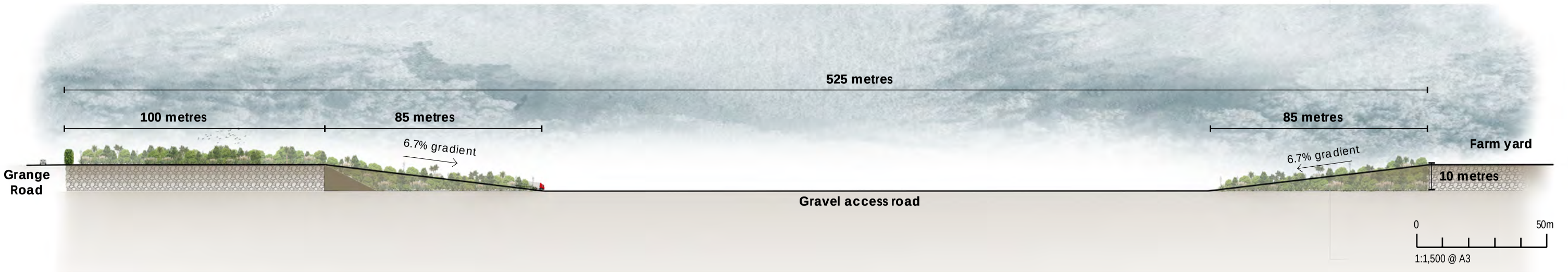
Plagianthus regius
Ribbonwood



Sophora microphylla
S.I Kowhai

KEY

- At Risk - Naturally Uncommon
- At Risk - Declining
- Threatened - Nationally Critical
- Threatened - Nationally Endangered
- Threatened - Nationally Vulnerable
- Low Fire Risk
- Infill
- Margins



Section D-D: Grange Road Farm access

Boffa Miskell

www.boffamiskell.co.nz

This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

BURNHAM QUARRY

Grange Road Farm Access

Date: 16 June 2023 Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Rhys.Girvan@boffamiskell.co.nz | Drawn: HBI | Checked: RGi

Figure 11

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

---

www.boffamiskell.co.nz

Auckland	Hamilton	Tauranga	Wellington	Christchurch	Queenstown	Dunedin
09 358 2526	07 960 0006	07 571 5511	04 385 9315	03 366 8891	03 441 1670	03 470 0460



MARSHALL DAY Acoustics

BURNHAM QUARRY
ASSESSMENT OF NOISE EFFECTS

Rp 003 20211322 | 28 August 2023

290-292 Montreal Street
PO Box 4071
Christchurch 8140 New Zealand
T: +64 3 365 8455
www.marshallday.com

Project: **BURNHAM QUARRY**

Prepared for: **Burnham 2020 Ltd**
PO Box 17195
Greenlane
Auckland 1546

Attention: **Dan McGregor**

Report No.: **Rp 003 20211322**

Disclaimer

Reports produced by Marshall Day Acoustics Limited are based on a specific scope, conditions and limitations, as agreed between Marshall Day Acoustics and the Client. Information and/or report(s) prepared by Marshall Day Acoustics may not be suitable for uses other than the specific project. No parties other than the Client should use any information and/or report(s) without first conferring with Marshall Day Acoustics.

The advice given herein is for acoustic purposes only. Relevant authorities and experts should be consulted with regard to compliance with regulations or requirements governing areas other than acoustics.

Copyright

The concepts and information contained in this document are the property of Marshall Day Acoustics Limited.
Use or copying of this document in whole or in part without the written permission of Marshall Day Acoustics constitutes an infringement of copyright. Information shall not be assigned to a third party without prior consent.

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Approved	-		28 Aug 2023	J Farren / S Wilkening	A Woods

Certified System ISO 9001

SUMMARY

Marshall Day Acoustics has been engaged to assess noise emissions from Burnham 2020 Ltd's proposed Burnham quarry. We have assessed noise generation from the development – initial site establishment, gravel extraction and processing – with a particular focus on where these activities occur at the closest points to residential properties.

Noise mitigation has been considered in the design of the proposal, with the processing plant (the loudest noise source) located towards the centre of the site. Both long-term and temporary 3 metre high noise control bunds and stockpiles will be used at the site perimeter to further mitigate quarry noise effects on adjacent residences.

For the purposes of assessing compliance with the District Plan noise provisions, quarrying activity will commence at 0700 hrs and noise emissions from the site will not comply with the Operative District Plan (ODP) permitted activity night-time noise standards for the 30 minute period until 0730 hrs when ODP daytime noise limits apply. The largest margin of excess is 10 dB. We note this non-compliance does not alter the status of the activity which is full discretionary (for reasons other than noise) when assessed against the provisions of the ODP. The activity will comply with the Partially Operative District Plan (PDP) permitted activity noise limits at all times.

In order to assess potential noise effects of the operational site activities, we have provided project noise criteria that in our opinion are appropriate for the protection of residential amenity. The noise limits are identical to those in the PDP and reflect published guidance from the World Health Organisation and New Zealand Standard NZS 6802:2008 *Acoustics - Environmental Noise*. Our recommended project noise limits are set out below and apply within the notional boundary of a dwelling:

- Day 0700 to 2200 hrs 55 dB $L_{Aeq(15mins)}$
- Night 2200 to 0700 hrs 45 dB $L_{Aeq(15mins)}$ and 70 dB L_{AFmax}

Our detailed noise modelling, which is conducted on a conservative basis, confirms operational activities will comply with the proposed project noise limits and, as a result, noise effects will be reasonable in the context of the receiving environment.

We note both the ODP and PDP exempt traffic on public roads from compliance with the permitted activity noise limits. However, as a discretionary activity, it is appropriate to assess the potential noise effects from trucks. Moreover, we understand the proposed numbers of trucks will exceed the permitted activity standards in the ODP and PDP vehicle crossing rule. As a result, we have considered amenity effects on surrounding residents.

Trucks will travel to and from the site entrance on Aylesbury Road to State Highway 1. Existing traffic volumes are low on Aylesbury Road (north of Two Chain Road) and therefore there will be an adverse noise effect due to the increase in traffic noise, which, without mitigation, would be perceived as a slight to significant change in noise level during the day at existing dwellings. Truck noise effects can be mitigated with the provision of conventional noise control measures but these would need to be agreed with the affected landowner. Truck noise effects will be negligible to moderate at Burnham Camp which currently experiences elevated levels of traffic noise during the day.

Our assessment shows that construction activities, such as the implementation of noise control bunds, will comply with the applicable noise limits from New Zealand Standard NZS 6803: 1999 *Acoustics - Construction Noise*. Construction noise effects will be reasonable.

There will be no significant sources of vibration on site and we expect vibration effects to be negligible.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

TABLE OF CONTENTS

1.0 INTRODUCTION 6

2.0 PROPOSED ACTIVITY DESCRIPTION 7
2.1 Site Establishment 8
2.2 Extraction 8
2.3 Processing 9
2.4 Heavy Vehicle Movements on Public Roads 9
2.5 Hours of Operation 10
2.6 Light Vehicle Movements 10
2.7 Rehabilitation 10

3.0 EXISTING NOISE ENVIRONMENT 11
3.1 Measurement Locations 11
3.2 Measured noise levels – MP1 and MP2 12
3.3 Attended noise measurements – MP3 to MP7 14

4.0 NOISE ASSESSMENT CRITERIA 15
4.1 Selwyn Operative District Plan 15
4.2 Partially Operative District Plan (PDP) 16
4.3 Other Guidance 17
4.4 Recommended Assessment Criteria 17

5.0 OPERATIONAL NOISE ASSESSMENT METHODOLOGY 19
5.1 Operational Scenarios 19
5.2 Calculation methodology 23
5.3 Modelling assumptions 23
5.4 Noise Source Data 24

6.0 PREDICTED OPERATIONAL NOISE LEVELS 26

7.0 CONSTRUCTION NOISE ASSESSMENT 30
7.1 Construction Noise Limits 30
7.2 Calculated Construction Noise Levels 31

8.0 SITE GENERATED VIBRATION 32
8.1 Vibration Assessment Criteria 32
8.2 Vibration Generation 33
8.3 Vibration Assessment 34

9.0 NOISE FROM QUARRY TRAFFIC ON PUBLIC ROADS 35

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

9.1 Assessment Criteria 35
9.2 Potentially Affected Locations 36
9.3 Proposed Truck Noise Levels 40
10.0 ASSESSMENT SUMMARY AND CONCLUSIONS 43
11.0 RECOMMENDATIONS 44
APPENDIX A GLOSSARY OF TERMINOLOGY
APPENDIX B SUMMARY OF STANTEC TRAFFIC DATA FOR AYLESBURY RD
APPENDIX C NOISE SURVEYS
APPENDIX D NOISE CONTOUR PLOTS

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

1.0 INTRODUCTION

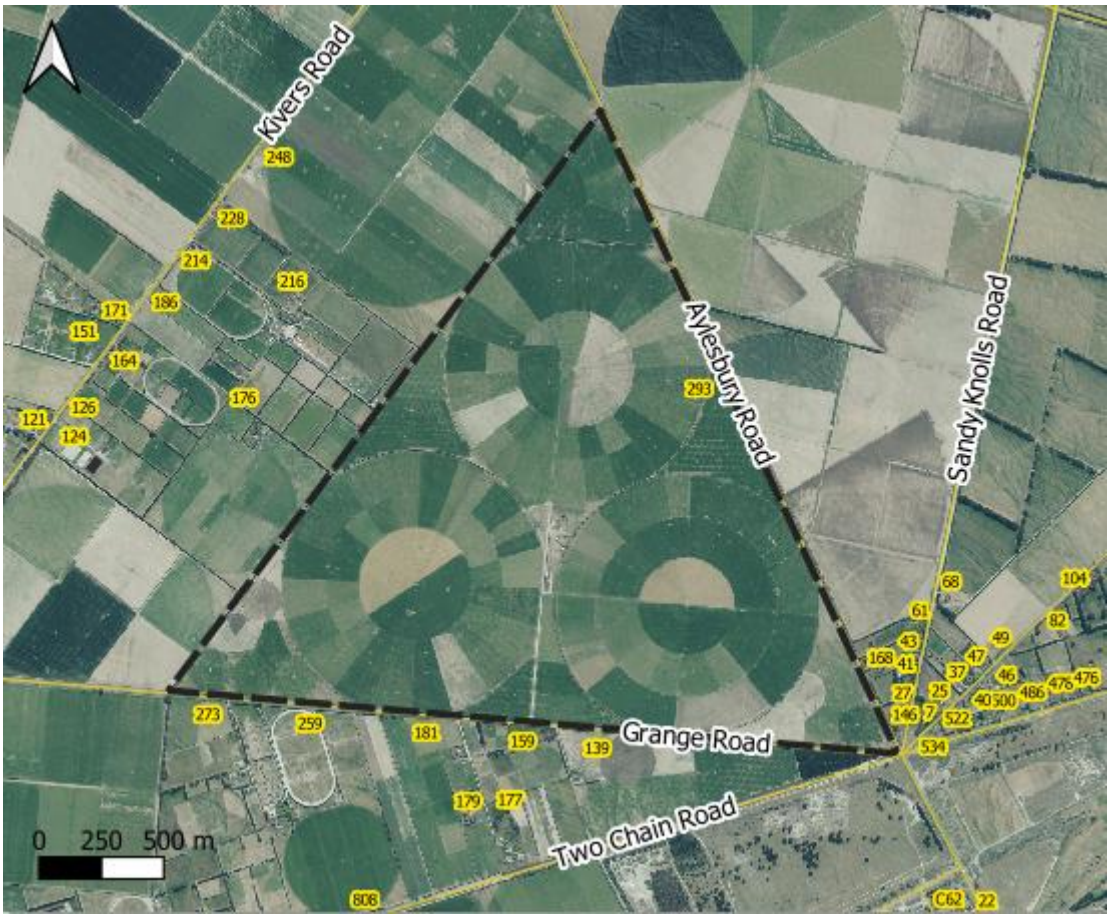
Marshall Day Acoustics has been engaged by Burnham 2020 Ltd to assess the potential noise effects associated with its proposed new quarry in Burnham, Christchurch. The quarry, to be known as "Burnham Quarry", will be located between Grange Road and Aylesbury Road, as shown in Figure 1.

This report describes:

- the proposed activity with respect to noise emissions;
- the nearest noise sensitive receivers and their existing noise environment;
- the applicable District Plan permitted activity standards and relevant published guidance;
- predicted noise levels over the lifespan of the quarry; and
- the potential adverse noise effects associated with the proposed activity.

A glossary of acoustical terminology used in this report is provided for reference in Appendix A.

Figure 1: Aerial view of the proposed site and nearest dwellings



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

2.0 PROPOSED ACTIVITY DESCRIPTION

Burnham 2020 Ltd is proposing a quarry with an expected lifetime of over 60 years. The proposal is described in detail in the land use consent application and in the following sections we focus on those aspects that have a bearing on noise generation.

The site will be excavated in phases with noise emissions changing with each phase. Figure 3 shows the overall landscape strategy for the proposal during each phase of extraction. From a noise perspective, the greatest potential noise effects are likely during Phases 1 to 4 which will take approximately the first 15 years. Initially, excavation will begin towards the central area of the site to create the processing area and stockyards, before proceeding clockwise around each irrigation pivot and clockwise around the site, starting at the southeast pivot. Extraction of Phase 13 is expected to occur between Years 56 to 60, noting that actual timings are dependent on demand for aggregate and are subject to change.

In the following sections, we discuss the key noise-related features of each phase. However, there are several aspects common to all phases and these are:

- A permanent 3 metre high noise control bund is proposed along part of the eastern site boundary as indicated in Figure 3.
- A 3 metre high stockpile will progressively be installed around the remainder of the site as extraction progresses. This stockpile will serve to act as a noise control bund.
- A 100 metre extraction setback from the property boundaries of existing dwellings will be established on Aylesbury and Grange Roads.
- A 17.5 metre extraction set back from the site boundary will be established for all other areas.
- Extraction will occur at a depth of approximately 10 metres meaning that the "working face" will act as an effective noise barrier for mobile equipment winning gravel. This is significant from a noise generation perspective as it means that noise sources are always screened from receivers by the edge of the pit. An example of this is shown in Figure 2. (As we discuss in Section 5.0, we have conservatively modelled the excavation depth as 8 metres.)

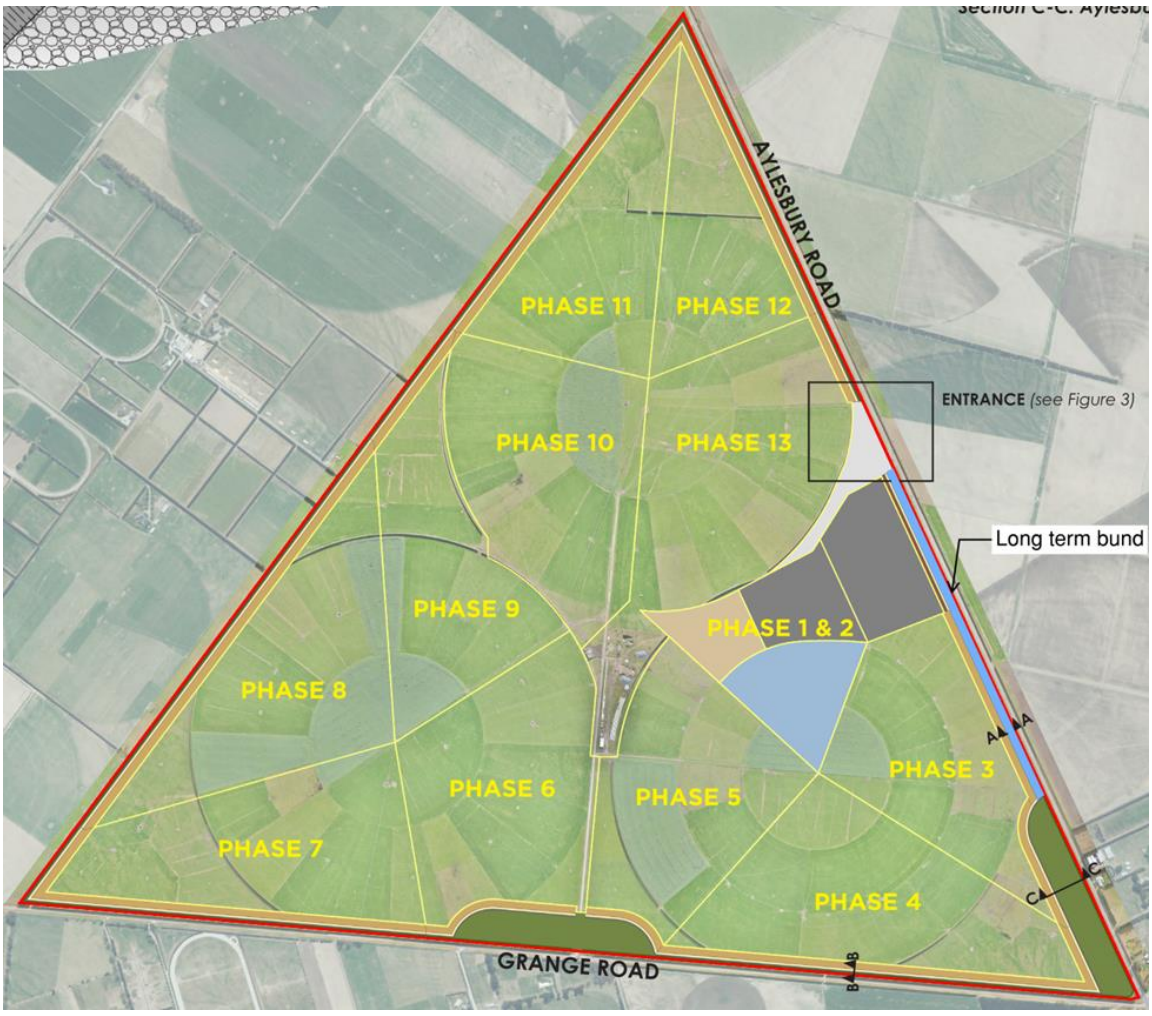
Figure 2: Example of loader activity at edge of pit



- Processing plant, loadout and stockyards will also be located on the floor of the excavated area approximately 10 metres below existing ground level.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 3: Site layout and phasing [image: Boffa Miskell]



2.1 Site Establishment

On-site activities will commence by establishing the quarry entrance, site office, amenities, parking, and weighbridge areas. This will involve stripping overburden and constructing the amenities and services. Stripped overburden will be utilised for bunds along the site boundary.

Once the site amenities and services are completed, topsoil and overburden will be stripped from the future production zone and primary and secondary stockyards. The stripped material will be used to construct screening bunds around the stockyard area and permanent bunds along Aylesbury Road. Excess topsoil stripped from these areas will be stockpiled and used for rehabilitation as the extraction progresses.

Mobile processing equipment will be used during the site establishment and may be located at existing ground level.

2.2 Extraction

After the site establishment, extraction will continue from the pit floor at approximately 10 metres below ground level, advancing towards the closest receivers up to 17.5 metres from the site boundary.

Initially, the quarry will use standard extraction machinery – excavators, wheel loaders and trucks. However, throughout the quarry's life the equipment is likely to change with further advances in technology.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Trucks will be used to transport the extracted material from the active extraction area to the production zone. The Applicant is investigating using overland conveyors in future to supplement or replace haulage by trucks.

Temporary edge treatment stockpiles will be constructed when excavation is within 200m of a boundary and may be constructed up to a year in advance. Once all excavation within 200m is complete the stockpile will be used as topsoil for the battered edge of the pit.

2.3 Processing

All processing will take place in the production zone using a combination of fixed and mobile plant. Where possible, materials will be conveyed to the stockyard for direct loadout and some stockpiling or loadout may occur in the production zone. We have assumed that trucks will be used to transport material from the extraction zone to the stockyard. If conveyors are used, noise levels will be less.

The fixed plant configuration will be finalised closer to the start of operations to enable the adoption of the most appropriate technology. We understand the plant will be capable of crushing, screening, and washing aggregate extracted from the site and incorporating recycled aggregate alternatives into the finished products.

Mobile processing equipment will be used in the production zone to supplement the fixed plant production as necessary. It will use the same infeed and stockpile methodology as the fixed processing plant.

No crushing or washing of products will occur in the primary and secondary stockyard. In both stockyards materials will be moved and stockpiled directly from the production zone and then loaded out into road trucks. In the primary stockyard only, some materials may be wet or dry screened and/or combined with other products. All screens in the primary stockyard will be enclosed.

2.4 Heavy Vehicle Movements on Public Roads

Burnham 2020 Ltd has provided indicative truck movements for the project as set out in Table 1. Trucks will travel to and from the site via Aylesbury Road to State Highway 1.

Table 1: Heavy vehicle movement generation forecasts

Daily (Movements per day)		Peak Hour (Movements per hour)	
Busiest Day (Proposed Consented Limit)	**Average (40% of Busiest Day)**	**Busiest Hour (15% of Busiest Day)**	**Typical (10% of Average Day)**
750	300	112	30

On up to 30 occasions per year, the applicant is proposing 10 truck movements per hour between 0500 and 0700 hrs which is considered night-time in the District Plan. We discuss noise generation from truck movements in Section 9.0.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

2.5 Hours of Operation

Burnham 2020 Ltd has supplied the following proposed hours of operation and associated activities set out in Table 2.

Table 2: Hours of operation

When			Proposed activity
At all times			Environmental mitigations (including dust control), light vehicle movements into and on site, operation of site office, site security and light maintenance
Early Morning	Monday to Saturday on up to 30 times per annum, excluding Public Holidays.	0500 to 0700	Loadout and access / egress of trucks operated by the quarry operator. (10 truck movements per hour).
	Sundays on up to 15 times per annum, excluding Public Holidays.	0500 to 0700	Loadout and access / egress of trucks operated by the quarry operator. (10 truck movements per hour)
Morning	Monday to Saturday, excluding Public Holidays.	0600 to 0700	Rehabilitation and movement of vehicles within site associated with that activity. Site pre-startup including operational warmup of on-site plant
Daytime		0700 to 2000	Full range of production activities within current operational area and/or primary and secondary stockyard

As described in Table 2, the production zone and stockyards will operate from 0700-2000 hours Monday to Saturday, while the following activities may take place at any time on any day:

- Environmental mitigations such as dust control
- Use of the site office
- Plant and equipment maintenance
- Light vehicle movements into and within the site

2.6 Light Vehicle Movements

In addition to the heavy traffic discussed above, we anticipate there will be light vehicle movements to and from the site each day. We expect the number of light vehicle movements will be low compared to the associated heavy traffic and existing traffic patterns on local roads. As a result, their noise generation will be negligible in the context of the project. We have therefore not discussed light traffic further in this report.

2.7 Rehabilitation

Excavated areas that are no longer active quarry areas will be progressively rehabilitated as required to enable productive use of the land. Edges will be battered to a maximum of 2:1. Rehabilitation of the pit floor will generally use soils from areas being actively stripped and the ground will be returned to pasture. For our assessment we have assumed that any silts required for rehabilitation will either be transported by trucks or earthworks machinery from the silt management zone.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

3.0 EXISTING NOISE ENVIRONMENT

The proposed Burnham Quarry site is within the Selwyn District and both the site and surrounding properties have a rural zoning in both the Operative and Partially Operative District Plans. We discuss the underlying zoning and applicable noise limits further in Section 4.0.

Most of the land surrounding the site is under agricultural use with dwellings clustered near the Aylesbury Road and Two Chain Road intersection and further east along Two Chain Road. There are also dwellings on Kivers Road and south of the site on Grange Road.

The Selwyn Equestrian Centre is situated on Kivers Road approximately 500 metres from the site boundary. Burnham Military Camp is directly south of the Aylesbury Road and Grange Road intersection.

3.1 Measurement Locations

In May 2022 and July 2023 we measured the ambient noise levels at 6 different locations in the vicinity of the proposed quarry with the aim of establishing the existing noise levels at and near the proposed site. Figure 5 shows the measurement locations in relation to the site and the nearest dwellings, which are described in Table 3.

Table 3: Noise measurement location description

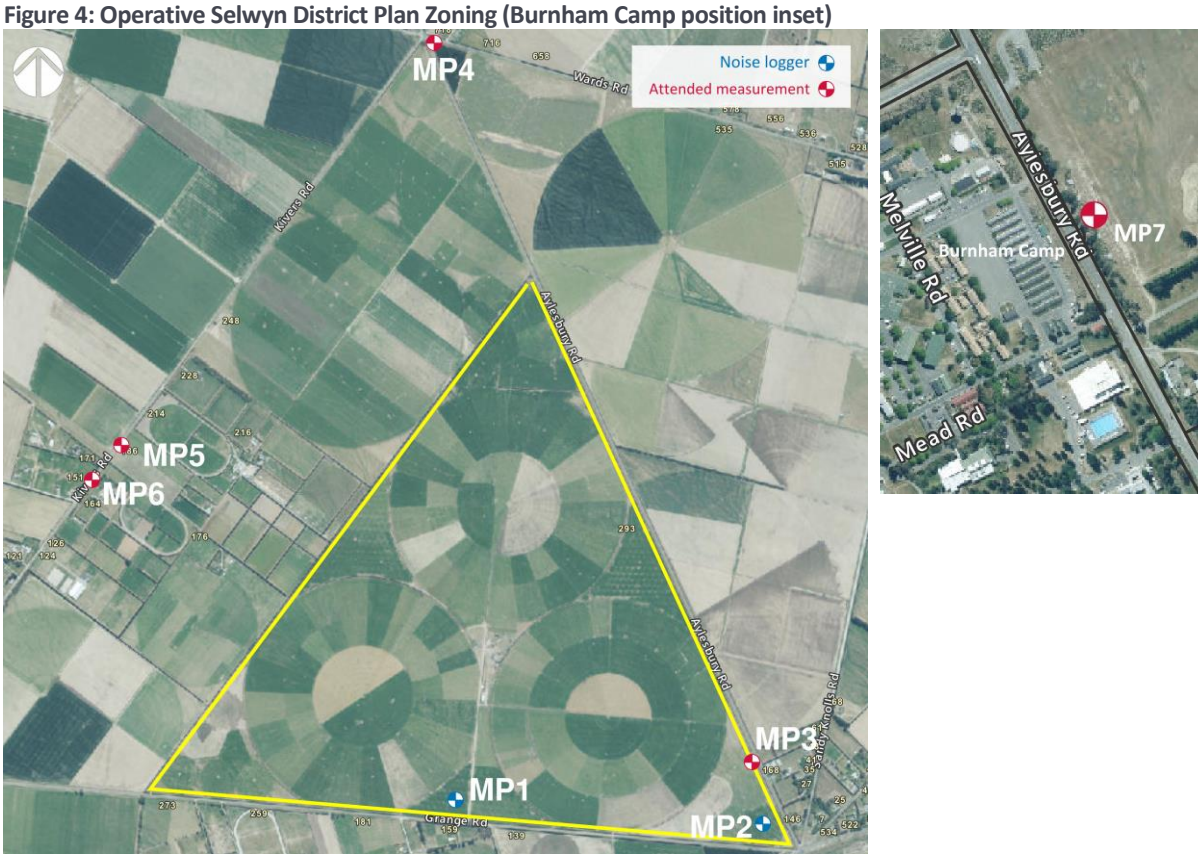
Ref	Location	Description
Unattended long duration logging		
MP1	Opposite 159 Grange Rd	Thursday 19 – Friday 27 May 2022 The position is the same distance from Grange Rd as the dwelling at 159 which is the closest dwelling to the south of the proposed site. Traffic on Grange Rd is the dominant noise source at the site.
MP2	Opposite 146 Aylesbury Rd	Friday 27 May – Friday 10 June 2022 The position is the same distance from Aylesbury Rd as the dwelling at 146 and is representative of the noise experienced by several dwellings along Sandy Knolls and Kerrs Roads which are the closest to proposed excavation in the south-east of the site. Traffic noise on Aylesbury, Two Chain and Grange Roads are dominant.
Attended short duration measurements – May 2022 and July 2023		
MP3	Aylesbury Road	Located approximately an equivalent distance from Aylesbury Road as the dwelling façade at 168.
MP4	Wards / Aylesbury Rd intersection	Representative of ambient noise environment in the vicinity of 718 Wards Road.
MP5 and MP6	Kivers Road	Representative of ambient noise environment in the vicinity of dwellings along Kivers Road.
MP7	Burnham Camp	Representative of ambient noise environment – measured at 7 metres from Aylesbury Road and corrected for distance to nearest Camp buildings.

All measurements were undertaken in general accordance with New Zealand Standard NZS 6801:2008 *Acoustics – Measurement of environmental sound*. Further details of the attended surveys and equipment are provided in Section C1.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Some road construction was occurring on Aylesbury Road south of the Grange Road intersection during these surveys. We consider that the survey positions were not generally significantly affected by the construction noise however, there may have been reduced traffic and therefore lower ambient noise levels overall.

Figure 4: Operative Selwyn District Plan Zoning (Burnham Camp position inset)



3.2 Measured noise levels – MP1 and MP2

Table 4 shows the measured average noise levels of the day and night-time periods, adjusted for adverse weather, from the long-term logging at positions 1 and 2. Figure 5 and Figure 6 show the average and daily variation in noise levels for MP1 and MP2 respectively.

At both locations local traffic movements were the dominant noise source along with natural environment sounds including wind generated leaf rustle and birdsong. Distant traffic on SH1 was also audible.

A plot of the noise levels throughout the logging periods is provided in Appendix C2.

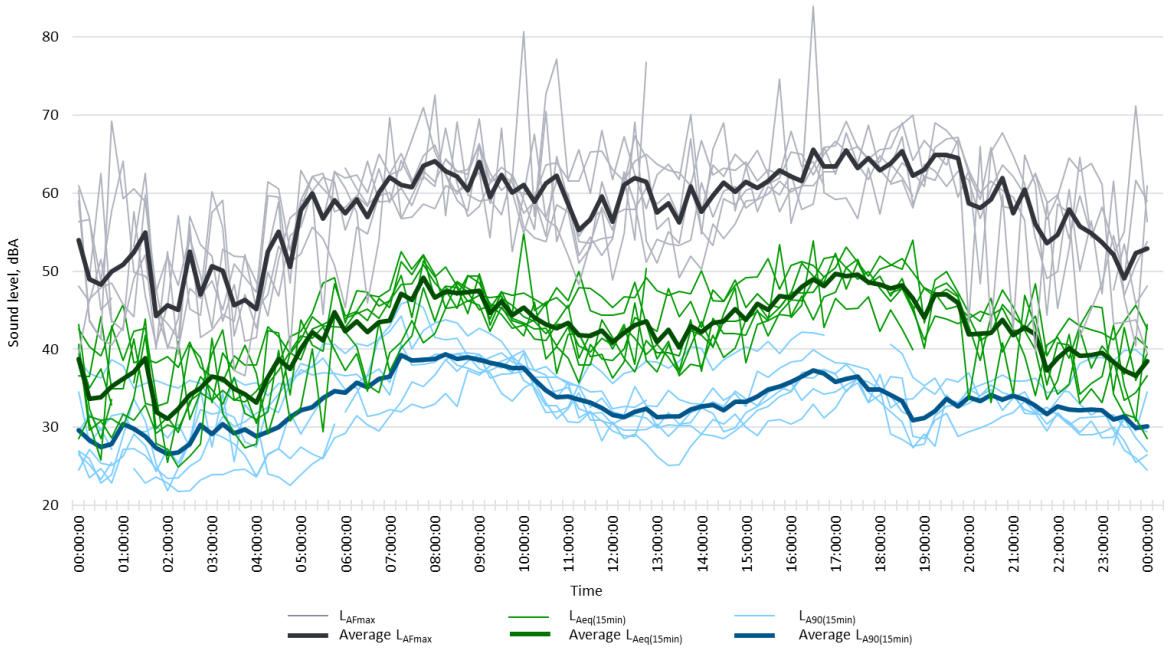
The measured short term noise levels are shown in Table 5.

Table 4: Long term noise survey results

Period	MP1 average noise level, dB			MP2 average noise levels, dB		
	L_{Aeq}	L_{A10}	L_{A90}	L_{Aeq}	L_{A10}	L_{A90}
Day (0700-2200)	47	48	35	49	51	40
Night (2200-0700)	41	39	31	45	43	33

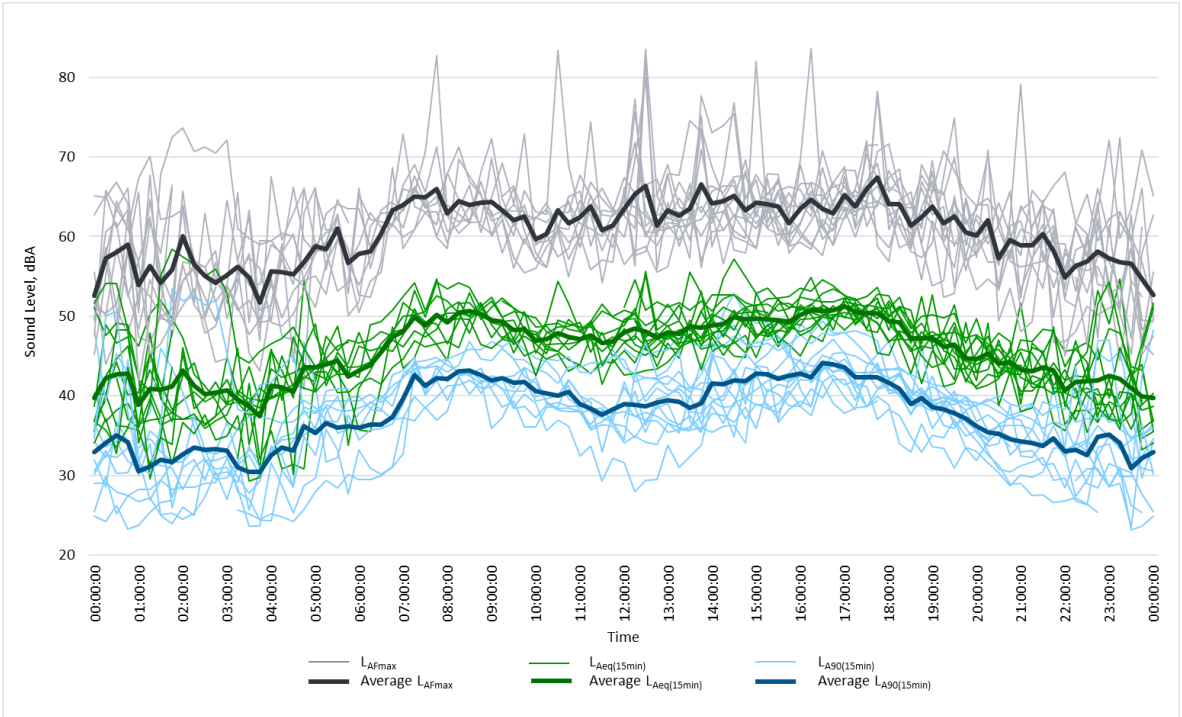
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 5: Position MP1 Grange Road – Average and daily variation of measured noise levels



Existing daytime noise levels at MP1 are 47 dB L_{Aeq} on average but vary over the course of the day. Passing traffic increases the noise levels by 10 dB between 0500 and 0800 hrs when a noise level of 49 dB L_{Aeq} is achieved before reducing to low 40's dB during the early afternoon. A second traffic noise peak of around 50 dB L_{Aeq} is achieved at 1700 hrs. Noise levels reduce steadily to around 40 dB L_{Aeq} at 2200 hrs.

Figure 6: Position MP2 Aylesbury Road - Average and daily variation of measured noise levels



The greater number of vehicle movements that passed this position mean that noise levels are slightly higher than MP1 and also show less variability during the daytime period. Noise levels begin

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

to increase at 0500 to a high of 50 dB L_{Aeq} at 0800 and 1700 hrs. During the early afternoon, noise levels are in the mid to high 40s dB L_{Aeq}.

3.3 Attended noise measurements – MP3 to MP7

Table 5 provides the measured noise levels at MP3 to MP7.

Table 5: Attended survey measurements

Position[A]	Approximate Location	Start time	Measured Noise Level, dB*			
			L_{Aeq}	L_{A10}	L_{a90}	L_{AFmax}
MP3	Aylesbury Road	12:05	63	54	39	89
		13:30	62	60	38	83
		15:00	61	56	38	82
MP3 arithmetic average			*62*	*57*	*38*	*85*
MP4	Aylesbury & Wards Rd intersection	12:11[B]	61	64	51	79
		14:57	61	63	42	77
		15:58	62	65	50	79
MP4 arithmetic average			*61*	*64*	*49*	*78*
MP5	Kivers Road	14:35	47	46	33	70
		16:18	44	48	36	59
MP6	Kivers Road	12:29	60	54	46	85
MP5 and MP6 arithmetic average			*56*	*51*	*42*	*71*
MP7	Burnham Camp[C]	14:30	64	67	51	83
		15:35	64	68	49	79
MP7 arithmetic average			*64*	*68*	*50*	*81*

[A] As shown in Figure 5

[B] All measurement durations are 15 minutes, aside from MP4 (12:11) which was cut short after 11 min

[C] The measured traffic noise level represented by the L_{Aeq} will reduce by approximately 9 dB at nearest Camp Buildings at 50 metres

Noise sources at these locations are similar to MP1 and MP2 in that passing vehicles dominate the noise environment with natural environment sounds audible in the lulls between traffic.

MP3 was selected to represent the existing traffic noise environment at 168 Aylesbury Road. As a result, noise levels are notably higher than the data collected at position MP2 which is further from the road – daytime noise levels are 62 dB L_{Aeq} on average compared with 50 dB L_{Aeq}. MP4 also experiences elevated traffic noise levels during the day – 61 dB L_{Aeq} on average.

Our site observations at MP5 and MP6 are that wind generated foliage noise was responsible for significant environmental noise levels and was not significantly affected by occasional passing traffic. Noise emissions at MP5 include local traffic and farm machinery in adjacent fields.

At MP7 Burnham Camp, traffic is the dominant noise source. Once corrected for distance, we estimate the daytime noise level at the closest Camp buildings to the road will be in the order of 55 dB L_{Aeq}.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

4.0 NOISE ASSESSMENT CRITERIA

Below we discuss the applicable District Plan permitted activity noise standards. As the proposed activity is fully discretionary, it is appropriate for us to perform an assessment of noise effects and have therefore considered a range of relevant published guidance which we discuss below.

4.1 Selwyn Operative District Plan

The site and immediate surrounds are zoned rural in the Operative District Plan.

Noise

The proposed quarry is located in the Rural (Outer Plains) Zone of the Operative Selwyn District Plan. The permitted activity noise limits for the Rural Zone are reproduced in Table 6 below, from Table C9.3 of Rule 9.16.1. These limits are assessed at *"the notional boundary[1] of any dwelling, rest home, hospital, or classroom in any education facility except where that dwelling, rest home, hospital or classroom is located within a living zone".*

Table 6: Operative Selwyn District Plan noise limits for rural areas

Time Period	Noise Limit
Day – 0730 to 2000 hours	60 dB L_{A10}
	85 dB L_{Amax}
Night – 2001 to 0729 hours	45 dB L_{A10}
	70 dB L_{Amax}

Also of relevance to this application is Rule 9.16.6 which states:

> *Rule 9.16.1 does not apply to the following activities:*
>
> > *Rule 9.16.6.1 Noise from any motor vehicle or any mobile machinery (including farm machinery and stationary equipment not fixed to the ground).*

This exemption is commonly applied to mobile vehicles on quarry sites within the Selwyn District.

We note the ODP provides an exemption from the noise standards for construction as a temporary activity for a period of up to 12 months (Rule 9.16.6.3).

Vibration

Rule 9.17.1.2 provides a permitted activity standard for activities generating vibration.

> *9.17.1.2 Except for blasting, any activity which involves vibration from any other source complies with New Zealand Standard 2631:1985-89 Parts 1-3*

We note that blasting is not proposed as part of the activity.

Traffic

With reference to Rule 9.16.6.1 above, the permitted activity noise limits do not apply to traffic. However, we understand the proposed number of trucks will exceed the permitted activity standards set out in Rule 9.13 and, as a result, we are required to consider Rule 9.13.2.2:

> *Any potential adverse effects of traffic on the amenity values of surrounding residents and on other uses of the road, including (but not limited to) stock droving;*

[1] "Notional Boundary" means a line 20 metres from any side of a residential unit or other building used for a noise sensitive activity, or the legal boundary where this is closer to such a building.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

4.2 Partially Operative District Plan (PDP)

Noise

Decisions were made on the proposed District Plan on 19 August 2023 and these provisions have legal effect.

Under the PDP, Burnham Quarry and the adjoining properties are in the General Rural Zone (GRUZ).

The proposed noise limits, where both the activity and the site receiving noise is in the General Rural Zone, from Rule NOISE-REQ1 – Table 5, are reproduced in Table 7 below. These limits are assessed *"at the notional boundary of any noise sensitive activity within any site receiving noise"*.

Table 7: PDP General rural zone notional boundary noise limits

Time Period	Noise Limit
Day – 0700 to 2200	55 dB L_{Aeq}
Night – 2200 to 0700	45 dB L_{Aeq}
	70 dB L_{Afmax}

The PDP provides permitted activity status to traffic on roads under Rule NOISE-R1:

3. *Traffic and rail noise generated within a land transport corridor. This does not apply to the testing (when stationary), maintenance, loading, or unloading of trains*

We understand the proposal will exceed the permitted activity trip generation under Rule TRAN-R4 Vehicle Crossings, and discretion is exercised against TRAN-MAT2 which, for all zones, requires consideration of:

1. *Any effects on the ease and safety of vehicle manoeuvring.*
2. *Whether the boundaries of a site support the formation of the vehicle crossing or accessway.*
3. *Whether the site can gain access from another road that is not a State Highway or Arterial Road listed in APP2 – State Highway, Arterial and Collector Road Classifications List.*
4. *The design and location of the vehicle crossing or accessway.*
5. *The anticipated number and type of vehicles, cycles, pedestrians or stock movements.*
6. *Any visual effects on road design and amenity values from not forming the vehicle crossing or accessway to the specified standards.*

Under TRAN-MAT2.6, potential adverse noise effects would typically be considered under the broad description of "amenity values". However, because of the large separation distance between the site's vehicle crossing and nearest noise sensitive locations, we expect the vehicle crossing will result in minimal adverse effects and have not considered this aspect further.

Construction Noise and Vibration

The proposed erection of temporary stockpiles and noise control bunds at the boundary would typically be assessed as construction noise. The applicable PDP construction noise limits are set out in NOISE-REQ2 and essentially replicate the provisions set out in New Zealand Standard NZS 6803: 1999 *Acoustics - Construction Noise*.

Whilst we do not expect the proposed activity to generate any significant vibration on site, we note Rule NOISE R-14 provides permitted activity standards for vibration and provides limits in NOISE-

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

TABLE4 - Vibration Thresholds. The limits are based on German Standard DIN 4150-3:2016 *Vibrations in buildings – Part 3: Effects on structures* which is in common use in New Zealand.

4.3 Other Guidance

4.3.1 National Environmental Noise Standards

The ODP requires noise to be measured and assessed in accordance with New Zealand Standard NZS 6801:1999 *Acoustics – Measurement of environmental sound* and NZS 6802:1991 *Assessment of environmental sound*.

The PDP and current industry best practice refer to the newer versions of these standards; NZS 6801:2008 *Acoustics – Measurement of environmental sound* and NZS 6802:2008 *Acoustics - Environmental Noise.*

NZS 6802:2008 recommends the following noise limits as the desirable upper noise limits of sound exposure at or within the boundary of any residential land use. These are included in NZS 6802 to guide territorial authorities in the development of local noise criteria, but it notes that the inclusion of an evening period and the hours of application are a matter for the local authority.

- Daytime – 55 dB $L_{Aeq(15\ min)}$
- Evening – 50 dB $L_{Aeq\ (15\ min)}$
- Night-time – 45 dB $L_{Aeq\ (15\ min)}$ and 75 dB L_{AFmax}

These values are consistent with the World Health Organization's Guidelines for Community Noise – discussed further in Section 4.3.2

4.3.2 International Guidance

The World Health Organisation's (WHO) Guidelines for Community Noise[2] is the key international guidance for environmental noise. This is commonly used in New Zealand as it discusses the health impacts of environmental noise and provides guideline values for the protection of health and sleep in various scenarios. The values that represent the onset of health effects in the general population for certain scenarios are reproduced below in Table 8.

Table 8: WHO Guideline Values for community noise in specific environments

Environment	Health effect(s)	dB L_{Aeq}	Time base	dB L_{AFmax}
Outdoor living area	Serious annoyance (daytime and evening)	55	16 hours	-
	Moderate annoyance (daytime and evening)	50	16 hours	-
Outside bedrooms	Sleep disturbance, window open	45	8 hours	60
Dwelling indoors	Speech intelligibility and moderate annoyance (daytime and evening)	35	16 hours	-
Inside bedrooms	Sleep disturbance (night-time)	30	hours	45

4.4 Recommended Assessment Criteria

In the following sections we assess the proposed activity's noise emissions for compliance against the ODP and PDP permitted activity noise standards. However, as a fully discretionary activity, we also evaluate the potential adverse noise effects and discuss suitable assessment criteria below:

[2] Berglund, B et al. *Guidelines for Community Noise.* World Health Organization (1999)

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

- The ODP daytime noise limit of 60 dB L_{A10} is outdated and deviates from what is currently considered a best practice noise limit for the protection of residential amenity.
- The ODP 60 dB L_{A10} is nominally 5 dB more lenient than the PDP, WHO and NZS6802 guidance. In light of this, and on review of the existing ambient daytime noise environment, we consider the PDP daytime noise limit of 55 dB L_{Aeq} will provide reasonable noise levels for nearby residential activity when assessed at the notional boundary of a dwelling.
- Whilst the ODP uses the L_{A10} noise metric, the PDP uses L_{Aeq} which represents current best practice for assessing noise emissions and is commonly referenced in published guidance describing appropriate levels of noise amenity. We propose L_{Aeq} is adopted for this project.
- At night, we consider the PDP noise limits of 45 dB L_{Aeq} and 70 dB L_{AFmax} to be appropriate. These limits reflect the recommended noise limits in WHO and NZS6802 for the protection of sleep.
- In the ODP, daytime is defined as 0730 to 2000hrs. The PDP reflects current best practice as outlined in NZS6802 which is that daytime is defined as 0700 to 2200 hrs.

Based on the above, we consider the noise limits provided in Table 9 are appropriate for assessing the project's on-site activity. These will result in a noise amenity commensurate with that anticipated by the ODP and PDP permitted activity standards and will result in reasonable noise effects.

Table 9: Recommended project noise limits

Time Period		Noise Limit
Day	0700 to 2200	55 dB L_{Aeq}
Night	2200 to 0700	45 dB L_{Aeq} and 70 dB L_{AFmax}

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

5.0 OPERATIONAL NOISE ASSESSMENT METHODOLOGY

The following sections describe our calculations of activity noise levels at the notional boundary of nearby dwellings in five different operational scenarios. We have focused on the scenarios that present the potential worst-case noise levels for the closest existing rural dwellings to the site. The following sections assess noise from both the short-term construction activities, operation of the quarry and truck movements on public roads.

5.1 Operational Scenarios

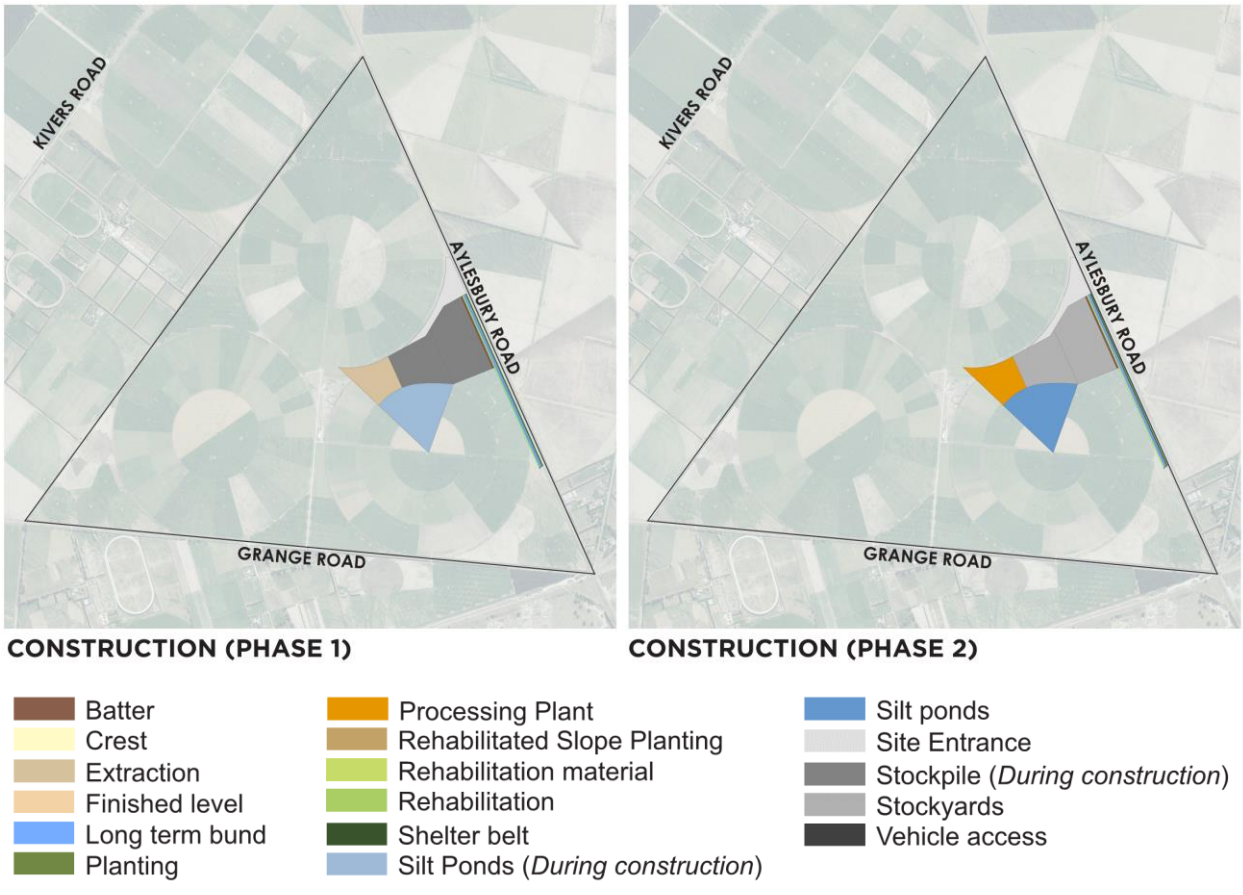
Scenarios 1 to 4 represent the typical daytime (0700 to 2000 hours) activities as described in Section 2.0, from site establishment to gravel extraction close to the dwellings in the south-east, south and west. Scenario 5 represents the operational activities expected during the evening and at night (from 2000 hours to 0700 hours).

5.1.1 Scenario 1 - Years 1 to 6 - Site Establishment (Phases 1 and 2)

The activity during years one to six will vary as the site is established. This phase, summarised in Section 2.1, will include gravel extraction and processing as well as the construction of site facilities and a permanent noise bund along Aylesbury Road. To represent a typical worst case operational scenario, we have modelled the following activities entirely at the existing ground level with one bund along the Aylesbury Road boundary of the stockyard area. The noise generating activities included are:

- Three mobile crushers, three mobile screens and three front end loaders in the processing area
- Two excavators extracting material from the primary stockyard zone
- 112 truck movements per hour in the stockyard

Figure 7: Years 1 to 6 (Phases 1 and 2) [image: Boffa Miskell]



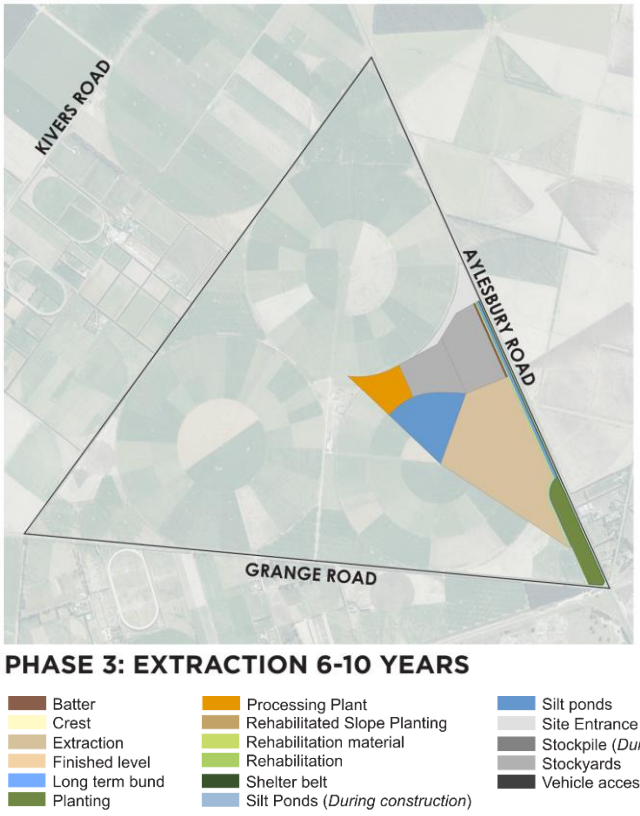
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

5.1.2 Scenario 2 – Years 6 to 10 (Phase 3)

Extraction in the south-east corner of the site with all machinery operating at 8 metres below ground level with the permanent bund along Aylesbury Road (refer to the location of the bunding as per phasing plan in Figure 3). Activities included are:

- Two front end loaders and one excavator working at the pit face (100 metre setback in south-east)
- Aggregate transported to the processing area by truck
- All processing, screening, and conveyance in the production zone
- Up to 112 truck movements per hour in the stockyard area

Figure 8: Years 6 to 10 (Phase 3) [image: Boffa Miskell]



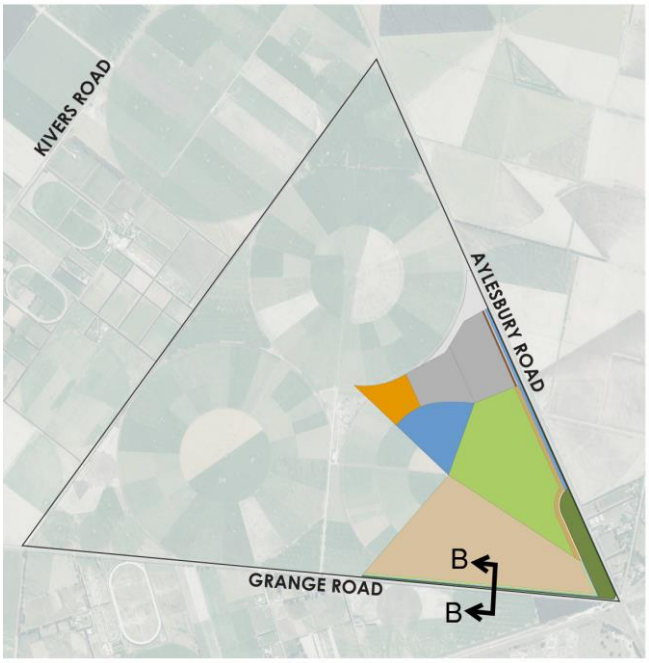
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

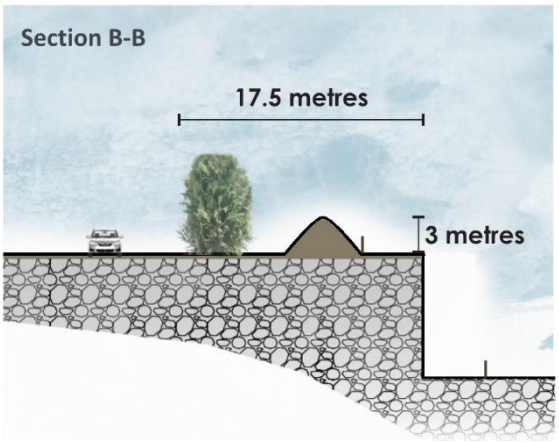
5.1.3 Scenario 3 – Years 11 to 15 (Phase 4)

Extraction towards the centre of the south site boundary, all at 8 metres below ground level with the permanent bund and a temporary bund along the south-eastern boundary. Activities include:

- Two front end loaders and one excavator working at the pit face
- Aggregate transported to the processing area by truck
- All processing, screening, and conveyance in the production zone
- Up to 112 truck movements per hour in the stockyard area

Figure 9: Years 11 to 15 (Phase 4) and section of temporary stockpile (Section B-B) [image: Boffa Miskell]





PHASE 4: EXTRACTION 11-15 YEARS

Batter
Crest
Extraction
Finished level
Long term bund
Planting
Processing Plant
Rehabilitated Slope Planting
Rehabilitation material
Rehabilitation
Shelter belt
Silt Ponds (*During construction*)
Silt ponds
Site Entrance
Stockpile (*During construction*)
Stockyards
Vehicle access

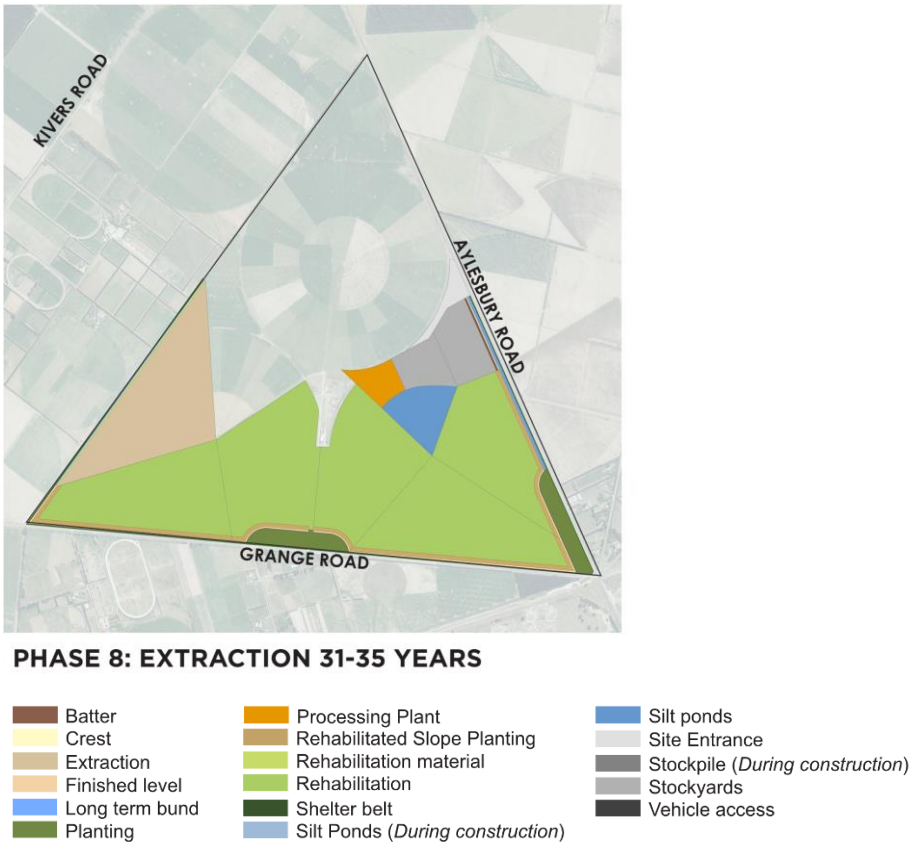
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

5.1.4 Scenario 4 – Years 31 to 35 – extraction to the west (Phase 8)

This scenario assesses noise emissions during extraction occurring at the closest point to the dwellings to the west. All machinery operating at 8 metres below ground level with the temporary stockpiling as indicated in Figure 10. Activities include:

- Two front end loaders and one excavator working at the pit face
- Aggregate transported to the processing area by truck
- All processing, screening, and conveyance in the production zone
- Up to 112 truck movements per hour in the stockyard area

Figure 10: Years 31 to 35 (Phase 8) [image: Boffa Miskell]



5.1.5 Scenario 5 – Night-time

As in Scenario 2 without any processing plant or machinery operating at the working face. 16 truck movements per hour in the stockyard.

5.1.6 Future scenarios

Gravel extraction and rehabilitation will continue clockwise around the site as represented by Phases 5 to 14 in Figure 1. For these phases, dwellings have larger separation distances to quarry extraction activities than those assessed in Scenarios 2, 3 and 4 above. As a result, predicted noise levels will be lower.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

5.2 Calculation methodology

Environmental noise modelling was completed with the SoundPLAN v9.0 software suite. This software calculates the noise level at receivers in accordance with the International Standard ISO 9613-2:1996 *Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation* which accounts for a range of factors that affect noise propagation outdoors including:

- The magnitude of noise sources
- Distance between the source and receiver
- Reflecting surfaces and the amount of ground absorption
- Screens, barriers, and/or other features in the propagation path
- Attenuation due to atmospheric absorption.

The effect of meteorological conditions is accounted for by assuming "supportive" propagation conditions – the wind is always going from the noise source to the receiver.

The estimated accuracy associated with this method is shown in Table 10 overleaf.

Table 10: Estimated accuracy for broadband noise (based on ISO 9613-2:1996)

Height, h*	Distance, d†	
	0 < d < 100 m	100 m < d < 1,000 m
0 < h < 5 m	±3 dB	±3 dB
5 m < h < 30 m	±1 dB	±3 dB

Note: These estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.
** h is the mean height of the source and receiver.*
† d is the mean distance between the source and receiver.

All noise levels have been calculated as a 15-minute equivalent continuous average with no adjustments (dB $L_{Aeq\ (15\ min)}$). Special audible character and duration adjustments have not been included as quarrying activity is assumed to be constant throughout any 15 minute period and does not typically include any special audible characteristics, such as tonality or impulsiveness, that warrant adjustment.

5.3 Modelling assumptions

We have made the following assumptions during our calculations:

- Ground elevation across the site and surrounds is based on the *NZ Contours (Topo 1:50k)* data from the Land Information New Zealand Data Service (LINZ).
- Site terrain was modelled assuming excavation, in accordance with the proposed phasing, to a minimum of 8 metres below the existing ground level interpolated from the LINZ contours.
- Cadastral boundaries are based on the *NZ Primary Parcels* data from LINZ.
- The ground absorption coefficient is hard (G = 0.0) within the active site area and mixed (G = 0.5) everywhere else.
- No acoustic screening or shielding from bunds, buildings, or barriers outside of the site has been allowed for.
- All receiving dwellings are assumed to be single storey.
- Noise levels are calculated at the notional boundary and 1.5 m above the local ground level.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

- Vehicle movements, when provided as a number of movements per hour, are assumed to be a constant level across the hour with 25% occurring in the 15 minute assessment period.

5.4 Noise Source Data

Our modelling uses data from previous measurements at similar quarry sites that generally correlates well with generic noise source data from British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*. Table 11 summarises the source data with sound power levels (L_{WA}) for fixed sources and sound exposure levels (L_{AE}) for moving sources.

Table 11: Model noise source data

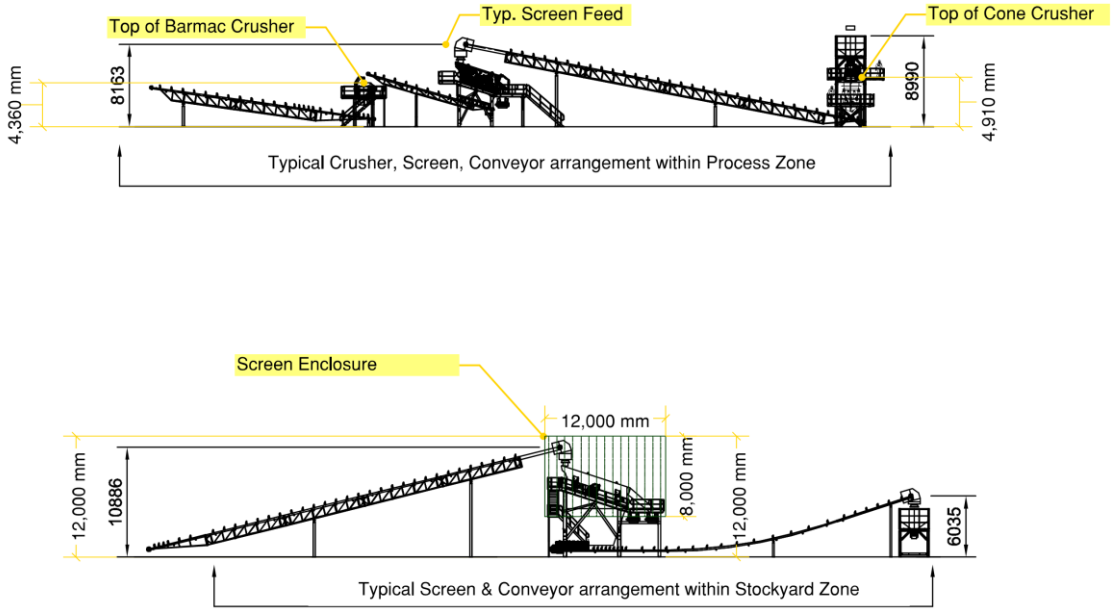
Item	Noise level (dB)	Source height* (m)
Road Truck	86 L_{AE} at 10 m	1.5
Excavator	108 L_{WA}	2.0
Front End Loader	105 L_{WA}	1.5
Mobile Crusher	112 L_{WA}	2.0
Mobile Screen	117 L_{WA}	3.0
Fixed Processing Plant		
Jaw Crusher	119 L_{WA}	4.0
Barmac Crusher	97 L_{WA}	3.0
Cone Crusher	117 L_{WA}	4.0
Screen	111 L_{WA}	10.0
Conveyers		
Inlet	99 L_{WA}	3.0
Belt	61 L_{WA} per metre	-
Transition	103 L_{WA}	-

**Source height is relative to the local terrain level at the source*

Figure 11 provides the typical arrangement and heights of the processing plant used in the noise modelling.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 11: Heights and general arrangement of fixed processing plant

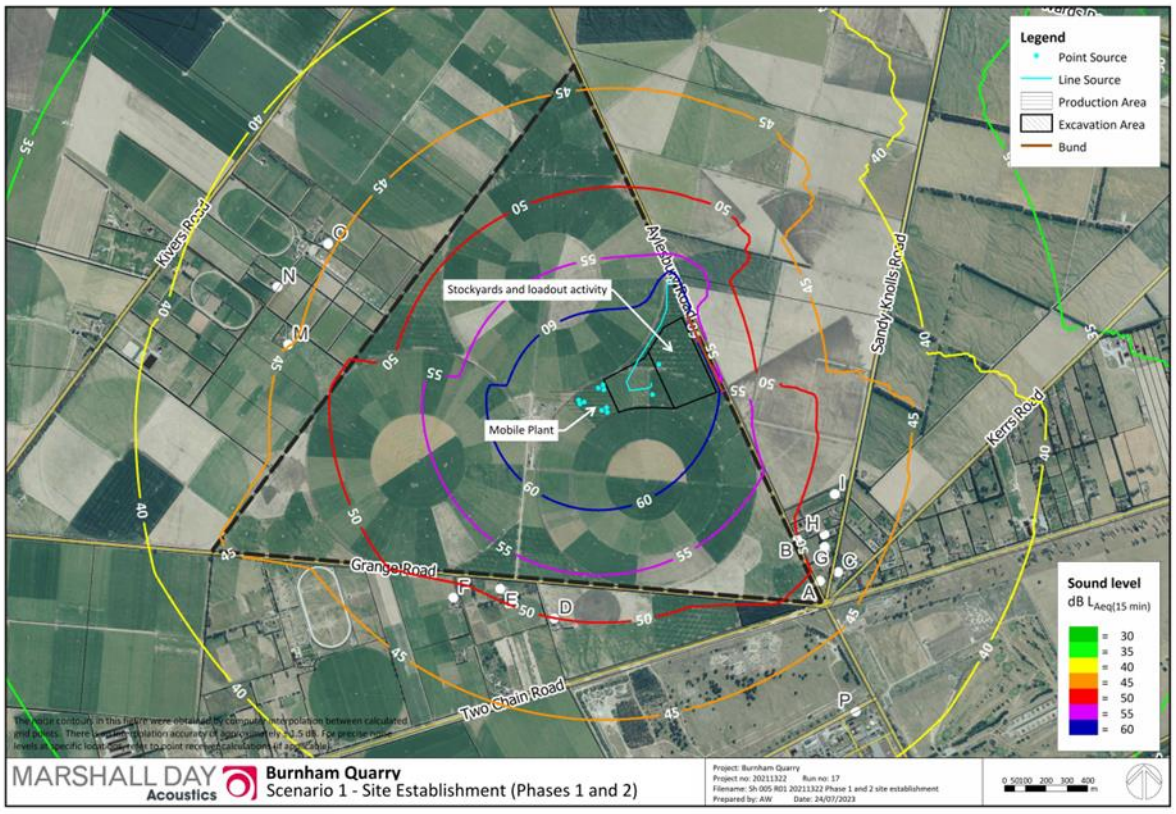


This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

6.0 PREDICTED OPERATIONAL NOISE LEVELS

The predicted noise level contours for each scenario described in Section 5.1 are provided in Figure 12 to Figure 16. Larger versions of these plots are provided in Appendix D.

Figure 12: Scenario 1 - Years 1 to 6 - Site Establishment



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 13: Scenario 2 – Years 7 to 10

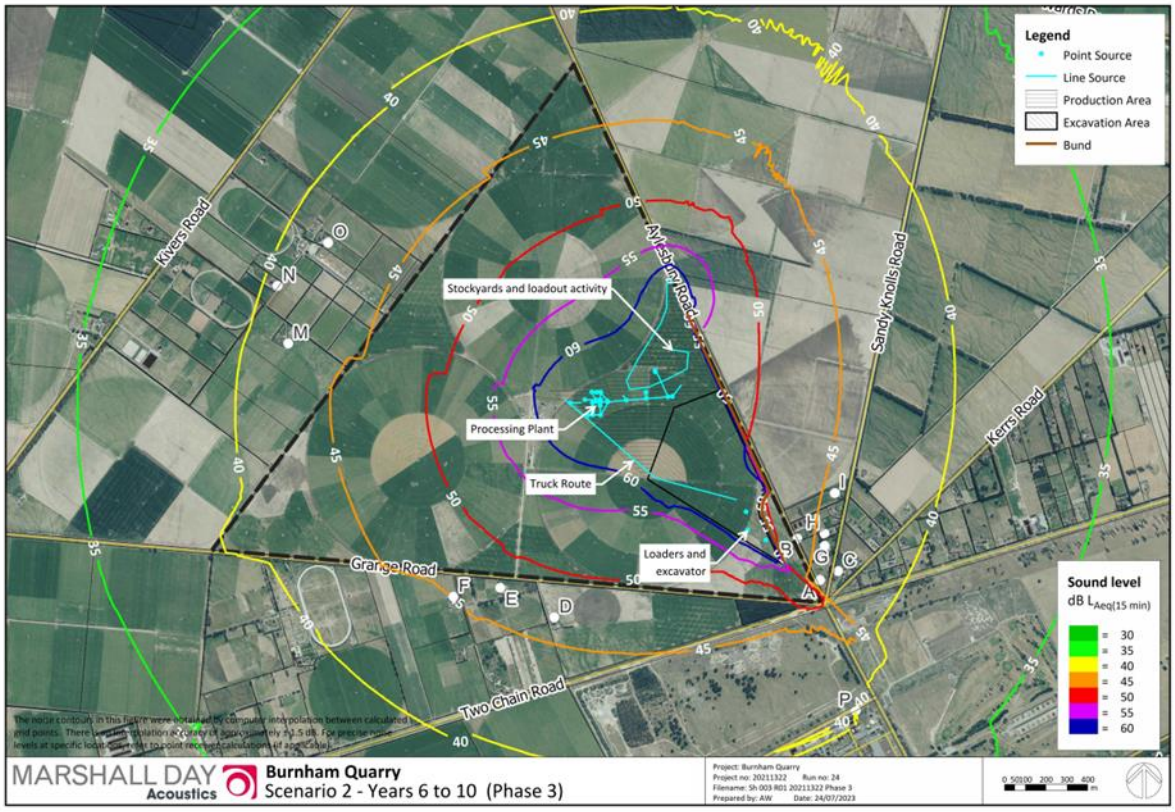
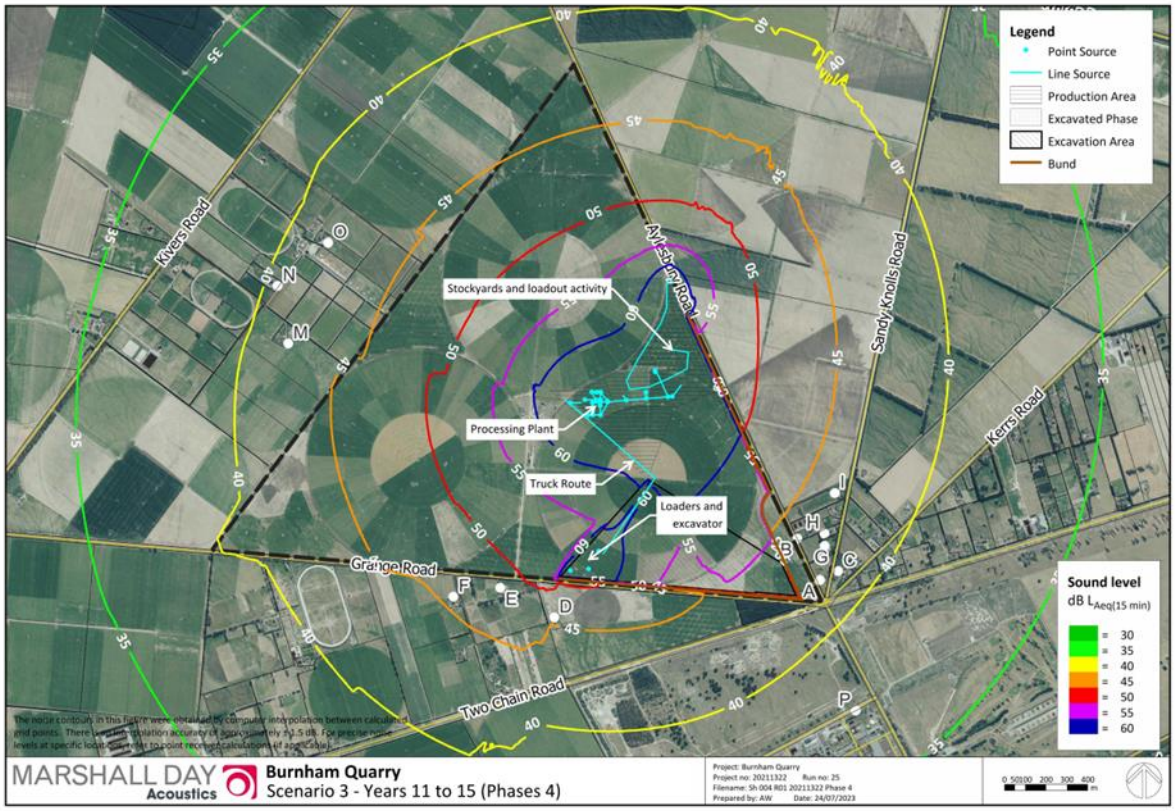


Figure 14: Scenario 3 – Years 11 to 15



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 15: Scenario 4 - Years 31 – 35

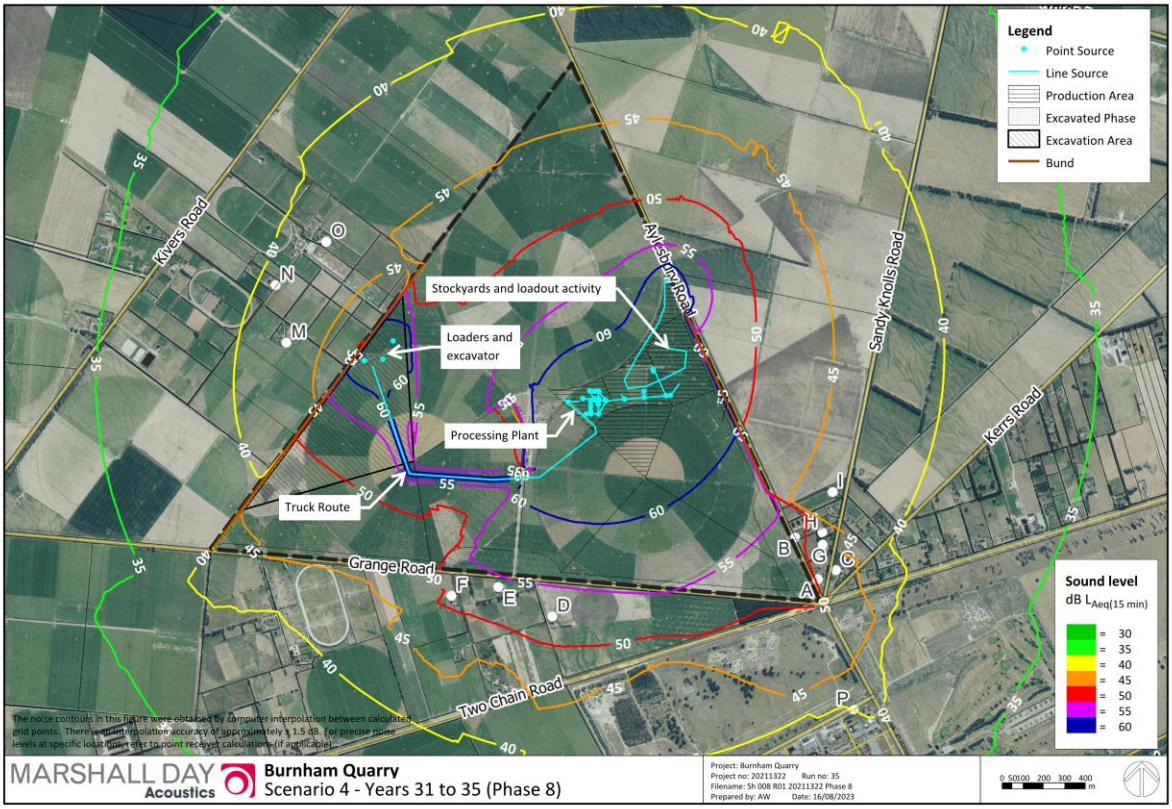
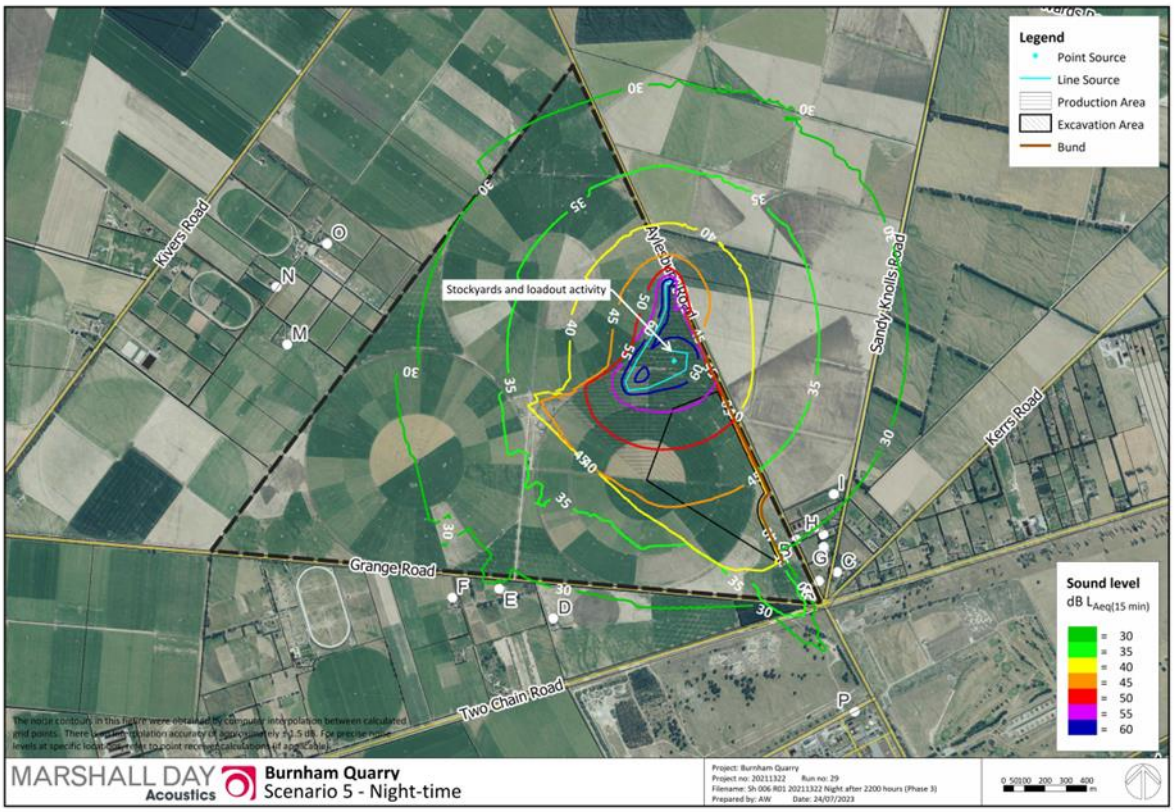


Figure 16: Scenario 5 – Night-time



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Table 12 provides the results of our noise modelling for the scenarios described in Section 5.1. This does not consider the noise from short term construction activities and truck movements on public roads.

Table 12: Calculated noise levels at point receiver locations, dB $L_{Aeq\ (15\ min)}$

		Daytime noise limit 55 dB L_{Aeq}				Night-time noise limit 45 dB L_{Aeq}
ID	**Address**	**Scenario 1 Establishment**	**Scenario 2 Years 6-10**	**Scenario 3 Years 11-15**	**Scenario 4 Years 31-35**	**Scenario 5 Night**
A	146 Aylesbury Road	47	44	42	49	28
B	168 Aylesbury Road	51	47	44	53	30
C	7 Kerrs Road	47	43	41	48	28
D	139 Grange Road	50	46	46	52	28
E	159 Grange Road	51	47	48	52	28
F	181 Grange Road	49	45	46	51	27
G	27 Sandy Knolls Road	48	44	43	49	29
H	35 Sandy Knolls Road	48	44	43	49	30
I	61 Sandy Knolls Road	48	44	43	43	31
J	578 Wards Road	38	37	36	37	24
K	716 Wards Road	37	34	34	34	19
L	718 Wards Road	36	33	33	33	18
M	176 Kivers Road	45	42	42	43	25
N	186 Kivers Road	44	41	41	41	24
O	216 Kivers Road	45	42	42	42	26
P	Burdons Road	42	40	37	41	23

The predicted noise levels in Table 12 show that all modelled scenarios will comply with the proposed project and PDP noise limits of 55 and 45 dB L_{Aeq} respectively during the day and night-time periods. Furthermore, we do not expect the night-time maximum noise criterion of 70 dB L_{AFmax} to be exceeded at any time. As a result, operational activity at the site will result in reasonable noise effects.

We note the modelled Scenario 5 – Night-time, does not include processing activity, but our predictions confirm that processing can occur in the night-time period between 0600 and 0700 hrs and comply with the proposed project noise limit of 45 dB L_{Aeq}.

For the purposes of assessing compliance with the applicable ODP permitted activity day/night noise limits of 60 and 45 dB L_{A10} respectively, it is appropriate to convert the metric L_{Aeq} to L_{A10} by adding 2 dB to the values in Table 12. Whilst noise emissions will mostly comply with the daytime and night-time noise limits, the proposed commencement of site activity at 0700 hrs means the night-time noise limit of 45 dB L_{A10} applies until 0730 hrs. The proposed activity will exceed the ODP permitted activity limit during this 30 minute period by up to 10 dB. We note these non-compliances do not affect the status of the application – it is already full discretionary.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

7.0 CONSTRUCTION NOISE ASSESSMENT

Site establishment activities such as construction of amenities, initial bunding, and final rehabilitation activities are commonly assessed as construction noise rather than operational noise as they:

- Are temporary activities that occur for a short period
- The character and duration of noise are consistent with rural activities that would otherwise be permitted on site
- The work will result in long term benefits for the site – such as noise reduction from bunds

The nature of these activities mean people will typically tolerate a higher noise level as long as it is no higher than necessary and occurs at an appropriate time of day.

7.1 Construction Noise Limits

The ODP does not provide construction noise performance standards and we consider it appropriate to assess construction activities against New Zealand Standard NZS 6803:1999 *Acoustics - Construction Noise* which provides recommended noise limits based on the expected duration of the works. These limits, unlike the operational noise limits, are assessed at one metre from the façade of the building affected by the noise. We note that NZS 6803:1999 is the Standard referred to in the PDP.

Table 13 (reproduced from Table 2 of NZS 6803:1999) provides the recommended noise limits for rural dwellings. Based on our current understanding of the project, we expect that the "long term" limits will be appropriate.

Table 13: ***Recommended upper limits for construction noise received in residential zones and dwellings in rural areas***

Time of week	***Time period***	***Duration of work***					
		Typical duration (dBA)		***Short-term duration (dBA)***		***Long-term duration (dBA)***	
		L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
Weekdays	*0630-0730*	*60*	*75*	*65*	*75*	*55*	*75*
	0730-1800	*75*	*90*	*80*	*95*	*70*	*85*
	1800-2000	*70*	*85*	*75*	*90*	*65*	*80*
	2000-0630	*45*	*75*	*45*	*75*	*45*	*75*
Saturdays	*0630-0730*	*45*	*75*	*45*	*75*	*45*	*75*
	0730-1800	*75*	*90*	*80*	*95*	*70*	*85*
	1800-2000	*45*	*75*	*45*	*75*	*45*	*75*
	2000-0630	*45*	*75*	*45*	*75*	*45*	*75*
Sundays and public holidays	*0630-0730*	*45*	*75*	*45*	*75*	*45*	*75*
	0730-1800	*55*	*85*	*55*	*85*	*55*	*85*
	1800-2000	*45*	*75*	*45*	*75*	*45*	*75*
	2000-0630	*45*	*75*	*45*	*75*	*45*	*75*

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

7.2 Calculated Construction Noise Levels

Due to the central location of the processing zone and site amenities, construction activities in these areas are unlikely to have noise effects that differ significantly from the noise levels expected during normal site operations.

The construction activity that is likely to have the greatest noise effect will be the construction of the permanent bund and 3 metre topsoil stockpiles along Aylesbury and Grange Roads due to the proximity to dwellings at that intersection, and lack of screening between the bund and the dwellings.

We have calculated noise from construction activity using the methodology described in NZS 6803:1999, for bund construction adjacent to the closest dwelling with overburden stripping occurring in the initial extraction area. Table 14 provides the range of mobile equipment that could be used at their anticipated noise levels. Noise source data has been taken from BS5228.

Table 14: Indicative noise levels at 1m from a building façade

Equipment	Sound Power	Façade Noise Level (dB L_{Aeq})				Limit Setback (m)
	(dB L_{wA})	5m	10m	20m	50m	70 dB L_{Aeq}
20t tracked excavator	103	84	78	72	63	25
40t Articulated dump truck	107	88	82	76	67	36
28t Bulldozer	107	88	82	76	67	36
Grader	114	95	89	83	74	69

The rightmost column in Table 14 shows the set back distances required for each item of mobile plant to achieve the "long term duration" daytime construction noise limit of 70 dB L_{Aeq} – they are in the range 25 to 69 metres and therefore well within the setback distance of 100 metres to the nearest dwelling.

This analysis shows construction activities on site will comfortably comply with the applicable NZS 6803 noise limits and the PDP construction noise rule.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

8.0 SITE GENERATED VIBRATION

There are no significant vibration sources associated with the operation of the proposed quarry (noting that there is no blasting required). The vibration-generating activities that will occur close to sensitive receivers are:

- Bund construction to the south-eastern boundary, using excavators and trucks; and
- Aggregate extraction by loaders at the edge of the quarry pit.

In our experience aggregate extraction results in very little vibration outside of the site, while bund construction is generally the activity with the most potential to generate vibration effects, due to its proximity to receivers (noting that the setback distance will be 100 metres from the nearest dwellings).

Both of these activities involve plant and equipment typical of construction activities. A number of documents provide guidance on the assessment and management of construction vibration, and these are discussed below.

8.1 Vibration Assessment Criteria

We consider it appropriate to consider potential vibration effects on buildings and human response through reference to the following guidance:

- Building damage – German Standard DIN 4150-3:2016 *"Structural Vibration - Effects of Vibration on Structures".* This standard is in common use in New Zealand and is referred to in PDP Rule NOISE R-14; and
- Human response – British Standard BS 5228-2:2009 "*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration"*.

Both of these Standards provide vibration criteria in terms of the Peak Particle Velocity (PPV), which are summarised in the following sections.

8.1.1 Building Damage Criteria

The DIN 4150-3:2016 Standard provides conservative guidance designed to prevent any damage (even superficial) to buildings. It sets criteria for both long- and short-term vibration that apply in all axes at the building foundation or in horizontal axes at the highest floor adjacent to a façade wall.

The Standard defines 'short-term' vibration as *'vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated*'. Common sources include blasting, drop-hammer piling, and dynamic consolidation. Long-term vibration is defined as all other vibration types not covered by the short-term vibration definition. Common sources include most construction machinery, vibratory rollers and vibro-hammer piling. Some sources (e.g. construction traffic) could be either or both, in which case the more stringent long-term values should be adopted. The key criteria are summarised in Table 15.

Table 15: Summary of building damage risk vibration criteria from DIN 4150-3:2016

Type of structure	Short-term				Long-term
	PPV at the foundation by frequency, mm/s			PPV at highest floor, mm/s	PPV at highest floor, mm/s
	1 – 10 Hz	10 – 50 Hz	50 – 100 Hz		
Commercial/Industrial	20	20 - 40	40 - 50	40	10
Residential/School	5	5 - 15	15 - 20	15	5
Historic or sensitive structures	3	3 - 8	8 - 10	8	2.5

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

The Standard states that *'experience has shown that if* [the guideline values] *are complied with, damage will not occur. Exceeding the* [guideline values] *slightly does not necessarily lead to damage'*.

8.1.2 Human Response Criteria

Annex B of British Standard BS 5228-2:2009 *"Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration"* provides guidance relating to human response to construction vibration in residential environments. These criteria are summarised in Table 16.

Table 16: Guidance for human response to construction vibration in BS 5228-2:2009, Annex B

Vibration (PPV)	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Comparing these values with those derived from the DIN Standard above, it is clear that people are likely to perceive and potentially adversely respond to vibration levels significantly below those which may cause superficial building damage (such as cracking in paint or plasterwork). Additionally, people are generally more sensitive to vibration at frequencies higher than those which cause building damage.

8.2 Vibration Generation

The closest dwelling to the construction of boundary bunds is at 168 Aylesbury Road, where the façade is approximately 100 metres from the proposed bund.

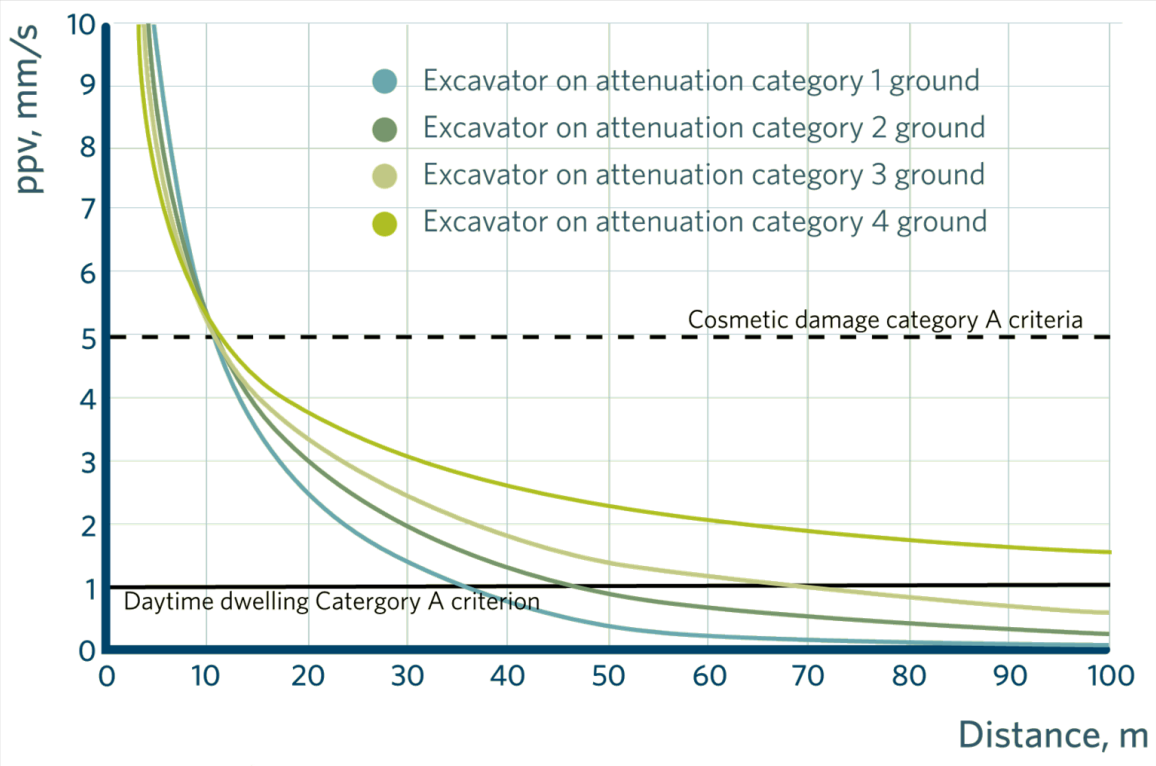
Vibration received at a location from any given source will vary depending on a number of factors that determine the ground propagation conditions, e.g. soil type, density, elasticity, etc. Figure 17 shows predicted vibration propagation over distance from an excavator for different ground types. This is from the NZTA's construction guidance[3] that has been developed based on empirical data discussed in their extensive research[4]. The ground categories are broadly from: 1 – weak or soft; to 4 – hard, competent rock.

[3] *State Highway Construction and Maintenance Noise and Vibration Guide*. NZ Transport Agency (2013).

[4] Cenek, PD, et al (2012) *Ground vibration from road construction*. NZ Transport Agency research report 485. 80pp.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 17: Predicted vibration from a Sumitomo SH120 excavator (Figure 4.31 of NZTA's construction noise guide)



The footnote to the NZTA's figure above notes that:

> *'… some of these data have been measured at distances less than 10m and subsequently corrected for distance. Using the 10m source data generally results in an over-prediction of the vibration level at distances less than 50m compared to using the original source data at the closer distance …'*

In practice, our recent measurement experience with similar sources indicates that the guidance in Figure 17 is somewhat conservative, as is generally the case for many "prediction" methodologies. For example, our own measurement data indicates typical levels of:

- 1.1 mm/s at 10 metres from Hitachi Zaxis 330LC excavator loading dump truck;
- 0.2 mm/s at 19 metres from Hitachi Zaxis 670LCH excavator loading dump truck; and
- 1.5 mm/s at 10 metres from an excavator operating a diaphragm wall rig.

On the basis of the data above, the conservative NZTA guidance suggest that vibration levels from an excavator working at 20 metres may vary between 2.5 and 3.8 mm/s, whereas our own measurements indicate that the upper levels of vibration will be between 1 and 2 mm/s.

8.3 Vibration Assessment

At 100 metres, even the most conservative (highest) estimations of vibration generation above are comfortably below the residential building damage criterion of 5 mm/s. Similarly, we expect vibration will be below the 1.0 mm/s threshold from BS 5228-2:2009 and will likely be imperceptible in practice.

Aside from bund construction, vibration from other activities received at the closest dwelling will be minimal. Similarly, vibration received at any other property from all activities (including bund and stockpile construction) is not likely to be perceptible within dwellings.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

9.0 NOISE FROM QUARRY TRAFFIC ON PUBLIC ROADS

Although road traffic noise generated outside of the site is not considered against the District Plan noise standards, reference to ODP Rule 9.12.2.2 requires us to assess the potential adverse noise effects on residential amenity.

There is no universally accepted way of assessing amenity effects from truck noise (as the District Plan noise limits do not apply), but the analysis typically falls into two categories:

i. The relative change in vehicle numbers (compared to existing) and how this changes the noise levels; and/or

ii. Predicting whether the future traffic noise levels would increase the existing ambient noise levels or exceed applicable guidance for residential amenity.

These matters will be considered in the following sections.

9.1 Assessment Criteria

In terms of national guidance, road traffic noise is outside of the scope of the usual environmental noise assessment Standard, NZS 6802. Guidance is instead given in New Zealand Standard NZS 6806:2010 *"Acoustics - Road-traffic noise - New and altered roads"*.

9.1.1 NZS 6806

For high-flow roads, traffic noise effects generally correlate best with longer term average noise levels. The lowest external noise criterion given in this Standard is 57 dB $L_{Aeq\ (24\ hr)}$, assessed at the façade of any sensitive building (e.g. dwelling) and based on the average annual daily traffic (AADT).

However, we note that NZS 6806 does not apply to existing roads, only new and altered roads with traffic volumes above 2000 AADT (at the design year). The Standard explains in clause 3.4.2 that:

> *'People's response to noise from traffic flows less than 2000 AADT is mostly to individual noise as a transient maximum sound level.'*

Furthermore, the Standard states (C1.3.1) that:

> *'Noise criteria recommended in this Standard are not intended to apply to low volume roads, for example those in isolated rural areas servicing a small number of dwellings … or business activities which generate low traffic volumes.'*

As we discuss below, Stantec's Transport Assessment Report (TAR) provides existing 5-day average traffic volumes on roads around the site as follows (refer to Appendix B):

- Aylesbury Road north of Two Chain Road — 460 vehicles per day
- Aylesbury Road south of Two Chain Road — 1,340 vehicles per day
- Aylesbury Road Burdons Road to State Highway 1 — 3,700 vehicles per day

This data shows that a significant portion of Aylesbury Road has traffic volumes less than 2,000 vehicles a day and, as a result, we consider that the guidance in NZS 6806 is generally not relevant to this project.

9.1.2 Noise Level Guidance

Similar mining and quarrying sites in recent years have adopted assessment criteria that were derived in part from detailed consideration over the application of both NZS 6802 and NZS 6806 to such site-specific traffic noise.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

A daytime traffic noise criterion of 55 dB $L_{Aeq\,(1\,hr)}$ is commonly applied to noise from heavy vehicles[5]. There is no similar commonly adopted guidance for acceptable limits of night-time noise exposure, other than reference to the NZS 6802 and WHO guidance discussed respectively in Section 4.3 and Section 4.3.2 of this report.

9.1.3 Noise Level Change

As discussed above, in lieu of any applicable absolute noise level criteria, it is appropriate to consider the degree of noise change in an environment and any resulting noise effects. As a guide, Table 17 describes the typical subjective reaction to any difference in noise level and demonstrates how this may result in a given level of adverse effects.

Table 17: Change in noise level

Change in Sound Level (dBA)	Subjective Reaction	Impact or RMA Adverse Effect
1 - 2	Imperceptible change	Negligible/less than minor
3 - 4	Just perceptible change	Slight/Minor
5 - 8	Appreciable change	Noticeable
9 - 11	Doubling of loudness	Significant/Substantial
> 12	More than a doubling of loudness	Severe

In our experience the categories above correlate well with reactions to road traffic noise, particularly for roads where effects are more related to the continuous levels of "steady" sound.

9.2 Potentially Affected Locations

The properties that could be affected by trucks travelling to and from the site along Aylesbury Rd to the State Highway are identified in Figure 18 and are discussed in turn below:

- 168 Aylesbury Road
- 146 Aylesbury Road
- Burnham Camp

[5] A commonly cited Environment Court case related is *Brookby Quarries Limited* (ENV-2014-AKL-000048)

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 18: Nearest dwellings to proposed truck route



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

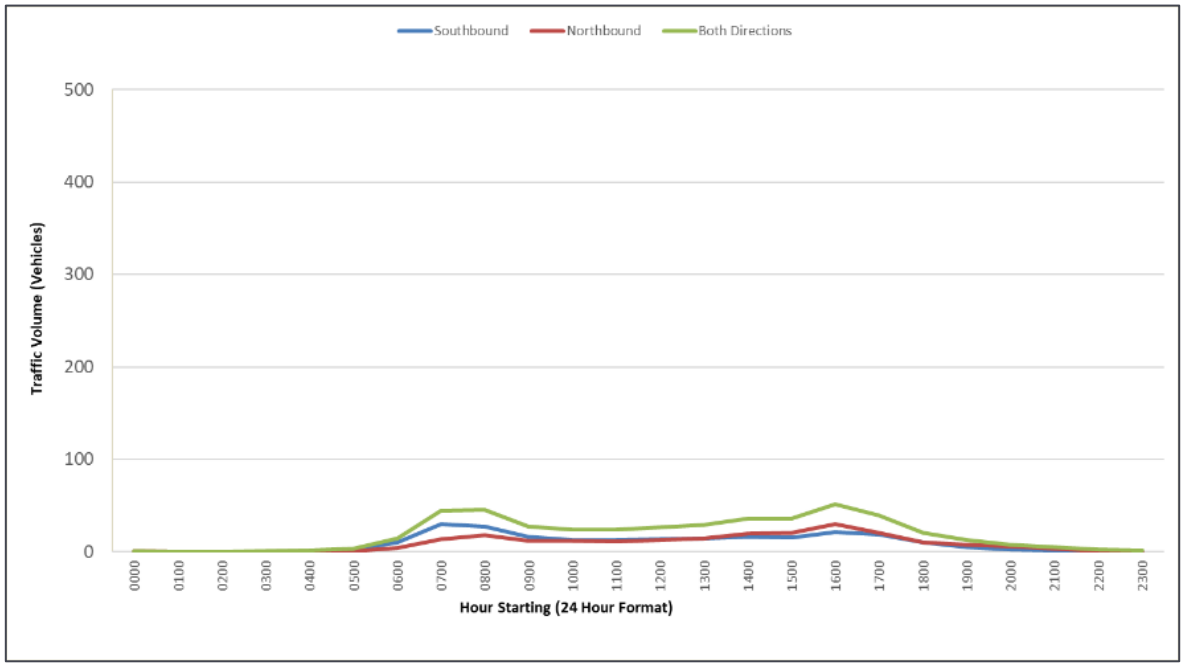
9.2.1 168 Aylesbury Road

The front façade of this dwelling is set back approximately 12 metres from Aylesbury Road. There is a business listed at this address and it is unclear if the dwelling is used for residential purposes – we have assumed so for this assessment.

Figure 19 provides the weekday traffic volume taken from the TAR and this indicates existing total traffic passing this property is 450 vehicles per day (with approximately 10% heavy vehicles) and movements almost exclusively occur between 0500 and 2000hrs. There are less than 10 vehicle movements past this property between 2200 and 0500hrs, at which point vehicle numbers start to increase. On average, there are currently 35 vehicles passing this dwelling every hour during the day, approximately 4 of which are heavy vehicles.

The average daytime noise level at the dwelling is in the low 60s dB $L_{Aeq(1hr)}$. At night the average noise level is approximately 40 dB $L_{Aeq(1hr)}$ when no vehicles are passing.

Figure 19: Weekday Hourly Traffic Volumes - Aylesbury Road north of Two Chain Road



9.2.2 146 Aylesbury Road

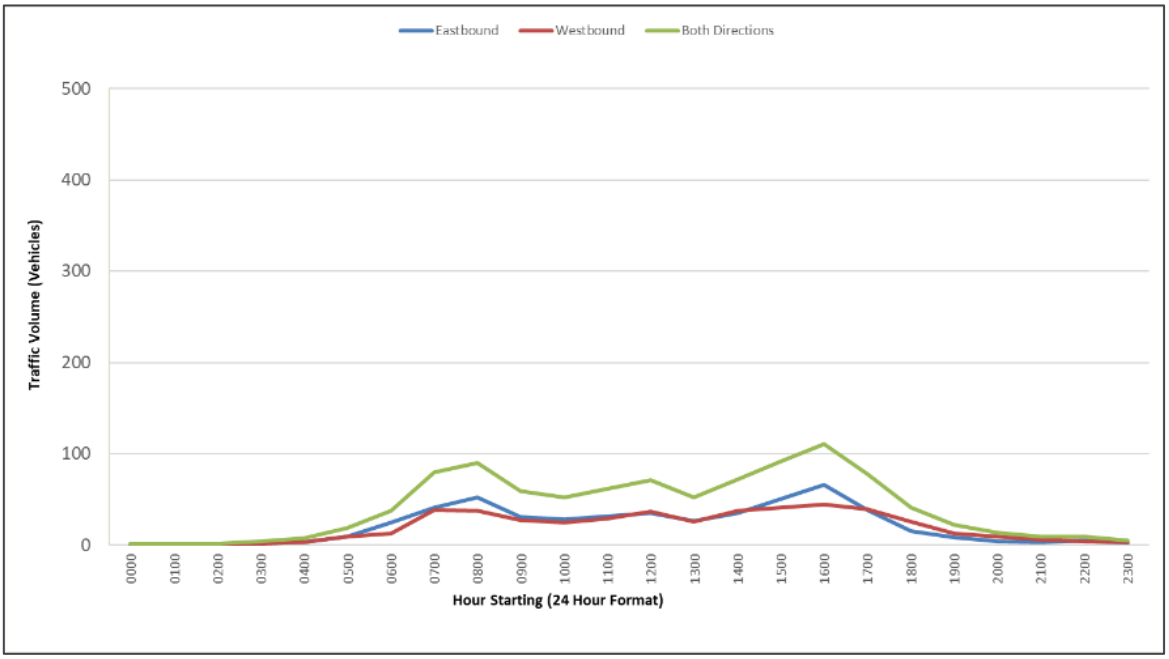
This dwelling is approximately 40 metres from Aylesbury Road and broadly representative of the potential noise effects received at other adjacent dwellings on Sandy Knolls Road. The property receives traffic noise from both Aylesbury and Two Chain Roads. Other roads in the vicinity contribute noise to a lesser extent and there are relatively few movements on Sandy Knolls Road. Existing Aylesbury Road traffic movements are noted above. Two Chain Road carries approximately 1,000 vehicles per day (14% heavy vehicles) with most movements occurring between 0500 and 2000hrs.

The average daytime noise level at the dwelling is approximately 50 dB $L_{Aeq(1hr)}$. At night the average noise level is approximately 40 dB $L_{Aeq(1hr)}$.

Figure 20 provides the weekday hourly traffic volume for the closest section of Two Chain Road.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 20: Weekday hourly traffic volumes on Two Chain Road east of Aylesbury Road



9.2.3 Burnham Camp

The section of Aylesbury Road past Burnham Camp currently carries relatively high vehicle numbers as indicated in Figure 21.

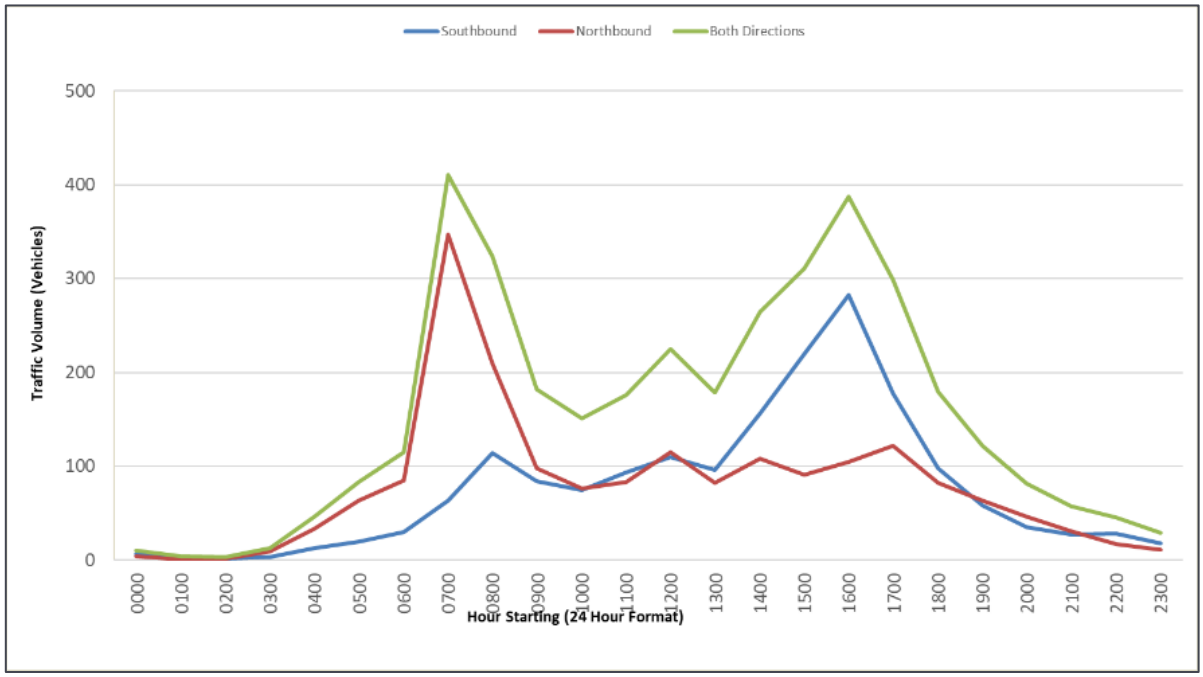
Traffic volumes are currently 3,700 vehicles per day between Burdons Road and State Highway 1. The hourly distribution shows morning and afternoon peaks and some activity into the late evening. Between 2200 and 0500 hrs there are approximately 150 vehicles past Burnham Camp and movements begin to steadily increase from around 0400 hrs. The Camp is also subject to traffic noise from State Highway 1 and this is likely to be more prominent at night.

We have based our analysis on the closest Camp buildings to Aylesbury Road which are the barrack-style structures set back approximately 50 metres. We do not know if activities within these building are noise sensitive but, in any event, provide a worst-case analysis. The most obvious residential dwellings within the Camp along Whites Road are much closer to SH1 and will experience relatively high existing traffic noise levels from SH1 and the railway and we do not consider them to be potentially affected.

During the day, the average noise level is in the order of 55 dB L_{Aeq} at the Camp. At night, the average noise level is approximately 45 dB L_{Aeq}.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 21: Weekday Hourly Traffic Volumes on Aylesbury Road - Burdons Road to SH1



9.3 Proposed Truck Noise Levels

As noted in Section 2.4, the quarry proposes to have the following truck movements:

- Average 300 movements per day
  30 movements per hour
- Maximum 750 movements per day
  112 movements per hour

We have assessed the likely noise effects on an hourly basis at each of the representative locations for these average and maximum values of 30 and 112 movements per hour. We have used a truck noise source level of 84 dB L_{AE} at a distance of 10 metres.

As described in Table 2, the applicant is seeking the ability to have up to 10 truck movements per hour between 0500 and 0700 hrs which is considered night-time in both the ODP and PDP.

9.3.1 168 Aylesbury Road

The anticipated truck noise levels for 168 Aylesbury Road are presented in Table 18.

Table 18: 168 Aylesbury Road - Relative change in daytime noise levels for different truck movements

No. of truck movements per hour	Truck noise level, dB $L_{Aeq(1hr)}$	Relative change, dB	Potential adverse noise effect	Below the 55 dB $L_{Aeq(1hr)}$ guideline value?
30 (average)	61	+3 to +5	Slight to Noticeable	Not applicable[1]
112 (maximum)	67	+7 to +10	Significant	Not applicable[1]

Note [1]: the existing ambient traffic noise level already exceeds the 55 dB L_{Aeq} guideline noise level.

The relative change in truck noise level can be considered to have a noticeable to significant adverse effect at this dwelling for the average and maximum truck movements respectively. However, with the provision of noise mitigation at the property, such as the provision of a noise control fence, truck noise would notably reduce by an estimated 5 to 10 dB and would result in noise effects within an

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

acceptable range. We note that noise mitigation would only be possible through an agreement between the Applicant and property owner.

We note that this dwelling already experiences daytime noise levels in excess of the 55 dB L_{Aeq} guideline noise level for the protection of residential amenity.

9.3.2 146 Aylesbury Road

The anticipated truck noise levels for 146 Aylesbury Road are presented in Table 19.

Table 19: 146 Aylesbury Road - Relative change in daytime noise levels for different truck movements

No. of truck movements per hour	Truck noise level, dB $L_{Aeq(1hr)}$	Relative change, dB	Potential adverse noise effect	Below the 55 dB $L_{Aeq(1hr)}$ guideline value?
30 (average)	54	+3	Just perceptible / Slight	Yes
112 (maximum)	60	+10	Significant	No

The relative change in noise level can be considered to have a slight to significant noise effect for the proposed average and maximum truck movements. However, the absolute noise level of 54 dB $L_{Aeq(1hr)}$ for the "average" case, is considered acceptable in terms of a residential daytime noise amenity.

9.3.3 Burnham Camp

The anticipated truck noise levels for the closest Burnham Camp buildings to Aylesbury Road are presented in Table 20.

Table 20: Relative change in daytime noise levels for different truck movements

No. of truck movements per hour	Truck noise level, dB $L_{Aeq(1hr)}$	Relative change, dB	Description of effect	Below the 55 dB $L_{Aeq(1hr)}$ guideline value?
30 (average)	54	0 to 2 dB	Negligible	Not applicable[1]
112 (maximum)	60	0 to 5 dB	Negligible to moderate	Not applicable[1]

Note [1]: the existing ambient traffic noise level already equals or exceed the 55 dB L_{Aeq} guideline noise level.

Our assessment indicates that the proposed average and maximum truck movements along Aylesbury Road would have negligible to moderate noise effects at the closest buildings within Burnham Camp.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

9.3.4 Early morning truck movements between 0500 to 0700 hrs

Whilst 0500 to 0700 is considered night-time in the both the ODP and PDP, Figure 19, 20 and 21 shows there are already notable traffic movements on Aylesbury Road and Two Chain Road during this time.

Table 21 shows the relative change in noise level for 10 truck movements per hour at each of the key assessment locations.

Table 21: Relative change in noise levels for 10 truck movements between 0500 and 0700 hrs

Location	10 movements per hour Truck noise level, dB $L_{Aeq(1hr)}$	Relative change, dB	Potential adverse noise effect
168 Aylesbury Road	56	5 to 10 dB	Noticeable to significant
146 Aylesbury Road	49	3 to 5 dB	Negligible to moderate
Burnham Camp	49	0 to 3 dB	Just perceptible / Slight

This analysis suggests the greatest potential for adverse noise effects will be for the dwelling at 168 Aylesbury Road. However, as noted above for daytime activity, the provision of appropriate noise control treatment will result in more reasonable noise effects for this dwelling.

Burnham Camp will be least affected by the proposed early morning truck movements as traffic noise levels are already elevated at this time of day, As a result we expect noise effects will be minimal at this location.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

10.0 ASSESSMENT SUMMARY AND CONCLUSIONS

We have predicted noise levels for various operational scenarios that represent the highest activity noise levels on site. Our assessment shows the site will comply with our proposed project noise limits which will provide reasonable noise effects at nearby residences. We anticipate noise levels will be lower than predicted for most of the time.

For the purposes of assessing compliance against the District Plan permitted activity standards, we note the activity will exceed the Operative District Plan permitted activity noise limits by up to 10 dB between 0700 and 0730 hrs. This is a result of the cross over of proposed operational hours and the night-time hours of the Operative District Plan. The site will comfortably comply with the Partially Operative District Plan noise limits at all times.

Existing ambient noise levels at adjacent residences set back 50 to 70 metres from Grange and Aylesbury Roads are broadly 40 to 50 dB L_{Aeq} during the day. The noise environment is dominated by traffic and natural environment sounds. Dwellings closer to these roads will experience higher noise levels from traffic in the order of 60 dB L_{Aeq}. For these dwellings, site activities may be audible during lulls in traffic but a level that is below the recommended criteria and appropriate for the protection of residential amenity.

Noise from construction activities, including the formation of bunds and site facilities, will comfortably comply with the applicable New Zealand Standard.

Vibration generation is likely to be highest during the construction phase but is expected to be negligible at dwellings and significantly below the applicable criteria for structural damage and human response.

Noise effects from quarry trucks have the potential, without mitigation, to range between negligible and significant depending on the proximity of dwellings to the road and the existing traffic activity. For example, daytime noise effects at Burnham Camp will be negligible for proposed average truck volumes of 30 movements per hour. At 168 Aylesbury Road, daytime truck noise effects have the potential to be slight to significant for proposed average and maximum truck movements respectively. Noise mitigation at this property will reduce truck noise levels and noise effects would be in a more reasonable range.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

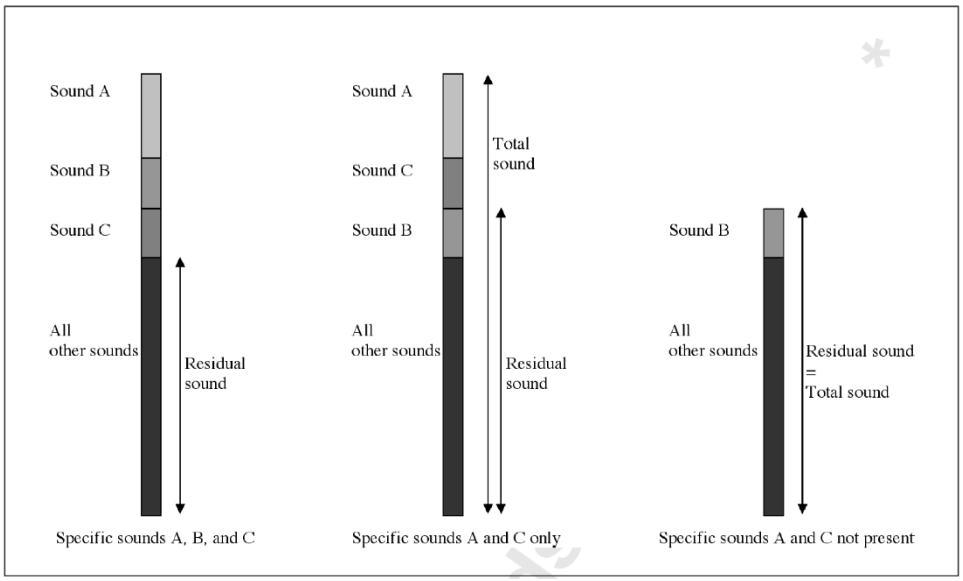
11.0 RECOMMENDATIONS

In order to ensure reasonable noise effects from site activity at nearest residents, we have provided the following suggested text that may be drafted into conditions of consent:

1. The consent holder shall ensure that all activities on the site, measured in accordance with the provisions of NZS 6801:2008 "Acoustics – Measurement of environmental sound", and assessed in accordance with NZS 6802:2008 "Acoustics - Environmental Noise", shall not exceed the following noise limits within the notional boundary of any dwelling, during the following times:
   - Daytime 0700 to 2200 hrs 55 dB $L_{Aeq(15mins)}$
   - Night 2200 to 0700 hrs 45 dB $L_{Aeq(15mins)}$ and 70 dB L_{AFmax}
2. Construction activities including erection of structures and buildings, formation of site access roads, bund construction and site rehabilitation, shall be conducted in accordance with NZS 6803: 1999 "Acoustics - Construction Noise", and shall comply with the "long term duration" noise limits contained within Table 2 of that Standard.
3. Should vehicle reversing alarms be required in vehicles owned by the site operator, only broadband noise alarms are to be used. Tonal reversing alarms are not permitted.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

APPENDIX A GLOSSARY OF TERMINOLOGY

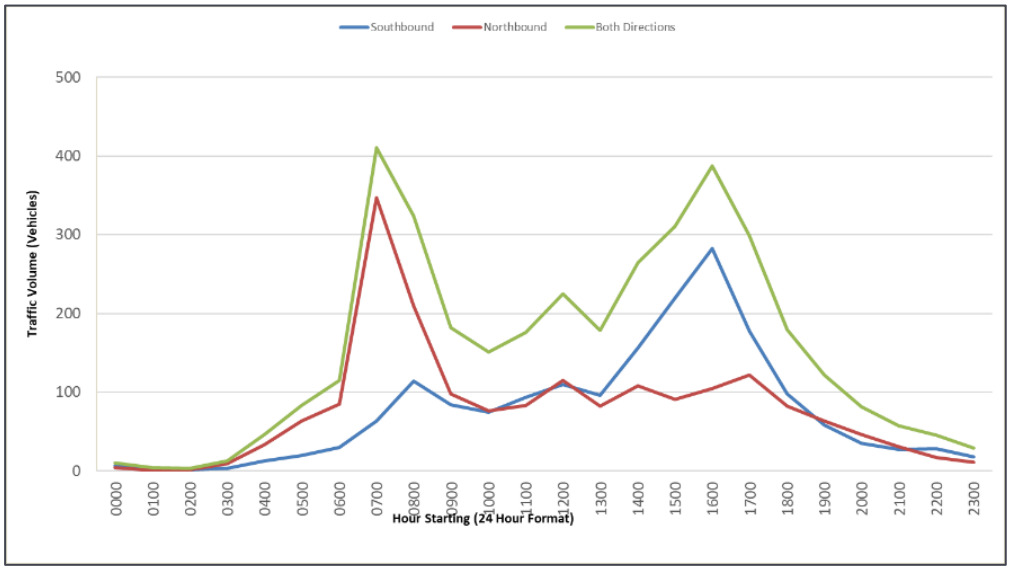
A-weighting	A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds. Sound levels using an "A" frequency weighting are expressed as dB L_A. Alternative ways of expressing A-weighted decibels are dBA or dB(A).
dB	Decibel. The unit of sound level.
L_{A10}	The A-weighted sound level exceeded for 10% of the measurement period, measured in dB. Commonly referred to as the average maximum noise level.
L_{A90}	The A-weighted sound level exceeded for 90 % of the measurement period, measured in dB. Commonly referred to as the background noise level.
L_{Aeq}	The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.
L_w	Sound Power Level. The calculated level of total sound power radiated by a sound source. Usually A-weighted i.e. L_{WA}.
Background sound	The sound that is continuously present in a room our outdoor location. Often expressed as the A-weighted sound level exceeded for 90 % of a given time period i.e. L_{A90}.
Noise	A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.
Notional boundary	A line 20 metres from any side of a dwelling, or the legal boundary where this is closer to the dwelling. This definition is from NZS 6802:2008.
Total sound **Or** **Ambient sound**	The totally encompassing sound in a given situation at a given time, from all sources near and far, including the Specific Sound. See also Residual Sound.  This definition is from NZS 6802:2008.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

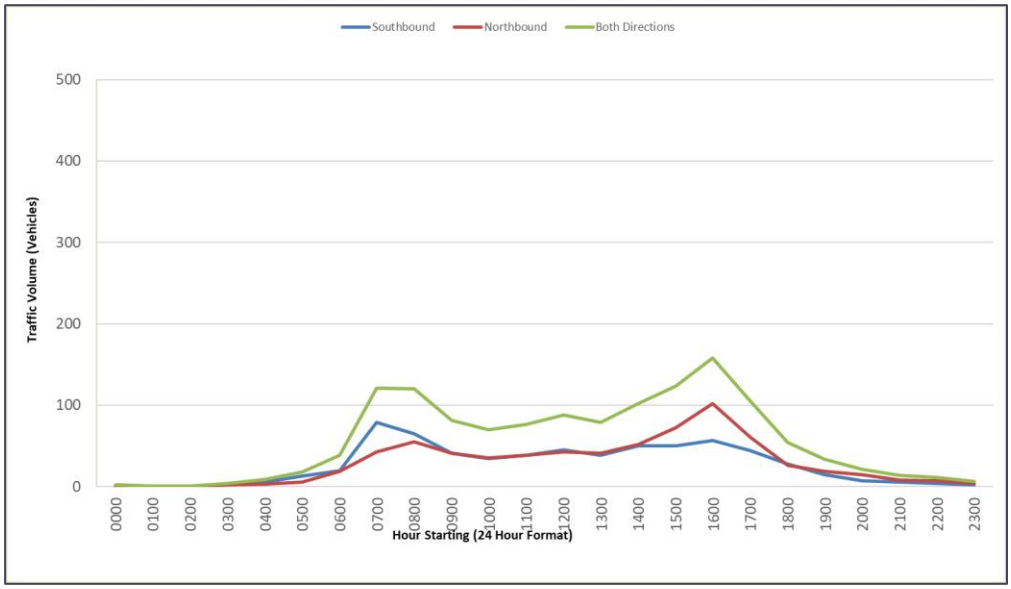
APPENDIX B SUMMARY OF STANTEC TRAFFIC DATA FOR AYLESBURY RD

Local Road Daily Traffic Volumes (vehicles per day)

Road Location	Weekday (5 day) Average Volume	Average Daily Volume (7 day)	Date
Aylesbury Road north of SH1	3,700	3,350	July 2022
Aylesbury Road south of Two Chain Road	1,340	1,225	July 2022
Aylesbury Road north of Two Chain Road	460	460	July 2022

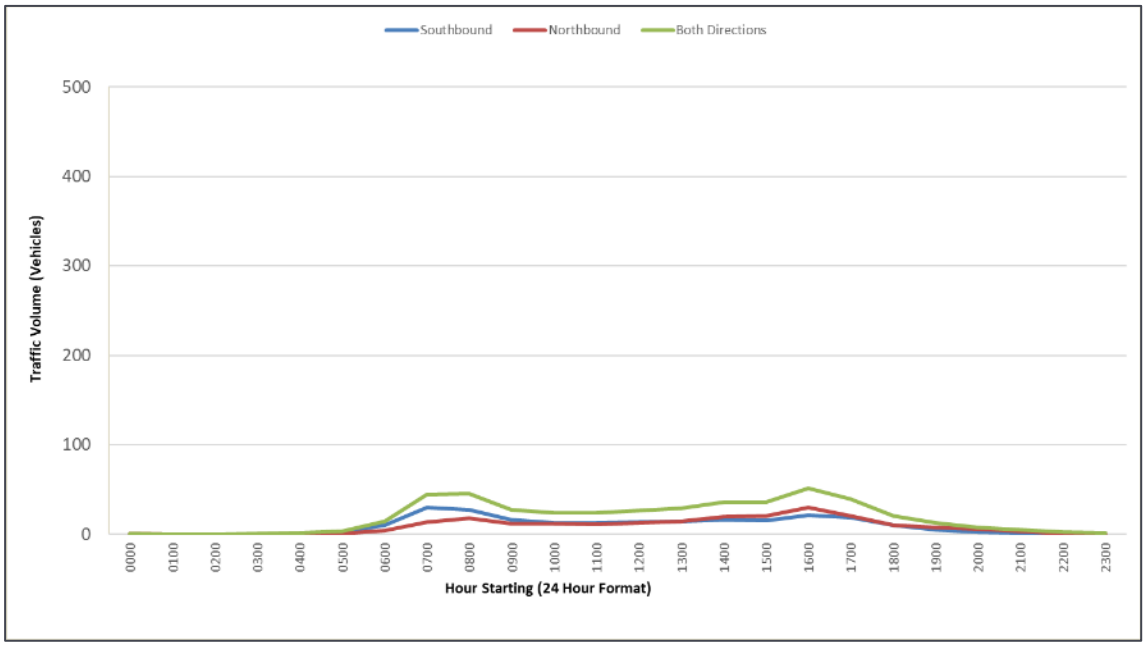


Weekday Hourly Traffic Volumes on Aylesbury Road North of SH1

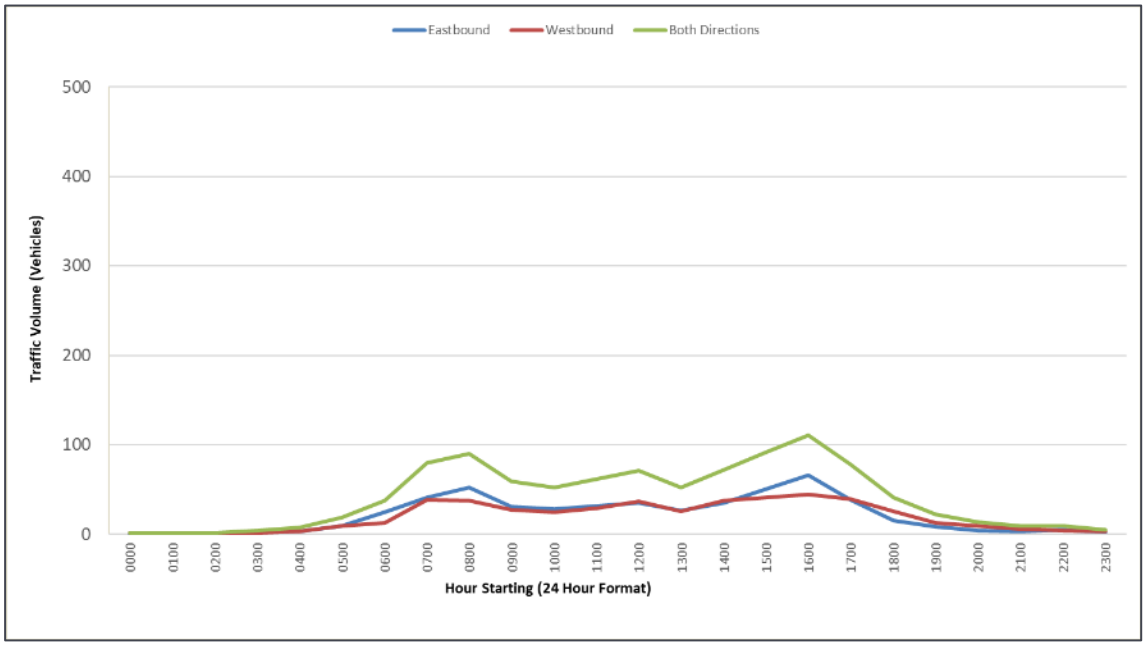


Weekday Hourly Traffic Volumes on Aylesbury Road South of Two Chain Road

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited



Weekday Hourly Traffic Volumes - Aylesbury Road north of Two Chain Road



Weekday hourly traffic volumes on Two Chain Road east of Aylesbury Road

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

APPENDIX C NOISE SURVEYS

C1 Attended survey details

19 May 2022

The key details of the noise survey are as follows:

Date: 19 May 2022, 1130 - 1330 hrs

Personnel: Anna Woods, Marshall Day Acoustics

Weather: Average temperature 16°C, 50% cloud cover, ~6 m/s wind from the north west.

Instrumentation: Brüel & Kjær Type 2250 analyser, serial 2683036, calibration due 22/09/2024
Brüel & Kjær Type 4231 calibrator, serial 2574264, calibration due 04/10/2023

Calibration: Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.1 dB.

27 May 2022

The key details of the noise survey are as follows:

Date: 27 May 2022, 1400 - 1630 hrs

Personnel: Anna Woods, Marshall Day Acoustics

Weather: Average temperature 13°C, 0% cloud cover, ~4 m/s wind from the south east

Instrumentation: Brüel & Kjær Type 2250 analyser, serial 2683036, calibration due 22/09/2024
Brüel & Kjær Type 4231 calibrator, serial 2574264, calibration due 04/10/2023

Calibration: Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.1 dB.

25 July 2023

The key details of the noise survey are as follows:

Date: 25 July 2023, 1300 - 1630 hrs

Personnel: Forester King, Marshall Day Acoustics

Weather: Average temperature 8°C, 100% cloud cover, ~3 m/s wind from the south west

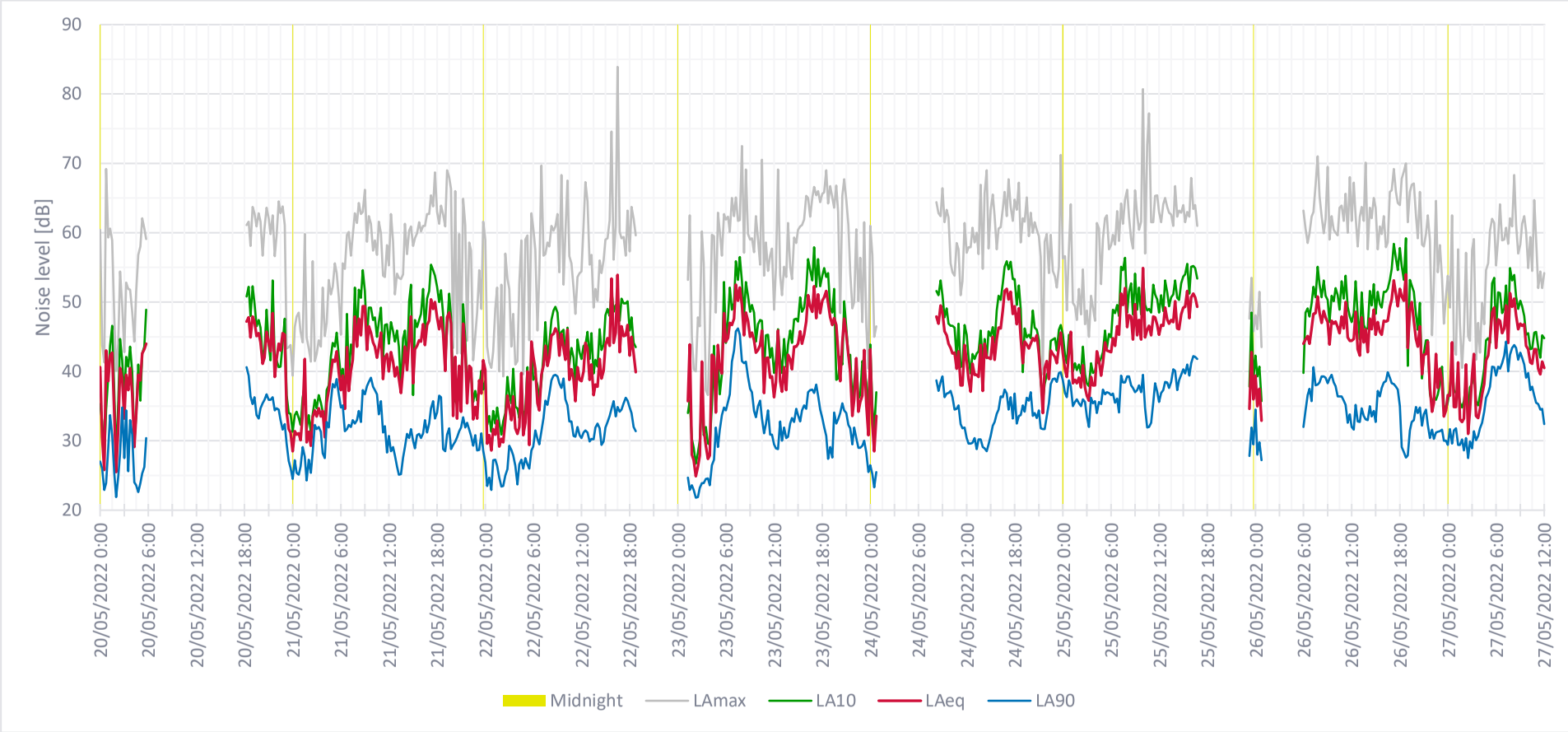
Instrumentation: NTi XL2-TA analyser, serial A2A-20483-E0, calibration due 01/04/2024
Brüel & Kjær Type 4231 calibrator, serial 1882775, calibration due 20/02/2024

Calibration: Field calibration of the equipment was carried out before measurements, and the calibration checked after measurements. Observed change less than 0.1 dB.

This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

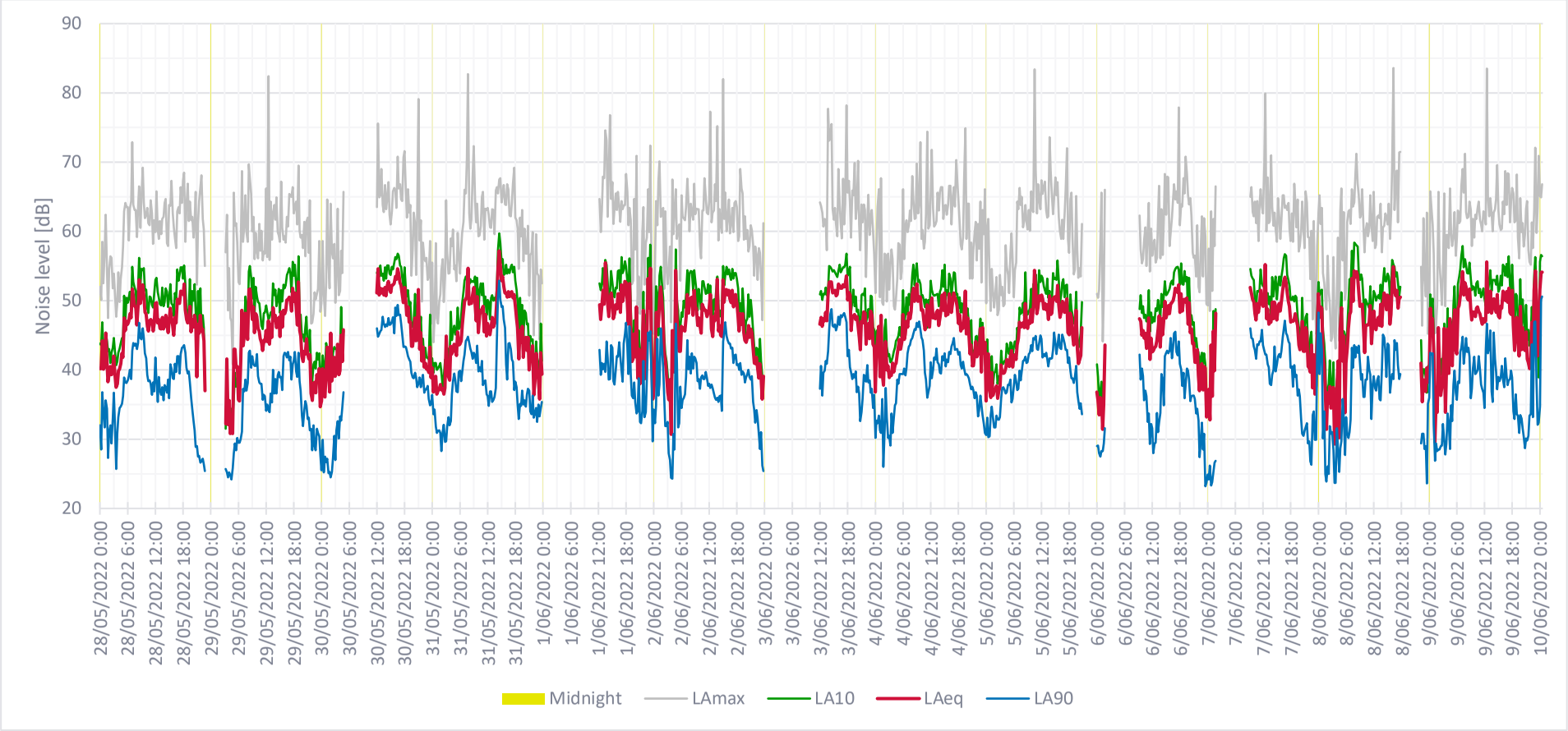
C2 Long term noise logger results

Figure 22: Logger position 1 – 8.5 days



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Figure 23: Logger position 2 – 13 days

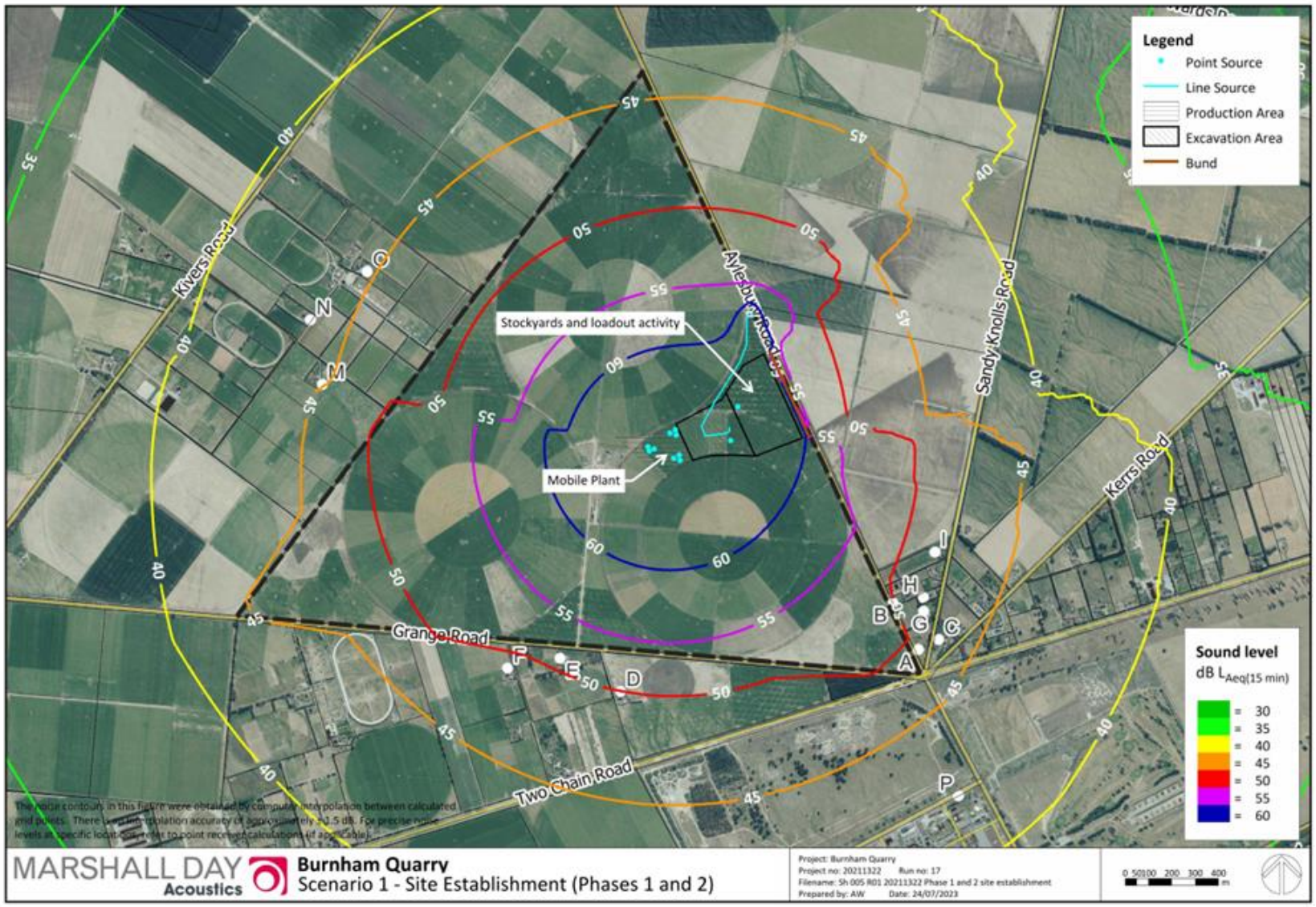


This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

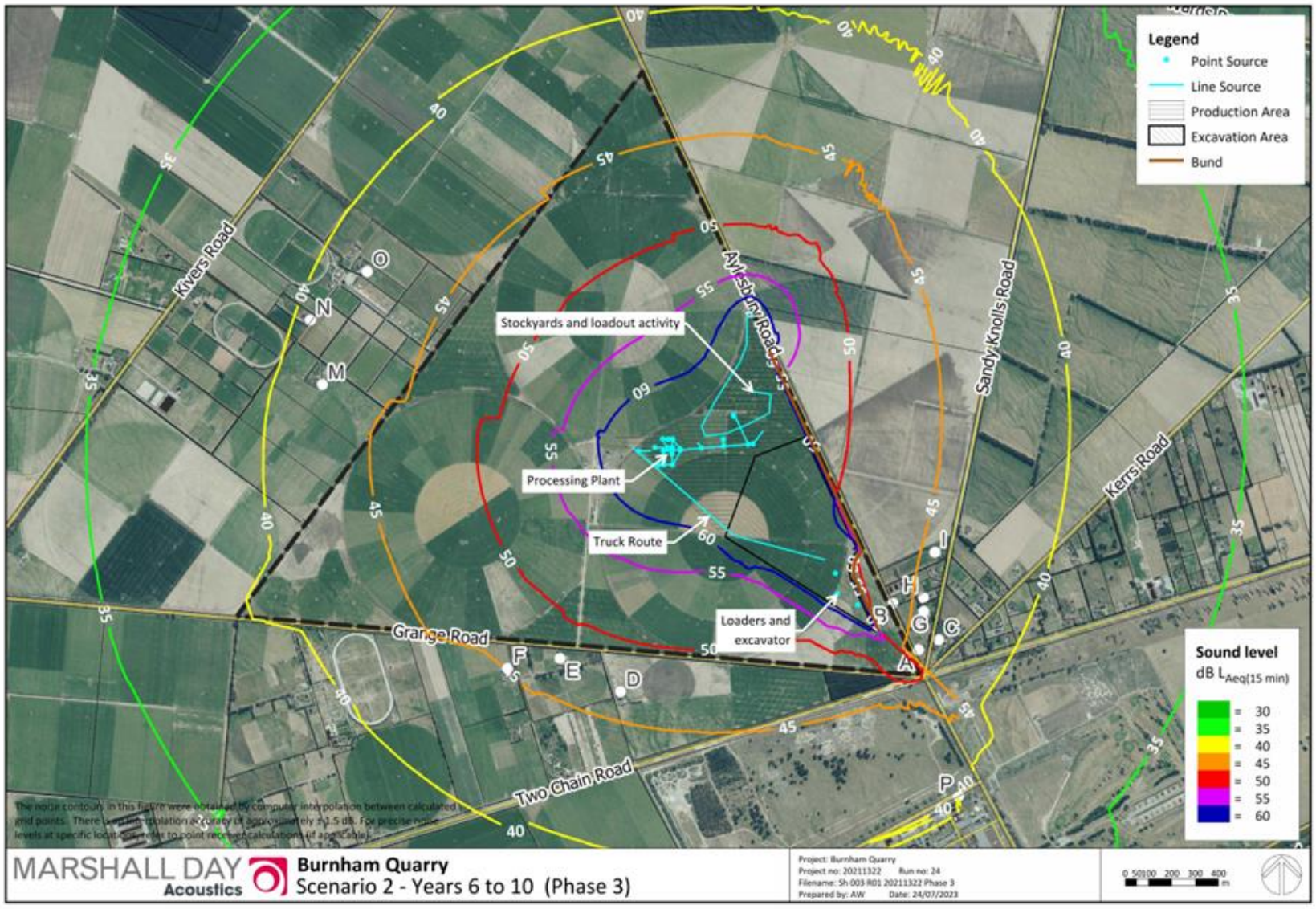
APPENDIX D NOISE CONTOUR PLOTS

(following pages)

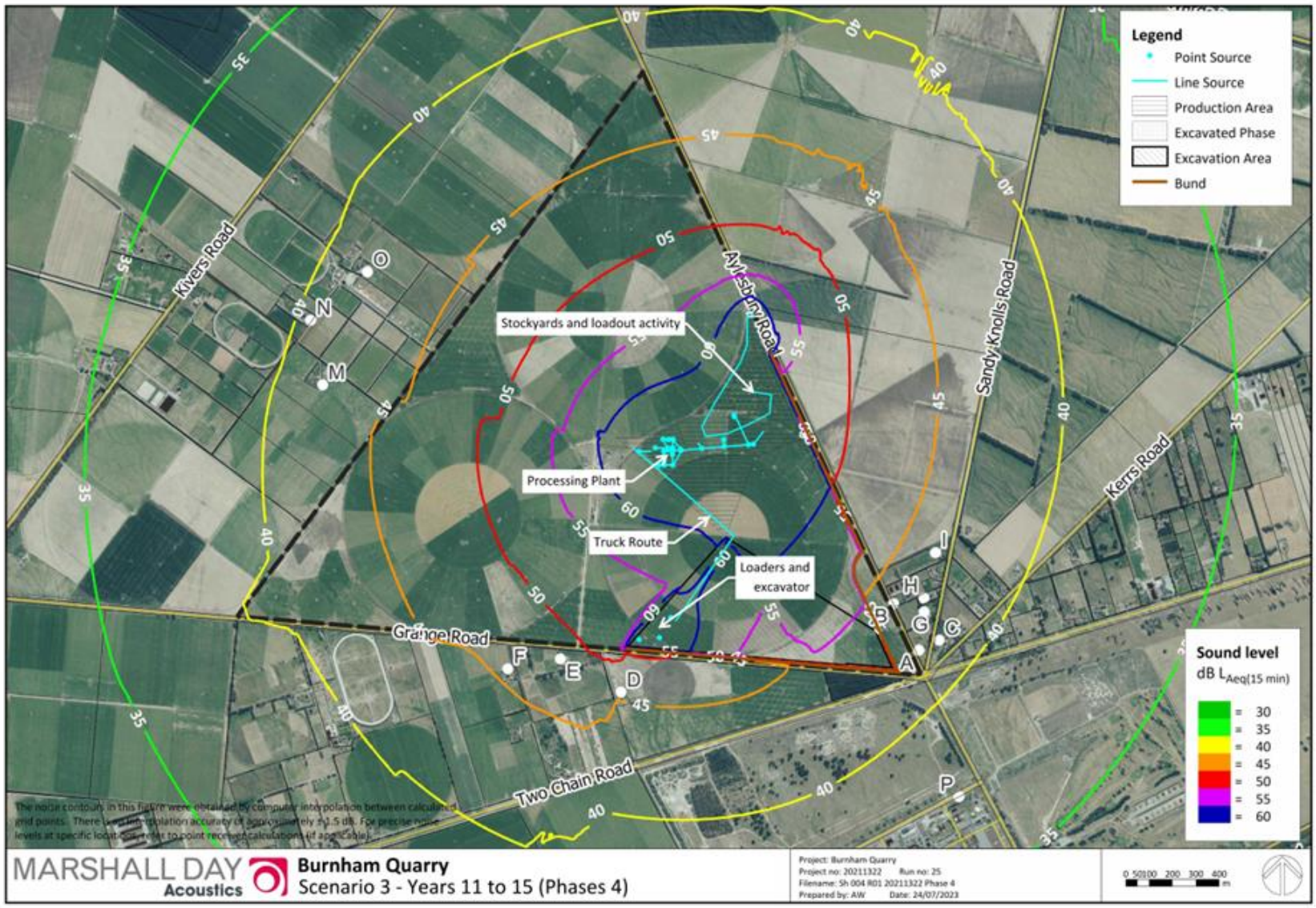
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited



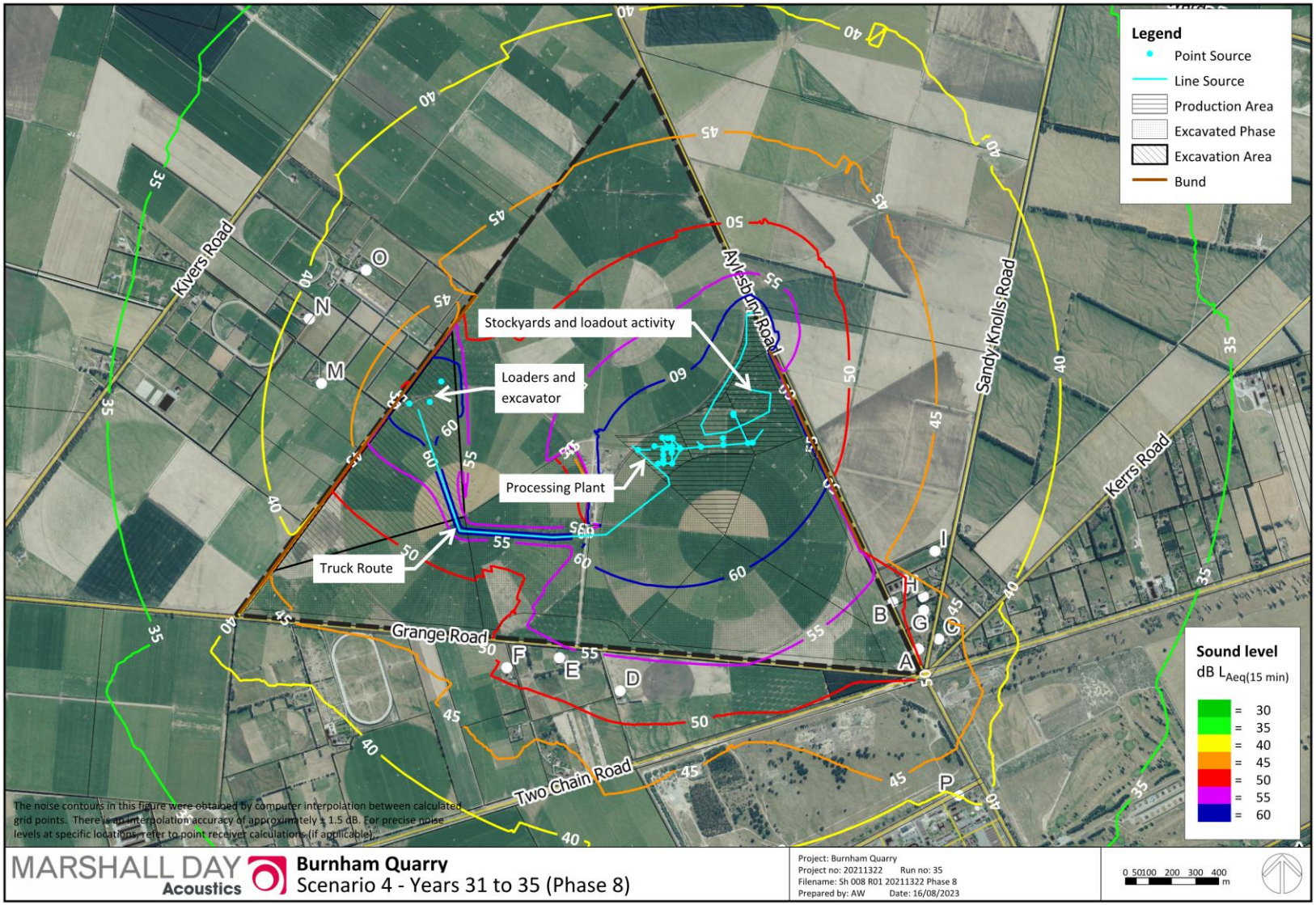
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited



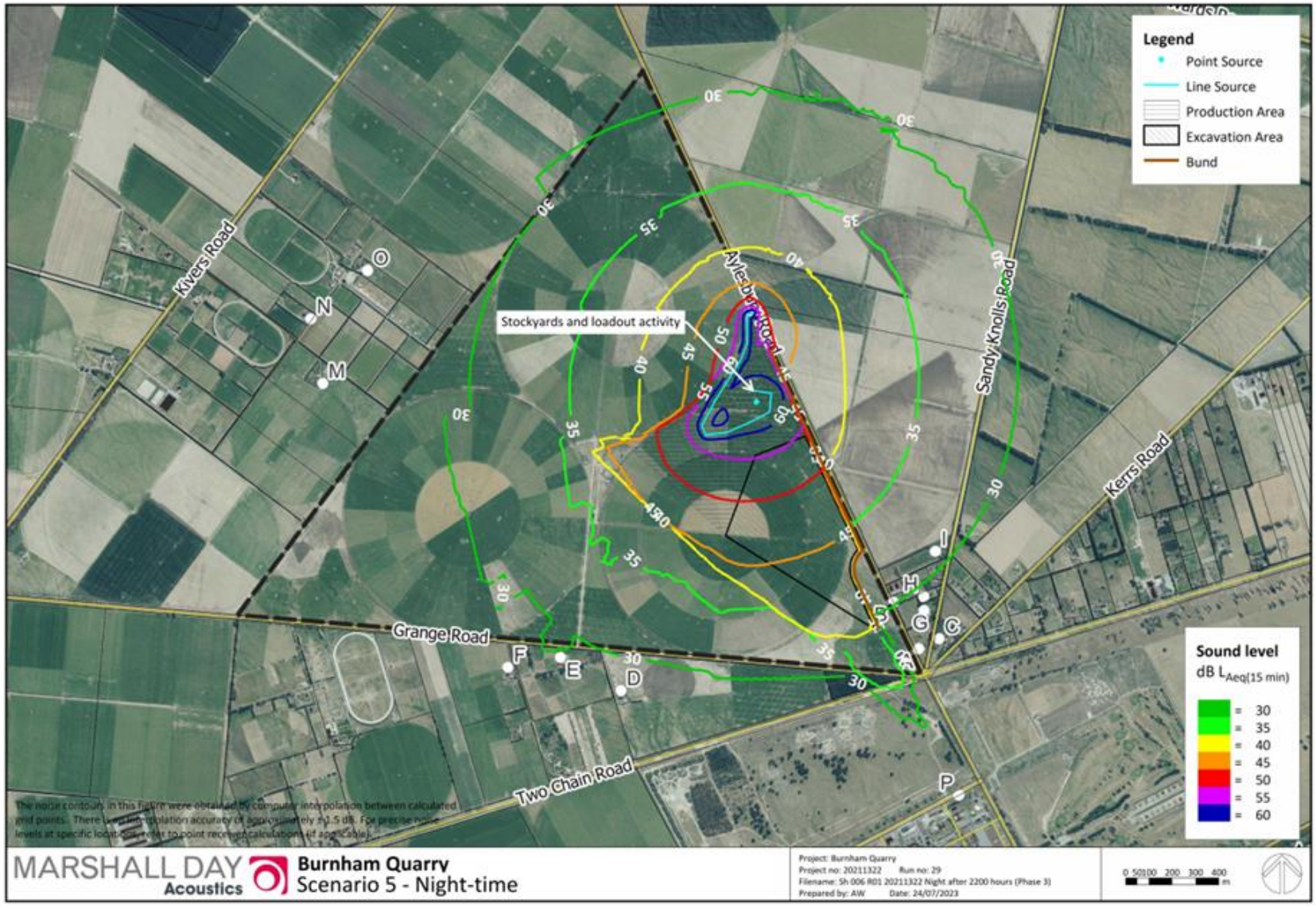
This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited



This document may not be reproduced in full or in part without the written consent of Marshall Day Acoustics Limited

Burnham Quarry

Transport Assessment Report

PREPARED FOR BURNHAM 2020 LTD | AUGUST 2023

We design with community in mind

Stantec

Revision Schedule

Rev No	Date	Description			
			Prepared by	**Reviewed by**	**Approved by**
1	11/8/23	Final Draft Report	AM	AL	AM
2	24/8/23	Revised to include Partially Operative District Plan	AM	AL	AM
3	31/8/23	Final Report	AM	AL	AM

This document was prepared by Stantec New Zealand ("Stantec") for the account of Burnham 2020 Ltd (the "Client"). The conclusions in the Report titled Burnham Quarry Transport Assessment are Stantec's professional opinion, as of the time of the Report, and concerning the scope described in the Report. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. The Report relates solely to the specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient's own risk.

Stantec has assumed all information received from the Client and third parties in the preparation of the Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

This Report is intended solely for use by the Client in accordance with Stantec's contract with the Client. While the Report may be provided to applicable authorities having jurisdiction and others for whom the Client is responsible, Stantec does not warrant the services to any third party. The report may not be relied upon by any other party without the express written consent of Stantec, which may be withheld at Stantec's discretion.

Quality Statement

Project manager	Project technical lead
Kyle Martin	Andrew Metherell

PREPARED BY Andrew Metherell		31 / 08 / 2023
REVIEWED BY Andrew Leckie		31 / 08 / 2023
APPROVED FOR ISSUE BY Andrew Metherell		31 / 08 / 2023

2 Hazeldean Road, Addington, Christchurch
P.O Box 13052
Tel 03 366 7449
STATUS FINAL | Project No 310205199

Executive Summary

Proposed Development

Burnham 2020 Ltd is seeking to establish a quarry to the north of Burnham, which will be operated by Winstone Aggregates (part of Fletcher Infrastructure and Concrete Limited). The land area involved is large at 362ha, and the quarry would represent a long-term aggregate resource to the Selwyn District and greater Christchurch area.

Site Location

The quarry site is located in the Selwyn District, west of Aylesbury Road to the north of Two Chain Road (ES Figure 1). It is zoned Rural Outer Plains in the Operative District Plan and General Rural in the Partially Operative District Plan (Decisions Version). Direct access for the quarry is proposed to Aylesbury Road, which forms the eastern boundary to the Site.



ES Figure 1: Site Location and Road Hierarchy Classification

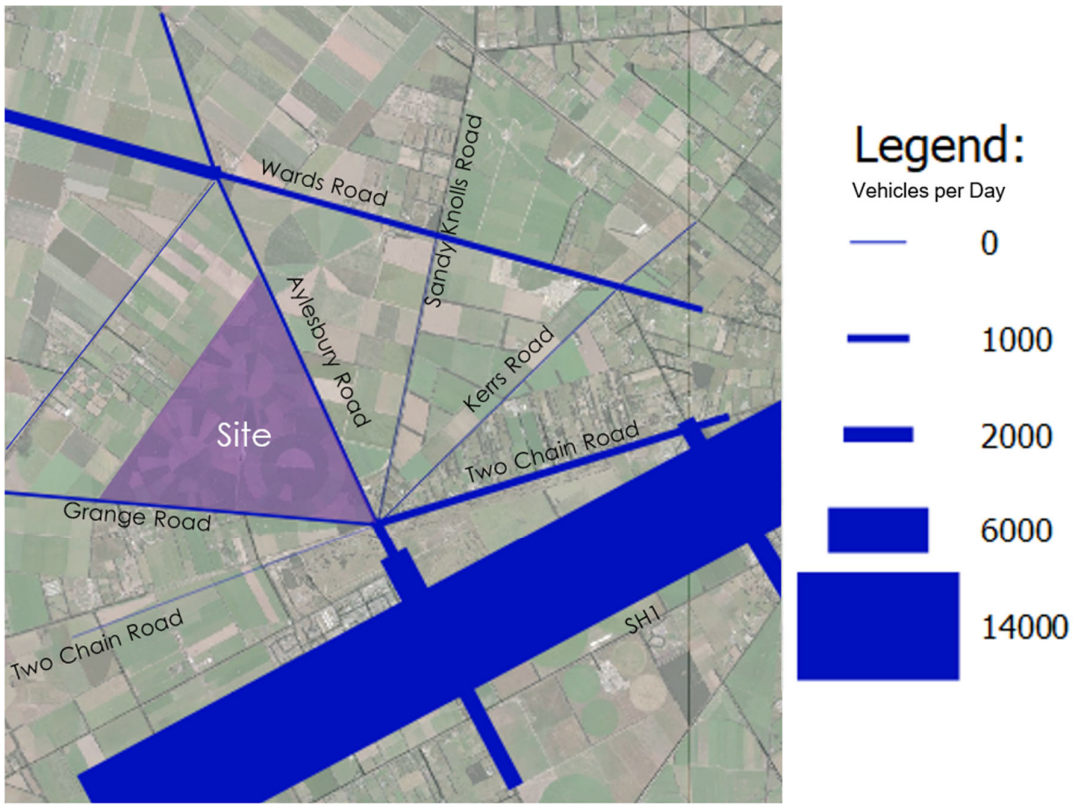
Aylesbury Road provides a connection to Burnham Road south of State Highway 1 (SH1) about 2.7km south of the Site access, and meets State Highway 73 (SH73) about 7.4 km to the north of the Site access. Adjacent to the site Aylesbury Road has a rural formation and speed limit. Between the site and SH1 Aylesbury Road provides access to the Burnham Military Camp, with most activity located on the western side of Aylesbury Road, south of Two Chain Road.

SH1 provides the primary strategic route for the South Island connecting all the major towns along the east coast. Aylesbury Road forms a Stop controlled cross road intersection at SH1, and crosses the Main South railway by way of a level crossing immediately north of SH1.

There is a public bus route that connects Burnham Military Camp to Rolleston, via Two Chain Road and Aylesbury Road. School bus routes operate in the area, although they do not travel down the section of Aylesbury Road adjacent to the site.

Transport Environment

Aylesbury Road past the site carries low traffic volumes of approximately 500 vehicles per day (vpd), even though it carries an Arterial road classification. Traffic volumes increase past the Burnham Military Camp, with traffic volumes of approximately 3,700vpd on a weekday. SH1 carries traffic volumes that are significantly higher, at approximately 14,000vpd, with the magnitude difference in traffic volume able to be seen in ES Figure 2.



ES Figure 2: Daily Traffic Volumes

The SH1 / Aylesbury Road intersection has some peak period congestion on the side roads, with the northern Approach from Aylesbury Road experiencing long queues in the afternoon peak period. There has been a previous history of serious crashes at the intersection leading to implementation of a lower speed limit that is activated by vehicles turning at the intersection.

There are no capacity related issues on the surrounding District Council road network, while the crash history indicates that there have been some vehicle turning/crossing crashes at intersections, and loss of control and turning crashes at locations between intersections. Most serious and fatal crashes have been reported on the State Highway road network, representative of the high traffic volumes.

Planned Infrastructure Changes

Waka Kotahi is planning a roundabout to replace the existing priority-controlled crossroad intersection at SH1 / Aylesbury Road. This will form part of the Road to Zero project on SH1 from Templeton to the Selwyn River. It is understood the project is planned for the period 2024-2027. The single lane intersection form proposed by Waka Kotahi is intended to maximise safety.

Significant changes are proposed by Waka Kotahi and Selwyn District Council for SH1 access at Rolleston to support improved safety and capacity of the connections. The changes are likely to lead to a new roundabout at SH1 / Walkers Road, and an increased function for Walkers Road and Two Chain Road.

Site Access

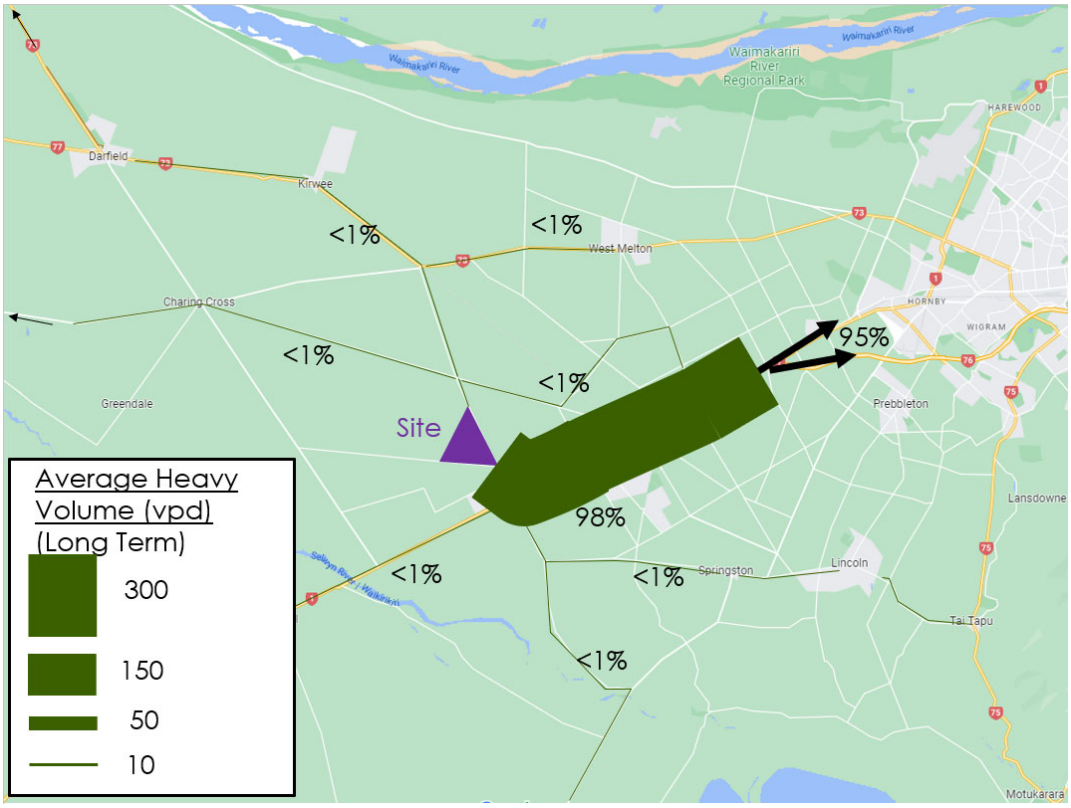
The proposed operations include quarrying, crushing, screening and stockpiling of aggregate, and transportation of processed aggregate from the Site. Access is to be provided mid-way along the Aylesbury Road frontage, remote from residential properties.

The Site access will be located where there is good visibility, where Aylesbury Road is straight, with wide verges. The access is to be designed to comply with District Plan requirements, and support a long term access solution. Further measures such as a concrete edge kerb and a "flag" light at the access have been recommended.

Traffic Generation and Traffic Distribution

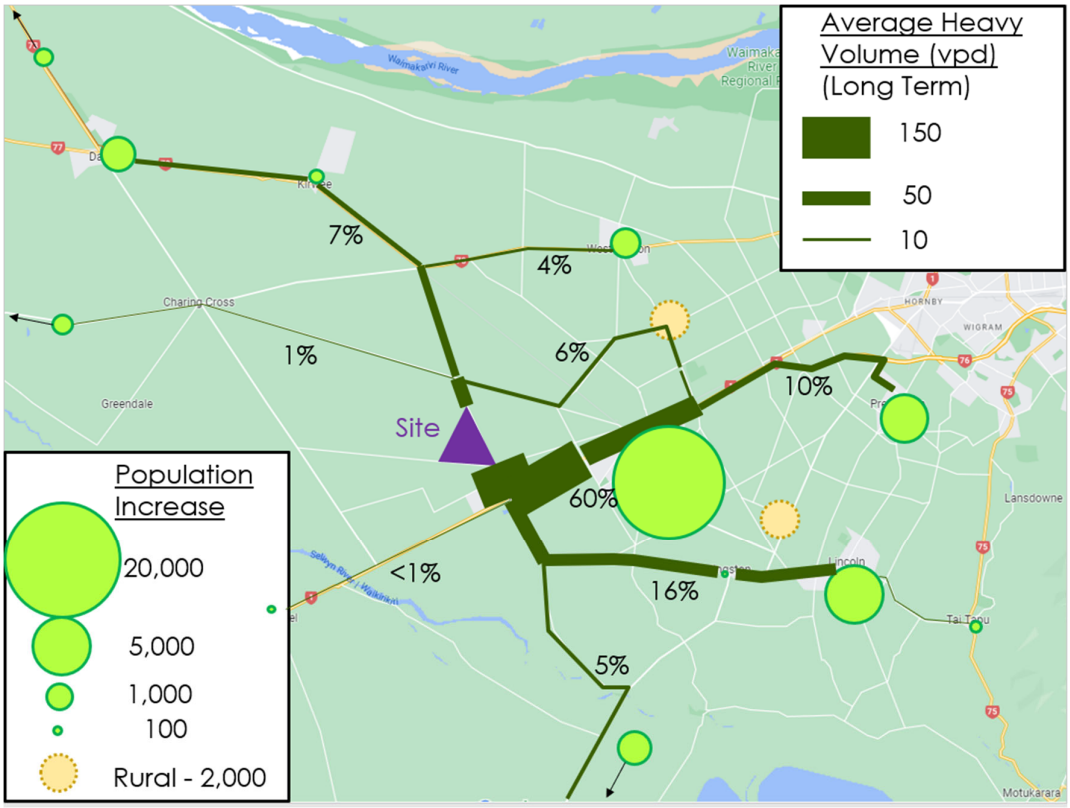
Maximum daily heavy vehicle traffic generation at the gate is proposed to be set through the Resource Consent at 750 heavy vehicle movements per day, which will be reached through progressive increases in demand over a long duration. Based on traffic generation patterns at Winstone Aggregates' former Yaldhurst quarry, the typical heavy traffic generation associated with that peak will be lower (approximately 300vpd on an average operating day, with maximum day of 750vpd).

Winstone anticipates that 95% of the aggregate will have a destination in and around Christchurch, which analysis summarised in ES Figure 3 indicates will rely on Aylesbury Road and SH1 for heavy vehicle movement.



ES Figure 3: Christchurch City Focus Traffic Volume Forecast (Indicative Routes)

It is also noted that the Selwyn District is fast growing, and the growth is anticipated to continue into the future. Council growth projections have been analysed to determine an alternative distribution of growth for the purpose of analysis of traffic distribution from the quarry. The alternative distribution shown in ES Figure 4 indicates a continued high reliance (more than 80% of trips) south of the site on Aylesbury Road, with the remaining trips spread around the surrounding road network.



ES Figure 4: Selwyn District Focus Scenario Long Term Traffic Volume Forecast (Indicative Routes)

Changes in Traffic Volume

The forecast traffic distribution has been added to existing traffic volumes to demonstrate the change compared to existing. There will also be background traffic growth, and that has been allowed for in more detailed intersection analysis.

The largest absolute changes will occur on Aylesbury Road between the site access and SH1, as that will accommodate more than 80% of generated traffic regardless of traffic distribution scenario. The relative change in traffic volumes decreases further from the site. A summary of the traffic pattern changes with the quarry are shown in ES Table 1, and the variation represents the alternative traffic distributions that may occur.

ES Table 1: Forecast changes in Travel Patterns with Quarry

Road Location	Existing Weekday (5 day) Average Volume	Quarry Additional Traffic		Indicative Typical Future Volume
		Average Additional	**Long Term Busiest Day Potential**	
Routes South				
Aylesbury Road north of SH1	3,700	110-300	750[C]	3,800-4,000
Aylesbury Road south of Two Chain Road	1,340	110-300	750[C]	1,450-1650
Aylesbury Road north of Two Chain Road	460	110-300	750[C]	570-750
Routes East				
Two Chain Road east of Aylesbury Road	1,000	0-20	45[S]	1,000-1,020
Routes North				
Aylesbury Road south of Wards Road	460	0-55	140[S]	460-515

The superscript indicates if the peak is associated with a Selwyn focus (S) scenario or Christchurch focus (C) scenario.

Transport effects

Positive Effects

The proposed quarry can lead to positive effects associated with minimising network travel if alternative sources are or would otherwise need to be located further from key destinations for the material. A primary reason major clients are likely to source material from the proposed quarry is likely to be based on minimising transportation distances. In turn, this has a network wide benefit of minimising vehicle kilometres travelled and accident exposure (which is a function of distance travelled).

Road Network Efficiency

A detailed investigation of the existing and future network response to increases in traffic generated by the quarry has been carried out. It shows that the intersection of Aylesbury Road with the access, and other side road intersections along Aylesbury Road will operate with traffic volumes that are sufficiently low that there will be negligible change in performance, and all intersections will operate with a high level of service.

The analysis of SH1 / Aylesbury Road shows that the performance of the intersection will deteriorate as a result of background growth. A recommendation has been included in the assessment that heavy vehicle traffic generation of the site is limited to 250 vpd up until the intersection is improved. That represents approximately 1% increase in traffic movements on the critical Aylesbury Road approach to SH1 in the weekday evening peak period.

The proposed roundabout by Waka Kotahi will address these performance issues, and will continue to operate efficiently over the next ten years. The worst performing approach will be the Aylesbury Road approach in the afternoon peak period, when delays will still represent stable conditions (LOS C).

Intersection Safety

Heavy vehicle tracking tests have been carried out for both the Aylesbury Road / Grange Road / Two Chain Road / Sandy Knolls Road and Aylesbury Road / Wards Road intersections. Whilst turning movements are likely to be very small, it was determined that some movements will not readily accommodate the vehicle tracking of truck and trailers. Some minor improvements are recommended for the two intersections to

ensure the turning movements can be accommodated if quarry generated traffic volumes making the movements exceed 10 vehicles per day.

Aylesbury Road

The section of Aylesbury Road between Two Chain Road and the site access is currently of a narrow width for the volume of traffic proposed to be added by the quarry. It is considered necessary for the road to be upgraded over that length to ensure a durable and safe use of the road. Recognising Council has plans for the road to be upgraded in the long term, and has a role to ensure its arterial network is adequately formed, it is recommended that the Applicant enter a private developer agreement with Council to facilitate this upgrade to the road network which is currently not included in the Long Term Plan.

Pedestrian and Cyclist Impacts

Review of potential effects on cyclists and pedestrians in the surrounding area shows that the quarry would not in itself generate the need for additional infrastructure for these modes of travel, with existing and Council planned facilities around Burnham Military Camp supporting movement in that area.

Transportation Route Management Plan

Although the Site is surrounded by District Council roads, there is expected to be very low use of roads to the north of the Site, or of Two Chain Road. Even under the (unlikely) scenario with the quarry only servicing Selwyn District, traffic volumes will not be inconsistent with the function of the roads, with access to Arterial and Collector Roads achievable. The use of local roads to the levels assessed can be managed with the implementation of a Transportation Route Management Plan, which includes some monitoring actions. It is also recommended that the unsealed local road routes of Kerrs Road and Sandy Knolls Road between Two Chain Road and Wards Road are not used due to their unsealed surfacing type.

District Plan

Operative District Plan

The quarry site is located within the Rural Outer Plains zone of the Operative Selwyn District Plan, and is subject to rules relating to traffic generation, parking and vehicle access contained within the Rural volume of the District Plan. Whilst details of some site elements such as parking will be confirmed through detailed design, there is sufficient space on site to meet District Plan rules on parking layout and manoeuvring.

From a transport perspective, the proposal triggers discretionary activity status with respect to:

- the level of traffic generation from the site, and
- the proposed use of Aylesbury Road (arterial) instead of Grange Road (local) for access.

It also triggers restricted discretionary activity status with respect to the proposed layout of the access which exceeds the requirement for a heavy vehicle access on an arterial road.

It is considered this Integrated Transport Assessment addresses these matters.

Partially Operative District Plan

The Partially Operative District Plan (August 2023 Decisions version) includes the site as General Rural zone. Similar to the Operative District Plan, the site activity and layout triggers restricted discretion within the TRAN rules with respect to:

- the level of traffic generation from the site, and
- the proposed use of Aylesbury Road (arterial) instead of Grange Road (local) for access; and
- the additional widening provided for the access on Aylesbury Road; and
- the peak hour traffic volumes trigger a requirement for a Basic Integrated Transport Assessment.

This Integrated Transport Assessment addresses all of these matters.

Conclusion

Based on the assessment carried out, it is considered the traffic related effects of the proposed quarry will be no more than minor if the following provisions and recommendations are implemented:

- The quarry is not to generate more than 250 heavy vehicle movements per day (on any one day) prior to the SH1 / Aylesbury Road intersection being upgraded to a roundabout, and a comprehensive vehicle routing management plan is required to assess the timing of movement and minimise effects on congestion at the intersection.
- Implementation of a Transportation Route Management Plan that achieves as far as practicable:
  - Minimisation of additional congestion at the Aylesbury Road and Stage Highway intersection.
  - No use of unsealed sections of Kerrs Road or Sandy Knolls Road between Aylesbury Road/Two Chain Road and Wards Road (as per proposed condition of consent)
  - Use of Aylesbury Road as preferred route to connect to/from SH1.
  - Minimise use of Two Chain Road to no more than 45vpd unless upgraded to a standard expected to accommodate heavy vehicles. A further limitation of no more than 10 heavy vehicle movements per day turning between Aylesbury Road (north) and Two Chain Road (east) until kerb adjustments are made to support the left turn from Aylesbury Road (north).
  - Minimise use of Wards Road / Aylesbury Road intersection to no more than 10 truck and trailer movements per day unless upgraded to support the right turn from Aylesbury Road south into Wards Road east.
- After the SH1 / Aylesbury Road intersection has been upgraded, limit the daily heavy traffic volume to a maximum of 750 heavy vehicle movements per day, on any one day;
- Access is to be to Aylesbury Road, and located approximately 1.7km north of Two Chain Road
- The Site access road is to be formed with a traffic lane in each direction at least 3.5m wide, and a sealed shoulder 1.0m wide, over at least the first 100m of the road. That is to minimise the likelihood of transfer of debris onto Aylesbury Road;
- Provide truck waiting areas on entry and exit within the Site, to avoid the need for trucks to wait on Aylesbury Road to enter the Site, or to park on the road while exiting (e.g. for paperwork);
- The access to Aylesbury Road is to be formed to a Waka Kotahi commercial vehicle access standard, including widening on the eastern side of the road, and entry side of the access;
- Aylesbury Road is to be widened between the Site access intersection and Two Chain Road to an 8.0m sealed carriageway width;
- The Aylesbury Road / Two Chain Road intersection is to be upgraded to support the left turn from Aylesbury Road (north) into Two Chain Road (east) not requiring truck and trailer vehicles crossing the centreline. Where this is not provided for, limit vehicles making the movement to no more than 10 truck and trailer movements per day and monitor movements and effects.
- The Wards Road / Aylesbury Road intersection is to be upgraded to support the right turn from Aylesbury Road south into Wards Road east being made without conflicting with westbound traffic on the Wards Road approach. Where this is not provided for, limit vehicle movements making the movement to no more than 10 truck and trailer movements per day and monitor movements and effects.

With those provisions, the quarry proposal can be supported from a transportation engineering perspective.

Contents

Revision Schedule i
Quality Statement ii
Executive Summary iii
Abbreviations 1
Glossary 2

1 Introduction 3
2 Site Context 4
2.1 Site Location 4
2.2 Road Hierarchy 4
2.3 Local Landuse Activity 5
2.4 Public Transport Network 7
3 Existing Transport Environment 9
3.1 Road Descriptions 9
3.2 Intersections 11
3.2.1 Aylesbury Road / Wards Road 11
3.2.2 Aylesbury Road / Two Chain Road 12
3.2.3 SH1 / Aylesbury Road 13
3.3 Aylesbury Road Railway Crossing 14
4 Existing Travel Patterns 16
4.1 State Highway 1 16
4.1.1 Average Daily Volumes 16
4.1.2 Seasonal Variations 16
4.1.3 Hourly Traffic Patterns 17
4.2 Local Road Traffic Volumes 19
4.2.1 Daily Traffic Volumes 19
4.2.2 Hourly Traffic Patterns 20
4.3 Intersection Traffic Volumes 22
4.4 Cyclists and pedestrians 25
4.5 Railway crossing performance 25
5 Road safety 26
6 Planned Infrastructure Changes 28
6.1 Aylesbury Road Level Crossing 28
6.2 SH1 / Aylesbury Road / Burnham Road 28
6.3 Rolleston Access 29
6.4 Rolleston to Burnham Cycleway 30

6.5 Aylesbury Road and Wards Road 31
7 Future Population Growth 32
7.1 Selwyn District 32
7.2 Burnham Military Camp 33
8 Proposed Quarry 34
8.1 Overview 34
8.2 Site Access Arrangements 34
8.3 Proposed Traffic Generation Limits 35
8.4 Hours of Operation 36
9 Traffic Generation Patterns 37
9.1 Overview 37
9.2 Heavy Vehicle Generation Variability 37
9.2.1 Yaldhurst Quarry Patterns 37
9.2.2 Forecast Burnham Quarry Traffic Generation Patterns 39
9.3 Travel Demands and Patterns 40
9.3.1 Scenario 1: Christchurch City Focus 40
9.3.2 Scenario 2: Selwyn District Focus 41
10 Potential Transport Effects 43
10.1 Changes in Traffic Volumes 43
10.2 Positive Effects 45
10.3 Site Access 45
10.3.1 Access Design Concept 45
10.3.2 Access Management 46
10.4 Road Network Efficiency 47
10.5 Intersection Efficiency 47
10.5.1 Assessment Year and Growth Assumptions 47
10.5.2 SH1 / Aylesbury Road / Existing Layout 48
10.5.3 SH1 / Aylesbury Road / Roundabout Layout 50
10.5.4 Site Access 52
10.5.5 Aylesbury Road / Burdons Road 52
10.5.6 Aylesbury Road / Two Chain Road 53
10.6 Intersection Safety Review 54
10.6.1 Aylesbury Rd / Grange Rd / Two Chain Rd / Sandy Knolls Rd 54
10.6.2 Aylesbury Road / Wards Road Intersection 55
10.7 Effect on Other Road Users 58
10.7.1 Cyclists 58
10.7.2 Pedestrians 58
10.8 Amenity Effects 60
10.9 Road Asset Improvements 60
10.10 Railway Level Crossing 61
11 Effects Summary 62
12 Transportation Route Management Plan 64
13 Operative Selwyn District Plan 65

14 Partially Operative District Plan 67
15 Conclusion 69

List of appendices

Appendix A Operative District Plan Assessment
Appendix B Partially Operative District Plan (Decisions Version) Assessment

List of tables

ES Table 1: Forecast changes in Travel Patterns with Quarry vii

Table 4-1: Local Road Daily Traffic Volumes (vehicles per day) 20
Table 4-2: Cycle and Pedestrian Counts 25
Table 4-3: Observed Train Crossings and Vehicle Queuing 25
Table 7-1: Burnham Camp Population 33
Table 8-1: Hours of Operation 36
Table 9-1: Heavy Vehicle Traffic Generation Forecasts 39
Table 9-2: Christchurch City Focus - Distribution of Truck Movements 40
Table 9-3: Selwyn District Focus - Distribution of truck movements (vehicles per day) 42
Table 10-1: Forecast changes in Travel Patterns with Quarry 44
Table 10-2: Heavy Vehicle Traffic Generation for Intersection Assessment 47
Table 10-3: Level of Service Criteria 48
Table 10-4: SH1 / Aylesbury Road (Existing Layout) Level of Service Assessment 49
Table 10-5: Aylesbury Road Approach to SH1 Interim Limits Investigation 49
Table 10-6: 2035 SH1 / Aylesbury Road (Roundabout) Level of Service Assessment 51
Table 10-7: Aylesbury Road / Site Access Level of Service Assessment 52
Table 10-8: Aylesbury Road / Burdons Road Level of Service Assessment 53
Table 10-9: Aylesbury Road / Two Chain Road Level of Service Assessment 54
Table 10-10: Aylesbury Road / Wards Road Traffic Movements (Selwyn District Focus) 56
Table 10-11: Road Cross-section Guidance 61

List of figures

ES Figure 1: Site Location and Road Hierarchy Classification iii
ES Figure 2: Daily Traffic Volumes iv
ES Figure 3: Christchurch City Focus Traffic Volume Forecast (Indicative Routes) v
ES Figure 4: Selwyn District Focus Scenario Long Term Traffic Volume Forecast (Indicative Routes) vi

Figure 2-1: Site Location in Greater Christchurch Context 4
Figure 2-2: Site Location and Road Hierarchy Classification 5
Figure 2-3: Local Landuse Context 6
Figure 2-4: Designations and Landuse Zoning in Partially Operative Selwyn District Plan 6
Figure 2-5: 820 Bus Service on Aylesbury Road and Two Chain Road (Source: Metroinfo) 7
Figure 2-6: School Bus Routes Near Burnham (Source: School Bus Route Maps Website) 8
Figure 3-1: Photographs of Local Roads 9
Figure 3-2: Photographs of Local Roads 10
Figure 3-3: Aylesbury Road / Wards Road Aerial Photo (Source: Canterbury Maps) 11
Figure 3-4: Aylesbury Road / Wards Road Approaches 12
Figure 3-5: Aerial Photo of Aylesbury Road / Two Chain Road Intersection (Source: Canterbury Maps) 13
Figure 3-6: Aylesbury Road / Two Chain Road / Grange Road Intersection 13
Figure 3-7: Aerial Photo of Aylesbury Road and SH1 Intersection (Canterbury Maps) 14
Figure 3-8: Photos of SH1 / Aylesbury Road 14

Figure 3-9: Photos of Aylesbury Road Railway Level Crossing 15
Figure 4-1: Traffic Growth Graph for 2010-2019 at SH1 southwest of Burnham Road 16
Figure 4-2: SH1 Daily Traffic volumes recorded in 2022 southwest of Burnham 17
Figure 4-3: Two-way traffic volumes at 01S00376, Oct 31-Nov 6 2022 18
Figure 4-4: Directional Volumes at 01S00376, Oct 31-Nov 6 2022 18
Figure 4-5: Daily Traffic Volumes 19
Figure 4-6: Weekday Hourly Traffic Volumes on Aylesbury Road North of SH1 21
Figure 4-7: Weekday Hourly Traffic Volumes on Aylesbury Road South of Two Chain Road 21
Figure 4-8: Weekday Hourly Traffic Volumes - Aylesbury Road north of Two Chain Road 22
Figure 4-9: Weekday hourly traffic volumes on Two Chain Road east of Aylesbury Road 22
Figure 4-10: SH1 / Aylesbury Road / Burnham Road 23
Figure 4-11: Aylesbury Road / Burdons Road Intersection Turn Counts 24
Figure 4-12: Aylesbury Road / Two Chain Road / Grange Road Intersection Turn Counts 24
Figure 5-1: Location of Fatal and Serious Injury Crashes 26
Figure 5-2: Crash Locations Map for Period 2018-2022 (Waka Kotahi CAS) 27
Figure 6-1: Waka Kotahi Engagement Brochure (June 2022) indicating Potential Rolleston Access Changes 29
Figure 6-2: Waka Kotahi Project Overview Map indicating realigned Walkers Road 30
Figure 6-3: SDC Long-term Plan 2021-2031 Cycleway Infrastructure Change 31
Figure 7-1: Population Growth 2023-2045 (SDC Long-term Plan 2021-2031) 32
Figure 8-1: Proposed Site layout (Source: Boffa Miskell) 34
Figure 8-2: Site Access Concept Design (Source: Boffa Miskell) 35
Figure 9-1: Daily truck movements at Winstone Aggregates Yaldhurst Quarry 38
Figure 9-2: Hourly number of truck movements at Winstone Aggregates Yaldhurst Quarry 39
Figure 9-3: Christchurch City Focus Traffic Volume Forecast (Indicative Routes) 41
Figure 9-4: Selwyn District Focus Scenario Long Term Traffic Volume Forecast (Indicative Routes) 42
Figure 10-1: Aylesbury Road Site Access Widening 46
Figure 10-2: Adjustment to Aylesbury Road – Two Chain Road northeast corner kerb 55
Figure 10-3: Aylesbury Road / Wards Road: Northbound Semi-Trailer Vehicle Tracking 56
Figure 10-4: Aylesbury Road / Wards Road: Southbound Semi-Trailer Vehicle Tracking 57
Figure 10-5: Burnham Pedestrian Crossing Demand Locations 59

Abbreviations

Abbreviation	Full Name
SDC	Selwyn District Council
Vpd	Vehicle movements per day
Vph	Vehicle movements per hour
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

Glossary

Term	Definition
Level of Service	Level of Service is a qualitative stratification of numerical performance measures to provide a simplified system to present road users' perceptions of the quality of service of a road or intersection.
LOS A	A condition of free-flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.
LOS B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A.
LOS C	In the zone of stable flow but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.
LOS D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
LOS E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.
LOS F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.

1 Introduction

Burnham 2020 Ltd Aggregates is seeking to establish a quarry to the north of Burnham, which will be operated by Winstone Aggregates (part of Fletcher Infrastructure and Concrete Limited). The land area involved is large at 362ha, and the quarry would represent a long-term aggregate resource to the Selwyn District and greater Christchurch area. The quarry will supply requirements for projects by Fletcher Infrastructure and Concrete Ltd (Winstone Aggregates) as well as the wider contracting industry.

The quarry site is located in the Selwyn District, west of Aylesbury Road to the north of Two Chain Road. It is zoned Rural Outer Plains zoned land. The proposed operations include quarrying, crushing, screening and stockpiling of aggregate, and transportation of processed aggregate from the Site. Maximum daily heavy vehicle traffic generation at the gate is proposed to be set at 750 heavy vehicle movements per day. Based on traffic generation patterns at Winstone Aggregates former Yaldhurst quarry, the typical heavy traffic generation will be lower (approximately 300vpd on an average operating day).

The proposed quarry site is located with access available to Aylesbury Road well separated from residential activity. Aylesbury Road is a lower volume arterial road, which in turn provides access to SH1 to the north and SH73 to the north. The majority of quarry traffic will pass Burnham Military Camp and cross the railway on Aylesbury Road, and access SH1 via a new roundabout planned to be constructed by Waka Kotahi as part of SH1 safety improvements.

This Integrated Transport Assessment report has been prepared as part of the resource consent application to document and summarises an assessment of the traffic-related effects of the proposed quarry. The assessment undertaken considers the existing transport environment in the area, the changes in transport infrastructure occurring in the area, the traffic generation associated with the proposed quarry, potential transport related effects, and the mitigation proposed.

A key recommendation of this assessment report is that Aylesbury Road between the site access and Two Chain Road should be widened to accommodate the increased heavy vehicle traffic, and that full traffic generation should only occur when the SH1 / Aylesbury Road intersection is formed as a roundabout. Ahead of that intersection upgrade, it is considered a lower maximum of 250 heavy vehicle movements per day should be applied. A heavy vehicle routing management plan is also recommended. With these and other more detailed mitigation recommendations as set out in this report, it is considered the quarry can be supported from and transportation perspective.

2 Site Context

2.1 Site Location

The proposed Burnham Quarry (the "Site") will be located within a 362ha block of land north of Burnham. The Site is about 1 km north of Burnham Military Camp and to the west of Rolleston in the Selwyn District. The strategic location in relation to Christchurch and the nearby townships of Rolleston and Lincoln is shown in Figure 2-1. Rolleston is about 7 km to the east via State Highway 1 with Lincoln being about 18 km away.

The Site is also centrally located with respect to other large settlements in the Selwyn district such as Darfield, West Melton and Leeston all being within 20 km travel distance.

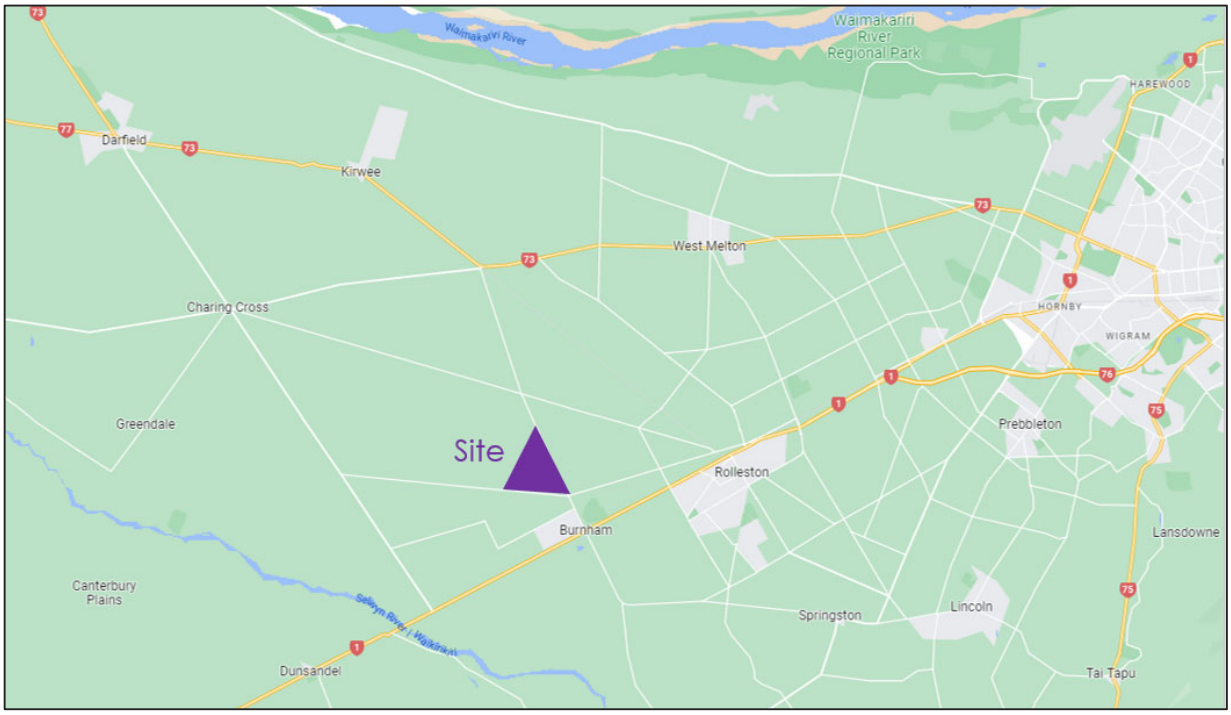


Figure 2-1: Site Location in Greater Christchurch Context

2.2 Road Hierarchy

Figure 2-2 shows the road network surrounding the Site. State Highway 1 (SH1) is about 2.7 km to the south of the Site access and provides the primary strategic route for the South Island connecting all the major towns along the east coast.

Aylesbury Road which forms the eastern boundary to the Site is classified in the Selwyn Partially Operative District Plan and Operative District Plan as an Arterial Road (Arterial Roads have a primary function of linking major settlements in the district). Aylesbury Road provides a connection to Burnham Road south of SH1 and meets State Highway 73 (SH73) about 7.4 km to the north of the Site access.

Grange Road is a local road and forms the southern border to the Site. It provides a connection between Aylesbury Road and Telegraph Road to the west.

Two Chain Road is an arterial road east of Walkers Road, and a local road between Aylesbury Road and Walkers Road.

Wards Road is classified as a collector road and crosses Aylesbury Road north of the Site. The eastern limit of Wards Road meets Two Chain Road at the edge of the Izone industrial area north of Rolleston. The

western limit of Wards Road meets Telegraph Road and Bealey Road at Charing Cross. The Operative District Plan applies a lower local road classification to Wards Road.



Figure 2-2: Site Location and Road Hierarchy Classification

The Main South Line railway runs parallel to and on the north side of SH1 past Burnham.

2.3 Local Landuse Activity

Figure 2-3 shows the local road network and landuse activities in the area. Most of the roads in the area service rural landuse and are formed to rural standards.

The Site is currently used for dairy farming operations, and it is proposed that will be an ongoing landuse on the balance of the proposed quarry Site. Within the Partially Operatrive District Plan it has a General Rural Zoning (GRUZ), and in the Operative District Plan it has a Rural Outer Plains zoning.

Figure 2-4 shows in coloured fill nearby landuse site Designations of significance in the Partially Operative Selwyn District Plan, including:

- Burnham Military Camp which is located on the western side of Aylesbury Road covered by the Ministry of Defence designation (MDEF-1) which also extends to cover a large tract of land south of Two Chain Road and north of the railway, both east and west of Aylesbury Road.
- Burnham School (MEDU-22) is located on Godley Road on the south side of Burnham Military Camp.
- The Rolleston Prison (MCOR-1) is located on the western side of Walkers Road, to the south of Two Chain Road, and the Youth Justice Residence (MCHI-1) is adjacent to it.

All of these designated sites have a Partially Operative District Plan GRUZ zoning. Figure 2-4 also shows the Partially Operative Selwyn District Plan zoning of Rolleston (which has mostly been updated to Medium Density Residential as part of Variation 1), with industrial development north of SH1, and residential south of SH1.

The Operative District Plan includes similar land designations on nearby land. Those designations include 441ha of land at Burnham Military Camp Designated DE1 Defence Purposes – Burnham Military Camp, and 63ha of land at Rolleston Prison (MC1).

Some other activities in the area include meat processing sites, equestrian facilities, a quarry, and a winery.

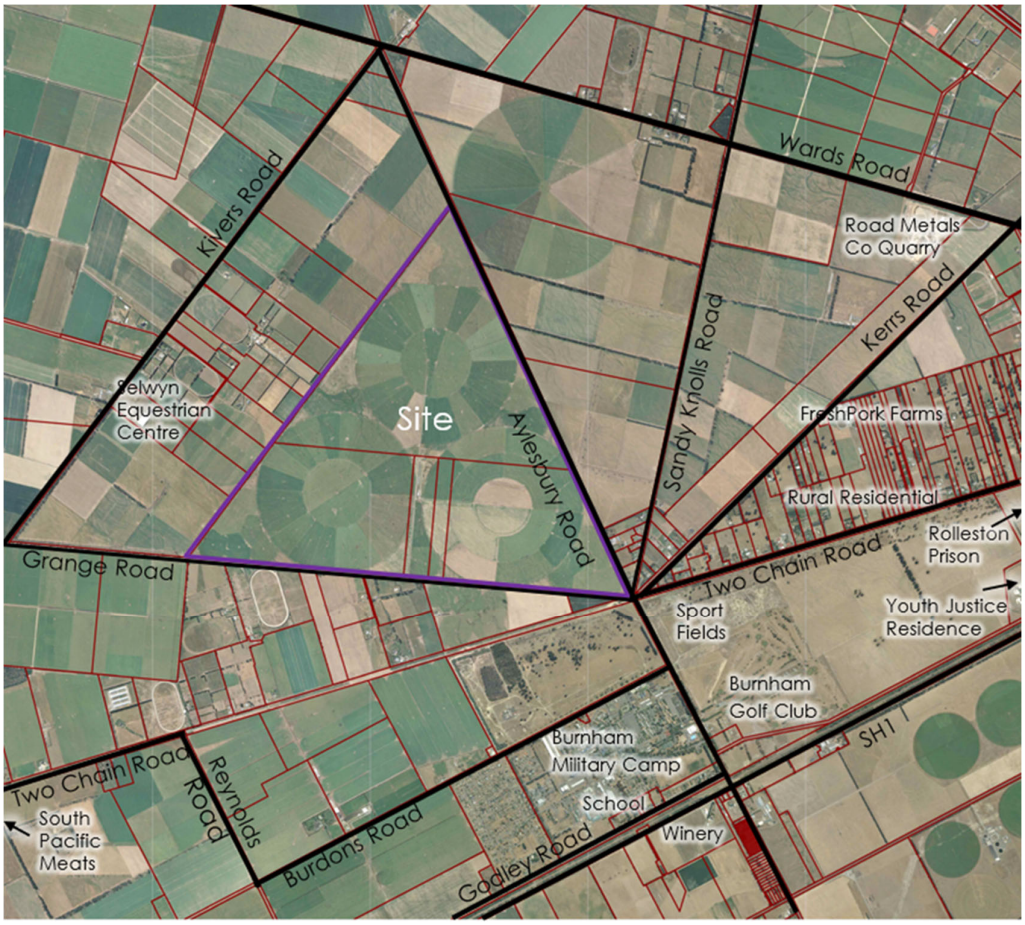


Figure 2-3: Local Landuse Context

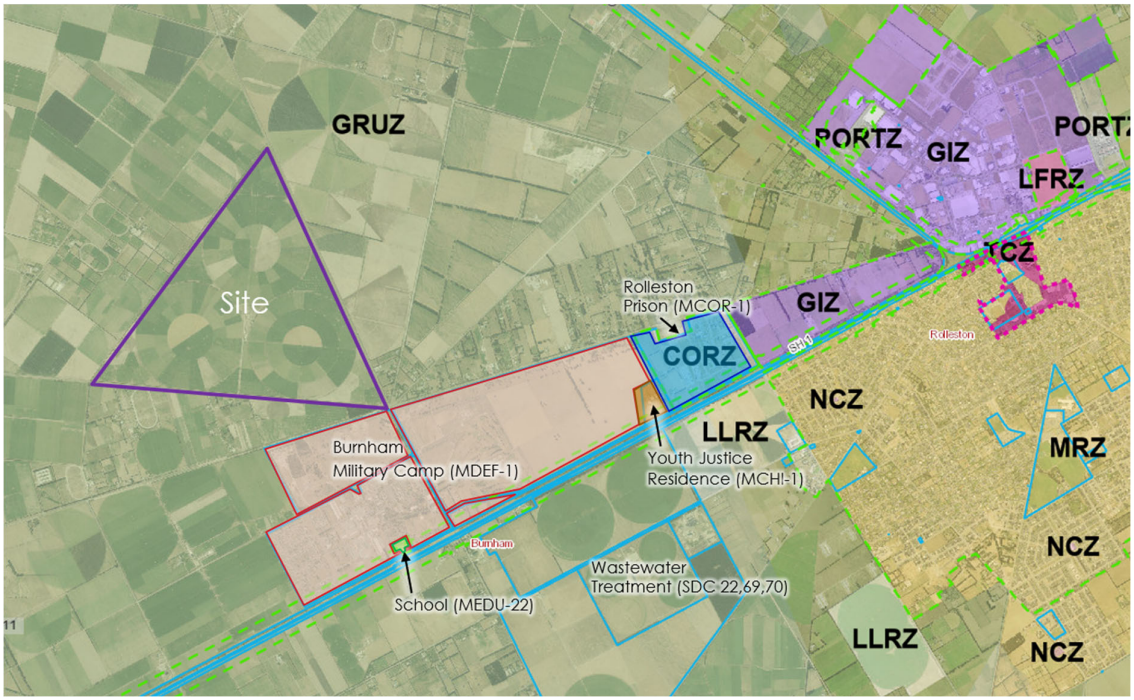


Figure 2-4: Designations and Landuse Zoning in Partially Operative Selwyn District Plan

2.4 Public Transport Network

The 820 Burnham / Lincoln via Rolleston bus route runs approximately hourly in each direction between the military camp and Rolleston via Aylesbury Road and Two Chain Road as shown in Figure 2-5. There are bus stops on Aylesbury Road outside the military camp, on Two Chain Road, just east of the Aylesbury Road intersection, and on Two Chain Road near Walkers Road.

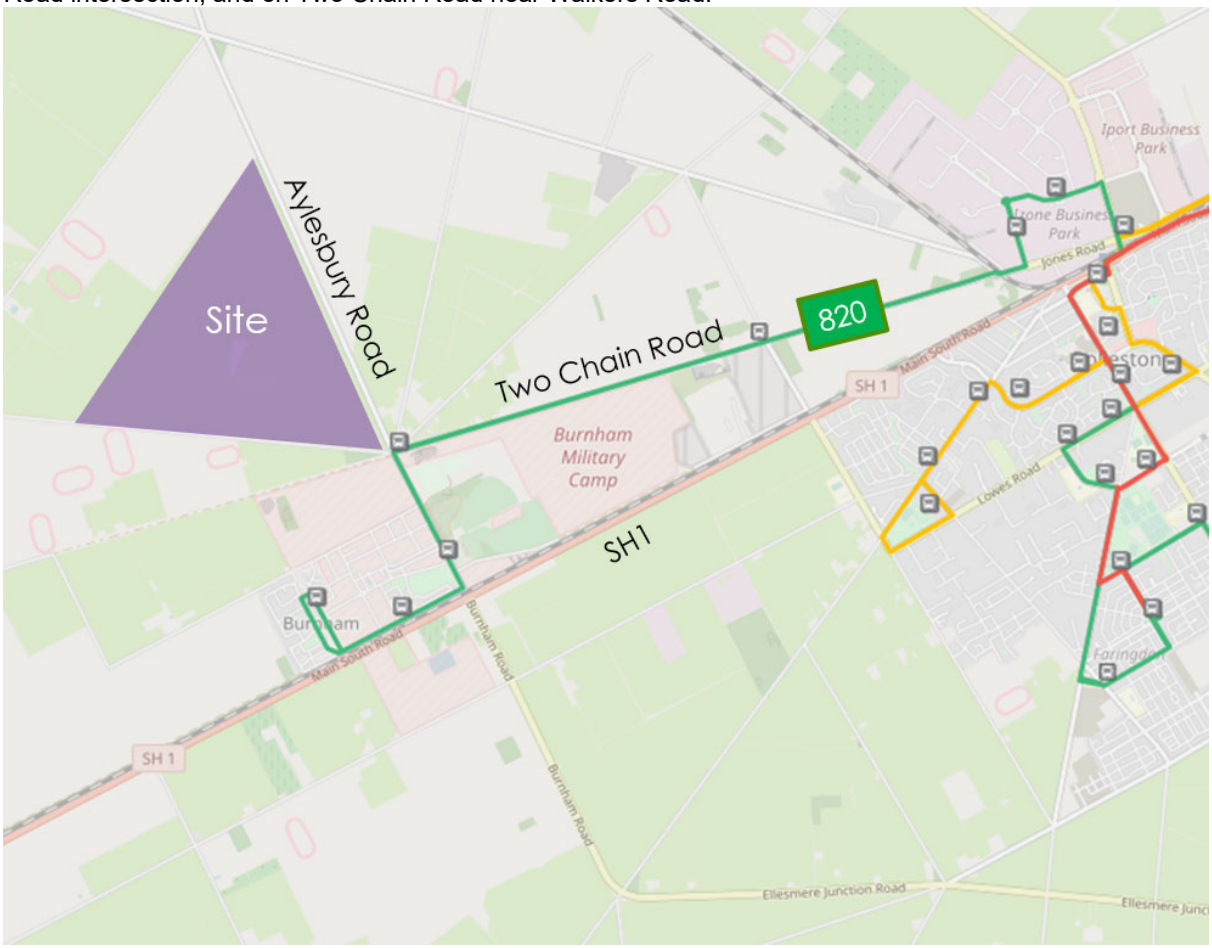


Figure 2-5: 820 Bus Service on Aylesbury Road and Two Chain Road (Source: Metroinfo)

There are two current school bus services which run in the vicinity of the Site, as shown in Figure 2-6. A school bus service for Rolleston College runs along Aylesbury Road between SH1 and Two Chain Road, and then Sandy Knolls Road to the north-east. The other school bus service is for Kirwee Model School and runs on Aylesbury Road, north of Wards Road, and Wards Road to the west of Aylesbury Road. There are currently no school bus routes which run immediately past the Site on Aylesbury Road or along Two Chain Road.

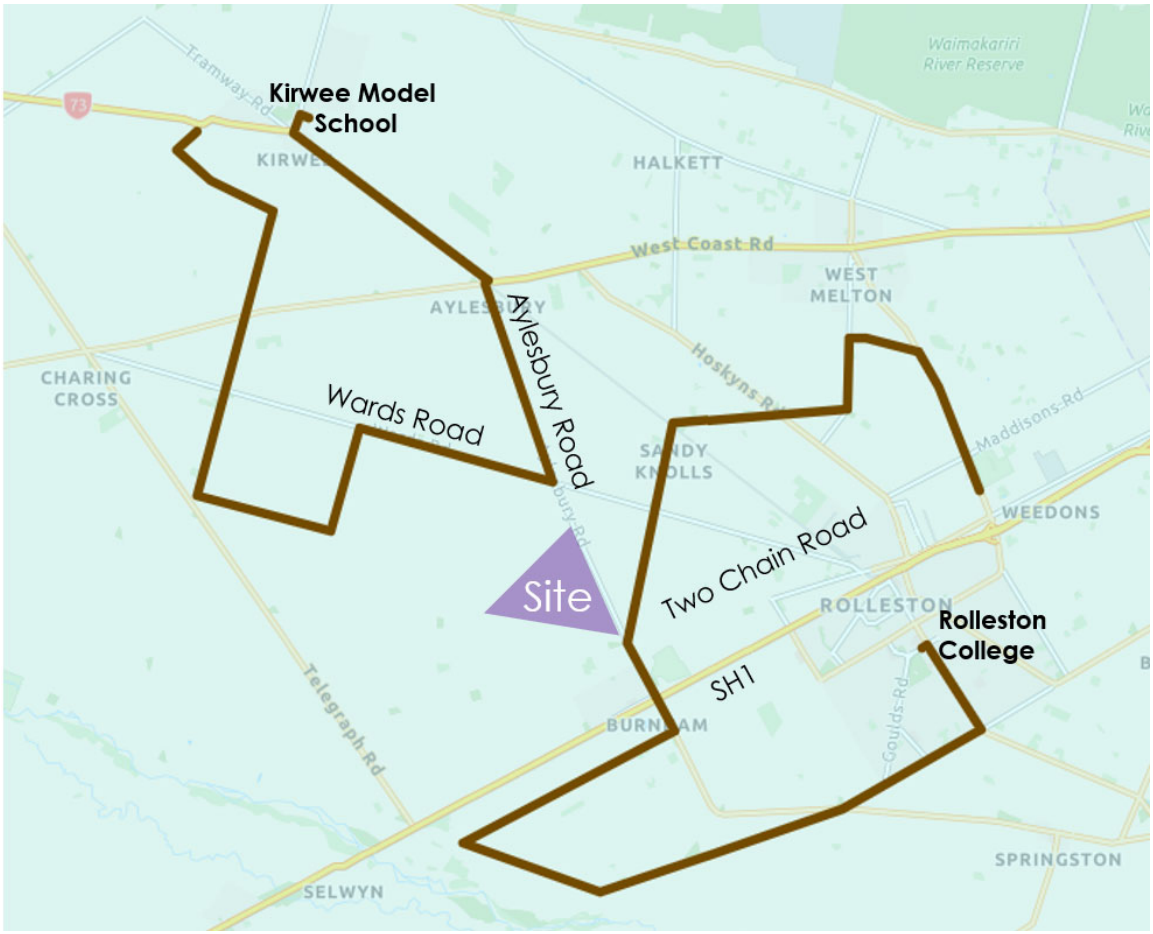


Figure 2-6: School Bus Routes Near Burnham (Source: School Bus Route Maps Website)

3 Existing Transport Environment

3.1 Road Descriptions

The section of Aylesbury Road between SH1 and Burdons Road has a 70km/h speed limit, whilst the remainder of the road network near the Site has a 100km/h speed limit. The following photographs show the current road conditions of various roads that form the local road network. Figure 3-1 demonstrates the conditions of Aylesbury Road (near Burnham Military Camp and north of Two Chain Road), Two Chain Road (east of Aylesbury Road) and Grange Road. The photographs below show that each of the roads has basic delineation in the form of a marked centreline.

	
Aylesbury Road (near camp) – looking north 7.3-8.2m wide road with separate shared path	Aylesbury Road (north of Two Chain Road) – looking south 5.8m wide road
	
Grange Road – looking west 6.1-6.2m wide road	Two Chain Road west of Walkers Road – looking west 5.8-6.0m wide road

Figure 3-1: Photographs of Local Roads

Figure 3-2 provides views to indicate the existing conditions of Sandy Knolls Road, Kerrs Road, Wards Road, Kivers Road and Walkers Road. Of note is that Walkers Road between SH1 and Two Chain Road has recently been upgraded to a 10m wide road and includes edgeline delineation and sealed road shoulders.

	
Sandy Knolls Rd south of Wards Road 6.4m wide road (partly sealed)	Kerrs Road (north of Two Chain Road) 6.1m wide sealed, then unsealed
	
Wards Road east of Aylesbury Road 6.8m wide sealed road	Kivers Road 5.9m sealed road
	
Walkers Road south of Two Chain Road 10m wide road	Walkers Road north of Two Chain Road 6.8-6.9m wide road

Figure 3-2: Photographs of Local Roads

3.2 Intersections

3.2.1 Aylesbury Road / Wards Road

The Aylesbury Road / Wards Road intersection to the north of the Site is a five-legged intersection within a 100km/h speed limit environment. Aylesbury Road has priority over the stop-controlled approaches on Wards Road and Kivers Road.



Figure 3-3: Aylesbury Road / Wards Road Aerial Photo (Source: Canterbury Maps)

The approaches are demarcated by paint marking and signs, and there are no traffic islands. The Wards Road stop-controlled approaches have some see-through effect, and there is some risk that drivers could not notice the stop control.

	
Aylesbury Road south Approach to Wards Road	Wards Road east Approach to Aylesbury Road

Figure 3-4: Aylesbury Road / Wards Road Approaches

The Aylesbury Road south and Wards Road east approaches have an acute angle between them, and large trucks would not be able to make some turning movements at the intersection without crossing into opposing traffic lanes.

3.2.2 Aylesbury Road / Two Chain Road

Figure 3-5 shows an aerial view of the Aylesbury Road / Grange Road / Two Chain Road / Sandy Knolls Road intersection at the southern edge of the Site, which is within a 100kmh speed limit area but close to the Burnham 70km/h speed limit zone on Aylesbury Road. This intersection is a 5-legged, stop-controlled intersection with Aylesbury Road having priority. Approximately 40m east of the intersection on Two Chain Road, there is a T-junction priority stop-controlled intersection with Kerrs Road.



Figure 3-5: Aerial Photo of Aylesbury Road / Two Chain Road Intersection (Source: Canterbury Maps)

The photographs in Figure 3-6 show that the intersection is formed with concrete corner kerbs and standard road markings and signage.

	
Aylesbury Road north approach to Two Chain Road	Two Chain Road east approach to Aylesbury Road

Figure 3-6: Aylesbury Road / Two Chain Road / Grange Road Intersection

3.2.3 SH1 / Aylesbury Road

Aylesbury Road meets SH1 at a stop controlled priority crossroad intersection with Burnham Road as shown in Figure 3-7. The intersection is located in an open road 100km/h speed limit environment, although there is a vehicle activated variable speed limit of 70km/h when vehicles are either waiting to turn from SH1 or from the side road.



Figure 3-7: Aerial Photo of Aylesbury Road and SH1 Intersection (Canterbury Maps)

	
SH1 east approach to Aylesbury Road	Aylesbury Road north approach to SH1

Figure 3-8: Photos of SH1 / Aylesbury Road

3.3 Aylesbury Road Railway Crossing

The Main South Line railway runs parallel to SH1 through Burnham and crosses Aylesbury Road about 40 metres north of the SH1 centreline and 30m north of the limit line on the approach to SH1. The crossing is within the 70km/h speed limit environment.

The position of the level crossing provides space for approximately 5 cars to queue within the 30m between the road and railway limit lines. It is half barrier arm and flashing light controlled with advance warning and rail “x” pavement markings in place. There are no pedestrian or cycle facilities.

	
North Approach	South Approach

Figure 3-9: Photos of Aylesbury Road Railway Level Crossing

The KiwiRail incident database identified two reported near-miss incidents that have occurred at this level crossing in the period January 2012-April 2022. The first incident involved a vehicle disregarding the warning signals and driving through them. The second incident involved the train emergency brakes being activated due to the rear of a truck remaining on the railway tracks.

4 Existing Travel Patterns

4.1 State Highway 1

4.1.1 Average Daily Volumes

Figure 4-1 shows the annual average daily traffic volumes recorded by Waka Kotahi at its count site (01S00376) on SH1 southwest of Burnham over the 2010-22 period. It shows that traffic volumes rose steadily over that period from about 11,000 vehicle movements per day in 2010 to nearly 14,000 vpd in 2019. This represents an annual growth rate of 2.4 percent per annum. Traffic volumes in 2020-22 were lower than in 2019 and can be attributed to the effects of COVID19 which resulted in a large number of low traffic volume days. However, the traffic volumes in 2021 and 2022 were approaching the volumes recorded in 2019.

The most recent count information suggests that heavy vehicles accounted for 13 percent of all vehicle movements on the highway.

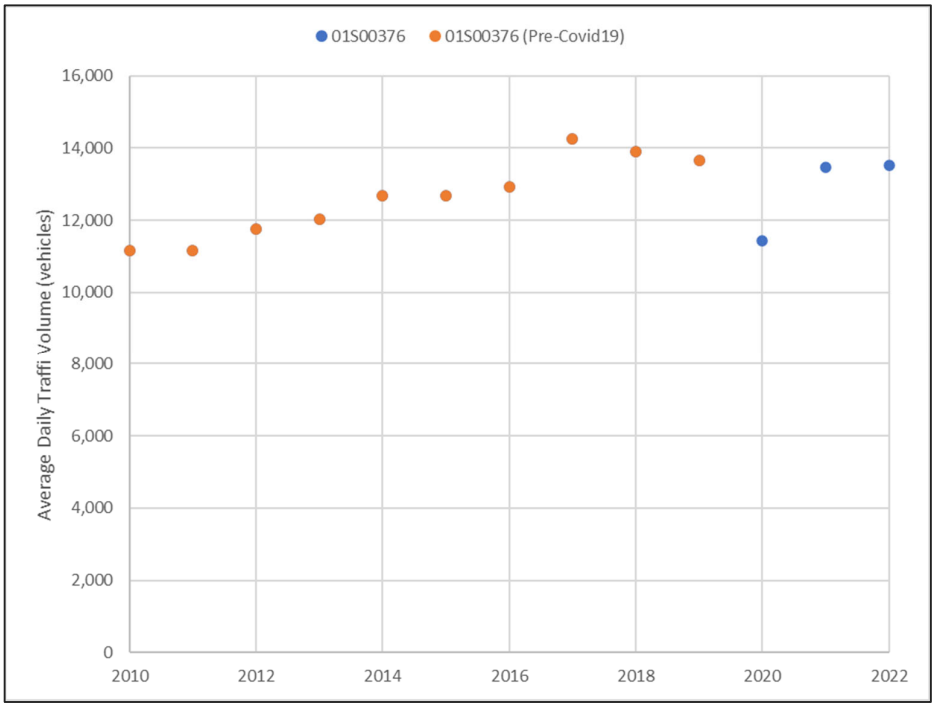


Figure 4-1: Traffic Growth Graph for 2010-2019 at SH1 southwest of Burnham Road

4.1.2 Seasonal Variations

Figure 4-2 shows the daily traffic volumes recorded at the Waka Kotahi count site southwest of Burnham in 2022. While there is a gap across the middle of the year, there is evidence of some seasonal variation with the lowest volumes, 10,000-12,000vpd, occurring in March and rising to 14,000-16,000vpd in the summer. There are consistent spikes in the flows on Fridays with flows that are 2,000-3,000vpd higher than during the rest of the week.

Based on the information available for 2022, the average daily volume was about 13,500 vpd and the 90th percentile volume was about 14,100 vpd. This represents a volume threshold that would normally be exceeded on about 35 days of the year. The count data indicates that these peak days are mostly Fridays.

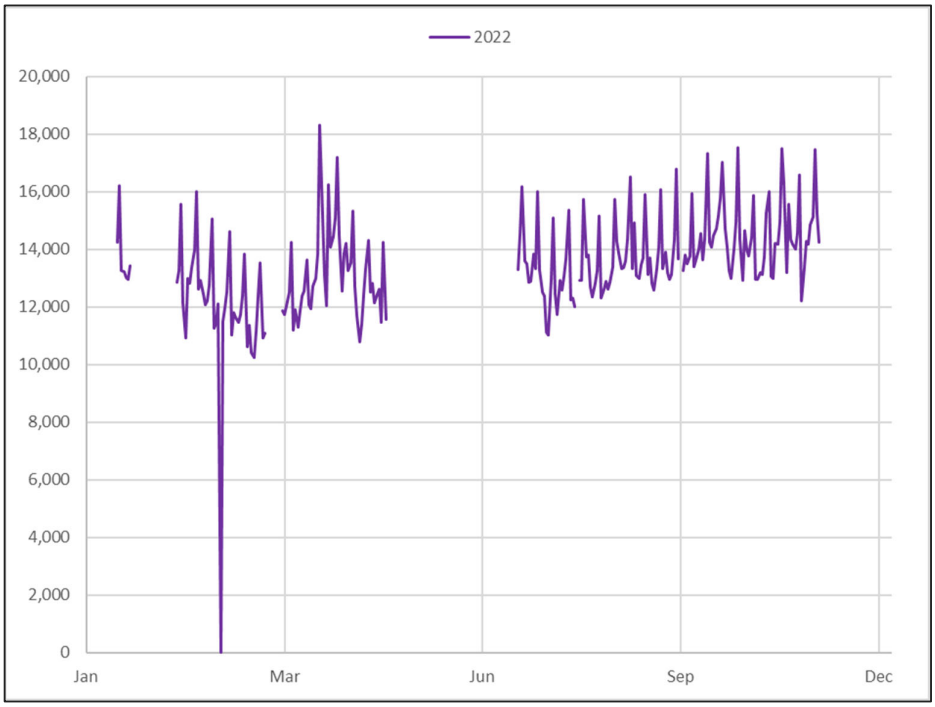


Figure 4-2: SH1 Daily Traffic volumes recorded in 2022 southwest of Burnham

4.1.3 Hourly Traffic Patterns

Figure 4-3 shows the two-way traffic volumes on SH1 southwest of Burnham in the first week of November 2022 which is representative of a week with 90th percentile flows for the year. On weekdays (Monday to Thursday), the flows show peaks of about 1,000 vehicles per hour (vph) in the morning (7:00-8:00am) and 1,200 vph in the afternoon (4:00-5:00pm). The pattern of flows on Friday was different and after an initial steep rise before 8:00am, they rise steadily during the day to an afternoon peak of about 1,400 vph.

At the weekend, there is a broad peak during the day from 9:00am through to 5:00pm with volumes of about 1,000 vph. On Sunday, there is a late afternoon period with higher volumes of 1,300 vph which is likely to be associated with holiday or recreational travel.

Figure 4-4 shows the traffic volumes by direction for the weekdays. During the week, the morning peak volume of 1,000 vph comprises about 55 percent of southbound traffic. There is a greater directional split in the afternoon peak with 40 percent being southbound and 60 percent northbound. On Friday, there was a similar directional split in the morning peak period, but the directional flows were more balanced in the afternoon with 665 vph being southbound and 700 vph recorded travelling north. The difference in flows on Friday is attributed to holiday and recreational trips from Christchurch.

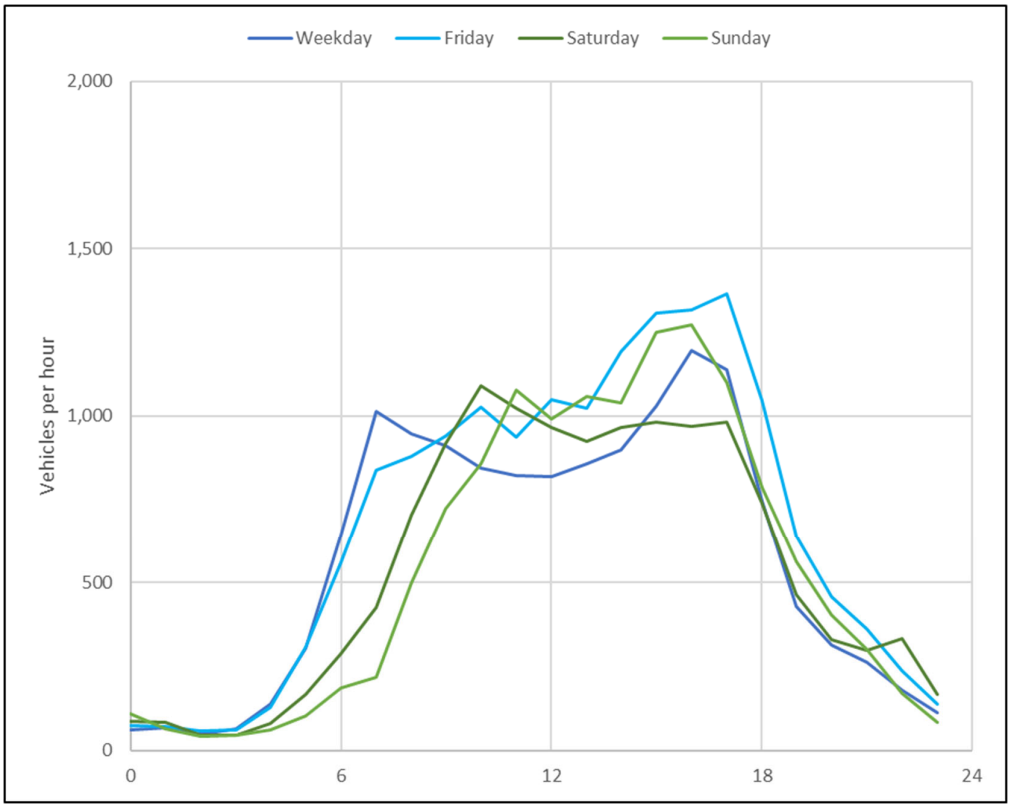


Figure 4-3: Two-way traffic volumes at 01S00376, Oct 31-Nov 6 2022

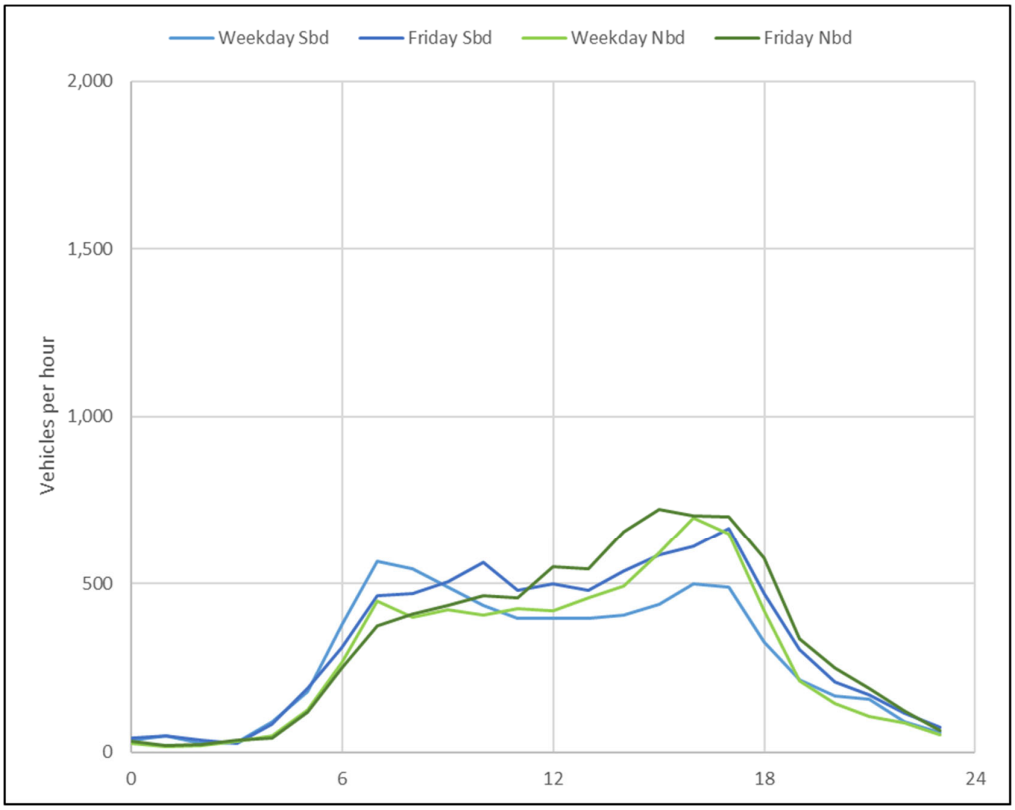


Figure 4-4: Directional Volumes at 01S00376, Oct 31-Nov 6 2022

4.2 Local Road Traffic Volumes

4.2.1 Daily Traffic Volumes

Traffic volumes on roads close to the Site are shown in Figure 4-5 with the widths of the lines proportional to the daily traffic volume. It is clear that the local road traffic volumes near the Site are of an order of magnitude smaller than the SH1 traffic volumes.

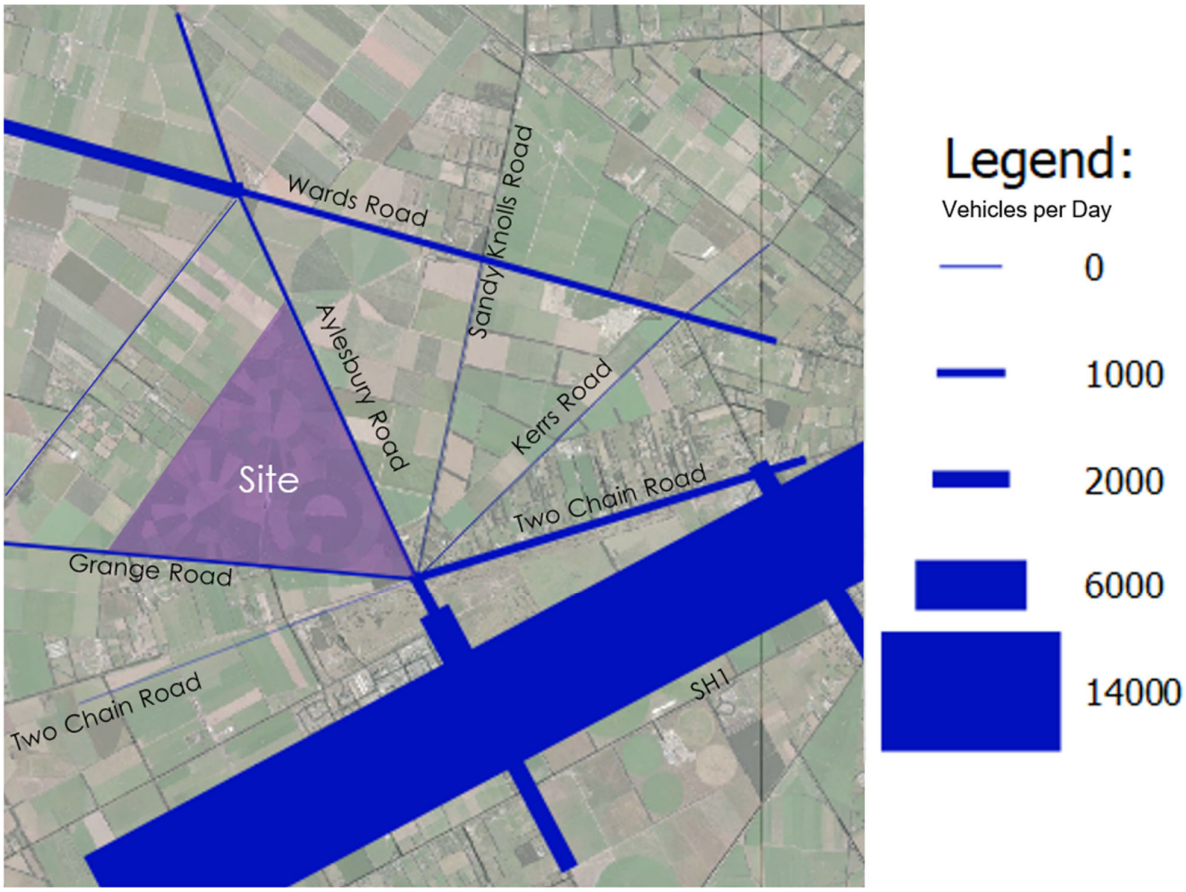


Figure 4-5: Daily Traffic Volumes

The traffic volumes are also presented in Table 4-1. Aylesbury Road north of SH1 is the busiest section of the District Road network. The Burnham military camp is the largest generator of vehicle movements in the area. The traffic volumes on Aylesbury Road fall rapidly north of the Two Chain Road intersection to about 460 vehicles per day.

Table 4-1: Local Road Daily Traffic Volumes (vehicles per day)

Road Location	Weekday (5 day) Average Volume	Average Daily Volume (7 day)	Date
Aylesbury Road north of SH1	3,700	3,350	July 2022
Aylesbury Road south of Two Chain Road	1,340	1,225	July 2022
Aylesbury Road north of Two Chain Road	460	460	July 2022
Two Chain Road east of Aylesbury Road	1,000	880	July 2022
Sandy Knolls Road north of Aylesbury Road	100	100	July 2022
Kerrs Road	160	150	July 2022
Kivers Road	N/A	136	February 2020
Grange Road west of Aylesbury Road	425	400	July 2022
Wards Road east of Aylesbury Road	1,620	1,580	July 2022
Walkers Road north of SH1	2,080	1,895	July 2022

4.2.2 Hourly Traffic Patterns

Figure 4-6, Figure 4-7 and Figure 4-8 show the variation in weekday hourly traffic volumes on Aylesbury Road from north of the SH1 intersection to north of the Two Chain Road intersection. These show the effects of the activity at Burnham military camp as well as some likely contribution from the residential landuse along Kerrs Road, Sandy Knolls Road and Two Chain Road.

Peak hour traffic volumes between the camp entrance and SH1 are about 400 vph with daily volumes of 3,700 vpd. North of Two Chain Road, the peak hourly volumes are 40-50 vph with an average weekday volume of about 450 vpd. Between Two Chain Road and Burnham Military Camp, the peak hour volumes increase to 120 vph in the morning and 160 vph in the afternoon with daily volumes reaching 1,300 vpd.

Figure 4-7 shows the much lower traffic volumes compared to areas to the south. There is a slightly dominant movement pattern from the residential activity on Kerrs Road, Sandy Knolls Road and Two Chain Road towards SH1 in the morning, and from SH1 in the evening. This differs from the movement pattern at the military camp which is predominantly into the camp from SH1 in the morning and reverses in the afternoon.

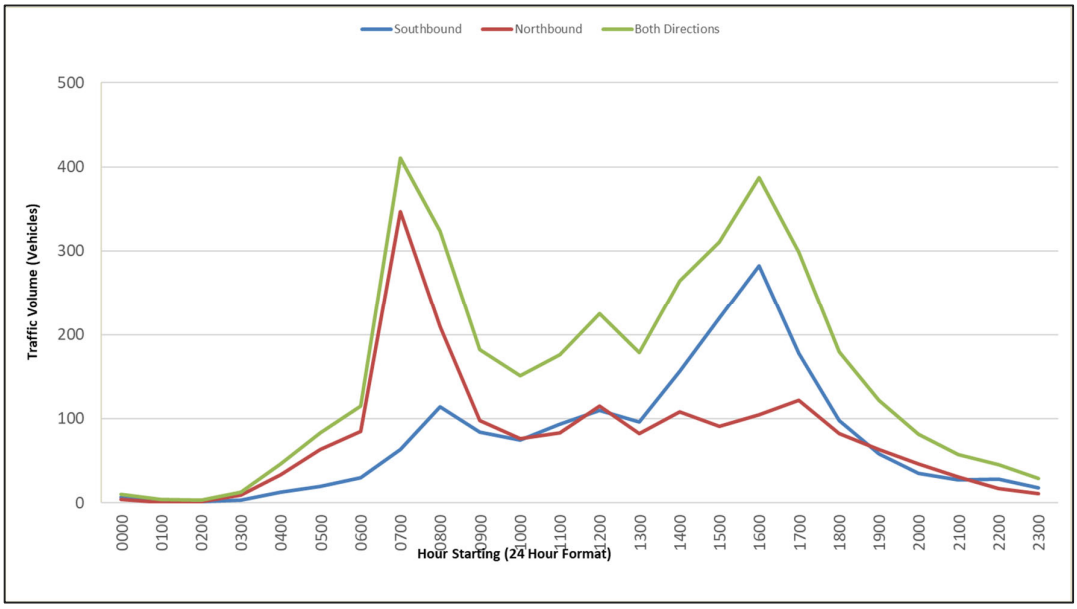


Figure 4-6: Weekday Hourly Traffic Volumes on Aylesbury Road North of SH1

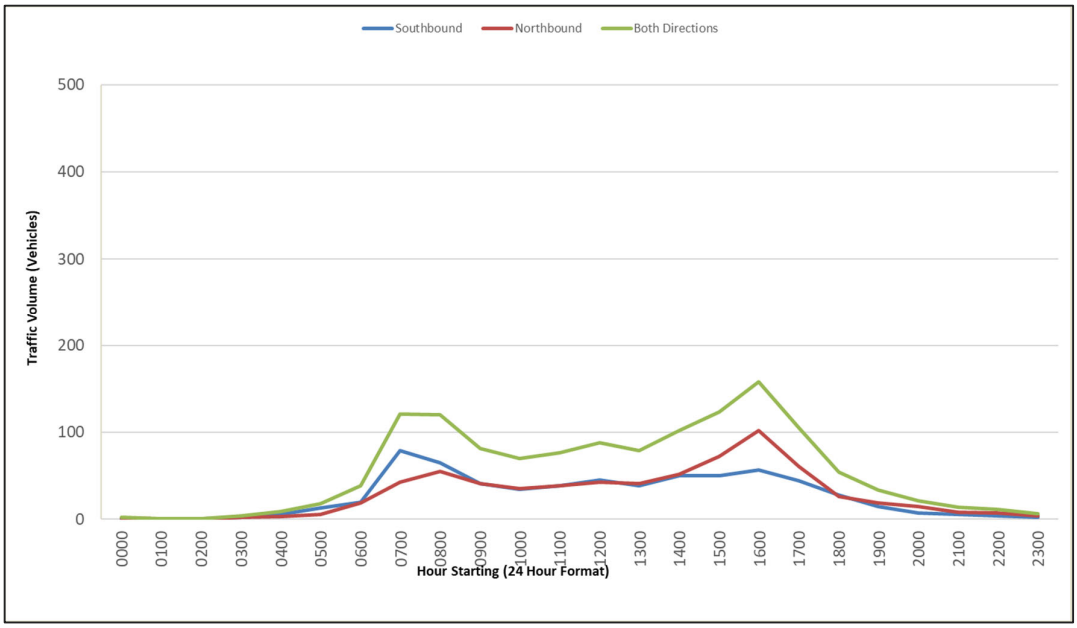


Figure 4-7: Weekday Hourly Traffic Volumes on Aylesbury Road South of Two Chain Road

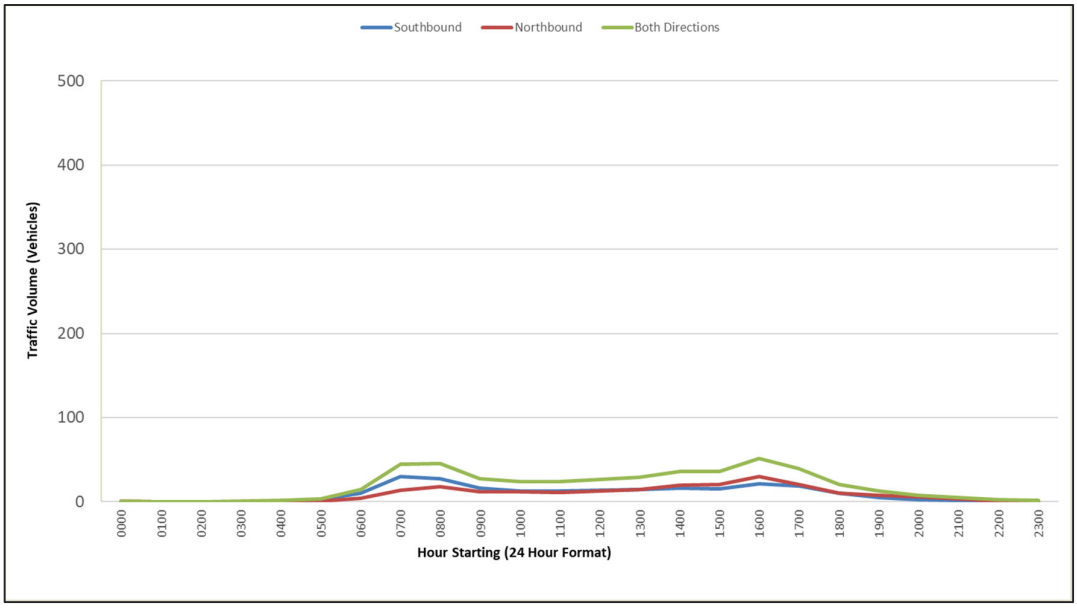


Figure 4-8: Weekday Hourly Traffic Volumes - Aylesbury Road north of Two Chain Road

Heavy vehicles account for 7-17 percent of movements on Aylesbury Road. The wide range reflects the high proportion of truck movements to and from Two Chain Road and the volume of light vehicle movements at the military camp.

Figure 4-9 shows the hourly variation in weekday traffic volumes on Two Chain Road east of Aylesbury Road. There are morning and afternoon peaks of about 100 vph with daily volumes of 1,000 vpd. Heavy vehicles account for about 12 percent of all movements.

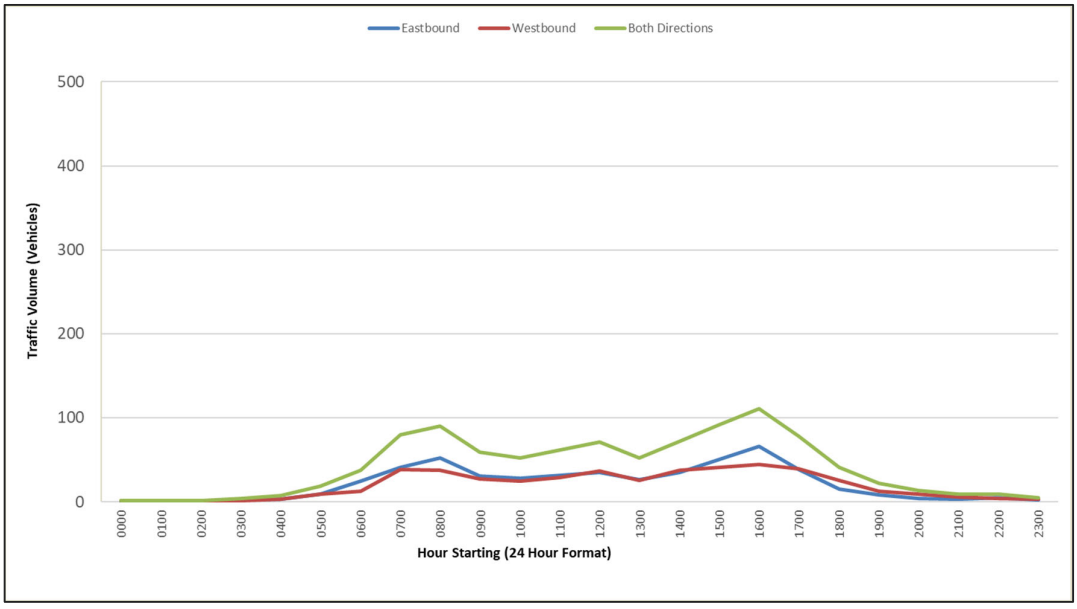


Figure 4-9: Weekday hourly traffic volumes on Two Chain Road east of Aylesbury Road

4.3 Intersection Traffic Volumes

Figure 4-10 shows intersection turn counts for the morning, midday, and evening peak periods at the SH1 / Aylesbury Road / Burnham Road intersection in November 2022. In the morning, there is a high demand for

the right turn into Aylesbury Road which is attributed primarily to activity at the military camp. This is also reflected in the demand for the reverse left turn from Aylesbury Road in the afternoon.

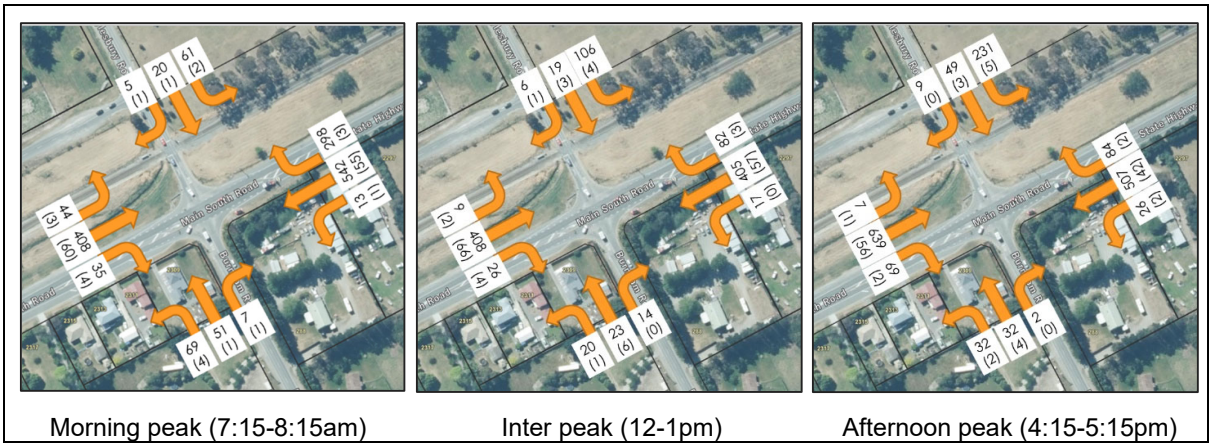


Figure 4-10: SH1 / Aylesbury Road / Burnham Road

Observations of turning movements at the intersection during the afternoon peak period indicate that the intersection operates with a low level of service at this time with long delays and queues extending beyond the railway crossing and Godley Road intersection.



Photograph 4-1: Observed queuing on Aylesbury Road approach to SH1 (November 2022)

Figure 4-11 shows turn counts at the Aylesbury Road / Burdons Road intersection. Dominant movements are to and from the south.

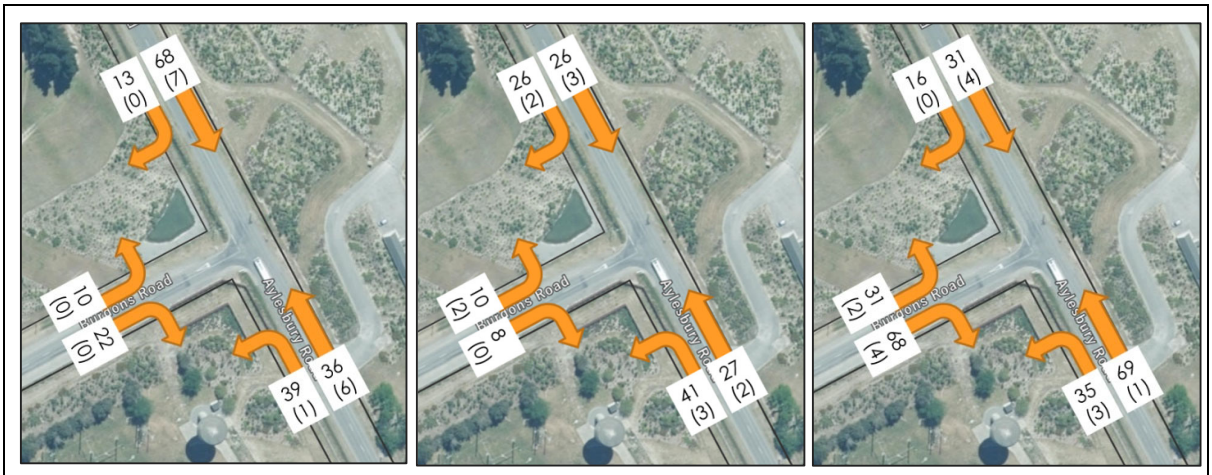


Figure 4-11: Aylesbury Road / Burdons Road Intersection Turn Counts

Figure 4-12 shows turn counts at the Aylesbury Road / Two Chain Road / Grange Road intersection[1]. In the morning, the dominant flow direction is towards SH1 but there is a high demand for the right turn movements from Aylesbury Road into Two Chain Road. During the afternoon peak period, the dominant movement pattern is into Sandy Knolls Road, Kerrs Road and Two Chain Road.

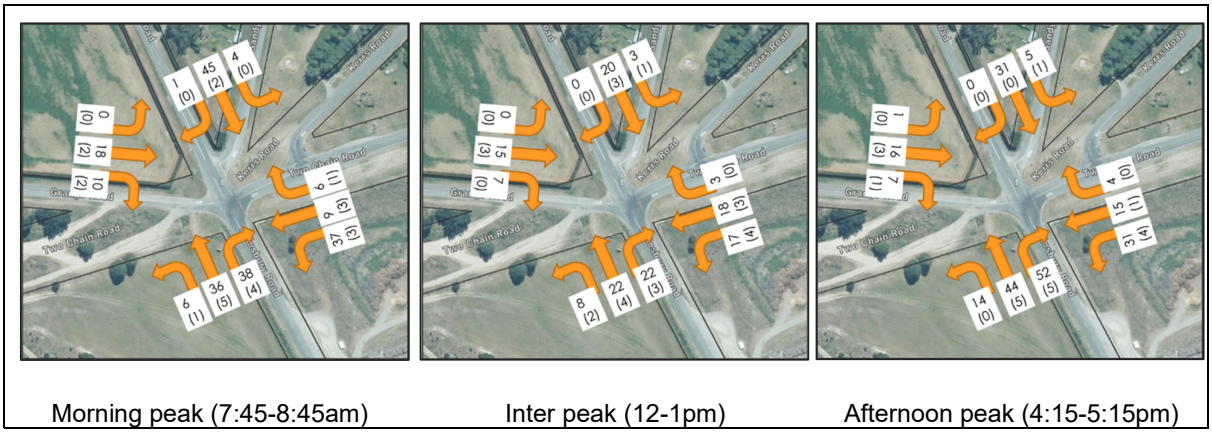


Figure 4-12: Aylesbury Road / Two Chain Road / Grange Road Intersection Turn Counts

[1] Turn counts for Kerrs Road and Sandy Knolls Road have been incorporated into other flows for simplicity.

4.4 Cyclists and pedestrians

As part of the full day traffic counts pedestrians and cyclists using the road network were recorded at the intersections of SH1 / Aylesbury Road and Aylesbury Road / Two Chain Road / Grange Road. The number of cycle and pedestrian movements recorded are set out below.

Table 4-2: Cycle and Pedestrian Counts

Road Location	Cycles	Pedestrians
Aylesbury Road north of SH1		
Morning 6am to 10am	5	0
Inter peak 10am to 3pm	5	0
Late afternoon 3pm to 7pm	9	0
Aylesbury Road / Two Chain Road / Grange Road		
Morning 6am to 10am	2	2
Inter peak 10am to 3pm	1	1
Late afternoon 3pm to 7pm	1	5

Peak period surveys carried out in July 2022 also indicated very few cyclists, over the six hour period (7-9am, 12-2pm, 4-6pm) the following number of cyclists were recorded:

- one at Aylesbury Road / Two Chain Road / Grange Road
- two at Aylesbury Road / Burdons Road
- two at SH1 / Aylesbury Road and
- none at Aylesbury Road / Wards Road

4.5 Railway crossing performance

A review of the intersection traffic counting videos showed there were 6 train movements over the 13 hours surveyed from 6am to 7pm. Typically closure time (from flashing lights activated, to barrier fully up) was between 1 minute and 1 minute 10 seconds. The maximum queue observed was 3 cars northbound, and 3 cars southbound. These queues did not interfere with operation of nearby intersections.

Table 4-3: Observed Train Crossings and Vehicle Queuing

Road Location	Train Direction	Road Closure	Queue Northbound	Queue Southbound
6:14am	Eastbound	1 min 8 sec	3 cars	1 car
9:53am	Westbound	1 min 8 sec	1 car	-
10:45am	Eastbound	58 sec	1 car	2 cars
1:00pm	Westbound	1 min 5 sec	2 cars	2 cars
2:20pm	Westbound	59 sec	1 car	-
3:19pm	Eastbound	40 sec	1 car	3 cars

5 Road safety

A search of the Waka Kotahi NZTA 'Crash Analysis System' (CAS) database has been undertaken for the purpose of reviewing the road safety in the vicinity of the Site. The most complete 5-year period of 2018-2022 was investigated for crashes.

The fatal and serious crashes were mapped, which indicated that the serious crashes are primarily occurring on the State Highway network, with one serious crash at SH1 / Aylesbury Road where a driver failed to give way and collided with a vehicle on SH1. The serious crash on Grange Road west of the Site involved an unlicensed driver travelling at high speed in the early hours of the morning hitting a cow and losing control.

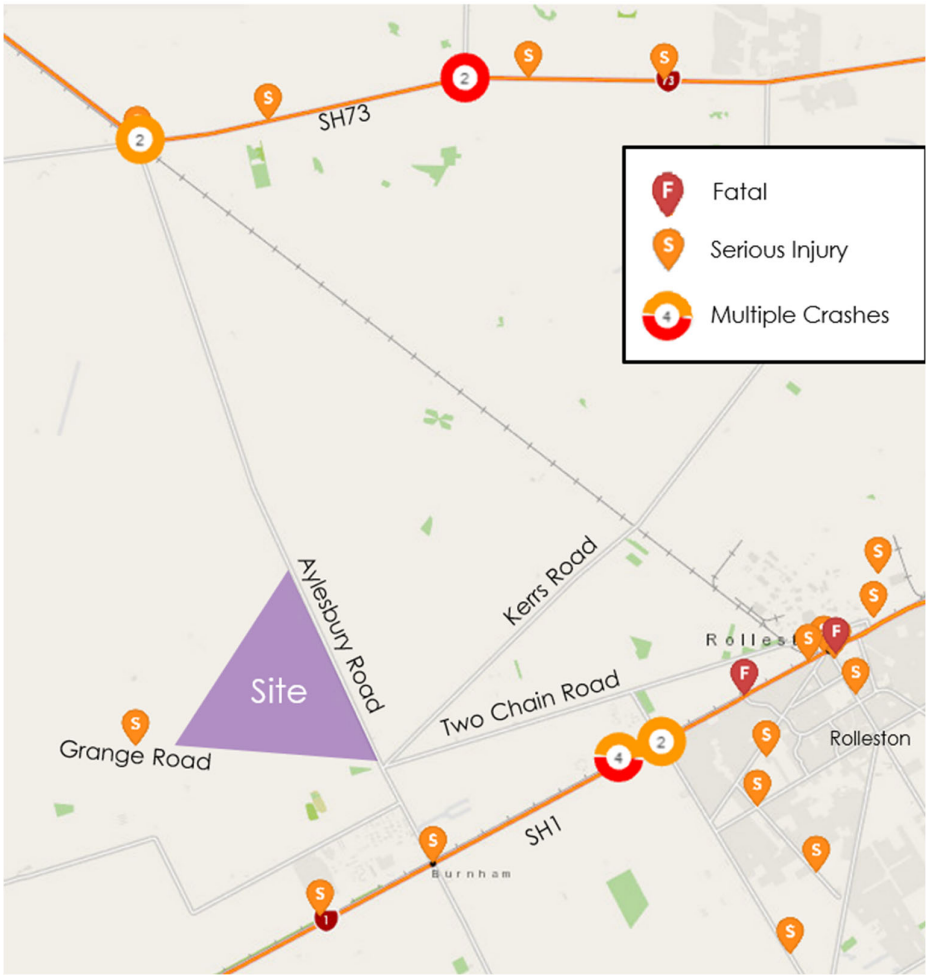


Figure 5-1: Location of Fatal and Serious Injury Crashes

A second and more focused search on roads near the Site was carried out, including all crashes (i.e. including non-injury and minor injury in addition to serious and fatal crashes). The search area is illustrated in Figure 5-2 and includes the area bounded by Two Chain Road, Grange Road, Kivers Road, Wards Road and Walkers Road, as well as Aylesbury Road to the Aylesbury Road / SH1 intersection. This was considered to be the relevant extent for which movements to/from the proposal Site will be concentrated.



Figure 5-2: Crash Locations Map for Period 2018-2022 (Waka Kotahi CAS)

A total of 28 crashes have been reported within the search area between 2018 and 2022. Of these crashes, 18 were non-injury (i.e., damage only), 8 were minor injury, with the remaining 2 being serious injury crashes.

Eight out of the reported crashes were at or close to the SH1 / Aylesbury Road intersection.

- 2 involved vehicles u-turning being hit by following vehicles
- 2 involved vehicles turning right from SH1 being hit by oncoming vehicles as they turned
- 6 involved vehicles pulling out of either Aylesbury Road or Burnham Road being hit by a vehicle travelling through on SH1.

There were eight other intersection crashes involving a vehicle turning or crossing being hit by a vehicle travelling through.

- Aylesbury Road / Burdons Road - one crash
- Aylesbury Road / Grange Road – one crash
- Aylesbury Road / Wards Road – two crashes
- Two Chain Road / Walkers Road – four crashes
- Wards Road / Kerrs Road – one crash

The midblock crashes involved a range of factors including:

- Losing control on unsealed surface (two crashes) and sealed surface (two crashes)
- Turning or u-turning vehicles being hit by other vehicles following (three crashes)
- Loss of control from hitting an animal (one crash)

Three of the crashes involved trucks, and in all cases the other vehicle involved in the crash collided with the truck after the other vehicle driver made a driving error.

No crashes involved pedestrians, cyclists, horses, or school buses.

6 Planned Infrastructure Changes

6.1 Aylesbury Road Level Crossing

A draft Level Crossing Safety Impact Assessment (LCSIA) was completed by Aurecon in 2022 for KiwiRail and released to Stantec for reference in this transportation assessment. The LCSIA report assessed the need for the crossing, as well as the safety performance. Some of the key points included:

- The "Top down" assessment, which looks at need for crossings assessed that closure of the railway level crossing was not considered reasonably practicable due to the function of Aylesbury Road accessing Burnham Military Camp. It was also assessed that it was not reasonably practical to close an alternative crossing on the nearby road network.
- Grade separation was not reasonably practical as cost would be disproportionate to the risk.
- Warning signs associated with short stacking between the railway and SH1 should be installed.
- Median islands on both approaches should be installed.
- An escape lane on SH1 on the northeastern side of the SH1 intersection with Aylesbury Road should be investigated.
- The condition of the crossing should be improved through various maintenance and minor improvement measures.
- Lighting at the crossing should be investigated.
- The level crossing safety score (LCSS) is currently resulting in "Medium" risk, and in the future (allowing for 10 years of traffic growth at 5% per annum) and after implementation of recommendations the risk remains at Medium. The LCSS score that generates the risk band decreases in the future, which achieves the minimum Criterion 2 requirement for an existing crossing upgrade.

The LCSIA indicates that the general form of the level crossing will largely remain the same, with minor modification, into the future.

6.2 SH1 / Aylesbury Road / Burnham Road

The Waka Kotahi NZTA 'National Land Transport Fund' (NLTF) outlines potential and approved investments in programmes and projects pertaining to transport infrastructure nationally.

The NLTF indicates that funding will be provided for Road to Zero projects on SH1 from Templeton to Selwyn River. Details regarding the projects have not been stated. It is understood that it will be similar to those of other Road to Zero projects with a focus on road centreline widening, installation of wire rope barriers and treatment of intersections in accordance with safe system principles.

Discussions with the Canterbury Waka Kotahi Senior Safety Engineer at various stages of the quarry planning have confirmed that a feasibility assessment for the SH1 / Aylesbury Road intersection has been completed as part of the Speed and Infrastructure Programme which includes a project for the intersection and adjacent section of highway. Detailed design is underway however Waka Kotahi is still working through property purchase requirements and consenting matters.

It is understood that the preferred option is a single lane roundabout with inscribed diameter (width including central island and circulating lanes) of 50m, with separation from the railway maintaining a distance of approximately 30m minimum between limit lines, which is likely to provide sufficient storage for a truck, trailer and car. No changes to the railway centreline are expected. The roundabout will provide both a primary safe system intersection transformation response to address safety concerns, and it also provides turnaround opportunity that is required on SH1 as a result of proposed median barrier treatments.

Cost management is likely to be required which could influence the ultimate size, although it is understood the roundabout design will enable the full range of traffic movements at the intersection in a safe and efficient manner. Consultation has not commenced. Funding is in the current NLTP for design and implementation, although it is understood that funding may also need to be included in the next NLTF programme 2024-2027. It is understood that no specific allowance for the potential Winstone quarry has been made in the feasibility planning, although it is a highway / arterial intersection so is expected to be designed to a high safety and efficiency standard that can accommodate traffic growth.

The effect of the intersection upgrade on the railway crossing is yet to be assessed by an updated LCSIA. However it is expected that the upgrade offers the opportunity to address many of the matters raised in the LCSIA.

6.3 Rolleston Access

As a part of the New Zealand Upgrade Programme (NZUP), Waka Kotahi NZTA in collaboration with the SDC and KiwiRail aim to improve highway intersection and rail provisions in the southern Rolleston area. The June 2022 engagement plan included as Figure 6-1 shows the recommended plan that was subject to further consultation and confirmed in December 2022.

Walkers Road and Two Chain Road (to the east of Walkers Road) will become a key commuter and freight route to and from the southwest, as direct access from SH1 at Hoskyns Road would be removed as part of providing a over of SH1 between the industrial and town centre areas. Construction is anticipated to commence in the period 2024 to 2026, starting with a roundabout at SH1 / Walkers Road / Dunns Crossing Road. That roundabout will require realignment of Dunns Crossing Road as shown in Figure 6-2.



Figure 6-1: Waka Kotahi Engagement Brochure (June 2022) indicating Potential Rolleston Access Changes



Figure 6-2: Waka Kotahi Project Overview Map indicating realigned Walkers Road

Complementary projects yet to be confirmed are expected to be funded by the SDC with the assignment of Two Chain Road/Walkers Road and Jones Road as southern freight routes. Infrastructure improvements will be required to support this.

6.4 Rolleston to Burnham Cycleway

The Selwyn District Council's (SDC) Long-Term Plan 2021-2031 includes provision for a new cycleway that would connect Rolleston to Burnham and be completed in 2029/2030 at a forecast cost of $2.7Million. The Selwyn District Walking and Cycling Strategy Action Plan includes a diagram (see Figure 6-3) indicating the section from the Rolleston industrial area will be a new off-road section north of the railway, before continuing along Runners Road to Aylesbury Road.



Figure 6-3: SDC Long-term Plan 2021-2031 Cycleway Infrastructure Change

No other specific roading projects are included in the Long Term Plan for the local road network.

6.5 Aylesbury Road and Wards Road

The Selwyn District Council Transportation Activity Management Plan forms part of the Long Term Plan and includes expected project timing within the 2021-2031 period, as well as long term projects expected in the District.

In the period 2021-2031 a relevant improvement is proposed for Two Chain Road:

- Two Chain Road Stage 1 widening 2028/29 Road Upgrade between Walkers Road and Wards Road – Rolleston Industrial southern link.

This project reflects the changes proposed by Waka Kotahi for the Rolleston access project, as well as landuse changes proposed by Plan Change 80.

In the period beyond the initial ten-year period, there is provision for further widening of Two Chain Road, between Aylesbury Road and Wards Road:

- Two Chain Road (Stage 2) Widening 2040/41 Between Walkers Road and Aylesbury Road – Rolleston Township southland from Burnham / SH1
- Aylesbury Road Widening 2044/45 Road Upgrade between Burdons Road and Bealey Road
- Wards Road Widening 2046/47 Road Upgrade between Two Chain Road and Bealey Road

This indicates that the existing road formation is expected to largely remain unchanged for the foreseeable future.

7 Future Population Growth

7.1 Selwyn District

The Selwyn District Long Term Plan includes a forecast of change in population in the Selwyn District, by location. This is of interest from the perspective of potential future areas of demand for material from a quarry.

The forecast is for an increase in population within the district of over 37,000 people between 2023 and 2045, from a 2023 base of approximately 76,000 people.

An analysis of population projections has been carried out, with increases between 2023 to 2045 shown in Figure 7-1. The diagram shows the dominance of Rolleston population growth in Selwyn District.

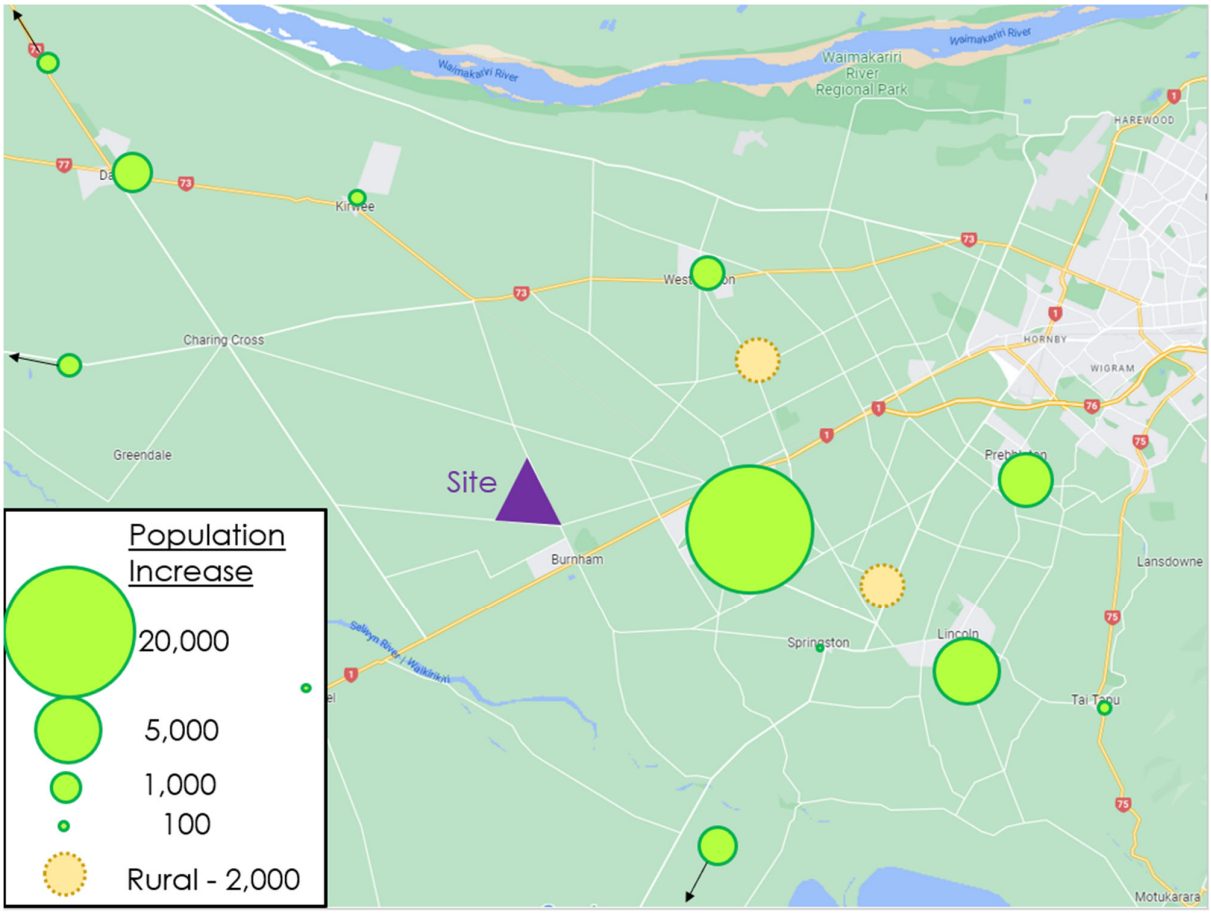


Figure 7-1: Population Growth 2023-2045 (SDC Long-term Plan 2021-2031)

By comparison, the long term year 2048 projections[2] for Christchurch City indicate changes in population of approximately 75,000 people, and potentially up to 140,000 people based on a high growth scenario. This is from a 2022 base of 389,000 people.

[2] https://ccc.govt.nz/culture-and-community/statistics-and-facts/facts-stats-and-figures

7.2 Burnham Military Camp

The Selwyn District Council Long Term Plan population forecast data does not indicate changes at Burnham. An investigation of Burnham Military Camp census data has been carried out to understand how patterns may have changed in the past, which may inform future considerations of traffic patterns, including worker travel to and from workplaces in the area. Table 7-1 shows the changes in population and workplace employment in Burnham.

Table 7-1: Burnham Camp Population

Year	Usually resident population	Total Workforce in Burnham
2006	1,203	675
2013	1,089	966
2018	1,146	1,236

The data indicates that the residential population has been quite consistent over the Census periods, whereas the number of people working at the Burnham Military Camp has increased quite substantially.

Approximately 98% of people that live in Burnham and work, have their workplace within Burnham, confirming the resident population is directly related to work activities on the Burnham Military Camp site. Of the people that work at Burnham, approximately 60% also live in Burnham. Of those travelling to Burnham for work from other areas, the following general direction of travel is involved:

- West via SH1 5%
- North 12%
- South across SH1 15%
- East via SH1 68%

The reported means of travel to work from outside areas to workplaces in Burnham is approximately 90-95% by private vehicle, and our observations indicated a small number of cyclists.

8 Proposed Quarry

8.1 Overview

Figure 8-1 provides a broad indication of the proposed quarry layout. The Site covers some 362ha of farmland, and will be developed progressively together with ongoing land rehabilitation.

Vehicle access to the Site for all quarry related traffic is proposed to be Aylesbury Road about midway between the Wards Road and Two Chain Road intersections. A permanent entrance driveway and office and amenities will be included at that location, with stockpiles located nearby.

The initial aggregate extraction will occur immediately south of the Site entrance. The processing plant and aggregate storage stockyards will be toward the centre of the Site. Aggregate extraction will continue in stages south on land bordering Aylesbury Road before moving to land bordering Grange Road and then moving up the western boundary of the Site to the north and back down Aylesbury Road towards the Site entrance. The staging and access location reflect a variety of factors including maintaining an efficient farm operation, managing environmental effects, and achieving access safely and efficiently. The overall quarry life is expected to be in the order of 60 years, depending upon the demand for aggregate from the quarry.

As farming operations will continue on the land, the area of the Site being quarried will move over time and farming activities will continue to access the land via the existing access on Grange Road. This access will not be used by quarry related traffic.

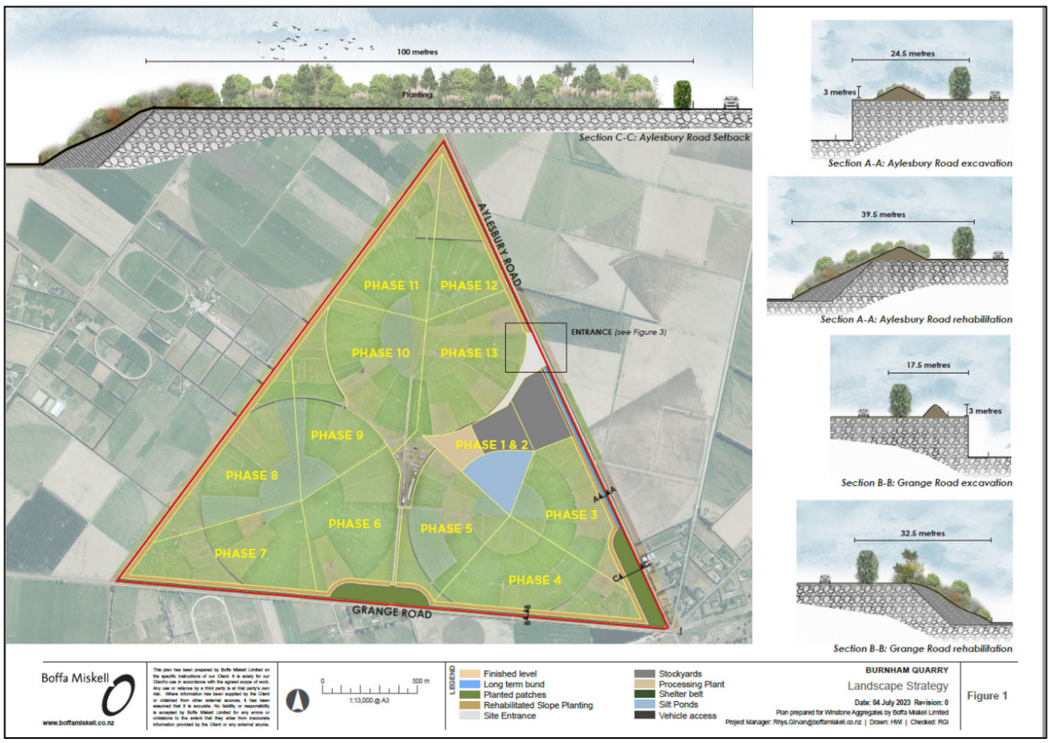


Figure 8-1: Proposed Site layout (Source: Boffa Miskell)

8.2 Site Access Arrangements

The Site access is proposed to be located on Aylesbury Road approximately 1.7km north of Two Chain Road. The positioning of the access is in an area between two central irrigation pivots and enables the staging to be carried out without affecting both pivots. A concept design for the Site access area is shown in Figure 8-2. The access will be formed with priority controls with localised widening of Aylesbury Road at the access as required by standard arterial road rural vehicle access design for non-residential activities.

A weighbridge will be installed within the Site and located so that there is sufficient queuing space to avoid any queuing of vehicles back onto Aylesbury Road.



Figure 8-2: Site Access Concept Design (Source: Boffa Miskell)

For permitted activities, the District Plan indicates a preference for access to Grange Road as a lower order road. As a result of the scale of the activity planned which is higher than permitted activity levels, and the characteristics of the road network, access to Aylesbury Road is considered to be more suitable, and can safely and efficiently be accommodated as assessed later in this report.

8.3 Proposed Traffic Generation Limits

Winstone Aggregates is seeking approval to operate the quarry with a maximum of 750 heavy vehicle movements per day.

These represent directional volumes of any vehicle so include a movement into the Site, and a movement from the Site in the total. In other words, the likely entering volume of vehicles entering the Site will be half the limit, and the exiting volume of vehicle will also be half the limit.

The type of vehicle covered by the proposed limit is any vehicle classed as larger than a light vehicle, with a gross vehicle mass exceeding 3.5 tonnes. For the quarry activity these can include a range of truck types that can service quarries, including medium rigid trucks such as smaller landscape supply vehicles, heavy rigid trucks carrying bulk aggregate, articulated single trailer trucks, and heavy rigid trucks with large trailers.

The limit is set with an expectation that in the long term there may be certain projects, or sustained periods of demand across the region that require this level of heavy vehicle movement. The limits proposed have been calculated by Winstone Aggregates based on their knowledge of market demand, variations in traffic generation patterns, and likely demand from the Burnham quarry over the long term. The aggregate produced by the quarry will increase over time with peak production potentially not being reached for more than 10 years after commissioning.

8.4 Hours of Operation

Table 8-1 shows the normal hours of operation proposed for various activities at the quarry site. Winstone Aggregates is also seeking approval for some activity outside these hours.

Table 8-1: Hours of Operation

When			Allowable Activities
At all Times			Environmental mitigations (including dust control), light vehicle movements into and on site, operation of site office, site security and light maintenance
Early-Morning	Monday to Saturday on up to 30 times per annum, excluding Public Holidays.	5am – 7am	Loadout and access / egress of trucks operated by the quarry operator. (10 truck movements per hour)
Sunday Mornings	On up to 15 Sundays per annum (excluding public holidays)	5am – 7am	Loadout and access / egress of trucks operated by the quarry operator.
Morning	Monday to Saturday, excluding Public Holidays.	6am – 7am	Rehabilitation and movement of vehicles within site associated with that activity. Site pre-startup including operational warmup of on-site plant
Day-Time		7am – 8pm	Full range of production activities within current operational area and/or primary and secondary stockyard.

9 Traffic Generation Patterns

9.1 Overview

The assessment of transportation related effects of the quarry is based on the maximum volume of heavy vehicles per day being sought by the resource consent application. That level is 750 heavy vehicle movements per day based on medium to long-term expectations of ongoing demand for aggregate in the greater Canterbury area. In addition, there will be some ancillary light vehicle movements.

This section of the report sets out how the traffic volumes will likely vary across the year based on that maximum volume. This allows additional assessment of transport related effects at levels that will be typically expected.

The quarry will add to Winstone Aggregates aggregate resources in Canterbury, including Winstone's existing Wheatsheaf quarry between Rolleston and Prebbleton access off Selwyn Road. Winstone also previously operated a quarry at Yaldhurst, accessed from Old West Coast Road, but sold the site in 2021 when the rock resource was depleted. The new quarry at Burnham is intended to replace aggregate supply from both the Yaldhurst Quarry and the Wheatsheaf Quarry when it reaches the end of its operational life in – 10 years.

Winstone Aggregates has supplied their forecast that 95% of heavy vehicle traffic generation of the Burnham site will be to Christchurch City. In that regard, the traffic generation patters at both Yaldhurst (when it was operational) and Wheatsheaf Quarries, which also both largely service Christchurch City are relevant in considering patterns of traffic movement through the seasons and across the day.

Detailed analysis of quarry patterns from a quarry formerly operated by Winstone in Yaldhurst obtained from weighbridge records has been carried out to inform:

- Daily variability, indicating relationship between maximum traffic generation and typical traffic generation on a day to day basis, including percentile daily volumes; and
- Hourly variability, being the relationship between the time of day, and the traffic generation at the site.

The variability observed at the Yaldhurst quarry, has then been applied to the Burnham quarry forecasts of traffic generation through the course of the quarry life to determine traffic forecasts for a range of percentile operating days during a year in which peaks are reached.

In addition, this section of the report also considers the light vehicle movements.

9.2 Heavy Vehicle Generation Variability

9.2.1 Yaldhurst Quarry Patterns

It is expected that the traffic generation of the quarry will operate with seasonal patterns similar to the existing Yaldhurst Quarry previously operated for many decades by Winstone Aggregates. To understand the traffic patterns at that quarry Winstone has supplied analysis of weighbridge records from the 2019 financial year, reported as heavy vehicle movements at that site. By analysing the day-to-day variation in historical movements at Yaldhurst, an assessment of the potential heavy vehicle movement on a day-to-day basis can be applied to the proposed Burnham quarry.

Figure 9-1 shows the average daily number of truck movements associated with aggregate exported from the Yaldhurst quarry from July 2019 to June 2020. The annual average level of production over that time involved approximately 200 truck movements per day. There was about 20 percent variation in monthly average production levels over that period although it is noted that the months with low production coincided with the early Covid19 lockdowns.

The highest production days in each month (excluding March and April due to Covid19 effects) varied from 300-480 vehicle movements with an average of the peak day per month being 360 vehicle movements. This suggests that the busier days at the quarry generated more than double the volume of movements of an

average day. The ratio of average day to busiest day could vary over time depending on local market conditions, such as whether there is a significant road construction campaign close to the quarry. The important point to take from the data is that the busiest day will not be the normal operation, and by definition a significant number of operating days will be around or below the average. Consideration of a maximum is very much a worst-case assessment, and many transport assessments would instead consider a lower design level of operation such as an 85th percentile day for understanding effects on the transport network. Previous assessments at the Yaldhurst Quarry have indicated that would be approximately 75-80% of the maximum day of a fully functional quarry.

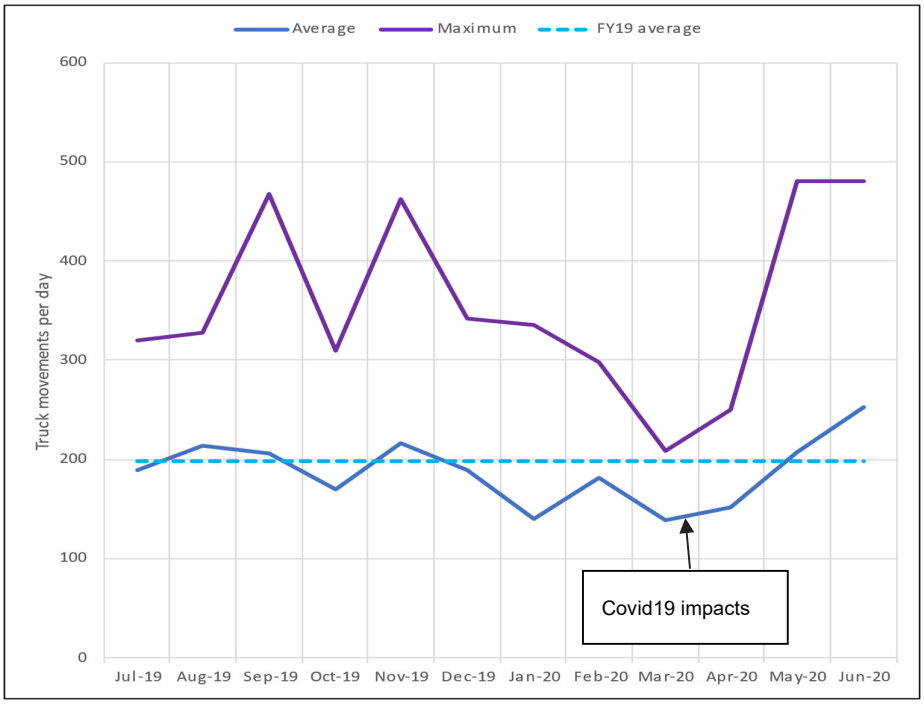


Figure 9-1: Daily truck movements at Winstone Aggregates Yaldhurst Quarry

Figure 9-2 shows the average and maximum hourly number of truck movements associated with the Winstone Aggregates Yaldhurst Quarry in 2019-20. It indicates the hourly average production rate is less than 20 movements per hour (in and out), with peak production reaching 60-70 truck movements per hour. Based on the information provided, on a typical day activity levels at the quarry rise quickly in the early morning after 6am, and remain at a consistent level through to the mid-afternoon before falling after 4pm. Maximum volumes are not experienced in the peak hours of the road network (7-9am, 4-6pm).

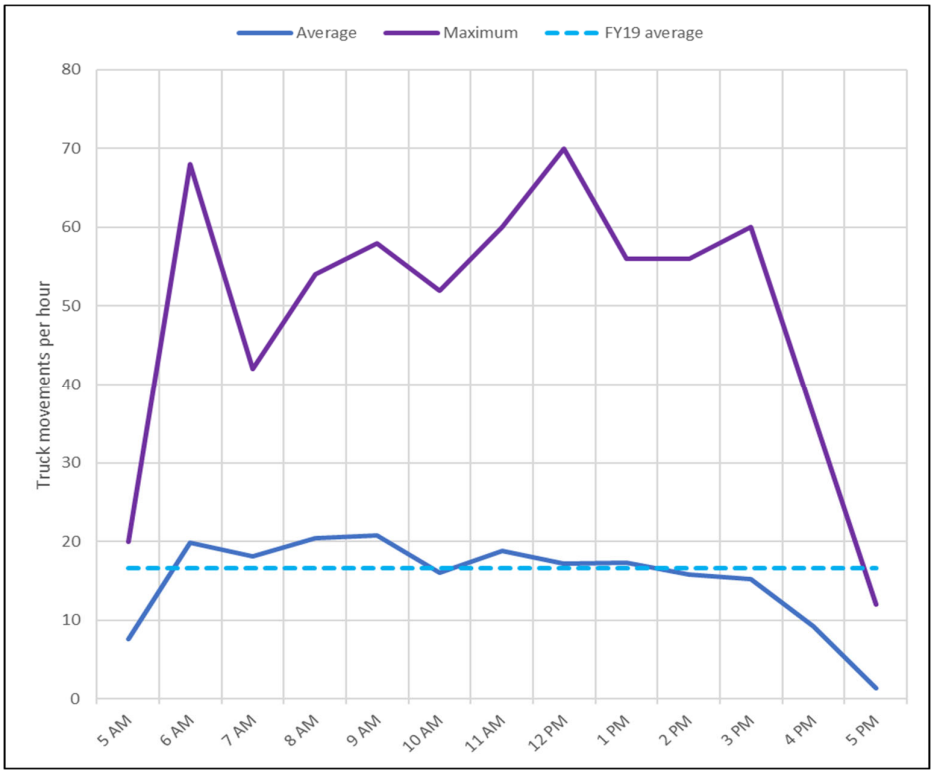


Figure 9-2: Hourly number of truck movements at Winstone Aggregates Yaldhurst Quarry

Further analysis of the average hourly truck movements indicates that during the average day, hourly production rates represented approximately 10% of the daily production rate. For the peak activity, the busiest hour represents approximately 15% of the maximum day.

9.2.2 Forecast Burnham Quarry Traffic Generation Patterns

The resource consent proposes to limit traffic generation at the Site to 750 heavy vehicle movements per day, which will enable the quarry to supply aggregate to satisfy expected demands.

Based on the Yaldhurst Quarry data, it is expected that day to day operation will result in significantly lower trip generation. The data indicates that when fully operational an average traffic generation of approximately 40% of the maximum will be expected, which equates to an average of 300 heavy vehicle movements per day. Peak hours are assessed at the relative percentages observed from the Yaldhurst Quarry data.

Based on the proposed maximum traffic generation, and considering the patterns of traffic generation from the Yaldhurst quarry, Table 9-1 provides calculated forecasts for transport assessment.

Table 9-1: Heavy Vehicle Traffic Generation Forecasts

Daily (vpd)		Peak Hour (vph)	
Busiest Day (Proposed Consented Limit)	**Average (40% of Busiest Day)**	**Busiest Hour (15% of Busiest Day)**	**Typical (10% of Average Day)**
750	300	112	30

9.3 Travel Demands and Patterns

The traffic distribution patterns for the proposed quarry have been assessed under two scenarios. The first scenario is forecast by Winstone and is based on trip patterns Winstone has projected, with the quarry being heavily weighted towards servicing Christchurch.

A second scenario is that the quarry will have a focus on servicing the Selwyn District, recognising other major quarries are located in Christchurch and the eastern edge of Selwyn District. It is likely that a change in quarry strategy would be required for this to occur.

The two scenarios enable a reasonable consideration of the varying potential outcomes for the local and strategic transport networks.

9.3.1 Scenario 1: Christchurch City Focus

Winstone anticipates that 95% of the quarried material could be to and from Christchurch City in the long term, as supplies near to the City are exhausted and Winstone supports its wider business in the city.

The direct route to all parts of Christchurch City is via SH1 east of Aylesbury Road. The remaining percentage would be spread around the Selwyn District, and involve low volumes as each route would accommodate less than 1% of the generated traffic. That is shown in table format in Table 9-2, and in diagrammatic form on **Figure 9-3** for typical and busiest days when the quarry is fully operational and producing at the proposed consent limit.

Table 9-2: Christchurch City Focus - Distribution of Truck Movements

Direction	Percentage Distribution	Vehicles Per Day	
		Average Day	Busiest Day
North-West (Hororata / Glentunnel via Wards Road	0.1%	0	1
North (Darfield / West Melton via Aylesbury Road)	0.5%	2	4
North-East (Rolleston Industrial via Local Roads)	0.5%	2	4
East (Rolleston, Rolleston Industrial, Prebbleton via SH1)	97.7%	293	733
South (Lincoln, Leeston via Burnham Road)	1.0%	3	8
West (Dunsandel via SH1)	0.2%	1	2

The table indicates that the quarry traffic would effectively almost rely on SH1 to the east, and all other roads will carry minimal quarry traffic, that would barely be perceptible.

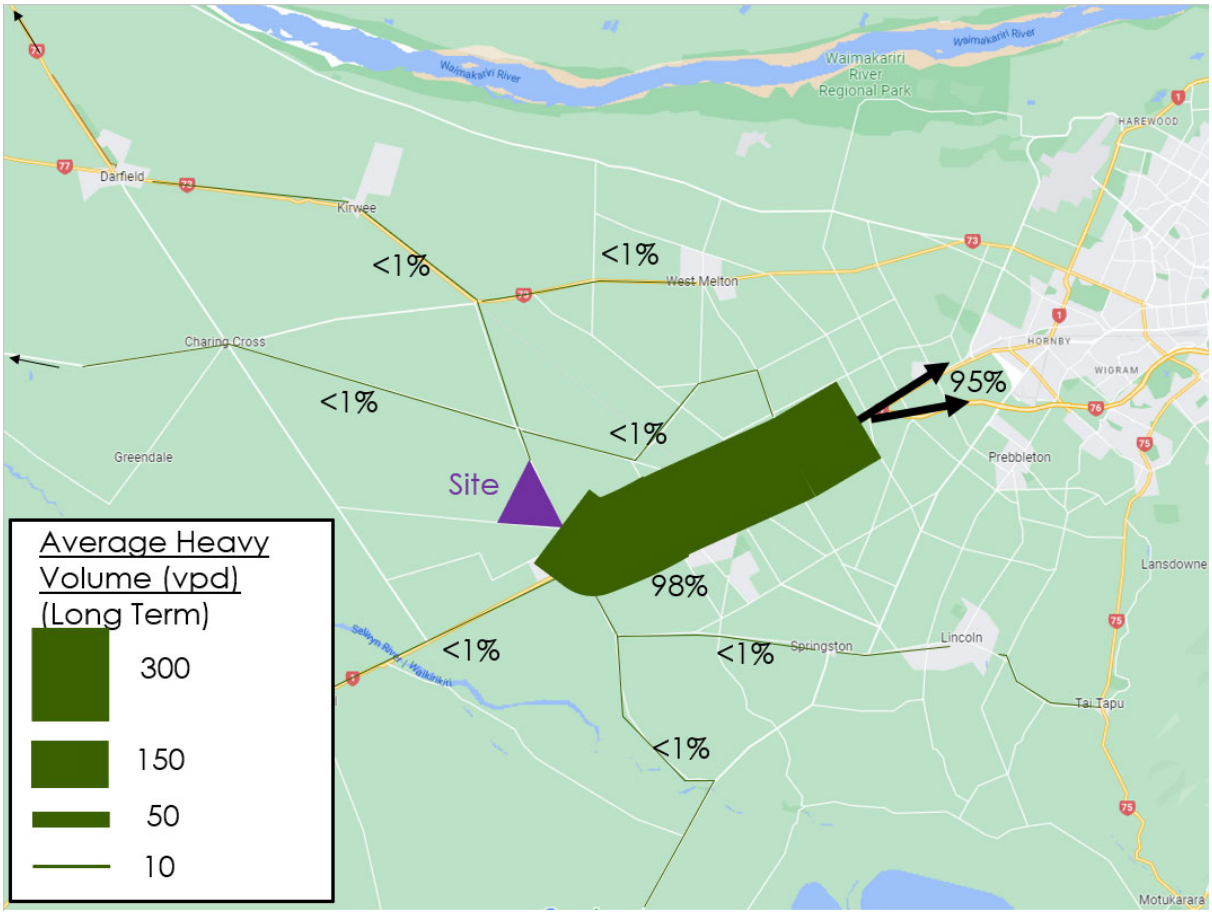


Figure 9-3: Christchurch City Focus Traffic Volume Forecast (Indicative Routes)

Whilst the volumes indicated are mostly less than 5 heavy vehicle movements per day, in practice if a destination is generating traffic movements, there is the potential for vehicle shuttling so that volumes on any particular day could be higher (with a compensating decrease in volume at another destination).

9.3.2 Scenario 2: Selwyn District Focus

Although truck movements will vary from day to day in response to construction project requirements, under this scenario it has been assessed that the pattern of movements will broadly reflect the location and size of growth in population centres. This will likely represent a worst case assessment of traffic on the Council road network. The traffic volumes under this scenario are calculated relative to the population growth in each location, and are presented in Table 9-3 and Figure 9-4 below for typical and busiest days when the quarry is fully operational and producing at the proposed consent limit.

Table 9-3: Selwyn District Focus - Distribution of truck movements (vehicles per day)

Direction	Percentage Distribution	Vehicles Per Day	
		Average Day	Busiest Day
North-West (Hororata / Glentunnel via Wards Road	1%	3	8
North (Darfield / West Melton via Aylesbury Road)	11%	33	83
North-East (Rolleston Industrial via Local Roads)	6%	18	45
East (Rolleston, Rolleston Industrial, Prebbleton via SH1)	60%	180	450
South (Lincoln, Leeston via Burnham Road)	21%	63	158
West (Dunsandel via SH1)	1%	3	8

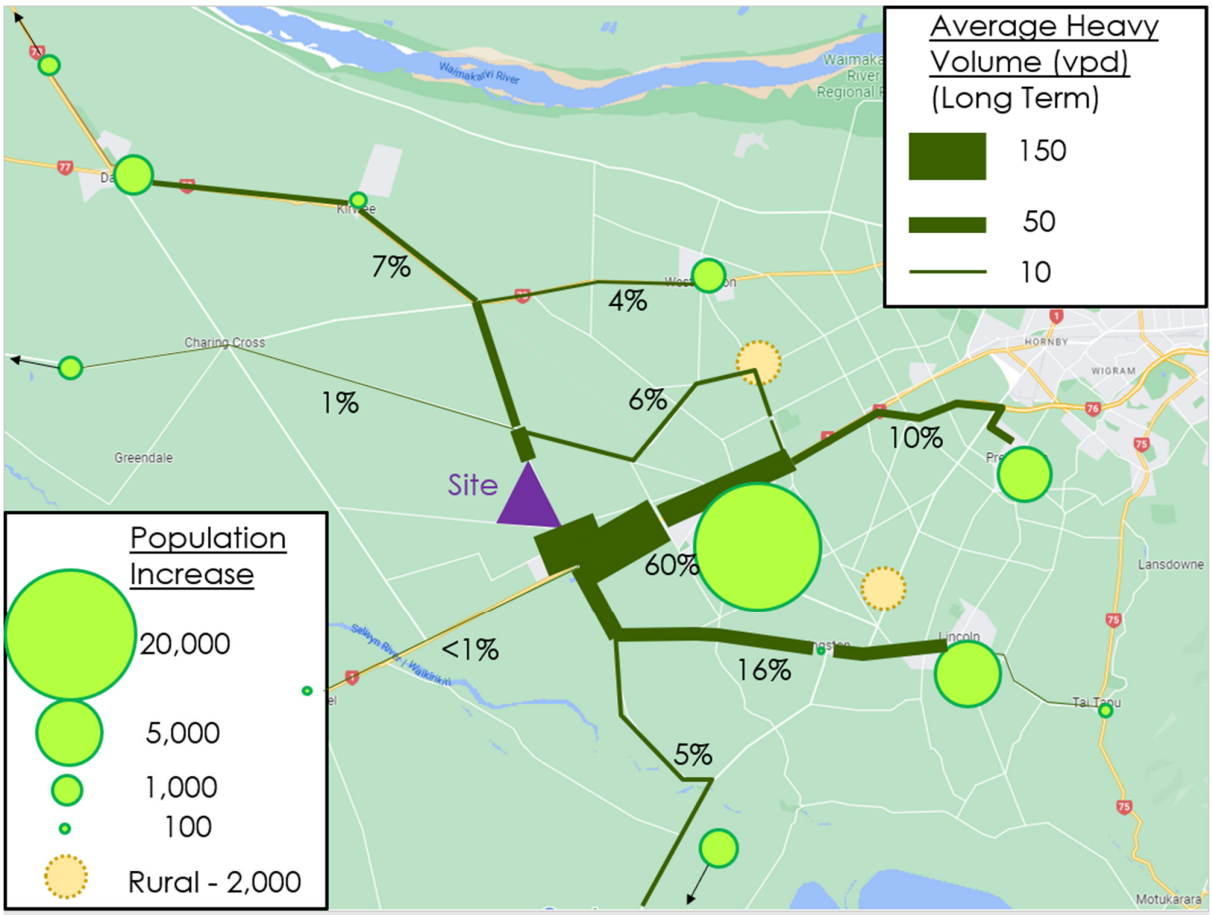


Figure 9-4: Selwyn District Focus Scenario Long Term Traffic Volume Forecast (Indicative Routes)

10 Potential Transport Effects

10.1 Changes in Traffic Volumes

Potential changes in traffic volumes will be most noticeable on the local road network and at intersections connecting with the state highway network.

As described in the preceding section, the Christchurch City focus scenario will result in highest traffic volumes on Aylesbury Road south of the Site connecting to SH1. The Selwyn District focus scenario will result in the highest volumes on other local roads .**Table 10-1** below indicates the potential range of traffic volumes on an average day between the medium and long term, and also the long term peak volume assessed. As any traffic volume is indicative, some rounding has been included. The superscript indicates if the peak is associated with a Selwyn focus (S) scenario or Christchurch focus (C) scenario.

It can be seen that the traffic volumes to be assessed will vary widely, with primary influences being where material is being used, and the level of production (with long term volumes higher than short/medium term).

However it is clear that Aylesbury Road will carry the bulk of the heavy vehicle movements. Some route choices exist to service different destinations, and it is not expected that the routes taken would be controlled. In some cases, routes may vary based on the time of day (and associated interaction with other traffic at intersections) or perceptions of the most desirable route.

The effects of potential changes in traffic patterns are discussed in the following sections of the report.

Table 10-1: Forecast changes in Travel Patterns with Quarry

Road Location	Existing Weekday (5 day) Average Volume	Quarry Additional Traffic		Indicative Typical Future Volume
		Average Additional	**Long Term Busiest Day Potential**	
Routes South				
Aylesbury Road north of SH1	3,700	110-300	750[C]	3,800-4,000
Aylesbury Road south of Two Chain Road	1,340	110-300	750[C]	1,450-1650
Aylesbury Road north of Two Chain Road	460	110-300	750[C]	570-750
Routes East				
Two Chain Road east of Aylesbury Road	1,000	0-20	45[S]	1,000-1,020
Walkers Road north of SH1	2,080, increasing to 8,000vpd with planned growth*	Not expected to be used		8,000-8,300
Routes North				
Aylesbury Road north of Wards Road	460 estimated	0-40	85[S]	460-500
Aylesbury Road south of Wards Road	460	0-55	140[S]	460-515
Wards Road east of Aylesbury Road	1,620	0-20	45[S]	1,620-1,640
Wards Road west of Aylesbury Road	1,620 estimated	0-3	10[S]	1,620-1,625
Other Roads Unlikely to be Used				
Sandy Knolls Road north of Aylesbury Road	100	Not expected to be used		100
Kerrs Road	160	Not expected to be used		160
Kivers Road	N/A	Not expected to be used		N/A
Grange Road west of Aylesbury Road	425	Not expected to be used		425

**Walkers Road will change to a primary arterial freight route to and from the Rolleston Industrial Area, such that volumes will increase over time. The PC80 ITA indicated long term peak traffic volumes of up to 790vph to 870vph indicative of daily traffic volumes of 8,000vpd on Walkers Road. Without PC80, traffic volumes are forecast to be approximately 5,500vpd.*

10.2 Positive Effects

The Site is situated in a location that is in reasonably close proximity to both SH1 and SH73, enabling efficient transport of material via the state highway network to Christchurch, Rolleston, and potentially Darfield. It is also well located with respect to Lincoln and other Selwyn towns. As demonstrated by the existing extraction from quarries in the area, such as Road Metals Co Ltd quarry on Wards Road, there is a clear demand for aggregate from a quarry in this area from a range of developments in the District.

As is typical of quarry activities, if major clients choose to take material from the Site, a primary reason is likely to be based on minimising transportation distances. In turn, this has a network wide benefit of minimising accident exposure (which is a function of distance travelled). The Site location is also well located on an existing arterial road to minimise reverse sensitivity effects from truck movement. Arterial roads have a function of supporting heavy vehicle and through traffic movement.

Regardless of this application, there would continue to be a demand for heavy vehicles to transport aggregate to and from the various destinations within the District, or to and from Christchurch. Although material from other quarries would most likely utilise different travel routes, dependent on the source and destinations of the product, such routes would inevitably still rely on the local road network through the District, and on the State Highway network.

10.3 Site Access

10.3.1 Access Design Concept

The volume of heavy traffic generated by the Site requires a high standard of access. The proposed access is located to easily comply with District Plan standards with respect to proximity to intersections, and there are no other dwelling or commercial activity property accesses in the vicinity. The use of the arterial Aylesbury Road is considered most suitable as the alternative Grange Road is a lower standard and function, and the level of traffic generation proposed is less consistent with the local road function of Grange Road.

The position of the Site access on Aylesbury Road is located to provide an optimal long-term solution for quarrying and rehabilitation of the Site. It is on an arterial road to minimise turns at local intersections. Whilst access in the southeast corner of the Site could enable shorter overall travel distance on the road network, travel to a central processing area would still be required within the Site, and such a location would have likely have greater adverse effects on the amenity of nearby dwellings.

There is unrestricted sight distance on Aylesbury Road and currently there are low traffic volumes of approximately 500 vehicles per day that will allow exiting traffic to select large gaps and accelerate away from the Site with minimal interaction or effect on through traffic.

It is recommended that the Site access is developed as generally shown in Figure 10-1. The Site access widening is designed to the Waka Kotahi Planning Policy Manual “Diagram E” standard for a 100km/h speed limit road. This standard is considered suitable for a high vehicle generating commercial vehicle access on a lower volume arterial road and exceeds the Selwyn District Plan requirement (Operative District Plan Rural Volume Diagram E10.D and Partially Operative District Plan TRAN-Diagram 7). It ensures that trucks can manoeuvre on the sealed widening surface.

While the development will involve laden heavy vehicles leaving the Site, it is considered that this aspect does not necessitate acceleration lanes on Aylesbury Road. It is considered that the access will safely accommodate the low volume of passing through traffic.

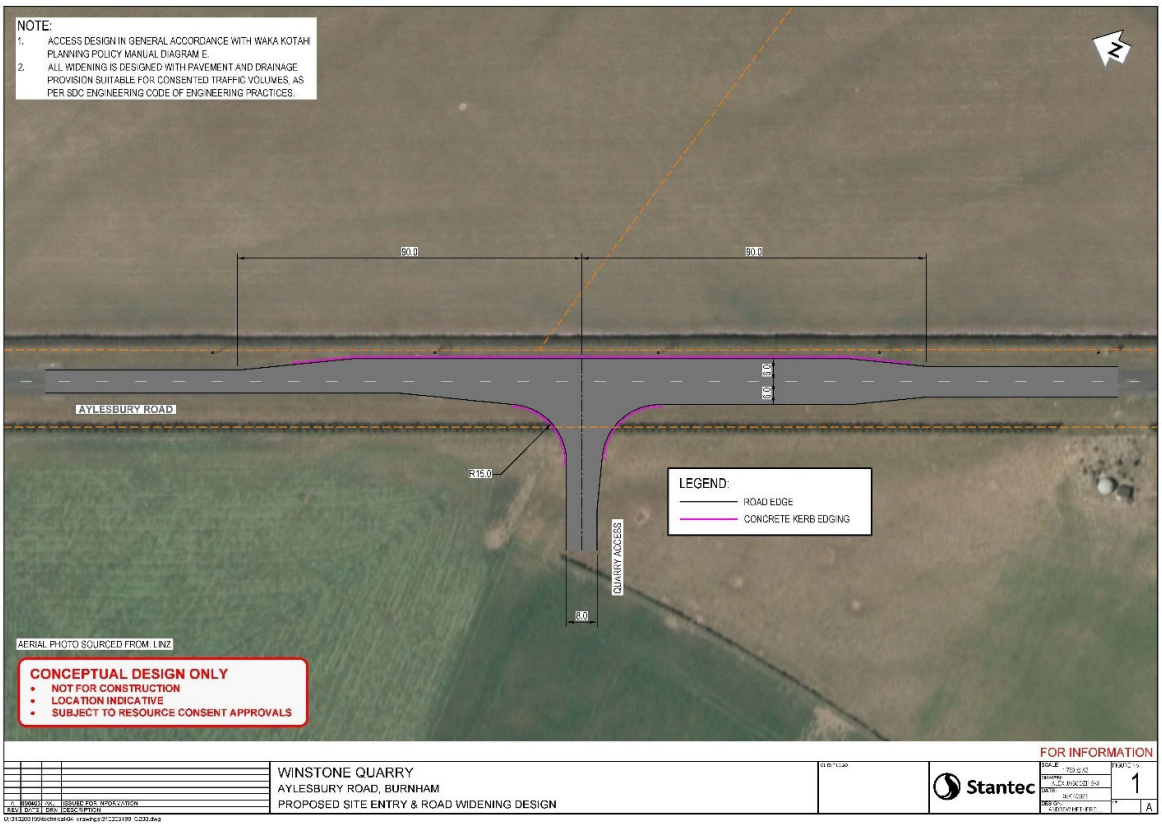


Figure 10-1: Aylesbury Road Site Access Widening

It is recommended that the widening is constructed to a high pavement and drainage standard to ensure that the widened pavement achieves a long service life without cracking or potential water damage. In some cases at other quarries, the road berm near the widening has been damaged by trucks tracking over the berm, and it is understood this particularly occurs if trucks park up on the widening, which could occur while a driver carries out paper work or waits for quarry opening. A concrete edge kerb on the edge of the widened road can significantly improve the durability of the widening, and define the widening location.

The access will be used at times of darkness, particularly in winter, and a “flag light” is recommended to highlight the location and position of access features. Delineation of the access with localised edge road markings would be beneficial, although that would require agreement with Council engineers given there are no edge markings elsewhere on Aylesbury Road.

10.3.2 Access Management

Quarry accesses require avoidance and management measures to minimise the likelihood of aggregate debris being deposited at the access as vehicles turn exiting the Site. The material can lead to a range of issues such as reduced skid resistance and potential for stones to be flicked up at passing vehicles. The primary mitigation measure is sealing the site access well into the Site (e.g. up to the weighbridge) and avoiding any uncontrolled access from unsealed internal access routes to the site access road close to the road boundary. Quarry operational procedures should ideally extend to the site access with regular monitoring of the access for deposited material, road sweeping of the access road, sweeping of the Aylesbury Road widening (under an approved Traffic Management Plan), and/or other on-site measures to minimise the deposit of materials.

10.4 Road Network Efficiency

The changes and total traffic volumes presented in **Table 10-1** as a result of the proposed quarry are at a level that does not alter the function of the various roads on a typical day, or even on a peak day. At the traffic volumes anticipated, movement on the District Road network will remain of a very high level of service.

Only Aylesbury Road north of SH1 carries traffic volumes higher than 3,000 vpd, and as indicated by existing performance the existing levels of traffic do not interfere with efficiency of movement along Aylesbury Road, or accessing Aylesbury Road from side roads. By comparison, it is noted that the parallel route of Walkers Road is forecast to carry approximately 8,000vpd. The key efficiency related location of interest in the network is the intersection with SH1, which already has some capacity constraints at peak times.

Once on the State Highway network, the volumes of Site related traffic form a minimal percentage of overall traffic, such that any effects are negligible.

10.5 Intersection Efficiency

10.5.1 Assessment Year and Growth Assumptions

As discussed earlier, the performance of intersections is the primary efficiency related matter in the transport network, and poor efficiency can also impact safety performance. Intersection performance can be sensitive to changes in traffic volumes associated with both general traffic growth and contributions from large developments. To enable suitable assessment of potential effects, a transport assessment for resource consent typically looks at the current transport network and the reasonably foreseeable future state of the environment. Given the planned changes to the road network, scale of the development and potential that it will take time to reach operating capacity, it is considered appropriate to consider effects in the future that provide for traffic growth and rather than relying on effects assessed against the current transport environment.

Industry guidance such as the NZTA Research Report 442 Integrated Transport Assessment suggests that resource consents should typically consider a future year at least five years from when the activity is proposed, and potentially more where development may occur over a longer timeframe. It also notes where no comprehensive transportation network traffic forecasts are available, then the assessment year should not be more than 10 years ahead given the uncertainty of predicted development. Council and Waka Kotahi transport plans typically set out planned investment for a period of up to 10 years into the future.

On this basis, the assessment has considered assessment years of 2030 and 2035. For year 2030, the assessment has assumed that the quarry may be operating at approximately 45% of its capacity based on indications from Winstone, and for 2035 it is assumed the quarry will be operating at its maximum capacity as sought by this consent application.

Table 10-2: Heavy Vehicle Traffic Generation for Intersection Assessment

Year	Quarry Operation	Daily (vpd)		Peak Hour (vph)	
		Busiest Day	Average	Busiest Hour	Average
Year 2030	45% capacity	338	135	50	14
Year 2035	100% capacity	750	300	112	30

Based on SH1 traffic growth patterns and Long Term Plan population projections for Selwyn District, 2% per annum linear growth has been assessed to establish future “without quarry” traffic volumes across the road network. It is considered these scenarios enable a robust exploration of potential traffic effects and how they may change over time. No adjustment has been made for Friday conditions, as based on experience with other quarry assessment the quarry is not expected to reach peak operating conditions on a Friday

afternoon. It is however noted that the road controlling authorities would need to consider a Friday scenario in determining the suitability of intersection design for accommodating traffic without a quarry consented.

For the analysis, the peak period profile of existing quarries has been considered and the full peak hour traffic generation has been applied to the morning (AM) peak hour, and 50% of the peak hour traffic generation of the Site has been applied for the evening (PM) peak hour. It is noted that for the absolute peak hour of production this is conservative, as in practice it is also not likely to coincide with the morning peak hour.

By way of summary of the analysis that follows:

- The local road network intersections and Site access are forecast to efficiently accommodate the quarry traffic into the future.
- The SH1 / Aylesbury Road intersection is already operating at or close to capacity at certain times of the day, and the analysis confirms that in the 2030 scenario, there would be very poor performance and traffic entering SH1 will need to divert to other intersections or adjust the time of travel. The 2035 scenario has not been modelled with the existing intersection form, as a roundabout has been proposed by Waka Kotahi.
- At 2035 with a roundabout layout, the SH1 / Aylesbury Road intersection is forecast to operate efficiently with the quarry.

The local roads where traffic increases will be experienced are straight and flat with wide grass verges, offering excellent sight distance at the access points such that exiting vehicles can continue to safely choose appropriate gaps in traffic to enter the traffic stream. Existing private property access along the local roads will be similarly unaffected in terms of the ability to access and egress the road network efficiently.

The level of service criteria based on the average delay for vehicles is set out in **Table 10-3** below.

Table 10-3: Level of Service Criteria

LOS Criteria	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F
Description	Minimal Delay		Modest Delays		Congested / Long Delays	
Stop Control Delay (s/veh)	d ≤ 10	10 < d ≤ 15	15< d ≤ 25	25 < d ≤ 35	35 < d ≤ 50	50 < d
Roundabout Delay (s/veh)	d ≤ 10	10 < d ≤ 20	20 < d ≤ 35	35< d ≤ 50	50 < d ≤ 70	70 < d

10.5.2 SH1 / Aylesbury Road / Existing Layout

The intersection model has been calibrated to queues observed in the morning and evening peak periods. To achieve reasonable calibration the intersection is modelled with a single lane approach even though in practice 2-3 vehicles can wait side by side in a left turn lane and a through/right turn lane. When the model is applied with a separate left turn lane, the delays are lower and will be representative of the delay at the stop line but do not represent the effect of the single lane queuing. It is noted that through and right turn movements still have high delays with the two lane queueing model. Whilst a micro-simulation method would enable more realistic queuing (and hence delay calculation) the expected change to a roundabout in the near term means that the more complex modelling method is not justified at this time. Rather, some engineering judgement is applied to the SIDRA Intersection modelling outputs.

The summary of the assessment for the various scenarios is included in Table 10-4 below.

Table 10-4: SH1 / Aylesbury Road (Existing Layout) Level of Service Assessment

Scenario	Performance *delay in s/veh (95%ile queue in veh), and LOS (colour)*			
	Existing	Year 2030 (Quarry at 45% capacity)		
		No Quarry	Average Day Quarry (Christchurch Focus)	Average Day Quarry (Selwyn Focus)
AM PEAK				
Aylesbury Road North Approach	27 (2)	53 (3)	55 (4)	66 (4)
Burnham Road South Approach	53 (4)	>180 (28)	>180 (29)	>180 (>30)
INTER PEAK				
Aylesbury Road North Approach	14 (1)	16 (2)	17 (2)	17 (2)
Burnham Road South Approach	21 (1)	27 (1)	27 (1)	28 (1)
PM PEAK				
Aylesbury Road North Approach	99 (20)	>180 (>30)	>180 (>30)	>180 (>30)
Burnham Road South Approach	38 (2)	83 (3)	89 (3)	94 (4)

The assessment demonstrates that the existing intersection layout already performs poorly in the morning and evening peak periods and the performance will worsen in the future as a result of general growth. The effect of the quarry traffic is generally not significant, although the ability of the intersection to accommodate additional traffic is compromised by its generally poor performance, and higher numbers of heavy vehicles in the long queue would create some additional instability of intersection performance.

If quarry traffic was to use the intersection, then overall volume of movements generated, and timing of movements would need to consider minimising movements on side roads in the peak periods. It is difficult to be prescriptive to a limit when there are times of the day that performance is poor and small changes in traffic volume can have a pronounced impact. However, recognising that the intersection is planned to be upgraded in the next few years, it is considered reasonable to enable the site establishment and initial site production subject to limitations on the overall traffic generated by the Site. Often, a development could be considered to have a small effect at changes in traffic volumes less than 5%, subject to local performance. The existing traffic volume on Aylesbury Road is some 3,700vpd on a weekday, and the following volumes represent percentages of quarry production and percentage of existing traffic volumes.

Table 10-5: Aylesbury Road Approach to SH1 Interim Limits Investigation

Possible Maximum Production Ahead of Intersection Upgrade	Percentage of Proposed Quarry Production Maximum (750vpd)	Equivalent Average Quarry Volume (vpd)	Average Quarry Generation as Percentage of Daily Aylesbury Road Existing Volume	Average PM Peak Additional Quarry Traffic Southbound on Aylesbury (vph)	Average PM Peak Percent Change to Aylesbury Southbound (289vph existing)
100vpd	13%	40vpd	1.1%	1	<1%
150vpd	20%	60vpd	1.6%	2	<1%
200vpd	27%	80vpd	2.2%	2	<1%
250vpd	33%	100vpd	2.7%	3	1%

It can be seen that the potential contribution to the PM peak traffic congestion will be very small if a staged quarry development traffic volume was permitted to proceed with the existing intersection form. The cumulative effect of the quarry on the critical PM peak traffic volume on Aylesbury Road will be indistinguishable from background traffic, with on average one heavy vehicle every 20 minutes using the Aylesbury Road approach to the intersection if 250vpd was adopted as a maximum generation for the quarry. This represents an average 1% change in the critical side road traffic movement in the PM peak

hour when queuing is most pronounced. This is expected to be well within the variation already occurring on a day-to-day basis. As the intersection that is already planned to be upgraded, is remote to the Site and onto a state highway, an interim site traffic generation is considered appropriate. This represents one third of the full capacity of the quarry.

An alternative consideration would be only permitting left turns from side roads at the intersection at peak times by utilising a variable sign (such as used on the Larsens Road approach to SH75 in Christchurch). This would enable the intersection to operate effectively at peak times, although it involves large detours for traffic potentially creating u-turn issues elsewhere, and is inconsistent with the arterial road classifications of both Burnham Road and Aylesbury Road. Based on the discussions with Waka Kotahi, it is understood that alternative lower capital cost treatments such as this are not being considered.

10.5.3 SH1 / Aylesbury Road / Roundabout Layout

Waka Kotahi is planning a single lane roundabout for SH1 / Aylesbury Road / Burnham Road, expected to be constructed within the next few years, with the project already having funding and that is expected to be extended into the NLTP 2024-2027. The roundabout is primarily a safety treatment that will address the existing delay issues, as well as supporting the Road to Zero corridor treatment that includes proposed central medians on SH1, which will require u-turns to be accommodated at the intersection for those accessing SH1 via left turn only at accesses and minor intersections.

A SIDRA model has been developed for a single lane roundabout, and tests have been carried out with the second scenario of the quarry at full operating capacity in 2035. The assessment with a single lane roundabout is included in Table 10-6.

Table 10-6: 2035 SH1 / Aylesbury Road (Roundabout) Level of Service Assessment

Scenario	Performance *delay in s/veh (95%ile queue in veh), and LOS (colour)*				
	Year 2035 (Quarry at 100% capacity)				
	No Quarry	Average Day Quarry (Christchurch Focus)	Average Day Quarry (Selwyn Focus)	Busiest Day Quarry (Christchurch Focus)	Busiest Day Quarry (Selwyn Focus)
AM PEAK					
Aylesbury Road North Approach	9 (1)	9 (1)	9 (1)	10 (2)	10 (2)
SH1 East Approach	9 (11)	9 (12)	9 (12)	9 (15)	9 (14)
Burnham Road South Approach	18 (3)	20 (3)	20 (4)	28 (5)	27 (5)
SH1 West Approach	12 (8)	13 (8)	13 (8)	16 (10)	15 (10)
INTER PEAK					
Aylesbury Road North Approach	8 (1)	9 (1)	9 (1)	9 (2)	9 (1)
SH1 East Approach	7 (3)	7 (3)	7 (3)	8 (3)	8 (3)
Burnham Road South Approach	10 (1)	10 (1)	10 (1)	11 (1)	11 (1)
SH1 West Approach	7 (3)	7 (3)	7 (3)	7 (3)	7 (3)
PM PEAK					
Aylesbury Road North Approach	17 (6)	18 (7)	18 (6)	22 (8)	21 (8)
SH1 East Approach	8 (5)	8 (5)	8 (5)	8 (6)	8 (5)
Burnham Road South Approach	10 (1)	10 (1)	10 (1)	10 (1)	10 (1)
SH1 West Approach	8 (6)	8 (7)	8 (7)	8 (8)	8 (7)

The assessment shows that the quarry has minimal effect on the operational performance of the intersection under typical average day operating conditions. When the busiest day traffic generation is assessed, a slight change in performance occurs on the side road approaches although that does not impact the overall efficiency of the roundabout, with SH1 still operating with very good LOS A. It is emphasised that the busiest day traffic volumes assessed represent a worst case scenario for assessment purposes noting the expected infrequent occasion of quarry generated traffic volumes at or near the peak hour volume assessed.

The detailed analysis outputs indicate that in the morning peak period the capacity of the single lane roundabout is close to being reached on both state highway approaches. At the traffic volumes assessed there is still sufficient capacity such that changes in traffic volume have small changes in performance, although it is likely that the roundabout would start to experience some additional queuing and delays beyond the 10-year assessment period. As noted earlier, this is beyond the foreseeable future transport environment for transport assessment and will be a matter for road controlling authorities to consider. It is noted that the single lane intersection form proposed by Waka Kotahi is intended to maximise safety, and as such there is intended to be some compromise on its ability to accommodate peak traffic volumes efficiently. This reflects the road safety strategy that has a focus on minimising adverse road safety outcomes, which is typically considered to be better achieved with a single lane roundabout compared to a multi-lane roundabout (as is currently implemented elsewhere on SH1).

10.5.4 Site Access

The proposed site access has been analysed in SIDRA under a future 2035 assessment year with the possible busiest operating day at the quarry. As the critical movement will be the right turn from the site the "Christchurch focus" scenario has been analysed. The summary outputs shown in Table 10-7 confirm that the access will operate efficiently at the busiest times of the day, with no vehicle queuing and very good levels of service. The proposed widening at the access allows other vehicles travelling through to do so with negligible effect from quarry related turning traffic.

Table 10-7: Aylesbury Road / Site Access Level of Service Assessment

Scenario		**Performance** ***delay in s/veh (95%ile queue in veh), and LOS (colour)***
		Year 2035 (Quarry at 100% capacity)
	Turn	Busiest Day Quarry (Christchurch Focus)
AM PEAK		
Aylesbury Road North Approach	Right	11 (0)
Site Access	Left	5 (0)
	Right	6 (0)
Aylesbury Road South Approach	Left	10 (0)
PM PEAK		
Aylesbury Road North Approach	Right	11 (0)
Site Access	Left	5 (0)
	Right	6 (0)
Aylesbury Road South Approach	Left	10 (0)

10.5.5 Aylesbury Road / Burdons Road

The Aylesbury Road / Burdons Road intersection has been analysed in SIDRA Intersection for a future year 2035, in the busiest morning and evening peak periods. The quarry does not add to turning volumes at the intersection, and therefore any change in performance would be a consequence of additional through traffic. The summary of the analysis as included in Table 10-8 shows the change in performance will be negligible, and Level of Service A will be retained on all movements in the future even on the busiest day for the quarry. A comparable result would be expected at each of the other side roads and accesses on Aylesbury Road north of SH1.

Table 10-8: Aylesbury Road / Burdons Road Level of Service Assessment

Scenario		Performance *delay in s/veh (95%ile queue in veh), and LOS (colour)*			
		Year 2045 (Quarry at 100% capacity)			
	Turn	2022	2035 without quarry	2035 Average Day Quarry (Christchurch Focus)	2035 Busiest Day Quarry (Christchurch Focus)
AM PEAK					
Aylesbury Road North Approach	Right	6 (0)	6 (0)	6 (0)	6 (0)
Burdons Road	Left	6 (0)	6 (0)	6 (0)	6 (0)
	Right	6 (0)	6 (0)	8 (0)	8 (0)
Aylesbury Road South Approach	Left	6 (0)	6 (0)	6 (0)	6 (0)
PM PEAK					
Aylesbury Road North Approach	Right	6 (0)	6 (0)	6 (0)	6 (0)
Burdons Road	Left	6 (0)	6 (1)	6 (1)	6 (1)
	Right	7 (0)	7 (1)	7 (1)	8 (1)
Aylesbury Road South Approach	Left	6 (0)	6 (0)	6 (0)	6 (0)

10.5.6 Aylesbury Road / Two Chain Road

The Aylesbury Road / Two Chain Road intersection has been analysed in SIDRA Intersection for both the existing scenario and a future year 2035, without and with the quarry, in the busiest morning and evening peak periods. The quarry does not add to turning volumes at the intersection, and therefore any change in performance would be a consequence of additional through traffic. The summary of the analysis as included in Table 10-9 shows the change in performance will be negligible, and Level of Service A will be retained for all movements in the future even on the busiest day for the quarry.

Table 10-9: Aylesbury Road / Two Chain Road Level of Service Assessment

Scenario	**Performance** *delay in s/veh (95%ile queue in veh), and LOS (colour)*		
	2022	2035 No Quarry	2035 Busiest Day Quarry at 100% (Christchurch Focus)
AM PEAK			
Two Chain Road Approach	7 (0)	8 (0)	8 (0)
Grange Road Approach	7 (0)	7 (0)	9 (0)
PM PEAK			
Two Chain Road Approach	7 (0)	7 (0)	8 (0)
Grange Road Approach	7 (0)	8 (0)	8 (0)

10.6 Intersection Safety Review

10.6.1 Aylesbury Rd / Grange Rd / Two Chain Rd / Sandy Knolls Rd

The existing safety record for the intersection indicated no existing road safety issues. The intersection carries traffic volumes that are easily accommodated with good levels of performance. Although Sandy Knolls Road is located close to Two Chain Road at the intersection, traffic movements are low and the proximity and slow-moving speed required to turn minimises crash risk.

The quarry is expected to add to through traffic volumes on Aylesbury Road, which would not require changes to the intersection layout. There is a possibility that a small proportion of the quarry generated traffic could use Two Chain Road east of Aylesbury Road for access between the quarry and the Rolleston Industrial areas north of SH1. If large heavy vehicles turn at the intersection to use the local road network to connect to Rolleston industrial area, the left turn kerb from Aylesbury Road into Two Chain Road would desirably be adjusted to enable the truck and trailer to turn left without crossing the centreline on either Two Chain Road or Aylesbury Road. This is indicated in **Figure 10-2**.

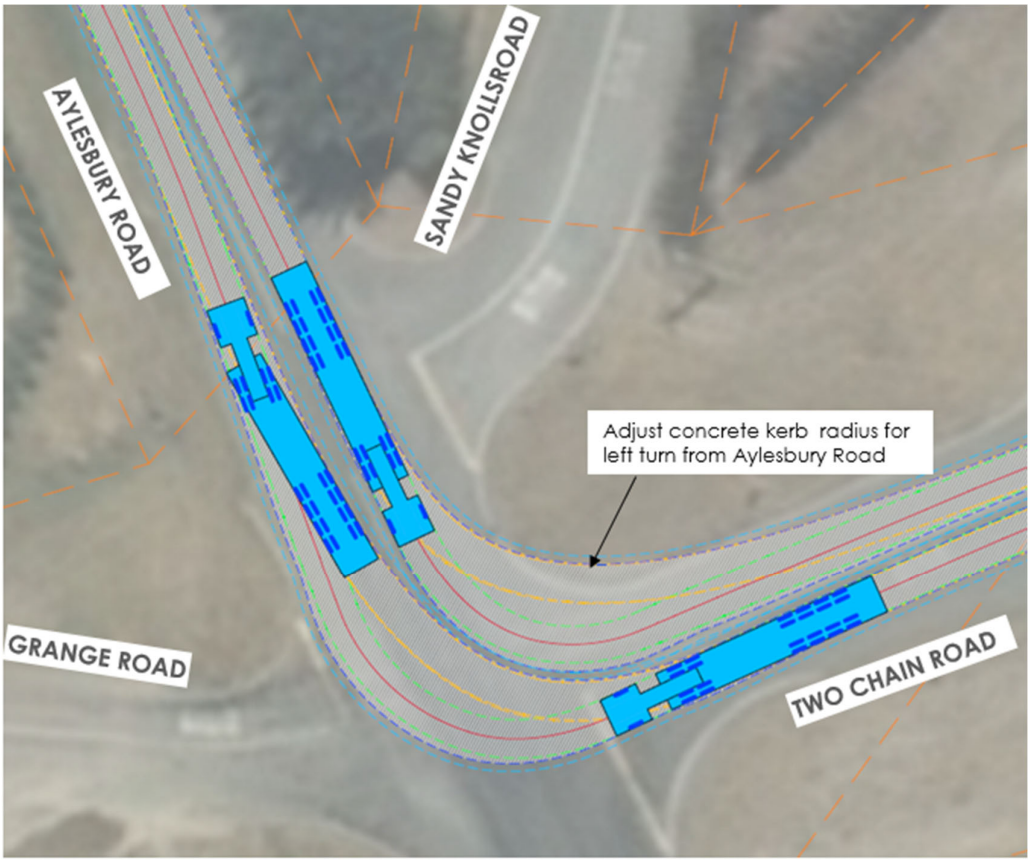


Figure 10-2: Adjustment to Aylesbury Road – Two Chain Road northeast corner kerb

The traffic volumes indicate that trucks already regularly make this movement, and the quarry could under the Selwyn Focus scenario add a similar volume again. To ensure that the intersection is capable of accommodating left turning trucks, it is considered the kerb adjustment should be provided as part of the quarry development if it is intended that trucks will use Two Chain Road.

10.6.2 Aylesbury Road / Wards Road Intersection

The Aylesbury Road / Wards Road intersection alignment has a poor alignment from a safety perspective, with a high potential for those travelling along Wards Road to miss the Stop sign control. There has been one minor injury and one non-injury crash at the intersection. There are no current plans for the intersection in the Selwyn District Infrastructure Plan. Seal widening improvements on both Aylesbury Road and Wards Road are currently planned for a period more than 20 years in the future which could be expected to also address intersection safety if required.

The quarry will, depending on the distribution of traffic that results, lead to some change in traffic movements through the intersection. With a Christchurch focused (Scenario 1) traffic distribution, less than 1% of the site traffic generation will use the intersection. This will result in between approximately 0 and 8 vehicle movements per day. The intersection currently provides for more than 2,000 vehicle movements per day, such that the change in use of the intersection will be negligible.

If the quarry generates a Selwyn focus (Scenario 2) traffic distribution, there is the potential for approximately 18% of the traffic generation to use the intersection. When the quarry is fully operational, that could result in approximately 54 vehicle movements per day on an average day, and approximately 135 vehicle movements per day on the busiest day. Of the quarry traffic using the intersection, the estimates for turning movements are set out in Table 10-10:

Table 10-10: Aylesbury Road / Wards Road Traffic Movements (Selwyn District Focus)

Movement	% of Site Generation (two-way)	From site		To Site	
		Average Day	Busiest Day	Average Day	Busiest Day
Aylesbury Road – Wards Rd east	6%	9	23	9	23
Aylesbury Road – Wards Road west	1%	1	4	1	4

The functional ability of the intersection to accommodate traffic under this Selwyn focus scenario has been investigated by considering articulated truck vehicle tracking (also representative of truck and trailer). **Figure 10-3** shows the movements from the Site turning onto Wards Road, and **Figure 10-4** shows the movements to the Site turning from Wards Road onto Aylesbury Road.

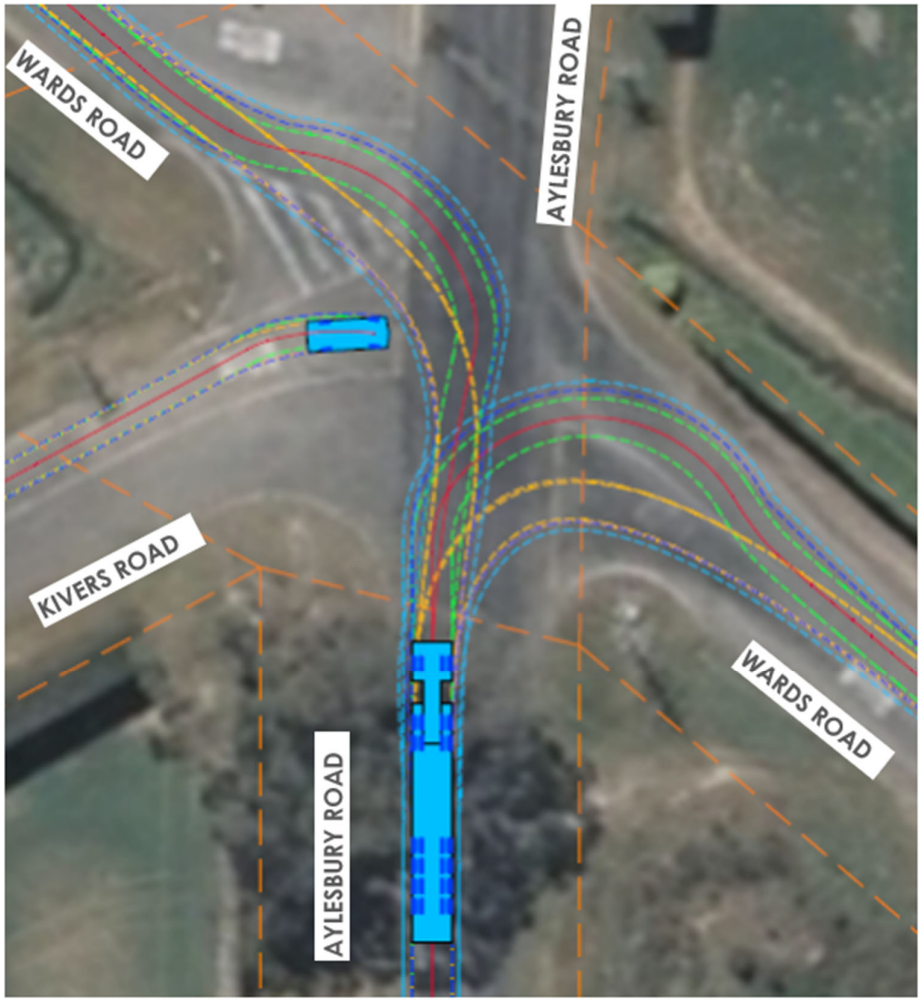


Figure 10-3: Aylesbury Road / Wards Road: Northbound Semi-Trailer Vehicle Tracking

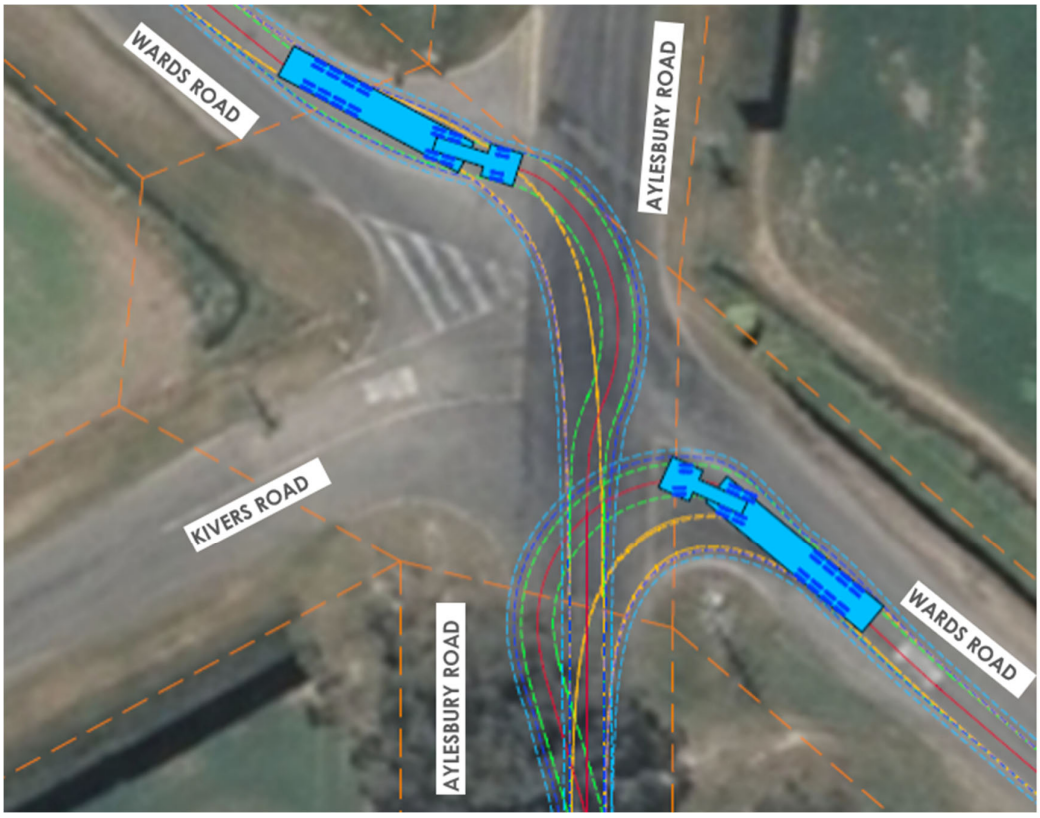


Figure 10-4: Aylesbury Road / Wards Road: Southbound Semi-Trailer Vehicle Tracking

The vehicle tracking demonstrates that the acute angle between Wards Road east and Aylesbury Road south creates some difficulty for the truck and trailer to make the manoeuvre within the marked lanes.

The left turn from Wards Road east is not critical as a truck driver can wait for a suitable gap on Aylesbury Road before making the turn. Given the low volume of traffic through the intersection, it is considered the truck crossing the centreline on Aylesbury Road would not affect its safe and efficient operation.

The right turn movement from Aylesbury Road south onto Wards Road east is more challenging in that the movement conflicts with the opposing direction where vehicles may either be at or approaching the stop line. If the movement is very occasional, such as with the Christchurch focus or even on an average day with the Selwyn focus (less than 1 movement per hour) it is unlikely to create significant concerns. However, as the regularity of the movement increases there is a greater risk of drivers being required to enable reverse priority to avoid the physical conflict.

As no improvements have been planned by Council, some mitigation or management is considered necessary for this movement, particularly if quarry traffic volumes making the movements exceed approximately 10 vehicles per day, with feasible options including:

- Widening Wards Road east approach (north and possibly south side) and/or Aylesbury Road (west approach) at the intersection sufficiently to enable the right turn from Aylesbury Road into Wards Road east to be made without impacting the westbound Wards Road traffic lane;
- In the absence of physical mitigation, managing volume of traffic movements generated by the quarry that could use Wards Road to/from the east so that it does not exceed approximately one movement per hour, recognising the intersection is between an arterial road and collector road (Partially Operative District Plan classifications) so some use should be enabled ‘as of right’. This would need to be addressed in a traffic management plan and include suitable monitoring to determine actual effects.

10.7 Effect on Other Road Users

10.7.1 Cyclists

The SDC is proposing to construct an off road cycleway north of the railway on Runners Road between Burnham and the Rolleston Industrial area. Aylesbury Road already has an off-road shared path connection past Burnham, on the eastern side of the road south of Burdons Road to Runners Road. The proposed expansion of the network with connection to Rolleston will enable Burnham residents to access Rolleston separated from the main road network. The change in traffic past Burnham will have a negligible effect on the cycle network.

Aylesbury Road past the Site is a defined rural arterial road and does not form part of the cycle network that has been planned by the Council. Currently there are very low cyclist volumes as indicated by the traffic surveys. In that regard, use of the road by heavy vehicles is considered suitable. Where cyclists do choose to use the road, they will need to share the lane with other vehicles, which is common across the District. The primary route used by quarry traffic is straight with excellent forward visibility so that drivers will be able to make a suitable judgement on whether it is safe to pass.

The additional heavy traffic on other nearby District Council rural roads will be low, at levels consistent with existing use, and the roads do not form part of the proposed Council cycling network.

10.7.2 Pedestrians

The quarry will predominantly generate increased traffic volumes on the section of Aylesbury Road between the site access and SH1.

Occasional pedestrian use of Aylesbury Road north of Burdons Road will primarily be associated with recreational walking, with a small number of dog walking movements observed in the traffic counts. Pedestrians will already either use the wide berm, or are able to use the berm as vehicles pass. As a rural arterial road, formal provision of pedestrian infrastructure is not expected and the change in traffic patterns will not result in pedestrian usage of the road being markedly different from existing. In that regard, it is considered unlikely that the quarry will have any influence on the need for infrastructure to service that part of the road network.

Through traffic volumes on the surrounding roads will remain at a sufficiently low level that pedestrians can easily choose gaps in traffic to safely cross the road, with good visibility to approaching vehicles.

There are some locations of possible focused pedestrian crossing demand on the section of Aylesbury Road past Burnham as summarised on **Figure 10-5**. Based on the existing traffic surveys and observations, the pedestrian movements are infrequent. Currently the only location with a crossing point is location 3, where the path simply joins the road shoulder on both sides of the road.

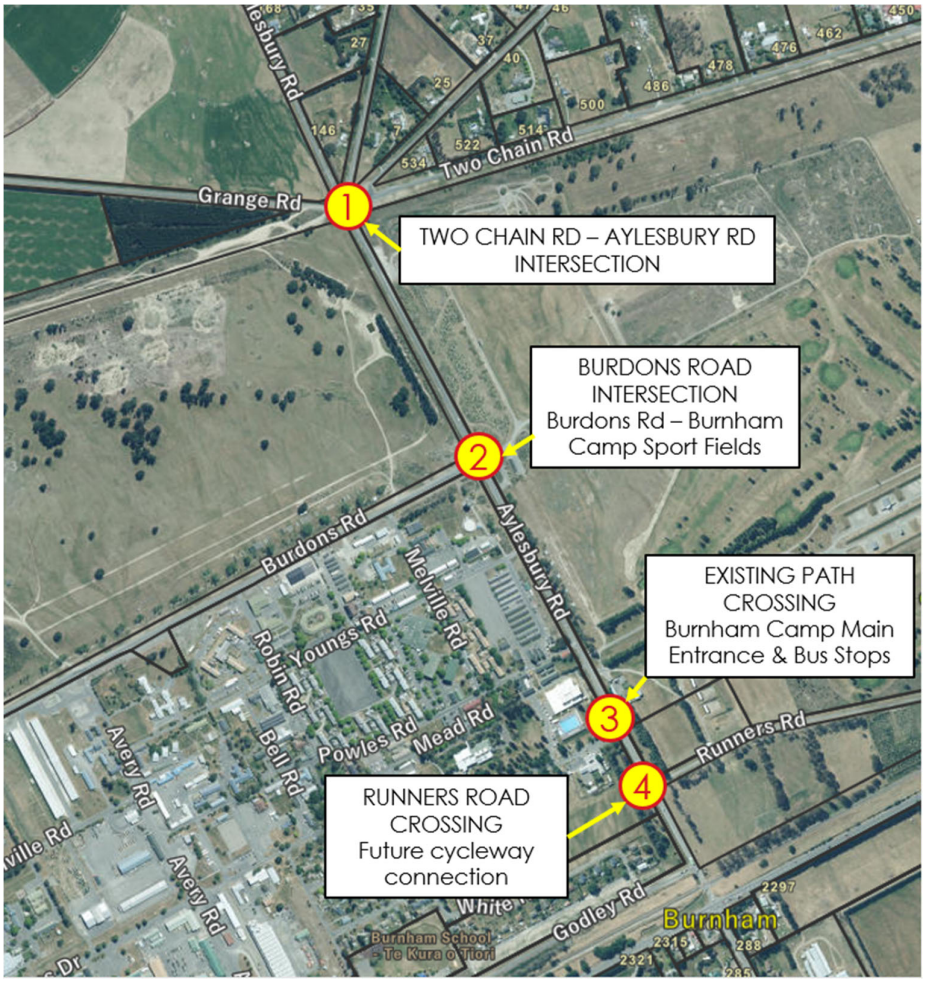


Figure 10-5: Burnham Pedestrian Crossing Demand Locations

Reference has been made to the Waka Kotahi Pedestrian Network Guidance. In terms of crossing delay, it notes that even without any physical aid pedestrian crossing delay would be "very good" at traffic volumes up to approximately 400vph which is the existing traffic volume north of SH1. Kerb extensions would enable "very good" crossing performance to still be achieved at traffic volumes of approximately 600vph. This indicates there is not an immediate need to provide a facility from a pedestrian delay perspective.

The guidance notes that vehicle operating speeds over 30km/h increase the severity of injury or likelihood of death in crashes involving pedestrians. Higher speeds make it more difficult for pedestrians to judge safe gaps and require longer sight distances. The current speed limit of 70km/h therefore does not support safe pedestrian crossing movement and consideration of reduced speed limit along this section of road would be a first step to reducing risk.

The guidance recommends that where a speed limit is 60km/h or less, crossing treatment options include raised signalised crossings, signalised crossings, or pedestrian/median refuges. Given the very low crossing demand, it is considered unlikely that signalised crossings would be contemplated. Rather, a standard treatment would likely involve a pedestrian/median refuge which would involve some localised widening of the road. As the road is an arterial road, and crossing demand is generated by non-quarry activities, and the change in peak hour volumes resulting from the quarry is small, it is considered such a facility would not be the responsibility of the proposed quarry operator as part of traffic effects mitigation.

On the wider road network, most travel will be on the state highway and arterial road network. On those roads pedestrian facilities are either provided in urban areas, or on rural roads infrastructure for pedestrians and horse traffic is not provided and those routes are not important pedestrian connections due to the existing levels of traffic.

10.8 Amenity Effects

The transport related amenity effect of the proposed quarry has been addressed to a large extent through positioning of the vehicle access away from dwellings, and access being provided direct to an arterial road which is a road type expected to accommodate through traffic including heavy vehicle movements. The arterial road network then connects to the state highway network and will accommodate most heavy vehicle movement from the quarry. Future traffic volumes will remain at a level where vehicles can access the road network from private property efficiently and safely.

There is a high level of rural residential activity alongside Two Chain Road, and the road carries a local road classification between Two Chain Road and Aylesbury Road. The proposed changes to Rolleston access and Plan Change 80 industrial development further east could result in changes to Two Chain Road, and ultimately a change in road classification. At this stage, however, it is understood no change is proposed.

Based on the convenience of movement and comparative standard of the direct route to SH1 via Aylesbury Road, the proposed quarry is expected to only utilise Two Chain Road as an option for local movements to the Rolleston Industrial area, potentially in combination with Wards Road and Kerrs Road to access the northern part of the area. The changes in traffic volumes are modest, likely representing less than 1% of generated traffic with the “Christchurch focus” distribution scenario, and approximately 6% of generated traffic spread across the available Two Chain Road and Wards Road routes with the “Selwyn focus” distribution. This level of change will not alter the function or resident use of these roads compared with existing.

It is however recommended that the unsealed local road routes of Kerrs Road and Sandy Knolls Road between Two Chain Road and Wards Road are not used due to their unsealed surfacing type. The roads in their current formation do not support regular use by heavy vehicles.

10.9 Road Asset Improvements

Aylesbury Road between the site access and Two Chain Road is currently a narrow road (currently 5.8m wide sealed width) for accommodating two way heavy vehicle movement into the future. The primary concern with an increase in heavy vehicles is that there will be increasing edge break. Large sections of edge break can contribute to an increased rate of pavement deterioration. From a road safety perspective, the road width itself does not significantly contribute to changes in road safety as drivers have good visibility of oncoming vehicles.

Assessment of the sealed road carriageway width desirable for the narrow section of Aylesbury Road between Two Chain Road and Aylesbury Road has been made with consideration to relevant guidance including:

- SDC Operative District Plan ‘Rule E10 Transport’, Table E10.5 (for new rural roads)
- Partially Operative District Plan ‘TRAN – Schedule 3 (for new roads in the GRUZ)
- Austroads ‘Guide to Road Design: Part 3 – Geometric Design’ Table 4.5
- NZS4404:2010 Land Development and Subdivision Infrastructure Table 3.2

For a road with AADT of 500-1000 vehicles per day, the following road cross-section guidance is available as indicated in **Table 10-11**.

Table 10-11: Road Cross-section Guidance

Activity	Traffic Lanes	Sealed Shoulders	Total Sealed Carriageway	Additional Unsealed Shoulder
SDC Operative District Plan – Rule E10 Transport', Table E10.5 Rural Arterial	-	-	**7.5m**	-
SDC Partially Operative District Plan - Rural Arterial	-	-	**8.5m-9.0m**	-
Austroads Full standard (500-1,000vpd AADT)	6.2m - 7.0m	0.5m each side	**7.2m- 8.0m**	1.0m each side
NZS4404:2010 Rural Make and Move (E6) (Volume ~ 1,000vpd)	5.5m – 5.7m	0.5m each side	**6.5m – 6.7m**	0.5m each side

Wider roads cost more to construct and maintain, so a width needs to be suitably justified based on the traffic conditions expected. Although an arterial road classification exists, the road is likely to maintain a low traffic function for through traffic in the future.

It is considered a conservative cross section should be considered over the section subject to the largest change in traffic volume of Aylesbury Road from the site access to Two Chain Road to ensure a long life outcome is achievable following any widening. In this case, it is considered the 8m wide road width required by Austroads (the standard applied for highways) would be necessary to accommodate the safe movement of trucks two-way, and address any potential long term pavement degradation and edge break risk from the narrow section of this road.

Other sections of the road are either already sufficiently wide to accommodate two-way traffic or will retain very low traffic volumes such that the quarry development would not generate effects that warrant widening. Two Chain Road east of Aylesbury Road is currently at a lower width standard and it is considered the assessed level of traffic (up to 45 heavy vehicle movements per day) can be managed through a Transportation Route Management Plan as described later.

Noting that the road is classified as an arterial road, and it is Council responsibility to ensure arterial roads are of suitable standard for the function, it is considered the Applicant should enter a Private Developer Agreement (PDA) with Council in respect of the contribution it makes to bringing forward a road upgrade that is warranted over this section of road regardless of the proposed quarry.

10.10 Railway Level Crossing

Aylesbury Road is an arterial road, and the change in traffic volumes resulting from the quarry is not significant when considered against that road function. It is expected that at the time of the design and implementation of the Waka Kotahi roundabout at SH1 / Aylesbury Road, Waka Kotahi or Council will be required to update the KiwiRail level crossings safety assessment (LCSIA) including taking account of the potential traffic volume changes. A range of design measures would be available to consider how to manage the queues generated by either SH1 (which already exist and will continue to occur in the long term regardless of the quarry), and any queue back from the railway line.

11 Effects Summary

The Site is well located on an arterial road that provides connections to SH1 Main South Road and SH73 West Coast Road. This enables most of the travel to and from the quarry to occur on the state highway and arterial road network.

Most traffic is expected to have a desired route along Aylesbury Road between the Site and SH1, and for that reason this is the area most sensitive to potential effects of changes in traffic volumes.

The existing form of intersection at SH1 / Aylesbury Road / Burnham Road is at capacity at peak times and some substantial queuing can occur. The additional of the quarry traffic is likely to exacerbate that queuing if quarry traffic coincides with the morning and evening peak period of traffic entering and exiting the Burnham Military Camp. Waka Kotahi has indicated it will be upgrading the intersection to a single lane roundabout as part of their transport network safety improvements. The intersection improvement is likely to occur in the 2024-2027 NLTP period. It is recommended that the 750vpd proposed heavy vehicle movement limit for the Site be reduced to 250 heavy vehicle movements per day until the intersection has been upgraded.

Assessment of future traffic conditions shows that the roundabout will perform well in the foreseeable future with moderate delays possible on side road approaches during peak periods in the 2035 scenario. Typical and peak quarry traffic generation will have a minor effect on performance. The level of delay is unlikely to generate safety issues. It was identified that the roundabout will be nearing its traffic carrying capacity at volumes slightly higher than those assessed, such that there is a risk that a single lane roundabout may generate some longer queuing in the long term (beyond that modelled as the foreseeable future). Any adjustments to design will be a matter for road controlling authorities to consider in future proofing design of intersection upgrades regardless of the quarry application.

The performance of the local road intersections, including those servicing Burnham Military Camp, and accesses on Aylesbury Road will continue to be at a very good level of service even on the busiest operational days at the quarry in the longer term. No changes are proposed to those intersections as a result of quarry development. Similarly, no changes are proposed for pedestrian or cycle infrastructure, as the most sensitive location past Burnham Camp already has shared paths and they will connect to a future path linking to Rolleston.

The width of Aylesbury Road south of Two Chain Road is adequate to accommodate quarry related traffic. The road is straight and there is excellent forward visibility. It is considered necessary for the section between Two Chain Road and the Site access to be widened to enable safe two-way heavy vehicle movement that minimises effects on the road pavement performance. A width of 8m is recommended based on industry standards, which essentially requires approximately 1m of widening on each side of the road over a length of approximately 1.5km. As the road is an arterial road, it is recommended that Winstone discuss the potential for inclusion of the widening in the Long Term Plan, or consider a private development agreement with Council as widening would normally be a Council role and responsibility, and essentially the quarry brings forward in time that need.

The proposed Site access will be formed to a standard that is consistent with an access standard typical of a commercial vehicle access on a state highway. That minimises the potential for pavement degradation at the access and offers a long term solution for the access. Additional provision of concrete kerbing, drainage design, and flag lighting is recommended.

Some additional road delineation could be considered for Aylesbury Road to support the increase in traffic in accordance with standards that would be expected through Waka Kotahi provisions. This would include either localised or full route edge line markings on the widened section of road, and markings to highlight the Site access.

Although the Site is surrounded by District Council roads, there is expected to be very low use of roads to the north of the Site, or of Two Chain Road. Even under the (unlikely) scenario with the quarry only servicing Selwyn District, traffic volumes will not be inconsistent with the function of the roads, with access to Arterial and Collector Roads achievable. It is however recommended that the unsealed local road routes of Kerrs Road and Sandy Knolls Road between Two Chain Road and Wards Road are not used due to their unsealed surfacing type. The use of Two Chain Road can also be managed to the levels assessed through implementation of a Transportation Route Management Plan.

Due to the constrained nature of the intersection at Aylesbury Road / Wards Road, quarry related heavy vehicle turning movements are recommended to be limited to one additional heavy vehicle movement per hour ahead of kerb adjustments at intersections. Similarly, the same provision should be made at the kerbing between Aylesbury Road (north) and Two Chain Road (east).

It is considered that with the local modifications proposed at the access and to the route connecting the site to SH1, and the planned modifications to SH1 / Aylesbury Road, the additional quarry traffic can be safely and efficiently accommodated within the transport network.

12 Transportation Route Management Plan

A transportation route management plan is sometimes adopted where a road is determined as unsuitable for heavy vehicle traffic, or where certain routes have been identified as most suitable and are to be encouraged to minimise or avoid effects on other parts of the road network.

It is important to note that the assessment has not identified any significant adverse traffic effects if some traffic utilises local routes as that level of use is predicted to only relate to small proportions of heavy vehicles, which are typical and expected to be provided for on rural roads.

In the local area, it is considered that a transportation route management plan could further support the movement of trucks by preferred routes, and particularly the route to and from SH1 via Aylesbury Road for most origin and destination points. By conveying preferred route information to those using the quarry, the assessed level of effects are more likely to be reduced (or at most realised). In this case, that would include the following provisions:

- No use of unsealed sections of Kerrs Road or Sandy Knolls Road between Aylesbury Road/Two Chain Road and Wards Road (as per proposed condition of consent)
- Use of Aylesbury Road as preferred route to connect to/from SH1.
- Minimise use of Two Chain Road unless upgraded to a standard expected to accommodate heavy vehicles. Before upgrades, Two Chain Road would only be used as an option for local movements to the Rolleston Industrial area expected to be approximately 45 heavy vehicle movements per day. A further limitation of 10 heavy vehicles per day is recommended to apply until minor kerb adjustments are made at the Aylesbury Road / Two Chain Road intersection.
- Limit use of Wards Road east of Aylesbury Road to 10 heavy vehicle movements per day until the recommended minor kerb adjustments are made at the Aylesbury Road / Wards Road intersection.

Monitoring of the management plan effectiveness can be achieved through occasional traffic surveys matching heavy vehicles entering / exiting the quarry with the movement made at the Aylesbury Road / Two Chain Road / Sandy Knolls Road / Kerrs Road intersection.

13 Operative Selwyn District Plan

The quarry site is located within the Rural Outer Plains zone of the Operative Selwyn District Plan, and is subject to rules relating to traffic generation, parking and vehicle access contained within the Rural volume of the District Plan. An assessment of the proposed development against the relevant transport rules is presented in Appendix A.

Whilst details of some site elements such as parking will be confirmed through detailed design, there is sufficient space on site to meet District Plan rules on parking layout and manoeuvring.

From a transport perspective, the proposal triggers discretionary activity status with respect to:

- Rule 4.5.1.8 - the level of traffic generation from the site, and
- Rule 9.13.1.2(a) - the proposed use of Aylesbury Road (arterial) instead of Grange Road (local) for access

It also triggers restricted discretionary activity status under Rule 4.5.1.6 with respect to the proposed layout of the access which exceeds the requirement for a heavy vehicle access on an arterial road, as well as the proposed use of Aylesbury Road (arterial) instead of Grange Road (local) for access. The matters of restricted discretion for Council to consider are set out below:

> *4.5.3.1 Whether the crossing is sufficiently removed from an intersection having regard to traffic volumes on the roads, and any other factors that will prevent conflict and confusion between vehicles turning at the crossing or at the intersection;*
>
> *4.5.3.2 The adequacy of available sight distances having regard to the 85th percentile operating speed of vehicles on the road;*
>
> *4.5.3.3 Whether there is a need to separate entry and exit in order to reduce potential traffic confusion and conflict;*
>
> *4.5.3.4 Whether the physical form of the road will minimise the adverse effects of access (e.g. whether the road offers good visibility; whether a solid median barrier will stop unsafe right turns or a flush median will assist right hand turns etc);*
>
> *4.5.3.5 Whether particular mitigation measures such as a deceleration or turning lane are required due to speed or volume of vehicles on the road;*
>
> *4.5.3.6 The design of the crossing to enable traffic exiting the site to safely enter the traffic stream;*
>
> *4.5.3.7 The location and design of the crossing in relation to pedestrian and cycle safety;*
>
> *4.5.3.8 Whether there is adequate queuing and parking space on site so that vehicles do not queue over vehicle crossings or on the State Highway or Arterial Road;*
>
> *4.5.3.9 Any potential cumulative effects of extra access points on the function of the State Highway or Arterial Road;*
>
> *4.5.3.10 Any relevant accident history of the State Highway in the vicinity of the site; and*
>
> *4.5.3.11 The particular traffic characteristics of an existing or proposed activity, including expected traffic generation, types of vehicles etc*

This report has addressed these matters relating to access location, access design, traffic effects of access, and the type and extent of traffic generation that has influenced the access design location and formation proposals. Council will be able to consider these matters of restricted discretion.

Permitted activities accessing a formed and sealed Arterial Road may generate up to 30 equivalent car movements per day (ecm/d). The Site will generate traffic well above this level. The Council discretion includes but is not limited to the following assessment matters in the District Plan associated with non-compliance with Rule 9.13.1:

> *9.13.2.1 Any works required to the road to upgrade it to the standards set out in the Council's Engineering Code of Practice;*
>
> *9.13.2.2 Any potential adverse effects of traffic on the amenity values of surrounding residents and on other uses of the road, including (but not limited to) stock droving;*

9.13.2.3 In respect to the integration of land use and transport, the appropriateness of the location within the existing and planned road network;

9.13.2.4 The position and design of any vehicle crossing or vehicle access and egress;

9.13.2.5 Any positive effects which may offset any adverse effects;

9.13.2.6 Any other relevant matters including relevant objective and policies; and

9.13.2.7 Any monitoring or review conditions.

This report has addressed matters relating to traffic generation and access formation, allowing Council to consider these matters of assessment.

14 Partially Operative District Plan

The Partially Operative District Plan (Decisions Version) is still subject to an appeal period.

A detailed review of the transport rules (TRAN) as included in the current ePlan (23 August 2023 revision) is included in Appendix B.

The transport rule assessment identified areas of non compliance with permitted activity standards that require assessment against Restricted Discretionary Activity status matters. It is considered these matters have been addressed through this Integrated Transport Assessment, and further assessment within this section has not been carried out to minimise repetition. The matters of assessment are reproduced below.

TRAN R4 (Vehicle crossings): sets the trip generation of the site permitted for an activity in the rural zone, which will be exceeded.

TRAN MAT2

1. Any effects on the ease and safety of vehicle manoeuvring.
2. Whether the boundaries of a site support the formation of the vehicle crossing or accessway.
3. Whether the site can gain access from another road that is not a State Highway or Arterial Road listed in APP2 – State Highway, Arterial and Collector Road Classifications List.
4. The design and location of the vehicle crossing or accessway.
5. The anticipated number and type of vehicles, cycles, pedestrians or stock movements.
6. Any visual effects on road design and amenity values from not forming the vehicle crossing or accessway to the specified standards

The vehicle crossing design and location has been assessed as suitable for accommodating the high level of traffic to be generated by the proposed quarry development.

TRAN REQ2 Access to Aylesbury Road rather than Grange Road triggers discretion as follows:

a. Whether there is a need to separate entry and exit points to reduce potential traffic confusion and conflict
b. TRAN-MAT1 Effects on the wider network
1. Any effects on the visibility and safety of pedestrians, cyclists or motorists.
2. Any effects, including cumulative effects, on traffic safety or the efficiency of land transport infrastructure.
3. The outcome of any consultation with the NZTA where the activity or works directly affect a State Highway.
4. The outcome of any consultation with KiwiRail where the activity or works directly affect the rail network.
5. Whether the physical form of the road will minimise any effect on access.
6. Any relevant crash history of the road in the vicinity of the site.
7. Any characteristics of a proposed activity or site that make compliance unnecessary, including expected traffic generation volumes and the types of vehicles.
c. TRAN-MAT2.4 The design and location of the vehicle crossing or accessway

The access to Aylesbury Road is preferred for a heavy vehicle generating activity of this scale, as the road function better aligns with movement of heavy vehicles. Traffic volumes on Aylesbury Road are low such that the safety and efficiency of the arterial road function will not be compromised.

TRAN-REQ5 vehicle crossing design with additional widening triggers discretion as follows:

TRAN-MAT1.7. Any characteristics of a proposed activity or site that make compliance unnecessary, including expected traffic generation volumes and the types of vehicles.

TRAN MAT2

1. Any effects on the ease and safety of vehicle manoeuvring.
2. Whether the boundaries of a site support the formation of the vehicle crossing or accessway.

3. Whether the site can gain access from another road that is not a State Highway or Arterial Road listed in APP2 – State Highway, Arterial and Collector Road Classifications List.
4. The design and location of the vehicle crossing or accessway.
5. The anticipated number and type of vehicles, cycles, pedestrians or stock movements.
6. Any visual effects on road design and amenity values from not forming the vehicle crossing or accessway to the specified standards

The access design and location have been chosen to minimise effects on the road network, the location is remote from other accesses, and the higher standard of design supports higher volumes of heavy vehicle movements. It is comparable to other high heavy vehicle generating accesses on the Selwyn rural road network.

Under TRAN-R8 the level of trip generation will trigger the Basic ITA requirement, with TRAN-MAT8 (Basic) matters of discretion as follows:

1. Whether the provision of access and on-site manoeuvring areas associated with the activity, including vehicle loading and servicing deliveries. affects the safety, efficiency, accessibility (including for people whose mobility is restricted) of the site, and the land transport network (including considering the network classification of the frontage road)

2. Whether the design and layout of the proposed activity promotes opportunities for travel other than private cars, including by providing safe and convenient access for travel using more active modes.

3. Whether the ITA has been prepared by a suitably qualified and experienced transport specialist.

4. Need for an ITA - Any characteristics of a proposed activity or site that are out of scope of an existing ITA but where expected traffic generation and access to existing multi modal connections mean requiring an ITA, in a manner set out in this rule, is unnecessary.

The Basic ITA matters have a focus on access to the site and the site itself, whereas due to the overall activity status of the consent application, a wider consideration of the transport network and influences on other modes of travel has been made, more akin to a full ITA. As the type of activity will predominantly generate heavy vehicle movements in a rural area, the focus of access design and internal site design has been on safely accommodating the vehicular traffic that will be generated. Access to multimodal connections is limited for the site itself, and the focus is on assessment of effects for other multimodal users.

15 Conclusion

The proposed Burnham quarry will generate a large volume of heavy traffic, albeit not inconsistent with other major quarries in the region. The heavy traffic volume will be capped at 750 vehicle movements per day. Based on the Winstone Aggregates prior operation of the Yaldhurst Road quarry patterns, that is expected to result in a median operational day traffic volume of approximately 300 heavy vehicles per day. This is assessed as a demand requirement that may be reached in approximately 10 years, with lower levels of traffic generation expected over the first 10 years of establishment.

The Site is well located with respect to the strategic road network. There is direct access to the arterial Aylesbury Road, which connects to SH1 at its southern end and SH73 at its northern end. Approximately 95% of the generated heavy traffic is forecast to travel directly between the site and SH1 before travelling on SH1 toward Christchurch. An alternative scenario has also been developed which has a Selwyn District focus and that also indicates over 80% of all movements are likely to be to the SH1 / Aylesbury Road intersection before utilising other parts of the strategic transport network.

Access to SH1 will be constrained in the immediate short term as the existing stop sign controlled intersection with Aylesbury Road is already operating with congestion for short periods in the morning and evening peaks. The intersection also has safety concerns which a high volume of heavy vehicles could exacerbate. If the roundabout proposed by Waka Kotahi is constructed, the intersection performance will improve, and the effect of the additional heavy vehicle traffic on performance will be negligible in the short term, and potentially minor in the future.

All of the local road intersections in the area operate with very good levels of efficiency, and that is forecast to continue in the long term with the quarry. No significant changes to intersection control or intersection formation are proposed as a result of the quarry proposal. A kerb adjustment on the northeast corner of the Aylesbury Road / Two Chain Road intersection would assist with ensuring left turns from Aylesbury Road north can be completed without crossing the centreline of either road.

The addition of quarry traffic on Aylesbury Road past Burnham Military Camp will not in itself generate the need for additional infrastructure for pedestrians, although it is noted that the posted road speed limit does not support safe pedestrian crossing movement and desirably a lower speed limit would be contemplated so that infrastructure to assist crossing can be installed. That would be a matter for consideration by the Selwyn District Council separate to this consent.

Access to the quarry Site is to be located on a lower volume section of the arterial Aylesbury Road. A high standard of vehicle crossing intersection is proposed to ensure heavy vehicles are able to manoeuvre safely and mitigate any potential issue on the road pavement. No efficiency issues are expected.

The section of Aylesbury Road between Two Chain Road and the site access is currently of a narrow width for the volume of traffic proposed to be added by the quarry. It is considered necessary for the road to be upgraded over that length to ensure a durable and safe use of the road. Recognising Council has plans for the road to be upgraded in the long term, and has a role to ensure its arterial network is adequately formed, it is recommended that the Applicant enter a private developer agreement with Council to facilitate this upgrade to the road network which is currently not included in the Long Term Plan.

The internal site layout will be optimised to ensure material is not deposited on the road, and if on occasion that does occur such as due to a poorly secured load, it is recommended site management processes include the ability to sweep the road under an approved temporary traffic management plan.

The remaining generated traffic will spread across various Council roads such that the additional volume on any one road will remain low. Having considered the road classifications, and existing and future traffic volumes, it is considered that the effects of the quarry are insufficient to generate the need for the Applicant to undertake additional road improvements.

It is considered the traffic related effects of the proposed quarry will be no more than minor if the following provisions and recommendations are implemented:

- The quarry is not to generate more than 250 heavy vehicle movements per day (on any one day) prior to the SH1 / Aylesbury Road intersection being upgraded to a roundabout, and a comprehensive vehicle routing management plan is required to assess the timing of movement and minimise effects on congestion at the intersection.
- Implementation of a Transportation Route Management Plan that achieves as far as practicable:
  - Minimisation of additional congestion at the Aylesbury Road and Stage Highway intersection.
  - No use of unsealed sections of Kerrs Road or Sandy Knolls Road between Aylesbury Road/Two Chain Road and Wards Road (as per proposed condition of consent)
  - Use of Aylesbury Road as preferred route to connect to/from SH1.
  - Minimise use of Two Chain Road to no more than 45vpd unless upgraded to a standard expected to accommodate heavy vehicles. A further limitation of no more than 10 heavy vehicle movements per day turning between Aylesbury Road (north) and Two Chain Road (east) until kerb adjustments are made to support the left turn from Aylesbury Road (north).
  - Minimise use of Wards Road / Aylesbury Road intersection to no more than 10 truck and trailer movements per day unless upgraded to support the right turn from Aylesbury Road south into Wards Road east.
- After the SH1 / Aylesbury Road intersection has been upgraded, limit the daily heavy traffic volume to a maximum of 750 heavy vehicle movements per day, on any one day;
- Access is to be to Aylesbury Road, and located approximately 1.7km north of Two Chain Road
- The Site access road is to be formed with a traffic lane in each direction at least 3.5m wide, and a sealed shoulder 1.0m wide, over at least the first 100m of the road. That is to minimise the likelihood of transfer of debris onto Aylesbury Road;
- Provide truck waiting areas on entry and exit within the Site, to avoid the need for trucks to wait on Aylesbury Road to enter the Site, or to park on the road while exiting (e.g. for paperwork);
- The access to Aylesbury Road is to be formed to a Waka Kotahi commercial vehicle access standard, including widening on the eastern side of the road, and entry side of the access;
- Aylesbury Road is to be widened between the Site access intersection and Two Chain Road to an 8.0m sealed carriageway width;
- The Aylesbury Road / Two Chain Road intersection is to be upgraded to support the left turn from Aylesbury Road (north) into Two Chain Road (east) not requiring truck and trailer vehicles crossing the centreline. Where this is not provided for, limit vehicles making the movement to no more than 10 truck and trailer movements per day and monitor movements and effects.
- The Wards Road / Aylesbury Road intersection is to be upgraded to support the right turn from Aylesbury Road south into Wards Road east being made without conflicting with westbound traffic on the Wards Road approach. Where this is not provided for, limit vehicle movements making the movement to no more than 10 truck and trailer movements per day and monitor movements and effects.

With those provisions, the establishment of the quarry in this location will not prevent the roading network operating safely and functioning as intended, and the quarry proposal can be supported from a transportation engineering perspective.

Appendices

Appendix A Operative District Plan Assessment

Rule	Requirement	Provided	Compliance
Rule 4 - Roading			
4.4.1	**Road and Engineering Standards** The forming, installation, upgrading, maintenance or replacement of any road shall be a permitted activity if the following standards are met: 4.4.1.1 Any part of any road does not have a gradient greater than: (a) 1:6 vertical; or (b) 1:20 horizontal. 4.4.1.2 Any road is formed to the relevant standards set out in Appendix E10.3, except that E10.3.1 shall not apply to works to existing roads undertaken by Council pursuant to the Local Government Act.	Road improvements will be carried out to satisfy the 7.5-9m wide required by Table E10.5.	Yes
4.5.1.1	**Access Gradient** Any part of any vehicular accessway does not have a gradient greater than: (a) 1:6 vertical; or (b) 1:20 horizontal.	Topography is flat	Yes
4.5.1.2	**Access Design Standard** Any vehicular accessway is formed to the relevant design and formation standards set out in Appendix 10.	See Appendix 10 standards below	Yes
4.5.1.3	**Access Separation and Sight Distance** Any vehicular accessway complies with the relevant separation and sight distance standards set out in Appendix 10.	See Appendix 10 standards below	Yes
4.5.1.4	**Gate Position** Any vehicle crossing which has a gate positioned across the vehicle crossing, has the gate either opening inwards towards the property and away from the road; or setback a minimum distance of 10 metres from the road boundary.	The gate position will be set well back from the road	Yes
4.5.1.5	**Vehicle Crossing** Vehicle crossings providing vehicle access to a sealed road is sealed: (a) For the full length of the vehicle crossing; and (b) From the edge of the carriageway to the property entrance or for the first 10 metres.	Fully sealed access road beyond property boundary	Yes
4.5.1.6	Any access to a State Highway or Arterial Road complies with the following: (a) No legal access is available from another lower classification road;	**(a) Access to Aylesbury Road, an arterial road, rather than the local Grange Road.**	**Restricted Discretionary Activity (Refer Section 13**

Rule	Requirement	Provided	Compliance
	(c) The vehicle accessway or vehicle crossing complies with the performance criteria given in Appendix E10.2.2, 10.2.3 and E10.2.4; (d) Provision is made for manoeuvring on site, so that reverse manoeuvring onto the State Highway or Arterial Road is not required.	**(c) Proposed standard includes more widening than requirement (consistent with E10.C1 for a state highway access)** (d)Manoeuvring can be provided on-site.	**of this report for discussion of the restricted discretion matters at 4.5.3)**
4.5.1.8	**Site Access Preferences** Any site with more than one road frontage to a road that is formed and maintained by Council, shall have access to the formed and maintained (and legal) road with the lowest classification.	**Access to Aylesbury Road, an arterial road, rather than the local Grange Road**	**Discretionary Activity**
4.6.1.3	**Parking** Any other activity [other than residential] is a permitted activity if, all car parking required by the Plan and loading spaces is located on-site or on land adjoining the site and not on the road reserve.	All loading spaces and parking spaces provided on-site	Yes
4.6.1.4	**Car Parking Dimensions** All car parking and loading spaces shall be formed to the relevant standard set out in Appendix 10.	See Appendix 10 standards below	Yes
4.6.2.1	**Vehicle Manoeuvring** Any other activity [other than residential] is a permitted activity if, all vehicle manoeuvring area is of sufficient size to enable any vehicle to turn on the site and not have to reverse onto the road.	On-site manoeuvring provided	Yes
4.6.3	**Disabled Car Parking** Any activity which involves the provision of goods or services to the general public shall be a permitted activity if the following conditions are met: 4.6.3.1 One disabled carpark is provided with the first 10 carparking spaces; and one additional disabled carpark space for every additional 50 carparking spaces provided. 4.6.3.2 The disabled carparks are: (a) Located as close to the entrance to the building or the site of the activity as practical; (b) Sited on a level surface; and (c) Clearly marked as being for mobility-impaired persons.	Can be provided	Yes
Rule 9 – Activities			
9.13.1.2 (a)	The maximum no. of vehicle movements for a permitted activity is 30ecm/d when accessed from a formed and sealed Arterial Road (averaged over any one-week period).	Greater than 30ecm/d	**Discretionary Activity** **Refer Section 13 of this report for discussion of the discretion matters at 9.13.2)**

Rule	Requirement	Provided	Compliance
Rule 10 – Transport			
E10.1.1	Minimum car park dimensions: Long term: 2.4m by 5.4m, aisle of 6.2m Medium term: 2.5m by 5.4m, aisle of 5.8m Disabled Parking: 3.2m by 5.4m, aisle of 6.2m (long term) or 5.8m (medium term).	Can be provided in compliance	Yes
E10.1.2.1	Any area for on-site parking or loading shall be available at all times for staff and visitors during the hours of operation and shall not be diminished by any subsequent erection of any structure, storage of goods, or any other use.	Can be provided in compliance	Yes
E10.1.4.1	The gradient of any on-site parking or loading area for any non-residential activity, shall be no more than: (a) At 90^0 to the angle of parking - 1:16; or (b) Parallel to the angle of parking - 1:20	Can be provided in compliance	Yes
E10.1.5.1	The manoeuvring area to and from any parking space shall accommodate at least the design motor car.	Can be provided in compliance	Yes
E10.1.5.2	The manoeuvring area to and from any loading space shall accommodate at least the design motor car.	Accommodating truck and trailers	Yes
E10.1.5.3	No loading space shall obstruct any on-site car parking space or any vehicle or pedestrian access.	Can be provided in compliance	Yes
E10.1.5.4	No vehicle shall be required to reverse out of any site onto a road.	Can be provided in compliance	Yes
E10.2.2.1	The required minimum distance from the site access on Aylesbury Road to the nearest intersection is 100m (Sandy Knolls Road).	Provided in compliance	Yes
E10.2.2.2	No part of any vehicle crossing shall be located closer than 30m to the intersection of any railway line.	Provided in compliance	Yes
E10.2.2.4	Any activity which generates more than 40 vehicle movements in any one day, no part of any vehicle crossing onto any arterial road shall be located closer than 60m to the departure side of any intersection; and/or 30m to the approach side of any intersection.	Provided in compliance	Yes
E10.2.3.1	Vehicle crossings onto classified roads must provide the required minimum sight distance of 282m in 100km/h speed limit area.	Provided in compliance	Yes

Rule	Requirement	Provided	Compliance
E10.2.4.4.1	Vehicle access to any site from any road or service lane shall be by way of a vehicle crossing constructed at the owner's or the developer's expense	Will be constructed at Applicant's expense	Yes
E10.2.4.4.5	Vehicle crossings to any site shall be constructed in accordance with Diagram E10.D if the crossing is to provide access to a commercial activity or is a heavy vehicle access.	Proposed standard more than requirement (consistent with E10.C1 for a state highway access)	**Restricted Discretionary Activity (See 4.5.1.6)**

Appendix B Partially Operative District Plan (Decisions Version) Assessment

Rule	Requirement	Provided	Compliance
TRAN Chapter Rules			
TRAN-R4 GRUZ	**Vehicle Crossings** a)The vehicle crossing is located no closer to an intersection with a State Highway or arterial road than; i. 60m to the departure side of any intersection; and ii. 30m to the approach side of any intersection; and b)The vehicle crossing does not service any: i. Service station; ii. Truck stop; or iii. Activity that generates more than 40vm/d. And this activity complies with the following rule requirements: TRAN-REQ2 Access restrictions TRAN-REQ3 Number of vehicle crossings TRAN-REQ4 Siting of vehicle crossings TRAN-REQ5 Vehicle crossing design and construction TRAN-REQ6 Vehicle crossing surface	Access separation from intersections is satisfied. Access will accommodate more than 40vm/d Refer to assessment of TRAN-REQ2 to REQ6	Restricted Discretion (TRAN-MAT2)
TRAN-REQ2	**Vehicle Crossing Access Restrictions** 10. Where a vehicle crossing is formed within an arterial road it shall comply with the following: No alternative legal access is available from a collector road or local road; and b. Sufficient on-site manoeuvring is available so reversing onto the arterial road shall not occur.	Access to arterial road rather than local road (Grange Road) On-site manoeuvring provided.	Restricted Discretion (TRAN-REQ2.11) with Matters for Discretion in TRAN-REQ2.13.

Rule	Requirement	Provided	Compliance
TRAN-REQ3	**Number of vehicle crossings** There is no more than two vehicle crossings per road frontage per site.	Single access for quarry activity proposed	Yes
TRAN-REQ4	**Siting of vehicle crossings** 1. Vehicle crossing(s) shall: a. comply with TRAN-TABLE4 Intersection Separation as illustrated in TRAN-DIAG1 Intersection Separation; and b. be located a minimum distance of 10m from the end of any splitter or approach island to a roundabout; and c. comply with TRAN-TABLE5 Sight Distances as illustrated in TRAN-DIAG2 Sight Distances. ; and d) not be formed within a State Highway.	Requirements satisfied	Yes
	5. Vehicle crossing(s) shall be no closer than 30m to the intersection of any railway line when measured from the nearest edge of the vehicle crossing to the limit line at the level rail crossing.	Requirements satisfied	Yes
	7. Where a vehicle crossing(s) is to be formed it shall comply with the minimum access separation distances listed in TRAN-TABLE6A - Accessway separation from other accessways (200m required)	Separation from other accesses well in excess of 200m	Yes
TRAN-REQ5	Vehicle Crossing Design and Construction 5. Vehicle crossing(s) (excluding those on a State Highway) shall comply with the following standards: b. TRAN-DIAGRAM6 - Vehicle crossing design standards - Arterial and Collector roads where	A higher standard vehicle crossing is proposed with widening both sides of the road and widening on the approach from the south.	Restricted Discretion (TRAN-REQ5.6) with Matters of Discretion in TRAN-REQ5.7 (TRAN-MAT1.7 and MAT2)

Rule	Requirement	Provided	Compliance
	the vehicle crossing provides access to either: i. a residential unit not on a local road; or ii. any other activity on a local road, arterial road, or collector road.		
TRAN-REQ6	**Vehicle Crossing Surface** 1. Vehicle crossings where they adjoin a sealed carriageway shall be sealed for the full width and length of the vehicle crossing between the carriageway and the site boundary.	Access will be sealed	Yes
TRAN-R6	**Parking, manoeuvring and loading areas** 3. Any parking, manoeuvring and loading areas associated with any activity that is not a residential activity. Where the activity complies with the following rule requirements (for GRUZ): TRAN-REQ8 Location of parking spaces TRAN-REQ9 On-site parking TRAN-REQ10 Mobility parks TRAN-REQ11 Cycle parks and facilities TRAN-REQ12 Vehicle loading areas TRAN-REQ13 Parking and loading gradients TRAN-REQ14 Access gradients TRAN-REQ15 Queuing spaces TRAN-REQ16 Vehicle manoeuvring TRAN-REQ17 Surface of parking and loading areas TRAN-REQ28 Landscape Strip for Parking Areas	Matters can be complied with through site design , as follows: REQ8: Parking will be on-site REQ9: N/A REQ10:Will be able to comply REQ11: N/A REQ12: N/A REQ13 and 14: Flat site in entrance area can comply REQ15: N/A REQ16: No reverse manoeuvring to road, parking spaces can meet requirements. REQ17: Any area accessed by the public for sale of aggregate will be metalled or sealed REQ28: N/A	Yes
TRAN-R7	**Rural vehicle movements and associated parking** Permitted vehicle movements accessing Aylesbury Road (formed, sealed, maintained by	N/A	N/A

Rule	Requirement	Provided	Compliance
	SDC, **arterial** road) are not defined		
TRAN-R8	High trip generating activities Basic ITA threshold: 50 vehicles per peak hour Full ITA threshold: 120 vehicles per peak hour	Peak movements on busiest day expected to be 112vph, average approximately 30vph in a peak hour (refer Table 9-1 or ITA)	Restricted Discretion (TRANR8.2) TRANR8.2.3.a Basic ITA threshold Required per TRAN-MAT8

DESIGN WITH COMMUNITY IN MIND

Communities are fundamental. Whether around the corner or across the globe, they provide a foundation, a sense of place and of belonging. That's why at Stantec, we always design with community in mind.

We care about the communities we serve—because they're our communities too. This allows us to assess what's needed and connect our expertise, to appreciate nuances and envision what's never been considered, to bring together diverse perspectives so we can collaborate toward a shared success.

We're designers, engineers, scientists, and project managers, innovating together at the intersection of community, creativity, and client relationships. Balancing these priorities results in projects that advance the quality of life in communities across the globe.

Stantec trades on the TSX and the NYSE under the symbol STN.
Visit us at stantec.com or find us on social media.

Level 2, 2 Hazeldean Road, Addington, Christchurch, 8024
PO Box 13052 Armagh Christchurch 8141
Tel 03 366 7449 | www.stantec.com

Preliminary Site Investigation – 139 Grange Road, Burnham

Prepared and updated for

Burnham 2020 Ltd

July 2023

PATTLE DELAMORE PARTNERS LTD
Level 2, 134 Oxford Terrace
Christchurch Central, Christchurch 8011
PO Box 389, Christchurch 8140, New Zealand

Tel +64 3 **345 7100**
Website **http://www.pdp.co.nz**
Auckland Tauranga Wellington **Christchurch**

solutions for your environment

Quality Control Sheet

TITLE	Preliminary Site Investigation – 139 Grange Road, Burnham
CLIENT	Burnham 2020 Ltd
VERSION	Final
ISSUE DATE	24 July 2023
JOB REFERENCE	C04096700
SOURCE FILE(S)	C04096700R002.docx

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE 

Holly Eeg

Reviewed and Approved by

SIGNATURE 

Scott Wilson

Limitations:

See Section 9.0 for Report Limitations.

Executive Summary

Pattle Delamore Partners Limited (PDP) has been asked by the current landowner Burnham 2020 Ltd to review and update information within a preliminary site investigation (PSI) report[1] prepared by PDP in 2020 for the property located at 139 Grange Road, Burnham. The original report was prepared for a due diligence process for the purchase of the site. The site has since been purchased and it is understood Burnham 2020 Ltd intend to continue with the farming operations whilst also progressively quarry the property to provide aggregate for construction projects. This PSI has been prepared to support the consenting process for the quarrying activity.

No additional site visit has been undertaken to assess current conditions since 2020, as it has been reported that there has been no change in land use activities onsite (i.e. the site is continuing to operate as a farm). Data sources used within the original PSI have been reviewed and updated, as required. This included reviewing the Environment Canterbury Listed Land Use Register (LLUR), current active wells / boreholes and current active consents.

The site history review shows the site was used as a forestry plantation from at least the 1940's until circa 2005. In 2005 the farm was converted to an irrigated cropping/cattle fattening farm and since 2010, the property has operated as an irrigated heifer grazing farm. Key land use activities that may have resulted in contaminating soils/groundwater (based on site walkover observations) include:

- An above ground diesel tank in the yard of the former forestry block (anecdotal information);
- Two above ground fuel storage tanks for refuelling farm vehicles;
- Storage of bulk fertilisers and other materials such as fence posts and used tyres which are used in the general operational aspects of the farm; and
- Waste pits/infill pits relating to past land use (anecdotal information) and current farming practices.

Based on the above, the following HAIL[2] activities have been identified for the site:

- '*Landfill sites*' (HAIL Reference G3)
- '*Waste disposal to land*' (HAIL Category G5)
- 'Bulk storage of fertilizer' (HAIL Category A6)
- '*Storage tanks or drums for fuel*' (HAIL Category A17)

No sampling of soils around the current operational yard area or known pit locations was considered necessary at this stage as these areas will continue to be used for the ongoing operation of the farm. However, broad-acre sampling of surface soils outside of identified the HAIL areas were undertaken to provide an initial indication to the presence of contaminants (if any) in the near surface soils. The sampling results showed the likely key indicator contaminants (i.e. heavy metals and organochlorine pesticides (OCPs)) at background levels for the area. The site history review and sample results suggest that although a number of potentially contaminating activities have been identified at the site, they are in discrete areas only and should not be interpreted across the wider site. These contamination sources were considered to be typical for a large forestry/farming operation.

As the site is currently being used as 'production land', the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soils to Protect Human Health) Regulations 2011* (referred to as the NESCS) is not applicable for the current soil disturbance activities and general operation for the current use of the site. However, the proposed change in land use as a quarry is not defined as 'production land' and therefore the NESCS regulations (soil disturbance and change in land use) will need to be taken into consideration for the proposed quarry development. Given these HAIL areas will continue to be used for the short to medium term, a detailed site investigation (DSI) has not been undertaken so the consent application will need to proceed down the **discretionary activity** process.

The recommended approach to managing the identified contamination source areas during the proposed future quarrying operations is through the development and implementation of a Site Management Plan (SMP). This would include the requirement to further investigate the HAIL areas identified in this PSI prior to any quarrying activities taking place in the sections of the quarry identified. It is recommended that this is included as a condition of the land use consent issued for the operation of the quarrying activities.

Table of Contents

SECTION		PAGE
Executive Summary		ii
1.0	Introduction	1
2.0	Site Details	2
2.1	Site Identification	2
2.2	Site Description	3
2.3	Environmental Setting	3
3.0	Desktop Review of Site History	4
3.1	Historical Aerial Photographs	4
3.2	Environment Canterbury Information	5
3.3	Selwyn District Council Information	6
3.4	Anecdotal Information	6
3.5	Site Inspection	7
4.0	Summary of Site History and Potential Sources of Contamination	8
5.0	Preliminary Soil Sampling Exercise	9
5.1	Soil Sampling Strategy and Analysis	9
5.2	Selected Guideline Criteria	10
5.3	Soil Sampling Results and Comparison to Guideline Criteria	10
6.0	Consideration of the NESCS	11
6.1	Provisions of the NESCS	11
7.0	Summary and Conclusions	12
8.0	References	14
9.0	Report Limitations	15

Table of Tables

Table 1: Site Details	2
Table 2: Historical Aerial Photographs	4

Appendices

Appendix A: Figures

Appendix B: Site Photographs

Appendix C: Environment Canterbury Bore Information

Appendix D: Historical Aerial Photographs

Appendix E: Environment Canterbury Listed Land Use Register

Appendix F: Environment Canterbury Resource Consent Information

Appendix G: Anecdotal Information

Appendix H: Results Tables

Appendix I: Laboratory Reports and Chain of Custody Information

1.0 Introduction

Pattle Delamore Partners Limited (PDP) has been engaged to undertake a review and updating of a preliminary site investigation (PSI; site history review) completed in February 2020 for the property located at 139 Grange Road, Burnham. It is understood the new landowner Burnham 2020 Ltd intends to continue with the farming operations whilst also progressively quarry the property to provide aggregate for construction projects in the region. This PSI has been prepared to support the consenting process for the quarrying activity.

The desktop assessment has been conducted through the inspection of relevant historical records including historical aerial photographs, council documentation as well as undergoing a site inspection in 2020. In addition, a limited soil sampling exercise was completed as part of the original assessment to provide contamination status (if any) of the near surface soils across the wider site.

The objectives of this PSI are to:

- Review the available information to determine the history of the site and whether any activities on the HAIL[1] have been undertaken at the site from past or present land use practises;
- Determine the key contaminants of concern associated with any identified potential sources of contamination and HAIL activities;
- Determine an indication of the contamination status of the near surface soils through a limited soil sampling investigation (broad-acre sampling only);
- Assess the applicability of the NESCS for the soil disturbance activities associated with the proposed quarry; and
- Assess if any new potentially contaminating activities have been undertaken at the site since February 2020.

This assessment has been carried out in general accordance with *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand* (MfE, 2011) and *Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils (Revised 2011).* This PSI has been certified by suitably qualified and experienced practitioner as required by the *Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soils to Protect Human Health) Regulations 2011* (referred to as the NESCS).

[1] *Hazardous Activities and Industries List* (Ministry for the Environment; MfE, 2011).

2.0 Site Details

The site proposed to be progressively quarried is the triangle shaped area of land bound by Grange Road to the south, Aylesbury Road to the east and Kivers Road to the west (here in referred to as 'the site'). The wider property forming the farm also includes two blocks of land on the southern side of Grange Road. These are referred to as the 'South Blocks' and are shown on Figure 1. The South Block areas are outside of the scope of this PSI as they are not intended to be quarried in the future. However, in some instances the data sources reviewed have included these blocks as they fall under the wider property.

A site location map and existing site layout is presented as Figure 1 in Appendix A.

2.1 Site Identification

The details of the site are provided in Table 1 below.

Table 1: Site Details	
Address	139 Grange Road, Burnham
Legal Description	CB82/294, CB137/244, CB31/285
Site Owner	Burnham Farm Limited
Grid Reference	NZTM BX23: 4262 7278
Area	Approximately 380 hectares
Zoning	Rural Zone – Outer Plains
Current Land Use	Operational Irrigated Heifer Grazing Farm
Surrounding Land Use	North: Open paddocks South: Grange Road followed by open paddocks, lifestyle block homes and Burnham Military Camp East: Aylesbury Road followed by open paddocks West: Open paddocks

2.2 Site Description

At the time of the PDP site inspection on 30 January 2020, the site consisted of an operational irrigated heifer grazing farm. The South Blocks were not included as part of this site inspection.

The majority of the site comprised of grassed paddocks, with the site divided into three main sections of north, south-west and south-east, based on three circular irrigation pivot systems. The sections of the site not included in the three main pivot irrigation systems have smaller separate irrigation systems. A yard area is located in the centre of the site comprising of a barn, mechanical workshop, refuelling tanks, portacabin, several silos, a stock yard and a waste pit. Other farming materials such as fence posts, a covered silage stockpile, rows of bailage and fertiliser are also stored in this area.

Photographs of the site are presented in Appendix B.

2.3 Environmental Setting

The geological map for the area (Forsyth et al., 2008 1:250,000) reports that the surrounding area is underlain by 'grey river alluvium beneath plains or low-level terraces (Q1a)".

The nearest surface water to the site consists of multiple field drains located in the paddocks surrounding the site. The Selwyn River is located 5.5km to the south of the site.

The Environment Canterbury (ECan) Land and Water Regional Plan (LWRP) shows that the site is located outside of the Christchurch Groundwater Protection Zone.

The ECan online GIS database was searched for groundwater bores / wells located within a 2 km radius of the site boundary. There are eleven groundwater bores recorded within the site's boundaries, all of which are used for irrigation or stock water supply. One-hundred and forty-three groundwater bores were recorded within a 2 km radius of the site, all of which are recorded as being 'active (exist, present)', including nineteen for water level observation, thirty-six for irrigation, fifty-eight for domestic supply and / or stockwater supply, three for commercial/industrial and two for geotechnical investigations.

Groundwater bores in the area indicate that groundwater would be expected to be encountered at a depth of approximately 10–20 m below ground level (bgl). Groundwater is expected to flow in a predominately south-easterly direction beneath the site.

A plot and table summarising the active bores within a 200 m radius of the site are presented in Appendix C.

3.0 Desktop Review of Site History

A desktop assessment was undertaken to provide an overview of any potential contaminants of concern that may be present at the site as a result of any documented past and present activities. The following information was sourced in order to establish the history of the site:

- Historical aerial photographs;
- Environment Canterbury (ECan) and Selwyn District Council (SDC) information; and
- Site inspection.

3.1 Historical Aerial Photographs

Historical aerial photographs for the site have been reviewed. The reviewed aerial photographs are presented in Appendix D.

Table 2: Historical Aerial Photographs	
1942	The site consists of paddocks, with a farmhouse in the south-east corner of the site. Forestry trees can be seen in sections of the paddocks and forestry access roads can be seen crosscutting the site. The farmhouse consists of two buildings surrounded by trees, with surrounding lawns and several outbuildings.
1962	The site is covered in mature forestry trees, with forestry access roads clearly visible and the farmhouse still visible in the south-east corner of the site with lawn surrounding the farmhouse.
1974	The property remains unchanged apart from the harvesting of some trees in the south-eastern corner of the site
1982	The farmhouse and associated outbuildings have been demolished. The hedges and lawns surrounding the demolished farmhouse are still present. The balance of the site appears to have been harvested with diagonal lines suggesting rows of slash (forestry debris during harvesting).
1994	The site has been replanted with forestry. A circular area of trees is visible in the location of the former farmhouse.
2004	The trees have been harvested across the site, with loading out areas and tracks visible. Ponded water is present in numerous areas across the site, particularly within loading out areas and the access tracks. Large ponded areas are noted centrally on the site and on the western boundary. It is unknown if these may have been pits.

Table 2: Historical Aerial Photographs	
2015-16	The property has developed into its current layout, with the positions of the three main pivots across the site clearly visible. The current yard is also visible in the southern central section of the site. The current waste pit can be seen next to the two silos located in the centre of the site. 100's of used tyres can be seen in the yard area (used for covering the silage stockpiles) with volume estimated to be less than 20 m^3.
2022	The property remains in its current layout. No significant changes are identified.

Notes:

1. *Historical aerial photographs sourced from Canterbury Map Partners, administered by ECan.*
2. *It should be noted that some aerial images are at a large scale and therefore of relatively low quality.*

3.2 Environment Canterbury Information

3.2.1 Listed Land Use Register (LLUR)

The ECan LLUR is used to hold information about sites that have used, stored or disposed of hazardous substances, based on activities detailed on the HAIL (MfE, 2011). It should be noted that the LLUR is not complete and new sites are regularly being added as ECan receives information and conduct their own investigations.

As of July 2023, the site remains unlisted on the LLUR. However, the neighbouring properties 168 Aylesbury Road, 177 Grange Road and Burnham Military Camp (Res 1176) located immediately east, south and southeast of the site respectively, are listed under two distinct HAIL Codes:

- A10 – Persistent pesticide bulk storage or use - Applies to the two residential / lifestyle block properties at 168 Aylesbury Road and 177 Grange Road. This primarily relates to greenhouse / tunnel houses associated with gardening and horticultural activities.
- G3 – Landfill Sites – RES 1176, Burnham (Burnham Military Camp) applies to a larger parcel associated with Military operations and development. Evidence of landfilling at this site was noted from 1994 to present.

These sites identified outside of the property are not expected to have resulted in any contamination of soils on the subject site and are located down hydraulic gradient of the site so are not expected to cause contamination via groundwater migration.

A copy of the LLUR documentation is presented in Appendix E.

3.2.2 Resource Consents

The ECan online GIS database was searched for resource consents located within a 2 km radius of the site. There are eighty-one resource consents recorded as 'issued-active', with ten recorded as being issued within the site. Consents CRC220897, CRC220897, CRC222635, CRC220897, CRC22089, and CRC222635 are six consent applications currently on-hold for water permitting. Consents CRC222536, CRC222536, CRC222536, CRC221642 are four ground water permits that are active under an S124 continuance and relates to groundwater take for irrigation purposes onsite.

There is considered to be no consented activity that would result in ground contamination that could impact site soils within 2 km of the site.

A table and plot of resource consents within a 2 km radius of the site are presented in Appendix F.

3.3 Selwyn District Council Information

The property files for the site were requested from Selwyn District Council and reviewed for this PSI. The files contained various building consents and applications, none of which related to environmental or potentially contaminating activities and therefore were of no relevance to this investigation and have not been listed here. There have been no changes on site since 2020 so no additional information from SDC was sought.

3.4 Anecdotal Information

The following information was provided during a telephone discussion on 27 January 2020 with the original site owner Mr Leo Donkers (Camden Group).

- The property was formerly used for logging until 2005 when the farm was converted from forestry to an irrigated cropping/cattle fattening farm;
- The site was purchased by the Camden Group in 2010 and converted to an irrigated heifer grazing farm;
- Several waste pits are located on site, including a former infilled pit on the western boundary and a current pit adjacent to the current yard in the centre of the site. There was no information regarding the composition of the former infilled pit, but the current waste pit was reportedly used for the disposal of general farming waste materials; and
- The former logging yard in the northern centre of the site formerly had an above ground diesel storage tank of unknown volume for the fuelling of the vehicles used for the forestry operations.

A plan showing the location of the former forestry yard and a plan showing the two pits (infilled and current), as provided by Mr Donkers, has been presented in Appendix G.

As part of updating this PSI in July 2023, the client (Dan McGregor) confirmed that there have been no new potentially contaminating activities at the site since the site inspection in 2020. The site has continued to operate as a working farm.

3.5 Site Inspection

A site inspection was undertaken by PDP on 30 January 2020. The main findings from the site inspection are summarised below. Key features are shown in Figure 1 presented in Appendix A and photographs of the site are presented in Appendix B.

- One main barn of corrugated iron construction is located in the central portion of the site associated with the current farming operations. The southern end of the barn is currently used for the storage of general farming materials/consumables and vehicles including tractors. This portion of the barn is unsealed and some minor hydrocarbon staining was observed on the ground surface. This was considered typical for normal farming operations where equipment is stored. The northern end of the barn is used as a vehicle workshop and has a concrete surface. A hazardous storage cupboard with signage (2WE – Agrichemicals) was evident in the workshop;
- Two shipping containers are located approximately 50 m north of the barn, with one container marked as containing anhydrous ammonia (fertilizer);
- In the centre of the site, approximately 200 m north of the barn are two above ground fuel storage tanks. One is an old disused diesel fuel tank and the other the current tank used to fuel the farm vehicles on site. There was no obvious significant staining on the surface surrounding these tanks;
- A waste pit was visible approximately 35 m east of the fuel storage tanks. The pit was approximately 4-5 m deep and was being used for the disposal of waste farming materials. Visible waste included organic material (vegetation and deceased farm animals), metal (wire etc), concrete, plastics including tarpaulins, and wood (including some treated wood such as fence posts);
- There were a number of used tyres (100's) placed on the top of the silage stockpile. Other used tyres were stored in the area; and
- The area of the former infilled pit on the western boundary (as reported by Mr Donkers) showed as a slight depression on the ground surface with relatively sparse grass growth during the site walkover.

4.0 Summary of Site History and Potential Sources of Contamination

The available historical information shows the site has been used predominantly for forestry purposes, converting to an irrigated cropping/cattle fattening farm in 2005 and becoming an irrigated heifer grazing farm in 2010 until present. There was no evidence to suggest that any herbicides/pesticides have been used historically at the site.

Key land use activities that may have resulted in contaminating soils/groundwater include:

- An above ground diesel tank was reportedly present in the yard of the former forestry yard (location estimated based on anecdotal evidence provided). This was likely a small above ground tank. The likelihood of there being any significant contamination in the ground associated with this fuel storage is low.
- Two above ground fuel storage tanks for refuelling farm vehicles are currently present on site;
- Storage of bulk fertilisers and other materials such as fence posts and used tyres which are used in the general operational aspects of the farm; and
- Waste pits/infill pits have been identified at the site. The current farming waste pit was observed during the site inspection and contained organics, metal, concrete, plastics and wood waste. The full composition and extent of the material in the pit is unknown. It is understood that future pits will be used in the general area. The composition of the material within the former infilled pit is unknown. Other pits may also exist across the site associated with general farming practices.

Based on this information, the potential contamination sources from past and present land use activities do exist but are confined to certain areas of the property only (refer Figure 3). The contamination sources were considered to be typical for a large forestry/farming operation.

The identified potential contamination sources/HAIL activities include:-

- '*Landfill sites*' (HAIL Reference G3) relating to potential for uncontrolled fill within identified past infilled pits and the current waste pit.
- '*Waste disposal to land*' (HAIL Category G5) associated with storage of general farming materials (treated timber posts) including 100's of used tyres.
- 'Bulk storage of fertilizer' (HAIL Category A6) associated with storage of fertilisers onsite.

- '*Storage tanks or drums for fuel*' (HAIL Category A17) associated with former fuel tank in forestry operations yard and two above ground fuel storage tanks located near to the current yard.

HAIL locations on the site are presented in Appendix A, Figure 2.

5.0 Preliminary Soil Sampling Exercise

No sampling of soils around the current operational yard area or known pit locations was considered necessary as these HAIL areas will continue to be used so will need to be individually investigated/remediated as the quarry progressively develops and expands into these areas. However, in order to provide a general indication of the contamination status of the broad-acre surface soils across the site (i.e. general soils outside of the identified HAIL areas), a preliminary soil sampling investigation was undertaken. This was to inform developers on whether controls in a Site Management Plan would need to be considered during the handling and management of potentially contaminated surface soils during the quarry development.

It should be noted the soil sampling does not constitute a full detailed site investigation (DSI) for the entire site. Additional targeted sampling would be required as the quarry is developed in identified/discovered HAIL areas.

5.1 Soil Sampling Strategy and Analysis

An appropriate soil sampling strategy was derived to meet the objectives described above. A total of 15 soil samples (SS1 to SS15) were collected in a general grid pattern across the site in order to provide broad acre coverage.

A plan showing the soil sampling locations is presented on Figure 1, Appendix A.

The soil profiles across the site displayed silty topsoil to a depth of 0.2 m – 0.3 m bgl, underlain by sandy gravel.

No obvious stains, odours or possible contamination sources were observed during the collection of the soil samples from across the site.

Representative soil samples were collected from the surface soils. On each occasion, a clean pair of nitrile gloves was used for sample collection to prevent cross contamination between samples and to protect the PDP site worker during sample collection. All samples were placed directly into glass jars with food grade plastic sealed lids supplied by Analytica Laboratories Limited (Analytica). Following collection, these samples were placed immediately into a chilly-bin containing frozen ice packs. The chilly-bin was sent with chain of custody documentation to Analytica in Hamilton for analysis. The samples were received the following day after shipment.

Samples were analysed for heavy metals and organochlorine pesticides (OCPs). These compounds are considered to provide a general indication as to the presence of any likely contamination associated with the general horticultural/agricultural land use activities across the site.

5.2 Selected Guideline Criteria

In the absence of any applicable land use standards/guidelines for the future use of the site, comparison of the laboratory results to the ECan background soil concentrations for selected trace elements in the major Canterbury soil groups has been undertaken (ECan, 2007). In particular, the total recoverable metals analytical results have been compared with ECan Level Two background soil concentrations for the 'Yellow Brown Stony' soil group in which the land is located.

Whilst OCP compounds are anthropogenic it is important to note that due to their historical ubiquitous application in agriculture, parklands and turf management they can be considered to also be present at low but detectable 'background' concentrations (MfE, 1998). While there are no official ECan background soil concentrations, ECan has recently recognised that some OCPs are ubiquitous in the environment and has adopted an interim 'background' level (0.431 mg/kg) for ∑DDT[2] (OCP compounds). This value was taken from the report prepared by MfE entitled '*Ambient Concentrations of Selected Organochlorines in Soils*' and dated December 1998.

5.3 Soil Sampling Results and Comparison to Guideline Criteria

The selected guideline criteria for heavy metals and OCPs are presented in Table A, Appendix H. A copy of the laboratory report and chain of custody documentation are presented in Appendix I.

Heavy Metals

All fifteen samples collected and analysed from locations SS1 to SS15 recorded heavy metal concentrations below the ECan (2007) background levels for the local soil type.

OCPs

No detectable OCP compound concentrations were reported in any of the fifteen samples, therefore all samples were below the MfE (1998) background level.

[2] For this assessment, the results for DDT, DDD and DDE are summed together (∑DDT) and compared to background soil concentrations and the soil contaminant standard for DDT.

6.0 Consideration of the NESCS

6.1 Provisions of the NESCS

The NESCS seeks to control activities on contaminated land so as to protect human health. The regulations apply to land which is described as having, has had or is more likely than not to have had an activity or industry described in the HAIL undertaken on it (i.e. the 'piece of land').

As discussed in Section 4.0, there have been land use activities carried out within discrete areas of the site that have the potential to have caused land contamination (i.e. HAIL areas) and these will need to be considered during future site development works. Soil sampling across the reminder of the site (i.e. outside of the identified HAIL areas) showed concentrations of key indicator contaminants at background levels for the area.

As the site is currently being used as 'production land', under regulation 5(8) the NESCS has only limited applicability, and applies for the following activities only:

- 5(8)(a) Removal or replacement of a fuel storage system;
- 5(8)(b) Soil disturbance of the piece of land which is being used for residential purposes (note that there is currently no residential use at the site currently);
- 5(8)(c) Subdivide the land in a way that causes the piece of land to stop being productive land; and
- 5(8)(d) Change of the use of the land in a way that causes the piece of land to stop being production land.

Therefore, on the basis of the above, the NESCS is not applicable for the current soil disturbance activities and general operation for 'production land'. However, the proposed change in land use as a quarry is not defined as 'production land' under the Section 2 of Resource Management Act (RMA; 1991) and therefore the NESCS regulations will need to be taken into consideration for the proposed quarry development.

For the proposed quarry development, the NESCS will potentially apply to the following activities:

- Disturbance of soils in the identified HAIL areas under regulation 5(4); and
- Changing the use of a land under regulation 5(6).

Soil disturbance is a permitted activity under regulation 8(3) provided that controls are put in place to minimise contact with soil during the disturbance, that the soil be reinstated to an erosion-resistant state within one month of completion of the works and that disposal of removed soil is to a facility authorised to receive such waste. The NESCS also sets limits on the volume of

soil disturbance (no more than 25 m^3 per 500 m^2 is disturbed), soil removal (no more than 5 m^3 per 500 m^2 is removed from the site per year) and duration of works (no longer than two months). Based on the nature of quarrying activities, these conditions will unlikely be able to be met so under regulation 8(5) the activity of soil disturbance in those areas where HAIL activities have been identified will require resource consent. No soil sampling has been undertaken in the identified HAIL areas as they will continue to be used for this activity in the short to medium term. As such, the consent application will need to proceed down the **discretionary activity** process.

Change in land use is a permitted activity under regulation 8(4) if it can be demonstrated through the review of the site history that it is highly unlikely that there will be a risk to human health if the activity is done to the 'piece of land'. Given the proposed activity will involve the disturbance of confirmed HAIL areas including farming landfill pits, there is the potential for exposure to uncharacterised waste material/contaminants and therefore a potential risk to human health exists. A resource consent would therefore be required to be obtained for the change in land use. Given the absence of a detailed site investigation of the identified HAIL areas, the consent application will need to proceed down the **discretionary activity** process.

The recommended approach to manage the identified contamination sources is to undertake targeted detailed site investigations of each HAIL area as the quarry development progresses (i.e. immediately prior to disturbance of these identified areas). This will ensure that any contamination sources associated with the ongoing use of the site as production land is captured in the assessments. The results of the testing will determine the appropriate course of action that is required and what remedial works, if any, are required. This would be outlined in a Site Management Plan prepared for the quarry development works.

There has been no assessment of any other consenting requirements associated with the operation of a quarry at the site.

7.0 Summary and Conclusions

PDP has reviewed and updated the available site history information for the portion of land within the property defined as 139 Grange Road, Burnham to reflect current site conditions as of July 2023. The objective of the investigation was to identify any potential sources of contamination from past and/or present land use activities at the site, determine an indication of the contamination status of the near surface soil through a limited soil sampling investigation and to assess the applicability of the NESCS for the future progressive development of the site as a quarry. This has been carried out to support the consenting process.

The site appears to have been used as a forestry plantation from at least the 1940's until circa 2005. In 2005 the farm was converted to an irrigated cropping/cattle fattening farm and more recently since 2010 the property has

been operated as an irrigated heifer grazing farm. The following HAIL activities have been identified across the site:

- '*Landfill sites'* (HAIL Reference G3) relating to potential for uncontrolled fill within identified past infilled pits (based on anecdotal information provided) and the current operational farming waste pit(s).
- '*Waste disposal to land*' (HAIL Category G5) associated with storage of general farming materials (treated timber posts) including 100's of used tyres.
- 'Bulk storage of fertilizer' (HAIL Category A6) associated with bulk storage of fertilisers onsite.
- '*Storage tanks or drums for fuel*' (HAIL Category A17) associated with former fuel tank in forestry operations yard and two above ground fuel storage tanks located near to the current yard.

No sampling of soils around the current operational yard area or known pit locations was completed as these areas will continue to be used for the ongoing operation of the farm and the progressive development of the quarry. However, broad-acre sampling of surface soils outside of the HAIL areas was undertaken to provide an initial indication to the presence of any contaminants in the near surface soils. The sampling results showed the likely key indicator contaminants (i.e. heavy metals and OCPs) at background levels for the area.

On the basis of the site history information and preliminary soil sampling results, a number of potentially contaminating activities have been identified at the site, however these are in discrete areas only and should not be interpreted across the wider site. These contamination sources were considered to be typical for a large forestry/farming operation.

As the site is currently being used as 'production land', the NESCS is not applicable for the current soil disturbance activities and general operation for the current use of the site. However, the proposed change in land use as a quarry is not defined as 'production land' and therefore the NESCS regulations (soil disturbance and change in land use) will need to be taken into consideration for the proposed quarry development. Given these HAIL areas will continue to be used for the short to medium term, a detailed site investigation has not been undertaken so the consent application will need to proceed down the **discretionary activity** process.

The recommended approach to manage the identified contamination source areas during the proposed future quarrying operations is through the development and implementation of a Site Management Plan. This would include the requirement to further investigate the HAIL areas identified in this PSI prior to any quarrying activities taking place in the sections of the quarry identified. It is recommended that this is included as a condition of the land use consent issued for the operation of the quarrying activities.

8.0 References

Forsyth, Barrell and Jongens., 2008; 1:250,000. Geology of the Christchurch Area. Institute of Geological and Nuclear Sciences 1:25,000 Geological Map 16. Lower Hutt, New Zealand.

Environment Canterbury, 2007. *Background concentrations of selected trace elements in Canterbury soils. Addendum 1: Additional samples and Timaru specific background levels*. Environment Canterbury Report R07/1/2.

Ministry for the Environment, 2011. *Hazardous Activities and Industries List*. Ministry for the Environment, Wellington.

Ministry for the Environment, 2011a. *Contaminated Land Management Guidelines No. 1: Reporting on Contaminated Sites in New Zealand*. Ministry for the Environment, Wellington.

Ministry for the Environment, 2011b. *Contaminated Land Management Guidelines No. 5: Site Investigation and Analysis of Soils (Revised 2011).* Ministry for the Environment, Wellington.

Resource Management (National Environment Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

9.0 Report Limitations

This report has been prepared on the basis of information provided by Burnham 2020 Ltd and others (not directly contracted by PDP for the work). PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared based on: visual observations of the site vicinity and analysis of fifteen soil samples. Soil samples were analysed by an analytical laboratory for a suite of heavy metals and OCPs. The site conditions as described in this report have been interpreted from, and are subject to, this information and its limitations and accordingly PDP does not represent that its interpretation accurately represents the full site conditions.

This report is based on the observation and sampling at fifteen locations at the site. The environmental conditions have been interpolated between the sampling locations, and accordingly the interpolated conditions cannot be guaranteed to be accurate.

The laboratory test results provide an approximation of the concentration of the tested parameters and are subject to the inherent limitations of the laboratory techniques used for the tests.

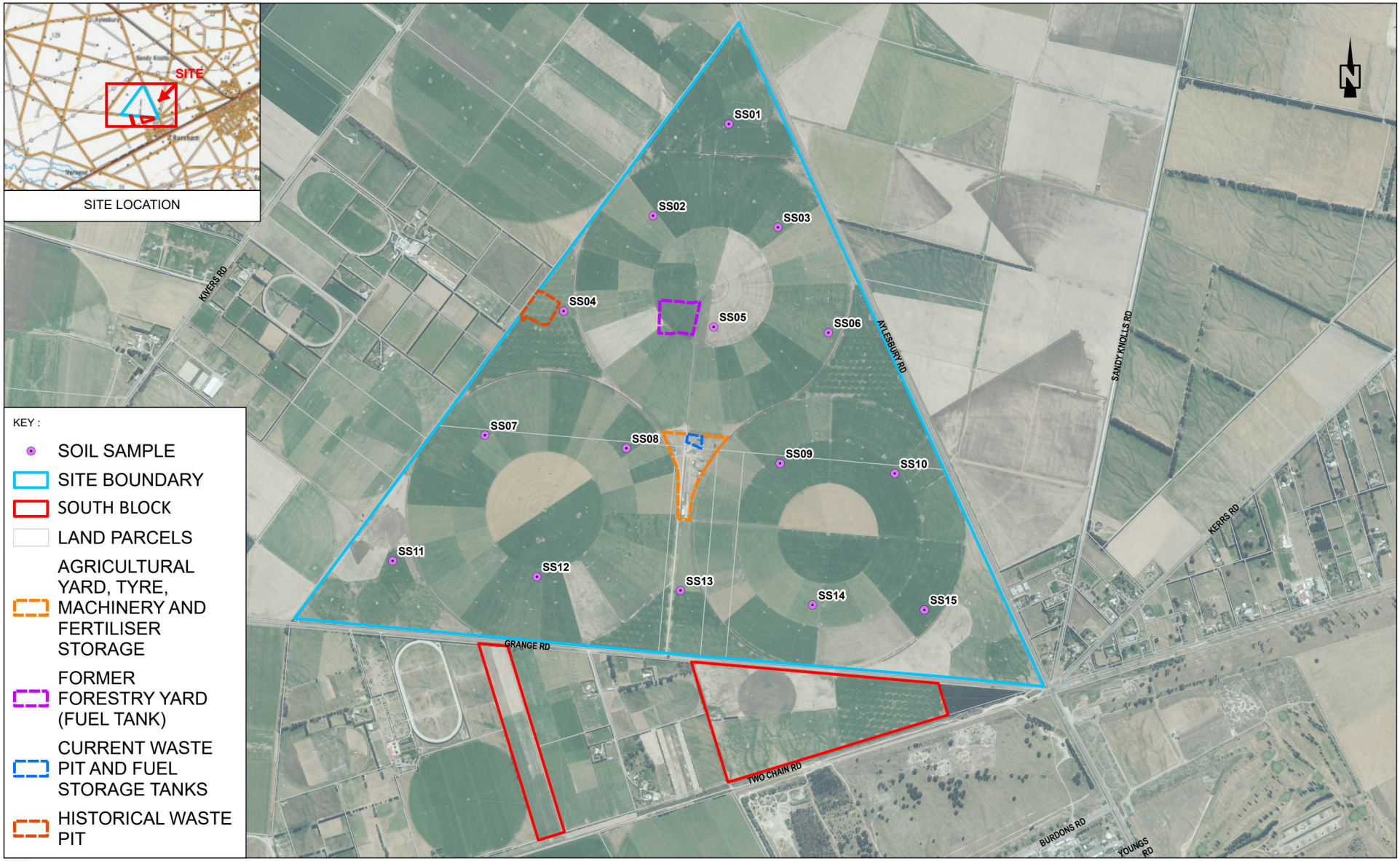
PDP has sampled and tested only for those chemicals that are described in this report. The presence or absence of other chemicals at the site is not considered in this report.

The information contained within this report applies to sampling soil undertaken on the date stated in this report, or if none is stated, the date of this report. With time, the site conditions and environmental standards could change so that the reported assessment and conclusions are no longer valid. Accordingly, the report should not be used to refer to site conditions and environmental standards applying at a later date without first confirming the validity of the report's information at that time.

This report has been prepared by PDP on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the report. PDP accepts no liability if the document is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

Appendix A: Figures



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

FIGURE 1: SITE LOCATION, SITE BOUNDARY AND SOIL SAMPLE LOCATIONS

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES

C04096100.mxd 23/07/2023 ISSUE 1



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

FIGURE 2: HAIL LOCATIONS

SCALE : 1:6,000 (A4)
0 25 50 100 150
METRES

C04096100.mxd 23/07/2023 ISSUE 1

Appendix B: Site Photographs



Photograph 1: (View north from the yard looking towards the silos)



Photograph 2: (View south towards the entrance of the site and the yard (historical fuel tank in left field of view))



Photograph 3: (Fuel storage tanks, historical (red tank) and current (white))



Photograph 4: (View of the northern side of the barn and mechanics workshop)



Photograph 5: (Inside of barn showing storage of various materials and some hydrocarbon staining on sandy gravel surface)



Photograph 6: (Current waste pit looking north-east, showing soil profile on northern edge of pit and waste material including wood, organics and tyres)

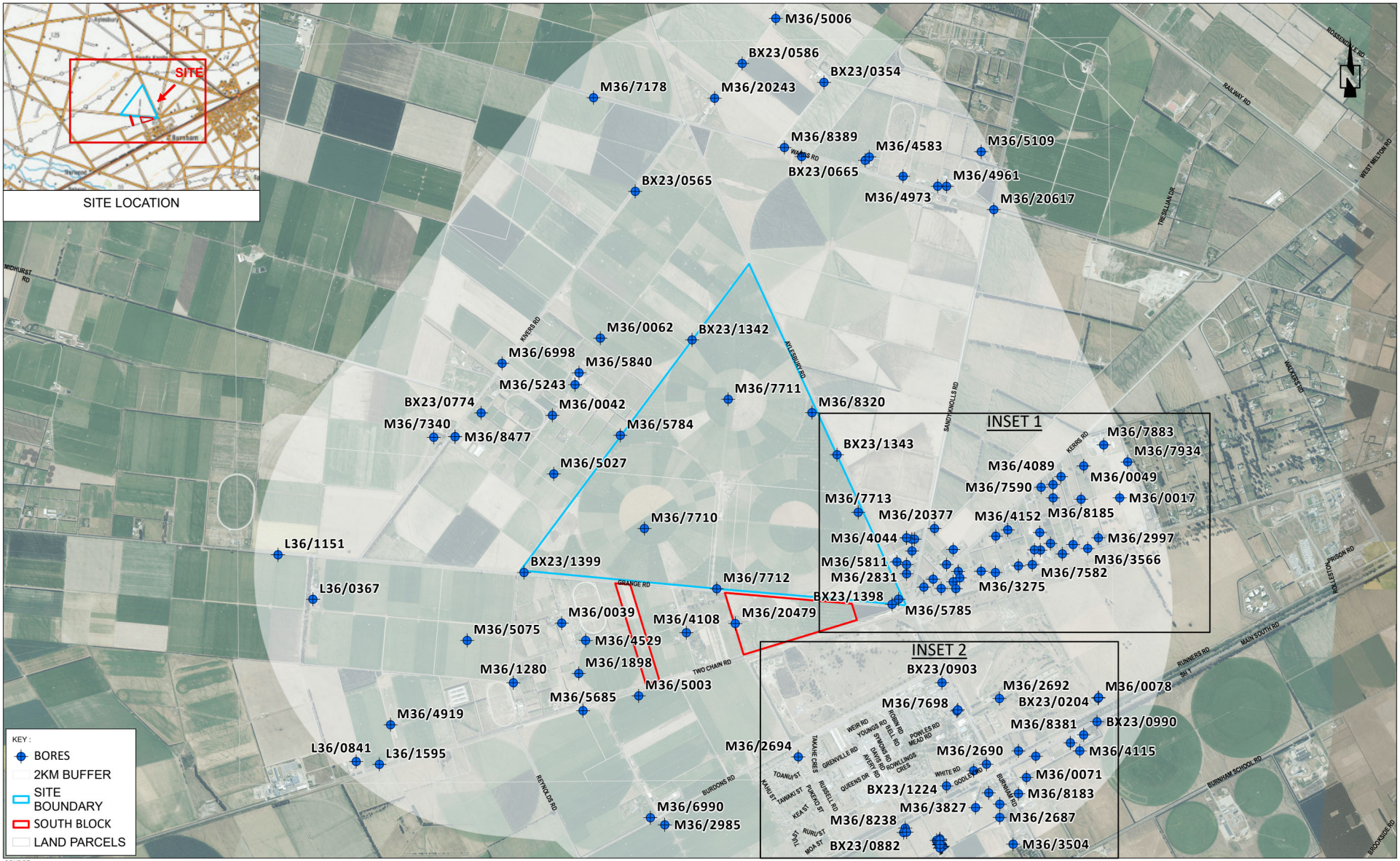


Photograph 7: (Close up of waste material, including dead stock)



Photograph 8: (Disturbed ground/depression shown on western boundary of site where former waste pit is located)

Appendix C: Environment Canterbury Bore Information



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
3. BORE INFORMTION PROVIDED BY ENVIRONMENT CANTERBURY AND USED WITH PERMISSION.

BORES WITHIN 2 KM OF SITE BOUNDARY



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
3. BORE INFORMTION PROVIDED BY ENVIRONMENT CANTERBURY AND USED WITH PERMISSION.

INSET 1: BORES WITHIN 2 KM OF SITE BOUNDARY

C04096100.mxd 23/07/2023 ISSUE 1



SOURCE:
1. AERIAL IMAGERY (FLOWN (2015-2016)) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
3. BORE INFORMTION PROVIDED BY ENVIRONMENT CANTERBURY AND USED WITH PERMISSION.

INSET 2: BORES WITHIN 2 KM OF SITE BOUNDARY

SCALE : 1:7,000 (A4)

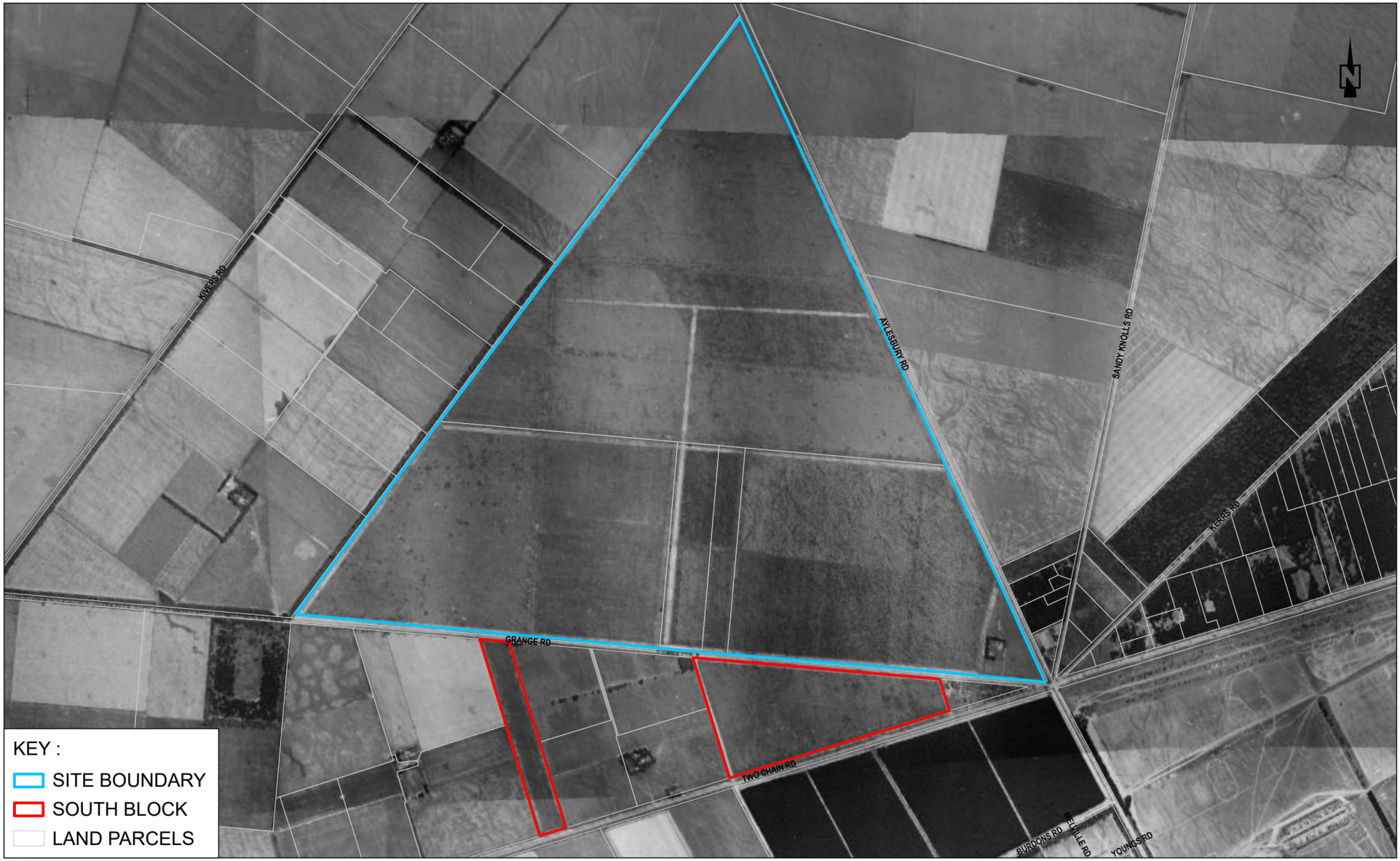
0 50 100 200 300

METRES

Bores located within a 2 km radius of the site (sourced from Ecan GIS Database July 2023)

	Well No.	Well Status	Depth (M)	Diameter (mm)	Well Use	Well Location	Well Owner	Well Type	Top Screen	Bottom Screen	Distance (m)
1	M36/7711	Active (exist, present)	148.38	300	Irrigation	Corner Alyesbury & Grange Road	Burnham Farm Limited	Bore or Well	118.38	142.38	570
2	M36/7710	Active (exist, present)	167.91	300	Irrigation	Corner Alyesbury & Grange Road	Burnham Farm Limited	Bore or Well	142.91	156.91	741
3	M36/8320	Active (exist, present)	101.78	150	Stock Supply	AYLESBURY ROAD	SELWYN PLANTATION BOARD	Bore or Well	94.28	100.28	790
4	BX23/1343	Active (exist, present)	34.19	50	Groundwater Quality	Aylesbury Road	Winstone Aggregates	Bore or Well	4.11	34.19	837
5	M36/7712	Active (exist, present)	162	300	Irrigation	160 Grange Road	Burnham Farm Limited	Bore or Well	133	153	856
6	M36/5784	Active (exist, present)	37.4	51	Water Level Observation	KIVERS ROAD	CHRISTCHURCH CITY COUNCIL	Bore or Well	13.8	37.4	859
7	M36/7713	Active (exist, present)	150.14	300	Irrigation	Corner Alyesbury & Grange Road	Burnham Farm Limited	Bore or Well	126.18	144.14	1020
8	BX23/1342	Active (exist, present)	37.13	50	Groundwater Quality	Aylesbury Road	Winstone Aggregates	Bore or Well	7.06	37.13	1050
9	M36/20479	Active (exist, present)	47.1	150	Domestic and Stockwater	139 Grange Road	Burnham Farm Limited	Bore or Well	41.6	47.36	1155
10	M36/4208	Active (exist, present)	54.5	400	Intsection	TWO CHAIN RD	BARTLETT W.E.	Bore or Well	51.4	54.4	1222
11	M36/5027	Active (exist, present)	52	200	Irrigation	KIVERS ROAD	Mr S J & Mrs A K Blakely	Bore or Well	50.5	52	1305
12	M36/5243	Active (exist, present)	52	150	Domestic and Stockwater	KIVERS ROAD	EASTGUN FARMS LTD	Bore or Well	50.5	52	1333
13	M36/5840	Active (exist, present)	52	150	Domestic and Stockwater	KIVERS ROAD	PATERSON, DJ	Bore or Well	50.5	52	1354
14	M36/5042	Active (exist, present)	53.3	300	Irrigation	KIVERS RD	Mr S J & Mrs A K Blakely	Bore or Well			1389
15	M36/5062	Active (exist, present)	127	127	Domestic Supply	KIVERS RD	SEATON, M D	Bore or Well			1404
16	M36/4744	Active (exist, present)	28.9	150	Domestic Supply	SANDY KNOLLS RD	GRIFFITHS AG & M	Bore or Well			1424
17	M36/3667	Active (exist, present)	45		Domestic Supply	SANDY KNOLLS RD	PEARSON D.L.	Bore or Well			1424
18	M36/5811	Active (exist, present)	48.5	150	Domestic and Stockwater	AYLESBURY ROAD	SALKELD, MD	Bore or Well	45.6	48.5	1429
19	M36/7928	Active (exist, present)	47.4	150	Domestic and Stockwater	SANDY KNOLLS ROAD	MR & MRS A & M GRIFFITHS	Bore or Well	45.9	47.4	1465
20	M36/4739	Active (exist, present)	30	125	Domestic Supply	SANDY KNOLLS RD	NEALE, T.D.& K.M.	Bore or Well			1484
21	M36/20534	Active (exist, present)	48	150	Domestic and Stockwater	41 Sandy Knolls Road	Mr G.W Hedges	Bore or Well	46.5	48	1497
22	M36/2885	Active (exist, present)	38.4	150	Domestic Supply	SANDY KNOLLS RD	CONSTABLE	Bore or Well			1502
23	M36/2831	Active (exist, present)	35	150	Domestic Supply	SANDY KNOLLS RD	TANGERDALE B.J.	Bore or Well			1535
24	BX23/1398	Active (exist, present)	23.2	50	Groundwater Quality	Aylesbury Road	Winstone Aggregates	Bore or Well	3.2	23.2	1570
25	M36/5785	Active (exist, present)	27.7	51	Water Level Observation	GRANGE ROAD	CHRISTCHURCH CITY COUNCIL	Bore or Well			1586
26	M36/20377	Active (exist, present)	54	150	Domestic and Stockwater	SANDY KNOLLS ROAD	ROAD METALS HOLDINGS LTD	Bore or Well	52.5	54	1605
27	M36/4528	Active (exist, present)	53.7	200	Irrigation	GRANGE "SILVERLEA FARM LTD"	Sarithero Trustees (2010) Limited	Bore or Well			1634
28	M36/0028	Active (exist, present)	39.4	180	Domestic Supply	Grange rd	Barton, D.S.	Bore or Well			1668
29	BX23/1399	Active (exist, present)	31.68	50	Groundwater Quality	Grange Road	Winstone Aggregates	Bore or Well	3.5	31.68	1693
30	M36/7728	Active (exist, present)	48	150	Domestic Supply	Kerrs Road	Ms IVE Milne	Bore or Well	46.5	48	1697
31	M36/8350	Active (exist, present)	54	150	Domestic and Stockwater	KERRS ROAD	MR D M SOMER	Bore or Well	52.5	54	1730
32	M36/1519	Active (exist, present)	45.1	150	Domestic Supply	KERRS ROAD	MOYLAN M.T.	Bore or Well	43	45.1	1776
33	BX23/0257	Active (exist, present)	54	150	Domestic and Stockwater	KERRS ROAD	ROAD METALS COMPANY LIMITED	Bore or Well	52.5	54	1785
34	M36/5003	Active (exist, present)	53	300	Irrigation	TWO CHAIN ROAD, CNR THOMAS ROAD	Mr M J & Mrs S E Thomas	Bore or Well	47	53	1785
35	M36/4153	Active (exist, present)	45.7	150	Domestic Supply	TWO CHAIN RD	JAMERSON A.	Bore or Well			1816
36	M36/1898	Active (exist, present)	54.1	200	Irrigation	TWO CHAIN RD	Mr M J & Mrs S E Thomas	Bore or Well	50.9	54.1	1860
37	M36/8271	Active (exist, present)	58	150	Domestic and Stockwater	KERRS ROAD	G D MCNEILL	Bore or Well			1874
38	BX23/0023	Active (exist, present)	54	150	Domestic and Stockwater	KERRS ROAD	MR & MRS R & S SAUNDERS	Bore or Well	52.5	54	1877
39	M36/6998	Active (exist, present)	78	300	Irrigation	Kivers Road	Mr & Mrs B R H & A M Fechney	Bore or Well	52.8	77.8	1889
40	M36/2811	Active (exist, present)	34.1	150	Domestic Supply	KERRS ROAD	RYAN, C & N.	Bore or Well	30.4	34.1	1907
41	BX23/0774	Active (exist, present)	55.2	150	Domestic and Stockwater	Kivers Road	Richard Stuart Trewavas	Bore or Well	52.2	55.2	1908
42	BX23/0193	Active (exist, present)	45	150	Domestic and Stockwater	TWO CHAIN ROAD	MR CAMERON GLEN WOODS	Bore or Well	43.5	45	1914
43	M36/1286	Active (exist, present)	42.2	150	Irrigation	TWO CHAIN ROAD	MOFFETT M.G.	Bore or Well			2036
44	M36/8477	Active (exist, present)	52.5	150	Domestic and Stockwater	KIVERS ROAD	MR D P & MRS D M STALKER	Bore or Well	50.5	52.5	2065
45	M36/8187	Active (exist, present)	48	150	Domestic Supply	82 KERRS ROAD	MR TIMOTHY PETER CHAPMAN	Bore or Well			2066
46	M36/4397	Active (exist, present)	52.5	150	Domestic and Stockwater	KIVERS RD	Mr R S J Trewavas	Bore or Well	50	52	2066
47	M36/5685	Active (exist, present)	83.1	300	Irrigation	TWO CHAIN ROAD	Mr M J & Mrs S E Thomas	Bore or Well	57	75.5	2073
48	M36/3275	Active (exist, present)	45	125	Domestic Supply	TWO CHAIN RD	CAMPELL D.R.	Bore or Well	44	45	2140
49	M36/4152	Active (exist, present)	45.4	150	Domestic Supply	KERRS RD	PATTERSON .T.	Bore or Well			2144
50	M36/2934	Active (exist, present)	24.3	150	Public Water Supply	BURNHAM CAMP	New Zealand Defence Force, Upper Hutt	Bore or Well			2180
51	M36/7340	Active (exist, present)	58	300	Irrigation	KIVERS ROAD	Mr R J Bell	Bore or Well	52	58	2224
52	M36/1280	Active (exist, present)	53	203	Domestic Supply	TWO CHAIN RD	Mr J D Owens	Bore or Well	49.3	53	2239
53	BX23/0903	Active (exist, present)	198	300	Public Water Supply	Youngs Road	NZ Defence Force	Bore or Well	189	195	2240
54	BX23/0565	Active (exist, present)	62.6	150	Domestic and Stockwater	Kivers Road	Melrose Ltd	Bore or Well	59.6	62.6	2241
55	M36/6059	Active (exist, present)	42	150	Domestic Supply	TWO CHAIN RD	FORSETS	Bore or Well			2288
56	M36/5075	Active (exist, present)	4.5	51	Water Level Observation	GEORGE SEYMOUR QUAY	CALTEX OIL (NZ) LTD	Well Cluster			2315
57	M36/7390	Active (exist, present)	48	150	Domestic and Stockwater	118 Kerrs Road	Mr & Mrs H & MC Campbell	Bore or Well	46	48	2356
58	M36/5023	Active (exist, present)	36.5	152	Commercial / Industrial	TWO CHAIN RD	Santa Rosa Marketing	Bore or Well	35.1	36.5	2372
59	M36/3942	Active (exist, present)	53.5	200	Commercial / Industrial	TWO CHAIN RD	Santa Rosa Marketing Limited	Bore or Well	51.5	53.5	2384
60	M36/7582	Active (exist, present)	48	150	Domestic and Stockwater	Two Chain Road	Mr D MacDonald & Ms P Frew	Bore or Well	45.5	48	2385
61	BX23/0756	Active (exist, present)	90	150	Domestic Supply	Two Chain Road	AH & Company	Bore or Well	87.3	90.3	2416
62	M36/2955	Active (exist, present)	30	150	Irrigation	KERRS RD	MCMILLAN J.A.	Bore or Well	28.5	30	2445
63	M36/1518	Active (exist, present)	46	150	Domestic Supply	KERRS ROAD	NICOL K.	Bore or Well	45	46	2450
64	M36/7691	Active (exist, present)	118.5	300	Irrigation	Wards Road	Mr & Mrs S E & D J Lill	Bore or Well	110.165	116.165	2456
65	M36/2693	Active (exist, present)	54.9	200	Domestic Supply	BURNHAM CAMP / Powles rd	New Zealand Defence Force, Upper Hutt	Bore or Well	44.8	48.2	2468
66	M36/7498	Active (exist, present)	51.8	168	Water Level Observation	Burnham Camp/ Fowles Rd	Ministry of Defence	Bore or Well			2469
67	M36/1601	Active (exist, present)	42	150	Irrigation	TWO CHAIN ROAD	AGNEW B & G	Bore or Well	39	42	2479
68	M36/8389	Active (exist, present)	53.77	150	Stock Supply	WARDS ROAD	MR & MRS S N & D J PANKHURST	Bore or Well	52.27	53.77	2497
69	M36/4089	Active (exist, present)	44.5	150	Domestic and Stockwater	KERRS RD	MCKENZIE PA & S	Bore or Well	42	44.5	2505
70	BX23/0865	Active (exist, present)	66	150	Domestic and Stockwater	578 Wards Road	Graeme & Estelle Blanchard Family Trusts	Bore or Well	60.78	62.28	2580
71	M36/3941	Active (exist, present)			Domestic Supply	TWO CHAIN RD	FLETCHER	Bore or Well			2583
72	BX23/0169	Active (exist, present)	56	150	Domestic and Stockwater	WARDS ROAD	MR RICHARD BROMLEY	Bore or Well	54.5	56	2603
73	M36/4583	Active (exist, present)	61.5	150	Irrigation	WARDS RD	DORE M.P	Bore or Well	58.5	61.5	2615
74	M36/6990	Active (exist, present)	54	300	Irrigation	Burdons Road	Mr M J & Mrs S E Thomas	Bore or Well	48	54	2635
75	M36/2692	Active (exist, present)	47.8	250	Irrigation	BURNHAM CAMP	New Zealand Defence Force, Upper Hutt	Bore or Well	43.3	47.8	2641
76	M36/5242	Active (exist, present)	46	150	Domestic and Stockwater	TWO CHAIN ROAD	BRYAN, J.G & B.M	Bore or Well	44.5	46	2646
77	M36/8185	Active (exist, present)	48	150	Domestic and Stockwater	KERRS ROAD	MR & MRS JP & TE GALLAVIN	Bore or Well	46.5	48	2661
78	M36/2985	Active (exist, present)	54.5	250	Irrigation	BURDONS RD	Mr M J & Mrs S E Thomas	Bore or Well	49.8	54.5	2666
79	M36/0049	Active (exist, present)	27.1	150	Domestic Supply	KERRS ROAD	DE VRIES	Bore or Well			2675
80	M36/4973	Active (exist, present)	55	150	Irrigation	WARDS ROAD	Mr R Bromley	Bore or Well	53.5	55	2683
81	M36/4961	Active (exist, present)	52	150	Domestic and Stockwater	WARDS RD, CNR SANDY KNOLLS RD	Mr & Mrs T P & S L Neale	Bore or Well	50.5	52	2722
82	M36/3566	Active (exist, present)	53.5	150	Irrigation	TWO CHAIN RD	Mr & Mrs B C & A Drake	Bore or Well	50	53	2760
83	M36/20627	Active (exist, present)	48	65	Geotechnical / Geological Investig	Wards Road	Road Metals Limited	Bore or Well	30	48	2824
84	M36/2997	Active (exist, present)	40	150	Irrigation	TWO CHAIN RD	GIBBS J & MA	Bore or Well	38.8	40	2824
85	M36/20243	Active (exist, present)	150	300	Irrigation	WARDS ROAD	Mr G J Pankhurst	Bore or Well	129.5	130.5	2832
86	M36/7881	Active (exist, present)	57.5	150	Domestic and Stockwater	KERRS ROAD	FRESHSPORE FARMS LIMITED	Bore or Well	54.5	57.5	2834
87	BX23/1224	Active (exist, present)	25.72	50	Groundwater Quality	Godley Road	New Zealand Defence Force	Bore or Well	6	25	2854
88	BX23/1233	Active (exist, present)	25.72	50	Groundwater Quality	Godley Road	New Zealand Defence Force	Bore or Well	6	25	2887
89	M36/2690	Active (exist, present)			Domestic Supply	AYLESBURY ROAD	MINISTER OF RAILWAYS	Bore or Well			2913
90	M36/0017	Active (exist, present)	47.3	203	Commercial / Industrial	TWO CHAIN RD	Messrs W D, S D & L G Glass	Bore or Well	41.4	47.3	2949
91	M36/8238	Active (exist, present)	14.5	150	Water Level Observation	STATE HIGHWAY 1	NEW ZEALAND ARMY	Bore or Well	11.2	14	2966
92	BX23/0882	Active (exist, present)	30.4	50	Geotechnical / Geological Investig	Main South Road	Defence Force New Zealand	Bore or Well	14	30	2990
93	M36/8237	Active (exist, present)	21.1	150	Water Level Observation	STATE HIGHWAY 1	NEW ZEALAND ARMY	Bore or Well	18.1	21	2997
94	M36/7934	Active (exist, present)	45	150	Domestic and Stockwater	TWO CHAIN ROAD	MR & MRS MA & DE SWAIN	Bore or Well	42.5	45	3006
95	M36/7178	Active (exist, present)	139.1	300	Irrigation	Wards Road	Mr G J Pankhurst	Bore or Well	93	99	3007
96	M36/4616	Active (exist, present)	20	51	Groundwater Quality	MAIN SOUTH ROAD	MINISTRY OF DEFENCE	Bore or Well			3009
97	BX23/0354	Active (exist, present)	120.21	250	Irrigation	Wards Road	SR Pankhurst	Bore or Well	111.21	117.21	3037
98	M36/5109	Active (exist, present)	56	150	Domestic Supply	SANDY KNOLLS ROAD	NEALE, T.P. & S.L.	Bore or Well	54.5	56	3087
99	BX23/0509	Active (exist, present)	30	150	Domestic Supply	Main South Rd	Jason Falcon	Bore or Well			3087
100	BX23/0586	Active (exist, present)	139.7	250	Irrigation	718 Wards Road	G J & J K Pankhurst	Bore or Well	107	113.7	3093
101	M36/3827	Active (exist, present)	48	150	Irrigation	MAIN SOUTH RD	Mr & Mrs A & M P Shand & Jamieson	Bore or Well	46	48	3114
102	M36/5317	Active (exist, present)	17.7	150	Groundwater Quality	MAIN SOUTH ROAD	NEW ZEALAND DEFENCE FORCE	Well Cluster	9.4	12.4	3131
103	M36/4919	Active (exist, present)	45	150	Irrigation	TWO CHAIN ROAD	FINCH, P.A. & TAYLOR, J.R.	Bore or Well			3147
104	M36/4767	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3159
105	M36/7918	Active (exist, present)	24	150	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well	16	23.5	3161
106	M36/4775	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
107	M36/4772	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
108	M36/4771	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
109	M36/4773	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
110	M36/4776	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
111	M36/4769	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
112	M36/4768	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
113	M36/4770	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH RD	Institute of Environmental Science & Research	Bore or Well			3169
114	M36/4774	Active (exist, present)	18	100	Water Level Observation	MAIN SOUTH ROAD	Institute of Environmental Science & Research	Bore or Well			3169
115	BX23/0800	Active (exist, present)	16.9		Water Level Observation		ESR	Bore or Well			3179
116	M36/9071	Active (exist, present)	42.7		Domestic Supply	BURNHAM ROAD	IRVING	Bore or Well			3192
117	BX23/0802	Active (exist, present)	17		Other - see comments		ESR	Bore or Well			3195
118	BX23/0801	Active (exist, present)	17.1		Water Level Observation		ESR	Bore or Well			3195
119	BX23/0805	Active (exist, present)	18.1		Other - see comments		ESR	Bore or Well			3196
120	BX23/0804	Active (exist, present)	18.1		Other - see comments		ESR	Bore or Well			3197
121	BX23/0805	Active (exist, present)	15.3		Other - see comments		ESR	Bore or Well			3198
122	BX23/0812	Active (exist, present)			Other - see comments		ESR	Bore or Well			3198
123	M36/6057	Active (exist, present)	19.2		Domestic Supply	BURNHAM ROAD	WRIGHT N.	Bore or Well			3206
124	BX23/0806	Active (exist, present)	16.3		Other - see comments		ESR	Bore or Well			3220
125	BX23/0807	Active (exist, present)	16.5		Other - see comments		ESR	Bore or Well			3221
126	BX23/0809	Active (exist, present)	16.4		Other - see comments		ESR	Bore or Well			3221
127	BX23/0810	Active (exist, present)	17.2		Other - see comments		ESR	Bore or Well			3221
128	BX23/0808	Active (exist, present)	17.3		Other - see comments		ESR	Bore or Well			3221
129	BX23/0811	Active (exist, present)	16.2		Other - see comments		ESR	Bore or Well			3222
130	M36/8183	Active (exist, present)	48	150	Domestic and Stockwater	CNR BURNHAM AND MAIN STH ROADS	PIC New Zealand Limited	Bore or Well	46	48	3238
131	BX23/0204	Active (exist, present)	22.5	50	Water Level Observation	Runners Road	SELWYN DISTRICT COUNCIL	Bore or Well	18	21	3247
132	M36/0078	Active (exist, present)	47.9	250	Irrigation	MAIN SOUTH & BURNHAM ROADS	New Zealand Defence Force, Upper Hutt	Bore or Well	43.3	47.9	3248
133	L36/0367	Active (exist, present)	51.5	300	Irrigation	BURNHAM RD	Mr B J & Mrs G Woods	Bore or Well	48	51.5	3249
134	M36/8478	Active (exist, present)	43	150	Domestic and Stockwater	MAIN SOUTH ROAD	MR & MRS P B & C PLEWS	Bore or Well	40	42	3266
135	M36/2687	Active (exist, present)	30	150	Domestic Supply	BURNHAM RD	DEARDON .S.	Bore or Well	28	30	3283
136	M36/8381	Active (exist, present)	51	150	Domestic Supply	2239 MAIN SOUTH ROAD	MR P & MRS L C FORD	Bore or Well	49.5	51	3309
137	BX23/0090	Active (exist, present)	16.72	50	Groundwater Quality	Main South Road	Selwyn District Council	Bore or Well	0.5	15.2	3335
138	M36/4115	Active (exist, present)	42.1	125	Domestic Supply	MAIN SOUTH RD	LOWE .S.	Bore or Well			3358
139	L36/1595	Active (exist, present)	48	200	Irrigation	Two Chain Road	Anderson, G R & R M	Bore or Well	45	48	3397
140	L36/1151	Active (exist, present)	52.4	300	Irrigation	GRANGE ROAD	Mr B J & Mrs G Woods	Bore or Well	49.4	52.4	3427
141	M36/5006	Active (exist, present)	60	300	Irrigation	CNR WARDS ROAD & AYLESBURY ROAD	Mr S N Pankhurst	Bore or Well	57	60	3448
142	M36/3504	Active (exist, present)			Domestic Supply	BURNHAM RD	BREMNER	Unknown			3502
143	L36/0841	Active (exist, present)	43.4	150	Irrigation	TWO CHAIN RD	Mr & Ms B M & C R Holden & Ward	Bore or Well	41.3	43.4	3520

Appendix D: Historical Aerial Photographs



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

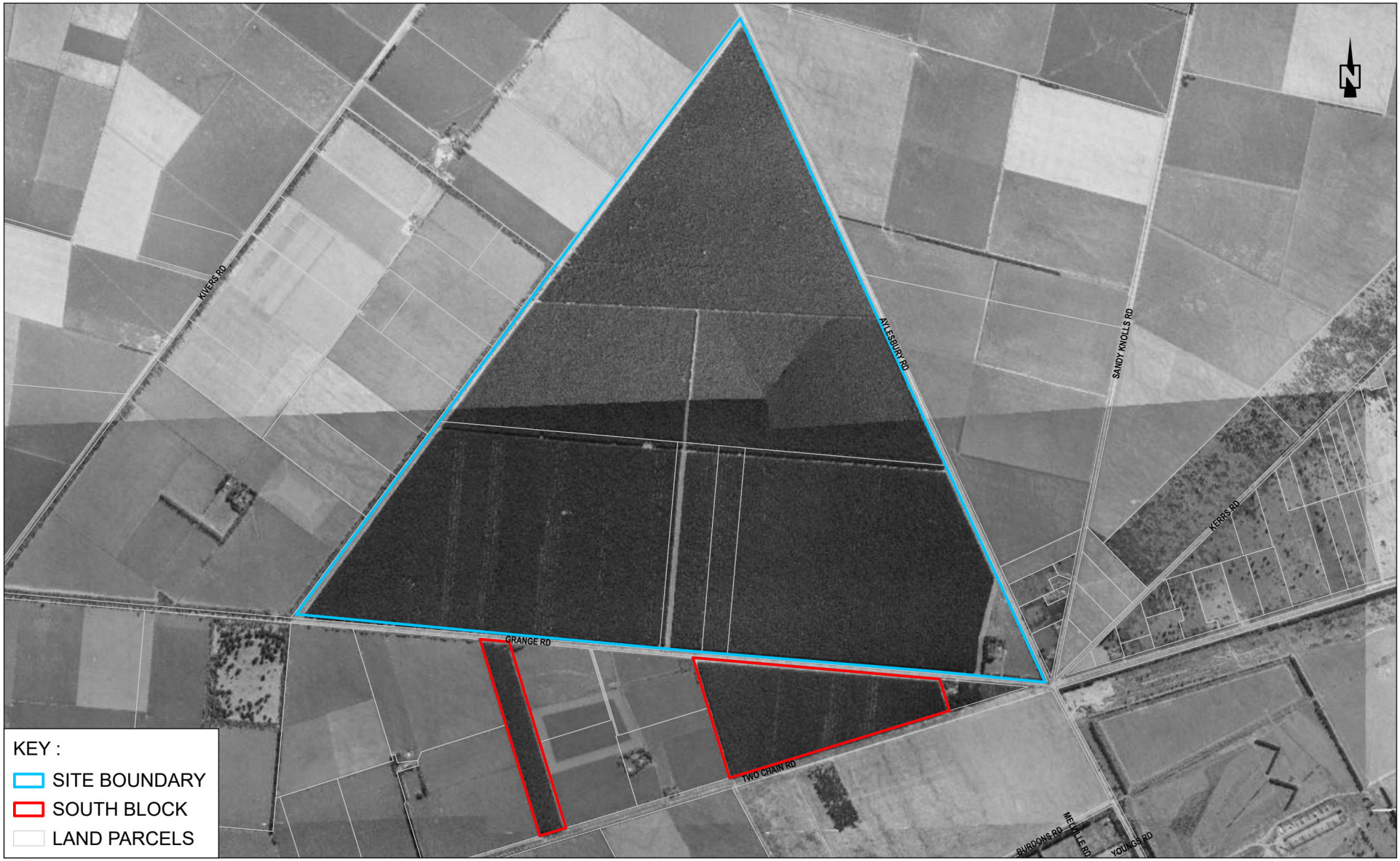
AERIAL PHOTOGRAPH: 1942

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES

C04096100.mxd 24/07/2023 ISSUE 1



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

AERIAL PHOTOGRAPH: 1962

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES

C04096100.mxd 24/07/2023 ISSUE 1



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

AERIAL PHOTOGRAPH: 1974

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

AERIAL PHOTOGRAPH: 1982

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES



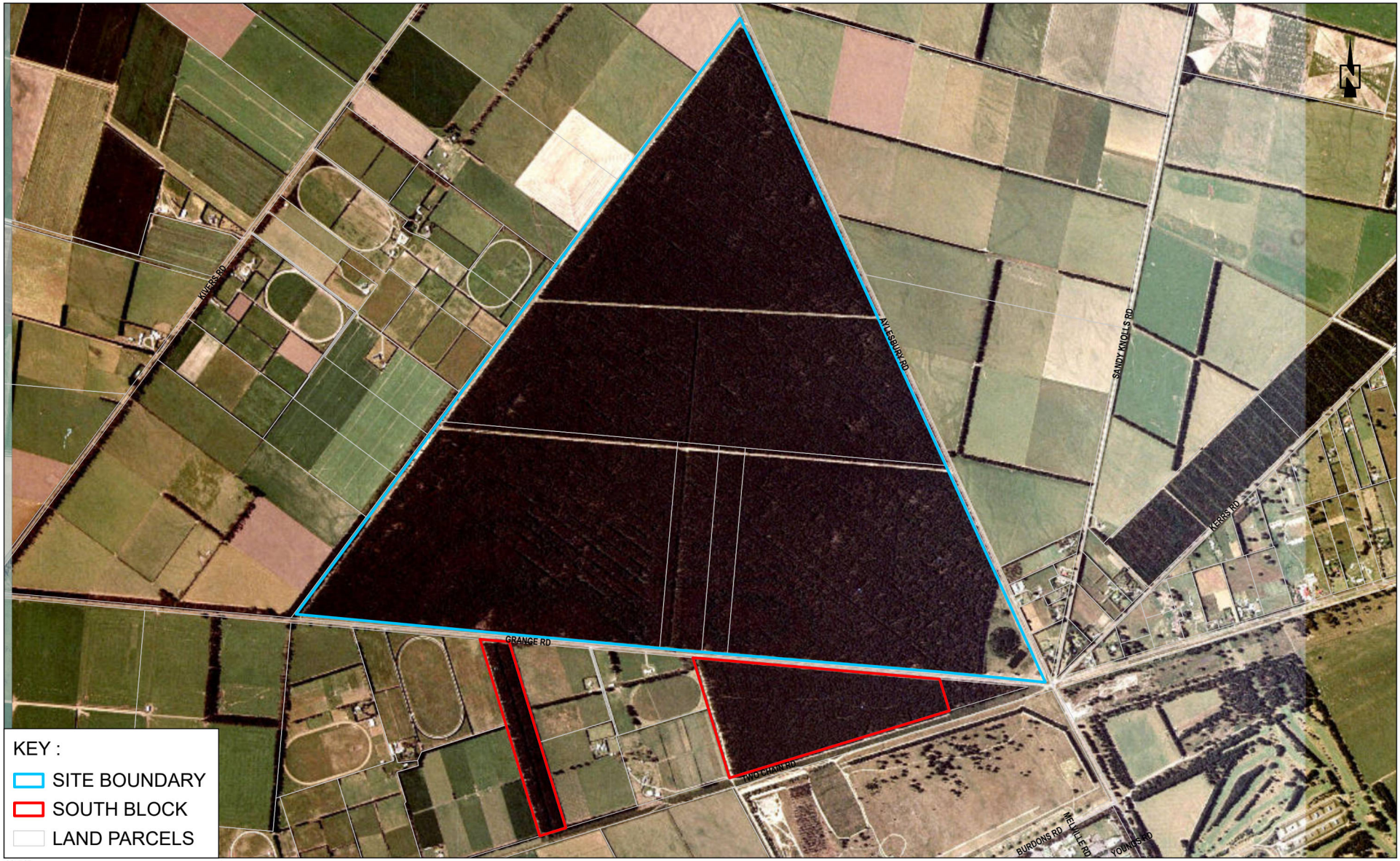
SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

AERIAL PHOTOGRAPH: 1994

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

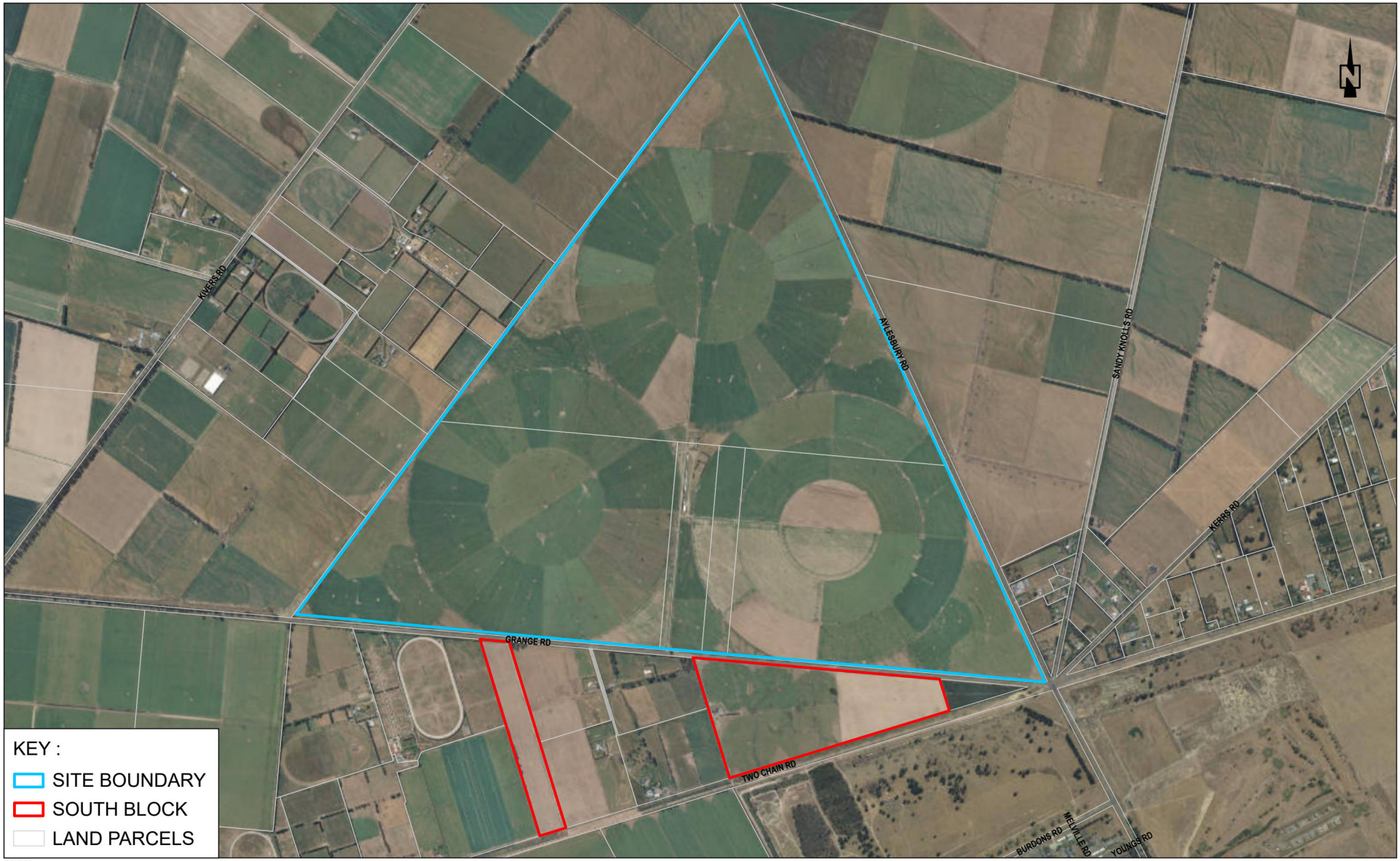
AERIAL PHOTOGRAPH: 2000

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES

BURNHAM 2020 LTD - BURNHAM QUARRY



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

AERIAL PHOTOGRAPH: 2015-16

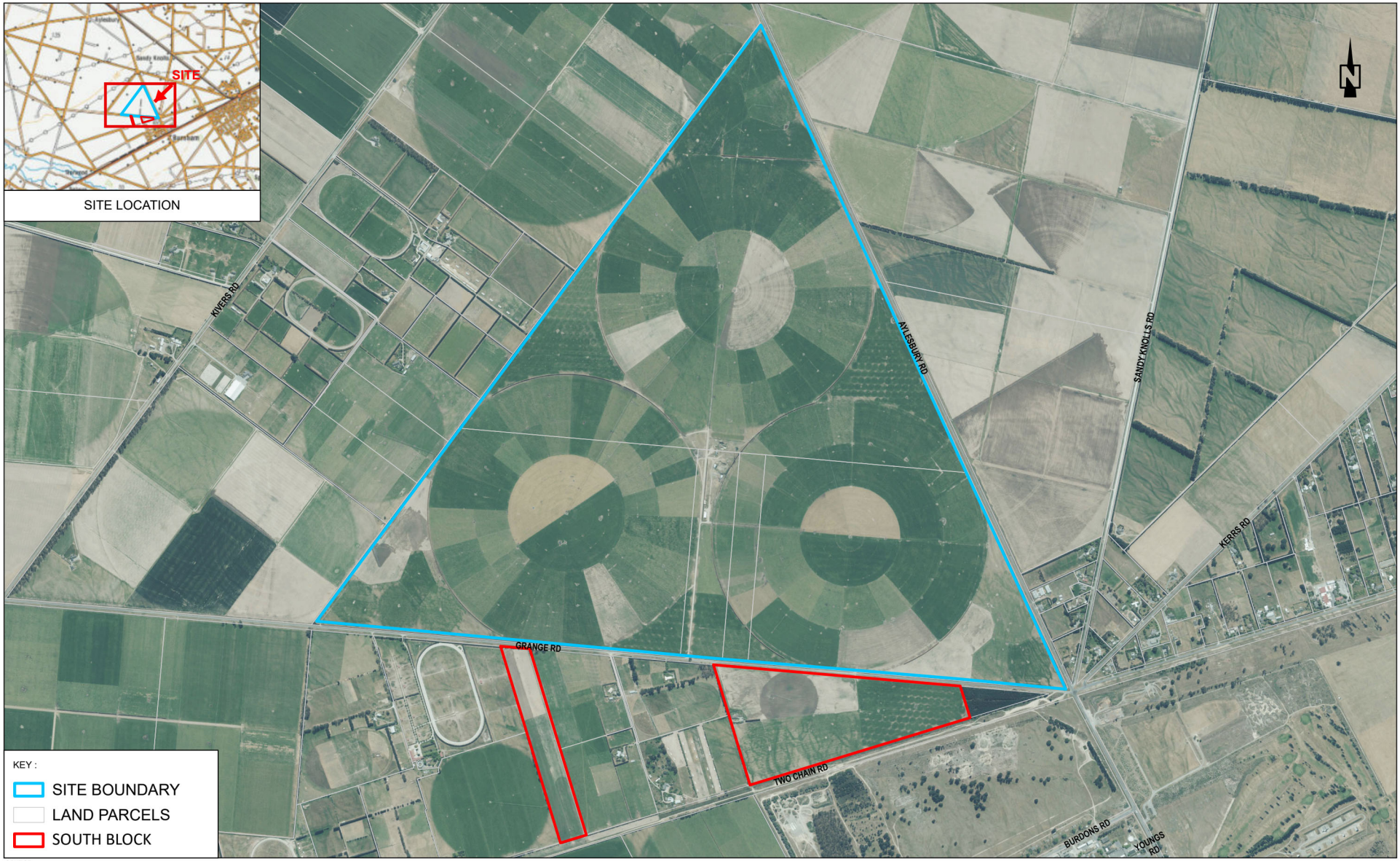
SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES

C04096100.mxd 23/07/2023 ISSUE 1

PATTLE DELAMORE PARTNERS LTD



SOURCE:
1. AERIAL IMAGERY SOURCED FROM CANTERBURY MAPS.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
3. BORE INFORMTION PROVIDED BY ENVIRONMENT CANTERBURY AND USED WITH PERMISSION.

AERIAL PHOTOGRAPH: 2020

SCALE : 1:20,000 (A4)

0 250 500

METRES

BURNHAM 2020 LTD - BURNHAM QUARRY



SOURCE:
1. AERIAL IMAGERY SOURCED FROM LINZ.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
3. BORE INFORMTION PROVIDED BY ENVIRONMENT CANTERBURY AND USED WITH PERMISSION.

AERIAL PHOTOGRAPH: 2022

SCALE : 1:20,000 (A4)

0 250 500

METRES

PATTLE DELAMORE PARTNERS LTD

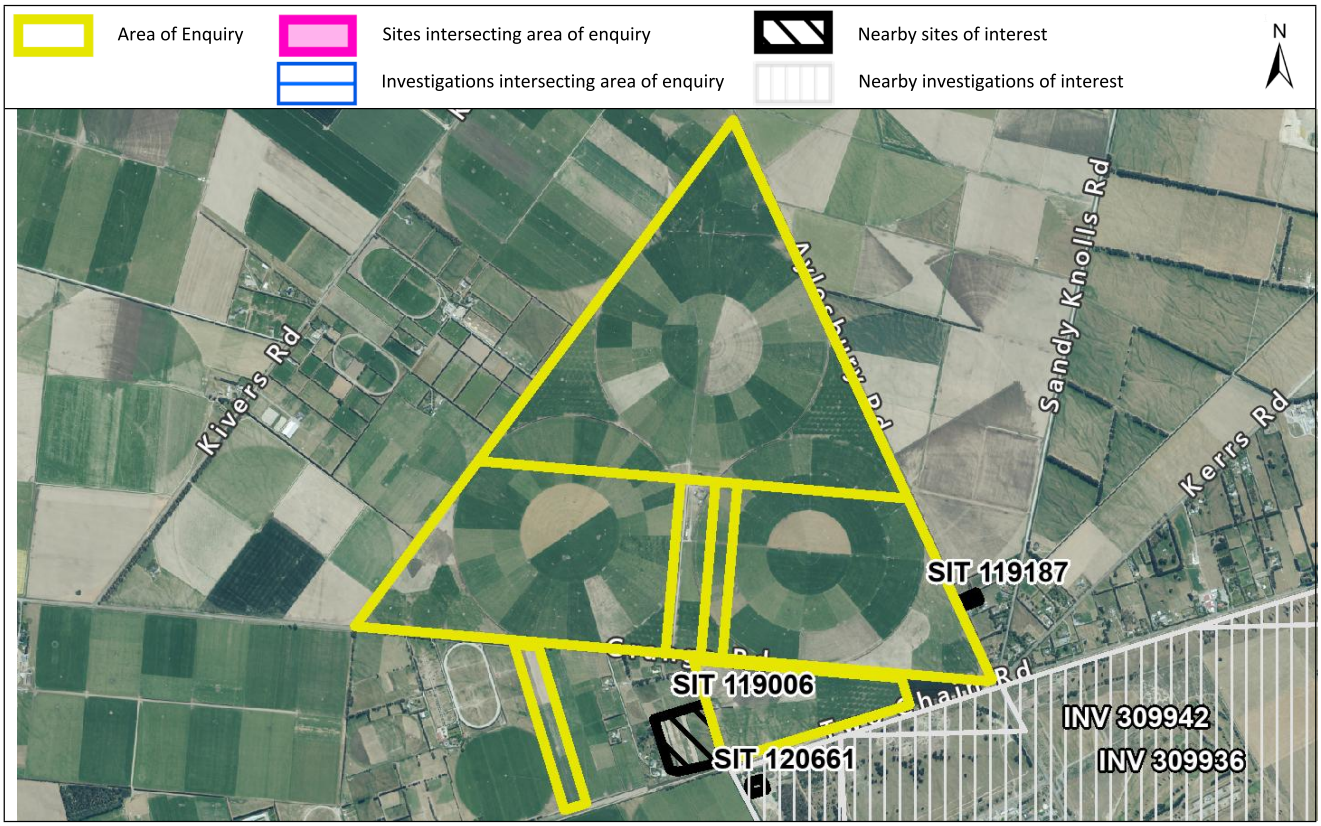
C04096100.mxd 24/07/2023 ISSUE 1

Appendix E: Environment Canterbury Listed Land Use Register

Property Statement
from the Listed Land Use Register

Visit ecan.govt.nz/HAIL for more information or
contact Customer Services at ecan.govt.nz/contact/ and quote ENQ349144

Date generated: 13 July 2023
Land parcels: RS 27777
RS 27724
RS 19387
RS 25412
RS 27725
RS 27776
RS 27862



The information presented in this map is specific to the area within a 200m radius of property you have selected. Information on properties outside the serach radius may not be shown on this map, even if the property is visible.

Sites at a glance

Sites within enquiry area

Site number	Name	Location	HAIL activity(s)	Category

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry only.

Nearby sites

Site number	Name	Location	HAIL activity(s)	Category
119006	177 Grange Rd	177 Grange Rd	A10 - Persistent pesticide bulk storage or use;	Not Investigated
119187	168 Aylesbury Rd	168 Aylesbury Rd	A10 - Persistent pesticide bulk storage or use;	Not Investigated
120661	RES 1176, Burnham	RES 1176, Burnham	G3 - Landfill sites;	Not Investigated

Please note that the above table represents a summary of sites and HAILs intersecting the area of enquiry within a 200m buffer.

More detail about the sites

Site 119006: 177 Grange Rd (Within 200m of enquiry area.)

Category: Not Investigated
Definition: Verified HAIL has not been investigated.

Location: 177 Grange Rd
Legal description(s): Lot 3 DP 55816

HAIL activity(s):

Period from	Period to	HAIL activity
1994	2005	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

5 Nov 2014 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

5 Nov 2014 Vineyard

5 Nov 2014 Area defined from 1994 to 2005 aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.

5 Nov 2014 Area defined from 1994 to 2005 aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Site 119187: 168 Aylesbury Rd (Within 200m of enquiry area.)

Category: Not Investigated
Definition: Verified HAIL has not been investigated.

Location: 168 Aylesbury Rd
Legal description(s): Lot 3 DP 21748

HAIL activity(s):

Period from	Period to	HAIL activity
2000	Present	Persistent pesticide bulk storage or use including sports turfs, market gardens, orchards, glass houses or spray sheds

Notes:

5 Nov 2014 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

5 Nov 2014 Greenhouse and tunnel house

5 Nov 2014 Area defined from 2000 to present aerial photographs. Horticultural activities (persistent pesticides) were noted in aerial photographs reviewed.

Investigations:

There are no investigations associated with this site.

Site 120661: RES 1176, Burnham (Within 200m of enquiry area.)

Category: Not Investigated
Definition: Verified HAIL has not been investigated.

Location: RES 1176, Burnham
Legal description(s): RES 1176

HAIL activity(s):

Period from	Period to	HAIL activity
1994	Present	Landfill sites

Notes:

7 Jan 2016 This record was created as part of the Selwyn District Council 2015 HAIL identification project.

7 Jan 2016 Area defined from 1994 to present aerial photographs. A landfill site was noted in aerial photographs reviewed.

Investigations:

INV 309942 **PFAS Preliminary Site Investigation: Burnham Military Camp**
Pattle Delamore Partners Ltd - Preliminary Site Investigation
1 May 2019

Summary of investigation(s):

Environment Canterbury has received a Preliminary Site Investigation report that includes all or part of the property you have selected.

A Preliminary Site Investigation seeks to identify potential sources of contamination resulting from current and historical land uses.

The preliminary site investigation may not have found any potential sources of contamination on the property you have enquired about. Where potential sources of contamination have been identified, a site identification number (e.g. SIT 1234) and land uses from the Hazardous Activities and Industries List (HAIL) will be shown on your statement.

This investigation has not been summarised.

Nearby investigations of interest

INV 309936 **NZDF HAIL Investigation Report**
ENGEO - Preliminary Site Investigation
1 Mar 2018

Summary of investigation(s):

Environment Canterbury has received a Preliminary Site Investigation report that includes all or part of the property you have selected.

A Preliminary Site Investigation seeks to identify potential sources of contamination resulting from current and historical land uses.

The preliminary site investigation may not have found any potential sources of contamination on the property you have enquired about. Where potential sources of contamination have been identified, a site identification number (e.g. SIT 1234) and land uses from the Hazardous Activities and Industries List (HAIL) will be shown on your statement.

This investigation has not been summarised.

Disclaimer

The enclosed information is derived from Environment Canterbury's Listed Land Use Register and is made available to you under the Local Government Official Information and Meetings Act 1987.

The information contained in this report reflects the current records held by Environment Canterbury regarding the activities undertaken on the site, its possible contamination and based on that information, the categorisation of the site. Environment Canterbury has not verified the accuracy or completeness of this information. It is released only as a copy of Environment Canterbury's records and is not intended to provide a full, complete or totally accurate assessment of the site. It is provided on the basis that Environment Canterbury makes no warranty or representation regarding the reliability, accuracy or completeness of the information provided or the level of contamination (if any) at the relevant site or that the site is suitable or otherwise for any particular purpose. Environment Canterbury accepts no responsibility for any loss, cost, damage or expense any person may incur as a result of the use, reference to or reliance on the information contained in this report.

Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

Appendix F: Environment Canterbury Resource Consent Information



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
5. RESOURCE CONSENT DATA PROVIDED BY ENVIRONMENT CANTERBURY AND USED WITH PERMISSION.

RESOURCE CONSENTS WITHIN 2 KM OF SITE BOUNDARY

SCALE : 1:22,500 (A3)

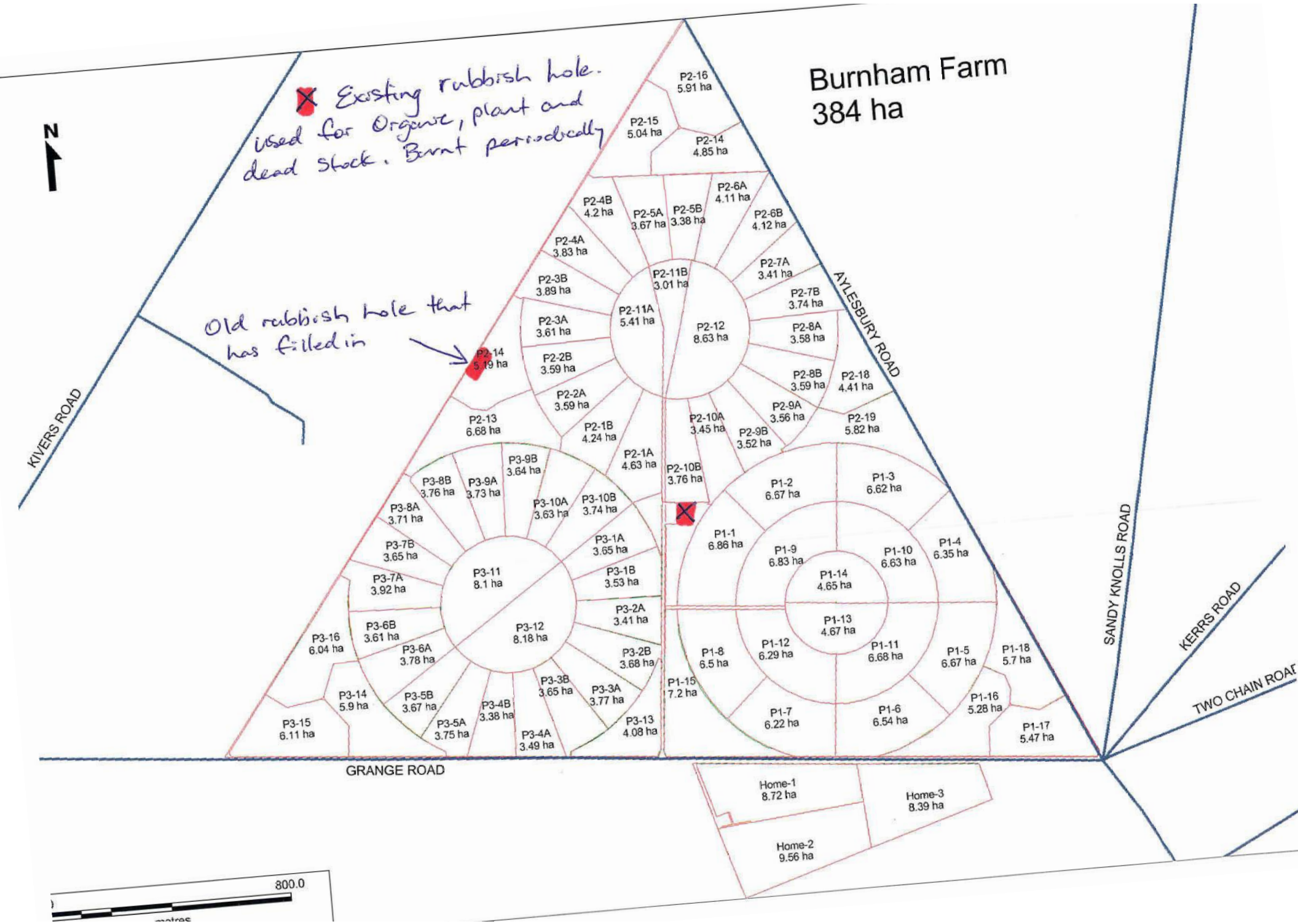
0 250 500 1,000 1,500
METRES

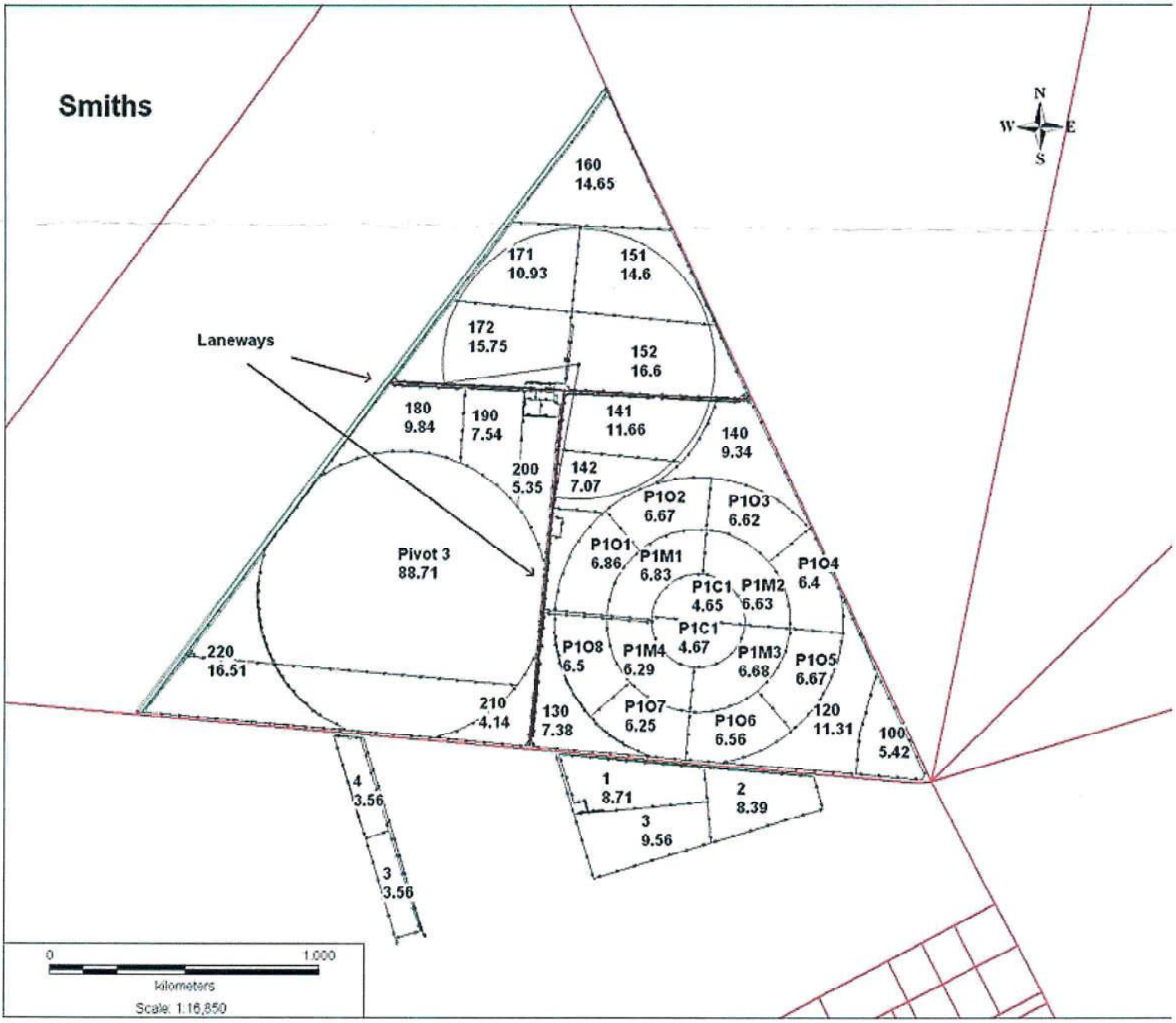
C04096100.mxd 23/07/2023 ISSUE 1

Resouce Consents Located within 2 Km of the site. (Sourced from ECan GIS Database in July 2023).

	Consent No.	Consent Type	Consent Status	Feature Type	Activity Text	Holder Name	Location	From Date	To Date
1	CRC062825.2	Water Permit (s14)	Issued - s124 Continuance	Water Take/Use	Take Groundwater	Road Metals Holdings Limited	Kerrs Road & Wards Road, BURNHAM	March 16, 2012	January 1, 9999
2	CRC110672	Land Use Consent (s9)	Issued - Active	Deposition Area	Deposit Substance	Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
3	CRC201418	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr M J & Mrs S E Thomas	Grange Road, Burnham	October 16, 2019	August 30, 2028
4	CRC213896	Water Permit (s14)	Issued - Active	Water Take/Use		New Zealand Defence Force	Burnham Military Camp, Burnham	March 3, 2021	January 31, 2035
5	CRC155796	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Mr B C & Mrs J H Geddes	171 Kivers Road, Burnham, RS 28109	March 11, 2015	
6	CRC133429	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Cameron Glen Woods	Two Chain Road, Burnham Lot 2 DP 438559	January 14, 2013	
7	CRC222635	Water Permit (s14)	Application on Hold	General Location		Burnham 2020 Limited	Corner of Aylesbury Road and Grange Road, Burnham		
8	CRC155793	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Mr B C & Mrs J H Geddes	171 Kivers Road, Burnham, RS 28109	March 11, 2015	
9	CRC173525	Certif of Compliance (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Mr M R & Mrs C J Cooper	536 Wards Road, Rolleston	November 23, 2016	
10	CRC195187	Discharge Permit (s15)	Issued - Inactive	Stormwater Residential		New Zealand Defence Force	Aylesbury Road, Burnham	July 9, 2019	July 9, 2024
11	CRC960786	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Richard Stuart James Trewavas	Kivers Road, BURNHAM	December 8, 1995	November 29, 2030
12	CRC182289	Water Permit (s14)	Issued - Active	Groundwater Take		Ziwi Limited	450 Two Chain Rd, BURNHAM	November 28, 2017	February 25, 2038
13	CRC201418	Water Permit (s14)	Issued - Active	Groundwater Take		Mr M J & Mrs S E Thomas	Grange Road, Burnham	October 16, 2019	August 30, 2028
14	CRC160104	Discharge Permit (s15)	Issued - Active	Dairy Effluent	Discharge Contaminant into Land to Water	Mr B C & Mrs J H Geddes & Mr J I G Cooke	171 Kivers Road, BURNHAM	June 30, 2015	October 31, 2027
15	CRC916650	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Messrs W D, S D & L G Glass	Sandy Knolls Road, Wards Road, Selwyn Plantation, BURNHAM	December 8, 1993	December 2, 2028
16	CRC222536	Water Permit (s14)	Issued - s124 Continuance	Water Take/Use	Take Groundwater	Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	November 23, 2021	January 1, 9999
17	CRC110815	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Road Metals Company Limited	Wards Road, BURNHAM	December 2, 2010	
18	CRC070501	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Mr G D McNeill & Ms A K R Hunter	40 Kerrs Road, BURNHAM	October 2, 2006	
19	CRC211454	Discharge Permit (s15)	Issued - Active	Stormwater Industrial	Discharge Contaminant into Land to Water	New Zealand Defence Force	Burnham Military Camp, 1 Powles Road, Burnham	June 4, 2021	June 4, 2046
20	CRC061111	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Hilary May Coffey	Two Chain Road, BURNHAM	October 5, 2005	
21	CRC157077	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr M P Jones & Sardinero Trustees (2010)	259 Grange Road, BURNHAM	October 29, 2015	June 26, 2038
22	CRC110676	Discharge Permit (s15)	Issued - Active	Contaminated Water	Discharge Contaminant onto Land to Water	Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
23	CRC141055	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	John William Sandford	500 Two Chain Road, Burnham, Lot 1 DP 440398	August 14, 2013	
24	CRC211454	Discharge Permit (s15)	Issued - Active	Discharge Area		New Zealand Defence Force	Burnham Military Camp, 1 Powles Road, Burnham	June 4, 2021	June 4, 2046
25	CRC220897	Water Permit (s14)	Application on Hold	Water Take/Use	Take Groundwater	Burnham Farm Limited	Cnr Aylesbury Road and Grange Road, BURNHAM		
26	CRC194802	Land Use Consent (s9)	Issued - Active	Farm	Farming	Ribbonwood Farms Limited	449 Grange Road, Burnham	July 19, 2019	July 19, 2034
27	CRC083022	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Timothy Peter Charman	82 Kerrs Road, BURNHAM	February 19, 2008	
28	CRC171927	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Gavin James Pankhurst	Wards Road, Aylesbury	September 20, 2016	June 13, 2039
29	CRC131273	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Mr B J & Mrs G Woods	Grange Road, BURNHAM	March 14, 2013	September 25, 2031
30	CRC110673	Land Use Consent (s9)	Issued - Active	Hazardous Storage	Use Land	Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
31	CRC222536	Water Permit (s14)	Issued - s124 Continuance	Water Take/Use	Take Groundwater	Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	November 23, 2021	January 1, 9999
32	CRC194957	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr & Mrs S G & D J Lill	Wards Road, Rolleston	May 21, 2020	May 21, 2035
33	CRC161180	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr B R H & Mrs A M Fechney & Mr B C & N	171 Kivers Road, Burnham	September 8, 2015	May 31, 2036
34	CRC194957	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Mr & Mrs S G & D J Lill	Wards Road, Rolleston	May 21, 2020	May 21, 2035
35	CRC110678	Discharge Permit (s15)	Issued - Active	Stormwater Industrial	Discharge Contaminant into Land to Water	Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
36	CRC190012	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr T P & Mrs S L Neale	Cnr Wards & Sandy Knolls Roads, ROLLESTON	June 14, 2018	August 9, 2030
37	CRC195187	Discharge Permit (s15)	Issued - Inactive	Stormwater Collection Are	Discharge Contaminant onto Land to Water	New Zealand Defence Force	Aylesbury Road, Burnham	July 9, 2019	July 9, 2024
38	CRC110672	Land Use Consent (s9)	Issued - Active	Cleanfill/Quarry		Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
39	CRC211453	Discharge Permit (s15)	Issued - Active	Stormwater Industrial		New Zealand Defence Force	Burnham Military Camp, 1 Powles Road, Burnham	June 4, 2021	June 4, 2046
40	CRC204338	Discharge Permit (s15)	Issued - Active	Discharge Area		Ziwi Limited	450 Two Chain Rd, Burnham	June 4, 2020	January 30, 2038
41	CRC101077	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Lauraine Frampton	Kivers Road, AYLESBURY	September 30, 2009	
42	CRC201418	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Mr M J & Mrs S E Thomas	Grange Road, Burnham	October 16, 2019	August 30, 2028
43	CRC042434.1	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Robert John Bell	Kivers Road, BURNHAM	July 8, 2011	January 30, 2041
44	CRC960786	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Richard Stuart James Trewavas	Kivers Road, BURNHAM	December 8, 1995	November 29, 2030
45	CRC110678	Discharge Permit (s15)	Issued - Active	Stormwater Collection Are	Discharge Contaminant into Land to Water	Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
46	CRC111574	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	John William Sandford	500 Two Chain Road, BURNHAM	May 4, 2011	
47	CRC157078	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr M J & Mrs S E Thomas	Grange Road, Burnham	October 29, 2015	June 26, 2038
48	CRC211455	Land Use Consent (s9)	Issued - Active	Disturb or Excavate Land		New Zealand Defence Force	Burnham Military Camp, 1 Powles Road, Burnham	June 4, 2021	June 4, 2046
49	CRC157077	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Mr M P Jones & Sardinero Trustees (2010)	259 Grange Road, BURNHAM	October 29, 2015	June 26, 2038
50	CRC213896	Water Permit (s14)	Issued - Active	Water Take/Use		New Zealand Defence Force	Burnham Military Camp, Burnham	March 3, 2021	January 31, 2035
51	CRC130668	Discharge Permit (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Darryle Herridge	170 Kerrs Road, Burnham	October 31, 2012	October 31, 2027
52	CRC152894	Land Use Consent (s9)	Issued - Active	Hazardous Storage	Use Land	Road Metals Company Limited	Wards Road, BURNHAM	November 13, 2014	November 13, 2049
53	CRC204646	Discharge Permit (s15)	Issued - Active	Stormwater Industrial	Discharge Contaminant into Land to Water	A H & Company Limited	450 Two Chain Road, Burnham	June 24, 2020	June 24, 2045
54	CRC131273	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr B J & Mrs G Woods	Grange Road, BURNHAM	March 14, 2013	September 25, 2031
55	CRC150795	Land Use Consent (s9)	Issued - Active	Disturb or Excavate Land	Excavate Material	Road Metals Company Limited	Wards Road, BURNHAM	August 25, 2014	May 27, 2048
56	CRC171927	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Gavin James Pankhurst	Wards Road, Aylesbury	September 20, 2016	June 13, 2039
57	CRC053697	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Mr & Ms D L & P J MacDonald & Frew	Two Chain Road, ROLLESTON	February 21, 2004	
58	CRC220897	Water Permit (s14)	Application on Hold	Irrigation Area	Take Groundwater	Burnham Farm Limited	Cnr Aylesbury Road and Grange Road, BURNHAM		
59	CRC110771	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Gavin James Pankhurst	718 Wards Road, ROLLESTON	November 26, 2010	
60	CRC211134	Land Use Consent (s9)	Issued - Active	Farm	Farming	Maatua Hou Limited	214 Kivers Road, Burnham	September 3, 2020	August 21, 2035
61	CRC916650	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Messrs W D, S D & L G Glass	Sandy Knolls Road, Wards Road, Selwyn Plantation, BURNHAM	December 8, 1993	December 2, 2028
62	CRC132812	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Road Metals Holdings Limited	Kerrs Road, Burnham, Lot 6 DP 440446	December 10, 2012	
63	CRC110675	Discharge Permit (s15)	Issued - Active	Cleanfill/Quarry		Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
64	CRC221642	Water Permit (s14)	Issued - s124 Continuance	Water Take/Use		Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	October 21, 2021	January 1, 9999
65	CRC171927	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Gavin James Pankhurst	Wards Road, Aylesbury	September 20, 2016	June 13, 2039
66	CRC190143	Land Use Consent (s9)	Issued - Active	Farm	Farming	Brian Ronald Hugh Fechney	171 Kivers Road, Burnham	August 23, 2018	August 23, 2033
67	CRC152588	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Mr D S & Mrs N L Barton	273 Grange Rd, Burnham, Selwyn, Lot 1 DP 30373	October 13, 2014	
68	CRC211138	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Maatua Hou Limited	214 Kivers Road, Christchurch	September 3, 2020	July 1, 2032
69	CRC163879	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr S N & Mrs D J Pankhurst & Mr G C Brow	Wards Road, AYLESBURY	November 10, 2015	June 13, 2039
70	CRC220897	Water Permit (s14)	Application on Hold	Water Take/Use	Take Groundwater	Burnham Farm Limited	Cnr Aylesbury Road and Grange Road, BURNHAM		
71	CRC071145	Land Use Consent (s9)	Issued - Active	Deposition Area	Deposit Substance	Mr B J & Mrs G Woods	Grange Road, BURNHAM	August 24, 2007	August 21, 2042
72	CRC194957	Water Permit (s14)	Issued - Active	Groundwater Take		Mr & Mrs S G & D J Lill	Wards Road, Rolleston	May 21, 2020	May 21, 2035
73	CRC180997	Discharge Permit (s15)	Issued - Active	Dairy Effluent	Discharge Contaminant into Land to Water	Mr B J & Mrs G Woods	Grange Road, BURNHAM	September 19, 2017	April 1, 2045
74	CRC190012	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Mr T P & Mrs S L Neale	Cnr Wards & Sandy Knolls Roads, ROLLESTON	June 14, 2018	August 9, 2030
75	CRC195375	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr S N & Mrs D J Pankhurst & Mr G C Brow	658 Wards Road, Burnham	February 25, 2020	February 25, 2035
76	CRC222536	Water Permit (s14)	Issued - s124 Continuance	Water Take/Use	Take Groundwater	Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	November 23, 2021	January 1, 9999
77	CRC062639.1	Discharge Permit (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Ms L T Whiteside & Mr C W Ahradsen	358 Two Chain Road, ROLLESTON	March 5, 2010	February 14, 2041
78	CRC182289	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Ziwi Limited	450 Two Chain Rd, BURNHAM	November 28, 2017	February 25, 2038
79	CRC167226	Land Use Consent (s13)	Issued - Active	General Location		Central Plains Water Trust	Kowai/Hawkins/Hororata/Selwyn/Waikirikiri/Waianiwaniwa Rvr	June 17, 2016	July 25, 2047
80	CRC220897	Water Permit (s14)	Application on Hold	Water Take/Use	Take Groundwater	Burnham Farm Limited	Cnr Aylesbury Road and Grange Road, BURNHAM		
81	CRC101077	Permitted Activity (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Lauraine Frampton	Kivers Road, AYLESBURY	September 30, 2009	
82	CRC190415	Discharge Permit (s15)	Issued - Active	Discharge Point		Freshpork New Zealand Limited	182 Kerrs Road, Burnham	September 6, 2018	September 6, 2033
83	CRC143414	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	New Zealand Defence Force	Burnham Military Camp, BURNHAM	January 22, 2014	January 31, 2035
84	CRC150795	Land Use Consent (s9)	Issued - Active	Mineral Extraction Area	Excavate Material	Road Metals Company Limited	Wards Road, BURNHAM	August 25, 2014	May 27, 2048
85	CRC220897	Water Permit (s14)	Application on Hold	Water Take/Use	Take Groundwater	Burnham Farm Limited	Cnr Aylesbury Road and Grange Road, BURNHAM		
86	CRC153833	Permitted Activity (s15)	Issued - Inactive	Human Effluent	Discharge Contaminant into Land to Water	Dave Patterson	Kivers Road, Burnham, Lot 1 DP 71233	November 27, 2014	
87	CRC180997	Discharge Permit (s15)	Issued - Active	Discharge Point		Mr B J & Mrs G Woods	Grange Road, BURNHAM	September 19, 2017	April 1, 2045
88	CRC211138	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Maatua Hou Limited	214 Kivers Road, Christchurch	September 3, 2020	July 1, 2032
89	CRC157078	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Mr M J & Mrs S E Thomas	Grange Road, Burnham	October 29, 2015	June 26, 2038
90	CRC960198.3	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Stuart Norman Pankhurst	Wards Road, BURNHAM	September 9, 2011	September 13, 2030
91	CRC080708.1	Discharge Permit (s15)	Issued - Active	Human Effluent	Discharge Contaminant into Land to Water	Charwill Limited	Kivers Road, BURNHAM	June 15, 2010	October 25, 2042
92	CRC211453	Discharge Permit (s15)	Issued - Active	Discharge Area		New Zealand Defence Force	Burnham Military Camp, 1 Powles Road, Burnham	June 4, 2021	June 4, 2046
93	CRC222536	Water Permit (s14)	Issued - s124 Continuance	Irrigation Area	Take Groundwater	Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	November 23, 2021	January 1, 9999
94	CRC213896	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	New Zealand Defence Force	Burnham Military Camp, Burnham	March 3, 2021	January 31, 2035
95	CRC213807	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr S J & Mrs A K Blakely	176 Kivers Road, BURNHAM	February 11, 2021	January 26, 2029
96	CRC042434.1	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Robert John Bell	Kivers Road, BURNHAM	July 8, 2011	January 30, 2041
97	CRC171927	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Gavin James Pankhurst	Wards Road, Aylesbury	September 20, 2016	June 13, 2039
98	CRC211455	Land Use Consent (s9)	Issued - Active	Disturb or Excavate Land		New Zealand Defence Force	Burnham Military Camp, 1 Powles Road, Burnham	June 4, 2021	June 4, 2046
99	CRC110675	Discharge Permit (s15)	Issued - Active	Cleanfill/Quarry	Discharge Contaminant into Air	Road Metals Company Limited	Wards Road, BURNHAM	May 27, 2013	May 27, 2048
100	CRC222536	Water Permit (s14)	Issued - s124 Continuance	Irrigation Area	Take Groundwater	Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	November 23, 2021	January 1, 9999
101	CRC131273	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Mr B J & Mrs G Woods	Grange Road, BURNHAM	March 14, 2013	September 25, 2031
102	CRC222536	Water Permit (s14)	Issued - s124 Continuance	Water Take/Use	Take Groundwater	Burnham 2020 Limited	Cnr Aylesbury Road and Grange Road, BURNHAM	November 23, 2021	January 1, 9999
103	CRC916329	Discharge Permit (s15)	Issued - Active	Piggery Effluent	Discharge Contaminant onto Land to Water	Messrs W D, S D & L G Glass	Sandy Knolls Road, Wards Road, Selwyn Plantation, BURNHAM	September 3, 1999	September 3, 2024
104	CRC235258	Water Permit (s14)	Issued - Active	Irrigation Area	Take Groundwater	Grass Gobblers Limited	Two Chain Road, BURNHAM	June 6, 2023	January 31, 2035
105	CRC235258	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Grass Gobblers Limited	Two Chain Road, BURNHAM	June 6, 2023	January 31, 2035
106	CRC240114	Water Permit (s14)	Issued - Active	Water Take/Use	Take Groundwater	Aylesbury Dairy Limited	Aylesbury Road	June 30, 2023	January 26, 2029

Appendix G: Anecdotal Information


Burnham Farm
384 ha
N
Existing rubbish hole.
used for Organic, plant and
dead stock. Burnt periodically
Old rubbish hole that
has filled in
KIVERS ROAD
AYLESBURY ROAD
SANDY KNOLLS ROAD
KERRS ROAD
TWO CHAIN ROAD
GRANGE ROAD
P2-16 5.91 ha
P2-15 5.04 ha
P2-14 4.85 ha
P2-6A 4.11 ha
P2-4B 4.2 ha
P2-5A 3.67 ha
P2-5B 3.38 ha
P2-6B 4.12 ha
P2-4A 3.83 ha
P2-7A 3.41 ha
P2-3B 3.89 ha
P2-11B 3.01 ha
P2-7B 3.74 ha
P2-11A 5.41 ha
P2-12 8.63 ha
P2-3A 3.61 ha
P2-8A 3.58 ha
P2-14 5.19 ha
P2-2B 3.59 ha
P2-8B 3.59 ha
P2-18 4.41 ha
P2-2A 3.59 ha
P2-9A 3.56 ha
P2-13 6.68 ha
P2-1B 4.24 ha
P2-10A 3.45 ha
P2-19 5.82 ha
P2-9B 3.52 ha
P2-1A 4.63 ha
P2-10B 3.76 ha
P3-9B 3.64 ha
P1-2 6.67 ha
P1-3 6.62 ha
P3-8B 3.76 ha
P3-9A 3.73 ha
P3-10A 3.63 ha
P3-10B 3.74 ha
P3-8A 3.71 ha
P1-1 6.86 ha
P1-4 6.35 ha
P3-1A 3.65 ha
P1-9 6.83 ha
P1-10 6.63 ha
P3-7B 3.65 ha
P3-11 8.1 ha
P1-14 4.65 ha
P3-1B 3.53 ha
P3-7A 3.92 ha
P3-2A 3.41 ha
P1-13 4.67 ha
P3-16 6.04 ha
P3-6B 3.61 ha
P3-12 8.18 ha
P1-8 6.5 ha
P1-12 6.29 ha
P1-11 6.68 ha
P1-5 6.67 ha
P1-18 5.7 ha
P3-6A 3.78 ha
P3-2B 3.68 ha
P3-3B 3.65 ha
P3-3A 3.77 ha
P1-15 7.2 ha
P3-14 5.9 ha
P3-5B 3.67 ha
P3-4B 3.38 ha
P1-16 5.28 ha
P3-15 6.11 ha
P3-5A 3.75 ha
P3-4A 3.49 ha
P3-13 4.08 ha
P1-7 6.22 ha
P1-6 6.54 ha
P1-17 5.47 ha
Home-1 8.72 ha
Home-3 8.39 ha
Home-2 9.56 ha
800.0


Smiths
N
W
E
S
160
14.65
171
10.93
151
14.6
172
15.75
152
16.6
Laneways
180
9.84
190
7.54
141
11.66
140
9.34
200
5.35
142
7.07
P1O2
6.67
P1O3
6.62
P1O1
6.86
P1M1
6.83
P1O4
6.4
Pivot 3
88.71
P1C1
4.65
P1M2
6.63
P1C1
4.67
220
16.51
P1O8
6.5
P1M4
6.29
P1M3
6.68
P1O5
6.67
210
4.14
130
7.38
P1O7
6.25
P1O6
6.56
120
11.31
100
5.42
4
3.56
1
8.71
2
8.39
3
9.56
3
3.56
0
1,000
Kilometers
Scale: 1:16,850

Appendix H: Results Tables

Analytica Laboratories Limited
Ruakura Research Centre
10 Bisley Road
Hamilton 3214, New Zealand
Ph +64 (07) 974 4740
sales@analytica.co.nz
www.analytica.co.nz

Certificate of Analysis

Pattle Delamore Partners Ltd
at Level 2, Grant Thornton House
Christchurch 8011
Attention: Kay Higginbotham
Phone: 0275353133
Email: edward.cromwell@pdp.co.nz

Lab Reference: 20-03730
Submitted by: Kay Higginbotham
Date Received: 31/01/2020
Date Completed: 4/02/2020
Order Number:
Reference: C04096700

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.

Heavy Metals in Soil

Client Sample ID			SS01	SS02	SS03	SS04	SS05
Date Sampled							
Analyte	Unit	*Reporting Limit*	20-03730-1	20-03730-2	20-03730-3	20-03730-4	20-03730-5
Arsenic	mg/kg dry wt	*0.125*	2.7	2.8	2.7	3.2	3.3
Cadmium	mg/kg dry wt	*0.005*	0.11	0.12	0.067	0.082	0.066
Chromium	mg/kg dry wt	*0.125*	11	13.0	12	12	13.2
Copper	mg/kg dry wt	*0.075*	4.8	4.2	3.4	4.1	4.3
Lead	mg/kg dry wt	*0.25*	11.8	12.5	11.7	11.6	12.7
Nickel	mg/kg dry wt	*0.05*	6.50	6.31	6.13	7.13	7.50
Zinc	mg/kg dry wt	*0.05*	44.3	42.7	38.3	41.7	49.9

Heavy Metals in Soil

Client Sample ID			SS06	SS07	SS08	SS09	SS10
Date Sampled							
Analyte	Unit	*Reporting Limit*	20-03730-6	20-03730-7	20-03730-8	20-03730-9	20-03730-10
Arsenic	mg/kg dry wt	*0.125*	2.8	3.0	3.2	3.4	2.9
Cadmium	mg/kg dry wt	*0.005*	0.065	0.090	0.044	0.095	0.065
Chromium	mg/kg dry wt	*0.125*	12	13.7	13.4	13.1	12
Copper	mg/kg dry wt	*0.075*	4.6	5.1	4.6	4.5	5.2
Lead	mg/kg dry wt	*0.25*	11.8	12.7	12.6	12.4	11.5
Nickel	mg/kg dry wt	*0.05*	6.59	7.33	7.75	7.37	6.93
Zinc	mg/kg dry wt	*0.05*	44.8	40.3	45.3	48.8	49.5

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation, with the exception of tests marked *, which are not accredited.

This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories

Heavy Metals in Soil

Client Sample ID			SS11	SS12	SS13	SS14	SS15
Date Sampled							
Analyte	Unit	*Reporting Limit*	20-03730-11	20-03730-12	20-03730-13	20-03730-14	20-03730-15
Arsenic	mg/kg dry wt	*0.125*	3.1	3.0	3.4	2.8	2.8
Cadmium	mg/kg dry wt	*0.005*	0.064	0.065	0.046	0.076	0.046
Chromium	mg/kg dry wt	*0.125*	13.3	12.6	13.5	12.6	12
Copper	mg/kg dry wt	*0.075*	4.1	3.2	4.8	3.3	3.1
Lead	mg/kg dry wt	*0.25*	12.8	12.8	15.4	12.6	11.6
Nickel	mg/kg dry wt	*0.05*	7.52	7.66	8.45	7.22	6.57
Zinc	mg/kg dry wt	*0.05*	49.7	47.6	50.3	44.1	40.7

Organochlorine Pesticides - Soil

Client Sample ID			SS01	SS02	SS03	SS04	SS05
Date Sampled							
Analyte	Unit	*Reporting Limit*	20-03730-1	20-03730-2	20-03730-3	20-03730-4	20-03730-5
2,4'-DDD	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDE	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDT	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDD	mg/kg dry wt	*0.003*	<0.003	<0.003	<0.003	<0.003	<0.003
4,4'-DDE	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDT	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Total DDT	mg/kg dry wt	*0.02*	<0.02	<0.02	<0.02	<0.02	<0.02
alpha-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
beta-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Chlordane	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan I	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan II	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
gamma-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Methoxychlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
trans-nonachlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
trans-Chlordane	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	93.4	87.7	94.1	89.0	90.4

This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories

Organochlorine Pesticides - Soil

Client Sample ID			SS06	SS07	SS08	SS09	SS10
Date Sampled							
Analyte	Unit	*Reporting Limit*	20-03730-6	20-03730-7	20-03730-8	20-03730-9	20-03730-10
2,4'-DDD	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDE	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDT	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDD	mg/kg dry wt	*0.003*	<0.003	<0.003	<0.003	<0.003	<0.003
4,4'-DDE	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDT	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Total DDT	mg/kg dry wt	*0.02*	<0.02	<0.02	<0.02	<0.02	<0.02
alpha-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
beta-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Chlordane	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan I	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan II	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
gamma-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Methoxychlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
trans-nonachlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
trans-Chlordane	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	93.0	89.4	87.3	89.9	89.2

Organochlorine Pesticides - Soil

Client Sample ID			SS11	SS12	SS13	SS14	SS15
Date Sampled							
Analyte	Unit	*Reporting Limit*	20-03730-11	20-03730-12	20-03730-13	20-03730-14	20-03730-15
2,4'-DDD	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDE	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
2,4'-DDT	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDD	mg/kg dry wt	*0.003*	<0.003	<0.003	<0.003	<0.003	<0.003
4,4'-DDE	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
4,4'-DDT	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Total DDT	mg/kg dry wt	*0.02*	<0.02	<0.02	<0.02	<0.02	<0.02
alpha-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Aldrin	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
beta-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Chlordane	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
delta-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Dieldrin	mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan I	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Endosulfan II	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01

This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories

Organochlorine Pesticides - Soil

Client Sample ID			SS11	SS12	SS13	SS14	SS15
Date Sampled							
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Endrin	mg/kg dry wt	*0.05*	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
gamma-BHC	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.005	<0.005	<0.005	<0.005	<0.005
Methoxychlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
trans-nonachlor	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
trans-Chlordane	mg/kg dry wt	*0.01*	<0.01	<0.01	<0.01	<0.01	<0.01
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*	90.4	87.8	89.1	85.1	92.0

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

OCP in Soil Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).

Total DDT Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)



Emily Hanna, B.Sc.
Trace Elements Team Leader



Kimmy Ignacio, B.Sc.
Technician

This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories

Analytica Laboratories Limited
Ruakura Research Centre
10 Bisley Road
Hamilton 3214, New Zealand
Ph +64 (07) 974 4740
sales@analytica.co.nz
www.analytica.co.nz

Sample Receipt Report

Pattle Delamore Partners Ltd
at Level 2, Grant Thornton House
Christchurch 8011
Attention: Kay Higginbotham
Phone: 0275353133
Email: edward.cromwell@pdp.co.nz

Lab Reference: 20-03730
Submitted by: Kay Higginbotham
Date Registered: 31/01/2020
Date Due: 5/02/2020
Order Number:
Reference: C04096700

Sampling Site:

Note: The published due date is that of tests done internally, subcontracted tests are subject to the sub-contractor's turnaround times and may be reported on or following the due date indicated.

Summary of Samples

Laboratory ID	Client Sample Reference	Date Sampled	Depth	Sample Type	Condition On Arrival
20-03730-1	SS01			Soil	Acceptable
20-03730-2	SS02			Soil	Acceptable
20-03730-3	SS03			Soil	Acceptable
20-03730-4	SS04			Soil	Acceptable
20-03730-5	SS05			Soil	Acceptable
20-03730-6	SS06			Soil	Acceptable
20-03730-7	SS07			Soil	Acceptable
20-03730-8	SS08			Soil	Acceptable
20-03730-9	SS09			Soil	Acceptable
20-03730-10	SS10			Soil	Acceptable
20-03730-11	SS11			Soil	Acceptable
20-03730-12	SS12			Soil	Acceptable
20-03730-13	SS13			Soil	Acceptable
20-03730-14	SS14			Soil	Acceptable
20-03730-15	SS15			Soil	Acceptable

Summary of Testing

		7 Heavy Metals in Soil	OCP in Soil	Dry Sieve
20-03730-1	SS01	✓	✓	✓
20-03730-2	SS02	✓	✓	✓
20-03730-3	SS03	✓	✓	✓
20-03730-4	SS04	✓	✓	✓
20-03730-5	SS05	✓	✓	✓
20-03730-6	SS06	✓	✓	✓

Summary of Testing

		7 Heavy Metals in Soil	OCP in Soil	Dry Sieve
20-03730-7	SS07	✓	✓	✓
20-03730-8	SS08	✓	✓	✓
20-03730-9	SS09	✓	✓	✓
20-03730-10	SS10	✓	✓	✓
20-03730-11	SS11	✓	✓	✓
20-03730-12	SS12	✓	✓	✓
20-03730-13	SS13	✓	✓	✓
20-03730-14	SS14	✓	✓	✓
20-03730-15	SS15	✓	✓	✓

Heavy Metals in Soil

Testing Breakdown

		Arsenic	Cadmium	Chromium	Copper	Lead	Nickel	Zinc
20-03730-1	SS01	✓	✓	✓	✓	✓	✓	✓
20-03730-2	SS02	✓	✓	✓	✓	✓	✓	✓
20-03730-3	SS03	✓	✓	✓	✓	✓	✓	✓
20-03730-4	SS04	✓	✓	✓	✓	✓	✓	✓
20-03730-5	SS05	✓	✓	✓	✓	✓	✓	✓
20-03730-6	SS06	✓	✓	✓	✓	✓	✓	✓
20-03730-7	SS07	✓	✓	✓	✓	✓	✓	✓
20-03730-8	SS08	✓	✓	✓	✓	✓	✓	✓
20-03730-9	SS09	✓	✓	✓	✓	✓	✓	✓
20-03730-10	SS10	✓	✓	✓	✓	✓	✓	✓
20-03730-11	SS11	✓	✓	✓	✓	✓	✓	✓
20-03730-12	SS12	✓	✓	✓	✓	✓	✓	✓
20-03730-13	SS13	✓	✓	✓	✓	✓	✓	✓
20-03730-14	SS14	✓	✓	✓	✓	✓	✓	✓
20-03730-15	SS15	✓	✓	✓	✓	✓	✓	✓

If you have any queries please email us at enviro.reception@analytica.co.nz or telephone 07 444 5574.

Note: Soil samples will be held onsite for 3 months. Samples will be disposed on the 20th of the 3rd month following the month of receipt (ie: Samples received in January will be disposed on the 20th of April), Please contact our environmental sample reception at enviro.reception@analytica.co.nz or 07 444 5574 if you wish to extend the samples holding period.

Note: Water samples will be held onsite for 1 month. Samples will be disposed of routinely according to receipt dates.

Appendix I: Laboratory Reports and Chain of Custody Information

Table A : Soil Sample Results - Heavy Metals and Pesticides - Burnham Quarry

Sample Name	SS01	SS02	SS03	SS04	SS05	SS06	SS07	SS08	Environment Canterbury Background Concentrations[1]
Sample Depth (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Laboratory Reference	20-03730-1	20-03730-2	20-03730-3	20-03730-4	20-03730-5	20-03730-6	20-03730-7	20-03730-8	Regional - Yellow Brown Stony
Date	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	
Heavy Metals									
Arsenic	2.7	2.8	2.7	3.2	3.3	2.8	3.0	3.2	6.35
Cadmium	0.11	0.12	0.067	0.082	0.066	0.065	0.090	0.044	0.14
Chromium	11	13.0	12	12	13.2	12	13.7	13.4	19.89
Copper	4.8	4.2	3.4	4.1	4.3	4.6	5.1	4.6	11.68
Lead	11.8	12.5	11.7	11.6	12.7	11.8	12.7	12.6	19.75
Nickel	6.50	6.31	6.13	7.13	7.50	6.59	7.33	7.75	13.91
Zinc	44.3	42.7	38.3	41.7	49.9	44.8	40.3	45.3	69.58
Organochlorine Pesticides (OCP)									
ΣDDT[2,5]	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	0.431[3]
Dieldrin[4,5]	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	-

Sample Name	SS09	SS10	SS11	SS12	SS13	SS14	SS15		Environment Canterbury Background Concentrations[1]
Sample Depth (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Laboratory Reference	20-03730-9	20-03730-10	20-03730-11	20-03730-12	20-03730-13	20-03730-14	20-03730-15		Regional - Yellow Brown Stony
Date	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020	30 January 2020		
Heavy Metals									
Arsenic	3.4	2.9	3.1	3.0	3.4	2.8	2.8		6.35
Cadmium	0.095	0.065	0.064	0.065	0.046	0.076	0.046		0.14
Chromium	13.1	12	13.3	12.6	13.5	12.6	12		19.89
Copper	4.5	5.2	4.1	3.2	4.8	3.3	3.1		11.68
Lead	12.4	11.5	12.8	12.8	15.4	12.6	11.6		19.75
Nickel	7.37	6.93	7.52	7.66	8.45	7.22	6.57		13.91
Zinc	48.8	49.5	49.7	47.6	50.3	44.1	40.7		69.58
Organochlorine Pesticides (OCP)									
ΣDDT[2,5]	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028	<0.028		0.431[3]
Dieldrin[4,5]	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55	<0.55		-

Notes:

1. Background concentrations of selected trace elements in Canterbury soils - Addendum 1. (ECan 2007, Report no. R07/1/2). Based on 'Regional - Yellow Brown Stony' soil type - background concentration value based on maximum plus half inter-quartile range (excluding outliers, which are indicated in brackets).
2. Results for DDT, DDD and DDE summed and compared to soil contaminant standard for DDT
3. Background soils concentration for DDT - Ministry for the Environment, December 1998. Ambient Concentrations of Selected Organochlorines in Soils. Ministry for the Environment, Wellington.
4. Results for Aldrin and Dieldrin summed and compared to soil contaminant standard for Dieldrin.
5. Where one or more of the compounds was below the detection limit, a value of half the detection limit was used in the sum. Where all compounds in the sum are non-detects, the overall detection limit is the sum of the detection limits.

All results in mg/kg.

Pattle Delamore Partners Limited

TECHNICAL MEMORANDUM

INVESTIGATION	Land Contamination – Additional Clarification of Risk	**PROJECT**	139 Grange Road, Burnham
CLIENT	Burnham 2020 Ltd	**PROJECT NO**	C04096100
CLIENT CONTACT	Dan McGregor	**PREPARED BY**	Scott Wilson
VERSION	Final (Version 2)	**SIGNATURE**	
		DATE	24 July 2023

Introduction

Pattle Delamore Partners Limited (PDP) has been asked to provide additional information in relation to the overall contamination risk associated with past and present land used activities at the property located at 139 Grange Road, Burnham. It is understood Burnham 2020 Ltd intend to progressively quarry the property to provide aggregate for construction projects.

A preliminary site investigation (PSI) report[1] was prepared by PDP as part of the due diligence process and identified a number of HAIL[2] activities to have occurred in the past, or are currently occurring on site. These activities have the potential to have caused some level of contamination of site soils and/or groundwater. This memo has been prepared to provide additional information to the background behind the categorisation of each of these activities and the associated level of risk for the future quarrying activity. It is understood that the farming operation will continue in the future with the quarrying activity progressively moving across the property. The quarried areas will be rehabilitated at a lower elevation following the removal of aggregate. As such, this assessment is based on the current land use activities for the current period and whilst the current farming activity will not change, the location of the potentially contaminating activities associated with farming may move (i.e. fuel storage, bulk fertilizer storage or offal pits etc).

Site History Summary

The PSI is a desktop assessment that looks at a range of information sources to help understand what land use activities have occurred on site in the past that could have resulted in contaminating site soils. The primary information sources for this investigation comprised the historical aerial photographs and the site inspection. Some anectodical information was also provided. The aerial photographs are one of the most reliable information sources as they represent a snapshot in time, however, they are only taken approximately every 10 years so also have their limitations. They do however provide a good generalisation of the primary land use activities.

Based on the available information the site appears to have been used as a forestry plantation from at least the 1940's until circa 2005 when the property was converted to an irrigated cropping/cattle fattening farm and more recently since 2010, an irrigated heifer grazing farm. There is no information of the land use activities prior to the 1940's. The site use at his time is unknown, but likely used for similar land use activities.

Given the property has been used as a forestry plantation until circa 2005, the likelihood that the more persistent contaminants of concern such as organochlorines (i.e. DDT) which were used to control pesticides in

[1] *'Preliminary Site Investigation – 139 Grange Road, Burnham'* PDP, July 2023.
[2] *Hazardous Activities and Industries List* (Ministry for the Environment; MfE, 2011).

historical farming operations is low, and this was supported by the non-detectable concentrations of DDT recorded in the near surface soils samples (PSI; PDP 2023). Further to this, there was no evidence to suggest that a sheep dip was located within the property. These two contamination sources are some of the more contaminating for rural areas such as this. The greatest potential for any land contaminating activities at this property is related to the more recent farming operations, which based on our observations when walking about the site were considered typical for a large operation like this.

Key Land Contaminating Activities Identified and Associated Risks

The two key land use activities identified (forestry and farming) have an inherit low risk of land contamination apart from possible localised areas associated with normal site operations typical for these land use activities. The key activities that were identified for the property that may have resulted in contaminating soils/groundwater are shown in the attached plan (sourced from the PSI report) and include the following:

- An above ground diesel tank was reportedly present in the pad of the former forestry yard (location estimated based on anecdotal evidence provided). This was likely a small above ground tank (possibly portable). The likelihood of there being any significant contamination in the ground associated with this fuel storage is low. In fact, it is likely that any impacts, if present at all, may not be identified during the quarrying activities. This was included for completeness based on the information provided by the former landowner in the event that petroleum hydrocarbons are identified during any future earthworks;
- Two above ground fuel storage tanks for refuelling farm vehicles are currently present on site. These are existing tanks and will continue to exist for the foreseeable future as the current operations continue. The presence of fuel tanks on farms to refuel farm machinery is typical. The risk associated with above ground tanks is low as any minor spillage is generally contained in the near surface soils and leaks can be quickly realised and repaired. There is considered a negligible risk to the future quarry activity provided appropriate controls and security of the tanks is maintained.
- Storage of bulk fertilisers and other materials such as fence posts (likely treated timber) and used tyres which are used in the general operational aspects of the farm. These are all items that you would expect to see in a normal farming operation and were again included for completeness. The contamination risk associated with these activities is generally low and would be restricted to the near surface soils only. This would be easily managed during any future site development works; and
- Waste pits/infill pits (former and current) and have been identified at the site. The current farming waste pit was observed during the site inspection and contained organics, metal, concrete, plastics and wood waste. The full composition and extent of the material in the pit is unknown. It is understood that additional pits will be created in the same general area as the farming operation will continue into the future. The composition of the material within the known former infilled pit is unknown. Other pits may also exist across the site associated with general farming practices. Waste pits are common and typical for most large farming operations. In this instance the pits are related to farming practices that have occurred at the site from 2005 onwards. This means the potential for some of the more persistent and hazardous contamination sources (i.e. drums of former pesticides or asbestos containing materials) is unlikely. The material will however require removal and disposal when these areas are encountered during the progressive quarrying activity. This can be easily managed through the preparation of a suitable site management plan which will outline the correct procedures for the excavation, removal and disposal of this material. Just because waste material has been disposed of, it doesn't necessarily mean that the surrounding soils are contaminated. This will likely depend on the type of waste material present. Only a small area of the waste was able to be observed and this material looked typical for a farming operation as opposed to highly hazardous materials.

The above activities are defined on the Ministry for the Environment (MfE, 2011) '*Hazardous Activities and Industries List*' (HAIL) which is a compilation of activities and industries that are considered likely to cause land contamination resulting from hazardous substance use, storage or disposal. The HAIL is intended to identify most situations in New Zealand where hazardous substances could cause, and in many cases have caused, land contamination. However, just because the land use activity has or is suspected to have occurred doesn't necessarily mean that this caused land contamination. This is determined through detailed site investigations activities including soil and groundwater sampling. Preliminary soil sampling was undertaken as part of the PSI, however, this was confined to the areas away from the known operational areas to provide a general characterisation of any past board-acre contamination. No indicators of contamination were identified in the surface soils with concentrations similar to those of background levels for the area. No sampling of soils in the current operational yard area or known pit locations was undertaken as these areas will continue to be used in the short to medium term so would need to be investigated prior to being developed anyway. Some contamination of soils would be expected in these areas, however, the level of contamination would be expected to be typical for a large farming operation.

The extent of the HAIL areas shown on the attached plan is a conservative assessment given the level of uncertainty of some of the locations. Further to this, the entire current farming operational area was included as a conservative approach given this area will be used for the general storage of farming equipment and materials that could contaminate the surface soils currently and in the future. The intention of identifying the HAIL locations was to highlight those areas where potential contamination may exist so that more detailed assessment for the presence of contamination can be investigated before those areas are disturbed in the future. It does not necessarily translate to these areas being contaminated or requiring remedial works to be undertaken.

As outlined in the PSI, the recommended approach to manage the identified contamination sources is to undertake targeted detailed site investigations of each HAIL area as the quarrying activity progresses (i.e. immediately prior to disturbance of these identified areas). This will ensure that any contamination sources associated with the ongoing use of the site as production land is captured in the assessments. The results of the testing will determine the appropriate course of action that is required and what remedial works, if any, are required. This would be outlined in a Site Management Plan prepared for the quarry development works.

The level of remedial works within each HAIL area will vary depending on the type and extent of contamination present. In those areas where waste material is encountered this will likely require sorting and/or off-site disposal, but for the majority of the other HAIL areas the level of contamination from normal farming operations would not be expected to cause sufficient contamination that large remedial works would be required. The majority of the soils would likely be suitable to remain onsite and used in perimeter bunding during the quarrying activity and possibly be reuse as topsoil for future land use purposes.

If you have any further queries or need further clarification, please feel free to contact me.

Limitations

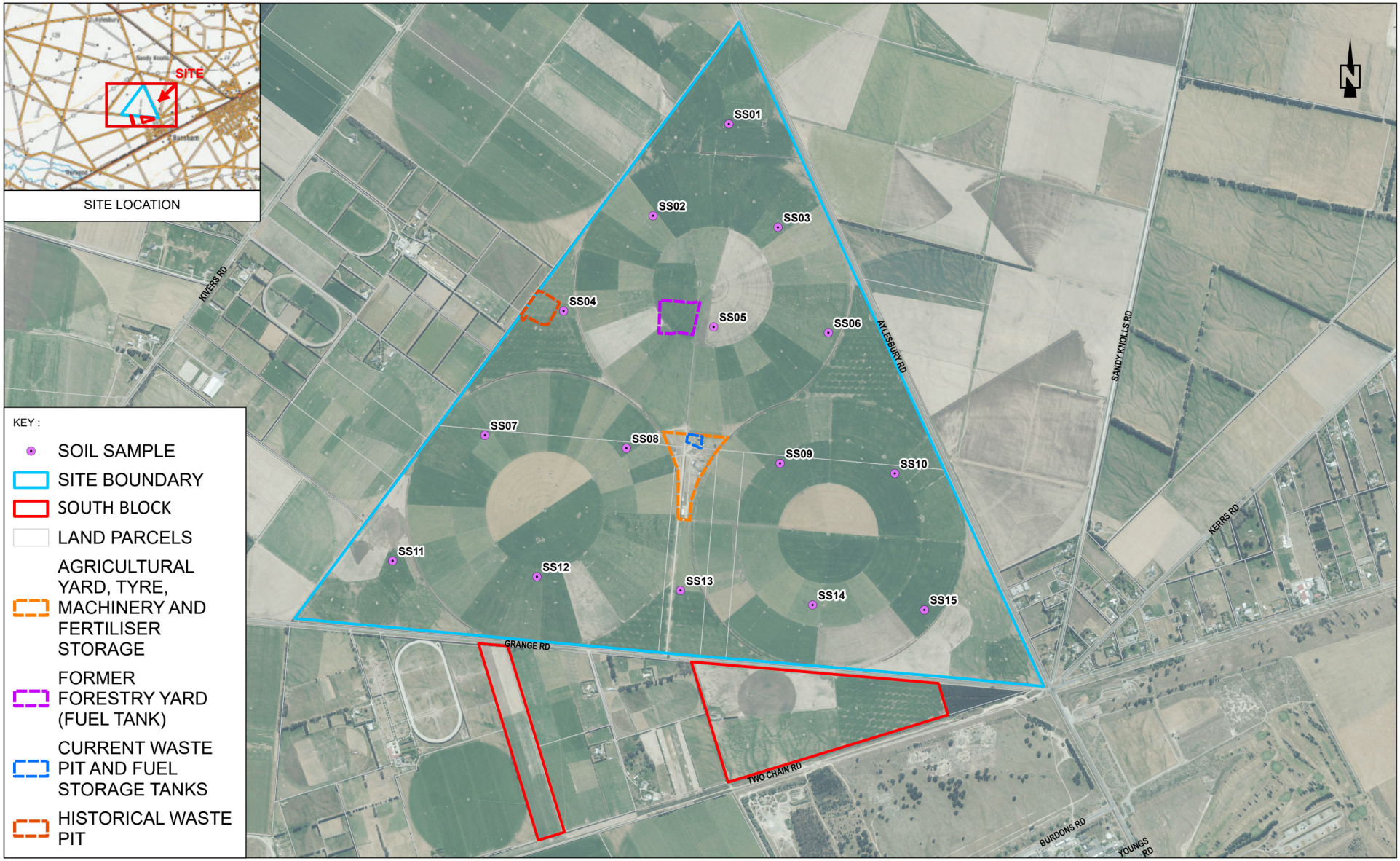
This memorandum has been prepared by Pattle Delamore Partners (PDP) on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the memorandum. PDP accepts no liability if the memorandum is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

The information contained within this document applies to the date stated in this document, or if none is stated, the date of this document. With time, the site and environmental conditions may change. Accordingly, the reported assessment is not guaranteed to apply at a later date.

TECHNICAL MEMORANDUM

Owing to the limited nature of this assessment, there may be soil and/or groundwater contamination conditions at the site that have not been identified and which have not been considered in this document.

This memorandum has been prepared by PDP on the basis of information sourced for the preparation of the Preliminary Site Investigation (PDP 2023). PDP has not independently verified the information to prepare the PSI and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

FIGURE 1: SITE LOCATION, SITE BOUNDARY AND SOIL SAMPLE LOCATIONS

SCALE : 1:20,000 (A4)

0 125 250 500 750

METRES

C04096100.mxd 23/07/2023 ISSUE 1



SOURCE:
1. AERIAL IMAGERY (FLOWN [2015-2016]) SOURCED FROM THE LINZ DATA SERVICE AND LICENCED BY CIA FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET SOURCED FROM THE LINZ DATA SERVICE https://data.linz.govt.nz/ AND LICENSED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.

FIGURE 2: HAIL LOCATIONS

SCALE : 1:6,000 (A4)

0 25 50 100 150

METRES

C04096100.mxd 23/07/2023 ISSUE 1

Boffa Miskell

Burnham Quarry

Ecological Impact Assessment Report
Prepared for Burnham 2020 Ltd

2 August 2023



Boffa Miskell is proudly a
Toitū net carbonzero certified consultancy

Document Quality Assurance

Bibliographic reference for citation: Boffa Miskell Limited 2023. *Burnham Quarry: Ecological Impact Assessment Report*. Report prepared by Boffa Miskell Limited for Burnham 2020 Ltd.		
Prepared by:	Scott Hooson Ecologist / Senior Principal Boffa Miskell Limited	
Reviewed by:	Vaughan Keesing Ecologist / Partner Boffa Miskell Limited	
Status: FINAL	Revision / version: 2	Issue date: 2 August 2023

Use and Reliance
This report has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Boffa Miskell does not accept any liability or responsibility in relation to the use of this report contrary to the above, or to any person other than the Client. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate, without independent verification, unless otherwise indicated. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Template revision: 20210624 0000

File ref: BM19954_009b_Ecology_Assessment_Report_Final_20230801.docx

Cover photograph: Proposed Burnham Quarry Site © Boffa Miskell, 2022

CONTENTS

1.0 Introduction 1

1.1 Scope and Purpose 1

1.2 Report Structure 1

2.0 Project Description 3

3.0 Methods 5

3.1 Desktop Review and Information Gathering 5

3.2 Site Investigations 5

3.3 Assessing Ecological Significance 6

3.4 Assessing Ecological Value and Ecological Effects 7

3.5 Other 7

4.0 Existing Ecological Environment 9

4.1 Ecological Context 9

4.2 Terrestrial Vegetation and Habitats 9

4.3 Freshwater Ecology 12

4.4 Birds 12

4.5 Lizards 14

5.0 Ecological Significance 15

6.0 Assessment of Ecological Effects 17

6.1 Vegetation Clearance 17

6.2 Birds 17

6.3 Lizards 19

6.4 Freshwater Ecology 19

7.0 Recommendations 19

8.0 Summary and Conclusions 20

9.0 References 22

Appendices

Appendix 1: Assessing Ecological Value and Ecological Effects

Appendix 2: Site Photographs

1.0 Introduction

Burnham 2020 Ltd are seeking approval for a new quarry and aggregate extraction activity at a 362 ha dairy farm located near Burnham, Canterbury (Figure 1). The site is intended to be excavated and rehabilitated in stages, with a maximum of 40 ha being operational at any one time. Extraction activity is expected to extend over a period of approximately 60 years.

Winstones have engaged Boffa Miskell Limited to undertake ecological investigations and prepare an Ecological Impact Assessment Report (EcIA) as part of the resource consent application for the project.

1.1 Scope and Purpose

This EcIA has been prepared to:

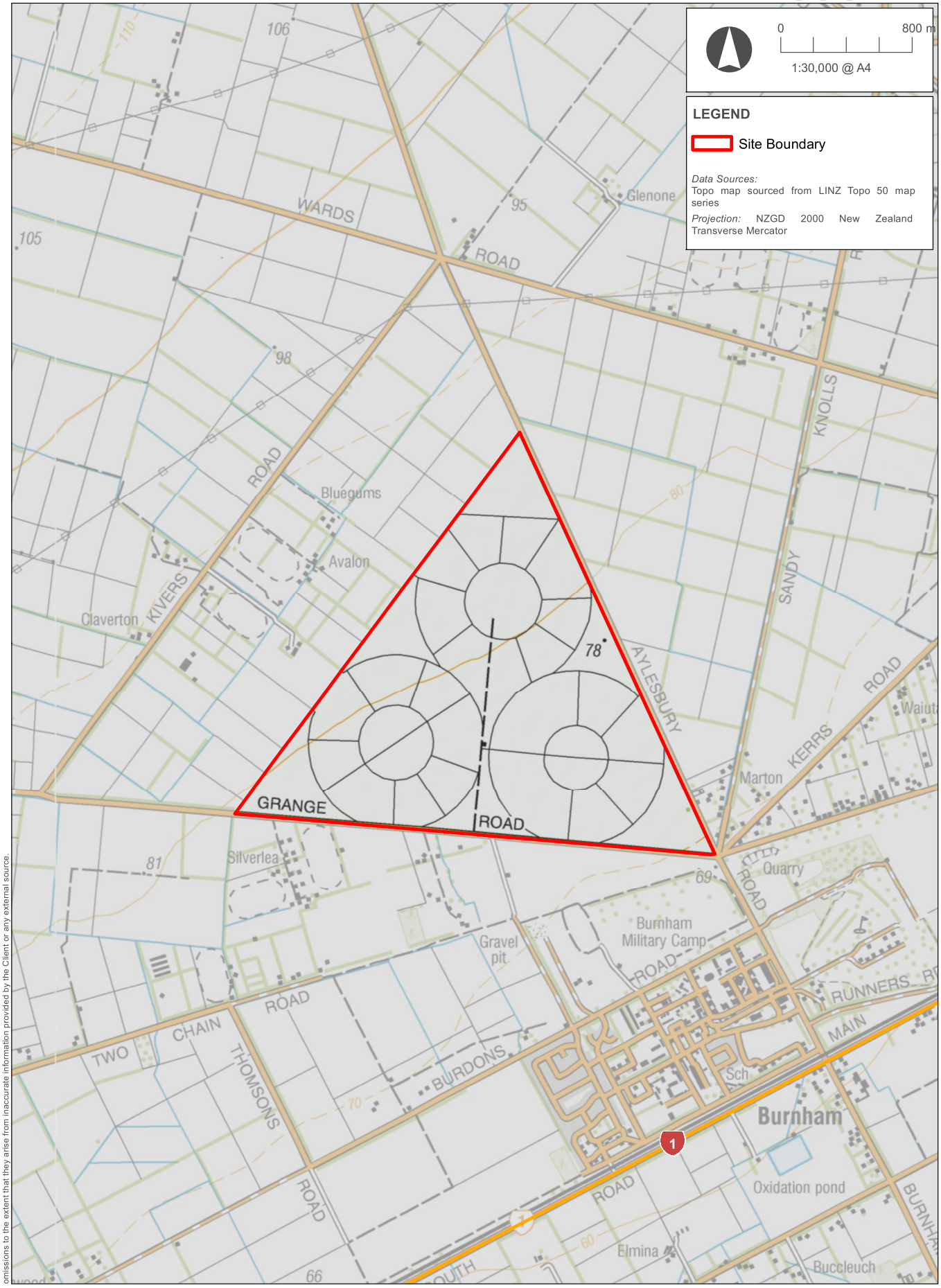
- Describe the existing ecological environment at the proposed quarry site;
- Assess the ecological significance and ecological value of the existing environment;
- Assess the actual or potential ecological effects of the construction and operation of the proposed quarry on the identified ecology values; and
- Develop recommendations to manage actual or potential adverse effects of the construction and operation of the proposed quarry on ecology values.

1.2 Report Structure

This report:

- Describes the project (Section 2.0);
- Outlines the methods used to undertake the site investigations and assessment (Section 3.0);
- Describes the existing ecological environment (Section 4.0);
- Assesses the ecological significance and ecological value of the existing environment (Section 5.0);
- Assesses the ecological effects of the project (Section 6.0);
- Provides impact management recommendations (Section 7.0); and
- Provides conclusions (Section 8.0).

File Ref: BM19954_012_A4P_SiteLocation.mxd



This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Boffa Miskell

www.boffamiskell.co.nz

BURNHAM QUARRY

Site Location

Date: 23 May 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: catherine.clark@boffamiskell.co.nz | Drawn: BMc | Checked: SHo

Figure 1

2.0 Project Description

The proposal is to establish and operate an aggregate quarry on the Canterbury Plains near Burnham, Canterbury. The proposal includes an approximate extraction area of 360 ha.

Throughout the life of the quarry the Site will be quarried and rehabilitated in stages. The proposed quarry will require initial construction (Phase 1) and aggregate extraction (Phase 2) to enable the setup of the site access, offices, amenities, stockyard ramp, and processing area. Access to the Site will be from Aylesbury Road near the mid-point of the eastern boundary.

After Phase 1 and 2 are completed (1 - 6 years), the remaining six phases will be carried out in approximately 5-year increments depending on demand. This will occur progressively and include the extraction of aggregate, followed by the rehabilitation of the area before moving onto the next phase. Throughout the operation of the quarry the total active area of the Site will be limited to no more than 40 ha. The depth of the pit will vary depending on depth to the water table, withg an approximate depth of 10 m below the existing ground level. During extraction, the Site will continue to be accessed for farming operations from Grange Road.

Prior to aggregate extraction, a long-term bund will be constructed from the proposed Aylesbury site access approximately 1 km southwards down the Site boundary. This will be present throughout the life of the quarry and will be encompassed within a 24.5 m setback from the road boundary. For the remainder of the Site, a temporary linear topsoil stockpile will be constructed along a 17.5 m setback prior to extraction. This will be to store overburden from the initial scraping of the soil during extraction and will be removed as part of rehabilitation upon the completion of each extraction phase.

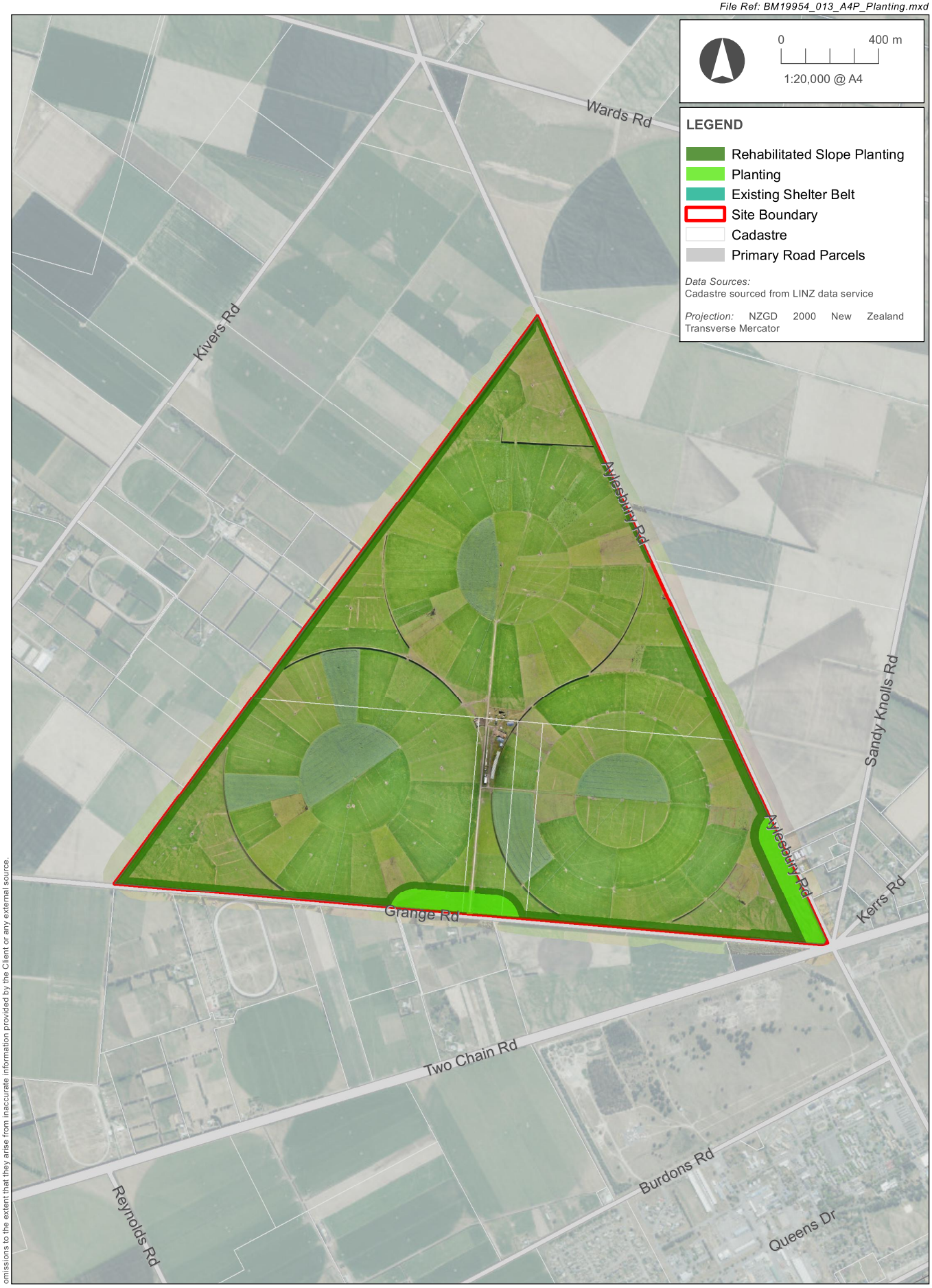
During the rehabilitation of each phase, the base of the pit will be resurfaced with a minimum of 400 mm of suitable materials including at least 200 mm of topsoil and sown with grass seed. The slopes of the pit edge will be regraded to an approximate 1:2 gradient and fenced to exclude stock.

As part of site rehabilitation, over the life of the project, the following areas will be progressively planted with indigenous plantings, which when completed, will total more than 29.3 ha (Figure 2 shows the completed rehabilitation planting):

- On the permanent bund within the 24.5 m extraction set-back along Aylesbury Road during the construction phase (1.2 ha);
- As part of rehabilitation the slopes of the pit edge will be regraded to an approximate 1:2 gradient and rehabilitated with native planting as aggregate extraction progresses around the Site (20.2 ha).
- Within the 100 m setback from neighbouring dwellings in the south-eastern corner along Aylesbury Road during Phase 3 at between 6 - 10 years (4 ha) and Grange Road during Phase 5 at between 16 - 20 years (3.9 ha). It is proposed that these areas will be planted to create a buffer between dwellings adjacent to this area of the Site, and to develop amenity and ecological value.
- At the Aylesbury Road Site entrance.

A more detailed description of the proposal can be found in the Assessment of Effects.

File Ref: BM19954_013_A4P_Planting.mxd



This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Boffa Miskell

www.boffamiskell.co.nz

BURNHAM QUARRY

Proposed Planting

Date: 16 June 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: catherine.clark@boffamiskell.co.nz | Drawn: BMc | Checked: SHo

Figure 2

3.0 Methods

3.1 Desktop Review and Information Gathering

A desktop review was undertaken to gather information on the existing ecological values within and adjacent to the property. The desktop review included reviewing:

Recent aerial imagery, including Google Earth;

GIS (Geographic Information System) databases including:

- Topographical (Topo50) data (Land Information New Zealand);
- Threatened Environment Classification (Walker et al. 2015);
- Ecological region and ecological district GIS layers;
- Environment Canterbury 'Canterbury Wetlands' and 'Canterbury Regional Wetlands' GIS layers (no longer publicly available, downloaded May 2019).

Ecological databases including:

- DOC Herpetofauna database records;
- Bird records for the general area on the New Zealand Bird Atlas[1]; and
- The NIWA-administered New Zealand Freshwater Fish database (NZFFD)[2].
- The Operative and Proposed Selwyn District Plans.

3.2 Site Investigations

A site investigation was undertaken by Scott Hooson (Senior Ecologist / Senior Principal) and Cara-Lisa Schloots (Ecologist / Graduate) on 19 May 2022. The Site was surveyed by four wheel drive vehicle and on foot. Field assessments and surveys were carried out as described below.

3.2.1 Vegetation and Habitats

During the vegetation surveys:

- The plant communities within the Site were classified using the classification system and naming conventions developed by Atkinson (1985);
- Plant species, and their overall cover (using the 'DAFOR' scale) was recorded in each of the main vegetation communities;
- General notes were made on the condition of the plant communities and habitats present;

[1] NZ Bird Atlas grid square: https://ebird.org/atlasnz/block/blkCY46 – accessed 18 November 2022.

[2] This database holds records of freshwater fish distributions and occurrences based on previous surveys.

- Habitat suitability for terrestrial indigenous fauna (lizards and terrestrial invertebrates) was assessed and incidental observations of other terrestrial fauna were recorded; and
- A handheld Garmin Global Positioning System (GPS) was also used to mark locations of interest, photographs were taken and field notes were recorded.

3.2.2 Birds

Birds were surveyed during the first site visit on 19 May 2022 as follows:

- Five-minute bird counts were conducted at six pre-determined locations (Figure 3). The counts followed the standard five-minute bird count methodology (Dawson & Bull 1975).
- A roaming inventory was also compiled of all bird species seen and heard during the field investigations outside of the formal five-minute count periods.

A second survey was undertaken for nesting birds on 11 October 2022 during the peak of the breeding season for most species. This survey involved:

- Carefully traversing the Site in a four wheel drive vehicle and stopping frequently to scope the paddocks within the Site with binoculars;
- Recording any breeding behaviour, or birds with nests or chicks;
- Completing five-minute bird counts at the same six pre-determined locations used during the last survey; and
- Completing a roaming inventory of all bird species seen and heard outside of the formal five-minute count periods.

3.2.3 Other Fauna

Due to lack of suitable habitat for lizards or indigenous terrestrial invertebrates of conservation value within the Site, formal surveys for lizards or terrestrial invertebrates were not considered necessary.

3.3 Assessing Ecological Significance

Section 6(c) of the RMA requires identification of sites of significant vegetation and significant habitats of indigenous fauna.

In Canterbury, Policy 9.3.1 of the Canterbury RPS provides the basis for use of the ecological significance criteria. Following Policy 9.3.1(1), significance, with respect to ecosystems and indigenous biodiversity, is to be determined by assessment of areas and habitats against four matters:

1. Representativeness
2. Rarity or distinctive features
3. Diversity and pattern
4. Ecological context

The Site was assessed against each matter using the criteria for determining significant indigenous vegetation and significant habitat of indigenous fauna listed in Appendix 3 of the CRPS (referring also to the Wildland Consultants (2013) non-statutory Guidelines). Following Policy 9.3.1(2), areas were considered to be significant if they met one or more of the criteria in Appendix 3.

Under Policy 9.3.1(3) of the CRPS, areas identified as significant are to be protected to ensure no net loss of indigenous biodiversity or indigenous biodiversity values as a result of land use activities.

3.4 Assessing Ecological Value and Ecological Effects

To determine the level of ecological effects associated with the proposal, we have followed the Environmental Institute of Australia and New Zealand's (EIANZ) Ecological Impact Assessment (EcIA) Guidelines (Roper-Lindsay et al. 2018). In summary, the EcIA method requires assessments of:

- The values of communities, habitats / ecosystems and species (Table 3, Table 4 and Table 5);
- The magnitude of impact (Table 6); and
- The level of ecological effect based on ecological value and magnitude of impact (Table 7).

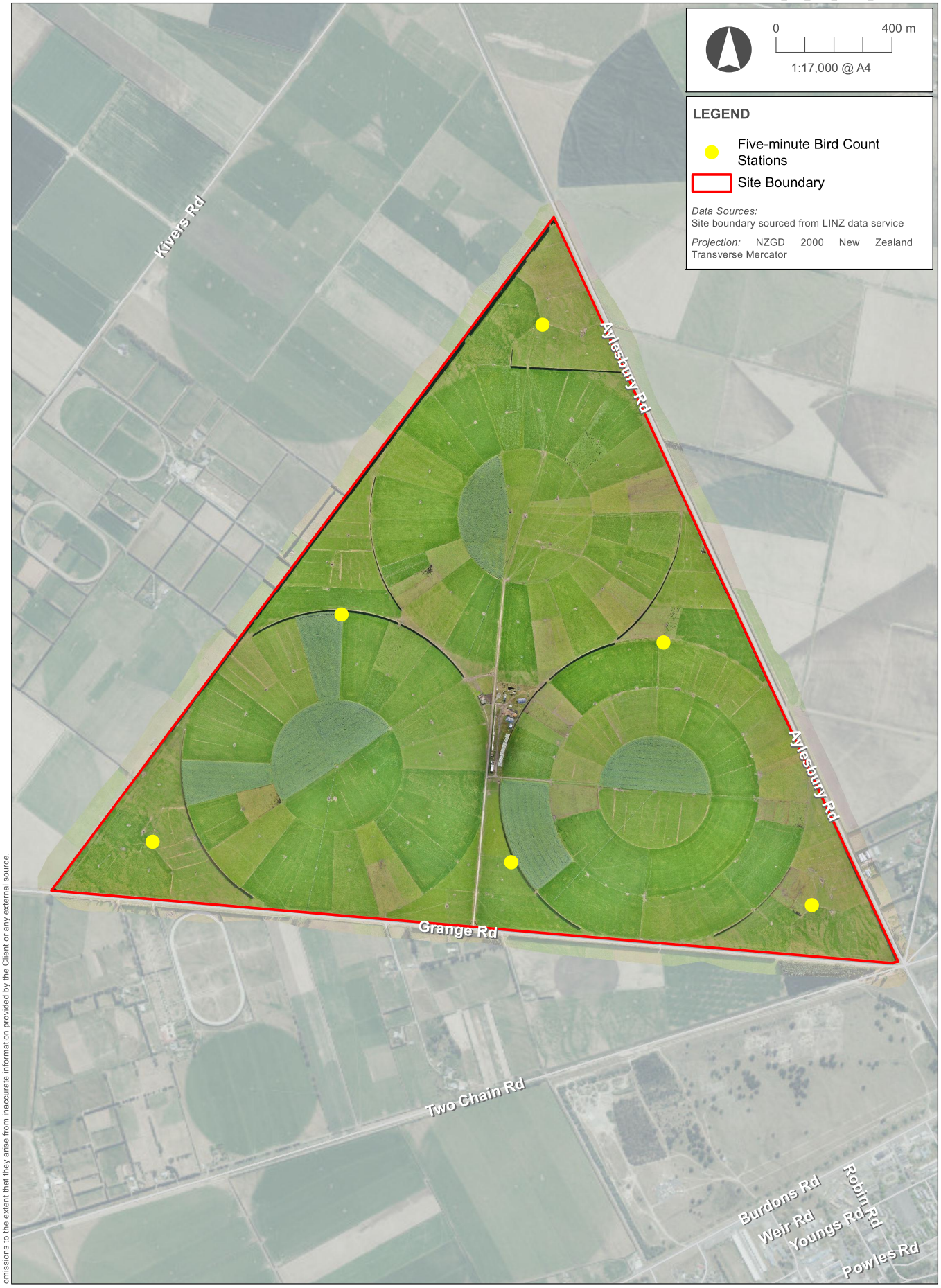
3.5 Other

Where possible, common names for plants and animals have been used in this report. Where a species does not have a common name, or its common name cannot be used to identify the species without ambiguity, scientific names have been used.

The conservation status of nationally Threatened and At-Risk indigenous species used in this report are from the most current versions of their respective New Zealand Threat Classification System (conservation status) lists[3].

[3] https://nztcs.org.nz/

File Ref: BM19954_011_A4P_5MBC_Stations.mxd



This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Boffa Miskell

www.boffamiskell.co.nz

BURNHAM QUARRY

Five-minute Bird Count Stations

Date: 15 June 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: Catherine.Clarke@boffamiskell.co.nz | Drawn: BMc | Checked: SHo

Figure 3

4.0 Existing Ecological Environment

The following sections summarise the known (and likely) values of the ecological environment within and adjacent to the proposed quarry site.

4.1 Ecological Context

The proposed quarry is within the Low Plains Ecological District (ED) in the Canterbury Plains Ecological Region (McEwen, 1987).

The original vegetation of the ED was likely to have been largely tōtara-matai forest on well-drained soils and kahikatea forest on poorly drained soils. Free-draining old and younger plains and terraces are thought to have supported kānuka forest and later successional tōtara-matai forest. Freshwater and saline wetlands of various types were also present, particularly nearest the coast (Steven & Meurk, 1996).

Nationally, the most significant losses of indigenous vegetation and habitats have occurred in lowland environments where development has been, and continues to be, most intensive. The Canterbury Plains Ecological Region is now among one of the most modified regions in New Zealand, with much of the natural, pre-Polynesian vegetation having been cleared (Leathwick et al., 2003; McEwen, 1987). The original vegetation of the Low Plains ED has been substantially depleted by human induced fire and land clearance for agriculture and settlement. Nearly all of the ED is intensively farmed or built (Harding 2009) and only 0.5% of the Low Plains ED is still covered in indigenous vegetation (Ecroyd & Brockerhoff, 2005).

4.1.1 Threatened Environment Classification

The Threatened Land Environments classification (Walker et al. 2015) shows how much indigenous vegetation remains within land environments and how much is legally protected. The classification system shows that all of the Canterbury Plains, including the proposed quarry site, are on land environments where less than 10% indigenous vegetation is left on these land environments nationally. The Site itself is located on land environment N1.1a where <10% indigenous vegetation remains on this land environment nationally (Cieraad et al., 2015; Walker et al., 2015).

4.2 Terrestrial Vegetation and Habitats

There are four main vegetation and habitats within the proposed quarry site:

- Exotic grassland (perennial ryegrass grassland);
- Fodder crops;
- Cultivated loamfield; and
- Shelterbelts (radiata pine treeland).

The location and extent of exotic grassland, fodder crops and cultivated loamfield changes depending on farm management activities. For example, at times, exotic grassland is ploughed and temporarily left as bare soil (loamfield) until it is replanted in pasture or fodder crops.

All of the vegetation and habitats on the Site are exotic. There is no naturally occurring indigenous vegetation on the Site.

4.2.1 Exotic grassland (perennial ryegrass grassland)

At the time of the site visit most of the Site was perennial ryegrass grassland (pasture) that is cultivated and irrigated by centre pivots and sprinklers and grazed by cattle and sheep (Appendix 1, Photo 1). The pasture was well maintained and there were few other species; white clover, annual meadow grass and shepherds purse are occasional throughout, and there were rare occurrences of other ubiquitous exotic pasture species such as cocksfoot, narrow-leaved plantain, broad-leaved dock, sheep's sorrel and dandelion. This exotic grassland is of **Negligible** ecological value.

4.2.2 Fodder crops

Paddocks are ploughed and sown in rotational fodder crops such as *Brassica* species for stock feed (Appendix 1, Photo 2). The location and extent of this cover type changes frequently depending on farm management activities. These rotational fodder crops are of **Negligible** ecological value.

4.2.3 Cultivated loamfield

At times paddocks are ploughed and remain in bare soil (loamfield) until they are planted in pasture grass or fodder crops (as described above). Several paddocks with recently ploughed bare soil were present at the time of the site visits. The location and extent of this cover type changes frequently depending on farm management activities. This cultivated loamfield is of **Negligible** ecological value.

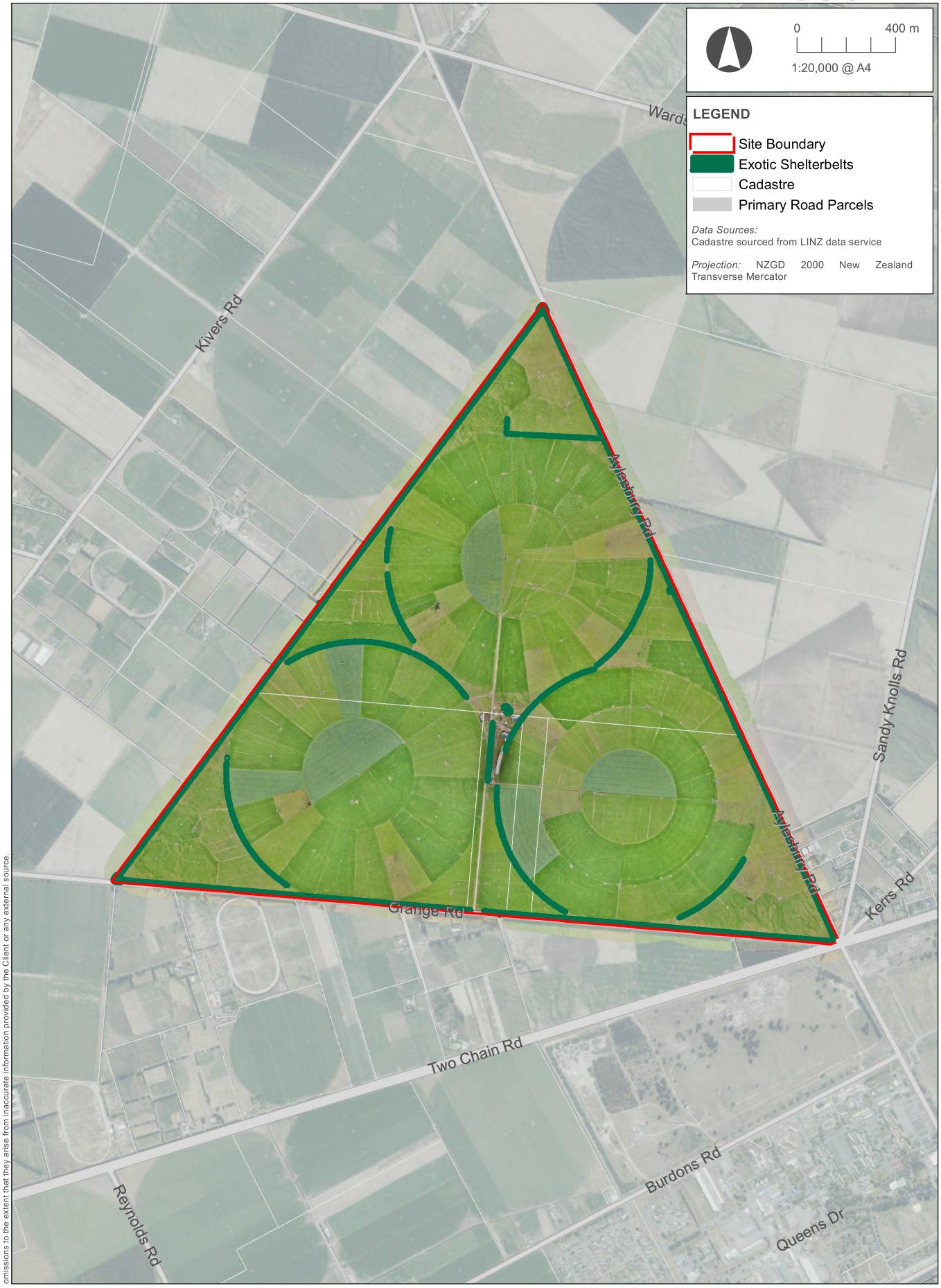
4.2.4 Shelterbelts (radiata pine treeland)

The Site is surrounded by radiata pine shelterbelts, with further shelterbelts present around part of the perimeter of each centre pivot (Figure 4, Photo 3, Appendix 1). These shelterbelts are approximately 4 – 5 m in height. In the few places where there is ground cover below the canopy this is dominated by cocksfoot. Gorse, scotch broom, yarrow and the exotic grasses Chewings fescue and sweet vernal are also occasionally present, as are numerous other herbaceous species such as black nightshade, narrow-leaved plantain, catsear and mouse-ear hawkweed. These shelterbelts are of **Negligible** ecological value.

4.2.5 Wetlands

There are no wetlands within the Site. The only periodically wet areas are limited to a small number of shallow depressions within improved pasture that are subject to temporary rain-derived water pooling or pooling from irrigation (Appendix 1, Photo 4). When dry they have a substrate of bare mud. These areas do not support wetland vegetation and are not 'wetlands' or 'natural inland wetlands' as defined by the RMA or National Policy Statement for Freshwater Management (NPS-FM; MfE 2020) respectively.

File Ref: BM19954_014_A4P_Shelterbelts.mxd



This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

Boffa Miskell

www.boffamiskell.co.nz

BURNHAM QUARRY

Existing Shelterbelts

Date: 02 August 2023 | Revision: 0

Plan prepared for Winstone Aggregates by Boffa Miskell Limited

Project Manager: catherine.clark@boffamiskell.co.nz | Drawn: BMc | Checked: SHo

Figure 4

4.3 Freshwater Ecology

There are no waterways or permanent water bodies within the quarry site. There is an artificial water course (a water-race) adjacent to the southern boundary of the Site on the opposite (southern) side of Grange Road. Freshwater ecology values are not considered further in this assessment.

4.4 Birds

A list of the bird species recorded, or likely to occur within and adjacent to the proposed quarry site in provided in Table 1. Information on their conservation status and whether they were recorded during site visits is also included.

This list is derived from:

- The site investigation;
- The bird species recorded within the 10 x 10 km grid square of the Ornithological Society of New Zealand's Atlas of Bird Distribution in New Zealand (Robertson et al., 2007) that encompasses the project site.
- The bird species recorded within the relevant 10 x 10 km grid square on the eBird database;
- An assessment of the suitability of the habitat for these species; and
- The likelihood of them occurring in habitats within, or adjacent to, the project site.

Of the 32 bird species recorded, or considered likely to occur, in habitats within or adjacent to the proposed quarry site, approximately half (15 species) are indigenous, and half are introduced. Of the indigenous species, one is classified as Threatened – Nationally Endangered (black-fronted tern), three are classified as At Risk – Declining (black-billed gull, South Island pied oystercatcher and red-billed gull) and the remaining 10 species have a conservation status of Not Threatened.

Of the four Threatened and At Risk species potentially present, only one At Risk species, South Island pied oystercatcher, was recorded on the proposed quarry site. This species was observed foraging in pasture and recently cultivated loamfield and is likely to be using similar habitat in the wider area for feeding. No evidence of South Island pied oystercatcher breeding on the Site (breeding behaviour, nests or chicks) was recorded during the October site visit, but it is possible this species could breed within improved pasture or cultivated loamfield within the Site. Black-fronted tern, black-billed gull and red-billed gull are all likely to fly over the Site and may forage within pasture and cultivated loamfield, however these species are not expected to breed on the Site as it does not provide suitable habitat[4].

Spur-winged plover chicks were observed on the Site, confirming this species breeds within the improved pasture or loamfield on the Site. One pair of paradise shelduck and one mallard duck were observed on the site with chicks during the October site visit. There is no breeding habitat for either waterfowl species on the Site, and it is considered most likely that they nested on suitable habitat on adjacent properties and have subsequently moved onto the Site with their chicks.

[4] Black-fronted tern and black-billed gull typically breed on braided rivers and red-billed gull breed in coastal habitats such as on islands or rocky areas on the coast.

Table 1: *Birds species recorded, or likely to occur within, or adjacent to, the proposed quarry site. Sorted by indigenous / introduced and by conservation status (Robertson et al., 2021). Superscript shows conservation status qualifiers and includes CD - Conservation Dependent, CI – Climate Impact, CR – Conservation Research Needed, Inc – Increasing, PD – Partial Decline, RF – Recruitment Failure, SO – Secure Overseas, and Sp – Sparse.*

Common Name	Scientific Name	Conservation Status	Site Visit
Indigenous Species			
Black-fronted tern	*Chlidonias albostriatus*	Threatened - Nationally Endangered[CI CD, PD, RF, Sp]	
Black-billed gull	*Larus bulleri*	At Risk - Declining[CI CR RF]	
SI pied oystercatcher	*Haematopus finschi*	At Risk - Declining[CI]	x
Red-billed gull	*Larus novaehollandiae scopulinus*	At Risk - Declining[CI]	
Black-backed gull	*Larus d. dominicanus*	Not Threatened[SO]	x
Grey warbler	*Gerygone igata*	Not Threatened	
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened	
Paradise shelduck	*Tadorna variegata*	Not Threatened	x
Pied stilt	*Himantopus h. leucocephalus*	Not Threatened[SO]	x
Pūkeko	*Porphyrio m. melanotus*	Not Threatened[Inc SO]	x
Silvereye	*Zosterops lateralis lateralis*	Not Threatened[SO]	
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened[SO]	x
Swamp harrier	*Circus approximans*	Not Threatened[SO]	x
Welcome swallow	*Hirundo n. neoxena*	Not Threatened[SO St]	x
White-faced heron	*Egretta novaehollandiae*	Not Threatened[SO]	x
Introduced and naturalised species			
Blackbird	*Turdus merula*	Introduced & Naturalised[SO]	x
California quail	*Callipepla californica*	Introduced & Naturalised[SO]	
Chaffinch	*Fringilla coelebs*	Introduced & Naturalised[SO]	
Dunnock	*Prunella modularis*	Introduced & Naturalised[SO]	x
Goldfinch	*Carduelis carduelis*	Introduced & Naturalised[SO]	x
Greenfinch	*Carduelis chloris*	Introduced & Naturalised[SO]	x
House sparrow	*Passer domesticus*	Introduced & Naturalised[SO]	x
Little owl	*Athene noctua*	Introduced & Naturalised[SO]	
Magpie	*Gymnorhina tibicen*	Introduced & Naturalised[SO]	x
Mallard	*Anas platyrhynchos*	Introduced & Naturalised[SO]	x
Pheasant	*Phasianus colchicus*	Introduced & Naturalised[SO]	x
Redpoll	*Carduelis flammea*	Introduced & Naturalised[SO]	
Rock pigeon	*Columba livia*	Introduced & Naturalised[SO]	x
Skylark	*Alauda arvensis*	Introduced & Naturalised[SO]	x
Song thrush	*Turdus philomelos*	Introduced & Naturalised[SO]	x
Starling	*Sturnus vulgaris*	Introduced & Naturalised[SO]	x
Yellowhammer	*Emberiza citrinella*	Introduced & Naturalised[SO]	x

In terms of the ecological value of these bird species (not of the Site as habitat for these species), following the EIANZ EcIA Guidelines approach:

- The nationally Threatened black-fronted term is of **Very High** ecological value;
- The three At Risk – Declining species (black-billed gull, South Island pied oystercatcher and red-billed gull) are of **High** ecological value;
- The 10 species that have a conservation status of Not Threatened and are nationally and locally common are of **Low** ecological value; and
- The introduced and naturalised (exotic) species are of **Negligible** ecological value.

4.5 Lizards

There are no records of lizards in areas within or adjacent to the Site in the DOC Bioweb Database. The closest records in the DOC Bioweb Database are of southern grass skinks, the closest of which is approximately 8.5 km from the Site.

In the context of the Site's historic uses (with the exception of a small area in the south-eastern corner the Site which was used for exotic plantation forestry up until at least December 2000[5]) and current land use, it is considered very unlikely that lizards occur within the Site. The intensively farmed, cultivated, grazed and cropped exotic habitats do not provide suitable habitat for lizards. Lizards are not considered further in this assessment.

[5] https://retrolens.co.nz

5.0 Ecological Significance

The criteria for assessing whether a site is ecologically significant are listed in Appendix 3 of the CRPS (Environment Canterbury 2013). Table 2 evaluates the Site against each of these criteria. Italicised text is from Appendix 3 of the CRPS. The non-statutory guidelines for the application of the CRPS criteria (Wildland Consultants 2013) were used to assist interpretation of the criteria.

Table 2: *Evaluation of the Site against the Canterbury Regional Policy Statement (Environment Canterbury 2013) criteria for determining significant indigenous vegetation and significant habitat of indigenous biodiversity*

Criteria	Criteria met?	Explanation
Representativeness		
1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type or represent all that remains of indigenous biodiversity in some areas.	No	The Site does not support any indigenous vegetation or habitats.
2. Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.	No	The Site does not support any indigenous vegetation or habitats.
Rarity/Distinctiveness		
3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.	No	While the Site is situated on a land environment where there is <10% indigenous vegetation left nationally, there are no indigenous vegetation or habitats on the Site.
4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within the relevant ecological district.	No	The only indigenous species recorded on the Site that is threatened, at risk, or uncommon, nationally or within the relevant ecological district is South Island pied oystercatcher. The Site provides foraging habitat for this highly mobile species, but the Site is not significant for this reason. Intensively managed / grazed exotic pasture and ploughed fields that provide temporary foraging habitat South Island pied oystercatcher are not considered to be significant under this criterion.
5. The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.	No	The Site does not contain indigenous vegetation or indigenous species at their distribution limit within the Canterbury Region or nationally.
6. Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an	No	The Site does not support indigenous vegetation or an association of indigenous

originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.		species that is distinctive, naturally of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.
Diversity and Pattern		
7. Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition reflecting the existence of diverse natural features or ecological gradients.	No	The Site does not support indigenous vegetation. The diversity of indigenous birds and fauna at the Site is typical of intensively managed farms on the Canterbury Plains. This criterion is not met.
Ecological Context		
8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.	No	The Site does not have any important ecological linkages or networks and does not provide an important buffering function.
9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.	No	The Site is not a wetland and does not include any wetland habitats. It is not significant under this criterion.
10. Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.	No	The Site does not provide important habitat for indigenous species, either seasonally or permanently. Intensively managed / grazed exotic pasture and ploughed fields that provide temporary foraging habitat South Island pied oystercatcher are not considered to be significant under this criterion (refer to Wildland Consultants 2013).

In summary, the proposed quarry site is not ecologically significant under any of the criteria for determining ecological significance in Appendix 3 of the CRPS.

6.0 Assessment of Ecological Effects

This section assesses the actual and potential effects of the construction and operation of the proposed quarry on ecology values. The level of effect is assessed in this section **without** the impact management measures recommended in Section 7.0), but **with the** implementation of site management that is part of the project as outlined in Section 2.0.

6.1 Vegetation Clearance

The existing exotic vegetation within the quarry footprint will be progressively removed and rehabilitated in stages over the life of the quarry (as described in Section 2.0; Figure 2). For each stage, vegetation and topsoil will be stripped and directly reinstated into areas being rehabilitated (the area stripped will be determined by the volume of aggregate required between the stripping period). Following aggregate extraction for each stage, the quarry floor will be returned to a standard which allows farming to be re-established (likely similar to the vegetation removed)

All of the vegetation and habitats within the Site are intensively farmed and comprised entirely of exotic vegetation, and there is no naturally occurring indigenous vegetation. None of the vegetation and habitats within the Site are ecologically significant and all are of Negligible ecological value. The proposal will not affect any indigenous vegetation communities or habitats, and from an ecological effects assessment perspective, no impact management measures are required for vegetation removal.

6.2 Birds

There are four potential effects on birds that are considered relevant in relation to the construction and operation of the proposed quarry:

- Habitat modification and displacement;
- Temporary displacement resulting from construction disturbance;
- Impacts on nesting birds; and
- Loss of habitat connectivity.

6.2.1 Habitat Loss and Modification

The construction and operation of the quarry will result in the loss of existing habitat for birds where quarry infrastructure is established and temporary habitat loss where active quarrying is occurring. Because the proposal is to progressively excavate and rehabilitate the Site, returning quarried areas to a standard that will enable it to be used for farming, throughout the life of the quarry, much of the Site will continue to provide the same or similar habitat for birds. At any one time the active area of the quarry will be no more than 40 ha.

The habitats within the Site (exotic grassland, loamfield, fodder crops and exotic shelterbelts) are entirely intensively managed farmland. These habitats do not provide important habitat for the nationally Threatened and At Risk species recorded within, or likely to occur within, the proposed quarry site (black-fronted tern, South Island pied oystercatcher, black-billed gull, red-

billed gull). While South Island pied oystercatcher were observed foraging in pasture and recently cultivated loamfield within the Site, black-fronted tern, black-billed gull and red-billed gull likely only use the Site infrequently and irregularly for foraging (if at all). Because similar intensively managed farmland habitats are widespread in the surrounding area, and across the Canterbury Plains the magnitude of the loss and modification of habitat on birds is Negligible and the Level of effect is considered to be Very Low.

6.2.2 Disturbance and Displacement

Quarry construction and operation activities, including the use of heavy machinery and increased vehicle / people movements have the potential to disturb and displace birds that may be interrupted in their normal foraging and other behaviours. However, the bird species that have been recorded at the Site, or that could be expected to use habitats within the Site, are all mobile species that are able to disperse into similar habitats that are widespread in the surrounding area, in the Low Plains ED and across the Canterbury Plains. Further, because the proposal is to progressively excavate the Site in stages, disturbance effects will be limited to a relatively small portion of the Site. In this context, the magnitude of the effect of disturbance due to quarry construction noise and activity is Very Low and level of effect is expected to be Very Low.

6.2.3 Nesting Birds

Potentially, there is a risk to nesting bird species if works for quarry establishment or expansion for extraction occurs during the breeding season (generally September to February). This could arise either through works to clear new ground damaging nests or via disruption of nesting behaviours due to noise and other disturbance.

The intensively farmed habitats within the Site provide limited breeding habitat for indigenous bird species. However, the exotic grassland and bare loamfield habitat provides potential nesting habitat for three indigenous bird species: South Island pied oystercatcher (At Risk – Declining), pied stilt and spur-winged plover (both Not Threatened).

- Spur-winged plover, which nest in improved pasture or loamfield were confirmed to be breeding on the site during the October site visit.
- No evidence of South Island pied oystercatcher breeding (breeding behaviour, nests or chicks) was recorded during the October site visit, but it is possible this species could nest within improved pasture or cultivated loamfield.
- No evidence of pied stilt breeding was recorded during the October site visit, but this species could nest in shallow depressions within improved pasture that are subject to rain-derived water pooling or pooling from irrigation.

There is the potential for works undertaken for quarry construction and expansion to damage or disturb a small number of nests of species such as South Island pied oystercatcher, pied stilt and spur-winged plover if construction is undertaken during the breeding season. This could lead to nest failure, but due the small number of nests potentially affected (if any) effects on the local populations of these species are unlikely and the magnitude of this effect, at worst would be Low. The level of effect on the Not Threatened spur-winged plover and pied stilt would be Very Low, but because South Island pied oystercatcher are of High ecological value (i.e. classified as At Risk – Declining), the level of effect on this species is considered to be Low.

Most indigenous bird species (but excluding spur-winged plover[6]) are either absolutely or partially protected under the Wildlife Act (1953) and it is unlawful to disturb the nesting of these species. To manage effects on any nesting indigenous bird species during quarry establishment or expansion, pre-construction nesting bird surveys are recommended (refer to Section 7.0).

6.2.4 Habitat Connectivity

The existing exotic shelterbelts within the quarry site (and those in the wider landscape) may have a minor role as ecological corridors assisting the movement and dispersal of indigenous fauna, including common indigenous forest bird species (such as South Island fantail, grey warbler and silvereye), across this part of the Canterbury Plains. However, these shelterbelts are not considered ecologically significant in this context.

6.3 Lizards

There is no suitable habitat for lizards within the Site. No effects on lizards are anticipated and no impact management measures are required.

6.4 Freshwater Ecology

There are no waterways or permanent water bodies within the Site. An artificial water course (a water-race) outside of the Site (adjacent to the southern boundary of the site on the opposite (southern) side of Grange Road is not expected to be affected by the proposed quarry. No impact management measures are required for freshwater ecology.

7.0 Recommendations

The following impact management measures are recommended to manage the effects of the proposed quarry.

- If works for quarry establishment or expansion that involve removal of vegetation occur during the bird breeding season (August to February) a pre-construction survey of the proposed works area, and unquarried habitat within a 200 m buffer area of the works area, should be undertaken by a suitably qualified ecologist / ornithologist to locate nests, or chicks of any indigenous bird species that are absolutely or partially protected under the Wildlife Act (1953).
  - The survey should be undertaken no earlier than eight working days prior to the works being carried out.
  - If nests or chicks of indigenous birds that are absolutely or partially protected under the Wildlife Act (1953) are found, measures to avoid, minimise or mitigate potential adverse impacts should be included in a pre-works survey report. At a minimum, mitigation measures should include maintaining an appropriate exclusion zone

[6] Spur-winged plover is listed on Schedule 5 of the Wildlife Act as 'Wildlife Not Protected'.

between breeding or nest sites and sources of continuous disturbance (but reduced minimum exclusion distances for intermittent, short-duration disturbance caused by work activities may be adopted where provided for by the bird survey report recommendations).

  - Any person carrying out works must be informed of any bird breeding or nesting sites.

- A suitably qualified ecologist should provide input into the Rehabilitation Plans for each stage of extraction activity to ensure that plantings are ecologically appropriate and achieve the best outcomes for indigenous biodiversity.

8.0 Summary and Conclusions

- This assessment has identified that:
  - All of the vegetation and habitats at the proposed quarry site are exotic and of Negligible ecological value. There are no naturally occurring indigenous vegetation or habitats within the Site.
  - There are no waterways, permanent water bodies or wetlands within the proposed quarry site.
  - The habitats within the Site generally do not provide important habitat for indigenous birds, including nationally Threatened and At Risk species which, except for South Island pied oystercatcher, likely only use the Site infrequently and irregularly for foraging. Similar intensively managed farmland habitats are widespread in the surrounding area.
  - A moderate diversity of indigenous birds is likely to use the intensively managed farmland within the Site, at least from time to time, but generally the Site does not provide important habitat for indigenous birds and these habitat types are widespread in the surrounding area, and across the Canterbury Plains. Of the four Threatened and At Risk species known, or likely to occur in the wider area, only South Island pied oystercatcher (At Risk - Declining) were recorded at the Site.
  - We consider that there is no suitable habitat for lizards, or indigenous terrestrial invertebrates of conservation importance, within the Site.
  - The proposed quarry site is not ecologically significant under any of the criteria for determining ecological significance in Appendix 3 of the Canterbury Regional Policy Statement.
- Because the Site is entirely intensively managed farmland, the potential ecological effects of the proposed quarry are limited.
- Although the intensively farmed habitats within the Site provide limited breeding habitat for indigenous bird species, if quarry construction and expansion is undertaken during the bird breeding season there is the potential for works to damage or disturb the nests of a small number of indigenous bird species including South Island pied oystercatcher. Pre-construction surveys for nesting birds are recommended to avoid this effect.

- Planting of at least 29.4 ha of indigenous vegetation, which is proposed as part of the project, will result in a substantial Net Gain in indigenous vegetation and habitats within the Site.
- Ecological input into the Rehabilitation Plans for each stage of extraction activity is also recommended to ensure that plantings are ecologically appropriate and achieve the best outcomes for indigenous biodiversity.
- The level of effect of the construction and operation of the proposed quarry on ecological values, with implementation of impact management recommendations, is expected to be Very Low. Overall, and taking into account the indigenous plantings proposed as part of the project, the proposal is expected to result in a Net Gain in indigenous biodiversity at the Site.

9.0 References

Atkinson, I. A. E. (1985). Derivation of vegetation mapping units for an ecological survey of Tongariro National Park North Island, New Zealand. *New Zealand Journal of Botany*, *23*(3), 361–378.

Cieraad E., Walker S., Price R., and Barringer J. 2015: An updated assessment of indigenous cover remaining and legal protection in New Zealand's land environments. *New Zealand Journal of Ecology 39*: 309-315.

Dawson, D.G. Bull, P.C. (1975). Counting birds in New Zealand Forests. *Notornis 22(2):* 101-109.

Ecroyd, C. E., Brockerhoff, E.G. (2005). Floristic changes over 30 years in a Canterbury Plains kanuka forest remnant, and comparison with adjacent vegetation types. *New Zealand Journal of Ecology* **29** (2): 279-290.

Environment Canterbury. (2013). *Canterbury Regional Policy Statement 2013*. Environment Canterbury.

Harding, M. A. (2009). Canterbury Land Protection Strategy: A Report to the Nature Heritage Fund Committee*. Wellington: Nature Heritage Fund*.

Leathwick, J.; Wilson, G.; Rutledge, D.; Wardle, P.; Morgan, F.; Johnston, K.; McLeod, M.; Kirkpatrick, R. 2003*. Land Environments of New Zealand.* David Bateman. 184p.

McEwen, W. M. (Ed). (1987). *Ecological Regions and Districts of New Zealand.* Third revised edition in four 1:50,000 maps. Booklet to accompany Sheet 3. New Zealand Biological Resources Centre. Publication No. 5. Department of Conservation, Wellington.

Ministry for the Environment (2020). *National Policy Statement for Freshwater Management 2020*. Wellington: Ministry for the Environment.

Robertson, C.J.R., Hyvönen, P., Fraser, M.J., Pickard, C.R. (2007). *Atlas of Bird Distribution in New Zealand 1999-2004*. The Ornithological Society of New Zealand. Wellington, New Zealand.

Robertson, H. A., Baird, K. A., Elliott, G. P., Hitchmough, R. A., McArthur, N. J., Makan, T., Miskelly, C. M., O'Donnell, C. J., Sagar, P., M., Paul Scofield, R., Taylor, G. A., Michel, P. Conservation status of birds in Aotearoa New Zealand, 2021. *New Zealand Threat Classification Series 36*. Department of Conservation, Wellington. 43 p.

Roper-Lindsay, J., Fuller, S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). *Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.* 2nd edition.

Steven, J.C., Meurk, C.D. (1996). *Low and High Plains Ecological Districts, Plains Ecological Region, Canterbury. Protected Natural Areas Survey Report* (Draft Report). Department of Conservation and Landcare Research.

Walker, S.; Cieraad, E.; Barringer, J. (2015). *The Threatened Environment Classification for New Zealand 2012: a guide for users.* Landcare Research, New Zealand Ltd, Dunedin.

Wildland Consultants (2013). *Guidelines for the Application of Ecological Significance Criteria for Indigenous Vegetation and Habitats of Indigenous Fauna in Canterbury Region*. Report No. 2289i. Prepared for Environment Canterbury, June 2013.

Appendix 1: Assessing Ecological Value and Level of Effects

Assessing Ecological Value

For communities, habitats and ecosystems we applied the four matters as described in the EIANZ guidance (Roper-Lindsay et al. 2018). Each of the four matters was assigned a score of "high", "moderate", "low" or "very low", based on the relevant attributes (Table 3).

The four scores were then combined to provide a single site score which ranges from "Very High" to "Negligible" based on the following system (refer to Table 4).

For species, we applied Table 5 to assign value to species as described in the EIANZ guidance (Roper-Lindsay et al. 2018).

Tables 3 - 7 are reproduced from the EIANZ EcIA Guidelines (Roper-Lindsay et al. 2018).

Table 3. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation / habitat / community for terrestrial ecosystems (from Roper-Lindsay et al. 2018).

MATTERS	ATTRIBUTES TO BE CONSIDERED
Representativeness	Criteria for representative vegetation and aquatic habitats: – Typical structure and composition – Indigenous species dominate – Expected species and tiers are present – Thresholds may need to be lowered where all examples of a type are strongly modified Criteria for representative species and species assemblages: – Species assemblages that are typical of the habitat – Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/distinctiveness	Criteria for rare/distinctive vegetation and habitats: – Naturally uncommon, or induced scarcity – Amount of habitat or vegetation remaining – Distinctive ecological features – National priority for protection Criteria for rare/distinctive species or species assemblages: – Habitat supporting nationally Threatened or At Risk species, or locally uncommon species – Regional or national distribution limits of species or communities – Unusual species or assemblages – Endemism
Diversity and pattern	– Level of natural diversity, abundance and distribution – Biodiversity reflecting underlying diversity – Biogeographical considerations – pattern, complexity – Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	– Site history, and local environmental conditions which have influenced the development of habitats and communities

MATTERS	ATTRIBUTES TO BE CONSIDERED
	– The essential characteristics that determine an ecosystem's integrity, form, functioning, and resilience (from "intrinsic value" as defined in RMA) – Size, shape and buffering – Condition and sensitivity to change – Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material – Species role in ecosystem functioning – high level, key species identification, habitat as proxy

Table 4. Assigning overall value to areas (refer to Table 3 for the matters to be considered for terrestrial communities) (Roper-Lindsay et al., 2018).

VALUE	DESCRIPTION
Negligible	Area rates Very Low for three matters and Moderate, Low or Very Low for remainder.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for two or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
High	Area rates High for two of the assessment matters, Moderate and Low for the remainder, or Area rates High for one of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Very High	Area rates High for three or all of the four assessment matters. Likely to be nationally important and recognised as such.

Table 5. Criteria for assigning ecological value to species (Roper-Lindsay et al., 2018).

ECOLOGICAL VALUE	SPECIES CLASSIFICATION
Negligible	Exotic species, including pests, species having recreational value.
Low	Nationally and locally common indigenous species.
Moderate	Species listed as any other category of *At Risk* (Recovering, Relict, Naturally Uncommon) found in the 'zone of influence' (ZOI) either permanently or seasonally; or Locally (ED) uncommon or distinctive species.
High	Species listed as *At Risk – Declining* found in the ZOI either permanently or seasonally.
Very High	*Nationally Threatened* (Nationally Critical, Nationally Endangered, Nationally Vulnerable) species found in the ZOI either permanently or seasonally.

Assessing Magnitude of Impact

Once the value of the ecosystem components had been determined, the magnitude of the impact was assessed. Magnitude is determined by a combination of scale (temporal and spatial) of effect and degree of change that will be caused in or to the ecological component. A typical scale of magnitude ranges from "Very High" to "Negligible" as shown in Table 6.

Table 6. Criteria for describing magnitude of effect (Roper-Lindsay et al., 2018).

MAGNITUDE	DESCRIPTION
Very High	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element / feature.
High	Major loss or major alteration to key elements/ features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element / feature.
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element / feature.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances/patterns; AND/OR Having a minor effect on the known population or range of the element / feature.
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the "no change" situation; AND/OR Having a negligible effect on the known population or range of the element / feature.

Assessing Level of Effect

The overall level of the effect on each ecological feature was determined by combining the ecological value of the vegetation communities, habitats, ecosystems and / or sites (Table 4) or species (Table 5) and the magnitude of the impact (Table 6) using the matrix in Table 7.

Table 7. Criteria for describing the level of effect (Roper-Lindsay et al., 2018).

		ECOLOGICAL VALUE				
		Very High	High	Moderate	Low	Negligible
MAGNITUDE	Very High	Very High	Very High	High	Moderate	Low
	High	Very High	Very High	Moderate	Low	Very Low
	Moderate	High	High	Moderate	Low	Very Low
	Low	Moderate	Low	Low	Very Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low	Very Low
	Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

The EIANZ EcIA guidelines (Roper-Lindsay et al. 2018) note that the level of effect can then be used as a guide to the extent and nature of the ecological management response required (including the need for biodiversity offsetting). For example:

- '**Very High**' represents a level of effect that is unlikely to be acceptable on ecological grounds alone (even with compensation proposals). Activities having very high adverse effects should be avoided.

- ‘**High**’ and ‘**Moderate**’ represents a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be managed through avoidance, design, or extensive offset or compensation actions.
- ‘**Low**’ and ‘**Very Low**’ should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking impact management measures developed during project shaping into consideration, then it is essential that prescribed impact management is carried out to ensure low or very low-level effects.
- ‘**Very Low**’ level effects can generally be classed as ‘not more than minor’ effects.

Appendix 2: Site Photographs



Photo 1: *Typical pasture dominated by perennial ryegrass.*



Photo 2: *A paddock sown with a brassica fodder crop.*



Photo 3: *A radiata pine shelterbelt on the property boundary.*



Photo 4: *An example of a wet depression within improved pasture where water pools after rainfall or irrigation.*

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Whangarei, Auckland, Hamilton, Tauranga, Wellington, Nelson, Christchurch, Dunedin, and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

---

www.boffamiskell.co.nz

Whangarei	**Auckland**	**Hamilton**	**Tauranga**	**Wellington**	**Nelson**	**Christchurch**	**Queenstown**	**Dunedin**
09 358 2526	09 358 2526	07 960 0006	07 571 5511	04 385 9315	03 548 8551	03 366 8891	03 441 1670	03 470 0460

Assessment of Soil Related Effects for Burnham Quarry

Prepared for

Burnham 2020 Ltd

July 2023

PATTLE DELAMORE PARTNERS LTD
Level 2, 134 Oxford Terrace
Christchurch Central, Christchurch 8011
PO Box 389, Christchurch 8140, New Zealand

Office +64 3 345 7100
Website **http://www.pdp.co.nz**
Auckland Tauranga Hamilton Wellington
Christchurch Invercargill

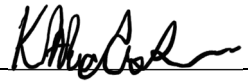
solutions for your environment

Quality Control Sheet

TITLE	Assessment of Soil Related Effects for Burnham Quarry
CLIENT	Burnham 2020 Ltd
VERSION	Final
ISSUE DATE	5 July 2023
JOB REFERENCE	C040961395
SOURCE FILE(S)	C04096139500R003_Soils AEE- final.docx

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE 

Katherine McCusker

Reviewed and Approved by

SIGNATURE 

Peter Callander

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Burnham 2020 Ltd and others (not directly contracted by PDP for the work), including Environment Canterbury. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

Executive Summary

The proposed quarry area ("the site") covers an approximate area of 362 hectares, is essentially triangular in shape and is bounded to the south by Grange Road, to the east by Aylesbury Road and to the west by farmland, paddocks and associated relatively remote housing. The site is currently a dairy support farm, irrigated by water supplied by Central Plains Water Limited and comes under their nutrient load and environmental management plan.

This site is Land Use Capability Class (LUC) 4, so it is not impacted by the proposed National Policy Statement (NPS) - Highly Productive Land, which became operative on 17 October 2022. Rehabilitation will progressively restore topsoil over areas already quarried to enable appropriate future uses.

The quarry activity is expected to use a maximum of 40 ha (11%) of the site at any time. Due to the scale of the site, the quarry and farm can co-exist. To ensure successful co-existence it is important that as much irrigated land as possible is maintained during the quarrying operation and that the land is rehabilitated after quarrying, returning its productive capability. Given that most of the irrigation is provided to the farming operation by centre pivot irrigators, minimizing the disruption to centre pivots is important to maximizing irrigated land and re-establishing irrigation during the rehabilitation process, which will be needed to return land to productive pastures.

The predominant soil is a Lismore 1a.1 (80%), a shallow well drained silt that is between 0.3 and 0.4 metres deep over gravels. The remaining 20% of soils are Lismore 2a.1 and Templeton 9a.1, that are also well drained silt soils with varying amounts of stones. When irrigated these soils are suitable for pastoral and arable crop production.

The first stage in preparing a new area for quarrying is to strip the topsoil. The proposed rehabilitation methodology following quarrying will see the 0.3 – 0.4 m thick soils from current stripping areas directly reinstated into areas being rehabilitated, being laid over a combination of silts and aggregate by-products. Soils from the site will be applied so that the re-established soil structure is the same the soil structure on the site before quarry activities occurred, thereby preserving the soil versatility.

The post-quarry landform is expected to remain on average around 10m below current ground level (bgl), being shallower in the south-east and deeper in the north and west. The intention of post-quarry rehabilitation is to ensure post-quarry farm productivity and to provide adequate filtration capacity between re-established pasture and groundwater resources, to limit the risk of pathogen infiltration from any farming activities which might occur on the rehabilitated site.

Glossary of terms

Cultivation: to prepare the land for sowing pasture or crops

Field Capacity: The maximum amount of soil water held in the soil after excess water has drained away.

Gravel: weathered rock fragments deposited as a result of sedimentary and erosive geological processes.

Pea gravel: gravel fragments less than 10 mm diameter

Suitably Qualified Rural Professional: a member of NZIPIM of Primary Management (NZIPIM) or a Certified Nutrient Management Advisor

Sand: The coarsest of the three soil textural classes (sand, silt, and clay); a soil particle between 0.06 and 2.0 mm in diameter.

Silt: The intermediate soil textural class between sand and clay; a soil particle between 0.002 and 0.06 mm in diameter.

Soil wetness and 'wet soil' a generic term to denote water content at or above the soil's plastic limit.

Soil plastic limit: The water content at which soil material becomes plastic (mouldable) and prone to compression and smearing. Although the plastic limit is not manifest in sandy soils, they are prone to compression at high water contents.

Subsoil: The physio-chemically and biologically altered layers below the topsoil that are functioning parts of the soil profile.

Topsoil The uppermost and most physically and biologically altered horizon, of undisturbed soil profiles.

Permanent Wilting point: the minimum amount of water in the soil that the plant requires not to wilt.

Executive Summary		ii
1.0	Introduction	1
2.0	Purpose of the Report	1
3.0	Overview and Environmental setting	1
3.1	Site description	1
3.2	Gravel Extraction Staging	3
3.3	Climate	3
3.4	Groundwater levels beneath the site	3
4.0	Soils Description	4
5.0	Land Use Capability	5
6.0	Soil Management Plan	7
6.1	Gravel Extraction Staging	9
6.2	Soil Rehabilitation	9
6.3	Sequence of soil placement	10
6.4	Irrigation	11
7.0	Assessment of Effects	11
7.1	Nitrogen loss to groundwater	11
7.2	Phosphorus loss to water	12
7.3	Pathogen loss to water	13
7.4	Nutrient loss to surface water	14
7.5	Soil loss to water	14
7.6	Soil Productivity	14
7.7	Effects of disturbance on soil properties and productivity	14
7.8	Dust	16
8.0	Soil monitoring	16
9.0	Statutory and planning documents related to soils and nutrient loss	17
9.1	National Policy Statement for Highly Productive Land	17
9.2	National Environmental Standard for Freshwater 2020 (NES-F)	18
9.3	Canterbury Regional Policy Statement	19
9.4	Canterbury Land and Water Plan	19
9.5	Land and Water Regional Plan including Proposed Plan Change 7	21
10.0	Conclusion	22
11.0	References	23

Table of Figures

Figure 1 Texture of Soil siblings for the site 5

Figure 2: Relationship between LUC classes and versatility of use (from Lynn et al., 2009). 6

Figure 3: Selwyn Waihora Land Use Classification A-1

Figure 4: Test Pit Locations A-2

Figure 5: Soil Map A-3

Table of Tables

Table 1: Soil on Burnham farm (S-map) 4

Appendices

Appendix A: Figures

Appendix B: Overseer report

Appendix C: Soil Management Plan

1.0 Introduction

Pattle Delamore Partners Limited (PDP) was commissioned by Burnham 2020 Ltd to undertake a soil management assessment of the underlying ground conditions for a proposed aggregate quarry venture.

Burnham 2020 has purchased an area of active farmland near Burnham (referred to as Burnham Farm), to utilise the underlying strata for aggregate production through quarrying and material processing. During the quarrying activities, the farm area yet to be quarried will continue to be run as a dairy support operation under the management of the previous owner. The quarry will progressively be rehabilitated back to farmland.

The proposed quarry area ("the site") covers an area of 362 hectares, is essentially triangular and is bounded to the south by Grange Road, to the east by Aylesbury Road and to the west by farmland and associated relatively remote housing.

2.0 Purpose of the Report

The purpose of this report is to provide:

- a summary of the soil and Land Use Capability units on Burnham Farm,
- a description of the soil management strategy to rehabilitate the soils for agricultural production following gravel extraction, and
- an assessment of effects relating to soil management and agricultural land use for the proposed activity, with particular reference to the Canterbury Regional Policy Statement, the Canterbury Land and Water Regional Plan, the National Policy for Highly Productive soils, and the National Environmental Standards-Freshwater.

3.0 Overview and Environmental setting

The applicant proposes to undertake gravel extraction on the property in stages over a period greater than fifty years. Up to around 22 ha will be actively quarried at any one time, this excludes the quarry offices, carparks, roads, and infrastructure (permanently located processing plant and stockyards) and the silt management zone. The land will be rehabilitated back to irrigated pasture farmland as quarrying progresses. A landscape plan has identified areas that will be planted in native plants to provide a buffer strip around the site.

3.1 Site description

The site is located within a block of land bound by Grange Road to the south, and Aylesbury Road to the east and is approximately 362 ha. Access to the farm office and yards is at 160 Grange Road.

The site is located within the Selwyn District and is 1 km from Burnham Military Camp and associated housing.

The site is an operational dairy support farm that totals 388 ha and has 375 ha in productive pasture and crops, which includes land on the south side of Grange Road that is not part of the area to be quarried. The current farming operation grazes 1650 heifer calves from 1st Dec to 31st April, and 1650 yearling heifers 1st May to 1st May. The farm also grazes 80 Jersey bull calves from 1st Dec through to heifer mating the following spring. The total stocking rate in the year end 2020 was 12,044 SU and 39.5 SU per grazed hectare. The farm will continue to operate in the short term with a similar stocking policy and stocking rate per productive hectare when the gravel extraction is underway. Total stock numbers will be adjusted to allow for the loss of productive land during quarrying.

The farm currently is fully irrigated by three 515m centre pivots (270 ha), four single span towable pivots (65 ha) and set sprinklers. Water for the irrigation is provided by Central Plains Water Limited (CPWL) at 208 l/second at 4 – 5 bar pressure and is sufficient to provide 5mm of irrigation per hectare throughout the irrigation season, except for when CPWL is under water take restrictions. The farm has soil moisture monitoring and follows irrigation good management practices.

The intention is to continue irrigating the pasture and crops of the farm area that is yet to be quarried, using CPWL water. The farm has a Farm Environment Plan (FEP) and comes under the environmental management of CPWL including their nutrient discharge allowance and FEP audit programme,

There are also 4 irrigation production bores on the property which provided irrigation water prior to the use of CPWL water, pursuant to an existing water permit held by Burnham 2020 Ltd (which it applied to renew on 26 August 2021 and 26 November 2021). Those bores continue to be available as irrigation supply if required and will provide the water supply for the proposed quarrying activities (pursuant to a consent application that is currently in progress).

Each year between 2018/19 and 2020/2021 35 ha of kale and 22 ha of annual forage ryegrass was grown for intensive winter feed and grazed between 1 May and 30 September. Between 2013 and 2017 fodder beet was also grown and the total area of forage crops was the same. Under the National Environmental Standards for Freshwater (NES-F) controls on the expansion of the area of land used for intensive winter grazing came into force from 1 May 2021. The maximum area of intensive winter grazing (kale and annual ryegrass) was 57 ha or 14.7% of the total farm area in the reference period of 1 July 2014 to 30 June 2019. For 2023 onwards the maximum area of intensive winter grazing will be less than 50 ha, all areas will be on less than 10 degrees of slope and can meet the other criteria for a permitted activity. No additional consent is needed under the temporary Intensification provisions in the NES-F.

The property has a farm environment plan (FEP), regular audits and the year ending current nutrient loss was 28 kg N/ha/yr (Overseer v 6.5.1).

The site perimeter along Aylesbury Road, Grange Road, and the property boundaries adjacent to Kivers Road is already fully screened by an evergreen shelter belt approximately 5m high by 3.5m wide. The quarrying operation will maintain the existing planting for a visual screen except where the new quarry entrance on Aylesbury Road will be established. Where there are gaps or poor screening, additional, or replacement planting will be undertaken.

In the SE corner of the site additional planting native will be completed within a 120m setback zone. Irrigation will be provided to ensure planting establishes.

3.2 Gravel Extraction Staging

The site will be extracted and rehabilitated in stages. Timeframes are estimated based on projected demand and are subject to change:

• Years 1-6. Initial extraction. These areas will be used to set up the processing plant area, stockyard, and amenities for the life of the quarry – as a result they will not be rehabilitated until the site's end of life.

• Years 7-10. Extraction towards the SE corner of the site. From the start of this stage the quarry will be progressively rehabilitated.

• Years 10+. Extraction and rehabilitation in a clockwise direction around pivot 1, then into pivot 2 and finally pivot 3, as shown in Figure 1 Appendix C. Areas between and beside pivots will be extracted and rehabilitated with each move into new areas enabling reinstatement behind the leading edge.

3.3 Climate

The long term average rainfall for Burnham Farm is 681 mm/year, average temperature of 11.8°C and annual potential evapotranspiration PET is 916mm/year. Climate data for the property has been sourced from OverseerFM's climate station tool (Overseer version 6.4.3) for the nitrogen losses.

3.4 Groundwater levels beneath the site

A groundwater report is being prepared that provides an assessment of the highest groundwater levels beneath the site (PDP, 2023). Quarrying will be managed to maintain a 1 m separation between the base of the quarry excavations and the highest estimated groundwater levels. The groundwater is shallower in the southern area of the farm and deeper in the more northern and western areas.

4.0 Soils Description

S-Map (Manaaki Whenua Landcare Research) has mapped the area at 1:50,000 and have identified soil type as predominately Lismore 1a.1 (80%). There are Lismore2a.1 and Templeton 9a soils mixed into the Lismore 1a. The proportions of soils may vary across the property as indicated by percentage of stones found in the soil and the depth and colour of the soil. The soils are classed as medium soils in Canterbury maps – Environment Canterbury Soil Types (Appendix A Figure 5)

The profile available water (PAW) is a measure of the capacity of the soil sibling to store water that is potentially available for plant growth. These soil siblings are all considered to have a moderate PAW, making them suitable to grow pasture and a wide range of crops.

Table 1: Soil on Burnham farm (S-map)

S-Map name	% of soil	Depth	Texture	% Stone at 400 mm	Drainage class	PAW at 60 cm (mm)	Soil Order
Lismore_1a.1	80	Shallow	silt	0 – 10%	Well drained	93	Brown
Lismore_2a.1	10	Shallow	silt	10 - 35%	Well drained	75	Brown
Templeton_9a.1	10	Moderately Deep	silt	0	Well drained	105	Pallic

PDP undertook a site investigation in December 2019 with forty-two test pits, logged, sampled to a target depth of 10.0m bgl and backfilled back to ground level. These test pits logs have been used to determine the depth of topsoil and subsoil for this report.

The site works were segregated into three phases based on the requirements of Winstone Aggregates, to gauge a better understanding of the geological resource.

For each phase of work, test locations were positioned using a Trimble Catalyst GPS location device and then scanned by the GPR operator prior to breaking ground. A test location plan is presented in the Appendix A Figure 4.

The average topsoil thickness was between 300mm and 400mm across the three phases of test pits (Table 2). Shallow soils are soils that are 20 – 45 cm deep to gravel or bedrock, therefore these soils are classed as shallow silt soils over gravel for drainage modelling.

The topsoil (A horizon) was identified as a dark brown sandy gravelly silt, dry well graded, sand, fine to coarse gravel, fine to coarse, rounded to subrounded slightly weathered Greywacke with organics, roots, and wood fragments.

Figure 1 shows the texture profile of the siblings found in the map unit. Each horizon is coloured according to its texture (source [Soil map unit factsheet (landcareresearch.co.nz)])

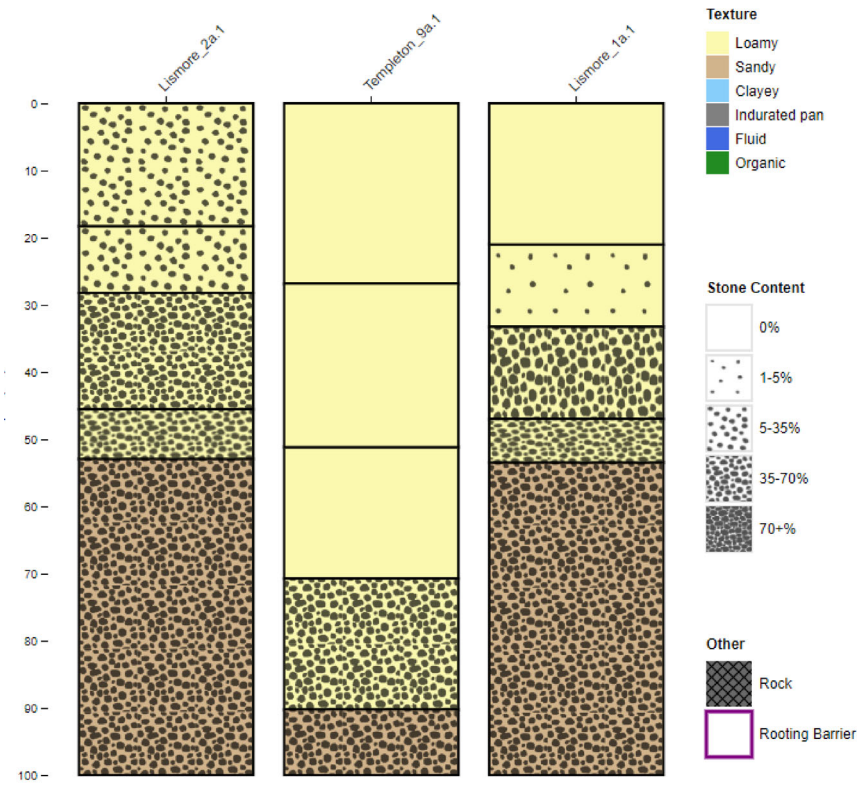
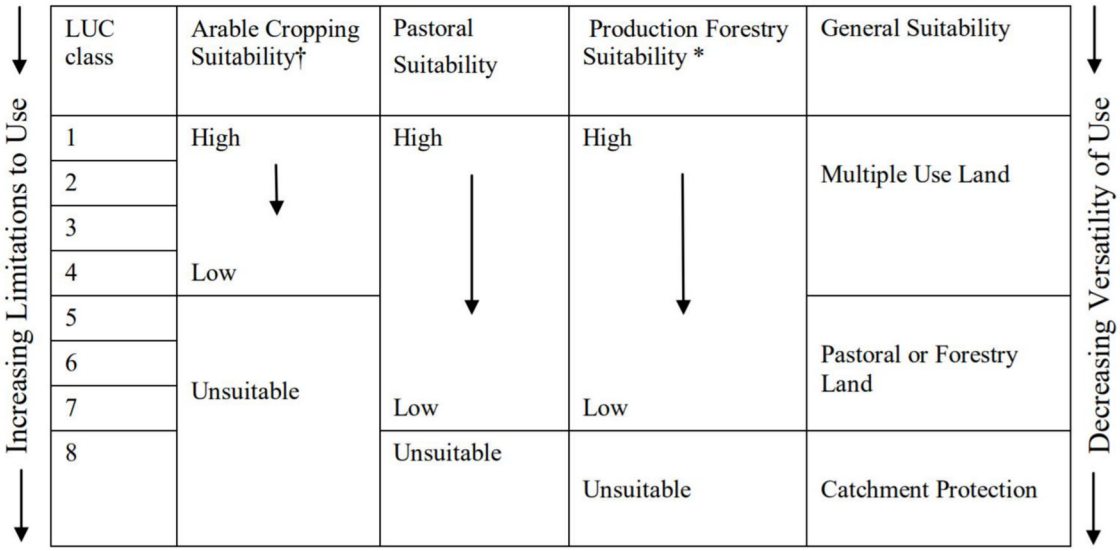


Figure 1 Texture of Soil siblings for the site

5.0 Land Use Capability

The Land Use Capability (LUC) classification is used to assess the long term sustainable capability of land to support production for cropping, pastoral farming, forestry, and soil/water conservation. Additionally, the classification indicates the versatility of the land and its given limitations for use (**Figure 2**).



LUC class	Arable Cropping Suitability†	Pastoral Suitability	Production Forestry Suitability *	General Suitability
1	High ↓	High ↓	High ↓	Multiple Use Land
2				
3				
4	Low			
5	Unsuitable	Low	Low	Pastoral or Forestry Land
6				
7				
8		Unsuitable	Unsuitable	Catchment Protection

Figure 2: Relationship between LUC classes and versatility of use (from Lynn et al., 2009).

A detailed description of the system is provided in the Land Use Capability Survey Handbook, a 3rd edition of which was published in 2009 (Lynn et al., 2009). The LUC classification is based on five inventory factors including rock type, soil type, slope, erosion, and vegetation.

The LUC mapping unit is in three parts:

- <u>The LUC class</u>

  The LUC class is the broadest grouping in the classification, identifying the general degree of limitation to arable use. It comprises eight classes. Classes 1 to 4 are classified on their suitability for cultivation for cropping, with class 1 being the most versatile with few limitations to use, through to LUC class 4 which has limitations, so it is marginal for cultivation for cropping. This site is LUC 4 due to the shallow topsoil over gravels which limits the cultivation options.

- <u>The LUC subclass</u>

  The LUC class is subdivided into one of four subclasses, depending on the major physical limitation to use. There are four limitations; erodibility (e), wetness (w), soil (s), and climate (c). They are denoted by the small letter e, w, s, or c after the LUC class number. This site is suitable for pastoral farming but limited by moderate soil(s) limitations.

- The LUC unit

  The third and most detailed level of classification is the LUC unit. The unit groups areas that require the same kind of management, the same kind and intensity of soil conservation treatment, and are suited to the same kinds of crops, pasture or forestry species which require specific conservation measures and management practices to achieve similar yields.

This site LUC class 4 becomes 4s 7 and is described as terraces and plains with shallow and stony soils of medium to low fertility in seasonally moisture-deficient districts. These soils are often irrigated to overcome the moisture deficits. They are suitable for occasional cropping, pasture farming, tree crops and maybe suitable for viticulture and berry fruit.

The information provided in the soil site investigation (section 4) also confirms these are shallow soils over gravels that are consistent with LUC 4 land.

6.0 Soil Management Plan

A draft Soil Management plan is provided in Appendix C This sets out the key concepts to inform a Soil Management Plan, including an explanation for why each action is required.

The purpose of the Soil Management Plan is to:

a) Ensure that the removal, management, and placement of soil avoids or minimises impacts on the soil properties prior to and following placement, and that the re-established soil retains the soil versatility of the original soil on the site, and

b) to ensure that soil management activities avoid potential adverse effects on the surrounding environment.

Key to the effective reestablishment of the soil on the gravel extraction site are careful pre-planning, adherence to the guidance provided in the Soil Management Plan, and the training of all staff involved.

The main on-ground factors that achieve successful land restoration and retain productive value of the land are preparation of the existing surface to ensure it has the appropriate contour, and careful removal and placement of the soil material and silt so they are not degraded or compacted.

Soil carbon is critical for soil health, it feeds the soil biology and helps retain soil moisture and nutrients. Average soil carbon stocks in New Zealand's agricultural soils are estimated at about 100 tonnes per hectare in the top 300mm. It is important that the topsoil is retained and applied back onto the rehabilitated areas, particularly as the reinstated subsoil (washed silt, pea gravel and other products) will be very low in soil carbon.

The assessment of the site geology has indicated the following materials that could be involved in rehabilitation of the land following quarrying:

- The topsoil depth appears to be uniform across the site at approximately 300mm – 400mm across the site and will contribute to the total post-rehabilitation depth;
- The samples show an average of 4.6% silt of the total extractable volume;
- There are likely to be minor additions to the rehabilitated quarry land from losses of washed products, sand and crushed fines and pea gravel.

However, there are a number of factors which could mean less material is available:

- The samples used may not be fully representative of all the material that is quarried;
- Some of the pea gravel is utilised to produce manufactured sand;
- Up to 50% of the product could be sold as either base course or pitrun, which is not washed so the silt from this portion of the product would not be available for rehabilitation;
- At this stage, the expected average depth of the quarry is 10m, but it is likely to be shallower in the south-eastern corner with higher groundwater and the shallower area will provide less material and therefore less silt, although this could be offset by excavations in other deeper areas of the site.

The reinstated soil will have at least 200mm depth of subsoil and at least 200mm depth of topsoil providing a soil profile depth of at least 400 mm with no significant barriers to plant roots.

If insufficient material is going to be available to create a soil with a depth of 400mm the options, then less material will be sold as pitrun/base course. Under the lease agreement with the farmer running the stock on the property, the soil Olsen P will need to be returned to the levels prior to quarrying. Pasture soil testing is normally to 60 cm. The reinstated subsoil will have very low levels of nutrients, and this is likely to make up 50 percent of the top 60cm of soil, therefore fertiliser will be required before or during pasture establishment.

Pasture is the best vegetation for preparing the soil for agricultural uses. The fine roots of pasture create soil structure and grow into the new subsoil to coat cracks and pores. Generally, after three years in pasture (post quarrying) and with careful stock management to avoid compaction, the soil will be suitable for a range of agricultural uses. The addition of deeper rooting pasture species for example plantain and chicory will help to increase the soil porosity and add organic material.

Temporary or permanent irrigation will be reinstalled on the rehabilitated areas, and pasture will be established as soon as possible after the soils are reinstated. Limitations for arable use should remain the same as the current land-use as the site will have slopes that are less than five degrees, be irrigated and have a similar depth of topsoil.

6.1 Gravel Extraction Staging

The gravel extraction will be staged with removal of topsoil and overburden undertaken incrementally. Staging the gravel extraction reduces the short term loss of productive land on the site and reduces the volume of soil requiring stockpiling and the time the soil is stockpiled. This in turn reduces the potential for soil degradation and soil loss (by overland flow runoff or wind). It's estimated to take approximately 6 years to extract and process the production zone, primary stockyard, and secondary stockyard. In years 7 – 10 extraction will be towards the SE corner of the site and from the start of this stage the quarry will be progressively rehabilitated. Extraction and rehabilitation will proceed together, with each move into new areas enabling reinstatement behind the leading edge.

6.2 Soil Rehabilitation

6.2.1 Subsoil

The subsoil is permitted up to 200mm of the final land surface and a minimum soil thickness (topsoil and subsoil) of 400mm is required over the quarry base. The final re-established subsoil profile should be predominantly fine matrix soil materials, free of stones over 150 mm in diameter and other coarse materials.

The following properties are required for the subsoil material:

- Silts either in slurry form or placed using dump trucks and earthworks machinery.
- The subsoil may include organic forestry residue and dead pasture material that was in the soil from the extraction site and stockpiled sub soil. This site came out of forestry in 2008/2009 and some forestry residues remain, large logs/roots will be removed.
- May include topsoil if there has been mixing of topsoil with subsoil.

- The subsoil material can include up to 35% by volume of gravels (moderately gravelly)[1] of 6-30 mm diameter[2] with fine soil matrix materials.

It is unlikely that large stones would be disposed into the land to be rehabilitated, as generally anything over approximately 30mm has good economic value. However, it is possible that a few larger stones could remain in the rehabilitated soil due to being present in the topsoil or from incidental incorporation into stockpiles.

6.2.2 Topsoil properties

The topsoil should occupy the upper 200-400 mm of the final re-established soil profile. This is to ensure the final re-established soil profile has a topsoil that has organic matter, nutrients, and fine matrix soil materials similar to the original soil profile.

The following properties are recommended for the topsoil material:

- Topsoil removed from the extraction site and stockpiled should be used.
- Coarse organic materials are not permitted in the topsoil (tree roots and forestry residues).
- The topsoil may include up to 10% (by volume) of organic material provided it is thoroughly mixed with the other soil material. If the topsoil is stripped from one area and immediately applied to a rehabilitation zone it may contain organic material from the pasture.
- The topsoil material may have some stones and gravels present in the topsoil that was stockpiled/removed from the extraction site.

6.3 Sequence of soil placement

Soil placement is the single most important operation in the restoration process. The soil must be placed under optimal conditions to specified depths on a platform graded to design levels.

The platform design determines the future landform and must consider materials available, groundwater levels, erosion hazard, slope criteria for restored land use, aspect, microclimate, aesthetics, and most importantly, drainage (Ramsay, 1986). Final slopes of five or less degrees are considered optimal for cropping. Due to the scale of the property the new floor will have a less than five degree slope.

[1] Milne JDG, Clayden B, Singleton PL, Wilson AD. 1995. Soil Description Handbook. Lincoln, New Zealand, Manaaki Whenua Press. 157p. (p46).

[2] Milne JDG, Clayden B, Singleton PL, Wilson AD. 1995. Soil Description Handbook. Lincoln, New Zealand, Manaaki Whenua Press. 157p. (p45).

Once the shape of the existing land surface has been attained, the soil materials need to be placed using light track-driven machinery or lighter quarry machines or flotation tyred machinery. The topsoil material needs to be distributed in such a way as to achieve an approximately uniform stable thickness over the whole area.

Any exposed soil surfaces require protection from wind erosion. Light surface wetting of the soil topsoil via irrigation is an acceptable method. All areas that are not being actively quarried will be maintained in vegetation.

6.4 Irrigation

The farm currently is fully irrigated by three centre pivots, single span towable pivots and set sprinklers. The existing centre pivots will remain in place for as long as possible.

The newly formed boundary slopes will not be irrigated by centre pivots' end guns to avoid topsoil being washed off. Low application rate irrigation (either temporary or permanent) will be installed to establish and maintain newly sown pasture.

The irrigation water is available from CPWL from September to April, this water will extend the timeframe when soil conditions are suitable for rehabilitation and allow new grass to be sown as soon as possible following the topsoil placement. This will prevent dust and soil cracking.

The site is to be progressively stabilised i.e.; each active stage must be remediated as the excavation commences for the next stage. The area of irrigation at the bottom of the pit will progressively expand.

7.0 Assessment of Effects

7.1 Nitrogen loss to groundwater

The nitrogen loss to water as estimated by OverseerFM v6.5.1 for the current farming operation is 28 kg N/ha/year and approximately 10,840 kg N/ha/year for the whole property, as shown by the Overseer report in Appendix B. Nitrogen losses are managed under CPWL's nutrient load.

During quarrying, up to 40 ha of the property will be utilised for that purpose at any one time, of which around 22 ha will occupy the active quarry workings that will progressively move throughout the farm area and the remaining area (around 18 ha will be at a fixed location for access, administration, silt management and processing facilities. The area of the site in which quarry activities are occurring will have a low nitrogen leaching rate, related to the nitrogen content in rainfall (2 kg N/ha/yr, as modelled in OverseerFM v 6.5.1) and any additional input and take-up from planted areas. The areas of native planting generally have low nitrogen loss although it depends on the plant species.

As land will be removed from agricultural production by the quarry operation and with the planting of native vegetation in the buffer zones and on the rehabilitated slope, the nitrogen loss from the proposed operation will decrease. When modelled in Overseer the proposed system with 40 ha of quarry and 23 ha of trees and scrub the nitrogen loss reduces to 24 kg N/ha or 9,385 kg N total, a 14 % reduction from the current operation.

The farming operation will also ensure the nitrogen loss per hectare will reduce further in accordance with any planning requirements or changes to CPWL nutrient load. This will be achieved using plantain (a herb shown to reduce nitrogen leaching on grazed pastures by 7 -20%) and by nutrient and stock management.

Following quarrying the thickness of the soils and gravels above the highest water table level (permanently unsaturated zone) will be reduced from the current minimum depth range of 8 – 12 m across the farm to a depth of 1 m minimum. The intermittently saturated zone within which the water table fluctuates will remain unchanged. However, instead of having 8 – 22 m of strata above the water table this will be reduced to a depth of 1 – 11 m, depending on where the groundwater level is at any time. This is not expected to change the mass of nitrate reaching the water table as no significant attenuation occurs in this zone, but the nitrate will reach the groundwater sooner than is the current case. In conclusion following the rehabilitation of the quarried land, annual losses of nitrate to groundwater will be lower than current losses if the same agricultural land use practices continue due to some of the area being planted in native vegetation.

7.2 Phosphorus loss to water

Phosphorus losses to water are usually from runoff to surface water. This site does not have any surface water. As part of the rehabilitation programme phosphate fertiliser will be used to raise the Olsen P levels to similar levels as before quarrying. Fertiliser applications will be based on individual paddock soil testing and designed to meet pasture demand as determined by the nutrient budgeting software OverseerFM for most macro-nutrients (particularly phosphorus and potassium).

The P leaching vulnerability for Lismore soils has yet to be determined (S-Map fact sheets). Phosphorus leaching can occur after phosphate fertiliser is applied to pasture and crops. To reduce the risk of P loss the farm will use the following good management practices:

- The farm will have a soil testing and monitoring programme to ensure phosphate fertiliser is applied at optimal rates to minimise leaching.

- Only irrigate to meet the moisture needs of the plant and avoiding drainage. Varying the depth of irrigation on a daily basis can minimise the quantity of drainage, which is minimised further by adjusting applications according to weather forecasts. Compared to uniform rate irrigation, the use of variable depth has been shown to decrease P losses by up to 80% (McDowell, 2017)
- The timing of fertiliser or effluent P application to soil can influence P loss, mainly because of the effect soil moisture can have on the propensity for the generation of P leaching. P fertiliser will not be applied to soil at, or close to, field capacity or if heavy rain is predicted, or in the months of May to September included.
- The use of lower water soluble P fertilisers if higher rates of phosphate fertiliser are required.
- The rehabilitated pasture area will use deeper rooting pasture species to take up phosphorous in the subsoil.

The proposed activity will have a less than minor effect on this nutrient loss as the farming activity will not change and there will be a small reduction in farmed area.

7.3 Pathogen loss to water

The ongoing use of Burnham Farm by one- and two-year old dairy heifer replacements creates a source of *E. coli* and other pathogens that can migrate downwards to the underlying groundwater system, particularly during heavy rainfall events. *E. coli* is the indicator organism used to assess compliance with drinking-water standards in New Zealand. During this migration from the ground surface through the sub-surface environment, *E. coli* numbers are reduced by filtration, desiccation, dispersion, dilution, and natural die-off over time. The soil profile contributes to this reduction in *E. coli* numbers.

The topsoil over most of Burnham Farm is described from test pits as a dark brown sandy gravelly silt, well graded, sand, fine to coarse gravel, fine to coarse, rounded to subrounded slightly weathered greywacke with organics, roots, and wood fragments. The average topsoil thickness is 0.3 – 0.4 m.

The process described earlier in this report whereby, following the completion of quarrying, existing soils from the farm will be stripped and placed over the quarried areas, with an additional silty subsoil layer, will aid in the removal of *E. coli*. Crops will be planted to help develop the soil structure and it is expected that 1 – 2 years after the completion of quarrying the topsoil will have the same, or better bacterial removal rates than currently exist.

7.4 Nutrient loss to surface water

Burnham Farm is located near the middle of the Canterbury Plains, approximately 6.5 km north of the Selwyn/Waikirikiri River and 12.5 km south of the Waimakariri River. Therefore, there will be no overland flow from the farming operation on this site to surface water.

7.5 Soil loss to water

Soil management for quarry activities typically requires measures to avoid the risk of soil loss to water. However, at this site there are no surface waterways on, or immediately adjacent to, the property. The quarry site and the rehabilitated site will mostly be below the surrounding ground level so overland flow to a waterway will not occur from these areas. The bunds created around the boundary of the property to screen the quarry will be covered or vegetated with grass to reduce soil damage and loss caused by wind and rain.

The Lismore soils these are well drained soils with moderate permeability over gravels with rapid permeability. The depth of topsoil is not expected to change, therefore it is expected that rainwater will drain through the profile to the groundwater rather than pond. Areas of obviously impeded drainage, which show by way of surface ponding, will be examined to establish if any moisture restricting layer exists and appropriate ripping or subsurface aeration undertaken to shatter such compacted layers.

7.6 Soil Productivity

Following full establishment of the pasture vegetation, the soil should be capable of production similar to land that has been cultivated for cropping and re-grassed. As the pasture establishes over the first year, soil properties will improve due to the positive impacts of the pasture cover. These will include development of soil aggregates and soil biological activity.

In general, soil properties are likely to change more rapidly in the first few years following re-establishment, and then slow as the soil settles towards longer term equilibrium conditions.

Under established land use, soil quality changes commonly occur over decades depending on the intensity of land use, at which point contemporary land management practices are likely to have a greater impact on the soil rather than the soil property changes associated with the reestablishment of the soil.

7.7 Effects of disturbance on soil properties and productivity

Any soil disturbance (as part of any activity) is likely to result in disruption to soil properties. Soil disturbance or disruption can occur with any land use practice (e.g., cultivation for cropping). Adherence to the Soil Management Plan (most importantly during the removal and placement of the subsoil and topsoil materials) will ensure the effects are minimised and are no more than the soil

disturbance effects resulting from land use practices such as cultivation for cropping, forest harvesting and intensive pastoral use.

The effects on soil properties are likely to be predominantly soil physical effects related to soil compaction, loss of soil structure and degradation of soil aggregates during removal, transport and storage, and compaction of the soil material during placement. In turn, these can lead to impeded soil drainage (reducing air and water flow pathways in the soil), reduced soil water storage capacity, and reduced soil pores for biological activity. Soil fertility is not considered to be of primary concern as this can be remedied with the addition of fertiliser. If the steps set out in the Soil Management Plan, then effects on soil properties following restoration will be minimised.

Re-vegetation to pasture should be undertaken as soon as practicable after topsoil placement. This will minimise possible deterioration of soil structure and development of erosion problems on bare cultivated soils.

To encourage the rapid recovery of the soil structure, only light weight stock such as sheep and Calves/Rising 1 year cattle will be grazed on the pastures and no stock grazed in July and August in the first year after sowing the new pastures. A management system which promotes grass harvesting (hay and/or silage) over the first two years after rehabilitation is to be encouraged. This helps prevent recompacting the soil. Across the grazed area of the property the stocking rate will remain at the same level as the current stocking. Good management of wet soil to avoid degradation of soil structure will be important, especially managing stock movement on the soils during wet periods when the soil is saturated and susceptible to pugging and compaction.

The applicant intends to return the land to a productive agricultural standard. The farm will continue to operate, in the short term, a similar stocking policy and stocking rate per grazed hectare when the gravel extraction is underway. Total stock numbers will be adjusted to allow for the loss of productive land.

The land will be returned to productive use incrementally as works progress so to have as little impact on the productivity of the site's soil as possible. Based on the guidance provided in the Soil Management Plan, the method of extraction has been designed to achieve this goal.

In the long term, the aim is that the land will be suitable for a range of uses. Following post extraction rehabilitation (including establishment of the pasture vegetation) the soil resource will be capable of supporting at least the same range of land uses as the current soil resource and the life supporting capacity of the soil will be retained.

7.8 Dust

Soil management related potential for dust is associated with soil removal and placement, soil storage, transport, and post placement management. Mitigations are provided in the dust mitigation section of the Air Quality Assessment for storage and transport. This property has existing irrigation and will re-establish irrigation for the final placement of soil and to establish pasture, reducing the risk of dust problems.

The existing shelter belts will be retained, and any gaps planted and there will be a 120m setback, planted in native vegetation, from neighbouring dwellings.

8.0 Soil monitoring

Many physical, biological and, to a lesser degree, chemical soil properties show up as visual characteristics. Changes in land use or land management can markedly alter these. Research in New Zealand and overseas shows that many visual indicators are closely related to key quantitative (measurement-based) indicators of soil quality. A 'miniVisual Soil Assessment' (VSA) has been adapted for New Zealand farmers from the Soil Quality Management Assessment (SQMS) developed by Plant & Food Research, the Visual Soil Assessment produced by the Soil Management Initiative (UK) and Manaaki Whenua - Landcare Research visual soil assessment field guide. It is based on the visual assessment of key soil 'state' and plant 'performance' indicators of soil quality, presented on a score card. A miniVSA has been selected as an appropriate monitoring tool for this site for the following reasons:

- monitors soil structure and porosity
- turbidity
- includes soil biology (earthworm count)
- is simple to do and can be carried out by a farmer or Rural Professional
- is usually carried out annually in late winter/early spring for pasture farming.

A good soil structure provides greater resistance to compaction and maintains the necessary soil porosity for roots to access air, water, and nutrients. The structure & porosity score along with the turbidity score assess the structure and stability of soil aggregates. Earthworms are an important biological indicator. Through their feeding and burrowing activities, earthworms can enhance nutrient availability, increase the infiltration and movement of air and water, and improve the structural condition and stability of soils.

Scores for each test are recorded on a score sheet. To allow comparative assessment of the soil quality of the re-established soil a control site in a paddock on an undisturbed site will be included in ongoing soil monitoring to

differentiate between the effects of contemporary land use management and effects associated with the re-establishment of the soil.

Annual monitoring using miniVSA (Appendix C) in the areas rehabilitated within the last three years from the start of Phase 2 (i.e years 7 -10) shall be implemented. If the soil Quality Assessment in the VSA is ranked as poor three years after rehabilitation, a plan will be developed and implemented to improve the soil quality.

Additional soil testing to inform farm management and nutrient management will be carried out and this will be included in the soil Management Plan.

9.0 Statutory and planning documents related to soils and nutrient loss

9.1 National Policy Statement for Highly Productive Land

The NPS-HPL identifies LUC 1, 2 or 3 land as highly productive. As this site is LUC 4, it is not subject to the proposed National Policy Statement (NPS) - highly productive land which became operative on 17 October 2022.

Canterbury Water Management Strategy

The site is located within the area managed by the Selwyn/ Te Waihora Zone Committee. The committee have generated a Zone Implementation Programme (ZIP) for this zone. ZIPs are non-statutory documents that are being completed by each of the Zone Committees within the Canterbury region. ZIPs contain zone-specific recommendations for water management to achieve the CWMS targets.

The Selwyn Te Waihora ZIP addresses critical issues in the sub-regional area such as setting limits for nutrients and the health of Te Waihora. Improving the health of the lake includes actions such as effective riparian management of lowland streams, grazing management, sediment removal, habitat enhancement and nutrient stripping via wetlands. Healthy lowland streams, best practice nutrient and water management, and the integration of kaitiakitanga into water management are all recognised as priority outcomes in the zone.

The issues regarding the quality of water include farm nutrient management in both irrigated and non-irrigated contexts, sedimentation problems e.g., gravel pits and stock water and lastly urban and rural water quality management issues i.e., the setting of nutrient load limits.

This property is covered by an audited Farm Environment Plan (FEP), and they are proposing to operate at or below the nitrogen loss reductions required under the Canterbury Land and Water Plan they can be considered to be meeting these requirements.

9.2 National Environmental Standard for Freshwater 2020 (NES-F)

The National Environmental Standards for Freshwater 2020 partially came into force on 3 September 2020. Parts of the standards have later enforcement dates.

The purpose of the NES is the 'regulation of activities that pose risks to the health of freshwater and freshwater ecosystems'. The NES sets out requirements that need to be complies with. These standards are set to:

a. Protect existing inland coastal wetlands;

b. Protect urban and rural streams from in-filling;

c. Ensure connectivity of fish habitat (fish passage);

d. Set minimum requirements for feedlots and other stockholding areas;

e. Improve poor practice intensive winter grazing of forage crops;

f. Restrict further agricultural intensification until the end of 2024; and

g. Limit the discharge of synthetic nitrogen fertiliser to land and require reporting of fertiliser use.

Regulation 22 - Use of land as dairy support

The area of dairy support will decrease and is therefore it is a Permitted Activity under Regulation 22.

Subpart 3 - Intensive Winter Grazing;

Regulation 26 condition 3 requires Freshwater Farm Plans, these are not yet available for Canterbury so they cannot comply with Regulation 26 condition 3, therefore they need to comply with condition 4.

(a) at all times, the area of the farm that is used for intensive winter grazing must be no greater than 50 ha or 10% of the area of the farm, whichever is greater; and

(b) the slope of any land under an annual forage crop that is used for intensive winter grazing is 10 degrees or less,

(d) livestock must be kept at least 5 m away from the bed of any river, lake, wetland, or drain (regardless of whether there is any water in it at the time); and

(e) on and from 1 May to 30 September of any year, in relation to any critical source area that is within, or adjacent to, any area of land that is used for intensive winter grazing on a farm:

(i) the critical source area must not be grazed; and

(ii) vegetation must be maintained as ground cover over all of the critical source area; and

(iii) maintaining that vegetation must not include any cultivation or harvesting of annual forage crops.

The proposal meets Regulation 26, Condition 4, by having a maximum of 35 hectares of intensive winter grazing, flat ground less than 3 degrees of slope, and no waterways or criteria source areas and therefore it is a Permitted Activity under Regulation 26.

Regulation 29 provides further conditions for land used for intensive winter grazing. The regulations are designed to mitigate the effects of grazing livestock on forage crops between 1 May and 30 September. The current operation grazes about 35 ha of winter forage crop for intensive winter grazing and this is less than the maximum area of 57 ha grazed in the 2014 – 2019 reference period, therefore intensive winter grazing on this farm is a permitted activity under the Freshwater NES.

Subpart 4 Regulation 33 Application of synthetic nitrogen fertiliser to pastoral land.

The proposal meets Regulation 33 by not exceeding the nitrogen cap for application of nitrogen. The current farm activities and proposed farm activity comply with the permitted activity rule for application of synthetic nitrogen fertiliser as a maximum of 190 kg N/ha/year is applied.

In summary this farm is a Permitted activity under the Freshwater NES.

9.3 Canterbury Regional Policy Statement

The Canterbury Regional Policy Statement provides an overview of the significant resource management issues facing the region and sets out objectives and policies to achieve the integrated management of the natural and physical resources of Canterbury.

Policy 7.3.7 relates to avoiding, remedying, or mitigating any adverse effects on freshwater quality. The proposal is consistent as nitrogen losses from the property will be appropriately managed through the farms FEP and the quarry will not increase the nitrogen load to groundwater.

Objective 15.2.1 and Policy 15.3.1 are concerned with the maintenance of soil quality. This proposal is consistent with maintaining soil quality and soils will be appropriately managed through the Soil Management Plan.

9.4 Canterbury Land and Water Plan

The Canterbury Land and Water Plan states quarry sites need to be "appropriately managed or rehabilitated once extraction ceases". Rehabilitation at Burnham Farm will progressively restore topsoil over areas already quarried to enable appropriate future uses.

Due to the scale of the site, the farming activity doesn't need to be completely replaced by quarry activities – the quarry and farm can co-exist. To ensure successful co-existence, it is important that the land is rehabilitated to restore its productive capability and as much irrigated land as possible is maintained during quarrying activities. Given that most of the irrigation is provided to the farming operation by centre pivot, minimizing the disruption to centre pivots is important in maximizing the area of irrigated land and re-establishing irrigation during the rehabilitation process will be needed to return land to productive pasture. During quarrying, up to around 22 ha of the property will be utilised for active extraction and rehabilitation at any one time.

Most of the LUC NZLRI classes 1 – 3 versatile soils, in the Selwyn District, are in the Selwyn – Waihora zone. The Selwyn – Waihora Zone in the Canterbury Water Management Strategy stretches from Te Waihora up to Springfield and the Rakaia to the Waimakariri Rivers, it excludes the hill and high-country areas of the Selwyn District. This catchment is approximately 281,400 ha.

The Land Use Capability map of this area is shown in Figure 3, attached to this report. Within the Selwyn District there are approximately 133,800 ha of land that are classified as LUC 1, 2 or 3 versatile land and a further 80,200 ha that is LUC 4, providing a total of 213,900 (76% of the catchment) that is LUC 1 to 4 land that can be used for pastural farming and cropping.

The proposed quarry will use a maximum of 40 ha of land at one time, which corresponds to 0.05% of the LUC 4 soils in the catchment and less than 0.02% of the LUC 1 to 4 land in the Selwyn – Waihora zone. It is proposed to progressively rehabilitate this area to enable its use for primary production.

There will be native planting equating to over 23 hectares, which will be progressively planted over the life of the quarry. This area will provide biodiversity and ecological benefits to the area.

9.4.1 Nutrient Management:

The use of land for farming (s9RMA) is permitted under rules 5.41 and/or 5.60 of the Land and Water Regional Plan and the discharge of contaminants from farming (s15RMA) is consented under rule 5.62 therefore, a separate Farming Land Use consent is not required for this property.

Nutrient Management is assessed under the Selwyn Te Waihora sub -region rules 11.5.6 – 11.5.19 as these prevail over the regional rules 5.41 – 5.64. The property is irrigated with water from an Irrigation Scheme (Central Plains Water Limited) and the Irrigation Scheme holds a discharge consent that includes this property so Rules 11.5.15 and 11.5.16 apply.

This property has been assessed by Central Plains Water limited as meeting the required 22% reduction in nitrogen loss from the baseline, that was required by 1 January 2022 for dairy support land. The proposed quarry activity will further reduce nitrogen loss to water. Nitrogen loss reductions are checked as part of scheduled Farm Environment Plan (FEP) audits.

9.5 Land and Water Regional Plan including Proposed Plan Change 7

The Canterbury Land and Water Regional Plan aims to provide clear direction on how land and water are to be managed in the region.

The LWRP contains objectives, policies and rules as required under section 67(1) of the RMA. The objectives, policies and rules in this Plan manage land, water, and biodiversity within the region in conjunction with other non-statutory methods. They are consistent with the vision and principles in the Canterbury Water Management Strategy (CWMS).

This Plan operates at two levels. There is a region-wide section, which contains the objectives, policies and rules that apply across the region. There are also ten sub-region sections.

The sub-region sections contain policies and rules which are specific to the catchments covered by that section. The policies and rules in the sub-region sections implement the region-wide objectives in the Plan in the most appropriate way for the specific catchment or catchments covered by that section. As there are no policies relevant to this proposal in the Selwyn sub-region (Section 11) Region-wide policies apply.

Region-wide Policies 4.1 and 4.2 refer to water bodes meeting freshwater outcomes and consider cumulative effects. Modelling of the proposal has shown the nitrogen loss for the property will likely decrease from the 2009-2013 baseline as part of the proposal which is consistent with these policies.

Policy 4.13 is focused on minimising the discharge of contaminants to surface water and groundwater. The proposal is generally consistent with this policy, in that the nutrient load will not increase.

Policy 4.14 is concerned with discharges that may enter groundwater. A conservative irrigation application rate to ensure the irrigation does not exceed the soil water holding capacity will be used.

Policy 4.40 and 4.41 are concerned with farm environment plans. A FEP is held by the property.

10.0 Conclusion

The soil management measures described in this report are designed to ensure that appropriate site rehabilitation will be implemented at the completion of each stage of quarry extraction. Whilst timing of stage completion can adapt to fluctuations in aggregate demand, the sequence of extraction activity forms the basis for how rehabilitation efforts occur. The soil management strategy will achieve the following:

- Progressive rehabilitation of the site throughout the stages of extraction.
- Stabilisation of quarry faces and grassing of completed and restored extraction areas to create a free draining and stable landform.
- Ensure any areas where works have been completed are left in a safe and stable condition.
- The site is rehabilitated in a way which enables pastural farming to occur in the future.
- Ensure that any areas where work is completed has adequate drainage and water infiltration for irrigated pasture farming
- Work with the farm to ensure the least disturbance to farming operations including irrigation of pasture
- Mitigation of any potential adverse environmental effects.

11.0 References

Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. 2009. Land Use Capability Survey Handbook – a New Zealand handbook for the classification of land 3rd ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science. 163p.

Humphries RN 2021 Good Practice Guide for Handling Soils in Mineral Workings Part Two: Model Methodology Soil Replacement with Bulldozers and Dump Trucks

Milne JDG, Clayden B, Singleton PL, Wilson AD. 1995. Soil Description Handbook. Lincoln, New Zealand, Manaaki Whenua Press. 157p. (p45 and p46).

PDP – Proposed Burnham Quarry – Air Quality 2023

Ramsay W.J.H 1986 Bulk soil handling for quarry restoration. Soil and land use management Volume 2, No. 1. Pp30-39.

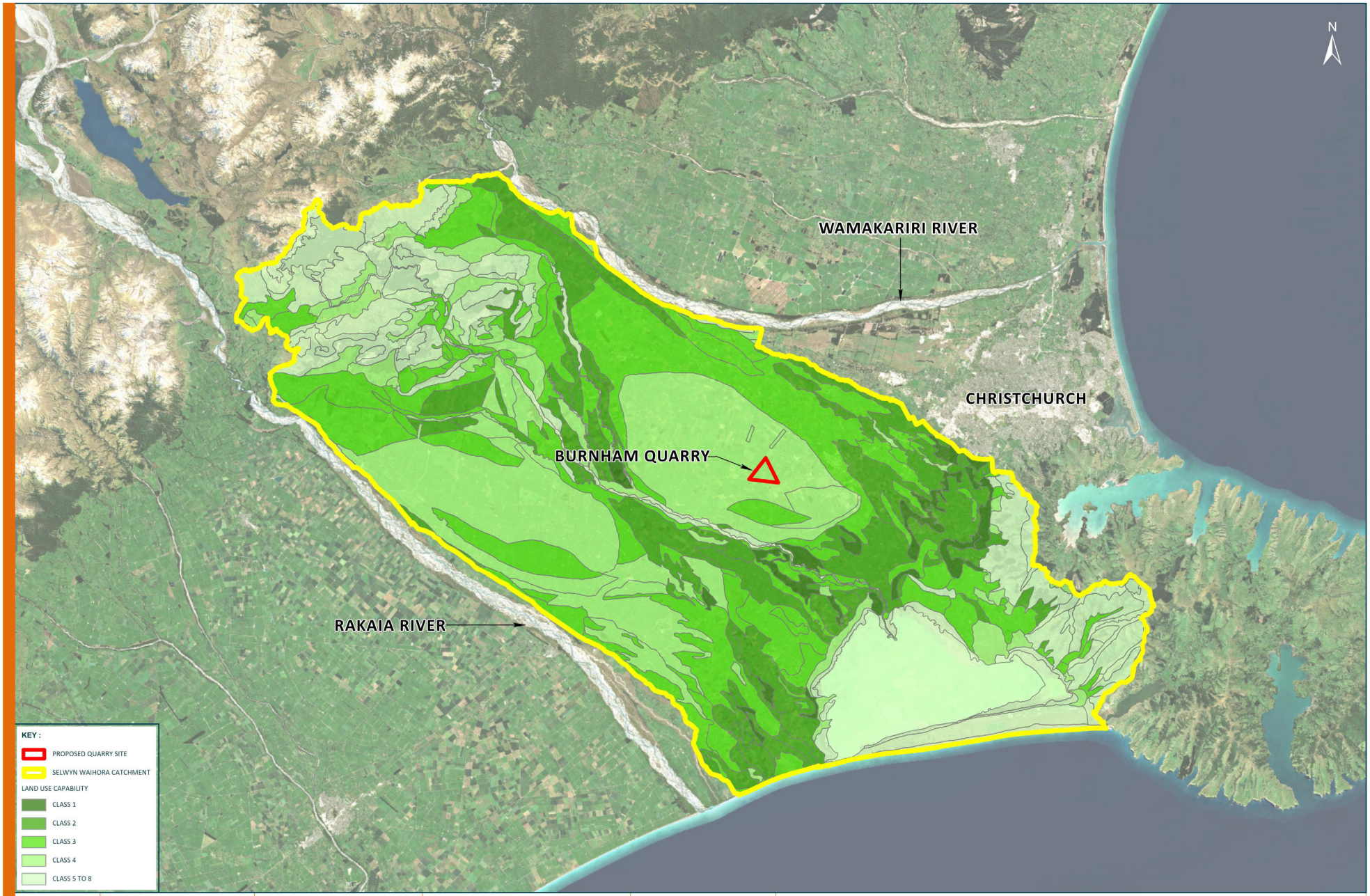
Shepherd, T.G. 2000: Visual Soil Assessment. Volume 1. Field guide for cropping and pastoral grazing on flat to rolling country. Horizons.mw & Landcare Research, Palmerston North

S-map fact sheets - reports (landcareresearch.co.nz)

Soil map unit factsheet (landcareresearch.co.nz)

Appendix A: Figures

© 2022 Pattle Delamore Partners Limited



0 5.5 11
KILOMETERS
SCALE : 1:350,000 (A3)

THIS DRAWING REMAINS THE PROPERTY OF PATTLE DELAMORE PARTNERS LTD AND MAY NOT BE REPRODUCED OR ALTERED WITHOUT WRITTEN PERMISSION. NO LIABILITY SHALL BE ACCEPTED FOR UNAUTHORISED USE OF THE DRAWING.

NO.	REVISION	DATE	BY
A	ISSUED	DEC 22	CB

SOURCE:
1. AERIAL IMAGERY (FLOWN 2017-2020) SOURCED FROM THE LINZ DATA SERVICE www.linz.govt.nz/about-linz/linz-data-service/help/using-linz-data/attributing-aerial-imagery-data AND LICENCED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATON AND INSET DERIVED FROM LINZ DATA.

CLIENT
BURNHAM 2020 LTD

FIGURE
FIGURE 3: SELWYN WAIHORA LAND USE CLASSIFICATION

PROJECT
BURNHAM QUARRY

© 2021 Pdp & Delamore Partners Limited



0 200 400
METRES
SCALE : 1:12,500 (A3)

THIS DRAWING REMAINS THE PROPERTY OF PATTLE DELAMORE PARTNERS LTD AND MAY NOT BE REPRODUCED OR ALTERED WITHOUT WRITTEN PERMISSION. NO LIABILITY SHALL BE ACCEPTED FOR UNAUTHORISED USE OF THE DRAWING.

NO.	REVISION	DATE	BY
A	ISSUED	DEC 22	CF

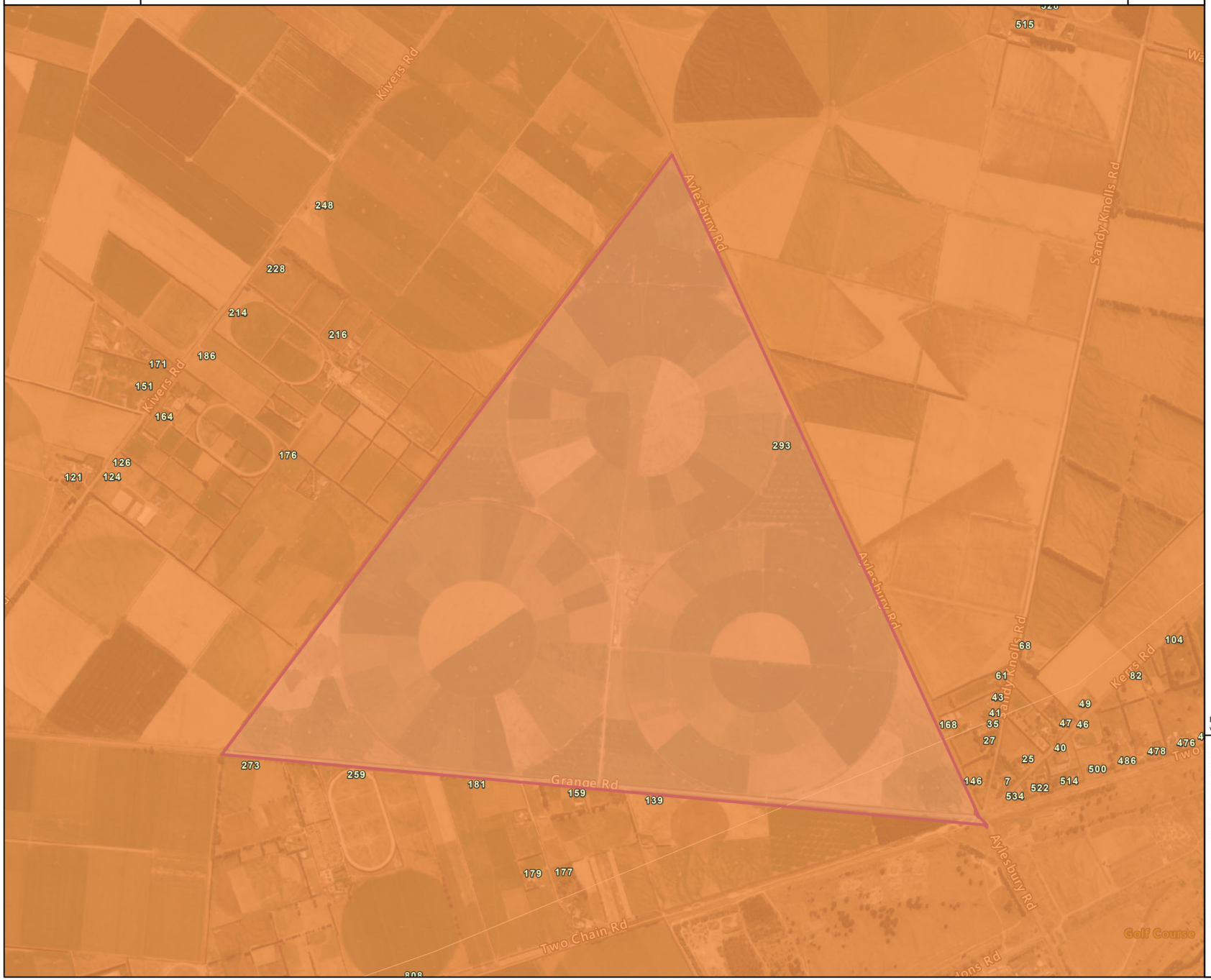
SOURCE:
1. AERIAL IMAGERY (FLOWN 2017-2020) SOURCED FROM THE LINZ DATA SERVICE www.linz.govt.nz/about-linz/linz-data-service/help/using-linz-data/at ribut ng-aerial-imagery-data AND LICENCED FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE.
2. CADASTRAL/TOPOGRAPHICAL INFORMATION AND INSET DERIVED FROM LINZ DATA.

CLIENT
BURNHAM 2020 LTD

FIGURE
FIGURE 4: TEST PIT LOCATIONS

PROJECT
BURNHAM QUARRY

Figure 5 : Soils



Burnham Farm
Medium
S - Map Data - Soils

Legend note: if you have a large number of layers on the map, they may not all be visible in the legend.

Disclaimer:

Information has been derived from various organisations, including Environment Canterbury and the Canterbury Maps partners. Boundary information is derived under licence from LINZ Digital Cadastral Database (Crown Copyright Reserved). Environment Canterbury and the Canterbury Maps partners do not give and expressly disclaim any warranty as to the accuracy or completeness of the information or its fitness for any purpose.

Information from this map may not be used for the purposes of any legal disputes. The user should independently verify the accuracy of any information before taking any action in reliance upon it.

0 0.2 0.4 0.6 0.8 Kilometres

Scale: 1:14,000 @A3

Copyright Environment Canterbury, Waimakariri DC, LINZ
Environment Canterbury 2023

Map Created by Canterbury Maps on 10/05/2023 at 5:11 PM

Appendix B: Overseer report

DISCLAIMER: This Report has been prepared solely for registered users of Overseer who download it from the Overseer application, and have accepted Overseer's Terms of Use. While reasonable efforts have been made to ensure that the Overseer software model used to prepare this Report keeps up with the latest scientific research, Overseer Limited gives no warranties, representation or guarantees, express or implied in relation to the quality, reliability, accuracy and/or fitness for any purpose of the Report. Overseer Limited expressly disclaims and assumes no liability whatsoever arising directly or indirectly from the use of, or reliance on this Report.
COPYRIGHT: With the exception of user-supplied data, this Report is © 2018 Overseer Limited. All rights reserved. You may copy and distribute this Report in its entirety, as long as you do not mislead anyone as to its origin or implications, and provided you do not remove or alter the disclaimer above or this copyright notice.

CAMDEN GROUP - AYLESBURY GRAZING LTD (BURNHAM)

139 Grange Rd, Burnham 7675, New Zealand

OverseerFM

Year ending 2020

Analysis type	Year end
Is publication	No
Application version	5.0.1.1
Printed date	10 May 2023, 5:16PM
Model version	6.5.1

Farm details

N 28 kg/ha | 10,839 kg P 0.3 kg/ha | 114 kg GHG 14,605 kg/ha | 5,681.3 tonnes NCE: 18 v6.5.1

Total area	388.8 ha
Productive block area	375.00 ha
Nitrogen conversion efficiency (NCE)	18%
N Surplus	281 kg/ha
Region	Canterbury

Total liveweight brought (kg/ha grazed)	842
Total liveweight reared (kg/ha grazed)	1871
Total liveweight sold (kg/ha grazed)	2601

Percent male beef animals	4
Beef / dairy grazing stock rate (RSU)	12044

Analysis comments

DATE	BY	TYPE	COMMENT
26 Jun 2019, 9:00AM	Ravensdown Admin	General	Property description, location and valuation numbers: -43.603552, 172.291260

Blocks

NAME	TYPE	AREA (HA)	N LOSS	N LOSS/HA	N IN DRAINAGE (PPM)	N SURPLUS/HA	P LOSS	P LOSS/HA	BLOCKED AREA %	N FARM LOSS %
Lism_1a.1 Pivot	Pasture	200	5,646	28	14	299	21	0.1	53	52
Lism_1a.1 Spinners	Pasture	105	2,932	28	14	293	11	0.1	28	27
Kale to Pasture	Crop	35	848	24	12	194	7	0.2	9	8
Pasture to Kale	Crop	35	1,393	40	19	231	12	0.3	9	13
Other sources	Other	-	21	-	-	-	63	-	-	-

Farm soils

S-MAP REF/NAME	GROUP/ORDER	DRAINAGE CLASS	MODIFIED	TOTAL AREA (HA)	% OF PROD. BLOCKS	BLOCKS
Lism_1a.1	Sedimentary/Brown	Well	Yes	375	100	4

Enterprises

STOCK NUMBERS

NAME	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Beef	1712	1712	1777	1777	1712	3279	3286	3279	3164	1632	1632	1632

RSU

NAME	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Beef	828	929	1018	951	761	1236	1268	1294	1507	1169	536	547

Irrigators

NAME	AREA COVERED	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
LINEAR AND CENTRE PIVOT Linear and centre Pivot 1	200 ha												
SOLID SET Solid set 2	105 ha												
LINEAR AND CENTRE PIVOT Pivot	70 ha												

Structures

No structures exist.

Supplements

CATEGORY	FEED	SOURCE	DRY WEIGHT?	AMOUNT	DESTINATION
Silage	Baleage	Purchased (225)	Yes	225 tonnes	Beef (225)
Baleage	-	Lism_1a.1 Pivot (197)	Yes	197 tonnes	Off farm (197)
Baleage	-	Lism_1a.1 Spinners (156)	Yes	156 tonnes	Off farm (156)
Silage	Pasture average quality silage	Purchased (461)	Yes	461 tonnes	Beef (461)

Crops

CROP/PASTURE	AREA (HA)	YIELD	GROWN (T/DM/YR)	INTAKE (T/DM/YR)	SUPPLEMENTS (T/DM/YR)
Ryegrass/white clover	305.0	-	7793	5208	353
Kale	35.0	525 T/ha dry matter	-	-	-
Pasture	35.0	-	-	-	-

Fertiliser

MANUFACTURER/MATERIAL	NAME	TOTAL APPLIED (KG)	N	P	K	S	CA	MG	NA
Ravensdown cropping	Ammo 31	37,500	11,513	-	-	5,400	-	-	-
Ravensdown other	Urea	140,000	64,400	-	-	-	-	-	-
Ravensdown cropping	Cropmaster DAP	10,500	1,848	2,100	-	105	-	-	-
Ravensdown other	Potassium chloride	5,250	-	-	2,625	-	-	-	63
Ravensdown super	Superphosphate	126,375	-	11,374	-	13,901	25,275	-	-
TOTAL		**319,625**	**77,761**	**13,474**	**2,625**	**19,406**	**25,275**	-	**63**

GHG - Total farm emissions

METHANE GHG EMISSIONS	N20 GHG EMISSIONS	C02 GHG EMISSIONS	TOTAL GHG EMISSIONS
3675.3 eC02/tonnes/yr	1417.9 eC02/tonnes/yr	588.2 eC02/tonnes/yr	5681.3 eC02/tonnes/yr

Farm nutrient budget

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	10,839	28
Phosphorus	114	0.3

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Foliar sprays	0	0	0	0	0	0	0
Fertiliser, lime and other	200	35	7	50	65	0	0
Irrigation	10	0	6	10	37	9	38
Supplements	34	5	32	4	8	3	2
Rain/clover fixation	99	0	2	4	2	4	18

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leaching, runoff and direct losses	28	0.3	9	59	31	1	7
As product	45	11	3	5	23	1	1
As prunings	0	0	0	0	0	0	0
Transfer	0	0	0	0	0	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	93	0	0	0	0	0	0
As supplements and crop residues	17	2	16	2	4	1	1

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	113	0	3	-5	1	0	0
Standing plant material	19	2	12	1	2	1	1
Inorganic mineral	0	2	-21	0	-1	-2	-2
Crop framework	0	0	0	0	0	0	0
Inorganic soil pool	5	20	24	0	53	13	51
Change in supplement storage	0	0	0	0	0	0	0
Root and stover residuals	25	2	0	5	0	0	0

Blocks

Lism_1a.1 Pivot

Pasture - Flat, 200 ha

N	28 kg/ha | 5,646 kg	P	0.1 kg/ha | 21 kg

BLOCK DETAILS

Area	200 ha	Average temp	Using farm climate (11.9 ℃)	Average rainfall	Using farm climate (667 mm/yr)	Annual PET	Using farm climate (917 mm/yr)
Distance from coast	29 km						

SOILS

100% LISM_1A.1
200 ha Brown

PASTURE

Pasture growth	25,550 kg DM/ha/yr	Removed	985 kg DM/ha/yr
Utilisation	70 %	Beef	30.88 rsu/ha
Intake	17,196 kg DM/ha/yr		

SUPPLEMENTS

Harvested (DM)	197 tonnes

CROP MANAGEMENT

Block type	Pasture	Hydrophobic condition	Use default
Topography	Flat	Susceptibility to pugging	Occasional
Pasture type	Ryegrass/white clover	Is compacted	No
Cultivated in last 5 years	No	Naturally high water table	No
Animals present	Yes		

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
RSU/HA												
Beef	1.93	2.74	2.73	2.55	2.24	3.64	3.74	3.81	4.11	2.81	0.27	0.31
FERTILISER APPLIED (KG/HA)												
N	-	31	25	25	25	25	25	25	25	-	-	-
P	-	-	2	28	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-	-
S	-	14	3	34	-	-	-	-	-	-	-	-
IRRIGATION APPLIED (MM)												
Avg applied (mm)	-	-	-	60	65	75	95	70	35	-	-	-
LINEAR AND CENTRE PIVOT 1 (LINEAR AND CENTRE PIVOT): OVERSEER DEFAULT (FIXED) | N:2.5 P:0.1 K:1.6 S:2.5 CA:9.3 MG:2.2 NA:9.5												
Supplied (mm)	-	-	-	63	68	79	100	74	37	-	-	-
Applied (mm)	-	-	-	60	65	75	95	70	35	-	-	-
Depth (mm)	-	-	-	5	5	5	5	5	5	-	-	-
Return (days)	-	-	-	1	1	1	1	1	1	-	-	-

NUTRIENT BUDGET

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	5,646	28
Phosphorus	21	0.1

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Effluent added	0	0	0	0	0	0	0
Fertiliser, lime and other	208	30	0	51	67	0	0
Irrigation	10	0	7	10	39	9	40
Supplements fed on blocks	32	4	30	3	8	3	2
Rain/clover fixation	123	0	2	4	2	4	18

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leaching, runoff and direct losses	28	0.1	10	56	30	1	6
As product	48	12	3	6	24	1	1
Transfer	7	1	5	0	1	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	100	0	0	0	0	0	0
As supplements and crop residues	18	2	18	2	4	1	1

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	171	7	0	6	0	0	0
Inorganic mineral	0	2	-20	0	-1	-2	-2
Inorganic soil pool	0	11	22	0	57	14	54

Lism_1a.1 Spinners

Pasture - Flat, 105 ha

N	28 kg/ha | 2,932 kg

P	0.1 kg/ha | 11 kg

BLOCK DETAILS

Area	105 ha	Average temp	Using farm climate (11.9 ℃)	Average rainfall	Using farm climate (667 mm/yr)	Annual PET	Using farm climate (917 mm/yr)
Distance from coast	29 km						

SOILS

100% LISM_1A.1
105 ha Brown

PASTURE

Pasture growth	**25,550 kg DM/ha/yr**	Removed	**1486 kg DM/ha/yr**
Utilisation	**70 %**	Beef	**30.27 rsu/ha**
Intake	**16,845 kg DM/ha/yr**		

SUPPLEMENTS

Harvested (DM)	**156 tonnes**

CROP MANAGEMENT

Block type	**Pasture**	Hydrophobic condition	**Use default**
Topography	**Flat**	Susceptibility to pugging	**Occasional**
Pasture type	**Ryegrass/white clover**	Is compacted	**No**
Cultivated in last 5 years	**No**	Naturally high water table	**No**
Animals present	**Yes**		

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
RSU/HA												
Beef	1.89	2.68	2.67	2.5	2.2	3.57	3.66	3.74	4.03	2.76	0.27	0.3
FERTILISER APPLIED (KG/HA)												
N	-	31	25	25	25	25	25	25	25	-	-	-
P	-	-	2	28	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-	-
S	-	14	3	34	-	-	-	-	-	-	-	-
IRRIGATION APPLIED (MM)												
Avg applied (mm)	-	-	-	60	65	75	95	70	35	-	-	-
SOLID SET 2 (SOLID SET): OVERSEER DEFAULT (FIXED) | N:2.5 P:0.1 K:1.6 S:2.5 CA:9.3 MG:2.2 NA:9.5												
Supplied (mm)	-	-	-	63	68	79	100	74	37	-	-	-
Applied (mm)	-	-	-	60	65	75	95	70	35	-	-	-
Depth (mm)	-	-	-	5	5	5	5	5	5	-	-	-
Return (days)	-	-	-	1	1	1	1	1	1	-	-	-

NUTRIENT BUDGET

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	2,932	28
Phosphorus	11	0.1

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Effluent added	0	0	0	0	0	0	0
Fertiliser, lime and other	208	30	0	51	67	0	0
Irrigation	10	0	7	10	39	9	40
Supplements fed on blocks	32	4	30	3	8	3	2
Rain/clover fixation	126	0	2	4	2	4	18

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leaching, runoff and direct losses	28	0.1	10	55	30	1	7
As product	48	12	3	6	24	1	1
Transfer	7	1	5	0	1	0	0
Effluent exported	0	0	0	0	0	0	0
To atmosphere	98	0	0	0	0	0	0
As supplements and crop residues	28	4	27	3	6	2	1

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	167	7	0	6	0	0	0
Inorganic mineral	0	2	-22	0	-1	-2	-2
Inorganic soil pool	0	10	16	0	56	14	53

Kale to Pasture

Crop - 35 ha

N	24 kg/ha | 848 kg	P	0.2 kg/ha | 7 kg

BLOCK DETAILS

Area	35 ha	Average temp	11.9 ℃	Average rainfall	667 mm/yr	Annual PET	917 mm/yr	Latitude	-43.603552	Longitude	172.29126
Distance from coast	29 km										

SOILS

100% LISM_1A.1
35 ha Brown

PASTURE

Pasture growth	25,550 kg DM/ha/yr	Removed	0 kg DM/ha/yr
Utilisation	70 %	Beef	32.15 rsu/ha
Intake	17,885 kg DM/ha/yr		

ARTIFICIAL DRAINAGE

Drainage method	None

CROP MANAGEMENT

Block type	Crop	Crop rotation final month	September
Cultivated area	100 %	Years in pasture	8
Headlands and tracks	0 %	Prior land use	Grazed pasture
Other areas	0 %		

CROPS

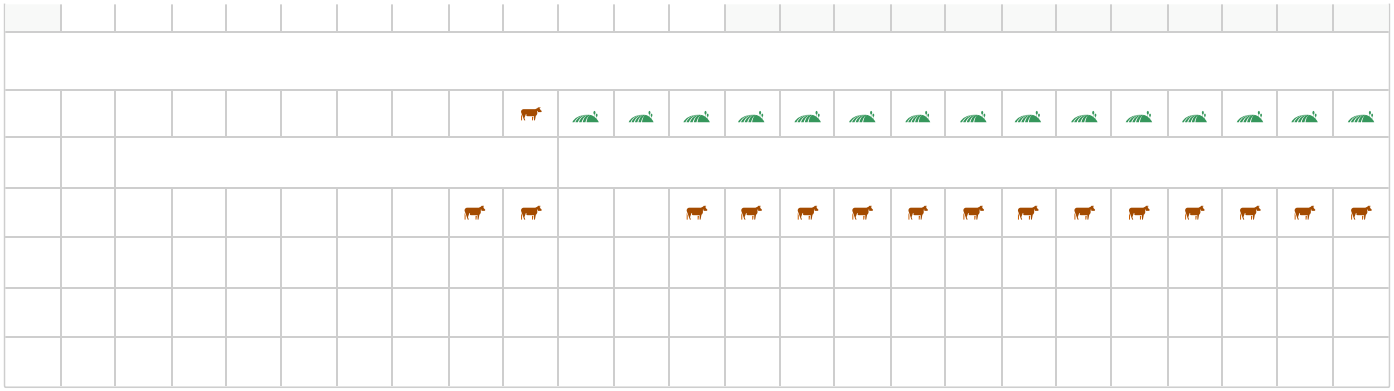
Kale

Category	Fodder
Crop type	Kale
Sown	November - Year 1
Yield	525T
Cultivation practice at sowing	Direct drilled

Pasture

Category	Permanent pasture
Crop type	Pasture
Sown	July - Year 1
Cultivation practice at sowing	Minimum till
Defoliation management	Grazing only

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
RSU/HA																								
Beef	-	-	-	-	-	-	-	-	-	-	-	-	2.65	2.33	3.79	3.89	3.97	4.28	2.93	0.29	0.32	2.01	2.85	2.84
FERTILISER APPLIED (KG/HA)																								
N	-	53	46	46	-	-	-	-	-	-	-	-	25	25	25	25	25	25	-	-	-	-	31	25
P	-	60	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	-	-	-	-	-	-	2
K	-	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S	-	3	-	-	-	-	-	-	-	-	-	-	34	-	-	-	-	-	-	-	-	-	14	3
IRRIGATION APPLIED (MM)																								
Avg applied (mm)	-	-	-	-	-	-	-	-	-	-	-	-	60	65	75	95	70	35	-	-	-	-	-	-
PIVOT (LINEAR AND CENTRE PIVOT): OVERSEER DEFAULT (FIXED) | N:2.5 P:0.1 K:1.6 S:2.5 CA:9.3 MG:2.2 NA:9.5																								
Supplied (mm)	-	-	-	-	-	-	-	-	-	-	-	-	63	68	79	100	74	37	-	-	-	-	-	-



NUTRIENT BUDGET

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	848	24
Phosphorus	7	0.2

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Effluent added	0	0	0	0	0	0	0
Fertiliser, lime and other	208	30	0	51	67	0	0
Irrigation	10	0	7	10	39	9	40
Supplements	32	4	30	3	8	3	2
Rain/clover fixation	2	0	2	4	2	4	18

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leaching, runoff and direct losses	24	0.2	4	162	27	1	6
As product	50	12	3	6	25	1	1
Transfer	7	1	5	0	1	0	0
To atmosphere	102	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	-184	-49	0	-66	0	0	0
Standing plant material	231	21	184	14	23	15	8
Inorganic mineral	0	2	-47	0	-1	-2	-2
Inorganic soil pool	23	56	-56	0	76	6	54
Root and stover residuals	-2	-8	-55	-48	-35	-5	-8

Pasture to Kale

Crop - 35 ha

N	40 kg/ha | 1,393 kg	P	0.3 kg/ha | 12 kg

BLOCK DETAILS

Area	35 ha	Average temp	11.9 ℃	Average rainfall	667 mm/yr	Annual PET	917 mm/yr	Latitude	-43.603552	Longitude	172.29126
Distance from coast	29 km										

SOILS

100% LISM_1A.1
35 ha Brown

PASTURE

Pasture growth	3,964 kg DM/ha/yr	Removed	0 kg DM/ha/yr
Utilisation	70 %	Beef	5.12 rsu/ha
Intake	2,775 kg DM/ha/yr		

ARTIFICIAL DRAINAGE

Drainage method	None

CROP MANAGEMENT

Block type	Crop	Crop rotation final month	September
Cultivated area	100 %	Years in pasture	8
Headlands and tracks	0 %	Prior land use	Grazed pasture
Other areas	0 %		

CROPS

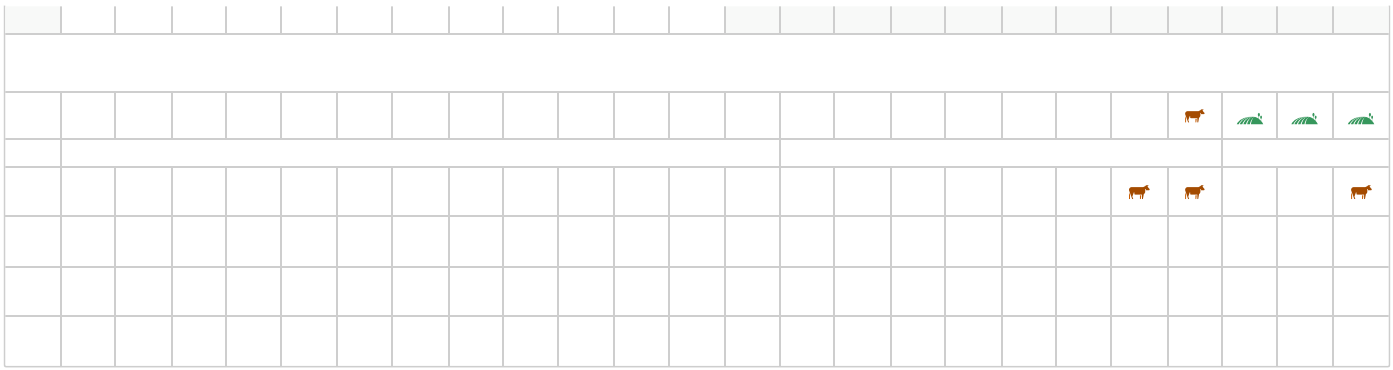
Kale

Category	Fodder
Crop type	Kale
Sown	November - Reporting year
Yield	525T
Cultivation practice at sowing	Direct drilled

Pasture

Category	Permanent pasture
Crop type	Pasture
Sown	July - Reporting year
Cultivation practice at sowing	Minimum till
Defoliation management	Grazing only

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
	Grazed pasture													Kale								Pasture		
RSU/HA																								
Beef	-	-	-	-	-	-	-	-	-	-	-	-	2.47	-	-	-	-	-	-	-	-	-	-	2.65
FERTILISER APPLIED (KG/HA)																								
N	28	26	26	26	26	26	28	-	-	-	31	-	-	53	46	46	-	-	-	-	-	-	31	28
P	-	-	-	-	-	-	-	-	-	-	-	-	28	60	-	-	-	-	-	-	-	-	-	2
K	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-	-	-	-
S	-	-	-	-	-	-	-	-	-	-	14	-	34	3	-	-	-	-	-	-	-	-	14	3
IRRIGATION APPLIED (MM)																								
Avg applied (mm)	-	-	-	-	-	-	-	-	-	-	-	-	60	45	75	95	70	35	-	-	-	-	-	-
PIVOT (LINEAR AND CENTRE PIVOT): OVERSEER DEFAULT (FIXED) | N:2.5 P:0.1 K:1.6 S:2.5 CA:9.3 MG:2.2 NA:9.5																								
Supplied (mm)	-	-	-	-	-	-	-	-	-	-	-	-	63	47	79	100	74	37	-	-	-	-	-	-



NUTRIENT BUDGET

LOSSES FROM ROOT ZONE

	TOTAL LOSS (KG/YR)	LOSS PER HA (KG/YR)
Nitrogen	1,393	40
Phosphorus	12	0.3

NUTRIENTS ADDED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Effluent added	0	0	0	0	0	0	0
Fertiliser, lime and other	203	90	75	54	67	0	2
Irrigation	10	0	6	10	37	9	38
Supplements	32	4	30	3	8	3	2
Rain/clover fixation	20	0	2	4	2	4	18

NUTRIENTS REMOVED (KG/HA/YR)	N	P	K	S	CA	MG	NA
Leaching, runoff and direct losses	40	0.3	7	8	50	2	8
As product	30	7	2	4	15	0	1
Transfer	3	0	3	0	1	0	0
To atmosphere	62	0	0	0	0	0	0
As supplements and crop residues	0	0	0	0	0	0	0

CHANGE IN POOLS (KG/HA/YR)	N	P	K	S	CA	MG	NA
Organic pool	-149	-20	0	-39	0	0	0
Standing plant material	-24	-4	-50	-4	4	-3	-3
Inorganic mineral	0	4	-9	0	-1	-2	-2
Inorganic soil pool	27	72	104	0	8	12	48
Root and stover residuals	275	35	57	102	36	5	8

Appendix C: Soil Management Plan

Hydrogeology Assessment for Proposed Burnham Quarry

Prepared for

Burnham 2020 Ltd

July 2023

PATTLE DELAMORE PARTNERS LTD
Level 2, 134 Oxford Terrace
Christchurch Central, Christchurch 8011
PO Box 389, Christchurch 8140, New Zealand

Office +64 3 **345 7100**
Website **http://www.pdp.co.nz**
Auckland Tauranga **Hamilton** Wellington
Christchurch Invercargill

solutions for your environment

Quality Control Sheet

TITLE	Hydrogeology Assessment for Proposed Burnham Quarry
CLIENT	Burnham 2020 Ltd
VERSION	Final
ISSUE DATE	18 July 2023
JOB REFERENCE	C04096400
SOURCE FILE(S)	C04096400R001.docx

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE  

Tom Garden Peter Callander

Reviewed and Approved by

SIGNATURE 

Peter Callander

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Burnham 2020 Ltd [and] [others (not directly contracted by PDP for the work)], including Environment Canterbury. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

Executive Summary

The proposed quarry will occur within strata described as brownish-grey river alluvium which hosts a groundwater system used by water supply bores and is a source for spring-fed streams further down the plains. Most abstraction bores in the vicinity of the proposed quarry are screened from 25 – 70 m deep, with some deeper bores occurring from 90 – 150 m deep. The water table within the proposed quarry site is estimated to fluctuate from around 8 – 19.5 m deep in the south-east and 16.5 – 28 m deep m deep in the north-west. Monitoring of groundwater quality in the area shows elevated nitrate concentrations, sometimes exceeding the Maximum Acceptable Value in the NZ drinking water standards and occasional detections of *E.coli.* This is typical of the central Canterbury plains due to intensive agriculture land-use activities.

The quarry will excavate to a depth of 1 m above the highest historic groundwater level in the area. This is currently estimated to be an excavation depth of 7 m in the south-east area and 15.5 m in the north-west corner, with an average depth across the entire site of 10.5 m. There is some uncertainty in these predictions of the highest groundwater levels and on-site monitoring bores will allow more refined estimates as the quarrying proceeds. These highest groundwater levels have historically occurred infrequently, with isolated spikes of around 2 months duration occurring at a frequency of less than 1 in 20 years.

The operation of the quarry will strip the topsoil and expose the underlying gravels. This will enhance the infiltration of rainwater and water used in the quarry operation (particularly water used for washing aggregate) so as to increase recharge to the aquifer, whilst also removing the current sources of nitrate and *E. coli* that occur from the on-site farming activity.

The quarry uses some hazardous substances (primarily fuel and lubricating oil for vehicles and machinery) and will also have an on-site wastewater treatment system for their office buildings. These can all be managed to a standard that avoids contamination risks to the underlying aquifer.

The quarry pit will move around the farm with the current farming activity continuing to operate on the areas of the farm prior to them being quarried. At the completion of each quarried section the land surface will be rehabilitated using soils stripped from other parts of the farm so that some form of agricultural use can continue, albeit at a lower elevation. The effect of the quarrying will reduce the thickness of the unsaturated zone strata above the groundwater table. Drainage of nitrates from any post-quarry farming activities are expected to have a similar annual discharge rate to the current farming situation, if the current farming land use was to continue, because there is no significant attenuation of nitrate concentrations through the unsaturated zone, although the nitrate will reach the water table faster than currently occurs. *E. coli* numbers are reduced through the unsaturated zone due to processes such as

by filtration, desiccation and natural die-off over time. These processes will be lessened in the post-quarry environment, due to the decreased distance between the soil and the water table however a modelling assessment of potential flow paths to nearby bores shows that there will still be sufficient removal (on the order of 10 log cycles) to avoid adverse water quality effects.

Table of Contents

SECTION		PAGE
Executive Summary		ii
1.0	Introduction	1
2.0	Background	1
3.0	Hydrogeologic Setting	2
4.0	Expected Quarry Depth	4
5.0	Assessment of Quarry Activities on Groundwater	5
5.1	Aggregate Extraction	5
5.2	Quarry Water Use	6
5.3	Storage and Use of Hazardous Substances	6
6.0	Continuation of farming land use on the rehabilitated quarry land	7
7.0	Conclusion	7
8.0	References	8

Appendices

Appendix A: Figures

Appendix B: Bore Logs

Appendix C: Preliminary Assessment of Highest Water Table Level

Appendix D: Assessment of Proposed Quarry Effects on Nitrate Leaching to Groundwater

Appendix E: Assessment of Proposed Quarry Effects on *E. coli* Migration into Groundwater

Appendix F: Groundwater Quality Sample Results from Burnham Farm

1.0 Introduction

Burnham 2020 Ltd owns the 362 ha property known as Burnham Farm, shown in Figure 1. It proposes to progressively quarry the property to provide aggregate for construction projects. This report has been prepared by Pattle Delamore Partners Ltd, at the request of Burnham 2020 Ltd, to describe the hydrogeologic setting for the area and to assess the way in which the proposed quarry activity will interact with that hydrogeology.

2.0 Background

Burnham Farm is a modern dairy support block which is irrigated with water formerly supplied by groundwater bores under an existing consent, but more recently supplied by the Central Plains Water (CPW) scheme. The proposed quarry will operate within this farming operation, with around 18 ha utilised for long-term access, administration and aggregate processing facilities and a further 22ha of active quarry workings that will move progressively across the farm area and be rehabilitated at a lower elevation, following the removal of aggregate.

The quarrying activity will strip topsoil from the current farmland and then remove aggregate down to an elevation that is above the highest historical groundwater level for the property. Water supply for the quarrying activity will be sourced from on-site bores and the water will be used for processing plant operations, including the washing of aggregate, dust suppression, wheel washing, supply of water to the administration facilities and incidental irrigation of vegetation associated with the quarry. At the completion of each quarried area the base of the excavation will be reinstated with topsoil. The current farming operation and the associated irrigation of the farm, using water from the CPW scheme, is intended to continue as a land use prior to and alongside quarrying each section of the farm.

Based on this proposed quarrying activity, this report provides the following information:

- A description of the hydrogeologic setting
- An assessment of the expected depth of the quarry excavation, based on currently available information
- An assessment of how the quarrying activities affect the underlying groundwater
- An assessment of how the potential effects from the current farming land use will change following the completion of quarrying

The effects arising from the abstraction of groundwater by the on-site bores to provide the quarry water supply is the subject of a separate assessment report, PDP (2021).

3.0 Hydrogeologic Setting

The Burnham Farm property is located near the middle of the Canterbury Plains, approximately 6.5 km north of the Selwyn/Waikirikiri River and 12.5 km south of the Waimakariri River. The geology of the broader area consists of successive alluvial deposits comprising gravel, sand, silt and clay derived from the Southern Alps and deposited during the Quaternary period. The permeability of the strata is influenced by the age, depth of burial and depositional environment. The aquifers in the region are classified as semi-confined as they are overlain by low permeability fine grained strata (sand, silt and clay-sized particles) through which leakage can occur.

The 1:250,000 geological map of the Christchurch area (Forsyth, Barrell, & Jongens, 2008) describes the underlying geology as brownish-grey river alluvium beneath plains or low-level terraces. The local near surface geology in this area of the plains also consists of remnants of stabilised river (Waimakariri) sands.

The driller's logs for the water supply bores on the property (Appendix B) are generally consistent with the geological description above. The logs indicate that the strata generally consist of gravels with varying sand and clay content. Near the bottom of the bores, water-bearing sandy gravels were generally encountered, across which screens were placed in each bore.

Groundwater recharge in the area is generally from infiltration of rainfall on the plains and seepage from rivers, particularly the Waimakariri and Selwyn/Waikiriri. ECan regional piezometric contours indicate that the groundwater near the site flows in a generally south-easterly direction.

An assessment of long-term groundwater level records in the area is presented in Appendix C. This information indicates that the level of the water table at the site is expected to fluctuate over a depth range of around 8 – 19.5 m below ground level in the south-east of the site and around 16.5 – 28 m in the north-west of the site (as shown in Figure 5 of Appendix C). Lowest groundwater levels generally occur in late summer and autumn, and highest groundwater levels generally in spring.

A plot of yield versus the screen depth (i.e. depth to the top of the screen) for all bores within 2 km of the supply bores is provided in Figure 2, Appendix A. As shown, bore depths generally fit into two depth ranges, with one group of bores having screen depths of 25 – 70 m bgl and the other having screen depths of 90 – 150 m bgl. There is no clear trend of yield versus depth, however it is clear that there is more variability in yield of the shallower bores (0 – 103 L/s), while the deeper bores tend to be more consistent in their yield (11 -67 L/s).

Private dwellings in the area use groundwater as their source of drinking-water supply (at locations shown by the green dots in Figure 1 of Appendix E). In addition, within 2km of the site boundary, there are three community drinking water source protection zones, which apply to water supplied to communities of a size no less than 25 people, for no fewer than 60 days per year, all are located to the south of the farm property. These are the drinking water supply wells for the Burnham military camp and none of the protection zones intercept the land area of Burnham Farm (also shown in Figure 1 of Appendix E). The community drinking-water source protection zone defines an area where land-use and discharge activities should be carefully managed and monitored so as to minimise contamination risks for the water supply.

The details of these community water supply bores are:

- M36/2694 is located approximately 1200m to the south of Burnham Farm. The community drinking water source protection zone spans towards the north-west direction from the bore. M36/2964 is 24.3m deep.
- BX23/0903 is approximately 600m south-east of the site and is screened between 189 and 195m deep. Due to the depth of this bore it has a small circular source protection zone largely contained within the camp boundary.
- M36/2693, is approximately 900 m south-east of Burnham Farm and is screened between 44.8 and 54.9m deep. Its community drinking water source protection zone extends in a north-west direction and overlaps with the protection zone for bore BX23/0903.

Groundwater Quality

The groundwater quality of the area is typical of the central Canterbury Plains with shallow bores in particular showing the effects from the surrounding agricultural land use resulting in elevated concentrations of nitrate-Nitrogen and occasional detections of *E. coli.*

Groundwater quality data available through ECan in the vicinity of Burnham Farm is largely historical samples collected between 1975 and 1995. These show that 3 of the sampled bores had nitrate-N concentrations above the drinking-water maximum acceptable value (MAV) of 11.3 g/m^3 with an average nitrate-N concentration across all samples of 8 g/m^3.

One pair of bores (M36/4151 and M36/8187) provide a long-term record of nitrate-N concentrations. In 2005 bore M36/4151 (35 m deep) was replaced by bore M36/8187, 48 m deep located approximately 25m northeast of where the unused M36/4151 was located. The data from this pair of bores indicate that the concentrations of nitrate-N are steadily increasing over time, with values around the MAV or 11.3 g/m^3 recorded in 2020 and 2021. This pair of long-term

monitoring bores have also had 2 exceedances of the *E. coli* MAV (<1 MPN/100 mL) from 41 samples taken between January 2006 and November 2022. These exceedances occurred during July 2013 and September 2017and recorded values of 1 MPN/100mL.

All other parameters recorded in the ECan groundwater quality data base appear to have remained relatively constant and not unusually elevated through time.

Two bores within Burnham Farm were sampled in late May/ early June 2022 to provide an indication of groundwater quality beneath the site: one shallow bore (M36/5785, screened from 24.7 – 27.7 m deep) and one deep bore (M36/7711, screened from 118.4 – 148.4 m deep). The laboratory analysis reports for these samples are presented in Appendix F. They show the shallow groundwater has generally low concentrations for most parameters although nitrate-N is elevated at 7.5 g/m^3. Total coliforms were detected at 9 MPN/100mL, indicating a pathway for near surface bacteria to reach this shallow groundwater, although none of these were *E. coli* which is the drinking-water standards indicator of a health risk.

Similar, or slightly lower concentrations were recorded in the deep groundwater (bore M36/7711) with the notable differences being nitrate-N at 4.8 g/m^3 and no detections of total coliforms.

4.0 Expected Quarry Depth

The quarry proposes to excavate down to a depth that is 1m above the highest groundwater level that has historically occurred in that area. An assessment of that depth is presented in Appendix C. It uses long-term monitoring records to show that the highest historical groundwater levels (likely the highest since 1951) at the site likely occurred in spring 1978. An extrapolation of the records across monitoring locations shows that the peak groundwater level at the site in spring 1978 is estimated to have ranged from approximately slightly less than 8m below ground level on the southern side of the site, to approximately 16.5 m below ground level in the northern corner of the site. The mean of the peak groundwater level across the site in spring 1978 is estimated to be 11.5 m below ground level.

The groundwater level in spring 1978 is considered to be an appropriate level to use as an estimated maximum groundwater level, for the purposes of maintaining a 1 m buffer from the ground surface to groundwater. However, it must be recognised that the effects of the Central Plains Water Scheme and climate change could cause some difference in future groundwater levels compared to what has been observed in the past. Given that the quarry will progress gradually over several decades, it will be useful to refine the estimated maximum water table depth based on measurements made at the on-site groundwater monitoring bores. It is recommended that this site-specific data

should be reviewed at 5 -yearly intervals to update the estimate of the highest historic groundwater level.

After the quarry has excavated down to its maximum depth the surface will be rehabilitated by the placement of a minimum soil thickness (topsoil and subsoil) of 400mm. This final re-established subsoil profile should be predominantly fine matrix soil materials, free of rocks and other coarse materials. It will provide an additional buffer above the estimated highest groundwater level.

It is important to recognise that the highest groundwater levels occur infrequently and for limited periods. So, whilst there is some uncertainty regarding the highest groundwater level, it is helpful to consider the frequency and duration of an extreme high spike in groundwater levels might occur for. This is discussed in section 6.0 of Appendix C, which indicates that the highest estimated groundwater levels will occur at a frequency of less than a 1 in 20-year event and such historical spikes were recorded in only 1 or 2 consecutive monthly measurements. Therefore, such extreme spikes occur infrequently and are of limited duration.

5.0 Assessment of Quarry Activities on Groundwater

As noted above, the excavation activities will commence with the stripping of topsoil, followed by excavation and processing of aggregate and then reinstatement of soil at the lowered, post excavation surface. The key activities that might impact on the underlying groundwater resource are discussed in the following sections.

5.1 Aggregate Extraction

The removal of topsoil and excavation of gravels will change the surface of the ground, which in turn alters the rainfall infiltration which drains down to recharge the underlying groundwater. Under the current agricultural land use, the soils retain much of the rainfall and infiltration is reduced due to the uptake of soil moisture into plants. The water that infiltrates downwards through the soil carries with it nitrates and *E. coli*, which have the potential to contaminate the underlying shallow groundwater.

The removal of the soil during quarrying activities and the exposure of the underlying gravels will promote the infiltration, of both rainwater and water used within the quarry (as described in section 5.2), to the underlying groundwater and will remove the sources of nitrates and *E. coli* that currently occur from the agricultural land use. These changes are considered to make a positive change to the underlying shallow groundwater resource.

5.2 Quarry Water Use

The major use of water at the quarry is for processing aggregate. This mostly drains back to the aquifer when it falls on the ground, or discharges to settling ponds. Most of this water is expected to return to the underlying aquifer. It has primarily been in contact only with uncontaminated natural strata and accordingly is not expected to cause any adverse effect on the underlying aquifer.

Truck washing will occur within fully bunded concrete pads. Truck decks will be cleaned using only clean water. The washwater will primarily contain only fine sediment which will discharge to a sump, with overflow occurring to a soakpit. Body cleaning may involve biodegradable detergents and degreasers and may be expected to pick up hydrocarbons off trucks. This washwater will discharge to a sump and an oil-water interceptor, with the discharge water directed to a vegetated swale and then a soak pit. These discharges will promote the return of the water to the underlying groundwater resource in a manner that avoids adverse water quality effects.

The silt settlement basins also will take water and suspended silt derived from the natural strata. The water will be discharged through the base and sides of the basins, and the sediments and silts will remain in the basins. It may be necessary to clean out the basins as silt and sediment builds up, and these materials will be spread out within the site. Given that the water and suspended sediment are derived from the natural strata within and beneath the site this activity is not expected to cause any adverse effects.

Water used for dust suppression will be sprayed at a rate to help bind surface sediments. It is used during dry, windy weather and will primarily evaporate. It is not expected to drain back to the underlying groundwater.

It is expected that office wastewater will pass through an on-site wastewater treatment system prior to discharge to a subsurface dripline system through landscape and bunded areas located at, or near to, the original ground level in the general vicinity of the office buildings.

5.3 Storage and Use of Hazardous Substances

Storage of hazardous substance on site will be limited to plant and machinery fuel (diesel, unleaded petrol, bioethanol mix, hydrogen, ad-blue, etc.), lubrication (oils and greases), and small quantities of laboratory chemical for use in aggregates compliance testing. Fuel will be kept in double skinned tanks of up to 30,000L. Oil and greases will be stored in specially designed areas within the workshop area of up to 1,000kgs.

Refuelling will occur on paved surfaces draining to oil-water interceptors that discharge to soakpits.

A hazardous substance risk register and management plan will be developed for the site and comply with all relevant legislation.

6.0 Continuation of farming land use on the rehabilitated quarry land

When each section of quarry activity has reached its maximum depth, soil will be re-established and farming activities will recommence, albeit at a lower elevation that is closer to the water table than is currently the case. This will change the way in which any farming land-use will affect the underlying groundwater quality. This has been assessed in two memos, one dealing with nitrate leaching (Appendix D) and one dealing with the migration of *E. coli* (Appendix E).

In the case of nitrate (Appendix D), the annual loss of nitrate into the groundwater will remain largely the same as currently occurs, if the same farming land use were to continue, although the nitrate will reach the water table sooner than under the pre-quarry scenario.

E. coli from the current farming activity is mostly derived from animal excretions, which can migrate downwards through the soil and into the groundwater, particularly due to the extra seepage that occurs during heavy rainfall events. During this migration from the ground surface through the sub-surface environment, *E. coli* numbers are reduced by filtration, desiccation, dispersion, dilution and natural die-off over time. The quarrying activity will reduce the thickness of the unsaturated zone beneath the soil and bring the source of the *E. coli*, at the pasture surface, closer to the saturated groundwater flow system. The effects of this change are assessed in a memo presented in Appendix E. That assessment indicates there will be less reduction of the *E. coli* concentrations through the unsaturated zone between the surface soil profile and the groundwater table than is currently the case, but that there will still be sufficient removal (on the order of 10 log cycles) to avoid adverse water quality effects on neighbouring bores.

It is expected that the rehabilitated quarry land will progressively become available for farming use over the next five or six decades. It is not possible to predict with certainty what that use will be, how it will be undertaken, or under what conditions. Assuming the current use (or other uses with the same or lesser environmental outputs), it is expected that effects on groundwater quality at the completion of the quarrying activity will be within the range of other land-use effects that are typically occurring within the Canterbury region.

7.0 Conclusion

The water table within the proposed quarry site is estimated to fluctuate from around 8 – 19.5 m deep in the south-east and 16.5 – 28 m deep m deep in the north-west. The quarry will excavate to a depth of 1 m above these highest

historic groundwater levels, which corresponds to an average excavation depth across the entire site of 10.5 m. There is some uncertainty in these predictions of the highest groundwater levels and on-site monitoring bores will allow more refined estimates as the quarrying proceeds. These highest groundwater levels have historically occurred infrequently, with isolated spikes of around 2 months duration occurring at a frequency of less than 1 in 20 years.

The exposed gravels in the quarry will enhance the infiltration of rainwater and water used in the quarry operation so as to increase recharge to the aquifer, whilst also removing the current sources of nitrate and *E. coli* that occur from the on-site farming activity.

The use of hazardous substances (primarily fuel and lubricating oil for vehicles and machinery) within the quarry and an on-site wastewater treatment system for the office buildings will be managed to a standard that avoids contamination risks to the underlying aquifer.

Once an area of the farm has been quarried the soil cover will be reinstated and some form of agricultural use will continue, albeit at a lower elevation. The effect of the quarrying will reduce the thickness of the unsaturated zone strata above the groundwater table. Drainage of nitrates from the post-quarry farming activity are expected to have a similar annual discharge rate to the current farming situation, if the current farming land-use were to continue, because there is no significant attenuation of nitrate concentrations through the unsaturated zone, although the nitrate would reach the water table faster than currently occurs. *E. coli* numbers are reduced through the unsaturated zone due to processes such as by filtration, desiccation and natural die-off over time. These processes will be lessened in the post-quarry environment, due to the decreased distance between the soil and the water table however a modelling assessment of potential flow paths to nearby bores shows that there will still be sufficient removal (on the order of 10 log cycles) to avoid adverse water quality effects.

8.0 References

Pattle Delamore Partners Ltd, 2021; Renewal of Resource Consents CRC222536 for Take and Use of Groundwater for Irrigation and CRC221642 for Use of Groundwater for Quarrying Activities

Appendix A: Figures

Farm map showing irrigation types.



FIGURE 1: PLAN SHOWING IRRIGATION TYPES USED ACROSS BURNHAM FARM

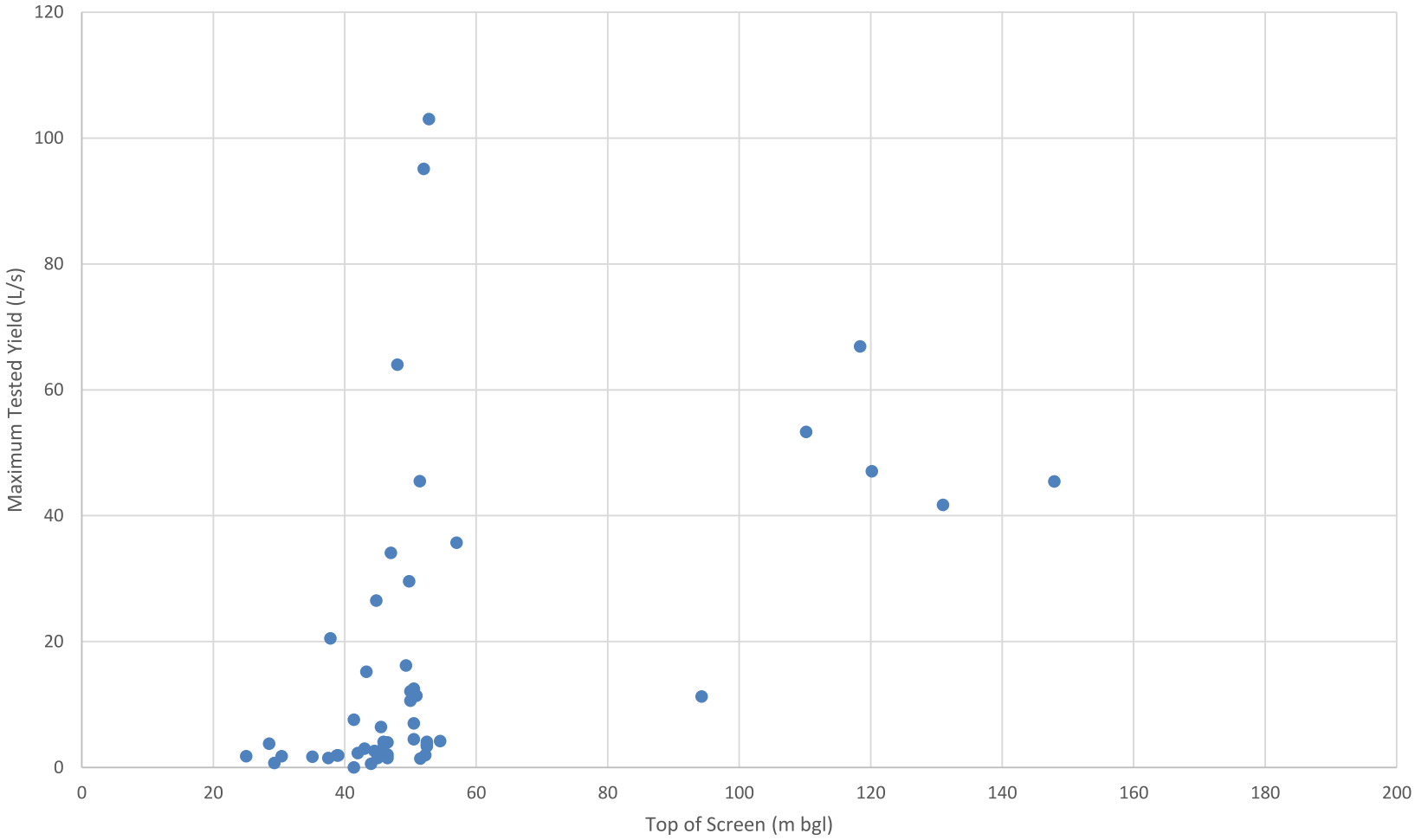


FIGURE 2: SCREEN DEPTH VERSUS YIELD, FOR ALL BORES WIHTIN 2 KM OF SITE

Appendix B: Bore Logs

#1 Well 92 Kw Submersible #1.

McMILLAN WATER WELLS LTD
120 High Street Southbridge Canterbury – Phone (03) 324 2571 – Fax (03) 324 2431

M36/7713

BORE REPORT-Redevelop and test pump

Client:: Selwyn Plantation Board
Driller/s: P Breward
Method: Rotary Percussion
Date Completed: 10/12/07
Grid Ref: M36:538-336
Site Location: Aylesbury Road

Lot No.:
Job No.: 5065
CRC No.: CRC042685
Bore No.: M36/7713

BORE CONSTRUCTION DETAILS:

Casing
Casing Length (m):
Casing Material: Steel
Top of Casing (m): 0.10 above ground level

Bore
Bore Depth (mbgl): 151.30
Bore Diameter (mm): 300

Telescoped Casing (if applicable)

Diameter (mm)	Length (m)	Set [from ; to] (mbgl)	
300	88.25	0.00	88.25
.250	116.50	85.10	116.56

Screen/s (if applicable) Top of Leader (m): 85.10 Length of Leader (m):

Type	Slot Size (mm)	Diameter (mm)	Length (m)	Set [from : to] (mbgl)	
.....					
.....					
.....					

WATER LEVEL INFORMATION: (at completion of bore) Static Water Level (m): 31.50 below ground level

BORE DEVELOPMENT & TESTING: (if applicable)

Development Duration(hrs): 22.00 Pumping Duration(hrs): 11.00

Flow Rate(gpm)	Draw Down (from SWL) (m)	Duration (hrs)
300	15.40	0.50
400	23.10	0.50
588	42.70	2.00
621 46 l/sec	46.10	8.00
Flow Shows	42-44 l/sec	

BORE HEAD SEALING: Sealed: no Sealing Material: na Capped: yes

Riser Column 81.2m + Motor Pump.

200mm PVC to Chuck. 534m.

Bore or Well M36/7713

Well Name :
Owner : Selwyn Plantation Board Limited

Environment Canterbury
Your regional council

Street of Well : Corner Alyesbury & Grange Road
Locality : Burnham
Grid Reference : M36:53637-34192 QAR 3
Location
Ecan Monitoring :
Well Status : Active (exist, present)
Uses : Irrigation

File no : CO6C/21988
Squalarc no :
Tideda no :
Allocation Zone : Selwyn-Waimakariri

Drill Date : 15 Sep 2006
Well Depth : 150.14m -GL
Initial Water Depth : -26.25m -MP
Diameter : 300mm

Measuring Point Alt. : 73.30m MSD QAR 4
Ground Level Around Well : -0.30m -MP
MP Description : TOC

Driller : McMillan Water Wells Ltd
Drilling Method : Rotary/Percussion
Casing Material : Steel
Pump Type :
Yield : 47l/s
Drawdown : 48m
Specific Capacity : 1l/s/m

Aquifer Type :
Aquifer Name :

Reading Count : 0
Strata Logs : 16
Aquifer Test : 0
Isotope Data : 0
Geophysical :
Fossil Data :

Highest GWL :
Lowest GWL :
First Reading :
Last Reading :
Calc. Min. GWL : -23.30m -MP
Last Updated : 08 Apr 2008
Last Field Check :

Screens :
Screen Type : Slotted Casing
Top GL : 120.18m
Bottom GL : 144.14m

Screen Type : Stainless steel
Top GL : 144.14m
Bottom GL : 150.14m

Date	Comments
26 Jul 2005	Awaiting water allocation issues to be resolved.
25 Oct 2006	Gridref changed from: M36:5314-3398 approx 564 metres from consented location BCR confirms. Depth 90 metres deeper than proposed.
09 Jul 2007	Kerry called and said that they have just started developing the well, and getting a pump test next week. I told him to tell us when he has started exercising this bore.
08 Apr 2008	Gridref changed from: M36:5368-3410 re X on topo map.
30 Apr 2008	routine monitoring visit measured flow at 31L/s

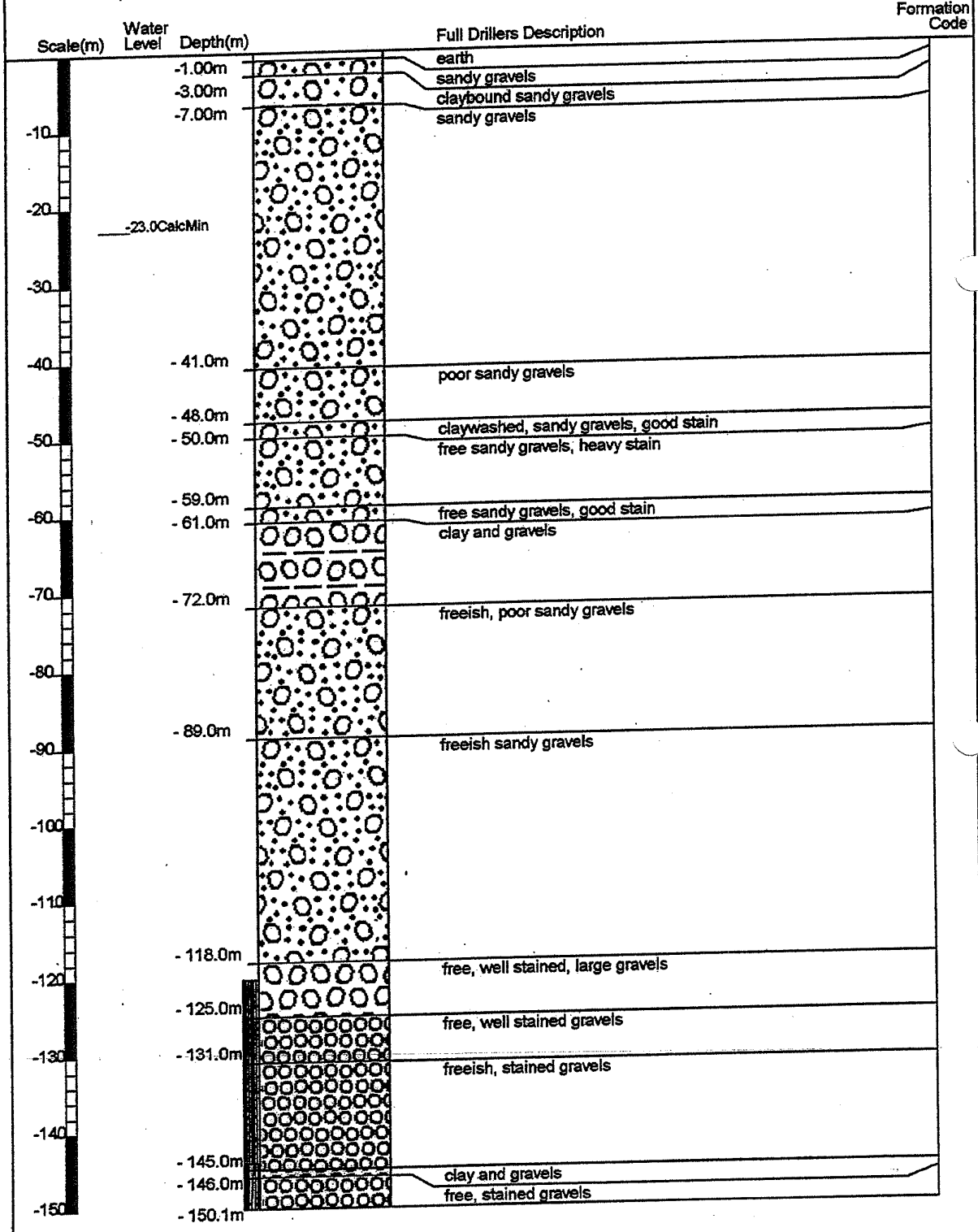
Pivot 1

92 Ha Pivot @ .6 = 55 l/Sec.

Borelog for well M36/7713

Gridref: M36:5361-3354 Accuracy : 3 (1=best, 4=worst)
Ground Level Altitude : 72.9 +MSD
Driller : McMillan Water Wells Ltd
Drill Method : Rotary/Percussion
Drill Depth : -150.14m Drill Date : 15/09/2006

Environment Canterbury
Your regional council



Burnham #3 Well.

McMILLAN WATER WELLS LTD
120 High Street Southbridge Canterbury – Phone (03) 324 2571 – Fax (03) 324 2431

BORE REPORT

M36/7710

Client:: Selwyn Plantation Board - Smith Block
Driller/s: V. Vasques Vagas/ P. Breward
Lot No.:
Job No.: 6030
Method: Rotary Percussion
CRC No.: CRC081840
Date Completed: 27/2/08
Bore No.: M36/7710
Grid Ref: M36:52031-34070
Site Location: Grange Road, Burnham

BORE CONSTRUCTION DETAILS:

Casing
Casing Length (m): 118.80
Casing Material: Steel
Top of Casing (m): 0.30 above ground level

Bore
Bore Depth (mbgl): 167.91
Bore Diameter (mm): 300

Telescoped Casing (if applicable)

Diameter (mm)	Length (m)	Set [from : to] (mbgl)	
300	119.80	0.00	119.80
250	29.91	118.00	147.91

Screen/s (if applicable) Top of Leader (m): 145.913 Length of Leader (m): 2.00

Type	Slot Size (mm)	Diameter (mm)	Length (m)	Set [from : to] (mbgl)	
Stainless Steel	2.5	200	9.00	147.91	156.91
Slotted Casing	5.0	200	11.00	156.91	167.91

WATER LEVEL INFORMATION: (at completion of bore) Static Water Level (m): 35.50 below ground level

BORE DEVELOPMENT & TESTING: (if applicable)

Development Duration(hrs): 48.50 Pumping Duration(hrs): 25.00

Flow Rate(gpm)	Draw Down (from SWL) (m)	Duration (hrs)
283	19.20	1.00
408	30.40	1.00
500	38.40	1.00
600	47.60	17.75

BORE HEAD SEALING: Sealed: no Sealing Material: na Capped: yes

McMILLAN WATER WELLS LTD
120 High Street Southbridge Canterbury – Phone (03) 324 2571 – Fax (03) 324 2431

BORE REPORT M36/7710

BORELOG:

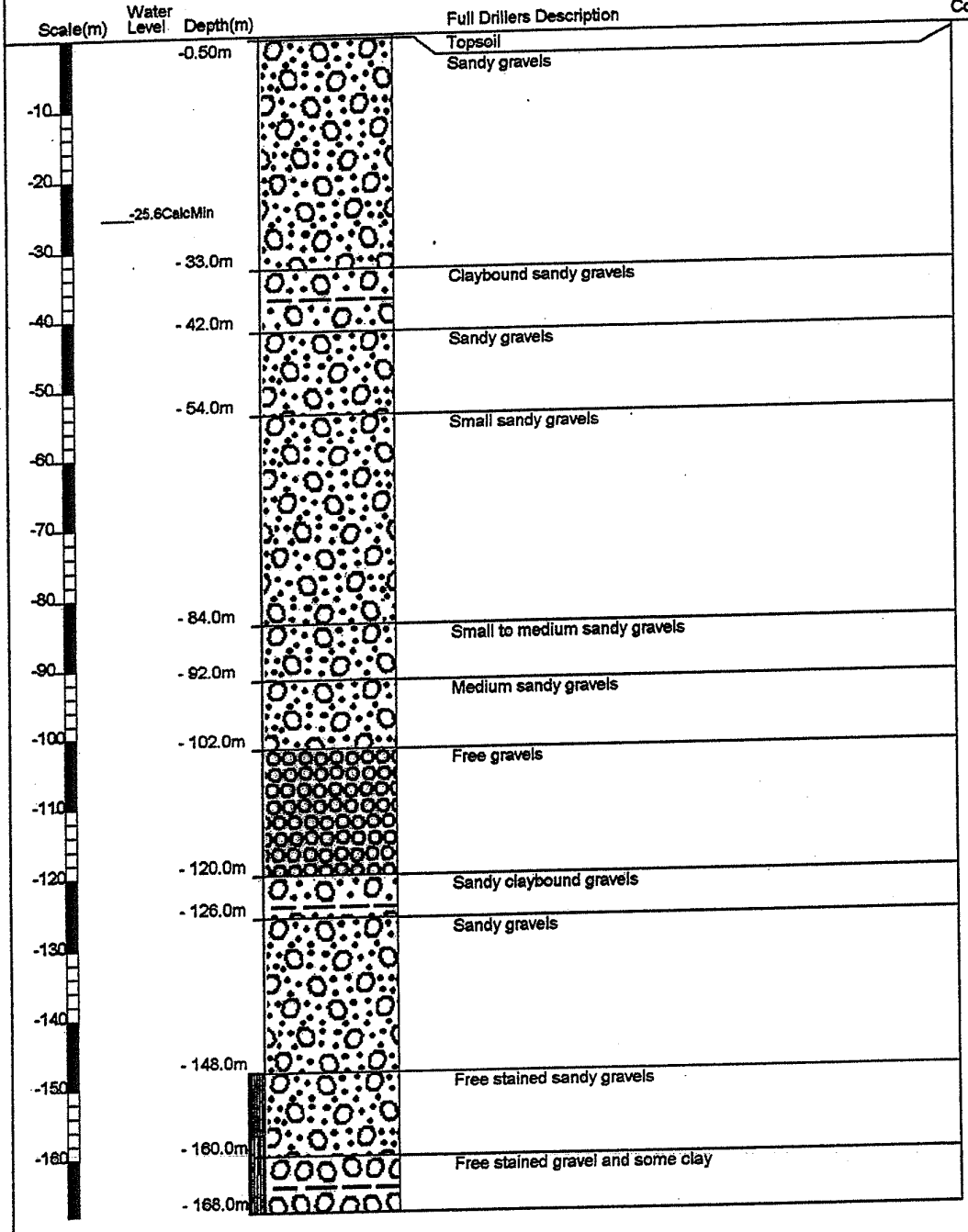
Depth Below Ground (m)		Strata Description	
Top	Bottom	Material: colour, composition, plasticity or particle/grain shape and grading, main soil/rock type, secondary components	WL (mbgl)
0.00	0.50	Top soil	
0.50	33.00	Sandy gravels	
33.00	42.00	Claybound sandy gravels	
42.00	54.00	Sandy gravels	
54.00	84.00	Small sandy gravels	
84.00	92.00	Small to medium sandy gravels	
92.00	102.00	Medium sandy gravels	
102.00	120.00	Free gravels	
120.00	126.00	Sandy claybound gravels	
126.00	148.00	Sandy gravels	
148.00	160.00	Free stained sandy gravels	
160.00	168.00	Free stained gravel and some clay	

ADDITIONAL NOTES: .....

Borelog for well M36/7710

Gridref: M36:52031-34070 Accuracy : 2 (1=high, 5=low)
Ground Level Altitude : 77.7 +MSD
Driller : McMillan Water Wells Ltd
Drill Method : Rotary/Percussion
Drill Depth : -168m Drill Date : 27/02/2008

Environment Canterbury



Burnham. # 2 well.

McMILLAN WATER WELLS LTD
120 High Street Southbridge Canterbury – Phone (03) 324 2571 – Fax (03) 324 2431

M36/7711

BORE REPORT

Client:: URS
Driller/s: V.vasquez / M.Ducan
.....
Method: Rotary Percussion
Date Completed: 28/6/07
Grid Ref: M36:5266-3504
Site Location: Smiths Block - Aylesbury Rd, Burnham

Lot No.:
Job No.: 4674
CRC No.: CRC042685
Bore No.: M36/7711

BORE CONSTRUCTION DETAILS:

Casing
Casing Length (m): 100.87
Casing Material: Steel
Top of Casing (m): 0.30 above ground level

Bore
Bore Depth (mbgl): 148.38
Bore Diameter (mm): 300

Telescoped Casing (if applicable)

Diameter (mm)	Length (m)	Set [from ; to] (mbgl)	
300	100.87	0.00	100.87

Screen/s (if applicable) Top of Leader (m): 97.88 Length of Leader (m): 2.50

Type	Slot Size (mm)	Diameter (mm)	Length (m)	Set [from : to] (mbgl)	
Stainless Steel	2.5	200	6.00	148.38	142.38
Slotted Casing	5.0	200	24.00	142.38	118.38
Blank	0	200	18.00	118.38	100.38

WATER LEVEL INFORMATION: (at completion of bore) Static Water Level (m): 33.16 below ground level

14m =

BORE DEVELOPMENT & TESTING: (if applicable)

Development Duration(hrs): 40.50 Pumping Duration(hrs): 12.00

Flow Rate(gpm) (l/m)	Draw Down (from SWL) (m)	Duration (hrs)
396 = 1499	4.44	1.00
529 2002	47.92	1.00
577 2184	8.82	1.00
725 2744	13.12	1.00
883 3343	19.39	3

BORE HEAD SEALING: Sealed: yes/no Sealing Material: ..... Capped: yes/no

Bore or Well M36/7711

Environment Canterbury
Your regional council

Well Name :
Owner : Selwyn Plantation Board Limited

Street of Well : Corner Alyesbury & Grange Road
Locality : Burnham
Grid Reference : M36:52660-35040 QAR 2
Location
Ecan Monitoring :
Well Status : Active (exist, present)
Uses : Irrigation

File no : CO6C/21988
Squalarc no :
Tideda no :
Allocation Zone : Selwyn-Waimakariri

Drill Date : 28 Jun 2007
Well Depth : 148.38m -GL
Initial Water Depth : -33.46m -MP
Diameter : 300mm

Measuring Point Alt. : 81.00m MSD QAR 4
Ground Level Around Well : -0.30m -MP
MP Description : ToC

Driller : McMillan Water Wells Ltd
Drilling Method : Rotary/Percussion
Casing Material : Steel
Pump Type :
Yield : 67l/s
Drawdown : 19m
Specific Capacity : 7l/s/m

Aquifer Type :
Aquifer Name :

Reading Count : 0
Strata Logs : 14
Aquifer Test : 1
Isotope Data : 0
Geophysical :
Fossil Data :

Highest GWL :
Lowest GWL :
First Reading :
Last Reading :
Calc. Min. GWL : -28.20m -MP
Last Updated : 19 Nov 2007
Last Field Check :

Screens :
Screen Type : Slotted Casing
Top GL : 118.38m
Bottom GL : 142.38m

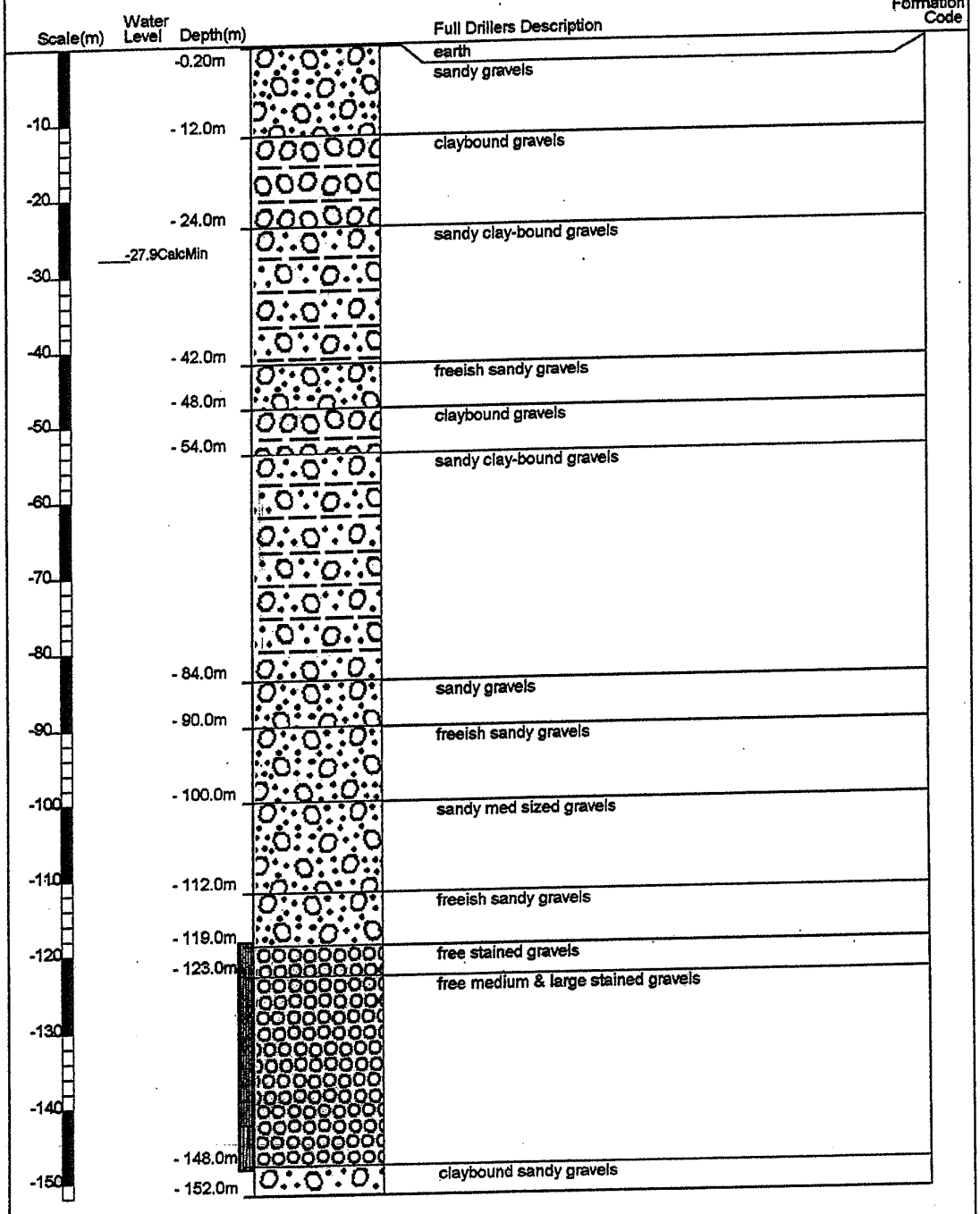
Screen Type : Stainless steel
Top GL : 142.38m
Bottom GL : 148.38m

Date	Comments
25 Jul 2005	Awaiting water allocation issues to be resolved.
17 Oct 2007	Gridref changed from: M36:5268-3507, new gridref from BCR
30 Jan 2009	Looks like a typo on BCR in the step test data - cahnged drawdown from 17.92 to 7.92 which fits dd curve

Borelog for well M36/7711

Gridref: M36:52660-35040 Accuracy : 2 (1=best, 4=worst)
Ground Level Altitude : 80.7 +MSD
Driller : McMillan Water Wells Ltd
Drill Method : Rotary/Percussion
Drill Depth : -152m Drill Date : 28/06/2007

Environment Canterbury
Your regional council



Burnham #4 Well.

Bore Report

McMILLAN DRILLING SERVICES

Client: Leo Donkers
Burnham Farm Ltd

Bore No.: M36/7712

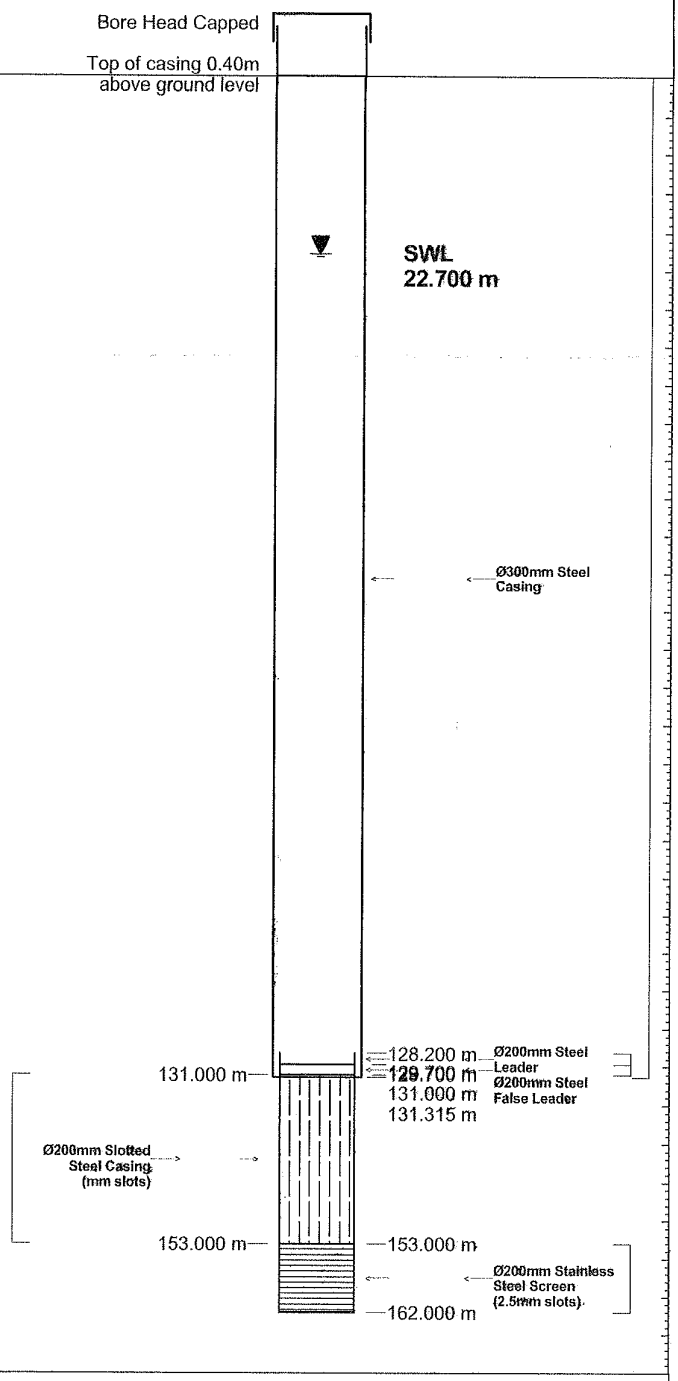
Job No.: 7924

Project: Drilling of New 12" (300mm) Well
Site Location: Aylesbury Road, BURNHAM
Driller(s): S. Lane
Method: Rotary Percussion

Date Completed: 5/11/2010
Grid Reference: M36:52574-33618
Consent No.: CRC103909
Lot Number:

Material Description	Depth (m)
Earth	0.20
Angular Claybound GRAVELS	6.00
Small subangular Claybound Sandy GRAVELS	13.00
Red/brown CLAY	14.00
Small/medium subangular Claybound Sandy GRAVELS	44.00
Medium smooth Sandy GRAVELS	45.50
Medium smooth free Sandy GRAVELS	55.00
Medium subangular Claybound Sandy GRAVELS	58.00
Small mixed Sandy GRAVELS with Clay	93.00
Small to medium Sandy GRAVELS with Clay	103.00
Small to medium very Sandy GRAVELS, some Clay	122.00
Medium rounded Sandy GRAVELS	152.00
Smooth round free Sandy GRAVELS	161.00
Smooth round GRAVELS, some Clay	162.00
Beyond depth drilled	

Casing & Screen Installation



Remarks:

Development Duration (hr): 64.5

Pumping Duration (hr): 10.25

Flow Rate (gpm)	Flow Rate (l/sec)	Draw Down (m)	Duration (hr)
275	20.8	28.250	1.00
346	26.2	35.760	1.00
408	30.9	43.090	1.00
483	36.6	52.570	1.00
550	41.7	62.700	6.25

Bore Diameter (mm): 300
Total Bore Depth (m): 162
Static Water Level (SWL) (m): 22.7
Total Depth Drilled (m): 162

120 High Street, Southbridge 7602, Canterbury, New Zealand | ph: (03) 324 2571 fax: +64 3 324 2431 web: www.drilling.co.nz

Report Created: 18/11/2010 9:56:48 a.m.

Appendix C: Preliminary Assessment of Highest Water Table Level

PATTLE DELAMORE PARTNERS LTD
Level 2, 134 Oxford Terrace
Christchurch Central, Christchurch 8011
PO Box 389, Christchurch 8140, New Zealand

Office+64 3 **345 7100**
Web **www.pdp.co.nz**
Auckland Tauranga Hamilton Wellington
Christchurch Invercargill

solutions for your environment

29 May 2023

Dan McGregor
Senior Project and Resource Adviser
Winstone Aggregates Ltd
PO Box 17-195
Greenlane
AUCKLAND 1546

Dear Dan,

BURNHAM QUARRY HIGHEST WATER TABLE ASSESSMENT

1.0 Introduction

Burnham 2020 Ltd proposes to develop a new quarry within the Burnham Farm property bounded by Grange Road and Aylesbury Road, near Burnham on the central Canterbury Plains.
Pattle Delamore Partners (PDP) has been engaged by Burnham 2020 Ltd to use the currently available data to assess the highest historical groundwater level, which is likely to be a limit imposed on the depth of the proposed excavations, and the likely highest future groundwater level beneath the site, which is relevant to the finished post-quarry elevation of the farm, so as to minimise the risk of groundwater inundation of the future land use. For example, at the present time it is considered that the land use at the site could be returned to agriculture after quarrying ceases, and the agricultural viability of the land could be adversely affected if inundation by groundwater were to occur. It is recognised that the currently available on-site data has only been monitored over a short period of time and therefore considerable extrapolation is required across monitored datasets to assess the highest groundwater level. However, the proposed quarry will develop gradually over a period of decades, which will provide ample opportunity for more refined estimates of the highest groundwater level to be determined in the years ahead based on longer term measurements from on-site bores.

This assessment uses a comparison of on-site shallow groundwater level monitoring data to nearby long-term groundwater level monitoring bores to produce extrapolated long-term groundwater level records, in order to estimate the highest historical groundwater levels and to contour these across the site.

This memo describes:

- The details of the groundwater level monitoring bores at the site.
- Details of nearby long-term groundwater level monitoring bores.
- Comparison of the on-site groundwater level monitoring record with the nearby long-term groundwater level monitoring bores, and creation of long-term extrapolated groundwater level records for the site.
- Assessment of the highest estimated historical groundwater level across the site.

- A consideration of the factors that might influence the highest groundwater level across the site in the future.

2.0 On-Site Groundwater Level Monitoring Bores

Three shallow groundwater monitoring bores are located on the site with transducer groundwater level monitoring records, with details provided in Table 1 below. Bore M36/5785 is a long-term existing shallow monitoring bore, while bores BX23/1342 and BX1343 were drilled for monitoring relating to the proposed quarry. Figure 1 shows the locations of these bores. There are also five water supply bores on the site that are more than 100 m deep. Due to the depth of these bores and the downwards hydraulic gradient at the site, the water levels measured in these bores are not appropriate to use for assessing the depth and seasonal fluctuations of the water table. Two additional shallow bores (BX23/1398 and BX23/1399) have recently been installed in the southwest and southeast corners of the site, and transducers were installed in these bores in May 2023. The groundwater level records from these bores will be used to create extrapolated records in the future and further refine the assessment detailed in this memo.

Table 1: Details of On-Site Monitoring Bores

Bore ID	Depth (m bgl[1])	Screened interval (m bgl[1])	Date drilled	Start of transducer record
Bores with transducer records used to develop extrapolated records				
M36/5785	27.7	24.7 – 27.7	Unknown (prior to 25/10/2006)	14/4/2022
BX23/1342	37.13	7.06 – 37.13	24/8/2022	9/9/2022
BX23/1343	34.19	4.11 – 34.19	30/8/2022	9/9/2022
Recently drilled bores				
BX23/1398	23.20	3.20 – 23.2	27/3/2023	10/05/2023
BX23/1399	31.68	3.50 – 31.68	28/3/2023	10/05/2023

Notes:
1. *Metres below ground level.*



Figure 1: Site location, and the location of monitoring bores used for creation of extrapolated groundwater long-term groundwater level records for the site.

Figure 2 shows the available transducer groundwater level data from each of the shallow monitoring bores on the site for which data is available. The data shows that the highest groundwater level was 8.7m bgl on the 6th of August 2022, recorded in bore M36/5785. This peak was not recorded in bores BX23/1342 and BX23/1343 as they had not yet been drilled at that time. The highest groundwater levels recorded in these bores were recorded on the 12th September 2022 and were 18.0m bgl in BX23/1342 and 14.2m bgl in BX23/1343. The transducer records presented in Figure 2 show that groundwater levels increase in depth towards the northwest. Note that the water level record in bore BX23/1343 stops on 15 December 2022 because the water level dropped below the level at which the transducer was positioned.

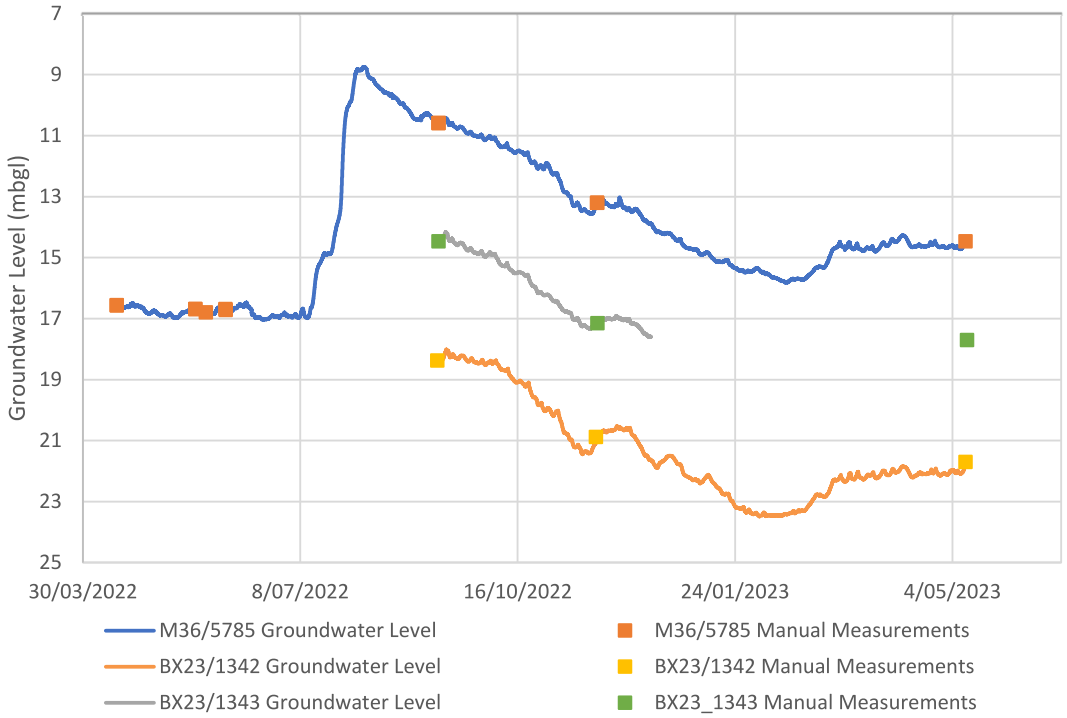


Figure 2: Transducer records from shallow onsite monitoring bores.

3.0 Nearby Long-Term Monitoring Bores

Burnham Farm is located in a transition zone between a shallow aquifer to the east, that thins and pinches out as water levels become deeper in a westerly direction across Burnham Farm, as shown by the summary map attached to a large group of Selwyn Waimakariri groundwater allocation zone consents and reproduced below as Figure 3 (i.e. the blue dotted line that passes through the south-eastern corner of the site shows the western extent of aquifer A1) and indicates that monitoring bore M356/5785 is within that shallow aquifer, but that the shallow aquifer may not be present across the remainder of the farm to the north and west. A conservative assessment will be to assume that the shallow aquifer could extend all the way across the farm and to use a long-term monitoring bore to the east, within that shallow aquifer, to simulate the long-term on-site water levels.

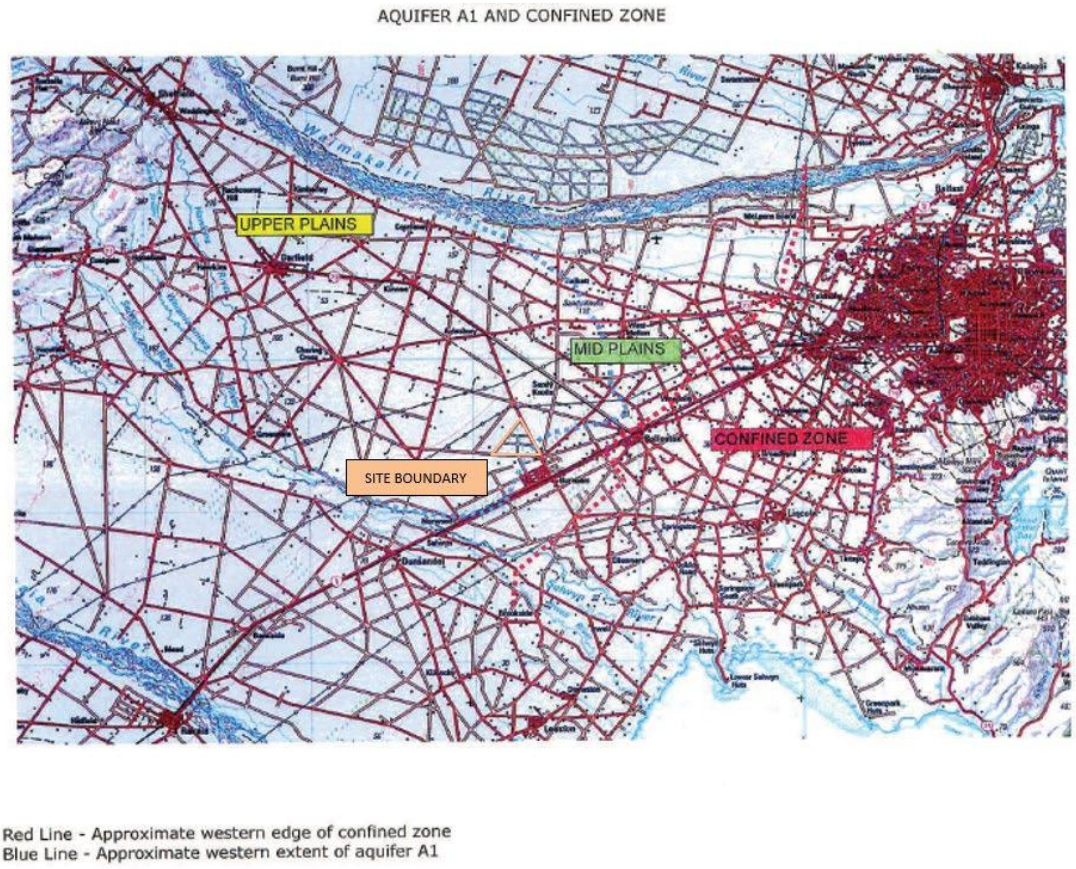


Figure 3: Selwyn Waimakariri Aquifer Zones

A review of Environment Canterbury (ECan) long-term monitoring bores shows that monitoring bore M36/0217 is most appropriate for the creation of long-term extrapolated groundwater records for the shallow bores on the site. It is 40.5 m deep, located approximately 9.5 km east of the site (as shown in Figure 1) and has a long-term record, from 1974 to 2023. Groundwater levels are generally between 20 and 12 m bgl. Groundwater levels tend to peak in spring, with the highest recorded groundwater level being on 27th September 1978 at 10.31 m bgl. The next three highest groundwater level measurements were recorded in September 1975, 1974 and 1977 respectively. It is noted that groundwater levels appear to have been measured on a 6-monthly basis in the 1970s, therefore the absolute highest groundwater level may not have been recorded in this bore. Figure 4 shows the water level record from bore M36/0217.

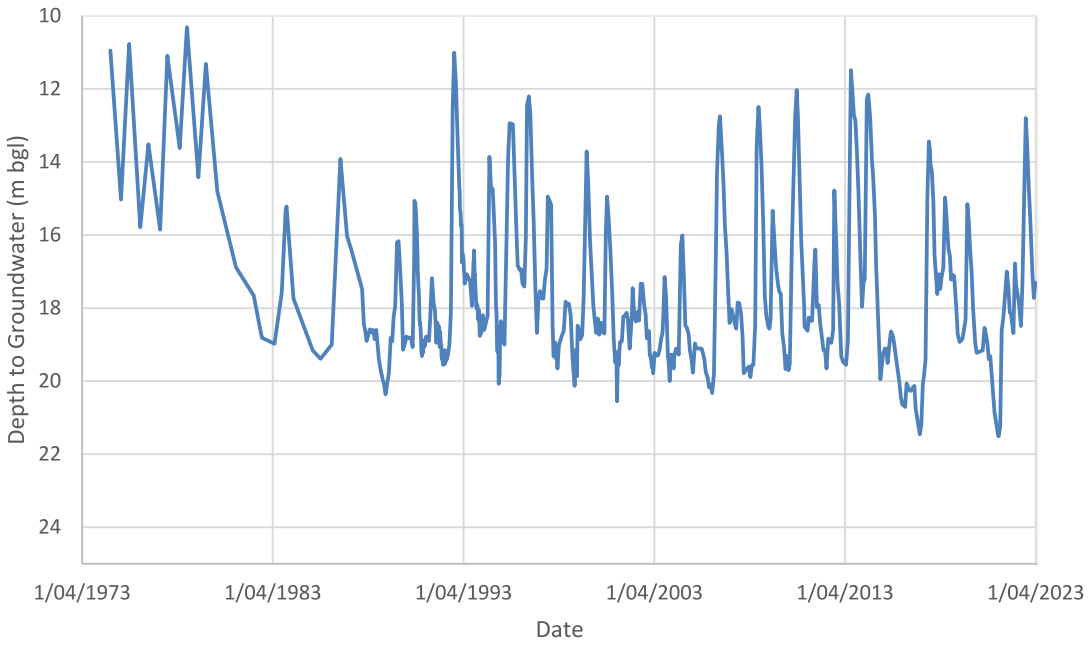


Figure 4: Groundwater level records for nearby long-term monitoring bore M36/0217.

4.0 Extrapolated Long-Term Groundwater Level Record

An extrapolated long-term groundwater level record for the shallow bores on site can be constructed by comparing the long-term monitoring bore record from M36/0217 to the three on-site monitoring bores.

As the time that each reading was taken was not recorded by ECan, it is assumed that each measurement at the monitoring bores was taken at midday. Using these measurements, regression tests can be run between the two data sets. The three regression tests all returned an R^2 value above 0.96. This shows that the data used in the test is a reliable match to the regression model. However, it should be noted that due to the relatively short period of monitoring on the site, only ten measurements from M36/5785 are available for comparison, seven measurements from M36/1342 and four measurements from BX23/1343. Table 2 shows the equations produced from the regression test and the regression plots are appended at the end of this letter. Using these three equations, records from all three onsite bores can be extended back to 1974. Figure 5 shows the extrapolated record constructed using the equations in Table 2 and as elevations in Figure 6.

The peak groundwater level was in September 1978 for all three onsite wells. The extrapolated record shows levels of 8.53 m bgl and 61.83 m RL at M36/5785; 16.42 m bgl and 69.05 m RL at BX23/1342; 12.144 m bgl and 65.73 m RL. Other notable peaks occurred in September 1975, October 1992 and August 2013.

Table 2: Details of Regression Relationships between M36/0217 and Onsite Monitoring Bores						
Bore ID	**Comparison bore**	**Equation**	**R^2 value**	**Minimum/ Maximum depth to groundwater at comparison bore (m bgl)**	**Minimum/ Maximum inferred depth to groundwater at on-site bore (m bgl)**	**Estimated maximum groundwater elevation at on-site bore (mRL)**
M36/5785	M36/0217	y = 0.9916x – 1.6922	0.9461	10.31/ 21.51	8.53/ 20.03	61.83
BX23/1342	M36/0217	y = 0.9368x + 6.7587	0.9130	10.31/ 21.51	16.42/ 26.91	69.05
BX23/1343	M36/0217	y = 1.0732x + 1.0796	0.9575	10.31/ 21.51	12.144/ 24.16	65.73

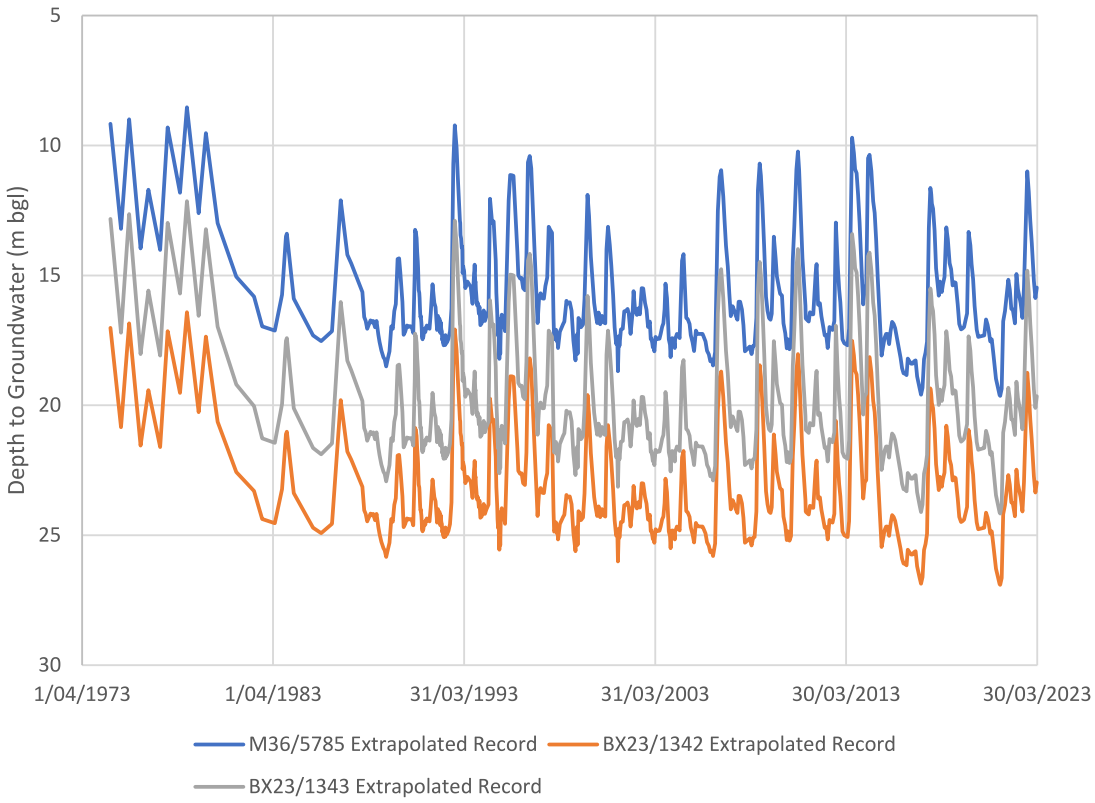


Figure 5: Extrapolated records (m bgl) based on M36/0217

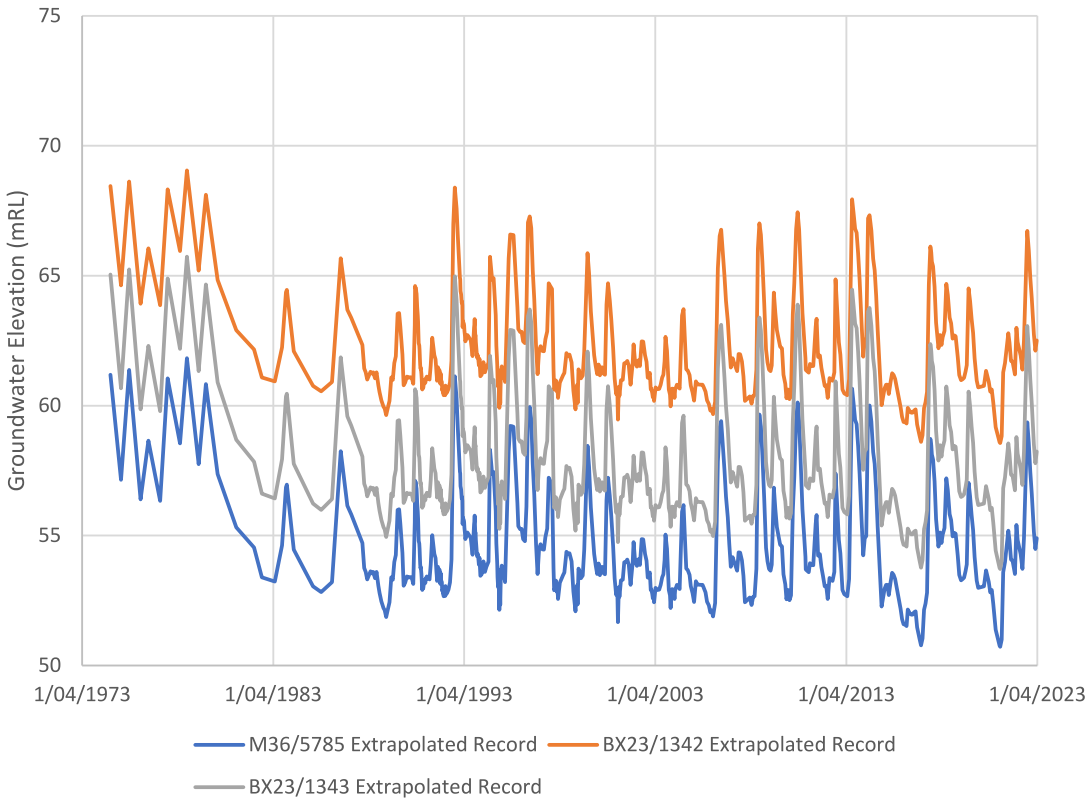


Figure 6: Extrapolated records (groundwater elevation) based on M36/0217

5.0 Highest Groundwater Table Assessment

Table 3 shows data from nearby ECan shallow monitoring bores (current and former) that have records that include the period in spring 1978. As with bore M36/0217 described in Section 4.0 above, all of the bores in Table 3 recorded their maximum groundwater level in spring 1978, and given the combined period of monitoring from all of the bores listed in Table 3 it can be inferred that the groundwater level peak at this period was the highest since at least 1951 (72 years). Therefore, the estimated groundwater level in spring 1978 is considered appropriate for estimating the highest historical groundwater level across the site.

Table 3: Details of Monitoring Bores

Bore ID	Depth (m bgl)	Minimum depth to water (m bgl)	Ground elevation from LiDAR (m RL)	Start of record	End of record	Date of highest groundwater level
L36/0087	58.50	24.42	105.39	04/01/1978	02/09/2003	06/11/1978
L36/0100	57.30	22.08	104.15	02/05/1978	07/06/1989	25/09/1978
M35/1000	48.80	18.36	104.54	23/09/1974	14/12/2022	26/09/1978
M36/0007	15.2	5.38	62.24	27/07/1951	2/08/1984	24/07/1978
M36/0039	39.40	9.19	66.98	26/09/1978	03/09/2003	26/09/1978
M36/0045	44.5	5.36	70.46	23/09/1974	3/09/2003	1/10/1978
M36/0049	27.1	8.14	71.05	27/09/1978	19/08/1991	27/09/1978
M36/0217	40.5	10.31	52.41	24/09/1974	16/11/2022	27/09/1978
M36/0255	24.4	5.78	43.18	14/04/1975	23/07/2018	27/09/1978
M36/0259	61.60	9.7	49.98	23/09/1974	12/05/2008	29/09/1978
M36/0451	44.50	2.61	51.59	20/09/1976	01/09/2003	27/09/1978
M36/0048	58	24.54	102.93	21/09/1976	7/05/1987	6/11/1978
M36/0046	43.8	7.6	77.73	23/09/1974	31/01/1995	27/09/1978
L36/0093	61.9	23.03	103.23	4/01/1978	8/01/1992	6/11/1978
M36/0040	59.4	27.34	106.8	1/02/1976	1/09/2020	6/11/1978

Many bores were only measured 6-monthly or quarterly in the 1970s, therefore the actual peak groundwater level in 1978 may not have been recorded for these bores, as the measurements for these bores were made in late September, which is generally a time of high groundwater levels but may not represent the peak level during that year. Of the nearby monitoring bores that were measured more frequently at that time, one shows higher water levels prior to late September (M36/0007, 0.6 m higher on 24/07/1978), while the other 3 show higher water levels later than late September when all other bores had their highest water levels measured (M36/0045, 0.36 m higher on 1/10/1978; L36/0087, 1.26 m higher on 6/11/1978 and L36/0100, 1.25 m higher on 6/11/1978). In order to account for this, the measured groundwater level from September 1978 in each bore that was not measured monthly was manually adjusted to a higher level, with the amount of adjustment based on best judgement by comparison to the amount that groundwater levels increased after September 1978 in bores that were measured more frequently at that time. The magnitude of adjustment varied from 0.1 m for the most downgradient bores, to 0.6 m for bore BX23/1342 at the upgradient end of Burnham Farm. Bore M36/5785 was adjusted by 0.2 m while BX23/1343 was adjusted by 0.3 m.

The minimum depth to groundwater was converted to peak groundwater elevation by using LiDAR to determine the ground elevation at each bore location. The peak measured groundwater elevation from each of these bores, as well as the peak inferred groundwater elevation estimated in the onsite shallow monitoring bores and bore M36/0465 using extrapolated records (described in section 4.0 above because

these bores were not measured in 1978), was contoured to provide a map of the estimated highest groundwater level in 1978, as shown in Figure 7 below.

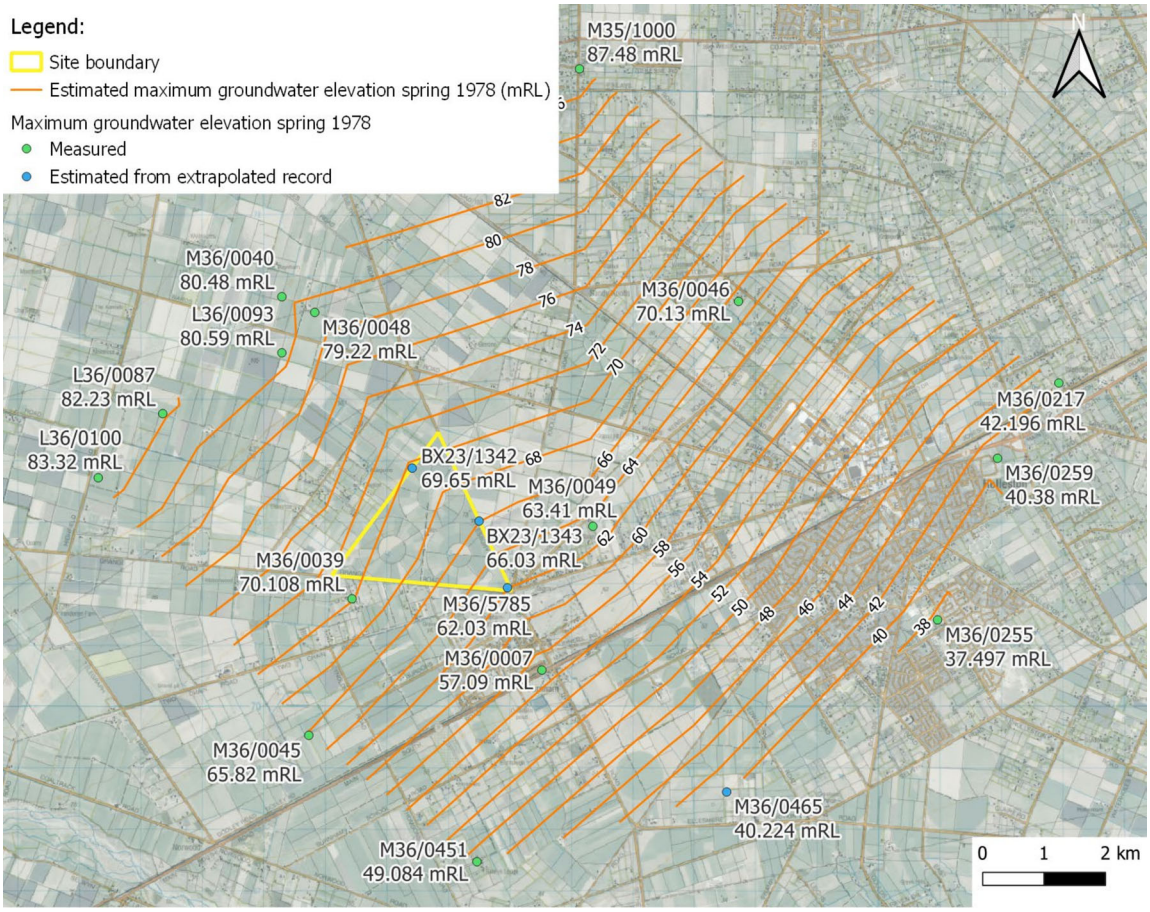


Figure 7: Piezometric contours of the estimated maximum groundwater elevation in spring 1978, based on measured groundwater levels and levels estimated from extrapolated records. 6-monthly and quarterly measurements manually adjusted as described in text above.

The piezometric contours are consistent with our conceptual understanding of the groundwater flow direction at the site. The contours presented in Figure 7 were used to estimate the depth to minimum depth groundwater across the site in 1978 by subtracting the estimated piezometric surface from the LiDAR digital elevation model. The resulting estimated peak depth to water contours (smoothed for clarity) are presented in Figure 8 below. The estimated minimum and maximum depth to groundwater in spring 1978 was slightly less than 8.0 m bgl on the southern side of the site, and approximately 16.5 m bgl in the northern corner of the site, respectively. The calculated mean depth to groundwater in spring 1978 across the site was 11.5 m bgl, which would correspond to a mean excavation depth of 10.5 m in order to maintain a 1 m clearance above the highest estimated groundwater level, based on the inferred level reached in spring 1978.

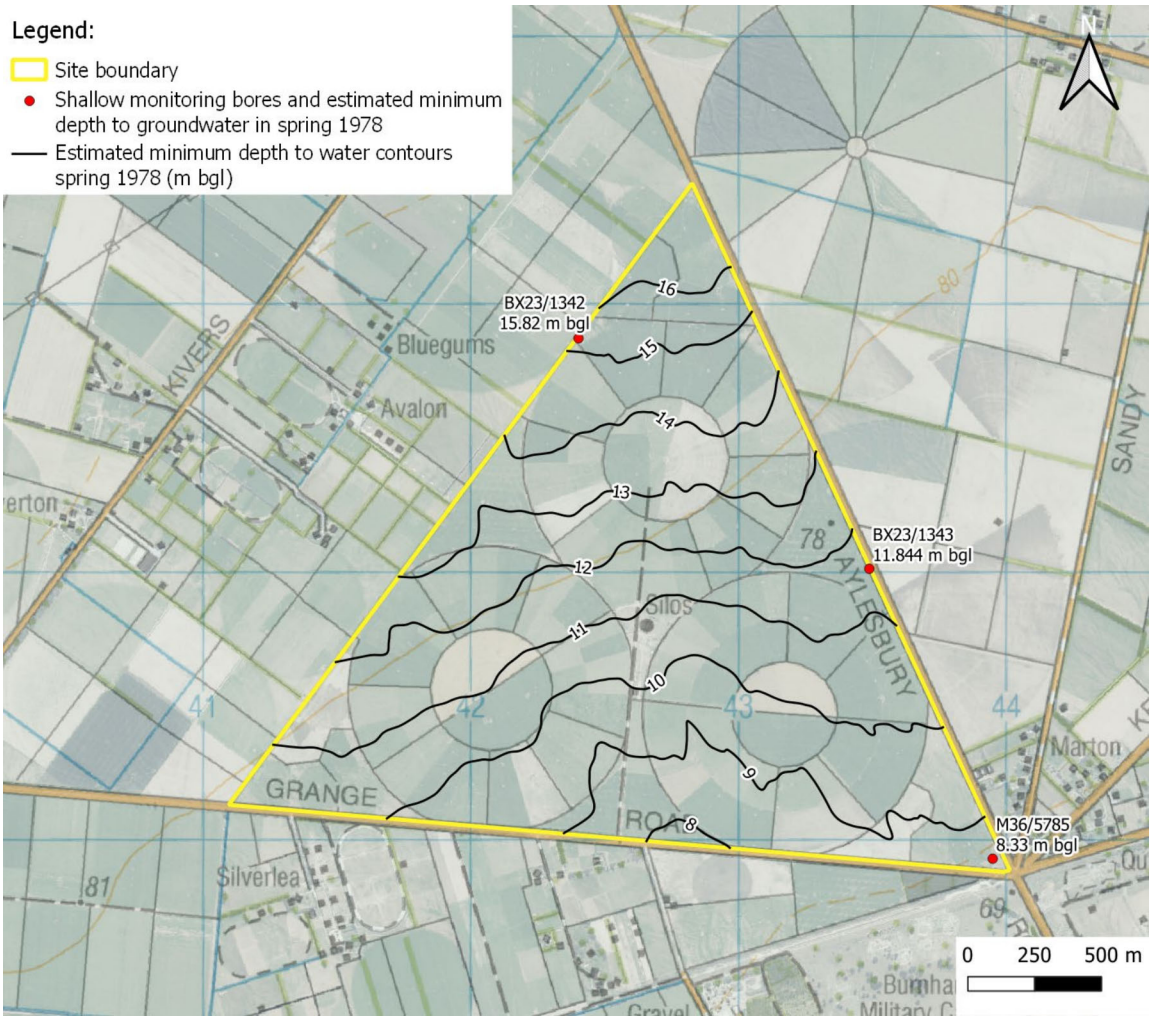


Figure 8: Contours of the estimated depth to groundwater across the site at the time of highest recorded groundwater levels in spring 1978.

It should be noted that it is possible that groundwater levels could peak at a higher level in the future than they did in 1978. Peak groundwater levels in 2022 were similar to the levels in 1978 but generally slightly lower, e.g. the peak 1978 level in bore M36/0217 was approximately 1.5 m higher than in 2022. The Central Plains Water (CPW) Scheme commenced the supply of water into this area in October 2018, so has now been operating for five complete irrigation seasons. This could contribute to groundwater levels being higher than has previously occurred, due to its use of Rakaia River water that brings more water into the area and reduced abstraction from groundwater.

Future groundwater levels could also be affected by climate change, although the likely effect of climate change on groundwater levels in Canterbury is highly uncertain. Temperature is projected to increase, which will generally increase evapotranspiration. A recent report by NIWA indicates that summer rainfall is projected to stay the same or slightly decrease (0 – 5%) on the central Canterbury Plains, however winter rainfall is projected to increase by 5 – 10% (NIWA, 2020). Flood flows in large alpine rivers are projected to increase, however Burnham Farm is in a part of the Canterbury Plains that is not expected to receive significant natural recharge from the Waimakariri River or Rakaia River. In light of the above projections, it is difficult to determine whether climate change will cause groundwater levels to generally increase or decrease, however it is possible that any increase in winter rainfall could cause isolated winter "spikes" in groundwater levels to become higher.

6.0 Percent Exceedance

Given the uncertainty in the evaluation of the highest groundwater level, it is useful to consider the estimated probability of high groundwater levels occurring, so as to indicate the significance of any unexpected spikes in high groundwater levels. The simulated annual maximum groundwater level for each of the three on-site monitoring bores has been evaluated to generate extreme value distributions for estimating the 1 in 5 year, 1 in 10 year and 1 in 20 year high groundwater level statistic, as provided in Table 4 below. There are many extreme value distributions to choose from, however the generalised extreme value (GEV) distribution (Rao and Hamed, 2000) shows a good fit to the extrapolated record data for each on-site bore.

Table 4: High Groundwater Level Estimated Return Periods for On-Site Bores

Bore	Estimated annual highest groundwater level (m bgl) [1]		
	1 in 5 year	1 in 10 year	1 in 20 year
M36/5785	11.0	9.8	8.8
BX23/1342	18.7	17.6	16.6
BX23/1343	14.8	13.5	12.4

Notes:

1. *Based on extrapolated record from bore M36/0217 and a generalised extreme value (GEV) distribution.*

The highest groundwater level contoured in in Figure 8 is less frequent than a 1 in 20 year event.

It is also useful to consider the amount of time that levels are generally at a peak. As an example, for bore BX23/1343, when the extrapolated groundwater record estimates groundwater levels higher than 14.0 m (between a 1 in 5 year and 1 in 10 year level), the groundwater level "spike" generally lasts two months or less, for example in 1992 levels higher than 14.0 m were only recorded in October and November of that year, and in 2010 only one monthly measurement (in September) was recorded above 14.0 m.

As groundwater monitoring continues at the site, a greater understanding of the range of seasonal fluctuations will be gained, and more robust extrapolated groundwater records will be able to be created to refine the estimates presented in this letter.

7.0 Conclusions

In summary, the results of the assessment described in this letter are as follows:

- The creation of extrapolated long-term groundwater level records indicates that the highest historical groundwater levels (likely the highest since 1951) at the site likely occurred in spring 1978.
- The peak groundwater level at the site in spring 1978 is estimated to have ranged from approximately slightly less than 8.0 m below ground level on the southern side of the site, to approximately 16.5 m below ground level in the northern corner of the site. The mean of the peak groundwater level across the site in spring 1978 is estimated to be 11.5 m below ground level.

- The groundwater level in spring 1978 may be an appropriate level to use as an estimated maximum groundwater level, for the purposes of maintaining a 1 m buffer from the ground surface to groundwater. However, it must be recognised that the effects of the Central Plains Water Scheme and climate change could cause some difference in future groundwater levels compared to what has been observed in the past.
- The proposed quarry will develop gradually over a long period of time which will allow for the assessment described in this letter to be repeated, and to become more robust, as further groundwater level monitoring data becomes available from ongoing monitoring at the site.

8.0 References

Ministry for the Environment. (2018). *Climate change projections for the Canterbury region*. Retrieved from https://environment.govt.nz/facts-and-science/climate-change/impacts-of-climate-change-per-region/projections-canterbury-region/

NIWA. (2020). *Climate change projections for the Canterbury Region. NIWA client report 2019339WN.*

Rao, A. R., & Hamed, K. H. (2000). Extreme Value Distributions. In *Flood Frequency Analysis* (pp. 207-255). Boca Raton: CRC Press.

9.0 Limitations

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Winstone Aggregates Ltd and others (not directly contracted by PDP for the work), including Environment Canterbury. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Winstone Aggregates Ltd for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

Yours faithfully

PATTLE DELAMORE PARTNERS LIMITED

Prepared by



Tom Garden

Hydrogeologist

Reviewed and Approved by

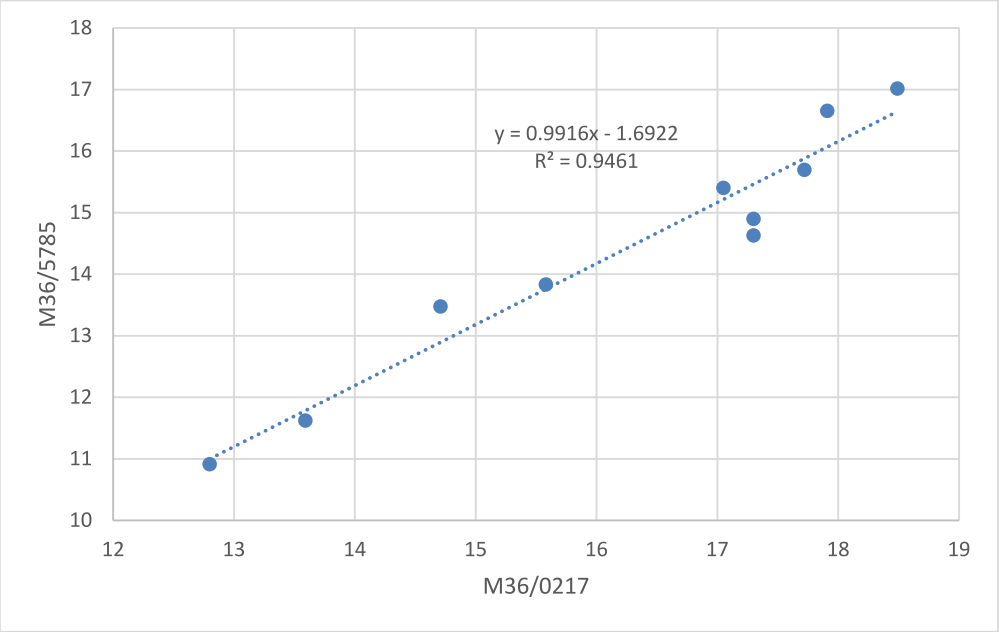


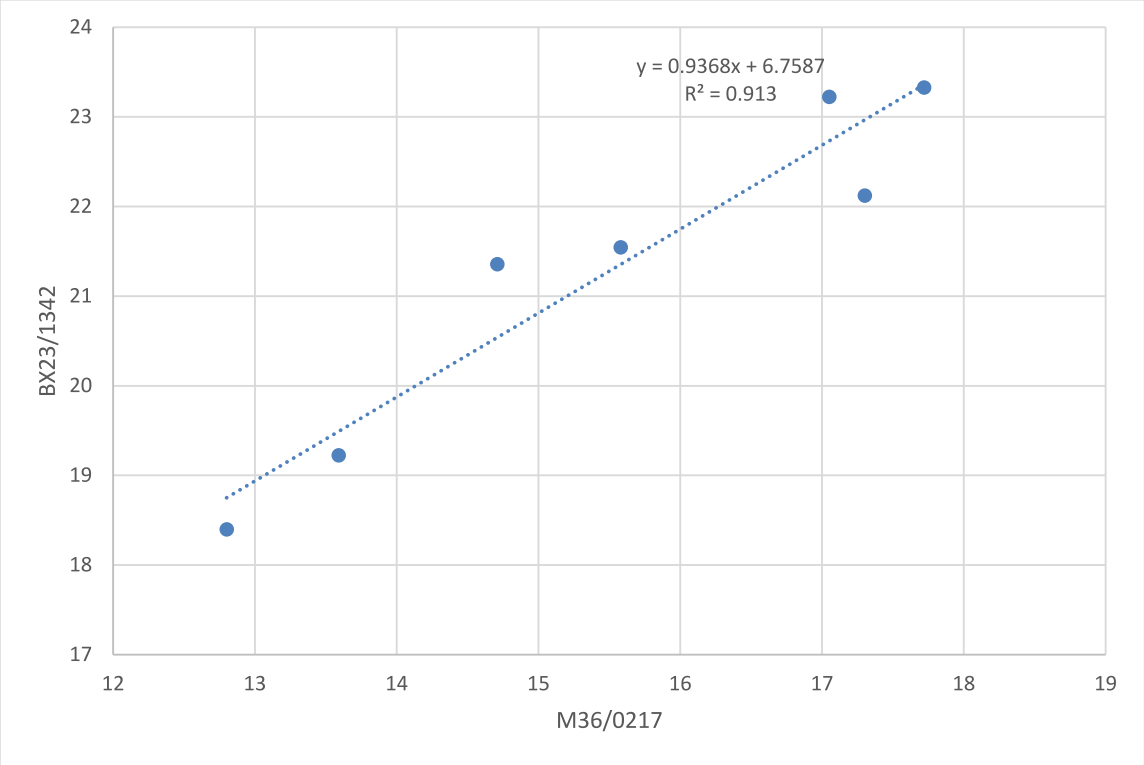
Peter Callander

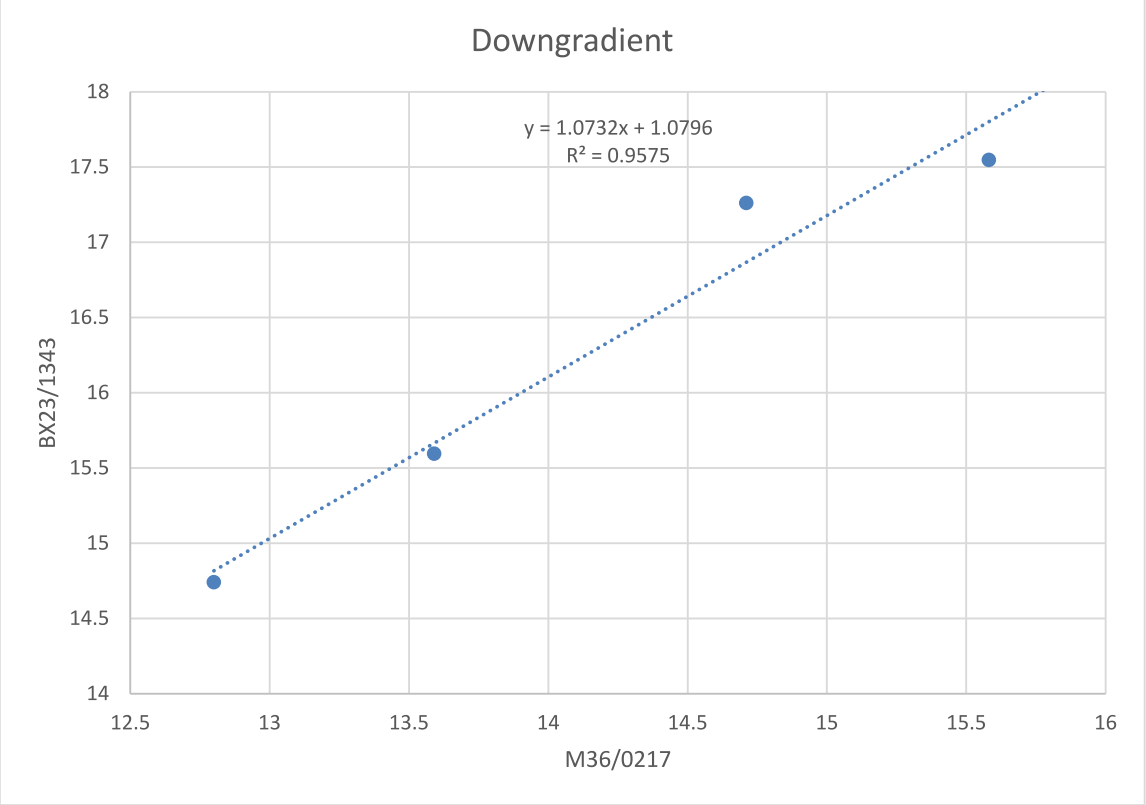
Technical Director-Water Resources

Appendix A: Regression Plots

M36/0217 – onsite bore comparisons






Downgradient
y = 1.0732x + 1.0796
R² = 0.9575
BX23/1343
M36/0217
18
17.5
17
16.5
16
15.5
15
14.5
14
12.5
13
13.5
14
14.5
15
15.5
16

Appendix D: Assessment of Proposed Quarry Effects on Nitrate Leaching to Groundwater

Pattle Delamore Partners Limited

TECHNICAL MEMORANDUM

INVESTIGATION	Nitrate leaching assessment for proposed Burnham Quarry and Farm	**PROJECT**	Renewal of Resource Consents CRC222536 and CRC221642 for Take and Use of Groundwater
CLIENT	**Burnham 2020 Ltd**	**PROJECT NO**	C04096400
CLIENT CONTACT	Dan McGregor	**PREPARED BY**	Peter Callander
DATE	15 November 2022	**SIGNATURE**	P. F. Callander

1.0 Introduction

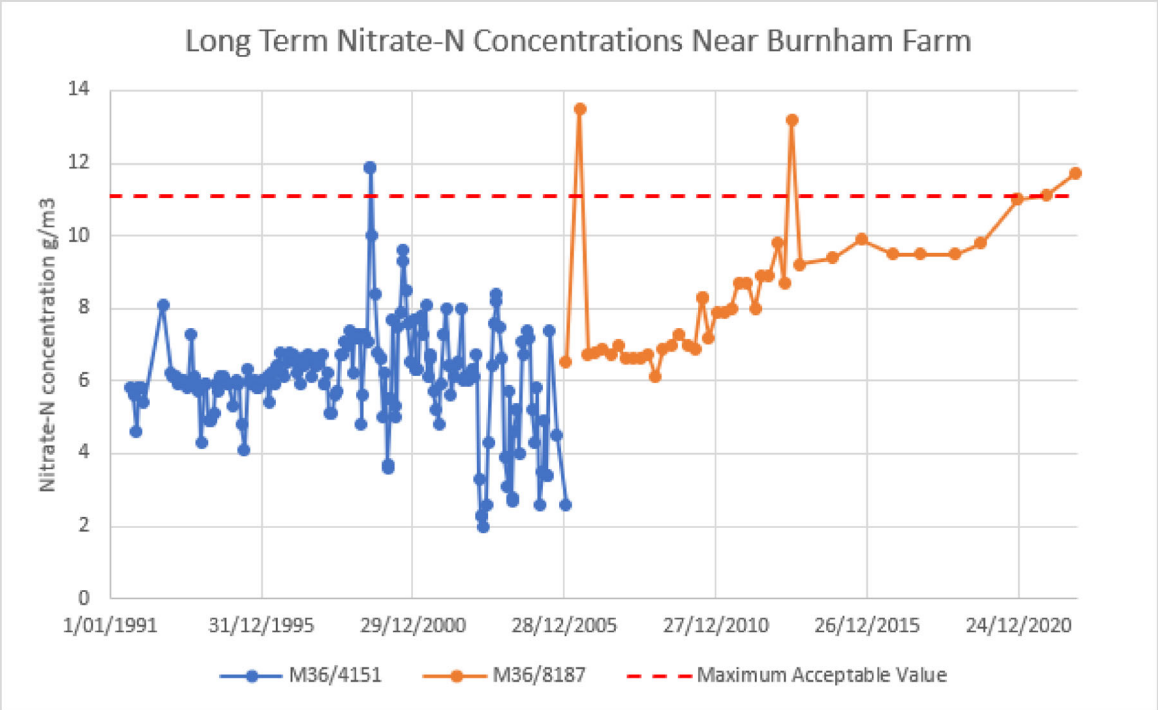
Burnham Farm is a modern irrigated dairy support block with approximately 70 paddocks covering an area of 362 ha. It is currently in pasture and kale crops for winter feed and is being grazed by one- and two-year old dairy heifer replacements. It is proposed to progressively quarry the property and return the land for farming activities, at a lower elevation compared to its current elevation. During a project planning workshop on 28 September, a question was raised as to how these changes in land use would affect the leaching of nitrogen into the underlying groundwater. This memo has been prepared to consider those changes.

The groundwater underlying the farm is part of an alluvial gravel aquifer system that is used by neighbouring property owners who abstract groundwater from wells on their properties to provide a source of drinking-water. Further down the plains (around 10 kilometres away), the groundwater also provides a source of water to spring-fed streams.

Nitrate is the common form of nitrogen that leaches from agricultural land use activities and at elevated concentrations it can cause adverse effects for both drinking-water supplies and spring-fed streams. A maximum acceptable value of 11.3 g/m^3 is specified for nitrate-N in the Drinking-water Standards for New Zealand 2005 (revised 2018). The NPSFM specifies an annual median nitrate-N concentration of 2.4 g/m^3 as the national bottom line for rivers.

2.0 Current Nitrate-N concentrations in groundwater

ECans groundwater quality database in the vicinity of Burnham Farm has mostly older groundwater samples collected between 1975 and 1995. These have average nitrate-N concentrations of 8 g/m^3, with 22 of the 138 samples (drawn from 3 bores) exceeding the MAV of 11.3 g/m^3. However, one pair of bores has a longer-term record. Bore M36/4151 is located on Kerrs Road, near the south-east corner from Burnham Farm. It is 31 m deep, but around 2005 it experienced low water levels and was replaced by bore M36/8187, which is 48 m deep, located around 25m to the north-east of M36/4151. The nitrate-N samples from this bore are plotted below and show a steadily increasing trend with the measurements in 2020 and 2021 all being around the MAV of 11.3 g/m^3.



A recent sample has been collected on 3 June 2022 from shallow bore M36/5785 (screened from 24.7 – 27.7 m deep) located in the south-eastern corner of Burnham Farm which had a nitrate-N concentration of 7.8 g/m^3.

3.0 N-leaching from current farming activities

The leaching of nitrogen from farm activities is typically quantified using the Overseer model. Whilst the accuracy of this model is sometimes questioned, it still provides a useful point of comparison of the relative change between different types of land-use.

The farm is irrigated by Central Plains Water Limited and comes under their nutrient load and environmental management plan. The property has a farm environment plan (FEP), regular audits and for the year ending 2020 the nutrient loss was 31 kg N/ha/yr and nitrogen drainage below the plant root zone is estimated at 16 g/m^3(Overseer v 6.4.3). This loss of nitrogen will typically be in the form of nitrate. The farm currently has 32 ha of kale (8% of the farm) for intensive winter grazing and this increases the nitrogen losses.

These reported losses from the farm soils leach downwards from the soil profile into the underlying groundwater. The geology of the broader area consists of successive alluvial deposits comprising gravel, sand, silt and clay sized particles. Long-term groundwater level records are available from several ECan monitoring wells in the vicinity. These show that seasonal variations in groundwater levels of around 11 m are common, with lowest groundwater levels generally occurring in late summer and autumn, and highest groundwater levels generally in spring. The available data indicates that the highest groundwater level may be around 16.5 m below ground level in the north of the site and around 8 m below ground level in the south-east area of the site.

Nitrate is highly soluble and does not adhere to sedimentary particles. Therefore, it will be present in the pore water that moves downward through the unsaturated zone towards the underlying water table. This subsurface drainage pathway can be divided into three categories, as shown in the Following Table.

Table 1. Subsurface environment below the soil zone

Zones of saturated strata beneath Burnham Farm	Approximate depth range of each zone	
	Prior to quarrying	Following quarrying
Permanently unsaturated strata above the highest groundwater level	0 – 16.5 m	0 - 1 m
Intermittently saturated strata within the range of water table fluctuations	8 – 28 m	1 – 12m
Permanently saturated strata below the lowest groundwater level	>28m	>12 m

As shown by the Table above, the proposed quarry will reduce this vertical separation distance to the highest groundwater level to around 1 m when the quarried area is restored to pasture.

4.0 N-leaching during quarrying

During quarrying, up to 40 ha of the property will be utilised for that purpose at any one time, of which 22 ha will occupy the active quarry workings that will progressively move throughout the farm area and the remaining 18 ha will be at a fixed location for access, administration and processing facilities. The area of the farm in which quarry activities are occurring will have a low nitrogen leaching rate, related to the nitrogen content in rainfall and any additional input and take-up from planted areas.

The estimated reduction in nitrate leaching due to the change from farming to quarrying is summarised in the following Table and shows a significant (10 times) decrease of around 1100 kg N/year in the N loss to groundwater due to the change in land use. Compared to the overall current annual N loss from Burnham Farm, estimated to be 11,222 kg of N (31 kg N/ha/yr over 362 ha) a reduction of 1100 kg corresponds to a 10% decrease.

Table 2. Comparison of N loss from the land surface

	N loss from current land use	N loss from associated quarry activities
Area	40 ha	40 ha
N Loss Rate	31 kg N/ha/year	3 kg N/ha/year[1]
Total N entering groundwater	1240 kg	120 kg

Notes:

1. *Parfitt et al (2008) suggest rainfall loading rates of 1 – 5 kg N/ha/yr and it is assumed that little modification to this rainfall may occur within the quarried area.*

The migration of the nitrate into the groundwater occurs due to downward migration of infiltrating rainwater and by inundation of the strata when the water table rises. These natural processes of water and associated nitrate migrating down to the water table will continue during the quarrying activity.

The moisture that is within the quarried strata will contain nitrate from the farming activity that was occurring prior to the commencement of quarrying. The quarried strata will be processed on site by washing the different sized particles and silt laden water will be pumped into settling ponds or spread out over land as part of the quarry rehabilitation. The volume of pore water in the unsaturated zone will be relatively small, with the active quarry area (22 ha) occupying only 6% of the Burnham Farm property. Furthermore, the infiltrating wash water occurring within this small working area will be quite localised and will not cause any significant rise in the groundwater levels. This process of washing the strata will therefore have a much smaller effect on the overall volume of nitrate that would enter the groundwater compared to what would occur from a rainfall event, which has a much wider scale of impact, both in terms of the area over which the rainfall occurs and the rise in the water table that results.

Consequently, the main effect on nitrate losses during the quarrying activity is the decrease in nitrogen leaching achieved by the interruption of the farming activity, as summarised in Table 2 above.

5.0 N-Leaching post quarrying

At the completion of quarrying the land is expected to return to some form of agricultural activity. For the purposes of this assessment we have assumed that the current farming practice will be resumed. The thickness of the permanently unsaturated zone (above the highest water table level) will be reduced from the current depth range of around 8 –16.5 m across the farm to a depth of around 1 m. The thickness of the intermittently saturated zone within which the water table fluctuates will remain unchanged at around 11.5 m, as will the N loss through the soil if the current land-use activity continues. Similarly, the mobilisation of nitrate into the groundwater system when the water table rises will continue as it does at present. However, instead of having 8– 28 m of strata above the water table this will be reduced to a depth of 1 – 12 m, depending on where the groundwater level is at any particular point in time. Consequently, the farm soils will be closer to the water table.

No significant attenuation of nitrate happens within this unsaturated zone therefore it is expected that the same mass of nitrate will reach the water table, but it will reach the intermittently saturated zone and the water table more quickly, due to the shorter travel distance to the water table. This is expected to be a small change that will not noticeably change the groundwater quality of the area.

6.0 CONCLUSION

Current nitrate-N concentrations in groundwater in the Burnham Farm area can occur at magnitudes around the Maximum Acceptable Value in the NZ Drinking-Water Standards. Farming activities such as those at Burnham Farm contribute to these elevated nitrate concentrations in groundwater. During quarrying activities that source of nitrate will significantly decrease.

Once the quarried area has been rehabilitated the soil surface will be closer to the water table but will still be above the highest estimated water table level. The mobilisation of nitrates into the groundwater when the water table rises, will still occur as it does at present. There is very little removal of nitrate once it leaches below the soil zone. Consequently, following the rehabilitation of the quarried land, annual losses of nitrate to groundwater will be similar to current losses if the same agricultural land use practices continue into the future. The main difference will be that the nitrate will have reached the groundwater sooner than is currently the case.

7.0 REFERENCES

Parfitt, R.L.; Baisden, W.T.; Schipper, L.A, & Mackay, A.D. (2008) Nitrogen inputs and outputs for New Zealand at national and regional scales: Past, present and future scenarios, Journal of the Royal Society of New Zealand, 38:2, 71-87, DOI: 10.1080/03014220809510547

This memorandum has been prepared by Pattle Delamore Partners (PDP) on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the memorandum. PDP accepts no liability if the memorandum is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

This memorandum has been prepared by PDP on the basis of information provided by Burnham 2020 Ltd and others (not directly contracted by PDP for the work), including Environment Canterbury and McMillan Drilling. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

© 2022 Pattle Delamore Partners Limited

Appendix E: Assessment of Proposed Quarry Effects on *E. coli* Migration into Groundwater

Pattle Delamore Partners Limited

TECHNICAL MEMORANDUM

INVESTIGATION	*E. coli* migration assessment for Burnham Farm	**PROJECT**	Renewal of Resource Consents CRC222536 and CRC221642 for Take and Use of Groundwater
CLIENT	**Burnham 2020 Ltd**	**PROJECT NO**	C04096400
CLIENT CONTACT		**PREPARED BY**	Neil Thomas
DATE	10 November 2022	**SIGNATURE**	

1.0 Introduction

Burnham Farm is a modern irrigated dairy support block with approximately 70 paddocks covering an area of 362 ha. It is currently in pasture and kale crops for winter feed and is being grazed by one- and two-year old dairy heifer replacements. The presence of stock creates a source of *E. coli* that can migrate downwards to the underlying groundwater system, particularly during heavy rainfall events. The groundwater underlying the farm is part of an alluvial gravel aquifer system that is used by neighbouring property owner who abstract groundwater from wells on their properties to provide a source of drinking-water. During this migration from the ground surface through the sub-surface environment, *E. coli* numbers are reduced by filtration, desiccation, dispersion, dilution and natural die-off over time. These processes operate in differing degrees as the *E. coli* move through the soil profile, the unsaturated subsurface zone and finally through the water saturated groundwater system.

A proposed quarry at Burnham Farm will reduce the thickness of the unsaturated zone and bring the source of the *E. coli*, at the pasture surface, closer to the saturated groundwater flow system. Pattle Delamore Partners (PDP) have prepared this memorandum to describe the change in *E. coli* attenuation rates and the change in contamination risks on drinking-water supply wells that arises from the proposed quarry at Burnham Farm.

2.0 Hydrogeologic Setting

Burnham Farm is located near the middle of the Canterbury Plains, approximately 6.5 km north of the Selwyn/Waikirikiri River and 12.5 km south of the Waimakariri River. The geology of the broader area consists of successive alluvial deposits comprising gravel, sand, silt and clay derived from the Southern Alps and deposited during the Quaternary period. The permeability of the strata is influenced by the age, depth of burial and depositional environment. The aquifers in the region are generally semi-confined.

The 1:250,000 geological map of the Christchurch area (Forsyth, Barrell, & Jongens, 2008) describes the underlying geology as brownish-grey river alluvium beneath plains or low-level terraces. The local near surface geology in this area of the plains also consists of remnants of stabilised river (Waimakariri) sands.

The driller's logs for wells in the area are generally consistent with the geological description above. The logs indicate that the strata generally consist of gravels with varying sand and clay content.

Groundwater recharge in the area is generally from rainfall and seepage from rivers, particularly the Waimakariri and Selwyn/Waikirikiri. Environment Canterbury (ECan) regional piezometric contours indicate that the groundwater near the site flows in a generally south-easterly direction.

Long-term groundwater level records are available from several ECan monitoring wells in the vicinity. These show that seasonal variations in groundwater levels of up to 10 m are common, with lowest groundwater levels generally occurring in late summer and autumn, and highest groundwater levels generally in spring. The available data indicates that the highest groundwater level may be around 16.5 m below ground level in the north of the site and around 8 m below ground level in the south-east corner of the site. The proposed quarry

may reduce this vertical separation distance to the highest groundwater level to around 1.5 m when the quarried area is restored to pasture.

Figure 1 shows the location of drinking-water supply wells on ECan's wells database, located within 1km of the proposed quarry property boundary. It also includes the Community Drinking-water Protection Zones that apply to water supplied for communities no fewer than 25 people for not less than 60 days each calendar year. These are the supply wells for the Burnham military camp and define zones where special land use measures may be required to protect the wells from contamination risks from contaminant sources such as *E. coli*. None of these protection zones extend into Burnham Farm.

The nearest downgradient wells are around 65 m from the Burnham Farm property boundary and around 150 m in the downgradient flow direction. They abstract groundwater from a variety of depths. A histogram of the well intake depths for all recorded drinking-water supply wells within 1 km of the Burnham Farm property is presented in Figure 2. It shows that the shallowest drinking water supply wells abstract from the 25 – 30 m depth range, although most wells are in the range of 40 – 55 m deep. Wells in the shallower depth range will be at greatest risk of *E. coli* contamination. Details of the community supply wells in the area, i.e. those for the Burnham military camp are summarised in Table 1.

Table 1: Community Drinking-Water Supply Wells for Burnham Military Camp

Well	Screen Interval (m bgl)	Diameter (mm)	Date-Drilled	Tested Yield (L/s)	Drawdown (m)
BX23/0903	189 - 195	300	26/4/2019	Unknown	Unknown
M36/2693	44.8 – 54.9	200	19/9/1957	26.5	8.5
M36/2694	24.3 [1]	150	Unknown	Unknown	Unknown

Notes:

1. *Well depth (screen interval unknown).*

3.0 *E. coli* Removal Rates

This section of the memo describes the various *E. coli* removal rates that apply to the Burnham Farm property, based on information presented in Schijven, J., Pang, L., and Ying, G.G. (2017).

The drinking water standard (NZDWS, 2018) for *E. coli* is <1 cfu/100 ml i.e. *E. coli* should not be detected in drinking water samples to comply with the drinking water standards. Therefore, the cumulative removal of *E. coli* along the pathway from the source to a downgradient well needs to reduce the concentrations from contaminant sources to < 1 cfu/100ml.

The source concentration of *E. coli* in paddocks that are used for agriculture, including dairy farming, is not well defined. However, some indication of the likely concentrations can be derived from information on *E. coli* concentration in untreated wastewater, for example septic tanks. Pang (2005) indicates that typical *E. coli* concentrations in raw effluent from septic tanks are around 1×10^6 cfu/100 ml. Likewise, concentrations of *E. coli* observed in dairy farm effluent ponds in New Zealand was recorded at concentrations up to 6×10^7 cfu/100 ml (Donnison, 2011). Therefore, concentrations would need to reduce by at least 8 log cycles to achieve the drinking water standards. This standard has been used in the following assessment, noting that source concentrations within paddocks are likely to be less than those observed in untreated wastewater and dairy farm effluent ponds.

There are three main components of bacterial removal as it travels from the surface to a well used to take groundwater:

- Removal as bacteria travel downwards through the soil directly underlying the source
- Removal as bacteria travel through the unsaturated zone between the soil and saturated strata
- Removal along a groundwater flow path between the source and a well.

The following sections of this memo discuss each of these components in more detail.

3.1 Soil

The top-soil over most of Burnham Farm is described from test pits as a dark brown sandy gravelly silt, well graded, sand, fine to coarse gravel, fine to coarse, rounded to subrounded slightly weathered Greywacke with organics, roots and wood fragments. The average topsoil thickness is 0.3 – 0.4 m.

S-Map (Manaaki Whenua Landcare Research) have mapped the area at 1:50,000 and have identified the soil siblings within the map unit, as described in Table 2. The profile available water (PAW) is a measure of the capacity of the soil sibling to store water that is potentially available for plant growth.

Table 2: Soil Siblings (S-map)

S-Map name	% of soil	Depth	Texture	Drainage class	PAW at 60 cm (mm)	Soil Order
Lismore_1a.1	80	Shallow	silt	Well drained	93	Brown
Lismore_2a.1	10	Shallow	silt	Well drained	75	Brown
Templeton_9a.1	10	Moderately Deep	silt	Well drained	105	Pallic

The proportions of soil siblings may vary across the property as indicated by percentage of stones found in the soil and the depth of topsoil.

Table 3 in Schijven et al (2017) presents bacterial removal rates for various types of soil. The soils at Burnham Farm that best match those reported rates are considered to correspond to a "shallow silt loam over gravel" which have a reported average bacterial removal rate of 4.04 $\log_{10}$/m. This soil type at Burnham farm, representing both topsoil and sub-soil, occurs over a thickness of 0.6 m so actual removal rates average 2.4 $\log_{10}$.

Following the completion of quarrying, existing soils from the farm will be stripped and placed over the quarried areas. Crops will be planted to help develop the soil structure and it is expected that 1 – 2 years after the completion of quarrying the soil will have similar bacterial removal rates to those that currently exist through the topsoil. For the purposes of a conservative assessment, we have assumed that the post-quarry soil is only 0.3 m thick, due to uncertainty regarding the sub-soil layer.

3.2 Unsaturated Zone

The unsaturated zone describes the strata that exists between the soil zone and the saturated groundwater zone. At present the available information indicates that this extends to a depth of around 8 – 28 m below ground level, depending on the elevation of the water table, which fluctuates seasonally. At the completion of quarrying the thickness of this zone could be reduced to a depth of around 1 – 11 m. It comprises the natural alluvial deposits of gravel, sand, silt and clay. Table 5 in Schijven et al (2017) report bacterial removal rates in the unsaturated zone. Their dataset is somewhat limited and because of that, it will be conservative to assume that this zone comprises coarse gravel. The reported bacterial removal rates average 0.44 $\log_{10}$/m.

3.3 Saturated Zone

The saturated groundwater flow system also comprises a mixture of natural alluvial deposits of gravel, sand, silt and clay. For lateral transport it will be conservative to assume transport occurs within coarse gravels, which are laid down on a general horizontal plain orientation. Table 7 in Schijven et al (2017) report bacterial removal rates in saturated aquifer strata. For tracer tests in uncontaminated coarse gravels the reported bacterial removal rates are around 0.02 $\log_{10}$/m for lateral transport. However, the intake zone for drinking-water supply wells occur several metres below the water table. As shown in Figure 2, the shallower wells occur at depths of 25 m (around 15 m below the shallowest water level and 5 m below the deepest water levels, with most well intakes being a further 15 m deeper than that). Therefore, any *E. coli* must migrate downwards through the strata, which will involve a longer flow path and the occurrence of at least some finer grained layers, which will increase removal rates, although quantification of vertical migration in the saturated zone is not described in Schijven et al (2017).

In order to assess vertical migration a 3-d analytical contaminant transport equation has been used (Hunt 2012). The removal rates for coarse clean gravel aquifers described in Schijven et. al., (2017) include those based on experiments described in Pang (1998). Other experiments are also described in Schijven et. al (2017) but we have used the Pang (1998) example as this is the best documented and also appears to best match analytical models for contaminant transport. Other experiments (Sinton, 2000) appear to have missed the peaks in breakthrough curves meaning that the results are less reliable. The experiments in Pang (1998) used an injection source of *B.subtilis* bacteria and an array of monitoring wells up to 85 m downgradient from the source. Concentrations were recorded at the water table in each of the downgradient wells and the reduction in concentrations of bacteria on a per metre basis was calculated, together with other aquifer parameters including flow velocities, retardation coefficients and dispersion. Therefore, the analytical model has been set up to replicate the results of the experiment, using similar aquifer parameters. A table showing the parameters used in the analytical model is provided in Appendix A, which also shows the parameters derived from observations in Pang (1998). Figure 3 shows the results of the analytical model compared to the Pang (1998) experimental results. In general, these indicate a close match.

The analytical model uses a decay rate of 2.4 log/day, which was adjusted to match the observed data, including the timing of the observed breakthrough curves. Although this parameter is labelled as a decay rate in the model, it takes on a surrogate role for bacterial filtration through the aquifer on the basis that travel time corresponds to distance travelled through the strata, resulting in more filtration with more distance travelled. Therefore, its value is not precisely analogous to a decay rate. However, we note that the bacteria chosen for the experiment described in Pang (1998) (*B. subtillis* spores) has a relatively low die off rate. Therefore, the results of the analytical model to bacteria such as *E. coli* are conservative because these would be expected to decay at a greater rate.

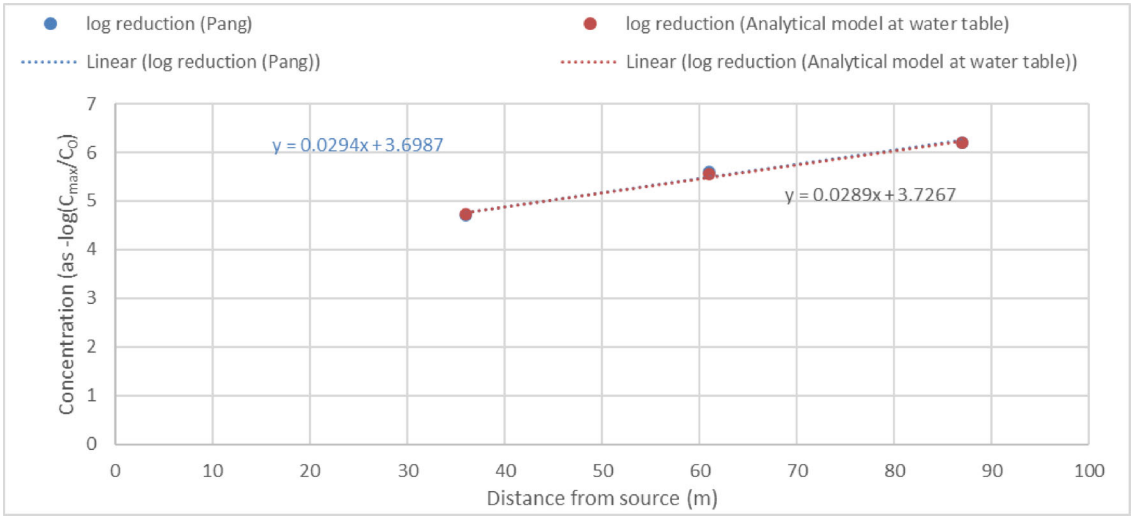


Figure 3: Modelled and observed (Pang, 1998) log reduction with distance from a source

The log removal rates in Pang (1998) are calculated as the slope of the line of best fit between the observed reduction in concentrations at different distances from the source along a flow path but does not include the reduction between the source and the closest monitoring well. Pang (1998) indicates a value of 0.031 log/m, whereas the analytical model indicates a value of 0.029 log/m (giving a 2.52 log reduction over 87 m). Given the close match between the observed results and the results from the analytical model, the results from the analytical model have been extrapolated to a distance of 150 m and a depth of 5 - 15 m below the water table (depending on low water level or high water level conditions).

The analytical model results indicates that the log reduction rate calculated over a distance of 87 m does not remain constant and reduces with increasing distance from the source. At a distance of 150 m, the model indicates an average log reduction rate of 0.022 log/m compared to 0.029 log/m at a distance of 87 m. Therefore, at the water table, the analytical model predicts a total log reduction of 3.3 at 150 m.

The analytical model indicates that at times of high water levels (when the shallowest well intakes are 15 m below the water table) an additional 7.7 log reduction would be expected to occur beyond the 3.3 log reduction at a distance of 150 m at the water table. At times of low water level (when the shallowest well intakes are around 5 m below the water table) the analytical model indicates an additional 1.0 log reduction would be expected to occur beyond the 3.3 log reduction at a distance of 150 m at the water table.

3.4 Combined Removal Rates

Tables 3 and 4 summarise the removal rates described in the preceding sections and combines them to indicate the overall removal rate for the current situation and for the post-quarry situation. Table 3 presents the bacterial removal rates under high water table conditions, while Table 4 presents the bacterial removal rates under low water table conditions

Table 3: Bacterial Removal Rates (under high/shallow water table conditions)

Zone	Prior to Quarrying			Post-quarry rehabilitation		
	Travel Distance (m)	Removal (log10)	Cumulative removal (log10)	Travel Distance (m)	Removal Rate (log10)	Cumulative removal (log10)
Soil Zone: shallow silt loam over gravel – vertical transport	0.6	2.4	2.4	0.3	1.2	1.2
Unsaturated Zone: coarse gravel – vertical transport	10	4.4	6.8	1	0.4	1.7
Saturated Zone: coarse gravel – lateral transport	150	3.3	10.1	150	3.3	5.0
Saturated Zone: coarse gravel – vertical transport	15	7.7	17.8	15	7.7	12.6

Table 4: Bacterial Removal Rates (under low/deep water table conditions)

Zone	Prior to Quarrying			Post-quarry rehabilitation		
	Travel Distance (m)	Removal (log10)	Cumulative removal (log10)	Travel Distance (m)	Removal Rate (log10)	Cumulative removal (log10)
Soil Zone: shallow silt loam over gravel – vertical transport	0.6	2.4	2.4	0.3	1.2	1.2
Unsaturated Zone: coarse gravel – vertical transport	20	8.8	11.2	11	4.8	6.1
Saturated Zone: coarse gravel – lateral transport	150	3.3	14.5	150	3.3	9.4
Saturated Zone: coarse gravel – vertical transport	5	1.0	15.5	5	1.0	10.4

The individual components of the removal processes are summarised in Figures 4 and 5 below. This indicates that the removal rates are reduced by around 5 orders of magnitude due to the lower ground surface, which is a result of the reduced thickness of the unsaturated zone once the quarry is rehabilitated.

However, while the cumulative log reduction is reduced because of the quarry and its rehabilitation, the cumulative log reduction reaches a minimum of 10.4 log cycles at a distance of 150 m from the property, which is the distance to the nearest water supply well. This reduction is still significantly in excess of the 8 log cycle reduction required to reduce concentrations to the drinking water standard (as illustrated in Figure 6 and 7). Therefore, the risk to downgradient wells, while elevated, remains acceptable.

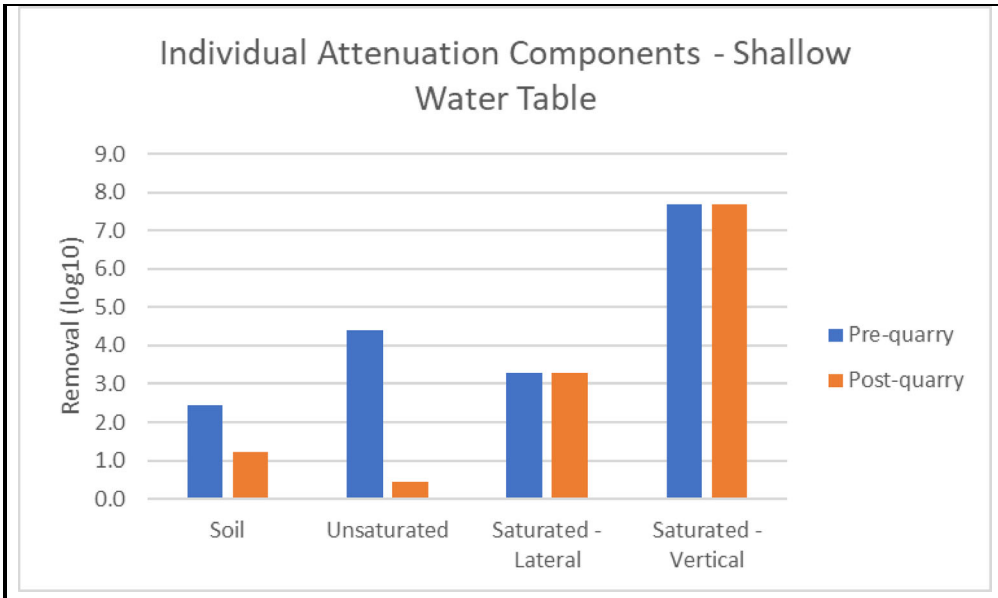


Figure 4: Bacterial removal rates for pre and post quarry under high water table conditions

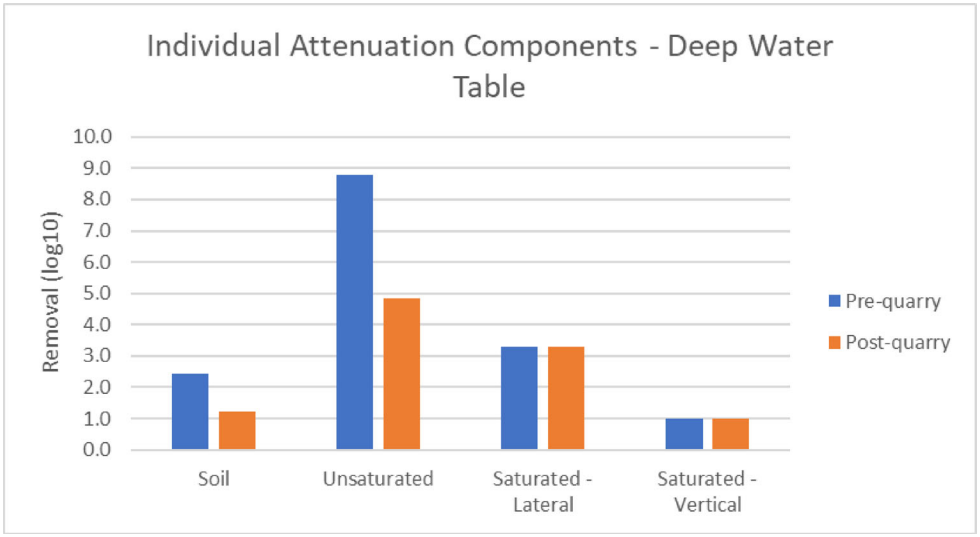


Figure 5: Bacterial removal rates for pre and post quarry under low water table conditions

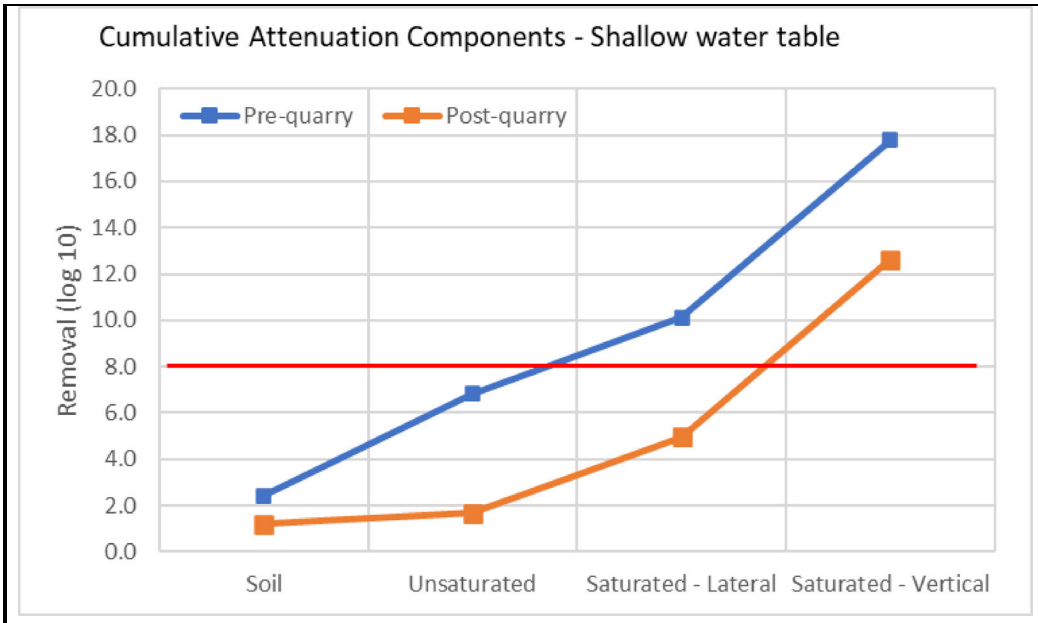


Figure 6: Cumulative bacterial removal rates for pre and post quarry under high (shallow) water table conditions

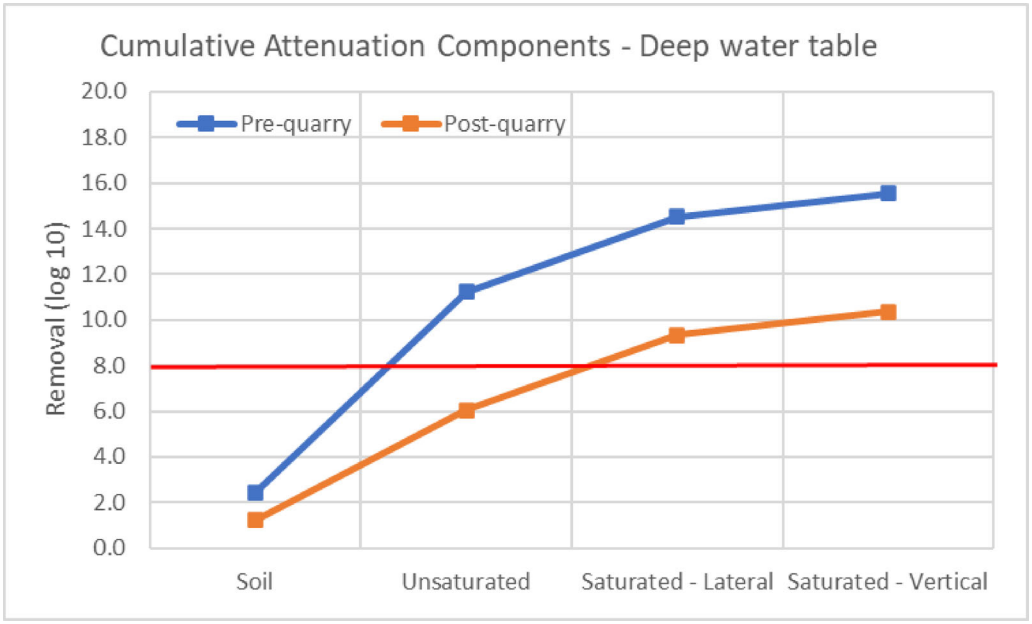


Figure 7: Cumulative bacterial removal rates for pre and post quarry under low (deep) water table conditions

4.0 CONCLUSION

Based on conservative examples of *E. coli* sources from farming activities it is expected that concentrations on the soil surface need to reduce by at least 8 log cycles to achieve the drinking water standards. This reduction in *E. coli* concentrations occurs as they migrate through the soil profile, the unsaturated strata and the underlying saturated groundwater system below the water table. The development of a quarry reduces the amount of *E. coli* reduction that occurs within the unsaturated zone. Assessments of the amount of post-quarry reduction to the nearest neighbouring domestic water supply wells to Burnham Farm is on the order of 5 log cycles, but the post-quarry ground conditions are still expected to achieve at least 10 log cycles removal between the farm and the closest bore 150 m downgradient, which is greater than the required value of 8 log cycles. On that basis it is expected that the current stocking land use can continue following the completion of quarrying without adversely affecting nearby drinking-water supply wells.

5.0 REFERENCES

Donnison, A., Ross, C., & McGowan, A. (2011). Escherichia coli and Campylobacter in two conventional Waikato dairy farm effluent ponds. New Zealand Journal of Agricultural Research, 54(2).

Hunt, B. (2012). *Groundwater Analysis Using Functions.xls.* Christchurch: University of Canterbury.

Pang, L., Close, M., & Noonan, M. (1998). Rhodamine WT and Bacillus subtilis Transport through an Alluvial Gravel Aquifer. *Groundwater, 36*(1).

Schijven, J., Pang, L., & Ying, G. (2017). Evaluation of subsurface microbial transport using microbial indicators, surrogates and tracers. In J. B. Rose, & B. Jiménez-Cisneros, *Global Water Pathogens; Part 2 Indicators and Microbial.* Michigan State University; UNESCO.

Sinton, L., Noonan, M., Finlay , R., Pang , L., & Close, M. (2000). Transport and attenuation of bacteria and bacteriophages in an alluvial gravel aquifer. *New Zealand Journal of Marine and Freshwater Research, 34*(1), 175-186.

This memorandum has been prepared by Pattle Delamore Partners (PDP) on the specific instructions of Burnham 2020 Ltd for the limited purposes described in the memorandum. PDP accepts no liability if the memorandum is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

This memorandum has been prepared by PDP on the basis of information provided by Burnham 2020 Ltd and others (not directly contracted by PDP for the work), including Environment Canterbury and McMillan Drilling. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

© 2022 Pattle Delamore Partners Limited

Appendix A:

Table A1: Model Parameters

Parameter	Pang (1998)	Analytical Model
Flow velocity (m/day)	50 to 85	70
Longitudinal dispersivity (α_x) at 36 m	0.38 – 1.65	1
Longitudinal dispersivity (α_x) at 61 m	0.06 – 2.41	1.5
Longitudinal dispersivity (α_x) at 87 m	0.2 – 0.3	1.8
Longitudinal dispersivity (α_x) at 150 m		2
Lateral (α_y) at 150 m		0.2
Vertical (α_z) at 150 m		0.02
Decay rate (log/day)	0.23 – 9.4	2.4
Retardation factor	0.75 – 1.13	0.8
Porosity	0.2	0.2
Input flux (cfu)	5.2×10^{11}	5.2×10^{11}

Appendix F: Groundwater Quality Sample Results from Burnham Farm

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Pattle Delamore Partners Limited	**Lab No:**	3000105 DWAPv1
Contact:	Mr Peter Callander	**Date Received:**	27-May-2022
	C/- Pattle Delamore Partners Limited	**Date Reported:**	02-Jun-2022
	PO Box 389	**Quote No:**	118028
	Christchurch 8140	**Order No:**	
		Client Reference:	C04096400
		Submitted By:	Mr Peter Callander

Sample Type: Aqueous

		Sample Name:	M36/7711 27-May-2022 10:30 am	**Guideline Value**	**Maximum Acceptable Values (MAV)**
		Lab Number:	3000105.1		
Individual Tests					
Total Nitrogen	g/m^3		4.6	-	-
Total Ammoniacal-N	g/m^3		< 0.010	< 1.2	-
Nitrite-N	g/m^3		< 0.002	-	0.06 0.91 (short term)
Nitrate-N + Nitrite-N	g/m^3		4.6	-	-
Total Kjeldahl Nitrogen (TKN)	g/m^3		< 0.10	-	-
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		< 1	-	< 1
Routine Water Profile					
Turbidity	NTU		1.15	< 2.5	-
pH	pH Units		7.8	7.0 - 8.5	-
Total Alkalinity	g/m^3 as $CaCO_3$		43	-	-
Free Carbon Dioxide	g/m^3 at 25°C		1.5	-	-
Total Hardness	g/m^3 as $CaCO_3$		55	< 200	-
Electrical Conductivity (EC)	mS/m		16.1	-	-
Electrical Conductivity (EC)	µS/cm		161	-	-
Approx Total Dissolved Salts	g/m^3		108	< 1000	-
Total Arsenic	g/m^3		< 0.0011	-	0.01
Total Boron	g/m^3		0.021	-	1.4
Total Calcium	g/m^3		16.8	-	-
Total Copper	g/m^3		< 0.00053	< 1	2
Total Iron	g/m^3		0.036	< 0.2	-
Total Lead	g/m^3		< 0.00011	-	0.01
Total Magnesium	g/m^3		3.0	-	-
Total Manganese	g/m^3		0.00107	< 0.04 (Staining) < 0.10 (Taste)	0.4
Total Potassium	g/m^3		0.99	-	-
Total Sodium	g/m^3		9.0	< 200	-
Total Zinc	g/m^3		< 0.0011	< 1.5	-
Chloride	g/m^3		9.8	< 250	-
Nitrate-N	g/m^3		4.8	-	11.3
Sulphate	g/m^3		2.8	< 250	-
Total Coliforms and E.coli					
Total Coliforms	MPN / 100mL		< 1	-	-
Escherichia coli	MPN / 100mL		< 1	-	< 1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Note: The Guideline Values and Maximum Acceptable Values (MAV) are taken from the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2018)', Ministry of Health. Copies of this publication are available from https://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2018

The Maximum Acceptable Values (MAVs) have been defined by the Ministry of Health for parameters of health significance and should not be exceeded. The Guideline Values are the limits for aesthetic determinands that, if exceeded, may render the water unattractive to consumers.

Note that the units g/m^3 are the same as mg/L and ppm.

Routine Water Assessment for Sample No 3000105.1 - M36/7711 27-May-2022 10:30 am

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

The pH of this water is within the NZ Drinking Water Guidelines, the ideal range being 7.0 to 8.0.
With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.

Hardness/Total Dissolved Salts Assessment
The water contains a low amount of dissolved solids and would be regarded as being slightly hard.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The Drinking-water Standards for New Zealand 2005 (Revised 2018) suggests a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was detected in this water but at such a low level to not be of concern.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a low level.
Manganese was found in this water at a low level.
Treatment to remove iron and/or manganese should not be necessary.

Bacteriological Tests
The NZ Drinking Water Standards state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present. Results obtained for Total Coliforms are only significant if the sample has not also been tested for E coli.

Escherichia coli was not detected in this sample.

Final Assessment
All parameters tested for meet the guidelines laid down in the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2018)' published by the Ministry of Health for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter. Performed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1
Turbidity	Analysis using a Hach 2100 Turbidity meter. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2130 B 23rd ed. 2017 (modified).	0.05 NTU	1
pH	pH meter. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D 23rd ed. 2017.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	1
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m^3 is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m^3, the Default Detection Limit for Total Nitrogen will be 0.11 g/m^3. In-house calculation.	0.05 g/m^3	1
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m^3	1
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Nitrate-N	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.05 g/m^3	1
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m^3	1
Sulphate	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	1
Routine Water Profile		-	1
Total Coliforms and E.coli			
Total Coliforms	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 51 wells. Analysed at Hill Laboratories - Microbiology; 101c Waterloo Road, Hornby, Christchurch. APHA 9223 B 23rd ed. 2017.	1 MPN / 100mL	1
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 51 wells. Analysed at Hill Laboratories - Microbiology; 101c Waterloo Road, Hornby, Christchurch. APHA 9223 B 23rd ed. 2017.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 27-May-2022 and 02-Jun-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Martin Cowell - BSc
Client Services Manager - Environmental

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
28 Duke Street Frankton 3204
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

Certificate of Analysis

Client:	Pattle Delamore Partners Limited	**Lab No:**	3007066 DWAPv1
Contact:	Mr Peter Callander	**Date Received:**	03-Jun-2022
	C/- Pattle Delamore Partners Limited	**Date Reported:**	13-Jun-2022
	PO Box 389	**Quote No:**	118028
	Christchurch 8140	**Order No:**	
		Client Reference:	C04096400
		Submitted By:	Mr Peter Callander

Sample Type: Aqueous

		Sample Name:	M36/5785 03-Jun-2022 3:08 pm	Guideline Value	Maximum Acceptable Values (MAV)
		Lab Number:	3007066.1		
Individual Tests					
Total Nitrogen	g/m^3		7.8	-	-
Total Ammoniacal-N	g/m^3		< 0.010	< 1.2	-
Nitrite-N	g/m^3		< 0.002	-	0.06 0.91 (short term)
Nitrate-N + Nitrite-N	g/m^3		7.7	-	-
Total Kjeldahl Nitrogen (TKN)	g/m^3		< 0.10	-	-
Routine Water + E.coli profile Kit					
Escherichia coli	MPN / 100mL		< 1	-	< 1
Routine Water Profile					
Turbidity	NTU		0.84	< 2.5	-
pH	pH Units		7.6	7.0 - 8.5	-
Total Alkalinity	g/m^3 as $CaCO_3$		38	-	-
Free Carbon Dioxide	g/m^3 at 25°C		1.8	-	-
Total Hardness	g/m^3 as $CaCO_3$		57	< 200	-
Electrical Conductivity (EC)	mS/m		18.5	-	-
Electrical Conductivity (EC)	µS/cm		185	-	-
Approx Total Dissolved Salts	g/m^3		124	< 1000	-
Total Arsenic	g/m^3		< 0.0011	-	0.01
Total Boron	g/m^3		0.0181	-	1.4
Total Calcium	g/m^3		14.6	-	-
Total Copper	g/m^3		< 0.00053	< 1	2
Total Iron	g/m^3		0.027	< 0.2	-
Total Lead	g/m^3		< 0.00011	-	0.01
Total Magnesium	g/m^3		4.9	-	-
Total Manganese	g/m^3		< 0.00053	< 0.04 (Staining) < 0.10 (Taste)	0.4
Total Potassium	g/m^3		1.21	-	-
Total Sodium	g/m^3		10.4	< 200	-
Total Zinc	g/m^3		< 0.0011	< 1.5	-
Chloride	g/m^3		11.2	< 250	-
Nitrate-N	g/m^3		7.5	-	11.3
Sulphate	g/m^3		3.2	< 250	-
Total Coliforms and E.coli					
Total Coliforms	MPN / 100mL		9	-	-
Escherichia coli	MPN / 100mL		< 1	-	< 1

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Note: The Guideline Values and Maximum Acceptable Values (MAV) are taken from the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2018)', Ministry of Health. Copies of this publication are available from https://www.health.govt.nz/publication/drinking-water-standards-new-zealand-2005-revised-2018

The Maximum Acceptable Values (MAVs) have been defined by the Ministry of Health for parameters of health significance and should not be exceeded. The Guideline Values are the limits for aesthetic determinands that, if exceeded, may render the water unattractive to consumers.

Note that the units g/m^3 are the same as mg/L and ppm.

Routine Water Assessment for Sample No 3007066.1 - M36/5785 03-Jun-2022 3:08 pm

pH/Alkalinity and Corrosiveness Assessment
The pH of a water sample is a measure of its acidity or basicity. Waters with a low pH can be corrosive and those with a high pH can promote scale formation in pipes and hot water cylinders.
The guideline level for pH in drinking water is 7.0-8.5. Below this range the water will be corrosive and may cause problems with disinfection if such treatment is used.

The alkalinity of a water is a measure of its acid neutralising capacity and is usually related to the concentration of carbonate, bicarbonate and hydroxide. Low alkalinities (25 g/m^3) promote corrosion and high alkalinities can cause problems with scale formation in metal pipes and tanks.

The pH of this water is within the NZ Drinking Water Guidelines, the ideal range being 7.0 to 8.0.
With the pH and alkalinity levels found, it is unlikely this water will be corrosive towards metal piping and fixtures.

Hardness/Total Dissolved Salts Assessment
The water contains a low amount of dissolved solids and would be regarded as being slightly hard.

Nitrate Assessment
Nitrate-nitrogen at elevated levels is considered undesirable in natural waters as this element can cause a health disorder called methaemaglobinaemia. Very young infants (less than six months old) are especially vulnerable. The Drinking-water Standards for New Zealand 2005 (Revised 2018) suggests a maximum permissible level of 11.3 g/m^3 as Nitrate-nitrogen (50 g/m^3 as Nitrate).

Nitrate-nitrogen was detected at a moderate level.

Boron Assessment
Boron may be present in natural waters and if present at high concentrations can be toxic to plants.
Boron was found at a low level in this water but would not give any cause for concern.

Metals Assessment
Iron and manganese are two problem elements that commonly occur in natural waters. These elements may cause unsightly stains and produce a brown/black precipitate. Iron is not toxic but manganese, at concentrations above 0.5 g/m^3, may adversely affect health. At concentrations below this it may cause stains on clothing and sanitary ware.

Iron was found in this water at a low level.
Manganese was not detected in the water.
Treatment to remove iron and/or manganese should not be necessary.

Bacteriological Tests
The NZ Drinking Water Standards state that there should be no Escherichia coli (E coli) in water used for human consumption. The presence of these organisms would indicate that other pathogens of faecal origin may be present. Results obtained for Total Coliforms are only significant if the sample has not also been tested for E coli.

Escherichia coli was not detected in this sample.

Final Assessment
All parameters tested for meet the guidelines laid down in the publication 'Drinking-water Standards for New Zealand 2005 (Revised 2018)' published by the Ministry of Health for water which is suitable for drinking purposes.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter. Performed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch.	-	1
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1
Turbidity	Analysis using a Hach 2100 Turbidity meter. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2130 B 23rd ed. 2017 (modified).	0.05 NTU	1
pH	pH meter. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	1
Free Carbon Dioxide	Calculation: from alkalinity and pH, valid where TDS is not >500 mg/L and alkalinity is almost entirely due to hydroxides, carbonates or bicarbonates. APHA 4500-CO_2 D 23rd ed. 2017.	1.0 g/m^3 at 25°C	1
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. Analysed at Hill Laboratories - Chemistry; 101c Waterloo Road, Christchurch. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	1 µS/cm	1
Approx Total Dissolved Salts	Calculation: from Electrical Conductivity.	2 g/m^3	1
Total Arsenic	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	1
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0053 g/m^3	1
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.053 g/m^3	1
Total Copper	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m^3	1
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1
Total Lead	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00011 g/m^3	1
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1
Total Manganese	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.00053 g/m^3	1
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.053 g/m^3	1
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	1
Chloride	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	1
Total Nitrogen	Calculation: TKN + Nitrate-N + Nitrite-N. Please note: The Default Detection Limit of 0.05 g/m^3 is only attainable when the TKN has been determined using a trace method utilising duplicate analyses. In cases where the Detection Limit for TKN is 0.10 g/m^3, the Default Detection Limit for Total Nitrogen will be 0.11 g/m^3. In-house calculation.	0.05 g/m^3	1
Total Ammoniacal-N	Filtered Sample from Christchurch. Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m^3	1
Nitrite-N	Filtered sample from Christchurch. Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Nitrate-N	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.05 g/m^3	1
Nitrate-N + Nitrite-N	Filtered sample from Christchurch. Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m^3	1
Sulphate	Filtered sample from Christchurch. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	1
Routine Water Profile		-	1
Total Coliforms and E.coli			
Total Coliforms	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. Analysed at Hill Laboratories - Microbiology; 101c Waterloo Road, Hornby, Christchurch. APHA 9223 B 23rd ed. 2017.	1 MPN / 100mL	1
Escherichia coli	MPN count using Colilert 18 (Incubated at 35°C for 18 hours) and 97 wells. Analysed at Hill Laboratories - Microbiology; 101c Waterloo Road, Hornby, Christchurch. APHA 9223 B 23rd ed. 2017.	1 MPN / 100mL	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 04-Jun-2022 and 13-Jun-2022. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.



Kim Harrison MSc
Client Services Manager - Environmental

Proposed Burnham Quarry – Air Quality

Prepared for

Burnham 2020 Limited

August 2023

PATTLE DELAMORE PARTNERS LTD
Level 5, PDP House
235 Broadway, Newmarket, Auckland 1023
PO Box 9528, Auckland 1149, New Zealand

Office +64 9 **523 6900**
Website **http://www.pdp.co.nz**

solutions for your environment

Quality Control Sheet

TITLE	Proposed Burnham Quarry – Air Quality
CLIENT	Burnham 2020 Limited
ISSUE DATE	24 August 2023
JOB REFERENCE	C04096800R001_revised.docx

Revision History

REV	Date	Status/Purpose	Prepared By	Reviewed by	Approved
1.0	8 August 2023	Final report	Jonathan Harland	Jonathan Harland	Andrew Curtis
2.0	24 August 2023	Revised final report	Jonathan Harland	Jonathan Harland	Andrew Curtis

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE

Jonathan Harland

Reviewed and Approved by

SIGNATURE

Andrew Curtis

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Winstone Aggregates and others (not directly contracted by PDP for the work)], including Pro-Manage Consulting Limited. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Winstone Aggregate for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

Table of Contents

SECTION		PAGE
1.0	Introduction	1
2.0	Background Information	1
2.1	Topography	2
2.2	Existing Air Quality	2
2.3	Rainfall	8
2.4	Meteorology	9
2.5	Sensitivity of the Receiving Environment	13
3.0	Assessment Methodology	15
3.1	Comparison with Assessment Criteria	16
4.0	Proposed Activities	17
4.1	Project Overview	17
4.2	Description of the Proposed Quarrying Activities	18
4.3	Emissions to Air	20
5.0	Proposed Mitigation	21
5.1	Overburden Placement	21
5.2	Aggregate Extraction Operations	23
5.3	Aggregate Processing	23
5.4	Stockpiles and Exposed Areas	24
5.5	Truck Loading and Transportation	25
5.6	Silt Management	27
5.7	Dust Monitoring	27
6.0	Assessment of Environmental Effects	30
6.1	Dust Emissions	30
6.2	Assessment of Nuisance Dust Effects	32
6.3	Assessment of Health Dust Effects	35
6.4	Cumulative Effects	37
7.0	Conclusion	37

Table of Figures

Figure 1: Site Location 2

Figure 2: Dust monitoring locations 3

Figure 3: Background 24-hour average PM_{10} concentrations 4

Figure 4: PM_{10} Polar Plot for Eastern Dust Monitor 5

Figure 5: Background 1-hour average PM_{10} concentrations 6

Figure 6: Percentage of dry days by month 9

Figure 7: Windrose from Darfield, Lincoln and Christchurch Airport 10

Figure 8: Wind rose from Site AWS (left) and WRF (right) 11

Figure 9: Predicted windrose for the proposed Burnham Quarry 12

Figure 10: Location of Sensitive Receptors 15

Figure 11: Proposed Quarry 18

Figure 12: Location of Proposed Dust Monitors 29

Figure 13: Difference in Particle Travel with Wind Speed 31

Table of Tables

Table 1: RCS Monitoring Results 7

Table 2: Wind Speed Frequency Distribution for Burnham Quarry 13

Table 3: Location of receptors close to the proposed quarry 14

Table 4: Visual Dust Monitoring Programme 28

Table 5: Frequency of high wind speeds in the direction of nearby receptors 32

Appendices

Appendix A: Draft Dust Management Plan

1.0 Introduction

Burnham 2020 Limited (operated by Winstone Aggregates) (Winstones) is proposing to establish a gravel quarry located approximately 500 metres to the north of the Burnham Military Camp (Burnham Camp). The proposed quarry is to be known as 'Burnham Quarry' and will produce a wide variety of aggregates, including basecourse, concrete aggregates and sealing chip that will be used in civil infrastructure projects in the Canterbury region.

The site is approximately 360 hectares in size, and it is anticipated that approximately 26 to 36 million bank cubic metres (BCM) of gravel will be available to be quarried from the site. The extraction rate will be influenced by the demand for aggregate, but the rate of extraction is expected to be on average 500,000 BCM per year which would give an expected life of the quarry of more than 60 years.

The proposal will require the removal of topsoil and overburden to access the resource, extraction of the resource and transportation of the material to the processing plant, and the processing of material which will involve washing, crushing, screening and stockpiling.

Pattle Delamore Partners Limited (PDP) has been engaged to assess the air quality aspects, and in particular dust effects, of this proposal. PDP has prepared a FIDOL assessment for the proposed Burnham Quarry, which is based on observations and experiences at other similar sites. The findings of this assessment are presented in the following sections of this report and will be used as supporting documentation for the consent applications to the Canterbury Regional Council (ECan) and the Selwyn District Council (SDC).

2.0 Background Information

When selecting the proposed site Winstones has tried to strike a balance between being in close proximity to the market and a location where there are as few as possible receptors that might be sensitive to quarry effects. The proposed Burnham Quarry is within a triangular block of land bounded by Grange Road to the south, Aylesbury Road to the east and pastoral land to the west. The site is currently used for dairy farming and the farming activities will continue to co-exist with the quarrying activities. The surrounding area is also used for farming activities, residential dwellings, lifestyle blocks, horse training facilities and further afield is the Burnham Military Camp. The closest dwelling to the proposed quarrying activities will be 100 metres to the east of the southeastern corner of the site. The site is shown as the white triangle in Figure 1.



Figure 1: Site Location

2.1 Topography

The topography of an area will largely influence wind speed and wind direction, and therefore is an important consideration in the potential for dust to be transported off-site. The proposed site and the surrounding area are relatively flat and therefore there are unlikely to be any localised wind effects based on the topography. The wider Canterbury area is influenced by the Southern Alps which results in prevailing winds from the northeast and southwest.

2.2 Existing Air Quality

PDP is unaware of any publicly available ambient air quality monitoring undertaken in the vicinity of the proposed site, therefore a monitoring programme has been undertaken to better understand the current background particulate concentrations. While the predominant pollutant generated from the proposed site is most likely to be nuisance dust (coarser particulate 30 – 100 micrometres (µm) in diameter) monitoring of finer particulate concentrations (PM_{10}) has been undertaken as this will help identify any potential dust concentrations that might result in health effects. Elevated concentrations of finer particulate can also help to indicate existing nuisance dust effects.

Monitoring commenced on 21 July 2022[1] and has been undertaken using a combination of nephelometers and a near reference Beta Attenuation Monitor (BAM) with the location of these monitors indicated in Figure 2. While neither of these types of monitors are considered reference standards under the National Environmental Standard for Air Quality (NES), the BAM uses the same measurement technique as other instruments that meet the USEPA

[1] The Western Dust Monitor wasn't installed until 16 August 2022

Federal Equivalent Method (FEM) and nephelometers are commonly used throughout New Zealand on projects of this nature. Therefore, PDP considers that these instruments are appropriate to provide indicative information on the existing concentrations of PM_{10} in the local area.



Figure 2: Dust monitoring locations

The daily average PM_{10} concentration measured between 21 July 2022 and 25 May 2023 is presented in Figure 4. Both the Western and Southern dust monitors recorded similar daily average concentration of 3.5 and 3.6 µg/m³ respectively, whereas the Eastern monitor had a higher daily average concentration of 5.8 µg/m³. The Eastern dust monitor recorded a number of days in mid-October where daily average concentrations were elevated and approaching the NES for PM_{10} (50 µg/m³). However, as a whole, the concentrations measured at these dust monitors are comparable to other rural background air quality monitoring sites, such as the Pongakawa Bush Road site[2] in the Bay of Plenty.

[2] Environment Bay of Plenty, NERMN Air Monitoring 2012, Environmental Publication 2012/02

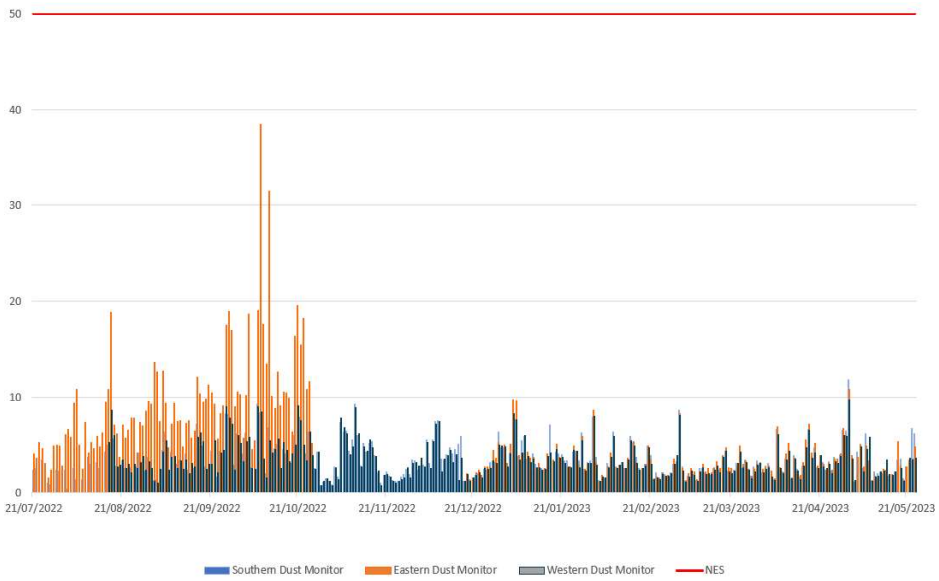


Figure 3: Background 24-hour average PM_{10} concentrations

To help understand the potential sources of dust currently experienced on site Figure 4 presents a polar plot of the data for the Eastern dust monitor. A polar plot shows three variables in one representation, wind speed, wind direction and 1-hour average PM_{10} concentration (µg/m³). A coloured dot is placed over the grid for each possible wind direction and speed. The colour of the dot represents the "maximum" concentration (in µg/m³) of PM_{10} measured at the monitoring site during the wind conditions at the spot i.e. for the plots below, the higher PM_{10} concentrations are indicated by red and the lower concentrations by purple. By presenting the three variables (concentration, windspeed and wind direction) on one figure, it makes it easier to understand the potential source of the dust.

Based on Figure 4, for the Eastern dust monitor, the main source of PM_{10} appears to be to the northwest of the dust monitor and occurs during very strong windspeeds (>10 m/s). While it is not clear what the source of the dust might be, given the rural nature of the surrounding land, it may have been from activities such as field cultivation. Regardless of the source of the dust, given that the higher concentrations coincide with very strong wind speeds the source could be some distance (potentially kilometres) away.

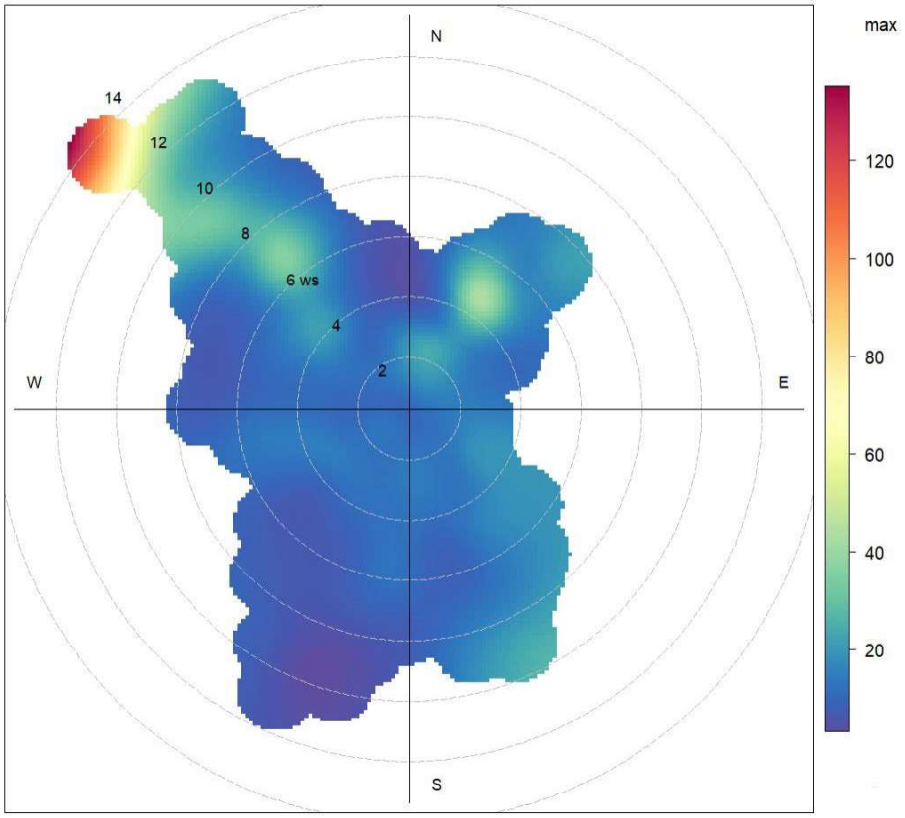


Figure 4: PM_{10} Polar Plot for Eastern Dust Monitor

The 1-hour average PM_{10} recorded at the three dust monitoring locations is presented in Figure 5. While concentrations are typically well below the MfE dust nuisance trigger value of 150 µg/m³, there have been a few occasions when background concentrations at the Eastern dust monitor were elevated and above the guideline value. These coincide with the highest daily averages and are a result of an unknown discrete event.

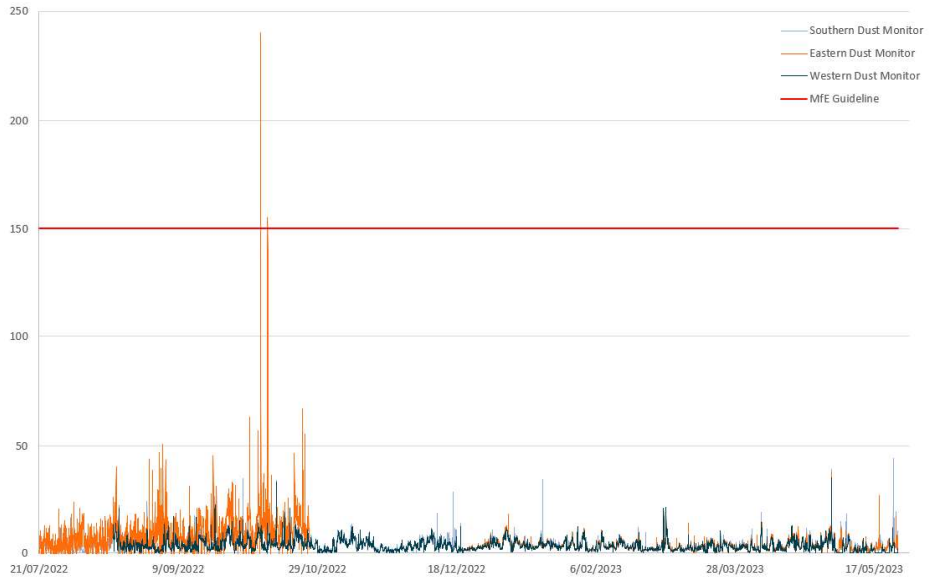


Figure 5: Background 1-hour average PM_{10} concentrations

2.2.1 Respirable Crystalline Silica

In addition to monitoring ambient PM_{10} concentrations, ambient monitoring for respirable crystalline silica (RCS) monitoring has also been undertaken using a Partisol 2000i with a PM_4 cyclone inlet. The RCS monitoring was co-located with the Eastern Dust monitor adjacent to Aylesbury Road. The monitoring was undertaken between 15 July 2022 and 3 January 2023.

PDP considers that the July to January RCS monitoring covers a wide range of surface moisture conditions (wet and dry periods) and doesn't expect the values to vary considerably during other parts of the year (January to June). This is mainly due to RCS concentrations being proportional to PM_{10} and dust concentrations. The monitoring data in Figure 5 suggests there will be no strong seasonal impact in the dust concentrations, with peaks representing individual discrete events, rather than more frequent peaks occurring in a dry season. PM_{10} concentrations on a monthly basis remain fairly constant, even over the typically drier months of January to March.

Each RSC sample was collected over a period of between two to four weeks. This period of sampling is a compromise. It is long enough to ensure that sufficient RSC is captured on the filter to be above the limit of detection and short enough period to identify monthly variations in concentrations. However, the sampling period is not directly comparable to the relevant 24-hour and annual RCS health guidelines. To enable the monitored RCS data comparable to the relevant health guidelines an assumption about the data needs to be made. The comparison of monitored RCS concentrations to health impact guidelines is provided below along the assumptions made. Table 1 presents a summary of the RSC monitoring.

Table 1: RCS Monitoring Results		
Start	**End**	**RCS (µg/m³)**
15/7/2022	11/8/2022	0.14
16/8/2022	15/9/2022	0.19
16/9/2022	13/10/2022	0.29
14/10/2022	28/10/2022	0.40
29/10/2022	12/11/2022	0.44
16/11/2022	30/11/2022	0.26
5/12/2022	19/12/2022	0.34
20/12/2022	3/1/2023	0.32
Average		0.30
Maximum		0.44

The RCS monitoring over this period indicates an average RCS concentration of 0.3 µg/m³ and a maximum concentration of 0.44 µg/m³.

In New Zealand, the Californian[3] (USA) and Victorian[4] (Australia) annual average health guideline of 3 µg/m³ is commonly adopted. As the monitoring was only undertaken over a period of approximately six months and therefore cannot be compared directly to the RCS annual average health guideline. For the reasons noted above PDP assumes that the six months of data collected is representative of concentrations that would be experienced throughout a full year and therefore can be compared to the annual guideline value.

Comparing the six-month average monitored concentration (0.3 µg/m³) to the RCS guideline (3 µg/m³) shows that on average over a year, concentrations are likely to be 10% of the guideline value. Even if the maximum monitored RSC concentration value of 0.44 µg/m³ was assumed to occur every month of the year then this would equate to an annual concentration of 0.44 µg/m³ which is well below (15%) the guideline value of 3 µg/m³.

PDP also reviewed the literature aiming to identify an appropriate short-term health assessment criteria of RCS. This review disclosed a Texas[5] (USA) 24-hour average health assessment criteria of 24 µg/m³. While there is no 24-hour average RCS monitoring data for the site, assumption can be made based on the 24-hour average PM_{10} concentrations. However, this is conservative as RSC is measured as PM_4 and therefore would be a small portion of the monitored PM_{10} concentrations (presented in section 2.2).

[3] (California) Office of Environmental Health Hazard Assessment, (2005). *Adopted Chronic Reference Exposure Levels for Silica (Crystalline Respirable).*
[4] EPA Victoria, (December 2007). *Mining and Extractive Industries.*
[5] Texas Commission on Environmental Quality, (December 2020). *24-hour ReV for Silica, Crystalline Forms.*

The 24-hour average PM_{10} concentrations at each of the monitoring sites are between 3.5 and 5.8 µg/m³. Because RSC is measured as PM_4 and not all PM_4 will be RSC the 24-hour average RCS concentrations must be well below monitored PM_{10} concentrations. Making a highly (even unrealistically) conservative assumption that all PM_{10} is RSC, the maximum RSC concentration (5.8 µg/m³) would be well below (12%) the Texas 24-hour health assessment criteria (24 µg/m³).

This conclusion can be tested by considering RCS the monitoring data. To compare the RCS monitoring data against the Texas 24-hour health assessment criteria, two assumptions must be made:

- ∴ All the RCS was captured in a single continuous 24-hour period during the 2 to 4 week sampling periods; and,
- ∴ All other days during this period had an RSC concentration of zero,

Using these assumptions, the monitored 24-hour average RSC concentrations would range between 4.2 µg/m³ and 7.8 µg/m³ with an average value of 5.3 µg/m³. For example, in the 27 day period between 16 September and 13 October where the average RCS concentration was 0.29 µg/m³, therefore worst case 24 hour average concentration would be 7.8 µg/m³ assuming every other day in the period had zero RCS.

Based on the above, PDP considers that background RCS concentrations will be well below the 24-hour guideline values.

The information presented in this section demonstrates that there will be no adverse short or long term health impacts from the background concentrations of RCS experienced at the site. The cumulative impact of RCS from background concentrations combined with source contributions of RSC is assessed in Section 6.3.

2.3 Rainfall

Rainfall acts as a natural dust suppressant and therefore reduces the potential for dust generation. Therefore, a key consideration in assessing the potential for dust emissions is identifying when the ground surface is likely to be wet or dry, i.e. when the evaporation rate exceeds the rainfall rate or soil moisture levels.

The percentage of dry days by month has been calculated based on the nearby Lincoln monitoring site for the years 2020 to 2022 and is presented in Figure 6. The driest months of the year are generally January and April, therefore greater consideration for and management of dust should be given during these drier months. Over the three-year period, the number of days where evaporation rates exceed rainfall in a 24-hour period (or 'dry days') was 888 days, which corresponds to 81 percent of the time.

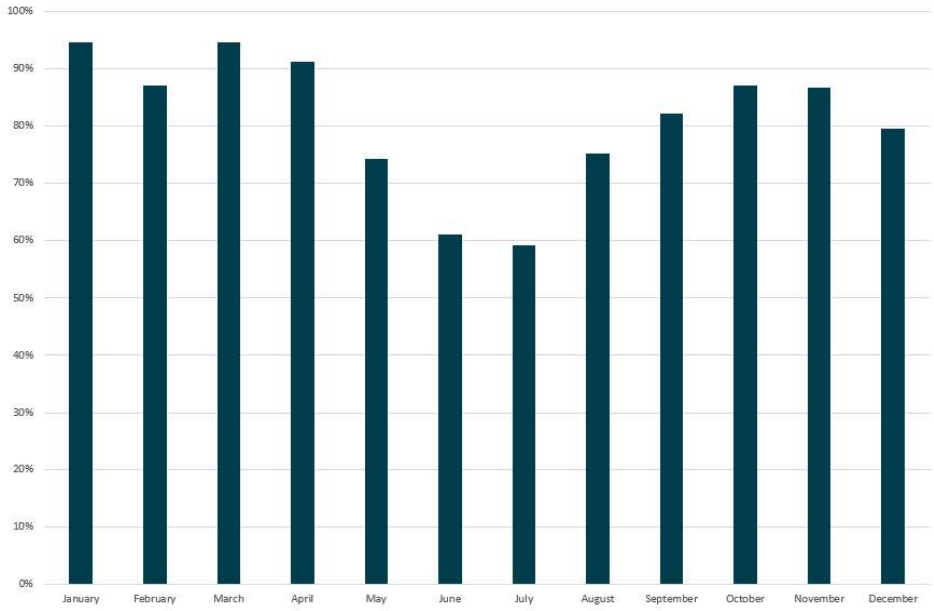


Figure 6: Percentage of dry days by month

2.4 Meteorology

Wind can have a significant effect on dust generation and transportation. The site has its own Automatic Weather Station (AWS), however this has only been in operation since 16 August 2022 and therefore does not cover a full year of meteorological conditions. The nearest publicly available meteorological weather stations relative to the site are at Christchurch Airport approximately 21 km to the northeast, Darfield approximately 15 km to the northwest and at Lincoln approximately 13 km to the east. As shown in Figure 7 there is a distinct difference in the wind patterns for the nearby meteorological sites, and therefore these sites would not represent the likely wind conditions at the proposed Burnham Quarry.

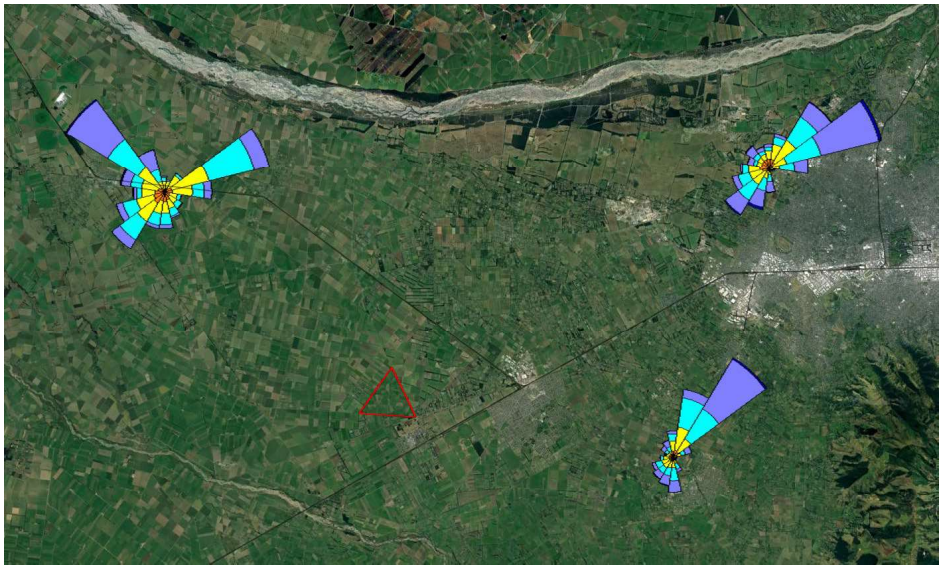


Figure 7: Windrose from Darfield, Lincoln and Christchurch Airport

Given the lack of suitable meteorological data, PDP has used a three-dimensional meteorological dataset developed using the Weather Research and Forecasting model (WRF[6]). The WRF dataset covered the area of the site at 1 km resolution for the years 2019-2020. Figure 8 compares the wind roses for the limited data collected to date at the proposed site and the WRF meteorological dataset for the same months (September to July). As can be seen, both datasets are showing dominant winds from both the northeast and northwest, however the WRF dataset appears to be overpredicting northwesterly winds and overall predicts stronger winds. Given that a significant number of receptors would be downwind of the proposed quarry during northwesterlies and that stronger winds are required to transport nuisance dust, PDP considers using the WRF dataset would most likely add conservatism to this assessment.

[6] https://www.mmm.ucar.edu/weather-research-and-forecasting-model

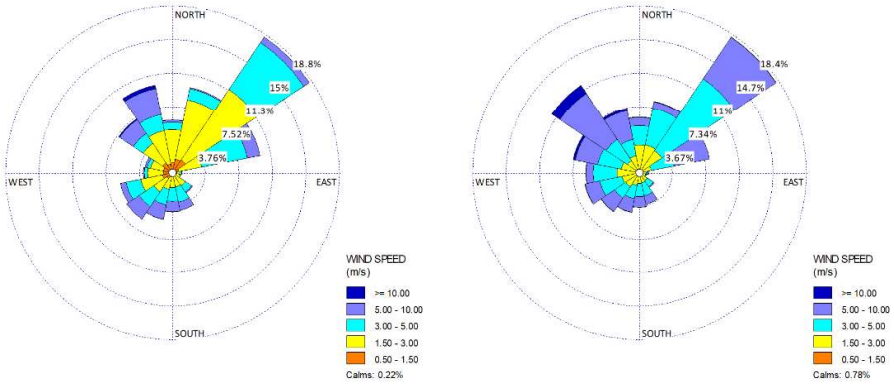


Figure 8: Wind rose from Site AWS (left) and WRF (right)

Figure 9 presents a wind rose for the site that was extracted for the entire WRF meteorological dataset period. The wind rose depicts wind speed and direction and the frequency at which they occur. From Figure 9 it is evident that the dominant wind directions are from the northeast and the northwest. Table 2 presents the predicted distribution frequency of wind speed. The predominant higher speed winds (greater than 5 metres per second (m/s)) originate from the northwest. Based on PDP's experience, it is these stronger wind conditions that have the greatest potential to cause off-site dust nuisance effects.

When wind speeds at the ground level reach 5 m/s they have the highest potential to transport dust off-site. In the case of the site and as discussed later, winds from the north northwest to the south have the potential to transport dust to the closest receptors along the southern boundary and southeast corner of the site, and these winds have speeds in excess of 5 m/s between 0 and 5.2 percent of the time. These predicted wind speeds are based on winds at 10 metres high and therefore will overpredict strong winds at ground level.

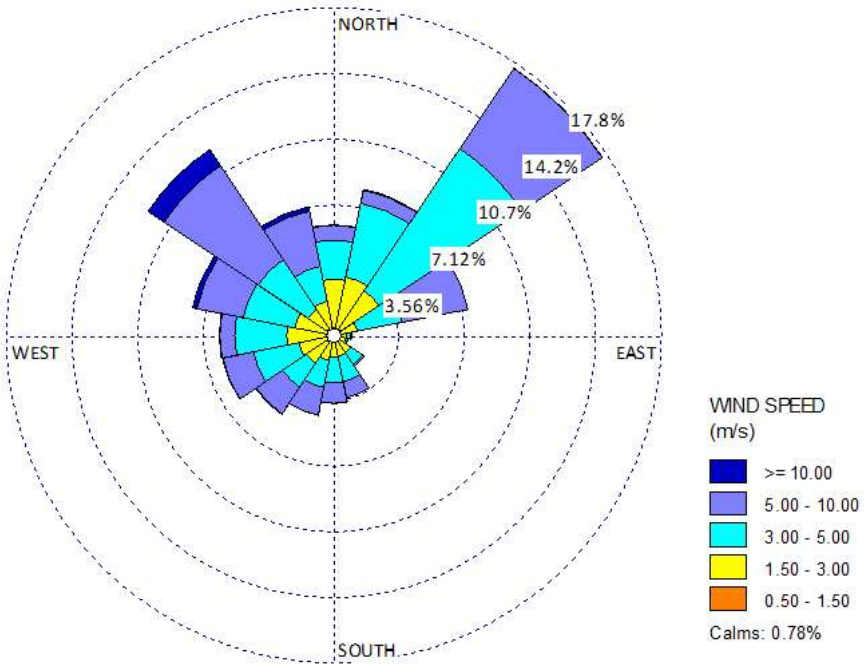


Figure 9: Predicted windrose for the proposed Burnham Quarry

Table 2: Wind Speed Frequency Distribution for Burnham Quarry

Direction	Wind Speed (m/s)		Total (%)
	0-5	>5	
North	5.2	0.8	6.0
North Northeast	7.4	0.8	8.1
Northeast	12.2	5.2	17.5
East Northeast	3.8	3.6	7.4
East	1.0	0.0	1.0
East Southeast	0.8	0.0	0.8
Southeast	1.9	0.1	2.0
South Southeast	2.6	0.9	3.5
South	2.6	1.1	3.7
South Southwest	2.9	1.5	4.4
Southwest	3.4	1.8	5.2
West Southwest	4.5	1.7	6.2
West	5.4	0.8	6.2
West Northwest	5.1	2.8	7.8
Northwest	5.0	7.1	12.1
North Northwest	3.9	3.3	7.1
Calms			0.8

2.5 Sensitivity of the Receiving Environment

A site investigation has been undertaken to identify discrete receptors considered sensitive to changes in air quality as a result of potential discharges to air from the proposed quarry.

In the context of this assessment, the term 'sensitive receptors' is defined as a location where people or surroundings may be particularly sensitive to the effects of air pollution. This type of receptor includes:

- Residential properties;
- Hospitals;
- Schools;

- Libraries; and
- Public outdoor locations (e.g. parks, reserves, beaches, sport fields).

The nearest sensitive receptors are summarised in Table 3 and Figure 10 shows these graphically. PDP has not included all of the dwellings as discrete receptors for practical purposes but has instead selected a number of locations that are representative of them. The representative locations were chosen based on wind direction, i.e. they would be representative of other dwellings along the same wind direction, and also the distance from the proposed quarry as it would be more likely to be impacted by dust when compared to another dwelling that is further way.

The closest dwelling relative to the site is approximately 25 metres to the east northeast of the site boundary, however as already discussed, Winstones will not undertake gravel extraction within 100 metres of a dwelling. Other than residential dwellings, the only other locations that might be sensitive to air quality impacts in the vicinity of the proposed quarry are Coronation Park and the Golf Club which are 250 metres and 700 metres respectively to the southwest.

Table 3: Location of receptors close to the proposed quarry

Receptor Name	Address	Closest Distance to Quarry Activity (m)	Direction Relative to the Quarry
R1	168 Aylesbury Road	100	East northeast
R2	159 Grange Road	150	South
R3	273 Grange Road	350	South
R4	176 Kivers Road	330	Northwest
R5	716 Wards Road	1,100	North northwest
R6	716 Wards Road	1,450	East northeast

Notes: Distance is measured from the closest proposed quarrying activity.



Figure 10: Location of Sensitive Receptors

3.0 Assessment Methodology

This assessment has been undertaken in accordance with the Ministry for the Environment (MfE) guidance for assessing and managing the environmental effects of dust emissions[7] (MfE GPG Dust).

It is common practise in New Zealand to undertake a qualitative assessment of the potential effects associated with large earth moving projects and the bulk handling of materials. This assessment has involved a review of the proposed activities that will be undertaken, and then determining the likely potential for these activities to cause nuisance dust which could affect the surrounding environment. In determining whether there is the potential for nuisance to occur, the following considerations have been made:

- The nature of the activity undertaken;
- How long the activities are likely to occur;
- The nature of the material being handled, placed and stored;
- Whether mitigation measures can be implemented to control the potential for effects (e.g. covering or storage of materials, use of water suppression, etc.);

[7] MfE Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, November 2016

- How close the local community is to the activities;
- The nature of the receptors in these communities and their sensitivity to dust; and,
- The prevailing meteorological conditions.

3.1 Comparison with Assessment Criteria

The assessment criteria used in the Canterbury Air Regional Plan (CARP) is based on the FIDOL assessment tool when determining whether or not a dust discharge has caused an objectionable or offensive effect.

PDP has undertaken a qualitative assessment to predict the effects from the proposed quarrying operations using the FIDOL assessment tool (Frequency, Intensity, Duration, Offensiveness and Location).

The FIDOL factors are explained in detail below:

- Frequency: relates to how often an individual is exposed to dust. Factors determining this include the frequency that the source releases dust (including its source type, characteristics and the rate of emission of the compound or compounds); prevailing meteorological conditions; and topography.
- Intensity: is the concentration of dust at the receptor location.
- Duration: is the amount of time that a receptor is exposed to dust. Combined with frequency, this indicates the exposure to dust. The duration of dust emissions, like its frequency, is related to the source type and discharge characteristics, meteorology and location. The longer the dust detection persists in an individual location, the greater the level of complaints that may be expected.
- Offensiveness: is a subjective rating of the unpleasantness of the effects of nuisance dust. Offensiveness is related to the sensitivity of the 'receptors' to the dust emission i.e., industrial premise may be more tolerant to dust concentrations than residential properties. Offensiveness can also be related to the colour of the dust, with natural tones being more acceptable than more distinct colours such as black from coal dust or yellow from sulphur.
- Location: is the type of land use and the nature of human activities in the vicinity of a dust source. The same process in a different location may produce more or less dust depending on local topography and meteorological conditions. It is also important to note that in some locations certain higher dust concentrations may be more acceptable than in others.

4.0 Proposed Activities

4.1 Project Overview

The proposed site is approximately 360 hectares in size and is currently a dairy farm and it is intended that farming activities will co-exist with the quarrying activities. Given that the site will also be used as a working farm, it is important to Winstones that the smallest possible area is used for quarrying activities and once an area has been quarried then it is rehabilitated to a standard which allows farming to be reestablished.

Winstones proposes to utilise as much of the site as possible, with extraction being undertaken up to 17.5 metres from the site boundary, except where there is permanent bunding and the setback will be 24.5 metres. Where there are dwellings close to the site boundary, the setback in these locations will be extended to provide for at 100 metres of separation between the dwelling and the extraction area. Therefore, based on this proposed footprint and an average quarry depth of 10 metres (depending on ground water level), it is anticipated that approximately 26 to 36 million BCM of gravel will be available to be quarried from the site. The extraction rate will be influenced by the demand for aggregate, but the rate of extraction is expected to be 500,000 BCM per year which would give an expected life of the quarry of more than 60 years.

The location of the site along with the proposed setbacks, processing and stockpiling areas, site access and each phase[8] of extraction is shown in Figure 11. Once the enabling works have been undertaken to establish the production and stockpile areas, along with the site facilities, extraction will move towards the southeast corner of the site and then move in a clockwise direction around the site. A more detailed staging plan showing the stages is provided in the Assessment of Environmental Effects.

[8] Each phase represents is approximately 5 years of production.

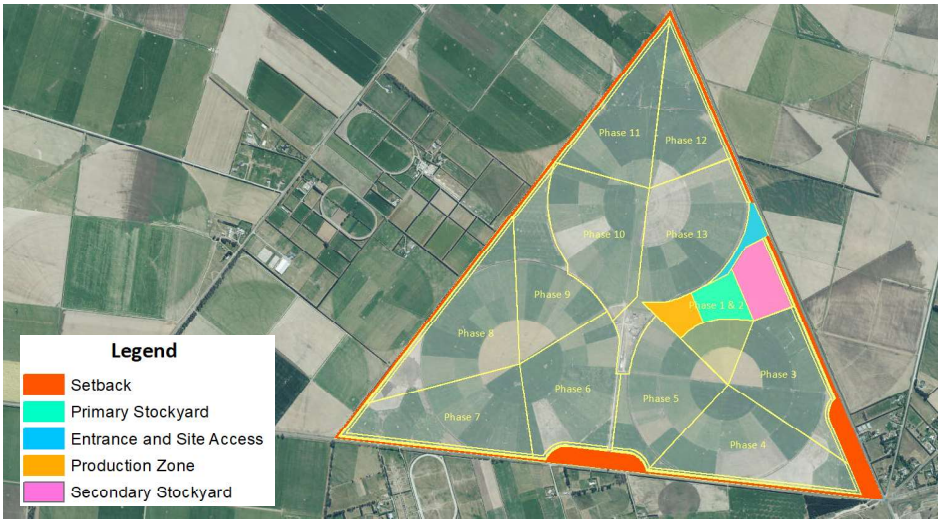


Figure 11: Proposed Quarry

4.2 Description of the Proposed Quarrying Activities

4.2.1 Site Establishment and Enabling Works

During the site establishment and enabling works the topsoil and overburden will be removed for the establishment of the quarry entrance, site office, amenities, parking and weigh bridge, production zone and stockyards. Material from these areas will be used to form the permanent bunding which will be in place for the life of the quarry. This bunding will be approximately three metres high and will run southward to the start of the 100 metre setback area in the southeast corner. In addition, 3 metre high topsoil stockpiles will be placed within the setback of each stage prior to the start of works in that area. These stockpiles will be removed as the stage is completed with the topsoil being used for rehabilitation.

4.2.2 Creation of Pit

The first extraction of material will create the production zone and stockpiling areas. Extraction will use the top-down method utilising excavators, wheel loaders and trucks. Material from this extraction will either be processed immediately using mobile processing equipment or stockpiled on top of future extraction areas.

4.2.3 Entrance and Site Access

The entrance and exit of the site will be located on Aylesbury Road. The entrance to the site will include offices, meeting rooms, amenities, light vehicle parking and the weigh bridge. From the entrance platform there will be a ramp leading down to the quarry floor which will include a wheel wash and a flood wash. The site entrance and the ramp down to the quarry floor will be sealed.

In terms of heavy vehicle movement, it is expected that the site will generate a maximum of 750 truck movements per day and up to 112 truck movements per hour. However, these maximum truck numbers are only expected during the latter stages of the quarry.

4.2.4 Production Zone

The production zone will house the processing plant which will include fixed plant as well as mobile plant as required. It is expected that there could be up to eight crushers operating in this area, with the material either being processed wet or dry.

Some stockpiling and loadout might occur in the production zone, but this will be generally limited to material that has a higher risk for dust emissions.

4.2.5 Primary and Secondary Stockyards

The primary stockyard is intended to contain those products which have a higher risk of dust emissions. Whereas the secondary stockyard is intended to contain products with a lower risk of dust emissions, bulk volume base coarse products, or slow-moving products with a low risk of dust emissions. Stockpiling bulk volume products in the secondary stockyard which is closer to the site access reduces the potential for wheel-based dust generation.

4.2.6 Extraction Zone

To access the resource below, overburden will be removed during a stripping campaign which will typically avoid the height of summer and the middle of winter. The amount of overburden material removed will be determined by the volume of aggregate required between stripping campaigns. Overburden from these stripping campaigns will be used to immediately rehabilitate areas where extraction is complete or be stored in temporary perimeter stockpiles before being used in the rehabilitation of the quarry.

Extraction of the resource will be undertaken using an excavator or front-end loaders by removing material from the toe of the quarry face. The extraction will advance from the inside to the outside of the site, meaning there is always a quarry face between the works and receptors.

Once the aggregate resource has been extracted it is Winstones intention to transport the majority of material to the production zone via conveyors however for conservatism this assessment is based on trucks moving this material. If used, conveyors will minimise dust generation and combustion emissions, especially when compared to typical load and cart operations with dump trucks and haul roads.

A temporary access road will be required to maintain the overland conveyors and provide access to the extraction and rehabilitation zone.

4.2.7 Silt Management

The approach to silt management will be finalised upon confirming the plant configuration. However, the following silt management methodology is envisaged:

- Silt will receive primary treatment in the production zone, most likely in the form of mechanical settling which will allow clarified water to be returned to the plant wash cycle. This clarified water is expected to make up a significant percentage of the overall water utilized by the production system. The residual silt slurry will be pumped to the silt management zone.
- The residual silt slurry will be retained within the silt management zone in ponds either holding it in a buffer capacity before pumping it on to rehabilitation or, reducing the moisture content so the silt can be stockpiled for future use in site rehabilitation.

4.3 Emissions to Air

The potential for air quality effects associated with the quarrying activities at the proposed Burnham Quarry relates almost exclusively to the potential for there to be dust emissions. While there is the potential for a number of vehicles operating on the site, the combustion emissions from the vehicles are considered to be insignificant and they are unlikely to result in any noticeable changes in air quality. Given that Winstones is investigating using conveyors and extracting equipment powered by electricity in the future and that the processing plant will be powered by electricity any combustion emissions from the site will be minimal.

Particulate matter in the environment generally falls into two categories: suspended and deposited particulate.

Suspended particulate matter is dust or aerosol which stays suspended in the atmosphere for significant periods of time. Its exact definition is dependent on the monitoring procedure adopted. The term Total Suspended Particulate (TSP) is commonly used to describe the total amount of suspended particulate in the atmosphere at any one time.

Deposited particulate matter is dust or aerosol which because of its aerodynamic diameter and density, falls from the air. In general terms, deposited particulate has a diameter of greater than about 30 µm. It is generally associated with nuisance effects such as soiling.

Suspended and deposited particulate arise from many natural and man-made sources. The most important sources globally are volcanoes and wind-blown dust, whilst on a local level, farms and fields, stationary and mobile combustion sources, road dust, wind-blown soil, pollen, and emissions from industrial processes are contributors.

The proposed quarry has the potential to generate dust from a number of potential operations. These include:

- Initial enabling works, including the construction of the haul roads and work platforms, removal of overburden, construction of erosion and sediment controls, and the formation of bunds.
- Extraction of aggregate.
- Operation of vehicles on the haul roads.
- Wind erosion of working areas.
- Rehabilitation of the completed areas.

A subfraction of the dust generated by quarry activities will fall into the category of PM_{10} which is regulated by a National Environmental Standard for Air Quality. PDP's experience at other sites is that PM_{10} from quarry activities is generally not measurable above background levels within a few hundred metres of the crusher. The Yaldhurst monitoring study which is discussed further in Section 6.3 also showed similar reductions in PM_{10} concentrations with distance.

Respirable crystalline silica (RCS) can also be present in the dust generated by quarry operations, and it is noted that any mitigation measures that control dust will also control RCS emissions. The activities which will generate dust and their mitigation measures are outlined in the following sub-sections.

5.0 Proposed Mitigation

This section of the report presents the mitigation measures that are used to control the effects of discharges to air during the proposed quarrying activities.

5.1 Overburden Placement

5.1.1 Process

The removal and placement of overburden occurs progressively as the quarrying activity progresses around the site, however these activities will only occur during earthmoving seasons (typically October to April). The overburden is stripped from the desirable material using excavators, with overburden loaded directly into trucks and transported to the site boundary and formed into bunds or immediately used to rehabilitate already quarried areas. As with overburden removal, as the active quarrying area progresses, the overburden bunds will be pushed back into the quarry pit for rehabilitation.

5.1.2 Potential Emission Sources

As overburden generally consists of soils, clays and weathered rock there is the potential for dust generation from this material. Dust emissions can occur from several sources which are:

- wind driven dust off exposed surfaces during overburden removal and the formation of bunds and topsoil stockpiles;
- dust being disturbed on haul roads between and within the excavation point and the bund construction areas;
- dust emissions from loading of trucks for transporting off-site; and,
- dust being disturbed as the bulldozer repositions overburden material in the creation of the bund to the desired contour.

5.1.3 Mitigation Measures

During overburden removal and placement the following mitigation measures will be implemented to mitigate the potential dust effects:

- watering the surface prior to disturbing it during dry weather conditions, if required;
- minimising the amount of vegetation, overburden and soil removal to a practicable level;
- controlling vehicle speeds to 20 km/h on unconsolidated surfaces;
- dampening of haul roads; and,
- mulching, grassing and / or planting of bare areas and bunds shall be undertaken as soon as reasonably practicable.

When it is impossible to avoid overburden disposal during particularly dry weather, watercarts or fixed sprinklers will be used to ensure that adequate dust suppression occurs to avoid generating off-site dust effects.

Water will be the primary mitigation tool that Winstones will implement to control dust. The use of water prevents (or suppresses) fine particulate from leaving the surface and becoming airborne through the action of mechanical disturbance or wind. In effect, the water acts to bind the small particles to the larger material, thus reducing the emission potential.

5.2 Aggregate Extraction Operations

5.2.1 Aggregate Extraction and Truck Loading

Once the desired quarried material is exposed, the material will be extracted and transported to the processing plant. While it is expected that extraction of the aggregate resource will start with standard quarrying machinery such as excavators and front-end loaders, Winstones is exploring options to utilise bucket wheel excavators in the future. For the purposes of a conservative assessment, PDP has assumed that the extracted material will be loaded into dump trucks and carted to the processing plant, although as mentioned earlier Winstone is investigating using conveyors to transport quarried material.

5.2.2 Potential Emission Sources

There are two primary sources of airborne emissions from this activity:

- Dust emissions from the excavation; and,
- Dust emissions from the placement of aggregate into the truck.

5.2.2.1 Mitigation Measures

For the majority of the time the rock extraction and truck loading will take place below ground level which will greatly reduce dust emissions. In addition, or when extraction and works are undertaken around or at current ground level such as enabling works, there are three possible techniques that are commonly to control dust from excavation and truck loading activities. These include wetting the material on the ground prior to the commencement of loading, the use of a fine water spray whilst loading is occurring, and / or the use of windbreaks to reduce wind velocities in the vicinity of the quarry.

5.3 Aggregate Processing

While the exact processing equipment is currently unknown, there will be potentially three stages of processing, these are: crushing (primary, secondary, tertiary and potentially quaternary), screening, and washing. The quarry will use a combination of fixed and mobile processing plant, with all processing undertaken in the production zone situated in the centre of the site. The fixed plant will be used to process the majority of the material, however mobile processing may be required to supplement the fixed plant production capacity in meeting peak demand. Mobile processing will also be used in the early establishment of the production and stockyard areas.

Described below are the potential emission sources from these activities.

5.3.1 Potential Emission Sources

The processing plants will be used for the manufacture of a wide range of materials for use in the roading, construction, concrete and asphalt industries. The material will most likely be fed into a jaw crusher and the crushed material will be passed over scalping screens. From the scalping screens the material will be further processed and depending on the end product, further crushing using jaws, cones or barmac crushers might be required. Material from the crushers will be either dry or wet screened and the final material will be stockpiled.

5.3.2 Mitigation Measures

The majority of the aggregates at Burnham Quarry will be processed wet, which will result in little potential for dust emissions from the processing plant. Additionally, Winstone is proposing to undertake the following mitigation:

- All dry screens will have either fixed line fogging installed or will be enclosed.
- All crushers will have fixed line fogging installed around the infeed and outfeed, with additional fogging on the first few metres on the discharge conveyor.
- All transfer points for unwashed or dry material will have fixed line foggers installed.
- Conveyors transferring unwashed dry products less than 5 mm will be covered.
- Fogging canons will be available to control residual emissions as required.
- Also, Winstones is proposing to locate the processing plant near the centre of the site (over 1,000 metres from the closest dwelling) and approximately 10 metres below existing ground level.

5.4 Stockpiles and Exposed Areas

5.4.1 Potential Emission Sources

Winstones intends to operate two stockpile areas. The primary stockpile area will be directly to the east of the processing plant, and this area will be used to store products that have a higher risk for dust generation (finer materials), whereas the secondary stockpile area will be further to the east and will be used to store lower risk material (coarser and/or washed materials).

The sources of dust from wind erosion are from exposed soil around the quarry, together with dust from the stockpiles and overburden piles generated during normal operation of the quarry.

5.4.2 Mitigation Measures

The following mitigation measures will be the main techniques to control dust emissions from stockpiles and exposed areas.

5.4.2.1 Height of Stockpiles and Bunds

Windspeed increases with height above ground and therefore minimising the height of stockpiles and bunds will reduce the potential for dust generation from these sources. Where practical Winstones will keep aggregate stockpiles to a maximum height of 5 metres above the existing ground-level and bunds to a maximum height of 3 metres.

5.4.2.2 Minimise Exposed Area

Dust emissions due to wind erosion are directly proportional to the surface area exposed. Accordingly, the most appropriate means of controlling wind erosion is to minimise, at all times, the area from which dust particles can be eroded.

5.4.2.3 Vegetate the Surface

This is generally the most effective means of control and usually the most economical way to control wind erosion. However, ground cover can take some time to establish, particularly if required during a slow growing period. Therefore, other measures, such as chemical stabilisation, are often required while vegetation is becoming established.

5.4.2.4 Irrigation with Water

The periodic irrigation of exposed land by water carts can control dust emission through the addition of moisture, which in turn consolidates the surface particles and creates a crust on the soil surface when drying occurs. The amount of water and frequency of irrigation to maintain a desired level of dust control will be a function of the season and of the crusting ability of the soil.

5.5 Truck Loading and Transportation

5.5.1 Potential Emission Sources

The load out of trucks and the transport of material around the site without mitigation measures has the potential to generate dust emissions. It is virtually impossible to prevent dust occurring from road sources, but it is possible to ensure that as far as practicable dust emissions from this source are minimised.

5.5.2 Mitigation Measures

During truck load out the most practical dust mitigation is to limit the drop height of the material. Additional measures can be adopted such as during truck load out applying water if the material is particularly dry and installing wind break screens if load-out activities are undertaken in exposed areas.

In terms of transportation, while Winstones is exploring the use of conveyors as much as practicable to transfer material from the processing area to the stockpile areas there will be times when trucks are required to move material between the two areas. The main transport related mitigation methods that will be used at the Burnham Quarry are roadway watering, speed reduction and road surface management.

5.5.2.1 Watering

In general, the use of water on unpaved roads is the most economic and effective means of controlling dust emissions. Water will be applied by a water cart, through a series of spray nozzles attached to a water storage unit which are mounted to the body of a vehicle, which enables even distribution of water to the road surface. In more permanent unsealed sections of road that are regularly used, Winstones will consider using fixed sprinklers to apply water.

Winstones will use water as the principal means of dust suppression on roads as there is sufficient water supply from the groundwater bores on-site.

5.5.2.2 Speed Reduction

In general terms, the emission of dust from road traffic is proportional to vehicle speed. Hence, any reduction in vehicle speed will also mean a reduction in dust emission. To some extent, the recommended speed of vehicles is dictated by the load they are carrying. However, the most important factor is the dryness of the road surface, such that adequate watering can reduce the need for tight speed restrictions.

At the proposed Burnham Quarry a speed restriction of 30 km/h will be enforced on all internal roads to reduce the potential for dust emissions and for safety reasons.

5.5.2.3 Haul Road Maintenance

After aggregate has been spread on an unsealed road surface, the movement of vehicles over time breaks it down into smaller pieces. At some stage, those small pieces will reach a size where they can become easily airborne. Winstones can avoid this matter occurring by ensuring that the road metal is replaced prior to this becoming a potential dust source on internal roads.

5.5.2.4 Sealed Entrance Road and Wheel Wash

Sealed road surfaces are generally installed in high risks areas as the potential for dust generation from this source is much lower than unsealed roads. However, dust can still become a problem on sealed surfaces when dust is deposited usually from vehicles tracking dust from unsealed areas. As with unsealed roads, applying water will control dust from these surfaces, however other measures such as sweeping are often undertaken. Additionally, the site will also use a wheel wash and a flood wash to remove dirt from trucks leaving the site. This will minimise the risk of dust tracking at the site entrance and onto public roads.

5.6 Silt Management

Based on the potential methodology discussed in Section 4.2.7, the following dust management is proposed:

- If silt ponds remain slurried or have a top surface with a high moisture content such that fugitive dust does not arise, then no specific dust controls are required on the ponds themselves.
- If the top surface of ponds dries out completely, it is expected to form a protective 'crust', which provided it is not subject to vehicle tracking, is unlikely to produce fugitive dust emissions. Given that flocculants are expected to be used in the primary silt treatment process, these will aid the development of a surface crust. If the protective crust does produce emissions, then controls will be put in place – wetting the surface or applying polymer or other approved suppressants will be used.
- Silt stockpiles will be treated with a polymer or other approved suppressant or vegetated.

5.7 Dust Monitoring

5.7.1 General Monitoring

There are a range of simple monitoring activities that can be regularly used to ensure that dust is being appropriately controlled at Burnham Quarry. These monitoring measures are regularly used at most quarry sites and are incorporated into the draft dust management plan (Appendix A). Table 4 sets out these measures.

Table 4: Visual Dust Monitoring Programme	
Monitoring Activity	**Frequency**
Check weather forecasts for strong winds and rainfall to plan appropriate work schedule and dust management response.	Daily
Inspect land adjacent to the site where possible, site exits and adjoining roads for the presence of dust deposition.	Twice daily
Observe weather conditions including wind and rain via observations and data outputs from weather stations.	Daily and as conditions change
Inspect all exposed surfaces for dampness and to ensure that the exposed un-stabilised area is minimised.	Daily and as conditions change
Inspect any stockpiles to ensure that they are not subject to wind erosions. Minimise as far as practical the height of stockpiles containing unprocessed or unwashed material.	Daily and as conditions change
Inspect dust generating activities to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced
Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas	Weekly

5.7.2 Dust Monitoring

Winstones is looking to continue undertaking continuous dust monitoring with telemetry at three locations around the Burnham Quarry. These will be on each boundary of the site and at a location nearest to receptors close to the extraction area. Figure 12 provides indicative locations for the monitors during the first stage of work. Given that the monitors will be able to measure PM_{10} concentrations and send data in 'real time', PDP recommends that dust is controlled using the following triggers and these triggers have been incorporated into the draft dust management plan.

Trigger Level 1 - (120 µg/m³ as a 1-hour average) - To identify that dust concentrations have reached a point where dust nuisance is likely to occur if action is not taken to implement mitigation measures. It would not be expected that dust concentrations would reach this level unless there are adverse weather conditions in conjunction with a failure of mitigation.

Trigger Level 2 – (150 µg/m³ as a 1-hour average) - If this trigger is exceeded it indicates that dust concentrations have reached a level which is unacceptable, and dust nuisance will occur. All activities that have the potential to generate dust on site, apart from dust mitigation, must cease until such time as dust concentrations drop below Trigger Level 1.

If an investigation identifies that site activities are not responsible for the high dust concentrations, site activities may resume prior to concentrations dropping to below Trigger Level 1.



Figure 12: Location of Proposed Dust Monitors

5.7.3 Wind Monitoring

As part of the monitoring programme, real-time meteorological data will be provided to the quarry staff, which will be used to alert staff of potential dust generating winds. PDP recommends that alerts are sent out when wind speeds exceed 5 m/s and 10 m/s (during two consecutive 10-minute periods) so quarry staff can review that the appropriate dust management and mitigation measures are in place.

As far as is practicable the monitor will be located in accordance with AS 3580.14 - 2011 Ambient Air – Guide for the Measurement of Horizontal Wind for Air Quality Applications.

6.0 Assessment of Environmental Effects

This section provides an assessment of the potential emissions resulting from the proposed activities set out in Section 4 with the mitigation measures described in Section 5.

6.1 Dust Emissions

The most significant potential effect from the mining activities is nuisance associated with dust deposition. The activities that could cause this are discussed in Section 4.3.

There are number of factors that are important to consider when determining whether any dust nuisance is caused by the disturbance and placement of materials. These include; size and density of the particles, wind speed and direction, height of release and the distance between the discharge point and the receptors.

These factors are all interconnected, and it is how they combine that determines the potential for an effect to occur.

However, typically the following applies:

- Heavier and larger particles require higher wind speeds to become airborne;
- Large particles will deposit faster than small particles of a similar density;
- More dense particles will deposit more rapidly than less dense particles of a similar size; and,
- Particles will travel further before depositing with a strong wind blowing than with a light wind blowing.

Despite this range of variables, the Institute of Air Quality Management (IAQM) Guidance on the Assessment of Mineral Dust Impacts for Planning[9] states that dust nuisance effects are generally only experienced within 400 metres of operations and that impacts from gravel extraction (which encompasses the proposed Burnham Quarry are uncommon beyond 250 metres. PDP considers that these distances are based on unmitigated sources and as Winstones will apply the various forms of mitigation described in Section 5.0 to reduce and control the potential for dust emissions the distance in which effects could occur will reduce significantly. Based on the types of activities that will be undertaken and guidance provided in US EPA technical documents[10], with mitigation in place it is likely that effects will only occur within 50 metres of sources that are located at ground level.

[9] IAQM (2016) Guidance on the Assessment of Mineral Dust Impacts for Planning. Institute of Air Quality Management, London.
[10] AP 42, Fifth Edition, Volume I Chapter 13 Miscellaneous Sources, Section 13.2.4 – Aggregate Handling and Storage Piles

Nuisance dust is typically between 30 and 100 µm in diameter. In practice, the large particles (i.e. greater than 30 µm) do not stay suspended in the atmosphere, as they tend to fall out rapidly and settle. The Ministry for the Environment (MfE) Good Practice Guide for Assessing and Managing Dust (GPG AMD) describes that in a 5 m/s wind, 100 µm particles would only be blown about 10 metres away from a source. Figure 13 depicts the distance potentially travelled by nuisance dust for a range of wind speeds based on a particle diameter of 50 µm (typical size of a visible particle). This is a reasonable assumption based on PDP's experience with dust nuisance. The release height in the figure is also typical of the height that dust is released from for a range of quarrying activities i.e. material being loaded into a truck. However, these distances are based on flat terrain and do not account for changes in terrain elevation. For the most part the surrounding receptors and the proposed quarry are on the same plain, but as work commences and the pit forms the distance that dust could travel based on a 3 metre drop height will be more conservative.

Based on the above discussion, 400 metres has been used in this assessment to conservatively indicate the distance within which some level of dust effects could be experienced if no form of mitigation were to be applied. Based on this guidance properties located further than 400 metres from the site are unlikely to be affected by dust during any wind speed conditions. Properties to the north (receptors R5 and R6) are greater than 400 metres away from the site therefore effects to these receptors are expected to be minimal with respect to dust nuisance. Therefore, these sites have not been considered any further in this assessment.

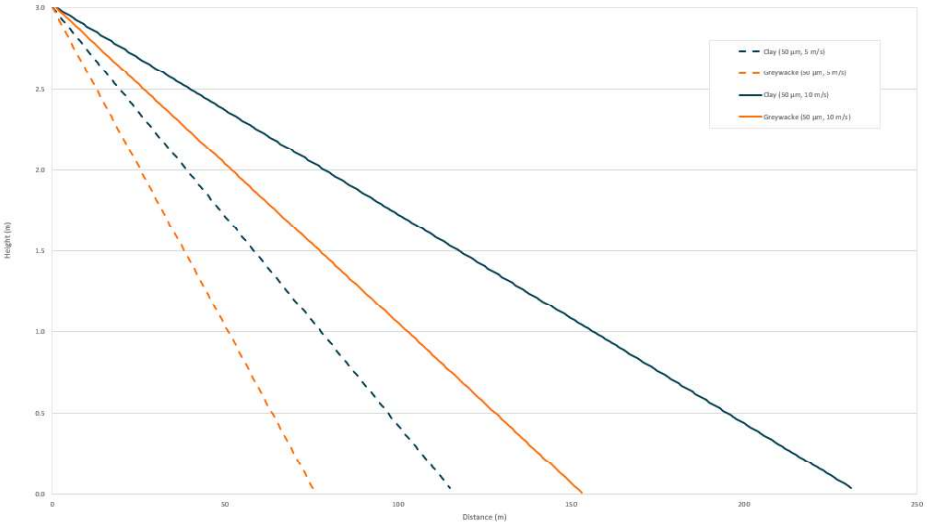


Figure 13: Difference in Particle Travel with Wind Speed

6.2 Assessment of Nuisance Dust Effects

6.2.1 Frequency

The frequency of dust discharges is influenced by the regular occurrence of suitable meteorological conditions to carry dust beyond the boundary to a sensitive receptor. Typically, nuisance dust would need winds greater than 5 m/s to travel beyond the site boundary. Given the information provided in Table 2, the predicted frequency of wind greater than 5 m/s occurs 31.6 percent of the time from all directions. Table 5 presents the frequency of high wind speeds in the direction of the nearby receptors which indicates that high wind speeds in the direction of receptors R1 and R2 are frequent, receptor R3 is moderately frequent and receptor R4 is infrequent. Frequency categories have been adopted from Table A3-2 of the Institute of Air Quality Management's (IAQM) Guidance on the Assessment of Mineral Dust Impacts for Planning[11]

For dust nuisance to occur, dust producing activities would need to coincide with the receptor affecting winds and during dry conditions. As these events must occur at the same time, the chances of dust nuisance occurring are smaller than the predicted wind frequencies in Table 5 and therefore less likely to occur. This, in combination with the proposed mitigation and monitoring, means that the frequency of any effects associated with the quarrying activities will be lower.

Table 5: Frequency of high wind speeds in the direction of nearby receptors

Receptor Name	Downwind direction	Percentage of high windspeeds	Frequency of wind
R1	North Northwest to South	15.9	Frequent
R2	North Northwest to East	13.7	Frequent
R3	North Northwest to Northeast	10.1	Moderately frequent
R4	East to South Southeast	1.0	Infrequent

Notes:

1. *The angle of wind direction is based on a distance of 400 metres, therefore the closer the receptor a wider angle of wind direction is used.*
2. *<5% infrequent, 5-12% moderately frequent, 12-20% frequent, >20% very frequent.*

[11] IAQM, 2016. *Guidance on the Assessment of Mineral Dust Impacts for Planning*

6.2.2 Intensity

Intensity relates to the concentration of dust that is likely to be experienced at any potential receptor, with dust concentration decreasing with increasing distance from the source. Finer suspended dust will disperse and dilute with increasing distance from the emission source and larger particles will deposit on surfaces close to the source. Therefore, dust intensity is a function of mitigation to manage concentration at the source, location of the dust source, windspeed and the pathway between the source and the receptor.

Receptors R1 and R2 are between 100 and 170 metres from the proposed works whereas receptors R3 and R4 are over 330 metres from the proposed works. These distances are based on the closest quarrying activity relative to the receptor over the entire life of the quarry and therefore the majority of works will be undertaken at distances much greater than these from receptors. For example, the processing plant will be at least 1 kilometre from any receptor, and at this distance, it is very unlikely dust from this source will have any noticeable effect on intensity at receptor locations. Based on the closest distance to the receptors, even without any mitigation, dust concentration would typically reduce by half within 100 metres of the source.

In addition to distance, the pathway in which dust must travel between the source and receptor will also affect dust intensity. Initial works such as overburden stripping and enabling works will occur at the same ground level relative to the surrounding receptors. However, the road boundaries with Aylesbury Road and Grange Road have been planted with evergreen trees that are now approximately 5-6 metres in height and the western boundary has also been planted with evergreen trees which means the pathway for the dust is not directly open and therefore these trees will also help to reduce dust intensity in certain metrological conditions. Once the pit is established, extraction will work from the centre outwards and from the toe of the pit, this means there will always be a pit wall between the activity and the receptors and the pit wall will have the same effect on the dust pathway, which should result in containing most dust effects.

When considering the potential screening of the trees around the boundary of the site, that most work will be undertaken below the surrounding ground and that Winstones will be implementing mitigation, dust intensity at nearby receptors should be low.

6.2.3 Duration

Duration relates to the length of time that dust discharges are likely to occur. In this case it is the time taken to mitigate dust discharges, should they arise. PDP considers based on the visual monitoring programme presented in Table 4 that if an event was to occur, at worst the duration would be limited to a period of no more than 2 to 4 hours at any one time. This being the time to recognise that dust emissions are occurring and to implement the mitigation.

With the use of continuous monitoring of dust and wind conditions using the alerts suggested in Sections 5.7.2 and 5.7.3, PDP considers that the duration of dust emissions could be reduced to 30 minutes.

On a larger scale, while this application assesses effects over a 35-year period, quarrying operations near the receptors will be for a much shorter duration due to the proposed quarrying sequence and the scale of the quarried site. For example, when quarrying activities will be undertaken in the southeast corner of the site, which has the potential to affect receptor R1, albeit low due to the mitigation and distances of the work, the duration of these works is expected to be between 5 and 8 years. Once quarrying moves away from this location and the land is converted back to farming, it is unlikely there will be any further dust effects on this location.

6.2.4 Offensiveness

PDP considers that dust emissions are unlikely to result in any off-site offensive or objectionable effects. This is based on the activities undertaken and the extraction methodology, distance to the sensitive receptor and mitigation measures that will be implemented.

Additionally, the type of materials that the dust comes from will be from overburden (soils and clay) and rock, which will be the same material that is found in the surrounding area when fields are cultivated or the material used in unsealed roads and driveways, and therefore any dust from the Burnham Quarry is likely to be of a similar nature to what would be around the area.

6.2.5 Location

Winstone considered several different sites before choosing the one at Burnham. One of the key criteria was striking a balance between locating the quarry away from populated areas to avoid any potential effects on a larger number of receptors, but while still keeping the quarry within a viable distance of its main markets. This site meets those locational criteria.

In terms of the surrounding environment, the majority of the nearby receptors are to the southeast of the site as well as located near the southern boundary. In recognising the relative closeness of these locations, the quarry design has excluded some areas of the site from quarrying to ensure that there is at least a

120 metre buffer distance to any dwelling. Likewise, the location of the processing plant in the centre of the site will minimise noise and dust effects.

In addition, PDP considers the potential for elevated levels of dust at receptors to be low due to a number of reasons relating to the locations of the quarry activities and the receptors. Most of the quarrying activities relative to the receptors are either at a sufficient distance or have intervening features such as wind breaks and bunds that will restrict the transportation of dust towards these locations, and therefore the potential for nuisance dust is low.

Also, the surrounding area is rural in nature, with a number of rural activities being undertaken, and it is not unusual to experience a degree of dust from working the land or unsealed roads. It is generally considered that there is a greater tolerance to dust effects in a rural setting.

6.2.6 FIDOL Conclusion

Having assessed the proposed quarry activities that have the potential to cause dust discharges against the FIDOL factors, PDP considers that it is unlikely, albeit with a low potential, that any sensitive receptors will be affected by site activities. While there will be some parts of the quarrying activities which will get close to some of the nearby sensitive receptors, given the mitigation and monitoring that will be undertaken the potential for nuisance dust effects will be low.

6.3 Assessment of Health Dust Effects

The potential human health impacts are driven primarily by the smaller size fraction of particulate (PM_{10} and smaller). Given the sources and type of dust which will be discharged from the proposed Burnham Quarry, PDP considers that the human health impact from the discharge of dust from the proposed development and operation of the pit likely to be low because:

- PM_{10} and particularly $PM_{2.5}$ are not significant components of the dust generated from quarry activities, and is therefore dust emitted is not generally in the inhalable fraction;
- Given low background PM_{10} concentrations of the rural environment, with the small contribution to PM_{10} from quarry activities, total cumulative concentrations of PM_{10} will be maintained well below the NESAQ criteria of 50 $\mu g/m^3$ as a 24-hour average and the AAQG criteria of 20 $\mu g/m^3$ as an annual average; and,
- Suppression of dust also suppresses PM_{10}.

To help understand the potential level of PM_{10} concentrations from quarrying activities, PDP has reviewed the monitoring commissioned by ECan between 22 December 2017 and 21 April 2018 around the Yaldhurst quarry area[12]. In this study, monitoring for PM_{10} was undertaken at 10 locations at a variety of different distances around the Yaldhurst quarries. The Yaldhurst study measured PM_{10} and RCS concentrations to assess the dust nuisance and the potential risk to public health. Yaldhurst represents a large area (230 ha) containing multiple quarries and a range of processing activities at a larger scale approximately five times larger than the proposed Burnham Quarry (40 ha active area).

A summary of the results from the Yaldhurst study applicable to this assessment are as follows:

- There were no exceedances of the NESAQ for PM_{10} as measured by the reference instruments (50 µg/m³ as a 24-hour average).
- The average PM_{10} 24-hour average concentrations for all the sites were between 21 and 27 µg/m³.
- There were 17 exceedances of the Ministry for the Environment (MfE) PM_{10} nuisance dust trigger level (150 µg/m³ as a 1-hour average). However, the majority of these exceedance occurred within 100 metres of the quarries.
- Out of 20 samples collected for respirable crystalline silica (RCS) only two sample detected RCS (within 50 metres of the quarry), and these were well below the recommended guidelines.

While this data is from a different location, it is a high quality and comprehensive data set collected from a combined site that is larger than the proposed Burnham Quarry. This data set provides robust information to inform a conservative (worst case) health impact assessment for the proposed Burnham Quarry.

While background monitoring presented in Section 2.2.1 has indicated that there is currently low concentrations of RCS, the data from the Yaldhurst study would indicate that quarrying activities are unlikely to significantly increase concentrations of RCS and therefore will still be below the health based guidelines.

Overall, based on this assessment PDP considers that there should be very low potential for health effects as a result of the proposed Burnham Quarry.

[12] Yaldhurst Air Quality Monitoring – Summary Report: 22 December – 21 April 2018. Prepared by Mote Ltd, 19 June 2018.

6.4 Cumulative Effects

PDP has reviewed the surrounding area for potential sources of nuisance dust. Based on this review there a number of potential sources such as horse training tracks, fields that are cultivated and an army vehicle training facility, but nothing that has the potential to generate significant nuisance dust concentrations other than the Road Metals Quarry 2.5 kilometres to the northeast of the site.

As already discussed, the likely distance that nuisance dust from the proposed Burnham Quarry could travel if no mitigation were undertaken is 400 metres and the same would apply for the Road Metals Quarry. Therefore, for a receptor to be affected by cumulative effects from the proposed Burnham Quarry and Road Metals Quarry, both these activities must be generating dust within 400 metres of a receptor at the same time when winds are blowing towards the receptor. Given that the distance between these two quarries is 2.5 kilometres it is unlikely that the proposed Burnham Quarry will result in cumulative nuisance dust effects.

7.0 Conclusion

PDP's assessment has concluded that there is some potential, if no mitigation measures were undertaken, for air discharges from the proposed Burnham Quarry to cause off-site effects. However, Winstones will utilise a number of mitigation measures that, if appropriately implemented, will most likely minimise dust emissions to within 100 metres of the source. Therefore, PDP considers that the potential for off-site dust effects at nearby receptor locations will be low and at a level that would be considered acceptable. Further, PDP considers that the potential for off-site dust effects at nearby receptor locations will be less than minor. This is based on the following:

- Most receptors are too far away to be affected by dust from the proposed quarry and there is only a small number of receptors that are close enough that could be affected if no mitigation was implemented.
- Based on the meteorological data for the area, the receptors to the southeast and south of the site would be downwind of the site during Frequent and Moderately Frequent (10.1 – 15.9 percent of the time) high wind speeds (>5 m/s) and receptors to the west would be downwind during high wind speeds infrequently (1 percent of the time). As the dust emission rates from the quarrying operations could be quite varied, there is an even lower probability of high emission rates occurring at the same time as dust transporting wind speeds blowing in the direction of these receptors.

- The frequency of dust emissions will be further reduced as Winstones will be continuously monitoring wind speed and direction and dust concentration to ensure that the appropriate mitigation is undertaken especially during wind conditions that might impact nearby receptors.
- Based on the distances between the dust sources and the receptors, dust particles are unlikely to affect a large number of the receptors. It is only the finer particles in strong wind conditions that have the potential to travel extended distances but given that the boundary of the site is planted with dense trees and there will be bunding around those parts of the boundary where quarrying is occurring, dust effects on the receptors will be minimised.
- Based on the Yaldhurst monitoring data, PDP does not consider that there is any additional risk for people currently living near to the quarry to experience health related effects as a result of dust.
- The proposed quarry will not result in cumulative effects as the closest source of potential nuisance dust is located approximately 2.5 kilometres away and therefore it is unlikely both sources will interact.

Appendix A: Draft Dust Management Plan

Dust Management and Monitoring Plan – Burnham Quarry

Prepared for

Winstone Aggregates

August 2023

D
R
A
F
T

PATTLE DELAMORE PARTNERS LTD
Level 5, PDP House
235 Broadway, Newmarket, Auckland 1023
PO Box 9528, Auckland 1149, New Zealand

Office +64 9 **523 6900**
Website **http://www.pdp.co.nz**

solutions for your environment

Quality Control Sheet

TITLE	Dust Management and Monitoring Plan – Burnham Quarry
CLIENT	Winstone Aggregates
ISSUE DATE	8 August 2023
JOB REFERENCE	C04096800R002_Draft.docx

Revision History

REV	Date	Status/Purpose	Prepared By	Reviewed by	Approved
1.0	8 August 2023	Draft	Jonathan Harland	Andrew Curtis	Andrew Curtis

DOCUMENT CONTRIBUTORS

Prepared by

SIGNATURE

Jonathan Harland

Reviewed and Approved by

SIGNATURE

Andrew Curtis

Limitations:

This report has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Winstone Aggregates and others (not directly contracted by PDP for the work), including Pro-Manage Consulting Limited. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the report. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

This report has been prepared by PDP on the specific instructions of Winstone Aggregate for the limited purposes described in the report. PDP accepts no liability if the report is used for a different purpose or if it is used or relied on by any other person. Any such use or reliance will be solely at their own risk.

© 2023 Pattle Delamore Partners Limited

D R A F T

Table of Contents

SECTION		PAGE
1.0	Introduction	1
1.1	Purpose	1
1.2	Background	1
1.3	Objectives	2
2.0	Consent Compliance and Key Performance Indicator	2
3.0	Site Activities	3
4.0	Sources, Management, and Mitigation Measures	4
4.1	Factors Influencing Dust Discharge	4
4.2	Sources of Dust	4
4.3	Dust Control	4
4.4	Tiered Mitigation Measures	5
5.0	Monitoring	10
5.1	Instrumental Monitoring and Trigger Levels	11
6.0	Contingency Measures	12
7.0	Roles and Responsibilities	12
7.1	Site Manager and Staff	12
7.2	Staff Training	13
8.0	DMP Review	14
9.0	Complaints	14
9.1	Receipt Procedure	14
9.2	Response Procedure	15
10.0	Emergency Contacts	16
11.0	References	16

Table of Figures

Figure 1: Site location and nearby receptors 2

DRAFT

Table of Tables

Table 1: Sources of Dust and Tiered Controls to be Employed 6

Table 2: Priority of Water Application for Dust Suppression 10

Table 3: Visual Dust Monitoring Programme 10

Table 4: Monitoring Trigger Levels 12

Table 5: Internal Environmental Emergency Contact Details 16

Table 6: External Environmental Emergency Contact Details 16

Appendices

Appendix A: Daily Log Form

Appendix B: Complaint Record

DRAFT

1.0 Introduction

This Dust Management Plan - Burnham Quarry (DMP) has been prepared by Pattle Delamore Partners Ltd (PDP) on behalf of Winstone Aggregates (Winstones) for the proposed quarry near Burnham.

This document is a draft DMP and provides a draft framework for managing dust emissions from the proposed quarry. Following the consent being granted, the DMP will be reviewed and updated to reflect any consent requirements.

1.1 Purpose

The purpose of the DMP is to provide a framework for managing dust emissions from the proposed quarry to avoid or mitigate potential dust effects and in particular to:

- facilitate the avoidance, remediation, and mitigation of any adverse effects of discharges of dust generated from the reclamation and construction works associated with the expansion; and,
- promote proactive solutions to the control of dust discharges from the site.

1.2 Background

The proposed Burnham Quarry will produce a wide variety of aggregates, including basecourse, concrete aggregates and sealing chip that will be used in civil infrastructure projects in the Canterbury region. The site activities will include, overburden removal and bund construction, gravel extraction, aggregate processing, stockpiling and reinstatement of quarried land.

An assessment of the sensitivity of the receiving environment and identification of the location of highly sensitive receptors is provided in Section 2.5 of the Air Quality Assessment of Environmental Effects (AEE), dated August 2023). The location of the proposed quarry and the location of the nearby sensitive receptors are shown in Figure 1.

DRAFT



Figure 1: Site location and nearby receptors

1.3 Objectives

The objectives of the DMP are to inform the quarry operations and site personnel of management and mitigation measures for quarry activities to minimise the adverse impacts of potential dust discharges on the receiving environment.

The DMP methods are designed to be practical for Winstones to implement, while the document is intended to be continuously improved to adapt mitigation where needed to ensure the required outcomes.

2.0 Consent Compliance and Key Performance Indicator

The environmental objective of the DMP is to ensure that the site will be managed to comply with the consent conditions related to the discharge of dust to air. The relevant performance indicator to ensure that the site activities will not result in dust that is objectionable to the extent that it causes an adverse effect beyond the boundary of the site.

Relevant consent condition(s) will be included here if applicable.

D R A F T

3.0 Site Activities

There are a number of activities that will be undertaken in the course of quarrying the proposed site, this includes the following:

- Site Establishment and Enabling Works – Overburden material is removed for the establishment of the quarry entrance, site office, amenities, parking and weigh bridge, production zone and stockyards. Overburden material from this activity will be used to form a permanent bund along sections of Aylesbury Road and Grange Road.
- Creation of the Pit - The first extraction of material will create the production zone and stockpiling areas. Extraction will use the top-down method utilising excavators, wheel loaders and trucks.
- Entrance and Site Access - The entrance and exit of the site will be located on Aylesbury Road. The entrance to the site will include offices, meeting rooms, amenities, light vehicle parking and the weigh bridge. From the entrance platform there will be a ramp leading down to the quarry floor which will include a wheel wash and a flood wash. The site entrance and the ramp down to the quarry floor will be sealed.
- Production Zone - The production zone will house the processing plant which will include fixed plant as well as mobile plant as required.
- Primary and Secondary Stockyards - The primary stockyard will contain those products which have a higher risk of dust emissions, whereas the secondary stockyard is intended to contain products with a lower risk of dust emissions, bulk volume base coarse products, or slow-moving products.
- Extraction Zone – Before accessing the resource overburden will be removed first during a stripping campaign, with this material being stored in temporary bunds along the border of the site. Extraction of the resource will be undertaken using excavator, front-end loaders or wheel bucket excavators. Extracted material will be transported to the Production Zone using either trucks or conveyors.
- Silt Management – That exact methodology is yet to be confirmed; however it is most likely to be in the form of mechanical settling.

DRAFT

4.0 Sources, Management, and Mitigation Measures

4.1 Factors Influencing Dust Discharge

The key factors influencing the discharge of dust from the proposed Burnham Quarry are:

- The size and the density of the material being handled. Coarse aggregate material content is unlikely to give rise to dust emissions when compared to fine clay material that might be found in overburden;
- The moisture content of the material. A high moisture content will act to bind particles and control any dust emissions;
- Strong winds blowing across exposed surfaces on dry days resulting in entrainment of dust material; and
- The extent of exposed areas.

4.2 Sources of Dust

The Site's key dust sources are as follows:

- Development and remediation of the site;
- Excavation of gravel;
- Site access road and other unsealed surfaces;
- Disturbing stockpiles; and
- Stockpiling.

4.3 Dust Control

Water will be the primary mitigation tool that Winstones will implement to control dust. The use of water prevents (or suppresses) fine particulate from leaving the surface and becoming airborne through the action of mechanical disturbance or wind. In effect, the water acts to bind the small particles to the larger material, thus reducing the emission potential.

While it is still unknown exactly how the water will be applied, it is expected to be undertaken using a combination of methods such as water carts, fixed and mobile sprinklers, etc., with water being applied at a rate as required to suppress dust.

As a benchmark for dust suppression the Ministry for the Environment Good practice guide[1] on assessing and managing dust recommends a water application one litre/m^2/hr.

[1] Ministry for the Environment. 2016. *Good Practice Guide for Assessing and Managing Dust.* Wellington: Ministry for the Environment.

D R A F T

4.4 Tiered Mitigation Measures

The proposed dust prevention on site uses a two-tiered approach. Tier 1 controls are employed routinely, and Tier 2 controls are implemented additionally in the unlikely situation that the Tier 1 controls do not prove to be fully effective. These control measures are summarised in Table 1.

Application of water for dust suppression as described in the Tier 1 and Tier 2 controls should be prioritised as shown in Table 1.

DRAFT

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Unpaved surfaces such as site access roads	⁘ Limit the area of exposed surfaces as much as practical. ⁘ Cover surfaces with coarse materials where practicable. ⁘ Compact all unconsolidated surfaces where practicable. ⁘ Trafficked unsealed surfaces will be watered on a regular basis using sprinklers and/or water cart system. ⁘ An onsite speed limit of 30 km/hr will be enforced.	⁘ Increase water application rate to ensure that in-use unpaved roads are kept damp. ⁘ Use polymer additives or chemical stabilisation to assist in forming a surface crust on site access roads only in rare occasion all other options are insufficient. ⁘ Further reduce speed limits.
Vehicles	⁘ Limit load sizes and ensure even loading to avoid spillages. ⁘ As far as practical minimise travel distances and/or maximise buffer distances between site access roads and site boundary through appropriate site layout and design. ⁘ Deep sided trucks (dump trucks) are used for transport within the site to reduce spills. ⁘ As above, an onsite speed limit of 30 km/hr will be enforced. ⁘ The main haul road into the site is sealed to prevent dust. ⁘ Sweeping of the sealed road is undertaken as required. ⁘ Any spills of soil from vehicles are swept up and washed down on the same day as the spill. ⁘ All vehicles exiting the quarry will pass through the wheel before leaving the site.	⁘ Limit vehicle speeds on unsealed surfaces to 10 km/hr when traveling within 250 m of the site boundary or when vehicle generated dust plumes approach the boundary of the site. ⁘ Dry soil material in trucks will be covered or wetted.

DRAFT

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Disturbing all materials including the working faces	⁘ The loading on to or removal of material from stockpiles will be only undertaken during low dust risk wind conditions (one hour average windspeed < 7.5 m/s). ⁘ Good practice machine operation will be implemented including minimizing drop heights and wetting dusty materials when needed (wind speeds above 5 m/s). ⁘ No materials will be disturbed when wind speeds are above 7.5 m/s.	⁘ Adequate water suppression systems must be available at the site to dampen areas that are to be worked prior to any earthwork commencing and shall be used on the site until further earthworks in that area are not required.
Aggregate Processing	⁘ Fitting water sprays and/or misters on the screens, crushers and conveyor transfer points. ⁘ Minimise drop heights from the loading of raw materials into the feed hopper and from stacking of stockpiles. ⁘ Locate mobile processing plant away from dwellings and below ground-level where possible (only applicable during the intimal phase if mobile plant is used). ⁘ Enclosing dry screens.	⁘ Dampen down raw material before entering the processing plant. ⁘ Reduce material throughput until any dust emissions can be controlled. ⁘ Use fog cannons as required.

DRAFT

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Stockpiles (including placement and removal)	⁘ Locate stockpiles as far away as practicable from identified sensitive receptors, with high-risk material stored within the primary stockpile area and lower risk material within the secondary stockpile area. ⁘ Orientate stockpiles to maximise wind sheltering as much as possible. ⁘ Maintain the height of gravel stockpiles to a practical height, but no more than 5 metres above the surrounding ground-level. ⁘ Maintain the height of bunds to a practical minimum of 3 metres. ⁘ Load and remove stockpiled material from site as soon as practical. ⁘ No materials will be disturbed when wind speeds are above 7.5 m/s.	⁘ Use polymer additives or chemical stabilisation to assist in forming a surface crust on stockpiles only in rare occasion all other options are insufficient. ⁘ Further limit the height and slope of stockpiles to reduce wind entrainment. ⁘ Vegetation of long-term stockpiles and bunds. ⁘ Dampen stockpiles if they are producing visible dust emissions.
Bund removal and rehabilitation	⁘ Areas are incrementally backfilled at regular intervals and re-grassed with suitable grass species as soon as practicable to limit potential for dust generation from exposed surfaces.	⁘ Use polymer additives or chemical stabilisation to assist in forming a surface crust on soil surfaces if delays in vegetation. ⁘ Addition of nutrients (fertiliser) to increase fertility and promote and maintain even revegetation. ⁘ Soil moisture management via irrigation (if available) to promote and maintain even revegetation.

DRAFT

Table 1: Sources of Dust and Tiered Controls to be Employed		
Source of Dust	**Tier 1 Controls (Routine)**	**Tier 2 Controls (Additional, as needed)**
Miscellaneous	⁖ Plan site layout so that mobile machinery and dust causing activities are located away from receptors as far as is practicable. ⁖ Ensure sufficient water is available on site. ⁖ Take account of daily forecast wind speed, wind direction and soil conditions before commencing an operation that has a high dust potential. ⁖ All site machinery should be regularly maintained to ensure optimal operation. ⁖ Targeted watering on areas within 250 m of sensitive receptors during high dust risk conditions.	⁖ Targeted watering on areas identified as high-risk for dust discharge as a result of visual inspections.

DRAFT

Table 2: Priority of Water Application for Dust Suppression			
Water Priority	**Type of Source**	**Proximity to Boundary**	**Wind Direction**
1	Overburden removal and bund construction / deconstruction	Any	Any
2	Active Haul Roads and Site Access	Any	Any
3	Processing Plant and Stockpiles	Within 250 m of the site boundary	Towards closest boundary with nearby receptors.
4	Working Area	Any	Towards closest boundary with nearby receptors.

5.0 Monitoring

To ensure that dust mitigation measures are implemented and are effective at minimising dust emissions, presented in Table 3 is a monitoring plan developed for Winstones. The frequency of the monitoring is defined but it must be noted that in the instance of strong winds, dust emissions off-site, or a complaint, the monitoring programme should be undertaken more regularly.

Table 3: Visual Dust Monitoring Programme	
Monitoring Activity	**Frequency**
Check weather forecasts for strong winds and rainfall to plan appropriate work schedule and dust management response.	Daily
Inspect land adjacent to the site, site exits and adjoining roads for the presence of dust deposition.	At least daily and more frequently if the wind is blowing from a potentially dust operation towards the boundary or sensitive receptor and the TSP or meteorological monitoring conditions are triggered (See Table 4)
Ensure instrumental monitors are operating correctly.	Daily
Observe weather conditions including wind and rain via observations and data outputs from weather stations.	Daily and as conditions change

DRAFT

Table 3: Visual Dust Monitoring Programme	
Monitoring Activity	**Frequency**
Inspect all exposed surfaces for dampness and to ensure that the exposed un-stabilised area is minimised.	Daily and as conditions change
Inspect dust generating activities to ensure dust emissions are effectively controlled.	Daily and as new activities are commenced
Inspect watering systems (sprays and water carts) to ensure equipment is maintained and functioning to effectively dampen exposed areas.	Weekly

5.1 Instrumental Monitoring and Trigger Levels

Winstone's will continuously monitor meteorological conditions including wind speed, direction and rainfall as well as PM_{10}. The dust monitors will be located along each boundary near where sensitive receptors might be located. The monitors will be located in accordance with AS/NZS 3580.1.1:2007 "Methods for sampling and analysis of ambient air Part 1.1: Guide to siting air monitoring equipment". The monitors will be maintained and calibrated by a suitably qualified person such as the instrument provider and in accordance with the manufacturer's instructions.

The meteorological site will be co-located with the dust monitor located on the southern boundary and will be installed and maintained where practicable in accordance with AS/NZS 3580.14 Methods for sampling and analysis of ambient air - Part 14: Meteorological monitoring for ambient air quality monitoring applications.

The instruments will provide continuous, real-time information on PM_{10} concentrations and wind conditions. Trigger values will be set for PM_{10} concentrations, wind speed and rainfall, and if reached will require additional dust mitigation measures as described in Section 4. There will be two dust trigger levels; a lower value which warns that dust concentrations are increasing above "normal" levels and an upper limit trigger level which should not be exceeded. The recommended trigger levels are shown in Table 4

The trigger level thresholds in Table 4 are preliminary values and may need to be adjusted depending on the monitor type and any subsequent feedback from neighbours. If there are any exceedances of the trigger level, Winstone's will undertake an investigation to determine the reasons for the exceedance and identify any remedial measures that can be taken to prevent further exceedances.

DRAFT

Table 4: Monitoring Trigger Levels		
Trigger		**Value**
TSP Trigger Levels	Warning	120 µg/m³ (1-hour average)
	Stop Work	150 µg/m³ (1-hour average)
Meteorological Trigger Levels	Wind speed	5 m/s (1 hour average)
	Rainfall	Less than 1 mm for previous 24 hours

6.0 Contingency Measures

The following contingency measures have been identified to ensure the dust management is working as intended:

- Break-down or failure of water suppression systems: As this is a vital control method, all dust generating activities may need to cease until the system can be restored if an alternative way of watering the surface is not available.
- If dust impacts, or a large number of complaints, occur, Winstone's will reduce the trigger levels presented in Table 4.
- If the monitoring equipment is offline either due to planned maintenance, equipment malfunction or power failures, Winstone's will use the water cart on all potentially dusty surfaces within close proximity to the boundary or dwelling whether or not dust is being generated, unless raining. This will continue until the instrument is back online.
- Water supply for dust suppression. In the extremely unlikely situation of not having the required level of water for dust suppression during prolonged dry periods, all dust generating activities will cease until an alternative water supply can be obtained.
- Ensure vehicles moving on-site have undergone regular maintenance so that vehicle emissions are kept to a minimum.

7.0 Roles and Responsibilities

7.1 Site Manager and Staff

The Quarry Manager will have day-to-day responsibility for the implementation of the DMP. The Quarry Manager will have the following responsibilities in respect of the management of dust. They shall ensure:

- That the conditions of all relevant resource consents are complied with at all times;

DRAFT

- That the dust control and mitigation measures and procedures outlined in the DMP are implemented effectively;
- That there are adequate personnel and equipment on-site at all times to enable the prescribed dust control;
- That the meteorological and dust monitoring programmes are carried out as required, including recording of daily observations;
- There is sufficient water supply for dust management;
- That any complaints received are investigated and resolved as far as practicable; and
- That all records are kept and are available for the relevant regulatory authorities.

All personnel working on the site have responsibility for the requirements of the air discharge consent conditions and the DMP and reporting to the Site Manager on these issues.

7.2 Staff Training

Successful dust management depends on appropriate actions by site personnel in the day-to-day operations of the site. Environmental training for all staff will be undertaken as part of the site induction programme. The environmental induction will include the following information specific to this DMP:

- Information about the activities that may cause dust discharges within the site with the potential to impact neighbouring areas;
- Consent requirements;
- Dust mitigation procedures;
- Description of dust and meteorological monitoring for the site; and
- Complaints management procedures.

Staff training records will be maintained on-site. The records will include:

- Who was trained;
- When the person was trained; and
- General description of training content and whether follow-up/refresher courses are required at a later date.

DRAFT

8.0 DMP Review

The DMP will be reviewed once per year and updated, with the necessary approval from Environment Canterbury. Approval will be required for any relevant revisions of a material nature for the DMP. The review will take into consideration:

- Any significant changes to dust management activities or methods;
- Key changes to roles and responsibilities;
- Changes in industry best practice standards or recommended dust controls;
- Results of inspection and maintenance programmes, logs of incidents, corrective actions, internal or external assessments;
- The outcome of investigations into discharges of dust or other air pollutants; and
- Changes to site operations i.e. once the site starts undertaking container operations.

Reasons for making changes to the DMP will be documented. A copy of the original DMP document and subsequent versions will be kept for the project records and marked as obsolete. Each new/updated version of the DMP documentation will be issued with a version number and date.

9.0 Complaints

While the measures in the DMP are aimed at preventing dust emissions as a result of on-site activities, there may be occasions when an incident occurs and a complaint from the public is received. Any complaint made will be promptly investigated to resolve the source of the dust emission and implement appropriate actions to mitigate the effects.

The following outlines guidance for receiving and keeping records of any complaints made.

9.1 Receipt Procedure

It is important to ensure that any complaints are recorded and promptly investigated to identify and resolve the cause of the complaint. Requirements and procedures for complaints are detailed below.

The Quarry Manager has the responsibility to respond to and follow up on all complaints regarding dust, and to ensure that suitably trained personnel are available to respond to complaints at all times.

DRAFT

Actions to be taken as soon as possible, following the receipt of a complaint, by the Quarry Manager include:

- Undertake a site inspection. Note all dust-producing activities taking place and the mitigation methods being used and take photographs for reference as appropriate. If the complaint was related to an event in the recent past, where possible, note any dust-producing activities taking place at that time;
- Initiate any remedial action necessary, which may include a stop work period;
- Note the time and date of the complaint/s and (unless the complainant refuses to provide them) the identity and contact details of the complainant. Ask the complainant to describe the discharge:
  - Is it constant or intermittent?
  - How long has it been going on for?
  - Is it worse at any time of day?
  - Does it come from an identifiable source?
- Meteorological data from the on-site station shall be downloaded;
- Note if the complaint has been referred to Environment Canterbury;
- As soon as possible (within 1 hour, where practicable), visit the area from where the complaint originated to ascertain if dust is still a problem;
- If it becomes apparent that there may be a source of dust other than the quarrying activities causing the complaint, it is important to verify this. Photograph the source and emissions;
- As soon as possible after initial investigations have been completed, contact the complainant to explain any problems found and remedial actions taken. Initiate a damage assessment if required; and
- If necessary, update any relevant procedures to prevent any recurrence of problems and record any remedial action taken.

9.2 Response Procedure

Following the receipt of the complaint, the following actions will be undertaken:

- Fill out the appropriate complaint form, attached as Appendix B to this DMP;
- Advise Environment Canterbury within 48 hours that a complaint has been received, what the findings of the investigation were, and any remedial action taken;

DRAFT

- Advise site personnel as soon as is practicable that a complaint has been received, what the findings of the investigation were, and any remedial action taken; and
- Call or visit the complainant to update them on the actions taken and to check that the issue has been resolved.

10.0 Emergency Contacts

Internal contacts for the site in the event of an emergency of other problems are provided in Table 5 and Table 6 below.

Table 5: Internal Environmental Emergency Contact Details

Role	Name	Organisation	Phone	Email
Quarry Manager	TBC	Winstone's	TBC	TBC
After Hours Contact	TBC	TBC	TBC	TBC

Table 6: External Environmental Emergency Contact Details

Role	Name	Organisation	Phone	Email
Consents Compliance Team	TBC	Environment Canterbury	TBC	TBC

11.0 References

Institute of Air Quality Management (IAQM). (2016). *Guidance on the assessment of mineral dust impacts for planning.*

Ministry for the Environment. (2016). *Good Practice Guide for Assessing and Managing Dust*. Available at www.mfe.govt.nz.

Pattle Delamore Partners Ltd, *Air Quality Assessment – Burnham Quarry,* August 2023.

DRAFT

Appendix A: Daily Log Form

Daily Dust Inspection Log

Date: _____ Time: _____

Inspection by: _____

Current weather conditions (e.g., sunny, cloudy, rainy):_____

Wind speed and direction (e.g., light, moderate, strong):_____

Weather forecast for next 24 hours (e.g., rainy, windy):_____

Area(s) inspected: _____

Scope of Inspection	Circle Relevant Item	Comments
Is there visible dust from site work activities, stockpiles, earthworks areas or haul roads?	Y N N/A	
Are unsealed surfaces dry and need spraying with water cart?	Y N N/A	
Are any exposed earthworks visibly dry and need water spray?	Y N N/A	
Stockpiles covered/stabilised where needed?	Y N N/A	
Are there any signs of dust going off site as a result of site activities? [Inspect land adjacent to the site exits and adjoining roads for the presence of dust deposits.]	Y N N/A	
If wind speeds are strong or forecast to be strong (over 5 m/s) are additional inspections, activity restrictions and mitigation measures being put in place? (e.g., increase water application, restrictions on dusty activities)	Y N N/A	
Are watering systems (e.g., water carts, wheel wash) operating effectively to minimise dust?	Y N N/A	
Are trucks carrying loose (uncovered) material entering or leaving the site?	Y N N/A	

Scope of Inspection	Circle Relevant Item	Comments
How frequently has water sprinkling/spraying been used today (i.e., number of water carts, time, area watered)		
Note and dust control equipment malfunctions (and remedial actions taken as appropriate)		
Any unusual on-site activities today?		
Complaints received / community feedback		

Appendix B: Complaint Record

DUST COMPLAINT & ASSESSMENT FORM

PART A: Complaint Details

Date: Time:

Complaint Received By:

Name:

Address:

Contact phone numbers:

Possible source:

Anonymous: Y/N

Is dust occurring now?

Complaint details (include impacts/effects experienced by complainant:

PART B: Complainant Location Assessment

Date: Time:

Assessors Name:

Person spoken to at complaint location:

Reason for investigation: COMPLAINT/PROACTIVE

Complaint details (include impacts/effects experienced by complainant:

INITIAL IMPRESSIONS:

Type of dust

Time of the intial impression:

Any visible dust deposits: Y/N

Plume width (if known):

VISIBLE DUST DEPOSITS

Describe approximate quantites and extent

When was surface last cleaned?

Frequency of cleaning:

Describe the appearance of the deposits:

Colour

Shape

Size

Crystalline or powdery

Hard, soft

Any odour

Water soluble

Other

Weather Data (see over)

Wind direction:
Wind velocity:
Cloud cover:
Temperature:
Rainfall in past 24 hrs:

Photos Taken: Y/N

Samples taken Y/N

Diagram/description of where photos were taken.

Diagram/description of where samples were taken:

Sample collection: Use a small paintbrush (clean) to sweep samples of the dust onto a sheet of paper and then into a clean plastic bag. At least half a teaspoonful will be required for analysis. Lesser amounts may be colected on strips of clear cellotape, which should then be stuck onto sheets of clear plastic to preserve the samples. Label all samples and record date, time, location, etc on a separate sheet of paper if required.

DRAFT

Based on your assessment on this occasion, which of the following applies:

- ☐ I did not find any dust
- ☐ I did find dust and consider it would not be objectionable at any location for any duration or frequency
- ☐ I did find dust and consider it would be objectionable if it became continuous
- ☐ I did find dust and consider it would be objectionable if it occurred on a regular or frequent basis
- ☐ I did detect dust and consider it to be objectionable even in periods of short duration.

FINAL CHECKLIST

- ☐ Upwind assessment completed. Record details below. If not, detail reason: _____
- ☐ Aerial photo/sketch showing location of assessment and upwind assessment attached
- ☐ Are there potential witness statements to obtain YES/NO

REMARKS

PART C: Off-site dust and 360° assessment

Assess the dust upwind of the suspected source and if possible conduct a 360° sweep around the source assessing the odour at different points

OTHER POTENTIAL SOURCES **Time:** _____

Check for road works, ploughing, construction activities, burn-offs, unsealed roads, unsealed sites

Site 1:

Wind direction: Wind strength: Wind stability: GPS Loc:

Visible dust: Desciption of dust

Comment:

Site 2:

Wind direction: Wind strength: Wind stability: GPS Loc:

Visible dust: Desciption of dust:

Comment:

Site 3:

Wind direction: Wind strength: Wind stability: GPS Loc:

Visible dust: Description of dust:

Comment:

Diagram of Suspected source, dust assessment sites and dust plume:

N

COMMENTS

PART D: Source On-site Investigation

If source of dust identified, visit site, identify yourself and show warrant. Explain the findings of your investigation to staff.

Date: Time: Source Identified:

Staff spoken to:: Position:

Staff contact phone number:

Current site operations:

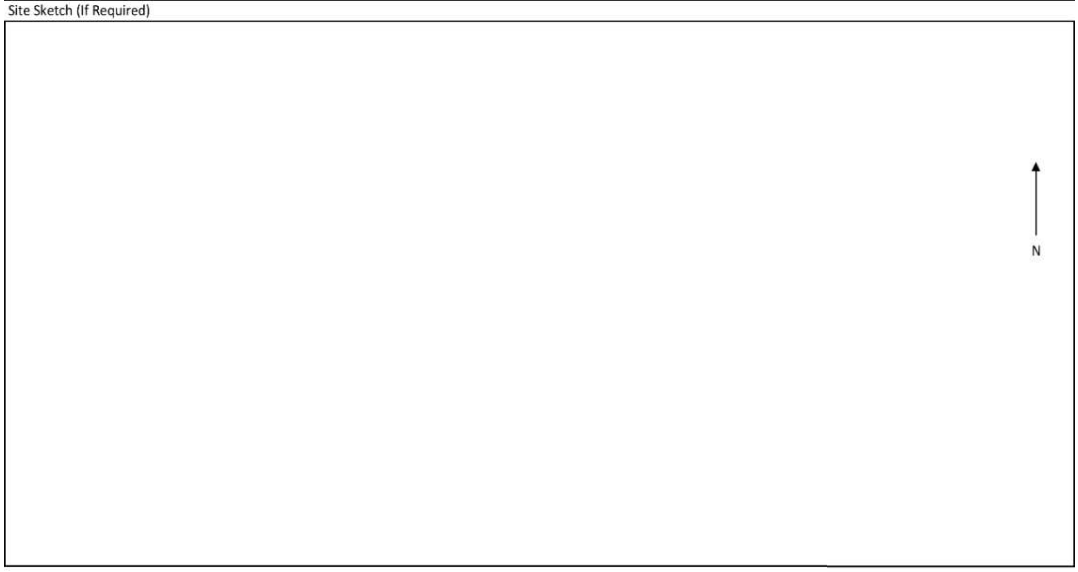
Reason/explanation given for dust

Other Comments

Monitoring results/samples/other records

D R A F T

Site Sketch (If Required)



SIGNED BY ASSESSOR _____ DATE: _____

PART E: Dust Reference Sheet

Definitions

Objectionable The term objectionable is the term used in consent conditions and is an ingredient of any subsequent enforcement action. It is a subjective term and is open to interpretation. There is guidance from case law which defines objectionable as: unpleasant or offensive or repugnant; open to objection or undesirable or disapproved of; noxious or dangerous. A test will be applied by the court that the term objectionable will be as it applies to "the minds of a significant cross section of reasonable people in the community". The assessor must bear this test in mind when completing their assessment.

Frequency How often an individual is exposed to dust nuisance events

Intensity As indicated by dust quantity/concentration and the degree of nuisance

Duration The length of the particular dust event

Character How objectionable the dust is, having regard to the nature of the dust

Land Beaufort Wind Scale

B. No.	Description	How to Recognise
0	Calm	Smoke rises straight up
1	Light Air	Smoke drifts
2	Light Breeze	Wind felt on face; leaves rustle
3	Gentle Breeze	Flags flap; twigs move all the time
4	Moderate Breeze	Papers blow; small branches move
5	Fresh Breeze	Small trees sway
6	Strong Breeze	Large branches move, wind whistles
7	Near Gale	Whole trees sway

Measuring Temperature

Use descriptions below or obtain local meterological data, especially temperature from websites such as www.metservice.govt.nz

Cold
Cool
Mild
Warm
Hot

Measuring Cloud Cover

Okta No.	Description
0	Clear Sky
1	Sunny
2	Mostly sunny
3	
4	Half the sky is covered in cloud
5	
6	Mostly cloudy
7	Considerable cloudiness
8	Overcast
F	Fog / Mist

During the day the sun is always shining, so the amount of sunshine reaching the ground depends on the amount and duration of any cloud cover. The amount of cloud cover is usually given in units called oktas. Each okta represents one eighth of the sky covered by cloud.

DRAFT



Underground Overground Archaeology

Burnham Quarry - 139 Grange Road

An archaeological assessment

Report prepared for Winstone Aggregates
Author: Lydia Mearns
Reviewed by: Tristan Wadsworth
Submitted: July 2023

Underground Overground Archaeology

Burnham Quarry - 139 Grange Road

An archaeological assessment

Report prepared by:
Underground Overground Archaeology Ltd
P.O. Box 388 | Christchurch 8140
T: 0800 654 686 | E: admin@underoverarch.co.nz
www.underoverarch.co.nz

Project Details

Archaeological Site No.	**Yet to be recorded**
Site Address	139 Grange Road, Burnham (Rural Sections 19387, 25412, 27724, 27776, and 27777)
Client	Winstone Aggregates
Client Contact	Dan McGregor
Report Authors	Lydia Mearns
Reviewed By	Tristan Wadsworth
Report Submitted	July 2023
Report Submitted To	Winstone Aggregates

Ownership and Disclaimer

This report has been prepared for Winstone Aggregates in relation to a specific work program at 139 Grange Road, Burnham. This report and the information contained herein are subject to copyright. Ownership of the primary materials created in the course of the research remains the property of the named researchers and Underground Overground Archaeology Ltd. This report remains the property of Winstone Aggregates and Underground Overground Archaeology Ltd.

The professional advice and opinions contained in this report are those of the consultants, Underground Overground Archaeology Ltd, and do not represent the opinions and policies of any third party. The professional advice and opinions contained in this report do not constitute legal advice.

Cover Photo: Aerial imagery from 1942 showing the current project area. Image: LINZ, 1942.

Executive Summary

Underground Overground Archaeology Ltd (UOA) has been commissioned by Winstone Aggregates to undertake an archaeological assessment of the property at 139 Grange Road, Burnham. Although the property is located within a wider area of known Māori occupation and European pastoral pursuits, there is no activity in the recorded history that indicates that the section had any specific use before 1900 that would be likely to result in the presence of archaeological remains on the property. As such, the works should proceed under an archaeological discovery protocol. Any archaeological features or material uncovered during works should be immediately reported to an archaeologist for investigation.

Abbreviations

Abbreviation	Definition
Heritage New Zealand	Heritage New Zealand Pouhere Taonga
NZAA	New Zealand Archaeological Association
RMA	Resource Management Act (1991)
UOA	Underground Overground Archaeology Ltd.

Table of Contents

Project Details i
Ownership and Disclaimer i
Executive Summary ii
Abbreviations iii
Table of Contents iv
List of Figures iv
1 Introduction 1
2 Statutory Requirements 3
2.1 Heritage New Zealand Pouhere Taonga Act 2014 3
2.2 Resource Management Act 1991 4
2.3 Protected Objects Act 1975 4
3 Methodology 5
4 Historical Background 7
4.1 Broadlands Station - Pastoral Runs 40, 76, 85, and 95 8
4.2 Rural Sections 19387 and 25412 9
4.3 Rural Section 27724 11
4.4 Rural Section 27776 and 27777 12
5 Previous Archaeological Investigations 18
6 Constraints and Limitations 19
7 Conclusions and Recommendations 20
8 References 21
Archaeological Discover Protocol 23
Contact details 23

List of Figures

Figure 1-1. Map of central and western Christchurch showing the location of the current project area (outlined in red). Image: Google Maps, 2022. 1
Figure 1-2. Aerial image of the current project area (outlined in red). Image: Canterbury Maps, 2022. 2
Figure 4-1. Map of the early Canterbury Pastoral Runs, showing current project area (outlined in red) located within Pastoral Run 40 which formed part of the Broadlands estate (outlined in blue). Image: Browning, 1860. 8
Figure 4-2. Detail from Survey Plan 2541, showing the current project area (outlined in red) surveyed as Rural Sections 19387, 25412, 27724, 27776, and 27777 in 1879. Image: LINZ, 1879. 9
Figure 4-3. Detail from Survey Plan 2541, showing the boundaries of Rural Sections 19387 and 25412 (outlined in blue). Image: LINZ, 1879. 10
Figure 4-4. Detail from a map of the Leeston Survey District in 1895, showing three rural sections owned by the Cross family from 1892 (outlined in blue) and indicating the location of Cross's Burnham Grange cob cottage residence (red pin) outside of the current project area (indicated in red). Image: McCardell, 1895. 11
Figure 4-5. Detail from Survey Plan 2541, showing the boundaries of Rural Section 27724 (outlined in blue). Image: LINZ, 1879. 12
Figure 4-6. Detail from Survey Plan 2541, showing the boundaries of Rural Section 27776 and 27777 (outlined in blue). Image: LINZ, 1879. 13
Figure 4-7. Detail from Survey Plan 2541, showing the boundaries of William Adams property (outlined in blue) and indicating the project area (coloured red). Image: LINZ, 1879. 14

Figure 4-8. Aerial imagery from 1942, showing the developments present within the current project area (outlined in red). Image: LINZ, 1942a; LINZ, 1942b. 15
Figure 4-9. Aerial imagery from 1942, showing the dwelling and outbuildings present on part of Rural Section 27724 on the corner of Aylesbury Road and Grange Road. Image: LINZ, 1942b. 16
Figure 4-10. Aerial imagery from 1974, showing the developments present within the current project area (outlined in red). Image: LINZ, 1974. 17
Figure 5-1. Map showing the recorded archaeological site in the vicinity of the project area (outlined in red). Image: ArchSite, 2022. 18

1 Introduction

Underground Overground Archaeology Ltd (UOA) has been commissioned by Winstone Aggregates to undertake an archaeological assessment of the property at 139 Grange Road, Burnham (Figure 1-1 and Figure 1-2). This assessment has been prepared to identify any potential archaeological sites which may be affected by future works for the development of a quarry. Archaeological sites are areas that witnessed human occupation prior to the year 1900 and are protected under the *Heritage New Zealand Pouhere Taonga Act* 2014. It has been prepared in accordance with Heritage New Zealand Pouhere Taonga's (2019) guidelines on preparing an archaeological assessment.



Figure 1-1. Map of central and western Christchurch showing the location of the current project area (outlined in red). Image: Google Maps, 2022.

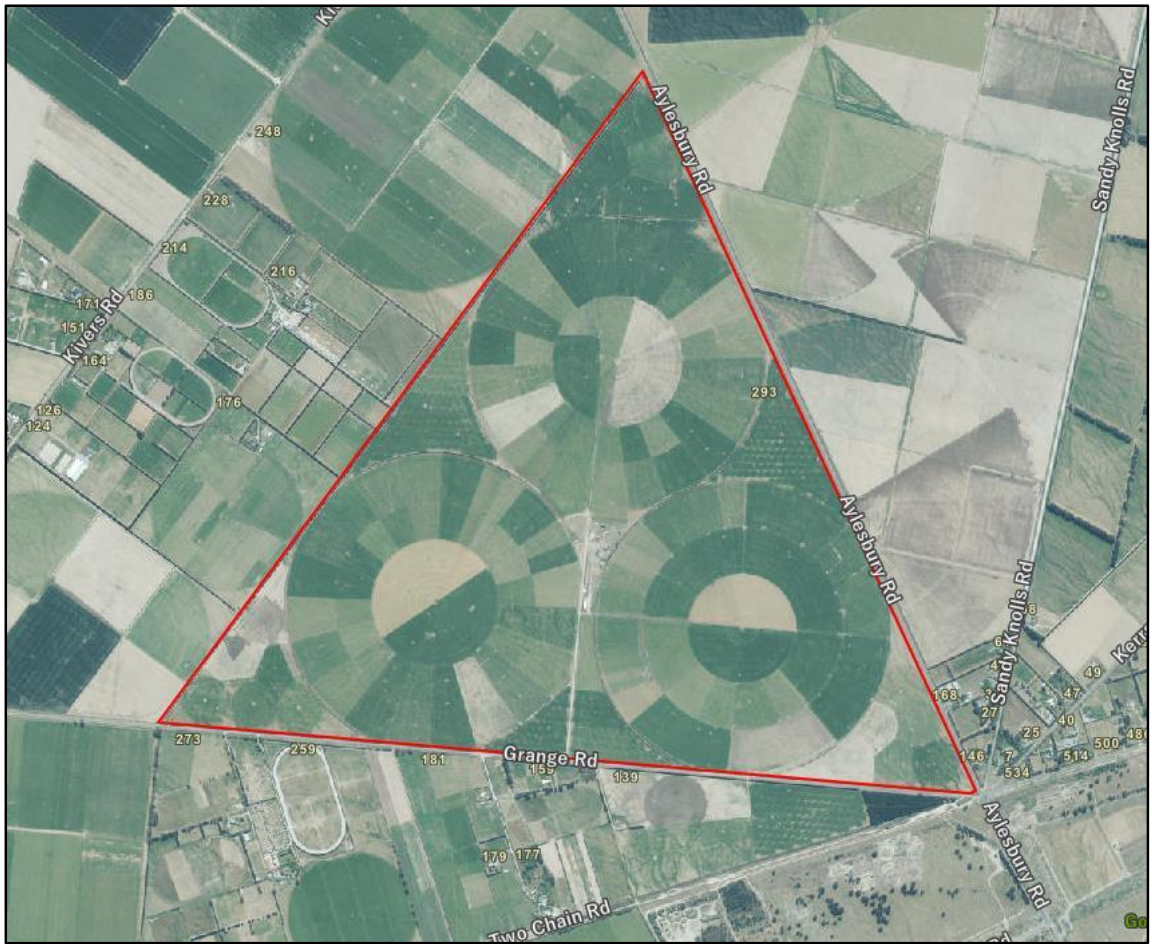


Figure 1-2. Aerial image of the current project area (outlined in red). Image: Canterbury Maps, 2022.

2 Statutory Requirements

The legislative requirements relating to archaeological sites and artefacts are detailed in the following sections. There are two main pieces of legislation that provide protection for archaeological sites: the Heritage New Zealand Pouhere Taonga Act 2014 and the Resource Management Act 1991. Artefacts are further protected by the Protected Objects Act 1975.

2.1 Heritage New Zealand Pouhere Taonga Act 2014

The Heritage New Zealand Pouhere Taonga Act 2014 came into effect in May 2014, repealing the Historic Places Act 1993. The purpose of this act is to promote identification, protection, preservation, and conservation of New Zealand's historical and cultural heritage. Heritage New Zealand administers the act and was formerly known as the New Zealand Historic Places Trust (Pouhere Taonga).

Archaeological sites are defined by this act as

(a) any place in New Zealand, including any building or structure (or part of a building or structure), that:
  (i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and
  (ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and
(b) includes a site for which a declaration is made under section 43(1)

Additionally, Heritage New Zealand has the authority (under section 43(1)) to declare any place to be an archaeological site if the place

(a) was associated with human activity in or after 1900 or is the site of the wreck of any vessel where that wreck occurred in or after 1900; and
(b) provides, or may be able to provide, through investigation by archaeological methods, significant evidence relating to the historical and cultural heritage of New Zealand.

Archaeological sites are protected under Section 42 of the act, and it is an offense to carry out work that may "modify or destroy, or cause to be modified or destroyed, the whole or any part of that site if that person knows, or ought reasonably to have suspected, that the site is an archaeological site", whether or not the site has been previously recorded. Each individual who knowingly damages or destroys an archaeological site without having the appropriate authority is liable, on conviction, to substantial fines (Section 87).

Any person wishing to carry out work on an archaeological site that may modify or destroy any part of the site, including scientific investigations, must first obtain an authority from Heritage New Zealand (Sections 44(a,c)). The act stipulates that an application must be sought even if the effects on the archaeological site will be no more than minor as per Section 44(b). A significant change from the Historic Places Act (1993) is that "an authority is not required to permit work on a building that is an archaeological site unless the work will result in the demolition of the whole of the building" (Section 42(3)).

Heritage New Zealand will process the authority application within five working days of its receipt to assess if the application is adequate or if further information is required (Section 47(1)(b)). If the application meets the requirements under Section 47(1)(b), it will be accepted and notice of the determination will be provided within 20 to 40 working days. Most applications will be determined within 20 working days, but additional time may be required in certain circumstances. If Heritage New Zealand requires its own assessment of the Māori values for the site, the determination will be made within 30 working days. If the application relates to a particularly complex site, the act permits up to 40 days for the determination to be made. Heritage New Zealand will notify the applicant and other affected parties (*e.g.*, the land owner, local authorities, iwi, museums, *etc.*) of the outcome of the application.

Once an authority has been granted, modification of an archaeological site is only allowed following the expiration of the appeals period or after the Environment Court determines any appeals. Any directly affected party has the right to appeal the decision within 15 working days of receiving notice of the determination.

Heritage New Zealand may impose conditions on the authority that must be adhered to by the authority holder (Section 52). Provision exists for a review of the conditions (see Section 53). The authority remains current for a period of up to 35 years, as specified in the authority. If no period is specified in the authority, it remains current for a period of five years from the commencement date.

The authority is tied to the land for which it applies, regardless of changes in the ownership of the land. Prior to any changes of ownership, the land owner must give notice to Heritage New Zealand and advise the succeeding land owner of the authority, its conditions, and terms of consent.

An additional role of Heritage New Zealand is maintaining the New Zealand Heritage list, which is a continuation of the Register of Historic Places, Historic Areas, Wāhi Tapu, and Wāhi Tapu Areas. The list can include archaeological sites. The purpose of the list is to inform members of the public about such places and to assist with their protection under the Resource Management Act 1991.

2.2 Resource Management Act 1991

The Resource Management Act 1991 (RMA) defines historic heritage as those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, and it may include historic sites historic sites, structures, places, and areas; archaeological sites; and sites of significance to Māori. It should be noted that this definition does not include the 1900 cut-off date for protected archaeological sites as defined by the Heritage New Zealand Pouhere Taonga Act 2014. Any historic feature that can be shown to have significant values must be considered in any resource consent application.

The heritage provisions of the RMA were strengthened with the Resource Management Amendment Act 2003. The Resource Management Amendment Act 2003 contains a more detailed definition of heritage sites and now considers historic heritage to be a matter of national importance under Section 6. The act requires city, district, and regional councils to manage the use, development, and protection of natural and physical resources in a way that provides for the well-being of today's communities while safeguarding the options of future generations.

Under the RMA, local authorities are required to develop and operate under a district plan, ensuring that historic heritage is protected. This includes the identification of heritage places on a heritage schedule (or list) and designation of heritage areas or precincts and documents the appropriate regulatory controls. All heritage schedules include, but are not limited to, all items on the New Zealand Heritage List/Rārangi Kōrero. Additional sites of significance to the local authority may also appear on the schedule.

The regulatory controls for historic heritage are specific to each local authority. However, most local authorities will require RMA resource consent for any alterations, additions, demolition, or new construction (near a listed place) with Heritage New Zealand being recognised as an affected party. Repair and maintenance are generally considered permitted activities.

2.3 Protected Objects Act 1975

The Protected Objects Act 1975 was established to provide protection of certain objects, including protected New Zealand objects that form part of the movable cultural heritage of New Zealand. Protected New Zealand objects are defined by Schedule 4 of the act and includes archaeological objects and taonga tūturu. Under Section 11 of the Protected Objects Act 1975, any newly found Māori cultural objects (taonga tūturu) are automatically the property of the Crown if they are older than fifty years and can only be transferred from the Crown to an individual or group of individuals through the Māori Land Court. Anyone who finds a complete or partial taonga tūturu, accidentally or intentionally is required to notify the Ministry of Culture and Heritage within:

(a) 28 days of finding the taonga tūturu; or
(b) 28 days of completing field work undertaken in connection with an archaeological investigation authorised by the Heritage New Zealand.

3 Methodology

An archaeological assessment is required to accompany an application for an archaeological authority, as stipulated in the Heritage New Zealand Pouhere Taonga Act 2014. In order to assess the archaeological resources of the project area, UOA conducted detailed documentary research and examined records of previously recorded site within the vicinity of the project area. A site visit to the area was not undertaken as potential sites were initially determined to be below the ground surface and would not be visible.

UOA consulted numerous sources of documentary evidence in order to determine the historical context of the project area. The results of the documentary research are provided in Section 4. The sources utilised in this research include:

- sources regarding the Māori occupation and developments
- local histories
- 19th century newspapers available through the Papers Past website
- LINZ survey plans and land titles
- historic aerial photographs

Previously recorded archaeological sites near the project area can provide information that is valuable for assessing the archaeology. UOA carried out a search of ArchSite to identify if there are any previously recorded sites on or near the project area. The results of the ArchSite search are documented in Section 5.

The assessment of archaeological and other values is based on criteria established by Heritage New Zealand (2019):

- The **condition** of the site(s).
- Is the site(s) unusual, **rare or unique**, or notable in any other way in comparison to other sites of its kind?
- Does the site(s) possess **contextual value**? Context or group value arises when the site is part of a group of sites which taken together as a whole, contribute to the wider values of the group or archaeological, historic or cultural landscape. There are potentially two aspects to the assessment of contextual values; the relationship between features within a site, and the wider context of the surroundings.
- **Information potential**. What current research questions or areas of interest could be addressed with information from the site(s)? Archaeological evaluations should take into account current national and international research interests, not just those of the author.
- **Amenity value** (e.g., educational, visual, landscape). Does the site(s) have potential for public interpretation and education?
- Does the site(s) have any special **cultural associations** for any particular communities or groups (e.g., Māori, European, Chinese.)

The overall level of significance was determined based on the evaluation of the criteria listed above; however, it is not possible to fully understand the archaeological significance of subsurface sites, features, and materials uncovered during the site works. It is important to recognise that the significance of a site may change on the basis of what is found during the work programme.

After determining the history of the site(s) and evaluating its archaeological value, UOA assessed the effects of the proposed work on the site. Specifically, UOA considered the following matters as outlined by Heritage New Zealand (2019):

- How much of the site(s) will be affected, and to what degree, and what effects this will have on the values of the site(s).
- Whether the proposed work may increase the risk of damage to the site(s) in future. For example, change from farming to residential use may make sites vulnerable to increased pedestrian and vehicular activity.

- Whether a re-design may avoid adverse effects on the site(s). It is recognised that detailed evaluation of alternatives may be beyond the scope of the archaeological assessment, however, some consideration of alternatives should be considered where possible.
- Possible methods to protect sites, and avoid, minimise or mitigate adverse effects should be discussed. These will form the basis of any recommendations in the final section.

Measures of reducing the potential adverse effects on the site(s), management of the archaeological resources, and mitigation of information loss were considered.

4 Historical Background

Traditional accounts relate to successive migrations to Te Wai Pounamu (the South Island) from Te Ika a Māui (the North Island). The earliest groups noted in oral traditions include Kāhui-Tipua, Hawea and Te Rapuwai, and Ngāi Tahu scholars have considered these groups as at least semi-mythical, as traditions regarding them are typically aetiological narratives explaining the origins of such things as kūmara or the Moeraki Boulders. Traditions regarding later groups (Waitaha, Ngāti Māmoe, and Ngāi Tahu) are by contrast primarily related to human events, rather than the supernatural (Tau and Anderson, 2008).

The first human settlers of Te Wai Pounamu for which traditional accounts and whakapapa are clear were Waitaha, descendants of the explorer Rākaihautū who arrived in the waka *Uruao*. They were followed later by Ngāti Māmoe, who migrated from Te Ika a Māui to the South Island around the late 16th/early 17th centuries. The relationship between Waitaha and Ngāti Māmoe was complicated, with periods of peace and intermarriage as well as conflict, but Ngāti Māmoe gradually came to establish mana whenua through both means over much of the South Island. In the early to mid-17th century, Ngāi Tahu migrated to the South Island from the lower North Island, and traditions recount their whakapapa to the East Coast and the *Tākitimu* waka. As with their predecessors, Ngāi Tahu came to establish mana whenua over most of the South Island through both conflict and intermarriage (Anderson, 1998; Tau and Anderson, 2008).

During the exploration of the Canterbury coast, Te Waihora (Lake Ellesmere) was found to be a plentiful source of fish and birds and attracted many Māori settlers to the area. Similarly, the Waikirikiri (Selwyn River) which flows from the Canterbury foothills across Kā Pākihi-whakatekateka-a-Waitaha (the Canterbury Plains) into Te Waihora, was also found to be a plentiful source for tuna (eels), inaka (whitebait), pūtakitaki (paradise duck), pārera (grey duck), pākura/pūkeko (swamp hen), pora (Māori cabbage), tutu, and aruhe (bracken fernroot). Numerous kāinga and mahinga kai were therefore established along its course, including the key settlement of Te Waikari, near modern-day Chamberlains Ford (Mahaanui Kurataiao Limited, 2019; Te Rūnanga o Ngāi Tahu, 2022).

Although the Waikirikiri and its surrounds are known to have been a treasured landscape for local Māori, as the current project area is located over 5 km away from the current footprint of the Selwyn River, it is unlikely that Māori archaeological material will be uncovered during the current project.

Following the acquisition of the land by the British Crown under the Kemp purchase in 1848, the land directly adjoining the city of Christchurch was surveyed into small rural sections while the surrounding land was taken up as large pastoral runs in the early 1850s. The land comprising the current project area appears to have been taken up at this time as part of Pastoral Run 40, which formed part of the Broadlands Station (Figure 4-1).

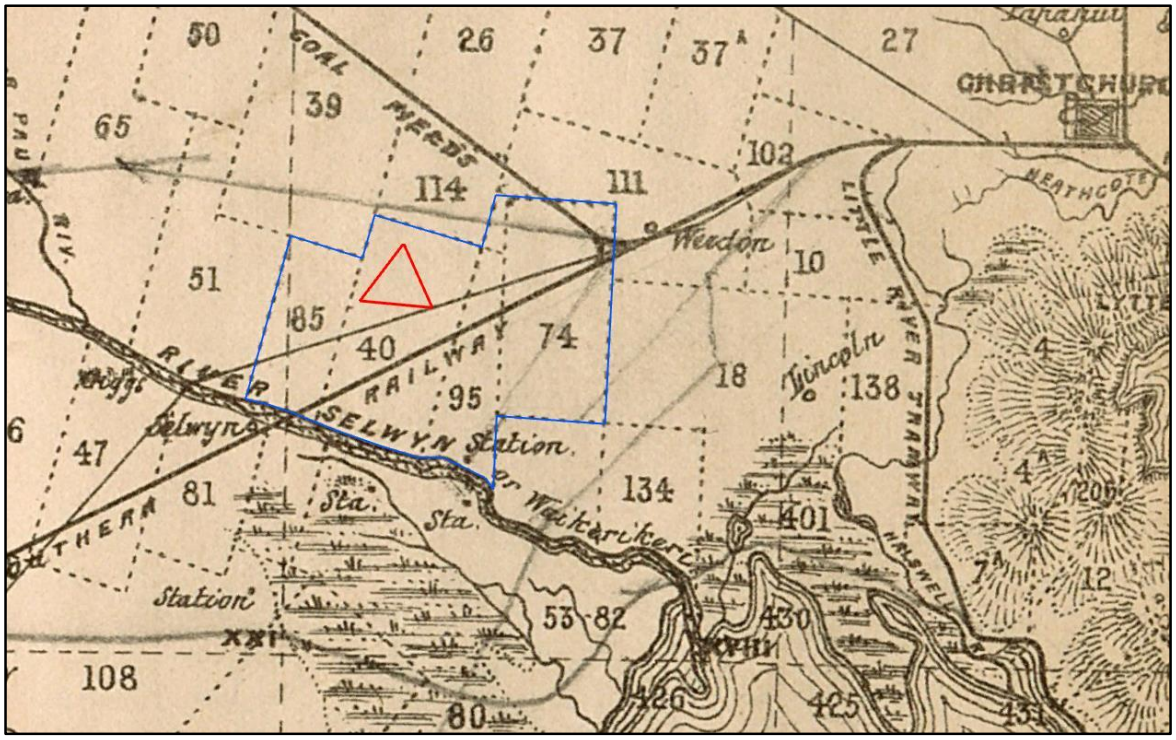


Figure 4-1. Map of the early Canterbury Pastoral Runs, showing current project area (outlined in red) located within Pastoral Run 40 which formed part of the Broadlands estate (outlined in blue). Image: Browning, 1860.

4.1 Broadlands Station - Pastoral Runs 40, 76, 85, and 95

John Cracroft Wilson took up Pastoral Runs 40, 76, 85 and 95 between 1854 and 1862, and he named the estate Broadlands.[1] Wilson owned a significant holding of land in Canterbury, including the Culverden, Highpeak, and Cracroft stations and the extensive Cashmere estate in Christchurch where he resided. During the 1850s and early 1860s Broadlands was worked as a cattle station, but during the late 1860s it was converted to a sheep station. Wilson hired Charles Hunt McAlpine as the Broadlands station manager in 1864, but shortly afterwards McAlpine became Wilson's partner. McAlpine then bought out Wilson in 1868 and continued to run the Broadlands estate until his death in 1872. Following McAlpine's death, his trustees appointed Hugh Knyvett as the manager of the Broadlands Station. Knyvett continued to manage the estate until the late 1870s when it began to be subdivided into rural sections and broken up into smaller farms (Acland, 1946: 38-39; MacDonald, 1952-1964: W599). Although it is likely that the land comprising the current project area was farmed during the 1850-1870s as part of the Broadlands estate, there is no evidence to suggest that the property was developed beyond agricultural purposes at this time. The 1860 map of the Canterbury pastoral runs suggests that the Broadlands Station house, where the manager likely resided, was located on Run 95 adjoining the Selwyn River over 6 km from the current project area (Figure 4-1).

When the Broadlands Station began to be subdivided into smaller rural sections, the land comprising the current project area was surveyed as Rural Sections 19387, 25412, 27724, 27776, and 27777, forming the legal boundaries of the current project area (Figure 4-2).

[1] Prior to Wilson purchasing Runs 74 and 85 they had been run together as a dairy station by William Browning Tosswill and Henry Francis Worsley between 1854 and 1862.

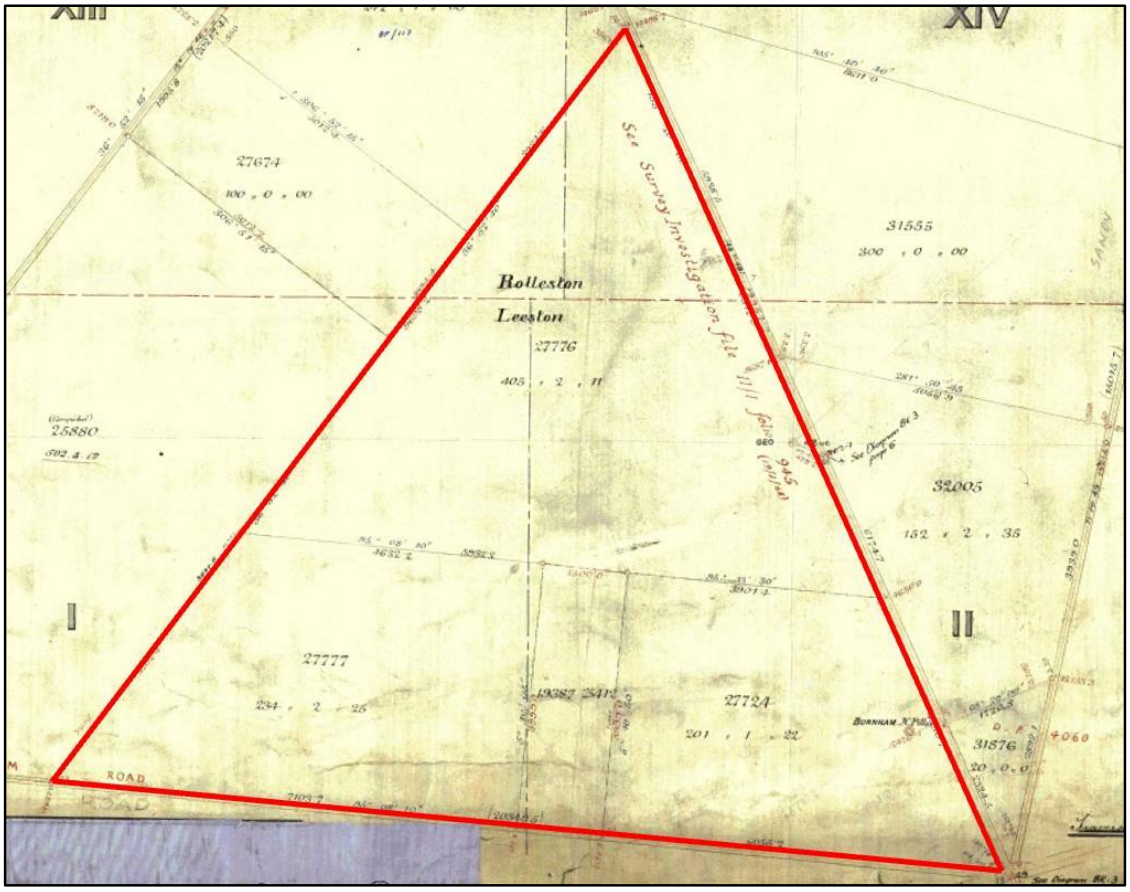


Figure 4-2. Detail from Survey Plan 2541, showing the current project area (outlined in red) surveyed as Rural Sections 19387, 25412, 27724, 27776, and 27777 in 1879. Image: LINZ, 1879.

4.2 Rural Sections 19387 and 25412

Rural Sections 19387 and 25412 comprise 52 acres of land fronting Grange Road (Figure 4-3). John Crop (also appears as Cross on Crown Grant) a labourer, was granted Rural Sections 19387 and 25412 by the Crown in February 1878 (LINZ, 1878). While no information could be found regarding a John Crop, there are references to a John Cross residing in the Burnham area in the Canterbury electoral rolls and newspapers in the 1870s-early 1890s (New Zealand Electoral Roll [Coleridge] 1885-1886: 4; [Selwyn] 1890: 5); *Press*, 25/3/1875: 4; *Star*, 23/8/1880: 4). Unfortunately, none of these references to John Cross indicate that he was occupying or residing on Rural Sections 19387 or 25412 during his ownership. John Crop/Cross continued to own the two rural sections until 1892.



Figure 4-3. Detail from Survey Plan 2541, showing the boundaries of Rural Sections 19387 and 25412 (outlined in blue). Image: LINZ, 1879.

Margaret Cross, wife of William Peter Cross, purchased Rural Sections 19387 and 25412 from Crop/Cross in 1892 and continued to own the sections until her death in 1923 (LINZ, 1878; *Press*, 27/2/1923: 13). It is possible that the Cross family are related to the previous owner of the property (Crop/Cross) though any such familial relationship is at present unknown. William Cross had arrived in Canterbury on board the *Lancaster Witch* in 1868 and after a few years farming in Brookside he decided to move to the Burnham area (MacDonald, 1952-1964: C827). Cross obtained a Crown Grant for Rural Section 14056 in 1872, which is located on the opposite side of Grange Road to the current project area (Figure 4-4; LINZ, 1870: 812). Cross is believed to have constructed a cob cottage on Rural Section 14056 in the c.1870s, which he called Burnham Grange, and the Cross family continued to reside in the dwelling for the remainder of William's life. The Burnham Grange cob cottage is still extant on the property today and is listed by Heritage New Zealand as a Category 1 Historic Place (Heritage New Zealand Pouhere Taonga, 2007). The extant building is located outside of the current project area and will not be affect by the proposed development. Although it is likely that the Cross family occupied Rural Sections 19387 and 25412 for agricultural purposes as part of their Burnham Grange premises, no information could be found to indicate that the two rural sections were developed beyond agricultural purposes during the 19th century. The Courtenay District Valuation Register, recorded in December 1908, indicates that Rural Sections 19387 and 25412 were fenced and laid out in grass but no buildings were present on the property at this time (Archives New Zealand, 1906-1911: 472).

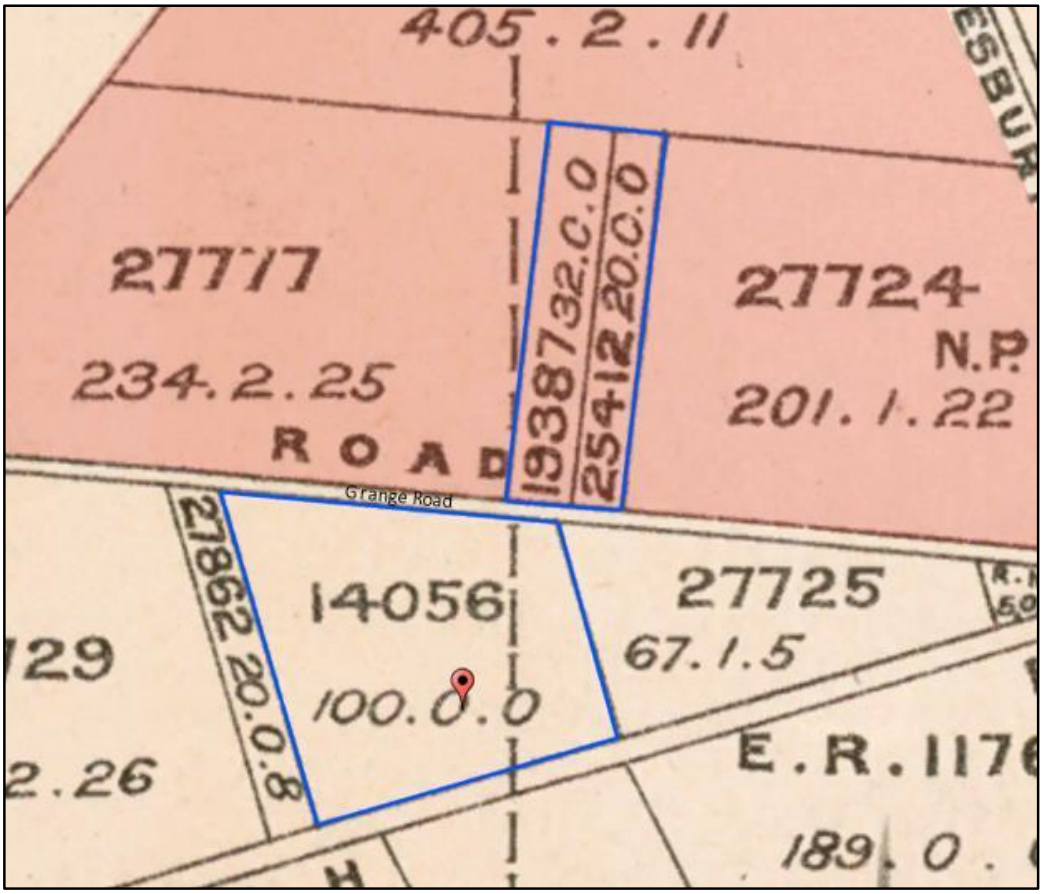


Figure 4-4. Detail from a map of the Leeston Survey District in 1895, showing three rural sections owned by the Cross family from 1892 (outlined in blue) and indicating the location of Cross's Burnham Grange cob cottage residence (red pin) outside of the current project area (indicated in red). Image: McCardell, 1895.

Following the death of Margaret Cross in 1923, ownership of Rural Sections 19387 and 25412 was taken up by John Johnston and Andrew Young, two farmers, who sold the sections to Charles Munro Smith in 1926 (LINZ, 1878). The development of Rural Sections 19387 and 25412 following the purchase by Charles Smith is continued in Section 4.4.

4.3 Rural Section 27724

Rural Section 27724 comprises just over 201 acres of land fronting Grange Road and Aylesbury Road (Figure 4-5). Edward John Tite Ford, a land agent, was granted Rural Section 27724 by the Crown in June 1886 (LINZ, 1886). Although no information could be found to indicate Ford occupied Rural Section 27724 during his ownership, Ford was recorded calling for tenders to sink a well in Burnham in July 1877 which may suggest he had taken ownership of Rural 27724 prior to the date of the Crown grant or that Ford, being a land agent, owned a number of properties in the Burnham area (*Star*, 17/7/1877: 2).

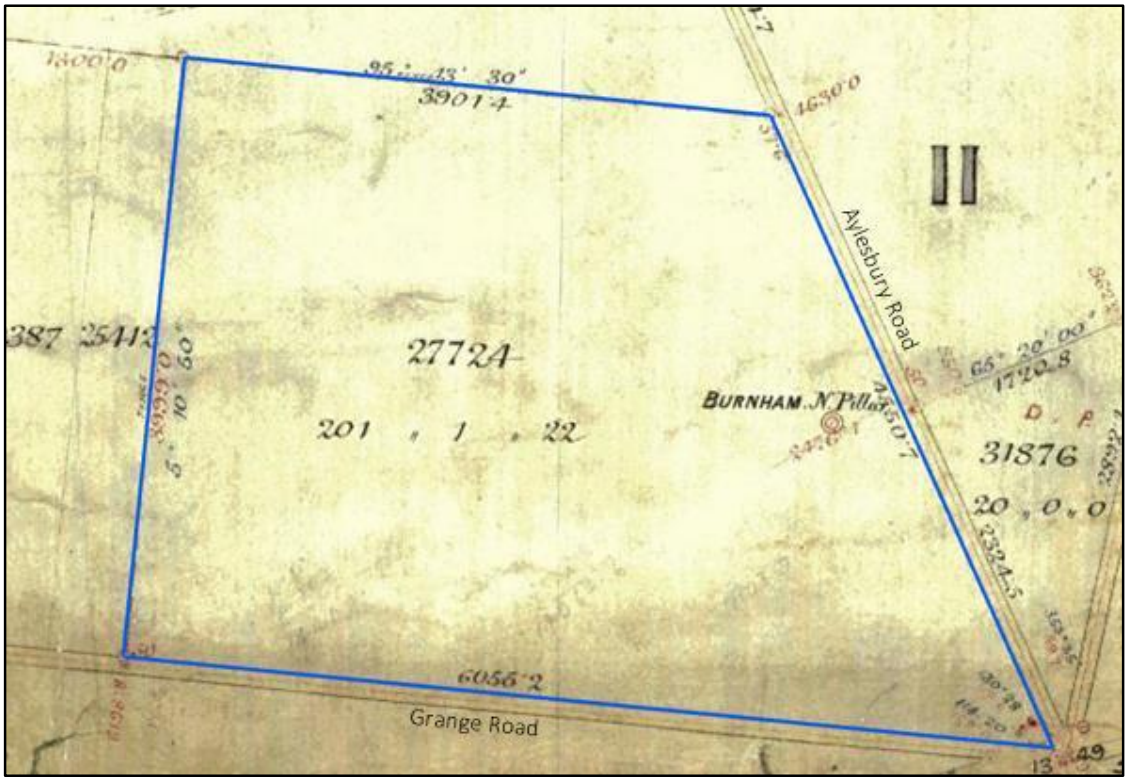


Figure 4-5. Detail from Survey Plan 2541, showing the boundaries of Rural Section 27724 (outlined in blue). Image: LINZ, 1879.

Robert Thompson, a Burnham farmer, purchased Rural Section 27724 from Ford in May 1889 (LINZ, 1889). Thompson sold the section within six months of purchasing it, and no information could be found to indicate he occupied or developed the land during his short tenure.

William Acton Adams, a solicitor, purchased Rural Section 27724 from Thompson in November 1889 (LINZ, 1889). The development of Rural Section 27724 following the purchase by William Adams is continued in Section 4.4.

4.4 Rural Section 27776 and 27777

Rural Sections 27776 and 27777 comprises 640 acres of land fronting Grange Road and Aylesbury Road (Figure 4-6). George Shaw, of Wellington, was granted Rural Sections 27776 and 27777 by the Crown in August 1884 but Shaw appears to have taken ownership of the land prior to this date, as he had already sold the section to George Michael Topham in July 1878 (LINZ, 1884). No information could be found to suggest the property was developed during Shaw's ownership.

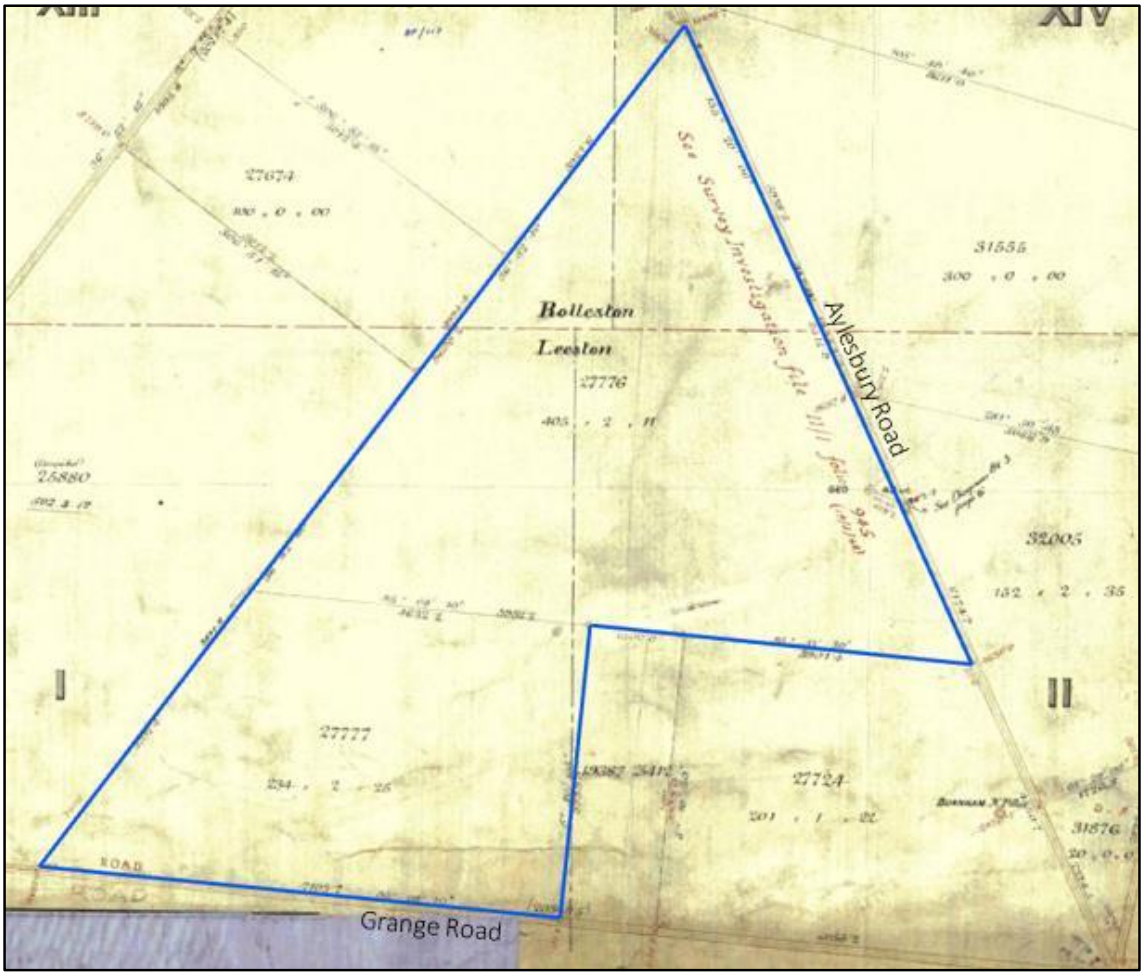


Figure 4-6. Detail from Survey Plan 2541, showing the boundaries of Rural Section 27776 and 27777 (outlined in blue). Image: LINZ, 1879.

George Michael Topham, a farmer in Upper Riccarton, purchased Rural Sections 27776 and 27777 in July 1878 and continued to own them until August 1885 (LINZ, 1884). Topham owned a number of properties in the Templeton, Yaldhurst, and Riccarton areas which he farmed (*Lyttelton Times*, 2/5/1876: 1). No information could be found to indicate Topham occupied or developed Rural Sections 27776 and 27777 during his ownership, however, evidence does suggest that he let the land to tenants during his ownership. In June 1878, Topham had advertised 100 acres of land in the Burnham area for lease, which either suggests Topham owned the two relevant rural sections prior to the date recorded on his certificate of title or that he owned a number of sections in the Burnham area as investments. Topham was recorded leasing Rural Sections 27776 and 27777 to a tenant in January 1881 (LINZ, 1884). Unfortunately, the name of the leaseholder is illegible on the certificate of title. It is not known if the tenant occupied the premises beyond agricultural purposes during their tenancy. Topham sold Rural Sections 27776 and 27777 in August 1885, at which time the sales notice indicates that it was purchased for £3 3s per acre, but no information is provided to indicate if the property contained any buildings or other developments (*Lyttelton Times*, 3/8/1885: 4).

Edward Salter, a land agent, and his son, Charles Edward Salter, a solicitor, purchased Rural Sections 27776 and 27777 in August 1885 (LINZ, 1884). It is likely that the Salters purchased the property as an investment, as no information could be found to indicate they occupied the property during their ownership. The 640 acres of land comprising Rural Sections 27776 and 27777 was offered for sale in September 1886, at which time the property was described as being covered in freshly laid grass, but there was no indication that the property contained any buildings or other developments (*Lyttelton Times*, 22/9/1886: 8). The property did not initially sell in 1886, and the Salters again offered if for sale in Match 1888 (*Press*, 21/3/1888: 4).

William Moir, a merchant, purchased Rural Sections 27776 and 27777 in May 1888 (LINZ, 1884). Moir offered 640 acres of land in Burnham for lease in September 1888, at which time the property was described as being subdivided into convenient paddocks and laid down in English grass but no information was found to suggest the property contained any buildings or other developments at this time (*Press*, 28/9/1888: 8). Moir does not appear to have found a tenant for the property in 1888, as a few months later in March 1889, Moir offered the 640-acre property for sale, describing it only as being subdivided into eight paddocks divided by live and dead fences and covered in English grass or native tussock (*Lyttelton Times*, 13/3/1889: 7).

William Acton Adams, a solicitor, purchased Rural Sections 27724, 27776, and 27777 in November 1889 and continued to own the properties until 1906 (LINZ, 1884; LINZ, 1889). Adams owned a significant holding of land in Canterbury and Nelson, but no information could be found to indicate he occupied Rural Sections 27724, 27776, and 27777 during his ownership (MacDonald, 1952-1964: A36). However, Adams does appear to have let at least part of the premises to tenants. In July 1890, at the meeting of creditors in the bankrupt estate of William Summerville, Summerville stated that he farmed 201 acres of land at Burnham (likely a reference to Rural Section 27724) which he leased from William Adams from a term of 5 years. Summerville further states, that his landlord (Adams) induced him to purchase iron from Matson and Struthers and wood from E. W. England to erect a stable, shed, and fencing on the property (*Lyttelton Times*, 3/7/1890: 3). Although Somerville indicates that he was induced to purchase the materials, there is no further evidence to suggest that he erected any buildings on the premises during the tenure of his lease.

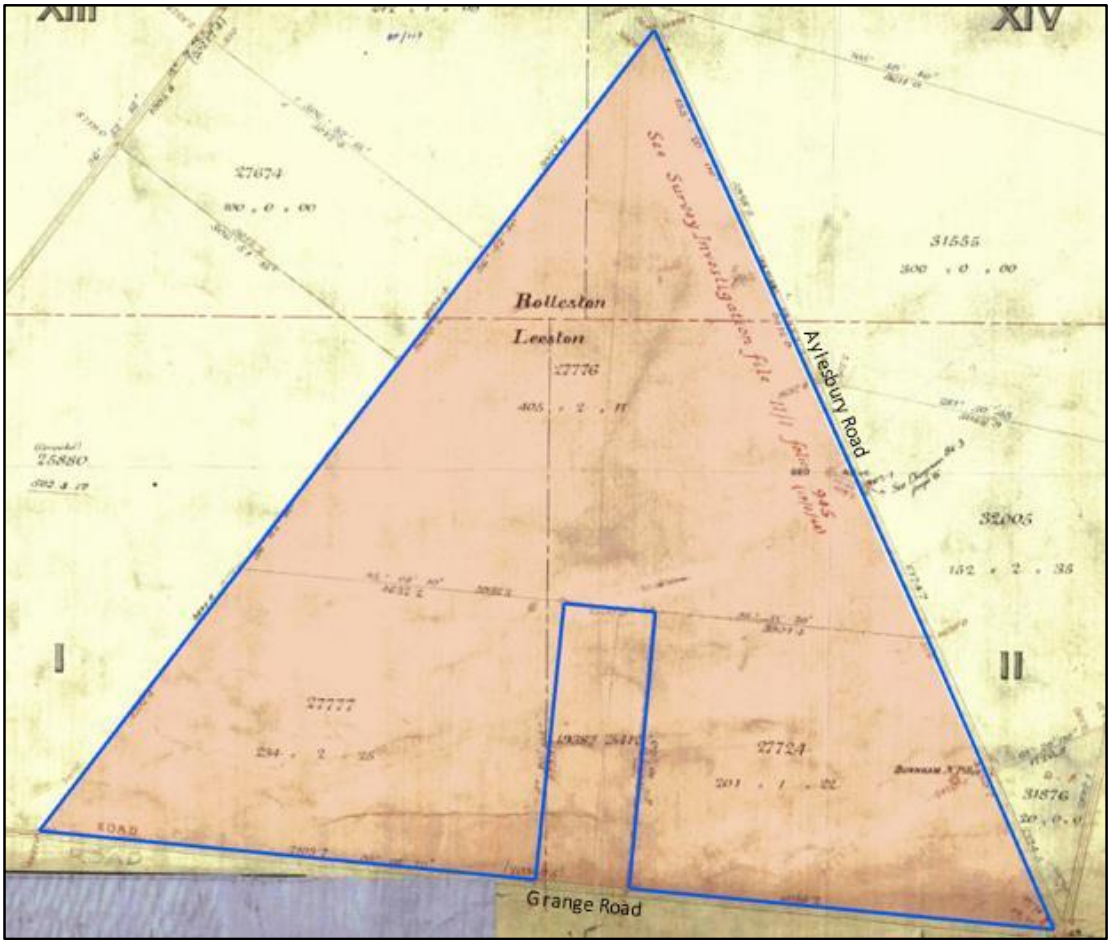


Figure 4-7. Detail from Survey Plan 2541, showing the boundaries of William Adams property (outlined in blue) and indicating the project area (coloured red). Image: LINZ, 1879.

William Frederick Conway, a farmer from Cust, purchased Rural Sections 27724, 27776, and 27777 from Adams in 1906 and continued to own them until 1913 (LINZ, 1884; LINZ, 1889). The Courtenay Road District Valuation Register, recorded in December 1908, indicates that Rural Sections 27724, 27776, and 27777 were

fenced and laid out in grass but no buildings were present on the property at this time (Archives New Zealand, 1906-1911: 493). This further suggests that no developments occurred on the property during the 19th century. Eli Scott, a farmer from Omihi, purchased Rural Sections 27724, 27776, and 27777 from Conway in 1913 and continued to own them until 1919 (LINZ, 1884; LINZ, 1889). Charles Munro Smith, a Lincoln flour miller, purchased Rural Sections 27724, 27776, and 27777 in 1919 and extended the boundaries in 1926 by purchasing the adjoining Rural Sections 19387 and 25412 in 1926 (LINZ, 1878). Smith was the first owner to combine all of the land comprising the current project area into one property.

His Majesty the King purchased the whole project area in 1936, and in 1937 he vested the land in the Selwyn Plantation Board for the purposes of planting, officially conveying it to them in 1994 (LINZ, 1878; LINZ, 1884; LINZ, 1889). Aerial imagery from 1942 shows the majority of the project area as pasture, suggesting that the land was being used for agricultural purposes at this time (Figure 4-8). The aerial imagery further reveals a dwelling and outbuildings present on part of Rural Section 27724, located at the corner of Aylesbury Road and Grange Road (Figure 4-9). As these buildings were not indicated to be present on the property in the 1908 valuation register, it suggests that the buildings were erected between 1908 and 1942. By the 1970s, portions of the project area were being used for forestry purposes (Figure 4-10). The 20th century dwelling house remained on the corner of Aylesbury Road and Grange Road until the c.1980s when it was removed (Canterbury Maps, 2022). The land comprising the project area was converted from a forestry block into an irrigated sheep and beef finishing farm by the Selwyn Plantation Board in 2005 and subsequently has been used as dairy grazing for Camden Group dry stock since 2010 (Camden Group, 2020).



Figure 4-8. Aerial imagery from 1942, showing the developments present within the current project area (outlined in red). Image: LINZ, 1942a; LINZ, 1942b.



Figure 4-9. Aerial imagery from 1942, showing the dwelling and outbuildings present on part of Rural Section 27724 on the corner of Aylesbury Road and Grange Road. Image: LINZ, 1942b.



Figure 4-10. Aerial imagery from 1974, showing the developments present within the current project area (outlined in red). Image: LINZ, 1974.

5 Previous Archaeological Investigations

There are no previously recorded archaeological sites located within the current project area (Figure 5-1). There are three recorded archaeological sites in the vicinity of the current project area, all of which are located within the site of the Burnham Military Camp. Archaeological site M36/412 records the site of the Burnham Industrial School which operated on the site of the Burnham Military Camp between 1873 and 1918. Archaeological site M36/270 records the location of the former 19th century Burnham Industrial School office building which was demolished in 2013. Archaeological site M36/408 records the site of the c.1864 All Saints Church which was moved onto the Industrial School site in 1903. None of these archaeological sites will be affected by the current project.

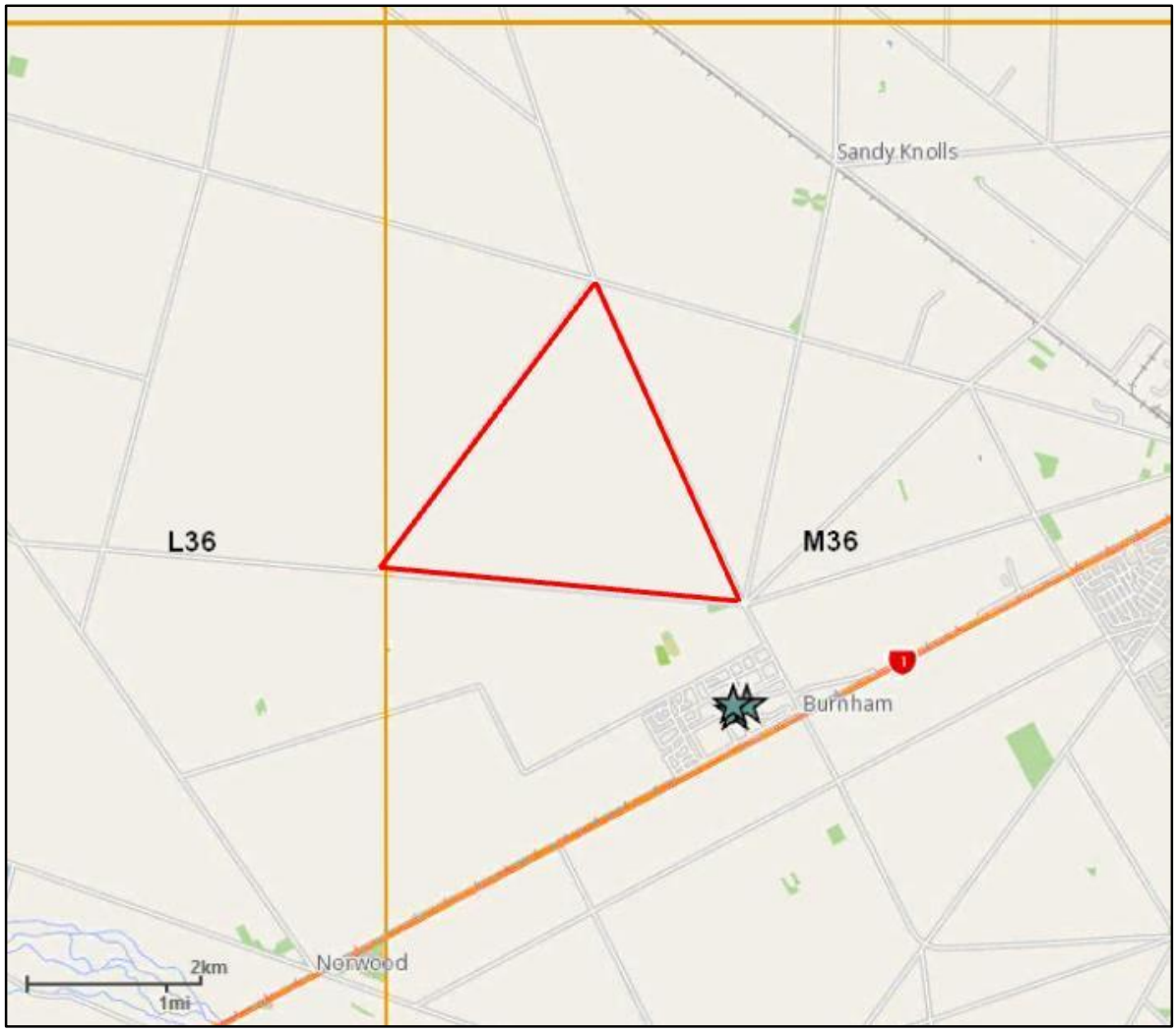


Figure 5-1. Map showing the recorded archaeological site in the vicinity of the project area (outlined in red). Image: ArchSite, 2022.

6 Constraints and Limitations

The historical narrative of the current project area is hindered by the limited information regarding the large farming properties in rural Canterbury. As it was common for large landowners to hire overseers to manager their estates, it is often difficult to find information regarding who was occupying these large properties and what developments they undertook on them.

7 Conclusions and Recommendations

Although there is a wider history of Māori and European occupation in the Burnham area, insufficient evidence was found during the research to suggest that the proposed area of works was occupied beyond pastoral uses prior to 1900. As such, it is considered unlikely that pre-1900 archaeological material would be uncovered during works in the area.

As such, UOA makes the following recommendations:

1. As a first principle, every practical effort should be made to avoid damage to any archaeological site discovered during the earthworks on the site.
2. The project should proceed under the Archaeological Discovery Protocol, outlined below. Any archaeological material encountered during the works should be reported to an archaeologist and Heritage New Zealand Pouhere Taonga. Local iwi should be consulted in the first instance if Māori material is encountered.

8 References

Acland, L. G. D., 1946. *Early Canterbury Runs*. Christchurch: Whitcombe and Tombs Limited.

Anderson, A., 1998. *The welcome of strangers: An Ethnohistory of Southern Maori A.D. 1650-1850*. Dunedin: Otago University Press.

Archives New Zealand, 1850. *Black Map 188 – Pastoral Runs Waipara River to Rangitata River*. Archives New Zealand, Christchurch Regional Office, CAYN-23142-CH1031-BM188-R22668127.

Archives New Zealand, 1906-1911. *Courtenay Road District - Valuation Register*. Archives New Zealand, Christchurch Regional Office, CAIG-3308-CH507-Box96/a-4/41-R2087339.

ArchSite, 2022. New Zealand Archaeological Association. [online] Available at: <https://archsite.eaglegis.co.nz/NZAA> Accessed May 2022

Browning, J. S., 1860. *Map of the Province of Canterbury, New Zealand, shewing the Pasturage Runs*. Christchurch City Libraries [online] Avaliable at: <https://christchurchcitylibraries.com/heritage/maps/220035.asp> Accessed June 2022.

Camden Group, 2020. *Aylesbury Grazing, Burnham*. [online] Avaliable at: <https://camdengroup.co.nz/portfolio/burnham/> Accessed June 2022.

Canterbury Maps, 2022. *Tour back in time through Christchurch, New Zealand*. [online] Available at: <http://canterburymaps.govt.nz/WebApps/tourofchch/#> Accessed May 2022.

Globe, 1874-1882. [online] Available at: <https://paperspast.natlib.govt.nz/newspapers> Accessed May 2022.

Google Earth, 2022. [online] Avaliable at: <https://earth.google.com/web/> Accessed May 2022.

H. Wise and Co. 1866-1954. Wises New Zealand Post Office Directories. Dunedin: H. Wise & Co.

Heritage New Zealand Pouhere Taonga, 2007. *Burnham Grange Sod Cottage*. [online] Heritage New Zealand List #7710. Available at: <https://www.heritage.org.nz/the-list/details/7710> Accessed June 2022.

Heritage New Zealand Pouhere Taonga (HNZPT), 2019. *Writing Archaeological Assessments. Archaeological Guidelines Series No. 02*. *Archaeological Guidelines Series 02*. Wellington: New Zealand Historic Places Trust Pouhere Taonga.

LINZ, 1870. *Canterbury Land District Deeds index – C15 – 13245-14972 – Rural sections register.* Archives New Zealand, Christchurch office, R22765330.

LINZ, 1878. *Certificate of Title 31/285, Canterbury*. Landonline.

LINZ, 1879. *SO 2541, Canterbury*. Landonline.

LINZ, 1884. *Certificate of Title 82/294, Canterbury*. Landonline.

LINZ, 1886. *Certificate of Title 120/213, Canterbury*. Landonline.

LINZ, 1889. *Certificate of Title 137/244, Canterbury*. Landonline.

LINZ, 1942a. Retrolens Historic Image Resource, Survey Number: SN224, Run 148, Photo Number 21. Available at <http://retrolens.nz/> Accessed June 2022.

LINZ, 1942b. Retrolens Historic Image Resource, Survey Number: SN224, Run 148, Photo Number 22. Available at <http://retrolens.nz/> Accessed June 2022.

LINZ, 1974. Retrolens Historic Image Resource, Survey Number: SN2713, RunB, Photo Number 2. Available at <http://retrolens.nz/> Accessed June 2022.

Lyttelton Times, 1851-1920. [online] Available at: https://paperspast.natlib.govt.nz/newspapers

MacDonald, G. R., 1952-1964. *Macdonald Dictionary of Canterbury Biography Project*. [online] Avalaible at: https://collection.canterburymuseum.com/objects> Accessed May 2022.

Mahaanui Kurataiao Limited, 2019. *Mahaanui Kurataiao - Te Taumutu Rūnanga*. [online] Available at: <https://mahaanuikurataiao.co.nz/te-taumutu-runanga> Accessed June 2022.

McCardell, H., 1895. *Leeston Survey District*. National Library of New Zealand [online] Avaliable: <https://natlib.govt.nz/records/21703560> Accessed June 2022.

New Zealand Electoral Roll, 1853-1981 [online]. Available at <http://home.ancestry.com.au/> Accessed June 2022.

Press, 1861-1945. [online] Available at: https://paperspast.natlib.govt.nz/newspapers

Star, 1868-1920. [online] Available at: https://paperspast.natlib.govt.nz/newspapers

Tau, T. M., and Anderson, A. (Eds.)., 2008. *Ngāi Tahu: A migration History - the Carrington text*. Wellington: Bridget Williams Books.

Taylor, W.A., 1952. *Lore and history of the South Island Maori*. Christchurch, N.Z.: Bascands Ltd.

Te Rūnanga o Ngāi Tahu, 2022. *Ngāi Tahu Atlas*. [online] Kā Huru Manu. Available at: <http://www.kahurumanu.co.nz/atlas> Accessed June 2022.

In the event that an unidentified archaeological site is located during works, the following applies:

1. Work shall cease immediately at that place and within 10 m around the site.
2. The contractor must shut down all machinery, secure the area, and advise the Site Manager.
3. The Site Manager shall secure the site and notify Underground Overground Archaeology Ltd. Further investigation by an archaeologist may be required.
4. If the site is of Māori origin, the Site Manager or project archaeologist shall notify the Heritage New Zealand Regional Archaeologist and the appropriate iwi groups or kaitiaki representative of the discovery and ensure site access to enable appropriate cultural procedures and tikanga to be undertaken, as long as all statutory requirements under legislation are met (*Heritage New Zealand Pouhere Taonga Act*, Protected Objects Act).
5. If human remains (kōiwi tangata) are uncovered the Site Manager or project archaeologist shall advise the Heritage New Zealand Regional Archaeologist, NZ Police and the appropriate iwi groups or kaitiaki representative and the above process under 4 shall apply. Remains are not to be moved until such time as iwi and Heritage New Zealand have responded.
6. Works affecting the archaeological site and any human remains (kōiwi tangata) shall not resume until Heritage New Zealand gives written approval for work to continue. Further assessment by an archaeologist may be required.
7. Where iwi so request, any information recorded as the result of the find such as a description of location and content, is to be provided for their records.
8. The project archaeologist, in consultation with Heritage New Zealand, will determine if an archaeological authority under the *Heritage New Zealand Pouhere Taonga Act* 2014 is required for works to continue.

It is an offence under S87 of the *Heritage New Zealand Pouhere Taonga Act* 2014 to modify or destroy an archaeological site without an authority from Heritage New Zealand irrespective of whether the works are permitted or a consent has been issued under the Resource Management Act.

Contact details

Underground Overground Archaeology Ltd
Director
Hayden Cawte
Hayden.cawte@underoverarch.co.nz
027 600 6152

Branch Manager
Kirsa Webb
kirsa.webb@underoverarch.co.nz
(03) 365 4686

Heritage New Zealand Pouhere Taonga
Area Archaeologist
Frank van der Heijden
archaeologistCW@heritage.org.nz
(03) 363 1884



Burnham Quarry

The economic significance of the proposed new Quarry at Burnham in Canterbury

NZIER report to Winstone Aggregates Ltd

24 July 2023

About NZIER

NZIER is a specialist consulting firm that uses applied economic research and analysis to provide a wide range of strategic advice.

We undertake and make freely available economic research aimed at promoting a better understanding of New Zealand's important economic challenges.

Our long-established Quarterly Survey of Business Opinion (QSBO) and Quarterly Predictions are available to members of NZIER.

We pride ourselves on our reputation for independence and delivering quality analysis in the right form and at the right time. We ensure quality through teamwork on individual projects, critical review at internal seminars, and by peer review.

NZIER was established in 1958.

Authorship

This paper was prepared at NZIER by Peter Clough.

It was quality approved by Mike Hensen

Registered office: Level 13, Willeston House, 22–28 Willeston St | PO Box 3479, Wellington 6140
Auckland office: Ground Floor, 70 Shortland St, Auckland
Tel 0800 220 090 or +64 4 472 1880 | econ@nzier.org.nz | www.nzier.org.nz

© NZ Institute of Economic Research (Inc). Cover image © Dreamstime.com
NZIER's standard terms of engagement for contract research can be found at www.nzier.org.nz.

While NZIER will use all reasonable endeavours in undertaking contract research and producing reports to ensure the information is as accurate as practicable, the Institute, its contributors, employees, and Board shall not be liable (whether in contract, tort (including negligence), equity or on any other basis) for any loss or damage sustained by any person relying on such work whatever the cause of such loss or damage.



Key points

This report examines the economic effects of aggregates (rock, sand, gravel) production at the proposed Burnham Quarry against the key economic considerations in the Resource Management Act, in section 5's references to economic well-being, and section 7(b)'s references to efficient use of resources.

The economic contribution of an industry is often viewed in terms of its impact on the measured economy, GDP, exports and employment. On that basis quarrying makes a positive contribution to the Canterbury economy, but not a large one.

Aggregates are relatively cheap to obtain, as long as there are sources close to areas of demand. Aggregates have a low value but are bulky and heavy to transport, so transport costs rise rapidly if such material has to be carried to an area from afar. Quarrying is a regionally significant industry not because of the high value of its output or the incomes and employment it supports, but because of its underpinning role in development and maintenance of infrastructure. Without continuing access to aggregate sources within economic cartage distance to demand, infrastructure costs would rise, and its affordability would decrease, impacting all the region's industries that use and rely on infrastructure.

Quarrying makes an economic contribution by avoiding costs that would arise if quarried materials were less available, affecting the cost and timeliness of new infrastructure:

- Congestion of infrastructure of fixed capacity, such as roads, pipelines, interchanges
- Delay in the alleviation of costs and risks borne by the community, such as protections against natural hazards like flooding and repairs of landslips
- Delay in treating environmental degradation, which increases the cost of remediation and reduces the well-being for communities waiting for the remedial work.

In pre-COVID 2019 Canterbury accounted for around 29% of New Zealand's total production tonnage of rock and aggregate (26% by value), compared to around 12.5% of the nation's gross domestic product. Canterbury is one of the largest producers of rock and aggregate in New Zealand, supplying infrastructure projects that support the Christchurch earthquake rebuild and wider regional development.

Although located in a rural area, Burnham Quarry is well placed to serve demands in Christchurch metropolitan area. It would not be the only rock and aggregate quarry in the city's hinterland, as there are around 20 quarries still consented and potentially operating in the local market. That may raise objection that the area is well served by quarries already and does not need to endure the disruption and potential for adverse effects that a new quarry would bring to the area.

That, however, is a static view of quarries' place in the community and overlooks the significance of aggregates and rock as foundational materials for maintaining current infrastructure of roads and pipelines, houses and buildings. All these structures have a finite design life and need to be repaired or replaced periodically, due to weathering, wear and tear in use, or technological developments that render current infrastructure no longer fit for purpose. There is a continuing need to replenish supplies of aggregate and rock as existing quarries are worked, and the most readily accessible and versatile material is

removed from existing sources, leaving less versatile material with higher extraction cost from existing sites.

Quarries on the Canterbury Plains are unusually shallow compared to other regions because the groundwater is found relatively close to the surface. This increases the need to expand horizontally into new quarries, as there are limited options for digging deeper.

Demand for new sources of quarry material is likely to increase in the future, partly in response to population growth, fuelling new building for residential and work purposes. Demand may also increase because of the impacts of climate change, which is expected to bring more frequent and extreme weather events, more damaging storms and floods necessitating more frequent repair and replacement of roads, stormwater systems and other infrastructure; also more pre-emptive mitigation measures, such as stop-banks to reduce flood risk and water storage to limit disruption resulting from droughts and dry periods.

International agreements on curbing climate change aimed at reducing net emissions of greenhouse gases to the atmosphere are also likely to increase the cost of transport that relies on fossil fuelled propulsion, encouraging a change in urban density and new public transport systems to reduce the emissions associated with daily travel patterns. All these things suggest an increasing demand for quarry products as the foundation for new infrastructure and building patterns.

The adequacy of current quarries to meet such growth in demand is difficult to determine, as annual production and remaining resource are shrouded in commercial confidentiality. However, estimates of the annual production and remaining stocks of the 20 or so quarries identified in Christchurch's hinterland suggest there could be sufficient resource available to meet somewhere between 14 and 20 years of further production at current annual demand levels. New Zealand's Emissions Reduction Plan is aiming to achieve Zero Net Carbon by 2050, with other milestone targets to hit at intermediate years like 2035. Reaching such targets requires a continuous stream of new quarries becoming successively available in future years to ramp up supply as other quarries wind down.

From an economics perspective the critical question in considering consents for the Burnham Quarry is not does Canterbury need another quarry, but rather, would the quarry result in adverse effects on the environment sufficient to outweigh the benefits of enlarging the network of quarries supplying the region? More specifically, would the new quarry cause adverse environmental effects that cannot be avoided, mitigated or remedied or otherwise made less than significant by applying conditions at a cost that does not undermine the economic viability of the quarry? Given the Burnham site's rural location, few close neighbours and lack of restrictive overlays and designations, it is unlikely that consenting the Burnham Quarry will have significant adverse economic effects.

It is sometimes argued that adding another quarry to the mix serving a market of a given size will lower the market returns and utilisation of all suppliers. Such arguments imply there is an economic adverse effect of a new quarry, but such implication is inconsistent with the RMA and its section 7(b) interest in efficiency of resource use and development. There are benefits for competition and supply security in widening the range of quarries, and arguments about the sufficiency of existing quarries risks conferring market power on existing quarries and may violate the RMA's s104(3) requirement that consent authorities are not to have regard to trade competition.

Contents

1 Introduction 1

2 How to assess economic contribution 1

3 Existing environment of the proposed Burnham Quarry 3
- 3.1 Aggregate is heavy and costly to transport 3
- 3.2 Demand for aggregate moves with population and economic growth 4
- 3.3 Canterbury has higher than national average demand for aggregate 5
- 3.4 Strong growth is forecast for Canterbury 6

4 Effect on community well-being and efficient use of resources 7
- 4.1 Quarrying's contribution to the regional economy is positive but modest 7
- 4.2 But quarrying has a wider economic significance for its region 8

5 The efficiency of extending quarry resources and providing for new development 9

6 Summary and conclusions 11

Figures

Figure 1 Production of aggregates (rock, sand, gravel) in New Zealand, 1993-2021 6

Tables

Table 1 Production of aggregates in Canterbury and New Zealand 5

1 Introduction

Winstone Aggregates is applying for consent for a new aggregate quarry in Burnham in Selwyn District. It would occupy a triangular site bordered by Grange Road and Aylesbury Road. The site covers 362 hectares and is currently used as farmland for dairying, located in a rural zone, with few close neighbours, no designations and no restrictive overlays. The site is sufficiently large that quarry operations can be confined to relatively small footprint of around 40 hectares at any one time, leaving room for mitigation planting and continuing farming on the remainder of the site.

The resource size is estimated to be 26 to 36 banked cubic metres (BCM) of aggregate Annual extraction will vary to match market demand but will average in the vicinity of 500,000 tonnes per year. Up to 15 people will be employed by a quarry operation of this scale.

This report focuses on the broader context of the economic consequences of aggregate production for the Canterbury regional economy. It is structured as follows:

- The role of economic analysis under the Resource Management Act;
- Aggregates production in the Canterbury region;
- The changes that the new quarry will bring to the environment, with effects on wellbeing; and
- Implications of the changes for efficient use and development of resources.

2 How to assess economic contribution

DRAFT

The purpose of the Resource Management Act (Act) is to promote the sustainable management of natural and physical resources (section 5(1)). Section 5(2) of the Act defines sustainable management as using resources in a way that enables people and communities to provide for their well-being and their health and safety, while sustaining the potential of those resources to meet reasonably foreseeable future needs and avoiding, remedying or mitigating any adverse effects of activities on the environment. Section 5(2)(a) explicitly excludes minerals from the sustaining potential requirement, in recognition that such a requirement would preclude any use of finite or exhaustible non-renewable resources and limit their contribution towards community well-being. However, sustainable management still applies to the environmental effects of utilising mineral resources which need to be avoided, remedied or mitigated.

In numerous decisions the Environment Court has recognised various economic threads woven into the Resource Management Act (RMA). The relevance of economics to decisions under the Act is most obvious in references to enabling economic well-being in section 5 and to efficiency in section 7(b) and some other parts of the Act.[1] In particular, section 32's requirement to assess costs and benefits of changes in plans and regulations. The Resource

[1] See, for example, in Marlborough Ridge Ltd v Marlborough District Council [1998] NZRMA 73, where the Court noted that all aspects of efficiency are "economic" by definition, because economics is about the use of resources.

Management Amendment Act (2013) reinforced this relevance with its s32(2)(a) requirement for cost benefit assessments to consider how opportunities for economic growth and employment are affected.

Despite the idea persisting in the public at large that "economic" means "commercial" or "financial", economics is not confined to matters covered by financial transactions or the simple enumeration of costs, jobs and effects on incomes. The defining characteristic of economics is its insights into choices made under conditions of scarcity: how limited resources are used in the satisfaction of potentially unlimited human wants.

Economics encapsulates “well-being” in the notion of economic welfare, which is related to people’s consumption possibilities, both of marketed goods and services and of other less tangible non-market effects, such as the contributions to quality of life derived from the natural environment. “Efficiency” is about obtaining greatest value from use or non-use of available resources, where value in principle covers both market and non-market effects. Economic value is expressed in people’s willingness to pay for things, which is easy to see for market goods where money is exchanged to purchase them. In practice non-market effects, such as the quality of air, water, landscape or biodiversity, are difficult to quantify or bring into the economic calculus. They often arise out of shared resources which people pay for indirectly, through the taxes and rates paid to government agencies that provide public goods, or through restraint on private activity, either voluntary or imposed by regulation. There is value in improvements in environmental conditions, but they are also not costless, often entailing expenditures or opportunity costs – income forgone – by some for the benefit of the wider community.

The RMA can be viewed as a process for assessing and controlling effects that are not managed in markets, such as “externalities” caused when people’s actions create effects that fall uninvited and uncompensated on third parties. Externalities include non-market effects, so their economic value is not readily apparent. In principle it is possible to use various non-market valuation methods to infer economic value for externalities, based on people’s willingness to pay for reduction in adverse externalities, or willingness to accept compensation for enduring them. Such methods are complex and produce results that can be contentious and open to challenge. A simpler alternative to implementing such methods is to use a value already estimated for an analogous situation, in a process known as value transfer, but this depends on finding a closely analogous situation. In practice, in RMA hearings it is often easier to not place economic value on non-market externalities and rely on other subject-matter experts’ assessments of the scale of their significance.

It is common in RMA contexts to present an economic impact analysis of a proposed application that shows how the expenditures on an activity impact on such economic variables as production, value added and employment. Such impacts include both the direct effect of spending in the locality by the project, and the indirect effect of expenditure that flows from the affected sectors and stimulates other sectors in the local economy. This is useful but does not cover the full economic consequences of proposed projects and plan changes.

An alternative analysis frame is that of cost benefit analysis which compares the effects of a proposal against a counter-factual in which it does not proceed and identifies the costs and benefits of one option against the other. Such cost benefit analysis looks at the present value of effects of the proposal over time, which is appropriate for considering the availability and use of an exhaustible finite resource such as rock (that is close to the

DRAFT

location where it will be used). It also, in principle, allows non-market effects in the analysis if they can be valued consistently with market values, although in practice this is possible for only a few such effects.

The economic impacts of any activity are generally greatest in the construction or establishment phase of a new development. Opening a new quarry would inject more expenditure into the local economy and provide a short- term stimulus for suppliers in the establishment phase, but such establishment costs could raise the cost of aggregates compared to those supplied from existing quarries. So, an impact analysis would be a misleading indicator of economic benefit. Similarly, an activity can have economic significance far greater than its economic impact would suggest where it harnesses a natural resource which would otherwise be untapped. Economic value arises not just from the observed transactions in the economy but also from avoiding the need to use more costly alternatives in sustaining economic activities.

3 Existing environment of the proposed Burnham Quarry

The proposed Burnham Quarry occupies a physical environment with potential for effects that are assessed by non-economic subject-matter experts. But it also occupies a place in an economic environment affected by and affecting the surrounding economy.

Aggregate is a fundamental but often overlooked input into the infrastructure on which the economy runs, as well as in numerous building products. Aggregate is used in large quantities for roads and concrete, with lesser quantities used for fill, drainage material and harbour and river protection (riprap). It is obtained either by excavating material and crushing it to desired sizes, or by extracting gravel and sand from riverbed, lacustrine or coastal deposits. Burnham Quarry will extract aggregate from old riverbed deposits.

Although aggregates are abundant in the Earth's crust, their cost of extraction and value in use varies widely. The cost of producing aggregates varies with the amount of over-burden that must be removed to access the useable rock material. The value of aggregate extracted depends on the quality of the quarried material and its versatility in use for a variety of products. There is uncertainty about the extent and quality of aggregate available from a given resource until it is extracted, and assessments of a given resource may change over time.

DRAFT

3.1 Aggregate is heavy and costly to transport

The high weight of aggregate makes it expensive to transport relative to the cost of extraction, so markets for aggregate tend to be localised. An industry rule of thumb is that the price of aggregates doubles with every 30 kilometres transported[2]. If the price at the quarry gate were $15 per tonne (roughly the price of aggregate for roading use), transporting material 30 kilometres at a cost of $0.50/tonne-kilometres travelled would double the cost of the product as it would incur another $15 per tonne. Higher value aggregate products can bear the cost of transport better than lower value ones: - transport costs would eliminate the profit margin on lower value fill materials and unprocessed

[2] Aggregate and Quarry Association refer https://issuu.com/contrafed/docs/q_m 1612_issuu_rev/47

aggregate products. Closure of quarries and relocation by even a few kilometres can make an appreciable difference to the cost of material for its users.

Aggregate sources are exhausted over time and need to be more or less continuously replaced. Rock may not be scarce but, readily accessible resources of high-quality rock are not common, both because of natural variation in the underlying rocks and because of restrictions on land use and quarrying activities imposed with the intention of reducing effects of extraction on neighbouring communities. So, when considering consenting or planning for extractive activities the broad economic question is about the relative scarcities of what is being sought (extracted minerals) and the potential environmental effects associated with extracting that material. Where the aggregate is locally scarce, and extraction would adversely affect something which is relatively abundant, then it can be economically worthwhile and efficient to incur higher cost and environmental impact to obtain the benefit of the extracted aggregate.

In economic terms it is efficient to restrict quarrying, by limiting extraction or imposing costly measures on residual discharges to air or water, only to the point where the marginal cost of additional restriction is equal to the marginal benefit obtained from it. Big changes in a short period of time can be disruptive of quarry operations and necessitate costly changes to the pattern of aggregate supply, whereas gradual adjustment with successive smaller changes over time will have less costly effects.

3.2 Demand for aggregate moves with population and economic growth

A long term (forty year)[3] study of demand for aggregate concluded that aggregate consumption is closely correlated with population and income growth. The relationship allows for technical factors that have lowered the demand for aggregate such as change in building practices[4] and specification of better performing materials[5] for roading. Roading and construction activities are the principal uses of aggregate in New Zealand. Cyclical fluctuations in these activities, as for instance from upswings and downswings in building activity, or the demands for aggregate created by specific roading projects, can cause peaks and troughs in quarrying activity.

Aggregate is produced to meet demand, so production figures are useful indicators of consumption of aggregate. The long-term demand for aggregate broadly moves in line with population which provides the employment base for local economic activity. Growth in population necessitates expansion of residential housing supply and in the streets and three waters infrastructure that directly serve it, and in the commercial spaces and institutional structures (such as medical centres, schools) that serve that population growth.

To illustrate the scale of aggregates' contribution to the built environment, over 4,000 tonnes of aggregate are used in the construction of one kilometre of standard highway pavement, while the building of a new six lane motorway can consume in excess of 20,000 tonnes for the same distance. Underground piped services along new streets may use up to 8,100 tonnes per kilometre of street. Up to 250 tonnes of aggregate can be used in the

[3] O'Brien J 'Planning for Growth? The Determinants of Aggregates Demand in New Zealand', IPENZ engineering TreNz 2006-003, 2006

[4] Reduction in safety and load factors required for reinforced concrete, greater use of pre-stressed concrete factors and achievement of higher concrete strengths using additives noticeably affected demand for aggregate in the 1970s.

[5] Upgraded specifications for basecourse in roading have reduced the ratio of aggregate used in roading to that for building from about 6:1 in the 1950's to 2:1 in the mid-2000s

DRAFT

construction of a single new house, although those of wooden frame and cladding construction could use substantially less[6].

3.3 Canterbury has higher than national average demand for aggregate

Based on aggregate production data from New Zealand Petroleum and Minerals and Statistics New Zealand population data, in pre-COVID 2019, Canterbury accounted for 29% by volume of New Zealand's production of aggregates, or 26% by value. That share dropped dramatically in the COVID-affected years of 2020 and 2021. The value share is larger than Canterbury's share of total economic production (12.5% of national GDP in 2019[7]), which implies that Canterbury uses more aggregate relative to its economic production than New Zealand at large.

Table 1 shows recent production tonnages and values of rock, sand and gravel, in Canterbury and all New Zealand. Note that there has been a reduction during the pandemic-affected years (2020 and 2021), and that production has been proportionately larger in Canterbury than in New Zealand at large. In Canterbury's case, demand for aggregate products was already slackening pre-pandemic with completion of large rebuild projects following the Christchurch and Kaikoura earthquakes.

Table 1 Production of aggregates in Canterbury and New Zealand

Annual production volume and value by rock type in Canterbury region and totals for New Zealand

	Volume (million tonnes)			Value ($ million)		
Year ending March	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
Rock for reclamation and protection	0.058	0.037	0.080	1.528	0.524	1.894
Rock, sand and gravel for building	1.288	0.724	0.178	25.236	11.090	2.414
Rock, sand and gravel for roading	5.016	2.633	2.486	61.261	34.706	17.258
Rock, sand, gravel and clay for fill	0.774	0.392	0.000	6.033	4.761	0.000
Sand for industry	0.098	0.048	0.000	2.987	1.382	0.000
Total Aggregates (rock, sand, gravel)	7.233	3.833	2.745	97.044	52.464	21.566
Other (Stone, lime, clay etc)	0.366	0.454	0.713	6.098	8.939	11.668
Total Canterbury Quarrying	**7.599**	**4.287**	**3.458**	**103.143**	**61.403**	**33.235**
Total New Zealand Aggregates	25.046	28.170	26.057	378.148	484.576	469.059
Total New Zealand Quarrying	**39.898**	**34.093**	**29.515**	**655.095**	**611.483**	**502.294**

Source: New Zealand Petroleum & Minerals: 2021 Mineral Production Statistics

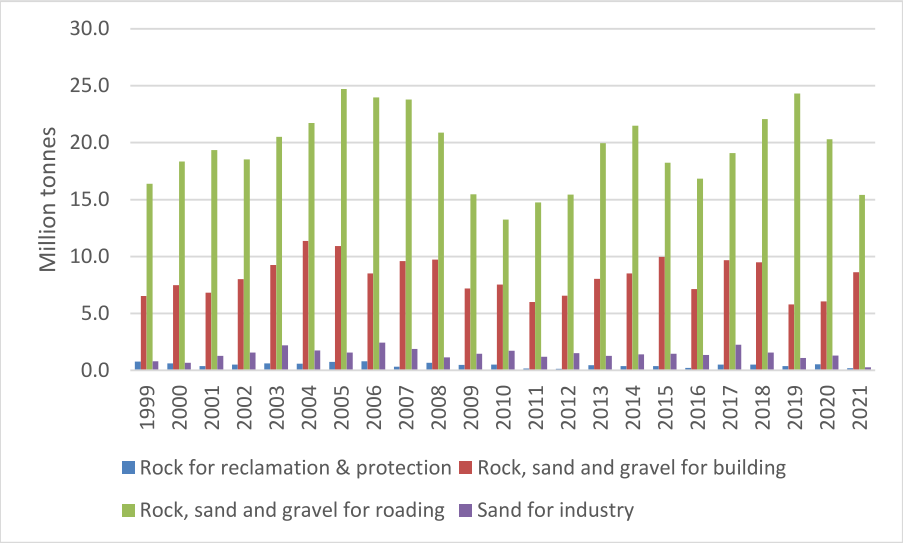
Apart from the pandemic, over the longer- term aggregate production varies over time with economic circumstances and demand. Figure 1 shows pronounced dips in aggregate production following the slump in demand caused by the Global Financial Crisis after 2008, and rising production boosted by earthquake rebuild after 2011 and again after 2016.

6 From "Providing solid foundations for New Zealand", Aggregate and Quarry Association of New Zealand, www.aqa.org.nz

7 Based on Statistics New Zealand, Regional Gross Domestic Product tables

DRAFT

Figure 1 Production of aggregates (rock, sand, gravel) in New Zealand, 1993-2021



Source: NZ Petroleum & Minerals aggregate production 1993-2021 Available at: https://www.nzpam.govt.nz/assets/Uploads/our-industry/statistics/aggregate-production-1993-2021.xlsx

3.4 Strong growth is forecast for Canterbury

Statistics New Zealand's population growth projections by territorial local authority suggest that Christchurch, Waimakariri and Selwyn districts face relatively high growth between 2023 and 2033, and beyond to 2043. The combined areas of Christchurch, Waimakariri and Selwyn are forecast to face an average annual growth rate of 1.38% between 2023 and 2033, and 1.15% between 2023 and 2043. Those rates of growth are the second highest in the South Island behind only the combined Queenstown Lakes and Central Otago districts (although the volume of additional people is considerably higher around Christchurch).

North Island centres like Auckland, Hamilton and Tauranga/Western Bay of Plenty face slightly higher growth rates, but because of the high cost of transporting rock they are effectively separate markets from those in the South Island. There is significant growth in population and housing expected in Christchurch and its hinterland, and that requires sufficient aggregate sources within easy reach to stop material transport costs from materially affecting the affordability of housing in the region.

Development of new quarry resources close to cities can be constrained by spread of residential areas and the "reverse sensitivity" of new residents to the effects of quarrying activity, the difficulty of finding green-field sites suitable for quarrying and limitations on quarry operations associated with heavy truck movements on local roads. Finding alternative sources of material to quarries that are constrained by operating restrictions to reduce adverse neighbourhood effects associated with discharges to air and water, removal and deposition of over-burden, extraction operations and transport of product, will involve higher costs. This is due to both longer transport routes from more distant sources and because of consent processes and the establishment costs of developing new quarries.

DRAFT

4 Effect on community well-being and efficient use of resources

The Burnham Quarry is planned to utilise an estimated resource that could sustained for over 60 years and with operations that employ up to 15 people each year. However, employment is only one indicator of its contribution to well-being, and not necessarily the main one.

Economic well-being can be defined in various ways, but there are three key interrelated components - income, consumption and wealth. Income is pivotal, as it can support current consumption, such as food, clothing, education, housing or leisure activities, or it can be saved to support consumption in the future[8]. More expansive definitions of well-being include people having sustainable income and assets so they can prosper or having the capabilities and skills to make the most of what's available to them. Such definitions put people at the centre of policy and move away from an attitude of "grow first, redistribute and clean up later"[9]. To illustrate the contribution of quarrying to the Canterbury region and its well-being, the following sections estimate the economic impacts it has at present, and discuss the implications of changes to those impacts[10].

4.1 Quarrying's contribution to the regional economy is positive but modest

The starting point is MBIE's Mineral Production statistics, which show that Canterbury produced 7.6 million tonnes of non-metallic minerals with a value of $103 million in 2019, but this fell through the pandemic years to 3.46 million tonnes worth $33.2 million in 2021. The unit value per tonne in 2021 is about 70 percent of what it was in 2019. This regional information on output volume and revenue is understated by the withholding of some information by some quarry operators to avoid identification of individual production figures.

Most of the production of rock, sand and gravel is for roading (61%), followed by stone for building (17%) and material for fill (9%). Most of it will also take place in the vicinity of Christchurch's urban area, as that is where most demand is concentrated.

In 2021 Canterbury's rock quarries produced total output worth $33.2 million, but in pre-COVID 2019 the corresponding figure was $103.1 million. Taking that as the region's gross output value of quarrying in a "normal year" and applying a ratio of gross output to value added for the metal ore and non-metallic mineral sector from Statistics New Zealand's input output tables, the contribution of quarrying to GDP in the region would be about $43.1 million in 2019, 0.11% of regional GDP. Within that GDP, compensation for employees accounted for around $16.5 million. Dividing this income figure by the average earnings in non-metallic mineral mining of around $70,000 per year, suggests the employment associated with this production would be around 235 Full Time Equivalent (FTE) jobs across the region. The corresponding figures for post-COVID 2021 are $13.9 million GDP, $5.3 million employee compensation and about 76 FTE jobs.

DRAFT

8 Available at; https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/4160.0.55.001~Jun%202015~Main%20Features~Economic%20wellbeing~10015

9 Available at: https://www.oecd.org/about/secretary-general/the-economy-of-well-being-iceland-september-2019.htm

10 This is an exercise particularly difficult at present, due to changes in presentation of MBIE's Regional Mineral Production Statistics, which do not disclose volumes produced of a range of non-metallic minerals (which were available in previous years), and also by delays in release of 2018 Census material which would provide more detail on employment.

These estimates are necessarily approximate due to data limitations. While neither the share of GDP nor the employment estimates seem particularly substantial against the regional totals, quarrying does create value and employment from an otherwise unused natural resource. To put this in perspective, very few business operations account for a large proportion of value added in any modern, diversified urban economy. The main significance of quarrying is not in its contribution to the measured economy, but in supplying material inputs to other businesses and infrastructure that support all economic activity. Quarries create value from a local natural resource servicing a market for aggregates in building and construction, roading and other public infrastructure that is most cost effectively supplied from local sources because of transport costs.

Direct spending by a quarry, like other businesses, will have an indirect flow-on or "economic multiplier" effect to the extent that it stimulates added business for suppliers of inputs to quarrying, and from added spending by those who receive income from it. In a 2008 study of the national quarrying activity, NZIER estimated multipliers on input supply of 1.9 for value added and 2.63 for employment, and the multipliers for combined effect on input supply and added consumer expenditure of 3.00 and 5.14 in value added and employment respectively.

While presented to show the interconnections of a business with other parts of an economy, data limitations make economic multipliers less reliable for local economies and they are inherently prone to overstate effects of potential changes in economic activity: the larger a new project, the more likely it is to place demands on locally constrained inputs like labour, which increases the price of inputs for all businesses that use them. That reduces profitability and output for some existing businesses that offset the new project's addition to output. Data issues aside, all regional or local multipliers will be lower than those at national level, as a regional economy is smaller and more reliant on importing from other regions than the national economy, so additional spending experiences more "leakage" out of the region. In the case of quarries, multipliers also understate the importance of the material supply to the economy: if restriction of quarrying increases the cost of aggregate supply and reduces the amount of investment in infrastructure such as roads or flood defences, the impediments this creates for local economic well-being, such as increased traffic congestion, wear and tear on vehicles or periodic losses from flood damage, are not the sort that show up in a multiplier based on inter-industry transactions.

DRAFT

4.2 But quarrying has a wider economic significance for its region

Quarrying has a minor contribution to the regional GDP but that is not the full measure of quarrying's economic significance. The main significance of quarrying is in providing materials and affecting their price for use in infrastructure which supports the value adding activities of all other sectors in the local regional economy, including building and construction, infrastructure and utility suppliers, transport operation, property managers and operations of owner-occupied housing. Put another way, the aggregates and quarrying industry is significant for Canterbury despite its relatively modest contribution to measured GDP and jobs, because of its underpinning role in infrastructure costs. Without quarrying facilities in the region in easy transport distance from the sources of demand, costs would increase, and affordability decrease, for all activities that rely on aggregate-based infrastructure such as roads, stop-banks, water storage, treatment plant and house building. By widening aggregate supply, the proposed Burnham Quarry would help avoid infrastructure disruptions that have a negative effect on community well-being.

5 The efficiency of extending quarry resources and providing for new development

Quarrying provides a capability to meet infrastructure needs that is most effectively met by local resources. That local sourcing also provides a source of resilience against the effect of disruptions to normal supply of materials. The economic value of such resilience is difficult to estimate but there is a strategic value in having that capability. The costs of business disruption caused by such events as floods or earthquakes is not so readily valued as property damage and other tangible losses but can be substantial.

Evidence presented to previous consenting hearings suggested aggregate demand around Christchurch from 2014 to 2041 was around 180 million tonnes and identified existing sites with potential supply of 140 million tonnes, leaving a shortfall of 40 million tonnes to be met by new quarries[11]. This is a logical, planning-based approach to providing for supply security over a foreseeable future[12]. However, it may give the impression that once sufficient supply is secured there is no need for further quarries until current sources are depleted, so having headroom capacity can be valuable in recovering from disruption more quickly.

However, as an economist, the last inference about "sufficiency" of quarries is an unnecessary restriction on quarry development. This is because the market for aggregate, as for other goods, is generally most efficient if there are many sellers in competition with each other. Competition sharpens the sellers' incentive to offer competitive low prices, which leaves consumers better off and enhances their well-being. The alternative of restricting the number of suppliers is less efficient because it can confer market power on suppliers, allowing them to increase their prices, and because with less supply there is more likelihood of spikes in demand not being able to be met without restricting demand by raising prices or by resorting to obtaining aggregates from further away, which also raises costs to consumers.

Aside from ensuring there is sufficient physical supply of material becoming available to meet future needs, there is also economic benefit in widening the choice of quarry sources in the district. These network benefits are apparent when a larger range of suppliers in a market gives greater range in the variety of product supplied, and hence a greater likelihood of customers finding what they want when they want it, instead of incurring costs from delayed availability or seeking delivery from further away. A larger network of active quarries improves the choice, reliability and timeliness of supply, as well as exerting the pressure on each quarry to search for efficiencies to improve its competitive position.

That Winstone Aggregates is seeking consent for a new quarry is evidence that the company thinks it can provide a positive return on investment. The company sees opportunity to continue supplying aggregate in the Christchurch area and is seeking consent to have the option of developing it at a time that seems most advantageous in the future. The company incurs the investment cost, bears all the risk around the future value obtained from the quarry and is best placed to decide on how much and when to make the

[11] See Statement of Evidence of Mr Richard Spencer English on behalf of Christchurch City Council, 16 October 2015, before the Christchurch Replacement District Plan Independent Hearings Panel.

[12] The evidence in these figures imply an annual average demand over the period of around 7 million tonnes, similar to the 2019 production but below that of 2018 (see Annex).

DRAFT

investment. As long as. RMA processes show the quarry can be operated without significant adverse effects in the bio-physical environment, there is no economic reason to object to a private entity making investments in new quarrying capacity. If there was a demonstrable shortfall in available supply to meet likely demand, to the extent that aggregated prices were being pushed up, there would be an adverse effect to economic conditions in the status quo which could be alleviated by consenting new quarries. But even in the absence of demonstrable shortage of supply, there is no reason to expect a new quarry would create significant adverse effects on the economic environment, as the new quarry increases competition and diversity in supply.

Demand for rock and aggregate tends to be price inelastic (i.e. relatively unresponsive to price changes), so any additional cost of quarried material due to supply restraints requiring aggregate to be sourced from further afield would be mostly borne by local consumers rather than result in reduced consumption. As the largest consumers of aggregate within the region are Councils, these bodies will be the most affected by price increases and additional costs they face will ultimately be borne by their ratepayers. In other words, for what is essentially the same service – supply of aggregates to infrastructure – there would be additional cost to be met from ratepayers' disposable incomes, which would reduce their ability to spend on other activities in the region, to the detriment of well-being of both ratepayer consumers and other businesses that would benefit from additional spending that is forgone.

There is an economic value in providing for quarries to work out their resources to the point where they are no longer economically worthwhile to extract, as this defers the date at which new resources need to be brought into production and defers the present value cost of their development. In the longer term, costs will rise as new resources will need to be found and developed, but planning can foster efficient use and development of resources by not unnecessarily restricting access to, preventing development or expansion of, or accelerating depletion of, these quarries' existing resources.

There are no complete alternatives to ensuring that there are quarries which can produce sufficient quality aggregates within the Region. Crushed aggregate from demolition concrete can be re-cycled and used as an alternative to coarse aggregate for use in new concrete products or roading or drainage materials[13]. However, this typically needs to be blended with raw coarse aggregate, as it is difficult to know the properties of recovered material and a high percentage of recycled aggregate can negatively affect new concrete's strength. As with fresh aggregate, the high cost of cartage (both gathering material as well as distributing products) and need for a reliable source of recovered material at a consistent grade quality affect the economic feasibility of recycling aggregates[14]. It seems very unlikely that recycled aggregate could substitute for more than a fraction of the range of materials available from newly quarried material.

When existing quarries are restricted or closed, production at the remaining quarries may rise, resulting in increased environmental effects at these quarries as well as increased traffic movements around these sites. Consent conditions may restrict such adverse effects, but any residual adverse effect would add to the full societal cost of supply resulting from volumes produced in the region or volume made up from more distant sources. This is a

[13] CCANZ (2010) Recycled aggregates in new concrete; Technical Report TR 14, Cement and Concrete Association of New Zealand.

[14] Winstone has suggested that recycled aggregates are very expensive to produce and are of limited use in concrete. They can be used to make a low-grade basecourse, but this product is far more expensive than the excess low grade scalped material – a by- product of the production processes of other local greywacke quarries.

DRAFT

potential adverse externality from quarries closing down, the impacts of which will be lower if there are many alternative quarries across which to spread the load of extra production. This is another reason not to restrict new quarry proposals on the grounds there are enough already: the ecosystem of quarries is dynamic and can change rapidly from a situation of sufficiency to inadequacy in supply of material.

6 Summary and conclusions

In 2019 Canterbury accounted for around 29% of New Zealand's production tonnage of rock and aggregate, but this dropped to just 11 % in COVID-affected 2021. Quarrying contributed 0.1% to regional GDP in Canterbury, but quarrying has an economic significance far beyond its relatively modest economic impact, as it supplies material for the physical infrastructure on which the economy depends. It is a regionally significant industry because of its underpinning role in development and maintenance of infrastructure, and without continuing access to aggregate sources close to demand, infrastructure costs would rise, and its affordability would decrease, with impacts for all the region's industries that rely on that infrastructure, both directly (infrastructure providers) and indirectly (infrastructure users like transport operators).

Aggregate is a fundamental input into the infrastructure on which the economy runs, with few cost-effective substitutes for the range of uses of aggregate in roading, building and civil construction. It is expensive to transport relative to its cost of extraction and ensuring low-cost supply requires economically accessible resources close to the location of demand.

Availability of versatile high-quality aggregate faces increasing constraints as existing resources have been depleted and residential encroachment has increased restrictions on the use of new resources. While it is difficult to reliably estimate shortfall in available supply to meet likely demand, there is no economic reason to expect a new quarry operated without significant adverse effects in the bio-physical environment to have a net detrimental economic outcome.

Regional economic well-being and the efficient use of resources will be served by the addition of Burnham Quarry as this would add to the number and diversity of sources of quarried material in the region and help secure supply of rock and aggregate products into the future. The addition of another quarry also increases competition between suppliers and choice for consumers, with lower economic cost of supplies and environmental effect than sourcing aggregates at greater distance.

DRAFT

Canterbury Regional Policy Statement 2013

CHAPTER 5 – LAND USE AND INFRASTRUCTURE

5.2 OBJECTIVES

5.2.1 Location, Design and Function of Development (Entire Region)

Development is located and designed so that it functions in a way that:

1. achieves consolidated, well designed and sustainable growth in and around existing urban areas as the primary focus for accommodating the region's growth; and

2. enables people and communities, including future generations, to provide for their social, economic and cultural well-being and health and safety; and which:

a. maintains, and where appropriate, enhances the overall quality of the natural environment of the Canterbury region, including its coastal environment, outstanding natural features and landscapes, and natural values;
b. provides sufficient housing choice to meet the region's housing needs;
c. encourages sustainable economic development by enabling business activities in appropriate locations;
d. minimises energy use and/or improves energy efficiency;
e. enables rural activities that support the rural environment including primary production;
f. is compatible with, and will result in the continued safe, efficient and effective use of regionally significant infrastructure;
g. avoids adverse effects on significant natural and physical resources including regionally significant infrastructure, and where avoidance is impracticable, remedies or mitigates those effects on those resources and infrastructure;
h. facilitates the establishment of papakāinga and marae; and
i. avoids conflicts between incompatible activities.

5.3 POLICIES

5.3.2 Development conditions (Wider Region)

To enable development including regionally significant infrastructure which:

1. ensure that adverse effects are avoided, remedied or mitigated, including where these would compromise or foreclose:
    a. existing or consented regionally significant infrastructure;
    b. options for accommodating the consolidated growth and development of existing urban areas;
    c. the productivity of the region's soil resources, without regard to the need to make appropriate use of soil which is valued for existing or foreseeable future primary production, or through further fragmentation of rural land;
    d. the protection of sources of water for community supplies;
    e. significant natural and physical resources;
2. avoid or mitigate:
    a. natural and other hazards, or land uses that would likely result in increases in the frequency and/or severity of hazards;
    b. reverse sensitivity effects and conflicts between incompatible activities, including identified mineral extraction areas; and

3. integrate with:
    a. the efficient and effective provision, maintenance or upgrade of infrastructure; and
    b. transport networks, connections and modes so as to provide for the sustainable and efficient movement of people, goods and services, and a logical, permeable and safe transport system.

5.3.7 Strategic land transport network and arterial roads (Entire Region)

1. In relation to strategic land transport network and arterial roads, the avoidance of development which: adversely affects the safe efficient and effective functioning of this network and these roads, including the ability of this infrastructure to support freight and passenger transport services; and
2. in relation to the strategic land transport network and arterial roads, to avoid development which forecloses the opportunity for the development of this network and these roads to meet future strategic transport requirements.

5.3.8 Land use and transport integration (Wider Region)

Integrate land use and transport planning in a way:

1. that promotes:
    a. the use of transport modes which have low adverse effects;
    b. the safe, efficient and effective use of transport infrastructure, and reduces where appropriate the demand for transport;
2. that avoids or mitigates conflicts with incompatible activities; and
3. where the adverse effects from the development, operation and expansion of the transport system:
    a. on significant natural and physical resources and cultural values are avoided, or where this is not practicable, remedied or mitigated; and
    b. are otherwise appropriately controlled.

5.3.12 Rural production (Wider Region)

Maintain and enhance natural and physical resources contributing to Canterbury's overall rural productive economy in areas which are valued for existing or foreseeable future primary production, by:

1. avoiding development, and/or fragmentation which;
    a. forecloses the ability to make appropriate use of that land for primary production; and/or
    b. results in reverse sensitivity effects that limit or precludes primary production.
2. enabling tourism, employment and recreational development in rural areas, provided that it:
    a. is consistent and compatible with rural character, activities, and an open rural environment;
    b. has a direct relationship with or is dependent upon rural activities, rural resources or raw material inputs sourced from within the rural area;
    c. is not likely to result in proliferation of employment (including that associated with industrial activities) that is not linked to activities or raw material inputs sourced from within the rural areas; and
    d. is of a scale that would not compromise the primary focus for accommodating growth in consolidate, well designed and more sustainable development patterns. and;
3. ensuring that rural land use intensification does not contribute to significant cumulative adverse effects on water quality and quantity.

CHAPTER 7 – FRESH WATER

7.2 OBJECTIVES

7.2.1 Sustainable management of fresh water

The region's fresh water resources are sustainably managed to enable people and communities to provide for their economic and social well-being through abstracting and/or using water for irrigation, hydro-electricity generation and other economic activities, and for recreational and amenity values, and any economic and social activities associated with those values, providing:

1. the life-supporting capacity ecosystem processes, and indigenous species and their associated freshwater ecosystems and mauri of the fresh water is safe-guarded;

2. the natural character values of wetlands, lakes and rivers and their margins are preserved and these areas are protected from inappropriate subdivision, use and development and where appropriate restored or enhanced; and

3. any actual or reasonably foreseeable requirements for community and stockwater supplies and customary uses, are provided for.

7.2.3.

The overall quality of freshwater in the region is maintained or improved, and the life supporting capacity, ecosystem processes and indigenous species and their associated fresh water ecosystems are safeguarded.

7.2.4 Integrated management of fresh water resources

Fresh water is sustainably managed in an integrated way within and across catchments, between activities, and between agencies and people with interests in water management in the community, considering:

1. the Ngāi Tahu ethic of Ki Uta Ki Tai (from the mountains to the sea);

2. the interconnectivity of surface water and groundwater;

3. the effects of land uses and intensification of land uses on demand for water and on water quality; and

4. kaitiakitanga and the ethic of stewardship; and

5. any net benefits of using water, and water infrastructure, and the significance of those benefits to the Canterbury region.

7.3 POLICIES

7.3.6 Fresh water quality

In relation to water quality:

1. to establish and implement minimum water quality standards for surface water and groundwater resources in the region, which are appropriate for each water body considering:

a. the values associated with maintaining life supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, and natural character of the water body;

b. any current and reasonably foreseeable requirement to use the water for individual, marae or community drinking water or stockwater supplies, customary uses or contact recreation;

c. the cultural significance of the fresh water body and any conditions or restrictions on the discharge of contaminants that may be necessary or appropriate to protect those values; and

d. any other current or reasonably foreseeable values or uses; and

2. to manage activities which may affect water quality (including land uses), singularly or cumulatively, to maintain water quality at or above the minimum standard set for that water body;

and

3. where water quality is below the minimum water quality standard set for that water body, to avoid any additional allocation of water for abstraction from that water body and any additional discharge of contaminants to that water body, where any further abstraction or discharges, either singularly or cumulatively, may further adversely affect the water quality in that water body:

a. until the water quality standards for that water body are met; or

b. unless the activities are undertaken as part of an integrated solution to water management in the catchment in accordance with Policy 7.3.9, which provides for the redress of water quality within that water body within a specified timeframe.

7.3.7 Water quality and land uses

To avoid, remedy or mitigate adverse effects of changes in land uses on the quality of fresh water (surface or ground) by:

1. identifying catchments where water quality may be adversely affected, either singularly or cumulatively, by increases in the application of nutrients to land or other changes in land use; and

2. controlling changes in land uses to ensure water quality standards are maintained or where water quality is already below the minimum standard for the water body, it is improved to the minimum standard within an appropriate timeframe.

7.3.9 Integrated solutions to fresh water management

To require integrated solutions to the management of fresh water by developing and implementing comprehensive management plans which address the policies of this Statement including addressing all the relevant matters set out in Appendix 2.

7.3.12 Precautionary approach and allocation without a planning framework

To take a precautionary approach to the allocation of water for abstraction, the damming or diversion of water, or the intensification of land uses or discharge of contaminants, in circumstances where the effects of these activities on fresh water bodies, singularly or cumulatively, are unknown or uncertain.

CHAPTER 9 - ECOSYSTEMS AND INDIGENOUS BIODIVERSITY

9.2 OBJECTIVES

9.2.1 Halting the decline of Canterbury's ecosystems and indigenous biodiversity

The decline in the quality and quantity of Canterbury's ecosystems and indigenous biodiversity is halted and their life-supporting capacity and mauri safeguarded

9.2.3 Protection of significant indigenous vegetation and habitats

Areas of significant indigenous vegetation and significant habitats of indigenous fauna are identified and their values and ecosystem functions protected.

9.3 POLICIES

9.3.1 Protecting significant natural areas

1. Significance, with respect to ecosystems and indigenous biodiversity, will be determined by assessing areas and habitats against the following matters:

    a. Representativeness

    b. Rarity or distinctive features

    c. Diversity and pattern

    d. Ecological context

The assessment of each matter will be made using the criteria listed in Appendix 3.

2. Areas or habitats are considered to be significant if they meet one or more of the criteria in Appendix 3.

3. Areas identified as significant will be protected to ensure no net loss of indigenous biodiversity or indigenous biodiversity values as a result of land use activities.

9.3.2 Priorities for protection

To recognise the following national priorities for protection:

1. Indigenous vegetation in land environments where less than 20% of the original indigenous vegetation cover remains.

2. Areas of indigenous vegetation associated with sand dunes and wetlands.

3. Areas of indigenous vegetation located in "originally rare" terrestrial ecosystem types not covered under (1) and (2) above.

4. Habitats of threatened and at risk indigenous species

9.3.4 Promote ecological enhancement and restoration

To promote the enhancement and restoration of Canterbury's ecosystems and indigenous biodiversity, in appropriate locations, where this will improve the functioning and long term sustainability of these ecosystems.

9.3.6 Limitations on the use of biodiversity offsets

The following criteria will apply to the use of biodiversity offsets:

1. the offset will only compensate for residual adverse effects that cannot otherwise be avoided, remedied or mitigated;

2. the residual adverse effects on biodiversity are capable of being offset and will be fully compensated by the offset to ensure no net loss of biodiversity;

3. where the area to be offset is identified as a national priority for protection under Policy 3.2, the offset must deliver a net gain for biodiversity;

4. there is a strong likelihood that the offsets will be achieved in perpetuity; and

5. where the offset involves the ongoing protection of a separate site, it will deliver no net loss, and preferably a net gain for indigenous biodiversity conservation.

Offsets should re-establish or protect the same type of ecosystem or habitat that is adversely affected, unless an alternative ecosystem or habitat will provide a net gain for indigenous biodiversity.

CHAPTER 11 - NATURAL HAZARDS

11.2 OBJECTIVES

11.2.1 Avoid new subdivision, use and development of land that increases risks associated with natural hazards New subdivision, use and development of land which increases the risk of natural hazards to people, property and infrastructure is avoided or, where avoidance is not possible, mitigation measures minimise such risks.

11.2.3 Climate change and natural hazards

The effects of climate change, and its influence on sea levels and the frequency and severity of natural hazards, are recognised and provided for.

11.3 POLICIES

11.3.1 Avoidance of inappropriate development in high hazard areas

To avoid new subdivision, use and development (except as provided for in Policy 11.3.4) of land in high hazard areas, unless the subdivision, use or development:

1. is not likely to result in loss of life or serious injuries in the event of a natural hazard occurrence; and

2. is not likely to suffer significant damage or loss in the event of a natural hazard occurrence; and

3. is not likely to require new or upgraded hazard mitigation works to mitigate or avoid the natural hazard; and

4. is not likely to exacerbate the effects of the natural hazard; or

5. Outside of greater Christchurch, is proposed to be located in an area zoned or identified in a district plan for urban residential, industrial or commercial use, at the date of notification of the CRPS, in which case the effects of the natural hazard must be mitigated; or

6. Within greater Christchurch, is proposed to be located in an area zoned in a district plan for urban residential, industrial or commercial use, or identified as a "Greenfield Priority Area" on Map A of Chapter 6, both at the date the Land Use Recovery Plan was notified in the Gazette, in which the effect of the natural hazard must be avoided or appropriately mitigated; or

7. Within greater Christchurch, relates to the maintenance and/or upgrading of existing critical or significance infrastructure.

11.3.2 Avoid development in areas subject to inundation

In areas not subject to Policy 11.3.1 that are subject to inundation by a 0.5% AEP flood event; any new subdivision, use and development (excluding critical infrastructure) shall be avoided unless there is no increased risk to life, and the subdivision, use or development:

1. is of a type that is not likely to suffer material damage in an inundation event; or

2. is ancillary or incidental to the main development; or

3. meets all of the following criteria:

a. new buildings have an appropriate floor level above the 0.5% AEP design flood level; and

b. hazardous substances will not be inundated during a 0.5% AEP flood event; provided that a higher standard of management of inundation hazard events may be adopted where local catchment conditions warrant (as determined by a cost/benefit assessment).

11.3.3 Earthquake hazards

New subdivision, use and development of land on or close to an active earthquake fault trace, or in areas susceptible to liquefaction and lateral spreading, shall be managed in order to avoid or mitigate the adverse effects of fault rupture, liquefaction and lateral spreading.

11.3.5 General risk management approach

For natural hazards and/or areas not addressed by policies 11.3.1, 11.3.2, and 11.3.3, subdivision, use or development of land shall be avoided if the risk from natural hazards is unacceptable. When determining whether risk is unacceptable, the following matters will be considered:

1. the likelihood of the natural hazard event; and

2. the potential consequence of the natural hazard event for: people and communities, property and infrastructure and the environment, and the emergency response organisations.

Where there is uncertainty in the likelihood or consequences of a natural hazard event, the local authority shall adopt a precautionary approach.

Formal risk management techniques should be used, such as the Risk Management Standard (AS/NZS ISO 31000:2009) or the Structural Design Action Standard (AS/NZS 1170.0:2002).

11.3.8 Climate change

When considering natural hazards, and in determining if new subdivision, use or development is appropriate and sustainable in relation to the potential risks from natural hazard events, local authorities shall have particular regard to the effects of climate change.

11.3.9 Integrated management of, and preparedness for, natural hazards

To undertake natural hazard management and preparedness for natural hazard events in a coordinated and integrated manner by ensuring that the lead agencies have particular regard to:

1. the investigation and identification of natural hazards;
2. the analysis and mapping of the consequential effects of the natural hazards identified;
3. the effects of climate change and resulting sea level rise;
4. the setting of standards and guidelines for organisations involved in civil defence and emergency management;
5. the development and communication of strategies to promote and build community resilience; and
6. any other matters necessary to ensure the integrated management of natural hazards in the Canterbury region

CHAPTER 12 – LANDSCAPE

12.2 OBJECTIVES

12.2.2 Identification and management of other landscapes

The identification and management of other important landscapes that are not outstanding natural landscapes. Other important landscapes may include:

1. natural character
2. amenity
3. historic and cultural heritage

12.3 POLICIES

12.3.3 Identification and management of other important landscapes

Identifying and managing other important landscapes that are not outstanding natural landscapes, for natural character, historic cultural, historic heritage and amenity purposes.

CHAPTER 14 - AIR QUALITY

14.2 OBJECTIVES

14.2.1 Maintain or improve ambient air quality

Maintain or improve ambient air quality so that it is not a danger to people's health and safety, and reduce the nuisance effects of low ambient air quality.

14.2.2 Localised adverse effects of discharges on air quality

Enable the discharges of contaminants into air provided there are no significant localised adverse effects on social, cultural and amenity values, flora and fauna, and other natural and physical resources.

14.3 POLICIES

14.3.1 Maintain and improve ambient air quality

In relation to ambient air quality:

1. To set standards to maintain ambient air quality in Canterbury based on concentrations of contaminants that cause adverse health effects and nuisance

2. Where existing ambient air quality is higher than required by the standards set, to only allow the discharge of contaminants into air where the adverse effects of the discharge on ambient air quality are minor.

3. To give priority to ensuring that PM10 ambient air quality improvements are achieved in Rangiora, Kaiapoi, Christchurch, Ashburton, Timaru, Geraldine and Waimate.

14.3.3 Avoid, remedy or mitigate localised adverse effects on air quality

To set standards, conditions and terms for discharges of contaminants into the air to avoid, remedy or mitigate localised adverse effects on air quality.

14.3.5 Relationship between discharges to air and sensitive land-uses

In relation to the proximity of discharges to air and sensitive land-uses:

1. To avoid encroachment of new development on existing activities discharging to air where the new development is sensitive to those discharges, unless any reverse sensitivity effects of the new development can be avoided or mitigated.

2. Existing activities that require resource consents to discharge contaminants into air, particularly where reverse sensitivity is an issue, are to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment.

3. New activities which require resource consents to discharge contaminants into air are to locate away from sensitive land uses and receiving environments unless adverse effects of the discharge can be avoided or mitigated.

CHAPTER 15 – SOILS

15.2 OBJECTIVES

15.2.1 Maintenance of soil quality

Maintenance and improvement of the quality of Canterbury's soil to safeguard their mauri, their life supporting capacity, their health and their productive capacity.

15.3 POLICIES

15.3.1 Avoid remedy or mitigate soil degradation

In relation to soil:

1. to ensure that land-uses and land management practices avoid significant long-term adverse effects on soil quality, and to remedy or mitigate significant soil degradation where it has occurred, or is occurring; and

2. to promote land-use practices that maintain and improve soil quality.

CHAPTER 18 - HAZARDOUS SUBSTANCES

18.2 OBJECTIVES

18.2.1 Avoid, remedy or mitigate adverse effects

Adverse effects on the environment from the storage, use, disposal and transportation of hazardous substances are avoided, remedied or mitigated.

18.2.2 New contamination of land

To avoid contamination of land.

18.3 POLICIES

18.3.1 Protection of sensitive areas and activities

Avoid actual or potential adverse effects, resulting from the use, storage or disposal of hazardous substances, in the following locations:

1. High hazard areas
2. Within a community drinking water protection zone, or within such a distance from a community drinking water supply that there is a risk of contamination of that drinking water source
3. In areas of unconfined or semi-confined aquifer, where the depth to groundwater is such that there is a risk of contamination of that groundwater
4. Within the coastal marine area and in the beds of lakes and rivers
5. Within any area identified by a district or regional plan as being sensitive to the potential effects of hazardous substances, which may include, but are not limited to, areas such as wāhi tapu, urupā, institutions and residential areas.

18.3.2 Avoid, remedy or mitigate adverse effects

To avoid, remedy or mitigate adverse effects on the environment, including contamination of land, air and water, associated with the storage, use, transportation or disposal of hazardous substances.

Canterbury Land and Water Regional Plan

Objectives and Policies

Section 3 - Objectives

3.1 Land and water are managed as integrated natural resources to recognise and enable Ngāi Tahu culture, traditions, customary uses and relationships with land and water.

3.2 Water management applies the ethic of ki uta ki tai – from the mountains to the sea – and land and water are managed as integrated natural resources recognising the connectivity between surface water and groundwater, and between fresh water, land and the coast.

3.5 Land uses continue to develop and change in response to socio-economic and community demand.

3.8 The quality and quantity of water in fresh water bodies and their catchments is managed to safeguard the life-supporting capacity of ecosystems and ecosystem processes, including ensuring sufficient flow and quality of water to support the habitat and feeding, breeding, migratory and other behavioural requirements of indigenous species, nesting birds and, where appropriate, trout and salmon.

3.8A High quality fresh water is available to meet actual and reasonably foreseeable needs for community drinking water supplies.

3.10 Water is available for sustainable abstraction or use to support social and economic activities and social and economic benefits are maximised by the efficient storage, distribution and use of the water made available within the allocation limits or management regimes which are set in this Plan.

3.11 Water is recognised as an enabler of the economic and social wellbeing of the region.

3.13 Groundwater resources remain a sustainable source of high quality water which is available for abstraction while supporting base flows or levels in surface water bodies, springs and wetlands and avoiding salt-water intrusion.

3.24 All activities operate at good environmental practice or better to optimise efficient resource use and protect the region's fresh water resources from quality and quantity degradation.

Section 4 – Policies

4.1 Lakes, rivers, wetlands and aquifers will meet the fresh water outcomes set in Sections 6 to 15 within the specified timeframes. If outcomes have not been established for a catchment, then each type of lake, river or aquifer should meet the outcomes set out in Table 1 by 2030.

4.2 The management of lakes, rivers, wetlands and aquifers will take account of the fresh water outcomes, water quantity limits and the individual and cumulative effects of land uses, discharges and abstractions will meet the water quality limits set in Sections 6 to 15 or Schedule 8 and the individual and cumulative effects of abstractions will meet the water quantity limits in Sections 6 to 15.

4.4 Groundwater is managed so that:

….

(e) overall water quality in aquifers does not decline; and

(f) the exercise of customary uses and values is supported.

4.7 Resource consents for new or existing activities will not be granted if the granting would cause a water quality or quantity limit set in Sections 6 to 15 to be breached or further over allocation (water quality and/or water quantity) to occur or in the absence of any water quality standards in Sections 6 to 15, the limits set in Schedule 8 to be breached. Replacement consents, or new consents for existing activities may be granted to:

(a) allow the continuation of existing activities at the same or lesser rate or scale, provided the consent contains conditions that contribute to the phasing out of the over allocation (water quality and/or water quantity) within a specified timeframe; or

(b) exceed the allocation limit (water quality and/or water quantity) to a minor extent and in the short-term if that exceedance is part of a proposal to phase out the overallocation within a specified timeframe included in Sections 6 to 15 of this Plan.

4.8A [From National Policy Statement on Freshwater Management 2014]

1. When considering any application for a discharge the consent authority must have regard to the following matters:

(a) the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and

(b) the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.

2. When considering any application for a discharge the consent authority must have regard to the following matters:

(a) the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their contact with freshwater; and

(b) the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their contact with fresh water resulting from the discharge would be avoided.

3. This policy applies to the following discharges (including a diffuse discharge by any person or animal):

(a) a new discharge or

(b) a change or increase in any discharge – of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.

4. Paragraph 1 of this policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July 2011.

5. Paragraph 2 of this policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2014 takes effect. 4.8B [From NPS-FM 2014].

1. When considering any application the consent authority must have regard to the following matters:

(a) the extent to which the change would adversely affect safeguarding the life-supporting capacity of fresh water and of any associated ecosystem and

(b) the extent to which it is feasible and dependable that any adverse effect on the life-supporting capacity of fresh water and of any associated ecosystem resulting from the change would be avoided.

2. This policy applies to:

(a) any new activity and

(b) any change in the character, intensity or scale of any established activity – that involves any taking, using, damming or diverting of fresh water or draining of any wetland which is likely to result in any more than minor adverse change in the natural variability of flows or level of any fresh water, compared to that which immediately preceded the commencement of the new activity or the change in the established activity (or in the case of a change in an intermittent or seasonal activity, compared to that on the last occasion on which the activity was carried out).

3. This policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July 2011.

4.11 The setting and attainment of catchment specific water quality and quantity outcomes and limits is enabled through:

(a) limiting the duration of any resource consent granted under the region-wide rules in this Plan to a period not exceeding five years past the expected notification date (a set out in the Council's Progressive Implementation Programme) of any plan change that will introduce water quality or water quantity provisions into Sections 6 – 15 of this Plan; but

(b) allowing, where appropriate, a longer resource consent duration for discharge permit granted to irrigation schemes or principal water suppliers under the region-wide nutrient management rules in this Plan, provided those permits include conditions that restrict the nitrogen loss from the land and enable a review of the consent under section 128(1) of the RMA.

Activity and Resource Policies

Discharges of Contaminants to land or water

4.12 There are no direct discharges to surface water bodies or groundwater of:

(a) untreated sewage, wastewater (except as a result of extreme weather-related overflows or system failures) or bio-solids;

(b) solid or hazardous waste or solid animal waste;

(c) animal effluent from an effluent storage facility or a stock holding area;

(d) organic waste or leachate from storage of organic material; and

(e) untreated industrial or trade waste.

4.13 For other discharges of contaminants into or onto land where it may enter water or to surface water bodies or groundwater (excluding those passive discharges to which Policy 4.26 applies), the effects of any discharge are minimised by the use of measures that:

(a) first, avoid the production of the contaminant;

(b) secondly, reuse, recovers or recycles the contaminant;

(c) thirdly, minimise the volume or amount of the discharge; or

(d) finally, wherever practical utilise land-based treatment, a wetland constructed to treat contaminants or a designed treatment system prior to discharge; and

(e) in the case of surface water, results in a discharge that after reasonable mixing meets the receiving water standards in Schedule 5 or does not result in any further degradation in water quality in any receiving surface waterbody that does not meet the water quality standards in Schedule 5 or any applicable water conservation order.

4.14 Any discharge of a contaminant into or onto land where it may enter groundwater (excluding those passive discharges to which Policy 4.26 applies):

(a) will not exceed the natural capacity of the soil to treat or remove the contaminant; and

(b) will not exceed available water storage capacity of the soil; and

(c) where meeting (a) and (b) is not practicable, the discharge will:

(i) meet any nutrient limits in Schedule 8 or Sections 6 to 15 of this Plan; and

(ii) utilise the best practicable option to ensure the size of any contaminant plume is as small as is reasonably practicable; and

(iia) ensure there is sufficient distance between the point of discharge, any other discharge and drinking-water supplies to allow for the natural decay or attenuation of pathogenic micro-organisms in the contaminant plume; and

(iii) not result in the accumulation of pathogens, or a persistent or toxic contaminant that would render the land unsuitable for agriculture, commercial, domestic, cultural or recreational use or water unsuitable as a source of potable water or for agriculture; and

(iv) not raise groundwater levels so that land drainage is impeded.

4.14B Have regard to Ngāi Tahu values, and in particular those expressed within an iwi management plan, when considering applications for discharges which may adversely affect statutory acknowledgement areas, nohoanga sites, surface waterbodies, silent file areas, culturally significant sites, Heritage New Zealand sites, any listed archaeological sites, and cultural landscapes, identified in this Plan, any relevant district plan, or in any iwi management plan.

Stormwater and community wastewater systems

4.17 Stormwater run-off volumes and peak flows are managed so that they do not cause or exacerbate the risk of inundation, erosion or damage to property or infrastructure downstream or risks to human safety.

Earthworks, land excavation and deposition of material into land over aquifers

4.18 The loss or discharge of sediment or sediment-laden water and other contaminants to surface water from earthworks, including roading, works in the bed of a river or lake, land

development or construction, is avoided, and if this is not achievable, the best practicable option is used to minimise the loss or discharge to water.

4.19 The discharge of contaminants to groundwater from earthworks, excavation, waste collection or disposal sites and contaminated land is avoided or minimised by ensuring that:

(a) activities are sited, designed and managed to avoid the contamination of groundwater;

(b) existing or closed landfills and contaminated land are managed and monitored where appropriate to minimise any contamination of groundwater; and

(c) there is sufficient thickness of undisturbed sediment in the confining layer over the Coastal Confined Aquifer System to prevent the entry of contaminants into the aquifer or an upward hydraulic gradient is present which would prevent aquifer contamination.

Soil stability

4.22 Sedimentation of water bodies as a result of land clearance, earthworks and cultivation is avoided or minimised by the adoption of control methods and technologies, such as maintaining continuous vegetation cover adjacent to water bodies or capturing surface run-off to remove sediment and other contaminants or by methods such as direct drilling crops and cultivation that follows the contours of a paddock.

Protect sources of drinking-water

4.23 Any water source used for drinking-water supply is protected from any discharge of contaminants that may have any actual or potential adverse effect on the quality of the drinking-water supply including its taste, clarity and smell and community drinking water supplies are protected so that they align with the CWMS drinking-water targets and meet the drinking-water standards for New Zealand.

4.23A The quality of water abstracted from community drinking-water supply sources is protected through:

(a) the application of a provisional protection zone around the source of any existing community drinking-water supply, unless a specific protection zone is included as a condition in the permit to take or use water; and…..

Hazardous Substances & hazardous activities

4.25 Unless the substance is approved under the Hazardous Substances and New Organisms Act 1996 to be applied onto land or into water, activities involving the use, storage or discharge of hazardous substances will be undertaken using the best practicable option to:

(a) as a first priority, avoid the discharge (including accidental spillage) of hazardous substances onto land or into water, including reticulated stormwater systems; and

(b) as a second priority, ensure, where there is a residual risk of a discharge of hazardous substances including any accidental spillage, it is contained on-site and does not enter surface water bodies, groundwater or stormwater systems.

Gravel Extraction

4.93 Recognise the value of gravel extraction for construction and maintenance of infrastructure, for economic activity, for flood management purposes and for the re-build of Christchurch.

4.94 Enable the extraction of gravel from land, provided adverse effects on groundwater quality are minimised and remediation is undertaken to minimise any ongoing risk of groundwater contamination.

Selwyn Te Waihora sub-section

11.4 Policies

The following policies apply in the Selwyn Te Waihora sub-region in addition to those set out in Section 4 of the Plan.

11.4.1 Manage water abstraction and discharges of contaminants within the entire Selwyn Te Waihora sub-region to avoid, remedy or mitigate adverse cumulative effects on the water quality of Te Waihora/Lake Ellesmere, rivers and shallow groundwater; and the flow of water in springs and tributaries flowing into Te Waihora/Lake Ellesmere and achieve, in combination with non-regulatory actions, the freshwater objectives and outcomes for the sub-region.

11.4.2 In recognition of the importance of the entire catchment to Ngāi Tahu, actively manage the Selwyn Te Waihora sub-region to enable Ngāi Tahu to exercise kaitiakitanga in the management of fresh water.

Managing Land Use to Improve Water Quality

11.4.11 Require any person discharging wastewater, liquid waste or sludge waste from an industrial or trade process into or onto land to adopt the best practicable option to manage the treatment and discharge of contaminants and not exceed the nitrogen load limit for industrial and trade processes in Table 11(i) unless Policy 11.4.12 applies.

11.4.12 Enable the discharge of wastewater, liquid waste or sludge waste from an industrial or trade process into or onto land which cumulatively will result in the exceedance of the nitrogen load limit for industrial and trade processes in Table 11(i) only in circumstances where the loss of nitrogen from the land, being from both the discharge and any farming activity occurring on the land, does not exceed any authorised discharge of nitrogen from the land that was occurring prior to the discharge of wastewater.

Current information, monitoring and review

11.4.38 Making decisions on the best available current information, including monitoring and periodic review of the effectiveness of the water quality limits and targets.

Canterbury Air Regional Plan

Objectives and Policies

Definitions:

Sensitive activity

means an activity undertaken in:

a. the area within 20m of the façade of an occupied dwelling; or
b. a residential area or zone as defined in a district plan; or
c. a public amenity area, including those parts of any building and associated outdoor areas normally available for use by the general public, excluding any areas used for services or access areas; or
d. a place, outside of the Coastal Marine Area, of public assembly for recreation, education, worship, cultural or deliberation purposes.

Objectives

5.1 Air quality protects the mauri and life supporting capacity of the environment.

5.2 Ambient air quality provides for the health and wellbeing of the people of Canterbury.

5.3 Competing demands for the use of the air resource of Canterbury are accommodated while unacceptable degradation of ambient air quality is avoided.

5.4 Degraded ambient air quality is improved over time and where ambient air quality is acceptable it is maintained.

5.5 Air quality is managed in a way that provides for the cultural values and traditions of Ngāi Tahu.

5.6 Amenity values of the receiving environment are maintained.

5.7 Discharges from new activities are appropriately located to take account of adjacent land uses and sensitive activities.

5.9 Offensive and objectionable effects and noxious or dangerous effects on the environment are generally avoided.

5.10 Developments and innovation in technology that have the potential to improve air quality are enabled.

Policies

Central policies applying to all activities

6.1 Discharges of contaminants into air, either individually or in combination with other discharges, do not cause:

a. adverse effects on human health and wellbeing; or
b. adverse effects on the mauri and life supporting capacity of ecosystems, plants or animals; or
c. significantly diminished visibility; or
d. significant soiling or corrosion of structures or property.

6.2 Recognise the value of air quality as a taonga to Tāngata whenua and manage adverse effects of discharges into air on wāhi tapu, wāhi taonga, and places of significance to Ngāi Tahu.

6.3 Manage the effects of discharges into air on ambient air quality by:

a. the spatial division of the Canterbury Region into areas inside and outside Clean Air Zones;
b. setting a 2ha property area threshold; and
c. setting thresholds for effects above which resource consents are required.

6.4 Reduce adverse effects of discharges on people where ambient air quality does not meet the value set in a national ambient air quality standard or guideline.

6.5 Minimise adverse effects on people where ambient air quality is degraded when assessed against a national ambient air quality standard or guideline.

6.6 Maintain ambient air quality in locations where the quality is acceptable when assessed against an ambient air quality standard set in a national ambient air quality standard or guideline.

6.8 Offensive and objectionable effects are unacceptable and actively managed by plan provisions and the implementation of management plans.

6.9 Discharges into air from new activities are appropriately located and adequately separated from sensitive activities, taking into account land use anticipated by a proposed or operative district plan and the sensitivity of the receiving environment.

6.10 If the sensitivity of the receiving environment is altered by authorised land use change, so that an existing discharge results in significant adverse effects on the receiving environment, require the effects of that discharge to be reduced and provide a reasonable timeframe for achieving that reduction.

6.11 When evaluating resource consent applications recognise locational constraints on activities, when imposing terms and conditions.

6.12 Where activities locate appropriately to mitigate adverse effects on air quality a longer consent duration may be available to provide on-going operational certainty.

6.13 Minimise the cumulative effects of discharges of contaminants into air by requiring:

a. permitted discharges to apply good environmental practices; and

b. discharges allowed by a resource consent to apply the best practicable option.

6.15 Recognise that changes in technology may allow for improvements in the quality of a discharge over the term of the consent and acknowledge this by imposing management and review conditions on new and replacement resource consents.

6.17 Where a discharge causes effects that are unpredictable because of scientific uncertainty or an absence of information adopt a precautionary approach to assessing the effects if there is a risk of high probability or high potential impact.

Industrial and trade activities and large-scale fuel burning devices

6.22 Applications for resource consent for discharges of contaminants into air from large scale fuel burning devices and industrial or trade activities shall identify the best practicable option to be adopted to minimise effects.

6.25 Applications for resource consent for discharges into air from industrial or trade activities or large-scale fuel burning devices classified as discretionary shall address:

a. where the discharge includes PM10, the mass emission rate of the proposed discharge relative to the total emission rate of all discharges within the Clean Air Zone; and the degree to which the proposed discharge exacerbates cumulative effects within the Clean Air Zone; and
b. localised effects of the proposed discharge and the location of sensitive receptors; and
c. available mitigation and emission control options; and
d. the duration of consent being sought and the practicability for the effects of the discharge to be reduced over time.

6.26 When considering applications for resource consent for the discharge of contaminants into air from large scale fuel burning devices or from industrial, trade or commercial activities, the CRC will consider the combined effect of all consented discharges into air occurring on the property.

6.28 Manage discharges of odour and dust from the storage, transfer, handling, treatment or disposal of liquid or solid waste, by ensuring that any discharges from those activities are appropriately located.

Operative Selwyn District Plan

Objectives and Policies

B1 NATURAL RESOURCES

B1 NATURAL RESOURCES

LAND AND SOIL — OBJECTIVES

Objective B1.1.1

Adverse effects of activities on the District's land and soil resources are avoided, remedied or mitigated.

Objective B1.1.2

People and their property are not affected by contaminated soil or unstable land and any adverse effects on the environment are avoided, remedied or mitigated.

Objective B1.1.3

Promote the sustainable management of the soil resources of the District.

LAND AND SOIL — POLICIES AND METHODS

CONTAMINATED LAND

Policy B1.1.1

Ensure any activity involving hazardous substance or waste disposal is carried out in a way which reduces the risk of contaminating land or soil.

Policy B1.1.2

Avoid adverse effects on people through exposure to contaminated land and mitigate or remedy any adverse effects on the environment.

Policy B1.1.3

Encourage the management of contaminated sites so that effects on peoples' health or on the environment are avoided.

SOIL DAMAGE

Policy B1.1.6

Encourage initiatives by Environment Canterbury and landowners to reduce the adverse effects of activities on soil structure and soil erosion.

Policy B1.1.7

Avoid removing large quantities of topsoil from sites unless:

- The site will be covered in hardstanding; or
- The topsoil will be replaced, and the site replanted, when the activity ceases.

VEGETATION AND ECOSYSTEMS – OBJECTIVES

Objectives B1.2.1

Significant areas of indigenous vegetation and habitats of indigenous fauna are recognised and protected and enhancing areas of indigenous vegetation is encouraged.

Objective B1.2.4

The potential adverse effects from activities on areas of indigenous vegetation, habitats of indigenous fauna, and indigenous biodiversity and functioning are avoided, remedied or mitigated.

VEGETATION AND ECOSYSTEMS — POLICIES AND METHODS

Policy B1.2.6

Adverse effects on indigenous ecosystems, vegetation and habitat should be avoided, remedied or mitigated where these areas are important for maintaining the indigenous biodiversity and ecosystem functions and natural character of the District.

WATER — OBJECTIVES

Objective B1.3.1

Contamination of ground water or surface water is avoided and/or mitigated and water quality improved in degraded waterbodies through changes in land management practices and controls on land uses likely to cause waterbody contamination.

WATER — POLICIES AND METHODS

POLICIES

Policy B1.3.2

Recognise and provide for the special interest of Tāngata whenua in resource management issues relating to water.

GROUND AND SURFACE WATER

Policy B1.3.4

Manage land to protect water resources and avoid, remedy, or mitigate adverse effects on surface water quality and quantity, and aquatic habitat from activities and development, including:

- Activities locating close to waterbodies; or
- Activities which may result in surface run-off of contaminants, or leaching of contaminants into groundwater.

OUTSTANDING NATURAL FEATURES AND LANDSCAPES

Objective B1.4.1

The Outstanding Natural Features and Landscapes of the District are recognised and protected from inappropriate use and development while still enabling people to provide for their economic and social well-being.

Policy B1.4.2

Recognise that landscapes will change over time and allow changes to landscapes provided that they complement the landscape and retain its core values.

PHYSICAL RESOURCES

TRANSPORT NETWORKS — OBJECTIVES

ROAD, PATHWAYS, RAIL AND AIRFIELDS

Objective B2.1.1

An integrated approach to land use and transport planning to ensure the safe and efficient operation of the District's roads, pathways, railway lines and airfields is not compromised by adverse effects from activities on surrounding land or by residential growth.

TRANSPORT NETWORKS — POLICIES AND METHODS

ROADS AND PATHWAYS

Policy B2.1.2

Manage effects of activities on the safe and efficient operation of the District's existing and planned road network, considering the classification and function of each road in the hierarchy.

Policy B2.1.4(a)

Ensure all sites, allotments or properties have legal access to a legal road which is formed to the standard necessary to meet the needs of the activity considering:

- the number and type of vehicle movements generated by the activity;
- the road classification and function; and
- any pedestrian, cycle, public transport or other access required by the activity.

Policy B2.1.13

Avoid planting trees or hedges in positions or allow them to grow to heights where they will shade roads for prolonged periods during winter.

Policy B2.1.14

Ensure property gates are designed and positioned to leave adequate space for motor vehicles to move off the carriageway before stopping to open them.

3 PEOPLE'S HEALTH, SAFETY AND VALUES

DISTRICT-WIDE NATURAL HAZARDS

NATURAL HAZARDS — OBJECTIVES

Objective B3.1.1
Activities do not cause or exacerbate natural hazards.

Objective B3.1.2
Measures to mitigate natural hazards do not cause or exacerbate adverse effects on the environment.

NATURAL HAZARDS — POLICIES AND METHODS

Policy B3.1.7

Ensure the risk of damage from avalanche, earthquakes or slips is minor when locating buildings, other structures or recreational facilities at high altitudes or on steep slopes.

Policy B3.1.8

Ensure any measures proposed to mitigate a potential natural hazard:

- Do not lead to or intensify a potential natural hazard elsewhere; and
- Any other adverse effects on the environment being avoided, remedied or mitigated.

HAZARDOUS SUBSTANCES — OBJECTIVES

Objective B3.2.1
To ensure that adequate measures are taken to avoid, remedy or mitigate any adverse effects to human health, to the amenity of townships, the rural environment and to the natural environment arising from the manufacture, storage, transport on water bodies and disposal of hazardous substances.

Objective B3.2.2
To ensure that adequate measures are taken during the manufacture, storage and disposal of hazardous substances to avoid, remedy or mitigate any adverse effects to the health of livestock and other farm animals, to domestic animals, to flora and fauna, and to the life-sustaining capacity and amenity values of waterbodies, land and soil resources.

HAZARDOUS SUBSTANCES — POLICIES AND METHODS

MANUFACTURE AND STORAGE

Policy B3.2.1(a)
Allow appropriate quantities and classes of hazardous substances to be stored in the rural area to provide for land use activities that are consistent with the District Plan objectives and policies for those areas; and

Policy B3.2.1(b)
Ensure hazardous substances are used and stored under conditions which reduce the risk of any leaks or spills contaminating land or water.

QUALITY OF THE ENVIRONMENT — OBJECTIVES

Objective B3.4.1

The District's rural area is a pleasant place to live and work in.

Objective B3.4.2

A variety of activities are provided for in the rural area, while maintaining rural character and avoiding reverse sensitivity effects.

QUALITY OF THE ENVIRONMENT — POLICIES AND METHODS

RURAL CHARACTER

Policy B3.4.1

Recognise the Rural zone as an area where a variety of activities occur and maintain environmental standards that allows for primary production and other business activities to operate.

Policy B3.4.3

Avoid, remedy or mitigate significant adverse effects of activities on the amenity values of the rural area.

Policy B3.4.4

Ensure that any adverse effects arising from "rural based" industrial activities in the Rural (Inner Plains) Zone of a size and scale beyond what is permitted by the District Plan and "other" types of industrial activities in all Rural zones are avoided, remedied or mitigated to the extent that the adverse effects are no more than minor.

Policy B3.4.6

Maintain low levels of building density in the Rural zone and the predominance of vegetation cover.

Policy B3.4.9

Require signs and noticeboards to be located on the site to which the sign or notice board relates except for:

- Temporary signs; and
- Signs and noticeboards located close to townships on the Plains area.

Policy B3.4.10

Ensure signs and noticeboards are designed and positioned to avoid:

- Restricting people's visibility along roads;
- Impeding access to or past sites;
- Nuisance effects from sound effects, moving parts, glare or reflectivity;
- Large structures protruding above rooftops.

GLARE AND NIGHTGLOW

Policy B3.4.11

Avoid night lighting shining directly into houses, other than a house located on the same site as the activity, or from vehicles using roads in the District.

NOISE AND VIBRATION

Policy B3.4.13

Recognise temporary noise associated with short-term, seasonal activities as part of the rural environment, but ensure continuous or regular noise is at a level which does not disturb people indoors on adjoining properties.

DUST

Policy B3.4.16

Mitigate nuisance effects on adjoining dwellings caused by dust from earthworks, or stockpiled material.

SHADING

Policy B3.4.17

Ensure buildings and trees do not excessively shade adjoining properties.

REVERSE SENSITIVITY EFFECTS

Policy B3.4.20

Ensure new or upgraded road infrastructure and new or expanding activities, which may have adverse effects on surrounding properties, are located and managed to mitigate these potential effects.

Proposed Selwyn District Plan (Decisions Version), August 2023

Objectives and Policies

DISTRICT IDENTITY

SD-O1 Sensational Selwyn

Selwyn is an attractive and pleasant place to live, work, and visit, where development:

1. takes into account the existing and anticipated character of individual communities;
2. is well-connected, safe, accessible, and resilient; and
3. enhances environmental, economic, cultural, social and health outcomes for the benefit of the entire District.

SD-02 District Wellbeing and Prosperity

Selwyn's prosperous economy and community well-being are supported through the efficient use of land, resources, and infrastructure, while ensuring existing activities are protected from incompatible activities and reverse sensitivity effects.

SD-DI-06 Thriving Rural Communities

Outside of defined urban growth areas Selwyn's highly productive land is retained for rural production activities and rural communities retain their rural character.

TRANSPORT

TRAN-Objectives

TRAN-O1

People and places are connected through safe, efficient, and effective land transport corridors and land transport infrastructure for all transport modes, which are well integrated with land use activities and subdivision development and reduce dependency on private motor vehicles.

TRAN-Policies

TRAN-P3

Require Integrated Transport Assessments to assess the effects of high trip generating activities on the surrounding land transport network to:

1. Maintain the safety and efficiency of land transport infrastructure by ensuring there is sufficient capacity in land transport corridors, and
2. Establish whether the high trip generating activity can be supported by active transport modes, including accessibility to safe and convenient walking and cycling connections and access to public transport and public transport facilities.

TRAN-P4

Manage the adverse effects of activities within the General Rural Zone that exceed the maximum number of vehicle movements for each site.

Recognising and protecting land transport networks and systems

TRAN P7

Recognise and protect the function of the District's land transport network and systems by managing land use activities and subdivision development to ensure the safe and efficient movement of people and goods by:

1. Avoiding significant adverse effects and minimising other adverse effects from activities on the safe, efficient and effective operation of land transport corridors and land transport infrastructure, particularly where it may reduce safe and efficient traffic flows within the strategic transport network and links with Christchurch City;

2. Ensuring land transport corridors and land transport infrastructure can efficiently and effectively provide for the volume and type of transport movements based on the network road classifications; and

3. Requiring the design, positioning, and maintenance of accessways, corner splays, vehicle crossings, intersections, footpaths, plantings, and signs to ensure appropriate sightline visibility is provided to road users to support safe and efficient vehicle, pedestrian, and cycle movements.

TRAN-P11

Manage vehicle access, vehicle crossings and manoeuvring areas to maintain the safe and efficient operation of land transport corridors and land transport infrastructure by:

1. Requiring all sites to have access to a road and to ensure that this access is constructed to the appropriate formation standards and is compatible with the network road classification;
2. Avoiding the need to reverse vehicles onto the strategic transport network;
3. Avoiding the establishment of new accessways and vehicle crossings to roads that require access across a rail line; and
4. Minimising the need to reverse onto Collector Roads through the provision of appropriate on-site manoeuvring areas.

HAZARDS AND RISKS

CONTAMINATED LAND

CL-OBJECTIVES

CL-O1

Human health and the environment are protected from the adverse effects of the use of contaminated land.

CL-P1

Require any proposal for subdivision, development, or use of contaminated land or potentially contaminated land to apply a best practice approach to investigate the risks, and either remediate the contamination or manage activities on contaminated land to protect people and the environment.

NATURAL HAZARDS

NH-Objectives

NH- O1

New subdivision, use, and development, (except for new important infrastructure and land transport infrastructure where NH-O2 applies instead):

1. is avoided in areas where the risks from natural hazards to people, property and infrastructure are assessed as being unacceptable; and
2. in all other areas, is undertaken in a manner that ensures that the risks of natural hazards to people, property and infrastructure are appropriately mitigated.

NH-O3

Methods to mitigate natural hazards do not create or exacerbate adverse effects on other people, property, infrastructure, or the environment.

NH-O4

The effects of climate change, and its influence on sea levels and the frequency and severity of natural hazards, are recognised and provided for.

NH-Policies

General

NH-P1

Avoid new subdivision, use, or development of land in high hazard areas (except for important infrastructure and land transport infrastructure where NH-P2 applies instead), unless the subdivision, use or development either:

1. is

a. not likely to result in loss of life or serious injuries; and b.
is not likely to suffer significant damage or loss; and c.
is not likely to require new or upgraded natural hazard mitigation works to mitigate or avoid the natural hazard; and either is: d.
not likely to exacerbate the effects of the natural hazard;

2. or, alternatively it is located in any of the following areas as at 6 December 2013, in which case the effects of the natural hazard must be avoided or appropriately mitigated.

a. Living 1 zone, Living X zone or Living Z zone;
b. in Lincoln, a Living B2 zone; or
c. a Business Zone.

NH-P3

Restrict new subdivision, use or development of land in areas outside high hazard areas but known to be vulnerable to a natural hazard, unless any potential risk of loss of life or damage to property is appropriately mitigated.

NH-P4

Natural hazard mitigation works shall consider:

1. approaches to risk management that reduce the need for physical works and similar engineering interventions;

2. the nature of the natural hazard risk and how it might change over at least a 100-year timeframe, including the expected effects of climate change;
3. the potential for adverse effects on indigenous biodiversity, Ngāi Tahu cultural values, or sites of historic heritage or geological value;
4. identification of and a plan for transition mechanisms and timeframes for moving to more sustainable approaches; and
5. the physical works necessary to ensure that the form and location of any structure is designed to minimise adverse effects on the environment.

NH-P5

When determining if new subdivision, use, or development is appropriate and sustainable in relation to the potential risks from natural hazard events, have particular regard to the effects of climate change.

Flood Hazards

NH-P10

In areas within the Plains Flood Management Overlay that are not a high hazard area, provide for :

1. important infrastructure and land transport infrastructure; and 2.
any other new subdivision, use, and development only where every new residential unit or principal building has an appropriate floor level above the 200 year Average Return Interval (ARI) design flood level.

NH-P12

Manage earthworks undertaken in the Waimakariri Flood Management Overlay and the Plains Flood Management Overlay to ensure that they do not exacerbate flooding on any other property by displacing or diverting floodwater on surrounding land.

Geotechnical Hazards

NH-P15

Within the Greendale Fault Avoidance Overlay, avoid the development or use of land, buildings or structures for any:

1. community facility; or
2. important infrastructure; or
3. land transport infrastructure; or
4. Major Hazard Facility

unless the activity:

a. does not pose a significant risk, or exacerbate an existing risk, to people or property; and
b. either:
    i. has a functional need or operational need to be in that location; or
    ii. is not vulnerable to the natural hazard; and
c. contributes to the resilience of the community in the event of a natural disaster.

NH-P17

Within the Fault Awareness Overlay, restrict the development of any:

1. important infrastructure and land transport infrastructure; or
2. Major Hazard Facility

unless the adverse effects of fault rupture can be mitigated so as to ensure that there is no greater risk to human health and safety during and after an earthquake.

HAZARDOUS SUBSTANCES

HAZS-Objectives

HAZS-O1

The benefits associated with activities involving the use, storage, disposal, and transportation of hazardous substances are recognised, while ensuring that risks to the environment and human health are minimised to acceptable levels.

HAZS-Policies

HAZS-P1

Enable activities involving the use, storage, disposal, and transportation of hazardous substances while managing the residual risk to people, property, and the environment to acceptable levels.

ECOSYSTEMS AND INDIGENOUS BIODIVERSITY

ECO-Objectives

ECO-O1

Indigenous biodiversity within the district is managed through the exercise of kaitiakitanga and stewardship, in order that:

1. Areas of significant indigenous vegetation and significant habitats of indigenous fauna are protected, and
2. Other indigenous biodiversity values are maintained and enhanced, and
3. The restoration and enhancement of areas of indigenous biodiversity is encouraged and supported.

ECO-O2

The relationship of Ngāi Tahu whānui, and their customs and traditions, with indigenous biodiversity is recognised and provided for, including through:

1. Facilitation and support for the exercise of kaitiakitanga in relation to indigenous species and habitats; and
2. Maintenance, enhancement, and restoration where degraded, of habitats that sustain mahinga kai; and
3. Enabling customary use of taonga species.

ECO-Policies

ECO-P11

Avoid planting pest tree and plant species that are listed in ECO-SCHEDI
Potential Pest Species} or in the Canterbury Regional Pest Management Plan 2018-2038.

ECO-P12

Ensure the maintenance of indigenous vegetation cover and habitat values in
extensive, dryland pastoral systems.

EARTHWORKS

EW-Objectives

EW-O1

Earthworks are undertaken in a manner that limits adverse effects on the surrounding environment.

EW-Policies

EW-P3

Manage earthworks to limit erosion, inundation or siltation so that it does not impede the functioning of natural biological and physical processes.

EW-P4

Minimise any adverse visual effects, loss of privacy, dust nuisance, or shading adverse effects during and on completion of earthworks.

LIGHT

LIGHT-Objectives

LIGHT-O1

Artificial outdoor lighting enables work, recreation, and entertainment activities to occur beyond daylight hours, while:

1. maintaining the health, safety, and amenity values of people; and
2. protecting the District's natural darkness and natural features.

LIGHT-Policies

LIGHT-P1

Manage new artificial outdoor lighting to minimise light spill and glare onto adjoining sites and glare onto adjoining sites and roads to provide for the health and safety of people and the safe, effective and efficient operation of the land transport network.

LIGHT-P2A

Recognise that artificial lighting may be required to support the operational needs of activities, including their health and safety requirements, and those needing to operate on a 24-hour basis.

LIGHT-P3

Minimise potential upward light that causes sky glow, whilst ensuring the safe, effective, and efficient operation of roads, public pedestrian access and public sports courts and grounds, by controlling new artificial outdoor lighting to:

1. maintain people's ability to view the night sky; and
2. maintain the distinct character and amenity values of the district's night sky; and
3. protect the health and well-being of people and ecosystems.

NOISE

NOISE-Objectives

NOISE-O1

The health and wellbeing of people and communities and their amenity values are protected from adverse noise effects, consistent with the anticipated outcomes for the receiving environment. .

NOISE-Policies

NOISE-P1

Manage noise effects by setting:

1. Maximum noise limits to reflect the character and amenity of each zone;

2. Limits on the location, frequency, and duration of specific activities that generate noise;

3. A vibration standard.

NOISE-P8

Manage the frequency and duration of noise from temporary activities, including sound amplified activities.

SIGNS

SIGN-Objectives

SIGN-O1

Signs contribute to the District's economic and community wellbeing, and transport safety.

SIGN-Policies

SIGN-P1

Enable signs that are an integral component of industrial, commercial, and community activities and important infrastructure.

SIGN-P2

Manage the size, design, location, and number of signs to maintain transport safety and the character and amenity values of the surrounding environment, including the values of Outstanding Natural Landscapes, the coastal environment, and the heritage values of identified heritage items and settings.

GENERAL RURAL ZONE

GRUZ- Overview

"The majority of the District is classified as the General Rural Zone, with the primary purpose being to provide for primary production activities and other compatible activities.
Generally, character and amenity within the General Rural Zone is characterised by a landscape dominated by openness and vegetation, and with significant visual separation between neighbouring residential buildings. Rural landscapes include rural production activities, including plantation forestry, mineral extraction, farming (including research farming and associated facilities) and associated structures and buildings as well as rural support services and rural industry. These activities may have associated levels of noise, dust and odour.

The General Rural Zone also has large areas of highly productive land which are important for primary production purposes. Whilst residential activities are part of the General Rule Zone, they should not compromise the ability of the Zone to be used for primary production. Establishing new sensitive activities, such as educational and health facilities, is generally not appropriate in the General Rural Zone. **…"**

GRUZ-Objectives

GRUZ-O1

Subdivision, use, and development in rural areas that:

1. supports, maintains, or enhances the function and form, character, and amenity value of rural areas;
2. prioritises primary production, over other activities to recognise its importance to the economy and wellbeing of the district;
3. allows primary production, those activities that directly support primary production and have a functional or operational need to locate with the General Rural Zone and important infrastructure, to operate without being compromised by incompatible sensitive activities and reverse sensitivity effects; and
4. retains a contrast in character to urban areas; and
5. protects highly productive land.

GRUZ-Policies

GRUZ-P1

Maintain or enhance rural character and amenity values of rural areas by:

1. retaining a low overall building density;
2. enabling primary production while managing adverse effects of intensive primary production, and mineral extractive industries;
3. managing the density and location of residential development;
4. retaining a clear delineation and contrast between the district's rural areas and urban areas; and
5. recognising that primary production activities can produce noise, dust, odour and traffic that may be noticeable to residents and visitors to the General Rural Zone.

GRUZ-P4

Provide for the economic development potential of the rural area by enabling a range of activities that:
1. have a direct relationship with, or are dependent on, primary production;
2. have a functional need, or operational need to locate in the rural area;
3. represent an efficient use of natural and physical resources; and
4. maintain or enhance the character and amenity values of the surrounding area.

GRUZ-P7

Avoid reverse sensitivity effects on:

1. lawfully authorised or established primary production activities;
2. activities that have a direct relationship with, or are dependent, on primary production; and
3. important infrastructure.

GRUZ-P8

Enable mineral extraction in the General Rural Zone to meet the District's and region's supply needs, including by recognising the need for mineral extraction to locate where the mineral resource exists, while:

1. managing the spatial extent and effects of mineral extraction activities in order to maintain the amenity values of sensitive activities and residential activities; and
2. internalising adverse environmental effects as far as practicable, including by using industry best practice and management plans; and
3. avoiding mineral extraction on highly productive land unless there is a functional or operational need to locate it on that land and the mineral extraction provides either:
    a. a significant national public benefit; or
    b. in the case of aggregate extraction, a significant national or regional public benefit.

GRUZ-P9

Ensure that mineral extraction sites are progressively rehabilitated to:

1. mitigate erosion and subsidence risks; and
2. reinstate the land so that it is suitable for an alternative permitted or consented activity.