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Fraser Thomas
ENGINEERS • RESOURCE MANAGERS • SURVEYORS

362 JONES ROAD,
HUNUA

PROPOSED MANAGED FILL – ENGINEERING REPORT

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HUNUA

PROPOSED MANAGED FILL - ENGINEERING REPORT

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TABLE OF CONTENTS

FIGURES AND DRAWINGS (refer separate volume)

33250/001	EXISTING AND SURROUNDING SITE PLAN
33250/002	EXISTING SITE PLAN

33250/003	PROPOSED FINISHED SITE PLAN
33250/100	PROPOSED FILLING AREA DEVELOPMENT PLAN
33250/110	PROPOSED NORTHERN CLEANFILL DEVELOPMENT SITE PLAN
33250/111	PROPOSED NORTHERN CLEANFILL CROSS SECTION PLAN
33250/112	PROPOSED NORTHERN CLEANFILL CROSS SECTIONS SHEET 1 OF 3
33250/113	PROPOSED NORTHERN CLEANFILL CROSS SECTIONS SHEET 2 OF 3
33250/114	PROPOSED NORTHERN CLEANFILL CROSS SECTIONS SHEET 3 OF 3
33250/120	PROPOSED NORTHERN CLEANFILL CUT AND FILL PLAN
33250/121	PROPOSED NORTHERN EROSION AND SEDIMENT CONTROL PLAN
33250/122	PROPOSED NORTHERN DIRTY WATER DIVERSION DRAIN LONG SECTIONS
33250/130	INDICATIVE NORTHERN CLEANFILL STAGING PLAN
33250/131	NOISE BUND DETAILS PLAN
33250/132	NOISE BUND DETAILS PLAN - SHEET 2 OF 2
33250/133	SOUTHERN FILL NOISE BUNDS
33250/134	NOISE BUND DETAILS PLAN
33250/140	REMOVAL OF EXISTING STREAM CROSSING
33250/141	LONG SECTION AND CROSS SECTION OF REINSTATED STREAM AND WETLAND
33250/150	PROPOSED SOUTHERN CLEANFILL DEVELOPMENT SITE PLAN
33250/151	PROPOSED SOUTHERN CLEANFILL CROSS SECTION PLAN
33250/152	PROPOSED SOUTHERN CLEANFILL CROSS SECTIONS SHEET 1 OF 1
33250/160	PROPOSED SOUTHERN CLEANFILL CUT AND FILL SITE PLAN
33250/161	PROPOSED SOUTHERN EROSION AND SEDIMENT CONTROL PLAN
33250/162	PROPOSED SOUTHER DIRTY WATER DIVERSION DRAIN LONG SECTIONS
33250-170	INDICATIVE SEDIMENT RETENTION POND SIZING - 2HA CATCHMENT AREA
33250-171	SEDIMENT RETENTION POND STANDARD DETAILS SHEET 1 OF 2
33250-172	INDICATIVE SEDIMENT RETENTION POND SIZING - 1.2HA CATCHMENT AREA
33250-173	SEDIMENT RETENTION POND STANDARD DETAILS SHEET 2 OF 2
33250/180	EROSION AND SEDIMENT CONTROL DETAILS SHEET 1
33250/181	EROSION AND SEDIMENT CONTROL DETAILS SHEET 2
33250/190	PROPOSED BORE LOCATION RELATIVE TO WASTEWATER DISPOSAL FIELD AND WHEEL WASHING AREA
33250/195	INDICATIVE FILLING PLAN SHOWING ACCESS ROADS AND TIPPING HEADS
33250/200	PROPOSED HAUL ROAD LAYOUT PLAN
33250/201	PROPOSED HAUL ROAD ACCESSWAY LAYOUT (SHEET 1 OF 2)
33250/202	PROPOSED HAUL ROAD ACCESSWAY LAYOUT (SHEET 2 OF 2)
33250/220	PROPOSED HAUL ROAD ACCESSWAY LONGSECTIONS
33250/250	PROPOSED HAUL ROAD ACCESSWAY CUT AND FILL PLAN
33250/251	PROPOSED HAUL ROAD ACCESSWAY EROSION AND SEDIMENT CONTROL PLAN
33250/300	PROPOSED STORMWATER PLAN - OVERALL PLAN
33250/301	PROPOSED STORMWATER PLAN - HAUL ROAD ENTRANCE (SHEET 1 OF 3)
33250/302	PROPOSED STORMWATER PLAN - HAUL ROAD ENTRANCE (SHEET 1 OF 3)
33250/303	PROPOSED STORMWATER PLAN - HAUL ROAD ENTRANCE (SHEET 1 OF 3)
33250/304	PROPOSED STORMWATER PLAN - LONG SECTIONS

33250/305	PRE AND POST DEVELOPMENT CATCHMENT COMPARISON PLAN
33250/350	PROPOSED NORTHERN UNDERFILL STRIP DRAIN
33250/351	PROPOSED SOUTHERN UNDERFILL STRIP DRAIN
33250/400	ENHANCEMENT PLANTING AND WEEDING CONTROL AREAS (SHEET 1 OF 3)
33250/401	ENHANCEMENT PLANTING AND WEEDING CONTROL AREAS (SHEET 2 OF 3)
33250/402	ENHANCEMENT PLANTING AND WEEDING CONTROL AREAS (SHEET 3 OF 3)
33250/500	PROXIMITY OF FILL AREAS TO HAYS CREEK SOURCE WATER RISK MANAGEMENT AREAS
33250/501	HAYS CREEK DAM PRINCIPAL STORMWATER FLOW PATHS FROM FILL SITE
33250/502	STORMWATER SAMPLING PLAN

APPENDICES

A Calculations

B Shadow Analysis

C Groundwater Bore and Water Take Information

SCARBRO ENVIRONMENTAL LTD
362 JONES ROAD, HUNUA

PROPOSED MANAGED FILL – ENGINEERING REPORT

EXECUTIVE SUMMARY

In response to instructions from Scarbro Environmental Ltd (SEL), Fraser Thomas Limited (FTL) has prepared this Engineering Report and associated Assessment of Environmental Effects (AEE) to support a resource consent application for a Managed Fill facility at 362 Jones Rd, Hunua, occupying approximately 12ha of the 25.2ha site.

This Engineering Report and AEE has been prepared in accordance with the requirements of the Resource Management Act, the WasteMINZ Technical Guidelines for Disposal to Land (V3.1, September 2023) and the Auckland Unitary Plan: Operative in Part (AUP:OP).

It covers the following:

- Background information on the site and matters relevant to this application.
- Fill classification and waste acceptance criteria.
- Managed Fill Development.
- Erosion and Sediment Control Plan.
- Assessment of Environmental Effects.

Consents are sought for the following activities:

- Earthworks for filling.
- Operation of a Managed Fill.
- Decommissioning (abandoning) of an existing groundwater bore and construction of a new bore.

Other permitted activity works associated with the Fill development include a new groundwater take for vehicle wheel washing use and dust control and removal of an existing culvert and associated embankment forming a farm crossing.

Supporting technical reports prepared by Fraser Thomas Ltd comprise:

- Geotechnical Investigation Report;
- Preliminary Site Investigation (PSI) for Contamination;
- Fill Management Plan.

SEL are proposing to construct a Managed Fill comprising two separate areas of 9ha and 2ha (including associated drains and sediment ponds) on the northern and southern sides of the site respectively, with corresponding estimated fill volumes of 720,000m^3 and 70,000m^3, giving a combined fill volume of 790,000m^3. Filling will take place over a period of approximately 5-10 years and consent is sought for a total period of 10 years to provide some contingency should fill volumes be less than anticipated.

Erosion and sediment control will be provided by sediment ponds sized to cater for the entire Fill areas, with treated runoff discharged to the site watercourses.

The site will be fully owned by SEL and managed and operated by them.

The Managed Fill has been designed in accordance with best practice, while a Fill Management Plan has been prepared for use during Managed Fill operation. In respect to the matters addressed in this report, implementation of Managed Fill construction and operation in accordance with the design plans and Fill Management Plan, including waste acceptance, inspection, maintenance and site restoration requirements, should ensure that potential adverse environmental effects associated with the filling and associated activities are avoided or mitigated, so that these effects are less than minor.

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362 JONES ROAD, HUNUA

PROPOSED MANAGED FILL – ENGINEERING REPORT

1.0 INTRODUCTION

In response to instructions from Scarbro Environmental Ltd (SEL), Fraser Thomas Limited (FTL) has prepared this Engineering Report and associated Assessment of Environmental Effects (AEE) to support a resource consent application for a managed fill facility at 362 Jones Rd, Hunua, occupying approximately 12ha (including sediment removal ponds) of the 25.2ha site.

This Engineering Report and AEE has been prepared in accordance with the requirements of the Resource Management Act, the WasteMINZ Technical Guidelines for Disposal to Land (V3.1, September 2023) and the Auckland Unitary Plan: Operative in Part (AUP:OP).

The proposed Fill Facility is referred to as a "Managed Fill' based on definitions set out in the AUP:OP and under the WasteMINZ Disposal to Land Guidelines.

It covers the following:

- Background information on the site and matters relevant to this application.
- Fill classification and waste acceptance criteria.
- Managed Fill Development
- Erosion and Sediment Control Plan.
- Assessment of Environmental Effects.
- Fill Management Plan (separate report).

A number of specialist reports have been prepared by Fraser Thomas to support this application, including a Geotechnical Investigation Report and Preliminary Site Investigation (PSI) for contamination. These reports are provided under separate cover, with key points summarised in this report.

Table 1 gives an overview of consenting requirements in relation to this Engineering Report.

Table 1: Overview of Resource Consent Requirements

Activity	Overview	Regulations
Earthworks for filling	790,000m^3 of fill earthworks over 11ha area, including sediment pond and drains.	E11 Land Disturbance Regional: construction and filling of a managed fill: Earthworks over 2,500m^2 where the land has a slope equal to or greater than 10 degrees (A8) and earthworks located within a sediment control protection area (A9): **restricted discretionary activity;** Standard E11.4.1.

Activity	Overview	Regulations
		E12 Land Disturbance District: construction and filling of a cleanfill - Activities A6 and A10: Earthworks over 2,500m^2 and 2,500m^3: **restricted discretionary activity;** Standard E12.4.1.
Filling	Establishment and operation of a cleanfill of 790,000m^3 capacity operating over an estimated 5-10 year period	H19: Rural zones: Managed Fill – Activity A66: Cleanfill in the Rural-Mixed Rural zone: **discretionary activity**; Standard H19.4.1
Discharge of contaminants		E13 Cleanfills, Managed Fills and Landfills: Activity A5: **restricted discretionary activity –** managed fills that do not comply with Standard E13.6.2.2
Abandoning existing bore	Decommissioning existing bore located in northern fill area	E7 Activity A40 - decommissioning (abandoning) existing bore – **permitted activity** under E7.6.1.20
Bore permit	New groundwater bore and/or pump, to replace existing bore	E7 Taking, using, damming and diversion of water and drilling: Activity A41 – new bores for purposes not otherwise specified – **controlled activity;** Standard E7.6.2.3, E7.7.1 (4) and E7.7.2 (4)
Groundwater take	Use of groundwater from existing bore on site for wheel washing and dust control (estimated max 20m^3/d and 4000m^3/year	E7 Taking, using, damming and diversion of water and drilling: Activity A15 – groundwater take not exceeding 20m^3/d and 5,000m^3 per year: **permitted activity**
Stormwater diversion and discharge	Diversion and discharge of stormwater from impervious areas of the site, excluding unsealed or gravelled tracks	E8: Activity A7 - Diversion and discharge of stormwater runoff from impervious areas up to 5,000m^2 outside an urban area that complies with Standard E8.6.1 and Standard E8.6.2.4: **permitted activity**
OLFP piping	Upper section of OLFP3 will be piped under new haul road using a new culvert	E36: Activity A41 "Diverting the entry or exit point, piping or reducing the capacity of any part of an OLFP: **Restricted discretionary** activity.
Existing culvert removal and new bridge over stream near site entrance	Removal of the existing culvert of length <10m, with associated erosion/ scour management works of max 5m length	E3: Lakes, rivers, streams and wetlands: Activity A24: Demolition or removal of existing structures complying with E3.6.1.13 standards - **permitted activity;** Activity A29: Bridges or pipe bridges complying with E3.6.1.16 standards **– permitted activity** National Environmental Standard – Freshwater (NES-FW) – not applicable

Activity	Overview	Regulations
Soil disturbance and change in land use (NESCS)	Soil disturbance associated with construction of managed fill facility.	National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) – not applicable – refer separate PSI report

Note: Traffic, noise and visual effects are covered by others in separate technical reports.

2.0 BACKGROUND INFORMATION

2.1 SITE LOCATION AND IDENTIFICATION

Site location and ownership details are summarised below and the location is shown on Figure 1.

Table 2: Site Location and Ownership Details

Registered Owners	Lynley Ruth Monk, Lance Richard Patrick, Trevor Bryce Patrick, Wayne John Patrick
Street Address	362 Jones Rd, Hunua
Legal Description	Part Allotment 10 and Allotment 264 Parish of Hunua
Title	NA67C/593, NA67C/594
Total Area (ha)	252,000m^2
Zoning	Rural – Rural Production zone

The site is subject to a sale and purchase agreement to SEL, conditional on obtaining resource consents for the Managed Fill operation.

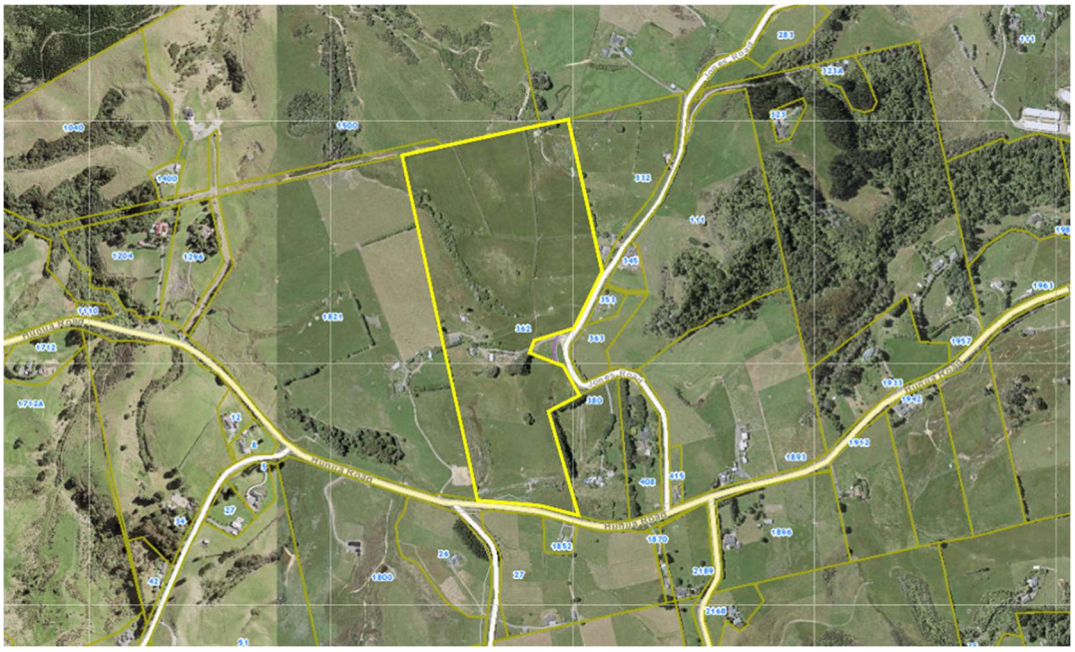

Figure 1: Site Location Plan

2.2 EXISTING LAND USE AND ACCESS

The site comprises one residential dwelling, multiple garages and utility sheds. It has been used for at least the last 80 years as a dry stock farm. The house has a roof rainwater harvesting water supply and its own on-site wastewater septic tank treatment and disposal system. The site is bounded by Jones Rd to the east and Hunua Rd to the south. The existing site access is off Jones Rd.

2.1 EXISTING WATER BORE

A groundwater bore is located on the northern half of the site in a paddock, as shown in FTL drawing 33250/002. This bore only supplies water for animal drinking to the troughs on the farm. It used to be connected to the dwelling, but the water was discoloured and stained sinks, so was disconnected.

A Council bore database search found no records of any bores on the subject site, from which it is inferred that the existing bore is not consented and groundwater has been taken from it under RMA S14 provisions. The current land owner has no information on the depth of the existing bore, other than noting that it could date back to the 1940s.

2.2 TOPOGRAPHY

The site has a moderate sloping landscape, including multiple gullies. The northern area is a gently rolling hill grading down to a stream running along the western boundary of the site, and to the north of the site. The highest point of the area is along the eastern boundary. The southern area is a steeper hill area, which grades from a ridge down to a separate stream along the western boundary of the site.

2.3 SOILS

The Manaaki Whenua - Landcare Research soils map shows the site to have Albic Ultic (UE) soils.

2.4 GEOLOGY

The Institute of Geological and Nuclear Sciences geological web map (NZ 1:250,000) indicates that the site is underlain by sandstone and siltstone rocks of the Waipapa group, consisting of a massive to thin bedded, lithic volcaniclastic metasandstone and argillite, with tectonically enclosed spilite, chert and red and green argillite.

Fraser Thomas Ltd have undertaken a geotechnical investigation of the subject site involving 23 hand augered boreholes (H1 – H23) across proposed filling areas and associated access roading. Topsoils were generally encountered between 0.2 – 0.4m depth below ground level (BGL). Topsoil was not encountered in Boreholes H10, H12, H14 and H19. Fill was encountered beneath the surficial topsoil material in Boreholes H15, H18, H21, H22 and H23 to a depth of

approximately 1.5m, 1.0m, 1.5m and 0.6m BGL respectively, and to the extent of Borehole H21. The fill material generally comprised of gravelly silts and clayey silts. Borehole locations H15 & H21 – H23 are located in the southernmost section of the site, and location H18 is located by the southern culvert. Due to the proximity of these locations to Hunua Road, it is suggested that the fill may have been reworked during construction of the cut section of road.

2.5 STORMWATER DRAINAGE AND RECEIVING ENVIRONMENT

The site is located at the top of the Slippery Creek catchment and is split into three sub-catchments drained by three stream tributaries that flow to the west or north-west. The two northern flowpaths flow into the Hays Creek Dam, the discharge of which combines with the southern flowpath and then flows to the west through the Hunua Gorge to the Manukau Harbour (receiving environment) near Drury township.

The northern sub-catchments collect some runoff from areas upgradient of the site. The western overland flowpath (OLFP) drains a catchment of 15.6ha at the site boundary and combines with the eastern OLFP (10.1ha at site boundary) to form a combined OLFP with a total catchment area of 54.3ha approximately 400m beyond the site boundary. The western OLFP includes some runoff fro a small culvert under Jones Rd, that has caused some localised scour/erosion at the discharge point into the site.

Figure 2: Site Drainage (Blue lines = streams from Geomaps)

The drainage for the southern area of the site is more complex. Geomaps shows two OLFPs within the site itself, comprising northern (5.3ha) and southern (14.1ha) OLFPs that exit the site in the south-western corner. The southern OLFP has significant runoff from the upgradient properties and Jones Road. A FTL engineer conducted a site investigation on Hunua Road to identify any drainage features that were not shown on Auckland Council Geomaps. Two stormwater pipes were identified upstream of the site which drained much of the OLFP

passing along Hunua Road. The culverts were estimated to be 225mm and 375mm diameter as shown in Figure 3. These drain the stormwater south of Hunua Road to the north of Hunua Road, which will then pass through the stream at the south end of the site – they will contribute relatively minor additional flows to OLFP1. There is a 600mm diameter culvert and associated embankment across this stream, forming an internal farm crossing within the site.

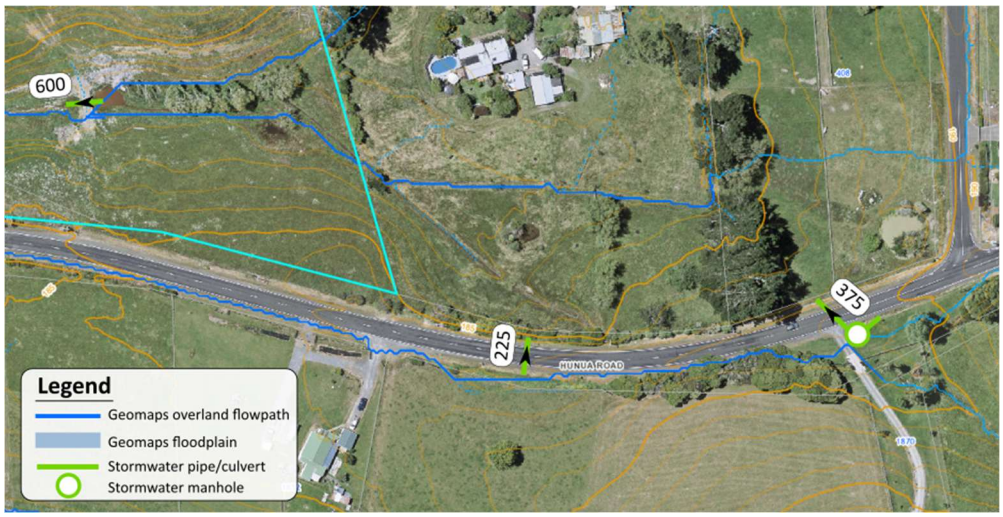

Figure 3: Southern Area Drainage (Blue lines = OLFPs from Geomaps)

There are localised floodplains associated with the streams which are generally restricted to the immediate vicinity of the watercourses and ponding areas. These OLFPs and floodplains are shown in Figure 4.

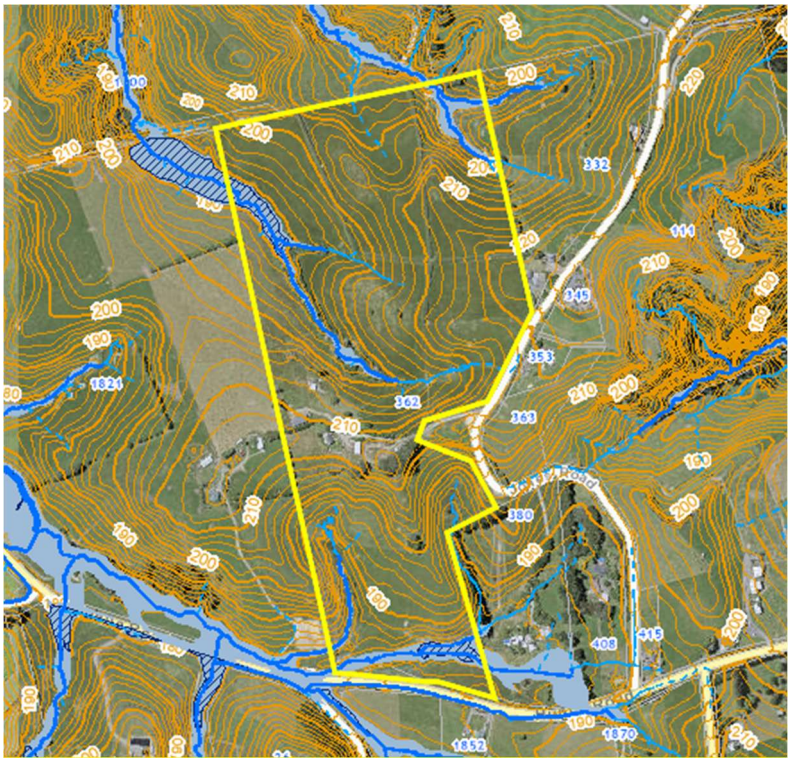

Figure 4: Site with Geomaps OLFP (blue lines), flood prone area (hatched blue areas) and floodplain (shaded blue areas) information

The Boffa Miskell ecological assessment identified five wetlands within the site at the locations shown in Figure 5. These are briefly described below with further information provided in the Boffa Miskell report:

- Wetland A (963m^2) is a low-lying, concave area located within the headwaters of an intermittent stream draining to the south of the property.
- Wetland B (1,458m^2) is located within the low-lying riparian zone of a permanent stream. The culvert for the farm crossing here has likely restricted flows resulting in ponding and expansion of the wetland feature upstream.
- Wetland C (699m^2) is located within a flat headwater basin which drains into a gully system before channelling into a defined stream channel.
- Wetland D is a small feature (158m^2) located within an OLFP of the western stream in the northern part of the site.
- Wetland E is a large feature (2,171m^2) located in the low-lying basin in the far north-eastern section of the proposed footprint. The wetland feature consisted of two tributaries with a pond located at the confluence.

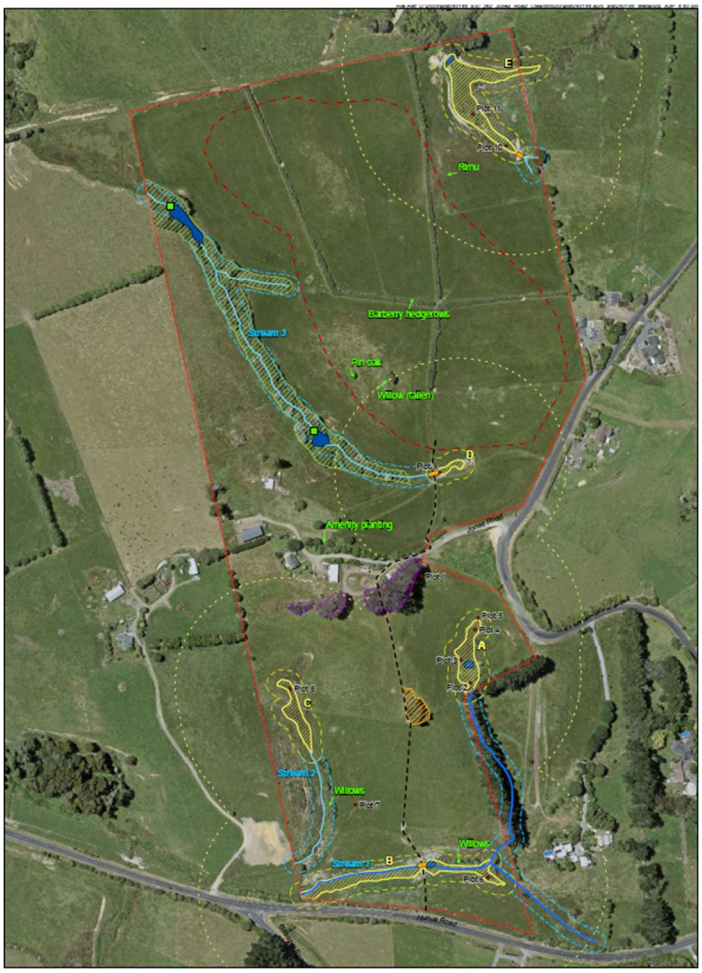

Figure 5: Wetlands (yellow shaded areas) identified within site from Boffa Miskell Ecological Investigation

2.6 GROUNDWATER

2.6.1 Underlying Aquifers

The site is not located in a High Use Aquifer Management Area according to the AUP:OP maps.

The PDP (March 2025) report "Proposed Sutton Block Expansion Groundwater & Surface Water Effects Assessment" provides some useful information on groundwater aquifers relevant to the site:

- The site is located above the Hunua West Greywacke aquifer.
- Groundwater at depth within the greywacke, which extends for several km, occurs in a fully saturated state and is referred to as "regional or deep groundwater". Groundwater movement in the regional groundwater is irregular, dependent on the intensity and continuity of fractures within and across individual strata. However, the main groundwater movement is thought to occur within its upper sections where rock defect openings are widest.
- Above the regional groundwater, there are pockets of local saturated zones (perched or shallow groundwater) which are not directly connected with the regional groundwater and generally discharge to local streams. The boundary between the shallow and deep groundwater systems is generally a transitional zone where there is a gradual increase in extent of the saturated zone with depth.
- The Waipapa Group Greywacke rocks form the basement of the site and consist mainly of jointed Mesozoic (Upper Jurassic) sandstones and siltstones of the Waipapa Group. These rocks have a thickness of up to 10,000m (Schofield, 1967). The basement rocks consist mainly of moderately strong to strong indurated argillites of coarse silt size. Finer and coarser-grained argillites form laminations within these rocks. The rock mass defects in the greywacke basement are bedding, veining, jointing and faulting. Bedding is difficult to determine; however, some interbedded argillite layers are visible north of the Drury Quarry. Veining is well developed in these rocks; the veins contain mainly quartz, prehnite, pyrite, quartzchlorite/calcite or dark red iron-oxide. The weathered greywacke is overlying these rocks with a variable thickness (2 to 20m).
- The main surface water (and natural regional groundwater) divide is to the east of Hays, Symonds and Maketu stream catchments. This divide separates the surface water catchments that discharge to the Tamaki Strait and Firth of Thames and the surface water catchments that discharge to the Manukau Harbour (via Hingaia Stream). These divides are shown in Figure 6.
- The general westerly groundwater flow in the deep groundwater system in greywacke is disrupted by the occurrence of the flow barrier faults (that is Hunua and Drury Faults). However, the shallow groundwater flow paths are contained within each sub-catchment.
- Figure 7 shows regional groundwater flow contour levels from PDP (2025). This shows that the regional groundwater table is about RL160m (equivalent to depths of 30m to 60m) near the site.

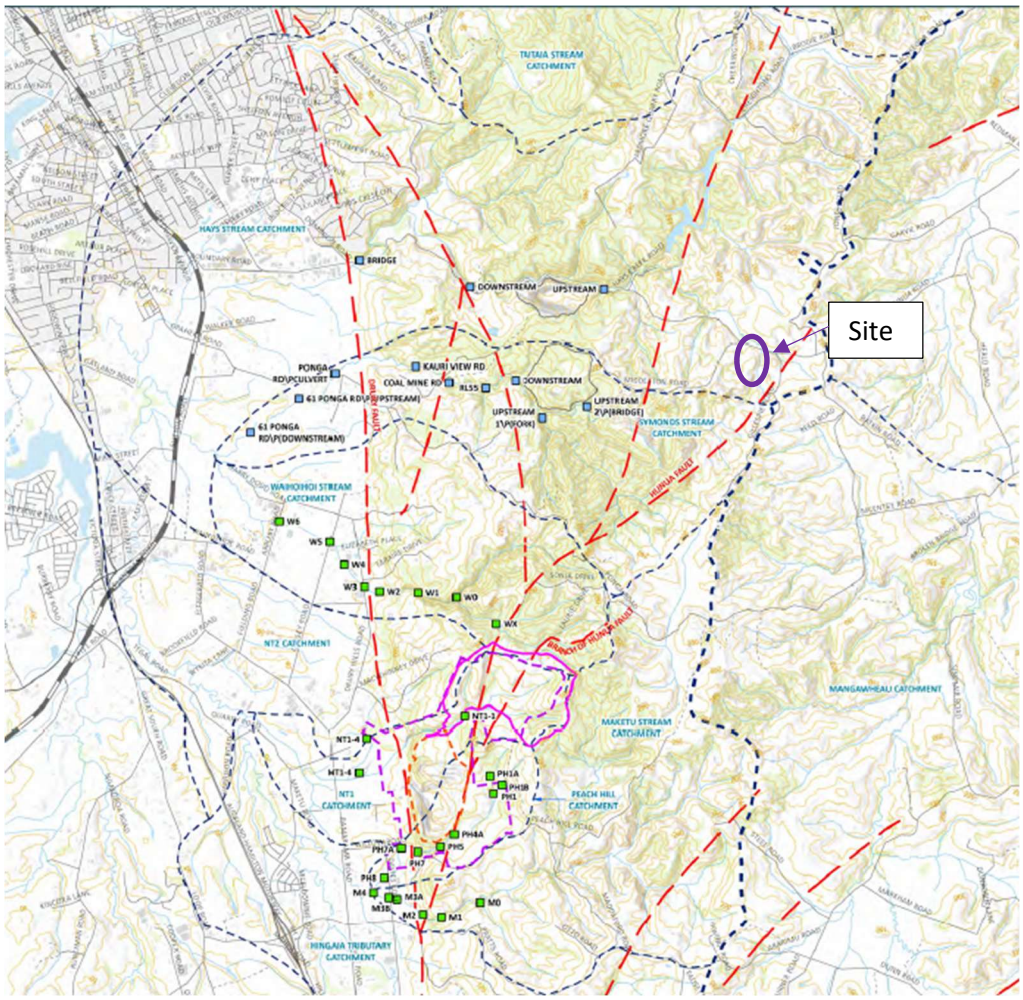

Figure 6: Surface Water and Natural Regional Groundwater Divides (from PDP, 2025) – legend below

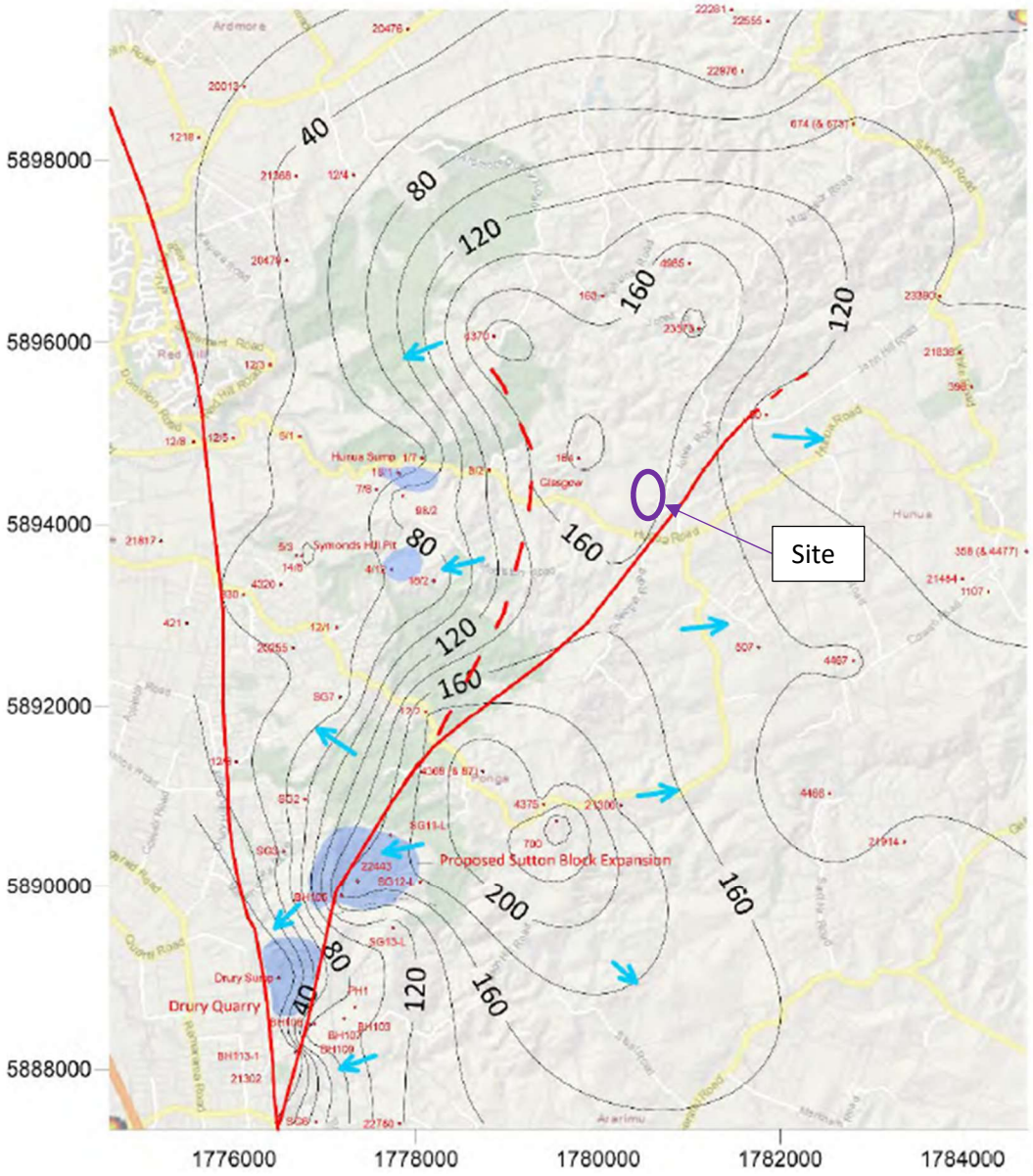

Figure 7: Existing Groundwater Level Contours (August 2024) showing the Regional Groundwater Flow Paths (arrows) from PDP (2025)

2.6.2 Nearby Bores

Auckland Council Regulatory Support undertook a bore search within 1-2km radius of the site at our request.

There are an estimated 17 groundwater bores within a 1km radius of the site boundary. These bores are shown in Table 3, with further information provided in Appendix C. The locations of these bores are shown in Figure 8. Of these records, seven are not considered relevant, as they relate either to consents that have expired, bores that have been decommissioned and backfilled or bores which were installed for geotechnical investigation and monitoring purposes. From the remaining list, another four bores are more than 1km from the proposed bore (as distinct from the site boundary), leaving 6 bores within 1km of the proposed bore.

However, the actual number of operational bores is not known. The limited bore drilling information indicates that groundwater in these bores was at around 55-60m or deeper (except for the 1940s bore which refers to a bore depth of 40m).

In response to a query on groundwater information in the area, Nicola Jones, Specialist, Coastal and Water Allocation Team, Auckland Council also sent through a bore log for Permit 98 (refer Appendix A) for Mr Lees of Hunua Rd, which appears to match Bore ID 164 below. This refers to this bore being drilled in 1988 to 123m into hard greywacke rock, (fractured bottom 10m) with 100dia casing grouted to 63m and with a static water level of 37m and a deep well pump rate of 1.5m^3/hr, supporting taking water from a depth of over 60m.

Nicola Jones further advised "*Unfortunately there are not many groundwater bores in this area and many of them are drilled pre 1987 (such as the stock bore on this site) which is when the consenting process started and we have little information on them.*"

Table 3: Bores within 1km of 362 Jones Road Site Boundary

Consent No	Bore ID	Address	Purpose	Distance from Proposed Bore (m)
LUC 60414022	-	306 Jones Rd	Construction of bore to 52m depth for use on the property	800
-	27892	210 Jones Rd	For stock use	1330
-	4459	1933 Hunua Rd	Not stated, drilled pre-1987	930
-	27891	1893 Hunua Rd	Construction of bore for stock purpose	600
-	21486	2134 Ponga Rd	Not stated (Hunua Greywacke aquifer)	1000
-	4453	5 Batkin Rd	Construction of bore pre-1987 to 55m depth for unknown purpose (Hunua Waitemata aquifer)	1270
-	4452	8 Batkin Rd	Construction of bore pre-1987 to 55m depth for unknown purpose	1400
-	4447	63 Gillespie Rd	Construction of bore pre-1987 to 67m depth for unknown purpose (Hunua Waitemata aquifer)	930
-	21476	34 Middleton Rd	Construction of bore around 1940s to 40m depth for unknown purpose (Hunua West greywacke aquifer)	870
-	21475	1041 Hunua Rd	Construction of bore to 96m depth for shed watering purposes (Hunua west greywacke aquifer)	1130
LUC 60271978-A	-	255 Jones Rd	Change of reference in Conservation Covenant 8058657.11 from Area Marked Y to being Area marked V on DP 575066. Withdrawn.	N/a

52095	23292	1041 Hunua Rd	Construction of bore for geotechnical investigation and monitoring purposes	N/a
52093	23290	Hunua Road (adjacent 1041 Hunua Rd)	Construction of bore for geotechnical investigation and monitoring purposes	N/a
10336	164	1040 Hunua Rd	Construction of 100dia bore to ~80m depth with steel casing to ~60m for stock/domestic purposes (expired)	N/a
44186	29802	1500 Hunua Rd	Construction of bore for stock and domestic purposes (expired)	N/a
11026	854	63 Gillespie Rd	Construction of 100dia bore to ~150m depth for stock purposes, with steel casing to ~66m (Franklin Waitemata aquifer) (expired)	N/a
11017	845	63 Gillespie Rd	Backfilling of an abandoned bore to 78m depth (decommissioned)	N/a

Note: Green = withdrawn or geotech investigation/monitoring bores; tan = expired or decommissioned bores

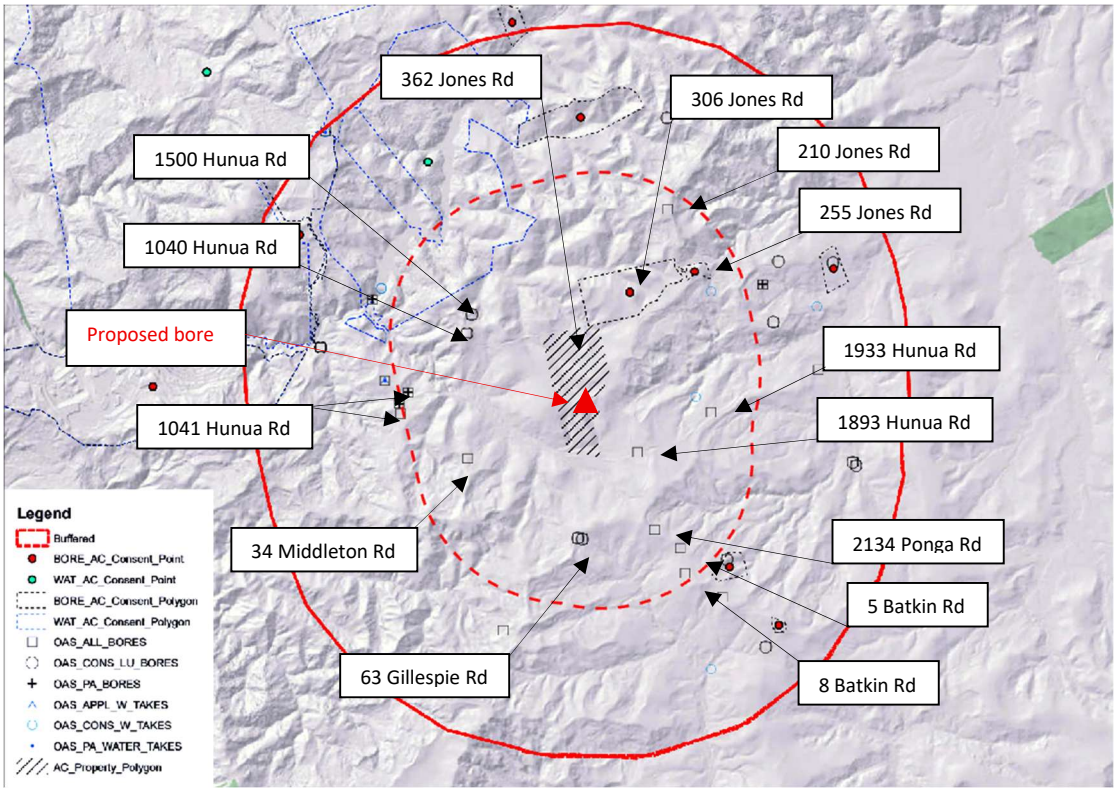

Figure 8: Existing Bores within 1km (red dashed line) of 362 Jones Road Site Boundary

2.6.3 Water Takes

Similarly, Auckland Council Regulatory Support provided water take search results within a 2km range of the 362 Jones Road Site Boundary. This search found that there are two water

takes within a 1km radius of the site boundary. These are shown in Table 4 and on Figure 9, with further information provided in Appendix C. Both of these are takes from surface water rather than groundwater and from a different surface water catchment to the catchments within which the site is located.

Table 4: Water Takes within 1km of 362 Jones Road Site Boundary

Consent No	Address	Granted	Purpose
2971	111 Garvie Rd	Feb 1981	To take from a River/lake up to 25m^3/d for pastoral use
5573	1933 Hunua Rd	Jan 1988	To take from a River/lake up to 50m^3/d for pastoral use

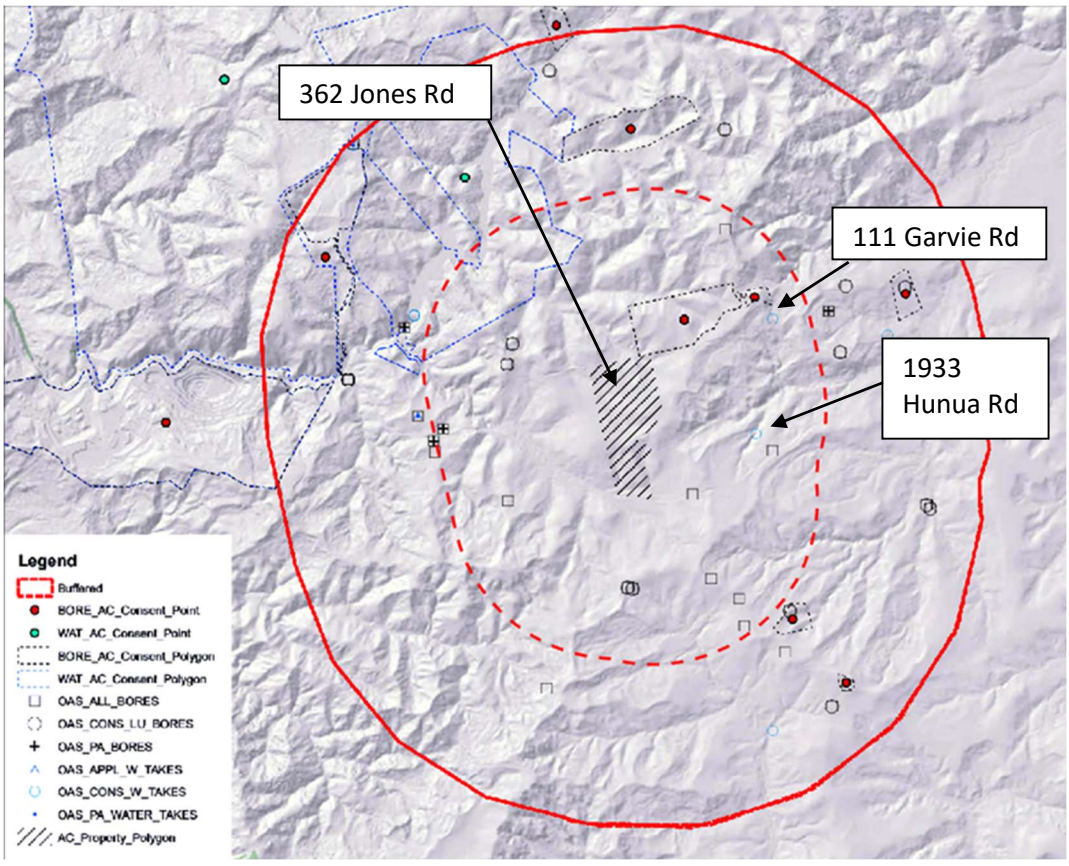

Figure 9: Existing Water Takes within 1km (red dashed line) of 362 Jones Road Site Boundary

3.0 FILL CLASSIFICATION

It is proposed that the Fill facility will accept "cleanfill", based on background concentrations for heavy metals in volcanic soils in the Auckland region, as well as some common organic contaminants and "accidental" residual asbestos at low levels. This means it will be a Managed Fill under both the WasteMINZ Disposal to Land Guidelines and the AUP:OP guidelines. The rationale for this is explained in this section.

3.1 WASTEMINZ TECHNICAL GUIDELINES FOR DISPOSAL TO LAND

The WasteMINZ Technical Guidelines for Disposal to Land were originally released in 2016 and updated in August 2018 and again in September 2023. They classify landfills in New Zealand

into five categories. Based on this classification system, the proposed cleanfill would be classified as a Class 3 Landfill, namely a **Managed Fill.**

A **Class 3 Managed Fill** accepts materials that comprise predominantly clean fill and controlled fill, which may also contain material with contaminant concentrations in excess of controlled fill limits. Site specific management controls are required to manage discharges to the environment. The fill material will not contain putrescible or reactive materials that when deposited may result in generation of leachate or landfill gas.

3.2 AUP:OP

Under the AUP:OP, the proposed facility would also be classified as a **Managed Fill**. This is defined in the AUP:OP as:

"*Facility where managed fill material is accepted for deposit."*

Where Managed Fill Materials are defined as:

"• *contaminated soil and other contaminated materials;*
• *natural materials such as clay, gravel, sand, soil, rock; or*
• *inert manufactured materials such as concrete and brick: and*

That does not contain:

- *hazardous substances or materials (such as municipal solid waste) likely to create leachate by means of biological breakdown;*
- *products or materials derived from hazardous waste treatment stabilisation or disposal practices;*
- *materials such as medical and veterinary waste, asbestos, or radioactive substances;*
- *combustible components; or*
- *more than 2 per cent by volume of incidental or attached biodegradable materials (e.g. vegetation)."*

3.3 PROPOSED FILL ACCEPTANCE APPROACH

3.3.1 WasteMINZ Class 5 Cleanfill WAC

The proposed Fill Waste Acceptable Criteria (WAC) generally come from the WasteMINZ Technical Guidelines for the Disposal to Land for Class 5 Clean Fills. The WasteMINZ Guidelines state the following:

- WAC for Class 5 Clean Fills are based on total concentrations.
- Materials placed within a Class 5 Clean Fill are effectively inert and the regional soil background levels for trace elements should be adopted as the basis for acceptance of materials for these sites.
- The presence of synthetic organic compounds, which are not naturally occurring and result from anthropogenic sources, are common in natural soils. These synthetic organic compounds can be present at detectable concentrations that do not present a risk to the receiving environment or influence the potential future land use. WAC should therefore

provide for the presence of these compounds up to concentrations where there is negligible potential for significant adverse effects as a result of direct contact with the waste or fill material or groundwater in contact with the waste or fill material.

- WAC for anthropogenic synthetic organic compounds should only be provided for the most common of these compounds. More persistent, potentially toxic or mobile synthetic organic compounds should not be accepted at Class 5 Clean Fills. WAC are therefore recommended only for the following synthetic organic compounds: TPH (total petroleum hydrocarbons), BTEX (benzene toluene ethylbenzene and xylene), PAH (polycyclic aromatic hydrocarbons); and pesticides (DDT).
- Waste or fill material containing detectable organic constituents not included in the above list should not be accepted at Class 5 Clean Fills.

3.3.2 Auckland Council Acceptance of the WasteMINZ Class 5 Cleanfill WAC

Auckland Council has accepted the WasteMINZ Class 5 Clean Fill waste acceptance criteria as being applicable to clean fills in the region, based on advice received by email from them in relation to this application on 12 March 2025:

"The AUP(OP) definition of 'Cleanfill material' has commonly been interpreted to mean that the concentrations of contaminants (manufactured chemicals) within such material must be below the laboratory detection limit. However, the Waste Acceptance Criteria for 'Cleanfill' (Class 5 Fill) in the recently-updated version of Technical Guidelines for Disposal to Land (Revision 3.1), WasteMINZ (2023) allow for trace concentrations of a limited range of synthetic organic compounds at Class 5 Fill facilities, acknowledging that urban soils are likely impacted by anthropogenic sources.

As per those guidelines "*the presence of synthetic organic compounds, which are not naturally occurring and result from anthropogenic sources, are common in natural soils. These synthetic organic compounds can be present at detectable concentrations that do not present a risk to the receiving environment or influence the potential future land use. WAC should therefore provide for the presence of these compounds up to concentrations where there is negligible potential for significant adverse effects as a result of direct contact with the waste or fill material or groundwater in contact with the waste or fill material*". Those updated guidelines have been endorsed by the Ministry for the Environment (in accordance with the Ministry for the Environment's website "*The updates were developed by a reference group, including members of the WasteMINZ Disposal to Land sector group steering committee, industry experts, and Ministry for the Environment staff*").

Therefore, under the 'Cleanfill material' definition, set out in the AUP(OP), we accept the presence of selected synthetic organic compounds in fill up to those levels specified in Table H-2 Class 5 WAC for Organic Elements in the Technical Guidelines for Disposal to Land (Revision 3.1), WasteMINZ (2023)."

3.3.3 Rationale for Facility being Managed Fill

The only reason why the proposed Fill is classified as a Managed Fill rather than a Clean Fill is because it wants to be able to accept soils with heavy metal concentrations exceeding the

non-volcanic background range, but within the volcanic background range. This results in higher WAC being adopted for five elements only, as shown below.

Table 5: Five Elements with Proposed WAC above Clean Fill WAC

Contaminant	Non-volcanic Background	Volcanic Background	WasteMINZ Class 3 Managed Fill
Boron	45	260	Not stated
Chromium	55	125	150
Copper	45	90	280
Nickel	35	320	320
Zinc	180	1160	1200

The corresponding WasteMINZ Class 3 managed fill WAC are also tabulated above. The WasteMINZ Class 3 criteria are based on the adopted WAC protecting groundwater drinking water (based on the New Zealand Drinking Water Standard, NZDWS (revised 2018)[1] x 20 DAF) and aquatic environment protection pathways (based on Australian and New Zealand Environment and Conservation Council (ANZECC) 95% freshwater protection criteria x 100 DAF).

In the WasteMINZ Class 3 WAC derivation, a DAF (dilution and attenuation factor) of 20 has been adopted as representative of the dilution of leaching porewater that will occur as the porewater/leachate travels to the groundwater abstraction point at the down-gradient boundary of the site. This is based on a USEPA (1996) weight of evidence finding that this value is conservative for a range of site conditions. A further DAF of 5, given a total DAF of 100, is assumed to be the minimum that would occur in groundwater discharging to a freshwater receiving environment, to account for dilution within a small stream.

For inorganic compounds, the WAC was estimated from the porewater concentration using a large dataset of SPLP (synthetic precipitation leaching procedure) results. The datasets ranged from in excess of 1200 data points to about 300 datapoints, the larger datasets being for the more commonly encountered contaminants (e.g., arsenic and lead) and consisted of up to ten years of data from the two laboratories in New Zealand which perform the bulk of this work. While SPLP testing is not performed as commonly as TCLP (toxicity characteristic leaching procedure), the data are considered the most representative available in New Zealand for the leachability of the metals and metalloids for which WAC were required.

In the cases of nickel and zinc, for which the datasets showed low leachability, the WAC values were chosen to be approximately the same as higher than typical background concentrations found in some geological conditions. This is to allow disposal to Class 3 Managed Fill from sites that could have such background concentrations.

The proposed Jones Rd Fill WAC for the five contaminants listed are all equal to (nickel) or less than (chromium, copper, zinc) corresponding WasteMINZ Class 3 WAC, noting that the Class 3 WAC do not include a target for boron. Hence, it can be expected that accepting fill material with contaminants within these WAC should not have any impact on groundwater drinking water or aquatic species.

[1] The NZDWS has since been updated again in 2022, but the relevant numbers used by WasteMINZ in their Class 3 WAC assessment are unchanged.

3.4 FILL SOURCES, TESTING AND WASTE ACCEPTANCE CRITERIA

The fill material will come from excess spoil from civil works undertaken by the Scarborough Group. This fill material will be subject to a rigorous pre-acceptance process for compliance with the appropriate Managed Fill thresholds, as described later in this report.

The proposed Managed Fill waste acceptance criteria are set out in Table 6, based on the above discussions.

Table 6: Proposed Waste Acceptance Criteria (WAC)

Parameter	Maximum Acceptable Concentration – Jones Rd Fill (mg/kg)
Heavy Metals	
Arsenic (As)	12
Boron (B)	260
Cadmium (Cd)	0.65
Chromium (Cr)	125
Copper (Cu)	90
Lead (Pb)	65
Mercury (Hg)	0.45
Nickel (Ni)	320
Zinc (Zn)	1160
Organic Contaminants	
TPH C_7-C_9	120
TPH C_{10}-C_{14}	58
Benzene	0.0054
Ethylbenzene	1.1
Toluene	1.0
Total xylene	0.61
Benzo(a)pyrene (equivalent)	2 (interim)
Total DDT	0.7
Asbestos	No detect (P/A test) at source; <0.001 % AF/FA and <0.01 % ACM (max 10% of verification testing)

4.0 PROPOSED MANAGED FILL DEVELOPMENT

4.1 OVERVIEW

SEL are proposing to construct a Managed Fill comprising two separate areas of 9ha and 2ha (including associated drains and sediment ponds) on the northern and southern sides of the site respectively, with corresponding estimated fill volumes of 720,000m^3 and 70,000m^3, giving a combined fill volume of 790,000m^3.

Filling will take place over a period of approximately 5-10 years and consent is sought for a total period of 10 years to provide some contingency should fill volumes be less than anticipated.

Erosion and sediment control will be provided by sediment ponds sized to cater for the entire Fill areas, with treated runoff discharged to the site watercourses.

The site will be fully owned by SEL and managed and operated by them.

The extent of the Managed Fill area, proposed fill depths, proposed final contours and selective cross-sections are shown on drawings 33250/100-181.

4.2 PRELIMINARY FILL PLANS

Preliminary fill plans sufficient for resource consent have been prepared for the site based on filling two separate areas, called the northern and southern areas respectively, using the following:

- 2016 Lidar contour data for the wider area, supplemented by targeted topographical survey of the subject site, covering the proposed new entrance off Hunua Road, and existing culvert.
- Recommendations from the acoustic report on noise bunds;
- Findings and recommendations from the ecological survey, which determined the extent of streams and wetlands and the required offsets to these features.
- Raising the finished ground level of the fill areas and contouring, so as to blend into the existing rural environment and topography in this area, based on advice from the landscape architect and noise specialists.

4.3 NORTHERN AREA

This comprises a mounded landform over an area of 9ha and of approximate volume 720,000m^3 that creates an elevated platform slightly higher (237m RL) than the existing high point on site (223m RL), based on preliminary discussions with the landscape architect on-site that the proposed Managed Fill should blend in with existing contours. It has variable side slopes up to a maximum of 1V:3H based on geotechnical advice, tying back into existing ground.

The perimeter of the Managed Fill has been designed so that all runoff from the Managed Fill area can be conveyed by perimeter gravity drains running around the Managed Fill and directed into two sediment removal ponds (SRPs), located at low points on the perimeter drainage system. This will result in minor changes to the catchment areas draining to the watercourses in the western and north area of the site, and hence will have a negligible effect on peak flows and volumes to these streams, based on all runoff being passed through the sediment ponds first, which has detention capacity in accordance with GD05.

Several hedges will be removed from the northern Fill area prior to filling this area.

The existing water bore within the northern fill area will also be decommissioned and abandoned prior to filling in this area.

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4.4 SOUTHERN AREA

The southern area comprises a mounded landform over an area of 2ha and of volume 70,000m^3 that creates an elevated platform of similar height (205m RL) to an existing ridge to the south which is at 198m RL (adjacent to the highest point of the proposed platform). It has 1V:3H side slopes tying back into existing ground.

Provision has been made for a single SRP located on the southern area of the site nearby the stream.

There are signs of a historic slip feature within the proposed fill area. Further geotechnical investigation work is required to prove that this area is suitable for filling. It is requested that geotechnical investigation of this area be done via consent conditions prior to any filling taking place in this location. This was discussed during the pre-application meeting with Council. After the meeting FTL were notified that Council had discussed this with Engineering Team Leader Rajinesh Kumar. It was confirmed that a condition of consent for geotechnical investigation of the southern area can be offered. However, it was noted that:

"This may impact viability of some or all of the proposed fill volume in this area and the applicant will need to accept this as a risk that the full consented volume may not be possible. This would be via a pre-development condition for this stage of the fill."

4.5 STAGING

The Managed Fill will be staged so that a maximum 2ha area is being filled at any one time. Preliminary staging plans are shown on drawing 33250/130. The staging is indicative only, as the filling will be an iterative process, with filling areas changing as required to build the final platforms. The staging plan may also need to be changed as site constraints and operational constraints are realised during either detailed design or once SEL has established on site.

4.6 AMENITIES AND ACCESS

It is proposed to utilise the existing buildings on-site for Managed Fill operations, with the existing house being used as the site office.

The Managed Fill operation will be serviced by existing power and telecom links to the site.

A new site accessway is proposed off Hunua Rd, with the location based on recommendations in the Commute Traffic Assessment and avoiding an existing power pole located in this area.

The road entrance will be off Hunua Road, and have a manual gate set back sufficiently to allow for a truck and trailer to park safely off the road. The road then narrows down to a 6m width suitable as a dual carriageway, sloping down towards the stream. Crossing the stream will be a single lane bridge. From the bridge onwards, the carriageway returns to a 6m width. There will be widenings around any corners as required, which will be worked out at detailed design.

There is an existing farm culvert crossing over the stream, which is in poor condition and is to be removed and replaced with a bridge crossing. This will result in a short section (approximately 5.5m) of stream and associated wetland in this area being reinstated.

Fraser Thomas have worked with Commute to confirm the accessway location and dimensions based on manoeuvrability of the largest anticipated vehicle into and out of the access.

The new internal access road will run through the subject site to the new site office, where incoming and exiting loads will be monitored by Managed Fill staff.

Additional internal access roads will run from this area to each Fill sub-stage, with turning circle areas being created for each Fill stage. The existing farm accessway off Jones Road will be retained, but will not be used by trucks bringing fill from the site or exiting the site. Preliminary access road details are provided in drawings 33250/200-251.

Specific design details will be provided for accessway works for each stage of filling in advance, as they will be designed and constructed progressively as part of Fill operations.

4.7 WATER SUPPLY

4.7.1 Water Demand Overview

The Fill water demand covers three different activities, as explained in Table 7.

Table 7: Estimated Daily and Annual Water Usage

Use	Description	Source	Max Daily Usage (m^3/d)	Annual Usage (m^3)
Staff	3-4 permanent staff x 50L/person/d	Roofwater harvesting	0.15-0.20	40-53
Wheel washing	Proprietary wheel wash with recycling tank	Roofwater harvesting + new bore	2.4	198
Dust suppression	Water for dust control purposes using water truck or similar	New bore + SRPs + tanker	22.7-57.7	202-515 (avg rainfall) 1,473-3,749 (20yr drought)
Total			25.25-60.3	440-766 (avg rainfall) 1,711-4,000 (20yr drought)

Notes:

1. Staff use based on 269 working days per yr (5.5 days per wk less 20d holidays).
2. Wheel washing water usage based on average water loss per vehicle of 25L, maximum of 96 vehicles per day and average of 7900 vehicles/yr.
3. Dust suppression water usage is explained further in section 4.7.2.

4.7.2 Dust Suppression Water Demand

Consultation with some other cleanfill or managed fill operations has indicated that water is generally only applied to the gravel access roading and tip head areas for dust suppression purposes during summer months (taken as being equivalent to the earthworks season, October to April inclusive; or 7 months of the year).

Hence, water demand requirements for dust suppression have been assessed based on estimated roading and tip head areas for each sub-stage of the northern and southern fill areas as shown on FTL drawing 33250/195. Combined access roading and tip head areas have been calculated for each sub-stage, as shown in Table 9, based on there being only one tip head at any one time.

GD05 (Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region) advises on pg 171 that the MfE's Good Practice Guide for Assessing and Managing Dust recommendation of 1 litre/m^2/hour (or 1 mm/m^2/hour) of water is generally considered conservative as the minimum amount of water that should be available on site is 5 mm/m^2/day. This should be applied incrementally so the ground surface remains moist.

Corresponding maximum daily water usage for dust suppression was calculated for each area, using the GD05 recommendation of 5L/m^2/day and taking into account monthly rainfall that occurs over the earthworks season, based on continuous rainfall records from the Auckland Council Hunua Nursery/Bowling Club rain gauge covering the period 1980-2025.

Analysis of the monthly rainfall data (see Table 8) shows that this area receives above average rainfall for the Auckland region, with average rainfall of 1436mm over the period 1980-2025 and even reasonable rainfall in drought years, with the lowest annual rainfall recorded over the 45 year record period being 1061mm. Rainfall over the earthworks season (October-April inclusive) is also reasonable, comprising 705mm over the 7 month period on average, reducing to 568mm for a 5 year drought, 508mm for a 10 year drought and 425mm for a 20 year drought. In comparison, the total estimated water demand for dust suppression over this period is 750mm, based on 5mm/d x 150 working days over this period. Hence, rainfall provides on average 94% of the dust suppression water demand, reducing to 57% in a 20 year drought.

Table 8: Rainfall Analysis

Item	Rainfall (Oct-Apr) (mm)	% of dust control water demand
Average	705	94
Minimum	361	48
Maximum	1234	165
20th percentile (5yr drought)	568	76
10th percentile (10yr drought)	508	68
5th percentile (20yr drought)	425	57
Dust control demand (based on 5mm/d x working days)	750	

Note: Percentile rainfall values calculated using a simplified approach, rather than a strict statistical analysis.

Table 9 displays these results and shows that the maximum daily water demand (on peak days with no rainfall) for dust suppression varies from 22.7-57.7m^3/d, with the largest quantities

being required during Stage N1, due to the significantly longer haul road involved to get to this Fill substage.

Estimated annual water demand for dust suppression ranges from 202-515m^3 in an average rainfall year, to 1,473-3,749m^3 in a 20 year drought.

Table 9: Water Demand for Dust Suppression

Stage	Haul Road (m^2)	Access Road + Tip Head (m^2)	Total (m^2)	Maximum Daily Water Usage – Summer (m^3/day)	Estimated Annual Demand – Average Rainfall Year (m^3/year)	Estimated Annual Demand – 20yr drought (m^3/year)
N1	3,271	8,270	11,541	57.7	515	3,749
N2	3,271	4,839	8,110	40.6	362	2,635
N3	3,271	6,818	10,089	50.4	450	3,277
N4	3,271	3,603	6,874	34.4	307	2,233
N5	3,271	1,520	4,791	24.0	214	1,556
S	3,271	1,263	4,534	22.7	202	1,473

4.7.3 Water Supply

Water supply will be provided to the site office by roof rainwater harvesting, as per the existing situation. No bore water should be required for site office use.

Water supply for the vehicle washing facility will be provided by roof water harvesting off nearby buildings, with storage in 4 x 30m^3 tanks, with topup provision from the new bore. These tanks will provide storage for up to 50 days maximum water demand, or 178 days average demand (based on 27 vehicles on average per day and 96 max per day). Hence, it is expected that most of the wheel wash supply will be provided from roof water harvesting, with bore topup being required infrequently and likely limited to drought years. Imported tanker water would be utilised in an extreme drought, if the permitted activity daily bore take limit is exceeded.

Water supply for dust control would be provided by a combination of:

- Roof water harvesting;
- Bore water use;
- Pumping water from the SRPs into additional 30m^3 storage tanks located by the SRPs;
- Imported tanker water, in an extreme drought, to avoid exceeding the permitted activity limit.

Section E7 of the AUP:OP Activity A15 provides for up to 20m^3/day to be taken from a groundwater bore, when averaged over any consecutive five day period and no more than 5,000m^3/year as a **permitted activity**. The proposed groundwater take volumes will be controlled to be within the permitted activity limits.

Based on the rainfall analysis undertaken, this area receives reasonable rainfall and it is expected that the above provisions will reliably provide for the required water demand, without exceeding the permitted activity groundwater take requirements.

If tanker water is required during an extreme dry period, then the tanker truck movements would be within the consented truck movements and not additional.

4.7.4 New Bore

Constructing a new bore would require a minimum 104mm diameter bore drilled down to 60-150m depth, with PVC casing to 50-70m depth, based on advice from Kiwi Welldrillers NZ Ltd. A new bore pump would also be required, with water pumped into 4 x 30m^3 above ground tanks. The proposed bore should be capable of extracting the maximum permitted quantity of water applied for – i.e. 20m^3/d when averaged over any consecutive 5 day period.

4.7.5 Bore System Management

The bore pump will be serviced regularly in accordance with supplier recommendations.

The bore pump and water storage system will be operated so that the tanks will be maintained full at the start of each working day, through the use of level floats to start and stop the bore pump, and subject to setting a total daily or weekly pump run time to avoid exceeding the maximum permitted daily limit, when averaged over any 5 day consecutive period.

As groundwater usage is anticipated to be relatively low, groundwater abstraction volumes will be measured using a simple method, involving a "run hours" meter, with pump flows being calibrated prior to commencing water abstraction and at 5 yearly intervals, so as to enable run hours to be converted to flows. Calibration verification records shall be provided to Council within 20 working days of measurement.

Water meter readings shall be recorded weekly at the same time each week, even if no water is being taken during any period. The meter shall be read either before pumping starts or at the end of pumping for a day. Water use, water meter reading and date shall be entered into Council's Water Use Data Management System (or any replacement database advised to SEL by Council in writing) every 15th day of March, June, September and December.

4.8 WASTEWATER

Wastewater from staff facilities will be treated and disposed using the existing on-site septic tank and land disposal system.

4.9 TRAFFIC MANAGEMENT

Truck numbers are estimated to be up to 96 vehicles/day (96 in, 96 out), comprising primarily truck and trailer units.

A speed limit of 20km/h will be imposed within the Managed Fill site, which will also assist with dust management.

4.10 FILLING OPERATIONS

4.10.1 Staging

Filling will occur in a number of sub-stages with a maximum of 2ha open at any one time.

4.10.2 Operational Hours

The operating hours for the site will be:

- Monday to Friday: 7:00am to 6:00pm;
- Saturday: 7:00am to 1:00pm
- Sundays and public holidays: Closed

The Managed Fill will not operate outside these hours. Although the site will be open for up to 11 hours per day, the first and last hours of the day are considered to be less productive due to site start-up and shut-down activities occurring.

4.10.3 Machinery

Proposed machinery for Managed Fill operation is:

- D6 bulldozer or equivalent,
- 21T excavator,
- One 18T Sheepsfoot compactor,
- One 6m^3 water cart

Any machinery refuelling that has to take place on-site will be conducted via a mobile refuelling service in a dedicated area near the site office. Hence, there will be no permanent fuel storage area on-site.

4.10.4 Access Control

Access to the site will be strictly controlled and limited to Scarborough Group vehicles and other approved contractors. The site will not be open to the general public.

4.11 PROPOSED SEQUENCING

The expected sequence of filling and associated activities is summarised below. These works will be constructed on a stage-by-stage basis, apart from the sediment controls which will cover the entire northern and southern Fill areas:

- Install all silt/sediment control structures required for the total filling area, including sediment retention ponds, diversion drains/bunds, as appropriate. Obtain approval from the relevant Authorities prior to commencing works.
- Install temporary access roads and turning areas.

- Remove vegetation as required.
- Strip topsoil and unsuitable materials and stockpile (separately) on designated stockpile areas.
- Install underfill drains and connect into perimeter swale.
- Undertake filling and compaction.
- Re-spread topsoil across filled areas.
- Mulch, hydroseed or grass all batters and exposed surfaces, as appropriate. Mulching or hydroseeding will be done on intermediate exposed surfaces, while grassing will be done on completed filling areas. This will be done progressively as different areas are completed.
- Decommission erosion and sediment control devices once exposed surfaces are fully stabilised.

Further details on specific items are given in the following sections as required.

4.11.1 Erosion and Sediment Control

Erosion and sediment control measures will be installed prior to any vegetation clearance and earthworks activities on the site. The proposed erosion and sediment control measures cater for the entire Managed Fill area (2x2ha ponds for northern Fill and 1x1.2ha pond for southern Fill area including sediment pond and drains) and hence provide a high degree of flexibility for development of the Managed Fill. These measures are described in Section 5 of this report.

4.11.2 Temporary Access Roads

Temporary stabilised access roading, tip heads and vehicle turning circle areas will then be constructed for each stage of filling. These roads will be progressively extended and/or relocated for each stage of filling, as required. Temporary access road details will be provided ahead of each stage of filling for Council approval.

4.11.3 Vegetation Clearance

Vegetation clearance will be undertaken in stages, in accordance with the progression of filling. It will comprise the removal of existing grass/weeds, as the first step of preparing a new area for filling.

Riparian areas will not have any vegetation removal.

The trees on site have been assessed in the Boffa Miskell ecological report. Some macrocarpa trees may need to be removed for construction of the haul road. The Fill design allows for the identified area of native vegetation in the central southern area of the site to be retained and protected for the duration of the filling activity.

4.11.4 Topsoil and Unsuitables Stripping and Stockpiling

Topsoil and any unsuitables will be stripped from each stage and temporarily stockpiled within part of the fill area, not currently being used for filling or where filling has been completed. All temporary topsoil stockpiles remaining in place for more than one month will either be mulched, hydroseeded or grassed.

4.11.5 Underfill Drainage

In accordance with the recommendations of the FTL geotechnical report, underfill (strip) drains will be constructed prior to the placement of fill to prevent groundwater from reaching elevated levels within the fill material during extreme transient events. These strip drains shall comprise 900mm wide by 300mm deep rectangular strip drains, with TNZ F/2 drainage aggregate fully wrapped in Bidim A29 geotextile or similar. The location of the proposed groundwater drainage system is shown on FTL drawing 33250/350-351.

Underfill drains may also be installed in other locations, if required, following stripping of topsoil.

4.11.6 Fill Placement and Compaction

Fill operations will be undertaken in small stages within the Fill footprint. Filling should be undertaken in accordance with the recommendations of the geotechnical report. New fill areas will be opened only as required. Filling will then commence with fill material brought to the site in trucks, deposited in the relevant area and re-positioned as necessary by excavator and/or bulldozer.

The fill will be shaped to direct runoff to dirty water diversion drains and fill material track rolled by site machinery for compaction to similar levels to the existing situation, in accordance with the fill specification in the geotechnical report. Drying or wetting of imported fill material should be undertaken, as required to achieve this. This level of compaction is appropriate, as the Fill area will revert to productive pastoral farming on the completion of filling. Hence, there is no need to compact the fill in accordance with development codes for residential development.

The outer faces of the fill will be at a maximum 1V:3H. 4m wide benches will be installed at appropriate vertical intervals, with further details of these benches provided at detailed design. These benches are primarily for erosion control purposes during Fill construction. It is expected they will be constructed at intervals of approximately 1 bench per 10m vertical height and will generally run along the contour to minimise the concentration of stormwater runoff. The northern area will have between 2 benches on the eastern side, and 4 benches on the western side. The southern area will have no benches. The Slope/W analyses in the geotechnical report allow for this scenario.

Any filling proposed on existing slopes greater than 11° (1V:5H) should be placed and compacted on benches cut into the slopes at the site.

Post filling, the benches will generally remain and will function as farm access tracks.

Actual fill locations will vary depending on considerations such as the type of material received, the season and the filling situation for the overall site. Some areas may be opened and closed several times during the life of the operation, and temporary and permanent stabilisation measures will therefore both be used.

A Geotechnical Completion Report should be provided on completion of each stage of filling works.

4.11.7 Final Landform and Site Restoration

The finished northern fill profile will reach a height of up to 237m RL and be gently sloping (i.e. natural rolling pasture) with a predominantly westerly aspect towards the western stream.

The finished southern fill profile will reach a height of up to 205m RL and be gently sloping with a predominantly westerly aspect towards the western watercourse.

Final completion works will involve shaping the surface to ensure a natural, non-engineered appearance and for it to merge naturally with the surrounding land. The sediment ponds and associated perimeter drainage will be decommissioned on completion of filling and site stabilisation, with site flow to be generally dispersed as sheet flow in accordance with existing overland flow patterns.

Final cover will comprise a minimum 150mm thickness of topsoil, sourced from the temporary topsoil stockpiles on-site. If necessary, additional topsoil will be imported to achieve the desired coverage.

Completed areas will be progressively stabilised with a protective surface cover (i.e. grass) to stabilise it against soil erosion and return the area to grazing.

4.11.8 Riparian Planting

The 10m riparian yard will be fenced and planted, as set out in the separate Planting Plan prepared by Boffa Miskell.

4.12 FILL MANAGEMENT PLAN

A Fill Management Plan has been prepared for the proposed Fill and is included in this application as a separate report. This Plan provides an overview of filling activity and sets out how the Fill will be managed and operated. This plan will be updated as required during the consenting process to address specific feedback received from Council and relevant consent conditions.

In accordance with the requirements of Section E13 of AUP:OP and best practice, the Management Plan addresses the following:

(a) A plan of the property showing the areas to be filled.
(b) The approximate quantity of material to be deposited, type of material, timing and progress of the operation, its operating hours and the Fill's completion date.
(c) Operation of the site, including placement and compaction of fill materials, daily operating procedures, Fill acceptance controls and monitoring, responses to natural hazards and unexpected discharges and conditioning of wet material.
(d) Proposed site operation records, including waste acceptance processes, load inspection records and monitoring, testing and sampling documentation.
(e) Sub-staging plans and details of internal access roads.
(f) Management measures for dealing with noise, dust and other detractions from the amenities of the area.
(g) Security (to prevent public dumping) and signage measures.
(h) Drainage measures.
(i) Erosion and sediment control measures.
(j) Mitigation and contingency measures.

5.0 EROSION AND SEDIMENT CONTROL

Required erosion and sediment control measures will be installed and maintained during the works in accordance with best practice, utilising recommended measures set out in GD05 (Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region 2016/005) (June 2016). This section summarises the proposed erosion and sediment control measures for the site during filling. The erosion and sediment control measures are shown on drawings 33250/121, 161, and 251.

The final design, location and sequencing of these measures may vary from that shown here, and will be determined on-site by the Operator prior to commencement of works within each stage of substage. Approval for any significant changes will be sought from Auckland Council, as required.

5.1 OBJECTIVES

Appropriate erosion and sediment control measures will be provided on-site in accordance with the AUP: OP and GD05. The main rational and objectives of these measures are:

- To minimize disturbance to areas where erosion may occur, including steeper slopes and exposed land.
- To stage filling to minimize the area worked on at any one time, to minimize the extent and duration of temporary topsoil stockpiles and to ensure revegetation can occur in a staged manner, so as to reduce the risk of silt/sediment running off the site and entering the downstream receiving environment.
- To ensure exposed areas are stabilized as soon as practicable by sowing, hydroseeding or mulching to prevent erosion.

- To install perimeter controls such as diversion drains and retention ponds to prevent sediment leaving the site.
- To maintain the gravel surface of the access road to minimize the potential for silt/sediment to be tracked off site.
- To provide guidance in case of unforeseen events including poor weather.
- To ensure all control measures are inspected and repaired after storm events.
- To ensure that the site is rehabilitated prior to the removal of sediment control measures.
- To mitigate dust emissions from the site during earthworks so as not to adversely affect any nearby properties.
- To minimize potential environmental effects.

5.2 EROSION AND SEDIMENT CONTROL MEASURES

The two fill areas are located within different catchments and the proposed perimeter drainage system means that they will form their own sub-catchments during Fill operation.

Hence proposed erosion and sediment control measures comprise open channel drains/bunds (referred to as dirty water drains) located around the Fill perimeter which will collect dirty runoff from the Fill area and convey it into three sediment ponds sized for their entire contributing catchments as shown in drawings 33250/121 and 161. Clean runoff from adjacent non-fill or completed and stabilised fill areas will be diverted from these SRPs, as much as practical. These measures will be in place for the duration of filling.

Clean runoff will derive from areas that have been fully stabilised and revegetated following filling and areas that have yet to be disturbed for filling. Dirty runoff will derive from areas that are being filled and from areas that are in the process of being stabilised and restored.

Runoff will generally be conveyed into these dirty water drains as overland flow to avoid unnecessary concentrations of site runoff. However, additional temporary measures may be installed at the discretion of the Fill Operator such as temporary dirty/clean water diversion drains, compacted bunds, contour drains, etc. This may be particularly useful to improve sediment removal, or to reduce chemical costs, if chemical flocculation has to be used.

5.2.1 Drains (up to 10% gradient)

All drainage channels will be constructed in accordance with GD05. They will have earthen bunds on the downgradient side and will be sized to take the 5% AEP storm with additional freeboard. The dimensions of the drains are shown on drawing 33250/181 and longitudinal gradients generally in the range of 1-10% as shown on drawings 33250/122 and 162. Any drains in excess of 2% gradient or 1m/s design velocity will be lined to provide for protection against scour/erosion. Drain sizings are based on the most conservative drain gradient for each drain type. Prior to construction, sizings may be revised to reflect actual gradients for different sections.

5.2.2 Drains (>10% gradient)

Drawings 33250/122 and 162 show that there are some sections of the perimeter dirty water drains that are over 10% in gradient, notably:

- Drain 1 – chainage 0-45m, and chainage 178-196 (63m)
- Drain 2 – chainage 94-134m and chainage 257-296 (52m)
- Drain 3 – chainage 196-246m (50m)
- Drain 4 – chainage 23-81 (58m)
- Drain 5 – chainage 7-123m and chainage 193-275 (198m)

Specific design will be required for these sections of drain to ensure they are adequately lined to provide for scour/erosion protection. If lined open channels are used, drop pits or manholes or other scour/erosion devices will be required at the end of each steep section of drain to reduce velocities and minimize scour/erosion.

Consideration will also be given to using pipe drop structures or flumes in some areas. These comprise a temporary pipe structure or constructed flume placed from the top to bottom of a steep slope. Any pipe drop structures or flumes would be designed in accordance with GD05 or by specific design.

5.2.3 Drop Out Pits

Drop out pits may be used on steeper sections of the site within the dirty water diversion drain to allow heavier sediment particles to drop out before they enter the sediment ponds, reducing the load on the ponds. Drop out pits are approximately 500-1,000mm deep and 1,000mm wide. They are easier to maintain and typically cheaper to desilt than desilting the sediment ponds.

5.2.4 Sediment Retention Ponds

Three sediment retention ponds (SRPs) are proposed, sized for the maximum dirty water catchment expected in each case, including the area of drains and sediment pond area. In reality, the worst-case scenario is considered to be a total catchment area of 2ha. General details of the sediment retention pond are shown in Table 10.

Table 10: Sediment Pond Details

Item	Northern Area – Ponds N1 & N2	Southern Area
Catchment Area (ha)	2.0	1.2
Design volume (3% criteria) (m^3)	600	360
Dead storage (m^3)	180	108
Live storage (m^3)	420	252
Freeboard (m)	0.3	0.3
Side slopes	1V:2H	1V:2H

Decants	2 x standard decants; 133 holes in each decant	1 x standard decant with 160 holes
Discharge pipe	150	150
Primary spillway	150mm riser pipe	150mm riser pipe
Secondary spillway	7.8m base width, 0.3m depth, 1V:3H side slopes	

5.2.5 Chemical Flocculation

During the very early stages of filling, dirty runoff generated from the fill area will contain dissolved and particulate particles deriving from the natural soils on-site. As fill material is brought in, the characteristics of the dirty runoff will change, being increasingly controlled by the nature of the fill being disposed of on-site. In this case the nature of the combined clean and dirty runoff entering the sediment pond will depend on the type and extent of the exposed soil types for dirty runoff and the extent and ground cover of stabilized/restored or yet to be disturbed areas.

For these reasons, flocculation bench testing will be undertaken of the natural soils on-site to determine if chemical flocculation is needed during the early stages of filling and the required dosing rate. Ongoing monitoring will then determine if any changes are required to the flocculant dosing regime. Bench testing will be undertaken using PAC (polyaluminium chloride).

5.2.6 Mulching, Temporary and Permanent Seeding

The primary objective of erosion and sediment control is to minimise the time ground is exposed prior to permanent stabilisation. If delays occur during the works or an intermediate form of stabilisation is required (such as on stockpiles or on fill prior to topsoil placement), mulching, geotextile fabric or hydroseeding may be utilised.

Permanent stabilisation can be achieved via the application of topsoil (150mm minimum), followed by seeding or planting. Permanent stabilisation is designed to permanently stabilise soil on disturbed areas to reduce sediment and runoff to downstream or off-site areas.

Application rates for seeding and mulching shall be as stated in Table 11 (from GD05).

Table 11: Typical Seeding, Fertiliser and Mulching Application Rates

Activity	Description	Application Rate
Temporary Seeding	Annual ryegrass	100-250kg/ha
Permanent Seeding	Perennial ryegrass – 70%; Fescues/cocksfoot – 20%; Clover/lotus – 5%; Browntop – 5%	200-400kg/ha
Fertiliser Application	N:P:K (15:10:10)	200-800kg/ha
Maintenance fertiliser	N:P:K (15:10:10) and urea	As required
Mulching	Straw or hay	4,000-6,000kg/ha
	Hydromulch (minimum 80% virgin or recycled wood)	2,200-2,800kg/ha
	Wood chip	10,000-13,000kg/ha

5.2.7 Dust Control Measures

Dust control aims to prevent or reduce the movement of dust from disturbed soil surfaces that may create nuisance, health hazards, traffic safety problems and/or off-site damage and discharge to the environment. Dust control should follow the guidance provided in the Ministry for the Environment Good Practice Guide for Assessing and Managing Dust 2016.

Areas subject to dust generation and movement include open fill areas exposed to wind, stockpiles of materials, bulk materials handling or vehicle movements.

Dust will be controlled at the Fill site by a range of measures from the following toolbox:

- Minimising the extent of the exposed area at any one time.
- Limiting traffic to established haul roads and minimising travel distances by optimising site layout.
- Controlling vehicle speeds.
- Maintaining road surfaces.
- Minimising tracking of dirt on vehicle wheels onto paved surfaces.
- Minimising drop heights when loading and unloading vehicles.,
- Limiting stockpile heights.
- Providing shelter from the wind for stockpiles, where practical.
- Consolidating and sealing off loose surface material.
- Progressive mulching and grass establishment, as works are completed in different areas.
- Use of a water cart to dampen exposed areas, if necessary, using water sourced from the sediment ponds, or from a dedicated storage tank supplied by the existing on-site bore and/or rainwater harvesting, if insufficient water is available from the ponds.
- Use of soil binders to form a cohesive membrane or protective crust that reduces windblown dust generation (refer GD05, Section G8.0 for further details) (contingency measure).
- Use of textiles as temporary covers on stockpiles or partially completed batter slopes, or as permanent cover (e.g. vegetation promotion blanket) on completed areas (contingency measure).

5.2.8 Litter

The fill materials deposited on-site are not expected to create any litter problems as they are relatively dense and unlikely to be blown around by the wind. Any minor bits of litter found on-site will be picked up and disposed of appropriately.

5.2.9 Weather Monitoring

Monitoring and predicting rainfall is essential to the performance of erosion and sediment control and civil works in general. All efforts shall be made to predict rainfall and undertake any high-risk work when extended periods of fine weather are predicted. When rainfall is predicted, all efforts shall be made to ensure that the measures mentioned above are in place

prior to rainfall and further inspections are made during rainfall and after to ensure that erosion and sediment control measures are functioning as intended.

5.3 MAINTENANCE

The sediment control measures shall be regularly monitored during operations and after any significant rain event. Maintenance of all structures including diversion drains/bunds and sediment ponds shall be carried out throughout the course of site earthworks and restoration.

Maintenance shall be the responsibility of the Operator and shall be carried out at appropriate frequencies ranging from daily to weekly, as appropriate and subsequent to any storm event that produces runoff. The maintenance inspection shall include, but not be limited to, the following:

- Inspection of the accessway to the site, including:
  - Repair of any accessway damage, including aggregate loss.
  - Inspection of the Hunua Road frontage and removal of any silt/sediment or other accumulated debris manually and/or by machine sweeping.
  - Check surrounding areas for dust and rubbish associated with works.
- Inspection and maintenance of any temporary roading/tracking.
- Inspection of topsoil and unsuitable stockpiling areas, including:
  - Inspecting and repairing silt controls, as necessary.
  - Inspecting the condition of mulch, hydroseed, grass and undertaking any remedial works required.
- Inspection of temporary diversion bunds and channels, including:
  - Checking for scour, sediment build-up, bund/channel integrity and outlet erosion, with remedial measures undertaken as required;
  - Checking for exposed areas and re-hydroseeding, where relevant.
- Inspection of sediment retention ponds, including:
  - Checking embankments, spillways, level spreader and any exposed areas.
  - Checking the sediment depth in the pond forebay and cleaning out as required (generally when 50% full of sediment);
  - Checking the sediment depth and removing sediment once it reaches 20% of the total sediment retention pond volume. To assist in gauging sediment loads, clearly mark the 20% volume height on the decant riser. The sediment shall be moved to a securely isolated and covered area such as the spoil storage area.
  - Checking the operation of the decant arrangement.
  - Checking the clarity of treated runoff to determine if supplementary chemical application is needed.
- Dust monitoring:
  - Monitor dust emissions on a daily basis. In windy, dry conditions, review dust emissions continuously.
  - Reapply water as required to effectively manage levels of dust generation, especially when soil moisture conditions become low during hot and windy conditions.
- Inspection of completed fill areas including:
  - Checking for exposed areas and re-seeding, mulching or turfing the exposed area;

- Checking for erosion and regrading the slopes and stabilizing, as necessary.

5.4 DECOMMISSIONING

Sediment control works may only be decommissioned once it has been determined that relevant Fill areas have been suitably stabilized through consultation and inspection by the Operator and Council. Decommissioning shall be undertaken by light weight equipment or manually where possible and include the following:

- Respread any topsoil stockpiled and decommission the topsoil stockpiling area.
- Backfill any temporary collection drains and/or remove any diversion bunds. Regrade localised areas to ensure overland flow occurs as broad sheet flow and is not channelised. Turf or sow grass seed as appropriate.
- Remove the embankments, bunds and decant structure and fill in the sediment removal ponds. Reinstate the areas by grassing.

5.5 INFORMATION AND MONITORING

It is important that good relations be maintained with Auckland Council and potentially affected neighbours throughout the duration of filling.

Immediate neighbours will be informed of the intended scope and duration of filling and kept informed of any changes to filling activity throughout the duration of the works.

All site staff and truck drivers bringing fill to the site shall be made familiar with the Fill Management Plan prior to entering the site.

The Operator should provide feedback regarding the performance of the erosion and sediment control measures and amendments shall be made as required.

No other monitoring is proposed other than what is required in the consent conditions.

6.0 ASSESSMENT OF ENVIRONMENTAL EFFECTS

This assessment of environmental effects focuses on the matters to be addressed under the earthworks and cleanfill requirements (Sections E11, E12 and E13) and other related matters of the AUP:OP specific to this engineering report.

6.1 ALTERATION TO NATURAL LANDSCAPE

The proposed Fill area is currently covered in pasture. The proposed filling activity will result in the staged stripping of existing grass/weed vegetation from the cleanfill area over a period of up to 10 years, with not more than 2ha being bare earth at any one time, followed by the restoration (topsoiling and grassing) of completed fill areas. The effects of the vegetation removal will be temporary in nature and confined to a small area and are considered to be less than minor.

The proposed fill activity will alter the landform, infilling the northern 9ha area with an average of 8m of fill with the maximum fill depth being 24m and infilling the southern 2ha area with an average of 3.5m of fill with the maximum fill depth being 10m. The effects of this change in landform are considered in the separate visual effects and planning assessment reports and not commented on further here, other than to advise that to assist this assessment, FTL has prepared lighting shadow effects graphics showing the effects of the changed fill landform for the northern Fill on "shadow time" compared with the permitted activity scenario for this zoning of 12m high (approx.) trees 5m offset from the boundary. These graphics are included in Appendix B of this report.

6.2 EROSION AND SEDIMENT

The northern and southern fill areas have been designed to form their own sub-catchments during filling. The proposed sediment ponds will capture all runoff from these sub-catchments and discharge treated runoff to the existing watercourses running through the site.

Sediment will be removed primarily by the sediment retention ponds. These ponds and the associated diversion drains/bunds have been designed in accordance with GD05 and best practice.

All installation works for the proposed stormwater system including any minor earthworks and trenching will be undertaken in accordance with relevant Council requirements for erosion prevention and sediment control.

The universal soil loss equation (USLE) has been applied to the Fill area based on a worst case scenario of 2.0ha of bare soil areas for 9 months and 2.0ha of completed filling area being restored for 3 months, based on the following approach:

- The existing fill areas vary in gradient and length in relation to sediment generation and overland flow. Runoff flow paths have been considered for each area with average gradients and lengths calculated.
- For the Fill, the topography on completion of filling has been considered. This gives a worst case scenario in terms of gradient (33.3%). Multiple runoff flow path lengths were calculated down the Fill batter slope to the perimeter drain and use to calculate an average length.
- Adopted K value of 0.40 based on site bore log information, with an adopted soil erodibility factor based on 35% clay, 60% silt and 5% sand content, representing in-situ soil conditions.
- Sediment delivery ratio of 0.7 adopted, based on gradients generally being over 10 degrees for both the existing and Managed Fill situations.
- Allowance for flocculant dosing in the sediment ponds, with an adopted sediment removal efficiency of 95%.

These results are summarised in Table 12.

Table 12: USLE Calculations

Area	Scenario	Pond N1/N2	Pond S1
Gradient (%)	Existing	11.5	12.5
	Filling	33.3	33.3
Length (m)	Existing	300	200
	Filling	150	75
LS Factor	Existing	5.3	4.9
	Filling	20.9	14.8
Sediment Loss (T/yr)	Existing	4.3	4.0
	Filling	18.6	13.1

The USLE estimated sediment loss ranges from 4.0-4.3 tonnes for the existing situation over a year, compared with approximately 13-18 tonnes over a 9 month filling and 3 month restoration cycle with floc dosing. The main reason for the calculated increase in sediment losses is that the Fill gradient is steeper than the existing situation, resulting in the slope length and steepness factor, LS, being much higher for the Managed Fill situation, compared with the existing situation.

In reality, it is quite difficult to apply the USLE methodology to this situation and the USLE results are considered likely to be over conservative in this case, for the following reasons:

- The assessment is based on site bore log information, with an adopted soil erodibility factor based on 35% clay, 60% silt and 5% sand content, representing in-situ soil conditions. These conditions represent the start of filling, but as filling progresses the soil erodibility factor is likely to change depending on the nature of the imported cleanfill material, and could potentially decrease.
- The USLE "existing situation" baseline calculation does not allow for any increased sediment generation from grazing activity on site compared with a grassed area.
- The USLE method has been applied to the end of each Fill stage, where the fill gradient is maximum. Prior to this, gradients will be intermediate between existing and final and sediment losses are expected to be less.
- The USLE calculations do not take into account the proposed 4m wide benching in the Fill profile. These benches will act to slow down runoff down the fill batter slopes, and remove some silt/sediment closer to source. Silt fences or similar could be installed along these benches as a primary means of removing sediment closer to source.
- The USLE calculations do not allow for the effect of the perimeter drain, most sections of which are graded at considerably less than 33%, giving an opportunity for some sediment to be removed during transit through the drain system. This could be promoted through incorporating check dams, drop out pits, filter socks, etc. at periodic intervals along the drain system to enhance silt/sediment removal.
- The sediment delivery ratio is likely to be less than 0.7, as the fill surface will be relatively rough for a significant proportion of the time, meaning more silt/sediment will be captured closer to source and not delivered to the ponds.

For these reasons, the USLE analysis is considered to be more useful qualitatively than quantitatively. In our opinion, its key message is that silt and sediment losses need monitoring particularly as the Fill gradient increases and some additional erosion sediment controls may be required closer to source to mitigate the effects of any increased sediment losses compared with the existing situation.

Sediment losses will be minimised by restricting the area of exposed soil at any one time to 2ha, while portions of the Fill should be able to be completed in less than the allocated time. Hence, the net effect is expected to be less than calculated above and is unlikely to have an adverse effect on the receiving environment, provided the Fill operation is managed well.

In response to Iwi comments during their site visit, some scour/erosion protection measures will be placed at the outlet of the culvert under Jones Rd that drains to the western watercourse in the northern area. These will comprise two layers of D50 150mm riprap on Bidim A28 geotextile, or similar approved. Indicative dimensions to be confirmed on-site are 0.5m wide by 3m long. Haul road crossings of this gully will also be culverted, with appropriate scour/erosion protection provided.

6.3 RUNOFF CONTROL

Runoff volumes are likely to increase during filling due to a change in the ground surface from grass and vegetation to bare soil and subgrade and an overall increase in contributing catchment steepness. This has been provided for in design of the runoff collection system, through the provision of a perimeter drainage system of relatively gentle gradient while all runoff will pass through the sediment ponds, which will result in a significant reduction in peak flows leaving the site, while some volume reduction may also occur as a result of infiltration through the base of the ponds and evaporative losses. Additional measures such as the check dams, pipe drop structures and/or flumes can also be used if necessary to control runoff.

Earthworks will be monitored on site by the Operator, who will review sediment control performance. Overall, given the modest scale of the proposed filling activity, the comprehensive stormwater collection and treatment system proposed, and subject to effective application and management of the aforementioned erosion and sediment control measures, the associated potential adverse environmental effects are considered to be less than minor. However, additional mitigation measures for runoff control are able to be installed where deemed necessary.

6.4 IMPERVIOUS AREA CHANGES

New “impervious areas” comprise the new site entrance off Hunua Road (sealed to match existing road), new bridge (surface to be confirmed) and gravel access road. These areas amount to 3,783m^2 from drawing 33250/195, of which the majority is gravelled.

Additional haul roads (gravel) will extend into the Fill areas in accordance with staging plans. According to the indicative staging plans shown in drawing 33250/195, these additional haul roads would cover 1,263m^2-8,270m^2 depending on the stage being served.

This increases the overall new impervious area on the site to a maximum of 12,031m^2. This total impervious area would reduce as filling moves southwards, due to a reduction in the temporary haul road length within the fill footprint. By the time the southern area is filled, the temporary haul road length is estimated to reduce to 1,263m^2.

Existing impervious areas comprise the existing farm access track (gravel) and six buildings on the site including the bore pump shed. These six buildings have an approximate total roof area of 810m^2 while the existing farm access tracks have an approximate area of 1,590m^2 measured off Geomaps aerial photographs.

Under AUP:OP Section E8 (stormwater diversion and discharge), Activity A7 is potentially applicable. This applies to diversion and discharge of stormwater runoff from impervious areas up to 5,000m^2 outside an urban area that complies with Standard E8.6.1 and Standard E8.6.2.4. For the purposes of these standards "the total impervious area" includes any additional impervious areas plus existing impervious areas on the site.

Standard E8.6.2.4 needs to be considered first. It requires:
(1) The total impervious area on the site excludes unsealed or gravelled tracks.
(2) Connection to a stormwater network is not practicable.

For this site, item (1) means that the majority of the new impervious areas do not need considering and new non-gravelled impervious areas reduces to 490m^2 new areas (new site entrance and likely the new bridge surfacing) and 810m^2 existing roofing areas, giving a total of 1300m^2. Item 2 is not practicable as there is no stormwater network in this area.

Table 13: Impervious and Gravelled Areas Summary

Item	Existing	Proposed
Roofing (6 buildings)	810	810
New bridge		45
New site entrance (sealed)		445
Gravelled Access roads (permanent)	1,590	4,861
Landfill Haul gravel roads (temporary)	0	1,263 to 8,270
Total	**2,400**	**7,379 to 14,431**
Net impervious areas, excluding gravelled roads	810	1300

Notes:
1. Assumed new bore pump shed will have similar roof area to existing bore pump shed; no changes proposed to other buildings
2. New impervious areas in this context are the new site entrance and likely the new bridge surfacing

General Standards from E8.6.1 to be considered are listed below, followed by an assessment of compliance with each criteria:

(1) The design of the proposed stormwater management device(s) must be consistent with any relevant precinct plan that addresses or addressed stormwater matters.

Assessment: Not applicable – no precinct plan applies to this area.

(2) The diversion and discharge must not cause or increase scouring or erosion at the point of discharge or downstream.

Assessment: Complies. Stormwater runoff from the site entrance will be by sheet flow and follow the natural topography, flowing overland before entering the southern stream. The bridge will be flat and small volumes of runoff will likely flow diffusely off its sides into the underlying stream. The additional impervious area represents 0.4% of the 14.1ha OLFP1 catchment area, which is negligible. Hence, neither runoff source are expected to result in any scour or erosion at the point of discharge or downstream. Similarly roof runoff is expected to discharge to the ground surface and become overland flow from the six individual buildings or be collected in roof water tanks for reuse (existing dwelling).

(3) The diversion and discharge must not result in or increase the following:

a) flooding of other properties in rainfall events up to the 10 per cent annual exceedance probability (AEP); or

b) inundation of buildings on other properties in events up to the 1 per cent annual exceedance probability (AEP).

Assessment: Complies. The new impervious area is a very small proportion (0.4% of the total OLFP1 catchment area) and hence is not expected to cause any adverse flood effects for the 10% and 1% AEP storm events affecting other properties and/or buildings. Geomaps does not show any downstream dwellings located in close proximity to the 1% AEPO floodplain extent. The building roof runoff will be low volume and is an existing situation and thus will have no impact on flooding.

(4) The diversion and discharge must not cause or increase nuisance or damage to other properties.

Assessment: Complies. Again, due to the new impervious area being a very small proportion (0.4% of the total OLFP1 catchment area, this is not expected to cause or increase nuisance or damage to other properties. Similarly, the building roofing already exists and is not to be changed, so will not result in any adverse nuisance related effects.

(5) The diversion and discharge of stormwater runoff must not give rise to the following in any surface water or coastal water:

a) the production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

b) any conspicuous change in the colour or visual clarity;

c) any emission of objectionable odour;

d) the rendering of fresh water unsuitable for consumption by farm animals; or

e) any significant adverse effects on aquatic life.

Assessment: Complies. This is not expected to occur, due to the small impervious area involved and the relatively low volume of traffic expected across the new entrance and bridge.

Stormwater runoff from the new entrance will also flow overland across grass before entering the southern stream, which will effectively function as a filter strip and provide some contaminant removal. Similarly, roof runoff that is not collected in water tanks, is expected to flow overland across grass before entering any streams, which will achieve some contaminant removal.

(6) Where the diversion and discharge is to ground soakage, groundwater recharge or peat soil areas any existing requirements for ground soakage, including devices to manage discharges or soakage, must be complied with.

Assessment: Not applicable.

Overall, this shows that the stormwater diversion and discharge from the site will be a permitted activity under the AUP:OP E8, Activity A7.

6.5 SURFACE WATER AND SEDIMENT QUALITY EFFECTS

6.5.1 On and Off-site Effects

Section 3.3.3 of this report explains why the expected effects of the managed fill operation on surface water and sediment are expected to be less than minor, as briefly summarised below:

- All but 5 of the proposed Fill WAC comply with Auckland Council Clean Fill WAC, as advised by them in March 2025, based on their adoption of the WasteMINZ Class 5 Clean Fill standards as being acceptable as Clean Fill WAC.
- The remaining five WAC (boron, chromium, copper, nickel and zinc) relate to background volcanic soils concentrations for the Auckland region, rather than non-volcanic background values, recognising that the Jones Rd Fill would potentially be receiving soils from both volcanic and non-volcanic areas across Auckland.
- These WAC are all within corresponding WAC for Class 3 Managed Fills. These WAC have been determined based on protecting groundwater drinking water (based on DWSNZ) and aquatic species (based on ANZECC 95% freshwater species protection.

Hence, it is considered that the proposed Fill WAC will not adversely affect any groundwater downgradient of the site that is used as drinking water, nor any aquatic species in surface waters.

Furthermore, it is expected that 95% of silt/sediment will be removed from stormwater runoff from operational areas prior to offsite discharge, further reducing the potential for effects on surface water and sediment. Refer to section 6.14.2, sub-section B3.2 for a further effects assessment relating to sediment.

6.5.2 Effects on Neighbouring Properties and Hays Creek Catchment

As explained above and in section 6.14.2 of this report, it is considered that potential effects on surface water and sediment are less than minor. This applies to stormwater discharges from the site. The effects on neighbouring properties and the Hays Creek catchment are expected to be even less, as explained further below.

The northern Fill area is split across two catchments. The eastern section makes up 3.0ha of a total catchment area at the site boundary of ~12.3ha. The western section makes up 6.0ha of a total catchment area at the site boundary of ~16.4ha. These two flowpaths combine

further downstream approximately 510-560m below the site, where the combined catchment is 259ha. At this point, the Fill area represents 3.5% of the combined catchment.

The southern Fill area makes up 2ha of the total catchment area at the site boundary of 19.4ha, while site runoff combines with other overland flowpaths (OLFPs) from the subject site and surrounds to form a much larger OLFP (78.4ha) area within 170m of the site boundary. At this point, the Fill area represents 2.6% of the combined catchment.

Hence, in both cases, the Fill areas make up relatively small proportions of the total contributing stormwater catchments within a relatively short distance of the site discharge point.

The Tonkin & Taylor Hunua Ranges Water Supply Catchment Risk Assessment (June 2024) advises that the total Hays Creek catchment area is 670ha, of which 72% is privately owned. 51% of the catchment is classified as exotic grassland, 25% as exotic forest and 9% as native forest (Landcare Research Land Cover database Version 5). Farming, horticulture and plantation forestry form part of the land use in this catchment, while all residential properties are expected to have their own on-site wastewater treatment and disposal systems.

The Northern Fill site is located at the southern end of the Hays Creek catchment and makes up 1.3% of this catchment area, while the shortest flowpath from the Fill area to the Hays Creek dam lake is approximately 1.3km. The Southern Fill site discharges stormwater via a different route, which bypasses the Hays Creek dam. Hence, the effects of stormwater discharges from the Managed Fill on the Hays Creek catchment are considered likely to be less than minor, given the nature of the fill material, the proposed GD05 compliance erosion and sediment control practices, including SRPs with chemical treatment, the small proportion the Northern Fill makes up of the Hays Creek catchment and the reasonable distance from the site to the Hays Creek dam lake.

6.6 OVERLAND FLOW AND FLOODING

6.6.1 Council Geomaps

Council Geomaps shows that the site is subject to four OLFPs. The southern side of the site is subject to two OLFPs (Figure 10). OLFP1 runs along the main stream along the southern boundary (FTL estimated 14.1ha catchment area). The contributing catchment of the OLFP is from upstream of the site, while as well as from the southern side of Hunua Road, as there are culverts under the road that will take some (minor) runoff under Hunua Road. OLFP2 runs along the western boundary (FTL estimated 5.3ha catchment area). Estimated 1% AEP flows are 4.28m^3/s and 2.14m^3/s respectively for OLFP1 and OLFP2.

The northern side of the site is also subject to two OLFPs. OLFP3 runs along the main stream along the north western boundary (estimated 16.4ha catchment area at site boundary), and OLFP4 along the northern boundary (estimated 12.3ha catchment area at site boundary). The estimated 1% AEP flows for each OFLP are 5.15m^3/s and 5.07m^3/s respectively for OLFP3 and OLFP4. OLFPs 3 and 4 are shown in Figure 11 below.

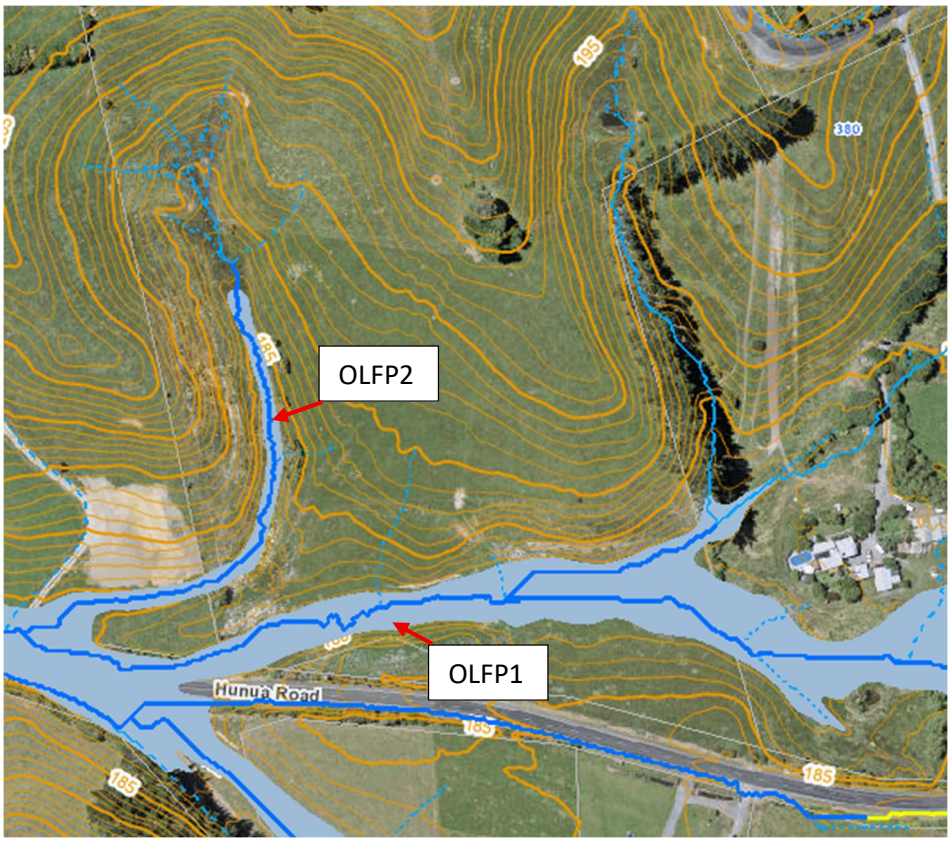


Figure 10: Geomaps OLFP and Floodplain Data for the Southern Area of the Site

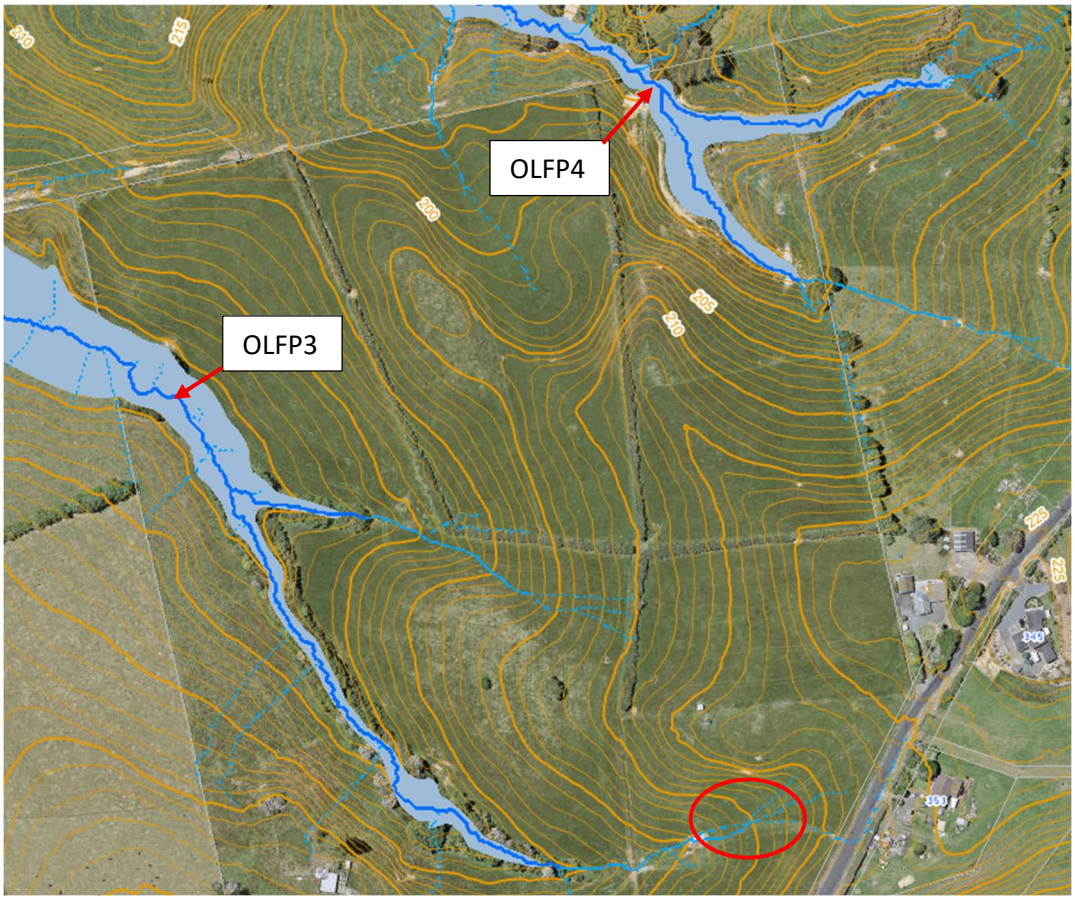


Figure 11: Geomaps OLFP and Floodplain Data for the Northern Area of the Site

6.6.2 Assessment

Our assessment has found:

- All of the OLFPs are classified as both OLFPs and floodplains under AUP:OP definitions.
- For OLFP1, the contributing catchment is mostly sheet flow from the site itself. The southern fill platform will be outside of the floodplain extent, and the fill platform will not impact the OLFP or floodplain. It is proposed to remove the culvert in the stream and associated embankment, which will reduce the floodplain extent on the site. It is proposed to install a bridge across the OLFP, which will be designed such that it has no impact on OLFP1 or its associated floodplain.
- For OLFP2, the contributing catchment is largely runoff from the upstream catchment. The southern fill platform will be outside of the floodplain extent, and the fill platform will not impact the OLFP or floodplain.
- For OLFP3, the contributing catchment is almost entirely from the site itself. The northern fill platform will be outside of the floodplain extent, and the fill platform will not impact the OLFP or floodplain.
- For OLFP4, the contributing catchment is largely runoff from the upstream catchment. The northern fill platform will be outside of the floodplain extent, and the fill platform will not impact the OLFP or floodplain.
- None of the overland flowpath entry or exit points on the site will be changed.
- The proposed two fill areas and associated bunds and stockpile areas are all located outside the major OLFPs and associated floodplains. They are subject to only minor overland flows which are more likely to occur as shallow sheet flow of low magnitude. Filling these areas should not be an issue in relation to affecting overland flow conveyance or flood storage, with the proposed fill drainage system providing alternative means for catering for these minor flows.
- The proposed erosion and sediment control ponds are located outside the major OLFPs and associated floodplains.

Overall, it is considered that the proposed Fill areas are likely to have less than minor effects on overland flows and flooding.

6.6.3 New Haul Road Crossing of OLFP3

It is however noted that the northern Fill access road will cross the upper area of OLFP3, within the area indicated by the red circle in Figure 11. There are three small OLFPs shown in this area with associated catchment areas off Geomaps of 3,646m^2, 2,611m^2 and 9,042m^2 going from north to south, giving a combined catchment area of 15,299m^2. Collectively, these three OLFPs and the southern most OLFP alone qualify as OLFPs in terms of the minimum 4,000m^2 catchment requirement.

These OLFPs will need to be piped under the haul road using a culvert. This will trigger a resource consent under AUP:OP Section E36 A41 “Diverting the entry or exit point, piping or reducing the capacity of any part of an OLFP as a **restricted discretionary** activity.”

Assessment criteria are listed under E36.8.1 (12) and repeated below, along with an assessment against each criteria:

(a) potential effects on the OLFP including:
- *(i) the obstruction of flows; and*
- *(ii) any change to location and capacity; and*
- *(iii) any changes in depth and velocity of flow; and*
- *(iv) any change to overland flow on other properties.*

(b) the provision of alternative overland flow paths;
(c) the extent of any associated earthworks; and
(d) the extent to which methods for long term maintenance of areas affected by flooding, such as easements, are provided.

Assessment: The haul road crossing of this OLFP will be designed with a culvert at the crossing point that will allow for estimated peak flows for the 1% AEP storm event with provision for climate change to be conveyed through it. Hence, there will be no obstruction of flows along the OLFP alignment and no changes to the location or capacity of the existing OLFP. There may be some localised changes in flow velocity and depth at the culvert inlet, as some heading up of flow is expected, but flow depth and velocities will revert to existing conditions downgradient of the culvert reasonably quickly based on the existing land gradient along the OLFP alignment (12%). There will be no changes to overland flow on other properties.

It is not necessary or practical to provide alternative OLFPs as the haul road runs across the entire OLFP catchment, while the extent of any associated earthworks will be minor, restricted to the width of the haul road (6m) plus 1-2m either side. Methods for long term maintenance of areas affected by flooding does not apply.

Overall, the proposed culvert crossing complies with all of these requirements and will not result in any adverse environmental effects.

6.7 SLOPE AND LAND STABILITY

The following measures will be taken to ensure that no adverse stability issues arise from the placement of fill material on-site:

- Unsuitable material will be removed prior to filling;
- Underfill drainage will be installed along the base of the shallow gullies running through the fill areas and other relevant locations where it is considered necessary;
- Benching of side slopes will be undertaken;
- The front batter slopes will not be steeper than 1V:3H (33%);
- Stormwater will be controlled with fill laid with a slight positive fall to avoid surface ponding;
- Completed fill areas will be topsoiled and grassed as soon as practicable, particularly all temporary and final batter slopes.

The FTL geotechnical investigation undertook specific slope stability analyses to determine the stability of the proposed fill profile, particularly the stability of the proposed end batter slope, using the computer programme Slope/W for various potential slip surfaces within the

soil veneer. Theoretical factor of safety values of 1.48-1.52 and 1.30-1.34 were obtained for the three cross-sections analysed for assumed wet winter and extreme transient (saturated) groundwater conditions respectively, for the moderately steep to steep slope represented by Cross Section AA, BB and CC (refer drawing G00417/02). These factor of safety values are considered to be satisfactory, being greater than the limiting values of 1.5 and 1.3 for wet winter and extreme transient (saturated) groundwater conditions respectively.

Overall, the effects of filling activity on slope and land stability are considered to be less than minor.

6.8 VEGETATION INCLUDING RIPARIAN VEGETATION

The existing vegetation (grass/weeds) will be progressively removed prior to filling and progressively replaced with productive pasture on completion of filling. The associated short-term absence of vegetation is minor in nature, while the restored pasture is likely to be of better quality than the existing grass/weeds.

6.9 WORKS WITHIN A WATERCOURSE

6.9.1 Sediment Pond Discharges

The discharge points from the three sediment ponds to the existing watercourses will be provided with riprap for scour/erosion protection. These outlets are located outside the nearby watercourse OLFP/floodplains and hence will not extend down the banks of the associated watercourses or across stream beds, nor will they change or alter the stream cross-sectional flow area. The extent of these works will be determined during preparation of construction drawings. The works will be undertaken in accordance with best practice and will have a less than minor effect on the existing watercourses. They will be a permitted activity under the AUP:OP.

6.9.2 Removal of Existing Culvert Crossing

The existing culvert crossing over the southern stream near the new site entrance is to be removed. These works are to be undertaken during a forecast period of fine weather (minimum 2-3 days) in summer season, ideally when no water is flowing in stream. The proposed methodology is set out below:

(a) Establish erosion and sediment controls. Install portable pump and sand bags to dam the stream on the upstream side and sand bags on the downstream side to capture any silt/sediment generated from the works;
(b) Remove any vegetation from culvert crossing;
(c) Remove road embankment (soil material) to stockpile. Place suitable materials in Fill facility and dispose of excess or unsuitable spoil off-site to appropriate facility. Contamination testing of fill material in embankment may be required based on visual observations (at discretion of SQEP).

(d) Remove existing 600mm dia culvert and any hardfill bedding material and associated inlet/outlet structures.
(e) Remove residual stream embankment down to existing stream bed level and undercut by 150mm.
(f) Trim stream banks to tie in with existing stream profile.
(g) Place 150mm clean topsoil on restored stream bed and stream batters and cover with biodegradable coir matting or similar, pinned in place.
(h) Grass stream bed and banks, using water tolerant grass (Outfield 'Rye' grass or similar approved; supplier – Prebble Seeds, 09 273 4682).
(i) Remove erosion/sediment controls and any temporary dams.

Notes:

- Works extent is approximately 100m^2 with estimated embankment volume of 33m^3.
- Estimated works duration is two days, but three days allowed to provide some contingency.
- Stream bed disturbance during construction will be limited to the minimum practical area and not more than 5m either side of the old culvert, excluding the length of the culvert itself.
- All construction materials and ancillary materials will be removed from the stream bed following completion of construction.

Post-culvert removal, the stream and associated wetland in this area will be enhanced.

It is assumed that the existing culvert was lawfully established. Hence, removal of the existing culvert will be a permitted activity under Rule E3.4.1 (Activity A24) of the AUP:OP, subject to complying with the requirements set out below, which will also ensure that there are no associated adverse environmental effects.

E3.6.1.13. Works on structures lawfully existing on or before 30 September 2013 and the associated bed disturbance or depositing any substance, diversion of water and incidental temporary damming of water for the demolition or removal of existing structures

(1) The activity must comply with the standards in E3.6.1.10 above (below).

(2) The structure must be removed from the bed as far as practicable.

(3) Any remaining sections must not be a hazard to public access, navigation or health and safety.

(4) The bed must be restored to a profile that does not inhibit water flow or prevent the passage of fish upstream and downstream in waterbodies that contain fish.

The proposed works will comply with items (2) – (4), as the existing culvert and embankment structure will be removed from the stream bed completely and no sections will be left in place, while the stream bed will be restored to a profile that ties in with existing upstream and downstream sections, that does not inhibit water flow or prevent fish passage.

E3.6.1.10. Standards for works on structures lawfully existing on or before 30 September 2013 and the associated bed disturbance or depositing any substance, diversion of water and incidental temporary damming of water

(1) All works on existing structures must comply with all of the following standards:

(a) during the activity bed disturbance upstream or downstream of the structure must not exceed 10m either side, excluding the length of the structure;

(b) best practice erosion and sediment control measures must be used to minimise any discharge of sediment, including sediment impounded behind an existing structure;

(c) debris or other material must not be re-deposited elsewhere in the bed of the lake, river or stream, or within the one per cent annual exceedance probability (AEP) flood plain;

(d) the activity must not cause more than minor bed erosion, scouring or undercutting immediately upstream or downstream; and

(e) the activity must not compromise the structural integrity of the structure.

The proposed culvert removal works will comply with E3.6.1.10, as the 10m limit either side of the structure will be achieved, best practice erosion and sediment controls will be put in place, no debris redeposition will occur; no more than minor bed erosion, scouring or undercutting will occur and the structure will be removed so item (c) is irrelevant.

6.9.3 New Bridge

The new southern stream crossing will involve a bridge, with no works proposed within the watercourse. The new bridge shall be designed to take the 1% AEP storm event with allowance for climate change without heading up. The new bridge will have a design life of at least 50 years.

Installation of the new bridge will be a permitted activity under Rule E3.4.1 (Activity A29) of the AUP:OP, subject to complying with the requirements set out below, which will also ensure that there are no associated adverse environmental effects.

E3.6.1.16 New structures and the associated bed disturbance or depositing any substance, diversion of water and incidental temporary damming of water for bridges or pipe bridges. It requires:

(1) The activity must comply with the standards in E3.6.1.14 above.

(2) Piles must not be located in, on or under the bed of the lake, river, stream or wetland.

Compliance with E3.6.1.14 is addressed below. The bridge will be designed at building consent stage and will ensure that no pipes are located in, on or under the bed of the stream/wetland that the bridge crosses.

E3.6.1.14. Standards for new structures and the associated bed disturbance or depositing any substance, diversion of water and incidental temporary damming of water

(1) Structure length must comply with all of the following:

(a) the total length of any extended structure must not exceed 30m measured parallel to the direction of water flow. This includes the length of any existing structure and the proposed extension but excludes erosion or scour management works;

(b) any required erosion or scour management works must not exceed 5m in length, either side of the extended structure. Such works protruding into the bed do not require a separate consent as they are authorised under this rule; and

(c) a new structure must not be erected or placed in individual lengths of 30m or less where this would progressively encase or otherwise modify the bed of a river or stream.

(2) During construction bed disturbance upstream or downstream of the structure must not exceed 10m either side, excluding the length of the structure.

(3) The structure must not prevent the passage of fish upstream and downstream in waterbodies that contain fish, except that temporary restrictions to fish passage may occur to enable construction work to be carried out.

(4) The structure must not cause more than minor bed erosion, scouring or undercutting immediately upstream or downstream.

(5) Construction material and ancillary structures must be removed from the bed following completion of the activity.

(6) Other than provided for by another rule, the activity must not increase the height or storage capacity of any existing dam.

(7) The 1per cent annual exceedance probability (AEP) flood shall be accommodated by the structure and/or by an overland flow path without increasing flood levels up stream or downstream of the structure, beyond the land or structures owned or controlled by the person undertaking the activity.

(8) Calculation of flow rates will be made using the Auckland Council Technical Publication 108: Guideline for stormwater runoff modelling in the Auckland Region, April 1999.

The proposed bridge will comply with E3.6.1.14, as set out below:

(1) The proposed bridge will be a single lane bridge and easily comply with the 30m length requirement (rule a). No erosion and sediment control works will be required within the stream extent as the bridge will span the stream (rule b). Rule (c) does not apply.
(2) Construction will not involve any stream bed disturbance, as the bridge will span the stream and be installed by crane.
(3) The bridge will span the stream and not interfere with fish passage, including during construction.
(4) The bridge will not cause any minor bed erosion, scour or undercutting.
(5) It is unlikely that any construction materials or ancillary structures would be required within the stream bed. If any are required these would be removed post-construction.
(6) This is not applicable.
(7) The bridge design will accommodate the 1% AEP storm event, including an allowance for climate change, without affecting flood levels upstream or downstream.
(8) The bridge design will use peak flows calculated from TP108.

6.9.4 NES Freshwater Assessment

Council have identified that consent is required under Regulation 45B(1) & (2) of the NES: Freshwater for works during removal of the culvert and construction of the new bridge/haul road, due to proximity to a wetland. An assessment against these requirements is set out below.

NES Freshwater regulations 45B (1) and (2) state the following:
(1) Vegetation clearance within, or within a 10 m setback from, a natural inland wetland is a discretionary activity if it is for the purpose of constructing or operating a landfill or a cleanfill area.
(2) Earthworks or land disturbance within, or within a 10 m setback from, a natural inland wetland is a discretionary activity if it is for the purpose of constructing or operating a landfill or a cleanfill area.

The NES Freshwater discretionary activity requirements state:
(6) A resource consent for a discretionary activity under this regulation must not be granted unless the consent authority has first—
(a) satisfied itself that the landfill or cleanfill area—
(i) will provide significant national or regional benefits; or
(ii) is required to support the quarrying activities regulated under regulation 45A; or
(iii) is required to support urban development regulated under regulation 45C; or
(iv) is required to support the extraction of minerals regulated under regulation 45D; and
(b) satisfied itself that—
(i) there is no practicable alternative location for the landfill or cleanfill area in the region; or
(ii) every other practicable alternative location in the region would have equal or greater adverse effects on a natural inland wetland; and
(c) applied the effects management hierarchy.

Each of these criteria are assessed below:

(a) (i) Significant national or regional benefits

The site is considered to be of significant regional benefit for the following reasons:

- It is increasingly difficult to find suitable Fill sites within the Auckland region due to population growth and urban expansion, NES (productive soil issues), NES Freshwater and permanent stream/wetland proximity issues and suitable road access,
- The ease of difficulty increases going from Class 5 (cleanfills) through to Class 1 (landfills) due to increasing engineering requirements and environmental protection considerations.
- The introduction of the national waste levy, which provides for differential charges between different Class Fill facilities and progressive annual increases in the levy has created a greater demand for cleanfill and managed facilities.
- It is taking increasingly longer times to consent such facilities – an estimated 1-3yrs for cleanfills and managed fills, based on FTL experience.

- The T&T "Clean and Managed Fill in Auckland" letter report for Auckland Council dated 16 March 2017, predicted the total demand for cleanfill/managed fill in the Auckland region in 2018 was 2,218,000 T/yr (with an accuracy of +15% and -65%). Projecting this out to 2025 on a pro rata population demand gives a 2025 demand of 2,232,500T/yr. Assuming a compacted waste density of 1.6-1.8T/m^3 gives an annual Cleanfill/Managed Fill volume requirement of 1,240,300-1,395,300m^3/yr. Hence, the Jones Rd Fill facility (790,000m^3) will satisfy demand for **0.57-0.64 yrs** based on T&T's best prediction extrapolated to 2025 (with a possible range of 0.49-1.82 years taking into account the stated ± percentage accuracies).
- Local factors supporting the Jones Rd Fill Facility include:
  - It's proximity to areas of growth (green and brownfield) in South Auckland.
  - It's proximity to the Winstone's quarry in Hunua, creating transport efficiencies for backloading empty trucks with hardfill materials, increasing vehicle utilisation efficiency and reducing transport related emissions.
  - It will be a consented, monitored site, run by a reputable company that doesn't "cut corners" with comprehensive fill acceptance checks and surface water monitoring proposed with independent SQEP oversight.

(a) (ii) - not applicable

(a)(iii) Most development projects involving earthworks generate excess clean/managed fill material requiring disposal, with the estimated demand in 2025 being 2,232,500 T/yr in 2025 from item (a) (i). This material has to go somewhere and it is best it is disposed of locally, to minimise transport related environmental effects (vehicle emissions) and reduce congestion on road network. This is particularly true for the Jones Rd site, given its proximity to areas of growth.

(a) (iv) – not applicable

(6) criteria (b)

(6)(b)(i) The applicant has been actively searching for an appropriate fill site in Auckland for the past 8 years. Many sites have been viewed and ruled inappropriate given issues of proximity to fill sources, parcel size, access, wetlands, streams, and/or Highly Productive Land (HPL). This site has proved to be the only suitable site the applicant has located. Being directly involved in the Auckland construction industry, they are acutely aware of the lack of consented fill sites available in suitable locations to take excavated fill from their development sites. This is resulting in increasing costs.

This site was chosen through multilayer specialist assessments. Sites further away create added cost (transport, carbon). Issues of HPL have been avoided. Tangata Whenua concerns, issues of wetlands and effects on freshwater features have been avoided, and in fact there will be improvements on the current state in relation to the wetlands and streams. The assessment of alternatives must be practical to the applicant as it is not reasonable to assess every parcel across Auckland.

(6)(b)(ii) This criteria does not seem relevant as the proposal increases the ecological value of the wetland – i.e. there is no equal or greater adverse effect. Furthermore, the vegetation clearance and earthworks activities do not relate to the Fill operation itself, but to construction of a much improved accessway across an existing stream (that could potentially apply to many rural properties wanting improved access). There are only minor temporary potential effects to manage during the activities (with adequate controls provided to cover these) and significant long term, permanent ecological benefits for the stream/wetland. Council also support removal of the existing culvert across the southern stream (Stream 1). From this perspective, it seems irrelevant to comment on every other practicable alternative location.

(6) (c). This item has been addressed separately by the project ecologist.

6.10 STREAM, WETLAND AND GROUNDWATER EFFECTS

Effects on the wetlands on-site are discussed in the Boffa Miskell Ecological report, with key points summarised below.

In the southern area, the wetland crossed by the haul road is deemed to be of low value, and there are benefits to this wetland due to the removal of the culvert. The bridge is to be built outside of the wetland extent, and therefore the impact on the wetland will be a net positive benefit.

In the northern area, there is a wetland at the head of a stream at least 10m away from the main filling area and a larger wetland in the north-eastern corner of the site. Both wetlands are considered likely to be fed by surface runoff and potentially shallow groundwater flows. Filling the northern area is not expected to compress the ground under the fill, based on FTL geotechnical investigation, and there will be some relatively minor changes in surface water catchments. Hence, shallow groundwater flows to the streams and wetlands in this area are generally expected to be maintained, so that baseflows are not expected to be changed. Similarly, infiltration to deep groundwater is considered unlikely to change. Overall, there is not expected to be any significant change in flows to these streams, wetlands and groundwater recharge. Also, refer to section 6.14.2 for further discussion on this.

There are also three wetland features in the southern area, outside of the proposed fill area. Again, there will be some changes to surface water catchments, but combined surface and shallow groundwater flows to these wetland features are expected to remain similar to the existing situation, and thus no adverse effects on stream function or wetland ecology are expected. Again, recharge to groundwater is expected to be similar to the existing situation.

The proposed activities will be located and managed to ensure that the ecological function of these streams and wetlands is maintained. In particular, there will be no change to the water level range or hydrological function of the wetlands. Planting the wetland features would further enhance biodiversity values.

Overall, with appropriate measures to avoid and minimise adverse effects, the residual adverse effects to these wetlands would be low or potentially a net gain.

6.11 NEW GROUNDWATER TAKE

The new groundwater will be a permitted activity subject to complying with the following criteria:

E7.6.1.4. Take and use of groundwater up to 20m^3/day when averaged over any consecutive 20-day period and no more than 5000m^3/year:

(1) The groundwater take must not be geothermal water unless it is for a purpose specified in section 14(3)(c) of the Resource Management Act 1991.
(2) The groundwater take must not be from the High-use Aquifer Management Areas Overlay.
(3) The groundwater take must not be for the purpose of dewatering or groundwater level control.
(4) The groundwater take must be located at least 100m from any other existing lawfully established groundwater take from the same aquifer.
(5) Notice on the prescribed form must be received by the Council 15 working days before undertaking this permitted activity.

The groundwater take is not from a high use aquifer management area and is not from geothermal water or for dewatering or groundwater level control. There are no known other lawfully established groundwater takes within 1000m of the proposed take and Council will be advised 15 working days before this activity begins. Hence, the proposed groundwater take will comply with all E7.6.1.4 requirements.

6.12 DECOMMISSIONING EXISTING BORE (E7.6.1.20)

Decommissioning of the existing bore will comply with the permitted activity standards set out in the AUP:OP E7.6.1.20 (*Drilling and use of holes and bores – decommissioning (abandonment) holes or bores)*.

The existing bore meets the standards in E7.6.1.16, in that it is not located in a Wetland Management Areas Overlay; no sample removal is proposed for groundwater quality analysis and the existing bore is not in any Historic Heritage Overlay area.

The decommissioning of the existing bore will comply with section 2 and 4 of "New Zealand Standards – NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock".

The Council will be notified on the prescribed council form prior to a bore being decommissioned and must be provided with details of the location of the bore.

The records required under section 4 of "New Zealand Standards – NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock" will be kept and forwarded to the Council no later than one month after the bore is decommissioned.

6.13 NEW GROUNDWATER BORE

The proposed new bore will comply with the permitted activity standards in E7.6.2.3 (Drilling and Use of holes and bores – New bores not otherwise specified) as listed and then assessed below:

(1) The bore must not be in a Wetland Management Areas Overlay.
(2) The drilling of the hole or bore must not destroy, damage or modify any places scheduled in the Historic Heritage Overlay.
(3) The bore must be constructed to avoid contaminants entering the aquifer penetrated by the bore.
(4) The bore must be constructed to avoid a hydraulic connection between penetrated aquifers with different pressures, water quality or temperature.
(5) The bore must be operated and maintained to avoid the leakage of groundwater to waste.
(6) The drilling and construction of the bore must comply with section 1, 2, 3 and 4 of "New Zealand Standards - NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock".
(7) The records required under section 4 of "New Zealand Standards - NZS 4411:2001 Environmental Standard for Drilling of Soil and Rock" must be kept and forwarded to the Council no later than one month after the bore is drilled.

The new bore is not located in a wetland management area overlay nor in the historic heritage overlay. It will be constructed by suitably qualified and experienced drillers in accordance with the relevant New Zealand standards (NZS4411:2001) and best practice and hence will avoid contaminants entering the aquifer penetrated by the bore, avoid hydraulic connections between different aquifers and avoid the leakage of groundwater to waste. Drilling records will be provided to Council within one month of the bore being drilled.

It will also comply with the requirements for controlled activities for new bores not otherwise specified under E7.7.1 (4) and E7.7.2 (4), as listed and then assessed below:

E7.7.1 (4):
(a) the location, depth and design of the bore and the design of the head works;
(b) effects on areas any scheduled historic heritage place;
(c) the provision for bore identification;
(d) maintenance of the bore;
(e) monitoring and reporting requirements; and
(f) the duration of the consent and the timing and nature of reviews of consent conditions.

E7.7.2 (4):
(a) the options for the location, depth and design of the bore and the design of the head works to avoid adverse effects on the groundwater resource and other groundwater users;
(b) the options to locate and design the bore and the head works to avoid adverse effects on any scheduled historic heritage places;
(c) the most effective method to identify the bore; and
(d) an effective programme of maintenance for the bore.

The bore has been located close to the internal haul road and near the site office, so that it is relatively close to where exiting vehicles are likely to have their wheels cleaned, so as to reduce associated pumping head.

The design of the bore and headworks will be based on New Zealand standards and best practice. A bore ID tag will be installed on the bore and recorded in the Fill Management Plan with the ID being the bore permit number.

Bore maintenance primarily involves regular pump servicing in accordance with supplier recommendations and periodic pump flow calibration. Monitoring and reporting requirements are set out in the separate Fill Management Plan.

The consent duration requested is two years, as this consent relates to putting down the new bore, which will be done prior to any filling works taking place on site.

There are no scheduled historic heritage places near the proposed bore location and hence this item is not relevant.

6.14 EFFECT ON HAYS CREEK DAM

6.14.1 Background Information

Hays Creek Dam forms part of the Auckland Drinking Water supply, which is registered with the Water Services Authority (Taumata Arowai). The Auckland Drinking Water Supply ID is AUC003.

Tonkin & Taylor Ltd (T&T) prepared the Hūnua Ranges Water Supply Catchment Risk Assessment for Watercare Services Ltd in 2024. This report identifies water quality risks affecting the Hays Creek Dam in relation to Source Water Risk Management Areas (SWRMAs):

- SWRMA1 for lakes relates to the lake and its bed within a 500m radius of the intake, extending 5m, into land from the lake edge.
- SWRMA2 for lakes, this comprises the whole lake and 8hr travel time within tributaries with a 100m buffer strip. T&T assumed a river water velocity of 1m/s as no flow monitoring data was available for this catchment. Thie ensures that all reaches within the tributaries to the dams are included in the SWRMA2 extent.
- SWRMA3 – this comprises the entire surface catchment upstream of a point 100m downstream of the intake.

These different RMAs are shown in Figure 5.1 of the T&T report, and in Figure 12 below.

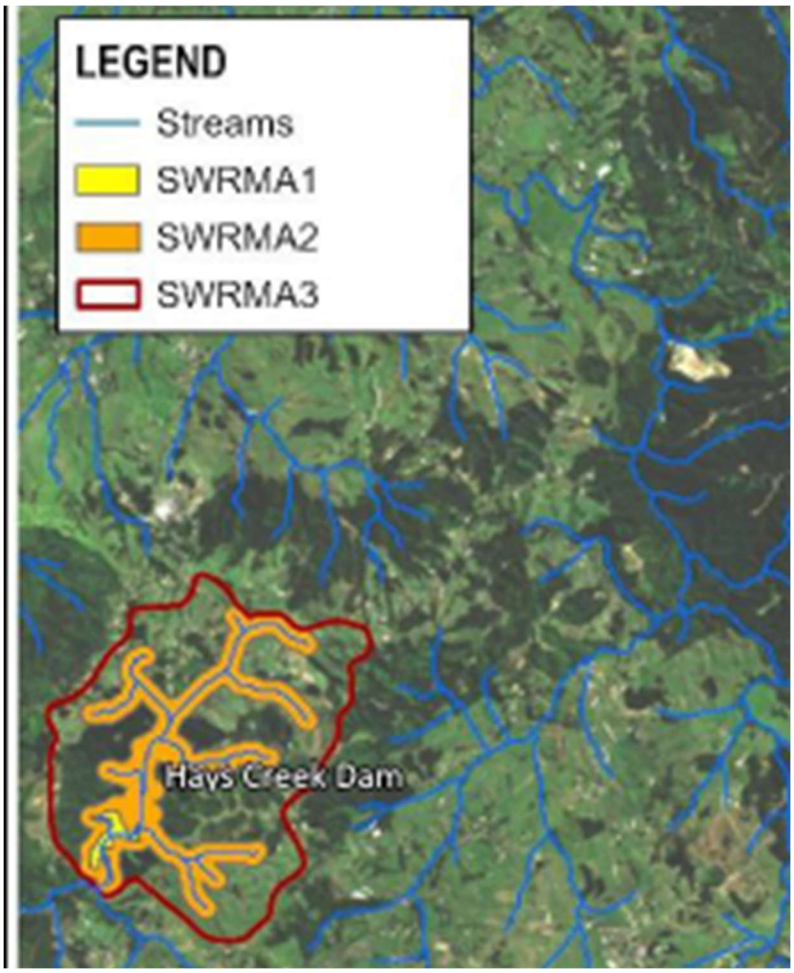


Figure 12: SWRMA Areas for Hays Creek Dam (from T&T, 2024, Figure 5.1)

These extents have been imported into AutoCAD and plotted on FTL drawing 33250/500. Review of this drawing shows that the SWRMA2 areas do not extend into the site and only the Northern Fill area is located within the dam catchment. It appears the SWRMA2 extents may be based on the extent of permanent streams, noting that Boffa Miskell identified both streams within the northern fill catchment as being intermittent. This also seems logical as intermittent streams are not subject to permanent flows and hence the velocity criteria of 1m/s used to define the SWRMA2 extent would not apply to intermittent stream reaches.

The T&T report identifies the following water quality risks in the Hays Creek dam catchment.

Table 14: Water Quality Risks in Hays Creek Catchment (T&T, 2024)

Theme	SWRMA	Potential contaminant	Contam-ination Pathway	Unmit-igated risk	Comments
Waste	1 and 2	Human or animal waste: bacteria and viruses	Indirect: surface runoff in SWRMA 1 and 2.	Class 5	Sheep grazing on dam face downstream of intake On-site wastewater disposal systems (septic tanks)
	1 and 2	Human or animal waste: protozoa	Indirect: Surface runoff	Class 5	

			in SWRMA 1 and 2		Wild animals present (possum, pigs, waterfowl) E.coli, cryptosporidium and giardia have been detected in raw water
Other	1 and 2	Fire: changes to raw water determinands during and after the fire event.	Indirect: Surface runoff in SWRMA 1 and 2	Class 3	Fire risk to raw water quality managed in Watercare Fire Management Plan and return to service sampling protocol.
	1 and 2	Accident or spill of chemicals in catchment	Indirect: Surface runoff in SWRMA 1 and 2 Direct: spill in SWRMA1	Class 3	Vehicle accident or fire on public roads or farm/ forestry access roads crossing the catchment. • Farm waste via burning or burial. • Fuel storage and use of equipment on private property or forestry blocks. • Spill or contamination during boat operation/ equipment refuelling. • Small quantities of cooling and lubricating oils for electronic compressor. • Occasional use of emergency diesel powered generators. • Intentional acts of damage as reservoir is accessible by the public. • HAIL Site borders SWRMA3.
Biological	1	Gold clam	Direct:potential to be located in SWRMA1	Class 3	Clams can reproduce rapidly and form large populations that can block water infrastructure and enter WTP intakes,

					pipes, and water tanks.

Note: Risk classifications are sourced from Watercare's Enterprise Risk Management Framework; not Taumata Arowai's DWQAR classification for source water protozoal treatment requirements.

T&T (2024) advises that the total Hays Creek catchment area is 670ha, of which 72% is privately owned. 51% of the catchment is classified as exotic grassland, 25% as exotic forest and 9% as native forest (Landcare Research Land Cover database Version 5). Farming, horticulture and plantation forestry form part of the land use in this catchment, while all residential properties are expected to have their own on-site wastewater treatment and disposal systems.

The Northern Fill site is located at the southern end of the Hays Creek catchment and makes up 1.3% of the Hays Creek catchment area, while the shortest flowpath from the Fill area to the Hays Creek dam lake is approximately 1.3km. The Southern Fill site discharges stormwater via a different route, which bypasses the Hays Creek dam. This is shown on FTL drawing 33250/501 and in Figure 13 below.

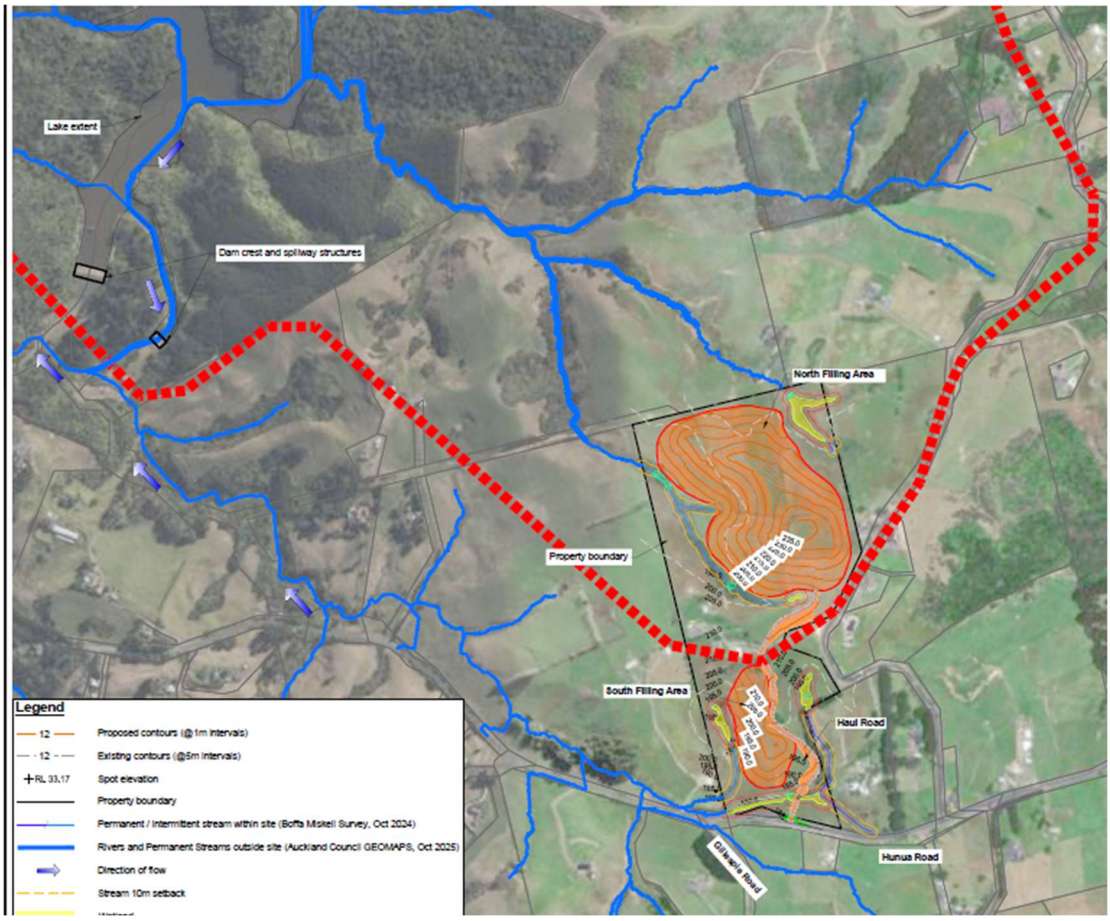


Figure 13: Stormwater Flowpath Routes from Fill Site (from FTL drawing 33250/501)

6.14.2 Potential Contamination of Public Water Supply

In their submission, Watercare raised three specific matters of concern that they considered were not addressed in the original consent application:

- Effect of discharges from underfill strip drains proposed beneath the fill areas.
- Actual and/or potential contamination effects of runoff from the portion of the proposed haul road that is within the Hays Creek dam catchment.
- The risk to the water supply catchment from contaminants is wider than those considered in the application. It notes that runoff will carry sediment and contaminants into drains and streams, while contaminants from the fill may also migrate through the soil and shallow groundwater via interflow, which can carry pollutants downslope towards the dam, especially in areas with fractured geology or underlying faults that facilitate subsurface movement. They further note that the proposed Fill site is underlain by a fault, which whilst not active presents a potential pathway for the migration of contaminants from the fill activity.

Each of these issues is responded to below in this revised application.

B1. Underfill Drains

Issue: *The actual and/or potential contamination effects of discharges from the underfill strip drains proposed beneath the fill areas that will discharge to the existing gully network;*

Response: The primary purpose of the groundwater underfill drains is to reduce pore water pressures in soils under the fill to assist with managing fill stability rather than to capture all groundwater – i.e. they are intended to manage seasonal increases in groundwater levels into the fill from natural ground below the fill. Any such groundwater is expected to have minimum contact with the overlying fill material and hence to be "clean". However, some groundwater percolating downwards through the fill material will also be picked up by the underfill drains.

The original design allowed for the underdrains to discharge to the perimeter drainage system for conveyance to the SRPs, but this was changed during the initial S92 process based on Council feedback, with all underdrains discharging directly to existing gullies, bypassing the SRPs. Based on Watercare's comments it is now proposed to adopt a conservative approach and revert to the original design. This means that all underfill drainage will be treated in the SRPs.

The Fill Management Plan (FMP) sets out the proposed surface sampling regime. This focuses on sampling from the SRP discharges and at the site discharge points. Underfill drain sampling is not proposed as part of routine sampling, for reasons explained further below and also because practically, these drains typically contain no or very low flows and hence represent a negligible proportion of the SRP inflows.

If there are any SRP and/or site discharge trigger level exceedances, the sampling methodology allows for tracing potential sources, including checking the underfill drains at that time. This is considered a more practical and appropriate sampling regime.

Hence, the effects of underfill drain discharges from the Managed Fill on the Hays Creek catchment are considered likely to be less than minor for the following reasons:

- the nature of the fill material (refer section B3.2 and section 3.3.)
- the proposed GD05 compliant erosion and sediment control practices, including SRPs with chemical treatment that underfill drain runoff will be directed to and treated in;
- flows from the underfill drains are likely to be very low and contain negligible to low contaminant levels;
- the small proportion the Northern Fill area makes up of the Hays Creek catchment, and
- the reasonable distance from the site to the Hays Creek dam lake.

B2. Haul Road Discharges

Issue: *The actual and/or potential contamination effects of runoff from the proposed haul road which will cross an existing overland flow path within the site that conveys runoff to a gully and stream that ultimately discharges to the Hays Creek Dam.*

Response: The extent of the haul road of concern is approximately 180m long. To address Watercare's concerns, it is proposed to construct a clean water diversion drain on the uphill side to divert runoff from crossing the road, and grade the road with a single crossfall to the downhill side. Runoff from the road will be collected in a table drain and then treated in a swale further downhill, with the treated runoff being discharged to the gully (Stream 3) within the northern catchment. These details are shown on FTL drawings 33250/190 and 202.

It is also proposed to install a proprietary wheelwash, that recycles water, with estimated water losses of 25L/vehicle. Any lost water will be collected in the same table drain and conveyed to the same swale for treatment. These details are shown on FTL drawing 33250/190.

Stormwater monitoring is also proposed of stormwater discharges from the site at the boundary. If any elevated contaminant concentrations are recorded exceeding site trigger levels (ANZECC 80% freshwater species protection criteria), then the source of these contaminants will be traced, including checking the access road as a potential source.

These measures should collectively ensure that haul road stormwater runoff discharges are appropriately managed so that effects on the Hays Creek catchment water quality are negligible. Furthermore, the potential effects of haul road runoff are considered less than from a farm race, which is a permitted activity and subject to E11/E12 of the AUP(OP).

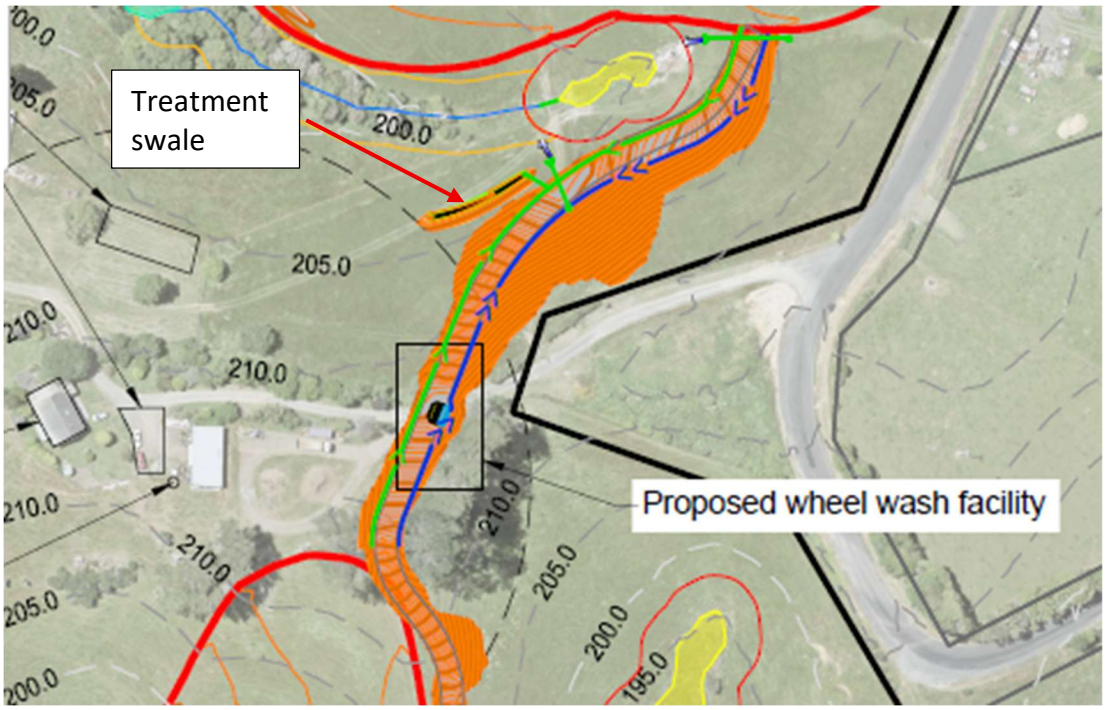


Figure 14: Haul Road Stormwater Swale and Wheel wash facility (from FTL drawing 33250/190)

B3. Wider Contaminants Issue

Issue: *The risk to the Water Supply Catchment from contaminants is wider than those considered in the application.*

Response: Of the contaminants listed by T&T in their water supply risk assessment for the Hays Creek catchment, the only one that applies to the proposed Fill is the "accident or spill of chemicals in the catchment". This only applies to PAC, the proposed chemical flocculant to assist with silt/sediment removal. A Chemical Treatment Management Plan will form part of the site's Fill Management Plan and will set out requirements for the safe storage of flocculant chemicals and procedures for dealing with any chemical spills. Adherence to the requirements set out in this Plan will ensure that the potential effects of any spills are managed and mitigated to avoid and minimise any associated potential environmental effects.

Other contaminants considered relevant to comment on include:

- Potential use of Organic Floc;
- Silt/Sediment, heavy metals and low level organics;
- PFAS

B3.1 Organic Floc

The reference to organic flocculants was made in the original application primarily based on experience from other consent applications for earthworks projects that some stakeholders (e.g. mana whenua) encourage the use of alternative flocculants. This is specifically referred

to in Section F2.1.7 of GD05. It is no longer proposed to consider organic floc, but instead to use PAC, which is a commonly used water treatment chemical.

B3.2 Silt/sediment, heavy metals and low level organics

The proposed Fill Waste Acceptable Criteria (WAC) come from the WasteMINZ Technical Guidelines for the Disposal to Land for Class 5 Clean Fills. As explained in section 3.3, overall, it is considered that the proposed Fill WAC will ensure there is low risk of any contaminants in received soils posing a risk to surface and groundwater quality, as summarised below:

- All but 5 of the proposed Fill WAC comply with Auckland Council Clean Fill WAC, as advised by them in March 2025, based on their adoption of the WasteMINZ Class 5 Clean Fill standards as being acceptable as Clean Fill WAC.
- The remaining five WAC (boron, chromium, copper, nickel and zinc) relate to background volcanic soils concentrations for the Auckland region, rather than non-volcanic background values, recognising that the Jones Rd Fill would potentially be receiving soils from both volcanic and non-volcanic areas across Auckland.
- These WAC are all within corresponding WAC for Class 3 Managed Fills. These WAC have been determined based on protecting groundwater drinking water (based on DWSNZ) and aquatic species (based on ANZECC 95% freshwater species protection).
- Hence, it is considered that the proposed Fill WAC will not adversely affect any ground or surface water downgradient of the site that is used as drinking water, nor any aquatic species in surface waters.

Further to this, rainfall on operational areas will have a relatively short contact time with the deposited fill material and will primarily pick up silt and sediment material, potentially including some contaminants in particulate form (e.g. heavy metals), subject to their leachability which is expected to be low. All runoff from operational areas will be collected and conveyed to sediment retention ponds (SRPs), where chemical flocculants will be added, based on bench testing, to promote the removal of suspended solids and other contaminants. The Universal Soil Loss Equation that is often used to estimate sediment losses from earthworks activities and is referred to in GD05 (section B1.4.1) advises applying a 95% sediment removal efficiency when chemical flocculation is used.

All sediment pond discharges will be to overland flow for passage through the proposed 10m width riparian planting, which will act as a further filtration barrier prior to the treated water entering any streams.

Furthermore, sediment pond discharges will be checked regularly for pH and clarity, with contingency measures implemented if the pH varies by more than ±1 pH unit or the clarity is less than 100mm. Hence, it is expected that almost all suspended solids, including associated contaminants, will be removed from the stormwater runoff prior to discharge off-site. The removed silt/sediment is deposited in the SRPs and will be periodically removed from them, thus eliminating the potential for this silt/sediment to be discharged to the receiving environment.

Further regular stormwater quality sampling is proposed as a check on this, as described in the updated FMP.

B3.3 PFAS (Poly- and perfluoroalkyl substances)

PFAS are widely used, long lasting chemicals, the components of which break down very slowly over time. The chemicals, which have been manufactured since the 1930s, are used in products such as non-stick pans, water-repellent fabrics, fast food wrappers, stain-resistant fabric coatings, cleaning products, cosmetics, paints and other household items including carpets and furniture. Because of their widespread use and their persistence in the environment, many PFAS are found in the blood of people and animals all over the world and are present at low levels in a variety of food products and in the environment. PFAS are found in water, air, fish, and soil at locations across the country and world. Scientific studies have shown that exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals.

Despite not producing PFAS on a large scale, New Zealand still faces environmental risks from these chemicals due to their presence in imported products like electronics, textiles, and metal plating materials. Everyday items such as non-stick cookware, stain-resistant carpets, water-repellent clothing, and food packaging are contributors to PFAS pollution. During use and washing, these chemicals can leach into wastewater systems, eventually making their way into natural ecosystems. Additionally, PFAS-containing waste often ends up in landfills, while wastewater treatment plants struggle to remove these persistent substances. As a result, treated effluent and sludge may still harbour significant PFAS levels, potentially contaminating waterways or agricultural land when used as fertiliser (source: Chemistry Institute of New Zealand).

In New Zealand, PFAS contamination sources include firefighting foams, industrial discharge, landfills and wastewater treatment, and imported consumer products. PFAS have been detected in New Zealand soils, particularly at sites with historical use of firefighting foams like airports and military bases. Major contamination has been identified at places like Ohakea and Woodbourne airbases, where elevated levels of these chemicals are present in both soil and groundwater.

PFAS has also been found at low levels in Wastewater Treatment Plants in New Zealand (Lenka, Kah and Padhye (J.Hazardous.Materials Vol428, 15 April 2022, 128257 "*Occurrence and Fate of Poly- and Perfluroalkyl substances (PFAS) in Urban Waters in New Zealand*". Associate-Professor, Dr Melanie Kah, one of the authors of this study, has advised that her Team have wanted to analyse background levels in "normal" Auckland soils on several occasions, but it is difficult to find funding for this. All the data she is aware of have been generated with a particular PFAS source in mind (e.g airbases), and thus likely exceeds "normal" background levels (person communication, email to S Finnigan, 28/9/2025).

Watercare completed PFAS sampling across all its water treatment plants (WTPs) in Auckland in 2018, which found PFAS to be below detection levels in all WTPs except Onehunga.

Monthly monitoring results since March 2018 showed that treated water from the Onehunga WTP exceeded the maximum allowable value of 0.07ug/L for Sum (PFHxS + PFOS) on at least two occasions. On the 9th of June 2022 Taumata Arowai introduced a new maximum acceptable value (MAV) for PFAS in drinking water supplies in New Zealand which came into effect from 14th November 2022. As the existing treatment technology employed at the Onehunga WTP does not remove PFAS, Watercare decided to take the Onehunga WTP out of service as a precautionary measure in late 2022. Long term options/requirements include possibly providing additional treatment, with the most effective technologies currently identified being GAC adsorption, ion exchange, nanofiltration and reverse osmosis. (Watercare Memorandum: Implications of New PFAS Limit on Onehunga Water Supply, 29 September 2022).

Watercare also uses its Waikato Water Treatment Plant to supply water to Auckland, but the primary contamination concern in the Waikato River is arsenic, not PFAS.

T&T (2024) advise that the Papakura WTP (TP04070) provides treated drinking water from the Hays Creek dam to a population of approximately 48,500 people. The WTP was commissioned in August 2023. Prior to this, the source was offline after the old plant was decommissioned in 2005. Treatment includes coagulation, flocculation, sedimentation, membrane filtration, advanced oxidation, UV disinfection, 2nd stage filtration (BAC), and chlorination. Protozoal treatment is as per T3 Protozoal Rules for Membrane Filtration (up to 4-Log) and T3 Protozoal Rules for Second Stage Filtration (0.5-Log). An additional 3 Log treatment is available via T3 Protozoal Rules for Ultraviolet Light Disinfection8. Bacterial treatment is as per T3 Bacterial Rules for Water Disinfected with Chlorine.

It is important to note that the proposed Fill facility is not a Landfill and will only accept fill and soil materials that comply with its WAC. It will not accept any products that contain PFAS. Hence, the focus on minimising the potential for PFAS to be present in fill material brought to the site is to ensure strict compliance with the Fill WAC, as set out in section 3.4 of this report.

In this case, it is proposed to add further requirements relating to materials that will not be accepted at the Fill facility to reduce the potential for PFAs materials to inadvertently be deposited on-site, namely:

- No materials from airports, military/air force sites and fire stations.
- No materials from sites that has been subject to fires, particularly where firefighting foams may have been used.
- No materials from the locations of on-site wastewater treatment and disposal fields.

No testing of stormwater discharges from the Fill site for PFAS is proposed.

B4. Contaminant Migration Pathways

B4.1 Issue: Migration of Contaminants in Fill as Shallow Groundwater (Interflow) to Dam

All fill materials accepted at the site must comply with the Site's WAC, which are stricter than the WasteMINZ Class 3 Landfill (Managed Fill) WAC. As explained in section 3.3 and also under Item B3, the Class 3 WAC have been carefully chosen to avoid potential negative impacts on groundwater and drinking water supplies. Contaminant leachability from the Fill is expected to be low and not to result in significant contaminant concentrations in any interflow that is produced from the Fill. Furthermore, only the Northern Fill area is located within the Hays Creek Dam catchment, the amount of interflow produced is expected to be small compared with surface runoff, and the Dam itself is approximately 1.3km from the site. For these reasons, the potential migration of contaminants in fill as shallow groundwater to the Hays Creek Dam is considered to be negligible.

B4.2 Issue: Potential Contaminant Migration Pathway via Inactive Fault

In assessing the query with respect to the proximity of the Hunua Fault to the site location at 362 Jones Road, Drury, reference has been made to the Fraser Thomas Ltd, Geotechnical Investigation Report, dated October 2024 for the subject site, the GNS Science geological map; 12b, Geology of the Pukekohe area, scale 1:50,000, dated 2023, and Google Earth Pro software. As discussed in Section 3.0 of the October 2024 report, the geological map indicates, as shown in Figure 15 below, that the Hunua Fault is located approximately 200m to the east of the subject site. It is therefore noted that, with reference to the plan provided in the Watercare submission, the Hunua Fault location is incorrectly annotated on the plan.

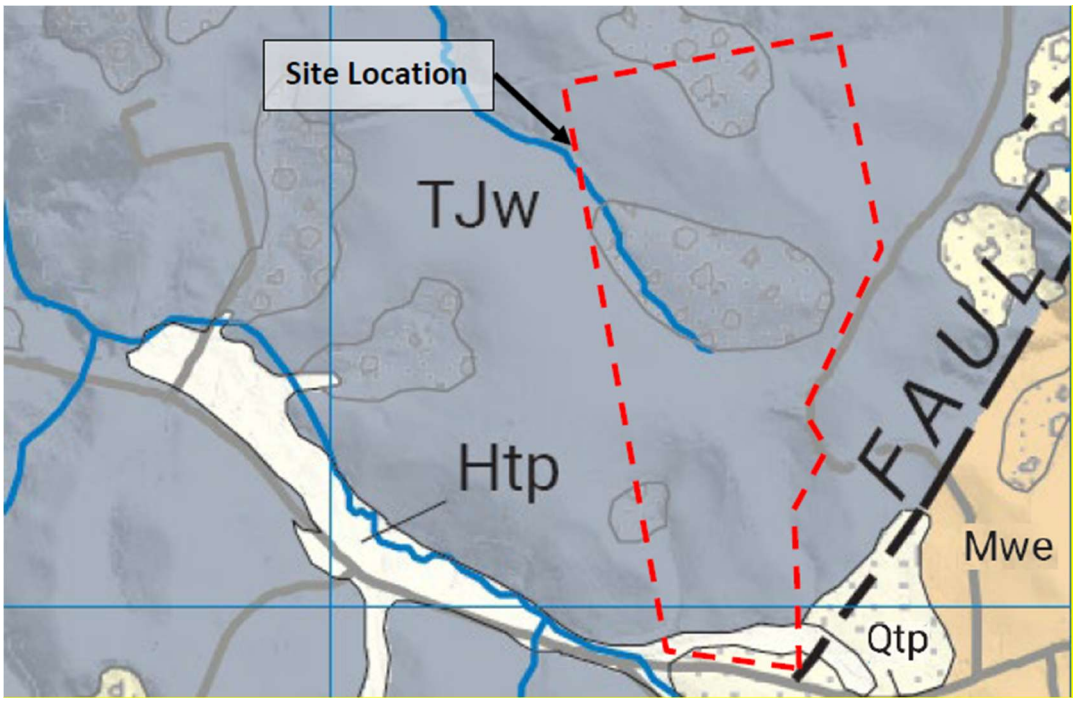


Figure 15: Excerpt from geology map showing site location with reference to Hunua Fault

It is reiterated that, as outlined in the FTL October 2024 geotechnical report, given the north-east trending Hunua Fault is mapped outside the development area, and is generally considered to be inactive (as shown in Figure 16), the Hunua Fault is unlikely to require additional consideration.

Figure 16: Excerpt from Google Earth Pro showing site location with reference to Hunua Fault location and description

It is further noted that the PDP (2025) report "Proposed Sutton Block Expansion Groundwater & Surface Water Effects Assessment" refers to the Hunua Fault having been inactive for at least the last 0.5 million years.

B5. Residual Flocculant Discharges

The FMP allows for following GD05 recommended practices to minimise potential negative human health and environmental effects. This includes ensuring that the pH should not be changed by more than ±1 and should not fall outside the range of 5.5-8.5.

Soluble aluminium would also be tested for to check for residual aluminium levels in discharges from the sediment retention ponds if PAC is used as a flocculant. A trigger level for aluminium would be set based on ANZECC guidelines for the protection of 80% of freshwater aquatic species. This is considered an appropriate threshold for checking impacts on downstream water quality. If the pH or soluble aluminium trigger levels are exceeded, appropriate contingency measures will be implemented as set out in the updated FMP, including stopping site discharges until contaminant concentrations reduce to within trigger levels. These practices should ensure that the effect of these chemicals used in chemical treatment of site stormwater discharges will be less than minor.

It is further noted that PAC is commonly used as a coagulant in water purification and hence is likely used at the Papakura Water Treatment Plant which treats water from the Hays Dam.

B6. Waste Acceptance and Monitoring

Watercare's primary concern here is that the risk that contaminated materials could be accepted by a managed fill activity located within a catchment that provides public water supply should be **avoided**, not mitigated or remedied.

The FMP sets out a range of practices that comply with current best practice in New Zealand comprising pre-acceptance checks and testing, random load checks and sampling and verification sampling to avoid in appropriate materials being deposited in the proposed Fill facility.

The proposed WAC comply with WasteMINZ Class 3 (Managed Fill) WAC, which are based on not causing potential human health and environmental effects on drinking water supplies and groundwater.

Further controls are proposed on not accepting fill materials from any of the following sites to minimise the potential for PFAS materials to inadvertently be deposited on-site, namely:

- No materials from airports, military/air force sites and fire stations.
- No materials from sites that has been subject to fires, particularly where fire fighting foams may have been used.
- No materials from the locations of on-site wastewater treatment and disposal fields.

In addition, in response to Watercare's submission, it is now proposed to regularly test SRP discharges and off-site stormwater discharges for elevated contaminant levels, to further avoid contaminant migration off-site towards the dam.

Collectively, these measures represent a robust system for avoiding contaminants being brought to the site, with this being checked by stormwater monitoring, along with appropriate mitigation and remedial measures to be implemented if any issues are found.

As stated in T&T (2024), 72% of the 670ha Hays Creek catchment area is privately owned, with 51% of the catchment classified as exotic grassland, 25% as exotic forest and 9% as native forest. Farming, horticulture and plantation forestry form part of the land use in this catchment, while all residential properties are expected to have their own on-site wastewater treatment and disposal systems. The Northern Fill makes up 1.3% of the Hays Creek catchment area and is considered likely to have less of an effect on the Dam water than other permitted activities in this catchment (e.g. regular clearing of plantation forestry, on-site wastewater disposal fields).

B7. Changes in Catchment Hydrology

Watercare have raised concerns about changes in catchment hydrology, including the physical alteration of landforms caused by the managed fill operation that may disrupt natural surface and subsurface flows. They are concerned that this could reduce the volume of water reaching the dam, particularly during dry periods, and affect the reliability of the water supply.

Additionally, they raised concerns that compaction of soils and creation of impervious surfaces may change groundwater recharge, affecting the hydrological balance of the catchment; the effects on other users in the High Use Streams Management Area Overlay, within which the Managed Fill is located and note that there is a risk of contamination of aquifers that contribute to the dam.

The attached FTL drawing 33250/305 compares the pre and post cleanfill natural catchment areas (both on-site and upgradient off-site). For the two northern catchments, pre and post development areas are within 1-2% of each other, which is not expected to result in any changes to catchment hydrology or groundwater recharge within the site itself.

This also means there will be negligible effects on other users in the High Use Streams Management Area Overlay. Surface water takes within 1km of the site are summarised in section 2.6.3 of this report. There were only two surface water takes, with both being located in different surface water catchments further east of the fill site (111 Garvie Rd, 1933 Hunua Rd).

Furthermore, surface runoff exiting the site to the north flows through two private properties (1500 Hays Creek Rd and 210 Jones Rd before entering the Hays Creek dam area. A Council database search within 2km of the site found no records of any surface water takes on these properties.

The catchment changes shown on FTL drawing 33250/305 are internal to the site and there is no change to the Dam catchment, as the north-western and north-eastern streams combine within 560m of the site's northern boundary, well before the dam itself (1.3km away).

Review of the geotechnical logs included in the FTL geotechnical report submitted with the consent application shows that the topsoil depth across the site varies from 0.10-0.35m with an average of 190mm. The Applicant is proposing to respread a minimum of 200mm of topsoil on completed fill areas, slightly more than existing.

The geotechnical report refers to the Waipapa Group residual soils that underly the proposed Fill areas as comprising silty clays, clays and clayey silts with variable sand and gravel content. In-situ undrained shear strength values measured in the residual soils ranged between approximately 55kPa and greater than 200kPa, corresponding to a stiff to hard consistency. In general, the measured shear strengths were greater than 100 kPa, corresponding to a very stiff consistency.

The proposed Fill involves stripping the existing topsoil and placing additional fill material on top of this and then replacing stripped topsoil to return the site to agricultural land use. The proposed fill specification has adopted a lower compaction standard than for residential subdivision, namely an average undrained shear strength of not less than 80 kPa and any one-test site value of not less than 50 kPa, and average air voids of not more than 12% and no one value over 14%.

FTL geotechnical engineering advice is that the underlying natural soils are already sufficiently "hard", that they are unlikely to undergo any significant consolidation settlement, due to the surcharge load from the overlying additional fill materials.

Collectively, this means that soil compaction is not expected to be significant, nor to change existing groundwater flow patterns and recharge.

Furthermore, the only new "impervious" surfaces being created are the access haul roads. These comprise the main access road of 3,271m^2 length and temporary access roads of 1,263-8,270m^2. These will be constructed from hardfill and will make up a total of 4,534-11,541m^2 (1.8-4.6%) of the site. These areas will be similar to farm gravel access tracks. They will result in a small increase in surface runoff from these areas compared with the existing situation, but again, this is not expected to affect surface flows or groundwater recharge. Appropriate measures can be incorporated into the Fill design to mitigate these effects, by for example, incorporating subsoil drains and check dams into the haul road swale, that will allow for some of the captured road runoff to infiltrate into the underlying soils and/or be temporarily stored in the swale, promoting infiltration into the ground.

In this situation, it is expected that groundwater recharge will remain similar to the existing situation – i.e. rainfall that soaks into the site soils, will be stored within the soil matrix up to the available water capacity, with excess rainfall then flowing laterally to the nearby local streams, contributing baseflow. Typically, the lateral flow occurs as "interflow" between a more permeable upper layer and less permeable lower layer (e.g. topsoil and subsoils). This mechanism is expected to continue in a similar manner to the existing situation, as the proposed topsoil depth is similar to existing, and the subsoils will be more compacted than the topsoil.

During filling in any sub-stage, a maximum of 2ha will be in operation at any one time. Surface runoff from these areas will go to sediment retention ponds, while infiltrating water is expected to behave in a similar manner to the existing situation and percolate through the fill material and discharge to the local streams either directly or via some being captured by the groundwater subsoil drainage system.

It is important to note that the purpose of the proposed subsoil drains under the fill is to reduce pore water pressures in soils under the fill to assist with managing fill stability rather than to capture all groundwater. Any groundwater collected by these drains will be conveyed to the SRPs and then discharged to nearby streams.

The proposed northern fill extent is 9ha while the Hays Creek dam catchment (based on areas draining to the dam only) is approximately 670ha (from T&T (2024) and independently checked in Geomaps). Potential recharge effects relate to ~1.3% of the catchment area and are therefore limited.

Hence, overall, it is expected that the potential impact of the proposal in terms of groundwater recharge will not have adverse effects on receiving freshwater ecological features. Furthermore, techniques are available to retain and promote groundwater recharge if necessary (e.g. subsoil ripping).

B8. Risk of Aquifer Contamination

Watercare's final statement in this section of their submission indicates there is a risk of contamination of aquifers that contribute to the dam.

As explained in Section B3.2, the proposed Fill WAC will ensure there is low risk of any contaminants in received soils posing a risk to surface and groundwater quality, based on the adopted criteria complying with the Auckland Council Clean Fill WAC, except for five parameters (boron, chromium, copper, nickel and zinc) where the adopted WAC relate to background volcanic soils concentrations for the Auckland region. These five WAC are all within corresponding WAC for Class 3 Managed Fills, which have been determined based on protecting groundwater drinking water (based on DWSNZ) and aquatic species (based on ANZECC 95% freshwater species protection). Hence, it is considered that the proposed Fill WAC will not adversely affect any ground or surface water downgradient of the site that is used as drinking water, nor any aquatic species in surface waters.

This demonstrates that the principal control of potential contamination of groundwater relates to the WAC for the managed fill. Soils to be placed with the fill are inert and at regional background levels for trace metals and synthetic compounds, as explained in the preceding paragraph.

There are two main groundwater aquifer systems in the area – shallow and deep.

The shallow aquifer generally represents perched groundwater and discharges to local streams. The risk of contamination of the shallow aquifer has already been discussed in section B4 of this response and is considered to be low, while stream quality monitoring is proposed to check this, with contingency measures put in place to address any issue that may arise.

Limited information on groundwater bores in the area indicates that the groundwater in the deeper aquifer is at about RL160m (equivalent to depths of 30m to 60m) from PDP (2025). At the site, additional protection of deeper groundwater is provided by:

- Sorption within the clay and silt rich residual soils present on-site.
- Attenuation within 30m to 60m thickness of variably saturated ground above the regional groundwater table.
- Low permeability conditions associated with greywacke bedrock.

On the basis of the above, the risk of groundwater contamination of the deep aquifer, which likely discharges to the dam based on the regional groundwater catchment divide, is considered unlikely.

B9. Dust

Watercare are also concerned that dust generated during fill operations can carry fine particulate matter and contaminants, which may be deposited on water surfaces, whilst

noting that Hays Creek dam is some distance from the site. This dust risk is considered below in relation to the dam surface and the wider catchment.

1. Dust risk direct to dam surface

The potential for dust migration to reach the dam is considered to be highly unlikely based on the FMP requirements around dust management and for the following additional reasons:

- The most significant prevailing wind directions in the Auckland region are from the north-east and south-west (NIWA, The Climate and Weather of Auckland, 2nd edition), both of which would direct any airborne dust from the subject site away from the Hays Creek Dam.
- The Hays Creek dam is approximately 1.3km from the site in a north-westerly direction from the site's northern boundary with intervening and variable topography and vegetation.

2. Dust risk to catchment

Dust controls have been proposed, with respective conditions offered, as follows:

- Minimising the extent of the exposed area at any one time.
- Limiting traffic to established haul roads and minimising travel distances by optimising site layout.
- Controlling vehicle speeds.
- Maintaining road surfaces.
- Minimising tracking of dirt on vehicle wheels onto paved surfaces.
- Minimising drop heights when loading and unloading vehicles.,
- Limiting stockpile heights.
- Providing shelter from the wind for stockpiles, where practical.
- Consolidating and sealing off loose surface material.
- Progressive mulching and grass establishment, as works are completed in different areas.
- Use of a water cart to dampen exposed areas.

These dust control measures are typical for managed fill facilities and are robust and consistent with best practice guidance (provided in the Ministry for the Environment Good Practice Guide for Assessing and Managing Dust 2016).

Collectively, this comprehensive dust management toolbox included in the FMP should ensure that dust emissions from the site are avoided as much as possible, and then mitigated if any do occur.

If dust from the Fill facility was to settle on the ground, this would be in the immediate vicinity and any associated contaminants would likely be picked up by the proposed stormwater discharge monitoring. If the dust was to settle outside the site, then the potential for it to reach the Hays Creek dam is considered unlikely. The associated dust would likely be similar or less than that generated from a ploughed paddock and or cleared forest block.

B10. Post Closure of the Managed Fill Activity

Watercare also raised concerns relating to potential post closure effects from the managed fill activity:

1. Residual contaminants
2. Erosion and stability risk - sediment
3. Long term monitoring and potential remediation

As each Fill section is completed, it will be covered with 200mm of topsoil, using topsoil harvested from the site pre-filling. Geotech logs indicate there should approximately be enough topsoil on-site to achieve this depth. Only topsoil that complies with the WasteMINZ Class 5 cleanfill material would be imported to make up any deficit (estimated as maximum 5% of required volume based on existing average topsoil depth of 190mm). Hence, the topsoil composition on the site post-filling is expected to essentially be the same as the existing situation.

The Fill profile has been designed to have a maximum gradient of 1V:3H which is less steep than a lot of the other pastoral land within the Hays Creek dam catchment. Hence, the Fill site post-filling is considered to pose a relatively low risk of scour/erosion.

The riparian planting along the streams running through the site will further protect stream water quality from the effects of any silt/sediment discharges that may occur from the site.

The Applicant is willing to offer the following condition applicable to post-filling to address Watercare's concerns:

- Continue surface water monitoring post-closure until three consecutive rounds spanning summer and winter conditions all comply with adopted trigger levels.

6.15 NEIGHBOURHOOD EFFECTS

The main neighbourhood effects associated with earthworks are noise, truck movements and air quality (dust).

6.15.1 Noise

Noise will be produced by trucks, bulldozer, compactor and excavator movements during normal working hours over the duration of filling activity. Construction noise shall meet the limits in and be measured and assessed in accordance with the requirements of NZS 6803P:1999 "The Measurement and Assessment of Noise from Construction, Maintenance and Demolition Work", as required.

Work shall not continue on the site if compliance with the above standard is not achieved. Mitigation measures to reduce noise levels will be implemented, if required (refer FMP).

Noise effects are addressed in a separate specialist noise report and are not commented on further here.

6.15.2 Truck Movements

Truck movements will not exceed 96 vehicles per day each way (192 vehicle movements in total). The average number of trucks is considered to likely be around 60 per day. These movements are not expected to impact on normal vehicle movements along Hunua Road, as assessed in the separate traffic assessment.

6.15.3 Air Quality (Dust)

Dust effects have already been addressed in section 6.14, section B9. This section provides an assessment of the proposed Managed Fill against the permitted activity rule and standards in E14 (Air Quality) of the AUP(OP).

The WasteMINZ Technical Guidelines for Disposal to Land (Revision 3.1, September 2023) advise that for Class 3-5 Fills, the only airborne contaminant risk is dust.

AUP(OP) E14 (Air Quality) refers to specific activities relating to landfills (A158-160) but none for clean fills or managed fills.

Review of E14 indicates that the proposed Fill activity may trigger:
A1: Activities meeting the permitted activity standards and not provided for by any other rule (permitted activity); and
A83: Earthworks and the construction, maintenance and repair of public roads and railways not meeting the general permitted activity
standards.

The permitted activity standards comprise:

(1) The discharge must not cause, or be likely to cause, adverse effects on human health, property or ecosystems beyond the boundary of the premises where the activity takes place.
(2) The discharge must not cause noxious, dangerous, offensive or objectionable odour, dust, particulate, smoke or ash beyond the boundary of the premises where the activity takes place.
(3) There must be no dangerous, offensive or objectionable visible emissions.
(4) There must be no spray drift or overspray beyond the boundary of the premises where the activity takes place.

Assessing against these standards:

(1) The airborne contaminant risk to consider here is dust. Dust will be controlled as set out in the Fill Management Plan, adopting appropriate measures from an extensive toolbox (refer section 5.2.7). Collectively these measures will ensure the dust from the Fill operation is adequately controlled and suppressed so as to be unlikely to cause adverse

effects on human health, property or ecosystems beyond the Fill site boundary, thus satisfying this criteria.

(2) As for item (1), the airborne contaminant risk to consider here is dust. Again, effective implementation of the FMP and the dust control measures provided for in a toolbox format, will ensure that dust from the site will not be noxious, dangerous, offensive or objectionable beyond the site boundary. The other items listed (odour, particulate, smoke or ash) do not apply to the proposed Fill activity.

(3) This is not relevant as there will be no dangerous offensive or objectionable visible emissions.

(4) This is not relevant as no spraying is proposed as part of the Fill operation.

6.16 ECOSYSTEMS

As outlined in Boffa Miskell's specialist ecological report, there are no significant ecosystems within the proposed Fill footprint. Adequate measures are being taken to minimise the potential for silt/sediment to enter the downstream receiving environment, while the proposed maintenance regime will check that these measures are in place and functioning properly. 10m setbacks are maintained to all streams and wetlands.

Hence, it is considered that the potential negative effects of filling activity on any ecosystems in the receiving environment will be avoided or mitigated by these means provided the proposed erosion and sediment control measures are correctly constructed and maintained.

6.17 CONTAMINATION

A Preliminary Site Investigation for contamination has been undertaken of the subject site focusing on the proposed filling areas (refer separate report). The contamination investigation involved a desktop study, site walkover and reporting associated with potential land contamination issues.

The following potential or actual HAIL activities on the subject site were identified, but all of these are located outside of the proposed works area and hence do not trigger the NESCS. For completeness, these activities are:

- Wastewater treatment system has been carried out at the site at a domestic scale and the system is still in use (*HAIL Category G6: Waste recycling or waste or wastewater treatment).*
- Possible soil contamination from historical asbestos and lead based paint usage (*HAIL Category: I Any other land that has been subject to the intentional or accidental release of a hazardous substance in sufficient quantity that it could be a risk to human health or the environment).*
- Potential uncertified filling of the northern culvert and southern section of site *(HAIL Category: I).*

Potential HAIL activities that are located within the proposed works area and hence do trigger the NESCS are:

- Potentially uncertified filling observed around the southern culvert (*HAIL Category: I).*

However, based on the information gathered in the PSI, it was concluded that the likelihood of the fill being offsite sourced was low. Furthermore, the area is small and localised; therefore, if the fill material is potentially contaminated, it is highly unlikely that there would be sufficient quantity to pose a risk to human or environmental health.

Therefore, it was considered that HAIL activity I does not apply and the contaminated land provisions of the NESCS do not apply to this site. Similarly, the contaminated land provisions of the AUP: OP do not apply to this subject site, as HAIL activities have been confirmed to not be present on site.

In summary, based on the information presented in the PSI report, it is unlikely that HAIL activities have occurred at the site where proposed works are to take place, and therefore it is highly unlikely that there may be a risk to human health if the areas of the site where HAIL activities have taken place are developed as part of the Managed Fill soil disturbance works.

6.18 MITIGATION AND CONTINGENCY MEASURES

Multiple measures have been included in the design of sediment control measures during the filling and restoration period to prevent excess sediment loads entering the existing stormwater system of open watercourses. These measures include:

- Undertaking the majority of the filling activity during drier weather conditions over summer months.
- Installation of appropriately sized sediment ponds, with chemical flocculation of dirty runoff.
- Stabilising exposed surfaces as soon as practicable upon completion of filling with mulch, hydroseed or grass to reduce erosion.
- Regular stormwater discharge quality monitoring.

Other possible mitigation measures that may be employed as required include:

- Placement of geotextile fabrics securely over any soil stockpiles to minimize soil loss from these stockpiles.
- Installing clean runoff diversion bunds/drains to minimise the loading on the sediment ponds.
- Installing additional silt/sediment controls closer to source to reduce sediment loads to the sediment ponds, including drop out pits, check dams, filter socks or similar along the perimeter drain system.

Provided these mitigation measures are in place and correctly maintained the risk of sediment runoff impacting on the local environment is less than minor.

7.0 PC120 NATURAL HAZARDS ASSESSMENT

Under PC120, the following additional assessments are required as part of this application to address the identified natural hazards that apply to this site, namely:

- Flood hazard risk assessment
- Landslide hazard risk assessment

7.1 FLOOD HAZARD RISK ASSESSMENT

7.1.1 Flood Hazard Area Classification

Flood hazard areas include floodplains, flood prone areas and overland flowpaths (OLFPs). They are categorised based on the depth and velocity of floodwaters into four classifications under the new PC120 E36 requirements.

Table 15: PC120 E36 Flood Hazard Classification Criteria

Hazard Classification	OLFPs & Floodplains		Flood prone areas
	Floodwater Depth	Depth x Velocity Product	Floodwater depth
Very High	≥1200mm	≥0.8m^2/s	≥1200mm
High	500-1200mm	0.4-0.8m^2/s	500-1200mm
Medium	300-500mm	0.24-0.4m^2/s	300-500mm
Low	≤300mm	≤0.24m^2/s	≤300mm

Notes:

1. OLFP & floodplain classification applies to the 1% AEP event; flood prone area classification applies to 50mm rainfall, assuming the primary stormwater system 100% blocked.
2. Hazard classification based on flood depth or depth x velocity (not both).

7.1.2 Activity Sensitivity to Natural Hazards

Under PC120, activity sensitivity to natural hazards is classified as less sensitive, potentially sensitive, or sensitive, with sensitive activities being sub-divided into two categories. Table 16 provides the definition and activities included in each category. In our opinion, the Managed Fill operation best fits within the "less sensitive" category, based on the stated definitions and by comparison with the activities included in different categories.

Table 16: PC120 E36 Activity Sensitivity Classifications

Sensitivity Classification	Definition	Activities included	Applicability
Less Sensitive	Activities where there is a minimal presence of people and buildings and which will not create public health or pollution issues in a natural hazard event.	Marine and port activities/facilities, accessory structures and services, marine industry, retail and passenger operations Informal recreation Organised sport and recreation Parks infrastructure Public amenities Parking and loading areas Forestry	Considered best fit for managed fill activity, based on definition and "forestry" and "mineral extraction" being included here and these activities being similar in nature.

		Mineral extraction Buildings for network utilities Rural activities*	
Potentially sensitive	Activities where people are regularly present and buildings are routinely required to carry out the activity, but people are not usually in a vulnerable state; and which are unlikely to create significant public health or pollution issues in a natural hazard event.	Offices, retail and commercial services Entertainment facilities Emergency services Community facilities* Education, correction and healthcare facilities without overnight accommodation Temporary activities Industrial activities* Intensive farming Equestrian centres Rural industries Post-harvest facilities	Not applicable, as buildings not required to carry out activity – site will have 4 staff (Site Supervisor, machinery/plant operators and general labour) and small site office.
Sensitive – A	Activities where people are regularly present and often in a vulnerable state because they sleep there, require medical treatment, or require extra assistance to evacuate.	Education and healthcare facilities with overnight accommodation Care centres, hospitals, supported residential care and retirement villages Correction facilities Residential dwellings and associated activities (including conversion of one dwelling into two or more dwellings and excluding working from home that do not involve additional people on-site) Marae Visitor accommodation including boarding houses Camping grounds	Not applicable
Sensitive - B	Activities which, if damaged, may create a significant public health or pollution issue during and/or after a natural hazard event.	Cemeteries and urupā Crematoriums Landfills Hazardous facilities and major hazardous facilities Service stations Industrial laboratories Manufacturing Waste management facilities	Not applicable – managed fill differs from landfill based on nature of deposited material – unlikely to create a significant public health or pollution issue if damaged during or after flood event. This is supported by

			information provided in section 3.3 of this report.

Note: *except those that are listed as 'Activities Potentially Sensitive to Natural Hazards'

7.1.3 Applicability to Subject Site

Geomaps shows that the majority of the site is not subject to any flood hazards, with identified flood hazard areas being confined to within close proximity of the watercourses running through the site. The associated hazards range from "low" to "very high", as shown in Figure 17. Most of the very high flood hazard area is associated with a deep flood prone area in the north-western corner of the site, caused by a farm crossing on the adjacent property that dams this watercourse. There is a second "high" hazard area associated with the southern watercourse, primarily associated with the existing culverted farm crossing.

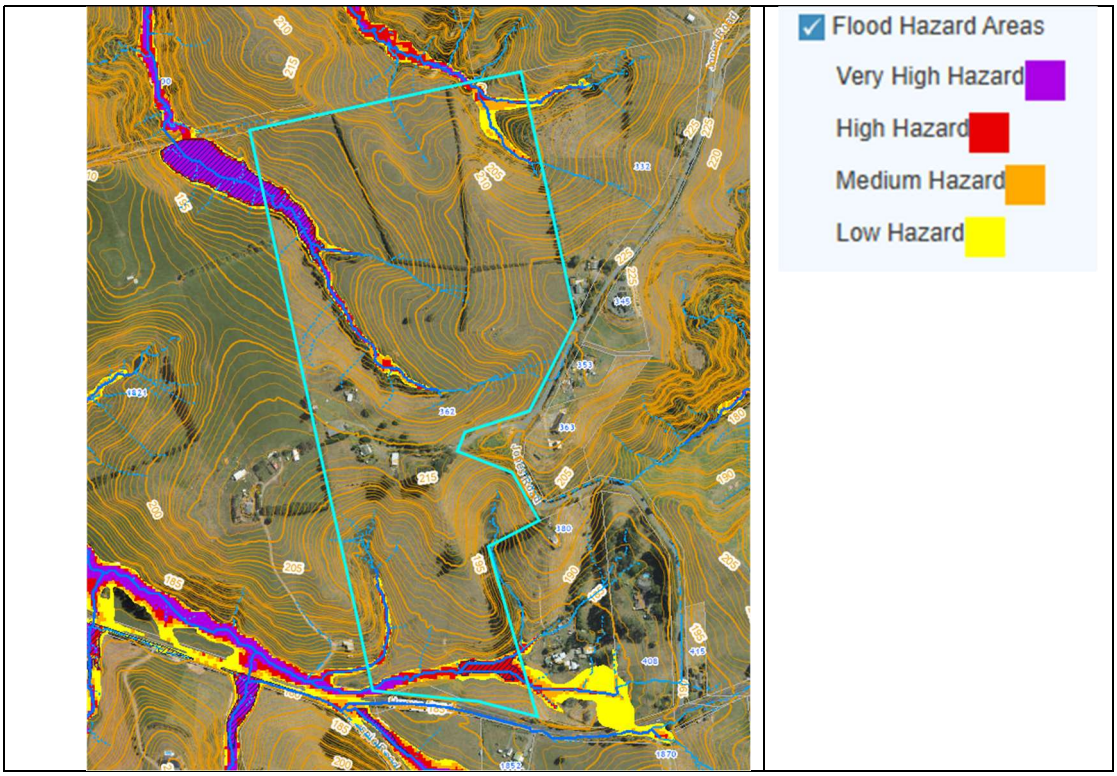


Figure 17: Flood Hazard Areas Applicable to Site

7.1.4 Southern Watercourse

The only proposed activities that are located within the southern flood hazard area are:

- Removal of the existing 600 diameter culvert and associated farm crossing embankment over the stream at the southern end of the site.
- Installation of a new bridge over the same stream.

The flood hazard in these areas is classified as low to high in this area from Geomaps, as shown in Figure 18. All other activities are located outside of identified flood hazard areas.

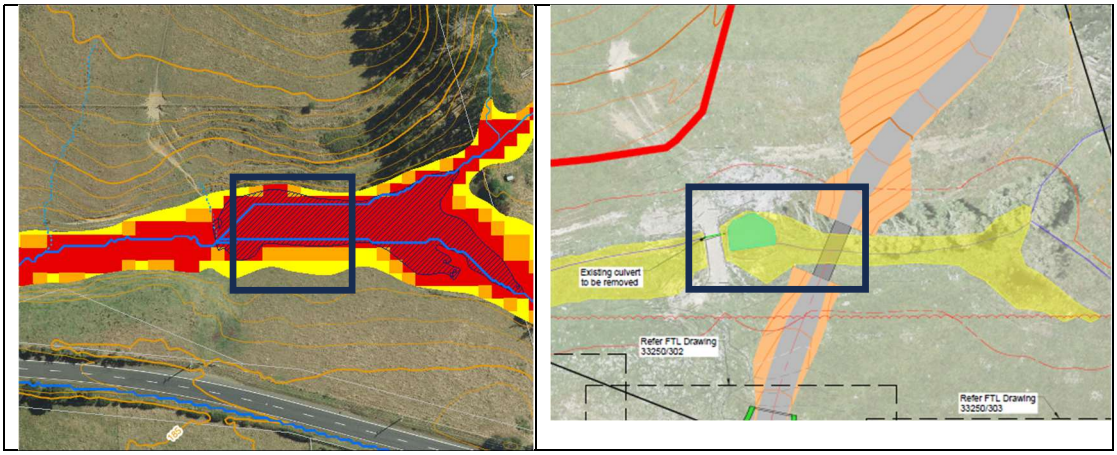


Figure 18: Box indicates location of culvert removal works and proposed bridge installation

FTL has undertaken hydrological/hydraulic analyses of the existing and post-bridge installation situations.

For the existing culvert and embankment crossing, Geomaps indicates that the flood prone area has a spill depth of 540mm which will be filled by 26mm of rain, ignoring the capacity of the culvert through the crossing.

Topo survey data indicates the depth from the culvert invert level to crossing crest is 910mm which is considerably greater than the Geomaps spill depth.

The flood hazard for flood prone areas needs to be determined for a 50mm storm. Assuming the flood prone area ponds up to the crossing crest level (10m width) and that the unattenauted 50mm storm peak flow (0.3m^3/s) flows across it, flow analysis gives a flow depth of 65mm across the accessway. This gives a maximum depth of water in the flood prone area of 975mm, which equates to a high hazard, consistent with Geomaps.

Flow analysis for the 1% AEP event with 3.8°C climate change and allowing for flow through the culvert shows that the depth of flow over the road crossing would be 0.40m with a velocity of 1m/s, giving a velocity x depth product of 0.40m^2/s, equivalent to a **high hazard**. This equates to a flow depth immediately upstream of the culvert of 1.31m, equivalent to a **very high hazard**.

In the future, with the culvert crossing replaced by the new bridge, analysis shows that the velocity and depth in the stream will be 0.33m and 1.70m/s respectively, giving a velocity x depth product of 0.56m^2/s, which equates to a **high hazard**. All flows are entirely contained within the stream channel with freeboard to the bottom of the bridge deck of ~850mm.

7.1.5 New Haul Road Crossing

There is a minor OLFP (upper portion of OLFP3) which the proposed access road to the northern fill area will cross. It is proposed to pipe these overland flows under the access road over a distance of ~23m, using a scruffy dome manhole inlet anda 525dia pipe. This system has been sized to take the 1% AEP peak flow with 3.8°C climate change. Flow analysis of this OLFP at the location where it intersects the access road has found that the flow depth and velocity are 0.09m and 1.31m/s respectively, giving a velocity x depth product of 0.12m^2/s. The flow depth and depth x velocity product correspond to a **low hazard**.

Post-haul road construction, the flood hzard will be unchanged above and below the road crossing, while the haul road itself will not be subject to any flood hazard.

7.1.6 Flood Hazard Classification

From Table E36.3.1B.2 for development outside of existing urbanised areas, the overall flood hazard classification for the above activities is summarised below.

Table 17: PC120 E36 Site Specific Activity Flood Hazard Classifications

Item	Activity Sensitivity	Flood Hazard Risk	Flood Hazard Classification
Culvert crossing removal and new bridge	Less sensitive	High	Acceptable
Partial piping of OLFP3 on new access road by northern fill	Less sensitive	Low	Acceptable

7.1.7 Flood Hazard Activity Assessment

Table 18 provides an assessment of which activities listed in Table E36.4.1A are applicable and the associated consent status.

Table 18: Table E36.4.1A. Activity Assessment

Activity	Activity Status				
		Very high flood hazard areas, high flood hazard areas, coastal erosion hazard area 1 and coastal inundation hazard area 1	**Medium flood hazard areas, coastal erosion hazard area 2 and coastal inundation hazard area 2**	**Low flood hazard areas, coastal erosion hazard area 3 and coastal inundation hazard area 3**	**Assessment / Comment**
Activities on land in flood hazard areas					
Use – flood hazard areas					
(A78)	Activities where natural hazard risk is significant in accordance with Table E36.3.1B.1 and E36.3.1B.2 in flood hazard areas	NC	NC	NC	Not applicable
(A79)	Activities where natural hazard risk is potentially tolerable in accordance with Table E36.3.1B.1 in flood hazard areas	N/A	D	RD	
(A80)	Activities where natural hazard risk is acceptable in accordance with Table E36.3.1B.1 and E36.3.1B.2 in flood hazard areas	P	P	P	Applicable – permitted activity
(A81)	Surface parking and above ground parking areas (including vehicle entry and exit points) in flood hazard areas	D	RD	P	Outside of FHA
(A82)	Below ground parking (including vehicle entry and exit points) in flood hazard areas	D	RD	RD	N/A to activity
(A83)	Storage of goods and materials in flood hazard areas	P	P	P	N/A to activity
(A84)	Storage of hazardous substances in flood hazard areas	RD	RD	RD	N/A to activity
(A85)	Conversion of non habitable rooms into habitable rooms within the ground or basement floor of a building in flood hazard areas	RD	D	RD	N/A to activity
Development (excluding infrastructure covered by A103-A107) – flood hazard areas					
(A87)	Fences, earth bunds, and walls in flood hazard areas	P	P	P	Outside of FHA
(A88)	Construction of private roads, roads intended to be vested, and accessways in flood hazard areas	RD	RD	P	**Assumed to apply to proposed access road**

					– RD for bridge; P for OLFP3
Development (excluding infrastructure covered by A103-A107) – 1% AEP floodplain and flood prone areas					
(A89)	On-site septic tanks, onsite wastewater treatment and Disposal systems and effluent disposal fields in the 1% AEP floodplain and flood prone areas	RD	RD	RD	N/A to activity
(A90)	Operation, maintenance, renewal, repair and minor infrastructure upgrading of land drainage works, stormwater management devices and flood mitigation works in the 1% AEP floodplain and flood prone areas	P	P	P	N/A to activity
(A91)	Construction of stormwater management devices or flood mitigation works that are to be vested in the Council or which are identified in a precinct plan incorporated into the Plan or an approved network discharge consent in the 1% AEP floodplain and flood prone areas	P	P	P	N/A to activity
(A92)	Construction of other land drainage works, stormwater management devices or flood mitigation works in the 1% AEP floodplain and flood prone areas	RD	RD	RD	N/A to activity
(A93)	External alterations to existing buildings (as existing at 03/11/25) which do not increase the gross floor area of the building in the 1% AEP floodplain and flood prone areas	P	P	P	N/A to activity
(A94)	External additions and alterations to existing buildings (as existing at 03/11/25) that increase the gross floor area by no more than $10m^2$ in the 1% AEP floodplain and flood prone areas	RD	RD	P	N/A to activity
(A95)	External additions and alterations to existing buildings (as existing at 03/11/25) that increase the gross floor area by more than $10m^2$ in the 1% AEP floodplain and flood prone areas	RD	RD	RD	N/A to activity
(A96)	New structures and buildings with a gross floor area up to $10m^2$ in the 1 per cent annual exceedance probability (AEP) floodplain and flood prone areas	RD	RD	P	N/A – new bridge over stream is $45m^2$ in area
(A97)	All other external additions and alterations to structures and buildings in the 1% AEP floodplain and flood prone areas	RD	RD	RD	N/A to activity
(A98)	All other structures and buildings (including retaining walls) in the 1% AEP floodplain and flood prone areas	RD	RD	RD	**Applies to new bridge over stream ($45m^2$ in area) - RD**

Development (excluding infrastructure covered by A103-A107) – overland flow paths					
(A99)	Flood mitigation works within an overland flow path required to reduce the risk to existing buildings from flooding hazards	P	P	P	N/A to activity
(A100)	Any buildings or other structures located within an overland flow path with a catchment less than 4,000m^2	P	P	P	N/A to activity
(A101)	Any buildings or other structures located within an overland flow path with a catchment greater than 4,000m^2	RD	RD	RD	N/A to activity
(A102)	Diverting the entry or exit point, piping or reducing the capacity of any part of an overland flow path	RD	RD	RD	**Applies to piping section of OLFP related to northern fill access road as it crossed upper area of OLFP3 - RD**

7.1.8 Compliance Assessment

This section provides an assessment of the identified relevant activities against the PC120 E36.6 standards and policies.

E36.6.A1 General standards - All activities (except activities (A108), (A114) and (A115)) listed as a permitted activity, controlled activity or restricted discretionary activity in Table E36.4.1B, must comply with the following standards by being undertaken in accordance with:

Table 19: General Standards Compliance Assessment

Criteria	Assessment / Comments
(a) geotechnical reports, prepared by a suitably qualified and experienced person in accordance with Auckland Council Code of Practice for Land Development and Subdivision, Section 2 (Earthworks and Geotechnical Requirements) and approved or certified by Council when associated with a building consent or resource consent;	Complies - Geotechnical report prepared by FTL and submitted as part of resource consent application – subject to Council approval / certification
(b) hazard risk assessment reports prepared by a suitably qualified and experienced person in accordance with E36.9 and Appendix 24 Landslide hazard risk assessment methodology and approved or certified by Council when associated with a resource consent or compliant proposal to subdivide, use or develop land within a landslide hazard risk area; and	Complies – Hazard risk assessment reports prepared as part of resource consent application, addressing landslide hazards

(c) any conditions of a building consent, resource consent or consent notice registered on the land title(s) associated with the site(s) and relating to landslide risk and geotechnical assessment matters.	Complies – Managed fill will comply with all building and resource consent requirements, including any consent notices.

(1A) for all restricted discretionary activities: effects on Māori Land, Treaty Settlement Land, marae, urupā, mana whenua cultural heritage and values

The site is not Māori land or Treaty Settlement land, nor does it feature a marae or urupā. The proposed farm crossing/culvert removal and bridge replacement will benefit the underlying wetland, which supports mana whenua values.

Removal of existing farm crossing and culvert and replacement with bridge:

- E36.8.2(4): For activities in flood hazard areas, refer to policies E36.3(3), E36.3(4A), E36.3(4B), E36.3(21).
- E36.8.2 (12A) for any buildings or structures including retaining walls (but excluding permitted fences and walls) located within an overland flow path with a catchment greater than 4,000m^2 : Refer to Policies E36.3(3), E36.3(4A), E36.3(4B), E36.3(21) and E36.3(29).

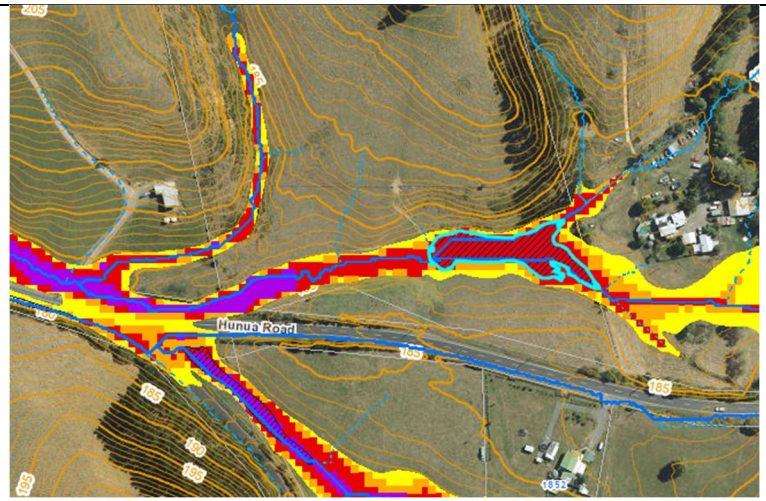
Accessways: E36.8.2 (4A) for the construction of private roads, roads intended to be vested and accessways in very high, high and medium flood hazard areas: refer to Policies E36.3(3), E36.3(4A), E36.3(4B) E36.3(21) and E36.3(26)

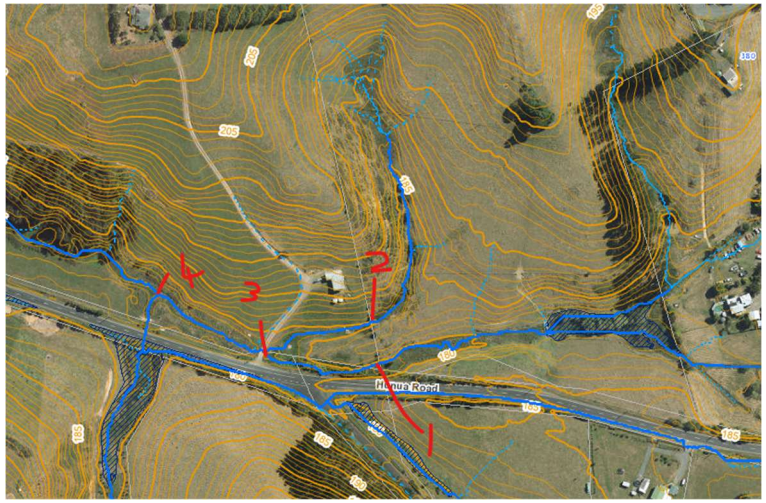
OLFP3 Partial Piping: E36.8.2 (12) for diverting the entry or exit point, piping or reducing the capacity in any part of an overland flow path: the potential impacts on the overland flow path; Refer to Policies E36.3(3), E36.3(4A), E36.3(4B), E36.3(21) and E36.3(29).

Table 20: E36.3 (3) Compliance Assessment

36.3 (3) Risk assessment requirements	Assessment / Comments
Where a resource consent is necessary, require proposals to subdivide, use or develop land that is subject to natural hazards to prepare a risk assessment that considers all of the following, taking into account the potential effects of climate change and adopting a precautionary approach where information is uncertain or incomplete:	
(aa) the type, frequency, range and scale of the natural hazard(s), including: (i) where there may be coinciding, compounding and/or cascading hazards; (ii) whether the hazard risks will be temporary or permanent;	**New bridge:** The existing high flood hazard is caused by the farm crossing over the southern stream (13.2ha catchment), with a 600dia pipe running under the crossing. The crossing creates a flood prone area behind it, which takes 28mm of rain to fill according to Geomaps and will then overtop the crossing, at a spill depth of 540mm. This farm crossing and culvert are to be removed and replaced with a bridge that will span the entire stream with no piers within the stream bed. Flow analysis shows that currently water will overtop the existing crossing, creating a high hazard, while post-bridge installation the flood hazard will be confined entirely to the stream (still high hazard), but the bridge will not be affected by flooding. The new bridge will also reduce the potential for blockage that exists with the current stream crossing and small culvert.

(iii) whether natural hazard events of lower intensity and higher frequency than the 1 per cent AEP event will impact the property and proposed activity;	(i) No coinciding, compounding and/or cascading hazards – proposed bridge will reduce potential for compounding hazard by eliminating potential for blockage of existing culvert under farm crossing. (ii) The activity relates to an existing high flood hazard on the farm crossing which will be permanently eliminated on replacement of this crossing with a bridge. A high flood hazard will remain in the stream itself (permanent), but the flood depth above the former farm crossing will be significantly reduced. (iii) The existing culvert is relatively small (600dia) and is expected to result in flow backing up behind it in more frequent flood events than the 1% storm. Replacement with a new bridge which has been designed to be able to convey the 1% AEP storm + 3.8^{o}C CC with no heading up will improve this situation. **OLFP3 Partial Piping:** This is a minor OLFP (2.3ha catchment currently, reducing to 1.7ha after haul road installation) on a relatively steep gully (12% gradient). The current flood hazard is low (depth = 0.9m; velocity = 1.31m/s, depth x velocity = 0.12m^2/s). The culvert has been sized to convey the 1% AEP storm event with climate change. Hence, there will be no obstruction of flows along the OLFP alignment and no changes to the location or capacity of the existing OLFP. There may be some localised changes in flow velocity and depth at the culvert inlet, as some heading up of flow is expected, but flow depth and velocities will revert to existing conditions downgradient of the culvert reasonably quickly based on the existing land gradient along the OLFP alignment. There will be no changes to overland flow on other properties. The flood hazard, post-culvert installation will be the same as existing above and below the new culvert and eliminated on the access road itself. Blockage of the culvert is unlikely as flows into the OLFP on the subject site are controlled by a small diameter culvert under Jones Rd, which forms the top of the catchment. There are no coinciding, compounding or cascading hazards. The hazard already exists, will not change above and below the culvert, as a result of the piping and is permanent. Lower impact flood events are not expected to impact the subject site or the proposed piping.
(c) the consequences of a natural hazard event in relation to the proposed activity;	**New bridge:** The effects of this existing hazard are largely confined to the subject site and do not affect any buildings on neighbouring properties upstream of the site. The culvert removal and installation of a replacement bridge will reduce these effects further. The existing flood prone area formed by the existing culvert takes only 26mm of rain to fill and hence will provide very little attenuation of peak flows in the watercourse. Hence, replacement of the culvert farm crossing with a bridge is not expected to result in any significant increases in peak flows and water levels downstream of the culvert for this reason, and due to combining with other OLFPs for significant catchment areas (13.2ha catchment at culvert, increasing to 18.4ha at site boundary, 20.2ha at the driveway on the neighbouring property and 78.4ha area within 170m of the site boundary.





Catchment areas at location 1 - 14.1ha; 2 – 5.3ha; 3 = 20.7ha, 4 = 78.4ha

OLFP3 partial piping: The consequences of a flood event are reduced, due to the access road being flood free, while there is no change to the existing natural hazard above and below the new culvert.

(l) existing and proposed mitigation measures;	**New bridge:** The bridge option and design has been deliberately selected for multiple reasons, including minimising potential adverse effects on the underlying wetland and will also eliminate the existing high flood hazard on the crossing itself, from elimination of overtopping. **OLFP3 partial piping:** The culvert under the access road has been sized appropriately so that there will be no ponding and the access road will not be overtopped in a 1% AEP storm event.
(m) residual risk;	**New bridge:** The residual risk is reduced, and relates to the depth and velocity of water along the watercourse, which will be returned to the pre-farm crossing situation. Ponding up behind the existing farm crossing and culvert will be eliminated. **OLFP3 partial piping:** The residual risk is minor either side of the culvert, unchanged from the current situation, and very localised. The risk on the haul road itself is eliminated.
(n) any relevant management plan, strategy or hazard risk assessment relating to the area.	**Both:** Not required.

Table 21: E36.3 (4A) Compliance Assessment

36.3 (4A) Risk assessment requirements	Assessment / Comments
Require all of the following matters to be considered when assessing consequences of natural hazards as part of a risk assessment:	
(a) accelerating or exacerbating the natural hazard and/or its potential impacts;	**New bridge:** The proposed works will eliminate the natural flood hazard on the existing farm crossing and its potential impact as explained above. **OLFP3 partial piping:** The proposed works will not change the existing low flood hazard at this location, above and below the new culvert.
(b) creating natural hazard risks that previously were not present at the location;	**Both:** Not applicable – flood hazard is existing and will reduce as a result of the proposed works.
(c) the type of activity being undertaken and its sensitivity to natural hazard events;	**New bridge:** Removal of the farm crossing and associated culvert will restore the original watercourse profile through this area, while the proposed bridge has been designed to avoid piers within the stream bed (also a wetland) and to be able to convey the 1% AEP + 3.8^{o}C CC storm event, without overtopping. This design also means that the bridge deck is well elevated above the watercourse and hence unlikely to block from any debris that may be washed down the stream. The bridge also reduces the flood hazard in terms of

	depth within the stream, while the bridge itself will not be subject to any flood hazard, due to its design and elevation. **OLFP3 partial piping:** The partial piping of OLFP3 is ~23m long, while sensitivity to natural hazard events is considered low as this is a minor OLFP, with minimal blockage potential, based on the contributing catchment and provision of a scruffy dome manhole inlet.
(d) creating or increasing the natural hazard risk(s) to people and communities, including long-term impacts from more frequent hazard events;	**New bridge:** Not applicable – flood hazard is existing and will be reduced as a result of proposed bridge. **OLFP3 partial piping:** Not applicable – minor hazard and contained entirely within the subject site.
(e) creating or increasing the natural hazard risk(s) to other properties, infrastructure and the environment; and	**New bridge:** Not applicable – flood hazard is existing and will reduce upstream, due to reduced water depth, as a result of proposed bridge. The existing flood prone area formed by the existing culvert takes only 26mm of rain to fill and hence will provide very little attenuation of peak flows in the watercourse. Removal of this culvert and associated crossing is not expected to result in any significant increases in peak flows and water levels downstream of the culvert for this reason, and due to combining with other OLFPs for significant catchment areas (13.2ha catchment at culvert, increasing to 18.4ha at site boundary, 20.2ha at the driveway on the neighbouring property and 78.4ha area within 170m of the site boundary. **OLFP3 partial piping:** Not applicable- flood hazard is minor and localised in nature and entirely contained within subject site.
(f) cultural impacts, including consequences for Māori land, Treaty Settlement Land, marae, urupā, mana whenua cultural heritage and values.	**New bridge:** Generally not applicable, except that proposed farm crossing/culvert removal and bridge replacement will benefit the underlying wetland, which supports mana whenua values. **OLFP3 partial piping:** Generally not applicable, as OLFP piping is relatively minor and contained entirely within subject site.

Table 22: E36.3 (4B) Compliance Assessment

36.3 (4B) Risk assessment requirements	Assessment / Comments
Require all of the following matters to be considered as part of a risk assessment of existing and future mitigation measures and residual risk:	
(a) whether any building, structure or activity located on land subject to natural hazards can be relocated within the site or removed;	**New bridge:** Relocation is not possible, as vehicle access required over watercourse – bridge will replace existing farm culvert crossing, which will be removed, representing an improvement to the existing situation.

	OLFP3 partial piping: It is not necessary or practical to provide alternative OLFPs as the haul road runs across the entire OLFP catchment and has to cross this gully, while the extent of the associated works is minor and localised, restricted to the width of the haul road (~23m). Relocation or removal is not possible.
(b) whether the use, design and construction of buildings and structures can mitigate risks associated with natural hazards;	**New bridge:** New bridge will reduce existing risks associated with existing flood hazard, as explained above. **OLFP3 partial piping:** New culvert will reduce flood hazard on the access road itself and not change existing low flood hazard either side of it, which relates to a minor OLFP.
(c) the extent to which methods for long term maintenance of areas affected by natural hazards, such as easements, are provided;	**New bridge:** Not applicable. Proposed bridge is elevated above flood risk and hence no easements required. Bridge will be maintained by Fill operator as required. **OLFP3 partial piping:** Not applicable – minor OLFP. Culvert will be maintained by Fill operator as required.
(d) the ability for site layout and management to limit exposure of people and property to natural hazards, including safe egress during a natural hazard event;	**New bridge:** The new bridge has been deliberately designed to minimise flood impacts by having no piers within the stream bed and being well elevated above flood levels. It will facilitate safe egress from the site during a flood event. **OLFP3 partial piping:** The culvert and associated road has also been sized to facilitate safe egress during a flood event.
(e) the effect of structures to mitigate hazards on landscape values and public access;	**New bridge:** The proposed bridge will be visually more attractive than the existing farm crossing, particularly when the proposed riparian planting is taken into account. **OLFP3 partial piping:** This culvert under the northern fill access road will be typical of farm culverts and access roading on many rural properties. No effects expected on landscape values. Both structures are located on private property and hence there is no public access.
(f) the robustness of the mitigation measures, their enforceability and the ability to carry out repairs and maintenance;	**New bridge:** The new bridge will be a robust structure and needs to be constructed by the client to provide vehicle access to the Fill areas. Very little maintenance is expected to be required and can be undertaken by the Fill operator or suitably experienced contractor, as required. **OLFP3 partial piping:** Culvert is required for vehicle access purposes and no additional mitigation measures are proposed or considered necessary.
(g) the potential consequences of events that exceed the design parameters of mitigation measures;	**New bridge:** Minor – the bridge deck is elevated ~850mm above the estimated flood level and its abutments will be appropriately designed and constructed in accordance with best practice. The

	contributing catchment is relatively small and flow velocities are not high. It is considered extremely unlikely that water could rise to the level of the deck. **OLFP3 partial piping:** Potential consequences are minor, due to small catchment and most flows into subject site being controlled by upgradient culvert under Jones Road. Any beyond design event would result in more flow into the scruffy dome and possible short term heading up around the scruffy dome. The impact is expected to be localised and contained entirely within the subject site.
(h) the potential effects resulting from failure of structural and nature-based mitigation measures over a 100-year timeframe;	**New bridge:** Bridge is expected to have at least a 50 year life; bridge failure would lead to any damaged bridge sections being removed from the watercourse (if present), while the bridge would need to be repaired promptly to continue to provide vehicle access across the gully. **OLFP3 partial piping:** Culvert expected to have at least a 50 year life. If culvert fails, it would need to be repaired or replaced promptly to continue to allow for vehicle access over the associated gully crossing. Potential effects considered minor, localised and short term in both cases.
(i) the impacts of the mitigation on other people, properties, infrastructure and the environment;	**New bridge:** New bridge will reduce upstream flood levels and have minor benefit on adjacent upstream neighbours and no increased adverse effect on downstream neighbours. It will enhance the underlying wetland and stream through associated riparian planting. No effects on other infrastructure. **OLFP3 partial piping:** No effects on other people, properties, infrastructure and the environment.
(j) whether natural hazard risks can be reduced for Māori Land, Treaty Settlement Land, marae, urupā, mana whenua cultural heritage and values;	**New bridge:** New bridge, through wetland enhancement and riparian planting is in accordance with Māori values. **OLFP3 partial piping:** Not applicable.
(k) the use of conditions of consent, including the duration of consent, to monitor changes in risk and to limit the exposure of people and property to natural hazards; and	**Both:** Fill operator will be highly motivated to maintain the bridge and culvert as both structures are essential to facilitating site access. Consent conditions could include bridge and culvert maintenance requirements, but query whether this is necessary.
(l) the extent to which it is practicable to mitigate residual risk where infrastructure has a functional or operational need to locate in a natural hazard area	**New bridge:** No additional mitigation considered necessary. The bridge is solely for use for vehicle access to the subject site and there are no increased adverse effects on upstream/downstream properties. **OLFP3 partial piping:** No additional mitigation considered necessary, due to culvert being on minor OLFP, for private use, and with no offsite effects.

E36.3 (21) Ensure all development, including fencing, storage of materials and goods, and earthworks, in flood hazard areas does not create or exacerbate flood risk on other sites

Assessment: As explained under assessments against policies, 3, 4A and 4B:

- the proposed new bridge will likely reduce the flood hazard for adjacent upstream neighbouring sites (due to reduced flood depth) and not increase the flood hazard downstream.
- The proposed partial piping of OLFP3 will only have minor, localised effects and no off-site effects.

E36.3 (26) Manage accessways, including private roads and public roads to be vested, and parking areas in flood hazard areas so that safe egress is provided where possible, and flood hazard risks are not increased reduced to as low as reasonably practicable.

Assessment: The proposed new bridge and access road are appropriately designed so as to ensure they are free from any flood hazards, providing safe egress from the site should such an event occur.

E36.3 (29) Maintain the function of overland flow paths to convey stormwater runoff safely from a site to the receiving environment by ensuring that any modifications do not result in a reduction in the capacity of the overland flow path and do not cause nuisance or damage to property or the environment.

Assessment: The proposed bridge will enhance the function of this OLFP, as it will remove the obstruction caused by the existing farm crossing and associated culvert and be sufficiently elevated so as not to impede or restrict flows under it. Analysis has shown that this will not cause nuisance or damage to downstream property or the environment.

The proposed partial piping of OLFP3 will not result in a reduction in the capacity of the OLFP, due to it being relatively minor and through appropriate sizing of the culvert, and will not cause nuisance or damage to other property, as the effects of this culvert will be localised and entirely contained within the subject site.

7.2 LANDSLIDE HAZARD RISK ASSESSMENT

7.2.1 Site Landslide Hazard Risk Assessment

Council Geomaps of landslide hazard risk assessment show that the site generally has a low-moderate risk for shallow landslide susceptibility and moderate-high risk for large scale landslide susceptibility. These maps are effectively a screening tool, as they are based on large scale, regional assessments. Site specific assessment is also required under PC120 using the Appendix 24 Landslide hazard risk assessment methodology. This has been done in the separate FTL geotechnical assessment report. This has found that the north filling area has a "low" risk of being adversely affected by slope instability events associated with landslides for both the existing situation and post-filling.

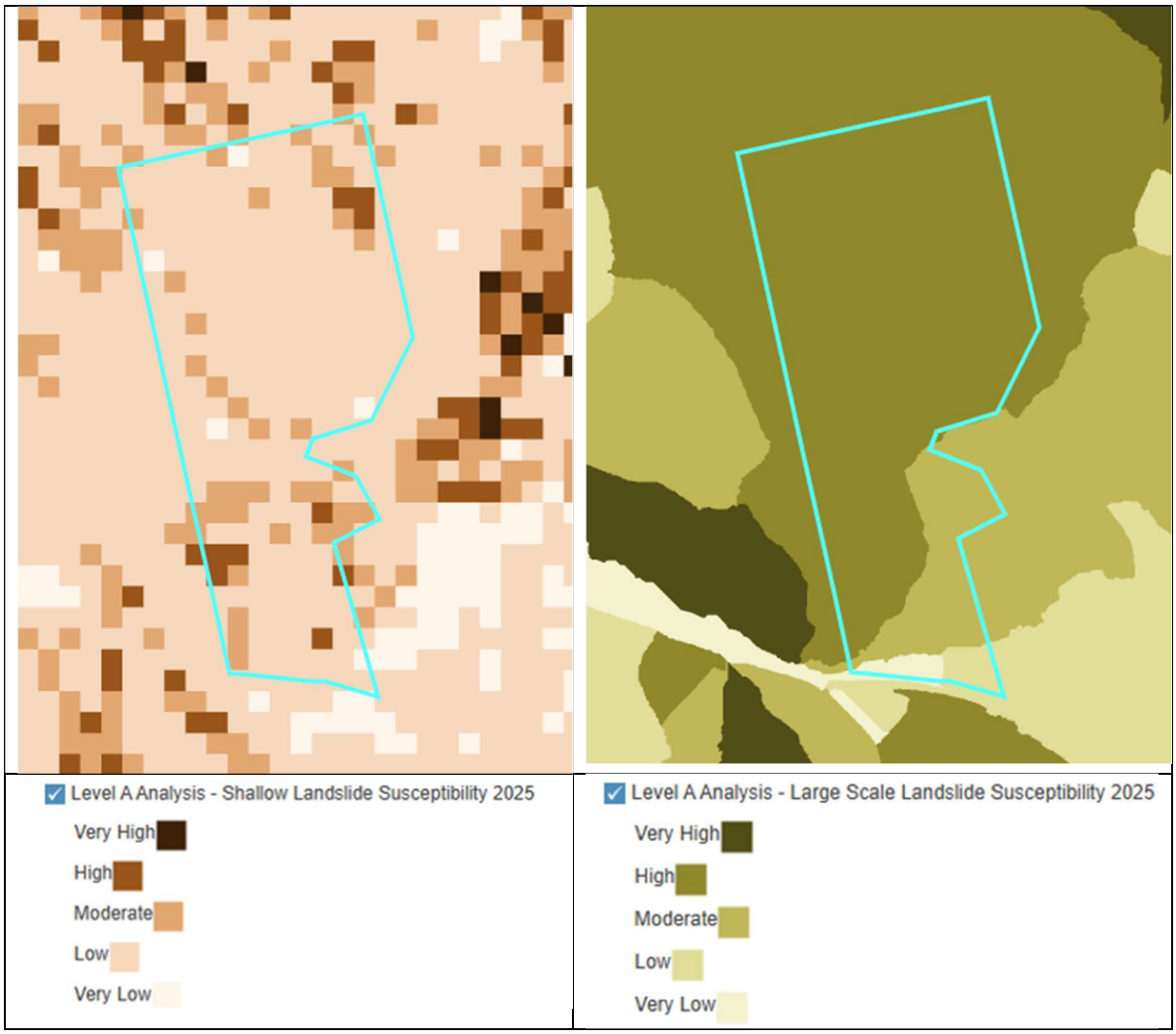


Figure 19: Geomaps Landslide Susceptibility Mapping

7.2.2 Activity Table E36.4.1B Review

Table 23: Table E36.4.1B Activity Assessment

Activity	Activity Status				
		High (significant) landslide hazard risk areas	**Medium (tolerable) landslide hazard risk areas**	**Low (acceptable) landslide hazard risk areas**	**Assessment / Comment**
Activities on land in landslide hazard risk areas					
Use – landslide hazard risk areas					
(A108)	Storage of hazardous substances in landslide hazard risk areas that comply with Standard E36.6.A1	RD	P	P	N/A to activity
(A109)	Storage of hazardous substances in landslide hazard risk areas that do not comply with Standard E36.6.A1	NC	RD	C	N/A to activity
Development and associated use, where applicable (excluding infrastructure covered by Table E36.4.1C) – landslide hazard risk areas					
(A112)	On-site septic tanks, wastewater treatment and disposal systems, effluent disposal fields, underground storage tanks, water tanks (including rainwater tanks) or stormwater pipes or soakage fields, accessways, private roads and roads intended to be vested in landslide hazard risk areas that comply with Standard E36.6.A1	RD	P	P	**Applies to new roofwater harvesting tanks and wheel wash recycling tank. PA as complies with Standard E36.6.A1. Refer section 7.1.8.**
(A113)	On-site septic tanks, wastewater treatment and disposal systems, effluent disposal fields, underground storage tanks, water tanks (including rainwater tanks) or stormwater pipes or soakage fields, accessways, private roads and roads intended to be vested in landslide hazard risk areas that do not comply with Standard E36.6.A1	D	RD	C	N/A to activity
(A114)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) associated with activities potentially sensitive and less sensitive to natural hazards in low (acceptable) landslide hazard risk areas	N/A	N/A	P	**Applies - P**

(A115)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area up to 20m^2 associated with activities sensitive to natural hazards in low (acceptable) landslide hazard risk areas and less sensitive to natural hazards in medium (tolerable) and high (significant) landslide hazard risk areas	P	P	P	N/A – site assessed as subject to low landslide hazard risk.
(A116)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area up to 20m^2 associated with activities potentially sensitive to natural hazards in medium (tolerable) and high (significant) landslide hazard risk areas that comply with Standard E36.6.A1	C	P	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A117)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area up to 20m^2 associated with activities potentially sensitive to natural hazards in medium (tolerable) and high (significant) landslide hazard risk areas that do not comply with Standard E36.6.A1	RD	C	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A118)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area up to 20m^2 associated with activities sensitive to natural hazard in medium (tolerable) and high (significant) landslide hazard risk areas that comply with Standard E36.6.A1	RD	C	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A119)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area up to 20m^2 associated with activities sensitive to natural hazard in medium (tolerable) and high (significant) landslide hazard risk areas that do not comply with Standard E36.6.A1	D	RD	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A120)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area more than 20m2 associated with activities less sensitive to natural hazards in medium (tolerable) and high (significant) landslide hazard risk areas that comply with Standard E36.6.A1	P	P	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A121)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area more than 20m^2 associated with activities less sensitive to natural hazards in medium (tolerable)	RD	C	N/A	N/A – site assessed as subject to low

	and high (significant) landslide hazard risk areas that do not comply with Standard E36.6.A1				landslide hazard risk.
(A122)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area more than 20m^2 associated with activities potentially sensitive to natural hazards in medium (tolerable) and high (significant) landslide hazard risk areas that comply with Standard E36.6.A1	RD	C	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A123)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area more than 20m^2 associated with activities potentially sensitive to natural hazards in medium (tolerable) and high (significant) landslide hazard risk areas that do not comply with Standard E36.6.A1	D	RD	N/A	N/A – site assessed as subject to low landslide hazard risk.
(A124)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area more than 20m^2 associated with activities sensitive to natural hazards in landslide hazard risk areas that comply with Standard E36.6.A1	RD	RD	P	N/A – site assessed as subject to low landslide hazard risk.
(A125)	New structures and buildings and external additions and alterations to existing structures and buildings (as existing at 03/11/25) with a gross floor area more than 20m^2 associated with activities sensitive to natural hazards in landslide hazard risk areas that do not comply with Standard E36.6.A1	NC	D	C	N/A – site assessed as subject to low landslide hazard risk.
(A126)	All other external additions and alterations to buildings and structures in landslide hazard risk areas that comply with Standard E36.6.A1	RD	P	P	N/A
(A127)	All other external additions and alterations to buildings and structures in landslide hazard risk areas that do not comply with Standard E36.6.A1	D	RD	C	N/A
(A128)	All other buildings and structures, including retaining walls, in landslide hazard risk areas that comply with Standard E36.6.A1	RD	P	P	**Applies to new bridge - P**
(A129)	All other buildings and structures, including retaining walls, in landslide hazard risk areas that do not comply with Standard E36.6.A1	D	RD	C	N/A

8.0 CONCLUSIONS AND RECOMMENDATIONS

This Engineering report and AEE has been prepared in accordance with relevant statutory requirements and technical guidelines.

SEL are proposing to construct a Managed Fill comprising two separate areas of 9ha and 2ha (including associated drains and sediment ponds) on the northern and southern sides of the site respectively, with corresponding estimated fill volumes of 720,000m^3 and 70,000m^3, giving a combined fill volume of 790,000m^3. Filling will take place over a period of approximately 10 years and consent is sought for a total period of 10 years to provide some contingency should fill volumes be less than anticipated.

Erosion and sediment control will be provided by sediment ponds sized to cater for the entire Fill areas, with treated runoff discharged to the site watercourses.

The site will be fully owned by SEL and managed and operated by them.

The Managed Fill has been designed in accordance with best practice, while a Fill Management Plan has been prepared for use during Managed Fill operation. In respect to the matters addressed in this report, implementation of Managed Fill construction and operation in accordance with the design plans and Fill Management Plan, including waste acceptance, inspection, maintenance and site restoration requirements, should ensure that potential adverse environmental effects associated with the filling and associated activities are avoided or mitigated, so that these effects are less than minor.

Figures and Drawings

(refer separate volume)

Appendix A

Calculations

A1: Erosion and Sediment Control

Fraser Thomas Overland Stormwater Runoff - Rational Method			
Job no:	33250	Date:	17/09/2024
Client:	SCARBOROUGH BROTHERS LTD	Revision:	1
Job Name:	362 Jones RD, Hunua	Designer:	FV
		Reviewer:	TB
Purpose:	20 year ARI Drains		

As per New Zealand Building Code E1/VM1, 2.0

117 mm/hr used as the intensity. Midway between both the 8.5 climate time frames.

Catchment runoff

Q = (C · i · A) / 360

Catchment coefficient based on NZBC clause E1

Stormwater intensity is taken from the HIRDS database output

RCP	8.5	Climate scenario - IPCC Representative Concentration Pathway (RCP)
ARI	20	yearly
Time of concentration method	Calculated	As per New Zealand Building Code E1/VM1, 2.3.2 b) or user input
User Time of concentration	N/A	minutes
Period	N/A	years

Catchment area	Surface type	Area, A_i ha	Run-off Coeff, Table 1 Ci	Slope correction Table 2 %	Run-off Coeff, Ci	T_c (min)	Intensity (mm/hr)	Flow Q (m^3/s)
D1A	Grass	0.400	0.67	0-5%	0.72	10	117.00	0.093
		0.400						**0.093**
D1B	Grass	0.800	0.67	0-5%	0.72	10	117.00	0.173
		0.800						**0.173**
D2	Grass	2.000	0.67	0-5%	0.72	10	117.00	0.433
		2.000						**0.433**
D3	Grass	2.000	0.67	0-5%	0.72	10	117.00	0.433
		2.000						**0.433**
D4	Grass	0.950	0.67	0-5%	0.72	10	117.00	0.206
		0.950						**0.206**
D5	Grass	0.950	0.67	0-5%	0.72	10	117.00	0.206
		0.950						**0.206**

Fraser Thomas Overland Stormwater Runoff - Rational Method			
Job no:	33250	Date:	17/09/2024
Client:	SCARBOROUGH BROTHERS LTD	Revision:	1
Job Name:	362 Jones RD, Hunua	Designer:	FV
		Reviewer:	TB
Purpose:	20 year ARI Drains		

As per New Zealand Building Code E1/VM1, 2.0

Catchment runoff

Q = (C · i · A) / 360

Catchment coefficient based on NZBC clause E1

Stormwater intensity is taken from the HIRDS database output

RCP	Historical	Climate scenario - IPCC Representative Concentration Pathway (RCP)
ARI	20	yearly
Time of concentration method	Calculated	As per New Zealand Building Code E1/VM1, 2.3.2 b) or user input
User Time of concentration	N/A	minutes
Period	N/A	years

Catchment area	Surface type	Area, A_i ha	Run-off Coeff, Table 1 Ci	Slope correction Table 2 %	Run-off Coeff, Ci	T_c (min)	Intensity (mm/hr)	Flow Q (m^3/s)
D1A	Grass	0.400	0.67	0-5%	0.72	10	111.00	0.088
		0.400						**0.088**
D1B	Grass	0.800	0.67	0-5%	0.72	10	111.00	0.164
		0.800						**0.164**
D2	Grass	2.000	0.67	0-5%	0.72	10	111.00	0.411
		2.000						**0.411**
D3	Grass	2.000	0.67	0-5%	0.72	10	111.00	0.411
		2.000						**0.411**
D4	Grass	0.950	0.67	0-5%	0.72	10	111.00	0.195
		0.950						**0.195**
D5	Grass	0.950	0.67	0-5%	0.72	10	111.00	0.195
		0.950						**0.195**

Fraser Thomas Overland Stormwater Runoff - Rational Method			
Job no:	33250	Date:	17/09/2024
Client:	SCARBOROUGH BROTHERS LTD	Revision:	1
Job Name:	362 Jones RD, Hunua	Designer:	FV
		Reviewer:	TB
Purpose:	100 year ARI Drains		

As per New Zealand Building Code E1/VM1, 2.0

155 mm/hr used as the intensity. Midway between both the 8.5 climate time frames.

Catchment runoff

Q = (C · i · A) / 360

Catchment coefficient based on NZBC clause E1

Stormwater intensity is taken from the HIRDS database output

RCP	8.5	Climate scenario - IPCC Representative Concentration Pathway (RCP)
ARI	100	yearly
Time of concentration method	Calculated	As per New Zealand Building Code E1/VM1, 2.3.2 b) or user input
User Time of concentration	N/A	minutes
Period	N/A	years

Catchment area	Surface type	Area, A_i ha	Run-off Coeff, Table 1 Ci	Slope correction Table 2 %	Run-off Coeff, Ci	T_c (min)	Intensity (mm/hr)	Flow Q (m^3/s)
D1A	Grass	0.400	0.67	0-5%	0.72	10	155.00	0.123
		0.400						**0.123**
D1B	Grass	0.800	0.67	0-5%	0.72	10	155.00	0.230
		0.800						**0.230**
D2	Grass	2.000	0.67	0-5%	0.72	10	155.00	0.574
		2.000						**0.574**
D3	Grass	2.000	0.67	0-5%	0.72	10	155.00	0.574
		2.000						**0.574**
D4	Grass	0.950	0.67	0-5%	0.72	10	155.00	0.273
		0.950						**0.273**
D5	Grass	0.950	0.67	0-5%	0.72	10	155.00	0.273
		0.950						**0.273**

Fraser Thomas Overland Stormwater Runoff - Rational Method			
Job no:	33250	Date:	17/09/2024
Client:	SCARBOROUGH BROTHERS LTD	Revision:	1
Job Name:	362 Jones RD, Hunua	Designer:	FV
		Reviewer:	TB
Purpose:	100 year ARI Drains		

As per New Zealand Building Code E1/VM1, 2.0

Catchment runoff

Q = (C · i · A) / 360

Catchment coefficient based on NZBC clause E1

Stormwater intensity is taken from the HIRDS database output

RCP	Historical	Climate scenario - IPCC Representative Concentration Pathway (RCP)
ARI	100	yearly
Time of concentration method	Calculated	As per New Zealand Building Code E1/VM1, 2.3.2 b) or user input
User Time of concentration	N/A	minutes
Period	N/A	years

Catchment area	Surface type	Area, A_i ha	Run-off Coeff, Table 1 Ci	Slope correction Table 2 %	Run-off Coeff, Ci	T_c (min)	Intensity (mm/hr)	Flow Q (m^3/s)
D1A	Grass	0.400	0.67	0-5%	0.72	10	146.00	0.116
		0.400						**0.116**
D1B	Grass	0.800	0.67	0-5%	0.72	10	146.00	0.216
		0.800						**0.216**
D2	Grass	2.000	0.67	0-5%	0.72	10	146.00	0.541
		2.000						**0.541**
D3	Grass	2.000	0.67	0-5%	0.72	10	146.00	0.541
		2.000						**0.541**
D4	Grass	0.950	0.67	0-5%	0.72	10	146.00	0.257
		0.950						**0.257**
D5	Grass	0.950	0.67	0-5%	0.72	10	146.00	0.257
		0.950						**0.257**

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Oct 31 2024

Drain Type 1 (1%)

Trapezoidal

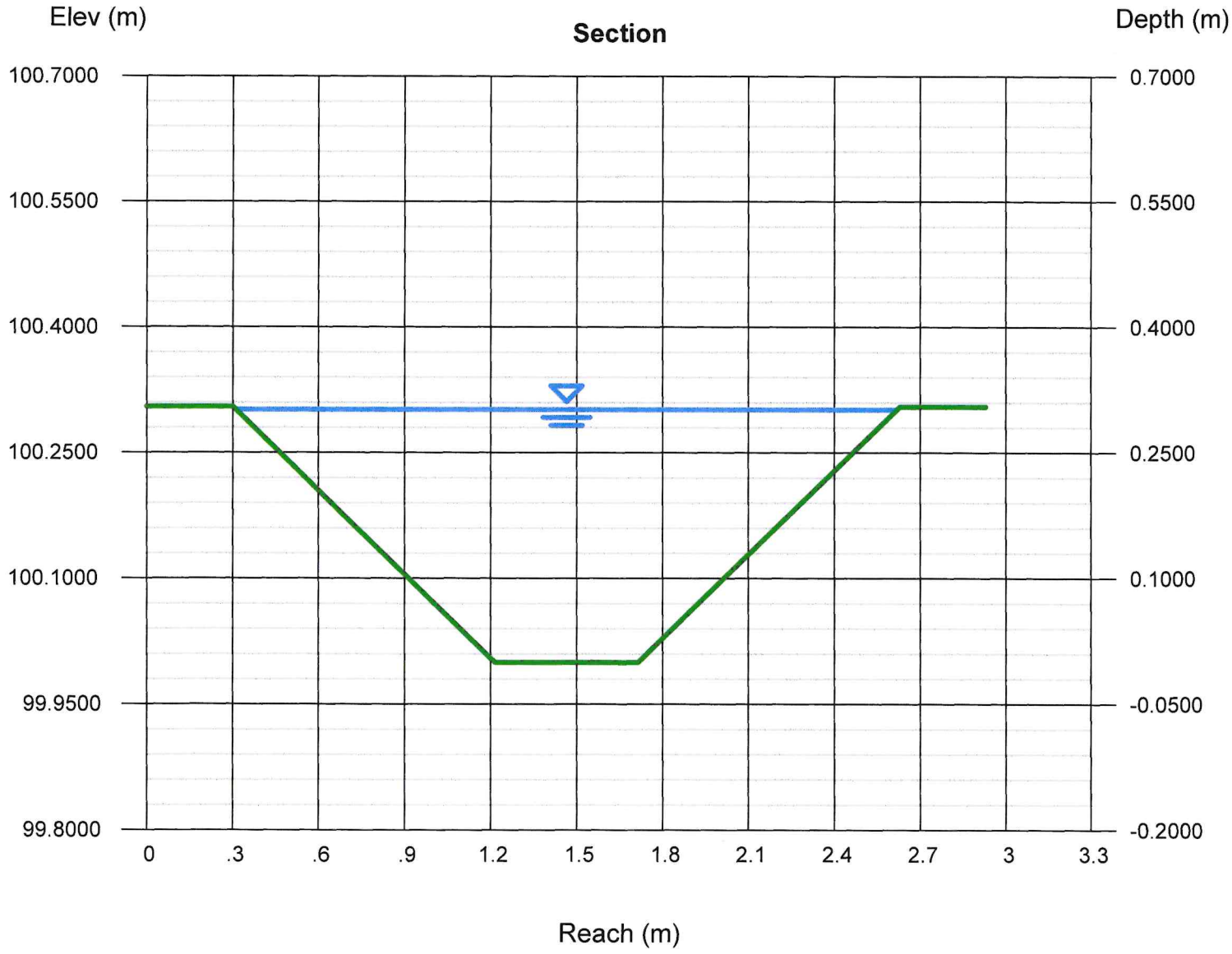
Bottom Width (m)	= 0.5000
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.3050
Invert Elev (m)	= 100.0000
Slope (%)	= 1.2000
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.5740

Highlighted

Depth (m)	= 0.3018
Q (cms)	= 0.5740
Area (sqm)	= 0.4240
Velocity (m/s)	= 1.3536
Wetted Perim (m)	= 2.4084
Crit Depth, Yc (m)	= 0.3048
Top Width (m)	= 2.3105
EGL (m)	= 0.3952



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Oct 31 2024

Drain Type 1 (5%)

Trapezoidal

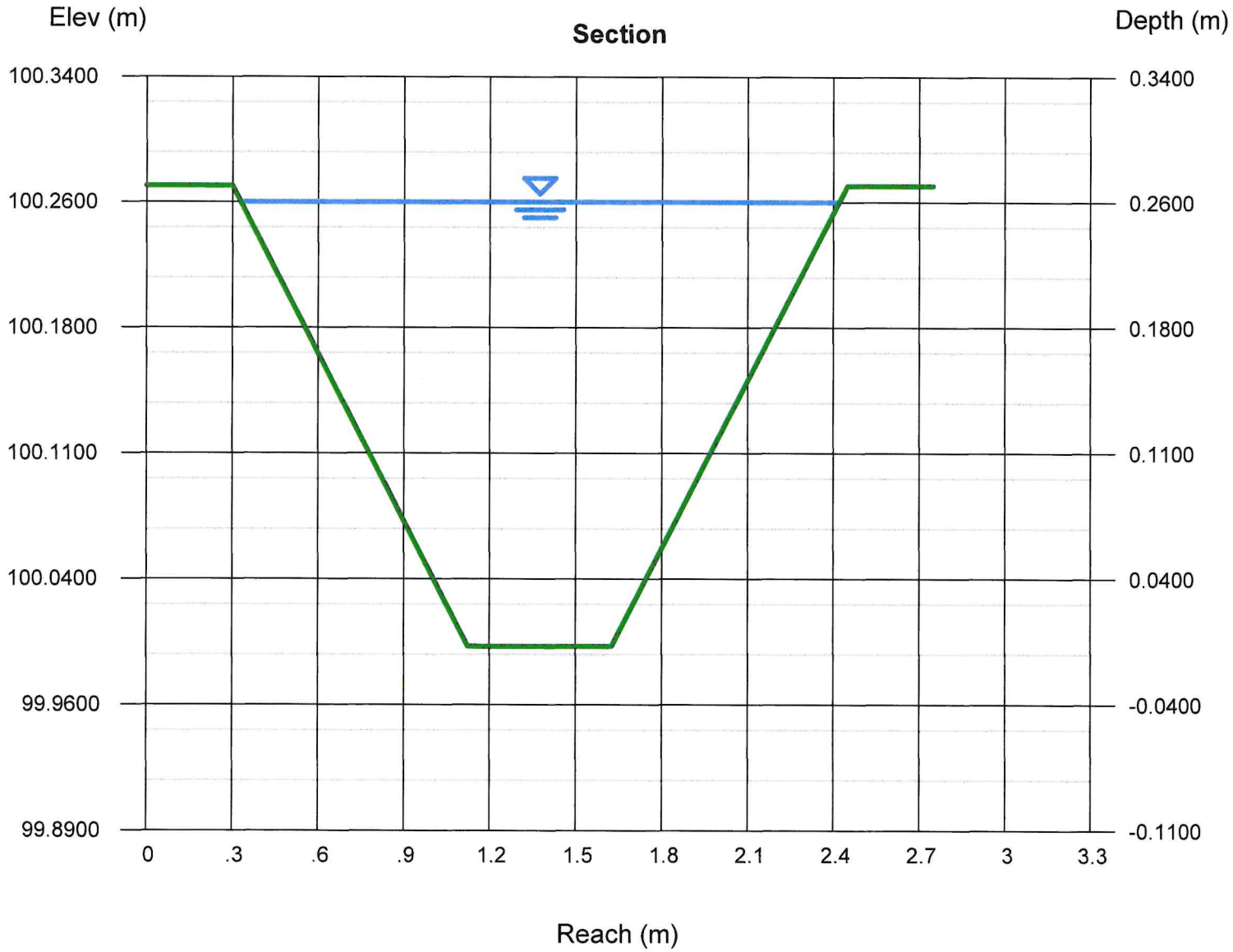
Bottom Width (m)	= 0.5000
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.2750
Invert Elev (m)	= 100.0000
Slope (%)	= 1.2000
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.4330

Highlighted

Depth (m)	= 0.2652
Q (cms)	= 0.4330
Area (sqm)	= 0.3435
Velocity (m/s)	= 1.2604
Wetted Perim (m)	= 2.1771
Crit Depth, Yc (m)	= 0.2652
Top Width (m)	= 2.0911
EGL (m)	= 0.3462



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Oct 31 2024

Drain Type 2 (1%)

Trapezoidal

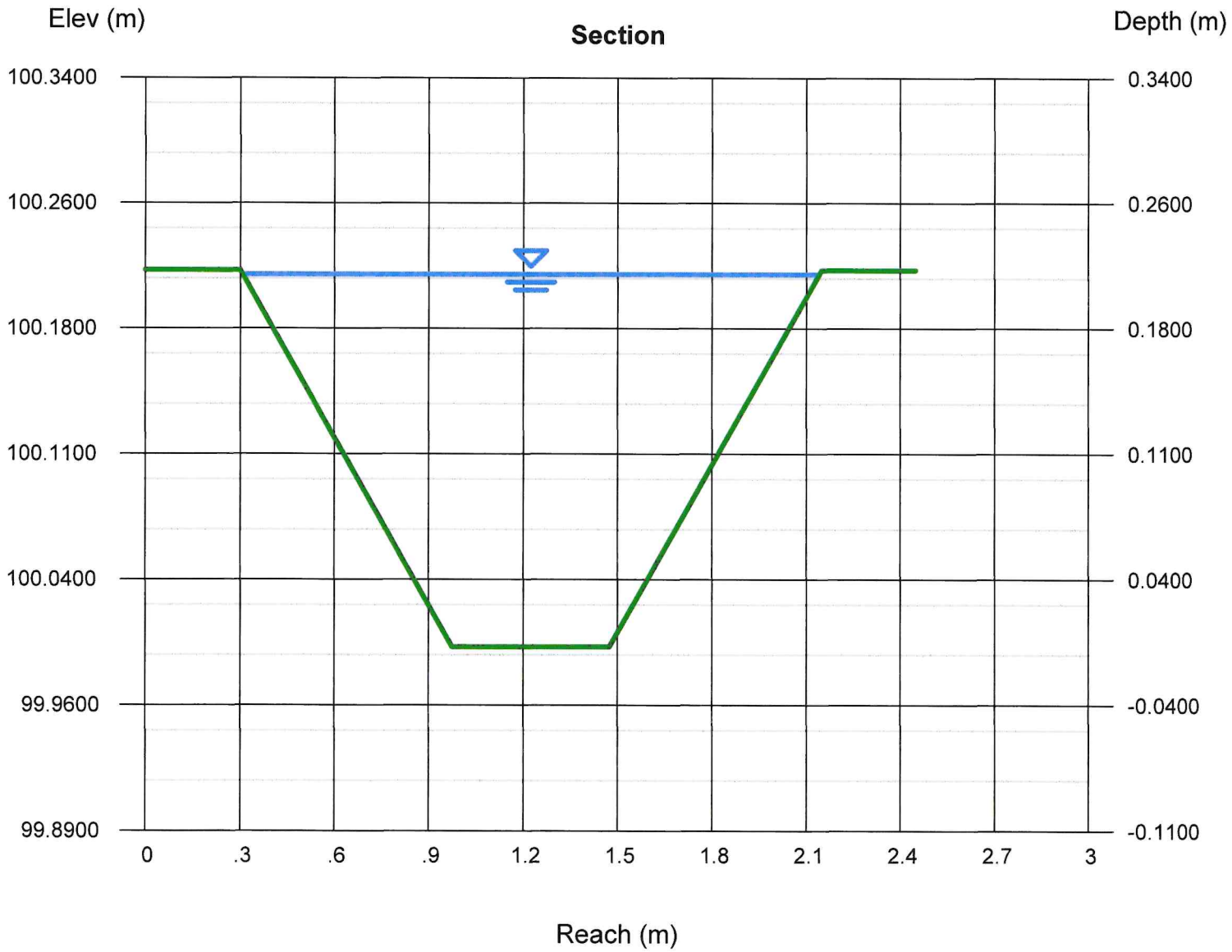
Bottom Width (m)	= 0.5000
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.2250
Invert Elev (m)	= 100.0000
Slope (%)	= 1.0000
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.2730

Highlighted

Depth (m)	= 0.2225
Q (cms)	= 0.273
Area (sqm)	= 0.2598
Velocity (m/s)	= 1.0509
Wetted Perim (m)	= 1.9072
Crit Depth, Yc (m)	= 0.2103
Top Width (m)	= 1.8350
EGL (m)	= 0.2788



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Oct 31 2024

Drain Type 2 (5%)

Trapezoidal

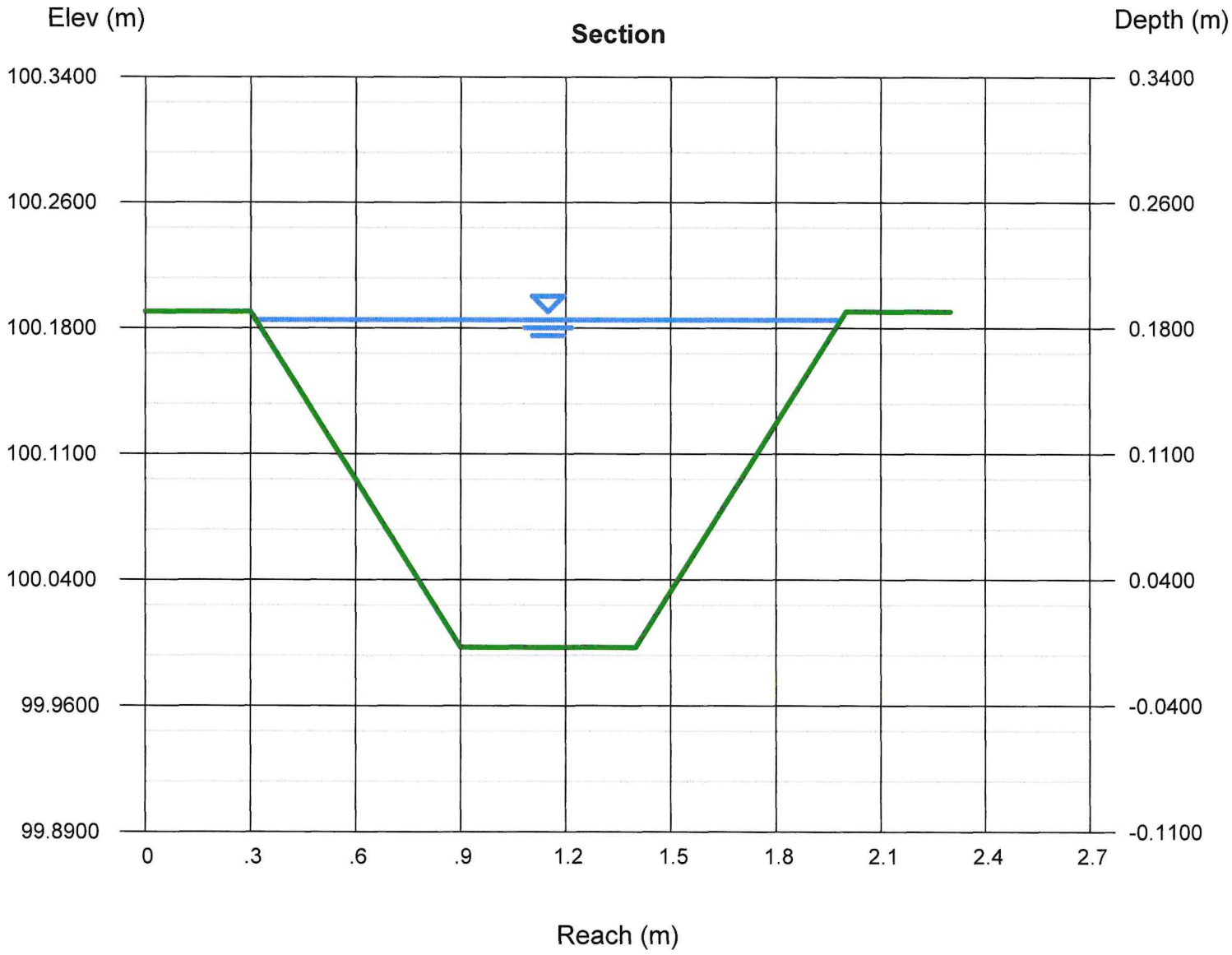
Bottom Width (m)	= 0.5000
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.2000
Invert Elev (m)	= 100.0000
Slope (%)	= 1.0000
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.2060

Highlighted

Depth (m)	= 0.1951
Q (cms)	= 0.206
Area (sqm)	= 0.2117
Velocity (m/s)	= 0.9731
Wetted Perim (m)	= 1.7337
Crit Depth, Yc (m)	= 0.1829
Top Width (m)	= 1.6704
EGL (m)	= 0.2434



Client	Scarbro Environmental L		**Northern**	By	TB	Date	30/08/2024
Job	33250		**Both ponds**	Checked	SF	Date	24/09/2024

Job location: Auckland

Catchment area: 2 ha Maximum catchment area = 5 ha
Catchment slope: 10 %
Catchment length: 250 m

Storage Volume Requirement

If catchment slope > 18 % then 3% catchment
Or if slope length > 200 then 3% catchment, else 2%
Volume requirement: 3% of catchment area
Storage volume: 600 m^3

Pond Parameters

Depth 1.8 m from invert to primary spillway
Length to width ratio 3
Internal batter slopes 1: 2
Entry batter slope 1: 3
Pond invert level 10 m RL
Baffles required: No

Location	Depth	Level	Width	Length	Area	Volume	Required
Base	0	10	5.9	30.3	179	0	
Dead storage	0.76	10.76	8.9	34.1	305	182	180
Primary spillway	1.8	11.8	13.1	39.3	515	605	600
Emergency spillway	2.1	12.1	14.3	40.8	583	769	
Top of pond	2.4	12.4	15.5	42.3	656	955	

Check:

Max decant operating range no more than 1.5m: OK
Live storage = 70% of storage volume OK
Dead storage = 30% of storage volume OK
Dead storage depth must be between 0.4 m and 0.8 OK

Decants

Number of decants: 2
Decant rate: 3 L/s per ha
Required decant flow: 6 L/s
Design decant flow: 6 L/s

Decants	RL	Holes
Decant 1	10.76	133.33333
Decant 2	11.28	133
Decant 3	NA	NA
Decant 4	NA	NA

Total holes
266.66667

Discharge Pipe

Spillway diameter 150 mm
Pipe gradient 1% (Pipe to be at 1-2% grade)
Pipe capacity 15 L/s
Pipe sufficient: Yes

Emergency spillway

Catchment C value 0.6
Rainfall rate 125 mm/hr 1% AEP storm event
Q_p 0.42 m^3/s

Emergency (1% AEP) spillway dimensions

Bottom width: 6 m
Side slope = 1V: 3 H
Spillway depth 0.3 m
Top width 7.8 m
Spillway capacity 1.86 m^3/s
Spillway sufficient: Yes

Forebay design

Level spreader level 12.2 m RL (100-200mm above emergency spillway level)
Forebay top width: 14.70 m
Forebay base width: 10.70 m
Forebay top length: 3 m
Forebay base length 1 m
Forebay depth 1 m
Forebay volume #N/A m^3

Client	Scarbro Environmental L		**Southern**	By	TB	Date	30/08/2024
Job	33250			Checked	SF	Date	24/09/2024

Job location: Auckland

Catchment area: 1.2 ha Maximum catchment area = 5 ha
Catchment slope: 10 %
Catchment length: 250 m

Storage Volume Requirement

If catchment slope > 18 % then 3% catchment
Or if slope length > 200 then 3% catchment, else 2%
Volume requirement: 3% of catchment area
Storage volume: 360 m^3

Pond Parameters

Depth 1.7 m from invert to primary spillway
Length to width ratio 3
Internal batter slopes 1: 2
Entry batter slope 1: 3
Pond invert level 10 m RL
Baffles required: No

Location	Depth	Level	Width	Length	Area	Volume	Required
Base	0	10	4.0	23.9	96	0	
Dead storage	0.8	10.8	7.2	27.9	201	117	108
Primary spillway	1.7	11.7	10.8	32.4	350	362	360
Emergency spillway	2	12	12.0	33.9	407	476	
Top of pond	2.3	12.3	13.2	35.4	467	607	

Check:

Max decant operating range no more than 1.5m: OK
Live storage = 70% of storage volume: Check live storage volume and dea
Dead storage = 30% of storage volume: OK
Dead storage depth must be between 0.4 m and 0.8 OK

Decants

Number of decants: 1
Decant rate: 3 L/s per ha
Required decant flow: 3.6 L/s
Design decant flow: 3.6 L/s

Decants	RL	Holes
Decant 1	10.8	160
Decant 2	NA	NA
Decant 3	NA	NA
Decant 4	NA	NA

Total holes
160

Discharge Pipe

Spillway diameter 150 mm
Pipe gradient 1% (Pipe to be at 1-2% grade)
Pipe capacity 15 L/s
Pipe sufficient: Yes

Emergency spillway

Catchment C value 0.6
Rainfall rate 125 mm/hr 1% AEP storm event
Q_p 0.25 m^3/s

Emergency (1% AEP) spillway dimensions

Bottom width: 6 m
Side slope = 1V: 3 H
Spillway depth 0.3 m
Top width 7.8 m
Spillway capacity 1.86 m^3/s
Spillway sufficient: Yes

Forebay design

Level spreader level 12.1 m RL (100-200mm above emergency spillway level)
Forebay top width: 12.40 m
Forebay base width: 8.40 m
Forebay top length: 3 m
Forebay base length 1 m
Forebay depth 1 m
Forebay volume #N/A m^3

Client	Scarbro Environmental Ltd		Pond N1/N2	By	SF	Date	12/10/2024
Job	33250			Checked		Date	

Erosion And Sediment Control - Universal Soil Loss Equation

A = R K LS C P

Soil Loss	**A**	tonnes/hectare/year
Rainfall Erosion Index	**R**	J/hectare
Soil Erodibility Factor	**K**	tonnes/unit of R
Slope Length and Steepness Factor	**LS**	dimensionless
Vegetative Cover factor	**C**	dimensionless
Erosion Control Practice Factor	**P**	dimensionless

DESIGN FACTORS

R = 0.00828* $p^{2.2}$ *1.70

p = 6 hour 2 year rainfall figure for site (multiply 2yr 24h rainfall by 0.628)

2 yr 24h rainfall = 55 mm

= **34**

p = 34.54 mm

K = 0.4

(assumed 60% silt, 35% clay, 5% sand)

Value from Table 4.1, Triangular Nomograph, Page 2, Module 4, ARC Workshop Training Course (Brown Hard Cover Book)

Organic Content = 1 % (Prior to construction)
0 % (During construction)
1 % (During restoration)

Most topsoils have organic matter >2%
(Enter a whole no. between 0 & 4. Leave if not sure)
Almost all construction sites have negligible quantities of organic matter

		Ground cover During eworks	Ground cover Post-eworks
Corrected K, prior to Construction	**0.594** Calcs based on 1% org content.		
Corrected K, during construction	**0.528** Edit manually using table on		
Corrected K, during restoration	**0.594** right off-sheet		

Enter relevant no of zones based on areas served by different sediment removal devices and ground cover

Catchment Data

Time periods:
Earthworks 39.0 wks
Restoration - grass 13 wks
wks/ha

LS Inputs	Exist	Cfill			
Slope (%)	11.50	33.30			
Length	300.00	150.00			
m (exponent dependent on slope)	0.5	0.5			

Slope	m
<1%	0.20
1-3%	0.30
3.5-4.5%	0.40
>5%	0.50

Section	Exist	Cleanfill			
Area (ha)	2.000	2.000	0.000	0.000	0.000
Construct'n Period(yrs)	0.00	0.75			
Restoration Period(yrs)	0.00	0.25			
LS	5.32	20.93	#NUM!	#NUM!	#NUM!

Formula calculation using "LS inputs" table

Pick from table	C	P
Prior to earthworks	**0.02**	**1.0**
During earthworks	**1.0**	**0.9**
During restoration	**0.1**	**1**

Treatment	C factor	P factor
Bare soil		
- compacted and smooth	1	1.3
- track walked on contour	1	1.2
- rough irregular surface	1	0.9
- disked to 250mm depth	1	0.8
Native Vegetation (undisturbed)	0.01	1.0
Pasture(undisturbed)	0.02	1.0
Temporary grass	0.1	1.0
Temporary cover crop	0.45	1.0

	DEB	SRP Areas	Silt fence
Sediment Delivery Ratio =	0.7	0.7	0.7
Sediment Control Efficiency % =	75	95	50

			USLE Parameters					Time	Gross Sed. Yield	Sed Del. Ratio	Sed. Control Efficiency	Net Sediment Loss
Section	**E/wks period**	**Area (ha)**	**R**	**K**	**LS**	**C**	**P**	**years**	**tonnes**		**%**	**tonnes**
	Present	2	34	0.594	5.32	0.02	1	1.00	4.31			4.31
Exist	During	2.000	34	0.528	5.32	1	0.9	0.00	0.00	0.7	75	0.0000
	Restor'n	2.000	34	0.594	5.32	0.1	1	0.00	0.00	0.7	75	0.0000
	Re-establishe	2.000	34	0.594	5.32	0.02	1	0.00	0.00			0.0000
								0.00	Sub Total (constr'n/restorat'n)			0.0000
	Present	0	34	0.594	20.93	0.02	1	1.00	0.00			0.00
Fill	During	2	34	0.528	20.93	1	0.9	0.75	508.85	0.7	95	17.8097
	Restor'n	2	34	0.594	20.93	0.1	1	0.25	21.20	0.7	95	0.7421
	Re-establishe	2	34	0.594	20.93	0.02	1	0.00	0.00			0.0000
								1.00	Sub Total (constr'n/restorat'n)			18.5517

Net sediment loss = gross sed yield x sediment delivery ratio x (1 - sediment control efficiency/100)

SUMMARY

Estimated total soil loss prior to earthworks :	**4.31**	tonnes over	**1.00** year
Estimated total soil loss during earthworks / restoration :	**18.55**	tonnes over	**1.00** year

Client	Scarbro Environmental Ltd		Pond S1				
Job	33250			By	SF	Date	12/10/2024
				Checked		Date	

Erosion And Sediment Control - Universal Soil Loss Equation

A = R K LS C P

Soil Loss	**A**	tonnes/hectare/year
Rainfall Erosion Index	**R**	J/hectare
Soil Erodibility Factor	**K**	tonnes/unit of R
Slope Length and Steepness Factor	**LS**	dimensionless
Vegetative Cover factor	**C**	dimensionless
Erosion Control Practice Factor	**P**	dimensionless

DESIGN FACTORS

R = 0.00828* $p^{2.2}$ *1.70

= **34**

p = 6 hour 2 year rainfall figure for site (multiply 2yr 24h rainfall by 0.628)
2 yr 24h rainfall = 55 mm
p = 34.54 mm

K = 0.4
(assumed 60% silt, 35% clay, 5% sand)

Value from Table 4.1, Triangular Nomograph, Page 2, Module 4, ARC Workshop Training Course (Brown Hard Cover Book)

Organic Content = 1 % (Prior to construction)
0 % (During construction)
1 % (During restoration)

Most topsoils have organic matter >2%
(Enter a whole no. between 0 & 4. Leave if not sure)
Almost all construction sites have negligible quantities of organic matter

		Ground cover During eworks	Ground cover Post-eworks
Corrected K, prior to Construction	**0.594**	Calcs based on 1% org content.	
Corrected K, during construction	**0.528**	Edit manually using table on	
Corrected K, during restoration	**0.594**	right off-sheet	

Enter relevant no of zones based on areas served by different sediment removal devices and ground cover

Catchment Data

Time periods:
Earthworks 39.0 wks
Restoration - grass 13 wks
wks/ha

LS Inputs	Exist	Cfill			
Slope (%)	12.50	33.30			
Length	200.00	75.00			
m (exponent dependent on slope)	0.5	0.5			

Slope	m
<1%	0.20
1-3%	0.30
3.5-4.5%	0.40
>5%	0.50

Section	Exist	Cleanfill			
Area (ha)	2.000	2.000	0.000	0.000	0.000
Construct'n Period(yrs)	0.00	0.75			
Restoration Period(yrs)	0.00	0.25			
LS	4.92	14.80	#NUM!	#NUM!	#NUM!

Formula calculation using "LS inputs" table

Pick from table	C	P
Prior to earthworks	**0.02**	**1.0**
During earthworks	**1.0**	**0.9**
During restoration	**0.1**	**1**

Treatment	C factor	P factor
Bare soil		
- compacted and smooth	1	1.3
- track walked on contour	1	1.2
- rough irregular surface	1	0.9
- disked to 250mm depth	1	0.8
Native Vegetation (undisturbed)	0.01	1.0
Pasture(undisturbed)	0.02	1.0
Temporary grass	0.1	1.0
Temporary cover crop	0.45	1.0

	DEB	SRP Areas	Silt fence
Sediment Delivery Ratio =	0.7	0.7	0.7
Sediment Control Efficiency % =	75	95	50

			USLE Parameters					Time	Gross Sed. Yield	Sed Del. Ratio	Sed. Control Efficiency	Net Sediment Loss
Section	**E/wks period**	**Area (ha)**	**R**	**K**	**LS**	**C**	**P**	**years**	**tonnes**		**%**	**tonnes**
	Present	2	34	0.594	4.92	0.02	1	1.00	3.99			3.99
Exist	During	2.000	34	0.528	4.92	1	0.9	0.00	0.00	0.7	75	0.0000
	Restor'n	2.000	34	0.594	4.92	0.1	1	0.00	0.00	0.7	75	0.0000
	Re-establishe	2.000	34	0.594	4.92	0.02	1	0.00	0.00			0.0000
								0.00	Sub Total (constr'n/restorat'n)			0.0000
	Present	0	34	0.594	14.80	0.02	1	1.00	0.00			0.00
Fill	During	2	34	0.528	14.80	1	0.9	0.75	359.76	0.7	95	12.5917
	Restor'n	2	34	0.594	14.80	0.1	1	0.25	14.99	0.7	95	0.5247
	Re-establishe	2	34	0.594	14.80	0.02	1	0.00	0.00			0.0000
								1.00	Sub Total (constr'n/restorat'n)			13.1164

Net sediment loss = gross sed yield x sediment delivery ratio x (1 - sediment control efficiency/100)

SUMMARY

Estimated total soil loss prior to earthworks :	**3.99**	tonnes over	**1.00** year
Estimated total soil loss during earthworks / restoration :	**13.12**	tonnes over	**1.00** year

A2: Swales and Culverts

Project	362 Jones Road
Job No	33250

By	FV	Date	4/12/2025
Checked	SF	Date	4/12/2025

SW Flow - Northern Haul Road

Runoff Curve Number (CN) and Initial Abstraction (I_a)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN	Pre-dev area (ha)	Post-dev area (ha)	CN x pre-dev area	CN x post-dev area
Group C	Vegetated area	74			0.00	0.00
Group C	Pasture/grassed/vegetated areas	74	1.548	1.250	114.52	92.50
Group C	Residential roofs/paving	98	0.320	0.135	31.36	13.23
Group C	Roads/access ways	98	0.480	0.315	47.04	30.87
		Total	2.348	1.700	193	137
		CN (weighted) = total product/total area =			82.2	80.4
		CN (pervious) = pervious product/pervious area =			74	74.0
		I_a (weighted) = 5 x pervious area/total area =			3.30	3.68

Time of Concentration

		Pre	Post	
Channelisation factor	C =	0.8	0.8	(from TP 108 Table 4.2)
Catchment length	L =	300	300	m (along drainage path)
Catchment length	L =	0.3	0.3	km (along drainage path)
Catchment slope	S_c =	0.084	0.084	m/m
Runoff factor, (CN/200-CN) =		**0.697**	**0.672**	
t_c =	$0.14xCxL^{0.66x}(CN/(200-CN))^{-0.55}xS_c^{-0.30}$ =	0.170	0.17	hrs
SCS Lag for HEC-HMS, $t_p = 2/3\ t_c$ =		0.11	0.11	hrs

Graphical Peak Flow Rate

			Pre	Post	
Catchment Area	A =		0.0235	0.0170	km^2 (from 1 above)
Runoff Curve Number	CN =		82.179	80.353	(from 1 above)
Initial Abstraction	I_a =		3.296	3.676	mm (from 1 above)
Time of Concentration	t_c=		0.17	0.17	hrs (calculated)
Storage	S=	((1000/CN)-10)x25.4	55.1	62.1	mm

Rainfall and Climate Change Allowance

Annual Recurrence Interval (ARI)		2	5	10	50	100
Climate Change Allowance: 3.8 °C		0.274	0.296	0.308	0.319	0.327
Rainfall				150		240

Pre-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**196.2**	**0.0**	**318.5**
Runoff Index, $c^* = (P_{24} - 2 x I_a)/(P_{24} - 2 x I_a + 2 x S)$			**-0.064**	**-0.064**	**0.633**	**-0.064**	**0.739**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#N/A**	**#N/A**	**0.163**	**#N/A**	**0.176**
Peak Flow Rate	$q_p = q^* x A x P24$	m^3/s	**#N/A**	**#N/A**	**0.750**	**#N/A**	**1.314**
Runoff Depth		Perv (mm)	**0.30**	**0.30**	**130.36**	**0.30**	**244.01**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**191.15**	**0.00**	**313.38**
Runoff Volume		Perv (m^3)	**4.6**	**4.6**	**2017.3**	**4.6**	**3776.1**
$V_{24} = 1000 x Q_{24} x A$		Imper (m^3)	**0.0**	**0.0**	**1529.2**	**0.0**	**2507.0**
		Total (m^3)	**4.6**	**4.6**	**3546.5**	**4.6**	**6283.1**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.015475	74.0	5.0	89.2
Imperv	0.008000	98	0.0	5.2

Post-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**196.2**	**0.0**	**318.5**
Runoff Index, $c^* = (P_{24} - 2 x I_a)/(P_{24} - 2 x I_a + 2 x S)$			**-0.063**	**-0.063**	**0.603**	**-0.063**	**0.715**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#N/A**	**#N/A**	**0.159**	**#N/A**	**0.174**
Peak Flow Rate	$q_p = q^* x A x P24$	m^3/s	**#N/A**	**#N/A**	**0.530**	**#N/A**	**0.939**
Runoff Depth		Perv (mm)	**0.30**	**0.30**	**130.36**	**0.30**	**244.01**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**191.15**	**0.00**	**313.38**
Runoff Volume		Perv (m^3)	**3.7**	**3.7**	**1629.4**	**3.7**	**3050.2**
$V_{24} = 1000 x Q_{24} x A$		Imper (m^3)	**0.0**	**0.0**	**860.2**	**0.0**	**1410.2**
		Total (m^3)	**3.7**	**3.7**	**2489.6**	**3.7**	**4460.4**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.012500	74.0	5.0	89.2
Imperv	0.004500	98	0.0	5.2

Peak Flows Summary

ARI (yr event)	Units	2	5	10	50	100
q_p (pre-dev)	m^3/s	#N/A	#N/A	0.750	#N/A	1.31424
q_p (post-dev)	m^3/s	#N/A	#N/A	0.530	#N/A	0.93939
Increase in q_p (post to pre)	m^3/s	#N/A	#N/A	-0.221	#N/A	-0.375
Increase in q_p (post to pre)	%	#N/A	#N/A	-29.41	#N/A	-28.52

Runoff Volumes Summary

ARI (yr event)	Units	2	5	10	50	100
Runoff volume (pre-dev)	m^3	5	5	3546	5	6283
Runoff volume (post-dev)	m^3	4	4	2490	4	4460
Increase in Vol (post to pre)	m^3	-1	-1	-1057	-1	-1823
Increase in Vol (post to pre)	%	-19.22	-19.22	-29.80	-19.22	-29.01

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 8 2025

Express Existing 100% Crossection Northern Haul Road

User-defined

Invert Elev (m)	= 211.5500
Slope (%)	= 13.4000
N-Value	= 0.030

Calculations

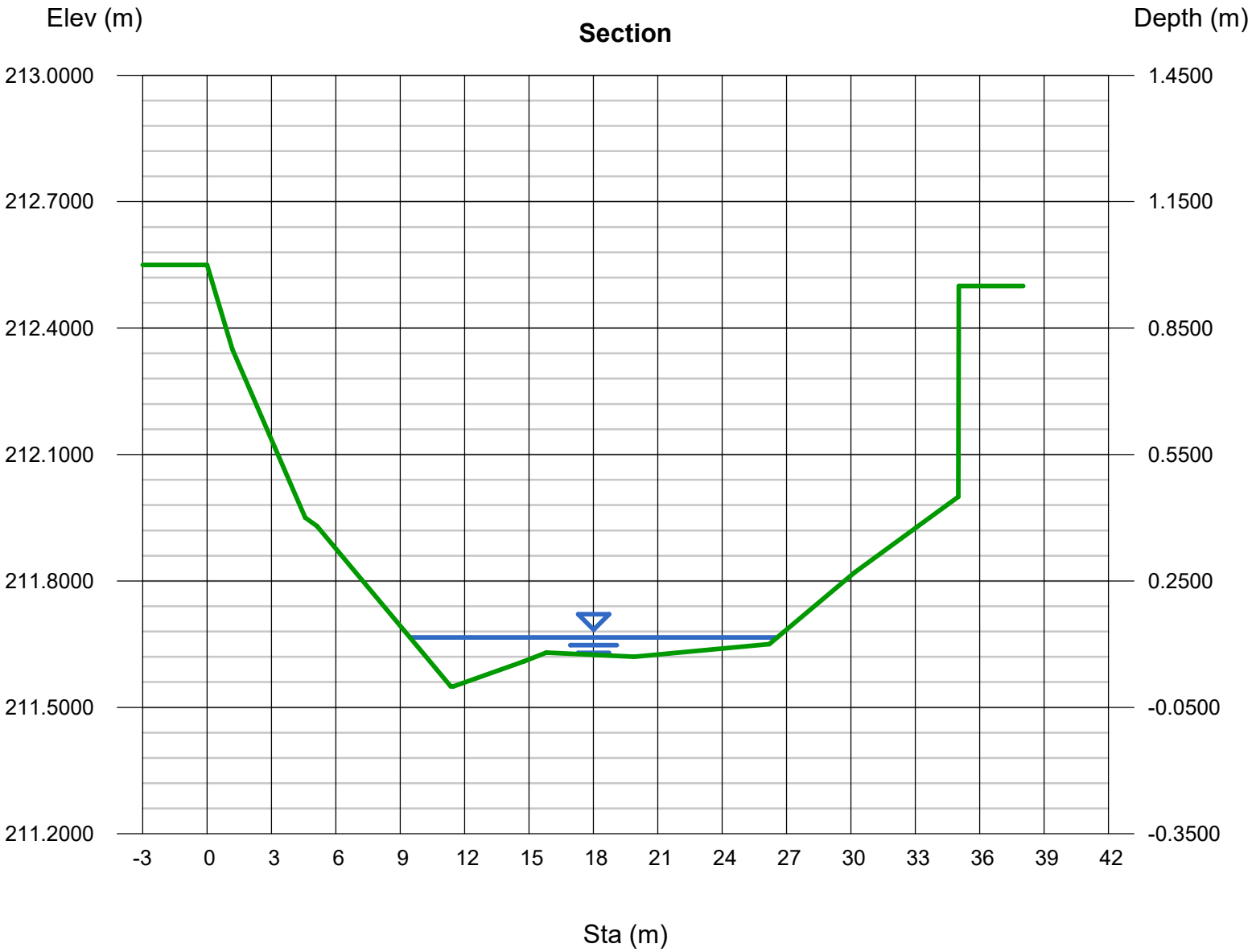
Compute by:	Known Q
Known Q (cms)	= 1.3140

Highlighted

Depth (m)	= 0.1158
Q (cms)	= 1.3140
Area (sqm)	= 0.8199
Velocity (m/s)	= 1.6027
Wetted Perim (m)	= 17.1174
Crit Depth, Yc (m)	= 0.1554
Top Width (m)	= 17.1127
EGL (m)	= 0.2468

(Sta, El, n)-(Sta, El, n)...

(0.0000, 212.5500)-(1.1800, 212.3500, 0.030)-(4.5700, 211.9500, 0.030)-(5.1300, 211.9300, 0.030)-(10.7000, 211.5900, 0.030)-(11.3500, 211.5500, 0.030)-(11.
-(14.8000, 211.6100, 0.030)-(15.8000, 211.6300, 0.030)-(15.8300, 211.6300, 0.030)-(19.9100, 211.6200, 0.030)-(26.2000, 211.6500, 0.030)-(30.1700, 211.8200,
-(35.0200, 212.5000, 0.030)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 8 2025

Express 10yr Proposed Crossection Northern Haul Road

User-defined

Invert Elev (m)	= 211.5500
Slope (%)	= 13.4000
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.5300

Highlighted

Depth (m)	= 0.0945
Q (cms)	= 0.5300
Area (sqm)	= 0.4069
Velocity (m/s)	= 1.3026
Wetted Perim (m)	= 10.4048
Crit Depth, Yc (m)	= 0.1219
Top Width (m)	= 10.4001
EGL (m)	= 0.1810

(Sta, El, n)-(Sta, El, n)...

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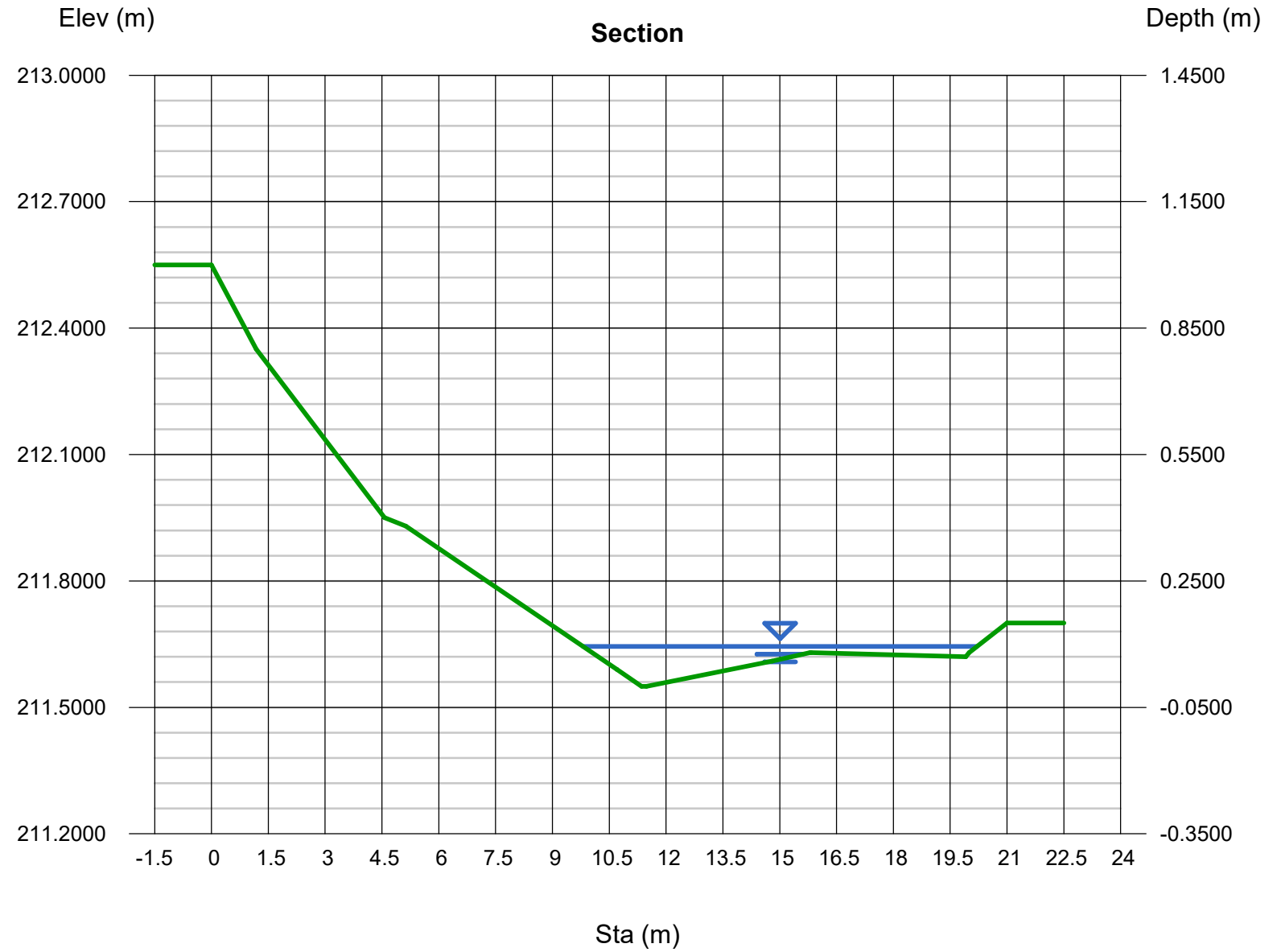
-(14.8000, 211.6100, 0.030)-(15.8000, 211.6300, 0.030)-(15.8300, 211.6300, 0.030)-(19.9100, 211.6200, 0.030)-(20.0000, 211.6300, 0.030)-(21.0000, 211.7000



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 8 2025

Express 100yr Proposed Crossection Northern Haul Road

User-defined

Invert Elev (m)	= 211.5500
Slope (%)	= 13.4000
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.9400

Highlighted

Depth (m)	= 0.1097
Q (cms)	= 0.9400
Area (sqm)	= 0.5689
Velocity (m/s)	= 1.6523
Wetted Perim (m)	= 10.8731
Crit Depth, Yc (m)	= 0.1524
Top Width (m)	= 10.8674
EGL (m)	= 0.2490

(Sta, El, n)-(Sta, El, n)...

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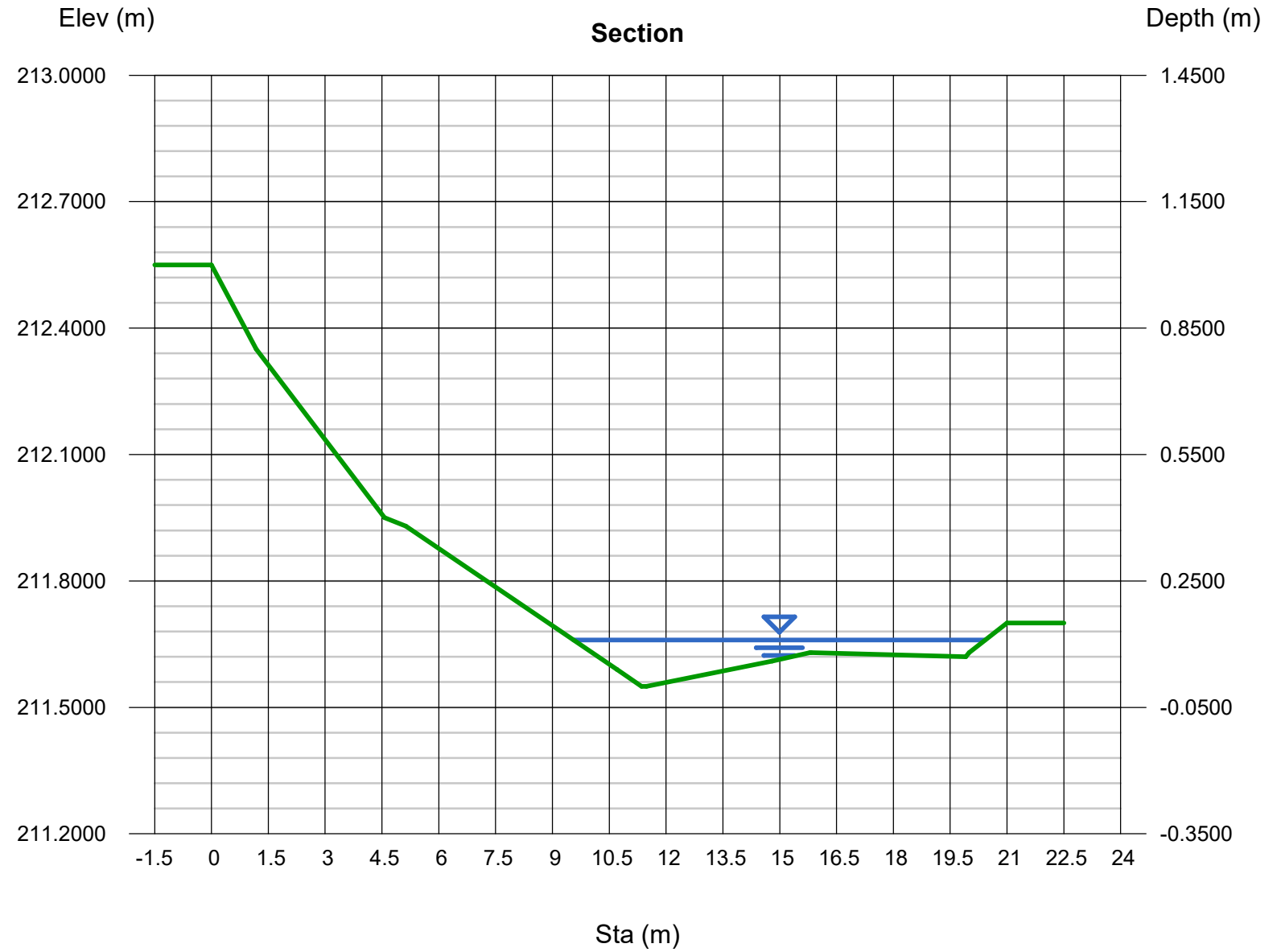
-(14.8000, 211.6100, 0.030)-(15.8000, 211.6300, 0.030)-(15.8300, 211.6300, 0.030)-(19.9100, 211.6200, 0.030)-(20.0000, 211.6300, 0.030)-(21.0000, 211.7000



Drop inlet calcs

Head (m)	H/D	Flow (m3/s) Orifice	Weir	
0	0	0	0	
0.02	0.019	#NUM!	0.017	
0.03	0.029	#NUM!	0.031	
0.04	0.038	#NUM!	0.048	
0.05	0.048	#NUM!	0.066	
0.06	0.057	#NUM!	0.087	
0.07	0.067	#NUM!	0.110	
0.08	0.076	#NUM!	0.134	
0.095	0.090	#NUM!	0.174	10yr flow
0.1	0.095	#NUM!	0.188	
0.11	0.105	#NUM!	0.217	100yr flow

MH dia = 1.05 m

Notes:

1. Orifice Flow = 0.62 x pi x Dia^2/4 x sqrt (2 x 9.81 x (h - D/2))
2. Weir: flow = 1.8 x pi x Dia x h^1.5

For h/D less than or equals 0.225, drop inlet behaves as weir
For h/D > 0.225, drop inlet becomes partially submerged
For h/D > 0.5, inlet is fully submerged and drop inlet will behave more like an orifice

$$OrificeFlow = 0.62 \times \pi \times \frac{Dia^2}{4} \times \sqrt{2 \times 9.81 \times \left(h - \frac{D}{2} \right)}$$

$$WeirFlow = 1.8 \times \pi \times Dia \times h^{1.5}$$

Notes:

1. Above equation for orifices primarily applies to vertical orifices where average head is adjusted by 0.5dia. It also applies to horizontal orifices when dia is sigificant proportion of orifice diameter due to vena contracta effect - see below from "Stormwater Best Management Practices and Detention" by Ben Urbonas and Peter Stahre
2. For scruffy domes however, recommend ignoring scruffy dome dia, as D >> h. This is consistent with TP10, pg 5-12

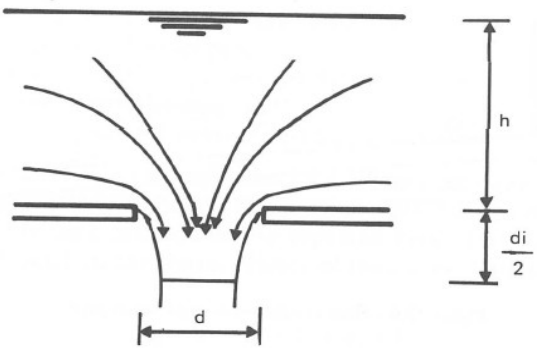


Figure 12.5 Flow through a horizontal orifice.

$$Q = C_d \cdot A \cdot \sqrt{2g \cdot \left(h - \frac{d}{2}\right)} \qquad (12.5)$$

which Q = discharge rate through the outlet,
C_d = discharge coefficient,
A = area of the orifice or nozzle,
g = acceleration of gravity,
h = water depth at outlet, and
d = diameter of the outlet opening.

Stormwater Capacity - Proposed

Project	**362 Jones Road**
Job No	33250
Description	Proposed Stormwater Network

By		Date	
Checked		Date	

Pipe		Flow Area	Design Storm	Area (m^2)	Pervious (m^2)	C	I (mm/s)	Q_d (L/s)	Invert Upstream	Invert Downstream	Pipe Length (m)	Pipe Grade (%)	Diameter (mm)	Velocity (m/s)	Q_c (L/s)	Pipe Check	% Pipe Capacity Used	Remaining Capacity (L/s)
From	To																	
East of Northern Haul Road	West of Northern Haul Road	OLFP	10yr	17000	11100	0.57	0.069	672.8	207.54	206.97	23	2.50%	525	3.15	681.9	Comply	99%	9
			100yr	17000	11100	0.57	0.106	1032.3	207.54	206.97	23	2.50%	650	3.61	1197.9	Comply	86%	166
Clean water drain low point	West of Northern Haul Road	Clean water	10yr	9000	7000	0.51	0.069	317.4	207.54	207.07	23.17	1.50%	450	2.21	351.5	Comply	90%	34
			100yr	9000	7000	0.51	0.106	487.0	207.54	207.07	23.17	1.50%	525	2.44	528.2	Comply	92%	41

Parameters:

1. Roughness coefficient, k_s (pipes < 1000mm) = 1.5 k_s (pipes > 1000mm) = 0.6

2. Intensity Values:

WQS yr (mm/s)		
10 yr (mm/s)	0.069	10min
100yr (mm/s)	0.106	10min

C Impervious 0.9
C Pervious 0.4 *Heavy clay soil types - NZBC E1 Table 1*

NOTES

1. Intensity values derived from TP108 24hr design rainfall maps and factored using climate change allowances and rainfall intensity factors from the AC Stormwater Code of Practice V3 Jan 2022.

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Apron Design

Explanation	Value	Unit
Calculations		
D_o (Pipe Diameter) =	525	mm
S_o (Pipe Gradient) =	2.50%	m/m
Q (Design flow) =	0.675	m^3/s
Q_f (Full flow) =	0.68	m^3/s
k (Roughness coefficient) =	1.50	
Q/Q_f =	0.99	
V_f (Full flow velocity) =	3.15	m/s
V/V_f =	1.01	
V (Design velocity) =	3.20	m/s
y/D_o =	0.95	
d_p (Depth of flow) =	0.50	m
F_o (Froude number) =	1.45	
d_s (Riprap Diameter)=	0.19	m
Apron Design		
D_A (Stone layer thickness) =	0.38	m
W_A (Width) =	1.575	m
L_a (Apron Length) =	5.63	m
D_{50} (Median riprap diameter) =	0.19	m

JN:	33250
Project Name	362 Jones Road
Design By:	FV
Check By:	TB
Council:	AC
Date:	4/12/2025

Fraser Thomas Limited
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PO Box 23273 : Hunters Corner : MANUKAU 2155
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Apron Design

Explanation	Value	Unit
Calculations		
D_o (Pipe Diameter) =	450	mm
S_o (Pipe Gradient) =	1.17%	m/m
Q (Design flow) =	0.317	m^3/s
Q_f (Full flow) =	0.31	m^3/s
k (Roughness coefficient) =	1.50	
Q/Q_f =	1.02	
V_f (Full flow velocity) =	1.95	m/s
V/V_f =	1.00	
V (Design velocity) =	1.95	m/s
y/D_o =	1.00	
d_p (Depth of flow) =	0.45	m
F_o (Froude number) =	0.93	
d_s (Riprap Diameter)=	0.10	m
Apron Design		
D_A (Stone layer thickness) =	0.21	m
W_A (Width) =	1.35	m
L_a (Apron Length) =	3.35	m
D_{50} (Median riprap diameter) =	0.10	m

JN:	33250
Project Name	362 Jones Road
Design By:	FV
Check By:	TB
Council:	AC
Date:	4/12/2025

Project	362 Jones Road
Job No	33250

By	FV	Date	4/12/2025
Checked	SF	Date	4/12/2025

SW Flow - Southern haul Road

Runoff Curve Number (CN) and Initial Abstraction (I_a)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN	Pre-dev area (ha)	Post-dev area (ha)	CN x pre-dev area	CN x post-dev area
Group C	Vegetated area	74			0.00	0.00
Group C	Pasture/grassed/vegetated areas	74	12.550	12.550	928.72	928.72
Group C	Residential roofs/paving	98	0.661	0.661	64.73	64.73
Group C	Roads/access ways	98			0.00	0.00
		Total	13.211	13.211	993	993
		CN (weighted) = total product/total area =			75.2	75.2
		CN (pervious) = pervious product/pervious area =			74	74.0
		I_a (weighted) = 5 x pervious area/total area =			4.75	4.75

Time of Concentration

		Pre	Post	
Channelisation factor	C =	1.0	1	(from TP 108 Table 4.2)
Catchment length	L =	750	750	m (along drainage path)
Catchment length	L =	0.75	0.75	km (along drainage path)
Catchment slope	S_c =	0.022	0.022	m/m
Runoff factor, (CN/200-CN) =		**0.603**	**0.603**	
t_c =	$0.14xCxL^{0.66x}(CN/(200-CN))^{-0.55}xS_c^{-0.30}$ =	0.483	0.48	hrs
SCS Lag for HEC-HMS, $t_p = 2/3\ t_c$ =		0.32	0.32	hrs

Graphical Peak Flow Rate

			Pre	Post	
Catchment Area	A =		0.1321	0.1321	km^2 (from 1 above)
Runoff Curve Number	CN =		75.200	75.200	(from 1 above)
Initial Abstraction	I_a =		4.750	4.750	mm (from 1 above)
Time of Concentration	t_c=		0.48	0.48	hrs (calculated)
Storage	S=	((1000/CN)-10)x25.4	83.8	83.8	mm

Rainfall and Climate Change Allowance

Annual Recurrence Interval (ARI)		2	5	10	50	100
Climate Change Allowance: 3.8 °C		0.274	0.296	0.308	0.319	0.327
Rainfall				150		240

Pre-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**196.2**	**0.0**	**318.5**
Runoff Index, $c^* = (P_{24} - 2 \times I_a)/(P_{24} - 2 \times I_a + 2 \times S)$			**-0.060**	**-0.060**	**0.527**	**-0.060**	**0.648**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#N/A**	**#N/A**	**0.100**	**#N/A**	**0.114**
Peak Flow Rate	$q_p = q^* \times A \times P24$	m^3/s	**#N/A**	**#N/A**	**2.588**	**#N/A**	**4.782**
Runoff Depth		Perv (mm)	**0.30**	**0.30**	**130.36**	**0.30**	**244.01**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**191.15**	**0.00**	**313.38**
Runoff Volume		Perv (m^3)	**37.2**	**37.2**	**16360.0**	**37.2**	**30624.3**
$V_{24} = 1000 \times Q_{24} \times A$		Imper (m^3)	**0.0**	**0.0**	**1262.6**	**0.0**	**2070.0**
		Total (m^3)	**37.2**	**37.2**	**17622.6**	**37.2**	**32694.3**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.125503	74.0	5.0	89.2
Imperv	0.006605	98	0.0	5.2

Post-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**196.2**	**0.0**	**318.5**
Runoff Index, $c^* = (P_{24} - 2 \times I_a)/(P_{24} - 2 \times I_a + 2 \times S)$			**-0.060**	**-0.060**	**0.527**	**-0.060**	**0.648**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#N/A**	**#N/A**	**0.100**	**#N/A**	**0.114**
Peak Flow Rate	$q_p = q^* \times A \times P24$	m^3/s	**#N/A**	**#N/A**	**2.588**	**#N/A**	**4.782**
Runoff Depth		Perv (mm)	**0.30**	**0.30**	**130.36**	**0.30**	**244.01**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**191.15**	**0.00**	**313.38**
Runoff Volume		Perv (m^3)	**37.2**	**37.2**	**16360.0**	**37.2**	**30624.3**
$V_{24} = 1000 \times Q_{24} \times A$		Imper (m^3)	**0.0**	**0.0**	**1262.6**	**0.0**	**2070.0**
		Total (m^3)	**37.2**	**37.2**	**17622.6**	**37.2**	**32694.3**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.125503	74.0	5.0	89.2
Imperv	0.006605	98	0.0	5.2

Peak Flows Summary

ARI (yr event)	Units	2	5	10	50	100
q_p (pre-dev)	m^3/s	#N/A	#N/A	2.588	#N/A	4.78178
q_p (post-dev)	m^3/s	#N/A	#N/A	2.588	#N/A	4.78178
Increase in q_p (post to pre)	m^3/s	#N/A	#N/A	0.000	#N/A	0.000
Increase in q_p (post to pre)	%	#N/A	#N/A	0.00	#N/A	0.00

Runoff Volumes Summary

ARI (yr event)	Units	2	5	10	50	100
Runoff volume (pre-dev)	m^3	37	37	17623	37	32694
Runoff volume (post-dev)	m^3	37	37	17623	37	32694
Increase in Vol (post to pre)	m^3	0	0	0	0	0
Increase in Vol (post to pre)	%	0.00	0.00	0.00	0.00	0.00

EXISTING SOUTHERN CROSSING CULVERT

Headwater Elevation (m)	Total Discharge (cms)	Culvert 1 Discharge (cms)	Roadway Discharge (cms)	Crest Height	Crest Length	Roadway Disharge Depth	Disharge cross sectional area	Velocity on roadway
180.85	2.59	0.68	1.91	180.60	10.25	0.25	2.56	0.75
181.00	4.78	0.71	4.08	180.60	10.25	0.40	4.10	1.00

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 8 2025

Express 100yr Existing Channel Under Proposed Bridge

User-defined

Invert Elev (m)	= 180.7000
Slope (%)	= 1.8000
N-Value	= 0.030

Calculations

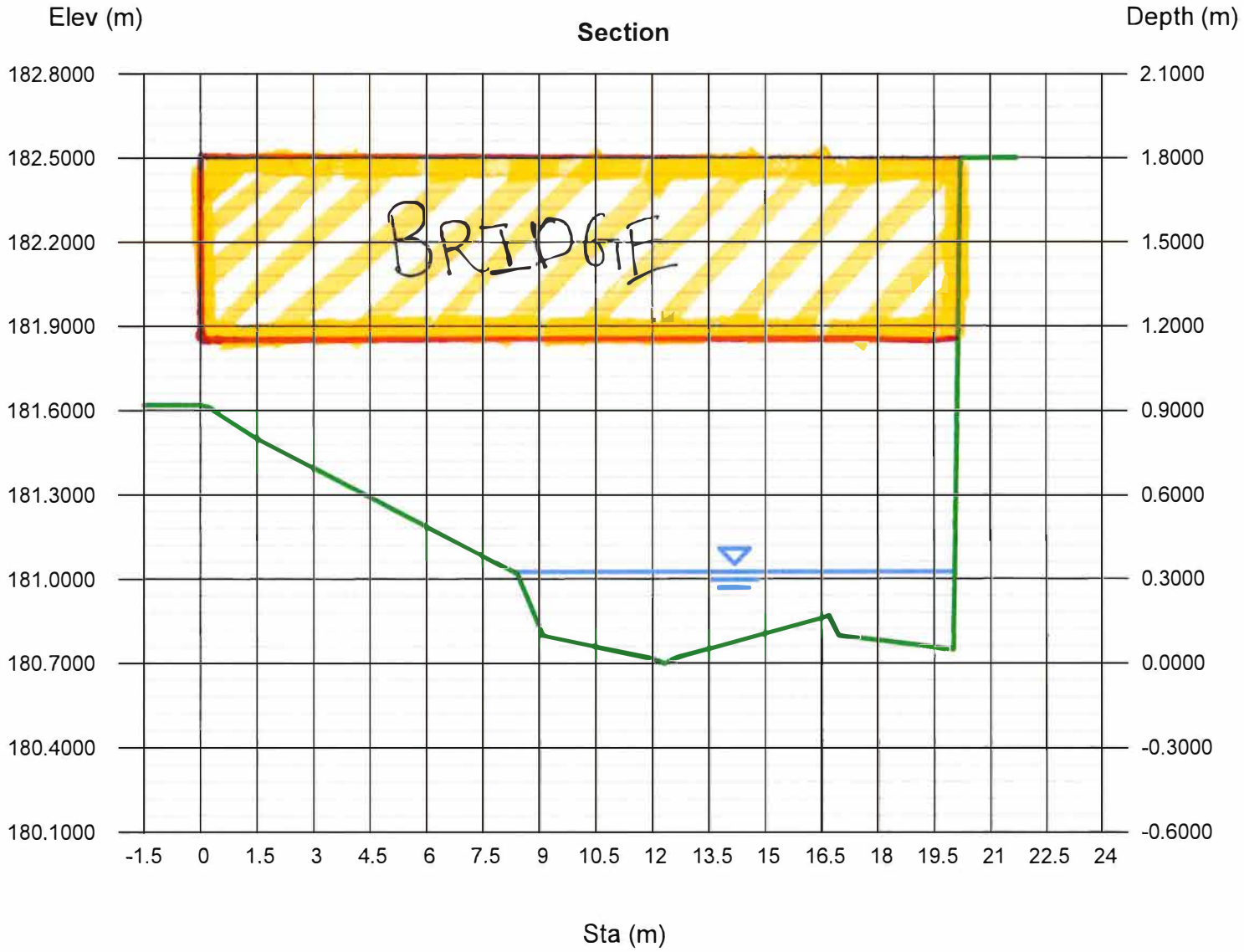
Compute by:	Known Q
Known Q (cms)	= 4.7800

Highlighted

Depth (m)	= 0.3261
Q (cms)	= 4.7800
Area (sqm)	= 2.8147
Velocity (m/s)	= 1.6982
Wetted Perim (m)	= 12.0057
Crit Depth, Yc (m)	= 0.3475
Top Width (m)	= 11.7099
EGL (m)	= 0.4732

(Sta, El, n)-(Sta, El, n)...

(0.0000, 181.6200)-(0.2600, 181.6100, 0.030)-(0.8900, 181.5500, 0.030)-(1.5200, 181.5000, 0.030)-(8.4100, 181.0200, 0.030)-(9.0900, 180.8000, 0.030)-(11.9
-(12.3100, 180.7000, 0.030)-(12.6300, 180.7200, 0.030)-(16.7000, 180.8700, 0.030)-(16.9600, 180.8000, 0.030)-(20.0000, 180.7500, 0.030)-(20.1000, 181.620



Project	362 Jones Road
Job No	33250

By	FV	Date	17/11/2025
Checked		Date	

SW Flow - Southern Catchment - Northern Haul Rd

Runoff Curve Number (CN) and Initial Abstraction (I_a)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN	Pre-dev area (ha)	Post-dev area (ha)	CN x pre-dev area	CN x post-dev area
Group B	Vegetated area	61			0.00	0.00
Group B	Pasture/grassed/vegetated areas	61			0.00	0.00
Group B	Residential roofs/paving	98			0.00	0.00
Group B	Roads/access ways	98		0.070	0.00	6.86
		Total	0.000	0.070	0	7
		CN (weighted) = total product/total area =			#DIV/0!	98.0
		CN (pervious) = pervious product/pervious area =			#DIV/0!	#DIV/0!
		I_a (weighted) = 5 x pervious area/total area =			#DIV/0!	0.00

Time of Concentration

		Pre	Post	
Channelisation factor	C =		0.8	(from TP 108 Table 4.2)
Catchment length	L =		111.7	m (along drainage path)
Catchment length	L =	0	0.1117	km (along drainage path)
Catchment slope	S_c =		0.089	m/m
Runoff factor, (CN/200-CN) =		**#DIV/0!**	**0.961**	
t_c =	$0.14xCxL^{0.66x}(CN/(200-CN))^{-0.55}xS_c^{-0.30}$ =	#DIV/0!	0.17	hrs
SCS Lag for HEC-HMS, $t_p = 2/3\ t_c$ =		#DIV/0!	0.11	hrs

Graphical Peak Flow Rate

			Pre	Post	
Catchment Area	A =		0.0000	0.0007	km^2 (from 1 above)
Runoff Curve Number	CN =		#DIV/0!	98.000	(from 1 above)
Initial Abstraction	I_a =		#DIV/0!	0.000	mm (from 1 above)
Time of Concentration	t_c=		#DIV/0!	0.17	hrs (calculated)
Storage	S=	((1000/CN)-10)x25.4	#DIV/0!	5.2	mm

Rainfall and Climate Change Allowance

Annual Recurrence Interval (ARI)		2	5	10	50	100
Climate Change Allowance: 3.8 °C		0.274	0.296	0.308	0.319	0.327
Rainfall				158		

Pre-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**206.7**	**0.0**	**0.0**
Runoff Index, $c^* = (P_{24} - 2 \times I_a)/(P_{24} - 2 \times I_a + 2 \times S)$			**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Peak Flow Rate	$q_p = q^* \times A \times P24$	m^3/s	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Runoff Depth		Perv (mm)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**201.61**	**0.00**	**0.00**
Runoff Volume		Perv (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$V_{24} = 1000 \times Q_{24} \times A$		Imper (m^3)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		Total (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.000000	#DIV/0!	5.0	#DIV/0!
Imperv	0.000000	98	0.0	5.2

Post-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**206.7**	**0.0**	**0.0**
Runoff Index, $c^* = (P_{24} - 2 \times I_a)/(P_{24} - 2 \times I_a + 2 \times S)$			**0.000**	**0.000**	**0.952**	**0.000**	**0.000**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#N/A**	**#N/A**	**0.188**	**#N/A**	**#N/A**
Peak Flow Rate	$q_p = q^* \times A \times P24$	m^3/s	**#N/A**	**#N/A**	**0.027**	**#N/A**	**#N/A**
Runoff Depth		Perv (mm)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**201.61**	**0.00**	**0.00**
Runoff Volume		Perv (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$V_{24} = 1000 \times Q_{24} \times A$		Imper (m^3)	**0.0**	**0.0**	**141.1**	**0.0**	**0.0**
		Total (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.000000	#DIV/0!	5.0	#DIV/0!
Imperv	0.000700	98	0.0	5.2

Peak Flows Summary

ARI (yr event)	Units	2	5	10	50	100
q_p (pre-dev)	m^3/s	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
q_p (post-dev)	m^3/s	#N/A	#N/A	0.027	#N/A	#N/A
Increase in q_p (post to pre)	m^3/s	#N/A	#N/A	#DIV/0!	#N/A	#N/A
Increase in q_p (post to pre)	%	#N/A	#N/A	#DIV/0!	#N/A	#N/A

Runoff Volumes Summary

ARI (yr event)	Units	2	5	10	50	100
Runoff volume (pre-dev)	m^3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Runoff volume (post-dev)	m^3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Increase in Vol (post to pre)	m^3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Increase in Vol (post to pre)	%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 8 2025

Haul Road Drain Southern Catchment 10yr

Trapezoidal

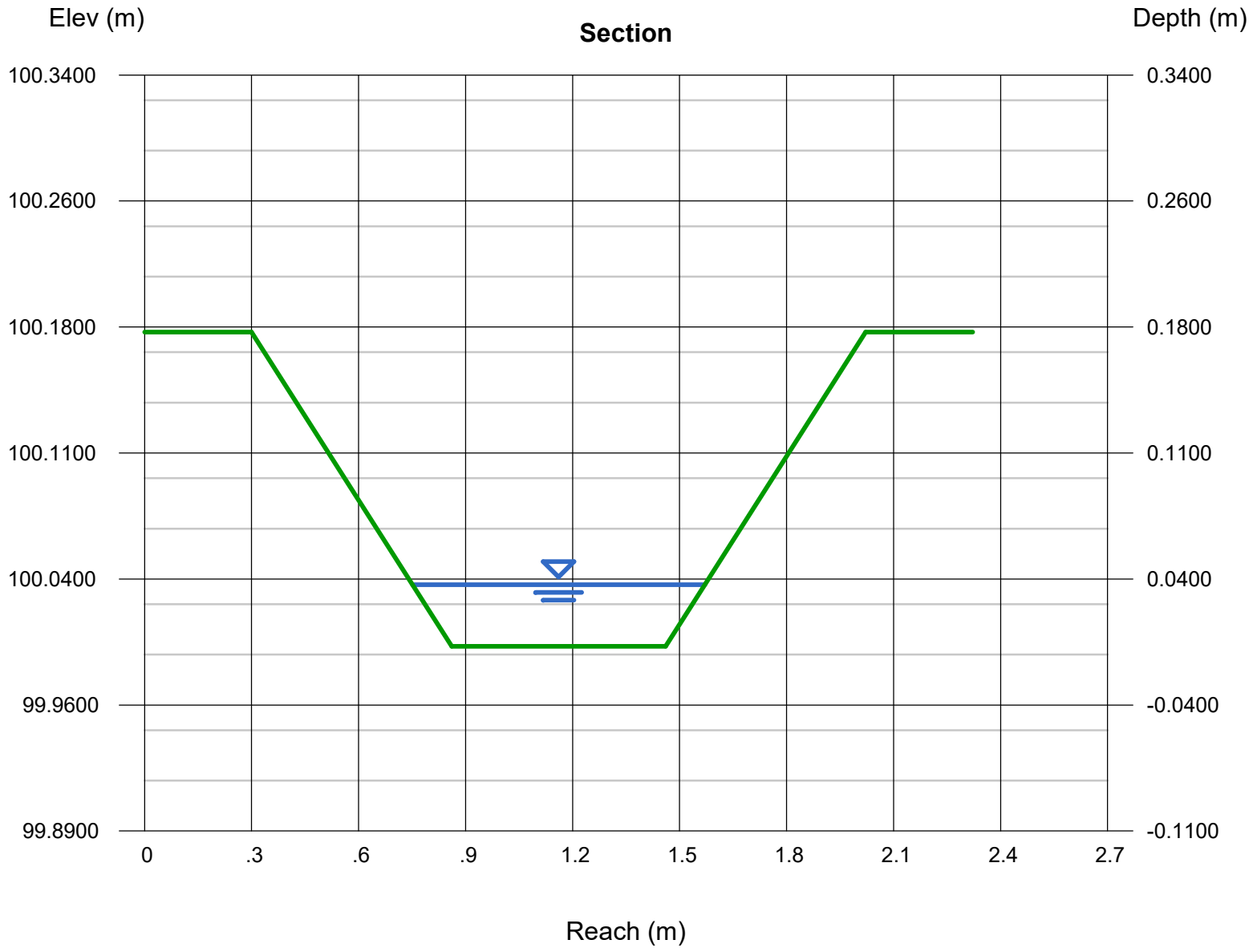
Bottom Width (m)	= 0.6000
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.1870
Invert Elev (m)	= 100.0000
Slope (%)	= 12.5000
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.0270

Highlighted

Depth (m)	= 0.0366
Q (cms)	= 0.027
Area (sqm)	= 0.0260
Velocity (m/s)	= 1.0401
Wetted Perim (m)	= 0.8313
Crit Depth, Yc (m)	= 0.0549
Top Width (m)	= 0.8195
EGL (m)	= 0.0918



Project	362 Jones Road
Job No	33250

By	FV	Date	17/11/2025
Checked		Date	

SW Flow - Northern Catchment - Northern Haul Rd

Runoff Curve Number (CN) and Initial Abstraction (I_a)

Soil name and classification	Cover description (cover type, treatment, and hydrologic condition)	Curve Number CN	Pre-dev area (ha)	Post-dev area (ha)	CN x pre-dev area	CN x post-dev area
Group B	Vegetated area	61			0.00	0.00
Group B	Pasture/grassed/vegetated areas	61			0.00	0.00
Group B	Residential roofs/paving	98			0.00	0.00
Group B	Roads/access ways	98		0.046	0.00	4.51
		Total	0.000	0.046	0	5
		CN (weighted) = total product/total area =			#DIV/0!	98.0
		CN (pervious) = pervious product/pervious area =			#DIV/0!	#DIV/0!
		I_a (weighted) = 5 x pervious area/total area =			#DIV/0!	0.00

Time of Concentration

		Pre	Post	
Channelisation factor	C =		0.8	(from TP 108 Table 4.2)
Catchment length	L =		79	m (along drainage path)
Catchment length	L =	0	0.079	km (along drainage path)
Catchment slope	S_c =		0.050	m/m
Runoff factor, (CN/200-CN) =		**#DIV/0!**	**0.961**	
t_c = $0.14xCxL^{0.66x}(CN/(200-CN))^{-0.55}xS_c^{-0.30}$ =		#DIV/0!	0.17	hrs
SCS Lag for HEC-HMS, $t_p = 2/3\ t_c$ =		#DIV/0!	0.11	hrs

Graphical Peak Flow Rate

			Pre	Post	
Catchment Area	A =		0.0000	0.0005	km^2 (from 1 above)
Runoff Curve Number	CN =		#DIV/0!	98.000	(from 1 above)
Initial Abstraction	I_a =		#DIV/0!	0.000	mm (from 1 above)
Time of Concentration	t_c=		#DIV/0!	0.17	hrs (calculated)
Storage	S=	((1000/CN)-10)x25.4	#DIV/0!	5.2	mm

Rainfall and Climate Change Allowance

Annual Recurrence Interval (ARI)		2	5	10	50	100
Climate Change Allowance: 3.8 °C		0.274	0.296	0.308	0.319	0.327
Rainfall				158		

Pre-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**206.7**	**0.0**	**0.0**
Runoff Index, $c^* = (P_{24} - 2 \times I_a)/(P_{24} - 2 \times I_a + 2 \times S)$			**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Peak Flow Rate	$q_p = q^* \times A \times P24$	m^3/s	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
Runoff Depth		Perv (mm)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**201.61**	**0.00**	**0.00**
Runoff Volume		Perv (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$V_{24} = 1000 \times Q_{24} \times A$		Imper (m^3)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
		Total (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.000000	#DIV/0!	5.0	#DIV/0!
Imperv	0.000000	98	0.0	5.2

Post-development

ARI (yr event)		Units	2	5	10	50	100
24 hour rainfall depth	P_{24}	mm	**0.0**	**0.0**	**206.7**	**0.0**	**0.0**
Runoff Index, $c^* = (P_{24} - 2 \times I_a)/(P_{24} - 2 \times I_a + 2 \times S)$			**0.000**	**0.000**	**0.952**	**0.000**	**0.000**
Specific Peak Flow Rate q* (from Fig 5.1)		$m^3/s/(km^2.mm)$	**#N/A**	**#N/A**	**0.188**	**#N/A**	**#N/A**
Peak Flow Rate	$q_p = q^* \times A \times P24$	m^3/s	**#N/A**	**#N/A**	**0.018**	**#N/A**	**#N/A**
Runoff Depth		Perv (mm)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$Q_{24} = (P_{24} - I_a)^2/((P_{24} - I_a) + S)$		Imperv (mm)	**0.00**	**0.00**	**201.61**	**0.00**	**0.00**
Runoff Volume		Perv (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
$V_{24} = 1000 \times Q_{24} \times A$		Imper (m^3)	**0.0**	**0.0**	**92.7**	**0.0**	**0.0**
		Total (m^3)	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Data	Area (km^2)	CN	I_a (mm)	S (mm)
Perv	0.000000	#DIV/0!	5.0	#DIV/0!
Imperv	0.000460	98	0.0	5.2

Peak Flows Summary

ARI (yr event)	Units	2	5	10	50	100
q_p (pre-dev)	m^3/s	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
q_p (post-dev)	m^3/s	#N/A	#N/A	0.018	#N/A	#N/A
Increase in q_p (post to pre)	m^3/s	#N/A	#N/A	#DIV/0!	#N/A	#N/A
Increase in q_p (post to pre)	%	#N/A	#N/A	#DIV/0!	#N/A	#N/A

Runoff Volumes Summary

ARI (yr event)	Units	2	5	10	50	100
Runoff volume (pre-dev)	m^3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Runoff volume (post-dev)	m^3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Increase in Vol (post to pre)	m^3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Increase in Vol (post to pre)	%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Dec 8 2025

Haul Road Drain Northern Catchment 10yr

Trapezoidal

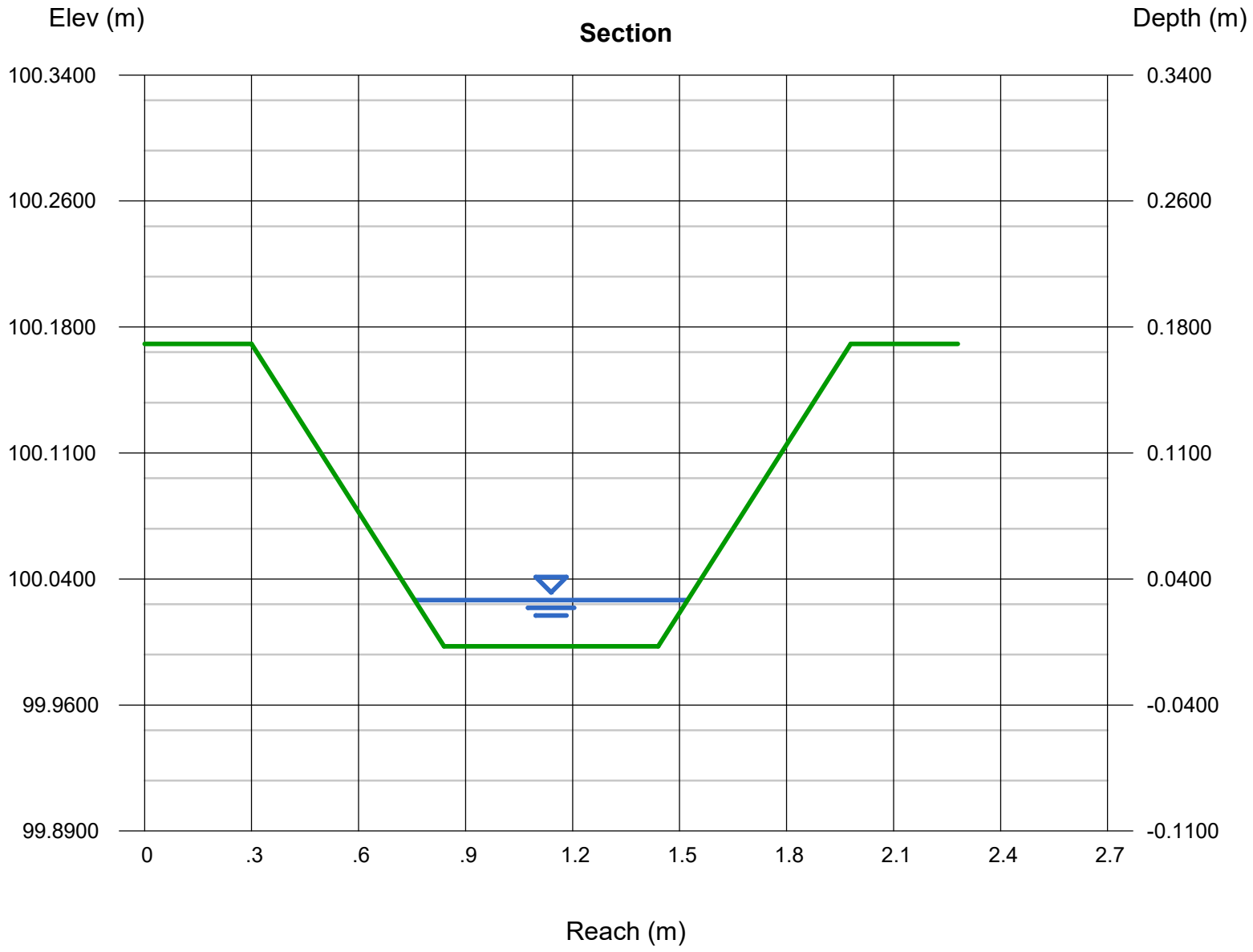
Bottom Width (m)	= 0.6000
Side Slopes (z:1)	= 3.0000, 3.0000
Total Depth (m)	= 0.1800
Invert Elev (m)	= 100.0000
Slope (%)	= 12.5000
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.0180

Highlighted

Depth (m)	= 0.0274
Q (cms)	= 0.018
Area (sqm)	= 0.0187
Velocity (m/s)	= 0.9617
Wetted Perim (m)	= 0.7735
Crit Depth, Yc (m)	= 0.0427
Top Width (m)	= 0.7646
EGL (m)	= 0.0746



Without check dam

Project	**362 Jones Road**		
Job No	33250		
Swale	Swale 1		
Gradient (%)	1.0%	***Underdrain required***	
10% 24h AEP Rainfall (mm)	158	*From TP108 rainfall charts*	

By	FV	Date	14/11/2025
Checked		Date	

BLUE CELL = INPUT

No Check dams (grade <5%)

Design for Water Quality Flow

Step 1: Calculate water quality runoff (Q_{WQ})

Rainfall Rate (mm/hr)	10	
Treatment Area (m^2)	1125	*Impervious only*
Runoff Coefficient	0.95	*Recommended 0.95 in GD01*
Q_{WQ} (L/s)	3.0	

Step 2: Select Swale Parameters

n	0.25	*0.25 for WQF*
Side slope (1V:zH)	5	*3-5 planted, >5 grassed*
Flow depth (m)	0.072	*max 0.1m grassed & 0.3m vegetated*
Base width (m)	0.600	*min. 0.6m, max 2.0m*

Step 3: Determine T, A and R

T (m)	1.32	*Water surface width*
A (m^2)	0.07	*Cross-sectional area*
R (m)	0.05	*Hydraulic radius*

Step 4: Determine swale velocity, flow & HRT

Available Length (m)	36	
Effective Length (m)	36.0	*$(L_1 Q_1 + L_2 Q_2)/Q_{total}$ or L/2 for continuous lateral inflow*
Swale velocity (m/s)	0.06	*< 0.8m/s*
HRT (min)	10.9	*> 9min to achieve WQ treatment*

Design for 10% AEP storm conveyance

Step 1: Calculate 10% AEP runoff

Rainfall Intensity (mm/hr)	67.8	*Adjusted for CC and 10min storm*
Area (Imp)	1125	*From WQF*
Area (pervious)	500	*Recommended C = 0.5 in GD01*
$Q_{10\%}$ (L/s)	24.8	

Step 2: Apply **SOLVER** to determine required flow depth

Q (L/s)	24.8	
n	0.03	*0.25 for vegetated, 0.03 for grassed*
Swale grade (%)	1.0%	
Side slope (1V:zH)	5	*From WQF*
Flow depth (m)	0.063	
Base width (m)	0.600	*From WQF*
Solver Parameter (Qdiff)	0.0	*Adjusts depth until Q matches*

Step 3: Determine T, A and R

T (m)	1.23	*Water surface width*
A (m^2)	0.06	*Cross-sectional area*
R (m)	0.05	*Hydraulic radius*

Step 4: Determine swale velocity, flow & Overall Dimensions

Swale velocity (m/s)	0.43	*< 1.5m/s*
Swale total depth (m)	0.21	*150mm free board above flow depth (if not in OLFP)*
Swale total width (m)	2.73	

A3: Water Use

Hunua Nursery/Bowling Club (AC Station 750010)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Oct-Apr	Nov-Mar
1980	140.7	126.6	125.2	63.6	72.0	139.3	154.0	115.9	90.2	52.3	72.2	89.5	1241.4	670.1	554.2
1981	55.2	43.9	40.6	252.8	29.5	187.0	129.7	157.3	134.2	102.0	154.1	99.9	1386.2	748.5	393.7
1982	58.2	101.5	126.4	152.3	104.4	53.0	95.4	52.6	103.4	119.2	25.4	93.2	1084.9	676.2	404.7
1983	64.7	50.5	76.8	136.9	78.4	102.4	71.0	90.0	124.1	191.9	38.0	157.3	1182.0	716.1	387.4
1984	121.2	70.1	195.3	44.7	106.2	104.2	134.8	147.8	80.4	36.6	113.9	144.7	1300.0	726.5	645.2
1985	129.0	187.2	122.1	96.1	156.1	198.6	183.1	105.3	109.1	56.7	133.4	170.0	1646.7	894.5	741.7
1986	283.8	114.8	50.2	62.5	119.5	77.8	184.9	162.0	80.5	145.5	83.4	54.7	1419.5	794.9	586.9
1987	87.7	71.3	160.3	131.6	101.0	125.8	185.6	175.4	28.7	109.2	97.6	156.4	1430.7	814.1	573.3
1988	7.3	86.7	264.7	23.1	143.1	93.0	213.2	198.0	104.6	112.5	94.6	215.3	1555.9	804.1	668.6
1989	257.0	50.6	47.7	106.4	109.6	148.1	85.0	146.0	165.6	200.7	100.0	84.5	1501.2	846.9	539.9
1990	76.6	15.0	92.5	115.6	148.0	124.0	211.7	202.3	92.0	167.0	193.7	36.8	1475.3	697.2	414.7
1991	72.9	101.0	55.8	178.9	49.9	120.0	166.4	238.9	174.6	102.4	121.1	98.7	1480.7	730.9	449.5
1992	126.3	64.0	48.0	66.5	134.9	88.6	209.2	279.1	102.6	173.2	107.0	95.8	1495.2	680.8	441.1
1993	54.1	30.5	53.6	86.6	133.8	212.1	28.6	152.2	74.7	52.1	126.9	56.0	1061.2	459.8	321.1
1994	46.1	33.1	43.9	85.5	118.1	126.3	219.6	120.5	227.8	148.5	38.1	23.5	1231.1	418.7	184.8
1995	70.5	125.9	177.1	71.7	111.7	200.4	256.4	106.8	126.9	108.3	118.6	155.9	1630.2	827.9	647.9
1996	23.4	63.0	94.6	177.9	133.6	248.0	201.2	193.6	132.1	58.4	80.2	202.2	1608.2	699.7	463.4
1997	22.7	41.0	107.5	92.5	127.9	169.6	62.8	119.5	252.8	110.5	95.3	76.5	1278.6	545.9	343.0
1998	14.0	113.5	82.3	45.4	105.2	146.4	396.6	163.4	106.0	131.7	89.3	53.5	1447.4	529.7	352.6
1999	151.7	33.3	83.2	91.3	74.0	124.0	193.0	166.0	71.0	88.8	176.7	49.5	1302.5	674.5	494.4
2000	111.9	12.1	57.5	198.0	88.3	172.0	193.3	129.6	98.4	90.1	101.5	93.2	1345.9	664.3	376.2
2001	43.8	135.5	34.7	174.1	281.2	88.4	122.4	159.7	93.3	121.9	144.3	229.6	1628.8	883.8	587.8
2002	61.5	63.6	111.7	79.5	104.2	162.6	187.4	111.7	121.6	107.6	92.6	124.5	1328.3	640.8	453.7
2003	166.5	102.2	113.2	50.0	119.6	165.1	109.7	105.8	234.6	161.6	92.9	102.9	1524.2	789.4	577.7
2004	73.9	325.8	18.8	25.1	221.0	177.7	117.5	125.3	104.7	146.4	92.7	203.0	1631.9	885.7	714.2
2005	30.8	84.5	106.5	22.5	184.3	126.9	174.7	71.7	119.6	212.6	59.7	137.5	1331.2	654.1	419.0
2006	99.9	19.2	66.0	220.5	224.6	125.6	108.6	156.0	55.8	151.3	126.8	67.7	1422.1	751.5	379.8
2007	142.4	0.6	181.3	94.8	37.1	125.4	218.2	136.5	73.0	150.0	85.9	105.5	1350.6	760.5	515.7
2008	18.8	48.5	52.5	134.5	96.0	188.0	367.9	254.3	66.9	123.8	93.7	119.0	1563.8	590.8	332.4
2009	70.0	190.5	53.0	63.5	146.0	121.2	173.7	126.2	131.9	149.6	53.4	91.3	1370.2	671.3	458.2
2010	66.7	55.1	20.5	48.7	168.9	246.2	124.0	297.6	180.7	55.7	60.2	111.2	1435.6	418.1	313.7
2011	320.1	28.3	205.6	121.6	176.8	170.9	157.3	85.0	116.9	143.7	62.8	192.2	1781.3	1074.4	809.0
2012	82.7	79.0	141.4	56.9	121.0	129.9	236.0	137.1	125.0	114.0	48.5	106.0	1377.3	628.4	457.6
2013	12.5	24.5	35.5	139.0	220.2	161.3	49.8	145.2	178.0	54.0	72.5	160.3	1252.8	498.3	305.2
2014	69.7	12.0	46.1	146.5	94.3	217.2	189.3	101.9	149.3	118.7	77.2	103.1	1325.4	573.3	308.2
2015	15.7	52.4	108.5	138.5	198.8	102.5	160.7	165.7	134.3	75.1	118.1	46.3	1316.8	554.8	341.1
2016	137.6	155.0	88.4	62.8	158.8	160.7	200.8	117.8	161.8	118.3	126.5	36.7	1525.1	725.2	544.1
2017	54.6	147.6	419.3	275.9	124.6	97.1	263.8	147.9	181.8	134.0	61.1	31.8	1939.4	1124.2	714.3
2018	172.3	207.9	78.0	155.1	190.5	240.8	164.9	188.7	57.7	NaN	118.1	NaN	1574.1		
2019	NaN	NaN	NaN	102.3	103.6	108.8	173.1	219.4	129.0	173.7	54.9	91.7	1156.3		
2020	9.3	14.9	39.3	54.2	163.0	255.2	122.0	145.5	55.8	50.9	156.0	36.7	1102.8	361.3	256.2
2021	85.9	69.7	71.2	108.1	82.5	173.9	143.2	126.1	212.5	183.0	105.0	93.5	1454.4	716.3	425.2
2022	10.5	52.7	115.9	20.3	130.9	152.8	316.6	143.4	171.3	161.2	170.5	100.7	1546.8	631.8	450.3
2023	342.9	301.5	80.4	98.7	296.9	129.5	143.7	107.4	188.8	134.6	92.9	183.3	2100.6	1234.3	1001.1
2024	71.5	70.7	102.4	104.3	132.1	131.3	121.4	122.3	142.1	146.6	100.4	99.5	1344.6	695.5	444.5
2025	49.7	29.5	46.9	203.2	175.5	272.4	264.1	105.8	191.5	209.5			1548.1	538.8	126.0
Average	93.0	84.6	98.7	108.3	134.7	152.0	173.6	148.4	127.3	123.4	98.4	108.7	1435.6	705.1	475.4
Min	7.3	0.6	18.8	20.3	29.5	53.0	28.6	52.6	28.7	36.6	25.4	23.5	1061.2	361.3	126.0
Max	342.9	325.8	419.3	275.9	296.9	272.4	396.6	297.6	252.8	212.6	193.7	229.6	2100.6	1234.3	1001.1
5th perc.	10.9	12.6	34.8	23.6	55.4	88.4	64.9	86.3	56.3	52.1	40.2	36.7	1116.2	424.9	263.5
10th perc.	14.7	16.7	39.8	45.1	76.2	95.1	90.2	103.6	68.9	54.7	54.0	39.7	1206.5	507.7	309.8
20th perc.	29.3	30.3	47.6	56.9	96.0	108.8	121.4	107.4	80.5	86.0	62.5	55.5	1300.0	565.9	342.2
														749.7	528.1

DC % from rain	
94.0	90.0
48.2	23.9
164.6	189.6
56.7	49.9
67.7	58.7
75.5	64.8

Dust water demand less rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Oct-Apr	Nov-Mar
Avg	-5.2	21.3	24.1	-4.4	-11.9	-38.2	-55.8	-25.6	-8.5	-5.7	20.4	-15.9		44.6	52.7
	-5.2	21.3	24.1								20.4	-15.9	44.8		
	-5.2	21.3	24.1	-4.4						-5.7	20.4	-15.9	34.7		
5th perc.	76.9	93.3	88.0	80.3						65.7	78.6	56.1	538.8	324.9	264.6
10th perc.	73.1	89.2	83.0	58.8						63.1	64.8	53.1	485.2	242.0	218.3
20th perc.	58.5	75.6	75.2	47.0						31.8	56.4	37.3	381.7	183.8	185.9

Notes:

1. Rainfall recorded 00:00 to 00:00 the following day
2. Dust control demand based on 5 mm/d over 5.55 days per wk less holidays

Mth	Days	Work days/mth	Holidays	Water appl. days	Water (mm)	Water (mm)	Water (mm)	
Jan	31	24.6	7	17.6	87.8	87.8	87.8	3 stat days + 4 other days
Feb	28	22.2	1	21.2	105.9	105.9	105.9	
Mar	31	24.6	0	24.6	122.8	122.8	122.8	
Apr	30	23.8	3	20.8	103.8	103.8		Assumed Easter in April
May	31	24.6	0	24.6	122.8			
Jun	30	23.8	1	22.8	113.8			
Jul	31	24.6	1	23.6	117.8			
Aug	31	24.6	0	24.6	122.8			
Sep	30	23.8	0	23.8	118.8			
Oct	31	24.6	1	23.6	117.8	117.8		
Nov	30	23.8	0	23.8	118.8	118.8	118.8	
Dec	31	24.6	6	18.6	92.8	92.8	92.8	2 stat days + 4 other days
Total	365.0	289.2	20.0	269.2	1345.8	749.7	528.1	
	Jan-Apr+Oct-Dec			149.9				
	Jan-Mar+Nov-Dec			105.6				

Water demand - dust suppression

					Estimated Annual Demand (m3/year)									
					Oct-Apr inclusive					Nov-Mar inclusive				
Stage	**Haul Road (m^2)**	**Access Road + Tip Head (m^2)**	**Total (m^2)**	**Maximum Daily Water Usage – Oct-Apr (m3/d)**	**No rainfall allowance**	**Avg rainfall**	**20th perc yr**	**10th perc yr**	**5th perc yr**	**No rainfall allowance**	**Avg rainfall**	**20th perc yr**	**10th perc yr**	**5th perc yr**
N1	3,271	8,270	11,541	57.7	8653	515	2122	2793	3749	6095	608	2145	2519	3053
N2	3,271	4,839	8,110	40.6	6080	362	1491	1963	2635	4283	427	1508	1770	2146
N3	3,271	6,818	10,089	50.4	7564	450	1855	2442	3277	5328	531	1876	2202	2669
N4	3,271	3,603	6,874	34.4	5154	307	1264	1664	2233	3630	362	1278	1500	1819
N5	3,271	1,520	4,791	24.0	3592	214	881	1160	1556	2530	252	891	1046	1268
S	3,271	1,263	4,534	22.7	3399	202	833	1097	1473	2394	239	843	990	1200

Note: Haul road areas counts the gravelled areas only for which dust control may be required - it excludes the sealed site entrance and bridge deck which will be sealed.

Checking %s same as above - OK

%									
94.0%	75.5%	67.7%	56.7%		90.0%	64.8%	58.7%	49.9%	
94.0%	75.5%	67.7%	56.7%		90.0%	64.8%	58.7%	49.9%	
94.0%	75.5%	67.7%	56.7%		90.0%	64.8%	58.7%	49.9%	
94.0%	75.5%	67.7%	56.7%		90.0%	64.8%	58.7%	49.9%	
94.0%	75.5%	67.7%	56.7%		90.0%	64.8%	58.7%	49.9%	
94.0%	75.5%	67.7%	56.7%		90.0%	64.8%	58.7%	49.9%	

Combined

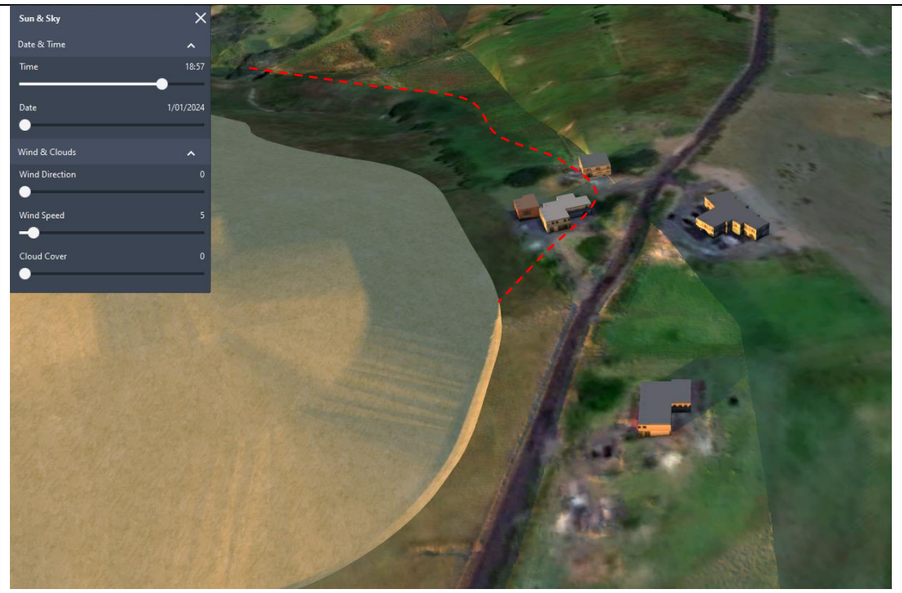
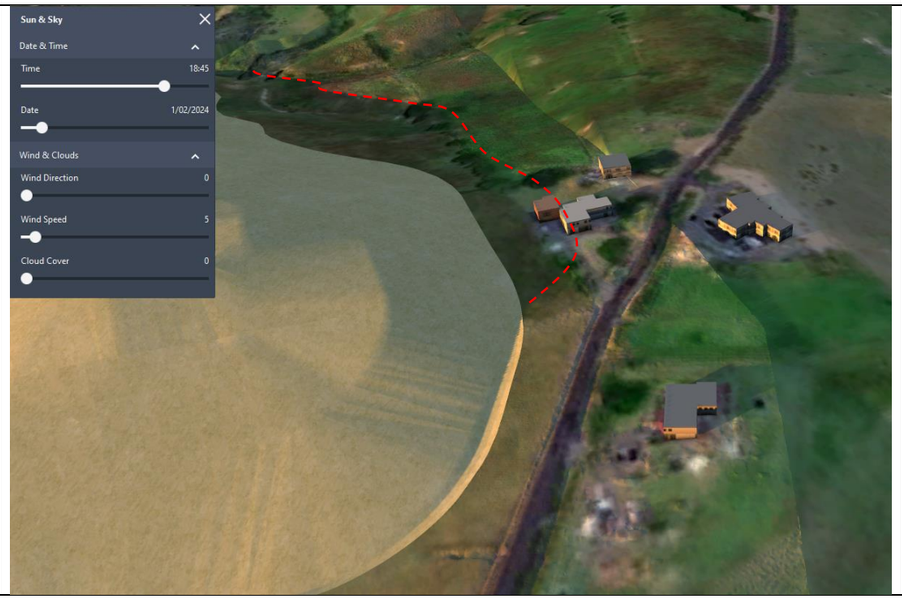
	Oct-Apr inclusive					Vehicle washing		Combined worst cases		
Stage	**No rainfall allowance**	**Avg rainfall**	**20th perc yr**	**10th perc yr**	**5th perc yr**	**Water Blaster**	**Wheel wash**	**NRA + WB**	**5th perc + WB**	**5th perc + WW**
N1	8653	515	2122	2793	3749	790	198	9443	4539	3947
N2	6080	362	1491	1963	2635	790	198	6870	3425	2832
N3	7564	450	1855	2442	3277	790	198	8354	4067	3475
N4	5154	307	1264	1664	2233	790	198	5944	3023	2431
N5	3592	214	881	1160	1556	790	198	4382	2346	1754
S	3399	202	833	1097	1473	790	198	4189	2263	1670

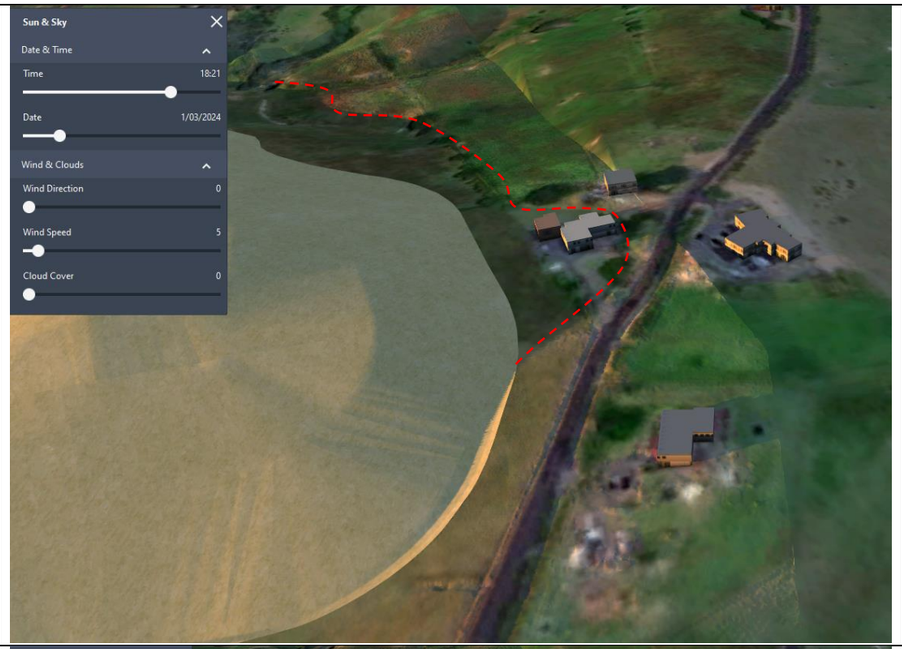
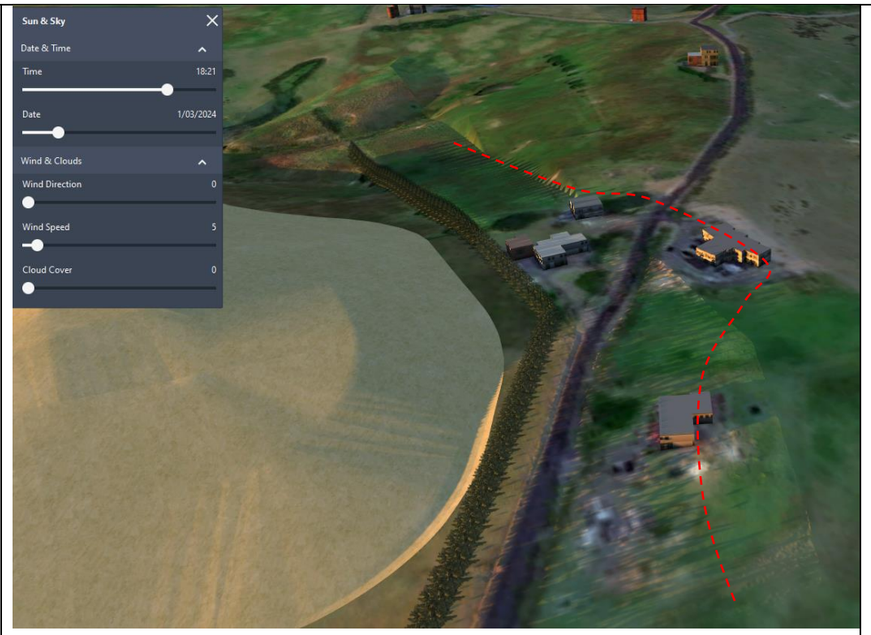
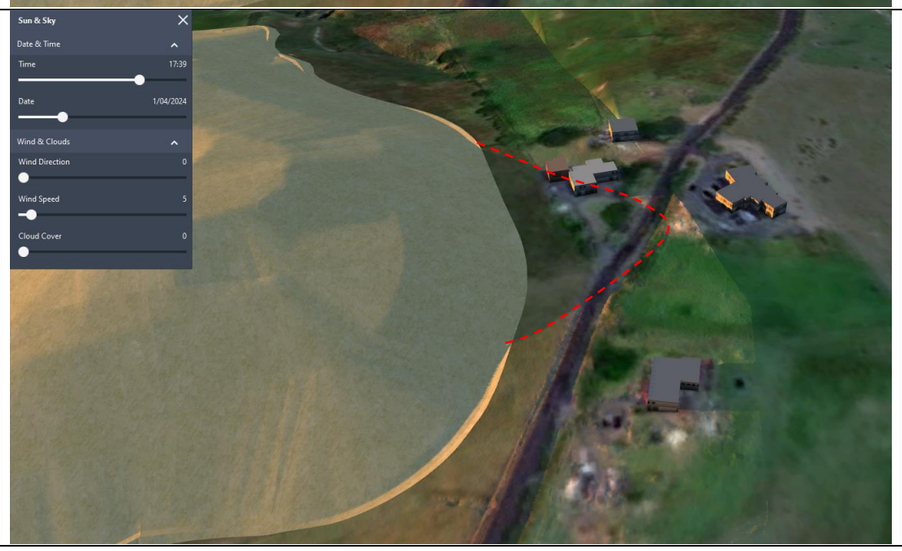
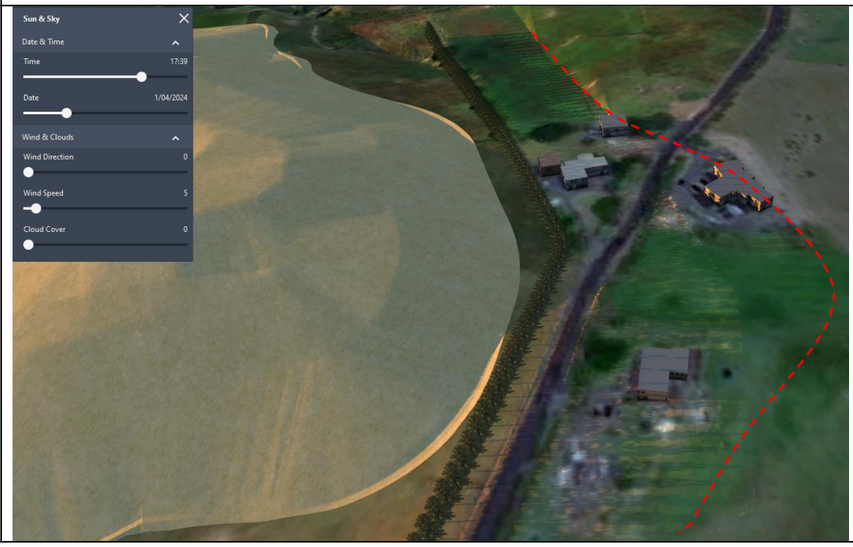
Notes: NRA =no rainfall allowance
WB = water blaster; WW = wheel wash

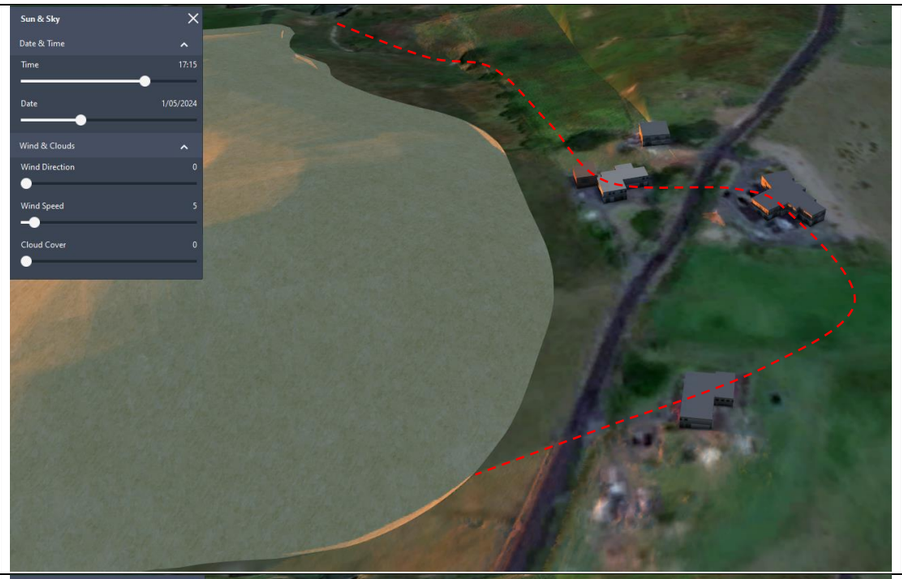
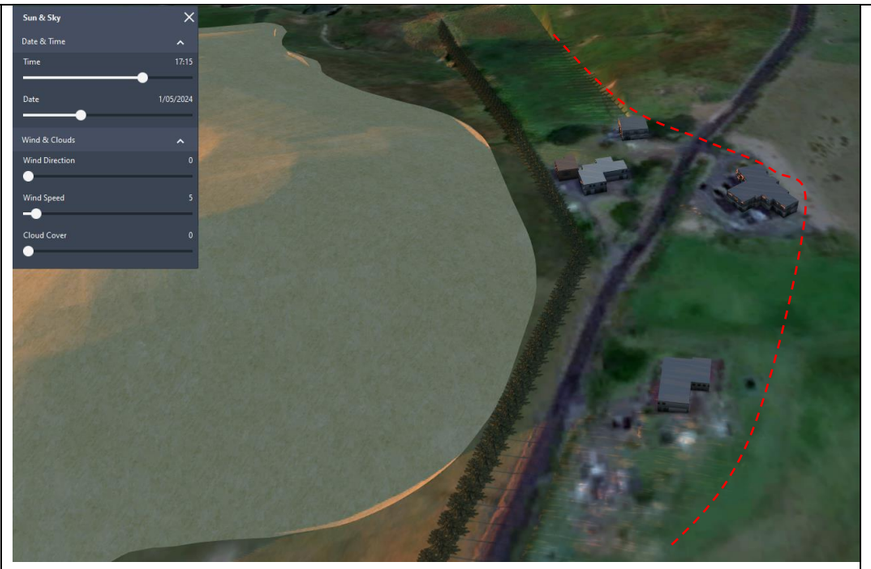
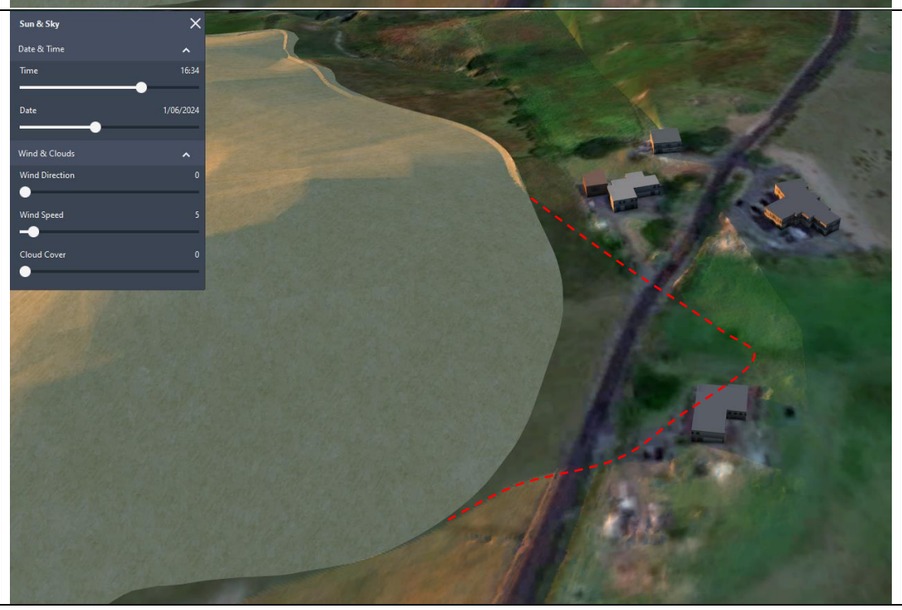
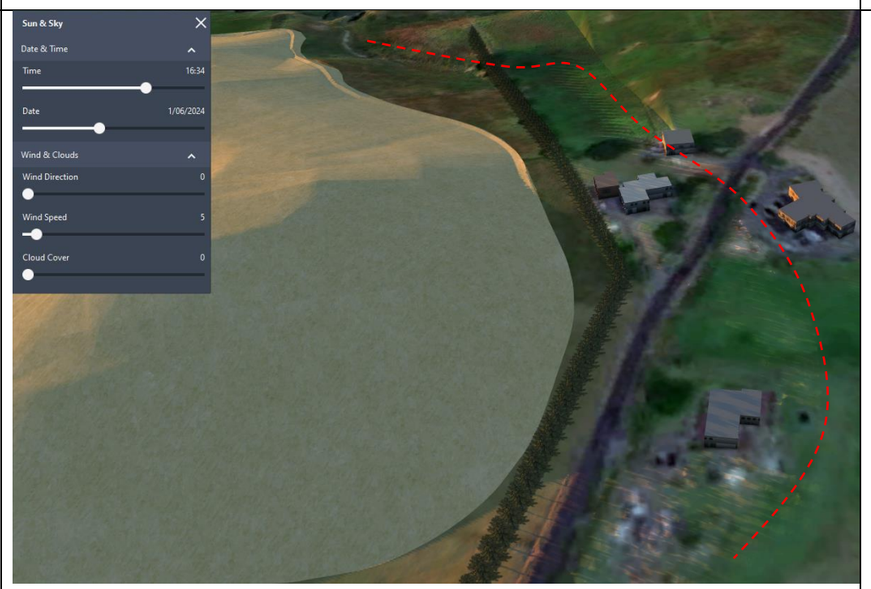
		Annual demand (m3/yr)	
Stage	Maximum Daily Water Usage – Oct-Apr (m3/d)	5th perc + WB	5th perc + WW
N1	60.1	4539	3947
N2	43.0	3425	2832
N3	52.8	4067	3475
N4	36.8	3023	2431
N5	26.4	2346	1754
S	25.1	2263	1670

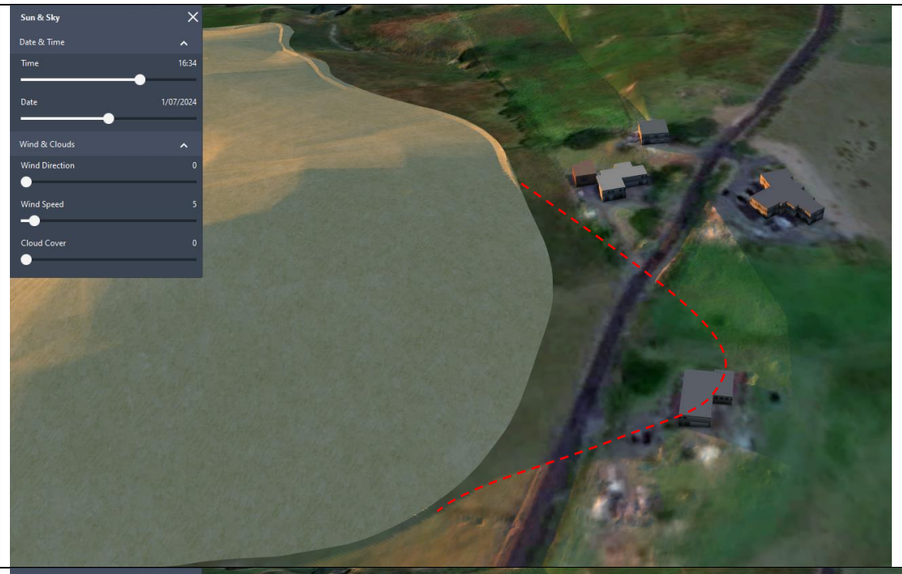
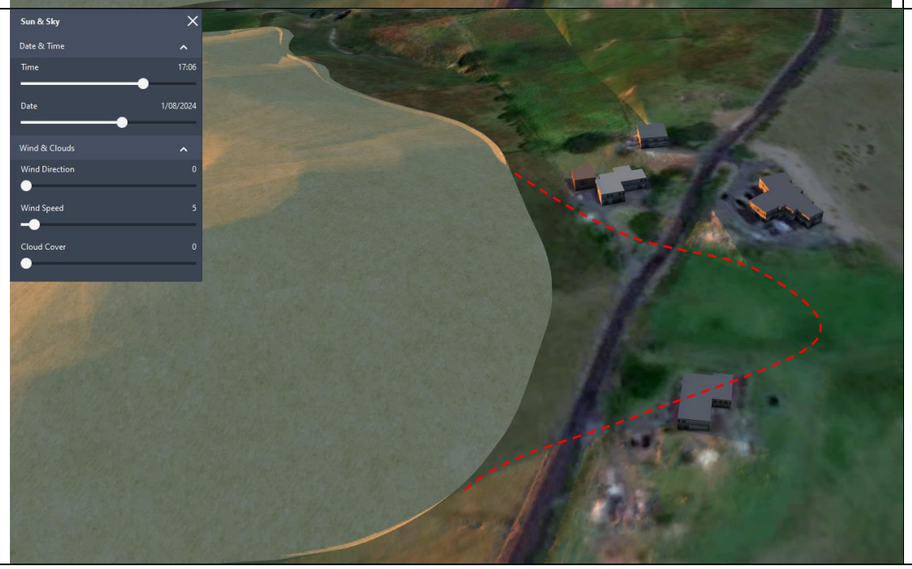
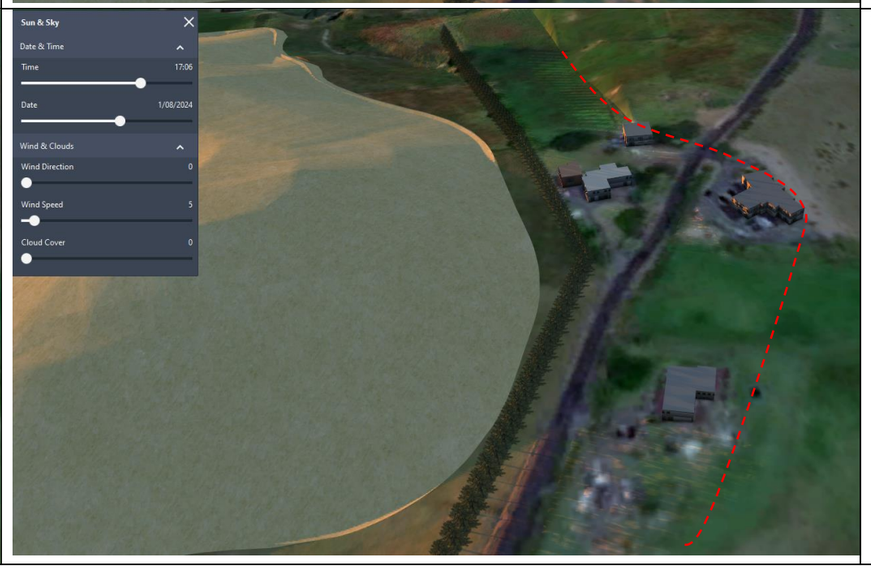
Appendix B

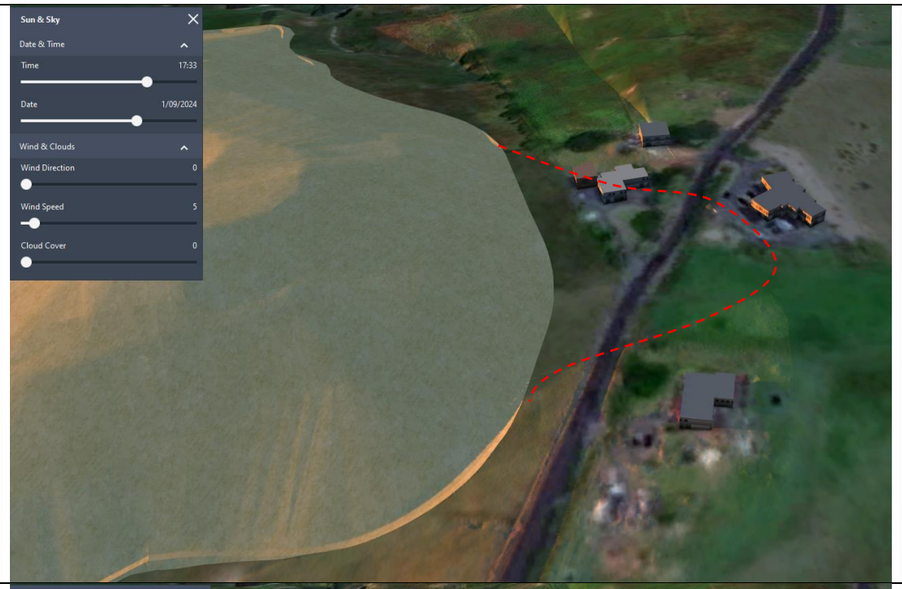
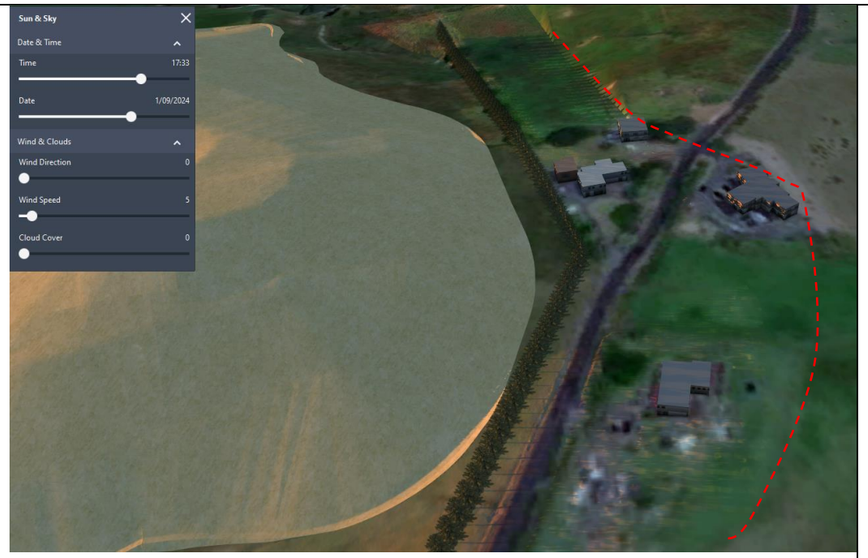
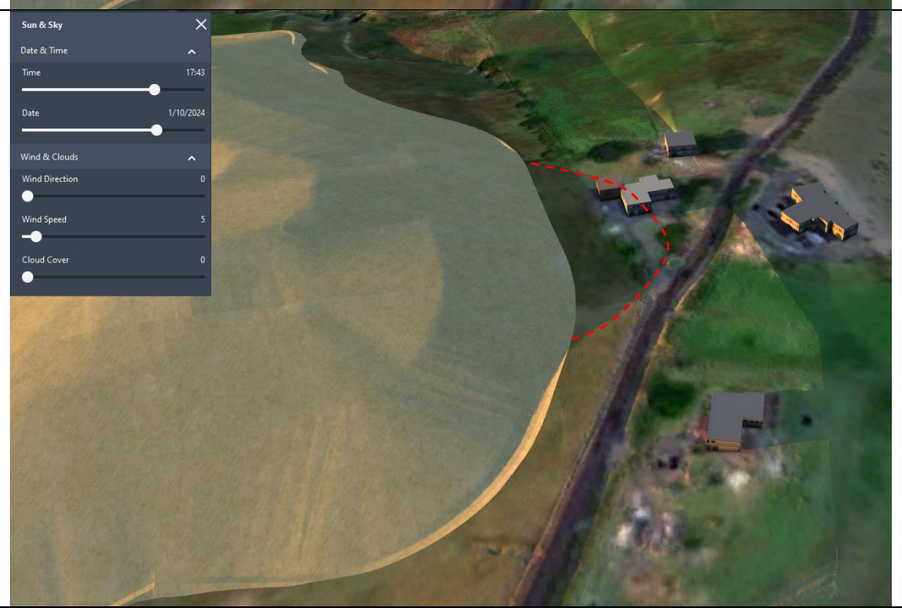
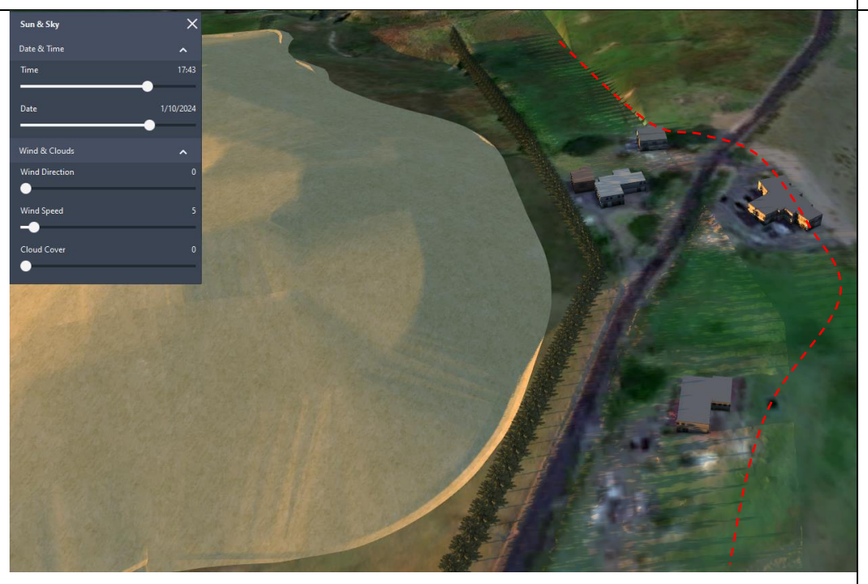
Shadow Analysis

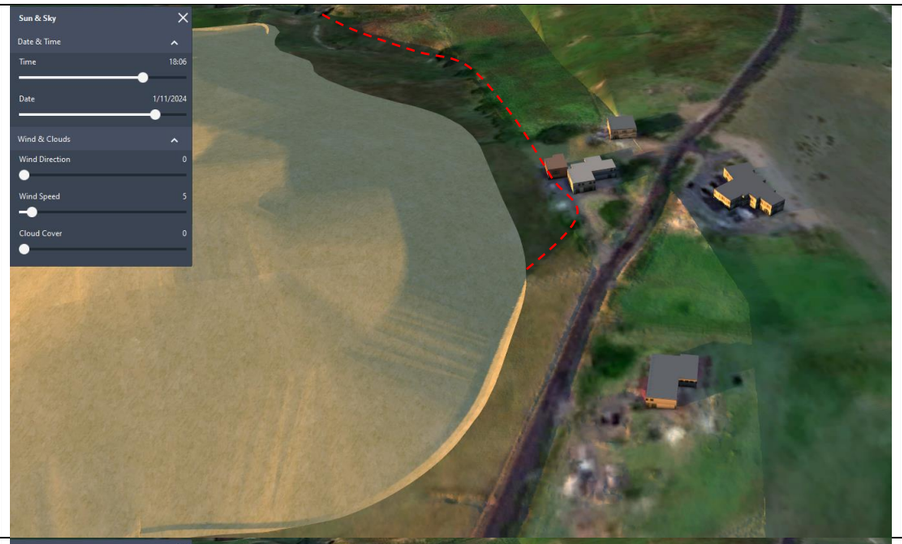
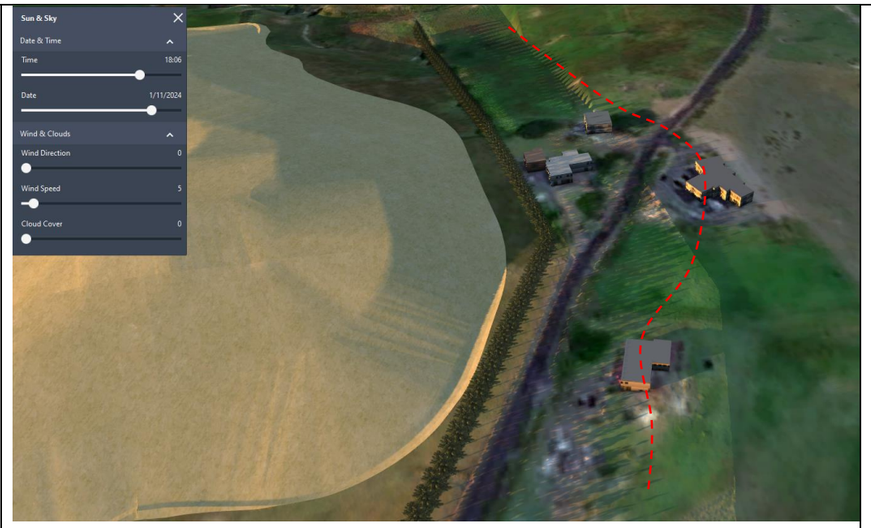
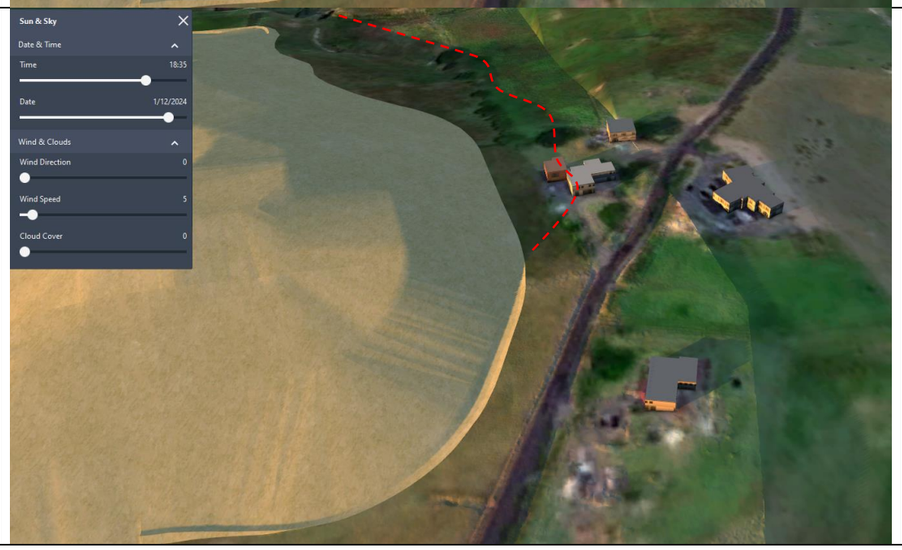
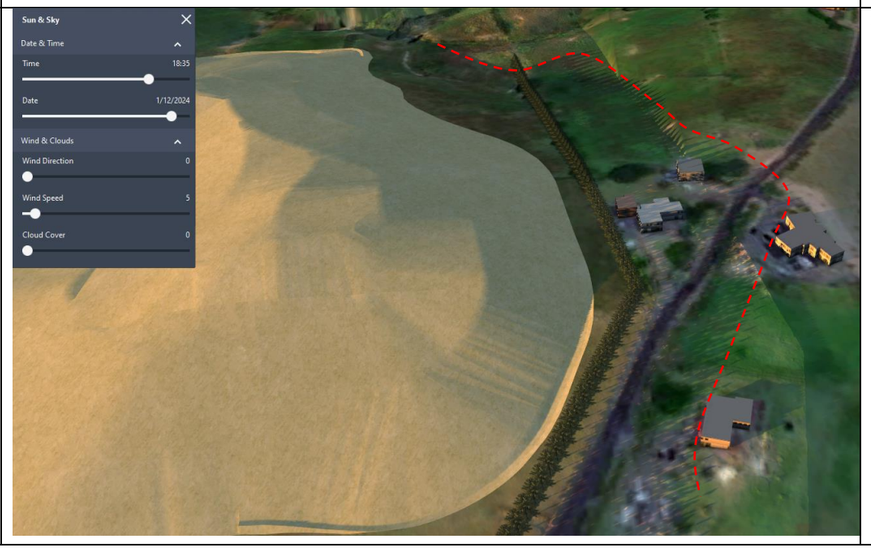
Date	No trees	With trees	No Trees Shadow Time	With trees shadow time	Sunset	No trees - Duration lighting affected (mins)	With trees - Duration lighting affected (mins)
1/1/2024			1857	1516	1944	47	268
1/2/2024			1845	1510	1931	46	261

1/3/2024			1821	1504	1902	41	238
1/4/2024			1739	1447	1814	35	207

1/5/2024			1715	1429	1734	19	185
1/6/2024			1634	1423	1710	36	167

1/7/2024			1634	1429	1712	38	163
1/8/2024			1706	1504	1733	27	149

1/9/2024			1733	1447	1758	25	191
1/10/2024			1743	1459	1822	39	203

1/11/2024			1806	1504	1851	45	227
1/12/2024			1835	1540	1922	47	222

Appendix C

Groundwater Bore and Water Take Information

Spreadsheet Notes:

1. Spreadsheets starting with OAS contain information from the old Auckland Regional Council consenting system. These include details about some of the bores drilled or takes (which are accurate up to 31 May 2017) and may also contain information such as an indication of depth drilled and with which aquifer the bore is associated.

2. Spreadsheets starting with the title AC Consent are lists from current AC SAP consenting system. They list the number of consents in a specified area. There is one spreadsheet for bores and one for water takes (where consent was needed)

Consent Reference	Consent Description	Transaction Type Description	Form Type Description	Consent Status	Application Sub Type	Lodged Date	Decision Date	Issued Date	Consent Decision	Consent GIS Classification	inside x	inside y
LUC60271978-A	Change of reference in Conservation Covenant 8058657.11 from Area Marked Y to being Area marked V on DP 575066.	Resource Management Follow-up Appl	Change of Condition (s127)	Completed	Drill or Alter Bore	20220404	20220517		Withdrawn	RMA Consent	1781292.077	5895130.615
LUC80308532		Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore			19990310		RMA Consent	1782211.188	5895149.038
LUC60414022	The drilling, construction and development of a new bore for use on the property. The bore is planned to be cased with fully grouted steel casing to a depth of 52mtr Bgl and drilled open hole to a dep	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore		20230630	20230314	Monitoring Complete	RMA Consent	1780866.138	5894992.579
LUC80306566	Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriat e depth.	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore			19880211		RMA Consent	1780537.895	5896150.194
LUC80310130		Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore			20020122		RMA Consent	1780088.134	5896778.665
LUC60414022	The drilling, construction and development of a new bore for use on the property. The bore is planned to be cased with fully grouted steel casing to a depth of 52mtr Bgl and drilled open hole to a dep	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore	19000101	20230630	20230314	Monitoring Complete	RMA Consent	1780866.138	5894992.579
LUC60320876	Permitted Activity - To authorise a replacement bore for domestic and stock supply.	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore		20180615120000	20180615	No Monitoring Required	RMA Consent	1778680.178	5895372.937
LUC80308081	Construction of a 100mm dia. bore to approx. 60m depth, installation and full cement grouting of steel casing to approx. 40m.	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore			19900208		RMA Consent	1781849.338	5892791.276
LUC80309496	Construction of a bore for the extraction of groundwater for stock and domestic use	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore			19980213		RMA Consent	1781523.069	5893175.351
LUC60328185	Permitted Activity - To authorise two investigation bores for groundwater investigation.	Resource Management Consent	Land Use Consent	Complete	Drill or Alter Bore		20191004	20191004	No Monitoring Required	RMA Consent	1777712.867	5894367.594

OBJECT ID	CONSENT NUMBER	FILE REFERENCE	CONSENT HOLDER	BORE ID	GRANTED DATE	EXPIRY DATE	CONSENT STATUS	PROCESSING OFFICER	PURPOSE	WORKS DESCRIPTION	EASTING	NORTHING	ACTIVITY STATUS	LAND USE	LAND USE UPDATED
5212	0			4463							1781854	5892773	Drilled		
4634	0			21476							1779792	5893892	Drilled		
1995	31846	C512-12-3621*	Winstone Aggregates (A Division of Fletcher Concrete & Infrastructure Limited)	22472	20051201	20061202	Expired	_Daryl Henehan	To authorise the construction of 3 bores for monitoring purposes.	Construction of a 3 bores with approximate depths of 85m, 135m and 60m. Installation of D Grade PVC casing and PVc Piezo screens with depth to top being 6m and depth to bottom being 12m. 2 Piezometers will be installed in each bore. 1 at the base and t	1778820	5894630	Drilled		
5198	0			4447							1780522	5893369	Drilled		
5209	0			4459							1781400	5894200	Drilled		
3821	0			23693							1780026	5892753	Drilled		
6394	10336	14/17/98	HP LEES	164	19880211	19890212	Expired	Andrew Millar	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.	1779785	5894725	Drilled		
5214	0			4465							1782339	5893872	Drilled		
6723	0			27891							1780914	5893938	Drilled		
4745	0			21486							1781029	5893423	Drilled		
7656	53002	C512-12-5235		29107	20131031		Assessment Completed	Reginald Samuel	The construction of one replacement bore for stock and domestic purposes.	The construction of a 100mm diameter bore to an approximate depth of 100-120m. Installation of steel socketed and screwed casing material to an approximate depth of 65m.	1781742	5895050	Drilled		20140109
4633	0			21475							1779349	5894192	Drilled		
5203	0			4452							1781230	5893136	Drilled		
1994	31846	C512-12-3621*	Winstone Aggregates (A Division of Fletcher Concrete & Infrastructure Limited)	22472	20051201	20061202	Expired	_Daryl Henehan	To authorise the construction of 3 bores for monitoring purposes.	Construction of a 3 bores with approximate depths of 85m, 135m and 60m. Installation of D Grade PVC casing and PVc Piezo screens with depth to top being 6m and depth to bottom being 12m. 2 Piezometers will be installed in each bore. 1 at the base and t	1778820	5894630	Drilled		
5406	52093	C512-12-4356	Papakura District Council	23290	20081219		Assessment Completed	Reginald Samuel	To authorise the construction of one bore for geotechnical investigation and groundwater monitoring using piezometers.		1779340	5894260	Proposed		
6734	0			27902							1782110	5894481	Proposed		
1962	31846	C512-12-3621*	Winstone Aggregates (A Division of Fletcher Concrete & Infrastructure Limited)	22472	20051201	20061202	Expired	_Daryl Henehan	To authorise the construction of 3 bores for monitoring purposes.	Construction of a 3 bores with approximate depths of 85m, 135m and 60m. Installation of D Grade PVC casing and PVc Piezo screens with depth to top being 6m and depth to bottom being 12m. 2 Piezometers will be installed in each bore. 1 at the base and t	1778820	5894630	Drilled		
6393	10335	14/17/97	HP LEES	163	19880211	19890212	Expired	Andrew Millar	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.	1780044	5896508	Drilled		
3004	21075	C512-12-2140	MR B ORUM MR F BASSETT MRS C ORUM MRS G BASSETT	20116	19980213	19990216	Expired	_Gillian Crowcroft	Authorise the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm diameter bore to a depth of approximately 100m and installation of PVC casing to approximately 40m depth.	1781506	5893225	Drilled		

LAND USE NOTE	BORE USE	ACTIVITY DESCRIPTION	SITE NAME	SITE DESCRIPTION	MAIN AQUIFER	AQUIFER	SUB AQUIFER1	SUB AQUIFER2	ENVIRONMENT REPORTING AREA	ALW PLAN ZONES	TLA	HYDSYS NUMBER	DATE DRILLED	TOTAL DEPTH	GROUND ELEVATION
		Drilled pre-1987 for BATKIN BW by DRILLING SPECIALTIES LTD.			Waitemata	Hunua Waitemata							19750225	51	203
		Owner: Mrs Middleton, farmed by son Richard. Details from Hunua Quarry survey of adjacent bores. Reportedly drilled around 1940s	Middleton	Middleton Rd, Hunua	Greywacke	Hunua West Greywacke					Franklin		19110101	40	216
	Observation / Piezo	To authorise the construction of 3 bores for monitoring purposes.	Winstone Aggregates HUN 05/2	Hunua Road East bore, Drury	Greywacke	Hunua West Greywacke			Auckland Central		Papakura		20060127	143.5	142.16
		Drilled pre-1987 for TAYLOR CR by HUTCHINSONS WELLDRILLING LTD.			Waitemata	Hunua Waitemata							19621031	67	221
		Drilled pre-1987 for MARTIN J by *** DRILLER UNKNOWN ***.											20000101		173
	Other	Drilled pre 1987 by driller unknown. Bore N2 location from Winstones Hunua bore survey 2010.	Costello, Raymond Peter & Judith Leonie		Greywacke	Hunua West Greywacke					Papakura				223
	Domestic/Stock	Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.		1108 Hunua Road, ,	Greywacke	Hunua West Greywacke					Franklin		19880322	123	221
		Same as Bore ID 619 Permit no. 10791 file 14/17/553	Batkin	Heald Rd, Hunua									19901116	64.33	119
	Stock		Sharon A & LM Kelly								Franklin				193
		Data from Wairoa River Catchment Survey, 1995-97	B & G Mahony	Batkin Rd, Pt Allot 1 DP 69197. (Postal, Ponga Rd, RD4, Drury)	Greywacke	Hunua Greywacke					Franklin		19110101		214
	Domestic/Stock	The construction of one replacement bore for stock and domestic purposes.	S M & S C Murray		Waitemata	Hunua Waitemata					Franklin		20131204	104	65.4
	Shed Watering	Owner: SR & JR Forrest, drill date unknown. Details from Hunua Quarry survey of adjacent bores	forrest	hunua rd	Greywacke	Hunua West Greywacke					Franklin		19110101	96	201
		Drilled pre-1987 for ANGLE MC by DRILLING SPECIALTIES LTD.			Waitemata	Hunua Waitemata							19750206	55	208
	Observation / Piezo	To authorise the construction of 3 bores for monitoring purposes.	Winstone Aggregates HUN 05/2	Hunua Road East bore, Drury	Greywacke	Hunua West Greywacke			Auckland Central		Papakura		20060127	143.5	142.16
	Observation / Piezo	To authorise the construction of one bore for geotechnical investigation and groundwater monitoring using piezometers.	Papkura District Council								Papakura				
	Domestic/Stock		Chris J & Susan E Marshall								Franklin				124
	Observation / Piezo	To authorise the construction of 3 bores for monitoring purposes.	Winstone Aggregates HUN 05/2	Hunua Road East bore, Drury	Greywacke	Hunua West Greywacke			Auckland Central		Papakura		20060127	143.5	142.16
		Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.		2 Jones Road, ,	Greywacke	Hunua West Greywacke					Manukau		19880222	114	162
	Domestic/Stock			16 McMurray Rd Hunua	Greywacke	Hunua Greywacke					Franklin		19980223	76	192

STATIC WATER LEVEL	STATIC WATER DATE	BORE LOG	AQUIFER TEST	DIAMETER FROM	DIAMETER TO	DIAMETER	CASING FROM	CASING TO	CASING TYPE	CASING DIAMETER	SCREEN FROM	SCREEN TO	SCREEN TYPE	CONTRACTOR	CONSULTANT	DATE CREATED	PROPERTY ADDRESS	LOC TYP	created user
21.5				0	51	100	0	30.78		100						20170601		Point	MASTER
							0									20170601		Point	MASTER
8.2	20060216			103	143.5	130	0	16	Steel	152						20170601	Hunua Road Drury Papakura	Point	MASTER
43.2				0	67	76	0	49.1		76						20170601		Point	MASTER
							0									20170601		Point	MASTER
				0		35										20170601		Point	MASTER
37		Y		0	123	100	0	63	Steel	100						20170601	1500 Hunua Road Drury Papakura	Point	MASTER
0.67				0	64	100	0	46.51		100						20170601		Point	MASTER
																20170601		Point	MASTER
				0		100										20170601		Point	MASTER
25.3		Y					0	65.4		100						20170601	173 Jones Rd R D 3 Papakura Franklin	Point	MASTER
							0									20170601		Point	MASTER
39				0	55	80	0	33.52		80						20170601		Point	MASTER
8.2	20060216			16	103	133	0	16	Steel	152						20170601	Hunua Road Drury Papakura	Point	MASTER
																20170601	Hunua Road Drury Papakura	Point	MASTER
2.4																20170601		Point	MASTER
8.2	20060216			0	16	203	0	16	Steel	152						20170601	Hunua Road Drury Papakura	Point	MASTER
20				0	114	100	0	65	Steel	100	64.5	114				20170601		Point	MASTER
25.2	19980223			0	76	100	0	36	PVC/ABS	100						20170601	Batkin Road Papakura Franklin	Point	MASTER

last edited user	last edited date	created date	VALIDATIONSTATE	inside x	inside y
MASTER	20170601095548	20170601095548	3	1781854	5892773
MASTER	20170601095548	20170601095548	3	1779792	5893892
MASTER	20170601095548	20170601095548	3	1778820	5894630
MASTER	20170601095548	20170601095548	3	1780522	5893369
MASTER	20170601095548	20170601095548	3	1781400	5894200
MASTER	20170601095548	20170601095548	3	1780026	5892753
MASTER	20170601095548	20170601095548	3	1779785	5894725
MASTER	20170601095548	20170601095548	3	1782339	5893872
MASTER	20170601095548	20170601095548	3	1780914	5893938
MASTER	20170601095548	20170601095548	3	1781029	5893423
MASTER	20170601095548	20170601095548	3	1781742	5895050
MASTER	20170601095548	20170601095548	3	1779349	5894192
MASTER	20170601095548	20170601095548	3	1781230	5893136
MASTER	20170601095548	20170601095548	3	1778820	5894630
MASTER	20170601095548	20170601095548	3	1779340	5894260
MASTER	20170601095548	20170601095548	3	1782110	5894481
MASTER	20170601095548	20170601095548	3	1778820	5894630
MASTER	20170601095548	20170601095548	3	1780044	5896508
MASTER	20170601095548	20170601095548	3	1781506	5893225

OBJECT ID	CONSENT NUMBER	FILE REFERENCE	CONSENT HOLDER	BORE ID	GRANTED DATE	EXPIRY DATE	CONSENT STATUS	PROCESSING OFFICER	PURPOSE	WORKS DESCRIPTION	EASTING	NORTHING	ACTIVITY STATUS	LAND USE	LAND USE UPDATED
5211	0			4461							1781477	5892976	Drilled		
5408	52095	C512-12-4358	Papakura District Council	23292	20081219		Assessment Completed	Reginald Samuel	To authorise the construction of one bore for geotechnical investigation and groundwater monitoring using piezometers.		1779400	5894330	Proposed		
4632	0			21474							1779245	5894407	Drilled		
5204	0			4453							1781200	5893300	Drilled		
5674	44186	C512-12-5553	Bethany V & Darren K Cantwell	29802	20150317	20160321	Expired	Reginald Samuel	To authorise the construction of one bore for domestic & stock supply.		1779818	5894849	Proposed		
6730	0			27898							1781743	5895045	Drilled		
9329	10679	14/17/441	Ross Batkin & Helen Edith Batkin	507	19900208	19910208	Expired	Andrew Millar	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 60m depth, installation and full cement grouting of steel casing to approx. 40m.	1781762	5892647	Drilled		
6724	0			27892							1781113	5895542	Drilled		
8041	53084	C512-12-5365*		29293	20140508		Assessment Completed	Reginald Samuel	The construction of three bores for Groundwater investigation purposes.	The construction of three 100mm diameter bores to a maximum depth of 40, 50, 60m. Installation of PVC casing material to an approximate depth of 40, 50, 60m.	1779162	5894946	Proposed		
6962	10252	14/17/14	MR IJ DONOVAN	80	19871015	19881021	Expired	Andrew Millar	Authorize the construction of a water bore for extraction of groundwater for stock, domestic and chicken farm requirements.	Construction of a 80mm dia. bore to approx. 90m depth, and installation of steel casing to approx. 40m.	1781846	5895199	Drilled		
9129	10791	14/17/553	Ross Batkin & Helen Edith Batkin	619	19901025	19911025	Expired	Andrew Millar	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 70m depth and installation of steel casing to approx. 30m.	1782339	5893872	Drilled		
9394	11026	14/17/788	Rodney Mitchell Taylor & Carolyn Alice Taylor	854	19920512	19930513	Expired	Andrew Millar	Authorize the construction of a bore for the extraction of groundwater for stock requirements.	Construction of a 100mm dia. bore to approx. 150m depth and installation of steel casing to approx. 66m.	1780518	5893364	Drilled		
9947	37806	C512-12-4602	High Hope Two Trust (Trustees Ian Henry Armstrong & Michael George Cantrick Stephens)	23573	20100323	20110331	Expired	Reginald Samuel	To authorise construction of a bore for domestic supply.	To construct a 100mm diameter bore to a depth of 110m. Installation of steel casing to 60m. Proposed grout full annular.	1781108	5896149	Drilled		
8620	27814	C512-12-3089	The Micaela Murray Trust (Suzanne Claire Murray, Stuart Marshall Campbell Murray & Micaela Murray)	21873	20030401	20040402	Expired	_Michelle Ip	Authorise the construction of a bore for stockwatering purposes.	Construction of a 100mm diameter bore to a depth of approximately 120m. Installation of steel socketed and screwed casing.	1781813	5894798	Drilled		
9354	11017	14/17/779	RG DAVIS	845	19920423	19920424	Expired	Andrew Millar	Authorize sealing of an abandoned bore.	Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.	1780550	5893360	Drilled		
9211	10811	14/17/573	Ross Batkin & Helen Edith Batkin	639	19901119	19911119	Expired	Andrew Millar	Authorize sealing an abandoned bore.	Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.	1782360	5893850	Drilled		
4929	0			4370							1778852	5896063	Drilled		
3286	22464	C512-12-2356	GEORGE HERBET EXTON	20578	19990310	20000311	Expired	_Gillian Crowcroft	Authorise the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm diameter bore to a depth of approximately120m and installation of steel casing to a depth of approximately 58.6m.	1782208	5895192	Drilled		

LAND USE NOTE	BORE USE	ACTIVITY DESCRIPTION	SITE NAME	SITE DESCRIPTION	MAIN AQUIFER	AQUIFER	SUB AQUIFER1	SUB AQUIFER2	ENVIRONMENT REPORTING AREA	ALW PLAN ZONES	TLA	HYDSYS NUMBER	DATE DRILLED	TOTAL DEPTH	GROUND ELEVATION
		Drilled pre-1987 for BATKIN BW by DRILLING SPECIALTIES LTD.											20000101	61	205
	Observation / Piezo	To authorise the construction of one bore for geotechnical investigation and groundwater monitoring using piezometers.	Papakura District Council								Papakura				
		Drilled pre-1987 for JA Glasgow, details from Hunua Quarry survey of adjacent bores	JA Glasgow	1040 Hunua Rd, Papakura	Greywacke	Hunua West Greywacke					Franklin		19870713	101.4	195
		Drilled pre-1987 for MURRAY C & ANGLE EJ by DRILLING SPECIALTIES LTD.			Waitemata	Hunua Waitemata							19760206	55	206
	Domestic/Stock	To authorise the construction of one bore for domestic & stock supply.	1500 Hunua Road, Drury								Franklin				
	Domestic/Stock		Suzanne Claire & Stuart Marshall Campbell Murray								Franklin			71.88	165
		Construction of a 100mm dia. bore to approx. 60m depth, installation and full cement grouting of steel casing to approx. 40m.		BATKIN ROAD, HUNUA.	Greywacke	Hunua Greywacke					Franklin		19900207	89	188
	Stock		Robin F & H R Lees								Papakura				254
	Observation / Piezo	The construction of three bores for Groundwater investigation purposes.	James Talbot on behalf of Watercare Services								Papakura				
		Construction of a 80mm dia. bore to approx. 90m depth, and installation of steel casing to approx. 40m.		Garvies Rd,, Hunua,	Greywacke	Hunua Greywacke					Franklin			90	165
		Construction of a 100mm dia. bore to approx. 70m depth and installation of steel casing to approx. 30m.	R Batkin	Heald Road, Hunua,	Greywacke	Hunua Greywacke					Franklin		19910228	64.33	119
		Construction of a 100mm dia. bore to approx. 150m depth and installation of steel casing to approx. 66m.		Gillespie Road,, Hunua,	Waitemata	Franklin Waitemata	Papakura East Waitemata				Franklin		19920605	77.5	220
	Domestic	To authorise construction of a bore for domestic supply.	High Hope Two Trust		Greywacke	Hunua West Greywacke					Manukau		20100423	183	236
	Shed Watering	150 cattle, 15 horses, 200 goats, 100 ewes + lambs			Greywacke	Hunua Greywacke					Franklin		20030416	90.3	163
		Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.		SH 18,, Coatesville,	Waitemata	Hunua Waitemata					Rodney		19920615	78	
		Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.		Heald Road, Hunua,	Greywacke	Hunua Greywacke					Franklin				
	Domestic/Stock	Drilled pre-1987 for LIFEGATE TRUST by ROBERTSON P.	Lifegate Trust	896 Hunua Rd, Papakura	Greywacke	Hunua West Greywacke					Papakura		19820413	119.8	253
	Domestic/Stock		George Exton	63 Garvie Rd, Hunua	Greywacke	Hunua Greywacke					Franklin		19990430	74.2	132

STATIC WATER LEVEL	STATIC WATER DATE	BORE LOG	AQUIFER TEST	DIAMETER FROM	DIAMETER TO	DIAMETER	CASING FROM	CASING TO	CASING TYPE	CASING DIAMETER	SCREEN FROM	SCREEN TO	SCREEN TYPE	CONTRACTOR	CONSULTANT	DATE CREATED	PROPERTY ADDRESS	LOC TYP	created user
				0	61	101	0			101						20170601		Point	MASTER
																20170601	1040 Hunua Road Drury Papakura	Point	MASTER
35.5	19870713	Y	Y	0	101.4	100	0	71.2		100						20170601		Point	MASTER
				0	55	76	0			76						20170601		Point	MASTER
																20170601	1500 HUnua Road Drury Franklin	Point	MASTER
38																20170601		Point	MASTER
45.8				0	89	100	0	51.36	Steel	100						20170601	Batkin Road Papakura Franklin	Point	MASTER
																20170601		Point	MASTER
															Soil & Rock Consultants	20170601	120 Hays Creek Road Drury Papakura	Point	MASTER
55.8				0	90	80	0	50	Steel	80						20170601		Point	MASTER
0.67	19901113			0	64.3	100	0	46.51	Steel	100						20170601	Heald Rd R D 3 Papakura Franklin	Point	MASTER
44.5				0	77.5	100	0	58.68	Steel	100						20170601		Point	MASTER
52.3	20100423	Y	Y	0	183	100	0	91	Steel	100						20170601	68 Jones Road Clevedon Manukau	Point	MASTER
45		Y		0	90.3	100	0	65	Steel	100						20170601	Garvies Road Papakura Franklin	Point	MASTER
				0	78	100	0	59								20170601	STATE HIGHWAY 18 COATESVILLE Rodney District	Point	MASTER
							0									20170601		Point	MASTER
61.4	19860108	Y		0	119.8	100	0	52.3		100						20170601		Point	MASTER
19.5	19990504		Y	0	74.2	100	0	65.4	PVC/ABS	100						20170601	63 Garvies Road Papakura Franklin	Point	MASTER

last edited user	last edited date	created date	VALIDATIONSTATE	inside x	inside y
MASTER	20170601095548	20170601095548	3	1781477	5892976
MASTER	20170601095548	20170601095548	3	1779400	5894330
MASTER	20170601095548	20170601095548	3	1779245	5894407
MASTER	20170601095548	20170601095548	3	1781200	5893300
MASTER	20170601095548	20170601095548	3	1779818	5894849
MASTER	20170601095548	20170601095548	3	1781743	5895045
MASTER	20170601095548	20170601095548	3	1781762	5892647
MASTER	20170601095548	20170601095548	3	1781113	5895542
MASTER	20170601095548	20170601095548	3	1779162	5894946
MASTER	20170601095548	20170601095548	3	1781846	5895199
MASTER	20170601095548	20170601095548	3	1782339	5893872
MASTER	20170601095548	20170601095548	3	1780518	5893364
MASTER	20170601095548	20170601095548	3	1781108	5896149
MASTER	20170601095548	20170601095548	3	1781813	5894798
MASTER	20170601095548	20170601095548	3	1780550	5893360
MASTER	20170601095548	20170601095548	3	1782360	5893850
MASTER	20170601095548	20170601095548	3	1778852	5896063
MASTER	20170601095548	20170601095548	3	1782208	5895192

OBJECTID	CONSENT NUMBER	FILE REFERENCE	CONSENT HOLDER	CONSENT STATUS	GRANTED DATE	EXPIRY DATE	PURPOSE	WORKS DESCRIPTION	EASTING	NORTHING	BORE ID	ACTIVITY STATUS	BORE USE
3097	21075	C512-12-2140	MR B ORUM MR F BASSETT MRS C ORUM MRS G BASSETT	Expired	19980213	19990216	Authorise the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm diameter bore to a depth of approximately 100m and installation of PVC casing to approximately 40m depth.	1781506	5893225	20116	Drilled	Domestic/Stock
4411	37806	C512-12-4602	High Hope Two Trust (Trustees Ian Henry Armstrong & Michael George Cantrick Stephens)	Expired	20100323	20110331	To authorise construction of a bore for domestic supply.	To construct a 100mm diameter bore to a depth of 110m. Installation of steel casing to 60m. Proposed grout full annular.	1781108	5896149	23573	Drilled	Domestic
3174	10252	14/17/14	MR IJ DONOVAN	Expired	19871015	19881021	Authorize the construction of a water bore for extraction of groundwater for stock, domestic and chicken farm requirements.	Construction of a 80mm dia. bore to approx. 90m depth, and installation of steel casing to approx. 40m.	1781846	5895199	80	Drilled	
3370	11017	14/17/779	RG DAVIS	Expired	19920423	19920424	Authorize sealing of an abandoned bore.	Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.	1780550	5893360	845	Drilled	
1640	31846	C512-12-3621*	Winstone Aggregates (A Division of Fletcher Concrete & Infrastructure Limited)	Expired	20051201	20061202	To authorise the construction of 3 bores for monitoring purposes.	Construction of a 3 bores with approximate depths of 85m, 135m and 60m. Installation of D Grade PVC casing and PVc Piezo screens with depth to top being 6m and depth to bottom being 12m. 2 Piezometers will be installed in each bore. 1 at the base and t	1778820	5894630	22472	Drilled	Observation / Piezo
246	10336	14/17/98	HP LEES	Expired	19880211	19890212	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.	1779785	5894725	164	Drilled	Domestic/Stock
245	10335	14/17/97	HP LEES	Expired	19880211	19890212	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.	1780044	5896508	163	Drilled	
1642	31846	C512-12-3621*	Winstone Aggregates (A Division of Fletcher Concrete & Infrastructure Limited)	Expired	20051201	20061202	To authorise the construction of 3 bores for monitoring purposes.	Construction of a 3 bores with approximate depths of 85m, 135m and 60m. Installation of D Grade PVC casing and PVc Piezo screens with depth to top being 6m and depth to bottom being 12m. 2 Piezometers will be installed in each bore. 1 at the base and t	1778820	5894630	22472	Drilled	Observation / Piezo
168	10679	14/17/441	Ross Batkin & Helen Edith Batkin	Expired	19900208	19910208	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 60m depth, installation and full cement grouting of steel casing to approx. 40m.	1781762	5892647	507	Drilled	
253	10791	14/17/553	Ross Batkin & Helen Edith Batkin	Expired	19901025	19911025	Authorize the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm dia. bore to approx. 70m depth and installation of steel casing to approx. 30m.	1782339	5893872	619	Drilled	
1026	44186	C512-12-5553	Bethany V & Darren K Cantwell	Expired	20150317	20160321	To authorise the construction of one bore for domestic & stock supply.		1779818	5894849	29802	Proposed	Domestic/Stock
1641	31846	C512-12-3621*	Winstone Aggregates (A Division of Fletcher Concrete & Infrastructure Limited)	Expired	20051201	20061202	To authorise the construction of 3 bores for monitoring purposes.	Construction of a 3 bores with approximate depths of 85m, 135m and 60m. Installation of D Grade PVC casing and PVc Piezo screens with depth to top being 6m and depth to bottom being 12m. 2 Piezometers will be installed in each bore. 1 at the base and t	1778820	5894630	22472	Drilled	Observation / Piezo
676	10811	14/17/573	Ross Batkin & Helen Edith Batkin	Expired	19901119	19911119	Authorize sealing an abandoned bore.	Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.	1782360	5893850	639	Drilled	
72	11026	14/17/788	Rodney Mitchell Taylor & Carolyn Alice Taylor	Expired	19920512	19930513	Authorize the construction of a bore for the extraction of groundwater for stock requirements.	Construction of a 100mm dia. bore to approx. 150m depth and installation of steel casing to approx. 66m.	1780518	5893364	854	Drilled	
2365	22464	C512-12-2356	GEORGE HERBET EXTON	Expired	19990310	20000311	Authorise the construction of a bore for the extraction of groundwater for stock and domestic supply.	Construction of a 100mm diameter bore to a depth of approximately120m and installation of steel casing to a depth of approximately 58.6m.	1782208	5895192	20578	Drilled	Domestic/Stock
2173	27814	C512-12-3089	The Micaela Murray Trust (Suzanne Claire Murray, Stuart Marshall Campbell Murray & Micaela Murray)	Expired	20030401	20040402	Authorise the construction of a bore for stockwatering purposes.	Construction of a 100mm diameter bore to a depth of approximately 120m. Installation of steel socketed and screwed casing.	1781813	5894798	21873	Drilled	Shed Watering

ACTIVITY DESCRIPTION	SITE NAME	SITE DESCRIPTION	MAIN AQUIFER	AQUIFER	SUB AQUIFER1	DATE DRILLED	TOTAL DEPTH	GROUND ELEVATION	STATIC WATER LEVEL	STATIC WATER DATE	BORE LOG	AQUIFER TEST	DIAMETER FROM	DIAMETER TO	DIAMETER	CASING FROM
		16 McMurray Rd Hunua	Greywacke	Hunua Greywacke		19980223	76	192	25.2	19980223			0	76	100	0
To authorise construction of a bore for domestic supply.	High Hope Two Trust		Greywacke	Hunua West Greywacke		20100423	183	236	52.3	20100423	Y	Y	0	183	100	0
Construction of a 80mm dia. bore to approx. 90m depth, and installation of steel casing to approx. 40m.		Garvies Rd,, Hunua,	Greywacke	Hunua Greywacke			90	165	55.8				0	90	80	0
Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.		SH 18,, Coatesville,	Waitemata	Hunua Waitemata		19920615	78						0	78	100	0
To authorise the construction of 3 bores for monitoring purposes.	Winstone Aggregates HUN 05/2	Hunua Road East bore, Drury	Greywacke	Hunua West Greywacke		20060127	143.5	142.16	8.2	20060216			0	16	203	0
Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.		1108 Hunua Road, ,	Greywacke	Hunua West Greywacke		19880322	123	221	37		Y		0	123	100	0
Construction of a 100mm dia. bore to approx. 80m depth, installation of steel casing to approx. 60m and P.V.C. screens to appropriate depth.		2 Jones Road, ,	Greywacke	Hunua West Greywacke		19880222	114	162	20				0	114	100	0
To authorise the construction of 3 bores for monitoring purposes.	Winstone Aggregates HUN 05/2	Hunua Road East bore, Drury	Greywacke	Hunua West Greywacke		20060127	143.5	142.16	8.2	20060216			103	143.5	130	0
Construction of a 100mm dia. bore to approx. 60m depth, installation and full cement grouting of steel casing to approx. 40m.		BATKIN ROAD, HUNUA.	Greywacke	Hunua Greywacke		19900207	89	188	45.8				0	89	100	0
Construction of a 100mm dia. bore to approx. 70m depth and installation of steel casing to approx. 30m.	R Batkin	Heald Road, Hunua,	Greywacke	Hunua Greywacke		19910228	64.33	119	0.67	19901113			0	64.3	100	0
To authorise the construction of one bore for domestic & stock supply.	1500 Hunua Road, Drury															
To authorise the construction of 3 bores for monitoring purposes.	Winstone Aggregates HUN 05/2	Hunua Road East bore, Drury	Greywacke	Hunua West Greywacke		20060127	143.5	142.16	8.2	20060216			16	103	133	0
Backfilling of an abandoned bore with cement grout from the bottom of the bore to ground level.		Heald Road, Hunua,	Greywacke	Hunua Greywacke												0
Construction of a 100mm dia. bore to approx. 150m depth and installation of steel casing to approx. 66m.		Gillespie Road,, Hunua,	Waitemata	Franklin Waitemata	Papakura East Waitemata	19920605	77.5	220	44.5				0	77.5	100	0
	George Exton	63 Garvie Rd, Hunua	Greywacke	Hunua Greywacke		19990430	74.2	132	19.5	19990504		Y	0	74.2	100	0
150 cattle, 15 horses, 200 goats, 100 ewes + lambs			Greywacke	Hunua Greywacke		20030416	90.3	163	45		Y		0	90.3	100	0

CASING TO	CASING TYPE	CASING DIAMETER	SCREEN FROM	SCREEN TO	DATE CREATED	PROPERTY ADDRESS	LOC TYP	created user	last edited user	last edited date	created date	VALIDATIONSTATE	inside_x	inside_y	PROCESSING OFFICER	ENVIRONMENT REPORTING AREA	TLA
36	PVC/ABS	100			20170601	Batkin Road Papakura Franklin	Point	MASTER	MASTER	20170601094303	20170601094303	3	1781506	5893225	_Gillian Crowcroft		Franklin
91	Steel	100			20170601	68 Jones Road Clevedon Manukau	Point	MASTER	MASTER	20170601094303	20170601094303	3	1781108	5896149	Reginald Samuel		Manukau
50	Steel	80			20170601		Point	MASTER	MASTER	20170601094303	20170601094303	3	1781846	5895199	Andrew Millar		Franklin
59					20170601	STATE HIGHWAY 18 COATESVILLE Rodney District	Point	MASTER	MASTER	20170601094303	20170601094303	3	1780550	5893360	Andrew Millar		Rodney
16	Steel	152			20170601	Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601094303	20170601094303	3	1778820	5894630	_Daryl Henehan	Auckland Central	Papakura
63	Steel	100			20170601	1500 Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601094303	20170601094303	3	1779785	5894725	Andrew Millar		Franklin
65	Steel	100	64.5	114	20170601		Point	MASTER	MASTER	20170601094303	20170601094303	3	1780044	5896508	Andrew Millar		Manukau
16	Steel	152			20170601	Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601094303	20170601094303	3	1778820	5894630	_Daryl Henehan	Auckland Central	Papakura
51.36	Steel	100			20170601	Batkin Road Papakura Franklin	Point	MASTER	MASTER	20170601094303	20170601094303	3	1781762	5892647	Andrew Millar		Franklin
46.51	Steel	100			20170601	Heald Rd R D 3 Papakura Franklin	Point	MASTER	MASTER	20170601094303	20170601094303	3	1782339	5893872	Andrew Millar		Franklin
					20170601	1500 HUnua Road Drury Franklin	Point	MASTER	MASTER	20170601094303	20170601094303	3	1779818	5894849	Reginald Samuel		Franklin
16	Steel	152			20170601	Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601094303	20170601094303	3	1778820	5894630	_Daryl Henehan	Auckland Central	Papakura
					20170601		Point	MASTER	MASTER	20170601094303	20170601094303	3	1782360	5893850	Andrew Millar		Franklin
58.68	Steel	100			20170601		Point	MASTER	MASTER	20170601094303	20170601094303	3	1780518	5893364	Andrew Millar		Franklin
65.4	PVC/ABS	100			20170601	63 Garvies Road Papakura Franklin	Point	MASTER	MASTER	20170601094303	20170601094303	3	1782208	5895192	_Gillian Crowcroft		Franklin
65	Steel	100			20170601	Garvies Road Papakura Franklin	Point	MASTER	MASTER	20170601094303	20170601094303	3	1781813	5894798	_Michelle Ip		Franklin

OBJECT ID	PERMITTED ACTIVITY ID	FILE REFERENCE	PERMITTED ACTIVITY HOLDER	BORE ID	TAKE ID	SITE ADDRESS	PURPOSE	EASTING	NORTHING	DATE CREATED	LOC TYP	created user	last edited user	last edited date	created date	VALIDATIONSTATE	inside x	inside y
446	53002	C512-12-5235		29107	0	173 Jones Rd R D 3 Papakura Franklin	The construction of one replacement bore for stock and domestic purposes.	1781742	5895050	20170601172309	Point	MASTER	MASTER	20170601093612	20170601	3	1781742	5895050
139	52093	C512-12-4356	Papakura District Council	23290	0	Hunua Road Drury Papakura	To authorise the construction of one bore for geotechnical investigation and groundwater monitoring using piezometers.	1779340	5894260	20170601172309	Point	MASTER	MASTER	20170601093612	20170601	3	1779340	5894260
322	53084	C512-12-5365*		29293	0	120 Hays Creek Road Drury Papakura	The construction of three bores for Groundwater investigation purposes.	1779162	5894946	20170601172309	Point	MASTER	MASTER	20170601093612	20170601	3	1779162	5894946
146	52095	C512-12-4358	Papakura District Council	23292	0	1040 Hunua Road Drury Papakura	To authorise the construction of one bore for geotechnical investigation and groundwater monitoring using piezometers.	1779400	5894330	20170601172309	Point	MASTER	MASTER	20170601093612	20170601	3	1779400	5894330

Consent Reference	Consent Description	Transaction Type Description	Form Type Description	Consent Status	Application Sub Type	Lodged Date	Decision Date	Issued Date	Consent Decision	Consent GIS Classification	inside x	inside y
WAT80323117	To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.	Resource Management Consent	Water Consent	Complete	Take			19860502	Superseded	RMA Consent	1778680.178	5895372.937
WAT80316391	To take and use surface water from a dam on an unnamed tributary of Hays Stream for water supply to Papakura District and surrounding districts.	Resource Management Consent	Water Consent	Ongoing Monitoring	Take			19980527		RMA Consent	1779528.991	5895854.217
WAT60353295	Permitted Activity - To take groundwater (Bore ID 29005) for the purposed of operation and wash down of training facilities.	Resource Management Consent	Water Consent	Complete	Take	19000101	20200409	20200409	No Monitoring Required	RMA Consent	1778066.161	5896451.772
WAT80322485	Application for change to conditions of consent to take water from a dam at Hay Creek municipal water supply dams. Conditions relate to scour valve discharges, installation of a flow measuring weir,	Resource Management Consent	Water Consent	Complete	Take			19890706	Superseded	RMA Consent	1779528.991	5895854.217
WAT80316391-B	To cancel the daily abstraction limit on consent 37316 that currently restricts the take of raw water from the Hays Creek Storage Lake on an unnamed tributary of Hays Creek for municipal supply to no	Resource Management Follow-up Appl	Change of Condition (s127)	Completed	Take	20200626	20201013	20201013	Granted	RMA Consent	1779528.991	5895854.217
WAT80318340	To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.	Resource Management Consent	Water Consent	Complete	Take			20030528		RMA Consent	1778680.178	5895372.937
WAT80323942	To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.	Resource Management Consent	Water Consent	Complete	Take			19930205	Superseded	RMA Consent	1778680.178	5895372.937
WAT60412731	Replacement application to renew existing resource consent (WAT60400593) for the taking and use of groundwater for quarrying operations at Hunua Quarry, 489 Hunua Road 255 Middleton Road, and part of	Resource Management Application	Water Consent application	Processing	Take	20221201				RMA Consent	1777712.867	5894367.594
WAT60353295	Permitted Activity - To take groundwater (Bore ID 29005) for the purposed of operation and wash down of training facilities.	Resource Management Application	Water Consent application	Complete	Take	20200219	20200409	20200409	Granted	RMA Consent	1778066.161	5896451.772
WAT60353295	Permitted Activity - To take groundwater (Bore ID 29005) for the purposed of operation and wash down of training facilities.	Resource Management Consent	Water Consent	Complete	Take		20200409	20200409	No Monitoring Required	RMA Consent	1778066.161	5896451.772
WAT60400593	To authorise the short term taking of groundwater from the Hunua West Greywacke Aquifer Zone, Hunua Wairoa Greywacke Aquifer and the Waitemata Aquifer and the use of this groundwater for quarrying act	Resource Management Consent	Water Consent	Construction Monitoring	Take			20220718		RMA Consent	1777712.867	5894367.594
WAT60400593	To authorise the short term taking of groundwater from the Hunua West Greywacke Aquifer Zone, Hunua Wairoa Greywacke Aquifer and the Waitemata Aquifer and the use of this groundwater for quarrying act	Resource Management Consent	Water Consent	Construction Monitoring	Take	19000101		20220718		RMA Consent	1777712.867	5894367.594
WAT60400593	To authorise the short term taking of groundwater from the Hunua West Greywacke Aquifer Zone, Hunua Wairoa Greywacke Aquifer and the Waitemata Aquifer and the use of this groundwater for quarrying act	Resource Management Application	Water Consent application	Complete	Take	20220413	20220718	20220718	Granted	RMA Consent	1777712.867	5894367.594

OBJECT ID	CONSENT NUMBER	FILE REFERENCE	CONSENT HOLDER	CONSENT STATUS	GRANTED DATE	EXPIRY DATE	REVIEW DATE	PROCESSING OFFICER	PURPOSE	WORKS DESCRIPTION	PROJECT TITLE	EASTING	NORTHING	ANNUAL ALLOCATION
151	5157	AG854938	Lifegate Trust	Replaced	19860502	19911231			To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.			1778850	5896055	
6380	5573	AR865375	M B HENWOOD & J R HENWOOD	Expired	19880128	19931231			To take from a River/lake up to 50 cmpd for - Pastoral			1781300	5894300	
4925	8175	AG928190	Lifegate Trust	Replaced	19930205	20030531	19980201	Stephen Crane	TO TAKE GROUNDWATER FOR DOMESTIC POTABLE WATER SUPPLY FOR PRIVATE VILLAGE	A 100 MM DIAMETER BORE		1778850	5896055	7300
3858	2971	AR802449	W R & J M Harvey	Replaced	19810218	19931231			To take from a River/lake up to 25 cmpd for - Pastoral			1781400	5895000	
2514	27906	8190	Lifegate Trust	Expired	20030527	20161231	20080531	Stephen Crane	To authorise the taking of groundwater for domestic potable supply for a private village and seven lot subdivision in accordance with Section 14 of the Resource Management Act 1991.	A 100 millimetre diameter, 120 metre deep greywacke aquifer bore located approximately 1400 metres north of Hunua Road.		1778850	5896055	5000
5808	5773	AK875580	Watercare Services Limited	Replaced	19890706	19951231			TO TAKE WATER FROM A DAM OF AN UNNAMED TRIBUTARY OF~HAYS STREAM FOR MUNICIPAL WATER SUPPLY FOR PAPAKURA~CITY~~			1779220	5895020	2400000
1961	37316	5580	Watercare Services Limited	Issued	20121220	20311231	20141231	Stephen Crane	To take and use surface water from a dam on an unnamed tributary of Hays Stream for water supply to Papakura District and surrounding districts.		Watercare Hunua Dams Change 2008	1779220	5895020	
1191	14011	AK955580	Watercare Services Limited	Superseded	19980527	20311231	20040531	_Mace Ward	Under section 14 of the RMA to take and use surface water from a dam on an unnamed tributary of Hays Stream for water supply to Papakura District and surrounding districts.			1779220	5895020	0
3888	71	AR660071	R BIRRY	Cancelled	19700602				To take up to 2.99 cmpd from a River/lake			1782500	5894500	
4097	655	AG660665	RT AVERY LN AVERY	Cancelled	19690326				DOMESTIC, STOCK, SHED, FIRE, GENERAL FARM USE,~~~~			1782100	5894900	
3873	48	AR660048	Ross Batkin & Helen Edith Batkin	Surrendered	19700320	20011001			To take surface water from an unnamed tributary of Mangawheau Stream for shed washing, milk cooling, stock drinking water.			1781400	5892500	1820

DAILY ALLOCATION	TAKE ID	ACTIVITY STATUS	PURPOSE CLASS	ACTIVITY DESCRIPTION	SITE NAME	SITE DESCRIPTION	MONITORING PRIORITY	AQUIFER	MANAGEMENT AREA	TLA	SOURCE	HYDSYS NUMBER	USE TYPE	RIVER LAKE ID	CATCHMENT
20	3669	Occurring	Other	To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.	Lifegate Trust		Not known	Greywacke	Franklin Groundwater	Papakura	Bore	W8190A	Community Supply	238	
50	3839			To take from a River/lake up to 50 cmpd for - Pastoral			Not known		Wairoa, Taitaia, Aroaro		River/lake		Pastoral	669	
20	3669	Occurring	Other	To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.	Lifegate Trust		Not known	Greywacke	Franklin Groundwater	Papakura	Bore	W8190A	Community Supply	238	
25	3845			To take from a River/lake up to 25 cmpd for - Pastoral		HUNUA ROAD, HUNUA	Not known		Wairoa, Taitaia, Aroaro	Franklin	River/lake		Pastoral	676	
20	3669	Occurring	Other	To take no more than 20m3/day & no more than 5000m3/year of water for residential and lifestyle farm use.	Lifegate Trust		Not known	Greywacke	Franklin Groundwater	Papakura	Bore	W8190A	Community Supply	238	
11500	3677	Occurring		Application for change to conditions of consent to take water from a dam at Hay Creek municipal water supply dams. Conditions relate to scour valve discharges, installation of a flow measuring weir, provision of a fish pass (replaced with trap & haul), ri	Hays Creek	Hays Creek dam, Hays Creek Rd, Hunua	Not known		Upper Manukau Surface Water	Papakura	Dam	W5580A	Municipal Supply	240	
	3677	Occurring		Application for change to conditions of consent to take water from a dam at Hay Creek municipal water supply dams. Conditions relate to scour valve discharges, installation of a flow measuring weir, provision of a fish pass (replaced with trap & haul), ri	Hays Creek	Hays Creek dam, Hays Creek Rd, Hunua	Not known		Upper Manukau Surface Water	Papakura	Dam	W5580A	Municipal Supply	240	
13500	3677	Occurring		Application for change to conditions of consent to take water from a dam at Hay Creek municipal water supply dams. Conditions relate to scour valve discharges, installation of a flow measuring weir, provision of a fish pass (replaced with trap & haul), ri	Hays Creek	Hays Creek dam, Hays Creek Rd, Hunua	Not known		Upper Manukau Surface Water	Papakura	Dam	W5580A	Municipal Supply	240	
3	3856			To take up to 2.99 cmpd from a River/lake			Not known		Wairoa, Taitaia, Aroaro		River/lake			666	
3	3852						Not known		Hunua Groundwater		Bore		Pastoral	666	
5	3849	Occurring	StockWatering	Shed washing, milk cooling, drinking water			Not known		Wairoa, Taitaia, Aroaro	Papakura	River/lake		Domestic and/or Stock Watering	683	

BORE ID	BORE STATUS	DATE CREATED	PROPERTY ADDRESS	LOC TYP	created user	last edited user	last edited date	created date	VALIDATIONSTATE	inside x	inside y
4370	Drilled	20170601172242	896 Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601095302	20170601095302	3	1778850	5896055
		20170601172242	HUNUA RD HUNUA Franklin District	Point	MASTER	MASTER	20170601095302	20170601095302	3	1781300	5894300
4370	Drilled	20170601172242	896 Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601095302	20170601095302	3	1778850	5896055
		20170601172242	HUNUA RD HUNUA Franklin District	Point	MASTER	MASTER	20170601095302	20170601095302	3	1781400	5895000
4370	Drilled	20170601172242	896 Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601095302	20170601095302	3	1778850	5896055
		20170601172242	120 Hays Creek Road Drury Papakura	Point	MASTER	MASTER	20170601095302	20170601095302	3	1779220	5895020
		20170601172242	120 Hays Creek Road Drury Papakura	Point	MASTER	MASTER	20170601095302	20170601095302	3	1779220	5895020
		20170601172242	120 Hays Creek Road Drury Papakura	Point	MASTER	MASTER	20170601095302	20170601095302	3	1779220	5895020
		20170601172242	No Address Franklin District	Point	MASTER	MASTER	20170601095302	20170601095302	3	1782500	5894500
		20170601172242	MAIN RD RD 3, HUNUA, PAPAKURA Franklin District	Point	MASTER	MASTER	20170601095302	20170601095302	3	1782100	5894900
		20170601172242	76 BATKIN ROAD HUNUA Papakura District	Point	MASTER	MASTER	20170601095302	20170601095302	3	1781400	5892500

OBJECT ID	APPLICATION NUMBER	FILE REFERENCE	APPLICANT	APPLICATION STATUS	LODGED DATE	PROCESSING OFFICER	PURPOSE	WORKS DESCRIPTION	PROJECT TITLE	EASTING	NORTHING	ANNUAL ALLOCATION	DAILY ALLOCATION	TAKE ID
222	24805	15329	John Alistair Glasgow & Marlene Joyce Glasgow	Withdrawn	20010103	Stephen Crane				1779245	5894407			20294

ACTIVITY STATUS	PURPOSE CLASS	ACTIVITY DESCRIPTION	SITE NAME	SITE DESCRIPTION	MONITORING PRIORITY	AQUIFER	MANAGEMENT AREA	TLA	SOURCE	HYDSYS NUMBER	USE TYPE	RIVER LAKE ID	CATCHMENT	BORE ID
Proposed		To take water from a Bore for - Pigs	JA & MJ Glasgow	1040 Hunua Road, Papakura	Not known	Greywacke	Auckland - Manukau Groundwater	Papakura	Bore		Pigs	293		21474

BORE STATUS	DATE CREATED	PROPERTY ADDRESS	LOC TYP	created user	last edited user	last edited date	created date	VALIDATIONSTATE	inside x	inside y
Drilled	20170601172200	1040 Hunua Road Drury Papakura	Point	MASTER	MASTER	20170601093351	20170601093351	3	1779245	5894407

OBJECT ID	PERMITTED ACTIVITY ID	FILE REFERENCE	PERMITTED ACTIVITY HO	TAKE ID	RIVER LAKE ID	RIVER NAME	SITE ADDRESS	PURPOSE	EASTING
311	53413	AG-928190		3669	238	HAYS CREEK	896 Hunua Road Drury P	To take no more than 20r	1778850
247	51256	15329		20294	293	HAYS CREEK	1040 Hunua Road Drury	A permitted activity to tak	1779245

NORTHING	DATE CREATED	LOC TYP	created user	last edited user	last edited date	created date	VALIDATIONSTATE	inside x	inside y
5896055	20170601172312	Point	MASTER	MASTER	20170601094254	20170601094254	3	1778850	5896055
5894407	20170601172312	Point	MASTER	MASTER	20170601094254	20170601094254	3	1779245	5894407

SC

164-10336

BARHAM-UNITED Welldrillers Ltd.

Telephone 07 871 5897 Fax 07 871 6513 Date 1/7/93
Mobile 025 925 036

BORE INFORMATION

Bore Log:

0-6 Topsoil & surface clays.

6-36 Brown yellow clays & silts.

36.-42 Brown clays.

42-60 Brown clay and rotten rock.

60-123. Hard greywacky rock. fractured bottom 10m.

Owners Name: Mr. Lees.
Address: Hukuna Rd.
Permit No: 98.
Date drilled: 22/3/88.
Purpose of Bore: Water

WELL CONSTRUCTION:
Bore Hole Depth: 123. m
Casing Depth: 63 m
Diameter of casing: 100 mm dia
Type of casing: Steel
Screens:
Type:
Depth Top: m
Depth Bottom: m
Cement grouted: 63-30 m
STATIC WATER: + top of casing
Static Water Level: 37 m
Flow Rate: 1.5. m3p/hr
Pumped with: Deepwell pump
WATER QUALITY: Good.

Pumping level 73 metres 1.5 m^3/h.

REMARKS:

GROUNDWATER A.R.W.B.
W.R. No 164/10336 H.A. Lees
NAME
TECHNICAL FILES 14/1/98
ACTIONED
BORE LOG
PUMP TEST
COMPUTER
WATER QUAL