Rural Section 22268, Title reference CB27B/314, Owner Murphy Farms Limited

Earthworks Report

for: South Island Resource Recovery Limited

PROJECT KEA

Job No:	64308#C
Version:	Rev 1
Date of Issue:	16/09/2022

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Cover photo: Project KEA's official logo, retrieved from https://www.projectkea.co.nz/

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1 INTRODUCTION

Babbage Consultants Limited (Babbage) have been engaged by South Island Resource Recovery Limited (SIRRL) to prepare an earthworks report to support the resource consent application for the proposed development of a new energy from waste plant (known as Project Kea) on a 14.85 ha site at Morven-Glenavy Road in Glenavy, Waimate District, Canterbury.

This report provides information on:

- the existing site
- the proposed development
- the proposed earthworks, including construction in ground water
- proposed erosion and sediment controls
- earthworks construction management

The information within this report is preliminary in nature and subject to further design.

2 SITE DESCRIPTION

2.1 Site Location

The site is located approximately 2 km north of the town of Glenavy, and approximately 3 km north of the Waitaki River, at the corner of Carroll's Road and Morven-Glenavy Road. The site location is shown in Figure 1 below.

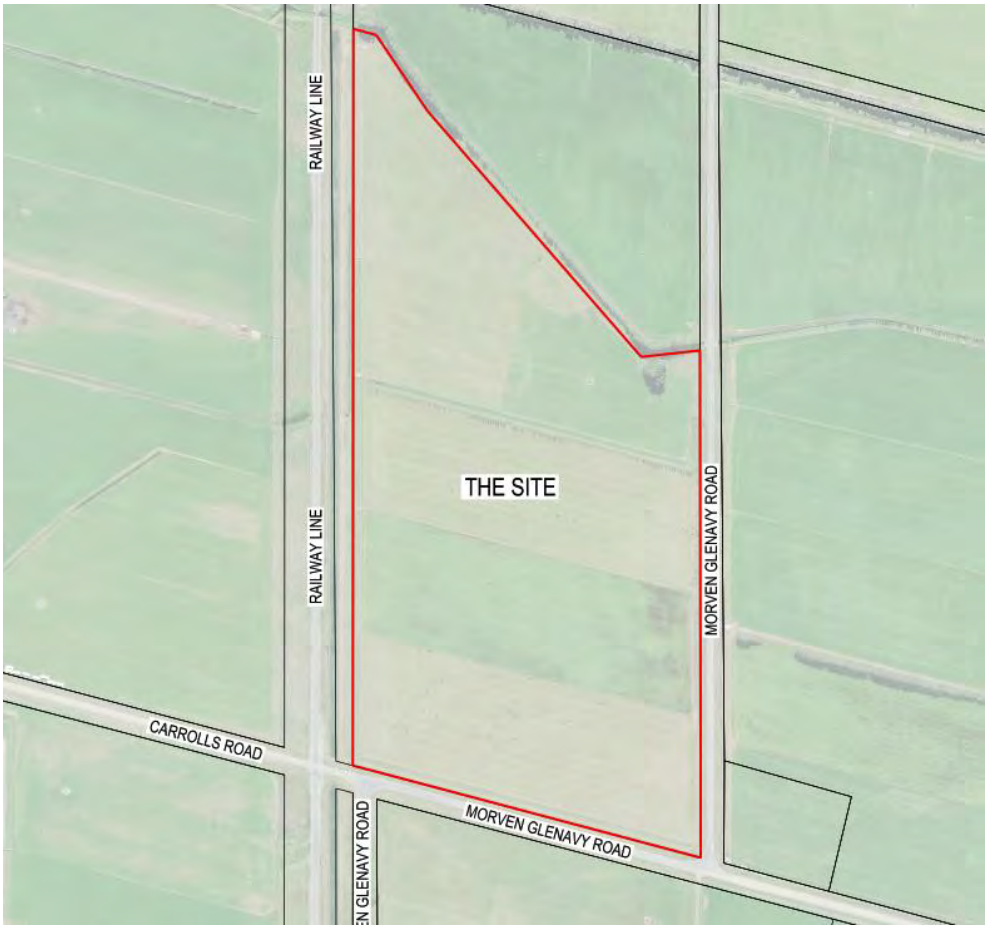


Figure 1. Site Location

The site is bounded by Morven-Glenavy Road to the south and east, an irrigation race and the South Island Main Trunk railway (SIMT) line to the west, and by Whitney's Creek to the north.

2.2 Property Details

The legal description of the site is Rural Section 22268, Title reference CB27B/314 with the owner being Murphy Farms Limited. The total area of the site is 14.85 hectares (ha).

2.3 Topography

The existing ground contours at the site are shown on drawing C00 in **Appendix B**.

The existing ground surface on the site generally slopes down from west to east with a very minimal gradient of approximately 0.3% (1v to 300h). The railway line elevation varies between approximately

RL 29.0m and RL 27.4m (northern site boundary and southern site boundary respectively), while the site is generally between RL 27.0m and RL 26.0m (western and eastern boundary respectively). The railway line is also elevated above the land to the east. The existing ground surface on the site is generally 1.5-2m below the top of the railway line.

2.4 Existing Water Surface Bodies and Open Channel

Whitneys Creek is located adjacent to the northern boundary of the site (on the adjoining site). The existing MGI Irrigation water race is located adjacent to the western boundary, between the railway line and the Project Kea site. These surface water bodies are shown in Figure 2 below and on drawing C00 in **Appendix B.**

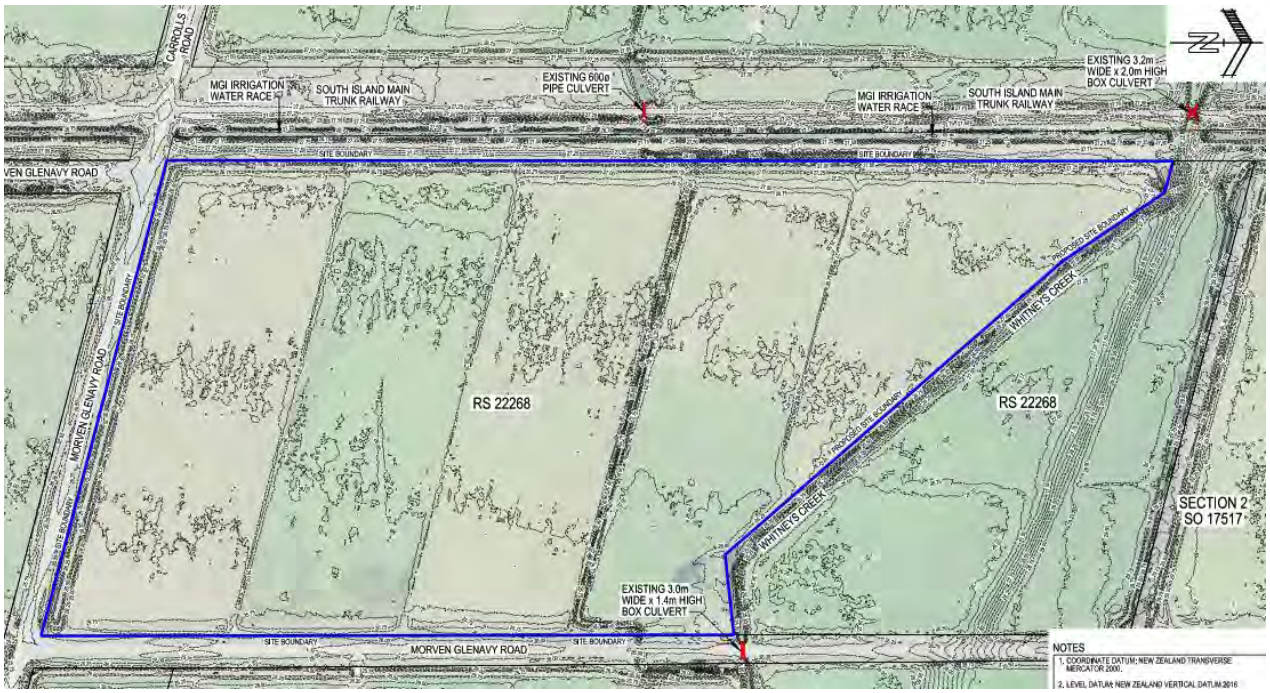


Figure 2. Existing Water Bodies

There is an existing 600 mm stormwater culvert below the railway, near the centre of the western boundary of the site. This pipe discharges to an open channel that crosses the site and exits the eastern boundary via a culvert below Morven Glenavy Road, and then discharges to Whitneys Creek.

3 PROPOSED DEVELOPMENT

The proposed development consists of a waste to energy plant with buildings and associated roading and carparking covering most of the site. It will include a railway siding along the western boundary with connection from the existing main trunk railway line. It is therefore anticipated the finished ground levels of the site will be raised above the existing surface levels to enable the railway siding to appropriately connect with the existing railway platform.

The proposed layout for the Project Kea site is provided in **Appendix A**.

Earthworks will be required over almost the entire site to achieve desirable finished surface levels to enable the construction of the proposed building platforms, road subgrades, construction of the waste bunker and installation of infrastructure, including stormwater management devices.

4 PROPOSED EARTHWORKS

4.1 General Scope and Methodology

The bulk earthworks will generally comprise of importing and placement of clean fill to form the building platforms and road subgrades. Excavation is to be undertaken on site to allow the construction of the waste bunker. Cut will also be required to form stormwater ponds. Material from these excavations will be utilised for fill on the site.

The existing topsoil will be stripped and stockpiled, then respread on the proposed landscape areas where possible. Excess topsoil and any unsuitable materials are to be transported and disposed off-site at an appropriate location. The ground conditions at the site and recommendations for the construction of the excavation for the waste bunker are provided in the Babbage Geotechnical Appraisal in **Appendix C**. The earthworks design has been undertaken in accordance with these recommendations.

The geotechnical assessment indicates the groundwater is likely to be encountered in excavation for the waste bunker and measures are to be put in place to suppress groundwater levels during the construction of the waste bunker. The effects of the temporary dewatering are assessed in the separate Babbage Groundwater Memorandum.

Earthwork construction is expected to be undertaken using conventional earthmoving plant and equipment.

4.2 Extent and Quantities

The extent of the proposed earthworks, finished ground levels, subgrade levels and cut and fill depths are shown on the earthworks drawings in **Appendix B**.

The proposed earthworks will extend over all of the site. In general, this will consist of the placement of between 1.0m and 2.0m of fill across almost all of the site, with the deeper fill placement in the western area of the site. The proposed depth of fill in the northern area of the site is generally less, between 0.25m and 1.0m, although up to 2.0m near the western boundary. The finished levels on the site generally fall south-eastwards, with the proposed elevation near the north-west corner at RL 29.0m and near the south-east corner at RL 26.5m.

Cut will be required for the construction of the stormwater infiltration basins in the southern and northern areas of the site. The cut depth for these basins is generally less than 0.75 m. A deeper cut, up to approximately 7.0 m is proposed for the waste bunker but this cut is limited to an area of approximately 90 m by 60 m in the central western of the site.

The estimated quantities for the proposed earthworks are provided in Table 1 below.

Table 1: Estimated Earthworks Quantities

Item	Quantity
Total earthworks area	148,000 m^2
Total cut volume:	**85,000 m^3**
- Strip topsoil to stockpile to respread	9,000 m^3
- Strip topsoil to off site	36,000 m^3
- Cut to fill	40,000 m^3
Total fill volume:	**130,000 m^3**
- Cut to fill	35,000 m^3
- Imported fill	95,000 m^3
Hardfill stabilisation:	
- Imported hardfill to stabilise building platforms and road	20,000 m^3

4.3 Construction Timeframes

The total earthworks construction period is expected to be a continuous period of approximately 12 months.

Installation of erosion and sediment controls is expected to occur within the first two weeks, prior to the start of earthworks construction. Stabilisation of completed earthworks surfaces is to occur progressively as building platform and road subgrades are completed. Stabilisation of landscaped and grassed area will be towards the end of the earthworks construction period.

4.4 Construction Access and Vehicle Movements

The main construction access to the site for the earthworks is to be from the southern boundary of the site from Morven Glenavy Road as shown on drawing C05 in **Appendix B**.

The anticipated heavy vehicle movements per day are provided in Table 2 below.

Table 2. Estimated Heavy Vehicle Movements

Construction Phase	Vehicle Type	Average vehicles / day	Average trips / day
Dispose excess topsoil off site	Truck and trailer	17	34
Import bulk fill to site	Truck and trailer	44	88
Import hardfill to site	Truck and trailer	9	18
Averages	**-**	**70 heavy vehicles / day**	**140 heavy vehicle trips / day**

4.5 Erosion and Sediment Controls

The proposed erosion and sediment controls have been designed in accordance with Environment Canterbury's Erosion and Sediment Control Toolbox and are shown on the drawings in **Appendix B**. The measures are also described below.

Stabilised Construction Entrance

A stabilised construction entrance will be installed at the main earthworks construction access to the site from the southern boundary of the site from Morven Glenavy Road.

Sediment Retention Ponds

Sediment retention ponds are not proposed for this site. The geotechnical assessment indicates the materials at the site consist of gravels and the imported materials are also likely to consist of gravels, which are low sediment generating materials. The site is also very flat with an average slope of less than 1 degree. Babbage was involved in the earthworks for the Oceania Dairy Factory, located north of the Project Kea site, and our observations during that earthworks construction phase were consistent with the anticipated low sediment generating materials expected for the Project Kea site. There were no significant issues with sediment controls during the earthworks construction for the Oceania Dairy Factory, and based on our past experience, we anticipate similar earthworks conditions for Project Kea. Sediment retention ponds are therefore considered to be unnecessary.

Decanting Earth Bunds

Decanting earth bunds (DEB's) may be installed for smaller catchments areas up to 3,000 m^2. The DEB's will also discharge treated runoff to the existing road water table drains.

Cleanwater Diversion Bunds and Runoff Diversion Channels

Cleanwater diversion bund are not considered to be required to divert cleanwater from upslope properties west of the site due to the presence of the elevated railway and the MGI water race immediately adjacent to the western boundary of the site. These features will divert cleanwater from upslope properties entering the site.

Existing Watercourse and Open Channels

Existing watercourses will be protected by the installation of runoff diversion channels to direct surface water runoff to sediment control devices. Silt fences are to be installed as secondary protection between the runoff diversion channels and the watercourses.

The existing open stormwater channel across the central area of the site is to be piped by extension of the existing 600 mm culvert across the site. This work will either be carried out prior to earthworks in the area of the open channel or appropriate sediment controls will be installed to upslope of the channel.

Stockpiles

Erosion and sediment control for the temporary stockpiles on the site will be managed in general accordance with Environment Canterbury's Erosion and Sediment Control Toolbox.

Specific erosion and sediment control management for the longer-term stockpiles will include:

- Locating at least 20 m from the edge of existing watercourses
- Limiting the average height to less than 3.0 m
- Placing mulching, topsoil and grassing for stabilisation

Progressive Stabilisation

The completed building platforms, road subgrades and landscaped / grassed areas to be progressively stabilised as they are completed to finished subgrade levels. The building platforms and road subgrades are to be stabilised by placement of hardfill. The landscaped / grassed areas are to be stabilised by placement of topsoil and grass seeding.

Dust Control

A Dust Management Plan will be prepared for the site prior to earthworks construction. The matters to be included in the Dust Management Plan are provided in section 6 of this report. Overall, the dust generation will be monitored by the contractor and dust will be controlled by water application as necessary and ultimately by progressive stabilisation of the completed earthworks surface.

Winter Earthworks

The estimated 12 month duration means that earthwork construction is proposed to extend through the winter period. The geotechnical appraisal indicates the materials at the site consist of gravels and the imported materials are also likely to consist of gravels. These are low sediment generating materials, and as such winter earthworks are considered to be feasible. Regular monitoring and increased maintenance as required will be utilised during the winter period.

Monitoring and Maintenance

Monitoring and maintenance are to be carried out generally in accordance with Environment Canterbury's Erosion and Sediment Control Toolbox and consists of:

- Weekly monitoring and recording of status of ESC control measures
- Monitoring immediately before and after any significant rainfall event
- Immediate repair of any defects in ESC control measures
- Monitoring of any change in catchment areas through the progress of the works
- Cleaning out of accumulated sediment from devices when 20% full
- Decommission only after stabilisation of upstream catchment

4.6 Waste Bunker Excavation, Dewatering and Groundwater Quality

Excavation of the waste bunker will be below the natural ground water level and hence dewatering will be necessary. The groundwater within the bunker excavation is to be pumped from the excavation to discharge to the ground surface north of the bunker excavation to recharge to underlying aquifer. The management of groundwater is addressed in the separate Babbage Groundwater Memorandum.

5 CONSTRUCTION EARTHWORKS MANAGEMENT PLAN

A Construction Earthworks Management Plan (CEMP) will be prepared by the contractor and submitted to council prior to commencement of the earthworks.

This plan will include detailed information on:

- General site management
- Council communications and approvals
- Engineer's communications and certification
- Earthworks construction timeframes and staging
- Earthworks construction methodology:
  - Site access and traffic management
  - Work hours
  - Off site disposal site(s)
  - Plant, equipment and personnel
  - Protection of existing property and services
  - Batter support or instability control
  - Hazardous substance spill protection
  - Stockpile management
  - Dust control
  - Site stabilisation
- Earthworks construction methodology for the waste bunker
- Erosion and sediment control measures
- Earthworks and sediment control monitoring and maintenance
- Contamination – site management
- Accidental discovery (cultural, archaeological, etc)
- Site reinstatement methodology

6 DUST MANAGEMENT PLAN

A Dust Management Plan (DMP) will be prepared by the contractor and submitted to council prior to commencement of the earthworks.

This plan will include detailed information on:

- General site management
- Earthworks construction timeframes and staging
- Site access and haul routes (to minimise dust generation)
- Stockpiling (to minimise dust generation)
- Adverse weather conditions (high wind speed)
- Plant and equipment (for dust mitigation) including water supply

7 APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of South Island Resource Recovery Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

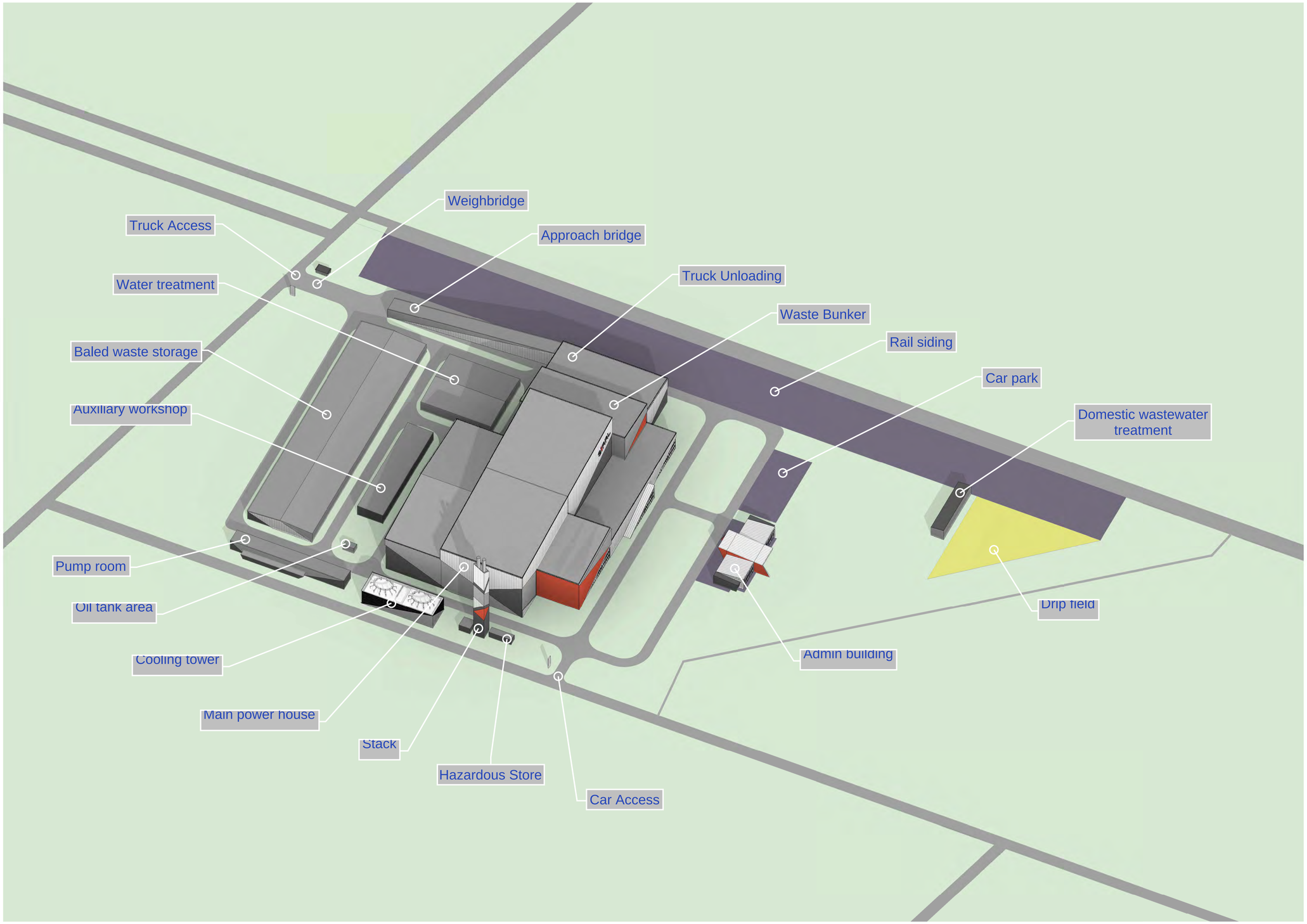
Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions. Where opinions or judgements are to be relied on they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Appendix A

Proposed Development Layout



PROJECT KEA
CONCEPT DESIGN
GLENAVY

SITE 3D VIEWS
SK19-00
14.09.2022

\\babakfs01\Revit-Server\Projects\64300\64308#A Project Kea\5 Design Folder\5.1 Revit\Building\64308#A_Project Kea_V2022_CS.rvt

Babbage
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64308#A

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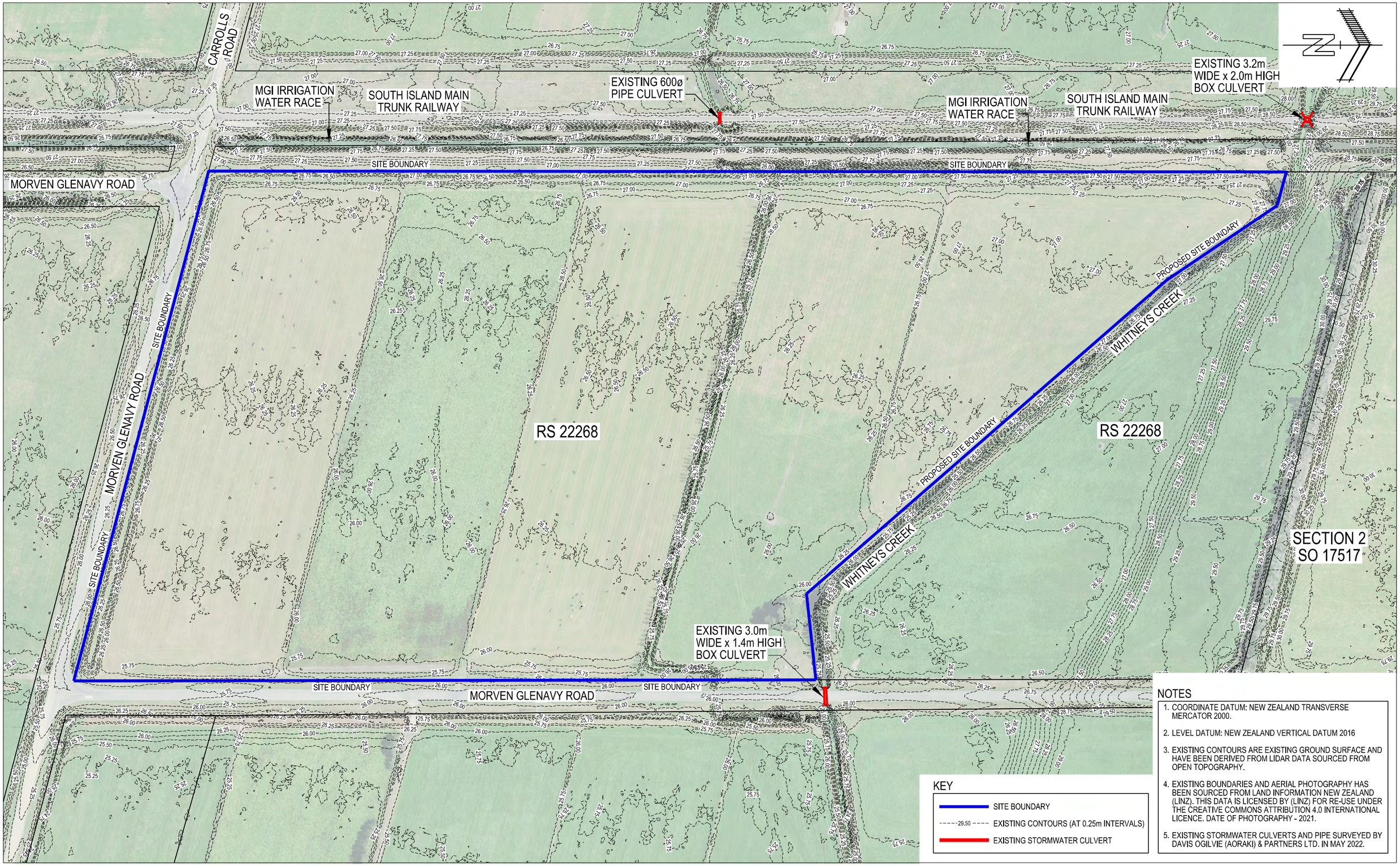
Appendix B

Earthworks Drawings



KEY

- SITE BOUNDARY
- 29.50 EXISTING CONTOURS (AT 0.25m INTERVALS)
- EXISTING STORMWATER CULVERT

NOTES

1. COORDINATE DATUM: NEW ZEALAND TRANSVERSE MERCATOR 2000.
2. LEVEL DATUM: NEW ZEALAND VERTICAL DATUM 2016
3. EXISTING CONTOURS ARE EXISTING GROUND SURFACE AND HAVE BEEN DERIVED FROM LIDAR DATA SOURCED FROM OPEN TOPOGRAPHY.
4. EXISTING BOUNDARIES AND AERIAL PHOTOGRAPHY HAS BEEN SOURCED FROM LAND INFORMATION NEW ZEALAND (LINZ). THIS DATA IS LICENSED BY (LINZ) FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE. DATE OF PHOTOGRAPHY - 2021.
5. EXISTING STORMWATER CULVERTS AND PIPE SURVEYED BY DAVIS OGILVIE (AORAKI) & PARTNERS LTD. IN MAY 2022.

DRAWING REVISIONS

REV	DATE	DRN BY	DES CHK	APPRVD	DESCRIPTION
A	2022.08.24	MJD		MJM	ISSUED FOR RESOURCE CONSENT
B	2022.09.14	MJD	MJM	MJM	ROAD NAME CORRECTED TO MORVEN GLENAVY ROAD (ALONG SITE SOUTHERN BOUNDARY)

	DATE	INITIAL
DESIGNED		
DRAWN	2022.08.19	MJD
DESIGN CHECK		
DRAWING CHECK	2022.08.19	MJM
APPROVED	2022.08.19	MJM

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CLIENT / PROJECT

SOUTH ISLAND RESOURCE RECOVERY LTD.

PROJECT KEA

DRAWING TITLE

EXISTING SITE PLAN

SCALE

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FOR RESOURCE CONSENT

JOB NO.	DRAWING NO.	REVISION
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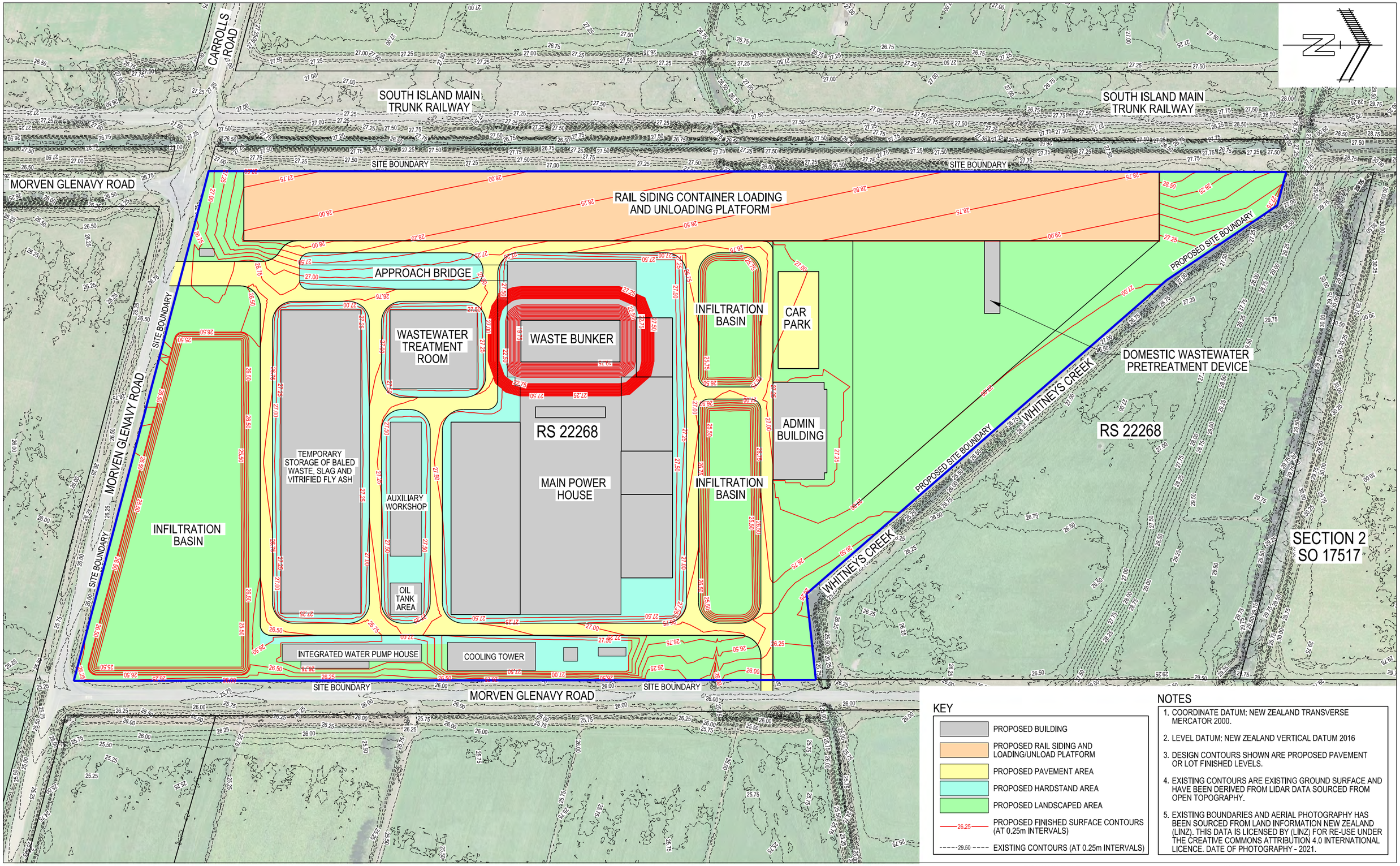

KEY

- PROPOSED BUILDING
- PROPOSED RAIL SIDING AND LOADING/UNLOAD PLATFORM
- PROPOSED PAVEMENT AREA
- PROPOSED HARDSTAND AREA
- PROPOSED LANDSCAPED AREA
- 26.25 PROPOSED FINISHED SURFACE CONTOURS (AT 0.25m INTERVALS)
- 29.50 EXISTING CONTOURS (AT 0.25m INTERVALS)

NOTES

1. COORDINATE DATUM: NEW ZEALAND TRANSVERSE MERCATOR 2000.
2. LEVEL DATUM: NEW ZEALAND VERTICAL DATUM 2016
3. DESIGN CONTOURS SHOWN ARE PROPOSED PAVEMENT OR LOT FINISHED LEVELS.
4. EXISTING CONTOURS ARE EXISTING GROUND SURFACE AND HAVE BEEN DERIVED FROM LIDAR DATA SOURCED FROM OPEN TOPOGRAPHY.
5. EXISTING BOUNDARIES AND AERIAL PHOTOGRAPHY HAS BEEN SOURCED FROM LAND INFORMATION NEW ZEALAND (LINZ). THIS DATA IS LICENSED BY (LINZ) FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE. DATE OF PHOTOGRAPHY - 2021.

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REV	DATE	DRN BY	DES CHK	APPRVD	DESCRIPTION
A	2022.08.24	JC	MJM	MJM	ISSUED FOR RESOURCE CONSENT
B	2022.09.14	MJD	MJM	MJM	ROAD NAME CORRECTED TO MORVEN GLENAVY ROAD (ALONG SITE SOUTHERN BOUNDARY)

	DATE	INITIAL
DESIGNED	2022.08.16	JC
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DESIGN CHECK	2022.08.19	MJM
DRAWING CHECK	2022.08.19	MJD
APPROVED	2022.08.19	MJM

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CLIENT / PROJECT

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PROJECT KEA

DRAWING TITLE

INDICATIVE FINISHED SURFACE LEVELS

FOR RESOURCE CONSENT

SCALE

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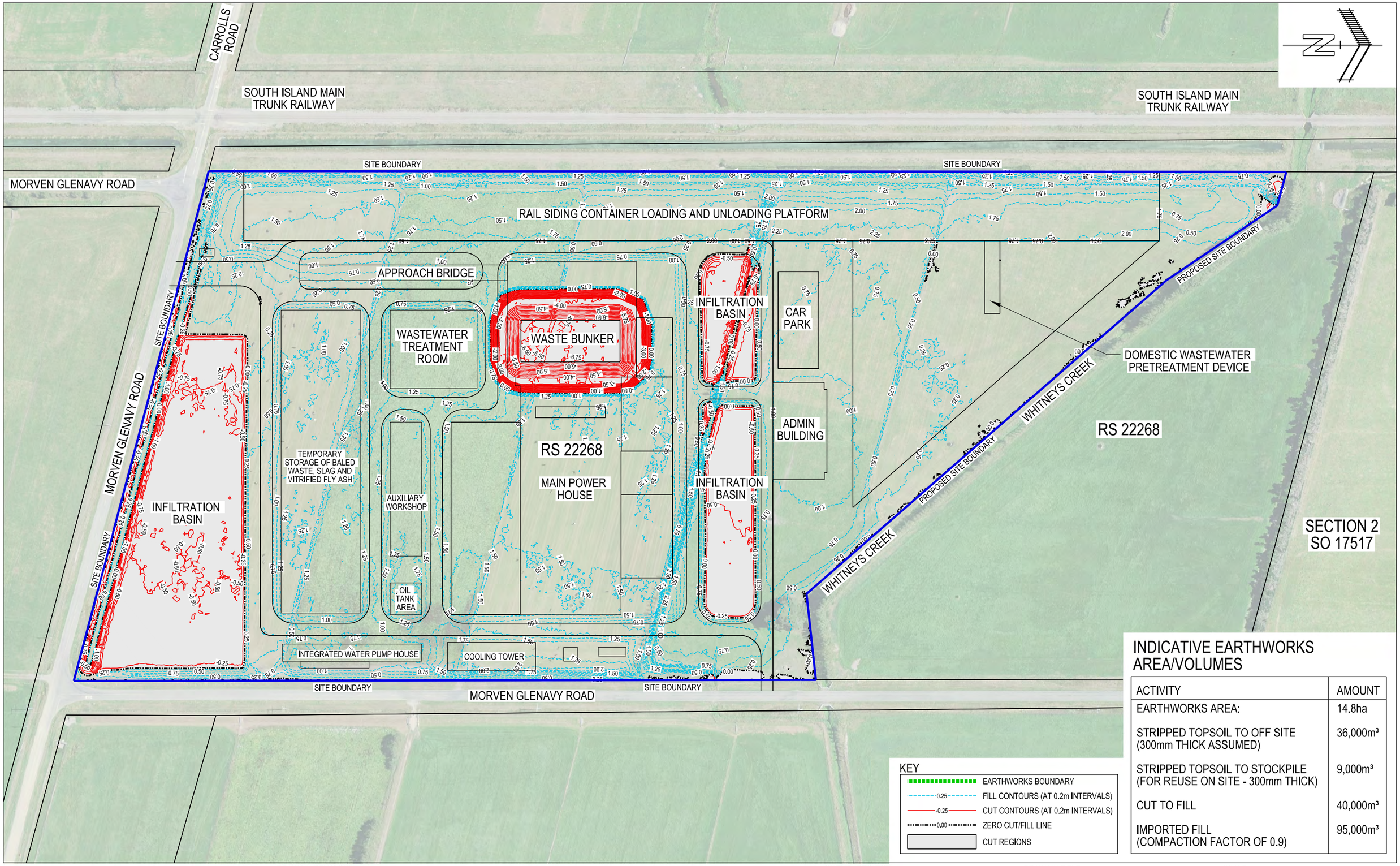

INDICATIVE EARTHWORKS AREA/VOLUMES

ACTIVITY	AMOUNT
EARTHWORKS AREA:	14.8ha
STRIPPED TOPSOIL TO OFF SITE (300mm THICK ASSUMED)	36,000m³
STRIPPED TOPSOIL TO STOCKPILE (FOR REUSE ON SITE - 300mm THICK)	9,000m³
CUT TO FILL	40,000m³
IMPORTED FILL (COMPACTION FACTOR OF 0.9)	95,000m³

KEY

- EARTHWORKS BOUNDARY
- 0.25 FILL CONTOURS (AT 0.2m INTERVALS)
- -0.25 CUT CONTOURS (AT 0.2m INTERVALS)
- 0.00 ZERO CUT/FILL LINE
- CUT REGIONS

Babbage

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	DATE	INITIAL
DESIGNED	2022.08.16	JC
DRAWN	2022.08.16	JC
DESIGN CHECK	2022.08.19	MJM
DRAWING CHECK	2022.08.19	MJD
APPROVED	2022.08.19	MJM

CLIENT / PROJECT

SOUTH ISLAND RESOURCE RECOVERY LTD.

PROJECT KEA

DRAWING TITLE

INDICATIVE CUT AND FILL CONTOURS PLAN

FOR RESOURCE CONSENT

SCALE

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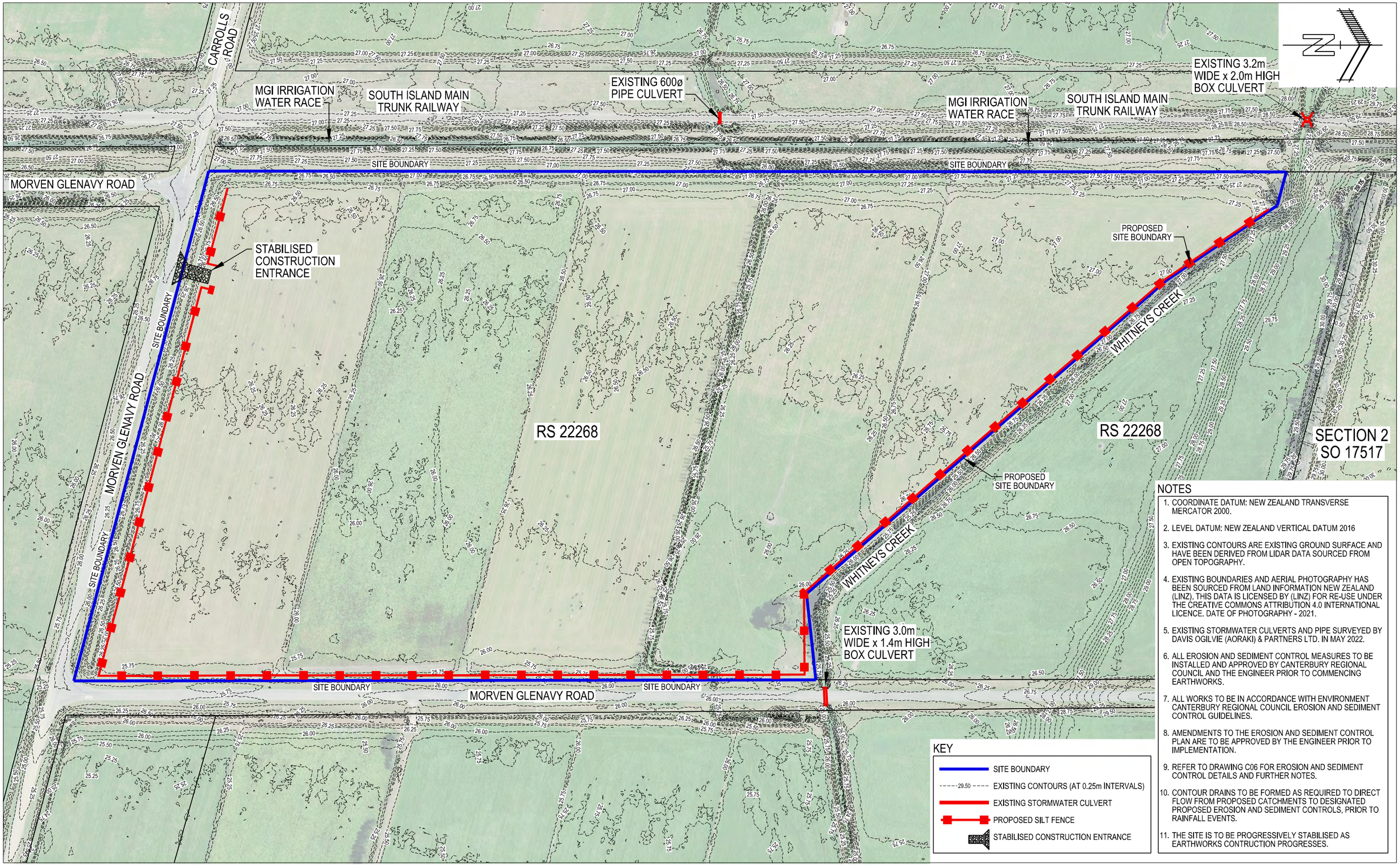

KEY

- SITE BOUNDARY
- EXISTING CONTOURS (AT 0.25m INTERVALS)
- EXISTING STORMWATER CULVERT
- PROPOSED SILT FENCE
- STABILISED CONSTRUCTION ENTRANCE

NOTES

1. COORDINATE DATUM: NEW ZEALAND TRANSVERSE MERCATOR 2000.
2. LEVEL DATUM: NEW ZEALAND VERTICAL DATUM 2016
3. EXISTING CONTOURS ARE EXISTING GROUND SURFACE AND HAVE BEEN DERIVED FROM LIDAR DATA SOURCED FROM OPEN TOPOGRAPHY.
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5. EXISTING STORMWATER CULVERTS AND PIPE SURVEYED BY DAVIS OGILVIE (AORAKI) & PARTNERS LTD. IN MAY 2022.
6. ALL EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED AND APPROVED BY CANTERBURY REGIONAL COUNCIL AND THE ENGINEER PRIOR TO COMMENCING EARTHWORKS.
7. ALL WORKS TO BE IN ACCORDANCE WITH ENVIRONMENT CANTERBURY REGIONAL COUNCIL EROSION AND SEDIMENT CONTROL GUIDELINES.
8. AMENDMENTS TO THE EROSION AND SEDIMENT CONTROL PLAN ARE TO BE APPROVED BY THE ENGINEER PRIOR TO IMPLEMENTATION.
9. REFER TO DRAWING C06 FOR EROSION AND SEDIMENT CONTROL DETAILS AND FURTHER NOTES.
10. CONTOUR DRAINS TO BE FORMED AS REQUIRED TO DIRECT FLOW FROM PROPOSED CATCHMENTS TO DESIGNATED PROPOSED EROSION AND SEDIMENT CONTROLS, PRIOR TO RAINFALL EVENTS.
11. THE SITE IS TO BE PROGRESSIVELY STABILISED AS EARTHWORKS CONTRUCTION PROGRESSES.

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DRAWING REVISIONS

REV	DATE	DRN BY	DES CHK	APPRVD	DESCRIPTION
A	2022.08.24	JC	MJM	MJM	ISSUED FOR RESOURCE CONSENT
B	2022.08.26	MB	MJM	MJM	CW DIVERSION BUND REMOVED.
C	2022.09.14	MJD	MJM	MJM	ROAD NAME CORRECTED TO MORVEN GLENAVY ROAD (ALONG SITE SOUTHERN BOUNDARY)

	DATE	INITIAL
DESIGNED	2022.08.22	MB
DRAWN	2022.08.22	MB
DESIGN CHECK	2022.08.23	JC
DRAWING CHECK	2022.08.23	MJD
APPROVED	2022.08.23	MJM

CLIENT / PROJECT

SOUTH ISLAND RESOURCE RECOVERY LTD.

PROJECT KEA

DRAWING TITLE

EROSION AND SEDIMENT CONTROL PLAN

FOR RESOURCE CONSENT

SCALE

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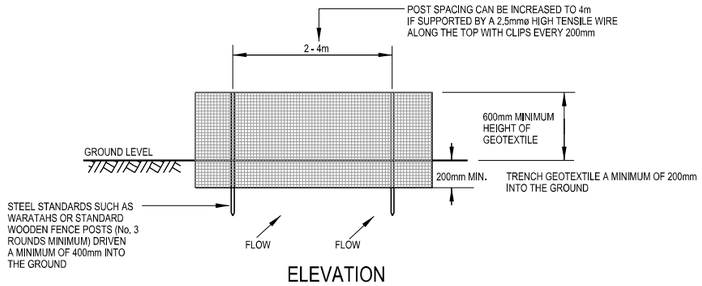

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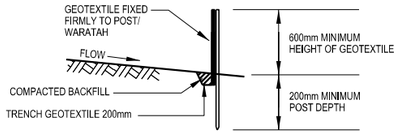
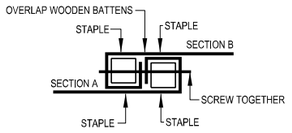
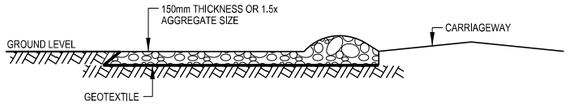


CROSS SECTION



STANDARD FABRIC JOINT



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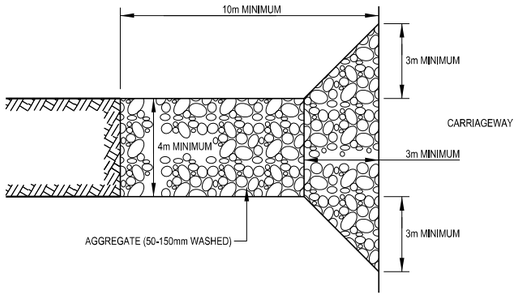
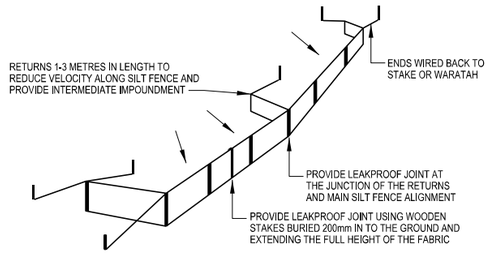


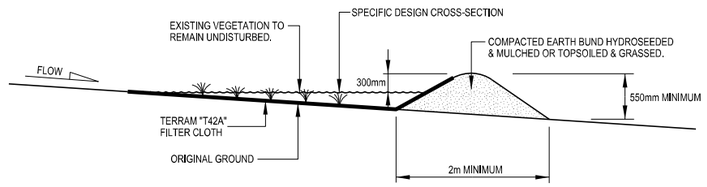
PLAN

STABILISED CONSTRUCTION ENTRANCE



PERSPECTIVE VIEW

SILT FENCE DETAIL



CLEAN WATER RUNOFF DIVERSION BUND CROSS SECTION

NOTES

1. ALL EROSION AND SEDIMENT CONTROL MEASURES MUST BE OPERATIONAL PRIOR TO ANY OTHER WORKS COMMENCING ON SITE. THE CONTRACTOR SHALL ARRANGE AND ATTEND A PRELIMINARY SEDIMENT CONTROL MEETING WITH THE COUNCIL, AS REQUIRED BY THE RELEVANT RESOURCE CONSENT.
2. A COPY OF THE EROSION AND SEDIMENT CONTROL PLAN SHALL BE AVAILABLE ON SITE DURING WORK HOURS AND ALL PERSONNEL INVOLVED IN THE EARTHWORKS ACTIVITIES ON SITE (INCLUSIVE OF SUB-CONTRACTORS) SHALL BE FAMILIAR WITH THE CONSENT AND PLAN REQUIREMENTS AS THEY RELATE TO EROSION AND SEDIMENT CONTROL.
3. ALL "CLEAN WATER" RUNOFF FROM THE STABILISED SURFACES, INCLUDING CATCHMENT AREAS ABOVE THE SITE, SHALL BE DIVERTED AWAY FROM THE EARTHWORKS AREAS.
4. ALL EROSION AND SEDIMENT CONTROLS SHALL COMPLY WITH EROSION AND SEDIMENT CONTROL GUIDELINES FROM ENVIRONMENT CANTERBURY. DIVERSION OF "CLEAN WATER" FROM THE UPSTREAM CATCHMENTS AROUND THE EARTHWORKS AREA SHALL BE BY MEANS OF DIVERSION DRAINS AND / OR OTHER APPROVED METHODS.
5. FURTHER SEDIMENT CONTROL WORKS MAY BE REQUIRED BY THE ENGINEER AS THE PROJECT ADVANCES. THESE WILL BE INSTALLED AS AND WHERE REQUIRED BY THE ENGINEER. THE CONTRACTOR IS SOLELY RESPONSIBLE FOR ENSURING THAT THE SITE HAS EFFECTIVE EROSION AND SEDIMENT CONTROL MEASURES OPERATING AT ALL TIMES.

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DRAWING REVISIONS

REV	DATE	DRN BY	DES CHK	APPRVD	DESCRIPTION
A	2022.08.24	MB	JC	MJM	ISSUED FOR RESOURCE CONSENT

	DATE	INITIAL
DESIGNED	2022.08.22	MB
DRAWN	2022.08.22	MB
DESIGN CHECK	2022.08.23	JC
DRAWING CHECK	2022.08.23	MJD
APPROVED	2022.08.23	MJM

CLIENT / PROJECT

SOUTH ISLAND RESOURCE RECOVERY LTD.

PROJECT KEA

DRAWING TITLE

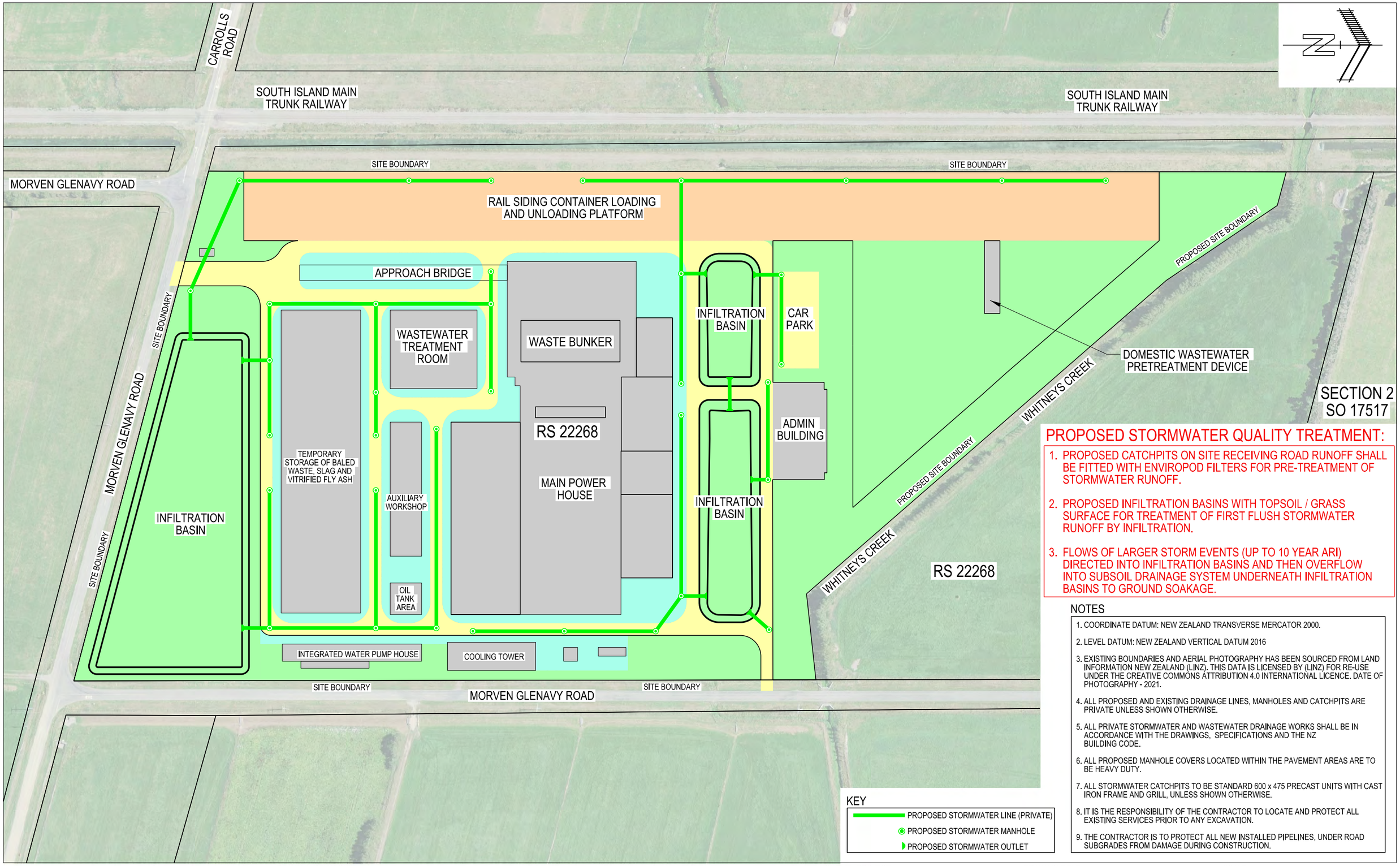
EROSION AND SEDIMENT CONTROL DETAILS

FOR RESOURCE CONSENT

SCALE

N/A

JOB NO.	DRAWING NO.	REVISION
64380	C06	A



SECTION 2
SO 17517

PROPOSED STORMWATER QUALITY TREATMENT:

1. PROPOSED CATCHPITS ON SITE RECEIVING ROAD RUNOFF SHALL BE FITTED WITH ENVIROPOD FILTERS FOR PRE-TREATMENT OF STORMWATER RUNOFF.
2. PROPOSED INFILTRATION BASINS WITH TOPSOIL / GRASS SURFACE FOR TREATMENT OF FIRST FLUSH STORMWATER RUNOFF BY INFILTRATION.
3. FLOWS OF LARGER STORM EVENTS (UP TO 10 YEAR ARI) DIRECTED INTO INFILTRATION BASINS AND THEN OVERFLOW INTO SUBSOIL DRAINAGE SYSTEM UNDERNEATH INFILTRATION BASINS TO GROUND SOAKAGE.

KEY

- PROPOSED STORMWATER LINE (PRIVATE)
- PROPOSED STORMWATER MANHOLE
- PROPOSED STORMWATER OUTLET

NOTES

1. COORDINATE DATUM: NEW ZEALAND TRANSVERSE MERCATOR 2000.
2. LEVEL DATUM: NEW ZEALAND VERTICAL DATUM 2016
3. EXISTING BOUNDARIES AND AERIAL PHOTOGRAPHY HAS BEEN SOURCED FROM LAND INFORMATION NEW ZEALAND (LINZ). THIS DATA IS LICENSED BY (LINZ) FOR RE-USE UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 INTERNATIONAL LICENCE. DATE OF PHOTOGRAPHY - 2021.
4. ALL PROPOSED AND EXISTING DRAINAGE LINES, MANHOLES AND CATCHPITS ARE PRIVATE UNLESS SHOWN OTHERWISE.
5. ALL PRIVATE STORMWATER AND WASTEWATER DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH THE DRAWINGS, SPECIFICATIONS AND THE NZ BUILDING CODE.
6. ALL PROPOSED MANHOLE COVERS LOCATED WITHIN THE PAVEMENT AREAS ARE TO BE HEAVY DUTY.
7. ALL STORMWATER CATCHPITS TO BE STANDARD 600 x 475 PRECAST UNITS WITH CAST IRON FRAME AND GRILL, UNLESS SHOWN OTHERWISE.
8. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE AND PROTECT ALL EXISTING SERVICES PRIOR TO ANY EXCAVATION.
9. THE CONTRACTOR IS TO PROTECT ALL NEW INSTALLED PIPELINES, UNDER ROAD SUBGRADES FROM DAMAGE DURING CONSTRUCTION.

Babbage

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DRAWING REVISIONS

REV	DATE	DRN BY	DES CHK	APPRVD	DESCRIPTION
A	2022.08.24	JC	MJM	MJM	ISSUED FOR RESOURCE CONSENT
B	2022.09.14	MJD	MJM	MJM	ROAD NAME CORRECTED TO MORVEN GLENAVY ROAD (ALONG SITE SOUTHERN BOUNDARY)

	DATE	INITIAL
DESIGNED	2022.08.16	JC
DRAWN	2022.08.16	JC
DESIGN CHECK	2022.08.23	MJM
DRAWING CHECK	2022.08.23	MJD
APPROVED	2022.08.23	MJM

CLIENT / PROJECT

SOUTH ISLAND RESOURCE RECOVERY LTD.

PROJECT KEA

DRAWING TITLE

INDICATIVE DRAINAGE LAYOUT PLAN

FOR RESOURCE CONSENT

SCALE

1:1000 @ A1
1:2000 @ A3

JOB NO.	DRAWING NO.	REVISION
64380	C10	B

Appendix C

Geotechnical Appraisal

TO:	Michael Martin	Date:	16 Sep 2022
COPY TO:	Paul Duder	Job No:	64308#GE
FROM:	Jordan Moll	eTrack No:	200043257

RE: PROJECT KEA – GEOTECHNICAL APPRAISAL

Introduction

As requested, we have undertaken a desk study of relevant available geotechnical information in the vicinity of the proposed waste-to-energy plant at Morven Glenavy Road in South Canterbury ("the Site").

The purpose of this memorandum is to summarise the findings from the desk study and provide preliminary geotechnical recommendations to support concept design and an application for resource consent.

Proposed Development

It is understood the proposed development will comprise numerous industrial structures, including a large incinerator, wastewater treatment room, workshops, and associated roading, car parking and ancillary structures.

A railway siding is proposed along the western boundary, with connection from the existing main trunk railway line. Bulk earthworks are required over the majority of the site, generally comprising filling between 1.0m and 2.0m above existing ground level to as indicated on the civil drawings.

Additionally, an underground bunker is required to store municipal waste, understood to be 70m by 30m and up to 8m deep. The excavation will extend below the groundwater table and require dewatering during construction. Further information regarding groundwater levels and dewatering considerations is presented within Babbage Groundwater Memorandum appended to the Babbage Earthworks Report.

Geology and Anticipated Subsurface Conditions

The site is underlain by glacial outwash deposits comprising gravels formed by successive periods of glacial advance, together with river terrace gravels. Previous geotechnical investigations undertaken on the neighbouring ODL site confirmed generally consistent natural soils comprising dense to very dense sandy gravel with some cobbles to the termination depth of investigations at 7.5m below ground level (bgl) with SPT N values consistently >50.

Numerous groundwater monitoring wells are available within the vicinity of the site. Whilst not geotechnical in nature, the monitoring well logs consistently indicate the presence of fairly homogenous gravels and sandy gravels to depths of at least 30m bgl.

Groundwater levels within the area have been extensively monitored and are summarised in Groundwater Memorandum. The results indicate that groundwater levels fluctuate significantly throughout the year, heavily influenced by the irrigation. Groundwater levels on the subject site are anticipated to range from ~2m bgl to ~8m bgl.

Project Evaluation

Based on the interpreted findings from the geotechnical desk study and the Babbage Groundwater Memorandum, we consider the site is suitable for the proposed development from a geotechnical perspective subject to the comments and recommendations below.

Ground conditions are anticipated to comprise 10m+ of dense gravel. The gravel can be expected to provide good bearing capacity, and shallow foundations are expected to be suitable for all structures on the site. The gravel beds are not considered susceptible to liquefaction, and significant settlement as a result of the proposed filling is unlikely.

Excavations for the waste storage bunker are anticipated to be achieved via cut batters and benching. For preliminary design purposes, temporary cut batters are recommended to be cut no steeper than 1V:3H within the lower 3m of the excavation and 1V:1.5H within the upper 5m, with a 3.0m wide bench between. Stability analyses has been undertaken based on these recommendations, which demonstrates a factor of safety of >1.3 is available for a range of effective stress parameters adopted for the gravel, which is considered acceptable for temporary works. Slope stability outputs are attached. Final temporary batter angles and excavation geometry will be confirmed following intrusive investigations during subsequent design stages.

Significant dewatering is anticipated to be required in the lower half of the excavation, depending on the time of year. As groundwater levels fluctuate significantly and are frequently lower than the depth of excavation required, the risk of permanent drawdown and associated settlement is negligible. During the dewatering activities, water is expected to be discharged to the paddocks at the Site. As the aquifer is unconfined and with high permeability, the discharge is expected to directly recharge the aquifer. The Babbage Groundwater Memorandum considers effects on groundwater availability or interference with neighbouring water bores will be less than minor.

Geotechnical investigations comprising numerous machine boreholes advanced using a sonic drill rig will be required during subsequent design stages and in support of building consent applications. Key considerations for detailed design will be the density of the gravel beds, and assessment of the likely

hydrostatic pressures that will be acting on the bunker that need to be considered and addressed by the Structural Engineer.

Yours sincerely

Jordan Moll

Geotechnical Engineering Manager

Attachments: Applicability and Limitations

Slope Stability Output – Bunker Excavation

APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

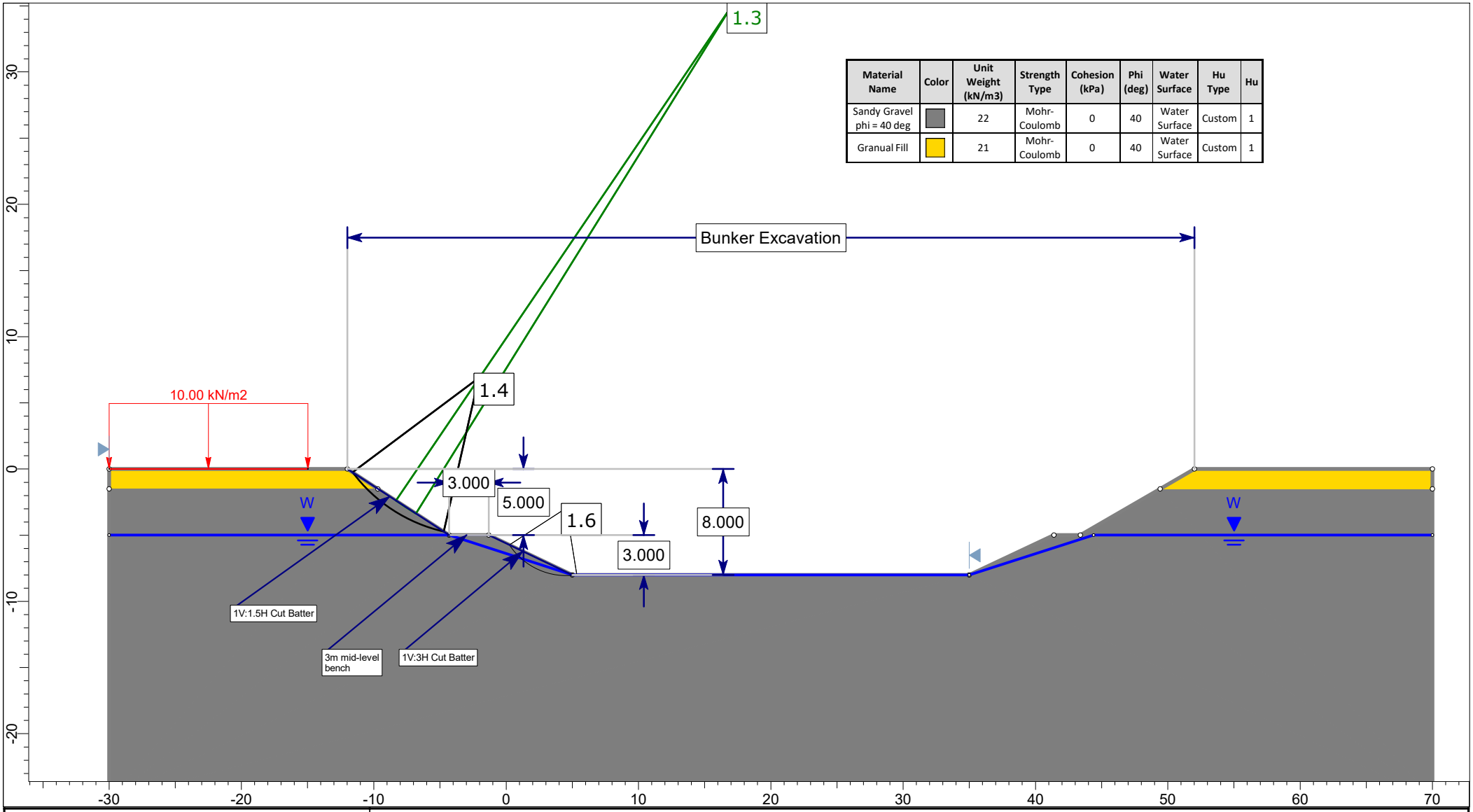
This report has been prepared solely for the benefit of South Island Resource Recovery Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Reliability of Investigation

Recommendations and opinions in this report are based on data from boreholes undertaken by Babbage for geotechnical purposes on nearby properties, and from publicly available borehole data. The nature and continuity of subsoil conditions away from these locations are inferred, and it must be appreciated that actual conditions could vary considerably from the assumed model.



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Sandy Gravel phi = 40 deg		22	Mohr-Coulomb	0	40	Water Surface	Custom	1
Granual Fill		21	Mohr-Coulomb	0	40	Water Surface	Custom	1

Babbage partners in excellence	*Project*	Project Kea	
	Analysis Description	Bunker Excavation Temporary Works	
	Drawn By	JM	*Company*
	Date	26 August 2022	*Figure No* 1

SLIDEINTERPRET 9.008