:

Te Puna Industrial Limited s92 Response Report

1 February 2023

CONFIDENTIAL

297 Te Puna Station Road

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Document Details:

Date: 16 November 2022
Reference: 2-9Z729.01
Status: DRAFT

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Document History and Status

Revision	Date	Author	Reviewed by	Approved by	Status
0	16.11.22	Bryan Duncan and Sarah Millar	Corinne Ankenbruck	Corinne Ankenbruck	Draft
1	23.11.22	Bryan Duncan and Sarah Millar	Corinne Ankenbruck	Corinne Ankenbruck	Draft
2	1.12.22	Bryan Duncan and Sarah Millar	Corinne Ankenbruck	Corinne Ankenbruck	Draft
3	1.02.23	Bryan Duncan and Sarah Millar	Corinne Ankenbruck	Corinne Ankenbruck	Final

Revision Details

Revision	Details
3	Civil Design Report
3	Stormwater and Site Management Plan Report

Contents

Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Te Puna Industrial Ltd. ('**Client**') in relation to the preparation of a Civil Design Report, a Geotechnical Assessment Report, and a Stormwater Report and Site Management Plan for the proposed development at 297 Te Puna Station Road, Te Puna ('**Purpose**') and in accordance with the Offer of Service dated 18 May 2022. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

In preparing the Report, WSP has relied upon data, surveys, analyses, designs, plans and other information ('Client Data') provided by or on behalf of the Client. Except as otherwise stated in the Report, WSP has not verified the accuracy or completeness of the Client Data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in this Report are based in whole or part on the Client Data, those conclusions are contingent upon the accuracy and completeness of the Client Data. WSP will not be liable in relation to incorrect conclusions or findings in the Report should any Client Data be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

The findings and recommendations given in this report are based on geotechnical investigations carried out at discrete locations. As the factual evidence has been obtained from discrete test locations, which by their nature only provide information about a small volume of soils, there may be conditions pertaining to the site which have not been disclosed by the investigation and which have not been taken into account in the report.

ABBREVIATIONS

SMP	Stormwater Management Plan
DTM	Digital Terrain Model
WBOPDC	Western Bay of Plenty District Council

1 Introduction

WSP New Zealand Limited (WSP) have been engaged by Te Puna Industrial Ltd to respond to the s92 Requests for Information from the Western Bay of Plenty District Council and Bay of Plenty Regional Council, and to provide recommendations for the proposed industrial development at 297 Te Puna Station Road, Te Puna.

We understand that an application for resource consent was previously submitted in January 2022, although several requests for information (RFIs) were received from the Western Bay of Plenty District Council (WBOPDC) and the Bay of Plenty Regional Council (BOPRC).

The report has been prepared in response to the RFIs prepared by WBOPDC and BOPRC, and is considered to be appropriate for resource consent purposes. The report shall be read in conjunction with the previous reports discussed below.

2 Civil Concept Design Report

2.1 Introduction

This report provides the technical documentation of the conceptual level design of the potential civil approach to support the development of an SMP for the site.

This report is to be read in conjunction with the following reports:

- Stormwater Report and Site Management Plan
- Geotechnical Report

This Design report has been prepared by WSP New Zealand Ltd to report on the design standards and assumptions used in the completion of the concept design of this project.

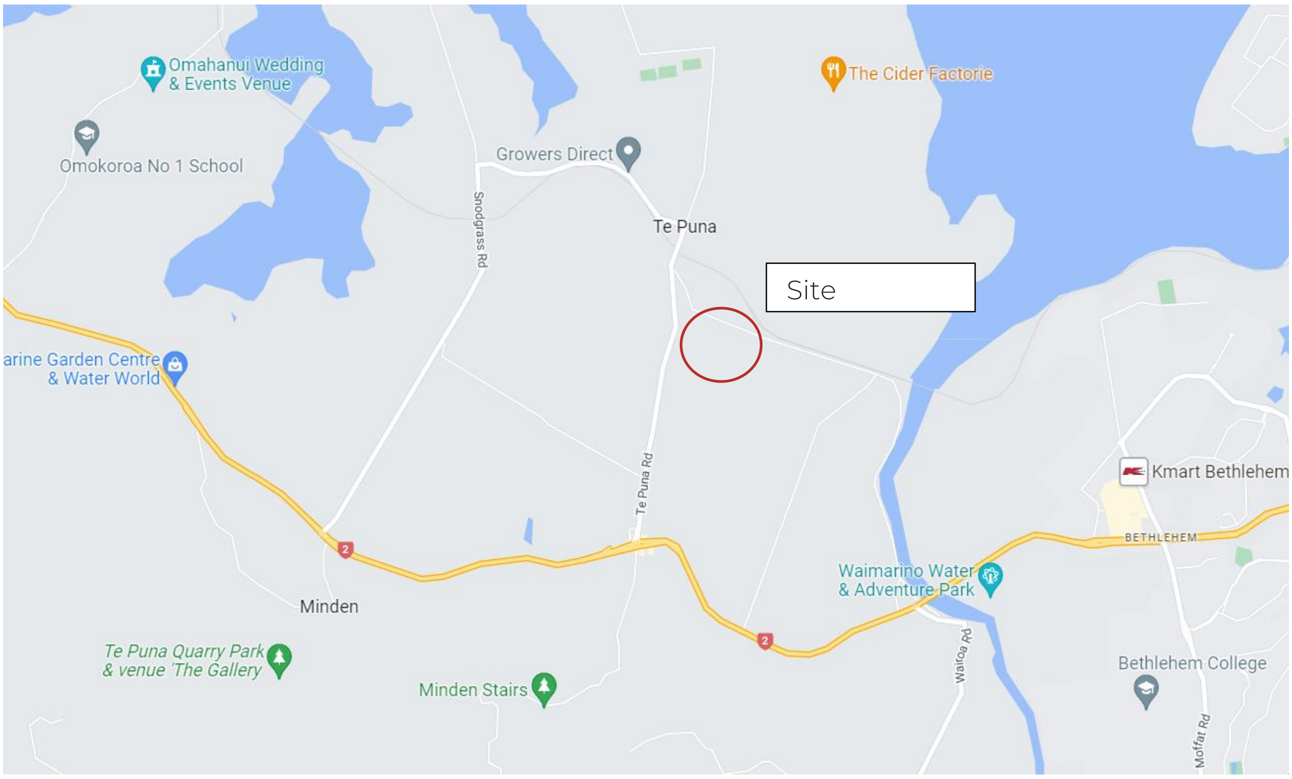

Figure 2-1 : Location Plan

2.2 Design Standards

The design standards adopted are:

- WBOPDC Development Code
- NZS 4404:2010 Land Development and Subdivision Infrastructure
- Austroads Guide to Road Design series
- All relevant technical specifications need to be considered at future design stages

2.3 Survey / LIDAR Digital Terrain Data

For the investigation and concept design the survey data utilised for the SMP has been based on Lidar and legal boundary information from Land Information New Zealand (LINZ), site coverage as shown in : LFigure 2-2.

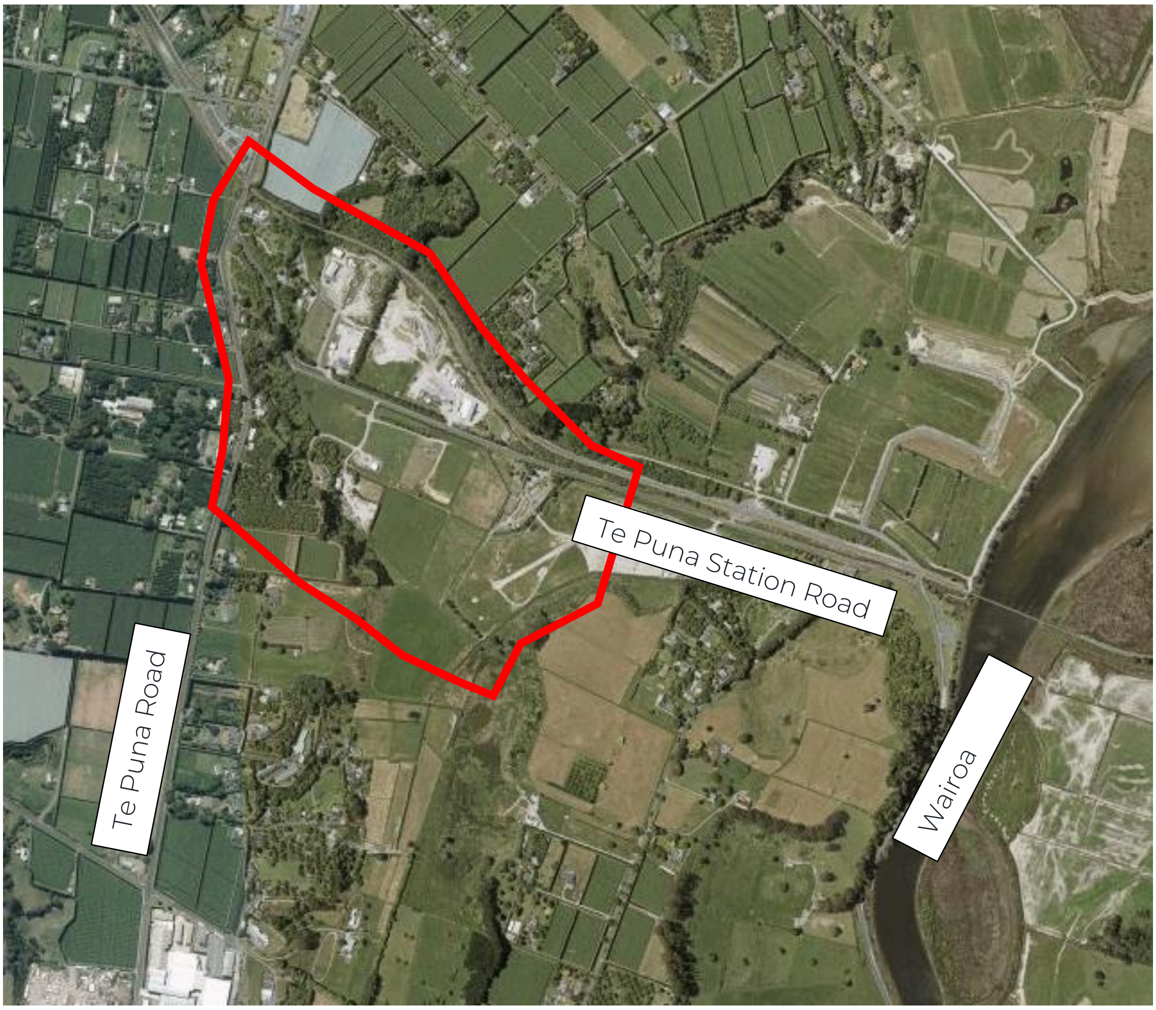

Figure 2-2 : Lidar DTM Coverage

2.4 Sewer Reticulation

Sewer reticulation has not been designed during the design. These will need to be investigated and designed in consultation with Western Bay of Plenty District Council during the development stage.

2.5 Water Reticulation

The Western Bay of Plenty District Council Development Code requires industrial water supply reticulation to meet Water Supply Classification FW3 with minimum of 150mm watermain. This needs upgrading from the existing 100mm council supply. If the Western Bay of Plenty District

Council has the calibrated water model, we can use the residual pressure (from the model) at their boundary to size appropriate connection and its utilities layout.

For detailed design phase we recommend the following:

- Modelling using nearest hydrant pressure log and one more hydrant for worst case scenario to feed into model
- Updated site utilities layout to meet FW3 in accordance to WBOPDC development code and New Zealand Fire Service Firefighting Water Supplies Code of Practice SNZ PAS 4509

Watermain capacity and sizing is governed by firefighting well above potable requirement, as long as the detailed design meets FW3 it can deliver site demand. A backflow prevention device may be required based on the nature of this industrial business. Based on the pipe sizes and initial investigation we see no reason why these requirements would not be met.

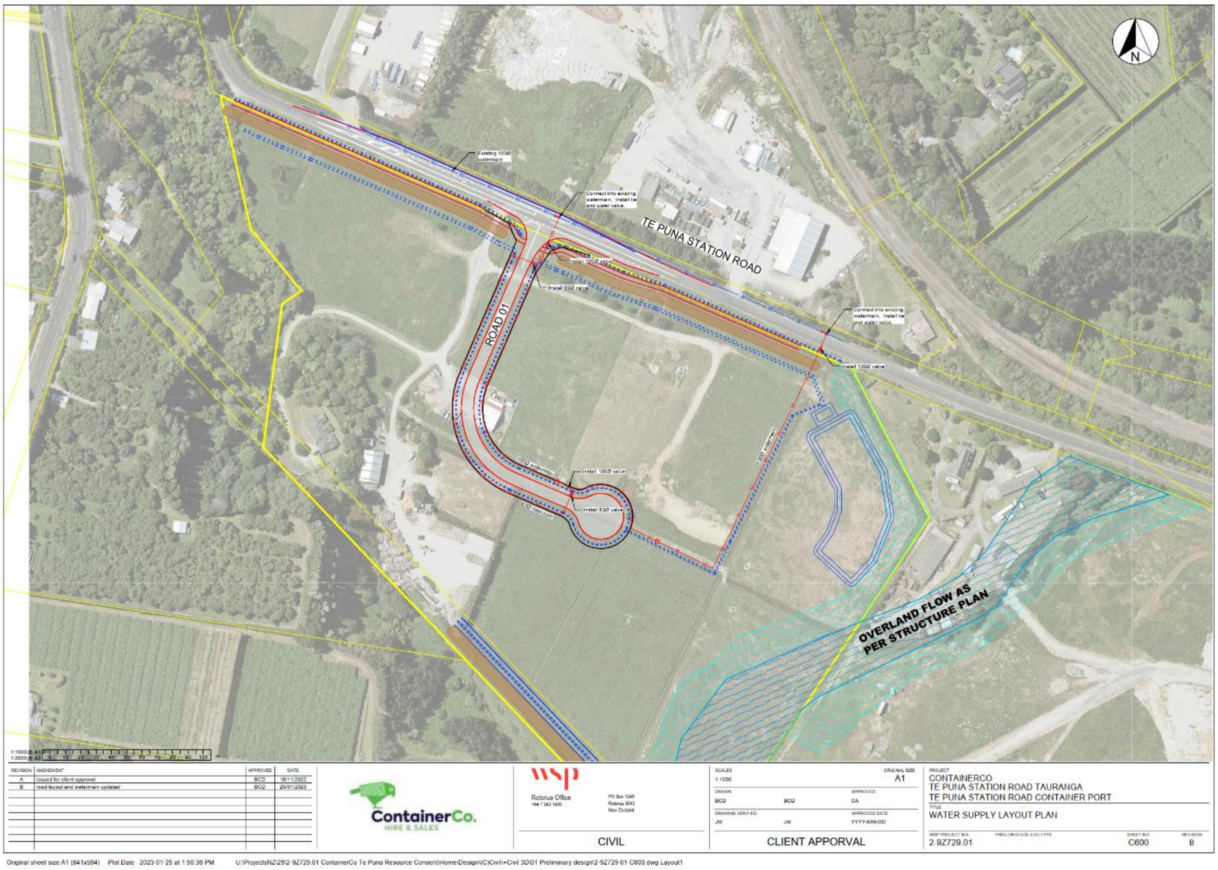

Figure 2-3 : Proposed Water Supply Plan

2.6 Geotechnical Assessment

Geotechnical investigations and assessments have been completed over the site and the assessment is detailed in the Geotechnical report submitted in this s92 response.

2.7 Earthworks

The site is flat contour and rising on the western side up to Te Puna Road. See Figure 2-4 for existing site contour plan.

Due to the nature of the existing contour being very low lying the design has generally raised the design contour to minimise flooding depth. The lease areas have been designed to have a crossfall no greater than 1%. The overland flow path as per the structure plan located to the west of the site is proposed to have no earthworks undertaken.

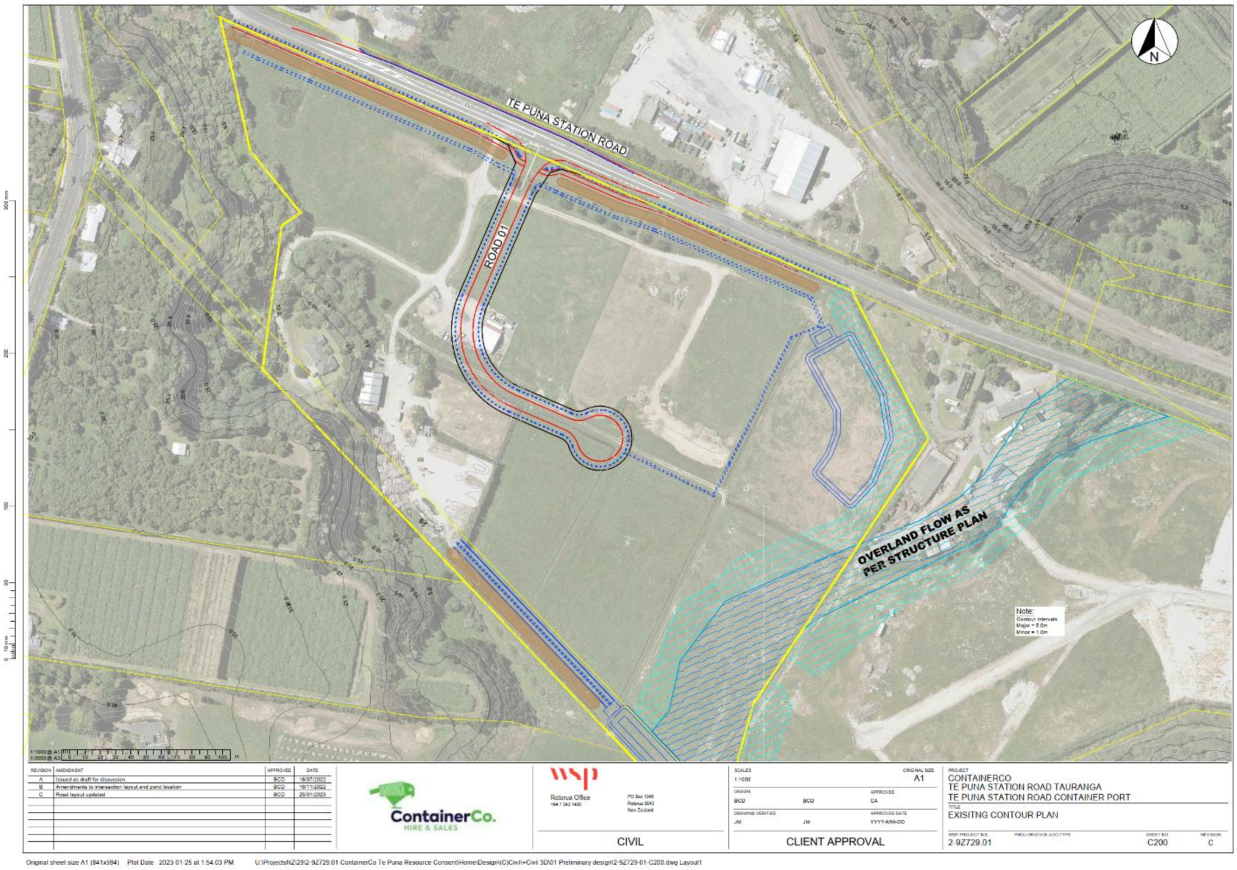

Figure 2-4 : Existing Contour Plan

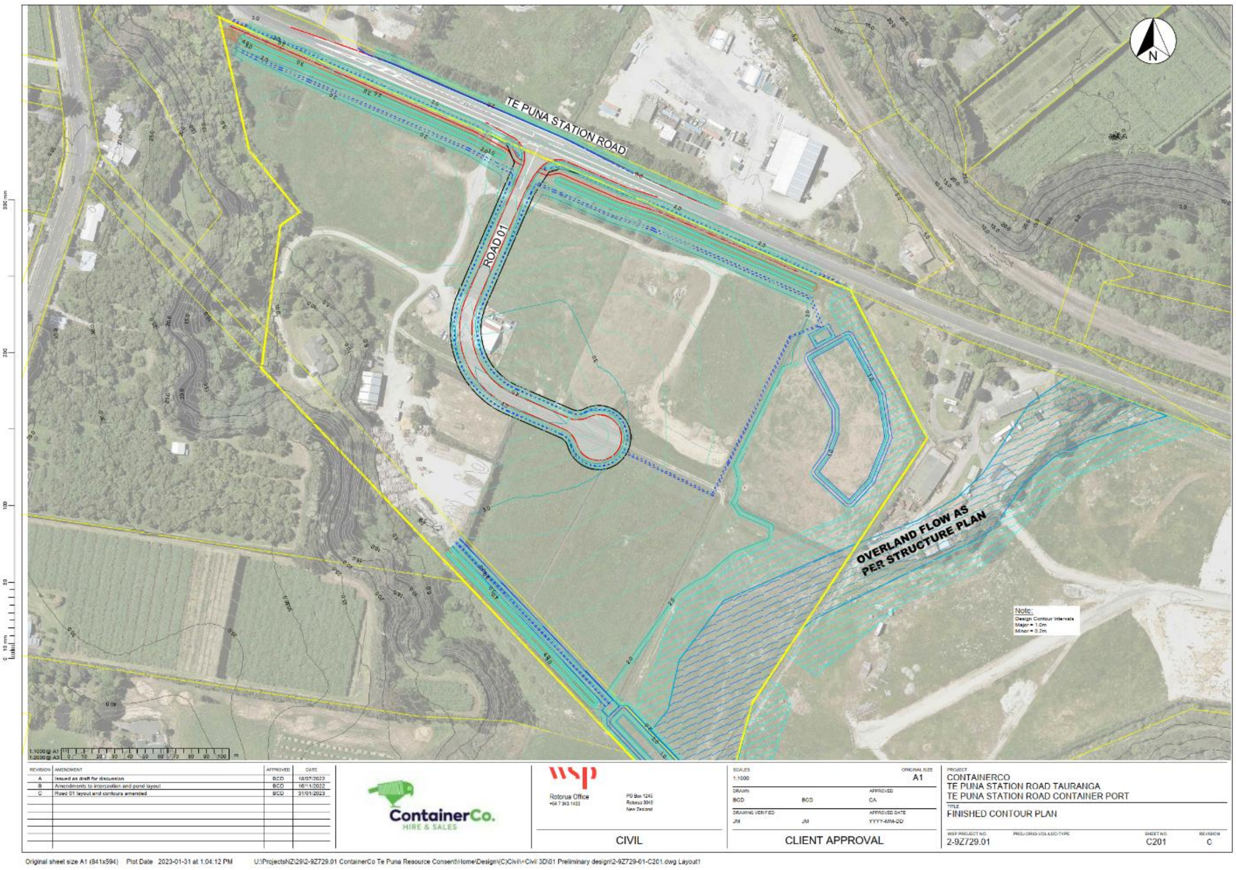

Figure 2-5 : Proposed Contour Plan

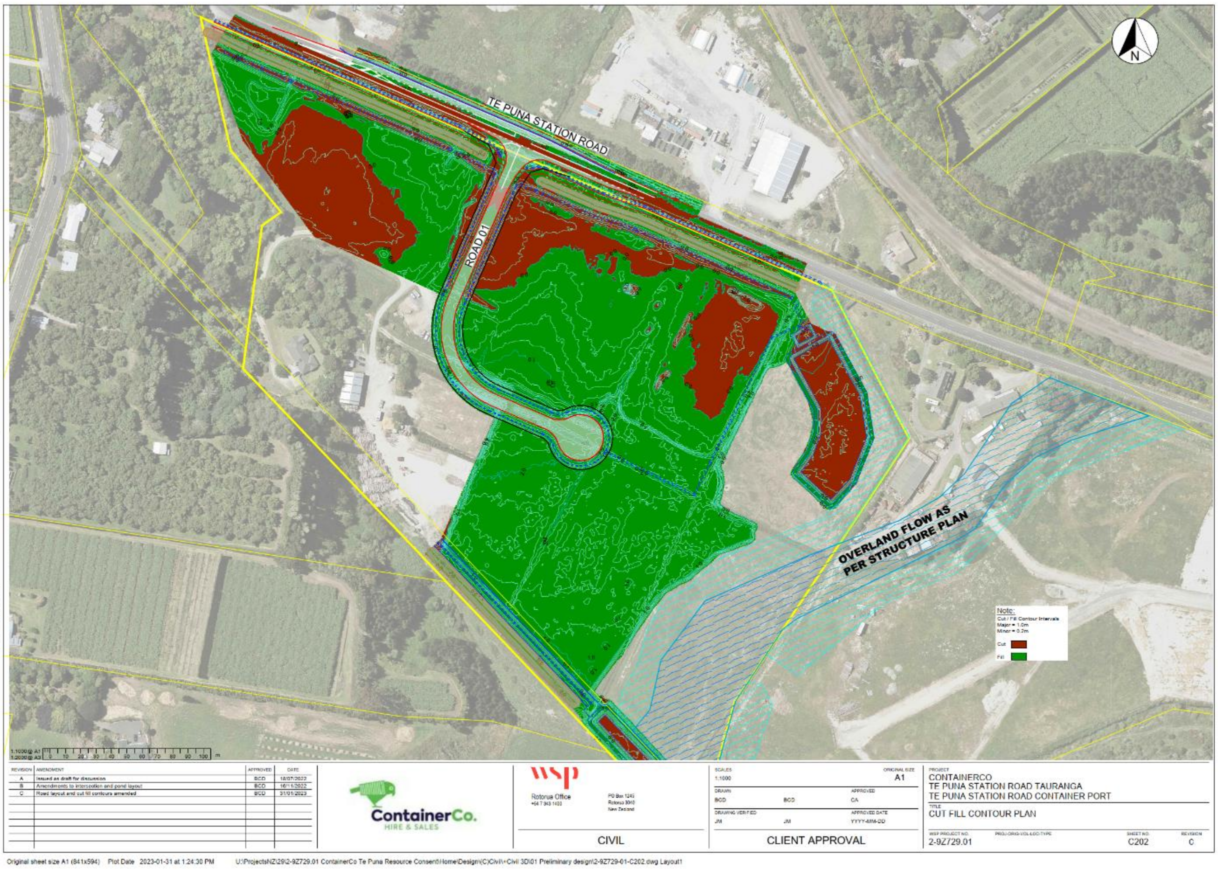

Figure 2-6 : Indicative Cut / Fill Plan

2.8 Road Network

2.8.1 Speed Environment and Design Speed

The surrounding environment and posted speed on Te Puna Station Road is 80 km/hr.

Road 01 design speed for the design road for this development has been set at 40 km/hr.

2.8.2 Horizontal Alignment

The horizontal alignment for Road 01 has been designed to provide access to the lease sites and provide adequate crossfalls and drainage across the lease sites.

2.8.3 Vertical Alignment

The vertical alignment has been designed to optimise lease site grades and site drainage. The maximum road grade is 1.3%.

Stormwater Swales are designed with grades no steeper than 2% to allow for pre-treatment prior to entering the ponds and due to the flat nature of the development site.

2.8.4 Cross Section

The road cross section details used for the design of Te Puna Station Road are:

- Nominal cross fall 3%
- Sealed lane width 4.25m
- See Figure 2-7 below for details

The road section details used for the design of Road 01 are:

- Nominal cross fall 3%
- Sealed lane with 4m (total sealed width 8m. No parking on road allowed for)

- See Figure 2-7 below for details
- Swale on both sides of the road
- Total formation width of 20m

The WBOPDC development code specifies 11m sealed road width including carparking. As carparking on the road has not been allowed for the design seal width has been reduced to 8m.

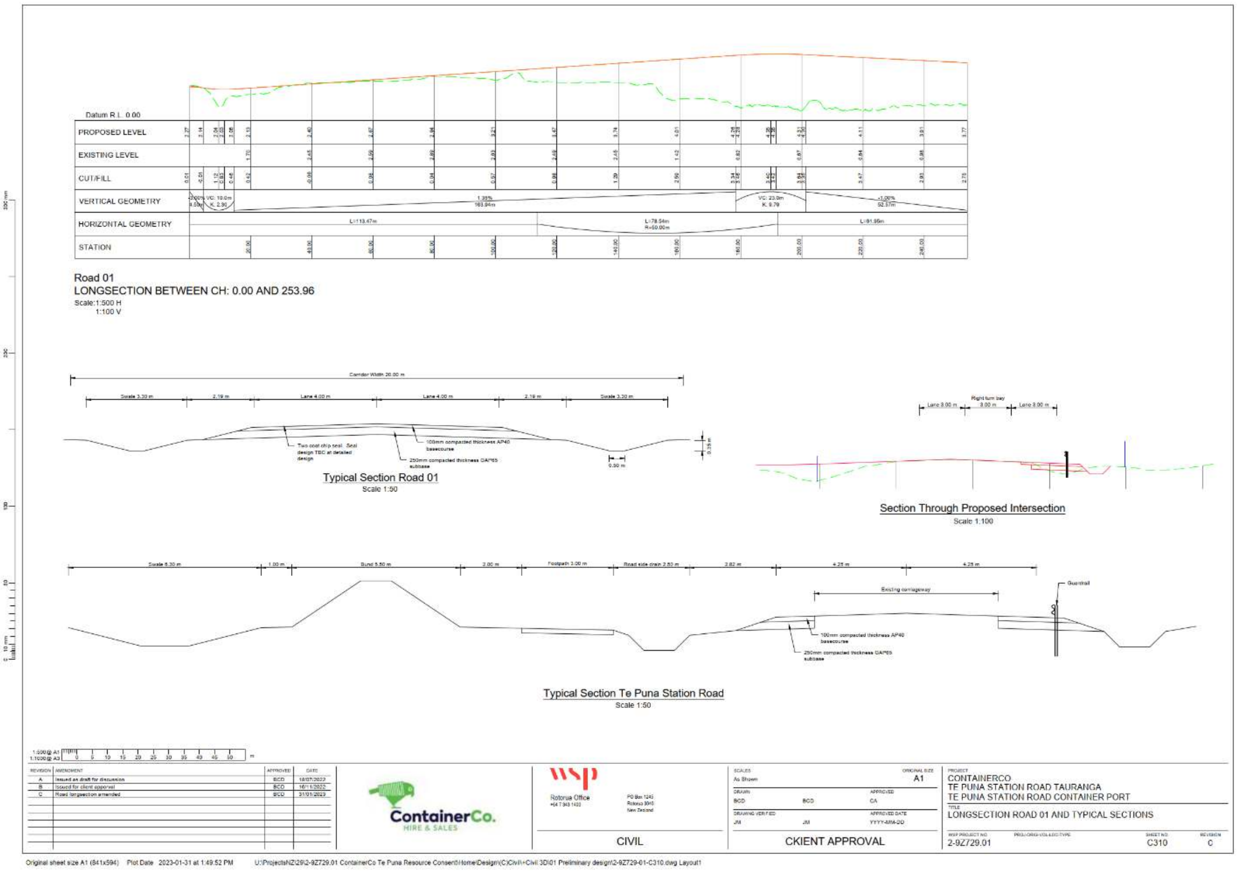

Figure 2-7 : Longsection Road 01 and Typical Sections

2.8.5 Provision for Pedestrian and Cyclists

Pedestrian and cyclist moment has been provided via shared path parallel to Te Puna Station Road and walkways through the wetland area.

2.8.6 Road 01 – Te Puna Station Road Intersection

The intersection of Road 1 with Te Puna Station Road has been placed to maximise site visibility and turning movements. The design is in accordance with WBOPDC Development Code which specifies All intersections are to be designed according to Austroads Guideline for Traffic Engineering Practice Part 5 – Intersections at Grade and meets the section 92 requirements which specifies that the left turn lane meets Waka Kotahi Diagram E.

The intersection is located along a straight section of Te Puna Station Road and has been designed to accommodate the Waka Kotahi RTS 18 Semi Truck. See Figure 2-8 and Figure 2-9 for intersection details.

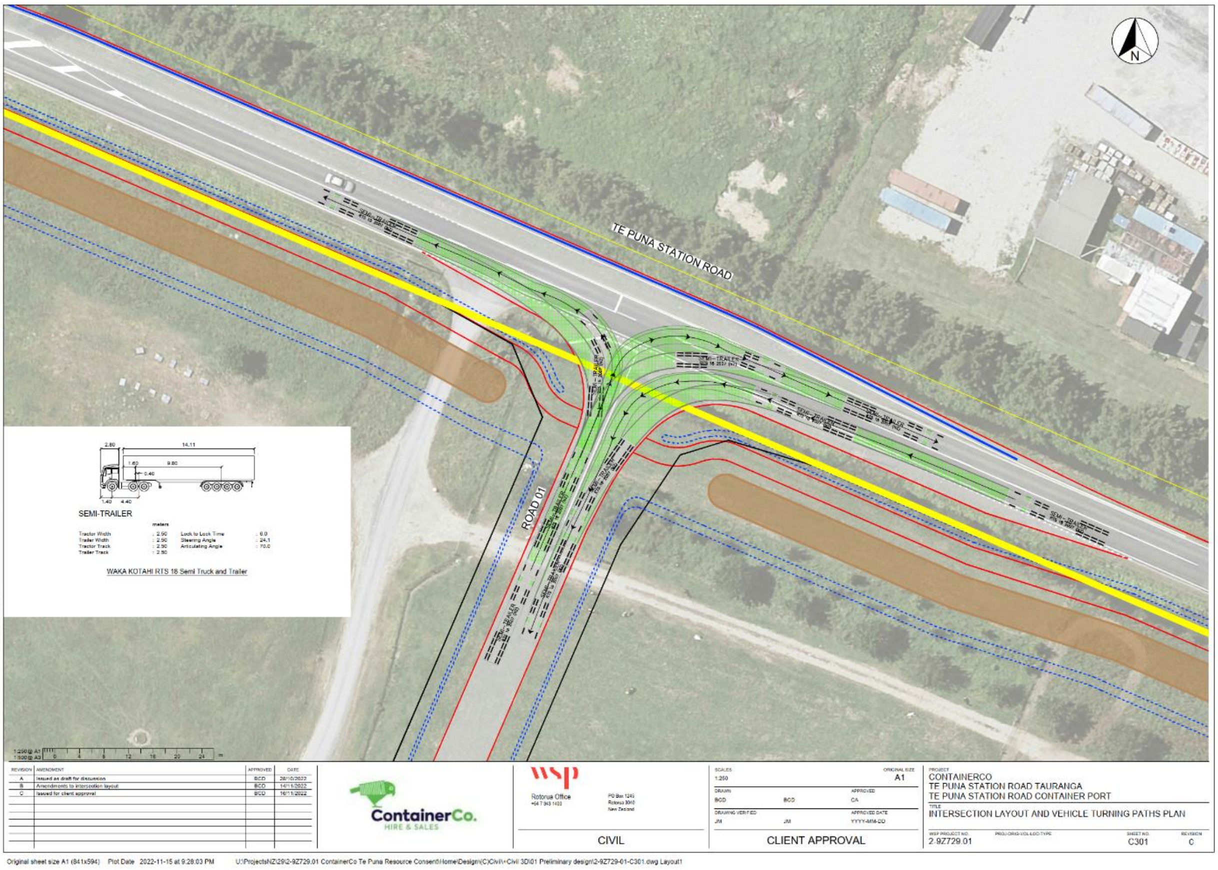

Figure 2-8 : Waka Kotahi RTS 18 Semi Truck and Trailer Turning Movements

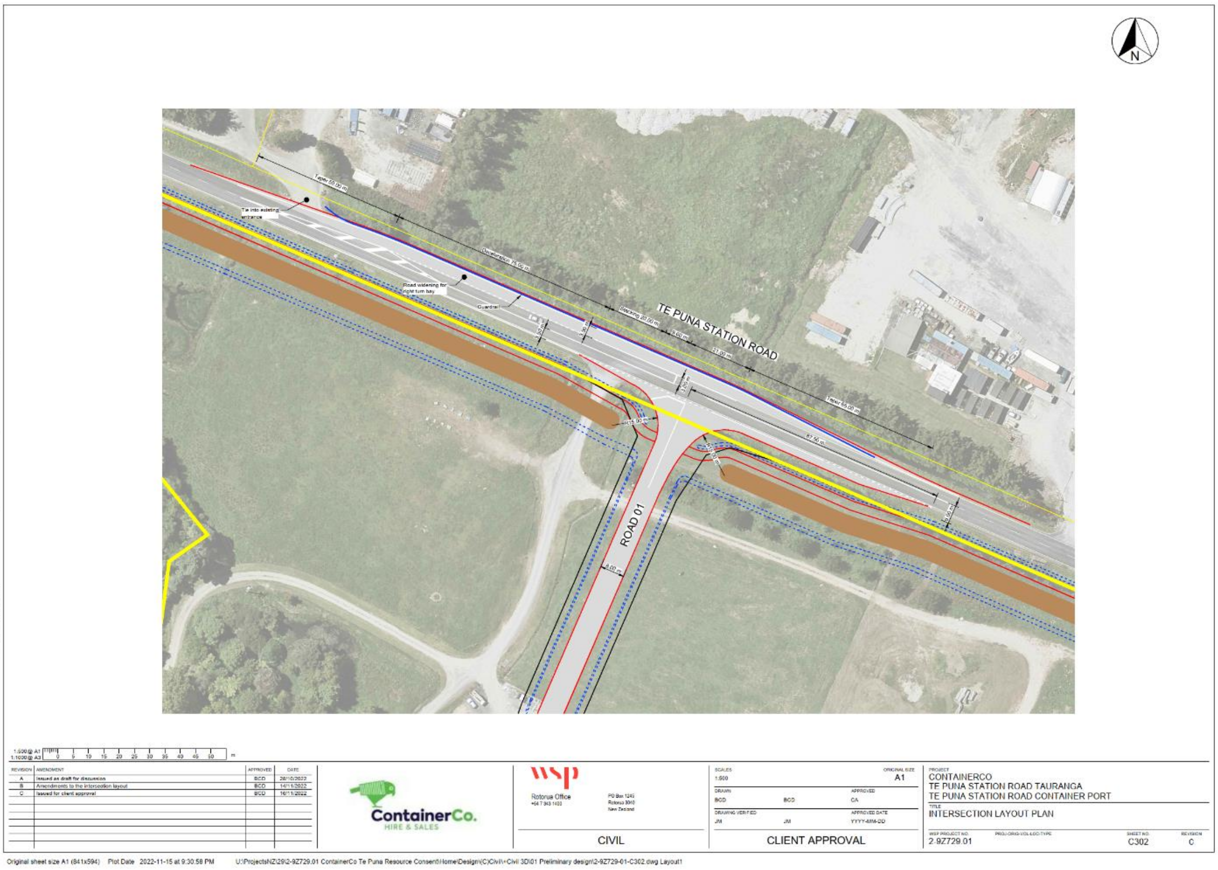

Figure 2-9 : Intersection Layout Plan

2.8.7 Stormwater

The design for the development stormwater has been designed to convey stormwater via side road swales pond 01 and pond 02. The swales have been designed to have grades no greater than 2%. When treated water to discharge from the ponds into the overland flowpath as per the structure plan.

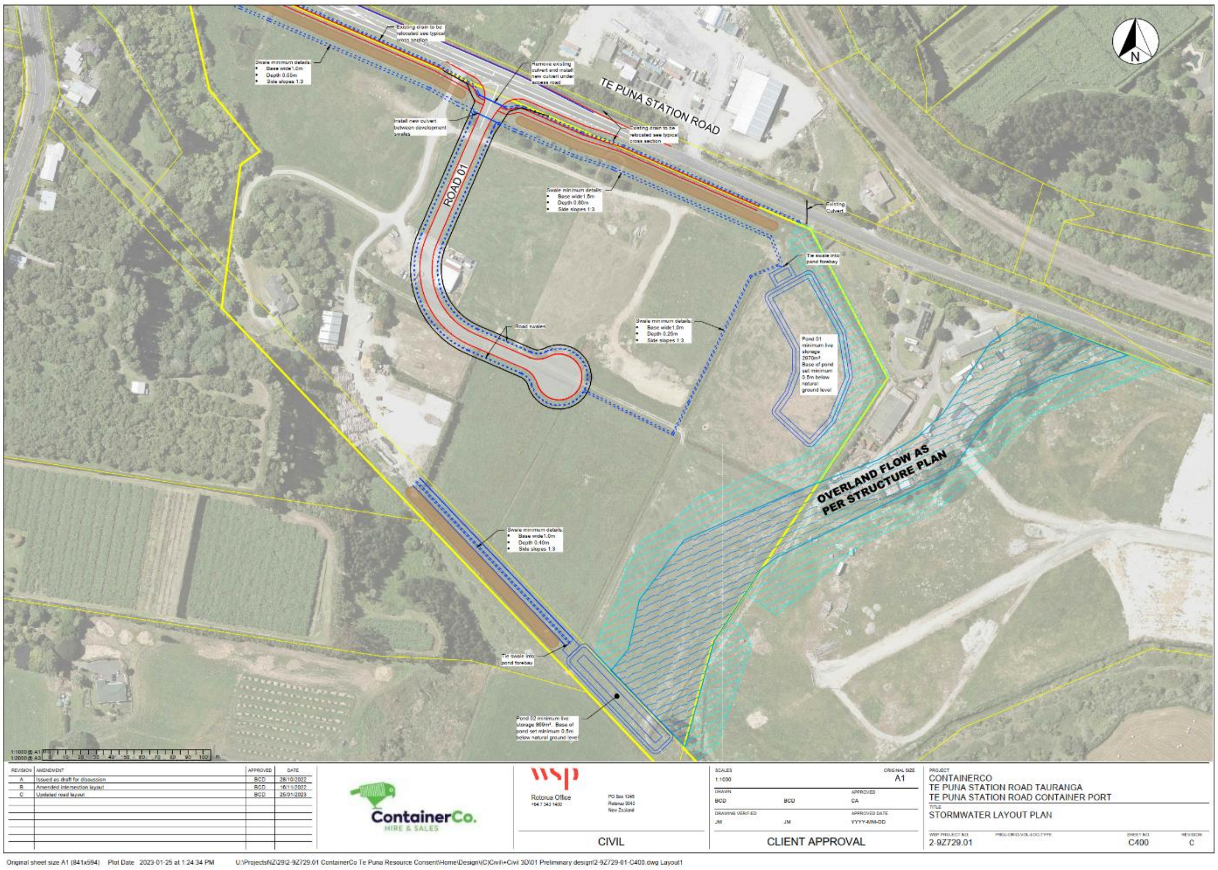

Figure 2-10 : Stormwater Layout Plan

The Te Puna Station Road drain on the northern side of the road has been designed to be relocated due to the road widening for the right turn bay in to Road 01. The existing southern drain parallel to Te Puna Station Road has been designed to be filled and relocated see Figure 2-7 for typical section details. This drain will discharge into the overland flow path as shown in Figure 2-10.

2.8.8 Ponds

Pond 01 has been designed with a capacity of 2970m3 and the base of the pond has been set a minimum of 0.5m below natural ground level.

Pond 02 has been designed with a capacity of 869m3 and the base of the pond has been set a minimum of 0.5m below natural ground level.

Both ponds are design with forebays which will provide pre-treatment prior to stormwater entering the ponds.

3 Stormwater Report

3.1 Roadside Drainage

Realign northern roadside drain

The northern roadside drain will have to be realigned to encompass the slip/turning lane. The additional area of road (contributing catchment) on the north side will be 750m^2.

Realign Southern Roadside drain

As with the northern roadside drain, to maintain the current level of service, the same cross-sectional area of drain must be provided.

We recommend that the southern roadside drain is also rerouted, so that the official crossing – which will likely be a heavy traffic rated box culvert is as narrow as possible to minimise costs, e.g:

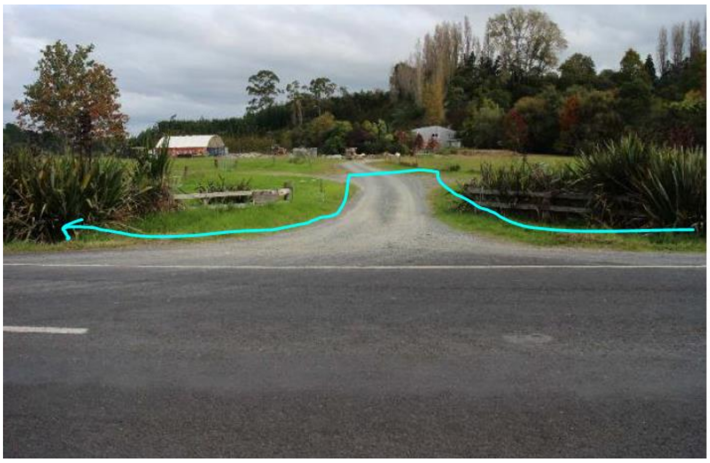

Figure 3-11 : Site Entryway at Te Puna Station Road

Stormwater from the ContainerCo site will not drain to the roadside drains, rather it will be collected in stormwater swales within the site, and conveyed to the stormwater treatment ponds, at the north east and south east extents of the site.

Site stormwater drains will flow west to east, and then North to South, discharging to the overland flow path on the masterplan which flows west to east.

The widened intersection into the site will drain to both the north and south roadside water table drains. These drains will be reconstructed so as to maintain their existing function. Realistically the drain volume can only be increased by widening the drain, as any additional depth created will be taken up by groundwater.

When road layouts are confirmed, the required drain cross sections can be confirmed.

The drains will be reconstructed in the new position in their original profile. There may be a small increase in widening required to account for the additional road surface.

3.2 Overland Flows and Flooding

Site drainage and how it will be ensured after fill is placed that intercepts the existing drainage on site can be found in the Civil Engineer Site Plans included in this s92 response report.

It should be noted that in accordance with the direction of the s.92 requests, development of the entire site, and holistic effects consideration of that development, is being considered.

Earthworks and fill placement is therefore considered for the entire site, not just 'Stage 1' as previously defined.

The proposed final level is 2.5m RL. Fill will not be placed in Masterplan overland flow path, but only on existing raised areas or the low-lying area in the image below.

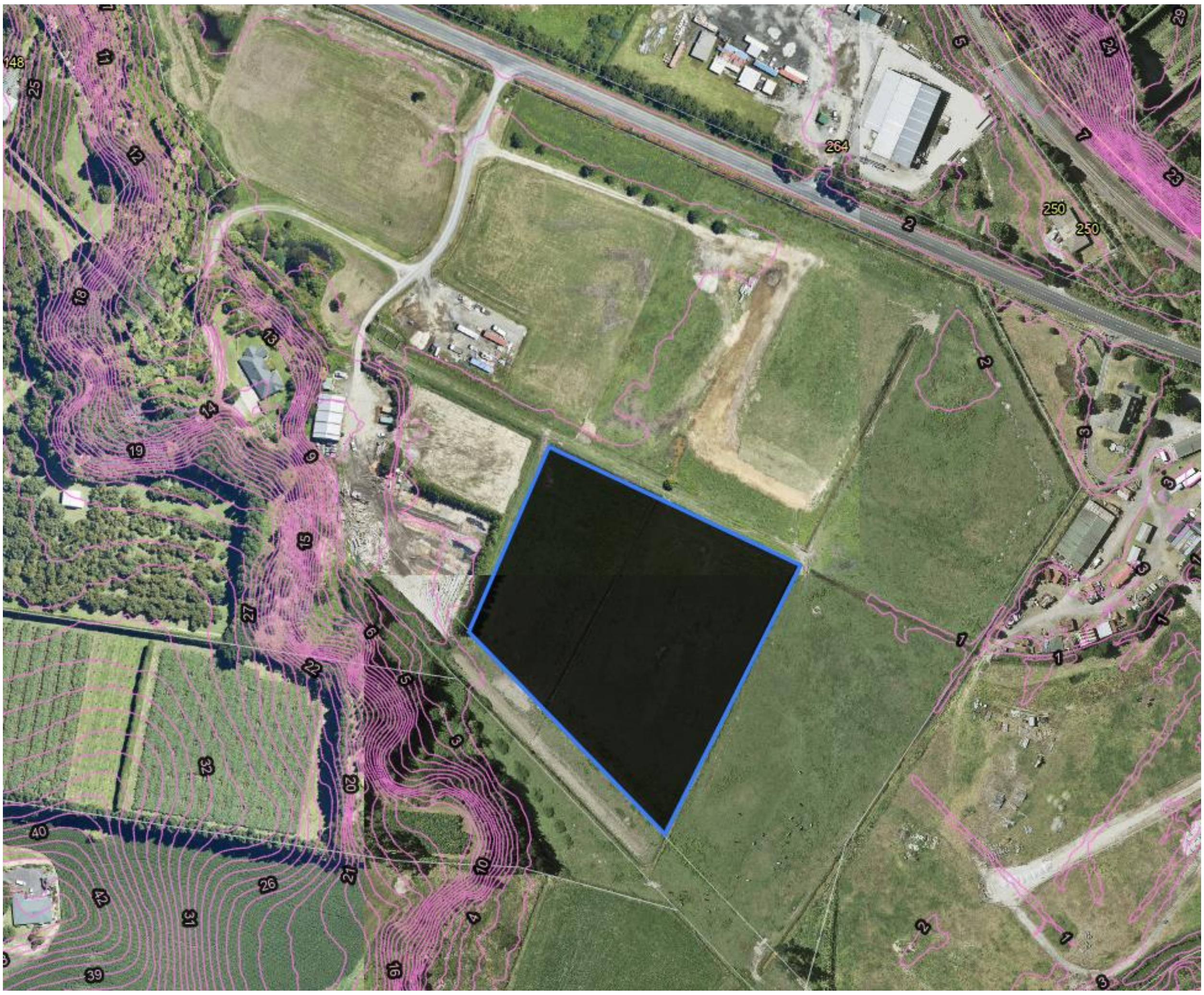

Figure 3-12 : Low lying fill area on site

Stormwater Discharge from developed (new and previously filled) area will be managed so as comply with 10% AEP requirements (storage), and 1% AEP requirements (attenuation). Treatment will be of first flush of the 1% AEP.

A spreadsheet of catchment peak flows, a spreadsheet of channel sizings for swale drains, and drawings are attached and below.

Filling of the low-lying area to the south and east of the site will reduce the area available for floodwater storage by approximately 16,000m^2, with the current level of that part of the site at between 1 and 2m RL. Other changes to the site, along with cut/fill modifications result in a nett loss in available flooding volume of the area. Volumes are detailed in the table below.

If the whole site (75,000m^2) were raised to 2.5m RL, the required volume of fill (and corresponding area not available for flood water) would be approximately as detailed below, with the corresponding estimated increase in flood water level:

Table 1 – Additional depth of flood water due to fill

Area	Volume of fill required m³	Area affected at flood level (m²)	Additional depth of flood water due to fill (m)
Raise whole site to 2.5m	8,654	398,501	0.022

It should be noted that the additional depth of water at site assumes a 'fence' around the site keeping the additional water in, so is not a realistic representation of what would happen on site.

3.2.1 Areas Affected by Flooding Levels

Graphically Assuming additional flooding from fill at the site only affects the following area:

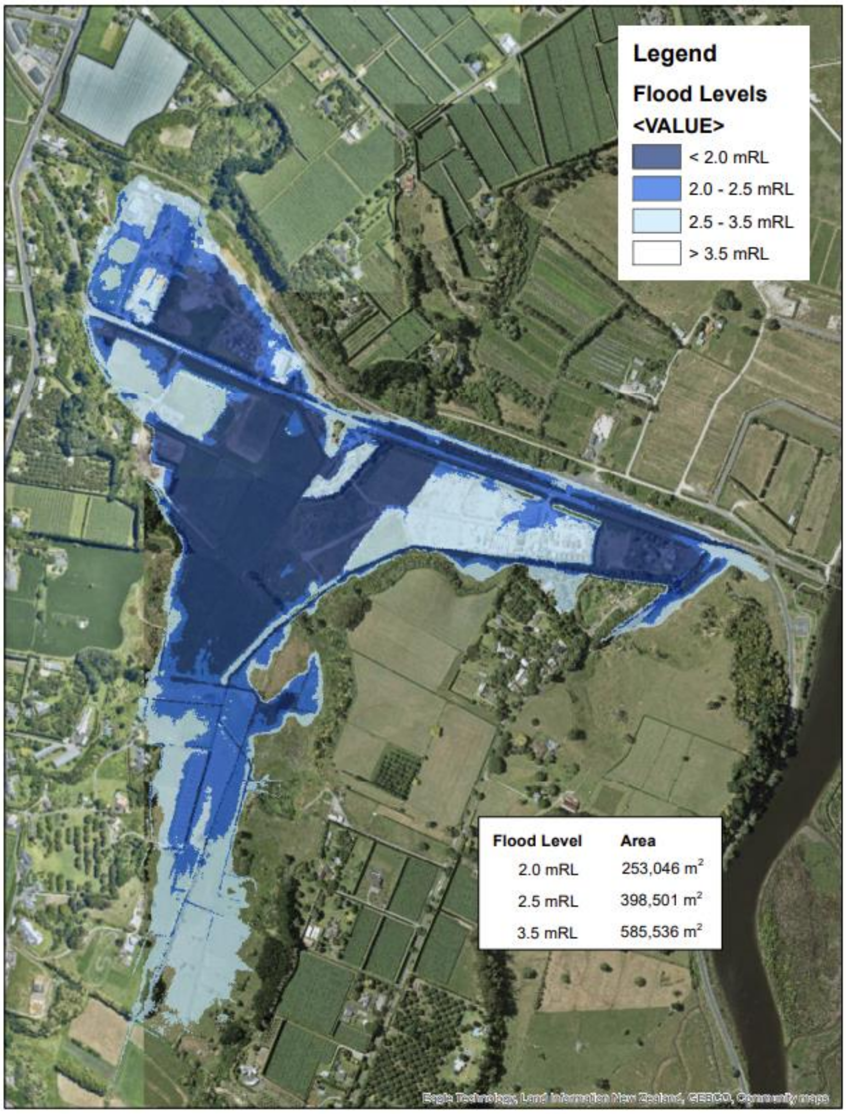

Figure 3-13: Flood levels

At a flooding level of 2.5m RL from either river floodwater or sea level rise /storm surge, the approximate affected area is depicted above in royal blue, and the additional depth of stormwater at this level from the fill at the ContainerCo site is 0.022m.

3.2.1 Wider Areas Affected

The wider area affected by additional flood water is taken from LiDAR, with surfaces generated at 2.0, 2.5 and 3.5m RL in the area south of the site, to the west of the Wairoa River, and extending to Te Puna Station Road – again, assuming that a restrictive boundary or 'fence' exists at that northern boundary, created by the road and surrounding hills. The additional depth of water assumes that water displaced by the fill sits evenly across the entire area.

In reality, the low area extends well to the north of Te Puna Station Road, encompasses, the Wairoa River, low flats on the true right of the Wairoa River, and the Tauranga Harbour, therefore the assessment of increased depths is conservative (on high side).

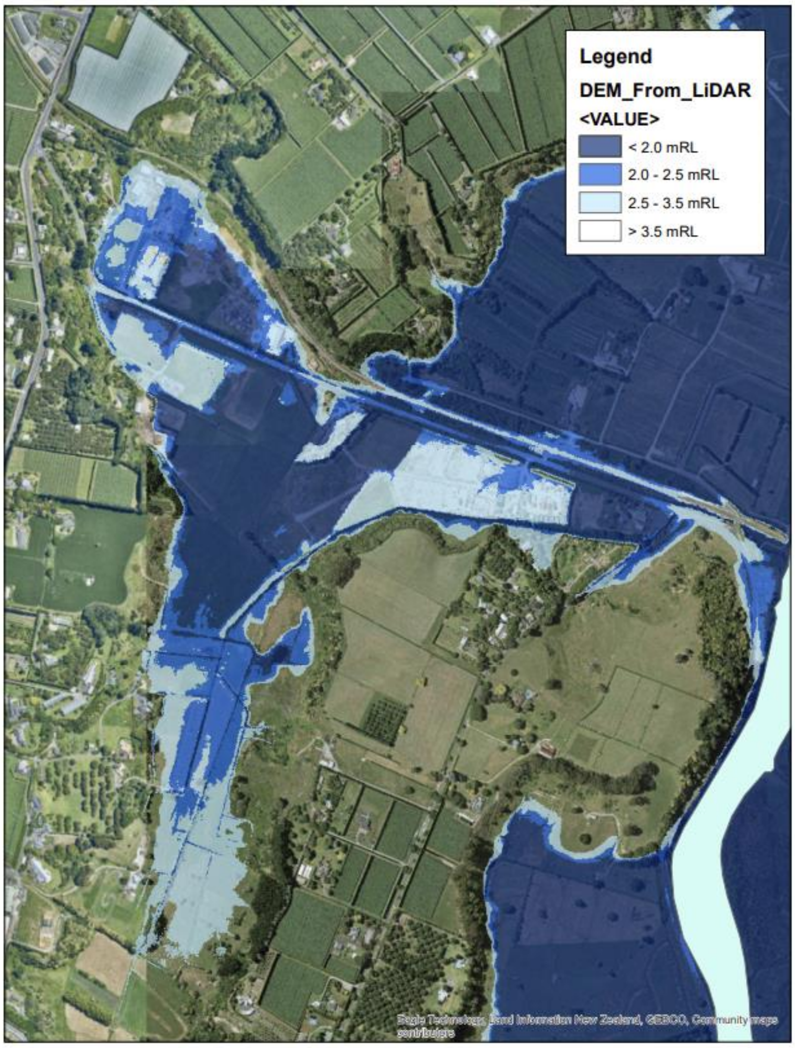

Figure 3-14: DEM from LIDAR

An outline of the distribution and defects of fill for future stages of the proposed development is included above, as well as an indication of how the site development will change any out-of-bank flow distribution of the Hakao Stream. We consider that the out of bank flow distribution upstream of the site, on the true left will not be affected by the proposed filling as the fill from the site will not encroach on the overland flow path.

Note that the flooding depicted is not purely from the ContainerCo proposed operation, but largely caused by predicted sea level rise, storm surge and waves, as per the NIWA model. https://atlas.boprc.govt.nz/api/v1/edms/document/A3338785/content

Considering the widespread actual distribution of the 0.022m (22mm) of floodwater to be displaced from the site, any adverse flooding effects beyond the site attributable to the proposed filling activities are considered extremely small and essentially immeasurable at any one location.

In principle realigning the northern roadside water table is straightforward. So long as the available cross sectional area in the drain matches what is provided currently, or increased slightly to account for additional road area, service provided in the drain will match the existing situation. Size of the drain would be determined at detailed design phase.

The new drain can be formed whilst the existing drain is in service, and will be completely on road reserve land.

The high seasonal water table, low lying nature of the land to the north of the drain and the requirement that the shelterbelt trees remain in place (?), means that the best location for construction is from the road, with a long reach digger. This will require traffic control with one way movement. Construction would be carried out outside of peak commuter hours.

The new drain would be fully formed prior to infill of the existing drain, including placement/ construction of any required culverts. All WSP drawings showing conceptual drainage details are to be refined at the detailed design stage. Moreover, assuming work in the road corridor is approved, we do not anticipate having to work across Overton's boundary or remove any of his trees.

To answer WBOPDC's question number 55 in their s92 RFI, drawing 202 in the original consent application was prepared by previous engineering consultants Vitruvius. The current approach for development across the entire site replaces DEBs for each 3000m2 stage of earthworks, with 2x sediment retention ponds servicing the entire site. The stormwater sediment management ponds will be constructed prior to the commencement of works, and with forebay and sediment retention pond sized to suit. The Pond(s) will be cleared of construction sediment and repurposed post development as a water treatment wetland.

Two sediment retention ponds with forebays will be constructed. One at the northeast extent of the site, and one at the southeast. Once construction is completed, the ponds will be remediated and re-purposed as stormwater/sediment treatment wetlands. The ponds will be sized to whichever has the larger requirement, sediment retention pond or stormwater treatment pond.

3.3 Stormwater Treatment and Soakage

WSP consider that a soakage test is not required, as soakage of stormwater is not being relied on. First flush retention will be provided in full in drains and the stormwater treatment wetland.

It is proposed that Full 10-year 10-minute retention stormwater retention is provided (in Swales and wetlands).

Changes to the site include the inclusion of grassed swales, sediment removing forebays and wetland treatment for stormwater. In the site development phase, the ponds will act as a wet pond system, consistent with the requirements of the BOPRC Erosion and Sediment Control Guidelines for Land Disturbing Activities, to remove sediment or silt generated during the construction phase as much as practicably possible. Employing best industry practice alongside the sediment retention ponds and forebays, such as diversion channels and bunds (utilising the same features within the site landscaping/permanent drainage solution), and silt fences at the extent of the earthworks area, is considered to ensure erosion and sediment effects off-site can be suitably managed and lowered as much as practicably possible. Adverse effects of temporary stormwater discharge during construction would be appropriately mitigated using these methods.

After construction the sediment control pond will be modified as discussed below in 'ongoing stormwater treatment'.

A temporary stormwater discharge consent will be required, along with ongoing stormwater discharge consent.

Stormwater is proposed to be treated both during and post development in a series of grassed swales, which will discharge to a sediment retention pond with forebay, which after development will be modified to become a stormwater treatment wetland. The workshop area will be further treated firstly by a proprietary treatment device prior to discharge of any water collected from that facility into the site-wide swale and pond management network.

Constructed wetlands are widely recognised for their ability to remove contaminants and sediments from contaminated water (Singh, 2015). Constructed wetlands remove heavy metals through a combination of sedimentation, filtration, binding to substrata, precipitation and uptake by plants, algae and bacteria (Yadav et al, 2012). Plants remove excess nutrients, namely nitrogen and phosphorus, and heavy metals from the water and store them in their tissues (Yadav et al, 2012). The wetland itself decreases water velocities to settle out particles, nutrients and metals in particulate form from the water column and store contaminants in the sediment (Griffiths, 2020).

The NZTA document Stormwater Treatment for Highway Infrastructure; table 8.1 advises that sediment reduction by various treatment methods are as follows;

Table 2 – Treatment Methods and Suspended Solids Reduction

Treatment method	% reduction in suspended solids after treatment
Swale	70
Wet pond	75
Wetland	90
Oil water separators	15

The wetland will operate with a decanting outlet, so that initial stormwater volumes are retained, discharging slowly over time. Discharge will be throttled and will be to the existing drain and overland flow path area, where the area currently discharges. Outlet will be throttled to ensure discharge of stormwater does not exceed 80% of the predevelopment discharge rate.

Treatment will be consistent with the requirements of the BOPRC Erosion and Sediment Control Guidelines for Land Disturbing Activities. No flocculants are proposed to be used.

For further information on calculations that demonstrate the stormwater system will be able to carry a 10 min 10% AEP rainfall event, and whether containers could float in a rainfall event, please see the spreadsheets attached in this report.

We have proposed to check the current permeability of the site, but suspect that this is already low, due to large quantities of fill. Our assessment of the runoff coefficient is that currently the area will have low permeability soil (listed as Pahoia silt loam, a Gley soil which is poorly drained). Current surface is short pasture grass, with a likely runoff coefficient (from Table 5.2 of BOPRC Hydrological and Hydraulic guidelines (H&H guidelines)) of 0.35.

The developed surface will be most like a railway yard, with compacted Gap65 or similar, with a runoff coefficient of 0.40. (Table 5.2 of H&H guidelines). We propose a runoff coefficient of 0.50 is used for design.

The rational method advises that for a 10 year 10 minute event, the runoff pre-development would be 577m^3 for the whole site, increasing to 659m^3 post development for the whole site. The whole volume must be retained – this will be achieved in the swales and stormwater ponds.

The rate of discharge from the developed site must be restricted such that discharge is 80% of the pre-development rate of discharge for the 100 year (1%AEP) event.

From the Rational Rural method, the rate of discharge of stormwater pre-development is 0.576m^3/s or 576 L/s. 80% of this rate is 461 l/s – the discharge from the treatment system(s) will be limited to 461 L/s. This will be achieved using a throttled outlet from the stormwater treatment pond(s). Rainfall which generates flows above the design flowrate will discharge over a formed weir.

We can assess stormwater for small events, but flooding is difficult to assess for as is. BOPRC have advised that sea level rise and storm surge will be more prevalent, effect wise. 2%, 1% and 0.2% have been modelled by NIWA for BOPRC. This has been discussed already above.

The swale system will be confined to the area which has been filled, and an additional area which will be filled in the future – swales will work in these areas, as the ground level is some 1m higher than the natural ground level (and may be raised somewhat) no swales are planned for low lying areas, as there is no proposed development in these areas.

The stormwater swales and sediment retention ponds will need to be established prior to, or at the same time as placement of fill.

3.4 Ongoing Stormwater Treatment

Stormwater treatment and retention likewise will be above groundwater level, with only dead volume below the ground level.

We propose that post development treatment will be in;

- grassed swales
- a sediment forebay
- treatment wetland.

The system will be used during construction and preloading as swales and a two pond system (for each side of the site). Post construction, the ponds should be cleared of accumulated sediment, and reinstated as sediment forebay, and planted, treatment wetlands.

The wetland base would be shaped to create deep zones in narrow bands (1.2m or more from proposed water surface to base) which will act to spread and slow the flow of water, creating areas where sediment will fall out of suspension, and to reduce the risk of preferential flow paths forming. These will be interspersed with shallow planted areas.

Excavated material can be used to create shallow planted areas.

The ponds+/wetlands will be roughly rectangular with dimensions of 5:1. The pond/wetland bunds would no more than 1.5m above existing ground level, with 0.5m wet area below current ground level, and a planned 1m of water during 'normal' treatment/retention events. Flows over the 20 minute 1% event would just flow out over the constructed weir to the drain/'natural' wetland.

Any stormwater event or flooding event which overwhelms the treatment wetland/pond will be stormwater only, as any contaminants will have been 'flushed' from the site to treatment in the initial stages of the event.

For edge planting most plants should initially be Carex sp. With Giant umbrella sedge and baumea. Other species should be interspersed (this can be done later) for biodiversity – cabbage tree, manuka, flax, toe toe, rushes etc.

In the wet edges (depth 20-40cm final depth) Carex and Baumea should form the majority of the plantings.

On the edges of deeper areas, Raupo will establish.

Planting should be carried out when the weather is more settled, to allow plants to establish during a drier period.

The natural planted wetland, to be created in the overland flow path can be a mixture of Cabbage tree, Swamp Maire, coprosma propinqua, Pukatea, swamp coprosma, manuka, flax, toe toe, carex, rush, giant umbrella sedge, bamboo spike sedge, lake club rush, marsh club rush and baumea. We recommend planting in stages, with initial plantings of Carex, baumea and giant umbrella sedge, as these will all establish well.

As with the treatment wetland, planting should be carried out when the weather is more settled, to allow plants to establish during a drier period. Planting of the overland flow area to create a more wetland like environment should be preceded by targeted spraying of weeds. The grass surface should be left in place to hold the topsoil in place, and hold moisture in the surrounding soil.

We recommend plants are staked to reduce the number of plants pulled out by Pukeko.

Subject to the above recommendations being followed, downstream water quality is expected to improve, as the site would no longer drain straight into roadside/boundary drains as currently occurs. Rather the developed site runoff would traverse multiple treatment mediums prior to discharge into the receiving environment.

4 Site Management Plan

ContainerCo operates across New Zealand and has two divisions being the Container Services and the Hire & Sales division.

Container Services:
This business provides services primarily to shipping lines, which includes storage, surveying of shipping containers to IICL and shipping line criteria as well as washing and repairing. The repairing ranges from general upgrades of floorboards, painting etc. to full-service repairs replacing corner castings, doors, side panels etc. In addition, this division also operates a refrigeration servicing unit which provides maintenance and repair services for the refrigerated components of the shipping containers.

The Container Servicing business currently operates out of eight depots located in Auckland, Tauranga, Napier, and Christchurch.

Hire and Sales:
This business provides services primarily to the general public, which includes the hiring and selling of containers of various grades as per customer demands.

Timing of Operations:
Currently sites operate Monday – Saturday from 0700 to 1800 hours depending on the region, season, and customer requirements.

4.1 Definitions

Spill – A spill is any deliberate or unintentional discharge of potential contaminant to land, stormwater drains, or directly into a stream, harbor, or other water.

Contaminant – may include but is not limited to:

- Fuel
- Hydraulic fluids
- Oils
- Coolants
- Paint (water-based, non toxic only)
- Chemical products (including detergents, soaps, and other cleaning products)
- Wash water
- Cargo

4.2 Environmental Risk Management

This section presents a summary of the environmental risks and controls that have been identified for ContainerCo operations. Summarised in bullet point below are the key potential environmental risks posed by ContainerCo operations:

- Noise Management
- Dust Management (ground dust)
- Oil Spill or Discharge Management
- Paint Spill/Spray and Other Hazardous Substances
- Waste & Recycling
- Lighting

The tables that follow detail the key risk management areas and the controls in place for the various areas of ContainerCo operations. These controls are to be reviewed and updated as part of ContainerCo's incident management and investigation process which requires a review of all hazards and controls.

4.3 Dust and Sediment Management

Objectives	To ensure the impacts of dust on adjacent businesses and the community are minimised. To ensure the impacts of dust on our own operation is minimised. To reduce the levels of dust generated in the first instance.		
Management Strategy	Dust issues managed principally by water trucks.		
		Responsibility	Timing
Control(s)	Where dust is identified as an issue, dust control measures will be implemented. These will primarily be the use of water carts. Vehicle movements controlled and kept to established roads. Wheel wash to prevent tracking of dust outside of our yard. Water applied is sufficient to address dust suppression only, and excessive runoff water is not created.	Supervisors and Site Managers	Daily
Performance Indicators	No complaints from adjacent premises and/or community.	Site Manager	Daily
Monitoring	Daily inspection of depot to occur, including: • visual check for dust/mud crossing the site boundaries visual check of high potential dust areas, such as entrance/exit roads and operational areas.	Supervisors	Daily
Reporting	Any complaints or incidents to be reported to the HSE Manager.	All employees to report. Site Manager to log.	Daily
Corrective Action(s)	Investigate cause of excessive dust. Investigate regular occurrences of dust at specific areas to determine if sealing options are needed.	Site Manager	As required

	Implement controls immediately (e.g. water carts). Implement administrative controls if required, such as altering roadways to avoid excessive dust generating areas of the yard until more favourable weather conditions.		

4.4 Lighting

ContainerCo does not intend to use artificial lighting through light poles or other means. It is anticipated that they will be using daylight hours to operate.

4.5 Hydrocarbon Spill or Discharge Management

Objectives	To minimise the potential for spills of any hydrocarbons (oils/petrol/diesel) to as low as reasonably practicable. To reduce the risk of any spills entering waterways.		
Management Strategy	Reduce quantity of hydrocarbons stored on site, implement appropriate controls and provide appropriate training and resources for a spill response.		
		Responsibility	Timing
Control(s)	All hydrocarbons to be stored in an appropriate bund that is capable of holding 110% of a spill from the largest container, or 10% of total volume of stored liquids, whichever is greater. Refuelling of vehicles/equipment done in designated areas only. Pre-start checks done to identify any leaks in the initial stages. Drip trays to be available in the event of a leak for mechanical stationary equipment such as hoists and gensets if not internally bunded. Vehicle/Machinery Servicing - All equipment will be regularly serviced to reduce emissions and reduce the chance of oil leaks on site. Appropriate controls in place to contain hydrocarbon leaks should they occur whilst servicing which may include use of drip trays when changing oil, bunded containers and the safe transporting of waste oils. Only qualified personnel are to carry out services on plant and equipment.	Supervisors and Site Managers	Daily

	Work is to be carried out in designated area that has is located well clear of any drains etc. General – A copy of the current Discharge Management Protocol will be kept at an appropriate location on site. Appropriate volume and type of spill response materials will be available at each work site. Spills to be contained and cleaned-up immediately. Resultant wastes (soils, rags and absorbent material) appropriately stored and disposed of by a licenced waste contractor as controlled waste. All spills reported and investigated as required. Training - Onsite spill response training will be carried out on a periodic basis. All deficiencies identified through training and testing of the procedures will be documented and rectified immediately. Training / awareness to be included in site induction (including all staff, contractors, subbies etc).		
Performance Indicators	Minor spills (<10L) to land contained, controlled and all contamination removed / cleaned-up within 24 hours. No spills to enter natural waterways. No contamination of soil or surface / ground waters. No spills that require an emergency response	Site Manager	Daily
Monitoring	Incident report outlining corrective actions taken and preventative measures to be implemented sent to HSE Manager with 48 hours Water samples from the site to be undertaken annually. Sample to be analysed by a certified company and submitted to HBRC Manager.	Site Manager	As required. Annually
Reporting	All spills that enter the natural waterways (regardless of volume) to be reported to the HSE Manager immediately.	All employees to report.	Daily

	All other spills to be reported as per the Incident Reporting timeframes	Site Manager to log.	
Corrective Action(s)	Stop work immediately, contain spill (if safe). Investigate cause of spill and assess. Implement improvements as required. Investigate & assess adequacy of response – implement improvements as required. Implement corrective measures prior to the recommencement of site works.	Site Manager	As required

4.6 Paint Spill / Spray and Other Noxious Substances

Objectives	To minimise the potential for spills of paint as low as reasonably practicable. To reduce the risk of paint overspray entering waterways and storm water drains. To reduce the risk of chemicals or contaminants from containers being washed into waterways.		
Management Strategy	Reduce quantity of paints and other noxious substances stored on site, implement appropriate controls and provide appropriate training and resources for a spill response.		
		Responsibility	Timing
Control(s)	Container Painting - All paint is to be stored in an appropriate bund that is capable of holding 110% of a spill from the largest container, or 10% of total volume of stored liquids, whichever is greater. Only employees trained in the Wagner/Painting Procedure OPR-SOP-011 are to undertaken painting and operate the Wagner. Cardboard is to be used for paint collection when painting doors and external walls of containers to capture any paint spray/overflow to prevent draining to waterways. Clean up of equipment used in the process of water-based painting is to be done on the wash within the containment area. Wash Bay – Container washing is only to be undertaken in designated wash bay areas. Wash bay areas to channel wastewater to	Supervisors and Site Managers	Daily

	a) 2 mm mini screen where larger solids are filter out, and then onto b) Hynds 2 stage to have either designated drains with fox valves for waste separation Drains are to be cleaned out on a regular basis to reduce risk of overflow and to ensure all water goes to the designated drainage areas. General – A copy of the current Discharge Management Protocol will be kept at an appropriate location on site. Appropriate volume and type of spill response materials will be available at each work site. Spills to be contained and cleaned-up immediately. Resultant wastes (soils, rags and absorbent material) appropriately stored and disposed of by an appropriately licenced waste contractor as controlled waste. All spills reported and investigated as required. Training – Onsite spill response training will be carried out on a periodic basis. All deficiencies identified through training and testing of the procedures will be documented and rectified immediately. Training / awareness to be included in site induction (including all staff, contractors, subbies etc).		
Performance Indicators	Minor spills (<10L) to land contained, controlled and all contamination removed / cleaned-up within 24 hours. No spills to enter natural waterways. No contamination of soil or surface / ground waters. No spills that require an emergency response	Site Manager	Daily
Monitoring	Incident report outlining corrective actions taken and preventative measures to be implemented sent to HSE Manager with 48 hours	Site Manager	As required. Annually
Reporting	All spills that enter the marine waterways (regardless of volume) to be reported to the HSE Manager	All employees to report.	Daily

	immediately. All other spills to be reported as per the Incident Reporting timeframes	Site Manager to log.	
Corrective Action(s)	Stop work immediately, contain spill (if safe). Investigate cause of spill and assess. Implement improvements as required. Investigate and assess adequacy of response – implement improvements as required. Implement corrective measures prior to the recommencement of site works.	Site Manager	As required

4.7 Solid Waste Management and Disposal

Objectives	Reduce waste volume, maximise recycling, reuse and recovery, prevent any waste/litter entering the environment.		
Management Strategy	Minimise environmental impacts by encouraging recycling and ensuring waste is disposed of appropriately.		
		Responsibility	Timing
Control(s)	Waste – Provide appropriate waste bins, type, volume and service frequency to accommodate anticipated waste streams. Recycling - Continually seek new recycling streams and provide recycling bins for approved recyclables. All loads arriving or leaving the site will be appropriately secured. Provide information regarding waste management in site specific inductions, including waste separation and importance of securing vehicle loads. Ensure licensed contractors are used to collect controlled wastes.	Supervisors and Site Managers	Daily
Performance Indicators	Hazardous materials all appropriately disposed. Recycling of all recyclable waste, e.g. metal, cardboard Records kept of waste leaving site.	Site Manager	Daily
Monitoring	Weekly inspection of work site to occur. Review of waste bins (% full, time to next service).	Supervisors	Daily

Reporting	Environmental incident report for any breaches to HSE Manager. Issues with waste bins/recycling should be reported to supervisor.	All employees to report. Site Manager to log.	Daily
Corrective Action(s)	Investigate cause of inappropriate waste disposal Review cause of issue and develop response, such as variation to bin size, service schedule or waste separation awareness. Implement controls.	Site Manager	As required

4.8 Noise Management

Objectives	To minimise the impacts of noise on the operation and surrounding areas. Construction activities undertaken in accordance with *Environmental Protection (Noise) Regulations 1997.*		
Management Strategy	Noise to be managed primarily through administrative (noise management plan) and associated equipment controls during operation.		
		Responsibility	**Timing**
Control(s)	All equipment used to be regularly maintained to ensure efficient operation. Pre-start checks and maintenance schedules to ensure equipment performance is as required. Noise-dampening equipment to be used on equipment with excessive noise generating characteristics where possible (e.g. generators stored in containers). Quiet options to be used where available (e.g. rubber mallets). Construction noise to adhere to District Plan standard NZS 6803:1999 Acoustics – Construction Noise.	Supervisors and Site Managers	Daily
Performance Indicators	No complaints from adjacent premises and/or community.	Site Manager	Daily
Monitoring	Weekly inspection of works sites to occur.	Supervisors	Weekly

	Service logs for equipment/machinery used on site.	Maintenance Manager	As required
Reporting	Any complaints or incidents to be reported to the HSE Manager.	All employees to report. Site Manager to log.	As required
Corrective Action(s)	Investigated cause of excessive noise. Implement corrective measures prior to the recommencement of site works. Reschedule of noise-generating activities to reduce noise annoyance.	Site Manager HSE Manager	As required

Appendix A - Flows Calculations

Peak Flow Design (Years) 10

1 in 10 primary retention
suggested RCP 8.5 to 20
Nik Kumar infrastructure

Site		C(8)(7)	C(6) (5)	C (4) (3)	C (2) (1)	C4 road 100y	C4 (road) 10y	100y SE Catchment (3)	100 y West catchment (1)	100y NE Catchment (2)	10y NE Catchment (2)	10y West Catchment (1)	10y SE Catchment (3)	whole catchment post development	Whole catchment area pre development
TM61	Update HIRDS at bottom														
Physical Input Data															
Calculated Data															
Table / Figure Data															
Catchment Area	m2	10357	9036	14202	79344	3996	3996	18178	17471	27453	27453	17471	18178	74570	74570
Length of Main Channel	m	237	187	213	414	150	150	135	180	328	328	180	135	400	400
Catchment Length	m	237	150	206	435	150	150	193	180	216	216	180	193	400	400
Catchment Area	km2	0.010357	0.009036	0.014202	0.079344	0.003996	0.003996	0.018178	0.017471	0.027453	0.027453	0.017471	0.018178	0.07457	0.07457
Length of Main Channel [1]	km	0.237	0.187	0.213	0.414	0.15	0.15	0.135	0.18	0.328	0.328	0.18	0.135	0.4	0.4
Catchment Length	km	0.237	0.15	0.206	0.435	0.15	0.15	0.193	0.18	0.216	0.216	0.18	0.193	0.4	0.4
K	(Area/Length^2)	0.184389966	0.4016	0.334668678	0.419310345	0.1776	0.1776	0.488013101	0.539228395	0.588413066	0.588413066	0.539228395	0.488013101	0.4660625	0.4660625
S	(Fig. 4.15 Culv man)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Top of Main Channel	m	37	37	31	45	3	3	3	3	3	3	3	3	3	3
Bottom Main Channel	m	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Main Channel Slope [3]	%	14.768	18.717	13.615	10.386	0.667	0.667	0.741	0.556	0.305	0.305	0.556	0.741	0.250	0.250
Wic	(Table 4.5 H&H Guidelin	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.1
Ws	(Fig. 4.11 using 1&2 Culv	60	60	60	60	60	60	60	60	60	60	60	60	60	60
W	(WicxWs)	90	90	90	90	90	90	90	90	90	90	90	90	90	66
C	(use W in Fig 4.12 Culv r	740	740	740	740	740	740	740	740	740	740	740	740	740	740
Storm Return Period	yrs	100	100	100	100	100	10	100	100	100	10	10	10	10	10
Storm Duration	mins	10	10	10	10	10	10	10	10	10	10	10	10	20	20
HIRDS	mm	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	23.2	23.2
Standard Rainfall Depth	mm	36	36	36	36	36	36	36	36	36	36	36	36	49	49
R	(HIRDS/Standard)	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.438888889	0.473469388	0.473469388
TM 61 Qp =	m3/s	0.109922818	0.099230353	0.139291463	0.50617179	0.053812291	0.053812291	0.167618498	0.162704923	0.22835951	0.22835951	0.162704923	0.167618498	0.521222069	0.521222069
Rational (Rural)															
Physical Input Data															
Calculated Data															
Table / Figure Data															
Time to Concentration	minutes	5.5	3.4	4.9	10.5	6.6	6.6	8.1	8.0	10.8	10.8	8.0	8.1	20.3	20.3
Catchment Area	km2	0.010357	0.009036	0.014202	0.079344	0.003996	0.003996	0.018178	0.017471	0.027453	0.027453	0.017471	0.018178	0.07457	0.07457
Storm Return Period	yrs	100	100	100	100	100	10	100	100	100	10	10	10	10	10
Storm Duration	min	10	10	10	10	10	10	10	10	10	10	10	10	20	20
HIRDS	mm/hr	184.8	184.8	184.8	184.8	184.8	112.2	184.8	184.8	184.8	112.2	112.2	112.2	112.2	69.6
Runoff Coefficient	(Table 5.2 EBOP doc)	0.35	0.35	0.35	0.35	0.95	0.95	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.4
		railway yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	y yards and similar	railway yards and similar	y soil with pasture cover
Rational Rural Qp =	m3/s	0.186080767	0.1623468	0.2551626	1.4255472	0.1948716	0.1183149	0.326598067	0.313895633	0.4932389	0.299466475	0.190579492	0.198291683	0.813434417	0.576674667
Rational (Urban)															
Physical Input Data															
Calculated Data															
Table / Figure Data															
Surface Type		Sparse Veg	Sparse Veg	Sparse Veg	Sparse Veg	Concrete/Asphalt	Concrete/Asphalt	Gravel surface	Gravel surface	Gravel surface	Gravel surface	Gravel surface	Gravel surface	Gravel surface	Short Grass
		0.0915	0.0915	0.0915	0.0915	0.0115	0.0115	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.15
Time to Concentration	minutes	9.7	6.8	9.1	15.5	5.4	6.6	8.7	9.1	12.1	14.8	11.1	10.6	22.7	89.5
Catchment Area	km2	0.010357	0.009036	0.014202	0.079344	0.003996	0.003996	0.018178	0.017471	0.027453	0.027453	0.017471	0.018178	0.07457	0.07457
Fraction of Impervious Area		0.05	0.05	0.05	0.05	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Storm Return Period	yrs	100	100	100	100	100	10	100	100	100	10	10	10	10	10
Storm Duration	min	10	10	10	10	10	10	10	10	10	10	10	10	20	20
HIRDS	mm/hr	184.8	184.8	184.8	184.8	184.8	112.2	184.8	184.8	184.8	112.2	112.2	112.2	112.2	69.6
Runoff Coefficient		0.75731	0.75731	0.75731	0.75731	0.88498	0.88498	0.88498	0.88498	0.88498	0.88498	0.88498	0.88498	0.88498	0.8844024
Pervious Runoff Coefficient		0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.7498	0.744024
Rational Urban Qp =	m3/s	0.40263093	0.351276729	0.552106253	3.084517572	0.181534177	0.110217179	0.825807877	0.793689593	1.247161605	0.75720526	0.481882967	0.501383354	2.056780543	1.275031148
Bare Clay-Loam Soil		0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033	0.033
Bare Sand		0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Concrete/Asphalt		0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115	0.0115
Gravel surface		0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
Lawns		0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325
Short Grass		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Sparse Veg		0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915	0.0915

Standard Depths	
Minutes	mm
10	36
20	49
30	58
60	76
120	104
360	203

HIRDS	
Minutes	mm
10	15.8
20	23.2
30	28.7
60	40.5
120	55.7
360	87.7

Minutes	mm/hr
10	94.8
20	69.6
30	57.4
60	40.5
120	27.85
360	14.61666667

Appendix B - 10 Year Retention Volume

Catchment	catchment area m2	RCP 6.0 to 2090 0 min rainfall	m3	length of scross section for storage m	m2	80% of predevelopm	pond dimensions
whole catchment	74570	22.1	1648				
whole catchment pre development runoff coeff (10y)	74570	22.1	577			461	
whole catchment post development runoff coeff (10y)	74570	39.1	1166				
whole catchment pre development runoff coeff (100y)	74570	39.1	1020			816	
whole catchment post development runoff coeff (100y)	74570	22.1	659				
west catchment (1)	17471	39.1	683	247	2.77		
NE Catchment (2)	27453	39.1	1073	550	1.95		
C(1)(2)	79344	39.1	1086				
SE catchment (3)	18178	39.1	249	270	0.92		
road (4)	3996	39.1	156	270	0.58		
catchment (4)(3)	14202	39.1	194				

	combined area *	rainfall	pond volume current rainfall (0.35 runoff coeff applied to (1)(2) & (4)(3)	rainfall	Pond volume rcp 6.0 to 2100	pond vol (m3)runoff coeff of 0.35 applied to all
pond NE (1+2+(1)(2)) (100y)	124268	39.1	2842	47.8	5940	2079
pond SE (3+4+(4)(3)) (100Y)	36376	39.1	599	47.8	1739	609

Swale specs

Catchment	peak flow (rational rural) (m3/s) RCP 6.0 to 2090 (2100)	peak flow (rational urban) (m3/s)	base width (m)	side slopes	Height (m)	top width (m)	area (m2)	vol flow (m3/s)	V (m/s)	length of drain (m)	volume of retention (m3)
C(8)(7)	0.186	n/a	1	01:00.3	0.25	1.15	0.269	0.242	0.899628		0
C(6) (5)	0.162	n/a	1	01:00.3	0.25	1.15	0.269	0.242	0.899628		0
[illegible]	0.348	n/a	1	01:00.3	0.32	1.19	0.351	0.354	1.008547		
C (4) (3)	0.255	n/a	1	01:00.3	0.3	1.18	0.327	0.321	0.981651		0
C (2) (1)	1.426	n/a	1.5	01:00.3	0.6	1.86	1.008	1.474	1.462302		0
C4 road 100y	0.182	0.182	1	01:00.3	0.25	1.15	0.269	0.242	0.899628		0
C4 (road) 10y	0.110	0.110	1	01:00.3	0.25	1.15	0.269	0.242	0.899628		0
100y SE Catchment (3)	0.327	0.826	1	01:00.3	0.56	1.336	0.654	0.84	1.284404		0
100 y West catchment (1)	0.314	0.794	1	01:00.3	0.55	1.33	0.641	0.817	1.274571		0
100y NE Catchment (2)	0.493	1.247	1.5	01:00.3	0.6	1.86	1.008	1.474	1.462302		0
10y NE Catchment (2)	0.299	0.757	1	01:00.3	0.55	1.33	0.641	0.817	1.274571		0
10y West Catchment (1)	0.191	0.482	1	01:00.3	0.4	1.24	0.488	0.5	1.02459		0
[illegible]	0.490	1.239	1.5	01:00.3	0.6	1.86	1.008	1.474	1.462302		
10y SE Catchment (3)	0.198	0.501	1	01:00.3	0.4	1.24	0.488	0.5	1.02459		0
[illegible]	0.453		1	01:00.3	0.4	1.24	0.488	0.5	1.02459		
whole catchment post development	0.813	2.057	1.7	01:00.3	0.68	2.108	1.295	2.058	1.589189		0
Whole catchment area pre development (current rainfall)	0.577	1.275	1.5	01:00.3	0.6	1.86	1.008	1.474	1.462302		0

combinations 100y only	m3/s	base width (m)	side slopes	Height (m)	top width (m)	area (m2)	vol flow (m3/s)	V (m/s)	length of drain (m)	volume of retention (m3)
1+2+ (2)(1)										
1+2	0.807	1	01:00.3	0.55	1.33	0.64	0.817	1.276563	437	280
(2)(1)+(4)(3)+(6)(5)+(8)(7)+3+4	2.537	1.7	01:00.3	0.8	2.18	1.552	2.644	1.703608	228	354
(4)(3)+(6)(5)+(8)(7)+3+4										

Appendix C - Road Flood Volumes and Displacement

Catchment	catchment m2	RCP 6.0 to 2090 / 10 min rainfall (m	m3	length of swal:d m	cross section for storage m2
whole catchment	74570	22.1	1648		
west catchment (1)	17471	18.7	327	247	1.32
NE Catchment (2)	27453	18.7	513	550	0.93
SE catchment (3)	18178	18.7	340	270	1.26
road (4)	3996	18.7	75	270	0.28

Te Puna Station Road Flood Volumes

Surface	Flood RL			Units
	2.0m	2.5m	3.5m	
Natural	47581	82820	185463	m^3
Combined Natural Design	39850	81897	183524	m^3
Difference	**7731**	**923**	**1939**	m^3

Catchment	catchment area m2	RCP 6.0 to 2090 y 10 min rainfall (r	m3	length of swale available m	required cross section for storage m2	area of treatment assume 1.5m depth (m2)	increased fill volume at 2.5m RL (m3)	Increased fill volume at 3.5m RL (m3)		Area of innundation under 2.0m RL (m2) fr Lidar	increased depth of flooding due to stormwater treatment (m)	Area of innundation under 2.5m RL (m2)fr Lidar	increased depth of flooding due to raise platform to 2.5 and stormwater treatment (m)	Area of innundation under 3.5m RL (m2) fr Lidar	increased depth of flooding due to raise platform to 3.5 and stormwater treatment (m)
whole catchment (20 min)	74570	47.8	3564			2376	39661	114231		253046	0.031	398501	0.022	585536	0.018
west catchment (1)	17471	30.8	538	247	2.18				depth in mm		31		22		18
NE Catchment (2)	27453	30.8	846	550	1.54					Note that these exclude the volumes of the ponds					
SE catchment (3)	18178	30.8	560	270	2.07										
road (4)	3996	30.8	123	270	0.46										

raised area

102877

Area	Volume of fill required m^3	additional depth if floodwater contained on ContainerCo site (m) (102,877m2)	wider Area affected at flood level (m^2)	Additional depth of flood water due to fill (m)
Raise south east corner to approx. 2m (level with remaining raised area)	16,000	0.15552553	253046	0.0632296
Raise whole site to 2.5m from 2m	37,500	0.364512962	398501	0.0941026
Raise whole site to 3.5m from 2m	112,500	1.093538886	585536	0.1921317

Appendix D - Channel Flow Capacity Calculation

***Project Name*: CHANNEL FLOW CAPACITY CALCULATION**

Fill In Blue Cells Only 0.001

CHANNEL CROSS SECTION INENTIFIER:

FLOWPATH DETAILS AT THIS X-SECTION

Longitudinal Grade:	1.00%
Roughness:	0.035

Wetted Perimeter	Area	Hydraulic Radius	$R^{2/3}$	Q
1.668	0.351	0.210	0.354	0.354

Q250 = 9.4	12			
q100 =	10.3			
v	Q50	9.1	v at 10.3 m/s	
1.010207			29.36816	

Base Stratum:

Base Widt	1	m			
LH Side Sl	1	V	to	0.3	H
RH Side Sl	1	V	to	0.3	H
Height (th	0.32	m			
Top Widtl	1.192				

1.668	0.351	

Area:	Left:	0.01536
	Centre:	0.32
	Right:	0.01536
	TOTAL:	**0.351** m^2

Appendix E - HIRDS V4 Depth Duration Frequency Results

HIRDS V4 Depth-Duration-Frequency Results
Sitename: ContainerCo site
Coordinate system: WGS84
Longitude: 176.0787
Latitude: -37.6833

DDF Mode	Parameter	c	d	e	f	g	h	i
	Values:	-0.00446	0.540844	-0.03914	0	0.276025	-0.01075	3.24392
	Example:	Duration (	ARI (yrs)	x	y	Rainfall Depth (mm)		
		24	100	3.178054	4.600149	255.8599		

Rainfall depths (mm) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	8.57	13.5	17.3	25.6	36.6	59.5	77.1	96.2	116	127	134	139
2	0.5	9.51	14.9	19.1	28.3	40.4	65.6	84.9	106	127	139	147	153
5	0.2	12.8	20.1	25.7	37.9	53.8	86.9	112	139	167	182	192	199
10	0.1	15.4	24.1	30.7	45.2	64.1	103	133	164	196	214	225	234
20	0.05	18.1	28.3	36	52.9	74.9	120	154	191	227	247	260	270
30	0.033	19.8	30.9	39.3	57.7	81.5	130	167	207	246	267	281	291
40	0.025	21.1	32.8	41.7	61.2	86.3	138	177	218	259	282	296	307
50	0.02	22.1	34.3	43.6	63.9	90.1	144	184	227	270	293	308	319
60	0.017	22.9	35.5	45.2	66.2	93.3	149	190	235	278	302	318	329
80	0.013	24.2	37.6	47.7	69.8	98.3	157	200	247	292	317	334	345
100	0.01	25.2	39.1	49.7	72.7	102	163	208	256	303	329	346	358
250	0.004	29.6	45.9	58.2	84.8	119	189	240	295	348	377	396	409

Depth standard error (mm) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	1.1	1.4	1.7	2.5	3.5	6.3	9.6	8.9	11	12	13	14
2	0.5	1.2	1.6	1.9	2.7	3.9	6.9	11	9.8	12	14	15	15
5	0.2	1.8	2.4	2.8	4	5.7	9.8	15	14	17	19	20	21
10	0.1	2.3	3.2	3.9	5.4	7.8	13	19	17	21	23	25	26
20	0.05	3	4.3	5.4	7.5	11	17	24	21	25	29	31	32
30	0.033	3.5	5.1	6.5	9	13	20	28	24	29	33	35	37
40	0.025	3.9	5.8	7.3	10	15	22	32	26	32	36	38	40

50	0.02	4.3	6.3	8.1	11	16	24	35	28	34	38	41	43
60	0.017	4.6	6.8	8.8	12	18	26	37	30	36	40	43	45
80	0.013	5.1	7.7	9.9	14	21	29	42	33	39	44	47	49
100	0.01	5.6	8.4	11	16	23	32	46	35	42	47	51	53
250	0.004	7.8	12	16	24	35	46	66	47	55	62	68	70

Rainfall depths (mm) :: RCP2.6 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.17	14.4	18.5	27.4	39	62.8	80.8	100	120	130	138	143
2	0.5	10.2	16	20.5	30.4	43.2	69.4	89.2	110	132	143	151	157
5	0.2	13.8	21.6	27.6	40.7	57.7	92.3	118	146	173	188	198	205
10	0.1	16.6	25.9	33.1	48.7	68.8	110	140	172	204	222	233	242
20	0.05	19.6	30.5	38.9	57.1	80.5	128	163	200	237	257	270	279
30	0.033	21.4	33.3	42.4	62.2	87.7	139	177	217	256	278	292	302
40	0.025	22.7	35.4	45	66	92.9	147	187	229	270	293	307	318
50	0.02	23.8	37	47.1	69	97.1	154	195	238	281	305	320	331
60	0.017	24.7	38.4	48.8	71.4	100	159	202	246	291	315	330	341
80	0.013	26.1	40.6	51.6	75.4	106	167	212	259	305	330	346	358
100	0.01	27.3	42.3	53.7	78.5	110	174	220	269	317	342	359	371
250	0.004	32	49.5	62.8	91.6	128	201	254	309	363	392	411	424

Rainfall depths (mm) :: RCP2.6 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.17	14.4	18.5	27.4	39	62.8	80.8	100	120	130	138	143
2	0.5	10.2	16	20.5	30.4	43.2	69.4	89.2	110	132	143	151	157
5	0.2	13.8	21.6	27.6	40.7	57.7	92.3	118	146	173	188	198	205
10	0.1	16.6	25.9	33.1	48.7	68.8	110	140	172	204	222	233	242
20	0.05	19.6	30.5	38.9	57.1	80.5	128	163	200	237	257	270	279
30	0.033	21.4	33.3	42.4	62.2	87.7	139	177	217	256	278	292	302
40	0.025	22.7	35.4	45	66	92.9	147	187	229	270	293	307	318
50	0.02	23.8	37	47.1	69	97.1	154	195	238	281	305	320	331
60	0.017	24.7	38.4	48.8	71.4	100	159	202	246	291	315	330	341
80	0.013	26.1	40.6	51.6	75.4	106	167	212	259	305	330	346	358
100	0.01	27.3	42.3	53.7	78.5	110	174	220	269	317	342	359	371
250	0.004	32	49.5	62.8	91.6	128	201	254	309	363	392	411	424

Rainfall depths (mm) :: RCP4.5 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.33	14.7	18.8	27.9	39.6	63.7	81.7	101	121	131	138	144
2	0.5	10.4	16.3	20.9	30.9	43.9	70.4	90.3	111	133	145	152	158
5	0.2	14	22	28.1	41.4	58.7	93.7	120	147	175	190	200	207
10	0.1	16.9	26.4	33.7	49.6	70	111	142	174	206	224	235	244
20	0.05	19.9	31.1	39.6	58.1	82	130	165	202	239	259	272	281
30	0.033	21.8	33.9	43.2	63.4	89.3	141	179	219	259	280	294	304
40	0.025	23.2	36	45.9	67.2	94.6	150	190	232	273	296	310	321
50	0.02	24.3	37.7	48	70.3	98.8	156	198	241	284	308	323	334
60	0.017	25.2	39.1	49.7	72.8	102	161	205	249	294	318	333	344
80	0.013	26.6	41.3	52.5	76.9	108	170	215	262	308	333	349	361
100	0.01	27.8	43.1	54.7	80	112	177	224	272	320	346	362	374
250	0.004	32.6	50.5	64	93.3	131	205	258	313	367	396	415	428

Rainfall depths (mm) :: RCP4.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.81	15.4	19.8	29.3	41.5	66.3	84.6	104	124	134	141	147
2	0.5	10.9	17.1	22	32.5	46.1	73.4	93.7	115	136	148	156	161
5	0.2	14.8	23.2	29.6	43.7	61.8	98	125	152	180	195	205	212
10	0.1	17.8	27.9	35.6	52.3	73.8	117	148	181	213	231	242	250
20	0.05	21.1	32.8	41.8	61.4	86.5	136	172	210	247	267	280	289
30	0.033	23	35.9	45.7	67	94.2	148	187	227	267	289	303	312
40	0.025	24.5	38.1	48.5	71.1	99.8	157	198	240	282	305	319	329
50	0.02	25.7	39.9	50.8	74.3	104	164	206	250	294	317	332	343
60	0.017	26.6	41.4	52.6	77	108	169	213	259	303	328	343	353
80	0.013	28.2	43.7	55.6	81.3	114	178	225	272	319	344	360	371
100	0.01	29.4	45.6	57.9	84.7	119	186	233	282	331	356	373	384
250	0.004	34.5	53.4	67.7	98.7	138	215	269	325	379	408	427	440

Rainfall depths (mm) :: RCP6.0 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.27	14.6	18.7	27.7	39.4	63.4	81.3	101	120	131	138	143
2	0.5	10.3	16.2	20.7	30.7	43.6	70	89.8	111	132	144	152	158
5	0.2	13.9	21.8	27.9	41.1	58.3	93.1	119	147	174	189	199	206

10	0.1	16.8	26.2	33.4	49.2	69.5	111	141	173	206	223	235	243
20	0.05	19.8	30.8	39.3	57.7	81.4	129	164	201	238	258	271	280
30	0.033	21.6	33.7	42.9	62.9	88.6	140	178	218	258	279	293	303
40	0.025	23	35.8	45.5	66.7	93.9	149	189	231	272	295	309	320
50	0.02	24.1	37.4	47.6	69.8	98.1	155	197	240	283	307	322	332
60	0.017	25	38.8	49.4	72.3	102	160	203	248	292	317	332	343
80	0.013	26.4	41	52.2	76.3	107	169	214	261	307	332	348	360
100	0.01	27.6	42.8	54.3	79.4	111	176	222	271	319	344	361	373
250	0.004	32.4	50.1	63.6	92.6	130	203	257	312	366	395	413	426

Rainfall depths (mm) :: RCP6.0 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	10.2	16.1	20.6	30.6	43.3	68.7	87.2	107	127	137	144	149
2	0.5	11.4	17.9	22.9	34	48.1	76.1	96.7	118	140	151	159	165
5	0.2	15.5	24.3	31	45.8	64.6	102	129	157	185	200	210	217
10	0.1	18.7	29.2	37.2	54.8	77.2	121	153	186	219	236	247	256
20	0.05	22.1	34.4	43.8	64.4	90.5	142	179	216	254	274	287	295
30	0.033	24.2	37.6	47.9	70.3	98.6	154	194	235	275	296	310	320
40	0.025	25.7	39.9	50.8	74.5	104	163	205	248	290	313	327	337
50	0.02	26.9	41.8	53.2	78	109	170	214	258	302	325	340	351
60	0.017	27.9	43.4	55.2	80.7	113	177	221	267	312	336	351	362
80	0.013	29.6	45.9	58.3	85.3	119	186	233	281	328	353	368	380
100	0.01	30.8	47.8	60.8	88.8	124	193	242	292	340	366	382	394
250	0.004	36.2	56	71.1	104	144	224	280	336	390	419	438	450

Rainfall depths (mm) :: RCP8.5 for the period 2031-2050

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	9.44	14.9	19	28.2	40.1	64.3	82.4	102	121	132	139	144
2	0.5	10.5	16.5	21.1	31.3	44.4	71.1	91.1	112	134	145	153	159
5	0.2	14.2	22.3	28.4	42	59.4	94.7	121	148	176	191	201	208
10	0.1	17.1	26.7	34.1	50.2	70.9	113	143	176	208	226	237	245
20	0.05	20.2	31.5	40.1	58.9	83	131	167	204	241	261	274	283
30	0.033	22.1	34.4	43.8	64.3	90.4	143	181	221	261	282	296	306
40	0.025	23.5	36.5	46.5	68.1	95.8	151	192	234	275	298	312	323
50	0.02	24.6	38.2	48.6	71.2	100	158	200	243	287	310	325	336
60	0.017	25.5	39.6	50.4	73.8	104	163	207	252	296	320	335	346
80	0.013	27	41.9	53.3	77.9	109	172	217	264	311	336	352	363
100	0.01	28.2	43.7	55.5	81.1	114	179	226	275	322	348	365	376
250	0.004	33.1	51.2	64.9	94.6	132	207	261	316	370	399	418	431

Rainfall depths (mm) :: RCP8.5 for the period 2081-2100

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	11.2	17.6	22.6	33.5	47.1	74	93.1	114	133	143	150	155
2	0.5	12.5	19.6	25.1	37.2	52.6	82.2	104	126	147	159	166	172
5	0.2	17.1	26.7	34.1	50.4	70.9	110	139	167	195	211	220	227
10	0.1	20.6	32.2	41.1	60.5	84.9	132	165	199	232	250	260	268
20	0.05	24.4	38	48.4	71.1	99.6	155	193	231	269	289	302	310
30	0.033	26.7	41.6	52.9	77.6	109	168	210	251	292	313	327	336
40	0.025	28.4	44.1	56.1	82.3	115	178	222	265	308	331	345	355
50	0.02	29.7	46.2	58.8	86.2	120	186	231	276	321	344	359	369
60	0.017	30.8	47.9	61	89.2	125	193	240	286	332	356	371	380
80	0.013	32.7	50.7	64.5	94.3	132	203	252	301	349	374	389	400
100	0.01	34.1	52.9	67.2	98.2	137	211	262	313	362	387	404	414
250	0.004	40.1	62	78.6	115	159	244	303	360	415	444	462	474

Appendix F - Container Float Calculations

assumes 2.5mRL site		
	float in ?m water	
20' cont flat	0.135816051	
20' cont end down	0.42	from online wedge calculator
40' cont flat	0.134925454	
40' cont end down	0.27	from online wedge calculator
2x 20' flat	0.271632101	
2x40' flat	0.269850907	

Event	Depth of water (RL)	20' Container Float? (Flat)	20' Container Float? (one end down)	40' Container Float?	40' Container Float? (one end down)	2 x 20' Container Float? (Flat)	2 x 40' Container Float? (Flat)
depth to float (m)		0.14	0.42	0.13	0.27	0.27	0.27
1 in 50 year event current	2.39	-0.25	-0.53	-0.24	-0.38	-0.38	-0.38
1 in 50 year event 1.25m SLR	3.66	1.02	0.74	1.03	0.89	0.89	0.89
1 in 100 year event current	2.72	0.08	-0.20	0.09	-0.05	-0.05	-0.05
1 in 100 year event 1.25m SLR	3.87	1.23	0.95	1.24	1.10	1.10	1.10
1 in 100 year event 1.6m SLR	4.18	1.54	1.26	1.55	1.41	1.41	1.41

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