Appendix F

Stormwater Memo

Memorandum

To:	Michael Gleissner	**Date:**	9 May 2017
From:	Kristi Whyte/Jandre van Zyl	**Our Ref:**	2663104
Copy:	Hamish Joyce/Malory Osmond		
Subject:	Project Otaki - Stormwater Memo		

1 Introduction

Project Otaki is located at 57 Johnson Road, Otaki (refer Appendix A). This site has neighbouring farmland to the North and South. Tawawera River is on the west side, with Hallet's Drain running along the front of the property on the east side. The aim of the proposed stormwater system is to mitigate any potential effects of the development on the stormwater discharge from the site. Mitigation of potential effects is to be done via detention of the stormwater utilising temporary storage in a dry pond and a swale system, allowing water to be released over an extended period of time.

2 Concept Design Stormwater Philosophy

The concept design for the stormwater has been based on the following criteria and assumptions:

- The stormwater management system for the site has been based on the Stormwater Management Guidelines for the Bay of Plenty region (2012/01) and Bay of Plenty Regional council (BOPRC) Hydrological and Hydraulic Guidelines (2012/02)
- The storm event information for the site was obtained from HIRDS and includes an allowance of 8% increase for the effects of global warming.
- All stormwater pipe work has been designed for a 10 year, 10 min storm.
- The concept stormwater detention design (pond and swale) has been sized based on a 2 year, 1 hour and 10 year, 1 hour rainfall intensities for the post development peak flow discharges. All storm controls include emergency controls for a 100 year, 1 hour rainfall intensities.
- The primary reason for a stormwater detention design is to control the flow for downstream flood protection and minimise, to the extent possible, downstream channel erosion.
- The swale and the pond will provide treatment to the runoff water by means of extended detention and swale residence time.

Surface run-off of the roofs will be collected through a number down pipes which in turn will discharge into the pond or swale. The downpipes will be fitted with overflows for major storm events. For pavement areas, the runoff will discharge directly into the pond, swale or into soakage drains. At this stage there has been no soakage tests undertaken for the site, if soakage is required this will be checked at detailed design stage. The pavement will be designed to have overland flow paths that direct water towards the swale or pond

The peak controlled stormwater flow from the swale and pond will discharge into the Hallet's drain on the east of the site. Hallet's drain connects to the Tarawera River approximately 15km further downstream. The current capacity of the Hallet's drain is unknown, including any historical flooding information, refer Appendix B for the existing stopbank design criteria from BOPRC. It should be

noted in the most current events, ex-cyclone Debbie and Cyclone Cook, there was no flooding of Hallet's drain at the location of the site (refer Appendix F). All stormwater discharges up to and including a 10 year event will be mitigated to pre-development flow rates.

It has been assumed that the discharge from the water filtration and cleaning processes can be discharged into the pond once it has been tested for is suitability and then discharged into Hallet's Drain. Refer "Project Otaki - Stormwater Memo, Nick Koppel, 2017"

3 Site Layout for Design

The pond is located on the east of the site. The swale drain will extend from west of the site around the south and to the pond on the east of the site. Both the pond and swale will be grassed. Due to the flat grade of the site the swale will have a subsoil drain to ensure it dries after a storm event. Refer Appendix B for the proposed development stormwater design.

Approximately two thirds of the site runoff will be collected in to the pond. This will provide storage to control peak rate discharges and provide water quality treatment, primarily through extended detention. The pond will be a dry pond due to the depth of the ground water level (approximately 2m below ground).

For the remaining site catchment areas, the run-off will be collected into the planted swale along the southern end of the site with a storage capacity of approximately 500m^3. To achieve the desired residence time for water quality performance, some of the hardstand pavement should include kerb channelisation to achieve the minimum residence time in the swale.

The buildings finished floor level has approximately been set at 11.75 RL, this is approximately 600mm above the existing ground. This aligns with the Regional Council suggested minimum building floor (Appendix C) based on flood levels for the site.

Machine refuelling areas will be bunded to control where the runoff goes and all runoff water will be treated before entering the stormwater system.

4 Stormwater Design

4.1 Pond and Swale

The BOPRC Hydrological and Hydraulic Guidelines uses the approach of a water quality storm event and uses an extended detention volume released over a 24-hour period to mitigate the effects of the development. The storage volume for larger events is calculated using a 1.5 factor and these volumes are released at the pre-development flow rates. Table 1 shows the calculated pre and post design flow rates and Table 2 shows the calculated volumes required.

The stormwater pond has been designed as a dry pond.

Table 1: Site Pre/Post Development Flow Rates

Site Flow Rates		
ARI	**Pre-development Runoff**	**Post-development Runoff**
2-year	0.12m^3/s	0.26 m^3/s
10-year	0.17 m^3/s	0.37 m^3/s
100-year	0.27 m^3/s	0.59 m^3/s

The pond has been sized to accommodate for an additional 250m^3 of storage for the additional flows from the water filtration and cleaning processes.

Table 2: Required Pond Volume

Pond Volume Required			
ARI	**Required storage volume – storm event**	**Required storage volume – including water treatment process water**	**Required RL (total)**
Extended Detention (ED)	1090 m^3	1340 m^3	10.0
2-year	1385 m^3	1635 m^3	10.3
10-year	2000 m^3	2250 m^3	10.6
100-year	3190 m^3	3440 m^3	11.1

The stormwater dry pond has been designed to release the extended detention volume over a 24-hour period. The pond also can contain and release volumes up to the 10-year storm event at pre-development flow rates as contain volumes for event up to the 100-year event. The design pond volumes are shown in Appendix D. The extended detention volume is 1340 m^3, this will be released at a restricted flow rate of less than 0.025m^3/s through a 100mm orifice at the base of the manhole riser.

The top of the manhole riser with the level of RL 10.6 allows all events greater than the 10 year event to drain overtop the manhole and flow directly to the primary outlet pipe, these events are only restricted by the size of the outlet pipe. The primary outlet of the pond is proposed to be a 375mm diameter pipe with an outlet velocity of 1.78 m/s during a 10 year event. The 2 year and 10 year events are discharged through a slot in the manhole at pre-development rates. The pond has emergency spillway to allow water to overtop into Hallet's Drain in a 100 year storm event or greater.

The swale is designed to have a velocity of less than 1.5m/s and meet a minimum of 9 minutes residence time to allow it to treat the stormwater runoff. A subsoil drain beneath the swale will allow the swale to dry out between events.

4.2 Erosion Protection

Water will drain to Hallet's Drain via a gravity pipe, there will be a headwall and rock anti scouring material (rip rap) placed at the outlet point into Hallet's Drain. This will extend 2.0m into the drain

and be 2.7m wide refer Figure 1 below. This will dissipate the energy of the outflow and reduce the velocity of the water into the drain minimising erosion of the stream bed. Due to the potential maximum velocity from the rock rip-rap will have a D_{50} of 0.2m in diameter.

The installation of this outlet and erosion protection will involve a temporary diversion of the drain. This could be achieved by sand bagging the area and having a pumped diversion around the area. The stream bed will be excavated and the rock rip-rap place to match existing stream bed profile.

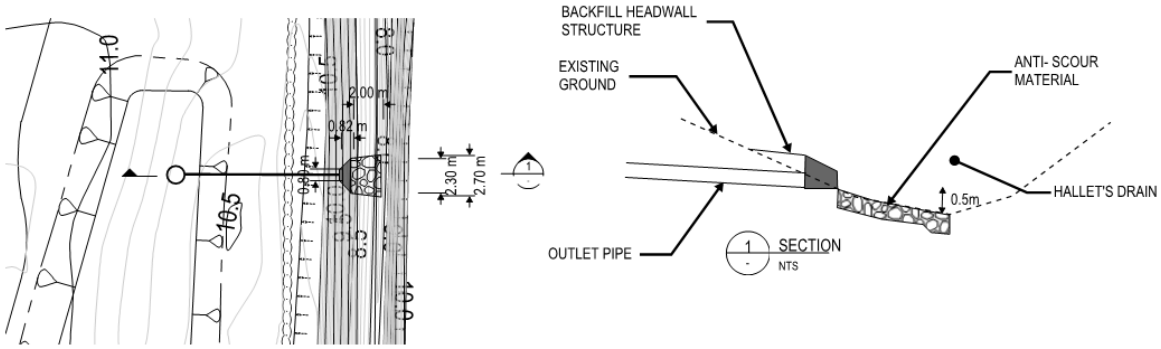

Figure 1: Proposed Outlet

4.3 Overland Flow Paths

The existing contours on the site and in the surrounding areas are shown in Appendix E. The site and surrounding areas are generally flat. It has been assumed the majority of the surface water would dissipate via soakage and that there is no notable existing overland flow paths entering the site.

During recent flood events (Cyclone Debbie – 6/4/17, Cyclone Cook – 13/4/17) the current landowner provided photographs of the site refer Appendix E. There was no significant flooding on the property or breaches of stopbanks for either Hallet's Drain or Tawawera River in this area.

The design includes a nominal allowance for potential overland flow paths through the site. The northern side of the site directs the boundary water towards a catchpit and includes subsoil drain to intercept any overland flow. This water is either removed via soakage or drains into the swale via a piped system. The southern side has the proposed swale which locally lowers the ground level on the southern side allowing any overland flow from the south to drain to the swale. It has been assumed that any overland flow is negligible and has not been calculated in the onsite stormwater design.

Overall the development should not have any negative effects due to stormwater on the adjacent land.

5 Appendix

A. Site Location

B. Proposed Development Concept Stormwater Design

C. BOPRC letter (Ref ENG-531096) Flood level query 57 Johnson Road, Otakiri

D. Actual Volume of Water Storage Available

E. Existing Contours

F. Photos from recent storm events (Cyclone Debbie – taken 6/4/17, Cyclone Cook – taken 14/4/14)

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Associate – Civil Engineering

on behalf of

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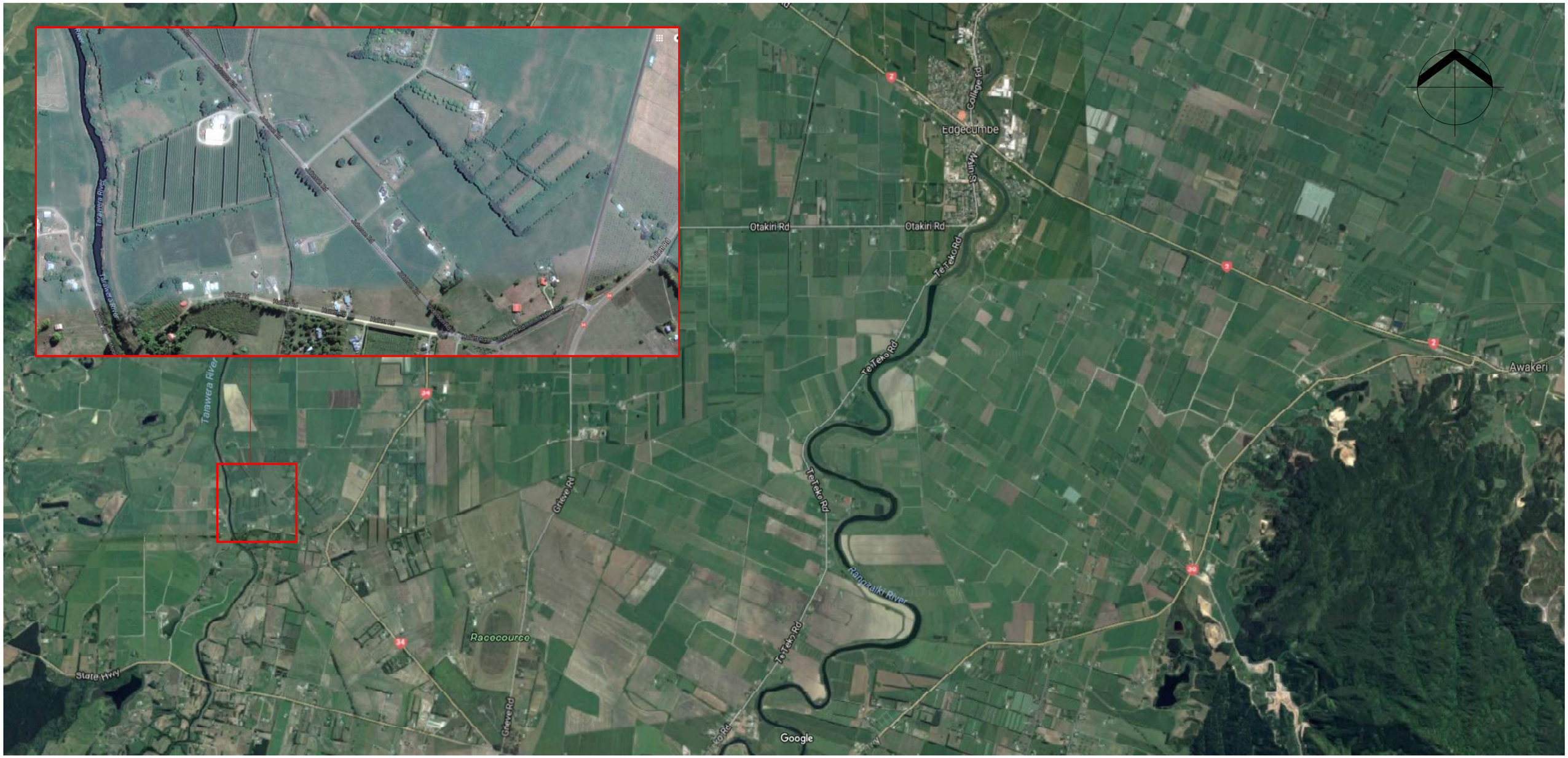
A - Site Location

Google Maps Rotorua



Memorandum

B - Proposed Development Concept Stormwater Design

Drawing Plotted: 14 Feb 2017 1:39 p.m.

SW — unless specified otherwise all stormwater pipes are 225mm uPVC RRJ SN16

SS — unless specified otherwise all Sanitary Sewer pipes are 225mm uPVC RRJ SN16

TW — Trade Waste Line

110mm Nexus Hiway Subsoil drain

W — W — W — DN 225 PE100 PN12.5 (fire water supply)

FW — Fire Water Ring Main

304 SS water supply to building (process water)

New Bore Location

Existing Culvert

Headwall structure

Fire Water Pump House

Assumed location of MBR Wastewater System suitable for 6000l/d- Sanitary Sewer System

Treated effluent distribution field

Propriety above-ground 120m3 Tradewaste tank and lift pump station (duty and standby pumps)

DN250mm 304 SS Sch 40

1050mm MH, coated with protective coating and suitable to HN-HO 72 loadings

375mm RCRRJ outlet with headwall structure

Existing Hallets Drain

225mm RCRRJ Class 6

Underground slab above trench to protect pipe against heavy loading

3400m3 Stormwater storage pond with stabilised slopes

1050mm SW manhole with heavy duty cover and lid

Pond and swale outlet 1050mm SW manhole with scruffy dome cover

1050mm Manhole with grated cover (bubble up from down pipe)

Proposed Soakage pit

1050mm SS manhole with heavy duty cover and lid

Existing Water Bore Location

304 SS water supply to building (process water)

CHECK PRINT
DRG: 2663104-CA-K002.dwg
DATE: 14 Feb 2017 1:39 p.m.
PROJECTNAME: 2663104

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DRAFTER		
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A	FOR INFORMATION	AWS			06.12.16

Drawing Originator: Beca

Original Scale (A1) 1:500
Reduced Scale (A3) 1:1000

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Client:

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Memorandum

C - BOPRC letter (Ref ENG-531096) Flood level query 57 Johnson Road, Otakiri

Our Ref: ENG-531096

5 December 2016

Jandre Vanzyl
Beca
Jandre.vanzyl@beca.com

Dear Jandre

Re: Flood level query 57 Johnson Road, Otakiri

I have reviewed the information we have available for 57 Johnson Road. The location of the area investigated by the desktop study is outlined in the attached map. Please note that the area of investigation (highlighted) does not reflect the property boundaries.

The elevation of the land within the property boundary ranges between 10.5 and 12.0m RL (Moturiki Datum 1953). The map shows the elevation of the land (from the Digital Elevation Model); with the lower elevation represented by the yellow colour.

The property is protected from the Tarawera River by stopbanks designed and maintained to contain a 1% Annual Exceedence Probability (AEP) flood. Risks associated with stopbanks include breach of the stopbanks and events that exceed the design capability. Other sources of potential flooding are Hallet's Drain which is next to the eastern boundary of the property. Hallet's Drain has stopbanks designed for the 20% AEP event.

Floodway Drainage Bylaw
The property is next to the Tarawera River Stopbank. Pursuant to the "Bay of Plenty Regional Council Floodway and Drainage Bylaw 2008", it is not permissible to either erect a structure within 12 metres of the landward side of any defence against water, or excavate within 60 metres of the landward toes of the Tarawera River stopbanks without the prior written authority of the Bay of Plenty Regional Council. Please refer to the Floodway and Drainage Bylaw 2008 for more information and direct any queries to Roger Waugh (BOPRC's Programme Leader - Rivers and Drainage).

Flood level

Based on our available information, BOPRC's recommendation is that the building floor level be elevated by at least 500m above general ground level and not obstruct any existing flow paths. This requirement is not applicable to those building sites located on ridges.

This is not a guarantee that any new dwelling will not be affected by flooding. It is also possible that in the future, the flood levels may be superseded by more up-to-date information. The information in this letter is valid for one year from the letter date.

BOPRC ID: A2502569

Minimum Floor Level

Based on the flood level, the local building authority will determine the appropriate freeboard that needs to be added to set the required Minimum Floor Level.

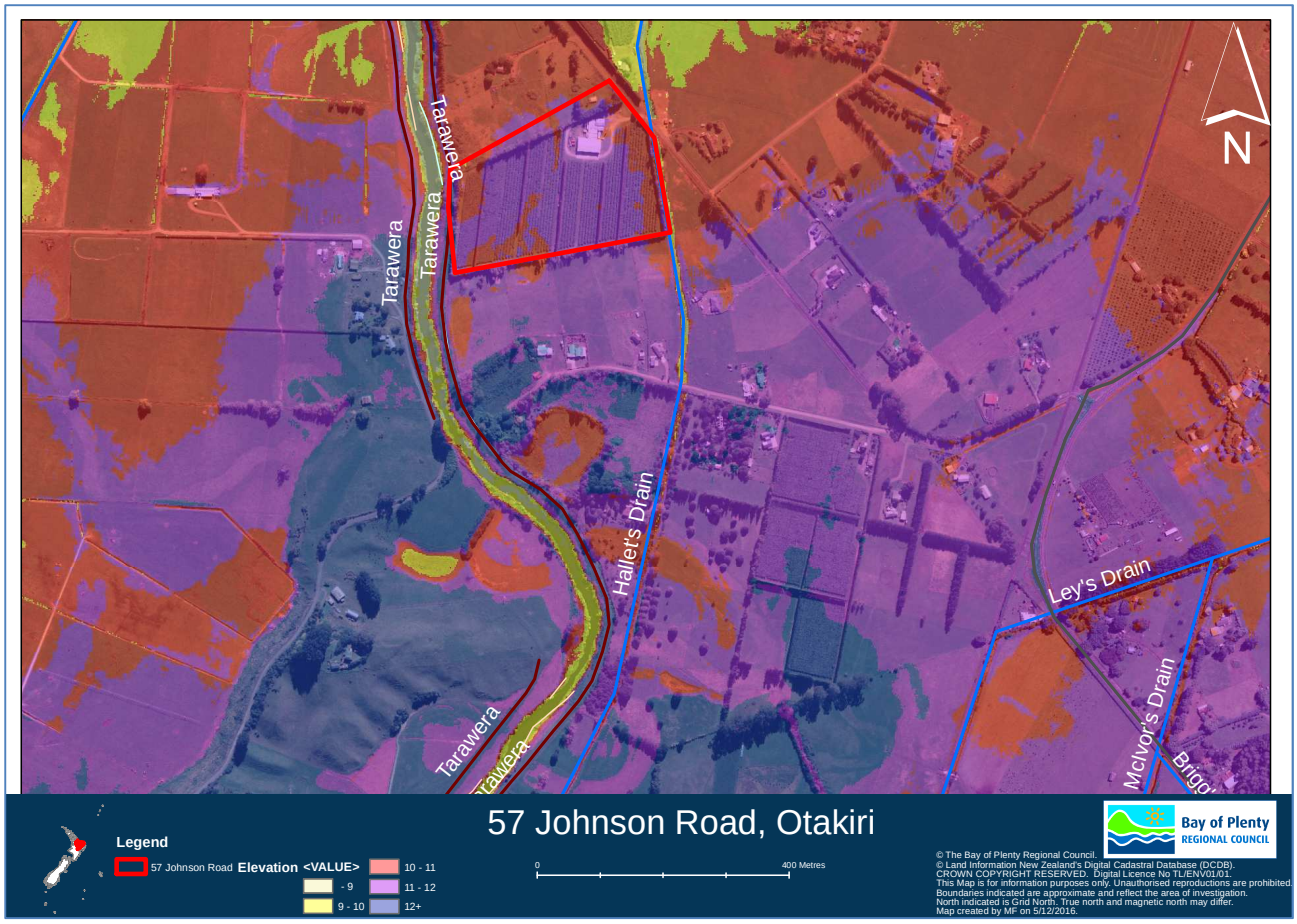
Minimum Floor Levels are set by Councils with consideration to the New Zealand Building Code, the Resource Management Act, the applicable District Plan and the latest information available. Please contact Whakatāne District Council for the Minimum Floor Level for this property.

Please contact me if you have any further questions.

Yours sincerely

Marnie Fornusek

Marnie Fornusek
Graduate Engineer



D - Actual Volume of Water Storage Available

Storage calculations to tin "MD01 DESIGN" - (with plan polygon "MD01 strs->INL")

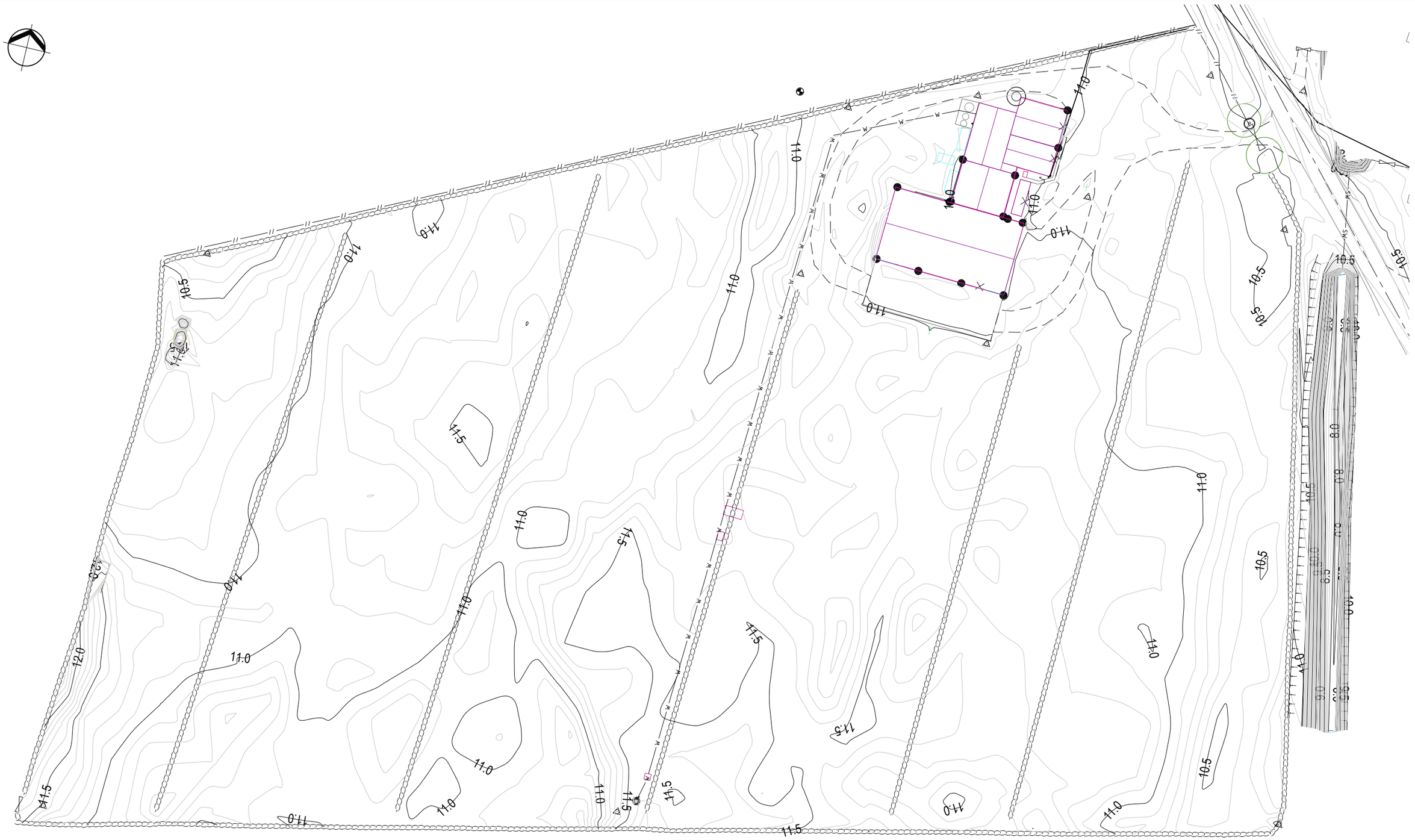
cut volumes are negative
fill volumes are positive

Height	Vol to Height	Plan Area	Slope Area
Delta Ht	Delta Vol	Delta Area	Delta Area
11.000	3171.012	2279.694	2328.347
0.200	449.997	60.719	64.009
10.800	2721.015	2218.975	2264.339
0.200	436.826	75.111	79.181
10.600	2284.189	2143.865	2185.158
0.200	417.440	117.878	124.263
10.400	1866.749	2025.987	2060.895
0.200	392.886	122.744	129.392
10.200	1473.863	1903.243	1931.502
0.200	368.562	120.494	127.020
10.000	1105.301	1782.749	1804.483
0.200	344.688	118.245	124.648
9.800	760.613	1664.504	1679.835
0.200	321.264	115.995	122.275
9.600	439.350	1548.509	1557.560
0.200	298.290	113.745	119.903
9.400	141.060	1434.764	1437.657
0.179	141.060	1434.764	1437.657
9.221	0.000	0.000	0.000
1.000	0.000	0.000	0.000
8.221	0.000	0.000	0.000

Polygon plan area = 2307.384

E - Existing Contours

Drawing Plotted: 10 Apr 2017 9:24 a.m.



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A	FOR INFORMATION	KNW			03.04.17

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Design			Approved For Construction*
Drawn			
Dsg Verifier			
Dwg Check			Date

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Client:

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HORIZONTAL DATUM: New Zealand Geodetic Datum 2000 For practical purposes, NZGD2000 equates to WGS84 VERTICAL DATUM: Mean Sea Level PROJECTION: New Zealand Transverse Mercator 2000

SCALE 1: 2,000

Projection: NZGD_2000_New_Zealand_Transverse_Mercator

Date Printed:
30 March 2017

F - Photos from recent storm event

Cyclone Debbie – taken 6/4/17

General Site View

Tarawera River

Hallet's Drain

Cyclone Cook – taken 14/4/14

General Site View

Hallet's Drain (North)

Hallet's Drain South

Appendix G

Nongfu Spring: On-site Wastewater Treatment and Effluent Disposal Memo

&

Schedule 5 On-site Wastewater Disposal Site and Soil Evaluation Checklist

Memorandum

To:	Michael Gleissner	**Date:**	7 June 2017
From:	Nick Koppel	**Our Ref:**	2663104
Copy:	Malory Osmond		
Subject:	Nongfu Spring - On-site wastewater treatment and effluent disposal		

1 Introduction

1.1 Background information

Nongfu Spring (NFS) is seeking to expand the existing water bottling plant in Otakiri (Eastern Bay of Plenty). As part of the capacity increase it is proposed that an onsite wastewater treatment and effluent disposal system be installed to service approximately 70 staff.

The wastewater includes discharges from:

- On-site toilets
- Lunchroom facilities
- Wash basins
- Small laundry facility
- On-site showers (expected to be infrequently used).

1.2 Scope

The scope of this memorandum is to define:

- Wastewater flows
- Effluent quality
- Effluent disposal area and system type
- The type of wastewater treatment system.

2 Site Assessment

A site assessment was conducted on 18-19/04/2017 to ascertain the soil properties of the site and determine percolation rates, the site assessment report is attached as Appendix A.

The site assessment outlines:

- The soil type and percolation rates
- Ground water level
- Travel time to the river.

The site is generally flat (no stability test required) and is currently occupied by a water bottling plant and kiwifruit vines. It is located at approximately 10-11m RL with the Tarawera River flowing north along the western boundary at approximately 8m RL. The disposal field will be approximately 40m from the Tarawera River. The expected travel time of the treated wastewater to the Tarawera River

is of the order of 12 days (under normal operational conditions and based on the greatest infiltration rate determined by on-site testing).

3 Details of the Discharge

The following assumptions have been made in order to determine the capacity and treatment requirements of the wastewater system:

- Service a total population (staff) of **70 people**
- Per capita wastewater volume of **60l/d per capita** (AS/NZS 1547:2012, Appendix H, Table H4, rural factory bore water supply (50l/d per capita)) – 20% contingency has been included in the per capita flow rate.
- Laundry facility 1,000l/d (single commercial washing machine)
- Average daily volume discharge of **5.2m^3/d** (Rule 14 invoked due to the daily discharge volume being >2.0m^3)

The on-site wastewater treatment and disposal system is sized for a capacity of 70 people, which is believed to be conservative. While the site may have more staff in the future (e.g. up to 75), a number of these employees will be on shift work and it is expected that a much lower number of staff will be continually on-site. While the exact number of employees typically on-site is unknown at this stage, the total number of staff will not be onsite all at the same time.

The wastewater treatment system design shall be based on the assumptions above and shall comply with the following effluent quality outlined in Table 3-1.

Table 3-1: Effluent requirements

Parameter	Value	Reference
Biochemical Oxygen Demand (BOD)		AS/NZS 1547:2012, Covered surface and shallow drip irrigation
90th percentile	<20mg/l	
Maximum	<30mg/l	
Total Suspended Solids (TSS)		
90th percentile	<30mg/l	
Maximum	<45mg/l	
Total Nitrogen (TN)		Bay of Plenty Regional Council (updated 8 May 2015), *On-site Effluent Treatment Regional Plan*: Rule 14
Maximum	<15mg/l	

4 Proposed Treatment System

The proposed treatment system for the treatment of sanitary sewage from the proposed NFS water bottling plant shall be a Hynds On-site MBR plant or suitable alternative that is compliant with AS/NZS 1546.3:2008 (septic tanks) and or 1546.1:2008 (aerated wastewater treatment systems). The plant consists of the following processes:

- Two compartment septic tank
- Aeration zone
- Membrane filtration

- Effluent storage and pumping to the discharge system

Figure 1 provides an illustration of the proposed wastewater treatment system.

Figure 1: illustration of a proprietary MBR on-site treatment system

The system can typically achieve a much better effluent quality than the requirements indicated in Section 3. A typical effluent quality for the proposed system is:

- BOD 5mg/l
- TSS 5mg/l
- Ammonia 5mg/l

A total nitrogen level of <15mg/l can also be achieved as required by rule 14 of the Bay of Plenty Regional Council; On-site Effluent Treatment Regional Plan.

5 Proposed Effluent Disposal System

The effluent disposal system design is based on the soil infiltration rates which are determined by the soil characteristics. A site investigation and permeability tests have been conducted by Beca Ltd (appended). The field infiltration rate or K_{sat} value was determined to be 27mm/h or 0.65m/d.

A K_{sat} value of between 0.5 and 1.5m/d is indicative of soil category 3 or 4 and a daily design loading rate of 30mm/d assuming a low pressure effluent disposal (LPED) system is installed (AS/NZS1547:2012, Appendix L). The design loading rate is lower (by a factor of 20) than the raw test rate recognising the accuracies of (limited) site testing and the expected reduction in long term performance due to clogging of soil; a Factor of Safety of 20 is consistent with US EPA recommendations for wastewater disposal and appropriate for the concept design. Further site-based testing will be required at detailed design to confirm infiltration rates across the wider disposal area. At that time, and once further details of the proposed system have been finalised, the design loading rate should be revisited to confirm it is appropriate and does not need to be decreased (requiring greater land area), or, if it can be increased to reduce the disposal area.

The basis of the effluent disposal system design is (as per AS/NZS1547:2012, Appendix L and M):

- A Low Pressure Effluent Disposal System based on a conventional piped trench
- Daily loading rate of 30mm/d
- Trench width of 600mm

- Trench length of 20m
- Trench depth will be approximately 400-600mm deep including a 100-150mm layer of topsoil with the remainder filled with aggregate
- Distance between trenches of 1m

The trench basal area required to discharge 5.2m^3/d of effluent is 175m^2 at loading rate of 30mm/d. With a trench width of 0.6m and a length of 20m a total of 15 trenches are required. With a 1m separation distance between each trench (wall to wall) a total area of 460m^2 is required. The trench system is illustrated in Figure 2, with the grey area indicating the trenches and the green area indicating the space between trenches.

Effluent from the MBR treatment system is transferred to a holding tank fitted with low pressure pumps and a level sensor. The level sensor is linked to a dose sequencing valve, which switches the discharge to a new set of trenches each time the level set point is triggered. This allows the trenches to be rested for a period of time each day.

An overall site plan is provided as Appendix B indicating the location of the discharge trenches.

Figure 2: Effluent discharge design

The disposal field will be planted with grass after construction and mowed once established. There is no need for a perimeter fence as there are no health concerns in regards to contact with the surface of the disposal field.

6 Potential Effects on Surface Water

The disposal field is located approximately 40m from the Tarawera River, which is within the recommended separation distance from a surface water body (15-100m) as outline in AS/NZS1547:2012.

It should also be noted that the wastewater will receive secondary level treatment and the effluent will comply with AS/NZS1547:2012 and AS/NZS1546.3:2008 or 1546.1:2008. The treated effluent loads are as follows:

- BOD 26g/d
- TN 79g/d.

This is assuming no treatment or dilution occurs as the effluent moves through the soil and through to the ground water and on to the Tarawera River.

BOPRC has supplied monitoring data for the Tarawere at three different sites for 2016:

- Kawerau Bridge
- State Highway 30
- Awakaponga.

Water quality data from 2016 for the Tarawera River has been analysed and the median and minimum result calculated for flow rate, BOD and TN loads, see Table 6-1.

Table 6-1: Tarawera flows and loads (2016)

Parameter	Median	Minimum
Flow (m^3/d)	2,067,000	1,149,000
BOD load (g/d)	2,480,000	109,000
TN load (g/d)	1,100,000	421,000

Provided the wastewater treatment process is compliant with AS/NZS1547:2012 the additional BOD and TN load to the Tarawera River from the effluent disposal system would result in a 0.001% - 0.03% increase in the in-stream concentration of BOD and TN.

If secondary treated effluent from the on-site wastewater treatment system were to enter the Tarawera River (undiluted and with no additional natural treatment) the result would be a negligible change in instream BOD and TN concentrations. The overall potential effect on the Tarawera River is expected to be negligible. It is unlikely that the change in concertation would be measurable after reasonable mixing.

7 Monitoring and Mitigation

- Treatment plant discharge monitoring for discharge parameters (BOD, TSS, Ammonia, TN, flow)
- 100% reserve area provided for mitigation and future expansion if required
- Any requirements for monitoring of groundwater levels and key water quality determinants around the disposal area will be discussed with the BOPRC.

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