

Our Ref: L20145b RevA

2 August 2023

Three Blokes Limited
PO Box 170
Matakana 0948

Attention: Dean and Kim Munro

Dear Dean and Kim,

**RE: ON-SITE WASTEWATER TREATMENT AND DISPOSAL REPORT
REPORT FOR THE PROPOSED DEVELOPMENT AT 362 MATAKANA VALLEY
ROAD, MATAKANA (PT ALLOT 51 PSH OF MATAKANA SO 1044)**

INTRODUCTION

This report has been modified from the original reporting completed in November 2017 to address the Request for Further Information referenced in the email correspondence received from Iksun Yang (Auckland Council Building Surveyor) dated 21 July 2023 associated with the proposed workshops building consent (BCO10364430). This modified report should also be read in conjunction with the letter prepared by Cable Bay Consulting Ltd dated 12 July 2023.

This office has been engaged to prepare a wastewater design and report at the above address and provide a report to accompany a building consent application with Auckland Council.

This office has visited and observed the above site on Tuesday the 12th September 2017 and a walkover survey was completed to locate suitable areas for on-site wastewater disposal and a sub-soil investigation was carried out to determine the underlying soil profile to facilitate design.

SITE DESCRIPTION

The site is located at No 362 Matakana Valley Road, Matakana. The site is located on the north eastern side of the road and is around 2km from the Matakana Township.

The site has a total land area of around 2.7 Ha and comprises an irregular shaped portion of land. The property encompasses a timber sales yard known as the Matakana Sawmill, comprising timber storage and processing sheds.

There is an overland flow path bisecting the site which flows in a west to east manner and this overland flow path flows into an upper tributary of the Matakana River. The river continues due south and discharges into the Mahurangi River. The stream embankments to the side of the overland flow path comprise steep slopes of around 30° to 40° and are within close proximity to the proposed planning shed location.

The existing vegetation near the eastern boundaries comprises both native bush and exotic trees.

PROPOSAL

This phase of the development includes the replacement/re-purposing of two existing drying sheds located in the south-eastern corner of the site, to be located in a similar location as the original buildings.

The November 2017 revision of this report was also used to inform the construction of a new Planing Shed to replace the existing fire damaged shed.

The architectural design of the replacement Planing Shed was carried out by Campbell Registered Architects Ltd. Their drawings referenced 14025 dated 28th August 2017 showed that the replacement Planing Shed included a lunchroom/office/showroom, and two workshops. The architectural plans also depicted one toilet with one hand-wash basin. The wastewater from this building is treated via the existing wastewater treatment facility for the original office (BPA58149) and has been approved by Auckland Council in 2018 under building consent BCO10260425.

The design of the new market buildings (also by Campbell Registered Architects Ltd) includes one shed with overall dimensions of 29.1m x 12.8m and the other with overall dimensions of 15.5m x 7.0m. For the purposes of this report, these are referred to as Shed One and Shed Two respectively.

The following assumptions have been used in the wastewater design;

Shed One - 30.18m x 12.0m:

- Ten Units
- Two unisex toilets & two hand wash basins

Shed Two - 15.2m x 7.0m:

- Two Units

It is assumed, that on average, that there will be 1.5 people working at each market shed (some have two people while others have one). This approach has been approved by the resource consent obtained for this project LUC60311264.

Discharge volumes for the proposed market sheds are based on likely occupancy levels and relevant likely typical daily wastewater flow allowances. TP58 design flow loads refer to the United States Environmental Protection Agency (USEPA) onsite wastewater treatment system manual. The USEPA manual identifies the following typical wastewater flows for an 'office' type building applies - refer appendices. While the term office may not be directly akin to a market shed, the use of the buildings facilities (toilets, wash basins) are.

If on average, there are 1.5 people per market shed, then the following applies:

Wastewater generated for market shed type occupancy = 49 litres/employee/day

10 Units x 1.5 people = 15 people

2 Units x 2 people = 4 people

Total = 19 people, or, 19 'employees'

19 employees x 49 l/day = 931 l/day

It is proposed to locate the wastewater disposal field in the southern area of the lot to treat the wastewater runoff from two new market shed facilities. This location has been approved

by Resource Consent LUC60311264. Refer to the attached plan for the wastewater disposal field location.

FLOOD PRONE AREAS & FLOOD PLAINS

The Auckland Council Geo mapping tool identifies that there are both **flood prone areas** and **flood plains** at the site.

A site-specific flood assessment report has been completed by this office referenced L20145cRev1 dated 13 April 2018.

The flood assessment report concludes that 0.05 AEP (20 year) flood level is RL 22.06m and the 0.01 AEP (100 year) flood level is RL 23.49m.

The proposed wastewater field is proposed to be installed at around RL 22.15m.

Resource consent has already been obtained for the proposed wastewater system, consent number LUC60311264.

Condition 11 of the resource consent requires that the wastewater from the proposed buildings be collected and disposed of in accordance with the wastewater report by Hutchinson referenced L20145b dated, 3rd November 2017, and located as per the flooding report by Hutchinson referenced L20145cRev1 dated 13 April 2018.

The proposed wastewater design complies with the above.

SITE INVESTIGATION AND APPRAISAL

The fieldwork carried out on the site involved the drilling of seven 50-mm diameter hand auger borehole to a maximum depth of 5.0 metres. The soils encountered during the sub-soil investigation are of category 5, moderate to slow drainage in terms of TP58, Table 5.1.

EXISTING ON-SITE WASTEWATER DISPOSAL

There is an existing consented Managers Cottage on site that has been designed for a four person occupancy with a daily wastewater flow of 560 litres/day. The Managers Cottage was consented in November 1996, consent number ABA963097.

A wastewater septic tank and field was installed in 1974, consent number BPA58149 associated with an office building. The replacement Planing Shed, consented in 2018, consent number BCO10260425, was approved by Auckland Council to connect into this existing septic tank and disposal field.

We understand the wastewater design flow from the office and planing shed is 3 full time equivalent employees at 40 litres/person/day equating to a total of 120 litres/day.

The combined total existing on site wastewater daily flow is therefore 680 litres/day.

ON-SITE WASTEWATER DISPOSAL DESIGN

We recommend the installation of an On-site Wastewater Treatment and Disposal System providing secondary treatment with an Aerated Wastewater Treatment System (AWTS),

utilising surface or near surface wastewater disposal via Pressure Compensating Dripper Irrigation (PCDI).

We have adopted an application rate (from TP58; Table 9.2 and Table TS5-2) of:

- 3mm/day (a maximum loading rate of 3litres/m²/day).

The design requirements for the on-site wastewater treatment and disposal system are as follows:

Occupancy Allowances:		
refer Table 3.4 USEPA	Occupancy 'Market Shed' equivalent	= 19 employees
Flow Allowances:	Occupancy 'Market Shed' equivalent	= 49ℓ/person/day
refer Table 3.4 USEPA		
Max Daily Wastewater Flow:	19 x 49 (proposed) Existing TOTAL	= 931 ℓ/day = 680 ℓ/day = 1,611 ℓ/day

Areal Application Area Calculation		
Design Land Disposal Area (Proposed):	$\frac{931 \text{ ℓ/day}}{3 \text{ ℓ/m}^2/\text{day}}$	= 310 provide: 310m ²
Linear Length of Lines:	310m ² / 1.0m spacing	= 310m

$$\text{Area:Volume Ratio} = \frac{26,672\text{m}^2 \text{ (Gross Lot Area)}}{1,611\text{ℓ/day (Max Daily Flow)}} = 16.6$$

This area:volume ratio exceeds the 3.0 threshold and the maximum daily flows do not exceed 3000-litres/day.

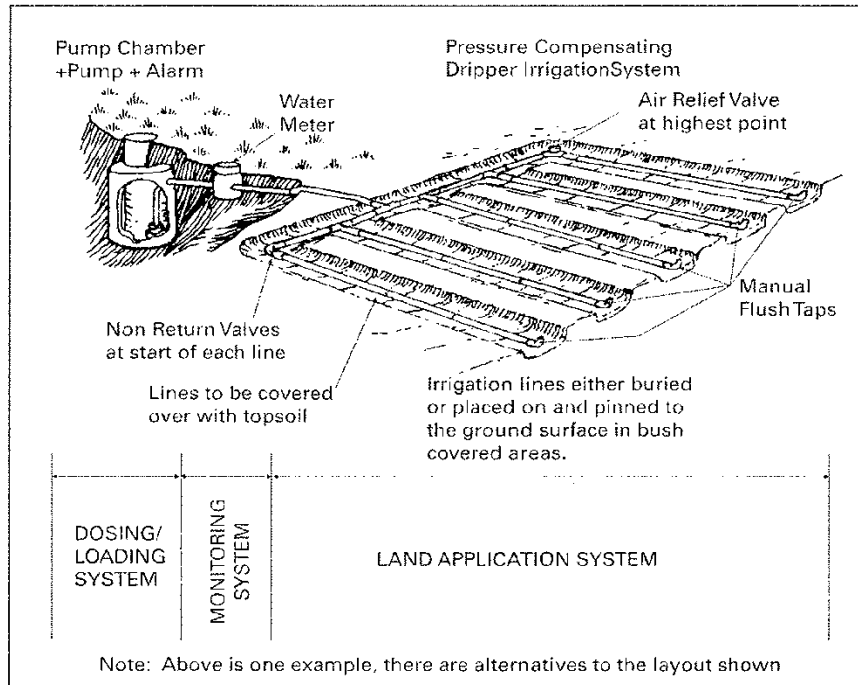
It is proposed to install a CleanStream Aerated Wastewater Treatment System using 310 linear metres of PCDI in a 310m²-disposal field located in the eastern area of the lot.

If the client installs a different type (brand) of AWTS during the building consent process, this office should review the specifications and provide a letter with the Producer Statement (PS4) Construction Review.

The PCDI should be laid to the contour of the site at 1.0m centres in either shallow trenches or on the surface and covered with mulch or bark.

Shown below is a typical PCDI system layout:

Figure 9.1: Schematic Diagram of a Pressure Compensating Drip Irrigation System



ASSESSMENT OF ENVIRONMENTAL EFFECTS

1). Groundwater

Winter groundwater level was encountered at approximately 1.7m below existing ground level. The wastewater disposal field is located on an elevated portion of the site. The proposed system produces secondary treated wastewater; we do not believe there will be any adverse effect on the groundwater in the area or nearby.

2). Odour/Noise

Due to the high treatment level provided by the aerated wastewater treatment system, we expect there to be little, if any, odour from the disposal field. We do not believe noise to be an issue with this site as the system is buried. The site is remote from any adjacent dwellings, affording protection from any unforeseen noise nuisance.

3). Protection from Failure

A maintenance agreement should be implemented with the contractor (at installation of the wastewater treatment system and on going) to ensure that the existing system operates without failure. High water alarms and emergency storage capacity is standard on this model of treatment system.

4). Alternative Methods

Due to the potential elevated groundwater level in winter months. We do not consider the site suitable for conventional trenches in the disposal field. An aerated wastewater treatment system will provide secondary treatment and utilises a surface or near surface disposal field.

5). System Management Plan

A system management plan will be implemented between the system installer (contractor) and the owner.

6). System Maintenance Contract

A system maintenance contract will be implemented between the system installer (contractor) and the owner.

At construction stage please check the conditions of the building consent. This office should be required to inspect the installation of the on-site wastewater treatment system and issue a Producer Statement (PS4) Construction Review. If required this office should inspect the on-site wastewater treatment system during installation and we will require a minimum of 24 hours notice prior to the inspection.

Should you wish to discuss any aspects of the above information, please contact the above office.

We trust this meets with your approval.

Yours faithfully
HUTCHINSON CONSULTING ENGINEERS LTD

Reviewed by


P. Farley
CIVIL MANAGER

Approved by


I. Hutchinson
MANAGING DIRECTOR

APPENDIX E

On-site Wastewater Disposal Site Evaluation Investigation Checklist

PART A: Contact Details

1.Applicant Details:

Applicant Name	Three Blokes Ltd		
Company Name			
	First Name(s)	Surname	
Property Owner Name(s)	Dean	Munro	
	Kim	Munro	
Nature of Applicant*	Owner		

(*i.e. Owner, Lessee, Prospective Purchaser, Developer)

2.Consultant/Site Evaluator Details:

Consultant/Agent Name	Hutchinson Consulting Engineers Limited			
Site Evaluator Name	N. Broad			
Postal Address	P O Box 150			
	Orewa 0946			
Phone Number	Business	(09) 426-5702	Private	
	Mobile	(021) 993416	Fax	
Name of Contact Person	Paige Farley			
E-mail Address	info@hc.co.nz			

3.Are there any previous existing discharge consents relating to this proposal or other waste discharge/disposal on the site?

☐ Yes ☒ ☐ No ☐ (Please tick)

If yes, give Reference Number(s) and Description

ABA 963097 BUILDING: SEPTIC TANK FOR MANAGERS RESIDENCE - NOVEMBER1996
RMA 22394 PLANNING: SEPTIC TANK FOR MANAGERS RESIDENCE - NOVEMBER1996

4.List any other consents in relation to this proposal site and indicate whether or not they have been applied for or granted.

If so, specify Application Details and Consent No.):

(e.g. Land Use, Water Take, Subdivision, Earthworks Stormwater Consents)

LUC60311264

PART B: Property Details

1. Property for which this application relates:

Physical Address of Property	362 Matakana Road Matakana, Auckland		
Territorial Local Authority	Auckland Council		
Regional Council	Auckland Council		
Legal Status of Activity	Permitted: ☒	Controlled: ☐	Discretionary: ☐
Relevant Regional Rule(s) [Note 1]	E5.6.2.4 Resource Consent LUC60311264 obtained		
Total Property Area (m ²)	26,000m ²		
Map Grid Reference of Property [Note 2]			
Notes: 1. In the Auckland Region, the relevant Permitted Activity criteria is as specified in the Auckland Unitary Plan (AUP). 2. NZMS 260 series, scale 1:50,000			

2. Legal description of land (as shown on Certificate of Title):

Lot No.	DP No.	CT No.
Sec 1 SO 400726, Pt Allot 51 Psh Of Matakana SO 1044		
Other (specify)		

Please ensure copy of Certificate of Title is attached.

PART C: Site Assessment – Surface Evaluation

(Refer TP58 – Sn 5.1 General Purpose of site Evaluation and Sn 5.2.2(a) Site Surface Evaluation)

Note: Underlined terms defined in Table 1, attached

1. Has a Desk Study been undertaken for this property

Yes ☒ No ☐ (Please tick)

If yes, please specify the findings of the Desk Study, and if not please specify why this was not considered necessary.

The wastewater dispersal site exhibits gentle topography with ground slopes less than 10° in gradient. The disposal field is located in the south western corner of the site. This area is elevated above any potential overland flow paths.

2. Has a Slope Stability Assessment been carried out on the property?

Yes ☐ No ☒ (Please tick)

If No, why not?

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If Yes, please give details of report (and if possible, please attach report):

Author:	-
Company/Agency	-
Date of Report	-
Brief Description of Report Findings	-

3.Site Characteristics (See Table 1 attached):

Provide descriptive details below:

<u>Performance of Adjacent Systems:</u>
Satisfactory
<u>Estimate Rainfall and Seasonal Variation:</u>
1230mm annually, relatively evenly distributed throughout the year
<u>Vegetation Cover:</u>
Pasture & existing imperious gravel areas
<u>Slope Shape:</u>
Convex
<u>Slope Angle:</u>
0° to 10°
<u>Surface Water Drainage Characteristics:</u>
Falling to watercourse on eastern boundary
<u>Flooding Potential: Yes/No</u>
No – above 0.01AEP plain
If yes, specify relevant flood levels on appended site plan, i.e. one in 5 years and/or 20 year and/or 100 year return period flood level, relative to disposal area.
<u>Surface Water Separation:</u>
15m+
<u>Site Clearances (Provide general description here and specific dimensions in part 6 below and in Site Plan):</u>
See below
<u>Site Characteristics:</u>

4.Site Geology of the subject property

Residual Waitemata Group

Geological Map Reference Number	NZ Geological Survey sheet R10
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5.What Aspect(s) does the proposed disposal system face (please tick)?

North		West	
North-West		South-West	✓
North-East		South-East	
East		South	

6.Site Clearances, which should also be shown on the site plan:

Separation Distance from	Treatment Separation Distance (m)	Disposal Field Separation Distance (m)
Boundaries	1.5	1.5
Surface water	15.0+	15.0+
Groundwater	1.7m	1.7m
Stands of Trees/Shrubs	n/a	n/a
Wells, water bores	20.0+	20.0+
Embankments/retaining walls	n/a	n/a
Buildings	3.0m	3.0m
Other (specify):		

PART D: Site Assessment – Subsoil Investigation

(Refer TP58 – Sn 5.1 General Purpose of Site Evaluation, Sn 5.2.2(b) Site Evaluation and Sn 5.3 Sub-surface Investigations)

Note: Underlined terms defined in Table 2, attached

1.Please identify the soil profile determination method:

Test Pit		(Depth_m)	No. of Test Pits	
Bore Hole	✓	(Depth 5.0m)	No. of Bore Holes	7
Other (specify)				
Soil Report Attached?	Yes	✓	No	(Please Tick)

2.Was fill material intercepted during the subsoil investigation?

Yes	✓	No		(Please tick)
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If yes, please specify the effect of the fill on wastewater disposal

500mm thick fill in some areas to the building platforms, however the fill is not likely to be within the wastewater disposal field and therefore not likely to be affected.

3.Has percolation testing been carried out?

Yes ☐ No ☒ (Please tick)

If yes, please specify the method

Test Report Attached? (Please tick)	Yes ☐	No ☒

4.Are surface water interception/diversion drains required?

Yes ☐ No ☒ (Please tick)

If yes, please show on site plan

5.Please state the depth of the seasonal water table

Winter	1.7(m) – BH No5	
Summer	?(m)	
Please indicate whether measured		☒ or estimated ☐ (please tick)

6.Are there any potential short circuit paths?

Yes ☐ No ☒ (Please tick)

If the answer is yes, please explain how these have been addressed

7.Based on results of subsoil investigation above please indicate the disposal field soil category (Refer TP58 Table 5.1):

Is Topsoil Present? No	If so, Topsoil Depth?	-
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Soil Category	Description	Drainage	Tick One
1	Gravel, coarse sand	Rapid draining	
2	Coarse to medium sand	Free draining	
3	Medium-fine & loamy sand	Good drainage	
4	Sandy loam, loam & silt loam	Moderate drainage	
5	Sandy clay-loam, clay loam & silty clay - loam	Moderate to slow draining	☒
6	Sandy clay, non-swelling clay & silty clay	Slow draining	
7	Swelling clay, grey clay, hardpan	Poorly or non-draining	

Reasons for placing in stated category

Results from borehole investigation.

PART E: Discharge Details

1. Water supply source for the property (please tick):

Rainwater (roof collection)	☒
Bore/Well	☐
Public Supply	☐

2. Calculate the maximum daily volume of wastewater to be discharged, unless accurate

water meter readings are available (Refer TP58 Table 6.1 and 6.2):

Number of Units	12	
Design Occupancy	19	(Number of People)
Per capita Wastewater Production	49	(Litres per person per day)
Other – Specify		
Existing	680	
Total Daily Wastewater Production	1611	(Litres per day)

3. Do you propose to install:

a) Full Water Conservation Devices?	Yes	☐	No	☒	(Please tick)
b) Water Recycling – what %?	%	☐	No	☒	(Please tick)

If you have answered yes, please provide additional information including the estimated reduction in water usage:

4. Is Daily Wastewater Discharge Volume more than 2000litres:

Yes	☐	(Please tick)
No	☒	

Note if the answer to the above is yes an AC wastewater consent will be required

5. Gross Lot Area to Discharge Ratio:

Gross Lot Area	26,672	m ²
Total Daily Wastewater Production	1611	(Litres per day) (from above)
Lot Area to Discharge Ratio	>16	

6. Does this proposal comply with the Auckland Council Gross Lot Area to Discharge Ratio of greater than 1.5

Yes	☒	No	☐	(Please tick)
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7.Does this proposal comply with the Auckland Council Gross Lot Area to Discharge Ratio of greater than 3

Yes ☒ No ☐ (Please tick)

8.Is an Auckland Council Discharge Consent Required?

Yes ☐ No ☒ (Please tick)

PART F: Primary Treatment *(Refer TP58 Section 7.2)*

1. Please indicate below the no. and capacity (litres) of all septic tanks including type (single/dual chamber grease traps) to be installed or currently existing:

Number of Tanks	Type of Tank	Capacity of Tank (Litres)
1	Primary Septic Tank	3500
1	Secondary Septic Tank	1200
	Total Capacity	4700

2. Is a Septic Tank Outlet Filter to be installed?

Yes ☐ No ☒ (Please tick)

If yes, please state the type

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PART G: Secondary and Tertiary Treatment

(Refer TP58 Section 7.3, 7.4, 7.5, and 7.6)

1.Please indicate the type of additional treatment, if any, proposed to be installed in the system (please tick):

Secondary Treatment	
Home aeration plant	☒
Commercial aeration plant	
Intermediate sand filter	
Recirculating sand filter	
Recirculating textile filter	
Clarification tank	
Tertiary Treatment	
Ultraviolet disinfection	
Chlorination	
Other	

Specify	
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PART H: Land Disposal Method (Refer TP58 Section 8)

1. Please indicate the proposed loading method (please tick)

Gravity	
Dosing Siphon	
Pump	✓

2. Is a high water level alarm being installed in pump chambers?

Yes	✓	No		(Please tick)
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3. If a pump is being used, please provide the following information:

Total Design Head	21	(m)
Pump Chamber Volume	700	(Litres)
Emergency storage Volume	3000	(Litres)

4. Please identify the type(s) of land disposal method proposed for this site (please tick)
(Refer TP58 Sections 9 and 10):

Surface Dripper Irrigation	
Sub-surface Dripper Irrigation	✓
Standard Trench	
Deep Trench	
Mound	
Evapo-transpiration Beds	
Other (please specify)	

5. Please identify the loading rate you propose for the option selected in Part H, Section 4 above stating the reasons for selecting this loading rate:

Loading rate	3	(Litres/m ² /day)
Disposal Area	Basal	(m ²)
	Areal	310 (m ²)

Explanation (Refer TP58 Sections 9 and 10)

6. What is the available reserve wastewater disposal area (Refer TP58 Table 5.3)

Reserve Disposal Area (m ²)	105
Percentage of Primary Disposal Area (%)	33

7. Please provide a detailed description of the design and dimensions of the disposal field and attach a detailed plan of the field relative to the property site:

Description and Dimensions of Disposal Field:

Area to south of lot, field forms 'U' shape along western, southern and eastern boundary

Plan Attached?	Yes	☒	No	☐	(please tick)
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If not, explain why not

PART I: Maintenance & Management (Refer TP58 Section 12.2)

1. Has a maintenance agreement been made with the treatment and disposal system suppliers?

Yes	☒	No	☐	(Please tick)
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PART J: Assessment of Environmental Effects

1. Is an assessment of environmental effects (AEE) included with application?

(Refer TP58 Section 5. Ensure all issues concerning potential effects addressed)

Yes	☒	No	☐	(Please tick)
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2. Are there any specific environmental constraints?

Yes	☐	No	☒	(Please tick)
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If yes, please explain

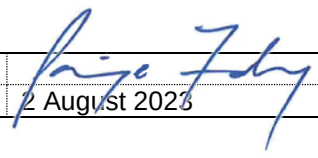
PART K: Is Your Application Complete?

1. In order to provide a complete application you have remembered to:

Fully Complete this Assessment Form	☒
Include a Location Plan and Site Plan (with Scale Bars)	☒
Include a Property Title (Certificate of Title)	☒
Attach an Assessment of Environmental Effects (AEE)	☒

2. Declaration

I hereby certify that, to the best of my knowledge and belief, the information given in this application is true and complete.

Name	P Farley	Signature	
Position	ENGINEER	Date	2 August 2023

APPENDIX G

Auckland Regional Council Technical Sheet G-1

LIST OF WATER TOLERANT PLANTS SUITABLE FOR ON-SITE WASTEWATER DISPOSAL SYSTEMS

GENERAL MATTERS TO CONSIDER WHEN PLANTING A LAND DISPOSAL AREA:

Plants that are suitable for planting in moist conditions, such as those associated with wastewater land disposal fields need to be selected on the basis of both their tolerance for such moist conditions and for their potential for high level of growth/high transpiration of moisture in such conditions.

Standard lawn grass is a proven effective high transpiration plant species in such conditions, as are a large number of other plant species seen in typical domestic gardens.

Consideration needs to be given to effects of roots from plants and from trees in particular on wastewater distribution pipe networks/emitter lines in land application systems. Potential for root intrusion/disruption to the pipe system must be considered prior to selection and planting of a plant or tree species.

Advice on such matters for particular plant species can be obtained from garden centre specialists and landscaping consultants.

NATIVE PLANTS SUITABLE FOR MOIST CONDITIONS IN THE AUCKLAND REGION:

The following list covers native plant species are considered to be suitable for planting in moist conditions, such as those associated with wastewater disposal fields in Auckland situations. They are all tolerant or fond of moist conditions and all are native to the Auckland region. Much of this information has been adapted from one of the ARC Botanic Gardens advisory leaflets; "14 - New Zealand plants for wet places" and the list edited and reviewed by Dr. Rhys Gardner Consulting Botanist, Auckland War Memorial Museum (August 2004).

Grasses, ground covers, and other plants

***Astelia grandis* (swamp astelia)**

Large clump forming plant with bright green, flax-like foliage. Female plants produce upright panicles of orange berries in the centre of the plant. This endemic species will not tolerate eutrophic conditions and prefers peat soils.

***Wechnum nova ezealandiae* (kiokio)**

Large, robust fern growing to 1 or even 2m, Hardy species that tolerates most conditions, but does best in well drained, shady areas.

Carex

There are many members of this genus which grow naturally in damp to wet areas. They all have quite fine drooping foliage and are vigorous in moist conditions. Most prefer very light shade. The following species have been identified for their suitability:

Carex dissita

Endemic species with dull green to reddish tufts often 0.5m tall (although this can vary). Tolerates a range of swampy habitats, but is also noted to grow on drier soils under forest cover.

Carex flagellifera

Endemic species with dense spreading reddish-brown tufts to 0.5m tall. Prefers damp soil and full sun, but is noted to thrive in a variety of habitats including boggy pasture.

Carex geminata

Robust and vigorous endemic species that grows to 1.5m tall. Thrives in a range of wet habitats. Suitable for a larger area.

Carex lessoniana

Robust and vigorous endemic species that grows to 1.5m tall. Similar to *C.geminata* in that the species is spreading and suitable for a larger wet area.

Carex secta (purei, makura)

Endemic species that exhibits tall spreading tussocks. Has been noted to grow to 3m tall, widespread in swampy areas. Useful in the creation of bird habitat.

Carex virgata

Endemic species that forms dense, light green tussocks up to 1m tall. Thrives in a variety of habitats including swamps, drain margins, seepages and wet pastures. Useful in the creation of bird habitat.

Cortaderia fulvida (toetoe)

Branching from the base and forming a clump to 4m high. Long strap-shaped leaves with red- orange coloured veins, flower heads cream yellow. New shoots exhibit pale waxy cover on lower parts unlike pampas grass) Prefers good drainage and semi-shade. Will struggle to compete if dried out in summer.

Cyperus ustutatus (toetoe upoko-tangata, giant umbrella sedge)

Vigorous leafy sedge growing to 1m in open damp places. Tolerates immersion in standing water within a range of habitats from seepages to wetlands.

Dicksonia squarrosa (wheki, tree fern)

Tree fern up to 7m tall that exhibits tolerance of wet open ground, and floods. Found to shelter and accumulate with other native plants. The base of the fern attracts biodiversity. Useful application to streambank and seepage habitats.

Elatostenia rugosum (parataniwha)

Herbaceous plant up to 0.5m tall that spreads by rhizomes. Bronze coloured foliage with serrated edge. Grows on moist sites in light to heavy shade. Intolerant of dry habitats.

Hypolepis dicksonioides

Large fern that prefers fertile moist, but well-drained ground, grows vigorously and spores into planted areas with abundance. Does however, die back during winter.

Phormium tenax (harakeke, flax)

Fast growing clump-forming flax with large stiff leaves, to 3m. Full exposure and sun. Moist to wet conditions. Does not have deep or wide roots. Easily propagated from split fans or grown from seed. Attracts birds, especially Tui.

Trees and shrubs

Consideration needs to be given to the effects of roots land application on wastewater distribution pipe networks. This problem can be more significant for large tree species.

Carpodetus serratus (putaputaweta, marbleleaf)

Lowland forest tree up to 7m tall. Large bunches of cream coloured flowers appear in spring followed by black berries.

Coprosma areolata

Species that grows to 4m tall, Low tolerance to drought, with medium to high fertility.

Coprosma robusta (karamu, shining karamu)

Shrubs or small trees growing to 3m+, with glossy green leaves. Masses of orange-red fruit in autumn are attractive to birds. Hardy plant.

Coprosma tenuicaulis (swamp coprosma)

Endemic species that grows to 3m tall. Leaves pale green with slender branches. Will tolerate a range of swampy to boggy habitats including standing water.

Cordyline australis (ti kouka, cabbage tree)

Palm-like in appearance with large heads of linear leaves and panicles of scented flowers. Sun to semi-shade. Prefers damp to moist soil. Grows eventually to 12m+ height.

Dacrydium dacrydioides (kahikatea, white pine)

Tree that grows to 40m. Moderately growing species, which prefers wetland and boggy environments. Application of this species must consider the possible impact of its root systems on the wastewater disposal field.

Geniostoma rupestre (hangehange)

Common forest shrub with pale green glossy foliage, growing to 2-3m. Tiny flowers give off strong scent in spring. Looks best in sunny position where it retains a bushy habit, and prefers well-drained soil.

Hebe stricta (koromiko)

Shrub or small tree growing to 2-5m in height. Natural forms have white to bluish flowers. Plant in full sun. Tolerates exposure. (NB Many cultivars and hybrids are available commercially, but these are all unsuitable for use near existing natural vegetation.)

Laurelia novae-zelandiae (pukatea)

Large upright tree (to 30m) with attractive bright green foliage and distinctive whitish bark. Fast growing and able to handle a wide variety of soils. It will tolerate periodic flooding, breathing roots develop in water logged soils. Can be grown from seed.

Tolerant of some sun and frost. Not tolerant of wind.

Leptospermum scoparium (manuka)

Shrub or small tree growing to 4m+ in height. Ubiquitous shrub varying in form throughout New Zealand. Ideal to provide shelter for other plants as it is quick growing and hardy. Requires full sun and. Hardy and tolerant of difficult conditions, including waterlogging and drought.

Melicytus ramiflorus (mahoe)

A fast growing yet long lived tree to 7m height. Prefers well drained fertile soils.

Tolerates some frost, wind and sun Birds are attracted to the blue berries.

Pennantia corymbosa (kaikomako)

Slow growing species that will reach 12m in moist, fertile sites. Useful species application in bank stabilisation or wetland habitats.

Plagianthus betulinus (ribbonwood)

Fast growing species to 15m. Similar application to that of Pennant/a corymbosa.

Rhopalostylis sapida (nikau)

New Zealand's only native palm, with red berries attractive to birds. Requires light shade, plenty of moisture and protection from wind when young. Grows well in areas of permanent dampness.

Syzygium maire (maire tawake)

Attractive and moderately growing wetland tree to 15m with bronze foliage, large bunches of reddish fruit and distinctive whitish bark. Requires a sheltered sunny position. Tolerates some frost.

Vitex lucens (puriri)

Fast growing to 20m in fertile, open but sheltered conditions. Will struggle with poor drainage during adolescence.