

CONSULTING STRUCTURAL / CIVIL ENGINEERS AND PROJECT MANAGERS

## LAND CAPABILITY ASSESSMENT REPORT

**CLIENT:** [REDACTED].

**JOB No:** [REDACTED]

**SITE ADDRESS:** [REDACTED]

**DATE:** 16<sup>th</sup> March 2018

### 1.0 GENERAL

#### 1.1 PURPOSE OF INVESTIGATION.

At the request of [REDACTED] [REDACTED] have been engaged to undertake a Land Capability Assessment (LCA) for the site at [REDACTED].

The purpose of the report is to provide the following information :-

- 1) the site conditions and sub soil profile at the site.
- 2) a detailed LCA for the proposed site.
- 3) a conceptual design for a suitable onsite wastewater management system.
- 3) provide recommendations on monitoring and management.

#### 1.2 DESCRIPTION OF THE DEVELOPMENT.

<b>Site Address :</b>	[REDACTED].
<b>Council Area :</b>	Wellington Shire Council.
<b>Zoning :</b>	Low density residential Zone.
<b>Allotment Size :</b>	70000 sqm.
<b>Domestic water supply :</b>	On site roof water collection.
<b>Anticipated wastewater load :</b>	Proposed three bedroom residence @ 4 people maximum occupancy. Design wastewater load is 150 L/person/day, total design load = 600 L/day. (source: AS/NZ 1547:2012 and EPA publication 891-2013).
<b>Availability of sewer :</b>	The area is unsewered and unlikely to be sewered on the short to medium term future.

### 2.0 SITE CONDITIONS AND SOIL ASSESMENT (SSC).

#### 2.1 SITE PLAN.

Refer to the attached site plan for the proposed development and LAA is attached to this report.

## 2.2 SITE FEATURES.

<b>Climate :</b>	The site experiences max. temperature with min. rainfall during summer. The B.O.M. website indicates with site experiences an annual rainfall of 727mm (Morwell Station) with an average of 108 rain days per year. The average annual pan evaporation is 1300mm.
<b>Exposure :</b>	The site has been partially cleared to accommodate farming. The block has high sun and wind exposure.
<b>Vegetation :</b>	The site is well grassed cover and contains native trees.
<b>Landform :</b>	The site appears linear planar.
<b>Slope :</b>	The displayed approximately 10 - 15% falls.
<b>Fill :</b>	No evidence of site fill was encountered in the disposal area.
<b>Rocks &amp; Outcrops :</b>	No surface rock or outcrops were encountered on the site.
<b>Erosion Potential :</b>	No signs of erosion on aerial photograph. Potential low.
<b>Surface Water :</b>	No evidence of existing surface water was found on the site.
<b>Flood Potential :</b>	We believe the site is above the 1:100 year flood level.
<b>Stormwater Runoff and Upslope Seepage :</b>	The area around the site has slight fall with little chance of upslope runoff. No evidence of groundwater seepage or springs were found on the site.
<b>Groundwater :</b>	There was no evidence of free groundwater within 1500mm of the existing surface level. There is no evidence of groundwater being used for domestic use within 60m of the site.
<b>Site Drainage and Subsurface Drainage :</b>	The site experiences negligible stormwater runoff. The loams overlying clays may become waterlogged and limit percolation rates.
<b>Recommended Buffer Distances :</b>	Refer to EPA Publication 891 - 2013 (Table 5). Main controlling requirement will be 6m from building and 3m from boundary allotment (down slope) and 60m to surface waters.
<b>Available Land Application Area (LAA) :</b>	Refer to site plan for location of LAA.

## 2.3 SOIL FEATURES

<b>Soil Depth :</b>	Soil depth greater than 1500mm with no hardpans present.
<b>Depth to Watertable :</b>	Groundwater not encountered to a depth of 1500mm.
<b>Course Fragments :</b>	< 2% course fragments (>2mm) were found in the profile
<b>Soil Assessment :</b>	The test pits indicate Brown/Red LOAMS overlying Brown/Red CLAY LOAMS. Soil Texture : 'Loams' overlying 'Clay loams'. (Table 4.1D1 AS1547) Soil Structure : Weak. (Table 4.1D4 AS1547) <b>Soil Category : 3</b> (Table 4.1.1 AS1547)

## 2.4 LCA MATRIX.

LAND FEATURES	LAND CAPABILITY CLASS RATING					SITE RATING
	Very Good (1)	Good (2)	Fair (3)	Poor (4)	Very Poor (5)	
<b>General Characteristics</b>						
<b>Site Drainage</b>	No visible signs of dampness	Moist soil, no free groundwater		Visible signs of dampness	Water ponding on surface	<b>1</b>
<b>Runoff</b>	None	Low	Moderate	High – req. diversion	Very High – unable to divert.	<b>1</b>
<b>Flood Levels</b>	Never		< 1 in 100	> 1 in 100 and < 1 in 20	< 1 in 20	<b>1</b>
<b>Dist to watercourses</b>	> 60m				< 60m	<b>1</b>
<b>Slope %</b>	0 - 2	2 - 8	8 - 12	12 - 20	> 20	<b>4</b>
<b>Landslip</b>	No potential failure		Low potential failure	High potential failure	Existing failure	<b>1</b>
<b>Groundwater depth (m)</b>	> 5m	5 – 2.5	2.5 – 2.0	2.0 – 1.5	< 1.5	<b>3</b>
<b>Rock Outcrops (% of surface)</b>	0	< 10	10 - 20	20 - 50	> 50	<b>1</b>
<b>Erosion</b>	No erosion potential	Minor	Moderate	High	Severe erosion potential	<b>1</b>
<b>Exposure</b>	High sun & wind		Moderate	Low		<b>1</b>
<b>Landform</b>	Hill crest, convex slope, plains		Concave slopes, footslopes		Floodplains	<b>1</b>
<b>Vegetation</b>	Turf, pasture				Dense forest, little understorey	<b>1</b>
<b>Ave. Rainfall (mm/yr)</b>	< 450	450 - 650	650 - 750	750 - 1000	> 1000	<b>3</b>
<b>Evaporation (mm/yr)</b>	< 1500	1250 - 1500	1000 - 1250		< 1000	<b>2</b>
<b>Fill</b>	No fill		Fill present			<b>1</b>
<b>Soil Profile Characteristics</b>						
<b>Profile Depth</b>	> 2m	1.5 – 2.0m	1.5 – 1.0m	1 – 0.5m	< 0.5m	<b>1</b>
<b>Course Frag. (%)</b>	< 10	10 - 20	20 - 40		> 40	<b>1</b>
<b>pH</b>	6 - 8		4.5 - 6		<4.5, > 8	<b>N/A</b>
<b>Emerson Aggregate</b>	4, 6, 8	5	7	2, 3	1	<b>N/A</b>

<b>Sodicity (ESP%)</b>	< 3.0		6 - 8	8 - 14	> 14	<b>N/A</b>
<b>Electrical Conductivity (ECe/dS/m)</b>	< 0.3	0.3 – 0.8	0.8 - 2	2 - 4	> 4	<b>N/A</b>
<b>Soil Permeability Category</b>	2 and 3	4		5	1 and 6	<b>2</b>
<b>Overall Site Rating</b>	<b>Poor</b>					<b>4</b>

### **3.0 PROPOSED DISPOSAL SYSTEM.**

#### **3.1 LAND APPLICATION SYSTEM SUITABILITY**

In reference to AS1547 – 2012 Table K1 & K2

<b><u>LAND APPLIC. SYSTEM.</u></b>	<b><u>SITE SLOPE</u></b>	<b><u>SOIL DEPTH</u></b>	<b><u>SOIL CAT. NO.</u></b>	<b><u>DEPTH TO W.T.</u></b>	<b><u>SEASONAL. SOIL SATURATI ON</u></b>	<b><u>SODIC SOIL</u></b>	<b><u>COURSE FRAG.</u></b>	<b><u>CLIMATIC FACTORS</u></b>	<b><u>LOT SIZE</u></b>
Absorption trenches	<15%	>1200mm	4	1.5m Need 600mm to W/T under bed	Provide cut off drains.	Loams/ Clay Loams.	No course fragments.	Not a significant factor.	Not critical.
	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>
Sub surface irrigation.	<30%	>1200mm	4	1.5m Need 0.6m min. to W/T.	Provide cut off drains.	Loams/ Clay Loams.	No course fragments.	Not a significant factor.	Not critical.
	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>
Surface irrigation.	<10%	>1200mm	4	1.5m Need 0.6m min. to W/T.	Provide cut off drains.	Loams/ Clay Loams.	No course fragments.	Rain exceeds evap. For 1 mth.	Req. addit. buffer under winds. N.G.
	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>O.K.</b>	<b>N.G.</b>

#### **3.2 PRIMARY EFFLUENT TREATMENT.**

Primary treated effluent refers to discharge from conventional septic tanks and includes all-waste, greywater and blackwater effluents.

#### **3.3 SECONDARY EFFLUENT TREATMENT.**

Secondary treatment should achieve an effluent quality to an EPA standard commonly known as 20/30. This requires the following limits :

BOD : < 20 mg/L  
SS : < 30 mg/L

### **4.0 RECOMMENDED DISPOSAL SYSTEM.**

Due to the overall site rating and soil properties recommend to adopt a **traditional trench beds** (constructed in accordance with Appendix L – AS/NZ 1547:2012) or **shallow sub surface drip irrigation system** (constructed in accordance with Appendix M – AS/NZ 1547:2012).

#### **4.1 TRENCH DESIGN (AS/NZ 1547:2012).**

##### **a) Primary Treated Effluent.**

Using AS1547:2012 Table L1 – ‘Recommended Design Loading Rates for Trenches & Beds’.

For     **Soil Category : 3**  
          **Soil Texture : Loams**  
          **Soil Structure : Weak**  
          **Design Loading Rate : Use Conservative Rate : 10 mm/day.**

$$L = Q/(DLR*W)$$

L	= Length (in m)	
Q	= Design daily flow (in L/day)	= 600 L/day
DLR	= Design loading rate (in mm/day)	= 10 mm/day (conservative)
W	= Width (in m)	= 0.45 m

$$L = 600 / (10*0.45) = 133.3 \text{ m}$$

For 600 L/day effluent rate the required total length of absorption trench is **133.3 m** for a **450 mm** wide trench. (Calculated in accordance with Clause L4.2 AS/NZ 1547:2012, Eq. L1).

**The available land application area is adequate for a primary treated effluent trench irrigation system.**

##### **b) Secondary Treated Effluent.**

Using AS1547:2012 Table L1 – ‘Recommended Design Loading Rates for Trenches & Beds’.

For     **Soil Category : 3**  
          **Soil Texture : Loams**  
          **Soil Structure : Weak**  
          **Design Loading Rate : 30 mm/day.**

$$L = Q/(DLR*W)$$

L	= Length (in m)	
Q	= Design daily flow (in L/day)	= 600 L/day
DLR	= Design loading rate (in mm/day)	= 30 mm/day (conservative)
W	= Width (in m)	= 0.45 m

$$L = 600 / (30*0.45) = 44.4 \text{ m}$$

For 600 L/day effluent rate the required total length of absorption trench is **44.4 m** for a **450mm** wide trench. (Calculated in accordance with Clause L4.2 AS/NZ 1547:2012, Eq. L1).

**The available land application area is adequate for a secondary treated effluent trench irrigation system.**

## **4.2 DRIP IRRIGATION DESIGN (AS/NZ 1547:2012).**

### **a) Drip irrigation (Secondary treated effluent).**

The sub surface drip irrigation system shall be designed in accordance with 'Appendix M6 Irrigation System Design' AS/NZ 1547:2012.

Using Table M1 AS/NZ 1547:2012

Soil Category : 3

Soil Structure : Weak

Design Irrigation Rate (DIR) : **3.5 mm/day (24.5mm/wk).**

Design wastewater load from site : **600 L/day (4200 L/wk)**

For a wastewater load of **4.20 cum/wk** with a maximum site irrigation rate of **24.5mm/wk** the irrigation surface area required is **171.4 sqm**. This is in isolation of a site water balance calculation.

**The available land application area is adequate for a secondary treated drip irrigation systyem.**

## **4.3 SITE WATER BALANCE.**

Refer to the spreadsheet attached to determine the required application area required to achieve a water balance in relation to the design irrigation rate, evapotranspiration and rainfall.

The climate data was obtained from the **Morwell** climate station (Site Number 085280).

From the spreadsheet the required irrigation area for the balanced conditions is **245 sqm**. This is less than the available on the site with the required buffer zones.

**The available land application area is adequate for secondary treated effluent surface irrigation.**

Due to the potential presence of some minor ground water in the disposal area over the winter months, it is recommended that a suitable cut-off drain be constructed on the uphill side of the trenches. This will prevent the ground water from entering the disposal area, thus improving the percolation rate of the area. (Refer detail attached.). It is also important that the trenches are not located in the natural drainage gullies on the site unless suitable surface drains are constructed to divert the surface water flow from the disposal area.

From the results obtained by testing, it can be seen that the percolation rate of the disposal area is suitable for the use of a septic tank and absorption trenches. The calculated percolation rate of **45.00 mm/hr** exceeds the minimum value required or absorption of 15 mm/hr and is below the rate were a soil becomes too permeable of 500 mm/hr.

## **5.0 CONSTRUCTION AND DRAINAGE REQUIREMENTS**

The disposal system shall be constructed in strict accordance with EPA CERTIFICATE OF APPROVALS and AS1547 : 2012.

Due to the location of open water around the site, care must be taken in locating the absorption trenches. The code requires a distance of 60m to any surface waters. Additional setbacks can be found in Table 5 of EPA Publication 891.3 : 2013.

The code also requires a distance of 6m minimum to any downhill storm water drain or building or allotment boundary.

The code also requires a distance of 15m minimum to any cutting or escarpment.

It is assumed in this report that the soil profile observed in the bore hole is representative of the entire site. If this is found not to be true then the Engineer must be notified so that any soil variation may be assessed.

[Redacted]

[Redacted]

March, 2018

[Redacted]



CLIENT: [REDACTED]  
PROJECT: [REDACTED].  
TESTED BY: [REDACTED].

JOB NUMBER: [REDACTED]  
PAGE NUMBER: 4  
DATE TESTED: 16<sup>th</sup> March 2018

BORE HOLE #: 1

DEPTH		SOIL TYPE	M/C	BEARING	COMMENTS
100					
200		Brown loams	Dry		
300					
400					
500					
600					
700		Brown/red clay loams	Dry	Stiff	
800					
900					
1000					
1100					
1200					

BORE HOLE #: 2

100					
200		Brown loams	Dry		
300					
400					
500					
600		Brown/red loams	Dry	Stiff	
700					
800					
900					
1000		Brown/red clay loams	Dry	Stiff	
1100					
1200					





CLIENT:



DATE: 23 March 2018

# Site Plan

