Contents

Attachments

1. Drawing 7461/G1 & G2
2. Dynamic Cone Penetrometer Probe Logs
3. Engineering Logs
4. GW059813 Groundwater Bore Log
5. Disposal Area Calculation Sheets
6. General Notes
7. Useful Background Information
8. Land Application Areas
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10. Wastewater Treatment Systems
11. Wastewater Dispersal Systems

The site is bounded by Matcham Road to the south, by undeveloped bush to the east, and by rural-residential properties to the north-west and south-west. The site is situated on the south facing lower slopes of a south-west trending ridge. Ground slopes are towards the south at up to approximately 27°. Vegetation comprises dense rainforest, native bushland and lantana. At the time of the investigation, the site was undeveloped.

The existing site layout is shown on attached drawings 7461/G1 and 7416/G2. Views of the site are given in photographs P1 and P2.

Photograph P1 – View towards north, taken from Matcham Road; access to property through road reserve visible in left frame

Photograph P2 – View towards north, taken from near southern boundary of property

3.3 Groundwater Bore Search

A groundwater bore search was undertaken using the NSW Department of Primary Industries, Office of Water online continuous water monitoring network. The online monitoring network uses a combination of automatic digital sensors and logging devices as well as manual sampling to provide a complete register of groundwater works, monitoring bores, telemetered bores and coal basin bores.

No registered groundwater bores were located within a 50 m radius of the property. Groundwater bore 'GW059813' lies approximately 150 m to the south east of the site.

The NOW work summary for groundwater bore GW059813 is provided in the attachment section of this report.

4. Fieldwork

4.1 Methods

The fieldwork, undertaken on 27 May 2016, consisted of a visual assessment of the site and surrounding area, excavation of one borehole (BH1) by hand auger methods and the driving of two dynamic cone penetrometer [DCP] tests (DCP 1 and DCP 2).

Representative disturbed soil samples were recovered from boreholes and examined for physical and chemical characteristics.

Drawing 7461/G2 show the locations of the borehole and DCP tests.

4.2 Results

The borehole was excavated to a depth of 1.2 m. The subsurface profile encountered in the borehole comprised sandy clay and silt soils to the limit of investigation.

The DCP probe at test location DCP1 was driven to termination at a depth of 1.3 m. The probe at test location DCP2 was driven to refusal at a depth of 0.95 m.

Neither groundwater nor seepage at surface level were encountered during the investigation.

Logs of the DCP tests and an engineering log of the borehole are provided in the attachment section of this report.

As identified in Table 1 and Table 2 above, the site features and limitations that may have adverse impacts to on-site wastewater disposal are steep site slopes, the potential for surface water run-on during rainfall events and the moderate exposure levels due to dense vegetation throughout the property.

It is recommended that interceptor bunds be constructed upslope of the land application area to divert surface run-on during rainfall events. Site exposure shall be re-assessed at completion of earthworks and land clearing to accommodate the proposed residence.

Information sheets on wastewater treatment options and diagrams of typical effluent dispersal methods are given in the attachment section of this report.

5.2 Calculation of Required Area for Dispersal Field

5.2.1 Calculation Methods

Five methods were used to calculate the required land application areas for primary- and secondary-treated effluent:

- Nominated Area method
- Minimum Area method
- Nitrogen Loading method
- Phosphorus Loading method
- Conventional and Evapo-transpiration / Absorption Trench sizing method

Each method uses different physical and chemical site characteristics to determine the required effluent dispersal area. The most suitable dispersal area sizing method will be determined with consideration to site specific limitations.

Typically, the method that produces the largest area for a particular dispersal mechanism is selected to enable the most effective on-site dispersal of effluent.

Each of the above methods is described in Table 3.

Based on textural assessment of the soil types encountered in the borehole drilled on site, the limiting soil horizon for subsurface effluent dispersal is inferred to be weakly structured clay loam. In accordance with Table L1 and M1 of Ref 1, this horizon is a Category 4 soil with an indicative permeability of 0.12 to 0.5 m/day.

Hydraulic Loading

The hydraulic loading has been estimated using the methodology detailed in Table H1 of Ref 1. Table 4 shows the estimated hydraulic load for the proposed residences using a tank water supply.

Table 4 – Hydraulic loading for tank water

Number of Bedrooms	No. of people	Hydraulic Loading (L/day)
4	6	720

5.2.3 Results

Table 5 presents the resultant minimum total land application areas calculated by each of the methods outlined in Table 3, using the hydraulic loading calculated in Table 4.

Table 5 – Calculated total land application areas

Residence Using tank water	**Treatment System**	**Required Dispersal Area (m^2)** Conventional Trench	**Required Dispersal Area (m^2)** ETA Trench	**Required Dispersal Area (m^2)** Subsurface Irrigation
4 Bedrooms	Septic	145	-	-
4 Bedrooms	AWTS	43	102	676 (1)

Notes to Table 5:
(1) This area is governed by the Phosphorus Loading Method

As shown on attached drawing 7461/G2, the approximate available dispersal area is in the order of 450 m^2.

On this basis, it is anticipated that the most suitable method of effluent disposal for the proposed development would be a conventional / arch trench receiving effluent treaded by an AWTS.

6.3 Drainage

An uphill diversion drain should be constructed to protect the dispersal area from potential surface run on during rainfall events.

Where site slopes allow, upslope subsurface seepage should be intercepted and diverted away from the dispersal area by a subsoil drain.

6.4 Installation

The installation of the subsurface irrigation system is to be undertaken by an experienced plumbing contractor.

6.5 Vegetation

The effluent dispersal site must be vegetated. The vegetation can include grasses and shrubs. Clippings and weeds removed from the dispersal area should be disposed of away from the area to avoid increased nutrient loads on the irrigation area. Likewise, clippings and other vegetation should not be disposed of on the area.

6.6 Effluent Quality

Effluent from the proposed wastewater treatment system is to be dispersed in the land application area in accordance with the requirements of Ref 1 and Table 14 of Ref 2. Methods to reduce effluent strength include:

- Using the minimum recommended amounts of low phosphate, biodegradable liquid detergents and cleaning agents;
- Avoiding large quantities of bleaches, disinfectants and whiteners; and
- Minimising the amount of solid waste entering the treatment system, especially non-biodegradable items such as plastics.

It is important that the owner makes a consistent effort to reduce the strength of the treated effluent.

6.7 Maintenance

The treatment system and dispersal fields should be regularly checked to ensure that they are operating correctly.

Signs of failure include surface ponding, effluent run off, erosion, leaching of the soil, poor vegetation growth including burnt vegetation, odours or the formation of surface crusts.

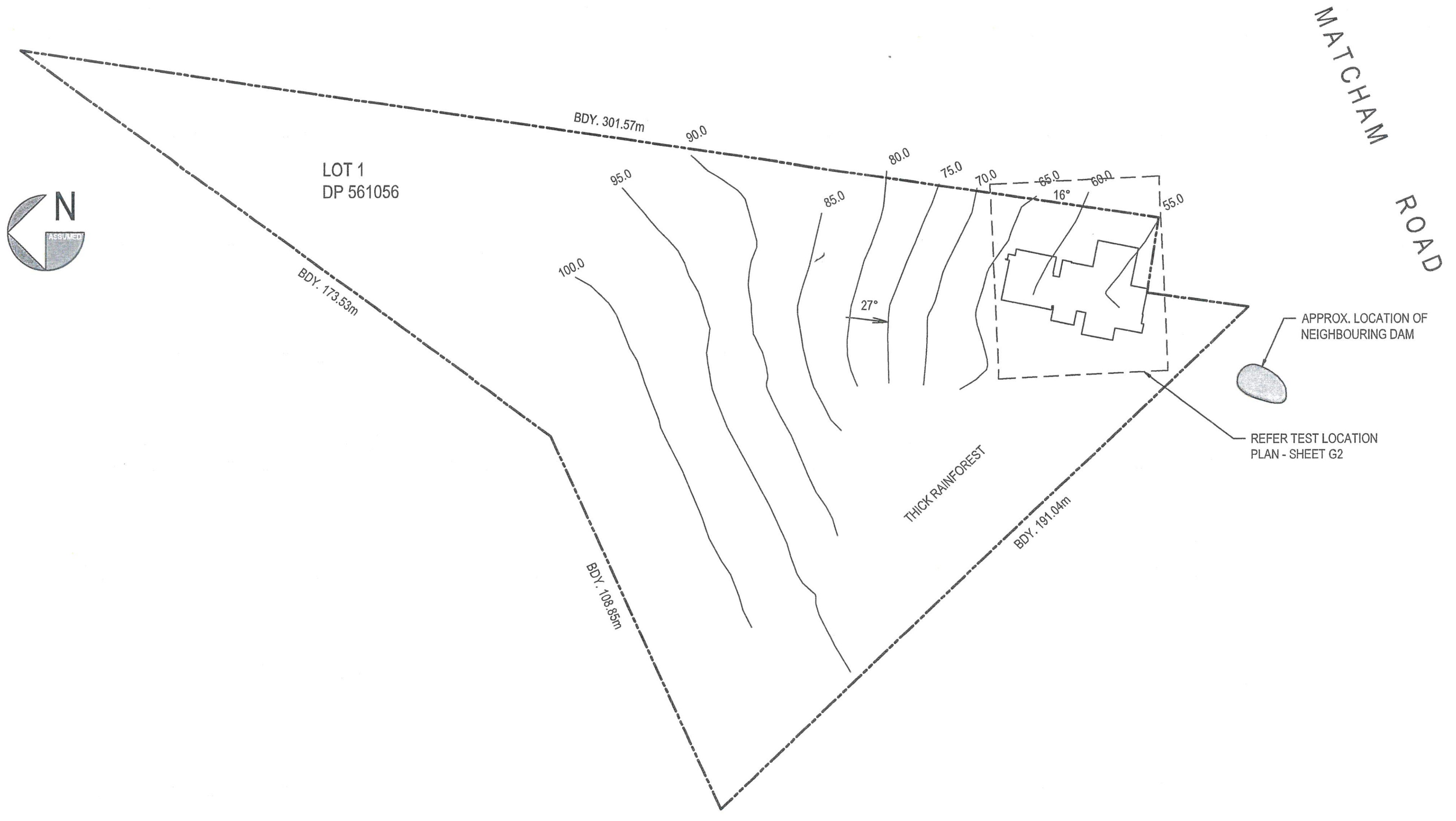
8. References

1. Australian Standard AS/NZS 1547:2012, 'On-site domestic wastewater management', Standards Australia (February 2012)

2. 'Environment & Health Protection Guidelines – On-site Sewage Management for Single Households', NSW Government (January 1998)

3. 'Gosford–Lake Macquarie special 1:100 000 geological sheet, 9131 and part sheet 9231', Geological Survey of NSW (2015)

4. 'Gosford–Lake Macquarie 1:100 000 soil landscape series sheet 9131–9231' and associated report, NSW Department of Conservation & Land Management (1993)



LOCALITY PLAN
SCALE 1:1000

REV.	DATE	ISSUE DESCRIPTION	DESIGN	DRAWN	CHECKED
-	5.03.18	Report Issue	-	AH	-

Approved:

5QS CONSULTING GROUP

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PROPOSED RESIDENCE
293 MATCHAM ROAD,
MATCHAM
MR J MCGARRY

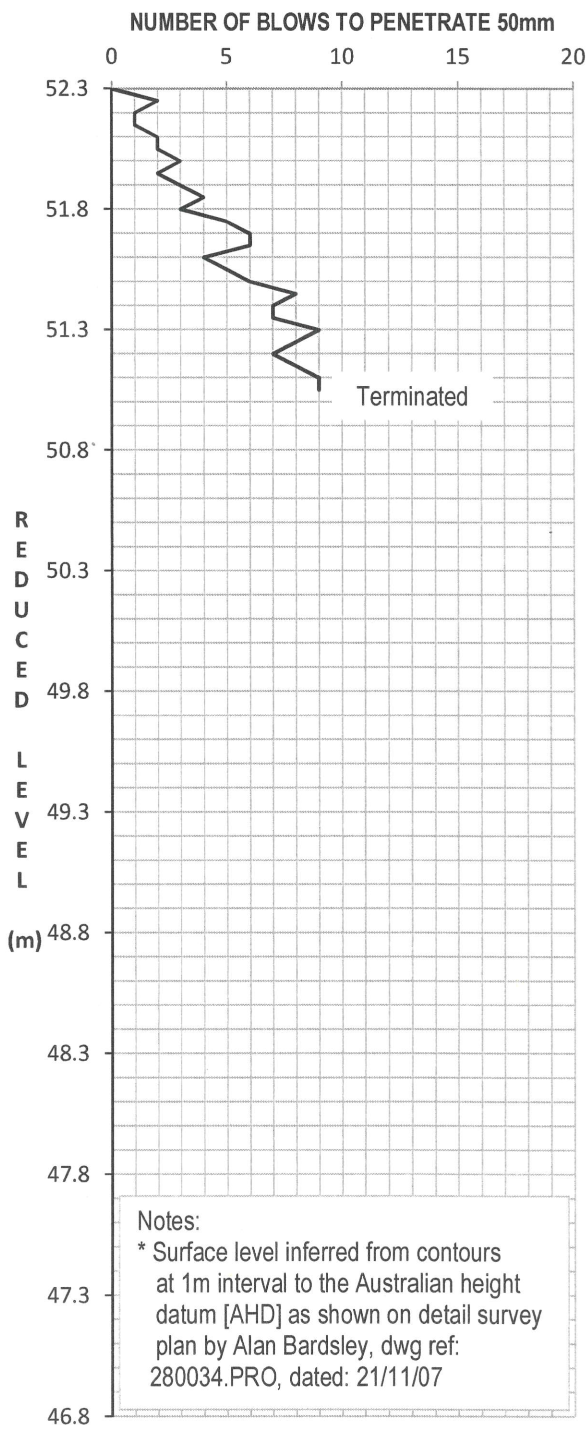
Drawing: 7461
Sheet: G1
Revision: -
Original Sheet Size: A3

DYNAMIC CONE PENETROMETER LOG

Location:	293 Matcham Road, Matcham		
Client:	Mr J McGarry	**5QS Ref:**	7461
Position:	See test location plan - Drawing 7461/G2	**Date:**	27-May-16
Groundwater:	Nil Encountered	**Logged By:**	LJD/WJM

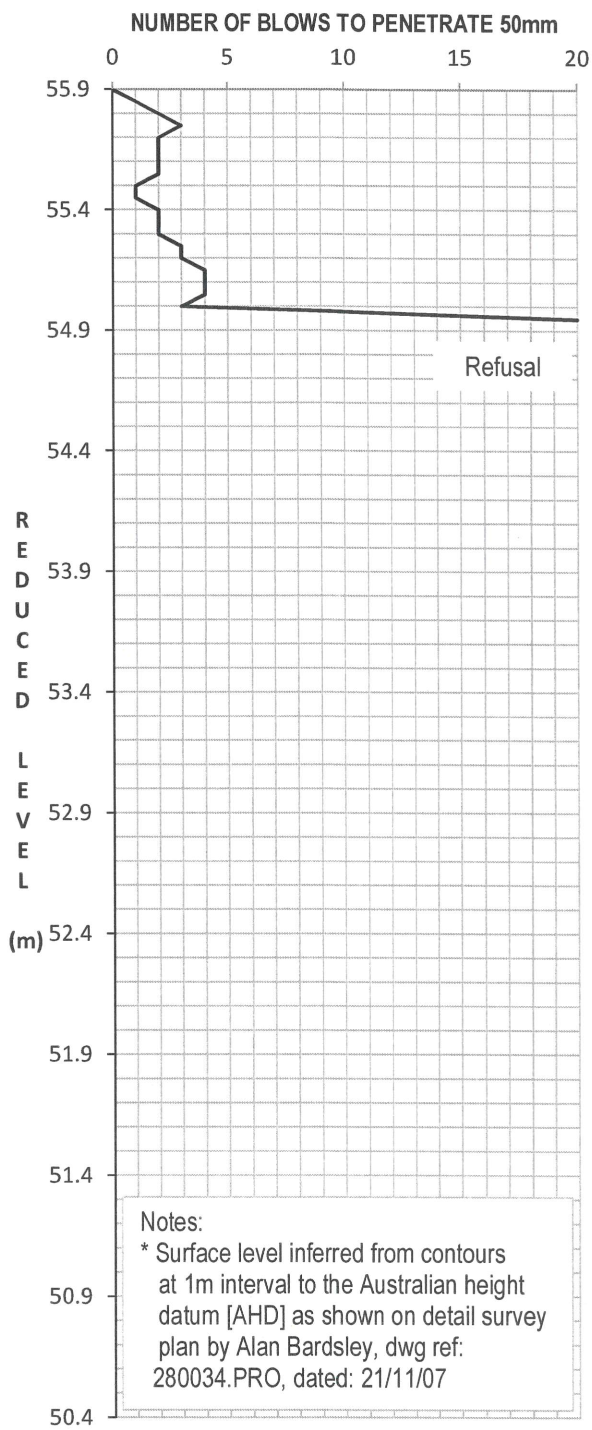
*** Surface RL:** 52.3 AHD

DCP 1



*** Surface RL:** 55.9 AHD

DCP 2



TERMS & SYMBOLS

Unified Soil Classification System (UCS)				
COARSE-GRAINED SOILS More than half the material (by weight) is individual grains visible to the naked eye	GRAVELLY SOIL More than half of the coarse fraction is larger than 4.75mm	CLEAN GRAVEL Will not leave a stain on wet palm	Substantial amounts of all grain particle sizes	GW
			Predominantly one size or range of sizes with some intermediate sizes missing	GP
		DIRTY GRAVEL Will leave stain on wet palm	Non-plastic fines (to identify, see ML below)	GM
			Plastic fines (to identify, see CL below)	GC
	SANDY SOIL More than half of the coarse fraction is smaller than 4.75mm	CLEAN SAND Will not leave not leave a stain on wet palm	Wide range in grain size and substantial amounts of all grain particle sizes	SW
			Predominantly one size or range of sizes with some intermediate sizes missing	SP
		DIRTY SAND Will leave stain on wet palm	Non-plastic fines (to identify, see ML below)	SM
			Plastic fines (to identify, see CL below)	SC

	Ribbon	Liquid Limit	Dry crushing strength	Dilatancy reaction	Toughness	Stickiness	
FINE-GRAINED SOILS More than half the material (by weight) is individual grains not visible to the naked eye (< 0.074mm)	None	<50	None to slight	Rapid	Low	None	ML
	Weak	<50	Medium to high	None to very slow	Medium to High	Medium	CL
	Strong	>50	Slight to medium	Slow to medium	Medium	Low	MH
	Very Strong	>50	High to very high	None	High	Very high	CH
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture						OL, OH, Pt

Description and classification of soils and rock in accordance with AS1726 'Geotechnical Site Investigations'

Plasticity A2.4(b)

Symbol	Descriptive term	Liquid limit (%)
NP	Non plastic	-
L	of low plasticty	< = 35
M	of medium plasticity	> 35 < = 50
H	of high plastic	> 50

Moisture Condition A2.5(a)

'Dry' (D)	Cohesive soils; hard and friable or powdery, well dry of plastic limit. Granular soils; cohesionless and free-running
'Moist' (M)	Soil feels cool, darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
'Wet' (W)	Soil feels cool, darkened in colour. Cohesive soils usually weakened and free water forms on hand when handling. Granular soils tend to cohere.

Consistency terms - Cohesive soils TA4

Term	USS (kPa)	Field guide to consistency
Very soft	< = 12	Exudes between fingers when squeezed in hand
Soft	12 - 25	Can be moulded by light finger pressure
Firm	25 - 50	Can be moulded by strong finger pressure
Stiff	50 - 100	Cannot be moulded by fingers, can be indented by thumb
Vary stiff	100 - 200	Can be indented by thumb nail
Hard	> 200	Can be indented with difficulty by thumbnail

Consistency terms - Non-Cohesive soils TA5

Term	Density Index (%)
Very loose	< = 15
Loose	15 - 35
Medium dense	35 - 65
Dense	65 - 85
Very Dense	> 85

NSW Office of Water
Work Summary

GW059813

Licence: 20BL131449

Licence Status: ACTIVE

Authorised Purpose(s): STOCK,DOMESTIC
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore open thru rock
Work Status:
Construct.Method: Rotary Air
Owner Type: Private

Commenced Date:
Completion Date: 01/10/1984

Final Depth: 38.00 m
Drilled Depth: 38.00 m

Contractor Name:
Driller:
Assistant Driller:

Property: N/A NSW

GWMA: -
GW Zone: -

Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.031	L2 DP603580 (19)
Licensed:	NORTHUMBERLAND	KINCUMBER	Whole Lot 2//603580

Region: 10 - Sydney South Coast
River Basin: 212 - HAWKESBURY RIVER
Area/District:

CMA Map: 9131-2S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)

Northing: 6302461.0
Easting: 354321.0

Latitude: 33°24'26.3"S
Longitude: 151°26'00.1"E

GS Map: -

MGA Zone: 0

Coordinate Source: GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	12.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
27.00	28.00	1.00	Consolidated	12.00		2.00			

Geologists Log
Drillers Log

Onsite Effluent Dispersal Assesment

SITE AND SOIL EVALUATION

Owner:	Mr J McGarry	**5QS Ref:**	7461
Site Location:	293 Matcham Road, Matcham	**Date:**	19-Dec-17
		Assessor:	Adam Hawkes

The following is a Site and Soil Evaluation summary in accordance with AS 1547-2012 "On-site Domestic Wastewater Management" and the Environment & Health Protection Guidelines "On Site Sewerage Management for Single Households"

Site Information and Assessment

Intended Water Supply: Tank Water

Wastewater Load: 720 L/d 5040 L/wk

Climate:			**Climate Data Source:**	
Annual Rainfall:	1320.8	mm	**Rainfall:**	Gosford
			Design Percentile:	50
Annual Evaporation:	1202.5	mm	**Evaporation:**	Peats Ridge

Topography:

Site Slope:	30 %	**Site Landform:**	Linear
Site Exposure:	Low	**Landform Shape:**	Linear Planar
Site Aspect:	Southerly	**Erosion Potential:**	Low
Site Drainage:	Moderately drained	**Surface Rocks:**	None visible
Run-on and Seepage:	Some expected	**Site Filling:**	Nil Encountered

Groundwater:

Groundwater bores in the area and their current purpose:	N/A
Horizontal distance to groundwater well used for domestic supply:	100m
Groundwater vulnerability:	Not within GW vulnerability Area

Interpreted Soil Properties

Depth to bedrock or hardpan:	).9 m to > 1.3 nm	**Depth to high soil watertable:**	> 1.3 m	m
Soil Structure:	Weakly Structured	**DLR - Irrigation:**	3.5	mm/d
Soil Texture:	Clay Loam	**DLR - Trenches (Primary):**	8	mm/d
Soil Permeability Category:	4.2	**DLR - Trenches (Secondary):**	20	mm/d
Indicative Permeability:	0.12 - 0.5 (K_{sat})(m/d)	**DLR - Mound:**	8	mm/d

Soil Analysis on Sample 1 : BH1 - 500mm

pH:	>5	
Emerson Aggregate Test:	3, 4, 5 or 6	
Electrical Conductivity:	<1	dS/m

Dispersal Area

Is there sufficient Land for a Primary Dispersal Area:	YES
Is there sufficient Land Area for Reserve Dispersal:	YES

Onsite Effluent Dispersal Assesment

Traditional Trench Sizing Method
Secondary Treated Wastewater

Owner:	Mr J McGarry	**5QS Ref:**	7461
Site Location:	293 Matcham Road, Matcham	**Date:**	19-Dec-17
		Assessor:	Adam Hawkes

The following is the Traditional Trench calculation method in accordance with AS 1547-2012 "On-site Domestic Wastewater Management" and the Environment & Health Protection Guidelines "On Site Sewerage Management for Single Households"

Site Information and Assessment

Intended Water Supply:	Tank Water	**Wastewater Load (Qd):**	720	L/d
Void Space Factor:	0.3	**Wastewater Load (Qw):**	5040	L/wk
Rainfall Runoff Coefficient:	0.25	**Design Loading Rate (DLR) (Secondary):**	20	L/m2/day

Climate Data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
Days in Month	31	28	31	30	31	30	31	31	30	31	30	31	365
Precipitation (mm)	139.0	148.1	149.8	136.2	119.1	127.6	79.0	75.9	68.6	82.9	92.4	102.2	1320.8
Evaporation (mm)	142.6	120.4	108.5	81.0	55.8	48.0	55.8	77.5	102.0	127.1	135.0	148.8	1202.5

Calculation Method - Water Balance

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Days in Month	31	28	31	30	31	30	31	31	30	31	30	31
Evaporation	142.6	120.4	108.5	81.0	55.8	48.0	55.8	77.5	102.0	127.1	135.0	148.8
Evapotranspiration (mm)	0	0	0	0	0	0	0	0	0	0	0	0
Precipitation (mm)	139.0	148.1	149.8	136.2	119.1	127.6	79.0	75.9	68.6	82.9	92.4	102.2
Retained Precipitation (mm)	104.3	111.1	112.4	102.2	89.33	95.7	59.25	56.93	51.45	62.18	69.3	76.65
DLR (mm)	620	560	620	600	620	600	620	620	600	620	600	620
Disposal Rate (mm)	515.8	448.9	507.7	497.9	530.7	504.3	560.8	563.1	548.6	557.8	530.7	543.35
Effluent Appplication (mm)	22320	20160	22320	21600	22320	21600	22320	22320	21600	22320	21600	22320
Disposal Area (m^2)	43.3	44.9	44.0	43.4	42.1	42.8	39.8	39.6	39.4	40.0	40.7	41.1

	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Application Rate		519	469	519	502	519	502	519	519	502	519	502	519
Disposal Rate		516	449	508	498	531	504	561	563	549	558	531	543
Application Difference		3	20	11	4	-12	-2	-42	-44	-46	-39	-28	-24
Increased Depth		11	66	38	15	-39	-7	-139	-147	-154	-129	-95	-81
Depth of Effluent (mm)	0	11	77	116	130	92	85	0	0	0	0	0	0

Trench/Bed Basal Area **43.0** m^2

Calculation Method - AS1547

$$\text{Trench/Bed Basal Area} = \frac{\text{Daily Hydraulic Load (Qd)}}{\text{Design Loading Rate (DLR)}}$$

$$= \mathbf{36} \; m^2$$

Required Basal Area

Worst Case Trench/Bed Basal Area = **43.0** m^2

General Notes – Continued

Foundation Depth

Where referred to in the report, the recommended depth of any foundation, (piles, caissons, footings etc) is an engineering estimate of the depth to which they should be constructed. The estimate is influenced and perhaps limited by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications based upon this report should provide for variations in the final depth depending upon the ground conditions at each point of support.

Engineering Logs

Engineering logs presented in the report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify economically. In any case, the boreholes or test pits represent only a very small sample of the subsurface profile.

Interpretation of information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling and the possibility of other than straight line variations between the test locations.

Drilling Methods

The following is a summary of drilling methods currently used by **Barker Harle**, and some comments on their use and application.

Continuous Sample Drilling: The soil sample is obtained by screwing a 75 or 100mm auger into the ground and withdrawing it periodically to remove the soil. This is the most reliable method of drilling in soils as the moisture content is unchanged and soil structure, strength, appearance etc. is only partially affected.

Test Pits: These are excavated using a backhoe or tracked excavator, allowing close examination of insitu soil if it is safe to descend into the pit. The depth of digging is limited to about 3 metres for a backhoe, and about 5 metres for an excavator. A potential disadvantage is the disturbance of the site caused by the excavation.

Hand Auger: The soil sample is obtained by screwing a 75mm Auger into the ground. This method is usually restricted to approximately 1.5 to 2 metres in depth, and the soil structure and strength is significantly disturbed.

Continuous Spiral Flight Augers: The soil sample is obtained by using a 90 – 115mm diameter continuous spiral flight auger which is withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays, and in sands above the water table. Samples, returned to the surface, are very disturbed and may be contaminated. Information from the drilling is of relatively lower reliability. SPT's or undisturbed sampling may be combined with this method of drilling for reasonably satisfactory sampling.

Hand Penetrometers

Hand Penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and recording the number of blows for successive 50mm increments of penetration.

Two, relatively similar tests are used:

1. Perth Sand Penetrometer (AS 1289.5.3.3) – A 16mm flat ended rod is driven with a 9kg hammer, dropping 600mm. This test was developed for testing the density of sands and is mainly used in granular soils and loose fill.

2. Cone Penetrometer/Scala Penetrometer (AS 1289.5.3.2) – A 16mm rod with a 20mm diameter cone end is driven with a 9kg hammer dropping 510mm. The test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio (CBR) have been published by various road authorities.

Sampling

Sampling is carried out during drilling to allow engineering examination, and laboratory testing of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending on the amount of disturbance during drilling, some information on strength and structure.

Undisturbed samples are taken by pushing a think walled sample tube into the soils and withdrawing this with a sample of soil in a relatively undisturbed state contained inside. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Details of the type and method of sampling are given in the report.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 series, Methods of Testing Soils for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

Land Application Areas

Irrigation Areas

Siting of surface irrigation areas

Surface irrigation areas shall be in a location away from regular pedestrian traffic and recreation areas, so that there is no risk of direct spray or wind-driven spray onto such areas. Effluent shall not be used for irrigation of fruit or vegetables.

Preparation of irrigation area

When a proposed irrigation area has low permeability, it is particularly important to ensure that the permeability of the soils in the irrigation area is improved and maintained and that there is adequate cover of porous and fertile topsoil (see AS 2223) to act as immediate storage for effluent applied to it, and to support the rapid growth of vegetation on the area to maximize evapotranspiration.

It may be necessary to import topsoil, but the possibility of improvement of the natural topsoil layer should not be overlooked. A vigorous plant root system will also lead to an improvement in soil structure and consequently to an increase in permeability. However reliance upon a vigorous plant root system to provide an improvement in permeability is a long term achievement and therefore soil improvement by other means is essential.

Requirements for irrigation systems

All irrigation pipework and fittings shall comply with all parts of AS1477 or AS2698.2. The distribution irrigation lines shall have a minimum depth of cover of 100mm.

There shall be no cross-connection between any irrigation pipework and a potable water supply.

Standard household hose taps and garden fittings shall not be used.

Along the boundary of the surface irrigation area there shall be at least two warning signs clearly visible to inform the occupants of the premises that recycled water is used for irrigation. Each sign shall comply with AS 1319 and have:

Lettering visible at 3m, and wording:

- Recycled water
- Avoid contact
- Do not drink

At the time of commencing to use the system, the warning sign and the landscaping or that surface preparation, or both, of the system must be completed.

Vegetation Suitable for Wet Soils

This section sets out suitable vegetation for growing in wet soils, eg. on evapotranspiration beds and areas.

Types of Vegetation

Climbers	
Bougainvilea	Kennedia
Hardenbergia	Lonicera japonica
Hibbertia scandens	Pandorea jasminoides

Grasses	
Buffalo	Kikuyu

Ground Cover	
Acanthus mollis	Liriope muscari
Coprosmo x kirki	Ophiopogon
Grevillea poorinda	Royal Mantle

Perennials	
Agapanthus preacox	Gazania x hybrida
Astor novi-belgii	Salvia x superba
Canna x generalis	Stokesia laevis
Chrysanthemum maximum	Viola hederacea

Shrubs	
Abelia x grandiflora	Correa alba
Euphorbia pulcherrima	Hebe speciosa
Cotoneaster glaucophyllus	Jasminum mesnyi
Cassia bicapsularis	Ceratostigma
Jasminum polyanthum	Callistemon citrinus
Chaenomiles lagenaria	Cotoneaster lacteus
Acacia longifolia	Nerium oleander
Lantana montevidensis	Westringia fruticosa
Leptospermum flavescens	Cuphea ignea
Plumbago auriculata	Thumbergia alata
Euonymus japonicus	Euphorbia milii
Pyracantha fortuneana	Cotoneaster pannosus
Jasminum officinale 'Grandiflorum'	Lantana camara(cultivars only)

Trees	
Leptospermum laevigatum	Banksia integrifolia
Leptospermum petersonii	Angophora costata
Eucalyptus botryoides	Callistermon salignus
Eucalyptus robusta	Callistermon viminalis
Photinea x fraseri 'Robusta'	Casuarina glauca
	Casuarina stricta
Tristaniopsis laurina	Nyssa sylvatica
Hakea saligna	Hakea salicifolia
Melaleuca quinquenervia – Sandy soil	Melaleuca styphelioides – Clay soil
Melaleuca armilaris – Sandy soil	Melaleuca linariifolia – Clay soil

Vegetation Suitable For Land Application Areas

Shrubs Cont'

Botanical Name	Approximate Height	Common Name or Variety
Callistemon subulatus	1 – 2m	Cobber
Callistemon viminalis	1 – 2m	
Callistemon viminalis	5 – 10m	Captain Cook
Callistemon viminalis	3 – 5m	Dawson River
Callistemon viminalis	50cm – 1m	Hannah Ray
Callistemon viminalis	1.5 – 2m	Little John
Callistemon viminalis	2 – 3m	Rose Opal
Goodenia ovata	1 – 1.5m	Western Glory
Hibiscus diversifolius	1 – 2m	
Kunzea capitata	1 – 2m	Swamp hibiscus
Leptospermum flavescens	< 2m	
Leptospermum juniperinum	1m	Tea-tree
Leptospermum lanigerum	1 – 2m	Tea-tree
Leptospermum squarrosum	< 2m	Woolley Tea-tree
Melaleuca alterifolia	4 – 7m	Tea-tree
Melaleuca decussate	1 – 2m	
Melaleuca lanceolata	4 – 6m	Cross-leaved Honey
Melaleuca squamea	1 – 2m	Myrtle
Melaleuca thymifolia		

Trees

Botanical Name	Approximate Height	Common Name or Variety
Acacia elongate	> 2m	
Acacia floribunda	2 – 4m	Gossamer Wattle
Agonis flexuosa	5 – 6m	Willow Myrtle
Allocasuarina diminuta	1.5m	
Allocasuarina paludosa	0.5m – 2m	
Angophera floribunda	Large Tree	
Angophera subvelutina	Large Tree	
Callicoma serratifolia	10 – 30m	River She-Oak
Casuarina cunninghamiana	6 – 12m	Swamp Oak
Casuarina glauca	Large Tree	Blueberry Ash
Elaeocarpus reticulates	Large Tree	
Eucalyptus amplifolia	10 – 30m	

Trees Cont'

Botanical Name	Approximate Height	Common Name or Variety
Eucalyptus botryoides	15 – 20m	River Red Gum
Eucalyptus camaldulensis	Large Tree	Blue Mountains Blue Gum
Eucalyptus deanei	Large Tree	River Peppermint
Eucalyptus elata	10 – 20m	Flooded Gum
Eucalyptus grandis	20m	Woollybutt
Eucalyptus longifolio	30 – 40m	Blackbutt
Eucalyptus pilularis	< 35m	Greygum
Eucalyptus punctata	20 – 30m	Swamp Mahogony
Eucalyptus robusta	30 – 50m	Sydney Blue Gum
Eucalyptus saligna	30 – 40m	Forest Red Gum
Eucalyptus tereticornis	20 – 40m	Ribbon Gum
Eucalyptus viminalis	10 – 20m	Lilli Pilli
Acmana smithii	< 40m	Native Teak
Flindersia australis	3 – 6m	Native Frangipani
Hymenosporum flavuum	3 – 4m	Bracelet Honey Myrtle
Melaleuca armillaris	4 – 7m	
Melaleuca decora	6m	
Melaleuca ericifolia	4 – 6m	
Melaleuca halmaturorum	2 – 3m	
Melaleuca hypericifolia	4 – 8m	Snow in Summer
Melaleuca hypericifolia	5 – 7m	Vroad Paperback
Melaleuca halmaturorum	6m	
Melaleuca hypericifolia	4 – 6m	
Melaleuca linarifolia	2 – 3m	
Melaleuca linarifolia	4 – 8m	
Melaleuca quinquenervia	5 – 7m	
Melaleuca squarrosa	6m	
Melaleuca stypheloides	6 – 15m	
Melia azedarach	15 – 20m	
Pittosporum spp.		
Syzgium paniculatum		
Tristania Laurina	8 – 10m	Bush Cherry
Viminaria juncea	5 – 15m	Kanuaka

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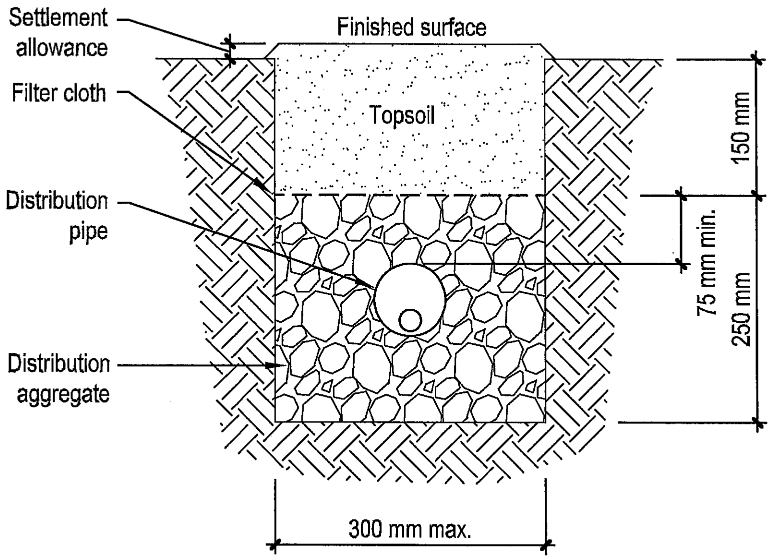
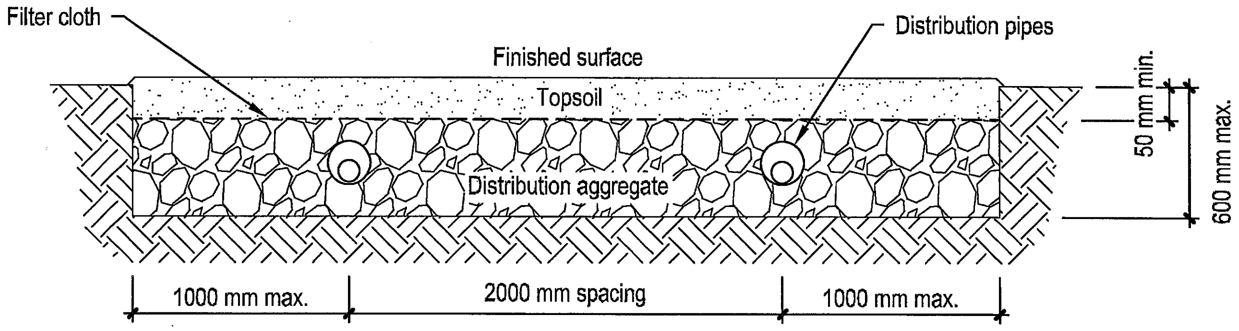
Wastewater Dispersal Systems

Conventional Trench, Conventional Bed and Self Supporting Arch Trench

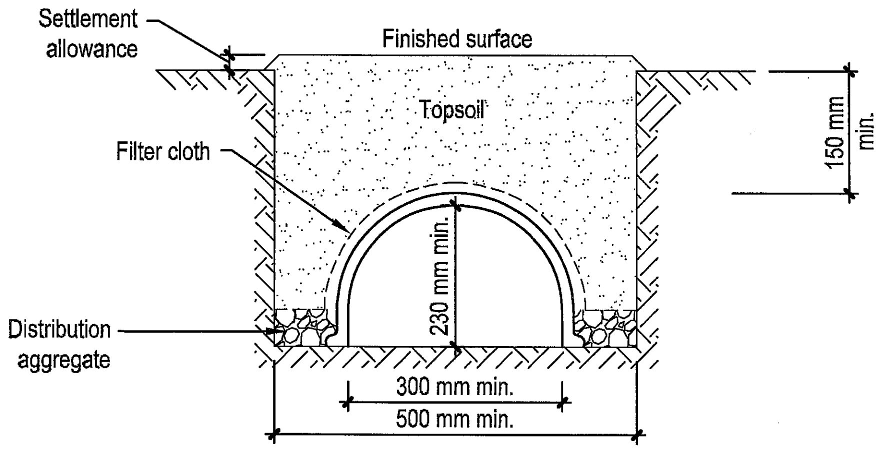


-Note: LPED lines can replace distribution pipes if required

Conventional Trench



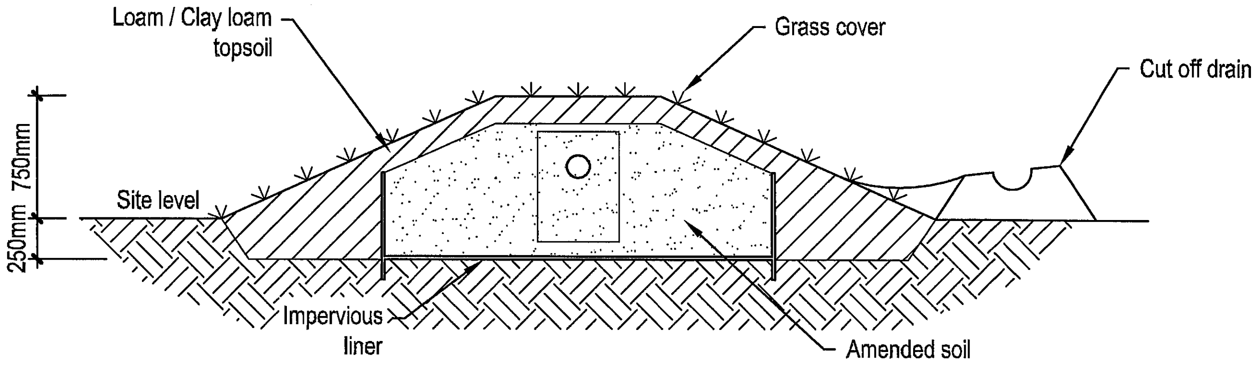
Conventional Bed



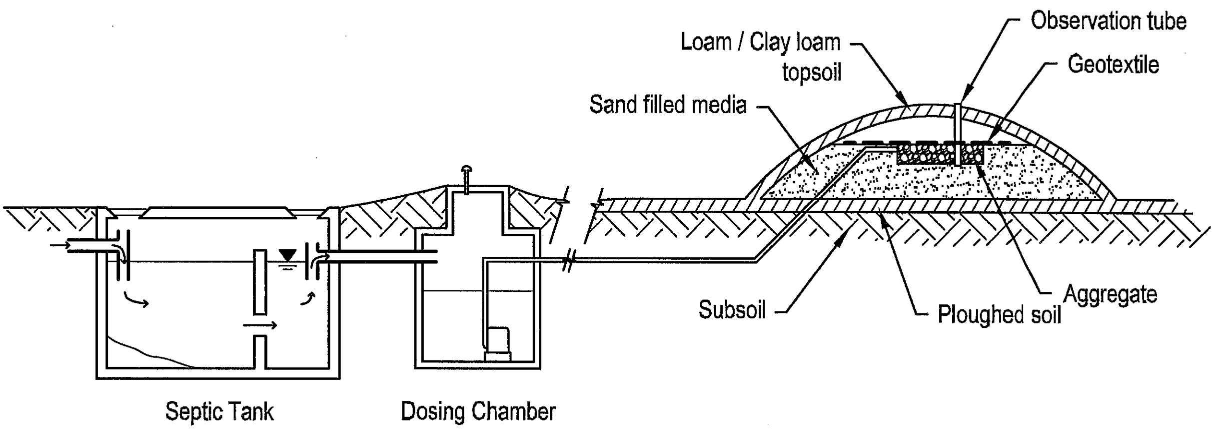
Self Supporting Arch Trench

Wastewater Dispersal Systems

Soil Mounds



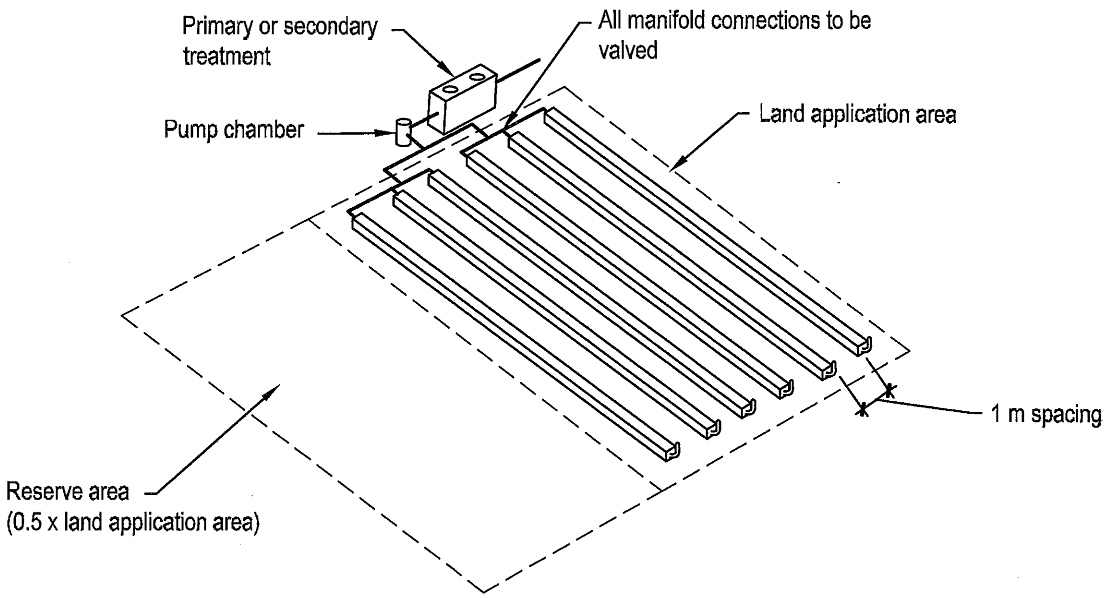
Amended Soil Mound



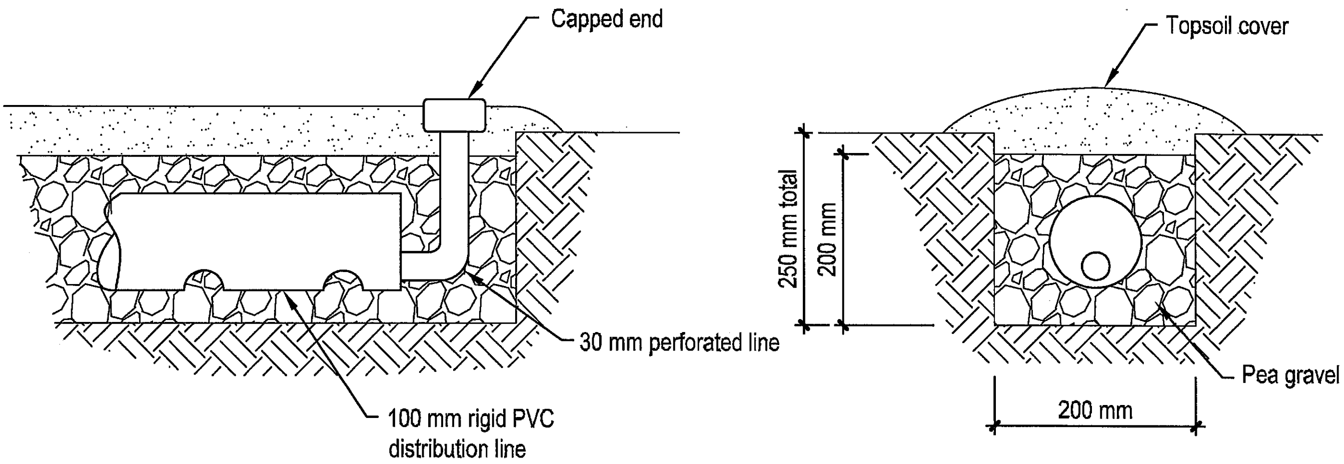
Sand / Wisconsin Mound

Wastewater Dispersal Systems

LPED Irrigation Layout



LPED Irrigation System Example Layout



LPED Trench

-See also ETA and Conventional Trench