Catalyst Environment

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On-site Wastewater Management Report

Proposed Subdivision: Stage 2, Lots 9-24 and Lots 31-37 (Cancelling Lot 1 SP 162871)
Mount Kilcoy Road, WINYA

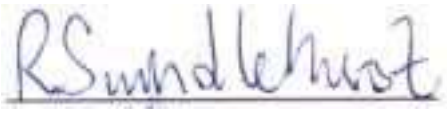
18 January 2021

Prepared for:
Tonlen Pty Ltd
c/o Lennium Group

Report details

Project ref:	1/27112020
Project Manager:	Robert Swindlehurst
Report title:	On-site Wastewater Management Report for Stage 2 of the Subdivision at Mt Kilcoy Road WINYA. Proposed Lots 9-24 and 31-37 cancelling Lot 1 SP 162871
Author:	Robert Swindlehurst
Client:	Tonlen Pty Ltd c/o Lennium Group

Catalyst Environment



Robert Swindlehurst BSc
Director

Date: 18 Janaury 2021

Contents

INTRODUCTION

1.1 Project

Catalyst Environment has been engaged by the Lennium Group, Brisbane on behalf of Tonlen Pty Ltd to undertake a site and soil evaluation and to prepare an On-site Wastewater Management Report for the proposed Stage 2 subdivision of Lot 1 SP 162871 into Lots 9-24 and 31-37 at Mt Kilcoy Road, Winya.

1.2 Proposed development

This evaluation and report has been prepared to support a Development Application to Somerset Regional Council. It is proposed to reconfigure the 40.150 ha site to create thirty seven rural residential lots ranging in area from approximately 5000-10,000 m^2 to 21,000+m^2. The proposed reconfiguration for Stage 2 (23 Lots) is shown in Figure 1, Appendix A.

For the purpose of this assessment, it is assumed that each of the proposed allotments will be improved with a four bedroom dwelling that will be supplied water via a reticulated community supply. It is proposed to treat all wastewater to advanced secondary standard using individual domestic wastewater treatment systems and disperse the resulting effluent within the bounds of each allotment in designated land application areas. There are no existing dwellings on existing Lot 1 SP 162871.

1.3 Relevant guidelines & references

The evaluation was conducted with reference to the following documents:

- *On-site domestic wastewater management*. AS/NZS 1547:2012. Standards Australia International Ltd and Standards New Zealand.
- *Queensland Plumbing & Wastewater Code, Version 1 2019*
- *Effluent Disposal Report (Lot 1 SP162871 at Kilcoy.* Land Resource Assessment and Management Pty Ltd (February 2010; Author: PG Shields)
- *Nobel, K. E. (ed.). (1996). Understanding and Managing Soils in the Moreton Region.* Department of Primary Industries Training Series, QE96003. Brisbane

1.4 Evaluation objectives

The objectives of the evaluation were to:

- Characterise the site and soil conditions.
- Determine the suitability of the proposed allotments for on-site wastewater management.
- Identify suitable land application area/s.
- Provide recommendations for the treatment of wastewater and sustainable land application of effluent within the bounds of each allotment.

1.5 Scope of work

To achieve the evaluation objectives, the following scope of work was undertaken:

- A desktop study including:
    1. Review of the development proposal.
    2. Review of geology and soil maps for the area.
    3. Review of current aerial photographs of the site and surrounds.
- An inspection of the site and surrounding environment to determine available land application areas and identify potential on-site wastewater management constraints.
- The drilling of 30 boreholes to a maximum depth of 1000 mm below the ground surface to characterise soil conditions throughout the site for determination of individual Lot requirements.

- Reference to a previous study by Land Resource Assessment and Management Pty Ltd (February 2010; Author: PG Shields) conducted a site investigation at Lot 1 with detailed soil profile descriptions at 7 sites. Soils were sampled to a depth of at least 1.5 m or to weathered rock, which ever came first. No groundwater was encountered at any of the examined sites. No regional watertable had previously been identified within 1.2 m of the ground surface.

- The preparation of this On-site Wastewater Management Report for submission to Somerset Regional Council.

2.0 Desktop assessment

2.1 Climate

The climate of the Somerset Region can be broadly described as subtropical. The area receives a mean annual rainfall of approximately 985 mm, with June – October being the driest months. Average rainfall, daily temperatures and evaporation are at their peak during the period between December to March (Australian Government Bureau of Meteorology)

Long Term Climate Data derived from BOM, Somerset Dam and Kirkleigh
Mean annual rainfall: 985.4 mm
Mean daily (annual) pan evaporation rate: 4.4 mm/day (1607.1 mm/year)
Net evaporation loss per day: = 1.70 mm/day

2.2 Topography

The existing Lot is situated directly adjacent to and to the south east of the intersection of Kilcoy-Murgon Road and Mt Kilcoy Road at Winya. A semi-intermittent portion of Kilcoy Creek is located 105 metres from the south east corner of Lot 1. The slope over much of the southern sections of Lot 1 falls away from the south west corner in a northerly to northeasterly direction. The existing Lot 1 has a generally northern aspect. Site elevations range from approximately 135 to 115 metres across the site from the south western corner in a northeasterly direction.

2.3 Soils

Soils found in the lower undulation regions of the Lot are developed on “the Neara Volcanics, a geological formation containing sedimentary rocks of conglomerate and sandstone as well as the volcanic rock andesite.
The higher undulating rises in the south-west have developed on metamorphic rocks of the Rocksberg Greenstone formation. This formation contains various forms of schist as well as amphibolite and phyllite”. (Shields PG; 2010)

3.0 Site & soil assessment

3.1 Surrounding environment

Lot 1 is currently zoned as 'Emerging Community' and is bordered by the zones shown in Table 3.1 below.

Table 3.1. Surrounding environment and land use

Direction	Environment
North	Rural
East	Emerging Community
South East	Emerging Community
South West	General Residential Zone (park Residential Precinct
West	Emerging Community
North-West	Rural

3.2 Site characteristics

The site features identified during the evaluation conducted on 21 August 2019 are provided in Table 3.2. The site and proposed subdivision is displayed in Figure 1, Appendix A.

Table 3.2. Site characteristics

Site feature	Description
Topography:	Sloping at 6-10% from the southwest (135 m AHD) towards the centre of the block. Easing to 2-6% from the centre of the block towards the northeast (115 m AHD)
Configuration:	Slope configuration varies across the whole the site.
Aspect:	The site aspect is generally towards the north, across the site
Erosion potential:	Limited erosion potential identified based on observation of current conditions, current existing grass coverage. Erosion potential higher on proposed Lots having a slope greater than 6%
Run on/flooding potential:	Low potential for surface water run-on.
Vegetation:	A mixture of native and introduced grasses are established throughout most of the site. Scattered clumps of Wattle and Eucalyptus regrowth in patches
Environmental Areas	An Easement/Drainage Reserve is proposed for the areas of Lot 1 that experience overland flow and/or potential flood impact. This includes parts of proposed Lots 15, 16 29, 30, 26 and 27. See Figure 1 Appendix A.
Exposure:	The site is well exposed to direct sunlight and the prevailing winds.
Presence of rock outcrops:	No large rock outcrops or large floaters were identified
Presence of fill:	No filling was identified within the site.
Site drainage:	The site overall is moderately well drained with runoff directed towards the north eastern/eastern boundary.
Presence of waterways:	There are no permanent waterways on Lot 1.
Setback distances achievable:	All mandatory setback distances are achievable at the site.

3.3 Sub-surface conditions

A total of 30 boreholes representative of the whole site, were drilled on 21 August 2019. Boreholes were drilled using a powered Techtronic 32 mm TCT auger and 75 mm Dormer hand auger.

Soil profile descriptions (bore holes) are included in Appendix C and the identified subsurface conditions are provided below.

3.4 Sub-surface conditions for Lots identified as requiring disposal to trenches

All of the existing Lot 1 is within the Higher Risk Catchment Area (HRCA) that is; the Water Supply Buffer Area. See Figure 1 Appendix E3, SRPS OM5 Catchment Management, Appendix A. Land within this classification of Catchment Management must have a minimum 400 m buffer to a waterbody in the HRCA. There are no waterbodies in the immediate or surrounding area within 400 m of Lot 1.

There is a 100 m buffer to a watercourse in the HRCA. The south east corner of Lot 1 is 105 m from Kilcoy Creek.

As an additional protection, the 100 m buffer/setback has been also applied for areas affected by overland flow and potential flood impact. For Lots that are not likely to be able to achieve this (depending on the position of the house on a Lot by a buyer), the use of spray irrigation has not been recommended for those Lots, see Section 3.7. Instead in these instances, subsurface disposal of advanced secondary treated water has been recommended instead.

It should be noted that this approach exceeds the requirements of both the National Standard *On-site domestic wastewater management*. AS/NZS 1547:2012 and the *Queensland Plumbing & Wastewater Code, Version 1 2019*. The Queensland Plumbing and Wastewater Code only requires a 10 m setback/buffer to dams and other water bodies, overland flow and flood impacted areas for either spray irrigation or subsurface disposal to trenches of advanced secondary treated effluent.

3.5 Soil Types

3.5.1 Type B

Consisting of a red/brown clay loam to 0.9 m depth (Lot 9). Lot 11 has a shallow layer of silty loam (0-200 mm) over a silty loam with weathered rock (200-600mm), with a light clay 600-900 mm.

These soils have been classified as equivalent to

Type B = Category 4 Clay Loam (equivalent), moderately structured, imperfectly drained and have an indicative Ksat Permeability of 0.5-1.5 m/day. AS/NZS 1547:2012 recommends a Design Irrigation Rate (DIR) of 3.5 mm/day for Category 4 soils, a DIR of 3.5 mm/day has been adopted..

Type B soils were found on proposed Lots 9 and 11.

No groundwater was encountered during these soil evaluations.

3.5.2 Type C

Consisting of silty clays between 0.2 and 0.6 m depth, overlying clays or silty, sandy clay or in some instances silty clay/light clay with very weathered rock.

The soils have been classified as equivalent to

Type C = Category 5 Light Clay moderately structured, poorly drained and have an indicative Ksat Permeability of 0.06-0.12 m/day. AS/NZS 1547:2012 recommends a Design Irrigation Rate (DIR) of 3.0 mm/day for Category 5soils, a DIR of 3.0 mm/day has been adopted..

Type C soils were found on the remaining proposed Lots: 10, 12-24 and 31-37.

No groundwater was encountered during these soil evaluations.

3.6 Separation distances

AS/NZS 1547:2012 provides two performance objectives that relate to setback or buffer distances, as follows:

1. *To protect public health by ensuring that risks associated with the discharge of human waste and domestic-wastewater to the environment are minimised*; and
2. *To maintain and enhance the quality of the environment by ensuring that surface and groundwater are not polluted*.

The recommended setback distances for land application areas are specified in the *Queensland Plumbing and Wastewater Code Version 1 2019).* The buffer distances are displayed in Tables 3.6a and 3.6b below.

See also;

Section 3.4 Sub-surface conditions for Lots identified as requiring disposal to trenches and Figure 1 Appendix E, SRPS OM5 Catchment Management.

Table 3.6a - Setback distances for surface irrigated land application area for a greywater treatment plant or an on-site sewage treatment plant

The separation distances are based on a spray plume with a diameter not exceeding 2 m or a plume height not exceeding 0.5 m above the finished surface level. Distances are given in metres from the edge of the irrigated wetted area to any point of the feature.

Feature	*Horizontal Separation Distance* **(metres)**
Property boundaries, pedestrian paths and walkways.	2 if level with or above wetted area
Property boundaries, pedestrian paths and walkways.	4 if below the wetted area
Water edge of a swimming pool.	6
Dwellings, recreation areas.	10

Table 3.6b - Setback distances for on-site sewage facilities and greywater re-use facilities

(Protection of surface water and ground water)

Feature	Separation	Distance	(metres)
For onsite wastewater treatment systems	**Advanced Secondary**	**Secondary**	**Primary**
Top of bank of permanent water course; or Top of bank of Intermittent water course; or Top of bank of a lake, bay or estuary or, Top water level of a surface water source used for agriculture, aquaculture or stock purposes or; Easement boundary of unlined open stormwater drainage channel or drain. Bore or a dam used or likely to used for human and or domestic consumption	10	30	50
Unsaturated soil depth to a permanent water table (vertically)	0.3	0.6	1.2

All of the above mandatory separation distances are achievable.

3.7 Site and soil constraints

Lot 1 is located in the HRCA and meets all required setbacks as detailed for this Catchment Management Area see Figure 1 Appendix E, SRPS OM5 Catchment Management. In particular proposed Lots 19-21 and 33, 34, 36, and 37, have been voluntarily identified as having insufficient available setback distances from overland flow or potential flood impact areas of 100 metres for spray irrigation.

These constraints can be overcome by:

1. Treating all wastewater to advanced secondary standard for all Lots.

2. On Lot's 19-21 and 33, 34, 36, and 37, disposal to subsurface trenches due to setback constraints.

3. Utilising spray irrigation on all other Lots 9-18, 22-24, 31, 32, and 35, to promote evapo-transpiration at the surface and reduce the requirement for deep drainage into the sub-soils.

4. Locating the Land Application Areas (Treated Effluent Disposal Areas) away from existing and proposed drainage lines and providing a minimum separation distance of 10 m between the application areas and any Overland Flow Path on the Lot

4.0 Hydraulic assessment

4.1 Wastewater flow allowance

The wastewater flow has been calculated based on the *Typical Domestic-Wastewater Flow Design Allowances - Australia* provided in AS/NZS 1547:2012. The expected wastewater flow for the proposed allotments has been calculated based on the typical allowance for a four bedroom dwelling with standard water reduction fixtures and reticulated community water supply. The expected wastewater flows are shown in Table 4.1 below.

Table 4.1. Wastewater flow allowance

Occupants/users	Typical wastewater flow (L/person/day)	Total daily wastewater flow Q_D (L/day)	Total weekly wastewater flow Q_W (L/week)
6[1]	150	900	6300

Table notes: 1. Typical four bedroom dwelling with a maximum of 6 occupants.

The above wastewater flow rates will vary based on the number of bedrooms and/or persons occupying each of the proposed allotments. Therefore, final wastewater flow allowances must be calculated when dwelling designs are submitted to Council.

4.2 Land application area Type B Soils (Spray Irrigation) Lots 9 and 11

The area required for the land application of effluent via irrigation has been calculated using the following equation:

Land Application Area (LAA) = Q_D / DIR

Where:

LAA = irrigation area (m^2)
Q_D = wastewater flow (L/day)
DIR = design irrigation rate (mm/day) 3.5 mm for Category 4 Soils

Therefore:

Type B Soils Land Application Area = 900/3.5 = 257 m^2

The above calculations indicate the minimum land application areas required to irrigate treated effluent sustainably, without exceeding the long term acceptance rate (LTAR) of the soil.

In addition, a 100% Reserve Area is available at these proposed Lots.

4.2 Land application area Type C Soils (Spray Irrigation) 10, 15-18, 22-24, 31, 32, and 35

The area required for the land application of effluent via irrigation has been calculated using the following equation:

Land Application Area (LAA) = Q_D / DIR

Where:

LAA = Land Application Area (m^2)
Q_D = Daily wastewater flow (L/day)
DIR = Design Irrigation Rate (mm/day) 3.0 mm for Category 5 soils

Therefore:

Type C Soils Land Application Area = 900/3 = 300 m^2

The above calculations indicate the minimum land application areas required to irrigate treated effluent sustainably, without exceeding the long term acceptance rate (LTAR) of the soil.

In addition, a 100% Reserve Area is available at each proposed Lot.

4.3 Land application area Type C Soils (Subsurface Trenches) Lots 19-21, 33, 34, 36 and 37

The area required for the land application of effluent into subsurface trenches has been calculated using the equation below. Constant Head Permeability tests were carried out for these Lots and a K_{sat} (saturated soil permeability) calculated for each result. Due to the presence of rock fragments and a high/moderate soil structure these Lots gave a better K_{sat} result than may have been expected from gross soil analysis alone. Therefore these Lots have been considered as Category 4 equivalents for the purpose of trench calculations and DLR. See K_{sat} results in Appendix D for Lots 20 and 34.

K_{sat} proposed Lot 20 = 0.6 m/day
K_{sat} proposed Lot 34 = 0.5 m/day

Design Loading Rate (DLR)

AS/NZS 1547:2012 p145 Table L1
Category 4 Clay Loams; High/moderate structure; Indicative permeabilty 0.5-1.5 (K_{sat} m/day);
Secondary treated effluent DLR = 30 mm/day

Land Application Area (LAA/trenches) X = Q_D / DLR x W where W is width of trench in metres

Where:

Trenches required	= X m of trenches w metres wide
Q_D	= wastewater flow (L/day)
DLR	= Design Loading Rate (mm/day)

Therefore:

Lots 19-21, 33, 34, 36 and 37
Type C Soil Trenches required = 900/30 x 0.9
= 33.3 m of trenches 0.9 m wide x 450 mm deep.

The above calculations indicate the minimum land application areas required to irrigate treated effluent sustainably, without exceeding the long term acceptance rate (LTAR) of the soil.

In addition, a 100% Reserve Area for trenches is shown at these proposed Lots.

5.0 On-site wastewater management

5.1 Wastewater treatment systems

Based on the findings of the site and soil evaluation, it is recommended that wastewater generated on each allotment be treated to advanced secondary standard using an aerated wastewater treatment system (AWTS) or similar. All AWTS use aeration of wastewater as an integral part of the treatment, which typically involves the following processes:

5.1.1 Settling of solids and flotation of scum in an anaerobic primary chamber;
5.1.2 Oxidation and consumption of organic matter through aerobic biological processes;
5.1.3 Clarification (secondary settling of solids);
5.1.4 Disinfection using chlorination or ultra-violet sanitiser; and
5.1.5 Regular removal of sludge to maintain the process.

Table 5.1 shows the effluent quality criteria for advanced secondary treated effluent.

Table 5.1. Advanced Secondary effluent quality

Parameter	Criteria
Biochemical oxygen demand (mg/L)	10
Total suspended solids (mg/L)	10
Thermotolerant organisms (org/100mL)	10

Table notes: Source: Queensland Plumbing and Wastewater Code Version 1 2019

Queensland Chief Executive Approved (CEA) Advanced Secondary Treatment Systems can be found here: http://www.hpw.qld.gov.au/construction/BuildingPlumbing/Plumbing/OnSiteSewerage/ApprovedSystems/Pages/AdvancedSecondary.aspx

5.2 Land application of effluent

Based on the expected wastewater flows and the site and soil conditions encountered, the following Land Application Areas will be required

Table 5.2 Land Application Areas Stage 2

Lot Numbers	Type Soil	LAA required (m^2)	LAA Adopted (m^2)
9, 11 (spray)	B	257	257
10, 15-18, 22-24, 31, 32, and 35 (spray)	C	300	306
19-21, 33, 34, 36 and 37 (trenches)	C	33.3 m of trenches 0.9 m wide	36 m of trenches 0.9 m wide

It should be noted that individual site assessments will be required for each allotment when dwelling designs are submitted, and that the land application areas may be reduced if the identified soil conditions are more favourable than those described in this report, or soil amelioration/improvements are undertaken. The designated land application areas are shown in Figure 1, Appendix A.

The irrigation systems will rely on natural physical, chemical and biological processes occurring between the effluent and the soil, vegetation, micro-organisms and atmosphere to utilise the various constituents of the effluent. A brief description of the spray irrigation method is provided below.

Note: All treated effluent wil be disinfected using chlorine or other approved method before it is irrigated either by spray irrigation or to trenches.

5.2.1 Surface-spray irrigation

Surface-spray irrigation is suited to soils of all permeability, as the effluent application rate and area of application can be designed to maximise in-soil treatment. Therefore, in highly permeable sandy soils or low permeability clay soils, the effluent can be distributed over a large area to promote unsaturated flow and provide additional in- situ treatment.

Effluent will be evenly distributed using low pressure, low volume sprinklers that produce coarse droplets. The sprinklers must have a maximum plume radius of 2.0 m and plume height of 0.5 m to prevent the production of aerosols. Sprinklers will be fitted to lengths of purple sullage hose and connected to fixed point turf valves. The irrigation systems must be installed to ensure that all effluent is contained within the designated land application areas.

Warning signs complying with AS 1319 must be installed at two points on the land application area boundaries. The signs must be clearly visible to property users, with wording such as 'Recycled Water – Avoid Contact – DO NOT DRINK'.

A typical surface spray irrigation design is provided in Figure 3, Appendix A.

5.2.2 Subsurface-trenches

Where particular site constraints exist (see Section 3.7 Lots 19-21, 33, 34, 36 and 37) subsurface disposal is recommended. Each of these Lots will have an advanced secondary treatment system which will irrigate the treated effluent to pressure dosed subsurface trenches. These can either be dosed sequentially via an indexing valve (eg K-Rain or similar) or via a three-way distribution box. Disposal to trenches in this manner provides additional in- situ treatment.

A typical pressure dosed subsurface (trench) irrigation design is provided in Figure 5, Appendix A

5.2.3 General effluent irrigation requirements

The land application areas must be constructed by a suitably experienced and qualified plumber and drainer following the requirements of AS/NZS 1547:2012. Effluent distribution pipes must be designed for effluent use and buried to a minimum depth of 0.15 m below the ground surface. The pipes must be permanently installed and should be lilac or lilac striped to indicate recycled effluent. Alternatively, lilac indicator tape must be laid over the treated effluent lines to indicate their presence. The irrigation systems must be installed to achieve the separation distances provided in Section 3.6.

The pump systems must have performance characteristics that are suited to the hydraulic characteristics of the irrigation systems. An in-line strainer (150 – 200 mesh) must be fitted to the pump discharge to facilitate system servicing and to prevent effluent solids being carried over from the treatment systems.

The irrigation areas must be planted with suitable grasses which will provide nutrient removal during active growth periods. The grass must be regularly mowed and the clippings removed from the site to maintain the nutrient uptake rate within the land application areas.

Alternatively the irrigation areas can be planted with suitable shrubs and ground covers (see Appendix B). The area must be covered with 150 mm of durable mulch after planting.

6.0 Maintenance

6.1 Service contract

Most AWTS require quarterly maintenance and servicing by a qualified service provider. The owner must enter into a service contract with a Council approved service provider, and a maintenance report must be completed and submitted to Council after each Service.

The owners must have a suitable understanding of the operational requirements and limitations of the wastewater treatment system. The land application area must be regularly inspected to identify faults with the irrigation system, including visual damage, surface ponding of effluent and/or unusual or offensive odours. All repairs and maintenance work conducted on the irrigation system should be undertaken by a suitably qualified and licensed service provider..

6.2 General maintenance

All residents and their guests must be aware of the following user and maintenance requirements:

6.2.1 On-site systems generally operate more efficiently when the wastewater load is minimised and 'shock loads' are avoided. Heavy water use activities such as laundering and showering should be evenly spread over the day and week.

6.2.2 Only detergents that are low in sodium and phosphorus should be used. Do not allow large volumes of bleaches, disinfectants, whiteners or spot removers to enter the system.

6.2.3 Do not allow foreign materials such as nappies, sanitary napkins, condoms and other hygiene products to enter the system.

6.2.4 Do not allow large volumes of food and cooking oils to enter the system and do not install an in-sink macerator.

6.2.5 The in-line strainer must be cleaned every three months to prevent clogging, and serviced by the service provider at least once per year.

6.2.6 Annual maintenance and servicing of the pump, including a check that the float switch is correctly set and operating must be undertaken by the service provider at each quarterly service.

6.2.7 The service provider must flush and maintain the irrigation system quarterly.

6.2.8 Surface water diversion mounds (see Appendix A Figure 4) and drains (where installed as part of the Approved Design) must be regularly maintained to prevent stormwater entering the irrigation area.

6.2.9 Where an area is planted and mulched the vegetation must be regularly trimmed to maintain active growth and nutrient uptake.

References

AS/NZS 1547:2012. *On-site domestic wastewater management*. Standards Australia International Ltd and Standards New Zealand. ISBN 0 7337 3439 1.

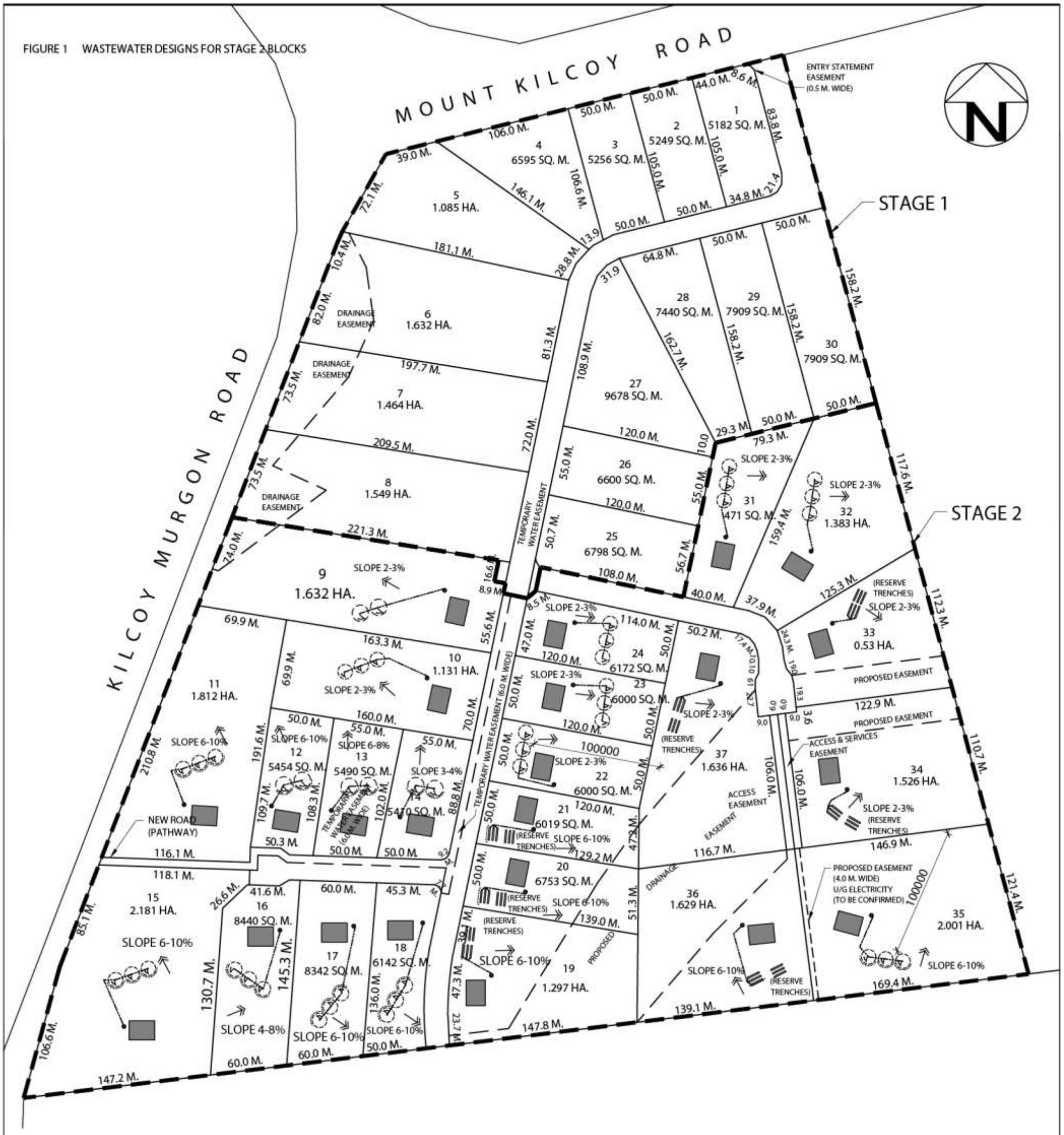
Queensland Plumbing and Wastewater Code, Version 1 2019

Effluent Disposal Report Lot 1 SP162871 at Kilcoy. Land Resource Assessment and Management Pty Ltd (February 2010; Author: PG Shields)

Nobel, K.E. (ed.). (1996). Understanding and Managing Soils in the Moreton Region. Department of Primary Industries Training Series, QE96003. Brisbane. ISBN 0 7242 6646 1

Appendix A Figures

FIGURE 1 WASTEWATER DESIGNS FOR STAGE 2 BLOCKS



LEGEND (WASTEWATER)

FUTURE 4 BEDROOM DWELLING

32 MM. Ø PUMPING LINE MIN. 100 MM. COVER

PRESSURE DOSED TRENCHES FROM ADVANCED SECONDARY HSTP. EACH TRENCH 12 M LONG X 900 MM WIDE X 450 MM DEEP. 2 M BETWEEN TRENCH WALLS. 3 TRENCHES PER NOMINATED LOT(S) SEE TRENCH DETAIL (FIGURE 4 APPENDIX A)

COARSE DROPLET SPRAY IRRIGATION CIRCLE 12.8 M. Ø (EACH = 128.7 SQ. M.) TOTAL AREA = 257 SQ. M. (CAT 4 SOIL)

COARSE DROPLET SPRAY IRRIGATION CIRCLE 12 M. Ø (EACH = 113 SQ. M.) TOTAL AREA = 226 SQ. M. (CAT 3 SOIL)

COARSE DROPLET SPRAY IRRIGATION CIRCLE 12 M. Ø (EACH = 113 SQ. M.) TOTAL AREA = 226 SQ. M. (CAT 3 SOIL)

OR

DIVERSION MOUND WHERE SLOPE IS 6% OR GREATER. SEE DETAIL

ADVANCED SECONDARY HSTP

MEASUREMENTS SHOULD BE CONFIRMED ONSITE

Catalyst Environment

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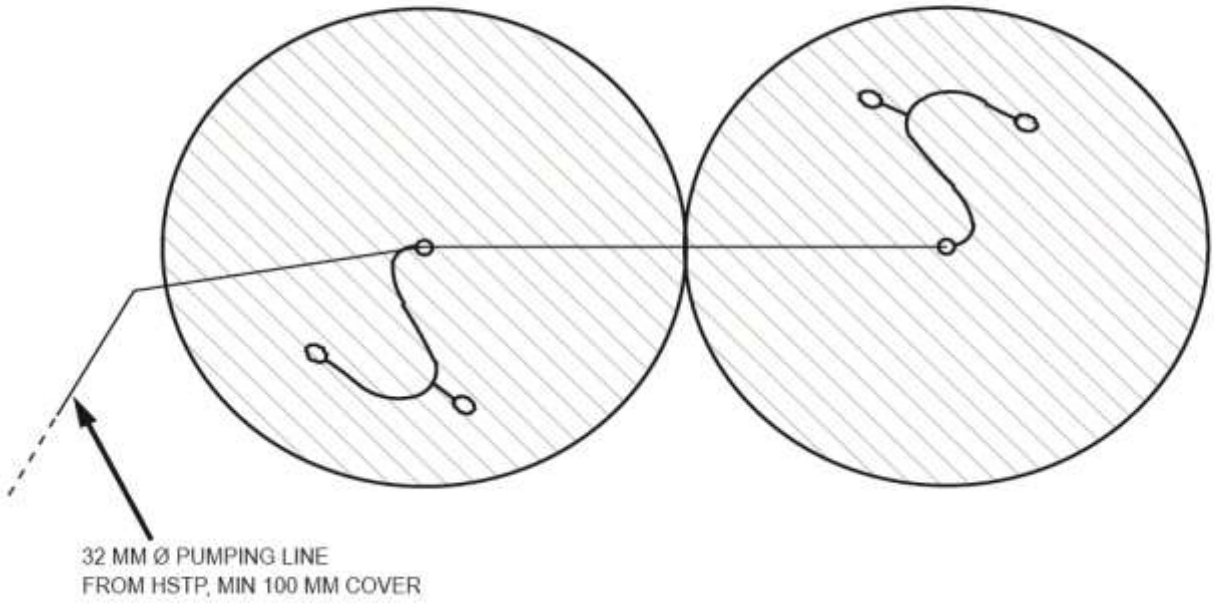
E: info@cees.com.au W: www.cees.com.au

A Division of Catalyst Environment & Education Services Pty Ltd. ABN 45 104 941 942 QBCC Licence Number 1175100

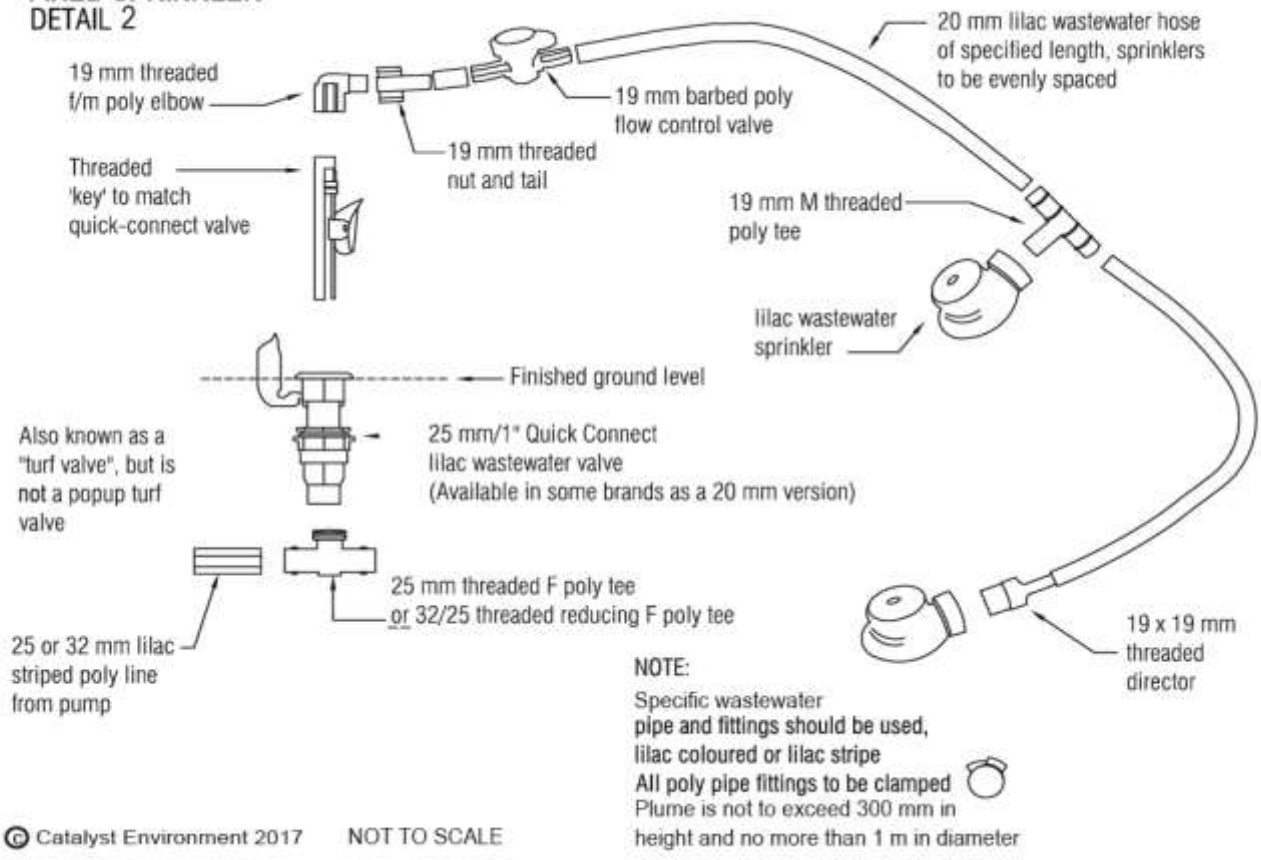
Site Address	Lot 1 SP 162871 (Stage 2) Mt Kilcoy Rd Winya	Clients	Tonlen Pty Ltd
Date of Inspection	21 August 2019	Job Description	Subdivision Stage 2
Plan Description	Site Plan Wastewater Irrigation Area	Plan Date	18 January 2021
Plan Number	1/27112020 (1:3000 @ A3)	Drawn By	CCS

FIXED SPRINKLER
DETAIL 1

FIGURE 3 FIXED SPRINKLER DESIGN



FIXED SPRINKLER
DETAIL 2



 NOT TO SCALE

FIGURE 3 TRENCH DETAIL (XS)

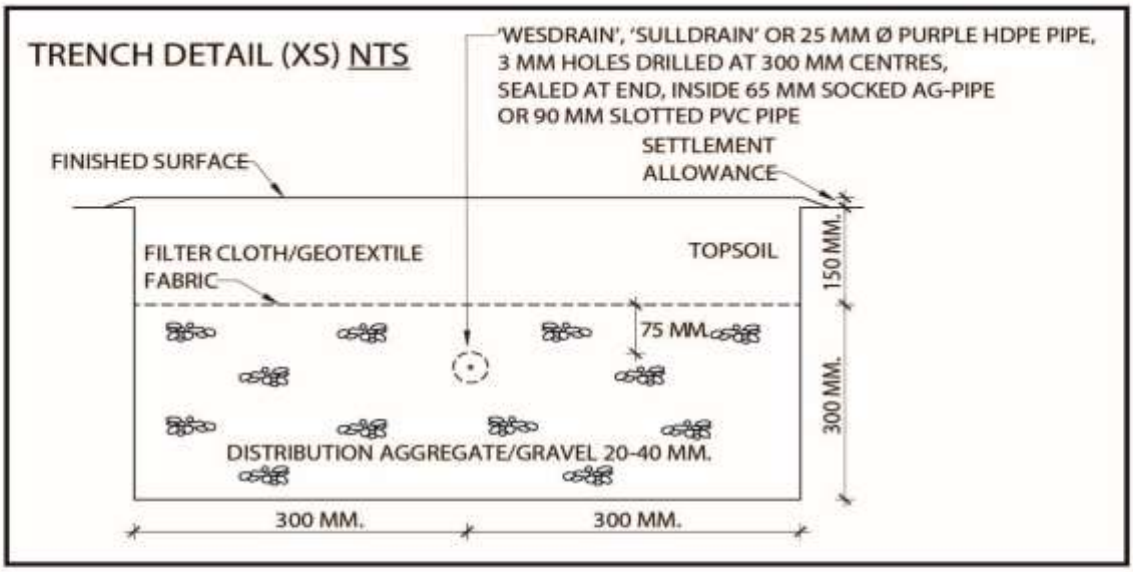
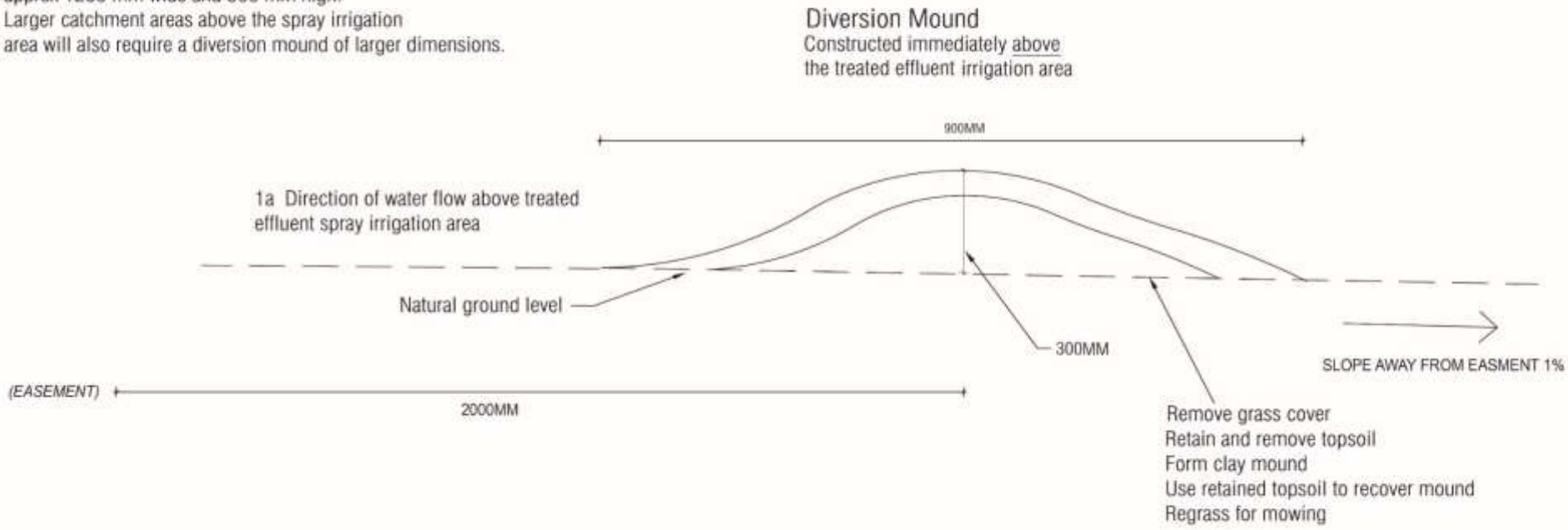


FIGURE 4 DIVERSION MOUND DETAIL (NTS)

4 Dimensions can be varied depending on % slope.
As a guide, a slope of 2% will requirq a diversion mound approx 500 mm wide and 200 mm high,
4% slope will require a diversion mound approx 600 mm wide and 300 mm high,
8% slope will require a diversion mound approx 900 mm wide and 350-400 mm high.
A slope of 12% will require a diversion mound approx 1200 mm wide and 500 mm high.
Larger catchment areas above the spray irrigation area will also require a diversion mound of larger dimensions.



Appendix B Suitable Plants for Effluent Disposal Areas

Suggested suitable vegetation for wet areas

Native Shrubs for Wet Areas

Baeckea virgata
Banksia robur
Callistemon Captain Cook
Callistemon citrinus
Callistemon cornboyensis
Callistemon Dawson River
Callistemon linearis
Callistemon pachyphyllus (red and green)
Callistemon pallidus
Callistemon pigidus
Callistemon rose opal
Callistemon SP Injune
Callistemon SP Severn Buer
Callistemon salignus
Callistemon sieberi
Hakea gibbosa
Leptospermum brachyandrum
Lepsospermum liversidgei
Melaleuca nodosa
Melaleuca thumifolia
Melastoma – Polyanthum

Exotic Shrubs for Wet Areas

Abelia x grandiflora
Alocasia purpurea
Canna
Clerodendrum heterphylla
Cuphea ignea
Cuphea micropetala
Cyperus

Climbers for Wet Areas

Bougainvillea
Hardenbergia
Hibbertia scandens
Kennedia
Lonicera japonica
Pandorea jasminoides

Grasses for Wet Areas

Buffalo
Kikuyu

Ground Covers for Wet Areas

Coprosma x kirki
Liriope muscari

Perennials for Wet Areas

Agapanthus preaecox
Canna
Canna x generalis
Chrysanthemum maximum
Gazania x hybrida
Viola hederacea

Native Trees for Wet Areas

Acacia concurrens
Acacia perangusta
Angophora costata
Callistemon salignus
Casuarina cunninghamia
Casuarina glauca
Eucalyptus alba
Eucalyptus drepanophylla
Eucalyptus grandis
Eucalyptus intermedia
Eucalyptus moluccana
Eucalyptus ptychorarpe
Eucalyptus robusta
Eucalyptus secane
Eucalyptus siderophylle
Eucalyptus tessellaris
Eucalyptus tereticornis
Harpullia pendula
Leptospermum petersonii
Melaleuca argentea
Melaleuca irbyana
Melaleuca leucondendron
Melaleuca linariifolia
Melaleuca linariifolia variety
Tricostochya
Melaleuca quinquinervia
Melaleuca styphelioides
Melaleuca viridiflora
Tristaniopsis laurina

Native Palms for Wet Areas

Livistonia australis

Appendix C Soil Profile Bore Logs Stage 2

(21 August 2019)
In accordance with *AS/NZS 1547:2012 On-site domestic wastewater management.*

Proposed Lots 9-12, 14, 19, 20, 22, 23, 32-37

BH = Lot #	Depth (m)	Soil Texture	Moisture Condition	Coarse fragments	Structure	BH Soil Category
STAGE 2						
9	0.00 – 1.0	Clay Loam (red/brown)	Sl. Damp	1%	Moderate	4
10	0.00 – 0.60	Silty clay	Sl. Damp	1%	Moderate	5
	0.60 – 1.0	Silty light clay (yellow)	Damp	1%	Moderate	
	0.60 – 1.0	V. sandy clay	Damp	Nil	Moderate	
11	0.00 – 1.0	Light clay with v. weathered rock	Sl. Damp	Nil	Moderate	5
12	0.00 – 0.20	Silty loam	Sl. Damp	1%	Moderate	4
	0.20 – 0.60	Silty loam with very weathered rock	Sl. Damp	1%	Moderate	
	0.60 – 1.0	Light clay (yellow)	Damp	1%	Moderate	
14	0.00 – 0.60	Light clay with v. weathered rock	Sl. Damp	Nil	Moderate	5
	0.60 – 1.0	V. weathered rock	Almost dry	Nil	Moderate	
19	0.00 – 0.40	Silty clay	Sl. Damp	1%	Moderate	5
	0.40 – 1.0	Light clay (red/brown) with weathered rock	Sl. Damp	5%	High/Moderate	4/5
20	0.00 – 0.40	Silty clay	Sl. Damp	1%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Sl. Damp	5%	High/Moderate	4/5
22	0.00 – 0.40	Silty clay	Damp	1%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Damp	2%	Moderate	
23	0.00 – 0.40	Silty clay	Sl. Damp	1%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Damp	2%	Moderate	
32	0.00 – 0.50	Very silty clay	Sl. Damp	1%	Moderate	5
	0.50 – 1.0	Silty clay	Sl. Damp	Nil	Moderate	
33	0.00 – 0.50	Very silty clay	Sl. Damp	2%	Moderate	5
	0.50 – 1.0	Silty clay with weathered rock	Sl. Damp	5%	High/Moderate	4/5

BH = Lot #	Depth (m)	Soil Texture	Moisture Condition	Coarse fragments	Structure	BH Soil Category
34	0.00 – 0.40	Silty clay	Sl. Damp	1%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Damp	5%	High/Moderate	4/5
35	0.00 – 0.40	Silty clay	Sl. Damp	1%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Sl. Damp	2%	Moderate	
36	0.00 – 0.40	Silty clay	Sl. Damp	2%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Sl. Damp	5%	High/Moderate	4/5
37	0.00 – 0.40	Very silty clay with weathered rock	Dry	2%	Moderate	5
	0.40 – 1.0	Silty clay with weathered rock	Sl. Damp	5%	High/Moderate	4/5

Appendix D Ksat results for proposed Lots 20 and 34

K_{sat} Calculation Sheet Lot 1 SP 162871 Mt Kilcoy Road, Winya

21/08/2019

Proposed Lot 20

Enter (length of Permeator tube used) **L (cm)** =	36
Radius of Permeator Tube **R_{perm} (cm)** =	3
Volume of water used in Permeator (cm^3) =	1017.88
Enter time of entire test **T (minutes)** =	16
Therefore Q=	63.62 cm3/min
Enter (depth of water in auger hole) **H (cm)** =	30
Enter (avg radius of auger hole) **r (cm)** =	5

K_{sat} formula = $1.6Q\{\sinh^{-1}(H/r)-1\}/2\pi H^2$

K_{sat} (cm/min) calculated =	0.04
K_{sat} (m/day) calculated =	0.60

Calculations

1.6 x Q =	101.7876
((H/r)-1) =	5
ASINH((H/r)-1))	2.312438
H/r=	6
2πH^2 =	5654.867
H^2	900

K_{sat} Calculation Sheet Lot 1 SP 162871 Mt Kilcoy Road, Winya

21/08/2019

Proposed Lot 34

Enter (length of Permeator tube used) **L (cm)** =	34
Radius of Permeator Tube **R_{perm} (cm)** =	3
Volume of water used in Permeator (cm^3) =	961.33
Enter time of entire test **T (minutes)** =	18

Therefore Q= 53.41 cm3/min

K_{sat} formula = 1.6Q{sinh-1(H/r)-1}/2πH2

K_{sat} (cm/min) calculated =	0.03
K_{sat} (m/day) calculated =	0.50

Enter (depth of water in auger hole) **H (cm)** =	30
Enter (avg radius of auger hole) **r (cm)** =	5

Calculations

1.6 x Q =	85.45132
((H/r)-1) =	5
ASINH((H/r)-1))	2.312438
H/r=	6
2πH^2 =	5654.867
H^2	900

Appendix E Analysis of Onsite Wastewater Treatment and Site Constraints

Stage 2 (Existing Lot 1 SP 162871)

Assessment with Regards to

- SRPS OM5 Catchment Management Overlay
- AS/NZS 1547 2012
- Queensland Plumbing & Wastewater Code Ver 1 2019
- Seqwater Development Guidelines Water Quality Management in Drinking Water Catchments GDE 00001 2017
- State Planning Policy Water Quality (July 2017)
- Other Rural Residential Developments in the Somerset Regional Council Area

SRPS OM5 Catchment Management Overlay

For Development activities in the Higher Risk Catchment Area (Water Supply Buffer Area) including onsite wastewater treatment and disposal;

1. 400 metre buffer to a waterbody in the Higher Risk Catchment Area (see Attachments 1 and 2)
2. 100 metre buffer to a watercourse in the Higher Risk Catchment Area (see Attachments 1 and 2)

Lot 1 SP 162871 is inside the Higher Risk Catchment Area (see Att 1). The 75 m buffer zone to a water course is just outside the South East corner of the existing Lot 1 (see proposed Lot 28).

There is one area towards the South East corner of the Lot that experiences or may experience episodes of overland flow. Provision for these events has been provided for by way of a proposed Easement/Drainage Reserve (see Appendix A Figure 1). A small portion at the eastern boundary of proposed Lots 26 and 27 has been identified as a potential flood impacted area.

AS/NZS 1547 2012

The Standard requires that onsite wastewater treatment units and their land application systems achieve sustainable and effective onsite domestic wastewater management to protect public health and the environment. With this in mind, only advanced secondary wastewater treatment systems holding a current Chief Executive Approval will be recommended, see Table 1.

Table 1

	BOD_5 (a)	**TSS** (b)	**TC** (c)
Advanced secondary treatment criteria	<10 mg/l	<10 mg/l	<10 mg/l

(a) 90% of the samples taken must have a BOD5 less than or equal 10g/m3 with no sample greater than 20g/m3;
(b) 90% of the samples taken must have total suspended solids less than or equal 10g/m3 with no sample greater than 20g/m3;
(c) 90% of the samples taken must have thermotolerant coliform count not exceeding 10 organisms per 100 ml with no sample exceeding 200 organisms per 100ml.

In some instances a secondary level treatment system could be used for certain Lots which exceed the minimum setback requirements to both natural and built environmental features as listed in the Queensland Plumbing and Wastewater Code, see Table 2 (subsurface and surface irrigated land application).

However, as an additional potential harm reduction step this report recommends that advanced secondary treatment level systems be required for all proposed Lots.

Queensland Plumbing and Wastewater Code Ver 1 2019

The relevant sections of the Queensland Plumbing and Wastewater Code relate to the setback and separation distances for onsite treated wastewater. See Tables 2 and 3 for subsurface and surface irrigated treated wastewater respectively.

The treatment level of the wastewater is also an important threshold, with the higher level treatment (advanced secondary) being the desired level for sensitive receiving areas. See Table 4

Table 2 Horizontal separation distance in metres (Subsurface)

Feature	Horizontal separation distance in metres		
	Up slope	Down slope	Level
Property boundaries, pedestrian paths, walkways, recreation areas, retaining wall, and footings for buildings and other structures.	2	4	2
Inground swimming pools	6	6	6
Inground potable water tank not exposed to primary effluent	6	6	6
Inground potable water tank exposed to primary effluent	15	15	15

Distances are given in metres and are measured from the edge of trench/bed excavation or subsurface irrigation distribution pipework to the nearest point of the feature

Table 3 Horizontal separation distance in metres (surface irrigated)

Feature	Horizontal separation distance in metres
Property boundaries, pedestrian paths and walkways	2
Water edge of a swimming pool	6
Dwellings, recreation areas	10

Distances are given in metres and are measured from the edge of the irrigated wetted area to any point of the feature

Table 4

Setback distances for on-site sewerage facilities Protection of surface water and groundwater.	Advanced Secondary	Secondary	Primary
Top of bank of permanent water course	10	30	50
Top of bank of intermittent water course			
Top of bank of a lake, bay or estuary			
Top water level of a surface water source used for agriculture, aquaculture or stock purposes			
Open stormwater drainage channel or drain			
Bore or a dam			
Unsaturated soil depth to a permanent water table (vertically)*	0.3	0.6	1.2

* In addition, a 2 m vertical setback to bedrock and groundwater will be required at all proposed Lots

4.4 Assessment benchmarks for accepted development

Assessment criteria	Description	Complies Y/N
AC1.3	The development involves a sewage treatment system (10 EP or less) and disposal area which complies with the following criteria: a. 50 m setback to a stream order 1-3 b. 100m setback to a stream order 4 or greater c. 400 m setback to the full supply level of a dam, lake, reservoir or watercourse that serves as a potable water supply; and d. Is not located on land with slope greater than 10% or on land below the 1% Annual Exceedance Probability (AEP) flood event.	 Yes Yes Yes Yes

4.5 Assessment benchmarks for assessable development

Performance outcomes	Performance Response
PO3 Where treated wastewater is irrigated to land, it will:	
a. be confined to a dedicated area of land onsite; b. be suitably located and sized; and c. use irrigation practices that will not harm groundwater and on-site surface water quality.	1. All treated wastewater will be applied to a specified irrigation area sized in accordance with the requirements of A/NZS 1547 2012 On-site domestic wastewater management and the Queensland Plumbing and Wastewater Code Ver 1 2019. 2. Groundwater will be protected by a 2 m vertical setback to bedrock and groundwater at all proposed Lots. 3. Mandatory quarterly (or annual where designated) servicing and maintenance inspections of the performance of the treatment system and the irrigation area, including the occurrence of any surface water runoff. 4. Use of diversion and retention mounds where necessary, to prevent the flow of surface waters over the land application area or from leaving the application area(s)

Seqwater Land Use Risk Tool (LURT)

Note 1: The online Land Use Risk Tool has not been functioning since October 2019.

In order to gain a 'Low' risk rating in the LURT the proposed wastewater treatment system and land application area I where the soil is a Category 5 (Light Clay) classified under A/NZS 1547 2012 should have the following characteristics:

Table 5

Criteria	Response
1 Be for a permanent residence (as opposed to holiday residence)	Lots are intended principally for the construction of primary dwellings
2 Either subsurface or absorption disposal method (as appropriate for the Category 5, Poorly drained soils – ETA not suitable)	Lots with a Category 4/5 soil and insufficient setbacks to the features listed in Seqwater Development Guidelines Water Quality Management in Drinking Water Catchments GDE 00001 2017, will have subsurface (trench) disposal of treated affluent.
3 1m vertical setback to bedrock and groundwater	A 2 m vertical setback to bedrock and groundwater will be required at all proposed Lots
4 Full exposure to sun and wind	Land application areas should not be shaded by trees or man-made shade features.
5 Disinfection by Chlorination	Disinfection by chlorination or other approved disinfection method (see A/NZS 1546) will be required at all proposed Lots

Note 2:
For Category 3 and 4 soils at the site (see Attached Soil Profile Bore Logs) the same Risk Management approach as demonstrated in Table 5 for Category 5 soils will be used.

State Planning Policy Water Quality (July 2017)

- Water resource catchments and water supply buffer areas

"Water resource catchments are areas where water from rain and run-off is collected by the landscape for harvesting from surface waters or groundwater systems to supply drinking water.
Located within water resource catchment areas are water supply buffer areas. These buffer areas are particularly vulnerable to contamination, including groundwater recharge areas and areas in the vicinity of a dam, lake, reservoir or watercourse off-take structures that supply drinking water. Water supply buffer areas are currently only mapped in South East Queensland.

Development has the potential to negatively impact on the cost, operational efficiency and safety of drinking water if not appropriately managed. For example, the impacts of development can result in increased sediment, pathogens and nutrients entering waterways, which may result in the interruption and/or loss of water supply, require higher levels of treatment (thus increasing costs), cause nuisance and/or harm to public health, or affect environmental values.
Within water resource catchments and water supply buffer areas, local planning schemes should ensure assessable development protects the environmental values of drinking water supply."

Conclusion

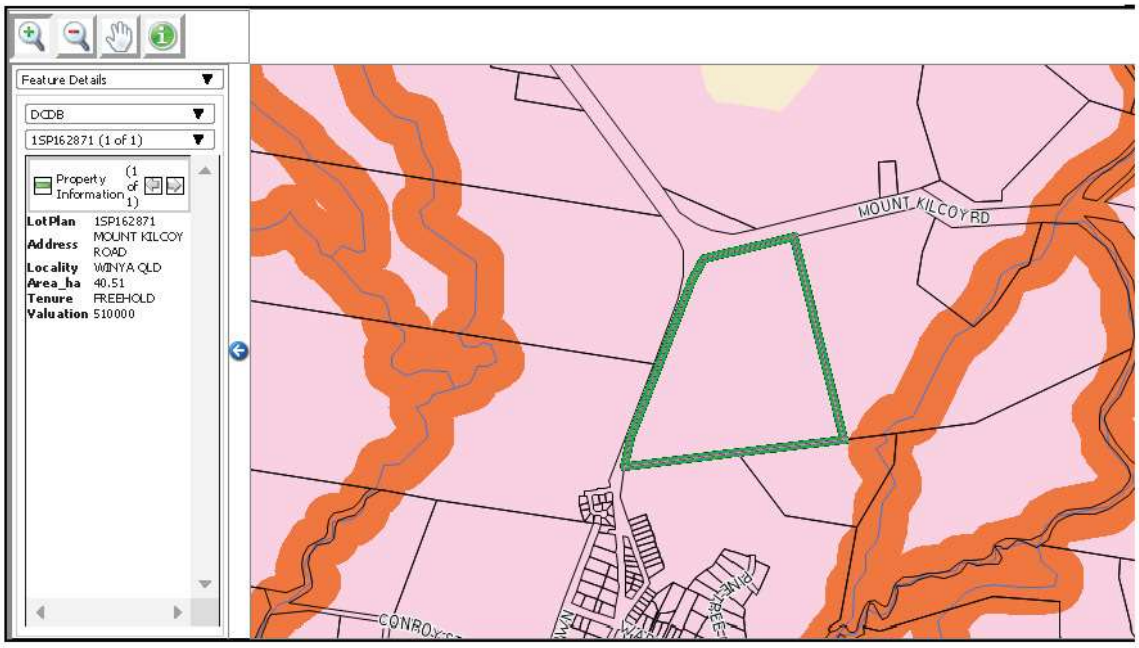
The proposed onsite wastewater management approach for the proposed Lots is consistent with the SPP for Water Quality.

Appendix E Figure 1

Part 5 - Decision

Decision not yet made

SRPS OM5 Catchment Management



SRPS OM5 Catchment Management Legend

- Waterbody
- Watercourse Centreline
- Higher Risk Catchment Area (Water Supply Buffer Area)
  - 400 metre buffer to a waterbody in the Higher Risk Catchment Area
  - 100 metre buffer to a watercourse in the Higher Risk Catchment Area
- Lower Risk Catchment Area
  - 150 metre buffer to a waterbody in the Lower Risk Catchment Area
  - 75 metre buffer to a watercourse in the Lower Risk Catchment Area