LAND CAPABILITY ASSESSMENT

PROPOSED DEVELOPMENT OF
A CLUSTER OF EIGHT - SINGLE BEDROOM
UNITS/STUDIOS PLUS A KITCHEN BLOCK
AT 1057 SIRLS ROAD
JARVIS CREEK
VIC 3700

(Project. 200611)
Revision 0 - January 2018
LAND CAPABILITY ASSESSMENT FOR ONSITE EFFLUENT REUSE/DISPOSAL
PROPOSED DEVELOPMENT - A CLUSTER OF EIGHT SINGLE BEDROOM UNITS/STUDIOS PLUS A
KITCHEN BLOCK
AT 1057 SIRLS ROAD, JARVIS CREEK VIC 3700
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Date: 16/01/2018
Neil Van Der Geest
Technical Officer
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(i) Assessor's Academic & Professional Qualifications

Neil Van Der Geest is a Technical Officer with SJE Consulting. He has a diploma of agriculture (awarded 2002) and has undertaken a range of studies in horticulture, project management and civil construction design. He is currently undertaking a Soil Management Course (ACS Distance Education). Neil has experience in civil drafting, construction supervision, agricultural management, strategic farm planning and surveying. All field work, reporting and site plans have been carried out by Neil Van Der Geest.

(ii) Assessors Professional Indemnity Insurance

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Executive Summary
Proposed a Cluster of eight single Bedroom Units/Studios plus a Kitchen Block
at 1057 Sirfs Road Jarvis Creek VIC 3700

The proposed development at 1057 Sirfs Road, Jarvis Creek (a Cluster of eight single Bedroom Units/Studios plus a Kitchen Block) is suitable for sustainable on-site effluent disposal. The assessment has been made in the context of prioritising public and environmental health with a design compromised between rational wastewater reuse and sustainable wastewater disposal. The site falls under the Catchment Management Authority of Goulburn Murray Water and is located in the Lake Hume Northern Section Catchment which is a Domestic Water Supply Catchment as proclaimed under the Soil Conservation and Land Utilization Act and in conjunction with the Land Conservation Act. It has been assumed the site will be supplied with tank water filled with captured rain. There are no plans for connection to sewer in the foreseeable.

The assessment has been undertaken in accordance with the current Code of Practice, Standards and incorporates current best practice.

Our field testing (which included soil profile logging, sampling and in-situ hydraulic conductivity testing), a differential level survey, laboratory testing and subsequent reporting (including water and nutrient balance modelling) has revealed that on-site effluent disposal is rational and sustainable. The capability assessment has shown that onsite effluent treated to 20/30 standard disposed via subsurface irrigation coupled with a dry composting toilet is possible.

Wastewater management includes storage, treatment, irrigation, monitoring and sampling.

With regard to density of development and cumulative risk, the assessment has considered risk associated with subsurface and surface flows. The site has no limiting constraints for effluent treated to 20/30 standard disposed via subsurface irrigation and has a combined risk number of 5 (Medium Risk).1

The proposed effluent field is at least 40m to any waterway. The tributaries/drainage lines to the south on feeds Jarvis Creek approximately 100m downstream; however the proposed disposal area achieves the buffers required by the Victorian Code of Practice - Onsite Wastewater Management, EPA Publication 891.4, July, 2016.

The irrigation area has been determined for the 90th percentile annual wet year and satisfies the requirements of SEPPs (Waters of Victoria) in that the effluent system cannot have any detrimental impact on the beneficial use of surface waters or groundwater.

The daily effluent volume of 210 litres per unit has been estimated from AS/NZS1547:2012 Table H1 assuming a single bedroom open planned dwelling which is connected to tank water only, coupled with a composting toilet. (See 2.2.5 Effluent Quantity for detailed breakdown of effluent volume.)

The LCA recommends a conservative, scientifically based, well founded wastewater management system with inherent multiple barriers of safety. Provided the recommendations of this report are implemented, all requirements of the Victorian Code of Practice - Onsite Wastewater Management, EPA Publication 891.4, July, 2016 and SEPPs (Waters of Victoria) can be met. For the proposed development the available areas are not limiting, with sufficient available area for expansion or duplication of the effluent areas should this be required.

It is recommended that effluent be treated to at least 20/30 standard with disposal via subsurface irrigation coupled with a dry composting toilet and the required area for disposal is listed below.

<table>
<thead>
<tr>
<th>EFFLUENT</th>
<th>SYSTEM</th>
<th>REQUIRED AREA (1 bedroom unit/studio with an estimated daily effluent flow of 210L/day)</th>
<th>TOTAL REQUIRED AREA (8 times 1 bedroom unit/studio with an estimated daily effluent flow of 1680L/day)</th>
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<td>EFFLUENT SHALL BE SPLIT INTO BLACK WATER AND GREYWATER WHERE GREYWATER WILL BE TREATED TO LEAST 20/30 STANDARD (ADVANCED SECONDARY STANDARD)</td>
<td>COMPOSTING TOILETS &amp; AVITS (various) &amp; OR SAND FILTER &amp; OR REED BED DISPOSED VIA SUBSURFACE IRRIGATION</td>
<td>110m²  220m²</td>
<td>1175m²  2350m²</td>
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</table>

The area in red text equals the minimum required area without reserve while the area in blue text includes a reserve area. Litres relate to volume of effluent per day as per AS/NZS 1547:2012 and clients' estimates.

1 Source: Approaches for Risk Analysis of Development With On-Site Wastewater Disposal in Open, Potable Water Catchments (Dr Robert Edis April 2014)
1. Site Investigation

1.1 Introduction

On instruction from the landowner, an investigation was undertaken to assess the lands’ capability for on-site effluent disposal for the proposed development at 1057 Sits Road, Jarvis Creek VIC 3700, as shown in Appendix F (Site Plan) and Appendix G (Site Photographs).

The site falls under the Catchment Management Authority of Goulburn Murray Water and is located in the Lake Hume Northern Section Catchment which is a Domestic Water Supply Catchment as proclaimed under the Soil Conservation and Land Utilization Act and in conjunction with the Land Conservation Act. The site will be supplied with tank water filled by captured rain. There are no plans for connection to sewer in the foreseeable future and the property is approximately 4.3ha.

The proposed effluent disposal area lies on a waxing divergent slopes feeding intermittent waterways/drainage lines to the south. The waterways/drainage lines to the south, a minimum of 40m away on feeds Jarvis Creek 100m, as measured horizontally along the surface runoff flow path, i.e. normal to the contours (see Appendix F).

The assessment has been made in the context of prioritising public and environmental health with a design compromise between rational wastewater reuse and sustainable wastewater disposal.

1.2 Investigation Method

The site investigation was carried out in accordance with the requirements of the Towong Council and guidelines outlined in Victorian EPA Publication Land Capability Assessment for Onsite Domestic Wastewater Management (Publication 746.1) and SEPPs (Waters of Victoria).


Our capability assessment involved the mapping of unique land-soil unit(s) which were defined in terms of significant attributes including: climate, slope, aspect, vegetation, soil profile characteristics (including soil reaction trend and electrical conductivity), depth to rock, proximity to water courses and escarpments, transient soil moisture characteristics and hydraulic conductivity.

Exploratory auger drilling was undertaken in conjunction with a series of constant head tests, which were prepared in accordance with AS/NZS 1547:2012 (Talma-Hallam Method). The results of the testing are given in Section 1.3.1.7 Soil Permeability, below, and in Appendix A.

Representative samples of soil material were taken for the laboratory determination of pH, EC, free swell, Emerson Class (using SAR 5 water) and dispersion Index. Phosphorus Sorption Index was obtained from the literature (adopting the lowest typical value for Australian residual clays). The results of the testing are given in Section 1.3.1.6 Subsurface Profile, below, and in Appendix C.

Water and nutrient balance analyses were based on the 90th percentile annual wet year rainfall data for Tallangatta (Bulli) and mean evaporation data for Hume Reservoir and were undertaken in accordance with Guidelines for Wastewater Irrigation, Vic E.P.A. Publication 168, April 1991 (Part), AS/NZS 1547:2012 and in-house methods. The rainfall and evaporation data were obtained from the National Climate Centre, Bureau of Meteorology. The data was subsequently analysed and applied to our water and nutrient balance analyses.

The results of the water and nutrient balance analyses are given in Appendix B, to this report.
1.3 Capability Assessment

We have used the attributes determined by the investigation to define one (1) land-soil unit as follows:-

1.3.1 Land-Soil Unit A

The land-soil unit (where the proposed effluent field is located) consists of one soil unit which is of slightly sloping terrain, as shown in as shown in Appendix F (Site Plan) and Appendix G. (Site Photographs) and Figure 1. Department of Primary Industries GeoVic - 3 online web site. The proposed effluent field is at least 40m to any drainage line/waterway.

The salient land soil attributes and constraints are summarised in Appendix D.

Figure 1 – Earth Resources - GeoVic - 3
1.3.2 Climate
The general area receives mean an annual rainfall of 840mm, 90th percentile annual rainfall of 1111mm and a mean annual evaporation of 1405mm. Mean monthly evaporation exceed the mean monthly rainfall from October through to April.

Rainfall and evaporation data are presented in Appendix B, to this report.

1.3.3 Slope and Aspect
The unit occupies a waxing divergent slope area. The proposed effluent field ground slopes approximately 15-20% and in easterly direction. Contours source from Google Earth and were confirmed during site inspection.

The unit is exposed to the prevailing winds and is exposed to dawn to dusk sunshine, as shown in Site Photographs (Appendix G) and the Site Plans (Appendix F). The proposed effluent field has westerly aspect.

1.3.4 Vegetation and Land Use
The unit is densely vegetated with grass and several trees as shown in Appendix G (Site Photographs).

For use in the water and nutrient balance we have used water, nitrogen and phosphorus uptake estimates representative of dense grass equivalent to a rye/clover mix, as shown in Appendix B.

1.3.5 Slope Stability and Erosion Potential
For the encountered subsurface conditions, slope degree and geometry and for the proposed range of hydraulic loadings, the stability of the natural ground slopes are unlikely to be compromised.

No instances of soil degradation were observed within this land-soil unit and for normal development, construction and operation, none is expected to manifest.

1.3.6 Subsurface Profile
The following interpretation of the general subsurface profile assumes conditions similar to those encountered in the test pits and boreholes are typical of the investigation area.

Note: If subsurface conditions substantially different from those encountered in the investigation are encountered during effluent distribution system excavations, all work should cease, and this office notified immediately.

The unit is underlain by Omeo Metamorphic Complex gneiss of Ordovician (Early Ordovician) Age. The general subsurface profile consists of:-

- A topsoil (A1-horizon) layer of fine dark brown sandy loam, with a soil reaction trend of 6.7pH and electrical conductivity of 0.81dS/m, to a depth of 0.14m, overlying;
- A soil (A2-horizon) layer of tan sandy clay of low plasticity, with a soil reaction trend of 6.2pH, electrical conductivity of 0.252dS/m and free swell of 5% to depths to depths of 0.31m overlying;
- A soil (B1-horizon) layer of mottled orange/brown micaceous coarse sandy clay of low plasticity with decomposing rock fragments, with a soil reaction trend of 5.6pH, electrical conductivity of 0.27dS/m and free swell of 25% to depths of 0.6m overlying;
- A soil (B2-horizon) layer of mottled white/orange/tan micaceous coarse sandy clay of low plasticity with decomposing granite fragments, with a soil reaction trend of 6.2pH, electrical conductivity of 0.297dS/m that is non-dispersive and free swell of 5% to depths of 1m (1m being the maximum depth the Christie Post Driver (CHPD78) and 1.6m sampling rod can achieve).

2 After Holtz (measures swell potential of fraction passing 450 micron sieve)
1.3.7 Soil Permeability

In situ permeability tests were attempted on the 21st of November 2017 on a suite of six (6) 7cm diameter auger holes drilled and prepared in accordance with AS/NZS 1547:2012 (TALMA-HALLAM METHOD). Permeability tests were carried out in the residual materials as follows:-

- The test holes were drilled up to a depth of 50cm,
- Time to equilibrium hydraulic conditions ranged from 0.25 to 0.5hrs, and,
- Testing used a wetted depth of soil section (hydraulic head) range of 16 to 22cm.

The results of the constant head permeability tests are presented in Appendix A, to this report.

The saturated hydraulic conductivity (K\text{SAT}) was calculated via AS/NZS1547:2012, TABLE 5.2 SOIL CATEGORIES AND RECOMMENDED DESIGN IRRIGATION/LOADING RATES (DIR/OLR) FOR LAND-APPLICATION SYSTEMS, as corrected. The hydraulic conductivity ranged from about 0.091m/day to 0.2m/day for the tested materials. The geometric mean for this site is 0.141m/day. For the limiting B-horizon clay soils, we have adopted an estimated saturated hydraulic conductivity (K\text{SAT}), of 0.005m/day for secondary treated effluent [20/30 Standard] disposed via subsurface irrigation.

The deeper clayey soils (estimated K\text{SAT}: 0.141m/day) soils will control effluent seepage rates with respect to determining the required irrigation area and to restrict surface rain flows to episodic events.

We have adopted a design loading rate of 6.25mm (Seepage Loss – Peak reduced by 20% due to slope of site – 5mm), which we believe is sufficiently conservative to ensure the local soils will control effluent seepage rates with respect to determining a sustainable hydraulic loading.

The clayey soils will control effluent seepage rates with respect to determining a sustainable hydraulic loading rate. Specifically, modelled peak deep seepage is taken as being significantly less than 12% of measured saturated hydraulic conductivity.

1.3.8 Colloid Stability

The results of the Emerson Crumb Tests, Dispersion Index tests and observations of discoloration of water in the bores suggest that the materials are non-dispersive.

Free swell tests indicate that the clays have a medium shrink-swell potential.

The electrical conductivity was determined for the A and B horizons using a 1:5 soil/water extract and converted to EC (saturation extract).

The determined electrical conductivity ranged from 0.81dS/m (topsoils) to 0.297dS/m (B-horizon).

1.3.9 AS1547:2012 Soil Classification

In accordance with AS/NZS1547:2012 the materials can be classified as Type 5a soils (light clays) requiring renovation.

After allocating proportional vertical and lateral flows and allowing for the potential perched water mounding and after the application of soil ameliorants, we have adopted a daily peak water balance seepage rate of 5mm for effluent treated to 20/30 standard with disposal via subsurface irrigation. This translates to an average daily deep seepage loss of 2.6mm. Due to the slope being approximately 15-20% we reduced Seepage Loss (Peak) to 5mm (from 6.25mm) and this translates to an application rate of 1.4mm.

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3 The water balance seepage loss rate is based on being <12% of the measured in situ testing hydraulic conductivity (or estimated using data base of like soils) of the limiting horizon plus a lateral flow component, effluent type and the effects of irrigation with saline effluent and soil characteristics including profile thickness (flow paths and storage), shrink-swell, dispersivity, soil reaction trend and renovation.
1.3.10 Surface Drainage

The proposed effluent area occupies a waxing divergent slope feeding intermittent waterways/drainage lines to the south, 40m away on feeding Jarvis Creek approximately 100m downstream as shown in Appendix F (Site Plan).

1.3.11 Groundwater

No seepage was encountered in any of the boreholes and any seasonally occurring perched groundwater is not expected to be significant. Based on site observations, the groundwater level is expected to be well below the surface (i.e. at least 2m below the proposed effluent site).

There is no recorded bore (potable or non-potable) on site (source: BIODIVERSITY INTERACTIVE MAP VERSION 3.2) which was confirmed during site assessment. The proposed effluent field is placed at least 300m from the nearest bore.

On-site effluent disposal systems designed, constructed, operated and maintained in accordance with the following recommendations cannot adversely impact on the beneficial use of surface waters and groundwater in the area.

1.3.12 Nutrient Attenuation

Clayey soils (as found on this site) can fix large amounts of phosphorous. Phosphate-rich effluent seeping through these soils will lose most of the phosphorous within a few metres. No phosphorous balance is required.

Nitrogen, contained in organic compounds and ammonia, forms nitrate-N and small amounts of nitrite-N when processed in an aerated treatment plant. Several processes affect nitrogen levels within soil after irrigation. Alternate periods of wetting and drying, with the presence of organic matter promotes reduction and in the groundwater (reported to nitrogen gas (denitrification). Plant roots absorb nitrates at varying rates depending on the plant species (see Appendix B), however nitrate is highly mobile, readily leached, and can enter groundwater via deep seepage and surface waters via overland flow and near-surface lateral flow.

For subsurface irrigation, and without taking into account further expected denitrification below the root zone and in the groundwater (reported to be in the vicinity of 80%), denitrification in the lateral flow (external to the irrigation areas but within the curtilage of the allotment) and plant uptake in the lateral flow, the irrigation area would need to be 669m$^2$ for 1680 litres/day of effluent (at an application rate of 2.5mm for effluent treated to 20/30 Standard) which would satisfy the requirements of SEPP (WATERS OF VICTORIA).
1.4 Risk Management & Mitigation

*SEPP (Waters of Victoria)* requires that the proposal be assessed on a risk-weighted basis and cumulative effects be considered. Insertion of properly designed, constructed and (reasonably) maintained AWTS/treatment to 20/30 standard cannot measurably increase the risk to the integrity of surface water quality or groundwater quality. Considering the annual localised rainfall, effluent shall be treated to a minimum (20/30) secondary standard with disposal via subsurface irrigation.

A multiple barrier approach is used in assessing this development, with components listed:-

1.4.1 Water Usage

With respect to daily effluent production, the system is overdesigned. Current best practice allows for a (continuous) daily effluent flow of 210 litres for each proposed single bedroom opened planned unit/studio. The design flow is unlikely to be continuous and (at least) standard water reduction fixtures are a mandatory requirement under local building codes.

1.4.2 Secondary Treatment Systems & Disposal Area

For this site, secondary effluent disposal via a subsurface irrigation is appropriate and sustainable.

<table>
<thead>
<tr>
<th>EFFLUENT</th>
<th>SYSTEM</th>
<th>REQUIRED AREA -1 b/room unit/studio with an estimated daily effluent flow of 210l/day</th>
<th>TOTAL REQUIRED AREA -8 times 1 b/room unit/studio with an estimated daily effluent flow of 1680l/day</th>
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<td>COMPOSTING TOILETS &amp; AWTS (various) &amp; or SAND FILTER &amp; OR REED BED DEPOSITED VIA SUBSURFACE IRRIGATION</td>
<td>110m² 220m²</td>
<td>1175m² 2350m²</td>
</tr>
</tbody>
</table>

The area in red equals the minimum required without reserve while the area in blue includes a full reserve area (a spare effluent field, which is left undeveloped, but can be commissioned in case of increase in daily effluent production due to contingences through the chain of ownership.) These dimensions may be modified to suit client’s needs provided the total area is adhered to.

1.4.3 Block Size

Many under-performing effluent fields are placed on blocks where area is limited. Limited area can lead to inadequately sized or inappropriately placed effluent fields and a lack of options should the daily effluent volumes increase.

In the subject site, size is not a constraining factor with ample area for extension or duplication of effluent disposal fields if required.

1.4.4 Management Plan

Historically, inadequate maintenance has played a major part in the failure of onsite effluent disposal systems. There is a management plan within this LCA (Appendix E). This plan gives guidance on the implementation of mandatory operation, maintenance and inspection procedures.

1.4.5 Sizing of the Treatment Systems

No specific proprietary treatment plant is recommended, however treatment system brands, or sand filters/reed beds must be certified by an accredited conformity assessment body (CAB) as conforming to the relevant Australian Standard. This accreditation is given by JAS-ANZ (*The Joint Accreditation System of Australia and New Zealand*).

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4 We would contend that there can be no significant cumulative effect if the provisions of *SEPP (Waters of Victoria)* are met (i.e. all wastes contained onsite).

5 For individual systems, and except for gross negligence, rudimentary maintenance would ensure that “failure” would be restricted to transient reductions in quality of effluent which would continue to be transferred to the subsoil. Potentially “dangerous” contaminated surface flow cannot occur while amelioration of contaminants will continue over the extraordinarily large flow paths and travel times controlled by the regional/local hydraulic gradients (see 1.4.6 Buffer Distances, below).
1.4.6 **Oversized Effluent Areas**

Design effluent areas are oversized and are based on conservative on conservative estimates of renovation and complete attenuation of nitrogen. The peak deep seepage rate is lower than the hydraulic conductivity of the limiting layer and it is highly unlikely that the proposed development will generate 1680 litres every day for a Cluster of eight single Bedroom Units/ Studios plus a kitchen block.

1.4.7 **Zoned Dosing**

It is recommended that the effluent area is (automatically) irrigated sequentially by zones or time, to promote the creation of transient aerobic and anaerobic soil conditions. The effluent field is sized conservatively for nitrogen attenuation, using pasture grass (rye/clover eq mix), which has a nitrogen uptake of 220 kg/ha/year. Zoned dosing will increase the efficiency of the field for removing nitrogen from the soil.

Undersized effluent fields are at risk of becoming anaerobic for long periods, with the risk of microbial build-up. This leads to secretion of microbial polysaccharides, which coat soil particles and restrict the ability of the soil to adsorb nutrients and attenuate pathogens. Polysaccharides can also coat the interior of pipes and block drainage holes if drainage is slow due to the field being overloaded with effluent. This can lead to effluent surcharge from the ends of the drainage pipes, forming preferential flow paths through overlying soil and draining overland to nearby surface waters.

The alternating aerobic and anaerobic conditions created by zoned dosing prevent the build-up of microbial polysaccharides, and ensures efficient renovation of effluent.

1.4.8 **Oversized Effluent Areas**

Design effluent areas are oversized and are based on conservative on conservative estimates of renovation and complete attenuation of nitrogen. The peak deep seepage rate is lower than the hydraulic conductivity of the limiting layer and it is highly unlikely that the proposed development (each unit) will generate 210 litres every day for a single bedroom open plan dwelling.

1.4.9 **Reserve Areas**

For effluent treated to a minimum secondary (20/30) standard, a reserve area is not required. Reserve areas are stipulated in the recommendations and constitute an additional barrier of safety. The reserve area is a spare effluent field, left undeveloped, but can be commissioned in the case of an increase in daily effluent production due to contingencies through the change of ownership and or thanks to an extension/additional bedroom.

1.4.10 **Pressure Compensated Subsurface Disposal**

Conservatively sized irrigation areas with pressure compensated subsurface disposal and zoned dosing deliver effluent directly into the soil. Under saturated conditions, water flow is downwards in the direction of maximum hydraulic gradient. For a surface flow containing effluent to occur, the effluent has to rise, against gravity, through at least 150mm of soil. Under unsaturated conditions, water flow is multi-directional due to capillary forces and matrix suction. The atmosphere provides a capillary break with capillary forces and matrix suction reducing to zero at the air/soil interface. Gravitational forces outweigh the capillary forces and matrix suction long before the surface is reached. Hence, any surface flow from the effluent area cannot contain any effluent, regardless of the intensity and duration of rain events. Surface flow can only consist of rainfall in excess of soil storage capacity and hydraulic conductivity.

Note: For a pressure compensated distribution network to function properly, lines must be placed parallel to contours and/or horizontal for even effluent distribution.
1.4.11 Buffer Distances

Buffer distances are set out in the Code of Practice to allow for attenuation of pathogens and nutrients, should an effluent surcharge occur, either overland or subsurface.

The proposed effluent disposal area is located at least 40m from any waterway, meeting the minimum requirement – see Victorian Code of Practice - Onsite Wastewater Management, E.P.A. Publication 891.4, July, 2016 – Table 5 – Note 4 when effluent is treated to 20/30 standard as a minimum.

The effluent field occupies a waxing divergent slope feeding intermittent waterways/drainage lines to the south at least 40m away. The waterways/drainage lines to south, on feeds Jarvis Creek approximately 100m downstream.

The time taken for groundwater to reach the nearest surface waters can be estimated by using the Darcy equation (which states that velocity is the product of the hydraulic conductivity and the hydraulic gradient).

From the literature, the regional gradient is less than 0.002.

Flow times can be estimated for groundwater to flow the 40m (minimum) to the nearest surface waters at this site.

For a conservative basement hydraulic conductivity of 3m/day with a hydraulic gradient of 0.002, the time taken for groundwater to flow a minimum distance of 40m is about 18 years approximately.

The stipulated buffer distances are in accordance with the requirements of the Code of Practice. The effluent field is placed at least 40m to the nearest waterway/drainage line as required by the Victorian Code of Practice - Onsite Wastewater Management, E.P.A. Publication 891.4, July, 2016 for category 2B to 6 soils.

1.4.12 System Failure

A properly designed and constructed onsite effluent system consisting of the treatment plant, storage and distribution to the irrigation field/trenches can suffer degrees of failure.

Failure can take the form of mechanical (plant), accidental (toilet blockages, damaged trench lines, high BOD influent), operational (power outage, overloading) and maintenance (failure to check filters, failure to participate in maintenance programme).

1.4.13 Mechanical Breakdown

Mechanical plant breakdown typically involves pump malfunction causing high water levels. This situation can be alarmed (both audible and visual). The proposed plant will benefit from a service contract providing 24 hour repair cycles. If the alarms were ignored (or malfunctioned) and the development continued to produce waste until the plant capacities exceeded (at least 3 days \(210 \times 8 = 1680 \text{m}^3/\text{day}\) therefore \(1680 \times 3 = 5040\)) for three day reserve for eight unit cluster), effluent would back up to the interior of the dwellings and/or surcharge through the plant hatches. It is difficult to imagine how this outcome could be allowed to manifest. In addition, a plant malfunction with the residents absent could not cause an effluent surcharge because no influent would be produced during this period.

1.4.14 Accidents

Toilet blockages and accidentally damaged lines could allow localised surface surcharge of treated effluent. This is why minimum buffers to surface waters have been maintained. High BOD influent (e.g. dairy or orange juice) can realise a lesser quality than 20/30 standard for some weeks. Provided the high BOD influent is not continuous, the soils will continue to satisfactorily renovate the effluent.

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This is a conservatively figure to demonstrate maximum possible flow rates. A conservatively low figure was used for calculation of effluent application rates (see recommendations) to demonstrate irrigation sustainability.
1.4.15 **Operational Breakdown**
Operational failures including power outages and transient hydraulic overloading are accommodated by the plant having capacity of at least 3 days - 5040l minimum for the eight unit cluster.

1.4.16 **Maintenance Breakdown**
Maintenance breakdowns such as failure to clean line filters can lead to expensive pump repairs and in extreme cases leakage (of 20/30 standard effluent) from the outlet pipe. This leakage would occur in proximity to the development and would be noticed and acted on.

Refusal to participate in the management programme would be acted on by the responsible authority within one maintenance cycle.

Pumped systems have mechanical components which can malfunction and will age. The management plan including the maintenance and monitoring programmes are essential to ensure safe onsite effluent disposal.

A prepaid maintenance, monitoring and reporting programme involving a certified and insured entity (i.e. external audit) would ensure safe onsite effluent disposal and reduce the responsible authority's burden of responsibility.

1.4.17 **Risk Summary**
With regard to dwelling density of the development and cumulative risk the assessment has considered risk associated with subsurface flows and surface flows.

In regard to subsurface flows, it is clear that provided the on-site system is adequately designed, constructed, operated and maintained (see items 1.4.1 through to 1.4.16), the risk to surface and ground waters is negligible. Once the effluent is placed underground, the extraordinary long travel times via ground water to surface waters ensures adequate nutrient attenuation.

The necessary items 1.4.1 through to 1.4.16 will require a high standard of quality assurance through all stages of system development (design, construction, operation, maintenance and monitoring).

The LCA recommends a conservative, scientifically based, well founded wastewater management system with inherent multiple barriers of safety. Cumulative risk from the proposed development is also extremely low. The risk of serious or irreversible damage is extremely low.

All requirements of *SEPP (Waters of Victoria)* have been met.
2. **Recommendations**

2.1 **Application**

The following recommendations are based on the results of our assessment, and are made in accordance with the *Code of Practice - Onsite Wastewater Management, E.P.A. Publication 891.4, July, 2016, AS 1726, and AS/NZS 1547:2012* (as required by the Towong Council).

They are based on the mean saturated hydraulic conductivity of the limiting clay materials and are designed to demonstrate the viability of on-site effluent disposal for the proposed development and a daily effluent production of up to **1680 litres** considered being conservative.

Our recommendations can be used by a person approved by the relevant authority as a guide to the design and siting of rational on-site effluent disposal systems for land-soil unit as described below.

2.2 **General**

2.2.1 **Disposal Strategy**

Based on the results of the water balance analysis and considering the prevailing surficial and subsurface conditions including soil profile thickness, slope and on condition that adequate site drainage is provided (as described in Section 2.6 Site Drainage below), on-site treatment plants with treatment to at least 20/30 standard are considered appropriate for effluent disposal for this land-soil. The effluent disposal strategy is controlled by restricted buffers and available area. Effluent from the residence will be split into black water and greywater. Black waste will be processed in a dry composting toilet with the compost disposed off-site via licenced contractor (subject to a Section 173 Agreement). Greywater will be treated by AWTS, sand filter or reed bed and used to irrigate pasture grasses and trees via pressure compensated subsurface irrigation. Continuous residential flows and peaks will be stored in a load balancing tank or facility (e.g. reed bed) and processed as the daily average effluent production.

2.2.2 **Effluent**

Effluent will be generated from up to 8 single bedroom open planned units plus a kitchen block and will include black water (toilet) and grey water (kitchen, bathroom, laundry and excess compost water).

2.2.3 **Effluent Quality**

Based on the results of the water balance analysis and considering the prevailing surficial and subsurface conditions including soil profile thickness, slope and on condition that adequate site drainage is provided, the greywater shall be treated (by AWTS, sand filter or reed bed) to a standard that meets or exceeds the water quality requirements of 20/30 standard.

Blackwater shall be treated via dry composting toilet and disposed off-site by a licenced contractor.

No specific proprietary treatment plant is recommended, however treatment system brands and models must be certified by an accredited conformity assessment body (CAB) as conforming to the relevant Australian Standard. This accreditation is given by JAS-ANZ (*The Joint Accreditation System of Australia and New Zealand)*.

2.2.4 **Sand Filters**

Sand filters provide advanced secondary treatment to water that has already undergone primary treatment in a septic tank or similar device. They contain approximately 600mm depth of filter media (usually medium to coarse sand, but other media can be incorporated) within a lined excavation containing an underdrain system. Selection of the filter media is critical and a carefully designed distribution network is necessary. A dosing well and pump is normally used to allow periodic dosing. Depending on the desired level of treatment, sand filters can be single-pass or may incorporate partial recirculation. A subsequent disinfection system is required to allow reuse by surface irrigation. There are several proprietary sand filter systems available today and detailed sizing and design of these systems is generally undertaken by the manufacturer.
2.2.5 Reed Beds
Reed beds provide advanced secondary treatment to water that has already undergone primary treatment in a septic tank or similar device. Reed beds such as the ‘Rhizopod system’ is an on-site wastewater treatment technology that takes advantage of evapotranspiration – the loss of water from the soil by evaporation and by transpiration from plants. This product is a unique completely contained recirculating hydroponic pod arrangement which uses plants to beneficially use and disperse the wastewater from your site. Detailed sizing and design of these systems is generally undertaken by the manufacturer.

2.2.6 Effluent Quantity
The daily effluent volume has been estimated from the CODE OF PRACTICE - ONSITE WASTEWATER MANAGEMENT, E.P.A. PUBLICATION 891.4, JULY, 2016, TABLE 4, AS/NZS 1547:2012 and client estimates.

Each proposed unit has a potential of realising a daily effluent production of 210 litres/day based on the following assumptions:-

- A single bedroom opened planned unit (where the number of people within residence equals one person per bedroom plus one)
- 150l per person per day when the proposed development is connected to tank water when WELS-rated water reduction fixtures. When black waste is captured in a dry composting toilet, the daily waste water flow is allowed to be 70% of total daily water usage.

Therefore:-

<table>
<thead>
<tr>
<th>Each Single Bedroom Dwelling/Unit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of people</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Total (l/day)</td>
<td></td>
</tr>
<tr>
<td>Therefore (l) per day</td>
<td>210</td>
</tr>
<tr>
<td>No. of Units/Studios</td>
<td>8</td>
</tr>
<tr>
<td>Total (l/day)</td>
<td>1680</td>
</tr>
</tbody>
</table>

Therefore conservatively design volume is **1680 litres per day**.

It is assumed that the establishment will be fitted with full WELS water-reduction fixtures including the combined use of reduced flush 6/3 litre water closets, aerator faucets and flow/pressure control valves on all water-use outlets.

2.3 Application Rates and Irrigation Areas for treatment to 20/30 (Secondary) Standard
An irrigation area/tranch length and application rate has been determined from the results of the water and nutrient balance analyses and AS/NZS 1547:2012 with ample area to duplicate if required (see Appendix B. Water & Nutrient Balance Analysis Treatment to 20/30).

2.3.1 Hydraulic Loading
To satisfy the requirement for no surface (rainwater) flows in the 90th percentile annual wet year, under an effective daily flow of 1680 litres of treated effluent, an area of 1175m² will be required applied at an application rate not exceeding 1.4mm/day

2.3.2 Nitrogen Loading
To retain all nitrogen onsite and to prevent any detrimental impact on the beneficial use of surface waters and ground waters, treated effluent should be applied at an application rate not exceeding 2.5mm/day on an area of 669m².

2.3.3 Design Loading
For a daily effluent flow of 1680 litres and to satisfy the requirement for no surface discharge in rainwater flows in the 90th decile wet year and on-site attenuation of nutrients, the effluent should be applied to an area of 1175m² at a rate not exceeding 1.4mm/day.
2.3.4 General Requirements

For treatment to 20/30 Standard via AWTS (various) & or septic tank with sand filter and/or reed bed with disposal via subsurface irrigation, it is assumed that the design, construction, operation and maintenance are carried out in accordance with relevant Australian Standards. Treatment system brands and models must be certified by an accredited conformity assessment body (CAB) as conforming to the relevant Australian Standard. This accreditation is given by JAS-ANZ (THE JOINT ACCREDITATION SYSTEM OF AUSTRALIA AND NEW ZEALAND). As part of a permit application to the Towong Council, the applicant will need to include a copy of the certificate of conformity from a CAB.

2.4 Inspections

We recommend that the mandatory testing and reporting as required in the ‘system specific’ CODE OF PRACTICE - ON SITE WASTEWATER MANAGEMENT, E.P.A. PUBLICATION 891.4, JULY, 2016, include an annual (post spring) report on the functioning and integrity of the distribution system and on the functioning and integrity of the cut-off drains and outfall areas.

2.5 Soil Renovation

To improve soil structure and to maintain stable pedds receiving saline effluent, soil renovation in the form of gypsum application is required. Gypsum shall be broadcast over the effluent area at a rate of 1kg/m². Smoothing of ground surface by redistribution of topsoil is required.

Gypsum can be broadcast over the irrigation area from time to time as required (generally every 5 years at a rate of 1kg/m²).

2.6 Site Drainage

Our recommendations for on-site effluent disposal have allowed for incident rainfall only and are conditional on the installation of a cut-off drain, which should be placed upslope of the disposal area. Care should be taken to ensure that the intercepted and diverted surface waters are discharged well away and down slope of the disposal field.

Cut-off drain details are shown in Appendix H (Typical Cut-Off Drain Details).

The owner should also ensure that any upslope site works do not divert and/or concentrate surface water flows onto the disposal area.

2.7 Reserve Areas

Due to construction and maintenance vagaries and possible effluent volume increases through the chain of ownership, there is sufficient available area for extension of the effluent areas if required, as shown in Appendix F. Effluent treated to at least 20/30 standard, a reserve area is not required but considered prudent as another safety barrier.

2.8 Buffer Distances

The water balance analysis has shown that potential surcharges from the effluent area would be restricted to episodic events.

Our analysis and evaluation has shown that the default setback distances given in the CODE OF PRACTICE, are conservative and can be applied without amendment given effluent is treated to at least 20/30 standard and disposed via subsurface irrigation.

Note: Allocation of buffer distances has not considered any potential impact on foundation material integrity. Your design engineer should take into consideration the proximity of the irrigation area to footings.

2.9 Summary of Recommendations

Our capability assessment has shown that at least one rational and sustainable on-site effluent disposal method (effluent treated to at least 20/30 standard and disposed via subsurface irrigation coupled with a dry composting toilet) is appropriate for the proposed development, subject to specific design criteria, described in this report.

A management plan is presented in Appendix E, to this report.
APPENDIX A. HYDRAULIC CONDUCTIVITY TEST RESULTS

Profile analysis in accordance with the CODE OF PRACTICE CODE and AS/NZS 1547:2012 and our laboratory determined swell potential shows the clay B-horizon soils to be moderately structured clay loams to light clays with saturated hydraulic conductivities in the range of 0.06 to 0.5m/day.

Constant head permeameter testing has realised a B-horizon hydraulic conductivity ranging from 0.091m/day to 0.2m/day. The geometric mean for this site is 0.141m/day. For the limiting B-horizon clay soils, we have adopted an estimated saturated hydraulic conductivity of 6.25mm/day for treatment to 20/30 [Secondary] Standard disposed via subsurface irrigation. Due to slope - a reduction of 20% to the DIR is required, resulting in an adopted DIR of 5mm/day.

**CONSTANT HEAD (TALSMA) METHOD**

**LAND SOIL UNIT A**

**LOCATION:** 1057 Sirls Road, Jarvis Creek VIC 3700

**DATE:** 16/01/2018

<table>
<thead>
<tr>
<th>HOLE #</th>
<th>DEPTH (cm)</th>
<th>RADIUS (cm)</th>
<th>DEPTH TO 90(cm)</th>
<th>HEAD (cm)</th>
<th>Q (cm³/min)</th>
<th>Ksat (m/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS1</td>
<td>57</td>
<td>3.5</td>
<td>90(cm)</td>
<td>21</td>
<td>10.7</td>
<td>0.139</td>
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<td>90(cm)</td>
<td>22</td>
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<td>0.130</td>
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</table>

Geometric Mean (m): 0.141
APPENDIX B 1_2 - RAINFALL DATA & EVAPORATION DATA

**REDISTRIBUTION OF RAINFALL**

Rainfall to be redistributed (9th decile) = 1111 mm/yr
Minimum mean rainfall = 46.3 mm
9th decile (annual) - mean rainfall (annual) = 270 mm

<table>
<thead>
<tr>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mean rainfall (mm):
- JAN: 52
- FEB: 46
- MAR: 57
- APR: 56
- MAY: 73
- JUN: 90
- JUL: 93
- AUG: 89
- SEP: 78.4
- OCT: 79.4
- NOV: 64.2
- DEC: 63.2
- TOTAL: 840.1

Deviation from minimum mean (mm):
- JAN: 6
- FEB: 0
- MAR: 11
- APR: 9
- MAY: 26
- JUN: 44
- JUL: 47
- AUG: 43
- SEP: 32
- OCT: 33
- NOV: 18
- DEC: 17
- TOTAL: 285

Redistributed rainfall (mm) (1):
- JAN: 57
- FEB: 46
- MAR: 67
- APR: 65
- MAY: 98
- JUN: 132
- JUL: 137
- AUG: 129
- SEP: 109
- OCT: 111
- NOV: 81
- DEC: 79
- TOTAL: 1111

1. The distribution is adjusted in proportion to the deviation of means from the minimum mean.

**RAINFALL DATA**

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
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<td>51.9</td>
<td>46.3</td>
<td>56.8</td>
<td>55.7</td>
<td>72.7</td>
<td>90.1</td>
<td>93</td>
<td>89</td>
<td>78.4</td>
<td>79.4</td>
<td>64.2</td>
<td>63.2</td>
<td>840.1</td>
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<td>18</td>
<td>19.2</td>
<td>9.4</td>
<td>7.7</td>
<td>1.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>266</td>
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<tr>
<td>5th %ile</td>
<td>1.4</td>
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<td>7.6</td>
<td>11.9</td>
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<td>10th %ile</td>
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<td>31.3</td>
<td>39.1</td>
<td>29.9</td>
<td>30</td>
<td>21.9</td>
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<td>Median</td>
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<td>41.2</td>
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<td>54.5</td>
<td>832.3</td>
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<tr>
<td>90th %ile</td>
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<td>142.3</td>
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<td>95th %ile</td>
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<td>169.8</td>
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<tr>
<td>Highest</td>
<td>229</td>
<td>276.6</td>
<td>301</td>
<td>191.2</td>
<td>218.8</td>
<td>246.1</td>
<td>266</td>
<td>187.6</td>
<td>196.6</td>
<td>236.4</td>
<td>167.3</td>
<td>197.4</td>
<td>1392.8</td>
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**EVAPORATION DATA**

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<th>Statistic</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
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<tbody>
<tr>
<td>Mean daily evaporation (mm)</td>
<td>7.8</td>
<td>7</td>
<td>5</td>
<td>2.9</td>
<td>1.5</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>2.4</td>
<td>3.7</td>
<td>5.6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Mean monthly evaporation (mm)</td>
<td>241.8</td>
<td>196</td>
<td>155</td>
<td>87</td>
<td>46.5</td>
<td>30</td>
<td>31</td>
<td>46.5</td>
<td>72</td>
<td>114.7</td>
<td>168</td>
<td>217</td>
<td>1405.5</td>
</tr>
</tbody>
</table>

**Station:** Tallangatta (Bullioh)  
Station Number: 82047  
Latitude: 36.19°S  
Longitude: 147.36°E  
Elevation: 220m  
Commenced: 1887  
Operational Status: Open
## SJE Consulting

### WATER/NITROGEN BALANCE (20/30 irrigation): With no wet month storage.

**Rainfall Station:** Tallangatta (Bullioh) / **Evaporation Station:** Hume Reservoir  
**LOCATION:** 1057 Sirrs Road, Jarvis Creek VIC 3700  
**16/01/2018**

**Client:** Louise Kelly

### Table: Water/Balance

<table>
<thead>
<tr>
<th>ITEM</th>
<th>UNIT</th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>YEAR</th>
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<tbody>
<tr>
<td>Days in month:</td>
<td>D</td>
<td>31</td>
<td>28</td>
<td>31</td>
<td>30</td>
<td>31</td>
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<td>31</td>
<td>30</td>
<td>30</td>
<td>30</td>
<td>365</td>
</tr>
<tr>
<td>Evaporation (mean)</td>
<td>mm</td>
<td>A</td>
<td>242</td>
<td>196</td>
<td>155</td>
<td>87</td>
<td>47</td>
<td>30</td>
<td>31</td>
<td>47</td>
<td>72</td>
<td>115</td>
<td>168</td>
<td>217</td>
</tr>
<tr>
<td>Rainfall (90th percentile)</td>
<td>B</td>
<td>57</td>
<td>46</td>
<td>67</td>
<td>65</td>
<td>98</td>
<td>132</td>
<td>137</td>
<td>129</td>
<td>109</td>
<td>111</td>
<td>81</td>
<td>79</td>
<td>1111</td>
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<tr>
<td>Effective rainfall</td>
<td>mm</td>
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<td>42</td>
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<td>88</td>
<td>118</td>
<td>124</td>
<td>116</td>
<td>98</td>
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<tr>
<td>Peak seepage Loss</td>
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<td>140</td>
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<td>Evapotranspiration (X)</td>
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<td>78</td>
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<td>12</td>
<td>19</td>
<td>29</td>
<td>46</td>
<td>67</td>
</tr>
<tr>
<td>Waste Loading (C1+B3-B2)</td>
<td>mm</td>
<td>C2</td>
<td>200</td>
<td>177</td>
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<td>57</td>
<td>81</td>
<td>101</td>
<td>144</td>
<td>171</td>
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<tr>
<td>Net evaporation from lagoons (10/0.8A-B1xlagoo area(ha))</td>
<td>L</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
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</tr>
</tbody>
</table>

**Volume of Wastewater**

| L   | E   | 52080 | 47040 | 52080 | 50400 | 52080 | 50400 | 52080 | 50400 | 52080 | 50400 | 52080 | 50400 | 52080 | 613200 |

**Total Irrigation Water (E-NL)/G**

| M   | F   | 44   | 40   | 44   | 43   | 44   | 43   | 44   | 43   | 44   | 43   | 44   | 44   | 522   |

**Irrigation Area (E/C2) annual.**

| N   | G   | 1175 |

**Surcharge**

| H   | 1175 |

**Actual seepage loss**

| mm  | J   | 1175 |

**Direct Crop Coefficient:**

| I   | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |

**Rainfall Retained:**

| 90% | K   |

**Lagoon Area:**

| 0   | ha  |

**Wastewater/Irrigation:**

| 1680 | L   |

**Seepage Loss (Peak):**

| 5    | N   |

**Irrig' Area (No storage):**

| 1175 | P2  |

**Application Rate:**

| 1.4  | Q   |

**Nitrogen in Effluent:**

| 30   | mg/L |

**Denitrification Rate:**

| 20%  | S   |

**Plant Uptake:**

| 220  | kg/ha/yr |

**Mean daily seepage loss:**

| 2.6  | mm |

**Annual N load:**

| 14.72 | kg/yr |

**Area for N uptake:**

| 669  | m² |

**Application Rate:**

| 2.5  | mm |

### Nitrogen Uptake:

<table>
<thead>
<tr>
<th>Species:</th>
<th>Kg/ha.yr</th>
<th>pH</th>
<th>Species:</th>
<th>Kg/ha.yr</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ryegrass</td>
<td>200</td>
<td>5.6-6.5</td>
<td>Bent grass</td>
<td>170</td>
<td>5.6-6.9</td>
<td>Grapes</td>
<td>200</td>
<td>6.1-7.9</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>90</td>
<td>5.6-6.9</td>
<td>Couch grass</td>
<td>280</td>
<td>6.1-6.9</td>
<td>Lemons</td>
<td>90</td>
<td>6.1-6.9</td>
</tr>
<tr>
<td>Lucerne</td>
<td>220</td>
<td>6.1-7.9</td>
<td>Clover</td>
<td>180</td>
<td>6.1-6.9</td>
<td>Cunn'a</td>
<td>220</td>
<td>6.1-7.9</td>
</tr>
<tr>
<td>Tall fescue</td>
<td>150-320</td>
<td>6.1-6.9</td>
<td>Buffalo (soft)</td>
<td>150-320</td>
<td>5.5-7.5</td>
<td>P radiata</td>
<td>150</td>
<td>5.6-6.9</td>
</tr>
<tr>
<td>Rye/clover</td>
<td>220</td>
<td>5.6-6.9</td>
<td>Sorghum</td>
<td>90</td>
<td>5.6-6.9</td>
<td>Poplar's</td>
<td>115</td>
<td>5.6-8.5</td>
</tr>
</tbody>
</table>

1. The distribution is adjusted in proportion to the deviation of means from the minimum mean.
APPENDIX C. LABORATORY RESULTS

LAND SOIL UNIT A

LOCATION: 1057 Sirls Road, Jarvis Creek VIC 3700
DATE: 16/01/2018

<table>
<thead>
<tr>
<th>BH</th>
<th>DEPTH (cm)</th>
<th>SOIL</th>
<th>NMC</th>
<th>FS</th>
<th>pH</th>
<th>EC_{10a}</th>
<th>EC_{EC}</th>
<th>DID IT SLAKE?</th>
<th>DISPERSION INDEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-14</td>
<td>Dark brown sandy loam</td>
<td>10.9%</td>
<td>-</td>
<td>6.7</td>
<td>54</td>
<td>0.810</td>
<td>N/A</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>15-31</td>
<td>Tan sandy clay of low plasticity</td>
<td>8.3%</td>
<td>5%</td>
<td>6.2</td>
<td>28</td>
<td>0.252</td>
<td>NO</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>32-60</td>
<td>Mottled orange/brown micaceous coarse sandy clay of low plasticity</td>
<td>12.5%</td>
<td>25%</td>
<td>5.6</td>
<td>30</td>
<td>0.270</td>
<td>YES</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>61-100</td>
<td>Mottled white/orange/tan micaceous coarse sandy clay of low plasticity</td>
<td>6.3%</td>
<td>5%</td>
<td>6.2</td>
<td>33</td>
<td>0.297</td>
<td>YES</td>
<td>0</td>
</tr>
</tbody>
</table>

1m being the maximum depth the Christie Post Driver (CHPD78) and 1.6m sampling rod could achieve.
<table>
<thead>
<tr>
<th>LAND FEATURE</th>
<th>LAND CAPABILITY RISK RATING</th>
<th>AMELIORATIVE MEASURES &amp; RISK REDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available land for LAA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment to Septic Standard with Trenches and beds</td>
<td>Exceeds LAA and duplicate LAA requirements</td>
<td>Non-limiting for treatment to Septic Standard with trenches and beds; Full reserve area available</td>
</tr>
<tr>
<td>Treatment to 20/30 Standard</td>
<td>Exceeds LAA and duplicate LAA requirements</td>
<td>Non-limiting for treatment to 20/30 standard; Full reserve area available</td>
</tr>
<tr>
<td>Aspect</td>
<td>North, north-east and north-west</td>
<td>Eastern aspect - design by water balance</td>
</tr>
<tr>
<td>Exposure</td>
<td>Full sun and/or high wind or minimal shading</td>
<td>Full sun - proposed location limits shade effect,</td>
</tr>
<tr>
<td>Slope form</td>
<td>Convex or divergent side slopes</td>
<td>Well-drained, however finished LAA surface requires smoothing and redistribution of topsoil &amp; cull off drains placed upside of effluent field.</td>
</tr>
<tr>
<td>Slope gradient:</td>
<td>&lt;5%</td>
<td>15-20%: Limiting risk for trenches.</td>
</tr>
<tr>
<td>Trenches and beds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsurface irrigation</td>
<td>&lt;10%</td>
<td>15-20% low risk for subsurface irrigation</td>
</tr>
<tr>
<td>Site drainage; runoff/run-on</td>
<td>LAA backs onto crest or ridge</td>
<td>Cut-off drain required upslope of effluent field.</td>
</tr>
<tr>
<td>Landslip (1)</td>
<td>Potential</td>
<td>All slopes stabilised by vegetation</td>
</tr>
<tr>
<td>Erosion potential</td>
<td>Low</td>
<td>Low grades but all runoff to be dispersed without concentrating flows.</td>
</tr>
<tr>
<td>Flood/inundation</td>
<td>Nevean</td>
<td>LAAs is approximately 20m above localised flood level.</td>
</tr>
<tr>
<td>Treatment to Septic Standard with Trenches and beds</td>
<td>Falls within Land Subject to Inundation Overlay</td>
<td>LAAs is approximately 20m above localised flood level.</td>
</tr>
<tr>
<td>Treatment to 20/30 Standard with subsurface irrigation</td>
<td>Falls within Land Subject to Inundation Overlay</td>
<td>&gt;=5% AEP</td>
</tr>
<tr>
<td>Distance to surface waters (m)</td>
<td>Buffer distance complies</td>
<td>Waterway within 60m.</td>
</tr>
<tr>
<td>Treatment to Septic Standard with Trenches and beds</td>
<td>Buffer distance does not comply</td>
<td>Reduce buffer distance not acceptable</td>
</tr>
<tr>
<td>Treatment to 20/30 Standard with subsurface irrigation</td>
<td>Buffer distance does not comply</td>
<td>Reduce buffer distance not acceptable</td>
</tr>
<tr>
<td>Distance to groundwater bones (m)</td>
<td>No bones on site or within a significant distance</td>
<td>No bones within 300m of effluent field.</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Plentyful/healthy vegetation</td>
<td>Denes grasses suitable for LAA.</td>
</tr>
<tr>
<td>Depth to water table (potentiometric) (m)</td>
<td>&gt;2</td>
<td>Surface</td>
</tr>
<tr>
<td>Rainfall (2) (90th percentile annual) (mm)</td>
<td>&lt;500</td>
<td>750-1000</td>
</tr>
<tr>
<td>Pan evaporation (mean) (mm)</td>
<td>&gt;1400</td>
<td>&lt;800 Design by water balance.</td>
</tr>
</tbody>
</table>
### APPENDIX D. 2 of 3

#### SOIL PROFILE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Structure</th>
<th>High or moderately structured</th>
<th>Weekly structured</th>
<th>Structureless, massive or hardpan</th>
<th>Uncontrolled poor quality/unsuitable filling</th>
<th>Improve structure by gypsum application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill materials</td>
<td>Nil or mapped good quality topsoil</td>
<td>Mapped variable depth and quality materials</td>
<td>Variable quality and/or uncontrolled filling</td>
<td>Uncontrolled poor quality/unsuitable filling</td>
<td>Any existing fill to be removed during regrading.</td>
</tr>
<tr>
<td>Thickness: (m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trenches and beds</td>
<td>&gt;1.4</td>
<td>&lt;1.4</td>
<td>&lt;1</td>
<td>1m thick profile: Limiting for trenches and beds</td>
<td></td>
</tr>
<tr>
<td>Subsurface irrigation</td>
<td>1.5+</td>
<td>1.0 to 1.5</td>
<td>0.75 to 1.0</td>
<td>&lt;0.75</td>
<td>1m thick profile. Non-limiting for irrigation</td>
</tr>
<tr>
<td>Permeability (3) (limiting horizon) (m/day)</td>
<td>0.15-0.3</td>
<td>0.03-0.15</td>
<td>0.01-0.03</td>
<td>&gt;3.0</td>
<td>Design by water balance</td>
</tr>
<tr>
<td>Permeability (4) (buffer evaluation) (m/day)</td>
<td>&lt;0.3</td>
<td>0.3-3</td>
<td>3 to 5</td>
<td>&gt;5.0</td>
<td>Evaluate flow times via Darcy’s Law (assume 1m/day for fractured igneous rocks)</td>
</tr>
<tr>
<td>Stomness (%)</td>
<td>&lt;10</td>
<td>10 to 20</td>
<td>&gt;20</td>
<td>Unremarkable</td>
<td></td>
</tr>
<tr>
<td>Emerson number</td>
<td>4.5, 6.8</td>
<td>7</td>
<td>2, 3</td>
<td>Non dispersive. Apply gypsum (at least 1kg/m²) to maintain stable peds under saline irrigation.</td>
<td></td>
</tr>
<tr>
<td>Dispersion Index</td>
<td>0</td>
<td>1 to 8</td>
<td>8 to 16</td>
<td>Non dispersive. Apply gypsum (at least 1kg/m²) to maintain stable peds under saline irrigation.</td>
<td></td>
</tr>
<tr>
<td>Reaction trend (pH)</td>
<td>5.5 to 6</td>
<td>4.5 to 5.5</td>
<td>&lt;4.5 to 8</td>
<td>Improve pH by gypsum application</td>
<td></td>
</tr>
<tr>
<td>E.C. (dS/m)</td>
<td>&lt;0.6</td>
<td>0.8 to 2</td>
<td>&gt;2</td>
<td>Non-restrictive.</td>
<td></td>
</tr>
<tr>
<td>Sodicity (ESP) (%)</td>
<td>&lt;5</td>
<td>6 to 8</td>
<td>&gt;8</td>
<td>Non-sodic (inf. from Em, Di, F5, pH &amp; EC) - Apply gypsum (at least 1kg/m²)</td>
<td></td>
</tr>
<tr>
<td>Free swell (%)</td>
<td>&lt;30</td>
<td>30 to 80</td>
<td>85 to 120</td>
<td>&gt;120</td>
<td>Low-swellling clays</td>
</tr>
</tbody>
</table>

[1] Landslide assessment based on proposed hydraulic loading, slope, profile characteristics and past and present land use.

**NOTES**

1. Estimated, tested or measured values lie within the ranges highlighted/coloured.
2. This Appendix is applicable to disposal of 20/30 standard effluent via subsurface irrigation
3. There are limiting factors for primary effluent disposed via trench network.
4. There are no limiting factors for effluent treated to 20/30 standard disposed via subsurface irrigation.
5. Possible perched groundwater can be managed by installation of cut-off drains.
   Evaluation of buffer distances via Darcy’s Law shows EPA default buffer distances to be adequate.
6. Hence, in terms of the definitions provided in Onsite Domestic Wastewater Management, E.P.A. Publication 746.1, March, 2003, (pages 14 and 15), the design, engineering and management inputs required for sustainable on-site effluent disposal are rational the design, engineering and management inputs required for sustainable on-site effluent disposal are rational and easily achieved without significant impost on the landowner.
## APPENDIX D. 3 of 3
THE LIKELIHOOD OF CONSEQUENTIAL IMPACTS OF PRIMARY ON-SITE WASTEWATER MANAGEMENT SYSTEM[6]

<table>
<thead>
<tr>
<th>LAND FEATURE</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
<th>RISK RATING</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance to reservoir (km)</td>
<td>&gt;15km</td>
<td>2 to 15km</td>
<td>&lt;2km</td>
<td>2</td>
<td>Approx. 9 kilometres to Lake Hume.</td>
</tr>
<tr>
<td>Soil type rating (from Part 1)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>Thickness: (m)</td>
</tr>
<tr>
<td>Distance to river (m)</td>
<td>&gt;60</td>
<td>40 to 80</td>
<td>&lt;40</td>
<td>1</td>
<td>At least 300m to Jarvis Creek</td>
</tr>
<tr>
<td>Distance to stream (m)</td>
<td>&gt;80</td>
<td>40 to 80</td>
<td>&lt;40</td>
<td>2</td>
<td>At least 40m to stream/s that feed Jarvis Creek</td>
</tr>
<tr>
<td>Distance to drain (m)</td>
<td>&gt;40</td>
<td>10 to 40</td>
<td>&lt;10</td>
<td>2</td>
<td>At least 40m to stream/s that feed Jarvis Creek</td>
</tr>
<tr>
<td>Lot size (ha)</td>
<td>&gt;10</td>
<td>2 to 10</td>
<td>0.2-2</td>
<td>2</td>
<td>4ha (approximately).</td>
</tr>
<tr>
<td>Density (houses/km²)</td>
<td>&lt;20</td>
<td>20-40</td>
<td>&gt;40</td>
<td>1</td>
<td>Approximately 10 possible allotments in adjacent km².</td>
</tr>
<tr>
<td>LCA rating (from Part 1)</td>
<td>1 (LOW)</td>
<td>2 (MEDIUM)</td>
<td>3 (HIGH)</td>
<td>3</td>
<td>Rainfall</td>
</tr>
<tr>
<td>System fall rate (%)</td>
<td>&lt;5</td>
<td>5 to 10</td>
<td>&gt;10</td>
<td>3</td>
<td>Assumed conservative value</td>
</tr>
</tbody>
</table>

## PART 3 - CALCULATED COMBINED RISK NUMBER

As part of the development of the Mansfield Shire WWMP Pilot Study, Dr Robert Edis identified major factors which influence the level of risk posed by an on-site system. These factors have a differing level of importance, or weighting, when considered relative to other factors and that the interaction between factors must also be considered.

The individual factors can be rated as low risk (R<2.5) which reflects the range in which there is no expected consequential impact on water quality, medium risk (R=2.5-5) which reflects the range in which the factor may influence the risk to water quality, though as a minor component of the overall risk, and high risk (R>5) which represents a significant influence on the risk to water quality.

The Edis risk algorithm weights the major factors appropriately in the context of protecting the integrity of the potable water supply, as shown below:

\[ R_c = \frac{R_{res} + R_{Sol} + (R_{riv} + R_{Drk} + R_{loc}) + (2 \times R_{LCA}) + (3 \times R_{fad} \times R_{Den})}{10} \]

where
- \( R_c \) = Combined Risk Number,
- \( R_{res} \) = Distance to reservoir risk rating
- \( R_{Sol} \) = Soil (or Land-Soil) risk rating
- \( R_{riv} \) = Distance to river risk rating
- \( R_{Drk} \) = Distance to stream risk rating
- \( R_{loc} \) = Distance to drain risk rating
- \( R_{LCA} \) = Lot size risk rating
- \( R_{LCA} \) = Land capability assessment risk rating (from Part 1)
- \( R_{fad} \) = System fall rate risk rating
- \( R_{Den} \) = Density of development risk rating

The combined risk number for this site is 5 (Medium Risk).

The results of the land capability assessment and risk analysis indicate that treatment to secondary (20/30) standard disposed via subsurface irrigation are appropriate for this site.

The risk can be reduced to negligible levels if effluent is treated to at least secondary level, as described in Section 2 of the land capability assessment.

[a] Source: Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments (Dr Robert Edis April 2014)
Appendix E. Management Plan

MANAGEMENT PLAN FOR ONSITE EFFLUENT REUSE/DISPOSAL TO SECONDARY STANDARD DISPOSED VIA SUBSURFACE IRRIGATION

PROPOSED DEVELOPMENT - A CLUSTER OF EIGHT SINGLE BEDROOM UNITS/STUDIOS PLUS A KITCHEN BLOCK

AT 1057 SIRLS ROAD, JARVIS CREEK VIC 3700

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1. Introduction
This document identifies the significant land-soil unit constraints (as identified in the SJE Consulting document ‘Land Capability Assessment, proposed development - a cluster of eight single bedroom units/studios plus a kitchen block at 1057 Sirls Road, Jarvis Creek VIC 3700 (Project. 200611) REV 0’ and their management and day-to-day operation and management of the on-site effluent system.

This management plan is to be read in conjunction with our land capability assessment for this land-soil unit at 1057 Sirls Road, Jarvis Creek VIC 3700 (Project. 200611) REV 0.

2. Significant land-soil unit constraints
2.1 Allotment Size
The day-to-day operation and management of on-site effluent systems, as described below, is not constrained by lot size or geometry.

Although all requirements of SEPP (WATERS OF VICTORIA) have been met or exceeded through conservative design, prudence dictates that individual lot owner(s) assiduously follow the management programme given in Section 4 Management, below.

2.2 Nitrogen Attenuation
To reduce nitrates to insignificant levels, the effluent cannot contain more than 30mg/litre total nitrogen. Your plant supplier must provide proof that the plant can achieve this output level. Provided the irrigation area at least as large as those required to satisfy the nitrogen loading, as described in the document named ‘Land Capability Assessment, proposed development - a cluster of eight single bedroom units/studios plus a kitchen block at 1057 Sirls Road, Jarvis Creek VIC 3700 (Project. 200611) REV 0’ (See sections 1.3.12 Nutrient Attenuation and 2.3.2 Nitrogen Loading) and that the (specified) grass is cut and harvested, nitrogen will be attenuated on-site.
2.3 Hydraulic Conductivity

The soils of this land-soil unit are low swelling clays with a moderate hydraulic conductivity. The hydraulic conductivity is significantly influenced by soil structure, soil colloid stability and swell characteristics. Breakdown or reduction of these soil parameters over time may manifest as reduced performance of the irrigation system. The monitoring and inspection regime detailed in Section 4.7 Service and Maintenance Programme, below, should be adhered to.

2.4 Site Drainage

Our recommendations for on-site effluent disposal have allowed for incident rainfall (not surface flow or lateral subsurface flow) and are conditional on the installation of a cut-off drain, which should be placed upslope of the disposal area. Care should be taken to ensure that the intercepted and diverted waters and any perched groundwater is discharged well away and down slope of the disposal field – refer to Appendix H showing standard cut-off drain details.

This diverted water should also be discharged in a manner to avoid scouring and/or erosion. It may be appropriate to discharge the water onto a stone/rubble dissipation area. The owner should also ensure that any upslope land-soil unit works do not divert and/or concentrate surface water flows onto the disposal area.

2.5 Vegetation

The effluent disposal areas have been sized via water balance analyses utilising crop factors for typical pasture (rye/clover mix).

3. The Onsite Effluent System

The onsite effluent system consists of the effluent from (toilets, kitchen, bathroom and laundry), the treatment plant (20/30 Standard via AWTS (various) & or a sand filter/reed bed, a dry composting toilet, irrigation area, storage, prescribed irrigation area vegetation, associated infrastructure (cut-off drains, outfall areas, fencing), a service and maintenance programme and on-going management including off-site disposal of composted material.

4. Management

The owner is required to understand (and ensure that tenants understand) that sustainable operation of the onsite effluent system is not automatic. Sustainable operation requires on-going management, as outlined below.

4.1 Effluent

Effluent will be generated from a cluster of eight single bedroom units/studios plus a kitchen block (possible population of 14) and will include black and grey water (all wastes).

4.1.1 Effluent Quality

Effluent should be treated to a standard that meets or exceeds the water quality requirements of the 20/30 standard for BOD/SS, as appropriate.

4.1.2 Effluent Quantity

The total daily effluent volume of 1680 litres has been calculated based on a cluster of eight single bedroom units/studios, up to 14 occupants at any one time, plus a kitchen block, using flow assumptions from AS/NZS1547:2012 and a 30% reduction due to the splitting of black and grey water. The site will be supplied with tank water filled by captured rain.

We recommend that the residence be fitted with full water-reduction fixtures including the combined use of reduced flush 6/3 litre water closets, shower-flow restrictors, aerator faucets, front-load washing machines and flow/pressure control valves on all water-use outlet.
4.2 Treatment Plant
For treatment to 20/30 Standard via AWTS (various) & or septic tank with a sand filter and/or reed bed and disposal via subsurface irrigation, it is assumed that the design, construction, operation and maintenance are carried out in accordance with relevant Australian Standards. Treatment system brands and models must be certified by an accredited conformity assessment body (CAB) as conforming to the relevant Australian Standard. This accreditation is given by JAS-ANZ (THE JOINT ACCREDITATION SYSTEM OF AUSTRALIA AND NEW ZEALAND). As part of a permit application to the Towong Council, the applicant will need to include a copy of the certificate of conformity from a CAB.

4.3 Disposal Area Requirement
For a daily effluent flow of 1680 litres and to satisfy the requirement for no surface rainwater flow in the 90th decile wet year and on-site attenuation of nutrients, the effluent should treated to 20/30 standard and be applied to an irrigation area of 1175m².

Effluent distribution is as detailed in Section 4.3.1, below.

In case of an increase in effluent production through the chain of ownership, there is sufficient area available for duplicating or extending the irrigation area. Any future proposed extensions should be undertaken in accordance with a revised land capability assessment.

4.3.1 Distribution System
For subsurface irrigation, the distribution system must achieve controlled and uniform dosing over the irrigation area. A small volume of treated effluent should be dosed at predetermined time intervals throughout the day via a pressurised piping network that achieves uniform distribution over the entire irrigation area.

Uniform delivery pressure of the effluent throughout the distribution system is essential. Drip rates should not vary by more than 10% from the design rate over the whole of the system.

To minimise uneven post-dripper seepage, the distribution pipes must be placed parallel with slope contours.

Line spacing shall be not wider than 1000mm under any circumstances.

To facilitate the creation of transient aerobic and anaerobic soil conditions we recommend that as part of the daily irrigation process, the effluent area be (automatically) irrigated sequentially by zones.

4.3.2 Soil Renovation
To improve and maintain stable soil structure under conditions of saline effluent, sustainable on-site effluent disposal is conditional on soil renovation in the form of gypsum application. Gypsum shall be broadcast over the effluent area at a rate of 1kg/m². The ground surface is to be smoothed by the redistribution of topsoil. Gypsum can be reapplied from time-to-time as required (generally every 5 years).

4.3.3 Buffer Distances
The water balance analysis has shown that potential surcharges from the effluent area would be restricted to episodic events.

The estimated hydraulic properties of the upper soil materials and hydraulic gradient (equivalent to the ground slope) have been used to evaluate (via Darcy’s Law) the buffer distances with respect to subsurface flows.

Our analysis and evaluation has shown that the default setback distances given in CODE OF PRACTICE – ONSITE WASTEWATER MANAGEMENT, EPA PUBLICATION 891.4 JULY 2016 TABLE 5 are conservative and can be applied without amendment.

For a building located down slope of an effluent field, an engineer should evaluate the integrity of building foundations with respect to the assigned buffer.

Note: Buffer distances are to be applied exclusive of the irrigation area.
4.3.4 Buffer Plantings
All down slope (Title inclusive) buffers may be required to filter and renovate occasional surface discharges. Hence, they are to be maintained with existing or equivalent groundcover vegetation.

4.3.5 Buffer Trafficking
On all disposal areas, buffer trafficking should be minimised to avoid damage to vegetation and/or rutting of the surface soils.

Traffic should be restricted to ‘turf’ wheeled mowing equipment and to maintenance, monitoring and inspections by pedestrians, where possible.

4.4 Vegetation
The system design for on-site disposal includes the planting and maintenance of suitable vegetation, as specified in ‘Land Capability Assessment, proposed development - a cluster of eight single bedroom units/studios plus a kitchen block at 1057 Sirfs Road, Jarvis Creek VIC 3700 (Project. 200611) REV 0’ and related documents.

Specifically this irrigation area has been sized (in part) utilising crop factors and annual nitrogen uptake for a ryegrass/clover mix.

The grass needs to be periodically harvested (mown and removed from the irrigation area).

Where a variation to recommended grass species is proposed, it must be demonstrated that the nutrient uptake and crop factors (as specified in ‘Land Capability Assessment, proposed development - a cluster of eight single bedroom units/studios plus a kitchen block at 1057 Sirfs Road, Jarvis Creek VIC 3700 (Project. 200611) REV 0’, Appendix B – water balance are met or exceeded.

4.5 Verification
The Towong Council is to be satisfied that the effluent system has been constructed as designed.

4.6 Associated Infrastructure
The following items are an integral part of the onsite effluent system;

4.6.1 Treatment Plant
The treatment plant/sand filter/reed bed should be serviced at least once a year (or as recommended in the Certificate of Approval) and the effluent should be sampled and analysed as required by the EPA requirements. The local authority is to ensure compliance.

The manufacturer’s recommendations are to be followed. Generally, low phosphorous and low sodium (liquid) detergents should be used. Plastics and other non-degradable items should not be placed into the tanks. Paints, hydrocarbons, poisons etc. should not be disposed of in sinks or toilets. Advice from a plumber should be obtained prior to using drain cleaners, chemicals and conditioners. It is important to ensure that grease does not accumulate in the tanks or pipes. Grease and similar products should be disposed of by methods other than via the on-site effluent system.

4.6.2 Cut-off Drains
Cut-off drains are designed to prevent surface and near-surface water flows from entering the effluent area. They should be constructed and placed around the effluent area, as detailed in the standard cut off drain details (Appendix H).

4.6.3 Outfall Areas
All pipe outfalls should be at grade and designed to eliminate scour and erosion.

A grassed outfall would normally be adequate. However, should monitoring and inspections reveal rill or scour formation, the outfall will need to be constructed so that energy is satisfactorily dissipated.

Should this situation occur, professional advice is to be sought.
4.6.4 Fencing
The disposal area is to be a dedicated area. Adequate ‘fencing’ must be provided to prevent
stock, excessive pedestrian movements and vehicular movements over the area.
Fencing may take any of the traditional forms or can be incorporated into landscape features
such as dense plantings.

4.7 Service and Maintenance Programme
The minimum requirements for servicing and maintenance are set out in the relevant Certificate of
Approval and the manufacturers recommendations.

4.7.1 Treatment Plant
A treatment system brands and models must be certified by an accredited conformity assessment
body (CAB) as conforming to the relevant Australian Standard. This accreditation is given by
JAS-ANZ (THE JOINT ACCREDITATION SYSTEM OF AUSTRALIA AND NEW ZEALAND). The local
authority is to ensure compliance.

4.7.2 Monitoring and Inspections
We recommend that the mandatory testing and reporting as described in the CODE OF PRACTICE
- ONSITE WASTEWATER MANAGEMENT, EPA PUBLICATION 891.4, JULY 2016, include an annual
report (post spring) as well as reporting as required post periods of heavy and/or prolonged
rainfall. The report shall address the function and integrity of the distribution system and the
function and integrity of the cut-off drains, outfall areas and soil media.

The effluent areas should be regularly inspected for excessively wet areas and vegetation
integrity.

The inspection regime described in ‘Land Capability Assessment, proposed development - a
cluster of eight single bedroom units/studios plus a kitchen block at 1057 Sirfs Road, Jarvis Creek
VIC 3700 (Project. 200611) REV 0’ should be strictly adhered to.
Appendix G. Site Photograph

Photo 1: View of soil log within proposed effluent disposal area.

Photo 2: View of testing within proposed effluent field.

Photo 3: View of nearest waterway from proposed development west of Sirls Road.

Photo 4: View from proposed effluent field from the intersection of Sirls Road and Jarvis Creek Road.
1. DRAIN TO BE DESIGNED, CONSTRUCTED BY AND MAINTAINED TO ENSURE THAT NO SURFACE AND PERCHED GROUNDWATER FLOWS ENTER THE IRRIGATION AREA.

2. DRAIN TO BE LOCATED ON ALL UPSLOPE SIDES OF OF IRRIGATION AREA.

3. DRAIN TO HAVE UNSPECIFIED FALL.

4. MINIMUM SOCKET DEPTH 100MM INTO CLAY SUBSOIL.

5. DRAIN CROSS-SECTIONAL AREA RELATED TO DESIGN FLOWS AS DETERMINED BY A SUITABLY QUALIFIED AND EXPERIENCED ENGINEER.

6. OFF-SITE DRAIN OUTFALL TO LEGAL POINT OF DISCHARGE SUBJECT TO LOCAL AUTHORITY REQUIREMENTS.

7. ON SITE DRAIN OUTFALL TO INCLUDE APPROPRIATE ENERGY DISSIPATION TO AVOID EROSION.

8. ALL DRAINS AND OUTFALL AREAS SUBJECT TO POST-SPRING INSPECTION.
Appendix I. SJE Consulting General Disclaimer

This report provides advice and recommendations in accordance with the scope of services.

The conclusions and recommendations made are made based upon data derived from examination of records in the public domain, interviews with officers of various Authorities and site conditions observed at the time of writing this report, and are considered to comply with the relevant requirements at the time of publication.

SJE has relied upon available information to form its recommendations and conclusions, however, time and impacts of future events June require further examination and data analysis, and June change the conclusions in this report.

No liability or responsibility can be accepted by SJE if this Report is relied upon by any third party for any purpose other than as identified in this report. If any data, analysis, recommendations or conclusions are unclear, SJE Consulting should be consulted for clarification.