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Ref: 3036_WMR_001

10/06/2022

On-Site Wastewater Management Report for proposed Recreation Facility at 231 Pacific Hwy, Mount White

Whitehead and Associates Environmental Consultants Pty Ltd ("W&A") was engaged by Trevor Clack of Northrop Consulting Engineers P/L (the "Client") to prepare an On-Site Wastewater Management Report (WMR) for proposed developments at 231 Pacific Hwy, Mount White (the "Site"). The Site, identified as Lot 1 DP207158, is approximately 3.34ha in area and is zoned RU1 (Primary Production) under the Gosford Local Environmental Plan (LEP 2014).

We understand Northrop Consulting Engineers P/L is assisting the Owner to prepare a Development Application (DA) to Central Coast Council ("Council") for the expansion on an existing DA of an already proposed 8-bedroom dwelling for the re-design into a commercial "Inn" including a ~130 seat restaurant and a day spa. The DA also includes the construction of 20 garden suite cabins; a pool with ancillary pool conservatory, a yoga studio ("shala"), a storage shed, an ornamental "reflection" pond as well as an array of landscaped pathways, gardens and hardstand areas. All proposed improvements, along with ancillary driveway and car parking areas, are included in this WMR.

The Site is bound by a private rural property to the north, Ashbrook's Road to the east, the Pacific Highway to the south and Calverts Creek to the west. The Site has been cleared of pre-existing structures in preparation for development. The property has mostly been cleared of native vegetation by previous land uses, with large areas of open lawn and grassland. The Site is not prone to flooding and is marginally bushfire affected (Vegetation Category 1 and buffer), as per Council mapping. Potable water will be sourced from roof (tank) supply and no reticulated sewer service is available.

This WMR presents the results of a land capability assessment that considers the inherent conditions and constraints of the Site with regard to On-site Sewage Management (OSSM) along with a conceptual design for a sustainable treatment and land application system suitable for development approval in accordance with relevant standards and guidelines currently enforced by Central Coast Council, as listed below:

- Central Coast Council - Application to Install On-site Sewage Management System;
- Gosford Council Development Control Plan (2014);
- AS/NZS 1547:2012 On-site Domestic Wastewater Management (Standards Australia/ Standards New Zealand, 2012);

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- NSW Health Department; Septic Tank and Collection Well Accreditation Guideline (2001);
- Environmental and Health Protection Guidelines: On-site Sewage Management for Single Households (Department of Local Government, 1998);
- Designing and Installing Onsite Wastewater Systems, A Sydney Catchment Authority Current Recommended Practice (2019); and
- Plumbing and Drainage Code AS/NZS3500.2.

1 Property Information

The following table presents information on the property investigated.

Feature	Description
Site Address	231 Pacific Hwy, Mount White
Lot / DP	Lot 1 DP207158
Local Government Area	Central Coast Council
Land Zoning	RU1 (Primary Production)
Lot Size (ha)	3.34
Sewer Connection Available	No
Potable Water Supply	Roof (tank) water supply

2 Development Proposal

2.1 Description

The proposed development at 231 Pacific Highway, Mount White comprises Stages 1 and 2 of planned development linked to the Site. Development components are listed below:

- an Inn / Restaurant with:
  - commercial kitchen and ~240m^2 dining area (~126 seat capacity);
  - day spa with 10 treatment rooms, a steam room, a pedicure room and amenities;
  - a lounge/function space; and
  - associated facilities such as a lobby, bathroom amenities, storage rooms and wine cellar.
- twenty (20) ~48m^2 detached 'garden suite' cabins;
- guest pool, with ancillary conservatory;
- storage building;
- yoga studio (Shala); and
- walkways, driveways, hardstand areas and landscaped gardens, with a large ornamental (reflection) pond.

2.2 Usage

The expected capacity and utilisation of each development component has been estimated in consultation with the Client, along with data obtained from similar W&A projects. The following assumptions are made:

2.2.1 Restaurant:

- The restaurant will be open for breakfast, lunch and dinner, 7 days per week, with potential for full capacity at all sittings.
- Available dining area in the restaurant is 236m²; with 105m² allocated for inside dining and 131m² for verandah dining (White + Dickson Architect Drawing No. CD.2.2 project; 2016).
- A density limit of ~1.86m² per diner[1] is applied, based on an expected 'fine dining' restaurant; resulting in an assumed capacity of 126 diners.
- Meal windows = 1 hour and 30 minutes for Breakfast, with 2 hour windows assumed for both Lunch and Dinner sittings.
- Average diner cover time will be 70 minutes (the assumed time each diner will spend in the restaurant during the respective sitting, allowing for clearing).
- Restaurant utilisation rates (covers) are estimated based on two (2) factors; sitting timeslot (breakfast, lunch or dinner) and sitting day (i.e. weekday or weekend day). The assumed utilisation summary is provided below:

	% (total capacity)
Weekday (Breakfast)	20%
Weekday (Lunch)	50%
Weekday (Dinner)	35%
Weekend day (Breakfast)	80%
Weekend day (Lunch)	80%
Weekend day (Dinner)	80%
Peak day meal	100%

- The Restaurant is expected to accommodate a maximum of 594 diners on a 'peak' day.
- Eight (8) full-time equivalent (FTE) non-resident staff will tend the restaurant on weekdays, increasing to sixteen (16) staff on weekend days.

2.2.2 Spa

- Operating 7 days a week, daytime hours only.
- 12 customers (guests/visitors) assumed per weekday, increasing to 18 customers on a weekend day and a maximum of 24 customers on a peak day.
- 8 (eight) FTE non-resident staff will tend the spa 7 days per week.

2.2.3 Cabin Accommodation:

- Maximum two (2) guests per room/cabin (1 bed)
- Average 'weekday' occupancy = 60% or ≈24 guests.
- Average 'weekend' day occupancy = 80% or ≈32 guests.
- 'Peak' day occupancy assumes all rooms are fully booked (maximum 40 guests).

[1] (www.dimensions.com/collection/restaurant-layouts)

2.2.4 Bar/Lounge/Function Space

- This area of the Inn is assumed to accommodate 30 customers (guests/visitors) per weekday, increasing to 75 customers on a weekend day and a maximum of 150 customers on a peak (function) day.
- Four (4) FTE non-resident staff will tend the bar 7 days a week (Northrop Due Diligence Report; Ref. NL203092-E01).

2.2.5 Office

- Two (2) non-resident (management/maintenance) staff will be in attendance on weekdays, reducing to one (1) on weekend days.

2.3 Seasonality

Natural seasonality and public holiday (i.e. long weekend) periods are expected to influence occupancy rates at the development, as is commonly experienced in the travel and accommodation industry. For estimation, a 'typical' design year is divided into low, shoulder and high season periods.

'Shoulder' periods are assumed to represent the long-term average occupancy of the development. These periods often fall either side of traditional holiday periods.

'High season' periods represent typical holiday times (e.g. Christmas break or school holiday periods), whereby everyday (weekday and weekend day) occupancy of all development components is expected to increase by ~130% (above the long-term averages).

Similarly, 'Low season' periods fall outside of traditional holiday times (e.g. school term), when it is assumed occupancy will decrease ~30% (below the long-term averages).

The assumed seasonality profile for the development is as follows:

- High Season period: mid-December to mid-February (and Easter break)
- Shoulder Season: mid-February to March; September to mid-December (and long weekends)
- Low Season: April to August

3 Wastewater Generation

3.1 Wastewater Quantity

Sanitary wastewater will be generated from individual development components as described previously (Section 2.2). As with many similar developments, wastewater generation is expected to fluctuate, with both inter-week and seasonal variation common.

To conservatively account for this variation, W&A have estimated wastewater generation based on the seasonal occupancy scenarios outlined above and using 'typical' flow allowances taken from operational guidelines as described in the following sections.

3.1.1 Cross- Patronage

It is reasonable to assume that a large proportion of visitors to the Site will use more than one facility during their stay. The Client has advised that guests staying in the 'garden suite' cabins will have package deal access for all on-site facility usage. On this basis, it is likely that this cross-patronage will result in an over-estimation of wastewater generation as visitors are 'double-counted' in individual development components.

Therefore, rather than differentiating between in-house (guest) and off-site (day visitor) design allowances for the bar, spa and restaurant uses, it is considered simpler to reduce the design flow allowance cabin guests to account for WC/bathroom use at these facilities.

Cabin Guest Design Allowance

The flow allowances associated with the bar, spa and restaurant attended by cabin guests can be reduced by one-third to 4.7 (0.33 x 14), 5 (0.33 x 15) and 8.3 (0.33 x 25) for bar, spa and restaurant use respectively. This totals ~18 L/person/day, which we argue can be removed from cabin guest design allowance.

In accordance with Table H4; AS/NZS 1547:2012 the design allowance for (Motel/Hotel) guests is 220L/person/day. As such, a reduction to 202 L/person/day (220-18) is assumed for cabin guest design allowances.

3.1.2 Design Allowance

Flow allowances for each development component were obtained from National and NSW guidelines as referenced in the following table. Where necessary, estimates are reduced from cross patronage assumptions detailed previously.

Development	Flow Allowance (L/Person/day)	Source
Cabin guests	202	Table H4; AS/NZS 1547:2012 for Motel/Hotel guest (reduced from 220)
Restaurant	25	Table H4; AS/NZS 1547:2012 for Motel/Hotel restaurant “diners"
Bar	14	NSW Septic Tank and Collection Well Accreditation Guideline (2001); Annex 3, for Hotel/Motels “bar patrons"
Spa	15	W&A estimate for day-spa “guests”, assuming WC/basin use only
Non-resident Staff	30	Table H4; AS/NZS 1547:2012 for Motel/Hotel "non-resident staff"

3.1.3 Generation Estimates

Based on expected occupancy (guests, staff and visitors) for individual development components (see Section 2.2) throughout a ‘typical’ year (see Section 2.3) and indicative flow allowances (see Section 3.1.2), anticipated hydraulic loads have been calculated for the proposal and are presented in the following table.

Restaurant attendance at each sitting is a product of four (4) factors; restaurant capacity, meal window time, cover time and restaurant utilisation rate, as expressed in the following formula:

Capacity x [Meal Window (mins) / Cover time (mins)] x Utilisation rate (decimal)

Example: a weekend day Breakfast will involve ~130 covers (126 x 90/70 x 0.8)

3036 - 231 Pacific Highway Mount White, Recreation Facility

	Number	Source	Typical Wastewater Flow Design Allowance (L/p/day)[1]	Unit	Covers/ Persons	Design Wastewater Flow (L/day)	Peaking Factor (%)	Peak Flow (L/hr)
Restaurant	N/A	Breakfast (weekday)	25	diner	32	810	300	135.0
		Breakfast (weekend day)	25	diner	130	3,240		540.0
		Breakfast (peak)	25	diner	162	4,050		675.0
		Lunch (weekday)	25	diner	108	2,700		450.0
		Lunch (weekend day)	25	diner	173	4,320		720.0
		Lunch (peak)	25	diner	216	5,400		900.0
		Dinner (weekday)	25	diner	76	1,890		315.0
		Dinner (weekend day)	25	diner	173	4,320		720.0
		Dinner (peak)	25	diner	216	5,400		900.0
		Non-resident staff (weekday)	30	staff	8	240		40.0
		Non-resident staff (weekend)	30	staff	16	480		80.0
Bar/Lounge/ Function Space	N/A	Weekday	14	patron	30	420		70.0
		Weekend day	14	patron	75	1,050		175.0
		Peak day	14	patron	150	2,100		350.0
		Non-resident staff	30	staff	4	120		20.0
Office	N/A	Non-resident staff (weekend)	30	staff	2	60		10.0
		Non-resident staff (weekend)	30	staff	1	30		5.0
Garden Suite Cabins	20	Weekday	202	guest	24	4,848		808.0
		Weekend day	202	guest	32	6,464		1077.3
		Peak day	202	guest	40	8,080		1346.7
		Non-resident staff	30	staff	3	90		15.0
Spa	N/A	Weekday	15	patron	24	360		60.0
		Weekend day	15	patron	36	540		90.0
		Peak day	15	patron	48	720		120.0
		Non-resident staff	30	staff	8	240		40.0
						Without Cross-patronage	With Cross-Patronage	
					Design Weekday (L/d)	12,210	11,778	1,953
					Design Weekend day (L/d)	21,470	20,894	3,477
					Design Peak day (L/d)	27,430	26,710	4,447

The table shows the generation estimates for each development component as well as a total summed wastewater generation for all development components during an average weekday, weekend day and peak operating day.

Total reductions to account for cross-patronage sum to ~2.62% of the total wastewater generation.

As shown, the design 'peak' day is expected to generate a maximum 26.71kL of sanitary wastewater at the Site. The restaurant is expected to be the major generator (contributing approximately 56% of total wastewater).

3.2 Wastewater Quality

The contaminants in wastewater have the potential to create undesirable public health concerns and pollute waterways unless managed appropriately. As a result, domestic wastewater must be treated to remove most pollutants and enable attenuation of the remaining pollutants through soil processes and plant uptake.

Wastewater generated by the development is expected to be broadly 'domestic' in nature, with combined wastewater; blackwater (toilet) and greywater (kitchen, laundry and shower) streams produced from the Inn and Day Spa operation. However, given the provision of a full commercial kitchen to service the 126-seat restaurant and function space, elevated levels of fats, oils and grease are to be expected. To account for this, pre-treatment of the kitchen waste stream is required (refer Section 5.1).

Pre-treated kitchen wastewater and all other untreated wastewater generated at the Site is expected to have characteristics similar to that described in the table below; which incorporates information taken from NSW DLG (1998).

Parameter	Typical Domestic Range	Expected
Biochemical Oxygen Demand	200-300mg/L	<250mg/L
Suspended Solids	200-300mg/L	<250mg/L
Total Nitrogen	20-100mg/L	~60mg/L
Total Phosphorus	10-25mg/L	~20mg/L
Faecal Coliforms	$10^3 – 10^{10}$ cfu/100ml	10^6 - 10^8 cfu/100ml
Oil and Grease	--	<150mg/L

4 Site and Soil Assessment

The Site investigation was undertaken by Ben Colautti and Charyssa Lawrence of W&A on 20 September 2021. Additional, site and soil investigation was completed in March 2021 by Douglas Partners as presented in their report “On-Site Effluent Disposal Assessment” (DP Project 202936.00). The following tables present the results of our site and soil investigation as well as relevant data from the Douglas Partners (DP) investigation.

A description of site physical constraints and the degree of limitation they pose to OSSM is provided in the table below. Reference is made to the rating scale in NSW DLG (1998).

<table>
<tr><th colspan="5">SITE ASSESSMENT</th></tr>
<tr><th>Parameter</th><th colspan="2">Data / Observation</th><th>Reference</th><th>Classification / Outcome</th></tr>
<tr><td>Climate</td><td colspan="2">The Site experiences a temperate climate typical of South Eastern Australia. Median annual rainfall for the Site is 978mm. Monthly rainfall ranges from 33.9mm in August to 140.4mm in February.
Mean annual pan evaporation for the Site is 1172.4mm. Potential evaporation exceeds rainfall for all months of a typical year at the Site except February, March and June.</td><td>BOM Stations: 61216 (Rainfall) 061351 (Evaporation)</td><td>Minor limitation</td></tr>
<tr><td colspan="2">Hydraulic balance (monthly) attached:
Nutrient balance (annual) attached:
Land Application Area (LAA) sizing attached:
Wet weather storage requirement:</td><td>Yes
Yes
Yes
N/A</td><td colspan="2">As per NSW DLG (1998) and AS/NZS 1547:2012 procedures</td></tr>
<tr><td colspan="2">Flooding
Land Application Area above 1:20 ARI flood level:
Land Application Area above 1:100 ARI flood level:
Electrical components above 1:100 ARI flood level:</td><td>
Yes
Yes
Yes</td><td>PMF Flood Extents and Hazard Category (Central Coast Council)</td><td>Minor limitation</td></tr>
</table>

SITE ASSESSMENT			
Parameter	**Data / Observation**	**Reference**	**Classification / Outcome**
Exposure	The available effluent management area (EMA) at the Site has partial tree coverage, with open grassed areas and landscaping. The EMA has good wind and moderate sun exposure (south-west facing).	Minor limitation	
Slope	Slope gradients range from 3-9% within the available EMA; and ~3% within the proposed LAA.	Minor limitation	
Landform	Landform in the available EMA comprises linear convergent to linear divergent slope configuration.	Minor limitation	
Vegetation	Vegetation within the available EMA includes cleared managed lawn areas and scattered mature eucalyptus trees. Grasses may be prone to reduced health due to soil fertility problems.	Minor to Moderate limitation	
Run-on and Seepage	Localised subsoil seepage reported in the DP investigation (>0.75m) within parts of the available EMA. Road drainage associated with Ashbrookes Rd upslope of the EMA is expected to intercept stormwater from the road surface.	Minor to Moderate limitation	
Erosion Potential	No erosion observed within the available EMA. Potential concerns can be addressed using erosion and sediment controls during construction and revegetation of LAA using turf (refer Section 8.2)	Minor limitation	
Site Drainage	Moderately well drained. Areas of standing water or hydrophytic (water-adapted) vegetation not indicated. Site drainage is assumed to the west towards Calverts Creek.	Minor limitation	
Fill	DP boreholes indicate that shallow fill (gravel) is existent in Douglas Partners BH1 and BH3 in the available EMA (see Figure 1, Appendix A).	Minor limitation	
Groundwater	NSW Office of Water GW bore registry records two (2) bore wells within 250m of the Site. One (1) bore well is located on the Site (GW 100608). This bore is constructed within the potential development footprint and is therefore expected to be decommissioned. A separate bore (GW 046725) is located on an adjacent property, ~70m east of the Site boundary and holds a current licence for domestic use. While bore GW046725 is located within the recommended 250m buffer (DLG, 1998), W&A	Moderate limitation	

SITE ASSESSMENT			
Parameter	**Data / Observation**	**Reference**	**Classification / Outcome**
	are satisfied that the risk to the bore is negligible due to its' elevation (~4m) above the proposed LAA location and its depth to water bearing of >60m below ground surface. The assumed GW gradient from the bore location is west (towards Calverts Creek) and Ashbrookes Road presents a physical barrier between the proposed LAA and the bore; therefore, the risk of subsurface or surface contamination of the bore is considered very low. *A copy of the GWR is provided in Appendix B*		

Applicable Buffers (NSW DLG, 1998)		
Permanent rivers and creeks (100m):	Yes	Not Achievable. Mitigation provided (see Section 7)
Intermittent watercourses, drainage channels and dams (40m):	Yes	Not achievable. Mitigation provided (see Section 7)
Groundwater wells and bores (250m):	Yes	Achievable
In-ground water supply tanks (4m – 15m):	Yes	Achievable
Lot boundaries (12m upslope and 6m downslope):	Yes	Not achievable. Mitigation provided (see Section 7)
Buildings, driveways and swimming pools (6m upslope and 3m downslope):	Yes	Achievable
Limiting horizon (GW, bedrock etc.) (0.6m):	No	Not achievable. Mitigation provided (see Section 6.6.2.1)

Surface Rock / Outcrop	No surface boulders/floaters or rock outcrops observed in available EMA during Site investigation.	Minor limitation
Effluent Management Area (EMA)	Approximately 3,800m^2 of 'available' EMA is identified at the Site (with reduced buffers). This area excludes recommended NSW DLG (1998) and *AS/NZS 1547:2012* setbacks and two (2) s88b 'utility' easements recorded on the property (electricity transmission and water supply). Available EMA is moderately limiting at the Site, as shown in Figure 1, Appendix A.	Moderate limitation

Concluding Remarks

No major limitations to OSSM are identified at the Site.

Surface drainage and (localised) shallow groundwater may pose a moderate constraint to OSSM; however, these limitations can be mitigated or avoided through conservative LAA design, location and installation.

Limited available EMA may present some constraint for provision of 'reserve area' (if required) or for other future development.

SOIL ASSESSMENT (physical)			
Parameter	**Data / Observation**	**Reference**	**Classification / Outcome**
Soil Depth	1,300-1,700mm in available EMA (on bedrock) (DP Project 202936.00)	Minor limitation	
Soil Profile	**W&A Boreholes** BH1 A_1: 0 - 200mm, single grained sandy loam (Cat 2) B_1: 200 - 700mm, single grained sandy loam (Cat 2) B_2: 700 - 1,200mm, moderately structured sandy clay (Cat 5) BH2 A_1: 0 - 150mm, single grained sandy loam (Cat 2) B_1: 150 - 700mm, single grained sandy loam (Cat 2) BH3 A_1: 0 - 100mm, single grained sandy loam (Cat 2) B_1: 100 - 400mm, single grained clayey sand (Cat 1) B_2: 400 - 900mm, moderately structured sandy clay loam (Cat 4) B_3: 900 - 1,200mm, strongly structured sandy clay loam (Cat 4) **DP Boreholes** BH1 F: 0 - 200mm, (gravelly) clayey sand (Cat 1/2) A: 200 – 1,200mm, single grained clayey sand (Cat 1) B: >1,200mm, weakly structured sandy clay (Cat 5) BH3 F: 0 - 200mm, (gravelly) clayey sand (Cat 1/2) A: 200 – 1,400mm, single grained clayey sand (Cat 1) B: >1,400mm, weakly structured sandy clay (Cat 5) BH5 A_1: 0 - 700mm, single grained clayey sand (Cat 1) A_2: 700 – 1,200mm, (gravelly) clayey sand (Cat 1) B: >1,200mm, weakly structured sandy clay (Cat 5) BH7 A: 0 – 1,500mm, single grained clayey sand (Cat 1) B: >1,500, weakly structured sandy clay (Cat 5) *Soil borelogs presented in Appendix B*	Minor limitation	
Depth to Water Table	Subsoil seepage encountered at ~800mm in BH1 and ~750mm in BH2 during W&A investigations. Subsoil seepage encountered in boreholes 1, 5 and 7 at between 300mm and 600mm below natural surface (following heavy rainfall) during DP investigations.	Moderate limitation	
Coarse Fragments (%)	0 - 20% (2 - 20mm gravel and 10 - 70mm sandstone fragments)	Minor limitation	
Soil Permeability	W&A conducted two (2) in-situ soil permeameter field tests in the available EMA: PH1 = 0.20m/day and PH2 = 0.22m/day	See Appendix B	Moderate limitation

SOIL ASSESSMENT (physical)			
Parameter	**Data / Observation**	**Reference**	**Classification / Outcome**
	(See Figure 1, Appendix A for test locations) Soil permeability and textural classification is consistent with soil Category 4 (clay loam) for the limiting subsoil horizon.	for Test Data	
Modified Emerson Aggregate Class (EAT)	Topsoil: 6-5 (stable) Subsoil: 6-5 (stable) in available EMA	Minor limitation	
Soil Landscape	The majority of the Site and available EMA is located on the **Somersby (so)** soil landscape, Landscape: gently undulating to rolling rises on deeply weathered Hawkesbury Sandstone plateau. Local relief to 40 m; slopes <15%. Rock outcrop is absent. Crests are broad and convex, slopes are long, and drainage lines are narrow. Extensively cleared low eucalypt open-woodland and scrubland. Limitations: localised permanent and seasonal waterlogging, moderate erosion hazard, stoniness, very low soil fertility, highly permeable soil.	1:100 000 Gosford - Lake Macquarie Soil Landscape Map (Murphy, 1993)	

Concluding Remarks

Site soils consist of sandy loam (Cat 2) topsoils to 700mm, underlain by sandy clay (Cat 5) subsoils to >1,200mm.

Soil conditions are generally minor in the available EMA; however, low in-situ permeability and seasonal groundwater movement presents moderate limitation to OSSM.

Based on permeability testing (0.20-0.22m/day) the soil is indicative of a Cat 4 soil, with a recommended DLR of 20mm/day for secondary this ensures negligible storage requirement in beds.

These limitations can be mitigated or avoided through conservative LAA design, location and installation. Subsoil drainage controls are recommended to address shallow seepage risk during extended wet-weather periods.

SOIL ASSESSMENT (chemical)			
Parameter	**Data / Observation**	**Reference**	**Classification / Outcome**
pH	Topsoil: 5.7-6.5, Subsoil: 5.2-6.15 Potential impacts of soil acidity can be effectively mitigated through soil improvement measures (see Section 8.1).	Strongly acidic to Neutral	Moderate limitation
EC (EC_e) (dS/cm)	Topsoil: 0.25-0.99, Subsoil: 0.19-0.77	Non-saline	Minor limitation
ESP (%)	5.18 (non-sodic)	DP Project 202936 – BH5 (Eastwest Online lab report)	Minor limitation
CEC (me/100g)	1.4 (very low fertility)		Major limitation
P-sorption (mg/kg)	536 (~8,040 kg/ha) (High)		Minor limitation

Concluding Remarks

Site subsoils exhibit strong acidity and very low fertility. While vegetation health at the Site does not appear to be adversely affected, this limitation can be addressed through soil improvement measures as discussed in Section 8.1.

For more information on soil chemistry see Appendix F.

5 Proposed Treatment System

5.1 Pre-Treatment

Wastewater generated from the commercial kitchen and food preparation area of the restaurant may contain elevated concentrations of fats, oil and grease. These substances do not readily breakdown and can clog treatment and land application systems if not adequately separated from the wastewater stream. Therefore, an appropriately-sized grease arrestor will be required between the kitchen drain and the wastewater treatment system.

A minimum 1.5kL (1,500L) commercial grease arrestor is recommended to be installed, in accordance with Section 4.3.3.1.2 of the Liquid Trade Waste Management Guidelines (DPIE, 2021). This should be operated, monitored and managed in accordance with Section 5.2.1 of the same document.

A Client advised location is provided in Figure 2, Appendix A.

5.2 Load Balancing

Due to the variable nature of wastewater load generation expected at the development, it is common to introduce 'flow balancing' to manage diurnal (daily) and seasonal fluctuations and achieve a more constant daily load to the wastewater treatment system.

This typically involves the installation of storage to withhold excess wastewater/effluent during busy periods and eliminate surge flows that can cause short-circuiting of the STP and/or LAA. It also allows for optimisation of the treatment system (and LAA sizing) by incrementally treating 'peak' flows upon entering lower generation periods.

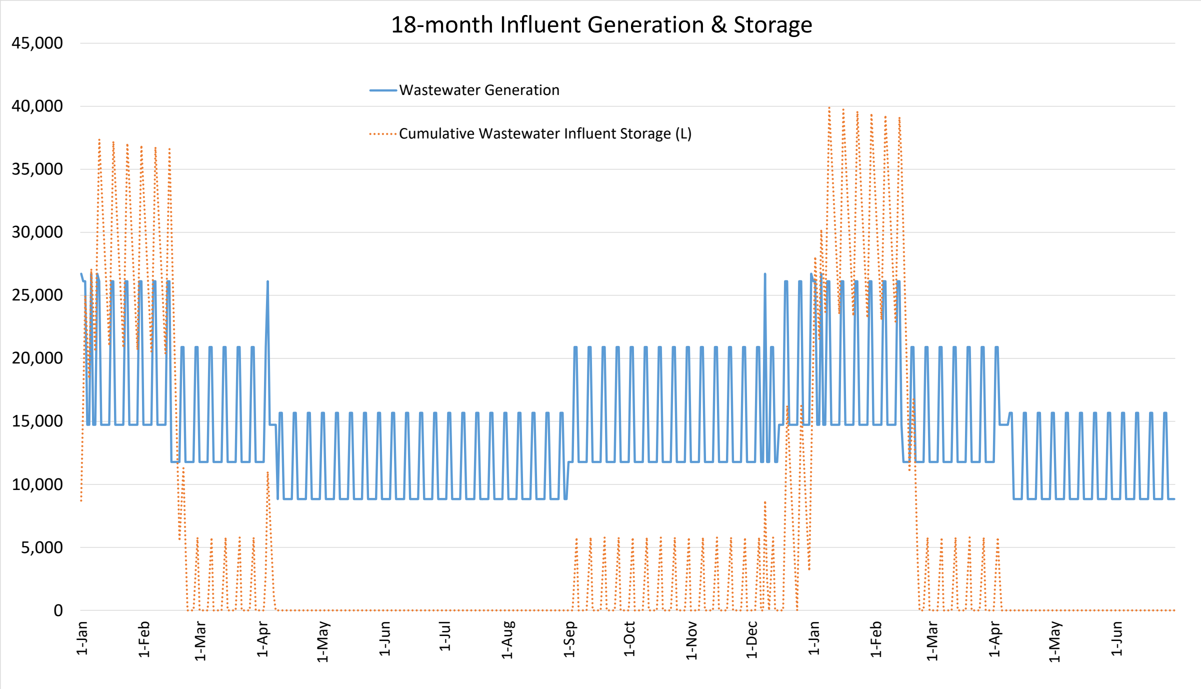
5.2.1 Influent Balancing

Without influent flow balancing, the proposed wastewater treatment system would require sufficient capacity to instantaneously treat all wastewater generated on a 'peak' operating day (estimated >26.71kL).

To determine the required size of the influent storage necessary to adequately balance the expected hydraulic loads from the development, an 18-month flow balancing analysis was prepared (copy attached at Appendix D). The analysis is used iteratively to determine an optimal balance between storage volume and wastewater treatment capacity, taking into consideration the variable generation volumes estimated throughout the operating year.

From the analysis, it can be demonstrated that based on the installation of influent flow balancing tank(s), the required treatment volume can be sustainably reduced to **18,000L/day**. This value has been used as the minimum 'design' treatment volume required at the Site under the development scenario.

The results of the analysis based on an 18-month operating cycle with an STP capacity of **18,000**L/day are provided graphically (below).



As can be observed the peak storage requirement occurs over the summer period where consistently high daily flows are expected. A storage volume of **50,000L** (rounded from 39,905L) is recommended.

5.2.2 Influent Balance Tanks

A nominal location for the balance tank(s) is west of the Inn carpark and below grade for visual amenity. The tank(s) should be fitted with an appropriate timed dosing mechanism to evenly transfer wastewater to the STP throughout the day up to the design load (**18,000**L/day) and should also include visual/audible high-water alarm and a 100mm PVC (high-level) bypass to the STP. A dual macerator pump set-up is recommended for pump failure contingency. With a 12.54kL (50-37.46kL) of free space if both pumps fail then ~11.3 hours (12.54/26.71 x 24) is provided to rectify pump failure on a peak day.

A client advised location is provided on Figure 2, Appendix A.

5.3 Treatment Options

Given the limited land area available for effluent application and the (potential) proximity of Guests and Site visitors, secondary treatment is considered the most suitable treatment standard to service the development.

Any proposal not of a domestic nature, or expected to receive an equivalent daily wastewater volume between 10 EP and 2,500 EP, is typically regarded as a 'commercial' sewage management facility, or sewage treatment plant (STP).

Appropriate secondary treatment technologies include (but are not limited to) the following:

- Aerated wastewater treatment systems (AWTS);
- Media filter systems; and
- Membrane filter systems.

Disinfection units are typically installed as a standard component of proprietary secondary treatment systems or can be installed as an add-on by the system supplier. We recommend that a disinfection system is installed with the chosen system. Disinfection units typically use one (1) or a combination of the following disinfection methods:

- Ultra violet (UV) irradiation; and/or
- Chlorination.

The secondary STP selected must be able to treat the (balanced) hydraulic load of up to 18,000L/day and consistently achieve the prescribed minimum effluent quality standard as detailed in Table 14 of the NSW DLG (1998) and reproduced below.

Parameter	Loading
Biochemical Oxygen Demand	<20mg/L
Suspended Solids	<30mg/L
Faecal Coliforms	<30cfu/100mL
Total Nitrogen	≤30mg/L
Total Phosphorus	≤10mg/L

The listed phosphorus and nitrogen concentration values are targets (only) and have been adopted for nutrient balance modelling.

5.3.1 Preferred STP

A commercial Aerated Wastewater Treatment System (AWTS) is recommended to service the proposed development.

These systems provide a robust, low maintenance treatment process and produce a high quality effluent suitable for controlled landscaping use. Details of the proposed ‘commercial’ AWTS will be provided by a licensed Contractor/installer, as selected by the Client. The system will likely include a primary/surge-management tank followed by a secondary treatment reactor, clarifier and disinfection and irrigation components.

Commercial secondary treatment systems are not accredited by the NSW Ministry of Health (NSW Health). Individual treatment systems will need to be designed as ‘fit-for-purpose’ for the site-specific wastewater load.

5.3.2 System Location

A client advised location is provided on Figure 2, Appendix A.

5.3.3 System Operation and Management

Successful performance of the OSSM system relies on good operational practice, as well as periodic monitoring and maintenance of the system. Certain aspects of monitoring and maintenance will be the responsibility of the property owners, while other matters will be addressed through routine servicing by a suitably qualified technician at the prescribed interval, as determined by Council.

All commercial secondary treatment systems are required to be serviced on a quarterly (3 monthly) basis by an approved service provider, with a copy of the inspection report submitted to Council.

5.4 Sewerage layout

W&A assume two (2) or more sanitary drains will be constructed from the Inn building, along with a separate drain line collected sewage from the 20 Guest Cabins.

Final drainage design will be the responsibility of a licensed plumber. All proposed sewerage will need to be installed and operated in accordance with NSW Plumbing and Drainage Code; AS/NZS 3500.2 or Water Services Association of Australia's (WSAA) sewerage code.

6 Proposed Effluent Management

This section describes the Site's capability for effluent management and provides design details, including sizing of the proposed LAAs. As detailed above, secondary treatment (with disinfection) is considered the most appropriate wastewater treatment option.

6.1 Buffers

Buffer distances from the available EMAs are recommended to minimise risk to public health, maintain public amenity and protect sensitive environments. Buffer or setback distances are recommended to provide a form of mitigation against unidentified constraints and reduce potential pathways of human and environmental exposure.

The following environmental buffers have been adopted for the Site, based on Table 5 of DLG (1998) and Council requirements for subsurface irrigation systems:

- 250m from domestic groundwater bores;
- 100m from permanent watercourses (reduced);
- 40m from intermittent watercourses and dams (reduced);
- 6m if area up-gradient and 3m if area down-gradient of property boundaries and driveways for SSI and 12m if area up-gradient and 6m if area down-gradient of property boundaries and driveways for absorption systems (reduced);
- 6m from paths;
- 6m from pools;
- 6m from dwellings; and
- Outside of 1 in 20-year flood levels

With the exception of the GW bore (GW 046725), property boundary, Calverts Creek (permanent waterway) and the drainage channel, all of the applicable buffer distances are achievable, as shown on the Site Plan (Figure 2, Appendix A).

6.2 LAA Options

W&A have considered the suitability of various land application systems in relation to the identified Site and soil limitations. In determining the suitability of the various options, we have assessed the site constraints and the relative environmental and public health risks associated with each.

The table below provides a summary analysis of the range of effluent land application options considered and presents a recommendation for the preferred approach.

Land Application Option	Suitable	Reasoning
Absorption Trenches/ Beds	Yes	Soil absorption systems are suitable for Cat 1-4 soils where available soil depth >1.2m. Secondary effluent quality effluent also means that the risk of clogging and groundwater contamination is appropriately mitigated.
ETA Beds	No	Not recommended for Cat 1 - 3 soils, per AS/NZS 1547:2012; Table L1.
Mounds	Possible	While suitable, Site conditions do not indicate the necessity for mounds to overcome an identified soil constraint. Mounds are further discounted due to their substantial cost.
Surface Irrigation (SI)	Possible	Considered suitable as garden irrigation, provided potential contact risks are suitably mitigated.
Subsurface Irrigation (SSI)	Yes	Subsurface irrigation is considered best-practice for this Site as it minimises the contact risk with the public, whilst maximising evapotranspiration for effective effluent assimilation. Considered suitable as garden and lawn irrigation reuse with buffer justification in accordance with Appendix R of AS/NZS 1547:2012.

Two (2) LAA options are considered suitable at the Site; pressure-dosed ‘raised’ absorption beds and subsurface irrigation in dedicated lawn areas. Further detail and discussion of each LAA option is provided in Section 6.6 following.

6.3 Effluent Flow Balancing

As per section 4.2, optimisation of the LAA is proposed on-site, in the form of effluent balancing.

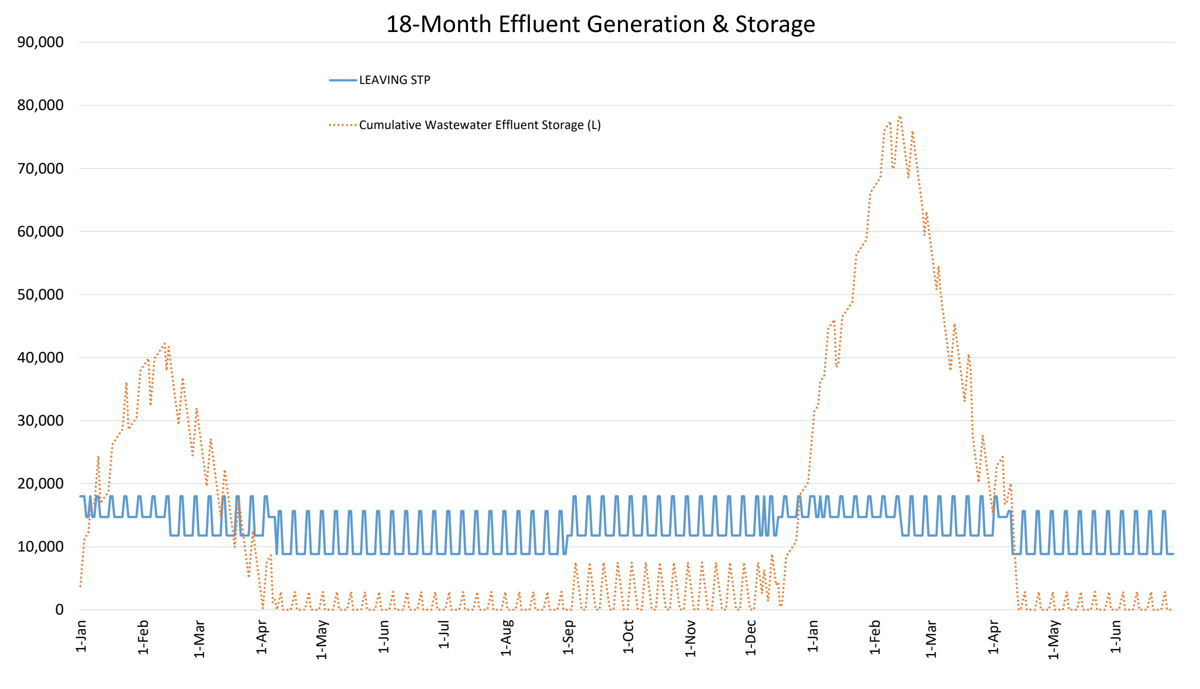
This involves the installation of effluent storage tanks to hold excess effluent during peak generation periods and eliminate surge flows that can cause overloading of the LAA. It also allows for optimisation of LAA sizing by ensuring that sufficient capacity is available throughout the year while managing soil loading rates to prevent off-site impact.

To determine the required size of effluent storage necessary to adequately balance the expected hydraulic loads from the STP, an 18-month flow balancing analysis was prepared (copy attached at Appendix D). The analysis is used iteratively to determine an optimal balance between effluent storage volume and LAA loading capacity, taking into consideration the variable assimilation capacity of the LAA throughout the year.

Striking a balance between installation cost and area requirements, W&A found an optimal relationship between LAA size and storage capacity. The analysis determined the optimal set-up is a maximum LAA acceptance rate of **14,250L/day** with **100,000L** (rounded from 78,373L) of required effluent storage capacity.

This ensures that while the STP has the capacity to manage daily generation up to 18,000L, the maximum load distributed to the LAA will be ≤14,250L/day. Of this peak day flow it is designed that 2,850L/day will go to SSI and 11,400L/day will go to beds.

Effluent storage levels within the balance tanks are expected to peak over summer throughout an 18-month period shown within the ‘cumulative wastewater storage’ column of the Effluent Flow Balancing sheet in Appendix D and as summarised graphically (below).



6.3.1 LAA Dosing design

It is proposed that twelve (12) beds and three (3) SSI zones will receive a (maximum) combined load of ≤14,250L/day. Each bed and zone is designed to accept 950L/day this ensures a 2mm storage maximum in beds (conservative). This results in 15 separate zones/beds (15 x 950L = 14,250), W&A propose three (3) SSI zones and twelve (12) absorption beds.

It is proposed effluent leaving the effluent balance tank will separate into 3 pipes via a 3-port indexing valve. Effluent in each of these three (3) pipes will then each enter 5-port indexing valves successfully equally separating the effluent stream into 15 SSI zones/beds. A timed dose mechanism (or similar) will ensure each pump cycle is 950L.

6.3.2 Effluent Balance Tank Location

A client advised location is provided on Figure 2, Appendix A.

6.4 Land Application Area (LAA) Sizing

Water and nutrient balance modelling were undertaken to determine the sustainable application rate for Site soils and to estimate the necessary size of the required LAA's to manage the 'design' hydraulic and nutrient loads from the development. The procedures for this generally follow the NSW DLG (1998) guidelines.

The water balance used is a monthly model adapted from the "Nominated Area Method" described in NSW DLG (1998). These calculations determine the minimum LAA size for the given effluent load for each month of the year. The water balance can be expressed by the following equation:

Precipitation + Effluent Applied = Evapotranspiration + Percolation + Storage

A conservative (annual) nutrient balance was also undertaken, which calculates the minimum application area required to enable nutrients to be assimilated by the soils and vegetation. The nutrient balance used here is based on the simplistic NSW DLG (1998) methodology but improves this by more accurately accounting for natural nutrient cycles and processes.

Model inputs and results of the analyses for both LAA options are presented in the table below. Full monthly water and nutrient balance results are presented in Appendix C.

Parameter	Units	Value	Comments
Design (daily) hydraulic load	L/day	11,400 (Beds) 2,850 (SSI)	Balanced load - see Section 6.3.1
Precipitation	mm/month	Median monthly	Lower Mangrove (Popran Rd) 61216
Pan evaporation	mm/month	Mean monthly	Peats Ridge (Waratah Road) 061351
Retained rainfall	Unitless	0.8	Conservative assumption that 80% of rainfall remains on-site and infiltrates the soil
Crop factor	Unitless	0.5-0.8	Crop factor adjusted for seasonal variation throughout the year.
Design (soil) loading rate/Irrigation rate	mm/day	20 (Beds) 5 (SSI)	Beds DLR based on Permeameter testing and conservative storage design (see Appendix C) SSI DIR Based on Table M1 *AS/NZS 1547:2012* for structureless Cat 2 soils with secondary quality effluent
Effluent total nitrogen concentration	mg/L	30	Expected effluent quality following secondary treatment, from Table 14 NSW DLG (1998)
Nitrogen lost to soil processes	annual percentage	20	Geary and Gardner (1996)
Effluent total phosphorus concentration	mg/L	10	Expected effluent quality following secondary treatment, from Table 14 NSW DLG (1998)
Soil phosphorus sorption capacity	mg/kg	536	Lab results for BH5 (Eastwest Online)
Nitrogen uptake rate by plants	kg/ha/yr.	260	Conservative estimate based on 50% of the published nutrient uptake rate in DEC (2004) for kikuyu grass (September-March)
Phosphorus uptake rate by plants	kg/ha/yr.	30	Conservative estimate based on 50% of the published nutrient uptake rate in DEC (2004) for kikuyu grass (September-March)
Design life of system (for nutrient management)	Years	50	NSW DLG (1998) guideline recommended design life

Results		
	Bed LAA	SSI LAA
Water Balance (m^2)	600	690
Nitrogen Balance (m^2)	**3,841**	**960**
Phosphorus Balance (m^2)	3,769	942

As shown, the minimum area required to manage the expected ‘design’ hydraulic load for the development comprises 600m^2 of ‘bed’ basal area and 690m^2 of SSI, based on the most limiting climate month of the year (i.e. June) and minimal allowance for (in-bed) effluent storage of **2mm** making DLR for beds adequately conservative.

Nutrient uptake is not a traditional component of soil absorption system design; however, modelling results indicate that a (minimum) area of 3,850m^2 (rounded) is required for the bed LAA and a further 960m^2 is required for the SSI LAA to accommodate nutrient assimilation (nitrogen).

Based on this, a nutrient buffer no less than 3,250m^2 (3,850m^2 - 600m^2) for the bed LAAs and 270m^2 (960m^2 - 690m^2) for the SSI LAA should be maintained in the adjacent and downslope area of the LAA footprint to assimilate excess nutrients within the surrounding soils and pasture.

The required nutrient buffers are shown on the Site Plan (Figure 2, Appendix A).

6.4.1 LAA Positioning

The preferred location of the ‘bed’ LAAs is identified along the eastern Site boundary, avoiding the water supply easement from Calvert’s creek as well as an intersecting pathway (see Figure 2, Appendix A).

The preferred location of SSI LAA is within proposed lawn areas at the ‘front’ of the Site and two zones at the ‘rear’ of the Site. The proposed irrigation area is ~80m from Calvert’s creek (the closest point).

6.5 Model Refinement

The majority of the generated effluent load will be dispersed outside of the recommended (DLG, 1998) 100m buffer to Calverts Creek; however, the concentrated nature of the proposed ‘bed’ LAA design warrants additional design investigation and analysis to support the sustainability of the approach.

While the (lumped) monthly water balance approach is useful for preliminary design, it is coarse and does not fully account for inter-month variation in climate inputs (particularly rainfall). Therefore, daily soil-water modelling is used to confirm the sustainability of the design.

6.5.1 Modelling Overview

The LAM is a Microsoft Excel based daily water, nutrient and pathogen mass balance model developed by BMT WBM for predicting the performance of OSSM systems under varying environmental conditions. The algorithms in the model have been derived from the Decentralised Sewer Model (DSM) and tailored to suit a single site application. It can assess long-term environmental and human health performance of wastewater systems.

The LAM requires a range of bio-physical parameters as inputs to determine whether a LAA option would be sustainable at the Site. The model predicts OSSM performance by simulating the movement of pollutants within the effluent load as it travels from the point source (on-site or community-scale systems) as surface or subsurface flows. The LAM does not predict the minimum area required to achieve zero surface runoff or deep drainage, instead, like the nominated area approach of the monthly water balance, the model predicts the surface and subsurface discharges based on a set of nominated conditions such as receptor sensitivity, soil, slope, climate, wastewater input and available area.

A summary of the model processes, inputs and results is provided below.

6.5.2 Model Inputs

The simulations were run for a data period of 60 years (1961-2021) and represent a conservative estimate of long-term performance based on available information and a set of assumptions as detailed.

Simulations were carried out for the preferred land application, as follows:

- Run 001 modelled flow into 600m^2 of bed LAA.
- Run 002 modelled flow into 690m^2 of SSI LAA.

Daily climate data used in the model was sourced from 'SILO Data Drill' information available through the QLD Department of Environment and Science. The adopted SILO data set uses the (FAO56) Penman-Monteith methodology to estimate reference evapotranspiration (ET0), which is a function of both evaporation and transpiration factors, based on a specific reference crop planted in the LAA (assumes turf).

Rather than simplistic loading rates, as utilised in monthly modelling, the LAM inputs include a more detailed estimation of the soils ability to receive, store and transmit water by approximating parameters such as effective saturation, field capacity, and the infiltration exponent. Soil input data is based on soil investigations undertaken within the EMA for the Site.

6.5.3 Results

Hydraulic and nutrient generation is divided into surplus loads discharged to the ground surface as ‘surface surcharge’ or draining below the root zone with subsequent (eventual) groundwater migration to surface water bodies or aquifers as ‘deep drainage’. The following sections outline the results of the modelling and their compliance with environmental and health protection objectives.

Copies of all LAM inputs and output results are presented in Appendix C.

<u>Hydraulic Loads</u>

Modelling of the movement of water, from both applied effluent (based from the “LAA volume” column of the flow balancing spreadsheet in Appendix D) and rainfall, through the soil is a key component of the LAM. The table below presents the mean annual overflow, surface surcharge and deep drainage predicted for the 60-year modelling period.

Parameter	**Run001**	**Run002**
Run Description	60 year modelled flow	60 year modelled flow
Total LAA (m^2)	600m^2	690m^2
Surface Surcharge Frequency (days/year)	6.7	0.0
Surface Surcharge as % total WWF	1.1	0.0
Deep Drainage (mm/day)	15.11	3.05

Nutrient and Pathogen Results

The following table summarises the predicted mean annual nutrient and pathogen loads generated by the LAA design and potentially released beyond the LAA footprint.

	Parameter	TP (kg/yr)	TN (kg/yr)	Total Virus (MPN/L)
Run 001	**Deep Drainage Output**	31.9	11.8	0.8
	Surface Surcharge Output	0.5	0.1	N/A
Run 002	**Deep Drainage Output**	6.3	0.3	2.6
	Surface Surcharge Output	0.0	0.0	N/A

6.5.4 Conclusion

Daily soil-water (LAM) modelling shows that surcharge (surface expression of effluent) is not expected based on the proposed (bed and SSI) LAA design. Deep drainage is the principal pathway for hydraulic and nutrient movement through and away from the LAAs.

Daily water and nutrient balance results are presented in Appendix C.

6.6 LAA Design and Construction

A detailed land application system design is beyond the scope of this WMR; however, this should be prepared upon receipt of development approval and before installation of the OSSM system. The detailed design should be undertaken by a specialist Contractor experienced with wastewater applications.

6.6.1 Absorption Beds

A conventional bed design allows for the safe and reliable application of generated effluent within the identified LAA at loading rates appropriate for the Site (subsoil) conditions. During wetter periods of the average climate year, treated effluent can be safely stored in the bed for later infiltration. A 'typical' bed installation comprises 300mm of (20-40mm) distribution aggregate below 100mm topsoil. A standard drawing of a generic absorption bed system can be found as Appendix L in *AS/NZS1547:2012*.

Based on the LAA sizing, W&A recommends the installation of twelve (12) pressure-dosed beds with dimensions of 2.5m (width), 20m (length) and 0.3m (depth).

The beds should be constructed in accordance with Appendix L in AS/NZS1547:2012 and the construction diagram presented as Figure 4 in Appendix A of this WMR.

The beds must be installed by a professional experienced in wastewater to ensure that effluent is distributed evenly across the entire area serviced. The finished ground surface of the beds should be mounded by 300mm to ensure 600mm free draining soil below the base of the bed (see section 6.6.1.1). The installer should also be careful to ensure that the minimum buffer distances from the LAA to property boundaries, drainage channels and the permanent waterway (Calverts Creek) are met.

6.6.1.1 Topsoil Improvement

The bed is designed with a DLR of 20mm/day in accordance with permeameter testing of the topsoil and conservative bed design. With ~700mm topsoil (section 3) overlying a sandy clay and 600mm of free draining topsoil required from the base of the bed (400mm below surface) a 300mm topsoil improvement is required.

The topsoil fill should overly all twelve (12) beds with 3:1 batter extending down from all sides. This topsoil can likely be won from the Inn and cabins building envelopes.

6.6.1.2 Distribution

W&A recommend a pressurised distribution system, which involves installation of two evenly spaced laterals within each bed (see Figure 4, Appendix A for construction guidance).

To optimise LAA performance, a dedicated distribution manifold will be installed within the beds. Distribution will be achieved by drilled PVC pipe (per LPED installation), and must be sleeved with 90mm slotted PVC pipe and with manual flush valves (in valve box) fitted to the terminal end of the distribution manifold on the bed.

A hydraulic indexing valve (or similar) should be fitted to evenly distribute the design hydraulic load evenly between the two (2) beds throughout the day.

It is important to ensure that the irrigation pump installed in the effluent balance tank is capable of managing ‘duty’ requirements for the LAA distribution system (installer to confirm). The details of the selected pump will be provided to Council with the application.

6.6.2 SSI

A nominal location for the SSI LAAs is shown in Figure 2, Appendix A. This area will be lawn. It is expected that adequate irrigation coverage can be achieved without comprising plant health.

Proprietary, pressure-compensating subsurface drip (PCSD) irrigation pipe designed for use with treated effluent should be used that will ensure distribution of effluent at uniform, controlled application rates. These products have been specifically designed for use with effluent and allow for the higher BOD_5, suspended solids, nutrient and biological loads usually present in effluent compared to potable water. They contain specially designed emitters that reduce the risk of blockage, typically incorporating chemicals that provide protection against root intrusion and biofilm development (e.g. Trifluralin or copper). The drip lines are coloured lilac to clearly identify that they are irrigating treated effluent

A critical element of the design process is irrigation hydraulics including selection of appropriate dripline, dosing and flush manifold pipe, lateral spacing and pump performance. PCSD typically needs an operating pressure at the emitter of 10-40m (head) to maintain pressure compensation. As such, higher head, low flow pumps are required to service drip irrigation systems that differ from pumps traditionally used in OSSM. This pump will also operate absorption beds adequately.

Lateral pipes should be spaced to provide good and even coverage of the area they service. Generally, they should be no more than 0.6m apart, roughly parallel and installed along the slope contour.

Effluent must be applied evenly across the LAA. It is recommended that the LAA be constructed in three (3) 230m^2 zones.

A detailed land application system design is beyond the scope of this report; however, this should be prepared upon receipt of development approval and before the installation of the system. The detailed design should be undertaken by an irrigation specialist experienced with wastewater applications. The design should include consideration of the following matters:

Irrigation drippers may be arranged in a moveable network and comply with the following design criteria:

- procedures for irrigation scheduling should be discussed, including information on timing and duration of irrigation and monitoring of Site and soil conditions to ensure that effluent is not irrigated when soils are saturated;
- regular inspection of the irrigation area should be undertaken to ensure that the system is serviceable, is effectively distributing the effluent and is not resulting in overloading and soil saturation over all or part of the irrigation area;
- the irrigation lines should be flushed regularly following the installer's recommendations;
- vegetation within the irrigation area should be regularly mowed and removed from the area to maintain nutrient budgets;
- An in-line 120µm disc filter should be installed downstream of the effluent balance tank to minimise the amount of solids entering the pipelines. This must be removed and cleaned regularly (at least at 3-monthly intervals). In addition, a flush main may be installed to periodically clean-out the irrigation lines to provide effective long-term performance. Either manual or automatic flush valves may be installed, with flush water directed back to the treatment system or absorption bed in the LAA. Air release valves will be installed at the high points in individual irrigation areas to prevent soil particles being sucked into the lines at the end of pump cycles as pipelines depressurise;
- no structures should be built or placed within the identified irrigation area; and
- Appropriate signage should be erected around the irrigation field indicating the use of effluent for irrigation, for example; 'RECLAIMED EFFLUENT – NOT FOR DRINKING'.

6.7 Reserve LAA and Storage redundancy

The proposed OSSM system design provides redundancy via three (3) mechanisms; tank storage, bed storage and reserve LAA.

6.7.1 Tank storage

W&A recommend that area north of the proposed 100,000L effluent balance facility (refer Figure 2, Appendix A) be reserved for potential installation of additional storage tanks (if deemed necessary).

6.7.2 In-Bed Storage

The proposed pressure-dosed absorption beds design assumes negligible storage (<2mm) for any month of the climate year. This value allows for additional water to be stored within the beds for short periods in the event of extended wet-weather periods without risk of surcharge.

6.7.3 Reserve LAA

Council require that a reserve LAA be available in the event of future problems with the preferred land application system installed. The provision of a 100% reserve LAA is not wholly achievable within the available EMA; however, W&A propose that 690m^2 of 'spare' EMA, south of the drainage channel, be maintained as reserve LAA (SSI).

7 Buffer Justification

7.1 Buffer Risk Assessment

A risk assessment was undertaken to support an appropriate reduction in the buffer to Calverts Creek, property boundaries and drainage channel for the proposed LAA locations. The risk assessment procedure is outlined in Appendix R of *AS/NZS 1547:2012*.

AS/NZS 1547:2012 recommends that if a high level of constraint is identified for any Site feature, the maximum setback values should be considered. However, in practice "the overall setback distance should be based on an evaluation of the [relevant] items and corresponding sensitive features and how these interact to provide a pathway or barrier to the movement of wastewater to site features.

The following mitigating assumptions are used in the proposed LAA design to support a reduction in the aforementioned buffer distances:

- Secondary treated effluent (with disinfection);
- Slope ≤10% within proposed LAA; and
- Subsoil application method, with >1.2m soil depth.

Based on this analysis, a reduced setback to the identified permanent waterway (Calverts Creek) from 100m to **30m,** a reduced setback to the identified property boundary from 6 to **3m** and a reduced setback to the identified drainage channel from 40 to **30m** is supported. Appendix E of this WMR provides additional information on the analysis method and full results. Buffer distances are shown on Figure 2 Appendix A.

7.2 Pathogen Transport

To address concerns regarding the transport of pathogens away from the proposed LAA towards sensitive subsurface receptors (Calverts Creek) we have considered the movement of viruses away from the LAA using an established 1-dimensional viral die-off model developed by Beavers and Gardner (1993) and refined by Cromer *et al*. (2001). Details of the methodology can be found in Cromer *et al*. (2001).

The model generally applies to wastewater moving in saturated soils, i.e. in shallow GW beneath a LAA. These conditions are considered most conducive to pathogen transport. In unsaturated (vadose zone) soils the travel distances will be substantially less. Surface transport in stormwater runoff is another obvious transport pathway for pathogens. However, the preferred system is based on subsurface application, where the risk of effluent resurfacing and running off-site is negligible.

Some key assumptions used in the modelling are provided below:

- Bacteria have lesser die-off times than viruses and can therefore be assumed to be eliminated within a shorter distance than viruses (Cromer et al., 2001);
- Viral reduction has been set at three (3) orders of magnitude. This figure is commonly used for secondary treated effluent to achieve total reduction of viral pathogens; and
- The average GW temperature is estimated at 11.1ºC. Cooler temperatures allow viruses to reside longer in the soil and hence provide potentially greater travel distances. Average GW temperatures closely approximate mean minimum air temperatures; therefore, the assumption of 11.1ºC is considered conservative.

The assumptions used in the modelling exercise and predicted maximum viral transport distances at the Site are provided in the following table. Appendix E provides additional information on the modelling methodology and full results.

Parameter	Value
Groundwater temperature (ºC)	11.1
Porosity of soil (decimal)	0.44
K_{sat} (m/day)	3.0
Groundwater gradient (%)	6
Depth to groundwater (m)	0.7
Horizontal distance travelled in groundwater (m)	**22.9**

Viral die-off modelling demonstrates that with secondary treated effluent, as proposed for OSSM at the Site, in Cat 2 topsoil, with a maximum slope of 6%; 100% pathogen reduction within the soil is expected to occur within **22.9m** from the LAA boundary.

7.3 Risk Outcome

Based on our analysis, the risk of hydraulic, nutrient and pathogen export to surface waters and groundwater posed by the proposed OSSM system is deemed acceptable. Furthermore, the human and environmental health risk to the public is considered low.

8 Mitigation Measures

8.1 Soil Improvement

Given that Site soils have very low fertility and are identified as strongly acidic vegetative growth may be impacted within the LAA. These properties can combine to reduce the soils' capacity to sustainably manage wastewater.

Prolonged application of sodium rich wastewater can exacerbate the situation. Application of a calcium mineral is a recognised way of reducing the effects of poor soil fertility and instability. It does this by supplying calcium to the affected soil and thereby elevating calcium concentrations with respect to sodium. Added calcium will improve the soil CEC and Ca/Mg ratio, improving fertility, while reducing the potential for soil structural degradation. Gypsum is the preferred soil amendment for improving soil fertility via raising calcium levels.

Site soils are defined as very strongly acidic; lime application is recommended to off-set potential future impacts on vegetation and pipework while improving the calcium / magnesium ratio and general soil fertility.

Gypsum and Lime are only slowly soluble in water, so simply broadcasting at the surface can be of limited benefit as it can take a long time for the calcium to penetrate the soil and reach the deeper soil layers. Therefore, it is recommended to incorporate a 50/50 Gypsum/Lime mixture into the subsoil during construction of the land application system. A suitable application rate of approximately 0.6kg/m^2 should be applied.

8.2 Vegetation Establishment

Vegetation that is suited to the application of effluent, preferably with high water and nutrient requirements (such as turf) should be established over the LAA following construction. A complete vegetation cover is important to reduce the erosion hazard and optimise water and nutrient uptake. It is possible that the current lawn within the EMA is feasible for use as turf cover, if effectively protected during excavation.

It is recommended to establish and maintain a vegetated buffer around the LAA. Plants must be selected that will not be so large as to shade the LAA once fully grown but ideally have high nutrient uptake. It is important that the LAA receives maximum exposure to sun and wind to maximise evapotranspiration.

To maximise assimilation of effluent-borne nutrients within the LAA, vegetation should be harvested and removed from the site under a programmed maintenance scheme and mulched elsewhere on-site for use in other landscaped areas that are not used for wastewater application. Mulching the clippings back onto the area from which they were cut is not recommended. An alternative is to dispose clippings in the general waste bin, or green waste bin collection service, if provided.

8.3 Stormwater Management

The performance of LAAs (and potentially treatment systems) can be adversely affected if stormwater is allowed to run onto these areas. Stormwater diversion berms or drains are designed to collect, divert and dissipate collected run-on away from the LAA.

W&A recommend installing a stormwater diversion berm upslope of the proposed LAA (see Figure 2, Appendix A) to minimise potential impacts of run-on. The structure should be designed and installed by a suitably qualified professional and be compliant with relevant guidelines and standards. The outlet must be stabilised and must discharge water in a safe location where it will not create an erosion hazard or impact on structures or neighbouring properties.

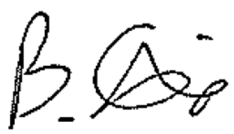
For reference, a standard drawing of an upslope diversion drain is presented as Figure 6, Appendix A of this WMR.

9 Conclusions and Recommendations

This completes our onsite wastewater management report for the proposed Recreation Facility at 231 Pacific Highway Mount White. To ensure the OSSM system is in compliance with Council's requirements, we recommend the following system set-up:

- Installation of a ≥1,500L grease arrestor immediately downstream of the restaurant kitchen.
- Installation of an in-ground 50,000L influent balance tank/pump well west of the Inn carpark. An appropriate mechanism should be in place to evenly transfer up to 18,000L/day of wastewater to the STP and should also include visual/audible high-water alarm and a 100mm PVC (high-level) bypass to the STP.
- Installation of a ≥18,000L/day 'secondary' STP. W&A recommends a commercial Aerated Wastewater Treatment System (AWTS) with disinfection.
- Installation of ≥100,000L worth of effluent storage on-site immediately downstream of the STP. W&A proposes one 100,000L effluent balance tank with an appropriate mechanism to evenly transfer wastewater to the LAAs throughout the day up to the design capacity and should also include visual/audible high-water alarm.
- The installation of 600m^2 of absorption beds in the form of twelve (12) 50m^2 beds. The installation of 690m^2 of subsurface drip irrigation in the form of three (3) 230m^2 zones. Each LAA must be installed within EMA on-site as per Figure 2 Appendix A.
- Each bed shall incorporate an additional 300mm of locally won topsoil fill of 300mm with a 3:1 batter on all sides.
- All aforementioned OSSM systems connected by piping in accordance with Plumbing and Drainage Code AS/NZS3500.2 and sized as per estimated wastewater generation values.
- Effluent or influent delivery pipes must be buried at a minimum depth of 500mm under any trafficable surface to prevent damage from compaction;
- A complete vegetation cover must be established and managed throughout the LAAs.
- No vehicles or livestock should be allowed to enter the LAA.

Yours Sincerely,



Ben Colautti

Environmental Consultant
Whitehead and Associates Environmental Consultants Pty Ltd

Appendix A

Figures

Figure 1: Site Plan Showing the Available Effluent Management Areas

3036: Onsite Wastewater Management Plan - Recreation Facility 231 Pacific Highway, Mount White, NSW

Whitehead & Associates Environmental Consultants

(Approx Scale) 0 50 100 150 200 m

Revision	1
Drawn	BC
Approved	MS

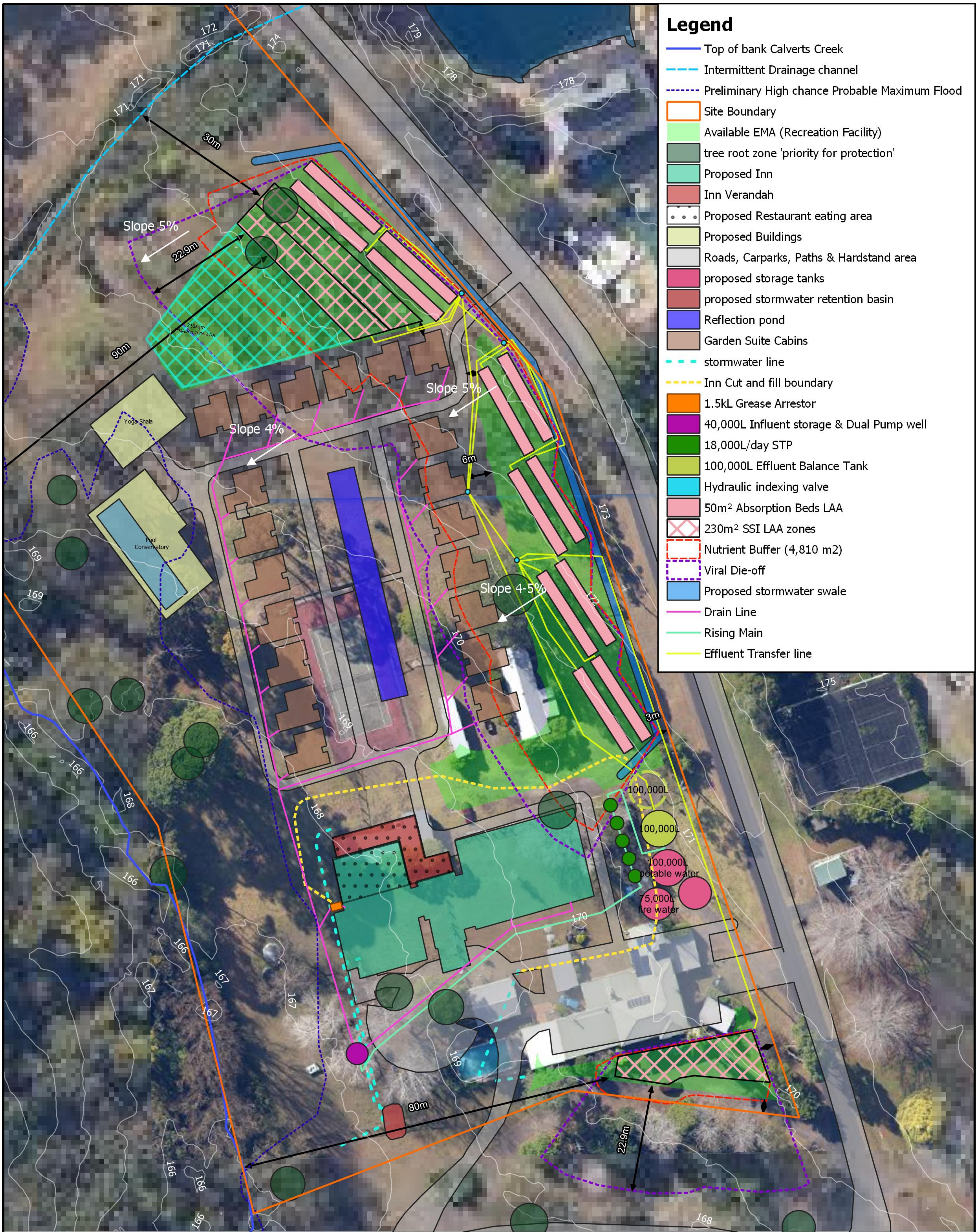


Figure 2: Site Plan Showing Proposed OSSM

3036: Onsite Sewage Management System for Recreation Facility at 231 Pacific Highway Mount White

Whitehead & Associates
Environmental Consultants

(Approx Scale) 0 10 20 30 40 50 60 m

N

Revision	2
Drawn	BC
Approved	MS

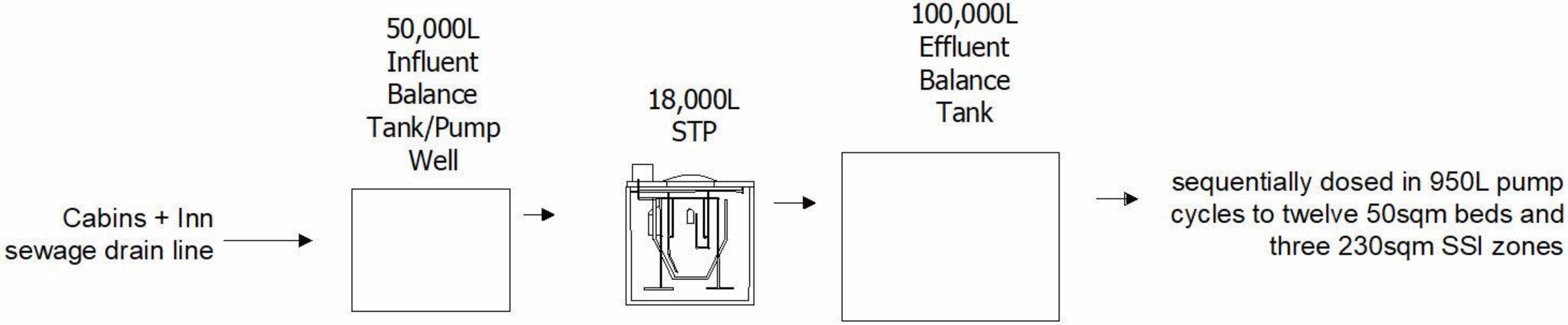


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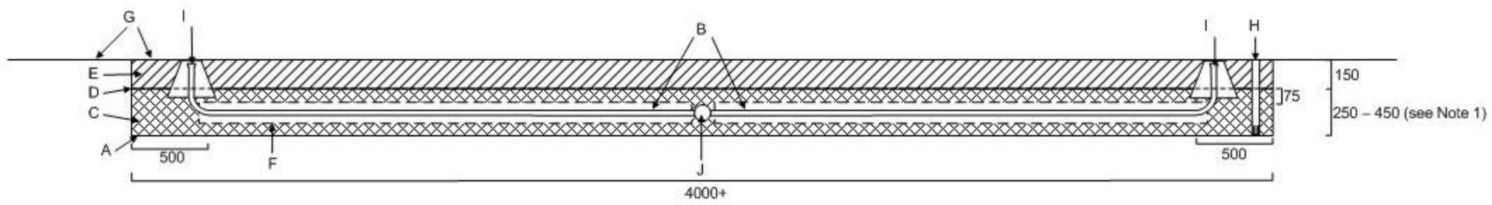
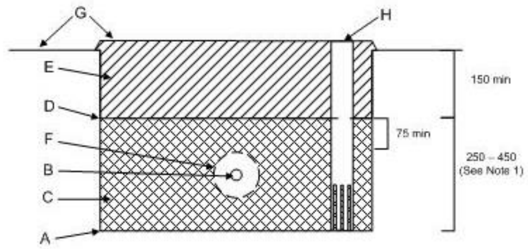
Figure 3 - Process Flow Diagram

Project:	3036
Drawn:	BC
Approved:	MS
Date:	9/6/22
Scale:	NTS

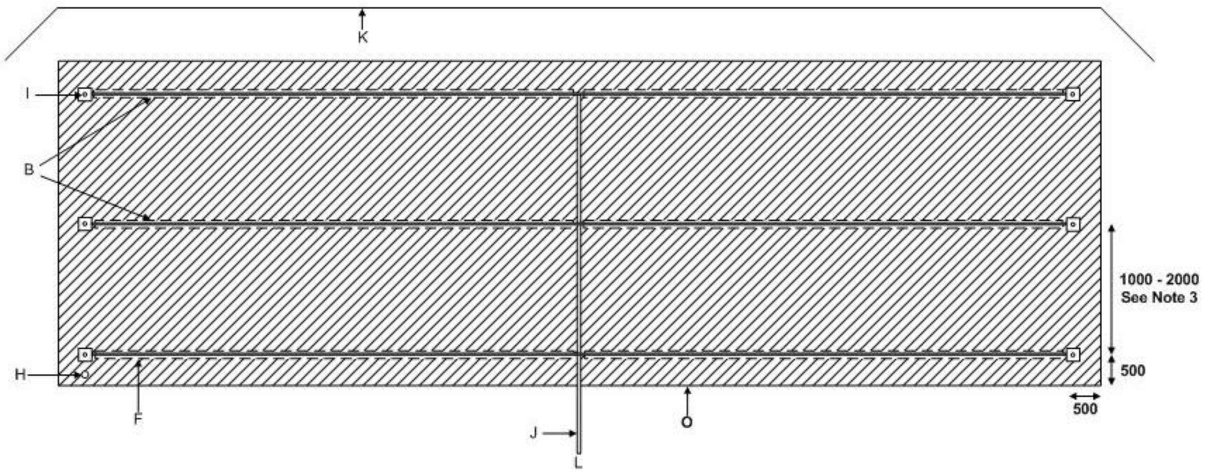
Cross Section: Pressurised Bed



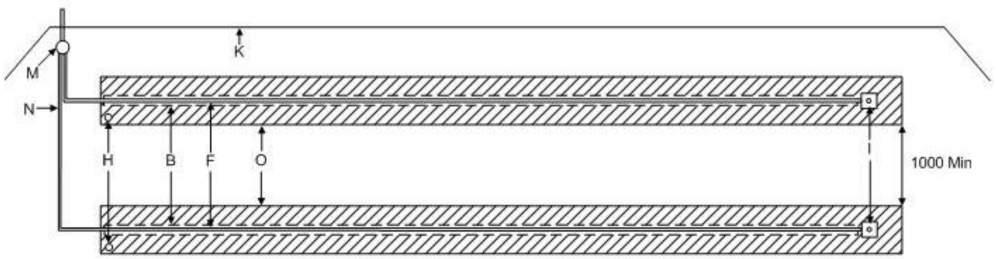
Cross Section: Pressurised Trench



Plan View: Pressurised Bed



Plan View: Pressurised Trench



Pressurised Trench / Bed Construction

A The base of the trench must be level to ensure even distribution of effluent. Base levels should be checked with a dumpy/ laser level.

B Pressurised dosing manifold consisting of 25mm PVC pipe with 3mm holes drilled (deburred) at 400mm centres facing upwards. Where a dosing siphon is used in place of a pump, holes will need to be 4-5mm depending on flow rate achieved. The total number and length of laterals will be determined by the required bed size (m^2) and the lateral spacing's shown in this drawing.

C 20-40mm distribution aggregate.

D Geotextile filter cloth.

E Clean local or imported topsoil (sandy loam to clay loam).

F 90mm slotted PVC or agricultural pipe over manifold laterals.

G Grass must be established across the construction area as soon as possible. Trench/ bed surface should be level or slightly mounded.

H Inspection port on downhill side of trench/ bed. Made from 50mm PVC pipe with perforations in the aggregate level of the trench/ bed.

I Individual flush points for each lateral. May be a screw cap fitting on a 90 -degree elbow level with the filter surface or a pressure controlled flush valve (such as those used for subsurface irrigation systems) inside an irrigation control box. Manual flushing should be carried out at least every twelve months.

J 40mm PVC dosing manifold. Larger systems may require different pipe sizes and orifice reducers at lateral connection points.

K Upslope stormwater diversion drain (see Standard Drawing No.2 for design detail). Subsoil drainage may be necessary on particular sites.

L Pump dosed effluent from treatment system. The pump must be capable of delivering the total flow rate required for all laterals whilst providing a 1.5m residual head (i.e. squirt height) at the highest orifice (with no more than 15% variation in squirt height across the whole bed). For beds with individual laterals no more than 10m long, it is acceptable to adopt a flow rate of 3.5 – 4 L/min/lineal metre. Total dynamic head (including friction loss) will need to be determined on a site-specific basis.

M Hydraulically operated indexing valve such as the 'K-Rain' or suitable alternative that delivers effluent to a different trench/ bed at each pump cut-in.

N 25mm polyethylene or PVC dosing manifold.

O Trench/ bed dimensions are an example only. The basal area of the land application area must be determined in accordance with the procedures set out in Council's DWMP, *AS/NZS 1547:2012* and EPA Code of Practice 891.3 (2013). The location and orientation of the area should be based on a site and soil assessment by a suitably qualified person. The system may comprise a single trench/ bed or multiple smaller trenches/ beds.

Notes

1. Trenches and beds should be constructed as shallow as possible (no less than 400mm deep) to maximise evapotranspiration, nutrient uptake by plants and the depth of soil available for effluent assimilation. Some trenches may need to be slightly deeper (e.g. 600mm) to create sufficient storage volume based on a water balance.
2. Trenches should be a maximum of 600mm wide. Optimum width will balance storage requirements against footprint and required trench length.
3. Nominal lateral spacing of 2000mm for clay loams to heavy clays, and 1000mm for sandy loams to sands.
4. Consideration should be given to ensuring all beds have a level base when determining an appropriate width. The distribution manifold must also be level. Beds longer than 30m will require specialist hydraulic design.

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FIGURE 4: STANDARD DRAWING OF PRESSURISED BED / TRENCH

Project: 3036
Drawn: BC
Approved: MS
Scale: NTS

NOTES

Design for long lateral runs on relatively uniform slope.

An earth bank diversion drain must be constructed upslope of each zone to divert stormwater run-on.

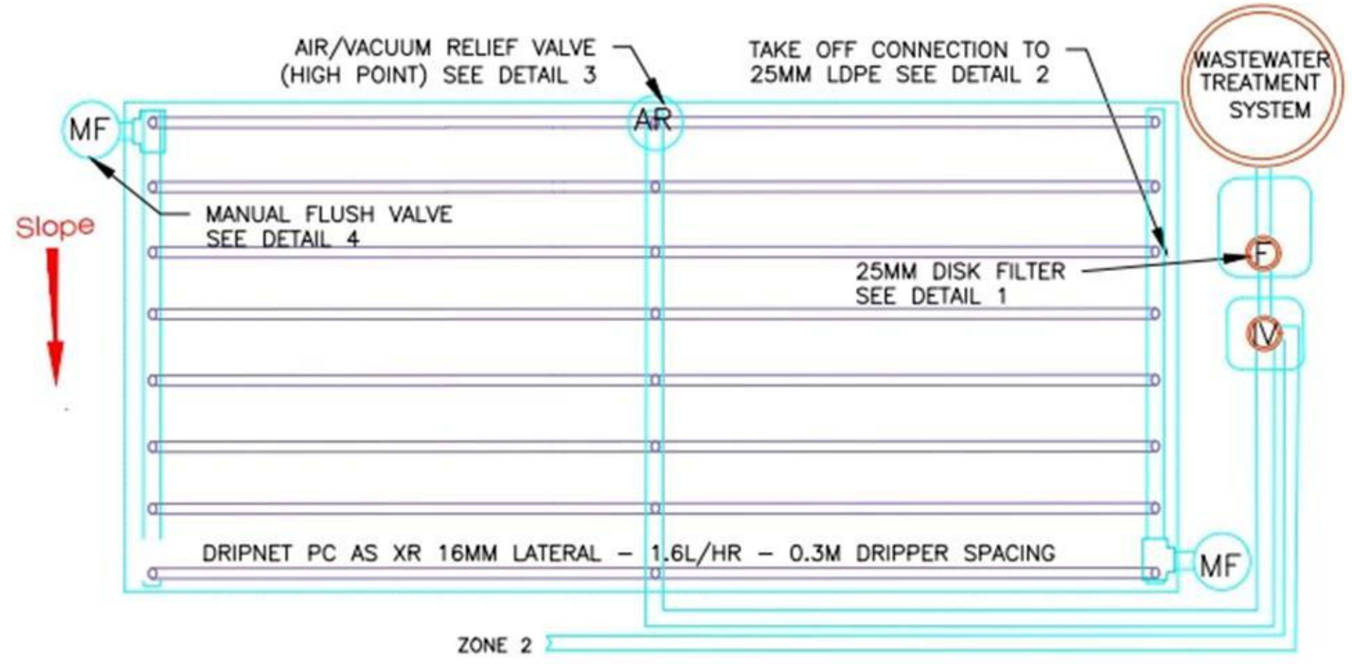
A Total application area = 852m2. Four zones of 213m2 each.

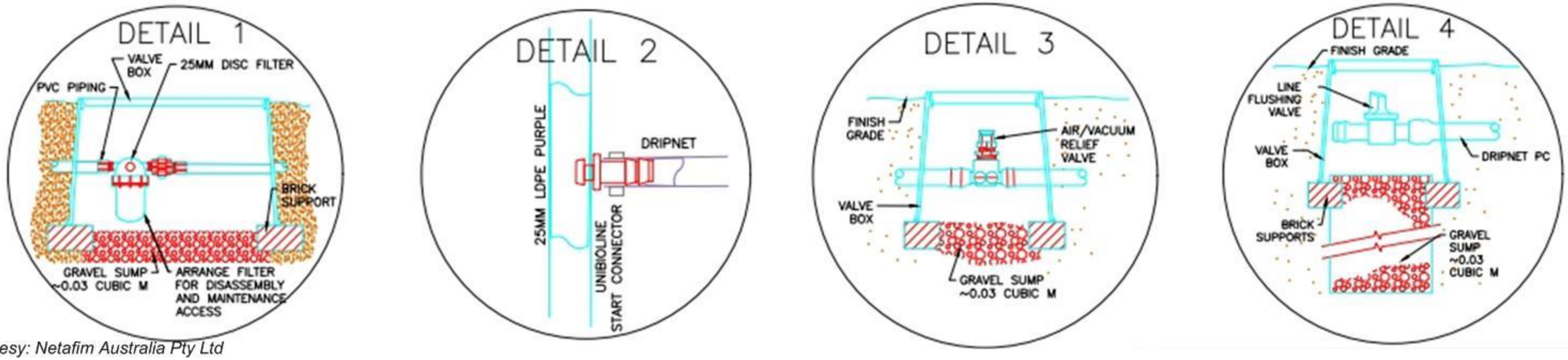
B Each zone is fed by a central distribution manifold with return flushing manifolds on the outer ends, each with a flush valve. An air/vacuum relief valve is located at the high point in each zone.

C Distribution and flushing return manifolds should be buried minimum 150mm below the ground surface.

D Pressure Compensating (PC) subsurface drip line with emitters at 0.3m spacing, with output 1.6L/hr, and laterals at 1000mm spacing and buried to a depth 150-200mm.

E Non-return valves to be installed on distribution and return flushing manifolds where fall is greater than 2m over the zone.

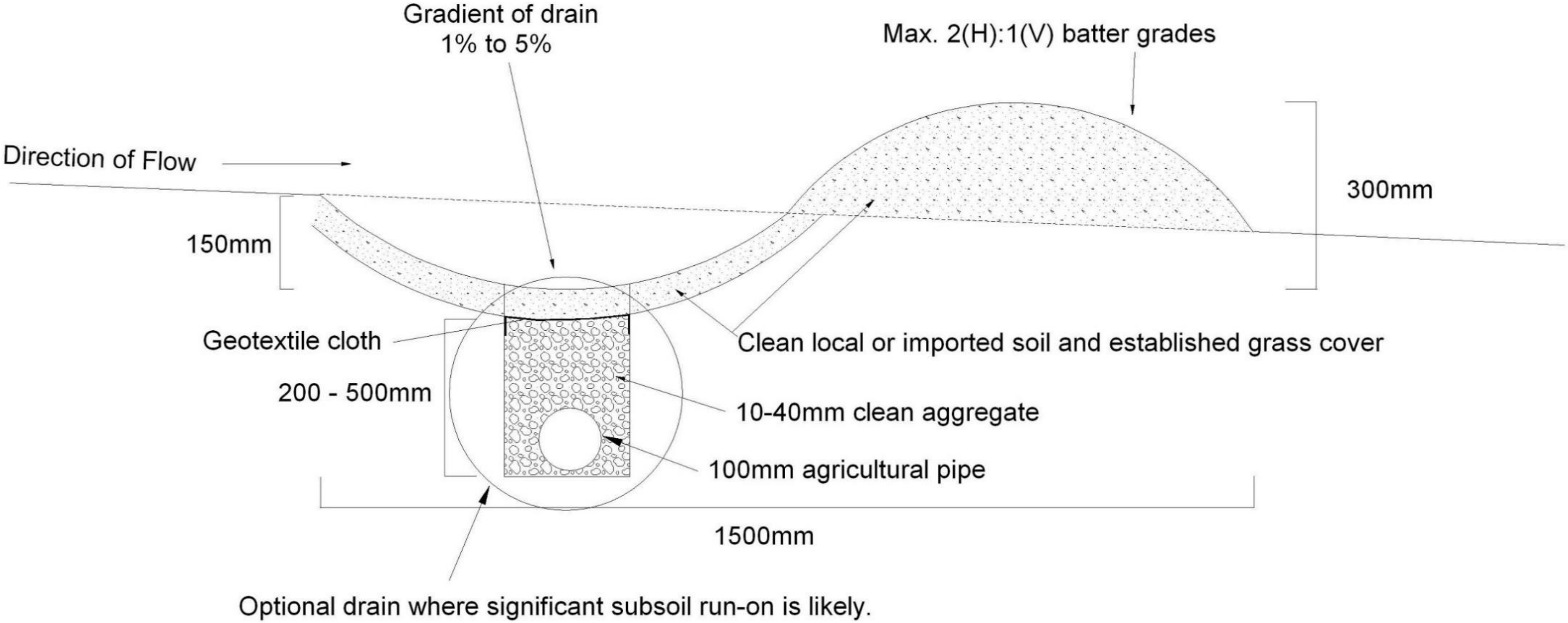




Courtesy: Netafim Australia Pty Ltd

Whitehead & Associates **Environmental Consultants**	*This standard design has been based on a generic area for irrigation based on typical conditions. It does not eliminate the need for a site and soil evaluation to be carried out or any additional consideration of site specific issues. It should be used as a generic guide only.*	**Figure 5:** **Standard Drawing, Subsurface Irrigation**

Cross Section: Upslope Diversion Drain



Whitehead & Associates Environmental Consultants	**FIGURE 6: UPSLOPE DIVERSION DRAIN**	**Project: 3036** **Scale: NTS** **Drawn: BC** **For visualisation purposes only, not for construction use**

Appendix B

Soil Borelogs and Laboratory Results

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Key to Soil Borelogs

Symbols

W	Watertable depth	●	Sample collected
X	Depth of refusal		

Moisture condition

D	Dry
SM	Slightly moist
M	Moist
VM	Very moist
W	Wet / saturated

Graphic Log and Textures

S - Sand
LS - Loamy sand
CS - Clayey sand

CL - Clay loam
SCL - Sandy clay loam
SiCL - Silty clay loam

Gravel (G)

SL - Sandy loam

LC - Light clay
SC - Sandy clay

Parent material (stiff)

L - Loam
LFS - Loam fine sandy
SiL - Silty loam

MC - Medium clay
HC - Heavy clay

Parent material (weathered)

SOIL BORE LOG

Whitehead & Associates
Environmental Consultants

Client:	3036	**Test Pit No:**	**BH1**
Site:	231 Pacific Highway, Mount White	Excavated/logged by:	B.C. and C.L.
Date:	20/9/21	Excavation type:	Auger & crowbar
Notes:	- refer to site plan for position of test pit		

PROFILE DESCRIPTION

Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1 0.2		BH1/1	A1	SL	Moderate	Dark greyish brown	Nil	2 - 10%	SM	Coarse fragments consist of 5% fine gravel and 2% medium gravel
0.3 0.4 0.5 0.6 0.7		BH1/2	B1	SL	Moderate	Dark yellowish brown	Nil	2 - 10%	SM	Coarse fragments consist of 5% fine gravel and 2% medium gravel
0.8 0.9 1.0 1.1 1.2		BH1/3	B2	SC	Moderate	White	<2% orange-red mottles	< 2%	M	

Soil Bore Log

Whitehead & Associates
Environmental Consultants

Client:	3036	**Test Pit No:**	**BH2**
Site:	231 Pacific Highway, Mount White	Excavated/logged by:	B.C. and C.L.
Date:	20/9/21	Excavation type:	Auger & crowbar
Notes:	- refer to site plan for position of test pit		

PROFILE DESCRIPTION

Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1		BH2/1	A1	SL	Moderate	Dark brown	Nil	< 2%	SM	
0.2		BH2/2	B1	SL	Moderate	Dark yellowish brown	Nil	2 - 10%	SM	Coarse fragments consist of 5% fine gravel
0.3										
0.4										
0.5										
0.6										
0.7										
0.8	Refusal on shallow floating rock.									
0.9										
1.0										
1.1										
1.2										

SOIL BORE LOG

Whitehead & Associates
Environmental Consultants

Client:	3036	**Test Pit No:**	**BH3**
Site:	231 Pacific Highway, Mount White	Excavated/logged by:	B.C. and C.L.
Date:	20/9/21	Excavation type:	Auger & crowbar
Notes:	- refer to site plan for position of test pit		

PROFILE DESCRIPTION

Depth (m)	Graphic Log	Sampling depth/name	Horizon	Texture	Structure	Colour	Mottles	Coarse Fragments	Moisture Condition	Comments
0.1		BH3/1	A1	SL	Moderate	Dark brown	Nil	2 - 10%	SM	Coarse fragments consist of 2% fine gravel
0.2		BH3/2	B1	SL	Moderate	Yellowish brown	Nil	2 - 10%	SM	Coarse fragments consist of 2% fine gravel
0.3										
0.4										
0.5		BH3/3	B2	SCL	Moderate	Brownish yellow	Nil	< 2%	SM	
0.6										
0.7										
0.8										
0.9										
1.0		BH3/4	B3	SCL	Strong	Reddish yellow	Nil	< 2%	M	
1.1										
1.2										

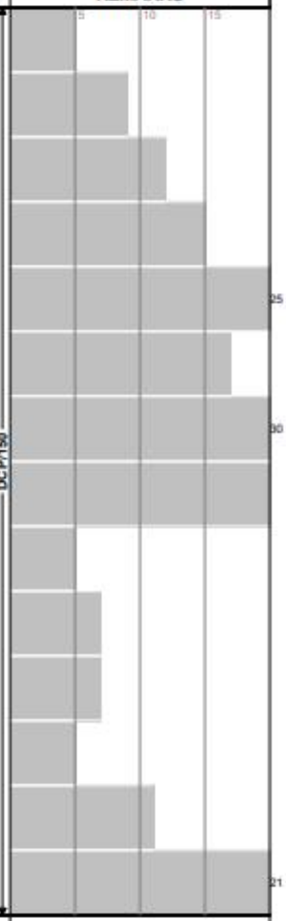
BOREHOLE LOG

CLIENT: The Trustee for Mount White Trust
PROJECT: Proposed Site Development
LOCATION: 231 Pacific Highway, Mount White

SURFACE LEVEL: 170 AHD
COORDINATE **E:**332284.8 **N:** 6296854
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 1
PROJECT No: 202936.00
DATE: 24/03/21
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS./DENSITY	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
seepage		0.0	FILL/ Gravelly Clayey SAND; grey brown; sand fraction medium to coarse; gravel fraction sub-angular to sub-rounded; trace rootlets		FILL		W		D		0.1	DCP/150	
0.3 m depth, 24/03/21		0.2	FILL/ Gravelly Clayey SAND; yellow brown and red brown; sand fraction medium to coarse; gravel fraction coarse, sub-angular to sub-rounded; clay fraction low; ironstone and sandstone gravels		FILL	VD	W		B	0.3–0.6	0.3–0.6		
	169	1							D		1.0		
		1.2	Sandy CLAY; yellow brown and grey; clay fraction low plasticity; sand fraction coarse 1.0-2.6m: soil is wet due to recent rainfall 1.3-2.3m: due to saturated conditions. no sample retained		XWM	L							
						D	M W						
	168	2				VD					2		
							<PL		D		2.6	PP	30
		2.7	Borehole discontinued at 2.70m depth Refusal on extremely weathered (sandstone)										



NOTES: (#)Soil origin is "probable" unless otherwise stated. (C)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

BOREHOLE LOG

CLIENT: The Trustee for Mount White Trust
PROJECT: Proposed Site Development
LOCATION: 231 Pacific Highway, Mount White

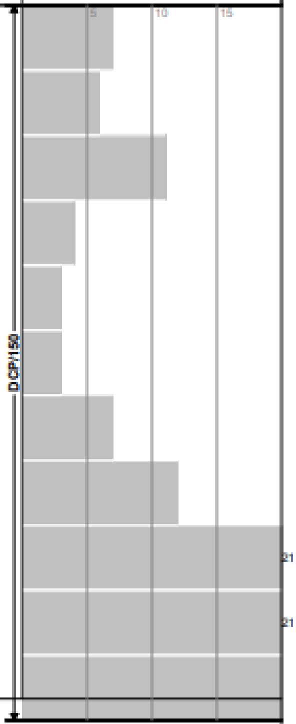
SURFACE LEVEL: 170.5 AHD
COORDINATE **E:**332267.4 **N:** 6296904.8
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 3
PROJECT No: 202936.00
DATE: 24/03/21
SHEET: 1 of 1

GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN*	CONSIS.† / DENSITY †	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)
24/03/21, No free groundwater observed	0.0	FILL/ Sandy GRAVEL; grey; gravel fraction coarse, sub-angular to sub-rounded; sand fraction coarse; trace organics igneous roadbase gravels	FILL		M	D	0.1
	0.2	Clayey SAND, trace gravel; yellow brown and grey brown; sand fraction medium to coarse; clay fraction low; gravel fraction sub-angular to sub-rounded; sandstone and ironstone	RES	MD; MD TO VD	W	D	0.7
	1.4	Sandy CLAY, with gravel; yellow brown and red brown; gravel fraction sub-angular to sub-rounded; sandstone and ironstone	XWM	H	<PL	D	1.6
	1.6	Borehole discontinued at 1.60m depth Refusal on extremely weathered (sandstone)					

RL (m): 170, 169, 168

TESTING AND REMARKS — TEST TYPE: DCP/150



NOTES: *Soil origin is "probable" unless otherwise stated. †Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

EXPORTED 02/06/21 10:59, TEMPLATE ID: DP_101.02.00_SOILLOG

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

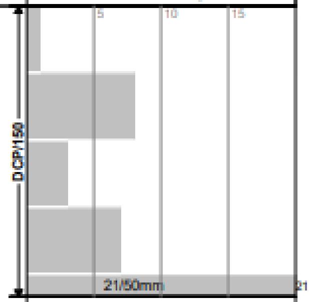
BOREHOLE LOG

CLIENT: The Trustee for Mount White Trust
PROJECT: Proposed Site Development
LOCATION: 231 Pacific Highway, Mount White

SURFACE LEVEL: 171.3 AHD
COORDINATE **E:**332229.7 **N:** 6296974.6
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 5
PROJECT No: 202936.00
DATE: 01/04/21
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
01/04/21	171	0.0	Clayey SAND, yellow brown, sand fraction medium to coarse; clay fraction low; trace organics			L TO MD	M to W		D D		0.3 0.6	DCP/150	21/50mm
		0.7	Gravelly Clayey SAND; red brown and yellow brown; sand fraction medium to coarse, low plasticity; gravel fraction coarse; ironstone gravels		RES		M to W						
	170	1.3	Sandy CLAY; red brown; clay fraction low plasticity; sand fraction medium to coarse; highly weathered sandstone		XWM	H	<PL		D		1.4		
		1.4	Borehole discontinued at 1.40m depth Refusal on sandstone										



NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

EXPORTED 02/06/21 10:39. TEMPLATE ID: DP_101.02.00_SOILLOG

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS:

OPERATOR: MJH
CASING:

LOGGED: MJH

BOREHOLE LOG

CLIENT: The Trustee for Mount White Trust
PROJECT: Proposed Site Development
LOCATION: 231 Pacific Highway, Mount White

SURFACE LEVEL: 168.1 AHD
COORDINATE E:332184 N: 6296935.4
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/--

LOCATION ID: 6
PROJECT No: 202936.00
DATE: 01/04/21
SHEET: 1 of 1

DEPTH (m)	DESCRIPTION OF STRATA	ORIGIN	CONSIS. / DENSITY	MOISTURE	SAMPLE TYPE	SAMPLE DEPTH (m)
0.0 – 0.15	TOPSOIL/ Silty SAND; grey brown; sand fraction medium to coarse; silt fraction fine; trace organics	TOP	L	M	D	0.1
0.15 – 1.5	Clayey SAND; yellow brown and red brown; sand fraction medium to coarse; clay fraction low	RES	VL TO L; MD	W	D	0.7
1.5 – 1.7	Sandy CLAY; yellow brown and red brown; clay fraction medium to high plasticity; sand fraction medium to coarse	RES	H	>PL		
1.7 – 1.75	Sandy CLAY; pale grey; highly weathered sandstone with soil like properties	XWM			D	1.75
	Borehole discontinued at 1.75m depth Refusal on sandstone					

GROUNDWATER: 01/04/21 (at approx. 0.4 m)

RL (m): 168, 167, 166

TESTING AND REMARKS: DCP/150 (0.0 – 1.7 m); 25/50mm

NOTES: [#]Soil origin is "probable" unless otherwise stated. [*]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: TOYOTA 4WD
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
REMARKS: Borehole affected by recent rainfall

OPERATOR: MJH
CASING:

LOGGED: MJH

BOREHOLE LOG

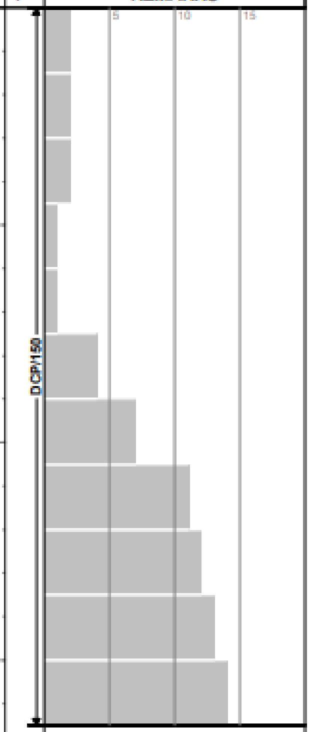
CLIENT: The Trustee for Mount White Trust
PROJECT: Proposed Site Development
LOCATION: 231 Pacific Highway, Mount White

SURFACE LEVEL: 172.7 AHD
COORDINATE E:332214.1 N: 6297014.1
DATUM/GRID: MGA94 Zone 56 H
DIP/AZIMUTH: 90°/---

LOCATION ID: 7
PROJECT No: 202936.00
DATE: 01/04/21
SHEET: 1 of 1

DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN	CONSIS./DENSITY	MOISTURE	SAMPLE REMARKS	TYPE	INTERVAL	TEST TYPE	RESULTS AND REMARKS
0.0	Clayey SAND; yellow brown and grey brown; sand fraction medium to coarse; clay fraction low		RES	L / MD / MD VD	M to W				DCP/150	
1.5	Sandy CLAY, trace gravel; yellow brown and red brown; clay fraction low plasticity; sand fraction fine to medium; ironstone gravels		RES		<PL					
1.7	Sandy CLAY; yellow brown and red brown; clay fraction low plasticity; sand fraction medium to coarse; highly weathered sandstone with soil like properties		XWM							
1.9	Borehole discontinued at 1.90m depth Refusal on sandstone									

GROUNDWATER: 01/04/21; 13/05/21
RL (m): 172, 171, 170



NOTES: [a]Soil origin is "probable" unless otherwise stated. [1]Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

EXPORTED 02/06/21 10:39. TEMPLATE ID: DP_101.02.00_SOILLOG

PLANT: TOYOTA 4WD
OPERATOR: MJH
LOGGED: MJH
METHOD: 60mm diameter Dynamic Continuous Push Tube Sampling
CASING:
REMARKS: Standpipe piezometer installed to 1.2m depth

				CLIENT SAMPLE ID	5/0.3	10/0.1	13/0.2	14/0.2
				DEPTH				
Test Parameter	Method Description	Method Reference	Units	LOR	210732-1	210732-2	210732-3	210732-4
pH (1:5 in CaCl2)	Electrode	R&L4B2	pH units	na	4.82	4.53	4.57	4.30
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.03	0.03	0.02
Phosphorus Buffer Index	UV-Vis	PMS-12	mg/kg	na	109	144	110	134
Phosphorus (Colwell)	Bicarb/UV-Vis	R&L 9B1	mg/kg	1	22.3	20.7	16.4	12.3
Phosphorus Sorption Capacity	Calc	PMS-12	mg/kg	na	536	642	537	610
Phosphorus Sorption Capacity	Calc	na	kg/ha	na	5358	6415	5369	6097
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	37.0	54.0	45.0	43.0
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	181	154	238	152
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	18.0	57.0	73.0	28.0
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	17.0	19.0	29.0	23.0
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	1	18.2	44.1	26.1	90.5
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.09	0.14	0.12	0.11
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	0.91	0.77	1.19	0.76
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.15	0.48	0.61	0.23
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.07	0.08	0.13	0.10
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.20	0.49	0.29	1.01
ECEC	Calculation	PMS-15A1	cmol/kg	na	1.43	1.96	2.33	2.21
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	6.03	1.62	1.96	3.26
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.63	0.29	0.19	0.47
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.65	7.08	4.95	4.99
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	63.5	39.4	51.1	34.4

Test #	PH1

Time (hr:min:sec)	Time after start (min)	Level in Tube (cm)	Drop of Level (cm)	Rate of Water Level Drop (cm/min)
	0	126.0		
	3	126	0.0	0.0
	6	126	0.0	0.0
	9	126	0.0	0.0
	12	126	0.0	0.0
	15	122.5	3.5	1.2
	18	122.5	0.0	0.0
	21	118.2	4.3	1.4
	24	118.2	0.0	0.0
	27	114.5	3.7	1.2
	30	110.3	4.2	1.4
	33	110.3	0.0	0.0
	36	105.8	4.5	1.5
	39	100.3	5.5	1.8
	42	100.3	0.0	0.0
	45	100.3	0.0	0.0
	48	97.6	2.7	0.9
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
Selected Steady Rate of Water Level Drop			(cm/min)	1.4
Rate of Loss of Water from Reservoir			(cm^3/min)	10.4

Parameter	Symbol	Value
Depth of Water in Test Hole (cm)	H	14
Radius of Test Hole (cm)	r	4
Inner Tube External Diameter (cm)	D_i	0.9
Outer Tube Internal Diameter (cm)	D_o	3.2
Rate of Water Level Drop (cm/min)	L	1.4
Inner Tube Cross Sectional Area (cm^2)	A_i	0.64
Outer Tube Cross Sectional Area (cm^2)	A_o	8.04
Flowrate (cm^3/min)	Q	10.37
Saturated Hydraulic Conductivity (cm/min)	K_{sat}	0.0138
Saturated Hydraulic Conductivity (m/day)	K_{sat}	0.20

Test # PH2

Time	Time after start	Level in Tube	Drop of Level	Rate of Water Level Drop
(hr:min:sec)	(min)	(cm)	(cm)	(cm/min)
	0	101.4		
	2	101.4	0.0	0.0
	4	93.9	7.5	3.8
	6	93.9	0.0	0.0
	8	90.2	3.7	1.9
	10	90.2	0.0	0.0
	12	86	4.2	2.1
	14	86	0.0	0.0
	16	86	0.0	0.0
	18	81.4	4.6	2.3
	20	75.9	5.5	2.8
	22	75.9	0.0	0.0
	24	70.8	5.1	2.6
	26	70.8	0.0	0.0
	28	70.8	0.0	0.0
	30	65	5.8	2.9
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
			0.0	0.0
Selected Steady Rate of Water Level Drop			(cm/min)	2.3
Rate of Loss of Water from Reservoir			(cm^3/min)	17.0

Parameter	Symbol	Value
Depth of Water in Test Hole (cm)	H	19
Radius of Test Hole (cm)	r	4
Inner Tube External Diameter (cm)	D_i	0.9
Outer Tube Internal Diameter (cm)	D_o	3.2
Rate of Water Level Drop (cm/min)	L	2.3
Inner Tube Cross Sectional Area (cm^2)	A_i	0.64
Outer Tube Cross Sectional Area (cm^2)	A_o	8.04
Flowrate (cm^3/min)	Q	17.03
Saturated Hydraulic Conductivity (cm/min)	K_{sat}	0.0155
Saturated Hydraulic Conductivity (m/day)	K_{sat}	0.22

WaterNSW
Work Summary

GW042725

Licence: 20CA100207

Licence Status: CURRENT

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

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

Commenced Date:
Completion Date: 01/06/1976

Final Depth: 100.50 m
Drilled Depth: 100.50 m

Contractor Name: (None)
Driller:
Assistant Driller:

Property: N/A NSW
GWMA: 606 - MANGROVE MOUNTAIN
GW Zone: 007 - LOWER MANGROVE AND POPRAN CREEKS GROUNDWATER SOURCE

Standing Water Level (m):
Salinity Description: 0-500 ppm
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:			
Licensed:	NORTHUMBERLAND	COWAN	Whole Lot 2//547622

Region: -
River Basin: -
Area/District: -

CMA Map:
Grid Zone:
Scale:

Elevation:
Elevation Source:

Northing:
Easting:

Latitude:
Longitude:

GS Map: -
MGA Zone:
Coordinate Source:

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
27.40	27.40	0.00	Consolidated			0.07			
49.00	49.00	0.00	Consolidated			0.19			
59.40	59.40	0.00	Consolidated	20.70		0.46			
94.40	94.40	0.00	Consolidated	20.70		0.91			

Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.70	1.70	Clay Sandy Stoney	Clay	
1.70	64.00	62.30	Sandstone Some Ironstone Bands Water Supply	Sandstone	
64.00	65.20	1.20	Shale Hard	Shale	
65.20	100.54	35.34	Sandstone Some Ironstone Bands Water Supply	Sandstone	

Appendix C

Water and Nutrient Balance Modelling

Water Balance & Storage Calculations - Bed Design

Site Address: 3036: 231 Pacific Hwy, Mount White

Whitehead & Associates
Environmental Consultants

INPUT DATA

Design Wastewater Flow	Q	11,400	L/day	From effluent Balancing
Design Loading Rate	DLR	20	mm/day	Litres/m^2/day - based on in-situ permeamter testing & Secondary treatment
Nominated Land Application Area	L	600	m^2	Used for iterative purposes to determine storage requirements based on nominated trench/bed bottom area
Crop Factor	C	0.5-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type
Runoff Coefficient	RC	0.8	unitless	Proportion of rainfall that remains onsite and infiltrates; function of slope/cover, allowing for any runoff
Void Space Ratio	V	0.4	unitless	Proportion of bed/trench that is available for storage (assumes aggregate)
Rainfall Data	Lower Mangrove (Popran Rd) - 61216			Median Monthly data (58 years)
Evaporation Data	PEATS RIDGE (WARATAH ROAD) - 061351			Mean Daily Evaporation (34 years)

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Days in month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	31	28	31	30	31	30	**365**
Rainfall	R		mm/month	83.6	140.4	116.9	68.4	38.2	68.5	35.5	33.9	43.5	65.3	72.8	92.4	83.6	140.4	116.9	68.4	38.2	68.5	**978**
Evaporation			mm/day	4.6	4.1	3.4	2.6	1.8	1.6	1.7	2.4	3.4	4	4.3	4.7	4.6	4.1	3.4	2.6	1.8	1.6	
Evaporation	E		mm/month	142.6	114.8	105.4	78.0	55.8	48.0	52.7	74.4	102.0	124.0	129.0	145.7	142.6	114.8	105.4	78.0	55.8	48.0	**1,172.4**
Crop Factor	C			0.80	0.80	0.75	0.70	0.60	0.50	0.60	0.70	0.75	0.80	0.80	0.80	0.80	0.80	0.75	0.70	0.60	0.50	
OUTPUTS (LOSSES)																						
Evapotranspiration	ET	ExC	mm/month	114.1	91.8	79.1	54.6	33.5	24.0	31.6	52.1	76.5	99.2	103.2	116.6	114.1	91.8	79.1	54.6	33.5	24.0	**876.2**
Percolation	B	DLRxD	mm/month	620.0	560.0	620.0	600.0	620.0	600.0	620.0	620.0	600.0	620.0	600.0	620.0	620.0	560.0	620.0	600.0	620.0	600.0	**7,300.0**
Outputs		ET+B	mm/month	734.1	651.8	699.1	654.6	653.5	624.0	651.6	672.1	676.5	719.2	703.2	736.6	734.1	651.8	699.1	654.6	653.5	624.0	**8,176.2**
INPUTS (GAINS)																						
Retained Rainfall	RR	RxRC	mm/month	66.9	112.3	93.5	54.7	30.6	54.8	28.4	27.1	34.8	52.2	58.2	73.9	66.9	112.3	93.5	54.7	30.6	54.8	**687.5**
Applied Effluent	W	(QxD)/L	mm/month	589.0	532.0	589.0	570.0	589.0	570.0	589.0	589.0	570.0	589.0	570.0	589.0	589.0	532.0	589.0	570.0	589.0	570.0	**6,935.0**
Inputs		RR+W	mm/month	655.9	644.3	682.5	624.7	619.6	624.8	617.4	616.1	604.8	641.2	628.2	662.9	655.9	644.3	682.5	624.7	619.6	624.8	**7,622.5**
STORAGE CALCULATION (Δ)																						
Storage remaining from previous month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the month	S	((RR+W)-(ET+B))/V	mm/month	-195.5	-18.8	-41.3	-74.7	-84.8	2.0	-85.6	-139.9	-179.3	-194.9	-187.4	-184.1	-195.5	-18.8	-41.3	-74.7	-84.8	2.0	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	
Maximum Storage Depth for Nominated Area	N		mm	2																		
Maximum Storage Vol. for Nominated Area	V	(NxL)/1000	m^3	1																		
BOTTOM AREA REQUIRED FOR ZERO STORAGE			m^2	530	592	584	570	567	601	567	548	533	530	530	533	530	592	584	570	567	601	

MINIMUM BOTTOM AREA REQUIRED FOR ZERO STORAGE: 601 m^2

Value is based on the worst month of the year, so the balance overestimates the storage requirement for all other months. Assumes zero effluent depth (storage) in trench/bed. Model is run for 18-months to ensure trench/bed empties at least once per cycle.

Bed Dimensions (m)	**Width =** 2.50	**Depth =** 0.3	**No. of Trenches/Beds**		12.0
Required Bed Length (m) =	240.00		**Interval spacing (m)**	**(m) =**	1 — Minimum spacing is 1 metre
Design Bed Length (m) =	20	(Max) recommended trench/bed length is 20m (primary)	**Total EMA Area**	**(m^2) =**	820 — Total area includes spacing between beds plus boundary buffer of 1.5 metres

Nutrient Balance

3036: 231 Pacific Hwy, Mount White **(Balanced Load)**

Whitehead & Associates
Environmental Consultants

Please read the attached notes before using this spreadsheet.

SUMMARY - LAND APPLICATION AREA REQUIRED BASED ON THE MOST LIMITING BALANCE = 3,841 m^2

INPUT DATA [1]

Wastewater Loading			Nutrient Crop Uptake					
Hydraulic Load	11,400	L/day	Crop N Uptake	260	kg/ha/yr	which equals	71.23	mg/m²/day
Effluent N Concentration	30	mg/L	Crop P Uptake	30	kg/ha/yr	which equals	8.22	mg/m²/day
% Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal	**Phosphorus Sorption**					
Total N Loss to Soil	68,400	mg/day	P-sorption result	536	mg/kg	which equals	8,040	kg/ha
Remaining N Load after soil loss	273,600	mg/day	Bulk Density	1.5	g/cm³			
Effluent P Concentration	10	mg/L	Depth of Soil	1	m			
Design Life of System	50	yrs	% of Predicted P-sorp. [2]	0.5	Decimal			

METHOD 1: NUTRIENT BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)		
Nitrogen	3,841	m²	Nominated LAA Size	820	m²
Phosphorus	3,769	m²	Predicted N Export from LAA	78.54	kg/year
			Predicted P Export from LAA	32.56	kg/year
			Phosphorus Longevity for LAA	8	Years
			Minimum Buffer Required for excess nutrient	3,021	m²

PHOSPHORUS BALANCE

STEP 1: Using the nominated LAA Size

Nominated LAA Size	**820**	m²				
Daily P Load	0.114	kg/day	→	Phosphorus generated over life of system	2080.5	kg
Daily Uptake	0.0067397	kg/day	→	Phosphorus vegetative uptake for life of system	0.150	kg/m²
Measured p-sorption capacity	0.804	kg/m²				
Assumed p-sorption capacity	0.402	kg/m²	→	Phosphorus adsorbed in 50 years	0.402	kg/m²
Site P-sorption capacity	329.64	kg	→	Desired Annual P Application Rate	9.053	kg/year
				which equals	0.02480	kg/day
P-load to be sorbed	39.15	kg/year				

NOTES

[1]. Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used. Otherwise data should be obtained from a reliable source such as,

- *Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households*
- *Appropriate Peer Reviewed Papers*
- *EPA Guidelines for Effluent Irrigation*
- *USEPA Onsite Systems Manual.*

[2]. A multiplier, normally between 0.25 and 0.75, is used to estimate actual P-sorption under field conditions which is assumed to be less than laboratory estimates.

Irrigation Area Water Balance & Storage Calculations

Whitehead & Associates
Environmental Consultants

Site Address: 3036: 231 Pacific Hwy, Mount White

INPUT DATA

Design Wastewater Flow	Q	2,850	L/day	Total Loading rate for SSI
Design Irrigation Rate	DIR	5.0	mm/day	Litres/m^2/day - based on Table M1 AS/NZS 1547:2012; Sandy Loam & secondary effluent
Available Land Application Area	L	690	m^2	Used for iterative purposes to determine storage requirements for nominated areas
Crop Factor	C	0.6-0.8	unitless	Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type
Runoff Coefficient	RC	0.8	unitless	Proportion of rainfall that remains onsite and infiltrates; function of slope/cover, allowing for any runoff
Rainfall Data		Lower Mangrove (Popran Rd) - 61216		Median Monthly data (58 years)
Evaporation Data		PEATS RIDGE (WARATAH ROAD) - 061351		Mean Daily Evaporation (34 years)

Soil Category (AS1547:2012)	DIR	Units
Gravels and Sands (1)	5	mm/day
Sandy Loams (2)	5	mm/day
Loams (3)	4	mm/day
Clay Loams (4)	3.5	mm/day
Light Clays (5)	3	mm/day
Medium to Heavy Clays (6)	2	mm/day

Parameter	Symbol	Formula	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Days in Month	D		days	31	28	31	30	31	30	31	31	30	31	30	31	31	28	31	30	31	30	**546**
Rainfall	R		mm/month	83.6	140.4	116.9	68.4	38.2	68.5	35.5	33.9	43.5	65.3	72.8	92.4	83.6	140.4	116.9	68.4	38.2	68.5	**978.0**
Evaporation			mm/day	4.6	4.1	3.4	2.6	1.8	1.6	1.7	2.4	3.4	4	4.3	4.7							
Evaporation	E		mm/month	142.6	114.8	105.4	78.0	55.8	48.0	52.7	74.4	102.0	124.0	129.0	145.7	142.6	114.8	105.4	78.0	55.8	48.0	**1172.4**
Crop Factor	C			0.80	0.80	0.70	0.70	0.60	0.60	0.60	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.70	0.70	0.60	0.60	
OUTPUTS (LOSSES)																						
Evapotranspiration	ET	ExC	mm/month	114.1	91.8	73.8	54.6	33.5	28.8	31.6	52.1	71.4	99.2	103.2	116.6	114.1	91.8	73.8	54.6	33.5	28.8	**870.64**
Percolation	B	DIRxD	mm/month	155.0	140	155.0	150.0	155.0	150.0	155.0	155.0	150.0	155.0	150.0	155.0	155.0	140.0	155.0	150.0	155.0	150.0	**1825.0**
Outputs		ET+B	mm/month	269.1	231.84	228.8	204.6	188.5	178.8	186.6	207.1	221.4	254.2	253.2	271.6	269.1	231.84	228.8	204.6	188.5	178.8	**2695.6**
INPUTS (GAINS)																						
Retained Rainfall	RR	RxRC	mm/month	66.88	112.32	93.52	54.72	30.56	54.8	28.4	27.12	34.8	52.24	58.24	73.92	66.88	112.32	93.52	54.72	30.56	54.8	**687.52**
Effluent Irrigation	W	(QxD)/L	mm/month	128.0	115.7	128.0	123.9	128.0	123.9	128.0	128.0	123.9	128.0	123.9	128.0	128.0	115.7	128.0	123.9	128.0	123.9	**1507.6**
Inputs		RR+W	mm/month	194.9	228.0	221.6	178.6	158.6	178.7	156.4	155.2	158.7	180.3	182.2	202.0	194.9	228.0	221.6	178.6	158.6	178.7	**2195.1**
STORAGE CALCULATION (Δ)																						
Storage Remaining from Previous Month			mm/month	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Storage for the Month	S	(RR+W)-(ET+B)	mm/month	-74.2	-3.9	-7.2	-26.0	-29.9	-0.1	-30.2	-51.9	-62.7	-73.9	-71.0	-69.6	-74.2	-3.9	-7.2	-26.0	-29.9	-0.1	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Maximum Storage for Nominated Area	N		mm	0																		
Storage Volume required	V	(NxL)/1000	m^3	0																		
LAND AREA REQUIRED FOR ZERO STORAGE			m^2	437	668	653	570	559	690	558	491	458	437	439	447	437	668	653	570	559	690	

MINIMUM AREA REQUIRED FOR ZERO STORAGE: 690 m^2

This value is based on the worst month of the year, so the balance overestimates the area/storage requirements and is therefore conservative for all other months

Nutrient Balance

3036: 231 Pacific Hwy, Mount White **(Balanced Load)**

Whitehead & Associates
Environmental Consultants

Please read the attached notes before using this spreadsheet.

SUMMARY - LAND APPLICATION AREA REQUIRED BASED ON THE MOST LIMITING BALANCE = 960 m^2

INPUT DATA [1]

Wastewater Loading			Nutrient Crop Uptake				
Hydraulic Load	2,850	L/day	Crop N Uptake	260	kg/ha/yr	which equals	71.23 mg/m^2/day
Effluent N Concentration	30	mg/L	Crop P Uptake	30	kg/ha/yr	which equals	8.22 mg/m^2/day
% Lost to Soil Processes (Geary & Gardner 1996)	0.2	Decimal	**Phosphorus Sorption**				
Total N Loss to Soil	17,100	mg/day	P-sorption result	536	mg/kg	which equals	8,040 kg/ha
Remaining N Load after soil loss	68,400	mg/day	Bulk Density	1.5	g/cm^3		
Effluent P Concentration	10	mg/L	Depth of Soil	1	m		
Design Life of System	50	yrs	% of Predicted P-sorp. [2]	0.5	Decimal		

METHOD 1: NUTRIENT BALANCE BASED ON ANNUAL CROP UPTAKE RATES

Minimum Area required with zero buffer			Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)		
Nitrogen	960	m^2	Nominated LAA Size	820	m^2
Phosphorus	942	m^2	Predicted N Export from LAA	3.65	kg/year
			Predicted P Export from LAA	1.35	kg/year
			Phosphorus Longevity for LAA	42	Years
			Minimum Buffer Required for excess nutrient	140	m^2

PHOSPHORUS BALANCE

STEP 1: Using the nominated LAA Size

Nominated LAA Size	**820**	m^2			
Daily P Load	0.0285	kg/day	→ Phosphorus generated over life of system	520.125	kg
Daily Uptake	0.0067397	kg/day	→ Phosphorus vegetative uptake for life of system	0.150	kg/m^2
Measured p-sorption capacity	0.804	kg/m^2			
Assumed p-sorption capacity	0.402	kg/m^2	→ Phosphorus adsorbed in 50 years	0.402	kg/m^2
Site P-sorption capacity	329.64	kg	→ Desired Annual P Application Rate	9.053	kg/year
			which equals	0.02480	kg/day
P-load to be sorbed	7.94	kg/year			

NOTES

[1]. Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used. Otherwise data should be obtained from a reliable source such as,

- *Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households*
- *Appropriate Peer Reviewed Papers*
- *EPA Guidelines for Effluent Irrigation*
- *USEPA Onsite Systems Manual.*

[2]. A multiplier, normally between 0.25 and 0.75, is used to estimate actual P-sorption under field conditions which is assumed to be less than laboratory estimates.

BMT WBM

Land Application Management Tool

Run Model

Site Data

Application Area (m^2)	600
Land Application Type	1
Storage Type	1
Application Method	1
Storage Capacity (m^3)	0
Storage Depth (m)	0
Average Slope (%)	7
Soil Type	so_ABS2
Crop Type	Default

Soil Data

Add New

	Layer # (Single Layer Version) 1
Effective Saturation (mm)	427.5
Field Capacity (mm)	345.0
Permanent Wilting Point (mm)	195.0
Saturated Hydraulic Conductivity (mm/day)	220.0
Soil Depth for P Sorption (m)	0.6
Bulk Density (kg/m^3)	1350.0
Depression Storage (mm)	0.0
Infiltration Rate (mm/day)	250.0
Infiltration Exponent	2.5
Coefficient P Sorption	61.0
Exponent P Sorption	0.46
Exponent P Desorption	0.23

Land Application and Acceptance Rates

Storage Seepage (mm/day)	0
Fixed Application Depth (mm)	0
Soil Water Trigger (mm)	0
Additional Application Depth (mm)	0
Nitrogen Crop Uptake (kg/ha/yr)	260
Phosphorus Crop Uptake (kg/ha/yr)	30

Wastewater Characteristics

Constant Daily WWF (m^3/day)	9.471	average flow
Total Nitrogen (mg/L)	30	Use WWF timeseries instead? No
Total Phosphorus (mg/L)	10	View Data
Virus (MPN/L)	100	
		0.0 m^3/day

Crop Data

Add New

January	1
February	1
March	1
April	1
May	1
June	1
July	1
August	1
September	1
October	1
November	1
December	1

Meteorological Data

View Data

Number of Years 60.7

	R	*ET*	*E*	*T*
Max	228.3	9.1	16.6	33.4
Min	0.0	0.4	0.0	6.1
Average	3.3	3.1	3.8	17.2
Median	0.0	2.8	3.5	17.2
Standard Deviation	10.4	1.6	2.0	4.6

ONLY grey cells require input.
Refer to comments within cells for instructions

BMT WBM

Land Application Management Tool

Summary of Results

View Timeseries Results

Runoff (surcharge) frequency	**6.7**	days/year
Runoff (surcharge) volume	**1.1**	% of total WWF volume
Deep drainage volume	**3313.0**	m3/yr or **15.13** mm/day
Total phosphorus load in runoff	**0.5**	kg/yr
Total nitrogen load in runoff	**0.1**	kg/yr
Total phosphorus load in deep drainage	**31.9**	kg/yr
PO4 concentration in deep drainage	**9.9**	g/cub.m
Total nitrogen load in deep drainage	**11.8**	kg/yr
NO3 concentration in deep drainage	**3.6**	g/cub.m
Total site virus load	**2593721**	MPN/yr
Total site virus concentration	**0.8**	MPN/L
Total site phosphorus load	**32.3**	kg/yr
Total site nitrogen load	**12.0**	kg/yr
Storage overflow frequency	**0**	number of years
	0.0	days/year
Storage overflow volume	**0.0**	cub.m/yr
	0.0	% of total WWF volume

BMT WBM

Land Application Management Tool

Run Model

Site Data

Application Area (m^2)	690
Land Application Type	2
Storage Type	1
Application Method	1
Storage Capacity (m^3)	0
Storage Depth (m)	0
Average Slope (%)	7
Soil Type	so_SSI2
Crop Type	Default

Soil Data

Add New

	Layer # (Single Layer Version) 1
Effective Saturation (mm)	451.3
Field Capacity (mm)	345.0
Permanent Wilting Point (mm)	195.0
Saturated Hydraulic Conductivity (mm/day)	220.0
Soil Depth for P Sorption (m)	0.6
Bulk Density (kg/m^3)	1350.0
Depression Storage (mm)	0.0
Infiltration Rate (mm/day)	250.0
Infiltration Exponent	2.5
Coefficient P Sorption	61.0
Exponent P Sorption	0.46
Exponent P Desorption	0.23

Land Application and Acceptance Rates

Storage Seepage (mm/day)	0
Fixed Application Depth (mm)	0
Soil Water Trigger (mm)	0
Additional Application Depth (mm)	0
Nitrogen Crop Uptake (kg/ha/yr)	260
Phosphorus Crop Uptake (kg/ha/yr)	30

Wastewater Characteristics

Constant Daily WWF (m^3/day)	2.368 average flow
Total Nitrogen (mg/L)	30
Total Phosphorus (mg/L)	10
Virus (MPN/L)	100

Use WWF timeseries instead? No

View Data

0.0 m^3/day

Crop Data

Add New

January	1
February	1
March	1
April	1
May	1
June	1
July	1
August	1
September	1
October	1
November	1
December	1

Meteorological Data

View Data

Number of Years 60.7

	R	*ET*	*E*	*T*
Max	228.3	9.1	16.6	33.4
Min	0.0	0.4	0.0	6.1
Average	3.3	3.1	3.8	17.2
Median	0.0	2.8	3.5	17.2
Standard Deviation	10.4	1.6	2.0	4.6

ONLY grey cells require input.

Refer to comments within cells for instructions

BMT WBM

Land Application Management Tool

View Timeseries Results

Summary of Results

Runoff (surcharge) frequency	**0.0**	days/year		
Runoff (surcharge) volume	**0.0**	% of total WWF volume		
Deep drainage volume	**769.3**	m3/yr	or	**3.05** mm/day
Total phosphorus load in runoff	**0.0**	kg/yr		
Total nitrogen load in runoff	**0.0**	kg/yr		
Total phosphorus load in deep drainage	**6.3**	kg/yr		
PO4 concentration in deep drainage	**6.1**	g/cub.m		
Total nitrogen load in deep drainage	**0.3**	kg/yr		
NO3 concentration in deep drainage	**0.3**	g/cub.m		
Total site virus load	**2019795**	MPN/yr		
Total site virus concentration	**2.6**	MPN/L		
Total site phosphorus load	**6.3**	kg/yr		
Total site nitrogen load	**0.3**	kg/yr		
Storage overflow frequency	**0**	number of years		
	0.0	days/year		
Storage overflow volume	**0.0**	cub.m/yr		
	0.0	% of total WWF volume		

Appendix D

Flow Balancing Assessment

INFLUENT FLOW BALANCING

				Wastewater Generation (L)	Treatment Volume (L)	Stored Wastewater (L)	Stored Wastewater from Previous Day (L)	Cumulative Wastewater Influent Storage (L)	Cumulative Storage Managed by Pumpout (L)	Pump out (as required)	Maximum Storage Requirement	Average daily generation (L)	
		Season	Day		18,000						39,905	13,762	
1-Jan	friday	high	weekday	26,710	18,000	8,710	0	8,710	8,710				
2-Jan	saturday	high	weekend	26,118	18,000	8,118	8,710	16,828	16,828				
3-Jan	sunday	high	weekend	26,118	18,000	8,118	16,828	24,945	24,945				
4-Jan	monday	high	weekday	14,723	18,000	-3,278	24,945	21,668	21,668				
5-Jan	tuesday	high	weekday	14,723	18,000	-3,278	21,668	18,390	18,390				
6-Jan	wednesday	high	weekday	26,710	18,000	8,710	18,390	27,100	27,100				
7-Jan	thursday	high	weekday	14,723	18,000	-3,278	27,100	23,823	23,823				
8-Jan	friday	high	weekday	14,723	18,000	-3,278	23,823	20,545	20,545				
9-Jan	saturday	high	weekend	26,710	18,000	8,710	20,545	29,255	29,255				
10-Jan	sunday	high	weekend	26,118	18,000	8,118	29,255	37,373	37,373				
11-Jan	monday	high	weekday	14,723	18,000	-3,278	37,373	34,095	34,095				
12-Jan	tuesday	high	weekday	14,723	18,000	-3,278	34,095	30,818	30,818				
13-Jan	wednesday	high	weekday	14,723	18,000	-3,278	30,818	27,540	27,540				
14-Jan	thursday	high	weekday	14,723	18,000	-3,278	27,540	24,263	24,263				
15-Jan	friday	high	weekday	14,723	18,000	-3,278	24,263	20,985	20,985				
16-Jan	saturday	high	weekend	26,118	18,000	8,118	20,985	29,103	29,103				
17-Jan	sunday	high	weekend	26,118	18,000	8,118	29,103	37,220	37,220				
18-Jan	monday	high	weekday	14,723	18,000	-3,278	37,220	33,943	33,943				
19-Jan	tuesday	high	weekday	14,723	18,000	-3,278	33,943	30,665	30,665				
20-Jan	wednesday	high	weekday	14,723	18,000	-3,278	30,665	27,388	27,388				
21-Jan	thursday	high	weekday	14,723	18,000	-3,278	27,388	24,110	24,110				
22-Jan	friday	high	weekday	14,723	18,000	-3,278	24,110	20,833	20,833				
23-Jan	saturday	high	weekend	26,118	18,000	8,118	20,833	28,950	28,950				
24-Jan	sunday	high	weekend	26,118	18,000	8,118	28,950	37,068	37,068				
25-Jan	monday	high	weekday	14,723	18,000	-3,278	37,068	33,790	33,790				
26-Jan	tuesday	high	weekday	14,723	18,000	-3,278	33,790	30,513	30,513				
27-Jan	wednesday	high	weekday	14,723	18,000	-3,278	30,513	27,235	27,235				
28-Jan	thursday	high	weekday	14,723	18,000	-3,278	27,235	23,958	23,958				
29-Jan	friday	high	weekday	14,723	18,000	-3,278	23,958	20,680	20,680				
30-Jan	saturday	high	weekend	26,118	18,000	8,118	20,680	28,798	28,798				
31-Jan	sunday	high	weekend	26,118	18,000	8,118	28,798	36,915	36,915				January
1-Feb	monday	high	weekday	14,723	18,000	-3,278	36,915	33,638	33,638				
2-Feb	tuesday	high	weekday	14,723	18,000	-3,278	33,638	30,360	30,360				
3-Feb	wednesday	high	weekday	14,723	18,000	-3,278	30,360	27,083	27,083				
4-Feb	thursday	high	weekday	14,723	18,000	-3,278	27,083	23,805	23,805				
5-Feb	friday	high	weekday	14,723	18,000	-3,278	23,805	20,528	20,528				
6-Feb	saturday	high	weekend	26,118	18,000	8,118	20,528	28,645	28,645				
7-Feb	sunday	high	weekend	26,118	18,000	8,118	28,645	36,763	36,763				
8-Feb	monday	high	weekday	14,723	18,000	-3,278	36,763	33,485	33,485				
9-Feb	tuesday	high	weekday	14,723	18,000	-3,278	33,485	30,208	30,208				
10-Feb	wednesday	high	weekday	14,723	18,000	-3,278	30,208	26,930	26,930				
11-Feb	thursday	high	weekday	14,723	18,000	-3,278	26,930	23,653	23,653				
12-Feb	friday	high	weekday	14,723	18,000	-3,278	23,653	20,375	20,375				
13-Feb	saturday	high	weekend	26,118	18,000	8,118	20,375	28,493	28,493				
14-Feb	sunday	high	weekend	26,118	18,000	8,118	28,493	36,610	36,610				
15-Feb	monday	Shoulder	weekday	11,778	18,000	-6,222	36,610	30,388	30,388				
16-Feb	tuesday	Shoulder	weekday	11,778	18,000	-6,222	30,388	24,166	24,166				
17-Feb	wednesday	Shoulder	weekday	11,778	18,000	-6,222	24,166	17,944	17,944				
18-Feb	thursday	Shoulder	weekday	11,778	18,000	-6,222	17,944	11,722	11,722				
19-Feb	friday	Shoulder	weekday	11,778	18,000	-6,222	11,722	5,500	5,500				
20-Feb	saturday	Shoulder	weekend	20,894	18,000	2,894	5,500	8,394	8,394				
21-Feb	sunday	Shoulder	weekend	20,894	18,000	2,894	8,394	11,288	11,288				
22-Feb	monday	Shoulder	weekday	11,778	18,000	-6,222	11,288	5,066	5,066				
23-Feb	tuesday	Shoulder	weekday	11,778	18,000	-6,222	5,066	0	0				
24-Feb	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
25-Feb	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
26-Feb	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
27-Feb	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894				
28-Feb	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788				February
1-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0				
2-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
3-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
4-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
5-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
6-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894				
7-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788				
8-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0				
9-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
10-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
11-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
12-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
13-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894				
14-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788				
15-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0				
16-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
17-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
18-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
19-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
20-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894				
21-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788				
22-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0				
23-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
24-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
25-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
26-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
27-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894				
28-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788				
29-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0				
30-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
31-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				March
1-Apr	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
2-Apr	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0				
3-Apr	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894				
4-Apr	sunday	High	weekend	26,118	18,000	8,118	2,894	11,012	11,012				
5-Apr	monday	High	weekday	14,723	18,000	-3,278	11,012	7,734	7,734				
6-Apr	tuesday	High	weekday	14,723	18,000	-3,278	7,734	4,457	4,457				
7-Apr	wednesday	High	weekday	14,723	18,000	-3,278	4,457	1,179	1,179				
8-Apr	thursday	High	weekday	14,723	18,000	-3,278	1,179	0	0				
9-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
10-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
11-Apr	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
12-Apr	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
13-Apr	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
14-Apr	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
15-Apr	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
16-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
17-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
18-Apr	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
19-Apr	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
20-Apr	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
21-Apr	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
22-Apr	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
23-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
24-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
25-Apr	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
26-Apr	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
27-Apr	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
28-Apr	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
29-Apr	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
30-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				April
1-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
2-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
3-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
4-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
5-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
6-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
7-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
8-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
9-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
10-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
11-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
12-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
13-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
14-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
15-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
16-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
17-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
18-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
19-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
20-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
21-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
22-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
23-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
24-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
25-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
26-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
27-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
28-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
29-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
30-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
31-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				May
1-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
2-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
3-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
4-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
5-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
6-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
7-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
8-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
9-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
10-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
11-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
12-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
13-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
14-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
15-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
16-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
17-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
18-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
19-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
20-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
21-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
22-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
23-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
24-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0				
25-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0				
26-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0				
27-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0				
28-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0				
29-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0				
30-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0				June

High flow period

Shoulder period

Low flow period

1-Jul	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
2-Jul	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
3-Jul	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
4-Jul	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
5-Jul	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
6-Jul	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
7-Jul	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
8-Jul	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
9-Jul	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
10-Jul	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
11-Jul	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
12-Jul	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
13-Jul	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
14-Jul	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
15-Jul	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
16-Jul	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
17-Jul	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
18-Jul	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
19-Jul	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
20-Jul	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
21-Jul	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
22-Jul	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
23-Jul	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
24-Jul	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
25-Jul	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
26-Jul	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
27-Jul	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
28-Jul	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
29-Jul	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
30-Jul	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
31-Jul	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	July
1-Aug	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
2-Aug	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
3-Aug	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
4-Aug	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
5-Aug	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
6-Aug	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
7-Aug	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
8-Aug	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
9-Aug	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
10-Aug	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
11-Aug	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
12-Aug	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
13-Aug	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
14-Aug	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
15-Aug	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
16-Aug	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
17-Aug	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
18-Aug	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
19-Aug	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
20-Aug	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
21-Aug	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
22-Aug	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
23-Aug	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
24-Aug	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
25-Aug	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
26-Aug	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
27-Aug	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
28-Aug	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
29-Aug	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
30-Aug	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
31-Aug	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	August
1-Sep	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
2-Sep	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
3-Sep	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
4-Sep	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
5-Sep	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
6-Sep	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
7-Sep	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
8-Sep	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
9-Sep	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
10-Sep	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
11-Sep	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
12-Sep	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
13-Sep	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
14-Sep	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
15-Sep	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
16-Sep	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
17-Sep	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
18-Sep	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
19-Sep	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
20-Sep	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
21-Sep	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
22-Sep	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
23-Sep	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
24-Sep	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
25-Sep	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
26-Sep	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
27-Sep	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
28-Sep	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
29-Sep	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
30-Sep	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	September
1-Oct	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
2-Oct	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
3-Oct	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
4-Oct	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
5-Oct	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
6-Oct	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
7-Oct	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
8-Oct	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
9-Oct	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
10-Oct	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
11-Oct	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
12-Oct	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
13-Oct	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
14-Oct	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
15-Oct	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
16-Oct	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
17-Oct	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
18-Oct	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
19-Oct	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
20-Oct	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
21-Oct	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
22-Oct	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
23-Oct	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
24-Oct	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
25-Oct	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
26-Oct	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
27-Oct	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
28-Oct	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
29-Oct	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
30-Oct	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
31-Oct	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	October
1-Nov	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
2-Nov	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
3-Nov	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
4-Nov	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
5-Nov	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
6-Nov	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
7-Nov	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
8-Nov	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
9-Nov	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
10-Nov	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
11-Nov	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
12-Nov	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
13-Nov	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
14-Nov	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
15-Nov	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
16-Nov	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
17-Nov	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
18-Nov	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
19-Nov	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
20-Nov	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
21-Nov	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
22-Nov	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
23-Nov	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
24-Nov	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
25-Nov	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
26-Nov	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
27-Nov	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
28-Nov	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
29-Nov	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
30-Nov	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	November
1-Dec	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
2-Dec	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
3-Dec	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
4-Dec	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
5-Dec	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
6-Dec	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
7-Dec	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
8-Dec	wednesday	Shoulder	weekday	26,710	18,000	8,710	0	8,710	8,710	
9-Dec	thursday	Shoulder	weekday	11,778	18,000	-6,222	8,710	2,488	2,488	
10-Dec	friday	Shoulder	weekday	11,778	18,000	-6,222	2,488	0	0	
11-Dec	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
12-Dec	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
13-Dec	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
14-Dec	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
15-Dec	wednesday	High	weekday	14,723	18,000	-3,278	0	0	0	
16-Dec	thursday	High	weekday	14,723	18,000	-3,278	0	0	0	
17-Dec	friday	High	weekday	14,723	18,000	-3,278	0	0	0	
18-Dec	saturday	High	weekend	26,118	18,000	8,118	0	8,118	8,118	
19-Dec	sunday	High	weekend	26,118	18,000	8,118	8,118	16,235	16,235	
20-Dec	monday	High	weekday	14,723	18,000	-3,278	16,235	12,958	12,958	
21-Dec	tuesday	High	weekday	14,723	18,000	-3,278	12,958	9,680	9,680	
22-Dec	wednesday	High	weekday	14,723	18,000	-3,278	9,680	6,403	6,403	
23-Dec	thursday	High	weekday	14,723	18,000	-3,278	6,403	3,125	3,125	
24-Dec	friday	High	weekday	14,723	18,000	-3,278	3,125	0	0	
25-Dec	saturday	High	weekend	26,118	18,000	8,118	0	8,118	8,118	
26-Dec	sunday	High	weekend	26,118	18,000	8,118	8,118	16,235	16,235	
27-Dec	monday	High	weekday	14,723	18,000	-3,278	16,235	12,958	12,958	
28-Dec	tuesday	High	weekday	14,723	18,000	-3,278	12,958	9,680	9,680	
29-Dec	wednesday	High	weekday	14,723	18,000	-3,278	9,680	6,403	6,403	
30-Dec	thursday	High	weekday	14,723	18,000	-3,278	6,403	3,125	3,125	
31-Dec	friday	High	weekday	26,710	18,000	8,710	3,125	11,835	11,835	December

1-Jan	saturday	high	weekend	26,118	18,000	8,118	11,835	19,953	19,953	
2-Jan	sunday	high	weekend	26,118	18,000	8,118	19,953	28,070	28,070	
3-Jan	monday	high	weekday	14,723	18,000	-3,278	28,070	24,793	24,793	
4-Jan	tuesday	high	weekday	14,723	18,000	-3,278	24,793	21,515	21,515	
5-Jan	wednesday	high	weekday	26,710	18,000	8,710	21,515	30,225	30,225	
6-Jan	thursday	high	weekday	14,723	18,000	-3,278	30,225	26,948	26,948	
7-Jan	friday	high	weekday	14,723	18,000	-3,278	26,948	23,670	23,670	
8-Jan	saturday	high	weekend	26,118	18,000	8,118	23,670	31,788	31,788	
9-Jan	sunday	high	weekend	26,118	18,000	8,118	31,788	39,905	39,905	
10-Jan	monday	high	weekday	14,723	18,000	-3,278	39,905	36,628	36,628	
11-Jan	tuesday	high	weekday	14,723	18,000	-3,278	36,628	33,350	33,350	
12-Jan	wednesday	high	weekday	14,723	18,000	-3,278	33,350	30,073	30,073	
13-Jan	thursday	high	weekday	14,723	18,000	-3,278	30,073	26,795	26,795	
14-Jan	friday	high	weekday	14,723	18,000	-3,278	26,795	23,518	23,518	
15-Jan	saturday	high	weekend	26,118	18,000	8,118	23,518	31,635	31,635	
16-Jan	sunday	high	weekend	26,118	18,000	8,118	31,635	39,753	39,753	
17-Jan	monday	high	weekday	14,723	18,000	-3,278	39,753	36,475	36,475	
18-Jan	tuesday	high	weekday	14,723	18,000	-3,278	36,475	33,198	33,198	
19-Jan	wednesday	high	weekday	14,723	18,000	-3,278	33,198	29,920	29,920	
20-Jan	thursday	high	weekday	14,723	18,000	-3,278	29,920	26,643	26,643	
21-Jan	friday	high	weekday	14,723	18,000	-3,278	26,643	23,365	23,365	
22-Jan	saturday	high	weekend	26,118	18,000	8,118	23,365	31,483	31,483	
23-Jan	sunday	high	weekend	26,118	18,000	8,118	31,483	39,600	39,600	
24-Jan	monday	high	weekday	14,723	18,000	-3,278	39,600	36,323	36,323	
25-Jan	tuesday	high	weekday	14,723	18,000	-3,278	36,323	33,045	33,045	
26-Jan	wednesday	high	weekday	14,723	18,000	-3,278	33,045	29,768	29,768	
27-Jan	thursday	high	weekday	14,723	18,000	-3,278	29,768	26,490	26,490	
28-Jan	friday	high	weekday	14,723	18,000	-3,278	26,490	23,213	23,213	
29-Jan	saturday	high	weekend	26,118	18,000	8,118	23,213	31,330	31,330	
30-Jan	sunday	high	weekend	26,118	18,000	8,118	31,330	39,448	39,448	
31-Jan	monday	high	weekday	14,723	18,000	-3,278	39,448	36,170	36,170	January
1-Feb	tuesday	high	weekday	14,723	18,000	-3,278	36,170	32,893	32,893	
2-Feb	wednesday	high	weekday	14,723	18,000	-3,278	32,893	29,615	29,615	
3-Feb	thursday	high	weekday	14,723	18,000	-3,278	29,615	26,338	26,338	
4-Feb	friday	high	weekday	14,723	18,000	-3,278	26,338	23,060	23,060	
5-Feb	saturday	high	weekend	26,118	18,000	8,118	23,060	31,178	31,178	
6-Feb	sunday	high	weekend	26,118	18,000	8,118	31,178	39,295	39,295	
7-Feb	monday	high	weekday	14,723	18,000	-3,278	39,295	36,018	36,018	
8-Feb	tuesday	high	weekday	14,723	18,000	-3,278	36,018	32,740	32,740	
9-Feb	wednesday	high	weekday	14,723	18,000	-3,278	32,740	29,463	29,463	
10-Feb	thursday	high	weekday	14,723	18,000	-3,278	29,463	26,185	26,185	
11-Feb	friday	high	weekday	14,723	18,000	-3,278	26,185	22,908	22,908	
12-Feb	saturday	high	weekend	26,118	18,000	8,118	22,908	31,025	31,025	
13-Feb	sunday	high	weekend	26,118	18,000	8,118	31,025	39,143	39,143	
14-Feb	monday	high	weekday	14,723	18,000	-3,278	39,143	35,865	35,865	
15-Feb	tuesday	Shoulder	weekday	11,778	18,000	-6,222	35,865	29,643	29,643	
16-Feb	wednesday	Shoulder	weekday	11,778	18,000	-6,222	29,643	23,421	23,421	
17-Feb	thursday	Shoulder	weekday	11,778	18,000	-6,222	23,421	17,199	17,199	
18-Feb	friday	Shoulder	weekday	11,778	18,000	-6,222	17,199	10,977	10,977	
19-Feb	saturday	Shoulder	weekend	20,894	18,000	2,894	10,977	13,871	13,871	
20-Feb	sunday	Shoulder	weekend	20,894	18,000	2,894	13,871	16,765	16,765	
21-Feb	monday	Shoulder	weekday	11,778	18,000	-6,222	16,765	10,543	10,543	
22-Feb	tuesday	Shoulder	weekday	11,778	18,000	-6,222	10,543	4,321	4,321	
23-Feb	wednesday	Shoulder	weekday	11,778	18,000	-6,222	4,321	0	0	
24-Feb	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
25-Feb	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
26-Feb	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
27-Feb	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
28-Feb	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	February
1-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
2-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
3-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
4-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
5-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
6-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
7-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
8-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
9-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
10-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
11-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
12-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
13-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
14-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
15-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
16-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
17-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
18-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
19-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
20-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
21-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
22-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
23-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
24-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
25-Mar	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
26-Mar	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
27-Mar	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
28-Mar	monday	Shoulder	weekday	11,778	18,000	-6,222	5,788	0	0	
29-Mar	tuesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
30-Mar	wednesday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
31-Mar	thursday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	March
1-Apr	friday	Shoulder	weekday	11,778	18,000	-6,222	0	0	0	
2-Apr	saturday	Shoulder	weekend	20,894	18,000	2,894	0	2,894	2,894	
3-Apr	sunday	Shoulder	weekend	20,894	18,000	2,894	2,894	5,788	5,788	
4-Apr	monday	High	weekday	14,723	18,000	-3,278	5,788	2,511	2,511	
5-Apr	tuesday	High	weekday	14,723	18,000	-3,278	2,511	0	0	
6-Apr	wednesday	High	weekday	14,723	18,000	-3,278	0	0	0	
7-Apr	thursday	High	weekday	14,723	18,000	-3,278	0	0	0	
8-Apr	friday	High	weekday	14,723	18,000	-3,278	0	0	0	
9-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
10-Apr	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
11-Apr	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
12-Apr	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
13-Apr	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
14-Apr	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
15-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
16-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
17-Apr	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
18-Apr	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
19-Apr	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
20-Apr	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
21-Apr	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
22-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
23-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
24-Apr	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
25-Apr	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
26-Apr	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
27-Apr	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
28-Apr	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
29-Apr	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
30-Apr	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	April
1-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
2-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
3-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
4-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
5-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
6-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
7-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
8-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
9-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
10-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
11-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
12-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
13-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
14-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
15-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
16-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
17-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
18-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
19-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
20-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
21-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
22-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
23-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
24-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
25-May	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
26-May	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
27-May	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
28-May	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
29-May	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
30-May	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
31-May	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	May
1-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
2-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
3-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
4-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
5-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
6-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
7-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
8-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
9-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
10-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
11-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
12-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
13-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
14-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
15-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
16-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
17-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
18-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
19-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
20-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
21-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
22-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
23-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	
24-Jun	friday	Low	weekday	8,834	18,000	-9,167	0	0	0	
25-Jun	saturday	Low	weekend	15,671	18,000	-2,330	0	0	0	
26-Jun	sunday	Low	weekend	15,671	18,000	-2,330	0	0	0	
27-Jun	monday	Low	weekday	8,834	18,000	-9,167	0	0	0	
28-Jun	tuesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
29-Jun	wednesday	Low	weekday	8,834	18,000	-9,167	0	0	0	
30-Jun	thursday	Low	weekday	8,834	18,000	-9,167	0	0	0	June

				Number 15	12	3							
EFFLUENT FLOW BALANCING		LEAVING STP		LAA Acceptance Volume (Total)	LAA Acceptance Volume (Beds)	LAA Acceptance Volume (Garden Irrigation)	Stored Wastewater (L)	Stored Wastewater from Previous Day (L)	Cumulative Wastewater Effluent Storage (L)	Cumulative Storage Managed by Pumpout (L)	Maximum Storage Requirement	Average daily effluent generation (L)	
				14,250	11,400	2,850					78,373	12,889	
1-Jan	friday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750			
2-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500			
3-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	7,500	11,250	11,250			
4-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	11,250	11,723	11,723			
5-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	11,723	12,195	12,195			
6-Jan	wednesday	18,000	14,250	14,250	11,400	2,850	3,750	12,195	15,945	15,945			
7-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	15,945	16,418	16,418			
8-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	16,418	16,890	16,890			
9-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	16,890	20,640	20,640			
10-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	20,640	24,390	16,390			
11-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	16,390	16,863	16,863			
12-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	16,863	17,335	17,335			
13-Jan	wednesday	14,723	14,250	14,250	11,400	2,850	473	17,335	17,808	17,808			
14-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	17,808	18,280	18,280			
15-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	18,280	18,753	18,753			
16-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	18,753	22,503	22,503			
17-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	22,503	26,253	26,253			
18-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	26,253	26,725	26,725			
19-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	26,725	27,198	27,198			
20-Jan	wednesday	14,723	14,250	14,250	11,400	2,850	473	27,198	27,670	27,670			
21-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	27,670	28,143	28,143			
22-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	28,143	28,615	28,615			
23-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	28,615	32,365	32,365			
24-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	32,365	36,115	28,115			
25-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	28,115	28,588	28,588			
26-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	28,588	29,060	29,060			
27-Jan	wednesday	14,723	14,250	14,250	11,400	2,850	473	29,060	29,533	29,533			
28-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	29,533	30,005	30,005			
29-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	30,005	30,478	30,478			
30-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	30,478	34,228	34,228			
31-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	34,228	37,978	37,978			January
1-Feb	monday	14,723	14,250	14,250	11,400	2,850	473	37,978	38,450	38,450			
2-Feb	tuesday	14,723	14,250	14,250	11,400	2,850	473	38,450	38,923	38,923			
3-Feb	wednesday	14,723	14,250	14,250	11,400	2,850	473	38,923	39,395	39,395			
4-Feb	thursday	14,723	14,250	14,250	11,400	2,850	473	39,395	39,868	31,868			
5-Feb	friday	14,723	14,250	14,250	11,400	2,850	473	31,868	32,340	32,340			
6-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	32,340	36,090	36,090			
7-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	36,090	39,840	39,840			
8-Feb	monday	14,723	14,250	14,250	11,400	2,850	473	39,840	40,313	40,313			
9-Feb	tuesday	14,723	14,250	14,250	11,400	2,850	473	40,313	40,785	40,785			
10-Feb	wednesday	14,723	14,250	14,250	11,400	2,850	473	40,785	41,258	41,258			
11-Feb	thursday	14,723	14,250	14,250	11,400	2,850	473	41,258	41,730	41,730			
12-Feb	friday	14,723	14,250	14,250	11,400	2,850	473	41,730	42,203	34,203			
13-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	34,203	37,953	37,953			
14-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	37,953	41,703	41,703			
15-Feb	monday	11,778	14,250	11,778	11,400	378	-2,472	41,703	39,231	39,231			
16-Feb	tuesday	11,778	14,250	11,778	11,400	378	-2,472	39,231	36,759	36,759			
17-Feb	wednesday	11,778	14,250	11,778	11,400	378	-2,472	36,759	34,287	34,287			
18-Feb	thursday	11,778	14,250	11,778	11,400	378	-2,472	34,287	31,815	31,815			
19-Feb	friday	11,778	14,250	11,778	11,400	378	-2,472	31,815	29,343	29,343			
20-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	29,343	33,093	33,093			
21-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	33,093	36,843	36,843			
22-Feb	monday	11,778	14,250	11,778	11,400	378	-2,472	36,843	34,371	34,371			
23-Feb	tuesday	11,778	14,250	11,778	11,400	378	-2,472	34,371	31,899	31,899			
24-Feb	wednesday	11,778	14,250	11,778	11,400	378	-2,472	31,899	29,427	29,427			
25-Feb	thursday	11,778	14,250	11,778	11,400	378	-2,472	29,427	26,955	26,955			
26-Feb	friday	11,778	14,250	11,778	11,400	378	-2,472	26,955	24,483	24,483			
27-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	24,483	28,233	28,233			
28-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	28,233	31,983	31,983			February
1-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	31,983	29,511	29,511			
2-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	29,511	27,039	27,039			
3-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	27,039	24,567	24,567			
4-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	24,567	22,095	22,095			
5-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	22,095	19,623	19,623			
6-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	19,623	23,373	23,373			
7-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	23,373	27,123	27,123			
8-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	27,123	24,651	24,651			
9-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	24,651	22,179	22,179			
10-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	22,179	19,707	19,707			
11-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	19,707	17,235	17,235			
12-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	17,235	14,763	14,763			
13-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	14,763	18,513	18,513			
14-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	18,513	22,263	22,263			
15-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	22,263	19,791	19,791			
16-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	19,791	17,319	17,319			
17-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	17,319	14,847	14,847			
18-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	14,847	12,375	12,375			
19-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	12,375	9,903	9,903			
20-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	9,903	13,653	13,653			
21-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	13,653	17,403	17,403			
22-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	17,403	14,931	14,931			
23-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	14,931	12,459	12,459			
24-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	12,459	9,987	9,987			
25-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	9,987	7,515	7,515			
26-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	7,515	5,043	5,043			
27-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	5,043	8,793	8,793			
28-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	8,793	12,543	12,543			
29-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	12,543	10,071	10,071			
30-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	10,071	7,599	7,599			
31-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	7,599	5,127	5,127			March
1-Apr	thursday	11,778	14,250	11,778	11,400	378	-2,472	5,127	2,655	2,655			
2-Apr	friday	11,778	14,250	11,778	11,400	378	-2,472	2,655	183	183			
3-Apr	saturday	18,000	14,250	14,250	11,400	2,850	3,750	183	3,933	3,933			
4-Apr	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,933	7,683	7,683			
5-Apr	monday	14,723	14,250	14,250	11,400	2,850	473	7,683	8,155	8,155			
6-Apr	tuesday	14,723	14,250	14,250	11,400	2,850	473	8,155	8,628	628			
7-Apr	wednesday	14,723	14,250	14,250	11,400	2,850	473	628	1,100	1,100			
8-Apr	thursday	14,723	14,250	14,250	11,400	2,850	473	1,100	1,573	1,573			
9-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	1,573	0	0			
10-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
11-Apr	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
12-Apr	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
13-Apr	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
14-Apr	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
15-Apr	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
16-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
17-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
18-Apr	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
19-Apr	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
20-Apr	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
21-Apr	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
22-Apr	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
23-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
24-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
25-Apr	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
26-Apr	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
27-Apr	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
28-Apr	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
29-Apr	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
30-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			April
1-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
2-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
3-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
4-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
5-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
6-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
7-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
8-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
9-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
10-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
11-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
12-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
13-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
14-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
15-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
16-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
17-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
18-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
19-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
20-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
21-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
22-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
23-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
24-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
25-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
26-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
27-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
28-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
29-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
30-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
31-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			May
1-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
2-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
3-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
4-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
5-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
6-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
7-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
8-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
9-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
10-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
11-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
12-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
13-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
14-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
15-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
16-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
17-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
18-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
19-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
20-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
21-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
22-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
23-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
24-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
25-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
26-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421			
27-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841			
28-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0			
29-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			
30-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0			June

High flow period

Shoulder period

Low flow period

1-Jul	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
2-Jul	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
3-Jul	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
4-Jul	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
5-Jul	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
6-Jul	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
7-Jul	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
8-Jul	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
9-Jul	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
10-Jul	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
11-Jul	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
12-Jul	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
13-Jul	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
14-Jul	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
15-Jul	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
16-Jul	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
17-Jul	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
18-Jul	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
19-Jul	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
20-Jul	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
21-Jul	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
22-Jul	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
23-Jul	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
24-Jul	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
25-Jul	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
26-Jul	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
27-Jul	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
28-Jul	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
29-Jul	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
30-Jul	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
31-Jul	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	**July**
1-Aug	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
2-Aug	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
3-Aug	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
4-Aug	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
5-Aug	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
6-Aug	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
7-Aug	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
8-Aug	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
9-Aug	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
10-Aug	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
11-Aug	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
12-Aug	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
13-Aug	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
14-Aug	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
15-Aug	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
16-Aug	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
17-Aug	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
18-Aug	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
19-Aug	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
20-Aug	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
21-Aug	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
22-Aug	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
23-Aug	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
24-Aug	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
25-Aug	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
26-Aug	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
27-Aug	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
28-Aug	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
29-Aug	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
30-Aug	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
31-Aug	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	**August**
1-Sep	wednesday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
2-Sep	thursday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
3-Sep	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
4-Sep	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
5-Sep	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
6-Sep	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
7-Sep	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
8-Sep	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
9-Sep	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
10-Sep	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
11-Sep	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
12-Sep	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
13-Sep	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
14-Sep	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
15-Sep	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
16-Sep	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
17-Sep	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
18-Sep	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
19-Sep	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
20-Sep	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
21-Sep	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
22-Sep	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
23-Sep	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
24-Sep	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
25-Sep	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
26-Sep	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
27-Sep	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
28-Sep	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
29-Sep	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
30-Sep	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	**September**
1-Oct	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
2-Oct	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
3-Oct	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
4-Oct	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
5-Oct	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
6-Oct	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
7-Oct	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
8-Oct	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
9-Oct	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
10-Oct	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
11-Oct	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
12-Oct	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
13-Oct	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
14-Oct	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
15-Oct	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
16-Oct	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
17-Oct	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
18-Oct	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
19-Oct	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
20-Oct	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
21-Oct	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
22-Oct	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
23-Oct	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
24-Oct	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
25-Oct	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
26-Oct	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
27-Oct	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
28-Oct	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
29-Oct	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
30-Oct	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
31-Oct	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	**October**
1-Nov	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
2-Nov	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
3-Nov	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
4-Nov	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
5-Nov	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
6-Nov	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
7-Nov	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
8-Nov	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
9-Nov	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
10-Nov	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
11-Nov	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
12-Nov	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
13-Nov	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
14-Nov	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
15-Nov	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
16-Nov	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
17-Nov	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
18-Nov	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
19-Nov	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
20-Nov	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
21-Nov	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
22-Nov	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
23-Nov	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
24-Nov	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
25-Nov	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
26-Nov	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
27-Nov	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
28-Nov	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
29-Nov	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
30-Nov	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	**November**
1-Dec	wednesday	11,778	14,250	11,778	11,400	378	-2,472	2,556	84	84	
2-Dec	thursday	11,778	14,250	11,778	11,400	378	-2,472	84	0	0	
3-Dec	friday	11,778	14,250	11,778	11,400	378	-2,472	0	0	0	
4-Dec	saturday	18,000	14,250	14,250	11,400	2,850	3,750	0	3,750	3,750	
5-Dec	sunday	18,000	14,250	14,250	11,400	2,850	3,750	3,750	7,500	7,500	
6-Dec	monday	11,778	14,250	11,778	11,400	378	-2,472	7,500	5,028	5,028	
7-Dec	tuesday	11,778	14,250	11,778	11,400	378	-2,472	5,028	2,556	2,556	
8-Dec	wednesday	18,000	14,250	14,250	11,400	2,850	3,750	2,556	6,306	6,306	
9-Dec	thursday	11,778	14,250	11,778	11,400	378	-2,472	6,306	3,834	3,834	
10-Dec	friday	11,778	14,250	11,778	11,400	378	-2,472	3,834	1,362	1,362	
11-Dec	saturday	18,000	14,250	14,250	11,400	2,850	3,750	1,362	5,112	5,112	
12-Dec	sunday	18,000	14,250	14,250	11,400	2,850	3,750	5,112	8,862	8,862	
13-Dec	monday	11,778	14,250	11,778	11,400	378	-2,472	8,862	6,390	6,390	
14-Dec	tuesday	11,778	14,250	11,778	11,400	378	-2,472	6,390	3,918	3,918	
15-Dec	wednesday	14,723	14,250	14,250	11,400	2,850	473	3,918	4,391	-3,610	
16-Dec	thursday	14,723	14,250	14,250	11,400	2,850	473	0	473	473	
17-Dec	friday	14,723	14,250	14,250	11,400	2,850	473	473	945	945	
18-Dec	saturday	18,000	14,250	14,250	11,400	2,850	3,750	945	4,695	4,695	
19-Dec	sunday	18,000	14,250	14,250	11,400	2,850	3,750	4,695	8,445	8,445	
20-Dec	monday	14,723	14,250	14,250	11,400	2,850	473	8,445	8,918	8,918	
21-Dec	tuesday	14,723	14,250	14,250	11,400	2,850	473	8,918	9,390	9,390	
22-Dec	wednesday	14,723	14,250	14,250	11,400	2,850	473	9,390	9,863	9,863	
23-Dec	thursday	14,723	14,250	14,250	11,400	2,850	473	9,863	10,335	10,335	
24-Dec	friday	14,723	14,250	14,250	11,400	2,850	473	10,335	10,808	10,808	
25-Dec	saturday	18,000	14,250	14,250	11,400	2,850	3,750	10,808	14,558	14,558	
26-Dec	sunday	18,000	14,250	14,250	11,400	2,850	3,750	14,558	18,308	18,308	
27-Dec	monday	14,723	14,250	14,250	11,400	2,850	473	18,308	18,780	18,780	
28-Dec	tuesday	14,723	14,250	14,250	11,400	2,850	473	18,780	19,253	19,253	
29-Dec	wednesday	14,723	14,250	14,250	11,400	2,850	473	19,253	19,725	19,725	
30-Dec	thursday	14,723	14,250	14,250	11,400	2,850	473	19,725	20,198	20,198	
31-Dec	friday	18,000	14,250	14,250	11,400	2,850	3,750	20,198	23,948	23,948	**December**

1-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	23,948	27,698	27,698	
2-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	27,698	31,448	31,448	
3-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	31,448	31,920	31,920	
4-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	31,920	32,393	32,393	
5-Jan	wednesday	18,000	14,250	14,250	11,400	2,850	3,750	32,393	36,143	36,143	
6-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	36,143	36,615	36,615	
7-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	36,615	37,088	37,088	
8-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	37,088	40,838	40,838	
9-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	40,838	44,588	44,588	
10-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	44,588	45,060	45,060	
11-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	45,060	45,533	45,533	
12-Jan	wednesday	14,723	14,250	14,250	11,400	2,850	473	45,533	46,005	38,005	
13-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	38,005	38,478	38,478	
14-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	38,478	38,950	38,950	
15-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	38,950	42,700	42,700	
16-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	42,700	46,450	46,450	
17-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	46,450	46,923	46,923	
18-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	46,923	47,395	47,395	
19-Jan	wednesday	14,723	14,250	14,250	11,400	2,850	473	47,395	47,868	47,868	
20-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	47,868	48,340	48,340	
21-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	48,340	48,813	48,813	
22-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	48,813	52,563	52,563	
23-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	52,563	56,313	56,313	
24-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	56,313	56,785	56,785	
25-Jan	tuesday	14,723	14,250	14,250	11,400	2,850	473	56,785	57,258	57,258	
26-Jan	wednesday	14,723	14,250	14,250	11,400	2,850	473	57,258	57,730	57,730	
27-Jan	thursday	14,723	14,250	14,250	11,400	2,850	473	57,730	58,203	58,203	
28-Jan	friday	14,723	14,250	14,250	11,400	2,850	473	58,203	58,675	58,675	
29-Jan	saturday	18,000	14,250	14,250	11,400	2,850	3,750	58,675	62,425	62,425	
30-Jan	sunday	18,000	14,250	14,250	11,400	2,850	3,750	62,425	66,175	66,175	
31-Jan	monday	14,723	14,250	14,250	11,400	2,850	473	66,175	66,648	66,648	**January**
1-Feb	tuesday	14,723	14,250	14,250	11,400	2,850	473	66,648	67,120	67,120	
2-Feb	wednesday	14,723	14,250	14,250	11,400	2,850	473	67,120	67,593	67,593	
3-Feb	thursday	14,723	14,250	14,250	11,400	2,850	473	67,593	68,065	68,065	
4-Feb	friday	14,723	14,250	14,250	11,400	2,850	473	68,065	68,538	68,538	
5-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	68,538	72,288	72,288	
6-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	72,288	76,038	76,038	
7-Feb	monday	14,723	14,250	14,250	11,400	2,850	473	76,038	76,510	76,510	
8-Feb	tuesday	14,723	14,250	14,250	11,400	2,850	473	76,510	76,983	76,983	
9-Feb	wednesday	14,723	14,250	14,250	11,400	2,850	473	76,983	77,455	69,455	
10-Feb	thursday	14,723	14,250	14,250	11,400	2,850	473	69,455	69,928	69,928	
11-Feb	friday	14,723	14,250	14,250	11,400	2,850	473	69,928	70,400	70,400	
12-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	70,400	74,150	74,150	
13-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	74,150	77,900	77,900	
14-Feb	monday	14,723	14,250	14,250	11,400	2,850	473	77,900	78,373	78,373	
15-Feb	tuesday	11,778	14,250	11,778	11,400	378	-2,472	78,373	75,901	75,901	
16-Feb	wednesday	11,778	14,250	11,778	11,400	378	-2,472	75,901	73,429	73,429	
17-Feb	thursday	11,778	14,250	11,778	11,400	378	-2,472	73,429	70,957	70,957	
18-Feb	friday	11,778	14,250	11,778	11,400	378	-2,472	70,957	68,485	68,485	
19-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	68,485	72,235	72,235	
20-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	72,235	75,985	75,985	
21-Feb	monday	11,778	14,250	11,778	11,400	378	-2,472	75,985	73,513	73,513	
22-Feb	tuesday	11,778	14,250	11,778	11,400	378	-2,472	73,513	71,041	71,041	
23-Feb	wednesday	11,778	14,250	11,778	11,400	378	-2,472	71,041	68,569	68,569	
24-Feb	thursday	11,778	14,250	11,778	11,400	378	-2,472	68,569	66,097	66,097	
25-Feb	friday	11,778	14,250	11,778	11,400	378	-2,472	66,097	63,625	55,625	
26-Feb	saturday	18,000	14,250	14,250	11,400	2,850	3,750	55,625	59,375	59,375	
27-Feb	sunday	18,000	14,250	14,250	11,400	2,850	3,750	59,375	63,125	63,125	
28-Feb	monday	11,778	14,250	11,778	11,400	378	-2,472	63,125	60,653	60,653	**February**
1-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	60,653	58,181	58,181	
2-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	58,181	55,709	55,709	
3-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	55,709	53,237	53,237	
4-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	53,237	50,765	50,765	
5-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	50,765	54,515	46,515	
6-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	46,515	50,265	50,265	
7-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	50,265	47,793	47,793	
8-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	47,793	45,321	45,321	
9-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	45,321	42,849	42,849	
10-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	42,849	40,377	40,377	
11-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	40,377	37,905	37,905	
12-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	37,905	41,655	41,655	
13-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	41,655	45,405	45,405	
14-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	45,405	42,933	42,933	
15-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	42,933	40,461	40,461	
16-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	40,461	37,989	37,989	
17-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	37,989	35,517	35,517	
18-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	35,517	33,045	33,045	
19-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	33,045	36,795	36,795	
20-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	36,795	40,545	40,545	
21-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	40,545	38,073	30,073	
22-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	30,073	27,601	27,601	
23-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	27,601	25,129	25,129	
24-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	25,129	22,657	22,657	
25-Mar	friday	11,778	14,250	11,778	11,400	378	-2,472	22,657	20,185	20,185	
26-Mar	saturday	18,000	14,250	14,250	11,400	2,850	3,750	20,185	23,935	23,935	
27-Mar	sunday	18,000	14,250	14,250	11,400	2,850	3,750	23,935	27,685	27,685	
28-Mar	monday	11,778	14,250	11,778	11,400	378	-2,472	27,685	25,213	25,213	
29-Mar	tuesday	11,778	14,250	11,778	11,400	378	-2,472	25,213	22,741	22,741	
30-Mar	wednesday	11,778	14,250	11,778	11,400	378	-2,472	22,741	20,269	20,269	
31-Mar	thursday	11,778	14,250	11,778	11,400	378	-2,472	20,269	17,797	17,797	**March**
1-Apr	friday	11,778	14,250	11,778	11,400	378	-2,472	17,797	15,325	15,325	
2-Apr	saturday	18,000	14,250	14,250	11,400	2,850	3,750	15,325	19,075	19,075	
3-Apr	sunday	18,000	14,250	14,250	11,400	2,850	3,750	19,075	22,825	22,825	
4-Apr	monday	14,723	14,250	14,250	11,400	2,850	473	22,825	23,297	23,297	
5-Apr	tuesday	14,723	14,250	14,250	11,400	2,850	473	23,297	23,770	23,770	
6-Apr	wednesday	14,723	14,250	14,250	11,400	2,850	473	23,770	24,242	16,242	
7-Apr	thursday	14,723	14,250	14,250	11,400	2,850	473	16,242	16,715	16,715	
8-Apr	friday	14,723	14,250	14,250	11,400	2,850	473	16,715	17,187	17,187	
9-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	17,187	18,608	18,608	
10-Apr	sunday	15,671	14,250	14,250	11,400	2,850	1,421	18,608	20,028	20,028	
11-Apr	monday	8,834	14,250	8,834	8,834	0	-5,417	20,028	14,612	14,612	
12-Apr	tuesday	8,834	14,250	8,834	8,834	0	-5,417	14,612	9,195	9,195	
13-Apr	wednesday	8,834	14,250	8,834	8,834	0	-5,417	9,195	3,779	3,779	
14-Apr	thursday	8,834	14,250	8,834	8,834	0	-5,417	3,779	0	0	
15-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
16-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
17-Apr	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
18-Apr	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
19-Apr	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
20-Apr	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
21-Apr	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
22-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
23-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
24-Apr	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
25-Apr	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
26-Apr	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
27-Apr	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
28-Apr	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
29-Apr	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
30-Apr	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	**April**
1-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
2-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
3-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
4-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
5-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
6-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
7-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
8-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
9-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
10-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
11-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
12-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
13-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
14-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
15-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
16-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
17-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
18-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
19-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
20-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
21-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
22-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
23-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
24-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
25-May	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
26-May	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
27-May	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
28-May	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
29-May	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
30-May	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
31-May	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	**May**
1-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
2-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
3-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
4-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
5-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
6-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
7-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
8-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
9-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
10-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
11-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
12-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
13-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
14-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
15-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
16-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
17-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
18-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
19-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
20-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
21-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
22-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
23-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
24-Jun	friday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
25-Jun	saturday	15,671	14,250	14,250	11,400	2,850	1,421	0	1,421	1,421	
26-Jun	sunday	15,671	14,250	14,250	11,400	2,850	1,421	1,421	2,841	2,841	
27-Jun	monday	8,834	14,250	8,834	8,834	0	-5,417	2,841	0	0	
28-Jun	tuesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
29-Jun	wednesday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	
30-Jun	thursday	8,834	14,250	8,834	8,834	0	-5,417	0	0	0	**June**

Appendix E

Buffer Risk Analysis and

Viral Die-Off

Project:	3036				AS1547:2012 Table R1 and R2 Buffer Distance Justification																		
		Constraint Scale			Risk Assessment									Revised Risk Assessment								Adopted Buffer Distance	
Site Feature	Site Constraint Items of Concern	Low Constraint	High Constraint	Applicable Constraint	Risk Assessment	Low (1)		Moderate (2)		High (3)		Risk Rating	Mitigation Measures	Low (1)		Moderate (2)		High (3)		Risk Justification	Revised Risk Rating	Available Buffer (m)	Minimum Acceptable Buffer (m)
Surface Water 15m (low) - 100m (high)	Microbial Quality of Effluent	Secondary treated effluent (with disinfection) and Contractual Service Agreement	Primary treated effluent (no disinfection)	Primary treated effluent (no disinfection)	High	✓	1		0		0	Moderate (<15)		✓	1		0		0	Maintain (minimum) primary treatment for intermittent loading (holiday house)	Moderate (<15)	30m to intermittent watercourses as per AS/NZS 1547:2012	30-60
	Surface Water	Category 1 to 3 soils no surface water down gradient within 100m; low rainfall area	Category 4 to 6 soils permanent surface water <50m down gradient; high rainfall; high resource / environmental value	Category 4 soil; proposed LAA <40m from downgradient intermittent drainage line; moderate rainfall area (~1,030mm pa)	High		0	✓	2		0		Daily (hydraulic) modelling used to size LAA to limit surface surcharge of effluent		0	✓	2		0	LAA conservatively sized.			
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application), >30% subsurface effluent application	Slope 2-12% in LAA; subsurface (absorption system) effluent land application method	Moderate		0	✓	2		0		Absorption system LAA to be located in low slope (<12%) area of EMA.		0	✓	2		0	Absorption system located on slope ≤12%			
	Position of Land Application Area in Landscape	Downgradient of surface water, property boundary, recreational area	Upgradient of surface water, property boundary, recreational area	Proposed LAA upgradient of surface water	Moderate		0		0	✓	3		Subsurface LAA to be located in low slope (<12%) area of EMA.		0	✓	2		0	Proposed LAA location as far away as possible (>30m) from sensitive receptor			
	Drainage	Category 1 to 2 soils; gently sloping area	Category 6 soils; sites with visible seepage; moisture tolerant vegetation; low lying area	Category 4 soils in an elevated, sloping landscape with good drainage observed within LAA	Moderate		0	✓	2		0		Address soil drainage and structural constraints. Install cut-off drain upslope of LAA to intercept run-on.		0	✓	2		0	Soil improvement measures and drainage controls to increase stability and drainage properties.			
	Flood Potential	Above 1 in 20 year flood contour	Below 1 in 20 year flood contour	Proposed LAA above 1 in 20 year flood contour	Low		0		0	✓	3				0		0	✓	3	Proposed LAA above flood prone area			
	Application Method	Drip irrigation or subsurface application of effluent	Surface / above ground application of effluent	Subsurface application	Low	✓	1		0		0			✓	1		0		0	LAA option of subsurface (absorption system) application			
Property Boundary 1.5m (low) - 50m (high)	Microbial Quality of Effluent	Secondary treated effluent with disinfection	Primary treated effluent	Secondary treatment with disinfection	Low	✓	1		0		0	Low		✓	1		0		0	Secondary treatment with disinfection	Low	1.5m within AS/NZS 1547:2012	1.5
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application) >30% subsurface effluent application	Low, ≤10% for subsurface application	Low	✓	1		0		0			✓	1		0		0	Low, ≤10% for subsurface application			
	Application Method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Subsurface application	Low	✓	1		0		0			✓	1		0		0	Treated effluent will be applied to subsurface			
Roads and pathways 2m (low) - 6m (high)	Microbial Quality of Effluent	Secondary treated effluent with disinfection	Primary treated effluent	Secondary treatment with disinfection		✓	1		0		0	Low		✓	1		0		0	Secondary treatment with disinfection	Low	2m below AS/NZS 1547:2012	2
	Slope	0-6% (surface effluent application), 0 -10% (subsurface effluent application)	>10% (surface effluent application) >30% subsurface effluent application	Low, ≤10% for subsurface application		✓	1		0		0			✓	1		0		0	Low, ≤10% for subsurface application			
	Application Method	Drip irrigation or subsurface application of effluent	Surface/above ground application of effluent	Subsurface application		✓	1		0		0			✓	1		0		0	Treated effluent will be applied to subsurface			

Beavers, Cromer, Gardner Viral Dieoff Model

3036 Site: 231 Pacific Highway, Mount White

Whitehead & Associates
Environmental Consultants Pty Ltd

Step 1	Use Figure 1 in Cromer *et al.* (2001) (reproduced below) to determine days travel time using groundwater temperature* and a selected order of magnitude reduction.	
	* If mean groundwater temperature is unavailable, mean daily air temperature can be used in most cases.	
Groundwater Temperature (°C)	11.1	Site Name: GOSFORD (NARARA RESEARCH STATION) Site number: 061087,
Order of magnitude reduction	3	orders of magnitude required for secondary treatment
Days required for viral reduction	**56**	(from Figure 1, below)

Step 2 — Calculate the predicted travel distance using Equation 4 from Cromer *et al.* (2001).
$Dg = (t-d_v.P/K)/(P/K.I)$

Time in days	t =	56	days
Effective porosity of soil (fraction)	P =	0.44	
Saturated hydraulic conductivity	K =	3	m/day
Groundwater gradient (fraction)	I =	0.06	
Vertical drainage before entering groundwater	d_v =	0.7	m

See notes below for description of values

Setback Distance	**Distance travelled in groundwater**	d_g =	**22.9**	**m**

Notes:

Porosity (P): Assume moderately structured sandy clay loam soils = 47%.
Ksat (K): Conservative assumption for a max Ksat of 0.12m/day for sandy clay loam.
Groundwater gradient (I): Assume max groundwater gradient of 10%.
Vertical drainage (d_v): Assume 0.8m of unsaturated flow before reaching groundwater.

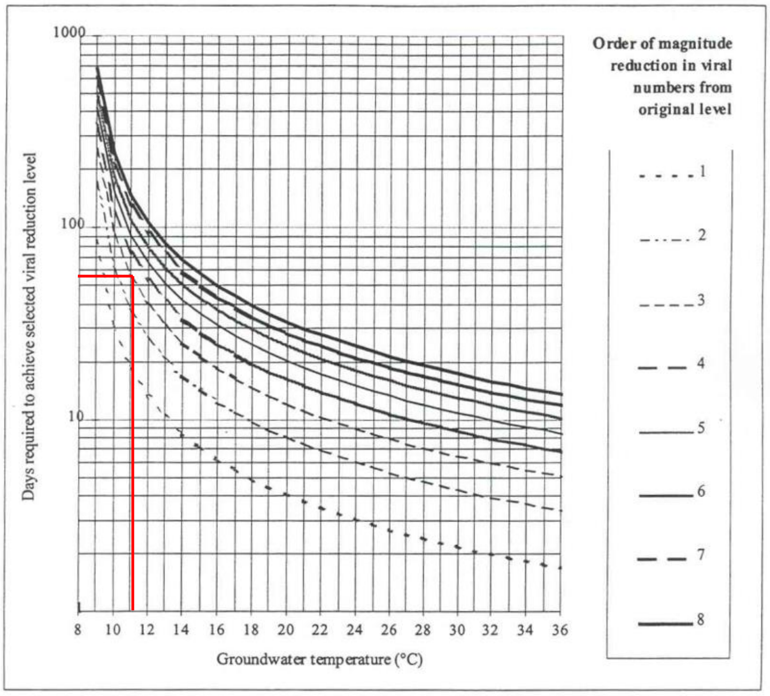


Figure 1. Relationship between Groundwater Temperature and Viral Die-Off Time for Various Order-of-Magnitude Reductions in Viral Numbers

(Figure 1 taken from Cromer et al., 2001)

Appendix F
General Notes

Soil Physical Properties / Chemistry

pH

This test is used to determine the acidity or alkalinity of native soils. pH is measured on a scale of 0 to 14, with 7 being neutral. Results below 7 are considered acid, while those above 7 are alkaline. For land application of effluent, soil with a pH of 4.5 to 8.5 should typically pose no constraints. Soil pH affects the solubility and fixation of some nutrients; this in turn reduces soil fertility and plant growth. By correcting soil pH beneficial plant growth is improved, assisting in the assimilation of nutrient and improving evapotranspiration of effluent. Most Australian soils are naturally acidic.

Electrical Conductivity

Electrical conductivity (EC) is a measure of a soil or soil/water extracts ability to conduct an electrical current. It is used as an indirect measure of a soil's accumulation of water-soluble salts, mainly of sodium, with minor potassium, calcium and magnesium. High EC within a land application area reflects general soil salinity and is undesirable for vegetation growth. The tolerance of vegetation species to soil salinity varies among plant types. Typically, EC readings of <4dS/m pose no constraints. There are a number of measures available to counter high soil EC values for land application of effluent; however, the most important measure relates to the conservative selection of application rates and appropriate application area sizing.

Emerson Aggregate Test

The Emerson Aggregate Test (EAT) is a measure of soil dispersibility and susceptibility to erosion and structural degradation. It assesses the physical changes that occur in a single ped of soil when immersed in water, specifically whether the soil slakes and falls apart or disperses and clouds the water. Dispersive soils pose limitations to on-site sewage management because of the potential loss of soil structure when effluent is applied. Soil pores can become smaller or completely blocked, causing a decrease in soil permeability, which can lead to system failure.

Cation Exchange Capacity

The cation exchange capacity (CEC) is the capacity of the soil to hold and exchange cations (positively charged molecules). Because some soils have a dominant negative charge, they can adsorb cations. Soils bind cations such as calcium, magnesium, potassium and sodium, preventing them from being leached from the soil profile and making them available as plant nutrients. CEC is a major controlling agent for soil structural stability, nutrient availability for plants and the soils' reaction to fertilisers and other ameliorants. A CEC of greater than 15 cmol+/kg or me/100g is recommended for land application systems. Adding organic matter (compost/humus) to soil can greatly increase its CEC.

Exchangeable Sodium Percentage

The exchangeable sodium percentage (ESP) is an important indicator of soil sodicity, which affects soil structural stability and overall susceptibility to dispersion. Sodic soils tend to have a low infiltration capability, low hydraulic conductivity, and a high susceptibility to erosion. When sodium dominates the exchangeable cation complex, soil structural stability declines significantly. Soil ESP is considered acceptable for effluent application areas when it is below 5%, marginal between 5% – 10% and limiting >10%. The ESP of application area soils can be improved by the measured application of calcium (lime/gypsum).

Phosphorus Sorption Capacity

Phosphorus sorption (P-sorption) capacity is a direct measure of a soils ability to adsorb phosphorus. Phosphorus is an important plant nutrient and is the limiting available nutrient in many aquatic environments. Excess phosphorus can increase the production of nuisance vegetative growth such as algae. The P-sorption capacity of the soil in an effluent application area relates to its ability to assimilate the phosphorus in the wastewater for the design life of the application area. P-sorption values greater than 400mg/kg is considered acceptable for land application of effluent, while values below 150mg/kg present a constraint.