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To	Megan Mather
From	Adam Bishop
Date	26 June 2020
RE	**Supplementary information – leachate management**

1. Introduction

The Development Application (DA) for the proposed Tamworth Organic Recycling Facility (ORF) was considered by the Northern Regional Planning Panel (NRPP) on the 19th February 2020. The panel deferred determination of the matter until supplementary information was provided.

The NRPP noted the following findings:

- In principle, a facility of this type would be beneficial as it would remove significant volume of materials from the waste stream and process them into useful products
- The proposal is permissible development in the subject zone (RU1 – Primary Production) and that the proposed use has been properly characterized as a 'Resource Recovery Facility'
- The Site of the proposed development is capable of satisfactorily accommodating a resource recovery facility provided that it is carefully designed and effectively managed and regulated.

The NRPP record of deferral identifies concerns about the adequacy of the current application in respect of several matters, one being:

> *"the effects and acceptability of leachate discharges on neighboring land uses and receiving water bodies"*

To address this concern pitt&sherry has compiled this Memo response that includes the following supplementary information:

- Review of leachate capture and storage systems and likelihood of leachate overflows against guideline criteria
- Predicted leachate water quality
- Design of stormwater systems to manage leachate overflows within the Site
- Review of potential impacts of leachate water in the event of an overflow
- Management of leachate to minimise potential impacts including:

- monitoring of volume/depth in leachate dam
- source controls to reduce leachate strength
- operational and environmental water quality monitoring, including for leachate, stormwater and groundwater
- management of overflows when they occur to minimise impacts on environment and neighbours;

2. Leachate capture and storage

2.1 Review of leachate dam size against EPA requirements

As outlined in the Environmental Impact Statement (pitt&sherry 2019; "EIS") and the Water Balance report (Appendix N in the EIS), the leachate management system is designed in accordance with the NSW EPA's Environmental Guidelines for Composting and Related Organics Processing Facilities (DEC 2004; the "EPA Guidelines"). The EIS notes that the water balance calculations would be refined during detailed design and by the operating contractor prior to construction to ensure the environmental objectives and mitigation measures outlined herein are achieved and that the system as designed is optimal for the operation of the facility.

In summary, the leachate dam capacity was set at 16 ML based on the results of the site water balance modelling. This capacity provides for:

- capture runoff from a 1 in 10 year, 24 hour storm event (approximately 99 mm rain depth) from all processing areas. This equates to approximately 3.1 ML storage. This is the minimum requirement based on the EPA Guidelines.
- additional storage capacity (approximately 13 ML) to manage the normal operational flows. This substantial additional storage component was included, to help manage operational water needs, increase security of supply of recycled leachate water, and minimise the risk of leachate overflows to the environment.

As such the proposed 16ML leachate dam meets the requirements for capturing runoff from a 1 in 10 year, 24 hours storm event in accordance with the EPA Guidelines.

Furthermore, it provides a very high factor of safety and is more than 5 times the recommended minimum size based on the EPA Guidelines.

The EPA is the Agency responsible for the ongoing operation and environmental performance of the ORF. The operator would be required to obtain an Environment Protection License (EPL) which would contain conditions and monitoring requirements related to leachate management. The EPA has issued their General Terms of Approval (GTAs) indicating their satisfaction with the ORF design and outcomes of the environmental assessment, including design and management of leachate capture and storage systems. This approval of the EPA is compelling and provides the consent authority with surety that the leachate management system meets relevant best practice criteria and is capable of being managed in an environmentally sustainable way.

2.2 Comparative review

Furthermore, to provide context as to the very high factor of safety built into the design and sizing of the leachate dam for the Tamworth ORF, we compared the design with the approved, built and licensed ORF at Awaba.

The Awaba facility commenced operating in 2017, is operated by Remondis for Lake Macquarie Council, operates at a similar capacity to the proposed Tamworth facility and is similar in design employing tunnel composting. The following comparisons are drawn (Table 1).

Table 1 Comparisons between Tamworth and Awaba leachate dam sizing factors

Comparison Criteria	Awaba (Operating)	Tamworth (Proposed)	Findings
Facility Size	44,000 tpa	35,000 tpa	The two facilities are a similar size
Annual Rainfall*	1011.2mm Mean annual rainfall (mm) recorded at Cooranbong (Lake Macquarie AWS)	673.6mm Mean annual rainfall (mm) recorded at Tamworth Airport AWS	The Awaba facility is located in a coastal environment where the annual rainfall and frequency of large rain events is significantly greater than at Tamworth.
Rain days*	148.4 days Mean number of days of rainfall annually	113 Mean number of days of rainfall annually	On average, Tamworth has fewer rain days per year than at Awaba
Design Storm For leachate management (the 1 in 10-yr, 24-hour storm)	181mm	99mm	Based on climate averages, the volume of leachate generated (due to stormwater runoff) at Awaba is almost double that at Tamworth
Dam Size	6ML	16ML	The leachate dam proposed at Tamworth is more than twice the size of the Awaba facility currently in operation.

* Bureau of Meteorology; Climate Statistics

This comparison between the operating facility at Awaba, and the proposed Tamworth facility, suggests a very large factor of safety is inherent in the sizing of the Tamworth leachate dam. A detailed water balance review would be undertaken during detailed design, and this could justifiably lead to a reduction in the leachate dam size without compromising operational performance or compliance with EPA guidelines.

2.3 Review of water balance model outcomes

The Water balance report (Appendix N in the EIS), described the GoldSim modelling process, summarised the outcome for a 16ML dam, and demonstrates compliance with the EPA Guidelines.

GoldSim is a widely used platform used to simulate complex systems and is commonly used for modelling environmental systems including water balances by creating a probabilistic model to predict future behavior.

By using GOLDSIM, the Water Balance is based on a robust model and contains 110 scenarios each of 20 years duration using rainfall data based on actual rain records. The scenarios represent all rainfall events in the model and therefore contain a representation of all probable events. i.e. not just average rainfall but including infrequent, large rain events equivalent to statistically derived 1 in 10-year and 1 in 50-year events. Hence, it is expected that the model would demonstrate overflows when the rainfall conditions exceed the conditions that the leachate dam was designed for.

The outcome of all the scenarios was that the prediction of overflows was "2 overflow events per 20 years in a median 20 year scenario". While this indicates the likelihood of overflows it should be taken into account that the GoldSim model also includes a number of scenarios that contain rainfall events exceeding the EPA design requirements.

At the request of TRC we have further considered how the water balance model and prediction of leachate conditions responds in the case of individual large rain events equivalent to 1 in 25-year, and 1 in 50-year, 24 hour events, respectively. We note these events are much larger than is required to be accommodated by the leachate dam under EPA requirements.

The GoldSim model includes a number of 20-year scenario runs that contain such events. Our analysis of the these results indicates that:

- Some of the GoldSim model outputs (scenarios) contain large rain events and the number of years containing these events is consistent with the expected probability when compared against Bureau of Meteorology (BOM) rainfall data. (i.e. GoldSim scenarios contain rain events with recurrence intervals of 1 in 10-yr, 1 in 25-yr, 1 in 50-yr etc. at a regularity that is in broad agreement with actual BOM data. This gives confidence that these large rain events are adequately reflected in the model;

- Removal of simulations containing 1 in 25 and 1 in 50-year rainfall events from the analysis, results in the model predicting zero overflow events.

The original prediction of probable overflow events was reviewed by analysing all scenarios individually that contained large rain events. The predicted number of overflow events per 20 year model scenario, depended on the magnitude of rain events contained in the scenario. Table 2 summarises the overflow predictions for model scenarios containing large rain events.

Table 2 Predicted overflow events for model runs containing large rain events

Model scenarios containing at least one of the following large rain events	**Predicted number of overflows per 20-year scenario**
1 in 10-year, 24 hour storm	0
1 in 25-year, 24 hour storm	0
1 in 50-year, 24 hour storm	1.5

To provide further explanation and visualization of the water balance a separate water balance model (spreadsheet based) was prepared based on annual average rainfall and evaporation. This spreadsheet model enables visualisation of pond storage and performance under a forced set of conditions, such as imposition of a large rain event. Figure 1 shows the magnitude of leachate pond inputs (rainfall-generated runoff, minus production demand/reuse) and outputs (evaporation) under average climactic conditions. Note that month 1 is January, Month 12 is December.

The net input (green line) and output (orange line) in Figure 1 are approximately balanced across a year. Evaporative losses are least during winter, greatest in summer. Rainfall inputs follow a similar pattern. Based on the balance of inputs and outputs to the leachate dam over the course of an average year, there tends to be a water surplus in the cooler months from May to September, and a deficit from October through to April.

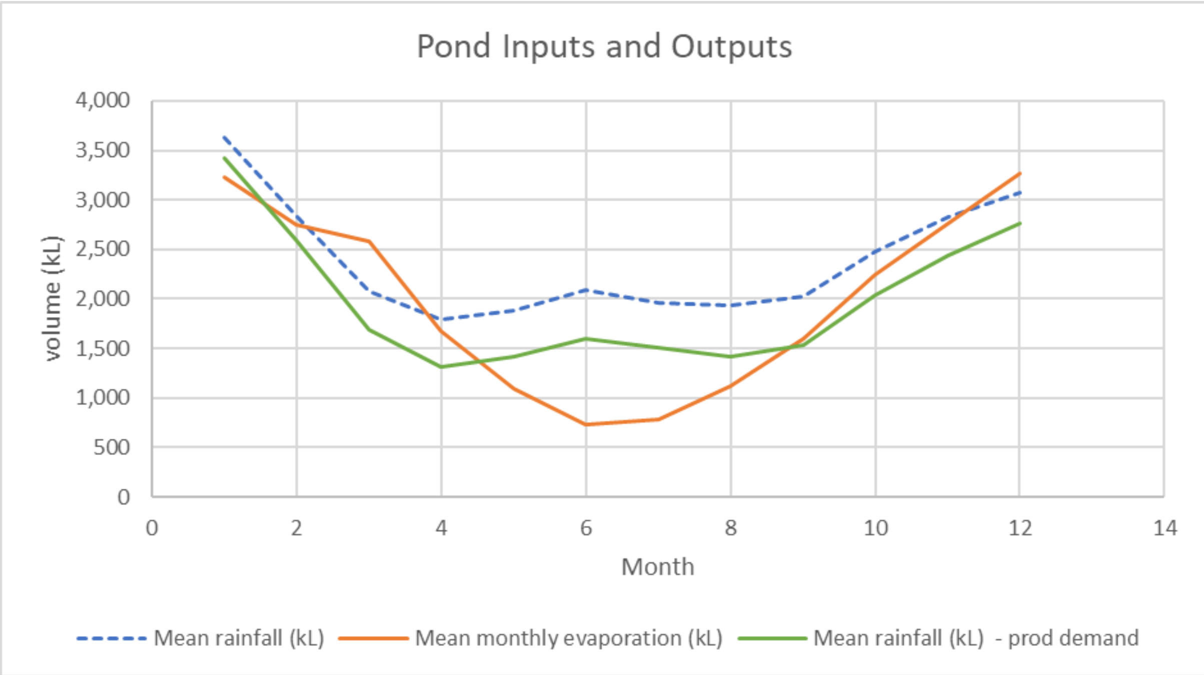


Figure 1 Pond input (rainfall – production use) and mean output (evaporation) under average rainfall conditions

Figure 2 below shows the leachate dam water levels over a nominal 5 year period of successive average rainfall and evaporation years, but with the imposition of a single 1 in 10 year, 24-hour rain event occurring in the winter of the first year (month 7). This event is equivalent to the design requirement specified by the EPA Guidelines. For the purpose of this analysis the level of the dam has been assumed to start at a high working level of 10,000kL.

It can be seen that the dam level increases in response to the large rain event, then reduces back to a similar level over the course of about 5 years. Within this broader trend is seen the pattern of dam levels rising and falling through the course of each year on a seasonal basis.

The balance of inputs (rainfall - production demand) and outputs (evaporation losses) is roughly even over an average year (blue line Figure 2) and this is exactly what the design must achieve at a minimum to avoid continuous water build up in the dam.

An additional factor that is important in controlling the water level, and responsible for the long term reduction apparent in the water level trend, is the expansion of the dam surface when the dam is holding more water. This larger surface area promotes extra evaporation (equivalent to increasing the evaporation line in Figure 1). There is actually a nett loss of water from the dam when the dam fills to a greater extent and hence has a larger evaporative surface. The level can be seen to reduce over time due to this extra evaporation over a period of 60 months (5 years) from the rainfall event.

Hence the dam at 16ML adequately contains the 1 in 10, 24 hour, event, and – under average conditions – returns to the high working level within 5 years. This balance uses a number of conservative factors in terms of leachate generation, as explained in Appendix N of the EIS, which gives additional confidence in terms of leachate capture and storage capacity.

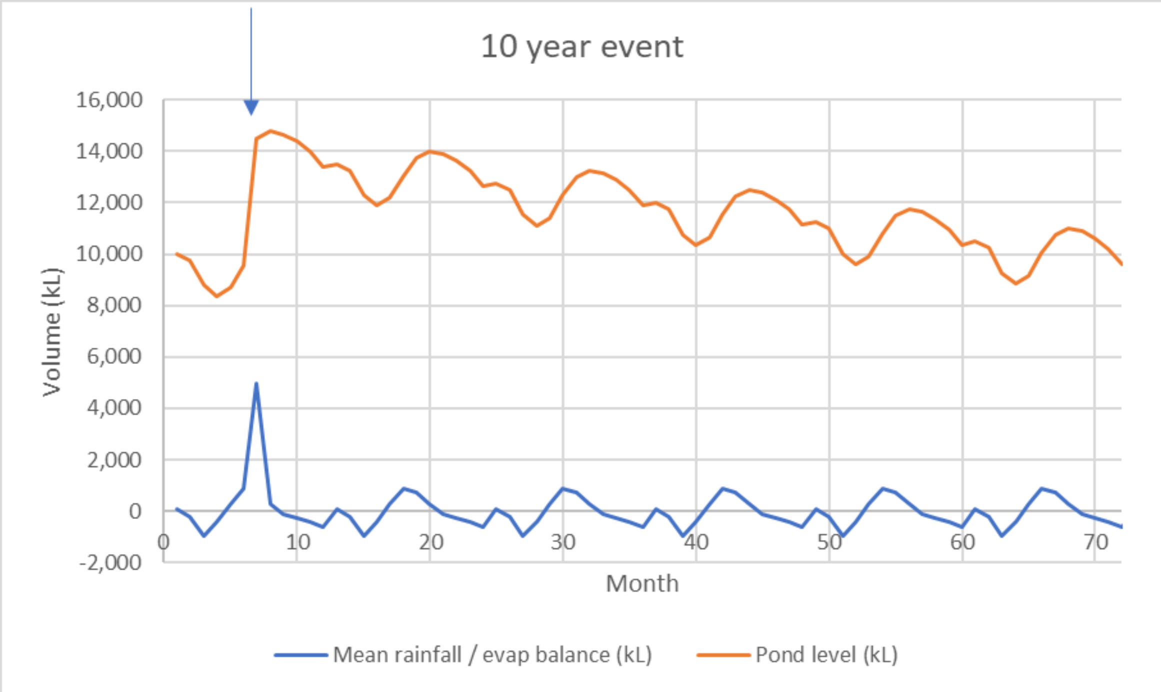


Figure 2 Pond balance under average rainfall conditions, with a 10-year rain event

A similar analysis to that above, conducted for other large rain events finds that:

- No overflow occurs in response to a 1 in 25 year 24 hour event. This is consistent with the results from GoldSim.
- Overflow occurs in response to a 1 in 50 year 24 hour event. A 1 in 50 year, 24 hour event will cause an overflow (as indicated in Figure 3 and by GoldSim modelling) and the dam will take 7.5 years to return to the high working level when average rainfall conditions follow.

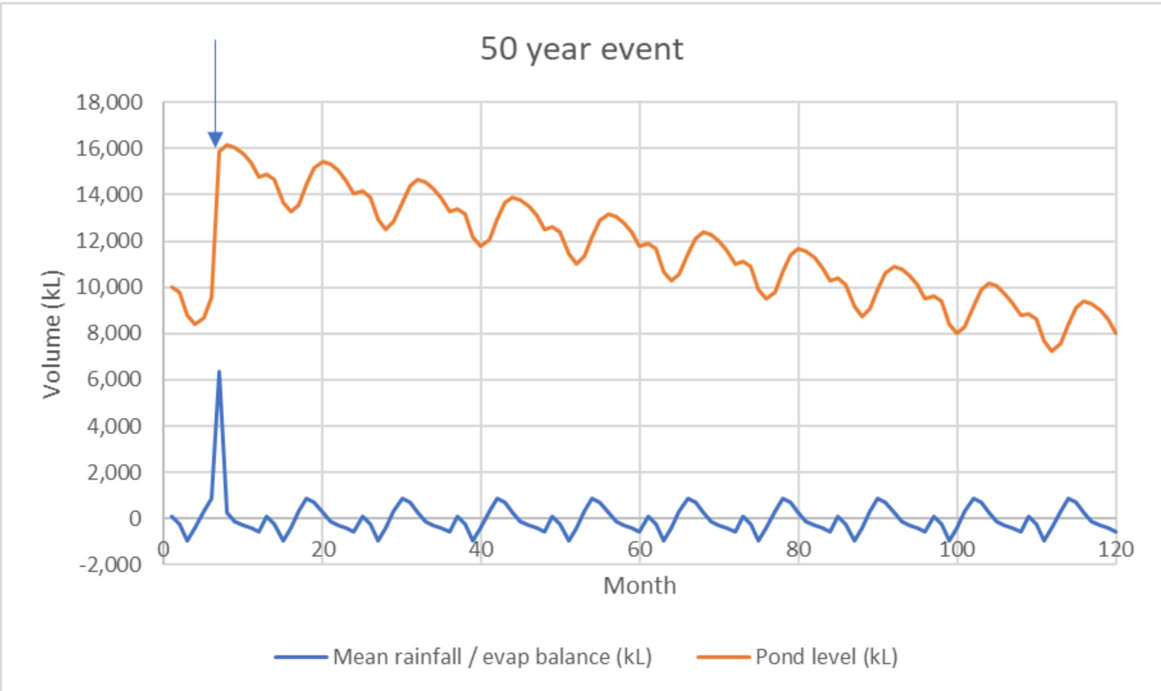


Figure 3 Pond balance under average rainfall conditions, with a 50-year rain event

This additional water balance review, as outlined above, confirms that the proposed leachate dam meets and exceeds the minimum 3.1 ML EPA requirements for leachate collection and storage. The proposed system is capable of managing leachate runoff resulting from a 1 in 10-year, 24-hour storm event, to a high degree of certainty, and is in fact capable of capturing runoff from much larger events such as a 1 in 25-year, 24-hour storm, as indicated in the details above.

A copy of the spreadsheet model output used to produce the above graphical representation of pond performance, is provided in Appendix A.

2.4 Management of water supply in dry weather conditions

The NRPP has requested additional information on the security and acceptability of water sources to meet operational demands.

The EIS and Water Balance report confirm that during average weather conditions the leachate and stormwater supply should be adequate to meet operational needs for the tunnel and biofilter loop water make-up and maturation pad moistening (if required).

During periods of below average rainfall, and particularly in drought, stormwater and leachate capture may be inadequate to meet the water needs of the Site. Under these conditions process water would be largely reliant on supplementary water. A supplementary bore water supply is proposed.

There are two existing bores on the property, the locations of which are indicated in the EIS (Figure 6-36 in the EIS). Groundwater investigations including pump testing by AquaNorth were referenced in the EIS and a copy of the AquaNorth report is provided in Appendix B. AquaNorth advised that the existing bore is stock and domestic and has been tested and supplying 40 litres per minute. Overall yield from this bore is at 60,000 litres per day. AquaNorth advised that long term bore developing may result in improved yield, but ultimately recommended that if a production bore is required a new bore should be drilled with a larger diameter (8”) and deeper (estimated at around 50 m). The existing bore is within an Irrigation area with wells that produce higher yields estimated up to 15 litres per second.

Assuming the existing supply rate can be achieved, a yield of around 60,000 L of water per day could be supplied. Such a water supply would be ample to supplement reuse of stormwater and leachate and meet the production demands during expected dry weather conditions.

Should the bore supply prove inadequate or pump yields be lower than predicted, the option exists to tanker water to the Site. If water supply became critically deficient, organic waste processing rates could be reduced by diverting waste elsewhere, such as to the existing Forest Road landfill. A relevant factor is that during drought conditions there is typically a significant reduction in received garden organics, so this may support a lower processing rate at the ORF with reduced water demand.

Given the importance of water security, it is expected that the facility Operator would employ water efficiency in production and work towards achieving a net water balance that does not rely, or relies very little, on supplementary water. This could involve design elements, to be borne out during detailed design, and also operational procedures that would be detailed in the OEMP.

Installation and use of a groundwater bore(s) is subject to approvals under the WM Act including a water access license, water supply work and water use approval. An application will be made once the detailed design of the facility is finalised. It is understood that WaterNSW has advised Council that they have no objection to the intended bore water supply but that further groundwater assessment is required as part of a future application to be submitted to the Natural Resource Access Regulator for determination. It is anticipated that further hydrogeological investigations including assessment of yield and potential impacts to the groundwater system, would be required as part of future application for approvals under the WM Act.

2.5 Characterisation of leachate and risks

The NSW EPA Guidelines describe the typical characteristics of leachate from composting facilities as:

- acidic, especially when they are generated under anaerobic conditions.
- can cause the dissolution of metals and metallic compounds that may be present in organics.
- under aerobic conditions alkaline leachates can be formed from organics with low carbon/high nitrogen ratios, such as food and animal organics.

In a general perspective, composting leachates are characterised by the presence of high concentrations of moderately biodegradable organic matter and nutrients (including compounds of nitrogen and phosphorus) and may contain toxic pollutants such as heavy metals and plasticisers depending on the feed source.

Consequently, leachates from composting and related organics-processing facilities have the potential to pollute groundwater and surface water bodies (such as rivers, creeks and dams). Their potential high nutrient content makes them a favourable host media for bacteria and other micro-organisms and gives them a high biological oxygen demand (BOD) (Tchobanoglous et al. 1993).

A paper published by Roy et al (2018) contains a detailed review of the literature on compost leachate, its generation, characterization and treatment. In a general perspective, composting leachates are characterised by the presence of high concentrations of moderately biodegradable organic matter and nutrients and contain toxic pollutants such as heavy metals and plasticizers.

Contaminants in compost leachate mainly occur from the percolation of water through the composting or composted organic waste. Concentrations of contaminants are highly variable due to two main factors: (1) the type of composted organic wastes (feedstock); and (2) the type of composting technology. The heterogeneous composition and seasonal variability of the feedstock both influence the composting leachate composition.

Accurate predictions about the likely quality of leachate form the Tamworth ORF cannot be made, indeed this is likely to be highly variable. The leachate will contain varying concentrations of organic matter, nutrients, metals and other inorganic constituents, and sediment. It will be heavily diluted by clean rainfall and stormwater runoff over the large maturation pad and operational area.

It is probable that during the times of greatest leachate generation (by volume), during large storm events, the leachate concentration will be weakest and heavily diluted. The leachate that is captured in the leachate dam is not expected to contain high or problematic concentrations of pathogenic organisms, given that the leachate source will be the pasteurised compost.

To provide an indication of the possible leachate quality, a review was undertaken of the leachate quality observed at the previously mentioned composting facility at Awaba. Monitoring of stored leachate in the dam is undertaken at Awaba on a quarterly basis in line with conditions in the site's EPL. Similar operational leachate quality monitoring would be undertaken at the Tamworth site, including monthly characterisation testing for the first 12 months.

A summary of Awaba monitoring results for the period June 2018 to January 2020, which are published online, is provided in Table 3.

Table 3 Summary of leachate quality at Awaba ORF (Jun' 2018 – Jan 2020)

Analyte	Unit	Average	Maximum	Minimum
Oil and Grease	(mg/L)	4.20	10.00	<2.00
pH	(pH)	8.02	8.76	6.71
Total suspended solids	(mg/L)	127.63	415.00	13.00
Alkalinity	(mg/L)	414.38	540.00	210.00
Electrical Conductivity	(uS/cm)	1876.71	2640.00	717
Nitrogen (total)	(mg/L)	30.48	59.30	14.10
Oxidised nitrogen (NOx)	(mg/L)	12.83	38.80	<0.05
Ammonia	(mg/L)	3.52	9.2	<0.05
Polycyclic aromatic hydrocarbons	(ug/L)	<0.5	<0.5	<0.5
Total organic carbon	(mg/L)	176.00	496.00	76.00
Total petroleum hydrocarbons	(ug/L)	946.67	1090.00	<50
Total phenols	(mg/L)	<0.05	<0.05	<0.05

2.6 Summary of water quality risks

Using the Awaba leachate quality as a baseline, a comparison was undertaken of the relative strength of several constituents in the leachate water, relative to the effluent strength criteria provided in the EPA's Environmental Guidelines: Use of Effluent by Irrigation (DEC, 2003). The leachate water would typically be rated as low to medium strength. Waste waters of similar strength and in many cases much higher strength, are regularly irrigated to land throughout NSW in accordance with managed effluent reuse systems designed in accordance with the aforementioned guidelines.

Based on the water quality analysis, it is expected that the key constituents in leachate water relevant to assessment of water quality and environmental risks, are organic matter and nutrients. These constituents when released in large quantities that cause runoff to waterways, can cause water pollution. When released to land at appropriate rates, these constituents provide important soil nutrients for use by plants and may be highly beneficial.

Any leachate released from the dam would become heavily diluted by stormwater from the ORF operational area and the broader Site during the high rainfall conditions that would be the primary trigger for an overflow event. Stormwater must travel a large distance over relatively flat terrain before reaching the Peel River. The intervening lands are low gradient, agricultural land and the soils and vegetation on these lands would have ample capacity to assimilate nutrients in stormwater from the ORF site and the broader catchment area that drains to these lands. Leachate from the ORF is not expected to contain any toxic or hazardous constituents in strengths that would be detrimental to adjoining lands or waterways, see Section 2.8 for further detail.

Overall, the risks to the environment, including soils, water quality and public health, from the highly infrequent (less than once every 10 years) release of leachate water are considered very low. The leachate presents a very low risk to neighbouring land uses and receiving waters.

2.7 Leachate management

The NSW EPA Guidelines adopt a risk based approach and has specified that a 1 in 10-year, 24-hour storm is an appropriate design storm event. Composting facilities are required to have in place a leachate management system capable of capturing the volume of leachate generated by such an event.

Using a water balance approach, it has been established that the proposed leachate dam provides a very large volume for capture and storage of leachate, that well exceeds the minimum requirements of the applicable EPA Guidelines, by a factor of about 5. Depending on antecedent dam storage levels, the dam would be capable in many cases of containing runoff from storms much larger than the stringent criteria prescribed by the EPA Guidelines. This provides a high degree of flexibility and certainty that the dam will function to meet and exceed the minimum requirements of the EPA.

Even with this high level of security, it is not possible or reasonable to expect that the leachate dam, regardless of its size, would be capable of managing all possible climactic events without its capacity being exceeded. It must be assumed that on very rare occasions the leachate dam storage capacity may be exceeded.

Management approaches to minimise the risk of leachate overflow and then minimise the risks due to overflows when they occur, would be outlined in the site operational environmental management plan (OEMP). A range of strategies and their relevance or applicability to the proposed Tamworth ORF are summarised in Table 4.

Table 4 Leachate management strategies and controls

Objective	Design or Management Controls
Leachate collection and storage designed to capture and contain potential leachate waters	Operational areas have been designed in accordance with the NSW EPA Guidelines. The proposed design satisfies the EPA criteria relating to capture and containment of leachate including the design of the leachate barrier, leachate dam liner and sizing of the leachate dam to contain the 1 in 10-year, 24-hour storm event.
Minimise leachate generation	The larger the operational area, the greater the volume of leachate generated during rainfall. The layout and size of operational areas that generate leachate have been optimized to minimise leachate generation. As part of detailed design the facility layout will be further fine-tuned and the size of the maturation pad may reduce.
Minimise leachate generation	Minimise mixing of clean water with raw and composted organics as any clean water that mixes with operational areas must be treated as leachate. Applicable stormwater controls including clean water diversion drains and bunds upslope of the maturation area are included in the facility design.
Minimise leachate generation	Clean roof water shall be collected in tanks and stored separately to leachate. The design includes roof water collection systems.
Minimise leachate generation	Raw organics shall be received and stored within the enclosed receival shed where it is isolated from rainfall and the elements, so as not to generate leachate. This is part of the facility design.
Minimise leachate generation	Avoid overwatering the maturing compost windrows to prevent excess moisture and leachate generation. Monitoring of compost moisture and moisture additions, would achieve this objective.

Minimise leachate generation	The facility is located away from natural waterways and flood prone areas to prevent flood events from inundating the facility. The proposed ORF is located on elevated, low gradient slopes, is not flood affected, and is well separate from permanent watercourses (> 1km from the Peel River as an overland flow path).
Manage leachate quality and minimise leachate strength	Source controls such as cleaning up any spilt organics would be employed to minimise transfer of contaminants to stormwater and leachate.
Manage leachate quality and minimise leachate strength	The maturation pad has been designed with suitable good drainage to prevent ponding of water in and around the composted organics. Good drainage should be maintained through maintenance of hardstands. Good drainage reduces the contact time of stormwater with organics to reduce the creation of organic pollutants.
Manage leachate quality and minimise leachate strength	Source controls would be employed to trap sediment and organics at source within the leachate drainage system. Options include sediment traps and pits.
Manage leachate quality and minimise leachate strength	Organics are to be pasteurised by in-tunnel composting prior to transfer from tunnels to the open maturation area for further composting. Pasteurisation of compost within tunnels will be achieved to meet the requirements of AS4454 (2003). Leachate that is collected in the leachate dam will be generated primarily from stormwater contact with matured compost, not raw organics, and this will prevent leachate being contaminated with potentially harmful microbial pathogens.
Manage leachate quality and minimise leachate strength	Leachate generated during tunnel composting is to be fully contained and recycled. Leachate generated by the early stages of organics composting, within the tunnels, is relatively high strength and likely to contain high concentrations of organic matter, nutrients and microbial pathogens. This leachate will be fully contained and recycled back through the in-tunnel composting process. The design intent is to prevent this relatively high strength wastewater from entering the external leachate collection and storage system.
Manage leachate quality and minimise leachate strength	The incoming waste stream would be monitored to ensure identification and removal of any unacceptable wastes which would be removed and stored appropriately before disposal offsite.
Manage leachate quality and minimise leachate strength	Aerator/s would be installed in the leachate dam to promote aerobic conditions in the dam. This would improve leachate quality and minimise the risk of odour generation.
Maintain and monitor leachate dam capacity	A water level gauge and telemetry system (i.e. SCADA) is to be installed in the leachate dam to monitor water levels. The gauge (such as a graduated vertical post) would clearly indicate the volume of stored water and also clearly mark the maximum operating level of the dam and the required freeboard for capture of the design storm as per the EPA Guidelines (this equals 3.1 ML). A telemetry system will support the supervisory control of dam levels and allow access to analyse real time data as required.
Maintain and monitor	Leachate would be reused where appropriate within the process and as the first

leachate dam capacity	priority for water supply. Reuse would include for moisture control of composting organics within the tunnels. Leachate would only be reused to provide moisture to the maturing or matured compost if deemed satisfactory by a detailed risk assessment and review of monitoring data.
Maintain and monitor leachate dam capacity	Additional options for leachate reuse or disposal could be considered in the future. Options include: • Reuse onsite by controlled irrigation. Irrigation reuse is an option that is not currently proposed but could reasonably be considered in the future. The leachate water is expected to be of a quality that could be sustainably irrigated, and the subject Site has ample land available to be irrigated. Any such proposal would need to be reviewed and approved by the EPA as part of an EPL modification. Modification to the consent or other approvals by Council could also be required. • Dispose leachate offsite. An option is to tanker leachate offsite for disposal to the Tamworth municipal sewage treatment plant under a trade waste agreement. Offsite disposal would likely be a last resort and only implemented if other management controls are proving ineffective and monitoring determined the quality of leachate to be especially problematic for release to the environment. • Production of a liquid fertiliser. Reuse of leachate as a liquid fertiliser would require further investigations and assessments to determine suitability and accessible markets / demands analysis. Any such proposal would be subject to approval by the EPA as part of an EPL modification and / or modification to the consent or other approvals by Council may also be required.
Control leachate overflows to minimise risk	Leachate overflows when they occur will be directed to a safe discharge location so as to minimise offsite risk. Leachate overflows would be controlled to minimise potential impacts on neighboring land uses, particularly the nearest adjoining landowner to the south. A simple drainage diversion is proposed to divert stormwater (and any leachate overflow) from the ORF to the east and along a maximum flow path within the subject property under the control of Council. Currently, stormwater runoff from the ORF location follows a flow path to the south, via a series of dams, and discharges south to the adjoining farmland. This will be modified. Details of the proposed stormwater diversion are provided in Section 2.8.
Monitor leachate quality	Leachate quality within the leachate dam will be monitored as part of a broader water quality monitoring program for the Site. A water monitoring program would be a requirement of the EPL. It is noted that the updated GTAs issued by the EPA in response to questions raised by the NRPP in the Record of Deferral, include conditions requiring water monitoring. The final details of water monitoring are still to be negotiated and would be outlined in the issued EPL and the site OEMP. The water monitoring program would be included as part of the OEMP. An indicative program would include, as a minimum: • Detail on the monitoring locations, frequency and parameters to be tested, as agreed with EPA and in line with the issued EPL;

- Proposed surface water monitoring locations, which are expected to include four on-Site and four off-Site (downstream) points, including:
  - Leachate dam (near outlet)
  - Stormwater Dam 2 downstream of leachate dam (near outlet)
  - Stormwater Dam 3 near southern boundary
  - Stormwater Dam 4 near eastern site boundary (final discharge point of stormwater from Site)
  - Four off-Site downstream locations on neighboring properties, selected based on identification of potential off-site flow paths and receiving water locations;
- Proposed groundwater monitoring locations, which are expected to include:
  - Groundwater monitoring bore up-gradient of processing area, nominally to the north-west of the maturation pad
  - Groundwater monitoring bore down-gradient of processing area, nominally to the east of the leachate dam;
- Analytes to include, as minimum: pH, EC, TSS, Oil and Grease, BOD, Total Phosphorus, Total Nitrogen, Ammonia, Metals (to be determined);
- Monitoring frequency to include:
  - Monthly leachate quality monitoring for the first year of operation
  - Quarterly for all monitoring points (potentially reducing to 6-monthly over time dependent on results)
  - Daily during any leachate overflow, monitoring at the leachate discharge point and downstream stormwater dams on the Site;

The locations of recommended monitoring points are indicated below in Figure 4 (on-Site locations) and Figure 5 (off-Site locations).

The above closely matches the monitoring program outlined in the updated GTAs but has been rationalized to suit the site conditions. This would be discussed further with the EPA as part of future negotiations for the EPL application.

Any off-Site monitoring locations would need to be selected based on agreement for access being reached with adjoining landowners. Given the nature of the downstream environment, monitoring locations are expected to often by dry. If no water is available this would be reported as such.

While the locations of off-Site monitoring points will be subject for further discussions with the EPA at the time of EPL application, we would make the point that monitoring within the Peel River, the nearest permanently flowing waterway to the Site, is not justified. This is due to the large distance between the Site and the Peel River. There are no permanent or regularly flowing waterways between the Site and the Peel River, only minor, intermittently flowing open depressions on the Peel River floodplain, contained on adjacent rural properties under private ownership.

2.8 Leachate Overflow Path

The discharge pathway for any leachate overflows would be controlled so as to minimise potential impacts on neighboring land uses, particularly the nearest adjoining landowner to the south. A simple drainage diversion is proposed to divert stormwater from the ORF (and any leachate overflow) to the east and along a maximum flow path within the subject property under the control of Council, before leaving Site. Currently stormwater runoff from the ORF location follows a flow path to the south, via a series of dams, before crossing the southern property boundary and discharging south to the adjoining farmland. The proposed diversion will greatly extend the runoff flow path within the subject Site.

Details of the existing flow path and proposed redirected flow path are show in in Figure 4. At a larger scale, Figure 5 indicates the approximate flow path of stormwater off-Site, from the Site to Peel River. This is via minor constructed waterways and thence an indistinct open drainage depression across the floodplain which flows intermittently.

A few key points are noted in relation to Figure 4 and the proposed stormwater drainage:

- Stormwater drainage in and around the proposed ORF site has been modified previously by construction of numerous dams, contour banks and constructed waterways. These drainage works appear to be well constructed and are likely to have been installed as part of a broader soil conservation program many decades ago;
- The proposed flow path does not involve diversion of water between major drainage catchments. The proposed redirection restores the drainage path to a more natural condition, more similar to that shown on the 1:25,000 topographic map;
- Dams 1, 2, 3 and 4 are all existing;
- Redirection of stormwater at Dam 2 can be readily achieved by installing a new spillway on its eastern side, and blocking the existing spillway at the western side with an earthen bank; and
- Design of the stormwater drainage system would be part of the detailed design process.

2.9 Conclusion

This memo presents supplementary information to that provided in the EIS and the Water Balance report. This supplementary information details how the design of the proposed organics recycling facility and in particular, the leachate management system, accords with the EPA guidelines. The facility design achieves a very high level of control with respect to leachate management.

The proposed leachate collection and storage system would manage leachate runoff resulting from a 1 in 10-year, 24-hour storm event, as required by the EPA. Being more than 5 times larger than required by the EPA design criteria, the leachate dam is capable of capturing runoff from much larger events.

Overall, the risks to the environment, including soils, water quality and public health, from the highly infrequent release of leachate water, are considered very low. The leachate presents a very low risk to neighbouring land uses and receiving waters. The anticipated key pollutants of concern in leachate, are organic matter (BOD) and nutrients. These pollutants would be assimilated within the soils and vegetation downstream of the Site. They present a similar risk profile to the use of agricultural fertilisers and are not hazardous.

A range of management controls are proposed to minimise the risks from leachate and include controls designed to minimise leachate generation, manage leachate volumes, reduce leachate strength and control leachate overflows when they occur. A proposed monitoring program is presented that will ensure risks due to leachate can be monitored, reviewed and reported publicly once in operation.

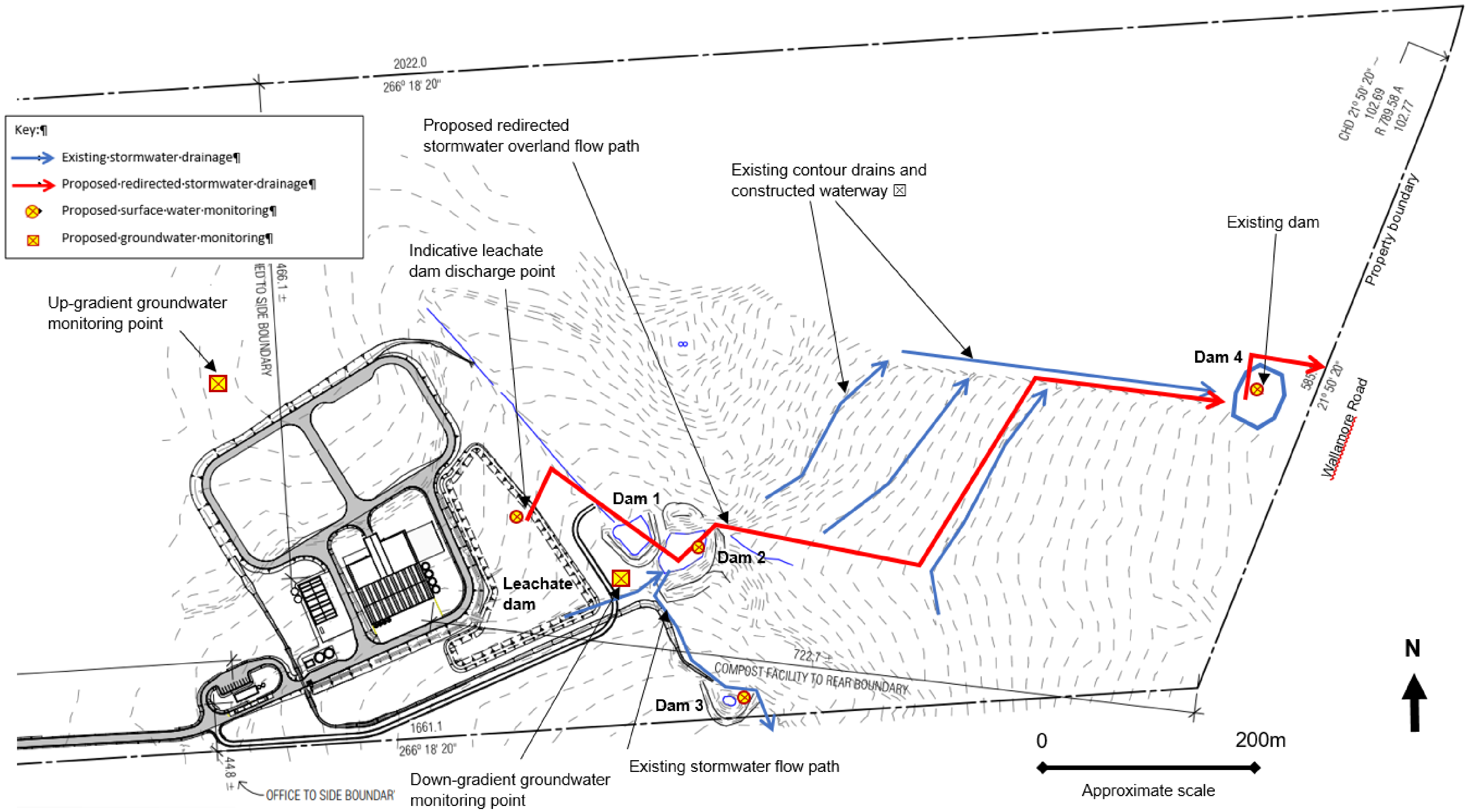


Figure 4 Plan showing existing and proposed redirected stormwater drainage paths, and proposed water monitoring locations

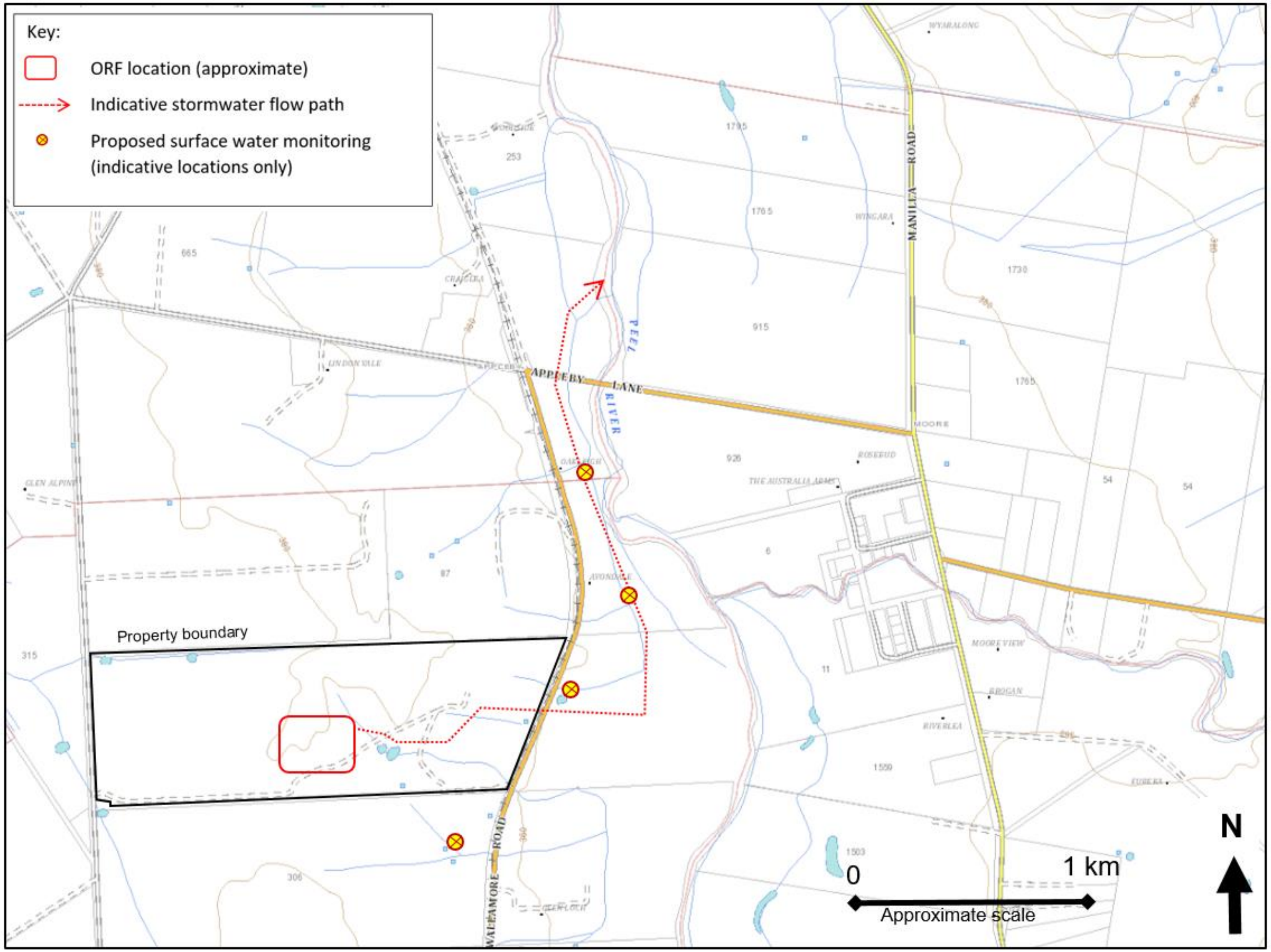


Figure 5 Plan showing indicative stormwater flow path to Peel River and surface water monitoring points

Spreadsheet Water Balance

Appendix A

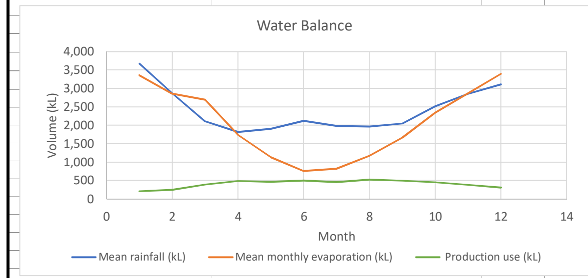
Model shows - minimal active area compensation (working on pads) - with a 10 year 24 hr event in year one - solve for area

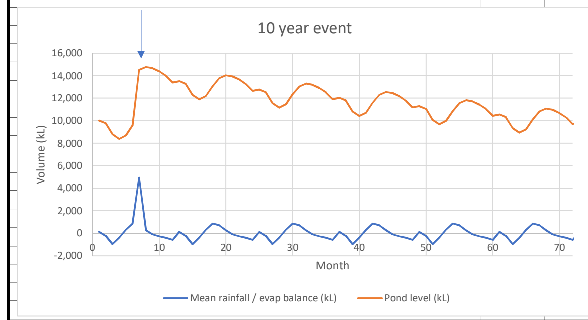
6,385 actual dam volume required (average year with event) kL

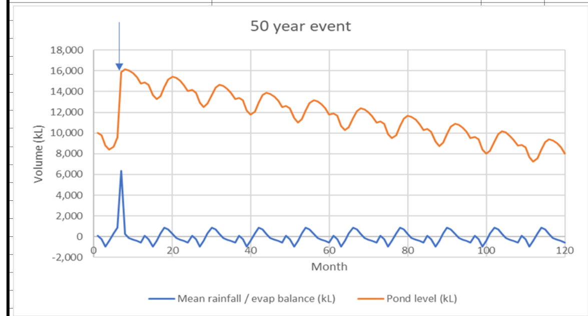
1.04 area change ratio from original design

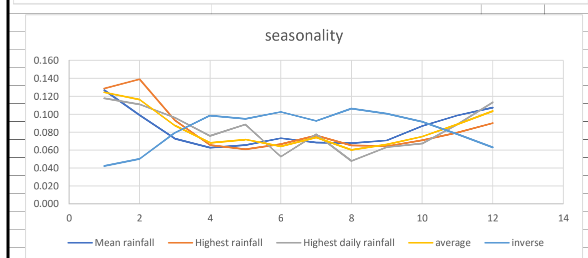
maturation pad active % area	(mound area = no water runoff)	20%
Land Areas	description	m2
1	hardstand around building	4,400
2	roads	8,000
4	stand south of building	1,200
5	maturation pads	16,800
total not including pond		30,400

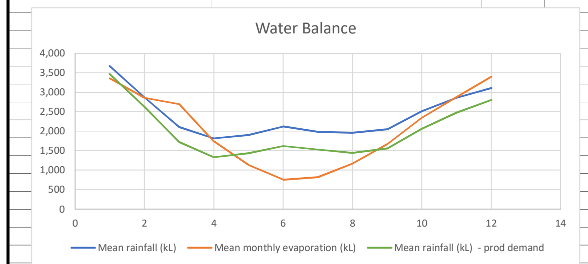
Pond area		
	Base pond m2 on sheet	12100
	base pond volume	16,000
	increase pond ratio for balance	1.04
	ammended pond m2 here	12,584
	ammended pond volume	16,640
total rain collection area including pond (m2)		42,984











	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	check cells	
days per month	31	28	31	30	31	30	31	31	30	31	30	31		
Raw Climate Data													year	
Month	1	2	3	4	5	6	7	8	9	10	11	12	total	base
Mean rainfall (mm)	85.4	66.7	49	42.2	44.2	49.3	46.1	45.6	47.6	58.4	66.4	72.3	673.2	
Highest rainfall (mm)	321.8	347.5	232.7	163.9	152	166.6	190.6	162.9	161	177.2	198.5	224.9	2499.6	
Highest daily rainfall (mm)	118.1	111.5	96.5	76.2	88.9	52.8	77.8	48	63.5	67.6	88.9	113.8		1,004
Mean daily evaporation (mm)	8.6	8.1	6.9	4.6	2.9	2	2.1	3	4.4	6	7.6	8.7	1974.042	
Mean monthly evaporation (mm)	266.6	226.8	213.9	138	89.9	60	65.1	93	132	186	228	269.7		

Standard Rainfall Event data (mm)	10%	1%	0.10%	0.05%
AEP 1 hour	38.8	60.1	86.4	95.3
AEP 24 hour	98.7	152	216	238
AEP 168 hour	175	248	388	444

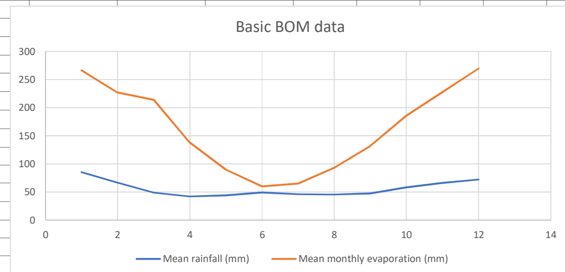
Monthly patterns (fractions of a year)	1	2	3	4	5	6	7	8	9	10	11	12	
Mean rainfall	0.127	0.099	0.073	0.063	0.066	0.073	0.068	0.068	0.071	0.087	0.099	0.107	1.000
Highest rainfall	0.129	0.139	0.093	0.066	0.061	0.067	0.076	0.065	0.064	0.071	0.079	0.090	1.000
Highest daily rainfall	0.118	0.111	0.096	0.076	0.089	0.053	0.078	0.048	0.063	0.067	0.089	0.113	1.000
average	0.124	0.116	0.087	0.068	0.072	0.064	0.074	0.060	0.066	0.075	0.089	0.104	1.000
inverse	0.042	0.050	0.079	0.099	0.095	0.102	0.093	0.106	0.101	0.092	0.078	0.063	1.000

Monthly Volume patterns (kL for actual areas on site)														
Mean rainfall (kL)	3,671	2,867	2,106	1,814	1,900	2,119	1,982	1,960	2,046	2,510	2,854	3,108	28,937	28936.83
Highest rainfall (kL)	13,832	14,937	10,002	7,045	6,534	7,161	8,193	7,002	6,920	7,617	8,532	9,667	107,443	
Highest daily rainfall (kL)	5,076	4,793	4,148	3,275	3,821	2,270	3,344	2,063	2,729	2,906	3,821	4,892	43,139	
Mean daily evaporation (kL)	108	102	87	58	36	25	26	38	55	76	96	109	817	
Mean monthly evaporation (kL)	3,355	2,854	2,692	1,737	1,131	755	819	1,170	1,661	2,341	2,869	3,394	24,778	

production demands - tunnel and biofilter (kL)													
tonne per year	35,000												
overall kL/tonne	0.14												
kL/year	4,900												
Production use (kL)	207	246	389	483	465	502	453	521	492	449	381	309	4,898

Monthly Volume patterns including production demands (kL for actual areas on site)													
Mean rainfall (kL) - prod demand	3,464	2,621	1,718	1,331	1,435	1,617	1,528	1,439	1,554	2,061	2,473	2,799	24,039
Highest rainfall (kL) - prod demand	13,625	14,691	9,614	6,562	6,068	6,659	7,739	6,481	6,428	7,168	8,151	9,358	102,545
Mean monthly evaporation (kL)	3,355	2,854	2,692	1,737	1,131	755	819	1,170	1,661	2,341	2,869	3,394	24,778

probability	10%	1%	0.10%	0.05%			4%	2%
1 in years	10	100	1000	2000	non standard 1 in		25	50
					mm rain 24 hr		117	131
Rainfall Event volume (kL)								
AEP 1 hour	1,668	2,583	3,714	4,096				
AEP 24 hour	4,243	6,534	9,285	10,230			5,030	5,642
AEP 168 hour	7,522	10,660	16,678	19,085				
Check - kL in land areas only AEP 24 hour	3,000							



Rainfall Event vol (as a % of 16640 kL store)	10%	1%	0.10%	0.05%
AEP 1 hour	10%	16%	22%	25%
AEP 24 hour	25%	39%	56%	61%
AEP 168 hour	45%	64%	100%	115%

Probability of highest monthly rainfall each month for twelve consecutive months		
years of existing data	116	
thus	1.68E-25	
or 1 in	##############	years
i.e. 1 in	5.94	British quadrillion years

Month by Month Water Balance (over 10 years)													Check cells	
Year 1 months	1	2	3	4	5	6	7	8	9	10	11	12		
start	10,000					event	4,243						nett	minimum volume (assuming same surface area retained)
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	4,951	268	-108	-279	-396	-595	3,503	6,385 based on Y1 and start at empty
Pond level (kL)	10,000	9,767	8,793	8,387	8,690	9,552	14,504	14,772	14,665	14,385	13,989	13,394	140,900	
Year 2 months	13	14	15	16	17	18	19	20	21	22	23	24		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595	-739	2142.613 based on Y2 and start at empty
level	13,503	13,270	12,296	11,891	12,194	13,056	13,765	14,033	13,926	13,646	13,250	12,655		
Year 3 months	25	26	27	28	29	30	31	32	33	34	35	36		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		2142.613
level	12,764	12,531	11,557	11,151	11,455	12,317	13,026	13,294	13,187	12,907	12,511	11,916		
Year 4 months	37	38	39	40	41	42	43	44	45	46	47	48		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		2142.613
level	12,025	11,792	10,818	10,412	10,716	11,578	12,287	12,555	12,447	12,168	11,772	11,177		
Year 5 months	49	50	51	52	53	54	55	56	57	58	59	60		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		2142.613
level	11,286	11,053	10,079	9,673	9,977	10,839	11,547	11,816	11,708	11,429	11,033	10,438		
Year 6 months	61	62	63	64	65	66	67	68	69	70	71	72		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		
level	10,547	10,314	9,340	8,934	9,237	10,099	10,808	11,077	10,969	10,690	10,294	9,699		
Year 7 months	73	74	75	76	77	78	79	80	81	82	83	84		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		
level	9,808	9,575	8,601	8,195	8,498	9,360	10,069	10,338	10,230	9,951	9,555	8,960		
Year 8 months	85	86	87	88	89	90	91	92	93	94	95	96		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		
level	9,069	8,836	7,862	7,456	7,759	8,621	9,330	9,599	9,491	9,212	8,816	8,221		
Year 9 months	97	98	99	100	101	102	103	104	105	106	107	108		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		
level	8,330	8,097	7,122	6,717	7,020	7,882	8,591	8,859	8,752	8,473	8,077	7,481		
Year 10 months	109	110	111	112	113	114	115	116	117	118	119	120		
Mean rainfall (kL) - prod demand	109	-233	-974	-406	303	862	709	268	-108	-279	-396	-595		
level	7,591	7,357	6,383	5,978	6,281	7,143	7,852	8,120	8,013	7,733	7,337	6,742		

solve for dam size so this is back to start position OR LESS ready for the next 10 year event

AquaNorth Groundwater Investigation

Appendix B

ABN: 22 120 188 463
2 Avro Street
PO Box 3333
West Tamworth NSW 2340

14 July 2019
Tamworth Regional Council
Att: Megan Mather

Re: Bore details 284 Appleby / Gidley road DP6235508

Megan,

Existing bore is stock and domestic tested and supplying 40 litres per minute (0.66 lps)
Overall yield from this bore is at 60,000 lts per day.
I believe the existing bore ID to be GW970550.1.1 to be confirmed – GPS -30.97856 & 150.846867 longitude.

I could suggest running the existing pump for a 2 week period at varied rates to develop the bore but could result with the same outcome being a yield of 40 litres per minute (0.66 lps). This could be done at low cost and risk requiring a TRC staff member checking every few days the flow meter. The only other cost is electricity and worst case burning the pump out which is of low value.

I would suggest applying for an Irrigation bore to be drilled within the area of a larger diameter being 8" / 200mm and deeper estimated after researching bores in the area that are for irrigation at 56 mt depth. There is also wells within the area and most producing over 15 lps.

On the NSW Groundwater explorer site several bores / wells show up within 870mt that are Irrigation. Cannot confirm flow rates via bore site details but can only from personal dealings with pump repairs and replacements within the area.

I hope this information is useful for further inquiries please contact myself on 0429 303333.

Regards

Brett Abrahams
Director Aqua Irrigation Holdings Pty Ltd.