

Greenacres Caravan Park

Environmental Evaluation RFI Response



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Document Control

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Environmental Evaluation RFI Response**

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1. INTRODUCTION

This report has been prepared for Greenacres Caravan Park by Simmonds & Bristow.

In October 2018 the Department of Environment and Science (DES) issued a *Notice to conduct or commission an environmental evaluation* to Greenacres Caravan Park (Aquarium Avenue Pty Ltd) (the **Notice**).

The Simmonds & Bristow report *C1903-004 Greenacres Caravan Park Environmental Evaluation of Treated Effluent Application to Land* (the **EE Report**) was submitted to DES on Monday 29th April, 2019 in response to the notice.

On the 14th May, 2019 a *Notice requesting further information* (the **RFI**) was received by Greenacres Caravan Park and Simmonds & Bristow.

This report provides additional information in response to the RFI. It also provides additional information relevant to the EE Report and the Notice.

The requests from the RFI are outlined underneath each heading in *italics*, and the responses to these are found following each request.

Additional Information is provided within the document and is marked as 'Additional information' in the headings.

Through consultation with the DES, it was noted that for a release strategy completely by land application an increase in deep drainage for the site would be preferable to a 'release to waters' strategy. Due to this a revised management strategy has been adopted compared to that outlined in the EE Report.

It should be noted, however, that a significant reduction in flow to the creek may also have an impact on the established vegetation along the creek line.

A glossary of terms used throughout this report can be found on page 76.

2. REQUIREMENT 1 – RFI – RELEASE TO SEWER

Requirement 1 of the RFI refers to 'Requirement 2' and 'Requirement 3' of the EE notice. These items asked that an investigation be conducted to evaluate a number of options for the release of waste water from Greenacres Caravan Park against section 13 of the EPP Water.

2.1 Investigate release of wastewater to sewer

Greenacres Caravan Park provided a table of estimated capital and running costs within a letter to DES on the 2nd June, 2019 regarding connection with the Redland City Council sewer network. The capital cost of infrastructure to connect was unreasonable for the business to support, being greater than \$500,000.

Within the same letter, Greenacres Caravan Park stated ninety percent (90%) of Greenacres Caravan Park tenants are either pensioners or low income earners, with 50% of those being long-term tenants of over five (5) years. The Residential Tenancy and Manufactured Homes Residential Parks legislation, limits the amount that Greenacres Caravan Park can increase rents annually, and subsequently they are unable to pass on the costs in order to fund a comparatively large (from their perspective) infrastructure project like the installation a connection to the nearest municipal sewer.

Simmonds & Bristow have contacted Redland City Council for any further information to comply with the Requirement 1 of the RFI; namely;

- a) What approvals are required from Redland City Council, including all associated application requirements;
- b) What the actual costs associated with the sewer connection and any other relevant approvals might be;
- c) Any other applicable requirements for the waste water to be released to sewer, such as a level of treatment, required by Redland City Council;
- d) Details of any advice from Redland City Council regarding the development application requirements, the application process and likelihood of obtaining the approval; and
- e) A detailed summary of how Greenacres would obtain any relevant approvals, meet costs (including any financing) or any other requirements.

During a discussion with the Wastewater operations team via phone call on the 25th June 2019, the property was discussed regarding the likelihood of approval. It was noted that the nearest pump station was more than 2 km away from the site (see Figure 1 below) and from the information on Redland City Council system there was no indication of any plans to expand the sewer network to the area near the Greenacres Caravan Park (Local Government Infrastructure Plan (LGIP)- 'Plan for trunk sewerage Infrastructure' map LGIP-03-45 Redland City Council).

The Principal Wastewater Engineer confirmed in writing on June 27th, 2019 that the Capalaba STP currently has no spare capacity to treat the additional flow. This email is attached in **Appendix H**.

While Redland City Council are planning to increase the capacity of the Capalaba STP, no approval will be likely, even if the costs were fully borne by the Caravan Park, for at least 3-4 years until the STP is upgraded and likely to have additional capacity.

At that time, the area surrounding Greenacres Caravan Park is not scheduled to be serviced by the Capalaba STP and the park would likely be required to build and operate a private pumping station and rising main at the Caravan Park's cost, to be able to connect to the municipal STP. This aligns with the information provided earlier by Greenacres Caravan Park to DES on the 2nd June, 2019..

The option of discharging effluent directly to the municipal sewer not only financially impractical and unreasonable, but is also unlikely to be approved by the council prior to the upgrade of the Capalaba STP (slated to be sometime within the next 4 years), due to the lack of spare STP to treat the additional flow..



Figure 1 below shows the surrounding area with water services shown, from Redland City Council's Red-e-map system. Greenacres Caravan Park is circled in red. The wastewater piping is green, with the closest pump station in the north-east corner near Runnymede Rd.

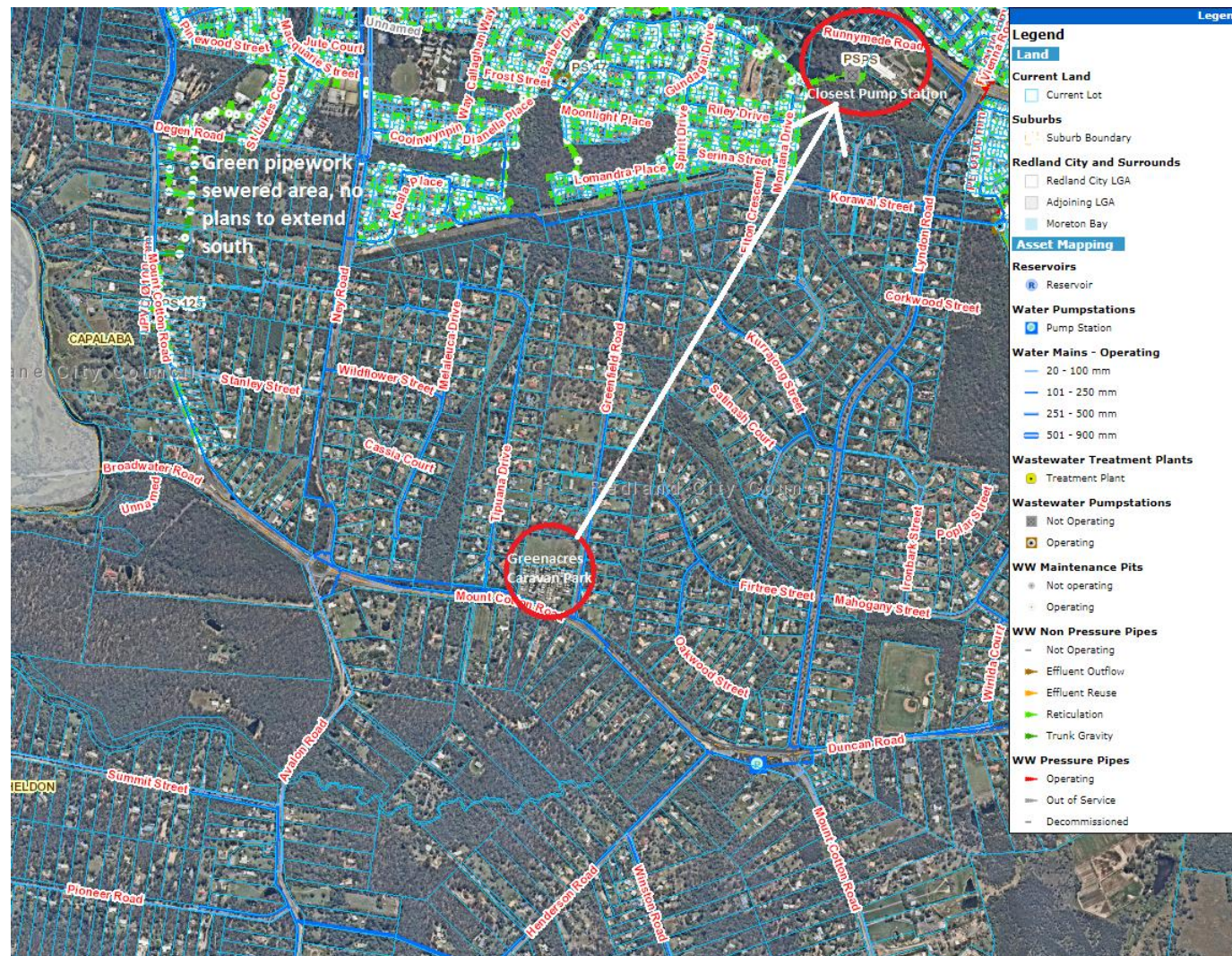


Figure 1 Redland City Council Sewer network map

3. REQUIREMENT 2 – RFI – DAILY FLOW DATA

Requirement 2 of the RFI stated that the environmental report does not list the daily flow data (preferably in Excel format) for treated sewage discharged from the Greenacres Caravan Park Sewage Treatment Plant. Providing flow graphs is not sufficient. You are requested to please provide the MEDLI input data in Excel format.

3.1 Format provided

Flow data used in MEDLI is able to be seen in the MEDLI pdf reports (in graph format) in the EE Report. The data is also available for technical staff that can open the provided MEDR files. This can be seen on the Waste Generation tab within MEDLI program.

MEDLI MEDR files and climate data file were provided to DES via email on the 7th May, 2019 on the same day they were requested.

Graphing was provided in the Environmental Evaluation Report (EE Report) for the recorded flows, but the raw excel data was not. The Excel format will be provided with this report as a separate document attached as **Appendix C**.

3.2 Flow Data

The flow meter readings are recorded by Greenacres Caravan Park on a generally weekly basis.

Excel data covering the period of March 2017 to January 2019 has been provided via a separate document entitled **Appendix C**, in addition to the MEDR and climate data files provided previously (7th of May 2019).

In the time period for the EE Report, meter reads were conducted as little as 4 days up to 18 days apart, over a period of ~2 years. The data provided by Greenacres Caravan Park was then calculated to a **daily average** and then plotted to arrive at the flow graphs provided in the EE report.

Understanding the variable reading times is imperative to understanding the format of the data provided in Excel.

The statistics generated for **average daily flow** were assessed. These were presented in Section 4 of the EE Report.

The average daily effluent release rate of 32.6 kL was documented in the *Notice to conduct or commission an environmental evaluation* received from DES; however this could not be replicated from the daily flow data provided by Greenacres Caravan Park.

The average daily effluent release for all data provided in the EE Report was only 23.7 kL. This value was rounded up to 25 kL for the purpose of a daily MEDLI input and was representative of the historical average for 2017 and 2018.

An additional scenario of 35 kL/day was also conducted to demonstrate compliance with the *Notice to conduct or commission an environmental evaluation*, although this value is higher than the average recorded for the site.

Both rounded effluent discharge rates of 25 kL/day and 35 kL/day have been used for all previous desktop and MEDLI modelling performed, based as 2 scenarios.

For the purpose of preparing information that is applicable to the future expansion and land use of the site, further MEDLI models have been performed at both an extrapolated rate for water usage using variable daily flows as well as set maximum daily flow rates of 45 and 50 kL/day. This is discussed further in Section 4.3 and the MEDLI models are discussed in Section 7 and attached as **Appendix G**.

4. ADDITIONAL INFORMATION – FLOW DATA

4.1 Abnormal events

The variable flow data used in the MEDLI models is based on the flows recorded in 2018-2019.

In March 2018 very high flows were recorded over a short period of time. A meter reading on the 21st March and then the 25th March indicated a flow of 386 kL or equivalent over the 4 days of 96.5 kL/day over this time period.

Greenacres Caravan Park has reported verbally that this is unusual and likely to have been the result of a water leak at that time. No re-occurrence of flows of this magnitude has been recorded to date.

It should be noted that these outlier values were still included in the MEDLI modelling and do contribute to the overtopping statistics. If daily flows in future do not experience spikes of this magnitude the overtopping experienced will be lower than the model predictions.

4.2 Site plans & Future wastewater generation

Greenacres Caravan Park has reported that to fund the significant changes to the site required for land application the caravan park is planning on implementing further sites in the 'future use zone' discussed in section 6.2.4 of this document.

This would potentially incorporate a further 15 sites within the park.

Additional waste generation is estimated at approximately 4 – 5 kL/day for the additional sites. The waste generation for the site has been calculated for the park (Refer Section 4.3), including these additional sites and this flow has been used in the revised models discussed within this RFI.

4.3 Historical versus potential future wastewater generation

The *Planning Guidelines for Water Supply & Sewerage* (DEWS, 2014) provide indicative average demands/flows for a range of dwelling types.

The *SEQ Water Supply and Sewerage Design & Construction Code (SEQ WS&S D&C Code) Design Criteria* (2013) also indicates local council area indicative flows for a range of dwelling types.

The recommended rates from the DEWS guidelines and the SEQ code, as well as historical values, have been calculated and compared in Table 1. For ease of readability, the greyed cells indicate the source data where flow calculations were based on.

Redland City Council (local government area for Greenacres Caravan Park) indicates planning scheme development density by type with a conventional baseline calculation for existing sewers of 210 L/EP (Equivalent Persons). The Mobile Home Park or Tourist Accommodation – Caravan Park has a Sewerage Development Density of 1.35 EP¹ /site, which equates to 283.5 L/site.

The flow usage for the current number of sites (103) and the proposed number of sites (118) have been calculated and are compared with the historical values prepared in the EE Report. These are presented in Table 1 below.

Table 1 Historical Flows and future expected flows

Information source	L/site	Flow kL/day (103 sites)	Flow kL/day (118 sites)
DEWS Caravan Park- van Minimum	300	31	35
DEWS Caravan Park- van Maximum	675	70	80
SEQ WS&S D&C Code (Redland CC Caravan park)	284	29	34
Rounded Historical Average (23.7 rounded to 25)	243	25	29
EE Notice figure (32.6 rounded to 35)	340	35	40
95 th Percentile for historical flow data	407	42	48

Table 1 indicates that Greenacres Caravan Park level of generation of wastewater is on the low end of the flow generation for the dwelling types applicable, indicating a good level of water efficiency on site.

In the EE Report MEDLI modelling conducted was based on the two figures of 25 kL/day and 35 kL/day.

Within this RFI, to incorporate potential future usage on site and to ensure the sustainability of the proposed land application system, further MEDLI models were conducted using daily flowrates of 45 and 50 kL/day.

This captures the 'worst case' scenario that both the site will be at maximum capacity AND the water use will be higher per site than indicated by historical data.

This introduces an increased degree of conservatism into the models, helping to ensure that any future Environmental Authority amendments can be assured of the suitability of the system going forward.

4.4 Capacity of STP

The existing STP is based upon aerobic fixed film technology, consisting of a trickling filter based system. The process consists of an inlet works utilising a coarse bar screen, a primary clarifier, trickling filter, secondary clarifier and Chlorine Dosing system.

¹ EP = Equivalent Person

Based upon inspections conducted prior to the Notice and EE Report, the process has also been upgraded more recently with an effluent filter, an anoxic cell a liquid chlorine dosing system, and improved baffling in the chlorine contact tank. These upgrades were recommended to address improve total nitrogen and total suspended solids removal, and to improve the robustness of the bacteriological disinfection system.

The following tables provide an overview of the capacity of each of the units of process based upon typical loading rates, taken from Wastewater Engineering Treatment and Resource Recovery, Metcalf & Eddy, 5th Edition, 2014.

Note that these tables do not comment on the current loading rates; they are an assessment of the possible loading the plant can accept based upon unit sizing to determine whether the plant can treat effluent at the rates indicated. Details of the current loading rates are provided in



Table 8.

Table 2 Primary Clarifier Capacity Check

Parameter	Value	Unit
Surface Area	13	m ²
Typical Loading	8 - 16	m ³ /m ² /day
Capacity at Typical Loading	120 - 200	m ³ /day

Table 3 Trickling Filter Capacity Check

Parameter	Value	Unit
Surface Area	28	m ²
Packing Volume	56	m ³
Packing Type	River Rock	
Typical Hydraulic Loading (Low Rate)	1 to 4	m ³ /m ² /day
Capacity at Typical Hydraulic Loading	28 to 112	m ³ /m ² /day
Typical Organic Loading Rate	0.09 to 0.3	kgBOD/m ³ /day
Capacity at Typical Organic Loading	5 to 17	kgBOD/day

Table 4 Anoxic Cell Check

Parameter	Value	Unit
Volume Installed	9.5	m ³
Estimated Design Volume	5.4	m ³
Estimated Capacity	60	m ³ /day

Table 5 Secondary Clarifier Capacity Check

Parameter	Value	Unit
Surface Area	5	m ²
Typical Loading	8 - 16	m ³ /m ² /day
Capacity at Typical Loading	40 - 80	m ³ /day

Table 6 Chlorine Contact Unit

Parameter	Value	Value
Calculated Volume	4	m ³
Required Residence Time	30	mins
Estimated Capacity at Typical Residence Time	40-160	m ³ /day

Table 7 Sand filter

Parameter	Value	Unit
Diameter	685	mm
Area (Estimated)	0.37	m ²
Typical Rate	120	L/m ² /min
Equivalent Flow	63	m ³ /day

These rates assume well configured process units with good inlet, outlet, and aeration and sludge management arrangements. As such, the actual performance of the treatment plant may be less than the estimated loading.

Based upon current details, the loading rates for the treatment plant should be approximately;

Table 8 Current Estimated Plant Loading Rates

Parameter	Value	Unit
Flow	30	m ³ /day
BOD Loading	7.6	kg/day
Primary Clarifier Loading	2.3	m ³ /m ² /day
Trickling Filter Hydraulic Loading	1	m ³ /m ² /day
Trickling Filter Organic Loading	0.14	kg/m ³ /day
Secondary Clarifier Loading	6	m ³ /m ² /day

Based upon standard published loading rates the treatment plant should be adequately sized for the current flow, and should achieve adequate treatment.

An increase in flow through the process is likely to be restricted by the size of the secondary clarifier, the filters, and some deficiencies in the trickling filter, including restricted aeration. If an increase in flow were to be accommodated the trickling filter aeration and secondary clarifier arrangements will need to be reviewed and improved. Adjustments may also need to be made to recycle rates, carbon dosing and any future chemical phosphorus precipitation systems.

For further photos and details of recommendations for process improvement within the STP, the process audit and site visit inspection reports are attached in **Appendix I**.

4.5 Water Balance

A water balance based on rainfall years (Maximum, Percentile and Minimum rainfall years) was presented in the EE Report. This was performed separately from MEDLI due to the dual release system proposed (release to waters and release to land), which could not be modelled within MEDLI.

DES indicated that an increase in deep drainage at this site to enable full land application to occur would be the preferred option to a dual release strategy.

Revised MEDLI models were performed for this RFI due to the change in management strategy to full land application. For these models the water balance within MEDLI is a suitable assessment for the management strategy as it is no longer a dual release system. As such the water balance spreadsheet is no longer required.

MEDLI models will be discussed in full later in this document.

5. REQUIREMENT 3 – RFI IRRIGATION MANAGEMENT PLAN

Requirement 3 of the RFI states that whilst the environmental report provides a proposed irrigation strategy, specific management measures to ensure the strategy is sustainably implemented have not been provided. The environmental report does not adequately address this query as it is considered a Treated Sewage Irrigation Management Plan should be provided which clearly address the previous criteria.

5.1 Irrigation Management Plan

Due to the additional information provided by DES on criteria that would be acceptable at the site in preference to regular release to waters within a dual release strategy, a review of the proposed management strategy has been undertaken.

The provided information in this RFI is different to that presented and described in the original EE Report, due to this new information.

An Irrigation Management Plan (IMP) has been prepared and is provided as a separate document in **Appendix D**. This document incorporates the changes provided in the following sections.



6. REQUIREMENT 4 – RFI – LAND IRRIGATION SIZE

Requirement 4 of the RFI states; the environmental report proposes irrigation to only around 1 hectare of land on the adjacent lot 5 on RP123875. No explanation has been provided in the environmental report as to why only around 1 ha is being proposed for irrigation purposes as there appears to be further land available (at least around 1.2 ha if not more) for effluent irrigation. Increase land for effluent irrigation will decrease the amount of deep drainage and possible groundwater contamination and the possibility of environmental harm being caused as a result of the proposed effluent irrigation. You are requested to provide an assessment of irrigation to a larger area that will minimise the volumes required to be released during rainfall events. In the event that a larger area cannot be utilised you are requested to provide the reasons why further land at the site cannot be utilised for effluent irrigation.



Figure 2 Vacant land area on Lot 5 RP123875 proposed by DES for irrigation

6.1 Proposed Irrigation Area size

Section 9.4 of the EE Report stated; “The proposed irrigation area is ~10,000 m², as shown in Figure 8, this value has been utilised in all MEDLI scenarios. This includes provisions for setbacks/buffers from boundary fences and an area for the proposed wet weather storage.”

Figure 8 from the EE Report as referenced in the above paragraph is replicated below as Figure 3 in this RFI Response.



Figure 3: EE Report Figure 8 - Proposed Irrigation Area

The EE Report stated the reasons for limiting the proposed irrigation area was due to the need to provide buffers, wet weather storage and a risk reduction zone. These are discussed again in detail in the following sections, with updated mapping and land use calculations.

Greenacres Caravan Park require additional land to continue to grow their business, a section of land was excluded from irrigation within the EE report for this purpose, but was not clearly defined. This 'future use zone' is now mapped and detailed in Section 6.2.4 below.

An updated map, including buffer zones, the future use zone and area for the WWS is provided as Figure 6.

6.2 Irrigation areas details Lot 5/RP123875

6.2.1 Wet Weather Storage

Regardless of whether there is full release of the wastewater to land (the preferred outcome), or a combined release of wastewater to land and waters, wet weather storage (WWS) for the treated effluent will be required.

There is no wet weather storage currently on site, as all treated water generated is released as per the current Environmental Authority.

Provision of space for the installation of wet weather storage was provided in Figure 8 of the EE Report. This was allowed for by reducing the proposed irrigation area via a 'cut-out' near the STP, labelled as WWS in that figure. This has not been taken into account by DES in the suggested irrigation area provided by DES in Figure 2.

To clarify, a magnified image of the STP area and the proposed wet weather storage area is provided in Figure 4 below.

The space provided is next to the STP area, where the treated effluent is generated and represents the most practical and reasonable area to locate the WWS. Seeking an alternative location would require additional installation, pipework and equipment costs, as well as operational costs to pump water to another location.



Figure 4 Proposed Wet Weather Storage Area

6.2.2 Risk Mitigation – waterlogging and run-off

In Section 11.4 of the EE Report it was indicated that the gentle slopes (3-5%) directed surface run off to the north-west corner.

. To reduce the risk of potential waterlogging in this area and potential surface rainfall run off to neighbouring properties, this corner was not included in the proposed irrigation area. The zone excluded is shown in Figure 5 below.



Figure 5 North-west corner of Lot 5/RP123875

6.2.3 Buffers/Setbacks

Buffers and Setbacks were described in the EE Report in Section 11.2 entitled Buffer distances/Setback under Section 11 'Irrigation Installation and Implementation Factors'.

AS1547:2012 provides guidance on the risk assessment of buffer distances. The guideline values and the buffers able to be provided are outlined in Table 9 below (replication of Table 15 from EE Report).

Table 9: Setback distance guidelines and provided values on Lot 5/RP123875

Setback distances for Subsurface land application area for on-site STP's (metres)		
Feature	Guideline (Low - High Risk)	Provided on Lot 5/RP123875
Property boundaries	1.5 - 50	5
Buildings	2 - 6	>5
Surface Water	15 - 100	>100
Bore, well	15 - 50	>300 ²
In ground water tank ³	4 - 15	>5
Retaining walls, embankments, escarpments, cuttings	3	>5
Groundwater	0.6 - 1.5	>30 ⁴
Hardpan or bedrock	0.5 - 1.5	>0.5

The buffer areas are shown in Figure 6 below as orange zones around the proposed irrigation area. The southern zone includes additional area to support the internal road network and access to the site.



Figure 6 Irrigation Area buffer/setback zones in Orange

² Registered bores (may or may not be in use)

³ No water tanks were observed during site inspection, however as these are in-ground they may be present on neighbouring sites. Buffer of 5m from boundaries provide this setback.

⁴ Estimated based on local bore logs

6.2.4 Future Business Use Zone

As discussed in Section 0, the Greenacres Caravan Park is not able to significantly increase the rental income for the site.

Greenacres Caravan Park plan to utilise the north-eastern section of Lot 5/RP123875 for future development to create further income to assist in funding the significant changes that are required as a result of application of treated effluent to land.

The Future use zone is provided in Figure 7 below, shaded pink, and comprises ~5,520 m².



Figure 7 Future Use Zone

6.3 Proposed Lot 5/RP123875 Irrigation Area

The proposed main irrigation area has been slightly increased since the EE Report and now consists of ~12,550 m² (1.25 ha). This is shown in Figure 8 below.



Figure 8 Lot 5/RP123875 Irrigation Area, with surrounding zones.

6.4 Land Use Summary Lot 5/RP123875

A summary of the land uses and the estimated areas of each type of land use on Lot 5/RP123875 is provided in Table 10 below.

Table 10 Land Use Area Summary Lot 5/RP123875

Land Use	Estimated Area ⁵	Comments
Units	m ²	-
Proposed Irrigation Area	12,550	Subsurface drip irrigation area
Western Buffer Zone	400	Property Boundary and Subsurface Stormwater drain easement
Northern Buffer Zone	660	Property Boundary
Southern Access Road & buffer zone and Eastern Buffer Zone	930	Access road within site and provides 10m buffer to buildings
Runoff/Waterlogging Risk Reduction Zone	400	Risk reduction for overland flow
Wet Weather Storage Zone	350	Designated space for storage tanks and associated pipework/pumps etc.
Future Use Zone	5,520	Site development
Total Land Area	20,810	Surveyed Area on Cadastral Map

⁵ Obtained by Queensland Globe measurements June 2019.

6.5 Potential further irrigation areas Lot 3/RP123875

A function called 'multirun' within MEDLI allows for sensitivity analysis to be conducted, which allows a comparison of variables such as area or wet weather storage (pond) size to be performed to determine which has the most impact on the outcomes.

Sensitivity analysis within MEDLI using the multirun function indicated that increasing irrigation area for the site was far more beneficial in reducing the risk of overtopping (and hence possible release to waters), than increasing the size of the Wet Weather Storage. To allow an increase of volume for land application, more irrigation area was required.

As such, the following potential further irrigation areas on Lot 3/RP123875 were investigated to supplement the main irrigation area on Lot 5/RP123875.

6.5.1 Lot 3/RP123875 Western Edge

The western garden/turf edge of Lot 3/RP123875 is currently used by tenants for storage and was investigated as an additional irrigation area, which could also benefit the aesthetics of the garden.

This strip is very thin piece of land, and with the buffer zone to the boundary and against the road, it was concluded that for the benefit of 100m² of additional irrigation area, this was not practical to utilise at this time.



Figure 9 Potential Western Edge Strip

6.5.2 Lot 3/RP123875 Southern Gardens

There is an existing grassed area and garden beds along the southern boundary of the site, adjacent to Mt Cotton Road. This area is downgradient from adjacent properties and roadways, so the buffer provided from the property boundary is can be reduced to the minimum 1.5m, instead of the 5m as provided on Lot 5.

Allowing for a 1.5m setback from the southern boundary line on Lot 3/RP123875 an estimated turf and garden edging irrigation area of ~950 m² has been calculated.

This garden is used as aesthetic edging, is not used for traffic or grazing and is considered suitable for the installation of sub surface irrigation to supplement the main irrigation area.



Figure 10 Southern Boundary irrigation Area Lot 3/RP123875

6.5.3 Amenities block Green Area

There is a small amount of green space in front of the amenities block. This is calculated at ~170m². This area has public traffic and use including clothes lines and pedestrian traffic. It was not deemed suitable for additional irrigation area at this time.

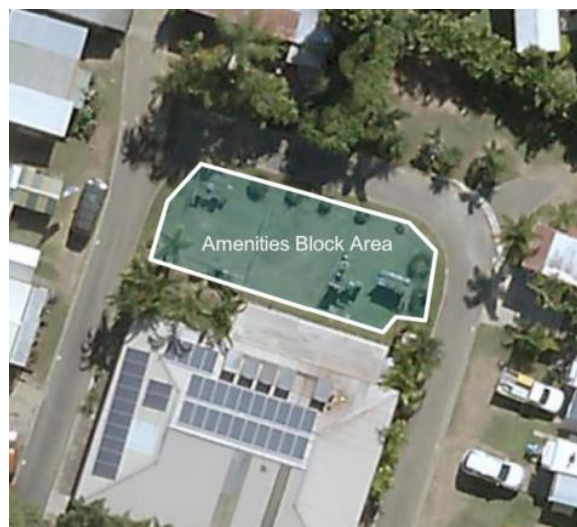


Figure 11 Amenities block Green space on Lot 3/RP123875

6.5.4 South Eastern Green Space

This area lies on the corner of Mount Cotton Rd and Greenfield Rd. It has a BBQ picnic shelter and covered seating (behind the edge tree line and not within the proposed irrigation area); with established trees surrounding grassed open green space.

This area is calculated at ~1,500 m² of available area utilising a 1.5m buffer to the boundary as the road is up-gradient), and is shown below in Figure 12. Setback provided to buildings is at least 2 m as per AS1547:2012 and Table 11.



Figure 12 South East Green Space on Lot 3/RP123875

6.6 Summary of Lot 3/RP123875 Potential Areas

AS1547:2012 provides guidance on the risk assessment of buffer distances. The guideline values and the buffers able to be provided for the areas in Lot3/RP123875 are outlined in Table 11 below

On the Southern boundary, these areas are down-gradient of property boundaries, so the buffer provided is 1.5 m instead of the 5 m provided in other areas that are up-gradient of the property boundaries.

Table 11: Setback distance guidelines and provided values on Lot 3/RP123875

Setback distances for Subsurface land application area for on-site STP's (metres)		
Feature	Guideline (Low - High Risk)	Provided on Lot 3/RP123875
Property boundaries	1.5 - 50	1.5 - 5
Buildings	2 - 6	>2
Surface Water	15 - 100	>100
Bore, well	15 - 50	>300 ⁶
In ground water tank ⁷	4 - 15	4
Retaining walls, embankments, escarpments, cuttings	3	3
Groundwater	0.6 - 1.5	>30 ⁸
Hardpan or bedrock	0.5 - 1.5	>0.5

Table 12 Summary of Lot 3/RP123875 potential Irrigation Areas

Land Use	Estimated Area ⁹ (m ²)
Southern boundary gardens and turf	950
South-eastern Green area	1,500
Total	2,450

6.7 Total Irrigation Area

The total available irrigation area for the application of treated effluent over the Lot 3 and Lot 5 / RP123875 is **15,000 m² (1.5 ha)**. This value has been utilised in the MEDLI runs within this RFI.

⁶ Registered bores (may or may not be in use)

⁷ No water tanks were observed during site inspection, however as these are in-ground they may be present on neighbouring sites. Buffer of 1.5 m from boundaries provide this setback.

⁸ Estimated based on local bore logs

⁹ Obtained by Queensland Globe measurements June 2019.

7. ADDITIONAL INFORMATION – UPDATED MEDLI MODELLING

7.1 Supplementary MEDLI modelling performed

DES indicated in a phone conversation on the 6th June, 2019 in increase in deep drainage for this site achieve to full land application would be preferable compared to a combined release to waters/release to land strategy.

In light of this, supplementary MEDLI modelling has been performed, including the changes and inputs outlined in Table 13.

Table 13 MEDLI Input Summary showing adjustments

Parameter	MEDLI Input EE Report	MEDLI Input this RFI	Reason/Comment
Flow	Average Daily Flows Only	Variable Flow Scenarios performed as well	Additional scenarios run to demonstrate values with daily/weekly variations.
Irrigation Rate	3.5 mm/day	5 mm/day	An application rate set deliberately higher than DIR to enable deep drainage via land application in preference to release to waters
Rainfall Cut-off	20 mm	20 mm	No scenarios have any reference to 40mm to avoid confusion with previous management strategy
Irrigation Area	1 ha	1.5 ha	To enable release via land application. See also Section 6
Wet Weather Storage	90 kL	90 kL	No change.
Pond Nutrient Fractions	Default MEDLI	Adjusted to match effluent fractions	Discussed in Section 13.3
Waste characteristics	TN 35mg/L TP 6.5mg/L TDS 430mg/L	TN 35mg/L TP 6.5mg/L TDS 430mg/L	No change

As mentioned in Table 13, the Design Irrigation Rate (DIR), provided in the EE Report (Section 8.1) and based on the soil type and AS1547:2012, was 3.5 mm/day. To achieve full application to land, the irrigation rate has been increased to 5 mm/day. Whilst increasing the DIR can pose a risk of increased waterlogging and deep drainage/leaching, the DIR of 3.5 mm/day was insufficient to achieve sufficient disposal whilst maintaining low to no overtopping of the WWS.

DES has indicated that deep drainage would be acceptable on site as a preferred outcome to release to waters. Modelling provided indicates that whilst deep drainage at the increased DIR has increased, leaching of nutrients still remains low. This is discussed in Section 7.2.4 below.

An increase in the DIR could cause water logging or surface run off. This irrigation rate is suitable with respect to surface run-off as it remains below the available water capacity of the soil, as calculated in the MEDLI program (top soil -15 mm), sub soils -33 mm and 42 mm, respectively¹⁰. Application is via sub-surface drip irrigation and modelling indicates that the increased DIR should not result in surface run off.

Table 14 on page 36 outlines a summary of the revised MEDLI modelling and scenarios performed.

7.2 MEDLI Sustainability Assessment

A full MEDLI sustainability assessment was performed within the EE Report. Changes to the system inputs and therefore outputs are discussed below.

7.2.1 Flow – Waste generation

In Table 14 multiple scenarios are presented for flow (waste generation) for the STP. The columns in grey are the scenarios based on variable flow as per Section 3 (Requirement 2 of the RFI).

The first grey column is the variable flows based on 2018-2019 data. The second grey column is the variable flows based on extrapolated data to incorporate the planned additional sites within the Caravan Park (Section 4.2).

The 'Max Effluent Discharge' scenarios of 45 & 50 kL/day have been provided to support any future EA amendments as they demonstrate the system is sustainable even under increased daily flow conditions in excess of the Caravan Parks current waste generation rates.

7.2.2 Rainfall Threshold

The EE Report included a management strategy with two (2) different rainfall thresholds. In the revised management strategy there is no planned release to waters.

A proposed irrigation rainfall cut off remains at 20mm. There are no references to 40mm rainfall thresholds within the revised management strategy or this RFI.

With the proposed irrigation cut off of 20 mm rainfall, the wet weather storage starts to fill if this volume of rainfall is exceeded and irrigation is prevented, or the inflow to the treatment plant is sufficiently high to be unable to be irrigated.

7.2.3 WWS volume & risk of overtopping

In peak periods, where treated effluent is produced in excess of the allowable irrigation volume, treated effluent is stored in the WWS until days where sufficient irrigation can occur to 'catch up' on the excess treated effluent stored.

Using the multi-run function within MEDLI, increasing land area was found to be far more beneficial to the system sustainability and reducing overtopping than increasing the wet weather storage volume. The WWS volume was not adjusted in the MEDLI models attached and remained at 90 kL.

¹⁰ MEDLI Soil profile for Greenacres Caravan Park – taken from MEDLI model calculated parameter.

With the adjustments in irrigation area and daily irrigation rate, all scenarios, indicate an overflow of less than 2.51% of the total volume of treated effluent produced. Overflow below 5% is generally considered acceptable¹¹.

7.2.4 Deep drainage

The deep drainage for the irrigated scenarios is approximately 3-5 times greater than that for the non-irrigated scenario.

It should be noted that MEDLI modelling indicates deep drainage as anything below the soil profile modelled, which is approximately 2 metres deep. The groundwater in the area is estimated at greater than 30 m below the surface. Confirmation of this is discussed in Section 8.

As has been indicated previously, these MEDLI scenarios have been modelled with an intentional increase in deep drainage to reduce the perceived risk of release to surface waters.

The 50 kL/day scenario had deep drainage of 4.5 times the non –irrigated scenario; however the variable flow scenarios for both current flows and extrapolated flows indicate approximately 2-3 times the non-irrigated scenario.

7.2.5 TN Leached

As the vegetation on site is a mix of Kikuyu and Ryegrass, the total nitrogen leached in all scenarios will be between the two values reported.

As indicated in the EE Report, Kikuyu and Ryegrass are blended together to provide full ground coverage and complement each other when the temperature profiles change through the seasons. Kikuyu thrives during summer and Ryegrass thrives during winter. This ensures the sward is in a viable and healthy state for nutrient uptake at all times.

For example, with a 50 kL/day flow the TN leached is modelled between 0.74 kg/ha/year (Kikuyu) and 8.37 kg/ha/year (Ryegrass). It was indicated in the EE Report that Kikuyu is the vegetation likely to dominate, with Ryegrass used to provide winter cover and fast germination for establishment.

This indicates that for flows of up to 50 kL/day, the combined TN leached (average 4.56 kg/ha/year) is modelled to be below 5 kg/ha/year. This demonstrates that the nitrogen leaching from the system at the maximum daily flows modelled is sustainable.

For the variable current flows the TN leached is modelled between 0.35 kg/ha/year (Kikuyu) and 1.45 kg/ha/year (Ryegrass).

For the variable extrapolated flows (expected wastewater generation including future land use) the TN leached is modelled between 0.37 kg/ha/year (Kikuyu) and 1.72 kg/ha/year (Ryegrass).

This demonstrates that for the current and likely flows experienced on site, there is very little nitrogen predicted to be leached through the soil profile, it remains similar values to those predicted in the non-irrigated scenario of between 0.29 kg/ha/year (Kikuyu) and 1.17 kg/ha/year (Ryegrass).

11 Sustainable effluent irrigation over the past decade – The role of MEDLI modelling for wastewater discharge, 2011 (Vieritz A, Ramsay I, Haworth L, Tennakoon S, Gardner E).

The average nitrate concentration of the deep drainage is low, with the maximum being 0.57 mg/L in the 50 kL/day scenario. For the variable current flows and variable extrapolated flows (expected wastewater generation including future land use) the average nitrate concentration is between 0.05 and 0.18 mg/L.

It should be noted that for all scenarios the bulk of nitrate leaching occurs in the establishment phase (eg first year) with the remaining years remaining low. This is demonstrated in Figure 13. Other than the establishment phase, the nitrate concentration of the deep drainage remains well below 0.2 mg/L for the rest of the modelled period. Similar profiles, with proportionately less concentration are seen in the models for the variable flows experienced on site.

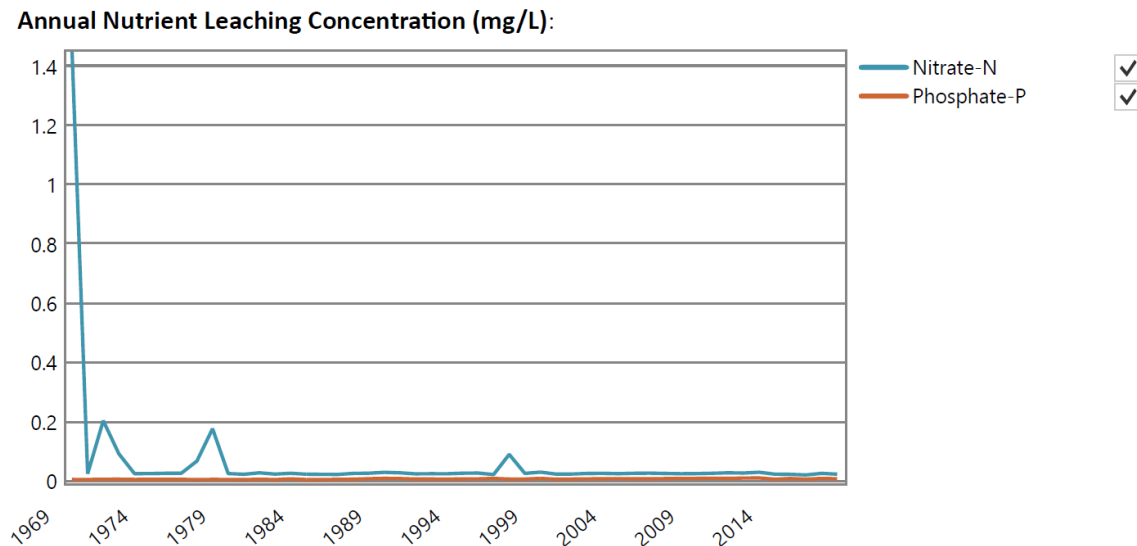


Figure 13 Nutrient leaching example (50 kL/day MEDLI scenario)

Additionally, the risk to groundwater remains low, due to the significant separation distance from application of treated effluent to the predicted presence of groundwater.

7.2.6 TP Leached

The total phosphorus leached in all scenarios is well below 1 kg/ha/year, and continues to be sustainable for this water quality, quantity and management strategy.

7.2.7 Vegetation & Plant Health

Plant health is indicated by the stress indices in Table 14 and the predicted annual yield and harvest frequencies. Other than the 'no irrigation scenario' there are no significant crop deaths.

An increase in the irrigation rate has not increase the water logging index for the irrigation area, indicating that whilst deep drainage may be induced the area is not waterlogged, nor do the models predict effluent induced surface run off

The annual yield increases with increasing irrigation. The harvest frequencies range between 3 and 5 per annum, which are reasonable for the vegetation selected and comparable to the predicted harvest requirements as discussed in the EE Report.

Table 14 MEDLI Model Output Summary

Parameter	Units	No Irrigation Scenario		Average Daily Aggregate Effluent discharge (25 kL/day)		Variable Flow Effluent discharge		Max Effluent Discharge (35 kL/day)		Max Effluent Discharge (45 kL/day)		Variable Flow Effluent discharge Extrapolated		Max Effluent Discharge (50 kL/day)	
Daily Flow	kL	25		25		Variable 2018-2019 (Avg 24.3)		35		45		Variable extrapolated for extra sites (Avg 27.8)		50	
Irrigation Rate	mm/day	0		5		5		5		5		5		5	
Irrigation Area	m ²	1.5		1.5		1.5		1.5		1.5		1.5		1.5	
Rainfall Cut off	mm	20		20		20		20		20		20		20	
Wet Weather Storage	kL	90		90		90		90		90		90		90	
MEDLI outputs															
Crop	Species	Kikuyu	Ryegrass	Kikuyu	Ryegrass	Kikuyu	Ryegrass	Kikuyu	Ryegrass	Kikuyu	Ryegrass	Kikuyu	Ryegrass	Kikuyu	Ryegrass
Irrigation Volume applied	kL/year	0	0	9,115	9,115	8,733	8,733	12,700	12,700	16,236	16,234	9,903	9,903	17,919	17,919
Average Overflow volume	kL/year	-	-	16	16	132	132	83	83	200	200	255	255	343	343
% overflow of total volume	%	-	-	0.18%	0.18%	1.5%	1.49%	0.65%	0.65%	1.22%	1.22%	2.51%	2.51%	1.88%	1.88%
No. overflow events exceeding 0.04kL	No./year	-	-	1.4	0.8	2.2	2.2	2.8	2.8	12.3	12.3	3.7	3.7	12.34	12.34
Proportion days irrigation prevented	fraction	1.00	1.00	0.04	0.04	0.11	0.11	0.04	0.04	0.04	0.04	0.11	0.11	0.04	0.04
Proportion days irrigation occurs	fraction	0.00	0.00	0.96	0.96	0.89	0.89	0.96	0.96	0.96	0.96	0.89	0.89	0.96	0.96
Irrigation	mm/year	0	0	608	608	582	582	847	847	1,082	1,082	660	660	1,195	1,195
Deep Drainage	mm/year	274	373	694	889	694	873	904	1,126	1,130	1,362	761	949	1,241	1,475
TN Leached	kg/ha/year	0.29	1.17	0.4	1.76	0.35	1.45	0.48	2.17	0.63	5.09	0.37	1.72	0.74	8.37
Average Nitrate-N conc of deep drainage	mg/L	0.1	0.31	0.06	0.2	0.05	0.17	0.05	0.19	0.06	0.37	0.05	0.18	0.06	0.57
TP Leached	kg/ha/year	0.000032	0.000043	0.02	0.02	0.02	0.02	0.03	0.04	0.05	0.08	0.02	0.02	0.07	0.11
Average phosphate-P conc of deep drainage	mg/L	0.000012	0.000012	0.0024	0.0024	0.0041	0.0049	0.0034	0.0038	0.0048	0.01	0.0026	0.0023	0.01	0.01
Annual Shoot DM Yield	kg/ha/year	4,029	5,113	15,751	14,921	15,053	14,633	18,721	16,842	21,137	18,151	16,095	15,438	22,173	18,656
Avg Normal Harvests per year	-	0.3	0.86	2.84	3.84	2.72	3.78	3.38	4.34	3.8	4.68	2.9	3.98	4	4.82
Avg Crop Deaths per year	No./year	2.04	2.16	0	0.04	0.00	0.02	0	0.02	0	0.02	0.00	0.02	0	0
Avg Annual nitrogen deficiency index	coefficient	0.73	0.61	0.63	0.38	0.64	0.40	0.55	0.26	0.47	0.15	0.61	0.36	0.44	0.11
Avg January temperature stress index	coefficient	0.00	0.46	0.00	0.46	0.00	0.46	0.00	0.46	0.00	0.46	0.00	0.46	0.00	0.46
Avg July temperature stress index	coefficient	0.55	0.01	0.55	0.01	0.55	0.01	0.55	0.01	0.55	0.01	0.55	0.01	0.55	0.01
Avg monthly water stress index	coefficient	0.21	0.18	0.02	0.00	0.04	0.01	0.01	0.00	0.00	0.00	0.03	0.01	0.00	0.00
Avg monthly water logging index	coefficient	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Relative Crop Yield due to salinity	fraction	-	-	1	1	1	1	1	1	1	1	1	1	1	1
Reliability of Supply Run															
Irrigation demand supplied	fraction	0.0	0.0	0.9	1.1	0.8	1.1	1.2	1.6	1.5	2.0	0.9	1.2	1.7	2.2

8. REQUIREMENT 5 – RFI - GROUNDWATER

Requirement 5 states that the EE Notice required among other things a consideration of any available information on groundwater. The report states that there is 36 m to groundwater (page 48 of 50 in EE Report). You are requested to provide the source of this data for the proposed treated sewage irrigation area and an assessment of the relevance to the site with respect to groundwater contamination due to the proposed treated sewage irrigation and any associated 'environmental harm' of groundwater at the site.

8.1 Groundwater Data Source

The information on page 48 in the EE Report is an assessment of deep drainage in the MEDLI Outputs and Diagnostics section.

More in depth information on groundwater can be found earlier in Section 6 on page 26 of the EE Report. Section 6 outlined with mapping (Figure 14 in EE Report), the contours around the area to show the predicted direction of groundwater flow in the area, as well as the locations of all the registered bores.

This mapping was provided by Queensland Globe and is replicated from Section 6 in the EE Report as Figure 14 below for ease of reference. Blue arrows show inferred groundwater flows, based on contours

Bore log source data was also collated and tabulated in Table 3 on page 27 of the EE Report.

This is also replicated below as Table 15 for ease of reference. It was noted while preparing this RFI that one registered bore (145366) was not listed in the table. This additional bore has been added in this RFI response.

The bore log source data obtained from Queensland Globe and used to derive Table 15 below is attached for reference in **Appendix E** of this RFI.

Table 15: Groundwater Bore Assessment

RN	~Distance to Irrigation Area (m)	Strata Information – Water bearing zone (m)	Status
79904	360	53-64m Water Bearing Shale	Existing
152692	820	36m - Decomposed Sandstone w/some water 48m - Decomposed Sandstone w/some water	Existing
133759	520	30m – Unknown 56m - Gravel	Existing
134769A	380	Nil @ 54m	Abandoned & Destroyed
133760	620	70m - Unknown	Abandoned & Destroyed
145366	610	Nil @ 66m	Abandoned & Destroyed

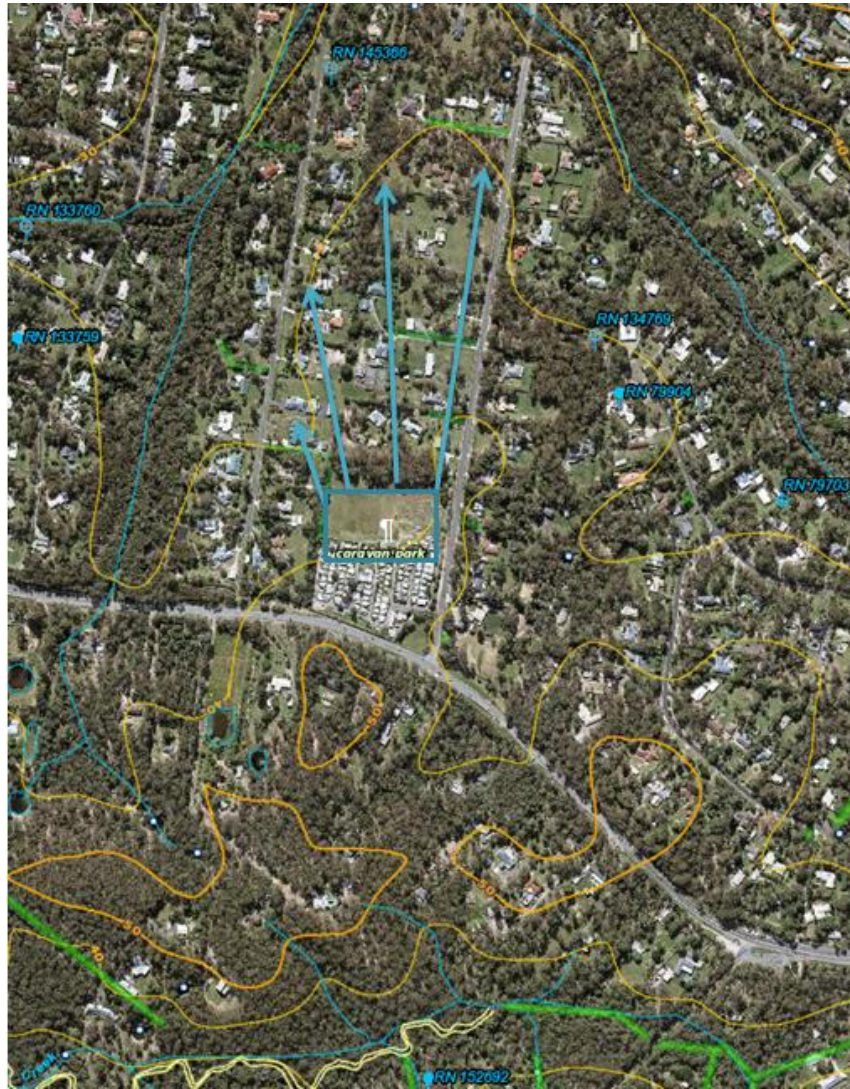


Figure 14 Caravan Park and surrounds with contours and surrounding groundwater bores –

The location of the bores in relation to the contour lines, along with the depth of the bores (based upon the data available), indicates that there is significant vertical buffer distance from the application of treated effluent at the surface to the level of groundwater in the area.

Onsite Domestic Wastewater Management Standard AS1547:2012¹² provides setback guidance risks for vertical setback buffer to groundwater between 0.6 – 1.5 m (low to high risk). The vertical buffer to groundwater is estimated at ~30m.

As shown in Figure 14, the closest registered bore (RN79904) is ~360m from the boundary of the proposed irrigation area. This complies with the guideline horizontal setback distance to bores/wells of 15 – 50 m (low to high risk).

Queensland Globe identifies the proposed irrigation area as having metamorphic rock aquifers, with likely groundwater directional flows entering an area of no identified aquifers although a groundwater monitoring bore (RN79904) is located in this band/area.

Data availability for standing water level measurements for all surrounding groundwater bores is limited; directional flows can only be assumed by land contour, natural groundwater flow and directional falls.

¹² AS1547 On-site Domestic Wastewater Management (2012) Table R1 and R2

8.2 Groundwater Monitoring Bore model conditions for release to land

Model operating conditions ERA 63 – Sewage Treatment indicates groundwater monitoring may be necessary in situations where irrigated water is likely to impact on groundwater.

If required, the monitoring should:

- a) be able to determine the impacts of the licensed activity on the groundwater quality in the underlying aquifer; and
- b) include, but not be limited to, a sufficient number of bores (minimum of three) installed at locations and depths which yield representative groundwater samples from at least the upper-most aquifer so as to:
 - i. establish the quality of groundwater that has not been affected by seepage or drainage of contaminants to groundwater from the activity; and
 - ii. detect any seepage of contaminants to groundwater from the licensed place; and
- c) include monitoring of background groundwater quality, hydraulically up-gradient of any release of contaminants to groundwater; and
- d) include monitoring of downstream groundwater quality, hydraulically down gradient of all storage ponds, sewage treatment plant and irrigation areas;
- e) include, but not limited to, six monthly monitoring of the quality of groundwater to detect any possible release(s) of contaminants; and
- f) Consider the potential use of groundwater in the vicinity.

8.3 Groundwater use in vicinity

As indicated in Table 15 above, the closest existing groundwater bore in use (according to Qld Globe¹³,) is ~320 m from the proposed irrigation area.

AS15457:2012 indicates that a horizontal buffer from the irrigation area to a bore or well should be at least 15 m (low risk) to 50 m (high risk).

High risk is considered to be highly permeable soils and gravel aquifers that may allow microbial contamination to be readily transported.

The treated effluent at Greenacres Caravan Park is dosed with chlorine for disinfection.

The buffer distance provided and the risk of microbial contamination is low as the soils sampled in the area (indicate soil types) are not highly permeable (i.e. gravel or sand).

It should also be noted that the surrounding properties rely on septic tank or similar on-site treatment technology and do not have the disinfection capability of the Greenacres Caravan Park STP.

AS15457:2012 indicates that a vertical buffer distance to groundwater should be 0.6 m (low risk) to 1.5 m (high risk).

The Queensland Plumbing and Wastewater Code 2019 (Table T5) indicates the vertical unsaturated soil depth to a permanent water table for secondary treated effluent is 0.6m.

The vertical buffer distance provided at Greenacres Caravan Park is estimated at greater than 30m.

¹³ Information unverified as no inspection has taken place.

8.4 Groundwater Monitoring Bore Installation Cost

The level of groundwater on the property has been estimated but has not been tested on site. The bores in the surrounding area have been utilised to infer an estimated groundwater level for the site.

Installation costs for groundwater monitoring bores is dependent on a number of factors, such as;

- a) Type of drilling/drill rig required
- b) Material being drilled
- c) Access to site
- d) Depth of bore

As the water table depth is unknown Rotary Air drilling is an appropriate choice for the type of drilling required. (*Groundwater Sampling and Analysis – A Field Guide, 2009*)

Groundwater bores are usually required both up-gradient and down-gradient of an irrigation area (as mentioned in Section 8.2). This allows comparison of the results upon sampling to assist in determining if any changes are natural or other sources, or potentially from impact in the irrigation area.

The minimum number of bores is usually three (3) (as mentioned in Section 8.2).

A quotation for the installation of groundwater monitoring wells has been included as **Appendix F**.

This quotation provided indicates that the estimated cost for installation of groundwater monitoring bores is significant due to the estimated depth of groundwater at the site. The estimated costs based on the quotation provided are outlined in Table 16.

This is a significant expense for Greenacres Caravan Park and consideration should be given to whether there is a likely impact on groundwater and whether groundwater monitoring is necessary.

Table 16 Estimated Cost for Installation of Groundwater Monitoring bore(s)

Rate		Unit	Expected Qty per well	Total per well	Est per job (3 wells)
Mobilise Rig	\$500	per job			500
Daily Rate	\$4,000	per day			8,000
125mm PVC pre-collar	\$30	per metre	35	1,050	3,150
Monitoring Well materials	\$45	per metre	35	1,575	4,725
Lockable Well Cover	\$150	per well	1	150	450
Sub Totals (excl GST)				2,625	16,825
Other items	Cost + 10%	per job	unknown	Cost + 10%	Cost + 10%
GW installation Design ¹⁴					1,800
Estimated Total Excl GST)					18,625

¹⁴ Allowance for consultancy fees to determine appropriate locations of the monitoring wells and supervision of works.

8.5 Common Groundwater Monitoring Parameters & Estimated Cost

The parameters for analysis of ground waters are based on the potential impacts from the application of treated effluent to the irrigation area

Table 17 below indicates commonly required parameters for groundwater monitoring for the purpose of assessment of the potential impact by application of treated effluent to land.

Table 17 Groundwater Monitoring Parameters

Parameter	Units
pH	pH
Electrical Conductivity	µS/cm
Suspended Solids	mg/L
CBOD ₅	mg/L
Total Nitrogen	mg/L
Total Phosphorus	mg/L
Ammonia	mg/L
Nitrate + Nitrite (NO _x)	mg/L
<i>E. coli</i> <u>or</u>	cfu/100mL
Enterococci	cfu/100mL
Reduced Standing Water Level (RSWL) <u>or</u>	mAHD
Standing Water Level (SWL)	m below TOC/surface

Due to the depth of the proposed monitoring bores, this limits the appropriate methods available for sampling.

Bailing is not ideal for deep bores due to;

- Time taken to remove required purge volume
- Impractical to remove the stagnant water in a deep bore with a bailer
- Disturbance of water column with this method

A micro-purge or similar groundwater sampling system should be utilised for bores between 30-50m in depth.

The minimum monitoring period according to the model conditions is 6-monthly.

Table 18 Estimated Cost for Monitoring of Groundwater bore(s)¹⁵

	Estimated Costs (excl GST)
Sampling	\$1,400
Laboratory Analysis ¹⁶	\$650
Interpretive Report	\$500
Sub Total	\$2,550
Estimated Annual cost	\$5,100

8.6 Groundwater level analysis timeframe

Due to the significant cost involved in this investigation Greenacres Caravan Park indicate that if the groundwater level investigation is still required by DES, they will not be able to perform this installation and analysis of groundwater monitoring bores until the end of March 2020.



¹⁵ This is not an official quotation for this work, prices subject to change

¹⁶ Based on Table 17 parameters.

9. ADDITIONAL INFORMATION - CREEK INVESTIGATION

It was indicated in the EE Notice Section A. Grounds Item 13 that 'The department considers that the discharge of treated effluent from your premises has the potential to cause environmental harm to the receiving waters due to the release of high levels of nutrients'.

It was indicated in the EE Notice Section A. Grounds Item 15 that 'The department considers that because people can access the receiving waterway, the high level of faecal coliforms being release from the premises has the potential to cause environmental harm, as it is likely to adversely affect recreational use of the area...'

9.1 Environmental Values and Water Quality Objectives

Coolnwynpin Creek is defined in the *Redland Creeks environmental values and water quality objectives Basin No. 145 (part) and Plan WQ1453* as lowland freshwater.

The limits that apply are indicated as Aquatic Ecosystem – moderately disturbed and are listed in Table 20 on page 51.

9.2 Sampling Points locations

The Stormwater Outlet, and approximately 350m downstream of the stormwater outlet were sampled in July 2019. These sample points are shown in Figure 15 and Table 19 below.

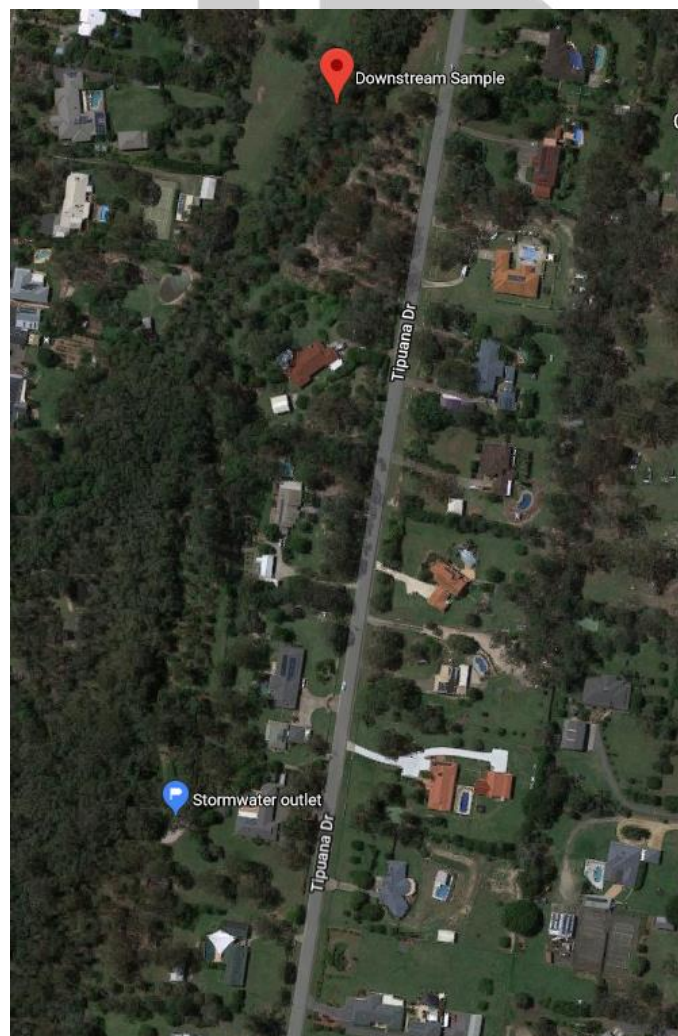


Figure 15 Sample point locations

Table 19 GPS locations of Release point details

Description	GPS location
Council drain to waters described as a tributary of Coolnwynpin Creek at 6.5km AMTD (Stormwater outlet)	-27.55973, 153.20484
Downstream ~350m sampling point	-27.556175, 153.205739



Figure 16 Stormwater Outlet Sample point west of Lot 9/RP230529



Figure 17 Downstream sample point for tributary of Coolnwynpin creek west of Lot 5/RP230530

9.3 Upstream of Receiving Environment

Upstream of the Stormwater Outlet the upper reach does not have a bed or bank edges (channel), rather is a wide flow path of wooded paperbark forest with small diameter trunks and tufted groundcover. The maturing of the paperbarks appears to be limited by potential lack of available water. This would be considered a drainage feature, not a water course according to the Water Act 2000, as it;

- a) is a natural landscape feature operating to concentrate overland flow during and immediately after rainfall events;
- b) does not have a distinctive channel that has a distinctive bed and bank that is contiguous
- c) flows for only a short duration after a rainfall event and;
- d) does not have enough continuing flow to create a riverine environment.



Figure 18 Drainage feature ‘upstream’ of Stormwater Outlet



Figure 19 Drainage feature 'upstream' of Stormwater Outlet 2

9.4 Stormwater Outlet

The stormwater outlet shown in Figure 20 provides the bulk of the water supply for the creek. Here vegetation is varied and surface water dependent, with water favouring riparian vegetation.



Figure 20 Surface floating vegetation at Stormwater Outlet



Figure 21 Samples at Stormwater Outlet showing vegetation in bank area in background

9.5 Immediately 'Downstream' of Stormwater Outlet

Downstream of the Stormwater Outlet there are clear bed and banks to the creek, with water favouring riparian vegetation.



Figure 22 Stagnant pool with riparian vegetation

As the stream progresses downstream, the water quality appears to improve visually.



Figure 23 Further downstream from stagnant pool



Figure 24 Continuing downstream, small creek underlying varied vegetation

9.6 ~300-350m Downstream of Stormwater Outlet

The vegetation downstream has larger, more established trees and a variety of water dependant vegetation.



Figure 25 Samples from Downstream sampling point



Figure 26 Vegetation at downstream sampling point.

9.7 Analytical Results

The results from the creek and a sample taken mid-way through the chlorine contact chamber are presented in Table 20 below.

These are presented alongside the current EA limits for the STP effluent, the Water Quality Objectives (WQO's) for the creek, and the ANZECC trigger value for Ammonia.

The STP chlorine contact chamber reports no exceedances of the EA limits.

The Stormwater Outlet & Downstream sample points are compared with the WQO's and ANZECC trigger value for ammonia. Items above the WQO's are highlighted grey and bolded.

Table 20 Physicochemical analysis of Creek & Stormwater Outlet July 2019

Parameter	Units	Current EA Limits	Treated Effluent – Cl ₂ chamber	WQO Lowland Freshwater Moderately disturbed	Stormwater Outlet	~350m Downstream	ANZECC Trigger Value 95% Protection of Species
Turbidity	NTU	-	23	50	13	6.8	-
Suspended Solids	mg/L	60 Max 30 (80 th %ile)	27	6	11	<1	-
Chlorophyll a	µg/L	-	NT	5	NT	NT	-
Total Nitrogen	mg/L	-	31	0.5	16	<0.1	-
Oxidised Nitrogen	mg/L	-	22	0.06	12	<0.005	0.7
Ammonia	mg/L	-	5.8	0.02	2.7	0.11	0.9
Organic N	mg/L	-	3.1	0.42	1.6	<0.8 ¹⁷	-
Total Phosphorus	mg/L	-	7.9	0.05	3.8	0.84	-
Orthophosphate (FRP)	mg/L	-	NT	0.02	NT	NT	-
Dissolved Oxygen	%	-	-	85-110	~56	~22	-
Dissolved Oxygen	mg/L	>2	NT	-	5.2	2.1	-
pH	-	6.5-8.5	7.1	6.5-8.5	7.1	6.8	-

¹⁷ Whilst below LOR, according to the TN by calculation Org N is below the WQO.

Table 21 Microbiological Analysis of Creek & Stormwater outlet July 2019

Parameter	Units	Current EA Limits	Treated Effluent	WQO	Stormwater Outlet	~350m Downstream
Thermotolerant Coliforms	CFU/100ml	1000 (Median of 5) 4/5 samples < 4000	40	100 ¹⁸	12,000	200
E.coli	CFU/100ml	-	8	-	<100	200
Total Coliforms	CFU/100ml	-	43	-	24,000	360

9.8 Discussion of Creek Results

9.8.1 Physicochemical parameters

At the time of sampling it was a sunny day with no rainfall recorded for the previous 4 days (BOM Station 40458 Capalaba Water Treatment).

Therefore there is no direct 'dilution' factor for catchment rainfall for this sampling event.

It should be noted that alternate sources of water for the stormwater outlet are likely to be present. There is almost a direct 2x reduction in concentration values reported between the treated effluent and the Stormwater outlet (Table 20).

From the Stormwater outlet there are clear banks and riparian vegetation. A variety of abundant and healthy vegetation along the course of the tributary (to the point that made traversing the area on foot too difficult) was observed.

The physicochemical parameters in Table 20 indicate that at the exit of the stormwater outlet the water quality **does not** meet the Water Quality Objectives for the creek, however there is significant improvement ~350m downstream.

Chemically at the downstream sampling point, only Total Phosphorus and Ammonia were still elevated above the WQO's for the creek.

Ammonia, however, was below the ANZECC Guidelines trigger level of 0.9 mg/L Ammonia for 95% species protection (relevant for a slightly to moderately disturbed system).

Physically, Dissolved Oxygen was variable, but also below the indicated guidelines. This is understandable as the creek is small, low flow, with little opportunity for aeration (i.e. no rapids, rock falls, etc).

The analysis conducted by DES on the 5th July 2018 indicated similar results for total nitrogen at the exit of the Stormwater Outlet (16 mg/L in Table 20 compared to 13 mg/L reported in the EE Notice), however there has been a reduction in Ammonia (2.7 mg/L in Table 20 compared to 6.2 mg/L in the EE Notice). The downstream sampling point of 120m in July 2018 did not demonstrate nutrient removal from the vegetation.

¹⁸ Stock Watering Median value

The sampling point taken in July 2019 was further downstream (~350m) and shows significant improvement in water quality, with less than 1% of the ammonia reported in the EE Notice from sampling in July 2018. There were no photos provided in the EE notice of the creek line or sampling points, however the creek line in July 2019 did not appear to suffer from stress with abundant and varied vegetation.

One stagnant pond close to the Stormwater Outlet appeared to support algae growth. It may be possible that nutrient results were higher within that area, but may not be representative of the surrounding water quality as no other reaches appeared to support this growth down to the downstream sampling point at ~350m.

9.8.2 Microbiological parameters

The creek at these locations is too small for primary contact recreation (swimming), but could be used for secondary recreation in this area, such as wading.

Guidelines for Managing Risks in Recreational Water (NHMRC) indicates secondary contact trigger limits are set at 95th percentile intestinal enterococci <40 org/100ml.

Enterococci was not analysed on these samples, however it can be seen that the exit of the STP has significantly lower microbiological counts compared to those reported at the Stormwater outlet and downstream.

Whilst this sample is a grab sample, and microbiological counts can vary, the stormwater outlet has a significantly higher microbiological count than the water quality upon exiting the STP, and may be attributed to alternative sources.

9.9 STP Microbiological Compliance – 2019 Results

Greenacres Caravan Park installed a liquid chlorine dosing pump in late 2018 and has seen significant improvement in the microbiological compliance with their Environmental Authority conditions for 2019.

In late 2018, counts >6,000 cfu/100ml in each half hourly sample were observed over multiple events.

From February 2019 – July 2019 all microbiological parameters have complied with the Environmental Authority limits stipulated, with the Faecal coliform median results reported at or below 80 cfu/100mL (against a limit of 1000 cfu/100mL), and 4 out of 5 samples for each event all below 4000 cfu/100mL. In most cases results have been at or below the laboratory limit of reporting (LOR) of 10 cfu/100mL.

The potential for environmental harm (due to adversely affecting the recreational use of the area) has been significantly reduced. Remaining microbiological counts reported at the Stormwater Outlet are likely to be from alternate sources.

9.10 Nutrient Results

Whilst Total Nitrogen (TN) and Total Phosphorus (TP) are stipulated on the Environmental Authority to be analysed monthly, there are no nutrient limits specified in the current Environmental Authority.

Available results from 2017 to 2019 indicate that TN increased from an average of 22 mg/L in 2017 to 32 mg/L in 2018. This has reduced again for data in 2019 to 26 mg/L (to July 2019).

The dense vegetation in the beds and banks of the creek are effectively utilising the nutrients and treating the water as it travels downstream.

The potential for environmental harm (due to adversely affecting the recreational use of the area) is significantly reduced by the time the water reaches the downstream sampling point.

It is suggested that further improvements to the STP in the form of chemical removal of TP may reduce the TP load to the Stormwater Outlet and allow the water quality objectives (WQO's) of the tributary to be met by the downstream sampling point.

9.11 Potential Impacts from reducing water flow

With the change from release to waters to release to land, there will be an estimated 98% reduction in flow of treated effluent to the tributary of Coolnwynpin Creek.

It should be taken into account that the sudden reduction of water inflow to the tributary may have an adverse impact to the ecosystem that has been established there.



10. REQUIREMENT 6 – RFI – NUTRIENT REMOVAL

Please list all additional and proposed forthcoming augmentation measures to 'achieve nutrient removal for periodic release to waters'. This could reasonably include any training in the efficient operation of the on-site sewage treatment plant to optimise nutrient reduction. Please explain why the chemical reduction of phosphorus (such as the use of alum) at the on-site sewage treatment plant is not a viable option as this is a very common form of phosphorus reduction at sewage treatment plants.

10.1 STP Process Review

On the 19th July, 2018 a process engineer from Simmonds & Bristow attended Greenacres Caravan Park and performed a basic process review. The effluent results at the time indicated that the treatment plant was not performing well with poor BOD, TN, TSS removal and poor effluent disinfection.

The review found that the process units were generally appropriately sized to achieve good effluent treatment with regards to BOD, TSS removal and nitrification; however some modifications or rectifications were required to either repair damage or modify units for improved performance. The recommendations included;

- a) Trickling filter refit to improve effluent distribution and filter aeration, to improve nitrogen and BOD removal capacity;
- b) Upgrade of Secondary Clarifier to improve effluent TSS removal, with either additional area or tertiary effluent filtration;
- c) Install a Pre-Anoxic Cell to allow for enhanced de-nitrification;
- d) Change Type of Chlorine used to Sodium Hypochlorite (Liquid Chlorine);
- e) Refit Chlorine Contact Tank with improved baffling to improve contact time and;
- f) Refit Flowmeter pipework to improve reading reliability.

In December 2018, after a number of the above recommendations were implemented, a Process Engineer from Simmonds & Bristow attended Greenacres Caravan Park to inspect the progress of the modifications and assess adequacy of the equipment.

During the inspection it was noted that the following upgrades had been installed, or were in the process of being installed by the site;

- a) Installation of a final effluent filter to reduce TSS, installed and ready to operate;
- b) Conversion of tablet chlorine to liquid chlorine dosing, installed and ready to operate;
- c) Chlorine Contact tank refit installed and operational;
- d) Installation of Pre-anoxic cell undergoing installation.

Additional work was recommended on the trickling filter to improve its function, which was primarily aimed at improving the aeration efficiency of the equipment. It was also stated that adjustments may be required to recycle rates once the pre-anoxic cell was brought online to optimise de-nitrification performance, and hence total nitrogen removal. It was also noted that additional carbon may be required to further improve de-nitrification and effluent TN.

As the sewage treatment plant did not have nutrient limits in the Environmental Authority, these recommendations were noted for general effluent quality. Additionally, the chemical removal of total phosphorus was not included in recommendations at the time, again as there was no nutrient limits on the EA.

The original process review and the site inspection report are attached as **Appendix I**.

10.2 Further augmentation measures

10.2.1 Phosphorus removal

The current results for total phosphorus do not pose a risk for the application of treated effluent to land (MEDLI models, see Section 7.2).

It is recognised however, that phosphorus in the current releases to waters may be contributing to phosphorus levels in the tributary of Coolnwynpin Creek (See Section 9) above the Water Quality Objectives for the creek.

To improve phosphorus removal and therefore water quality in the tributary of Coolnwynpin Creek, chemical precipitation of phosphorus will be required. This can be achieved by dosing a suitable coagulant to the treatment plant, ideally into the discharge from the trickling filter to the secondary clarifier. The coagulant precipitates dissolved phosphorus, allowing it to settle out, ultimately removing it as part of the waste sludge.

An aluminium based coagulant such as Aluminium Chlorohydrate (ACH) or aluminium Sulphate (Alum) would be recommended for use as the coagulant, with ACH being the preferred chemical due to the near neutral pH of the effluent generated and ease of handling. Removal of phosphorus to <3 mg/L in the treated effluent should be readily achievable.

A very low pumping rate would be required (preliminary calculations indicate ~80 mL/day using ACH). The adjustment of the chemical dosing pump can be determined based on effluent quality monitoring results, as the dosing rate can generally be calculated readily from effluent phosphorus content.

A range of suitable dosing pumps are available, including digital diaphragm pumps from companies such as Grundfos or Iwaki, or peristaltic pumps. The pump can dose simply from a neat ACH solution.

As the pumping rate is low, a low capacity pump is recommended.

10.2.2 Phosphorus removal timeframe

Greenacres Caravan Park indicates they will be able to purchase and install a chemical dosing pump for the chemical removal of TP by the end of November 2019.

10.3 Nitrogen removal

After the modifications indicated in Section 10.1, The STP currently is performing nitrification well but not to completion (resulting in a low ammonia residual), but is not performing denitrification (high oxidised nitrogen). As such, overall total nitrogen removal is limited.

The bulk of the modifications recommended for the plant have been performed, which has resulted in an improvement in effluent quality. Further improvements in nitrification performance may require further modification to the trickling filter, improving the aeration rate.

Improving de-nitrification will require tuning of the installed de-nitrification cell, which would include modification to recycle rates and may require additional carbon dosing to support the process.

10.4 Revised Irrigation Management Strategy

As mentioned previously, a revised management strategy, using full application to land as the release method has been developed. This is outlined in the Irrigation Management Plan (IMP), attached in **Appendix D**.

This management strategy is based upon land application only, and does not include intentional periodic release to waters as detailed in the first the EE Report. Only occasional (<2.5% of treated effluent produced) overtopping of the wet weather storage may occur during extended periods of high rainfall.

10.5 Nutrients and Impact to land

The MEDLI modelling has been performed using the waste characterisation of the treated effluent. The effluent characteristics meet, or are similar to, the model conditions provided by the DES for the release of treated effluent to land application (See also Table 25 for Proposed Environmental Authority release limits on page 71).

A risk assessment for the land application was performed in the EE Report and included;

- a) A description of the land which will receive the waste, including area, slope, flood potential, erosion potential and vegetation. (**Section 2 and Section 11 EE Report**)
- b) Soil characteristics, including results of any soil tests or percolation tests. This includes salinity, acidity, alkalinity and permeability. (**Section 7 EE Report**)
- c) Rainfall and evaporation data for the area. (**Section 2 EE Report**)
- d) Groundwater level and use. (**Section 6 EE Report and Section 7 this RFI**)
- e) Proximity of any streams, drains, watercourses, dams, soaks or springs. (**Section 2 and Section 11 EE Report**)
- f) Proximity of roads and public access. (**Section 2 and Section 11 EE Report**)
- g) Characteristics of the proposed discharges (**Section 3 & 4 EE Report and Section 3 this RFI**).
- h) An assessment of the likely effect of the discharges to land on the environment including results of water/nutrient balance calculations. (**Section 9 & 10 EE Report and Section 7 of this RFI**)
- i) The risk assessment must also consider the indirect risks to land as a result of operating the proposed ERA.

The risk assessment showed that there was negligible risk to the effluent disposal area from the land application of treated effluent.

10.6 Nutrients and release to waters under land application strategy

It is proposed that release to waters is only performed during periods of extended rainfall, when overtopping of the WWS may occur.

The risk of overtopping has been modelled to occur for less than 2.51% of the total effluent produced in the MEDLI model over a 50 year time period and is only likely when rainfall for the area is high, during which the catchment will have increased stormwater flow, resulting in dilution of any overtopping.

The EE Report calculated (Section 8.2) a dilution factor of 288:1 with a maximum effluent discharge volume of 100 kL/day¹⁹ during a 40 mm rain event²⁰.

The MEDLI models predict much lower volume overtopping events, with the maximum modelled at 343 kl **per year** over ~12 events. The overtopping is modelled to be generally <50 kL/day, therefore the dilution factor is greater than 500:1.



¹⁹ Current EA maximum release limit for wet weather days

²⁰ See C1903-004 Greenacres Caravan Park MEDLI Assessment Section 8.2

11. REQUIREMENT 7 – RFI – IMPACT OF RELEASE TO LAND

This states that the EE Notice requires a number of considerations to be outlined in order to evaluate the viability of a release strategy involving irrigation of effluent to land combined with a release to waters. The department acknowledges that the strategy proposed will result in an improvement to the potential environmental impact from the release of treated sewage from the Greenacres Caravan Park as a result of the activity. The department requests further information to ascertain the extent of environmental harm that may be caused by the proposed strategy. You are requested to provide the following additional information;

- a) The GPS Co-ordinates of the location of the release point W1.*
- b) Outline a management strategy taking into account soil saturation, precipitation and the potential lag time between rainfall events and when ordinary irrigation to land is to recommence, especially if a trigger of 40mm precipitation is suggested whereby treated sewage is proposed to be discharged to surface waters.*
- c) Outline what type of treated sewage release system is proposed i.e. passive, and or manual and or automated release of treated sewage in the event of rainfall, especially when precipitation exceeds 40mm.*
- d) Provide the location of the area dedicated to the disposal of dried sludge as permitted in the EA.*

11.1 GPS Co-ordinates of the release point W1

In the current Environmental Authority there are two references to release point W1. These may refer to different areas, based on the information outlined in the conditions to which they refer. This is explained below and summarised in Table 22.

Table 22 GPS locations of Release point details

Description	Condition related	GPS location
Exit of STP to subsurface stormwater drain	C4	-27.56252, 153.20635
Council drain to waters described as a tributary of Coolnwynpin Creek at 6.5km AMTD.	C3	-27.55973, 153.20484

Condition C3 states “*Contaminants must not be directly or indirectly released from any source on the approved place to any waters at any location other than the contaminants and sources at the location listed below: Release Point W1 Sewage wastes from the treatment plant discharging via a Council drain to waters described as a tributary of Coolnwynpin Creek at 6.5 km AMTD.*”

The stormwater outlet (council drain) located at the tributary of Coolnwynpin Creek 6.5km AMTD is indicated in Figure 27 as ‘Stormwater Outlet’ in the north-western corner.

The green lines indicate easements on the surrounding properties for stormwater drainage purposes and the path of the piping in which the treated effluent travels to that point. It should be noted that other sources of stormwater drain to the same stormwater outlet.

This was obvious during sampling at the stormwater outlet as a plastic soft drink bottle and other gross pollutants were evident (Figure 20). No gross litter is able to originate from the Greenacres Caravan Park STP due to the configuration of the inlet screen, outlets & weirs from the chlorine contact chamber.

Figure 28 is a photo of the Stormwater Outlet as at July 2019.



Figure 27 Aerial view of the Stormwater outlet location and the Exit of the STP



Figure 28 Stormwater Outlet at the ‘tributary of Coolnwynpin Creek’

Condition C4 states *“The total quantity of contaminants released from Release Point Number W1 during any dry weather day must not exceed 100 cubic metres and during a wet weather day must not exceed 250 cubic metres.”*

The flow meter for discharges from Greenacres Caravan Park STP are recorded at the discharge of the STP after the chlorine contact chamber and prior to entering the Stormwater pipe to travel underground through the easements to the Stormwater Outlet. This location is shown below in Figure 29. Note the green line travelling north showing the stormwater easement on Lot 5/RP123875.

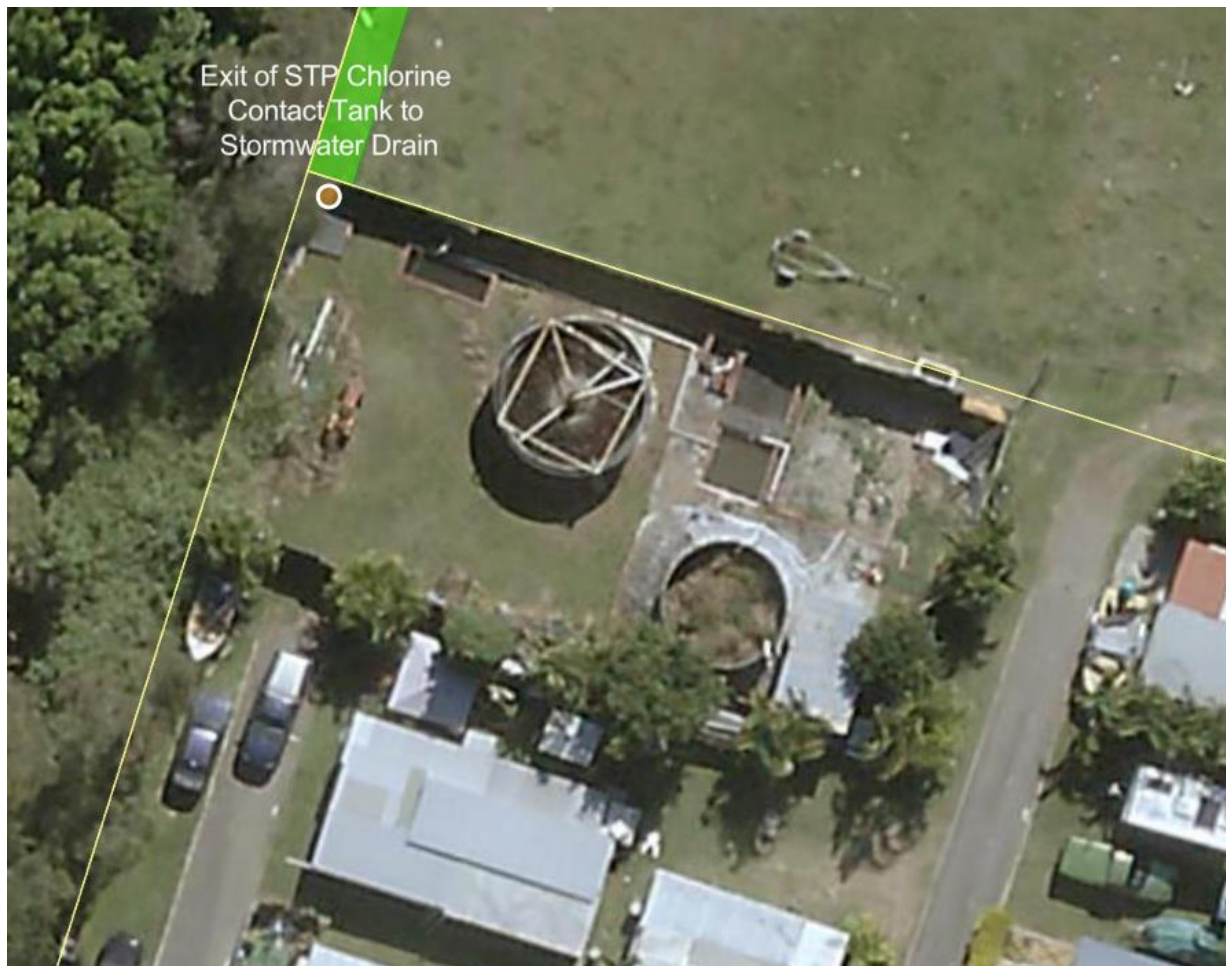


Figure 29 Exit of STP Chlorine contact tank to Sub surface drain

It would not be relevant or accurate to record flows at the Stormwater outlet to the creek as an indication of the flows through the STP, as a number of houses and the Tipuana Drive roadway have stormwater infrastructure that discharges to the same outlet.

Additionally, the stormwater outlet is not on property owned by Greenacres Caravan Park.



Figure 30 Chlorine contact tank and exit to subsurface drain

11.2 Management Strategy

As discussed in Section 4.2, due to the indication from DES that an increase in acceptable deep drainage would be preferable over combined release to waters strategy, the management strategy outlined in the EE Report has been reviewed and revised.

It is now proposed that release of treated effluent via land application be implemented, with 20mm rainfall threshold, with no planned release to waters.

Release to waters may occur only during extended or heavy rainfall inducing the overtopping of the wet weather storage. This has been modelled and discussed in previous sections.

The management strategy is also discussed further in the attached Irrigation Management Plan (IMP) attached in **Appendix D**.

11.3 Treated Sewage Release System

It is proposed that during high rainfall, when the irrigation area is unable to be irrigated, and the wet weather storage tanks are full, that overflow from the wet weather storage tanks be allowed to discharge to the existing release point of the stormwater drain. This is only likely to occur during high rainfall.

Irrigation of the treated effluent to land remains as the primary system of treated effluent disposal with no planned or scheduled release to waters.

In all MEDLI model scenarios performed, the overflow volume was less than 2.51% of the total treated effluent generated.

11.4 Location of Dried Sludge Area

The sludge drying area is located within the STP compound, as shown in Figure 31 below. Coordinates are Latitude -27.5626, Longitude 153.2066.

Condition (E4) of the current Environmental Authority indicates “*The defined contaminant release areas are described as landscaped areas of the approved place.*”

Additionally,

(E5) The contaminant release areas must not be used for grazing, recreational activities or as a traffic thoroughfare.

(E6) Public access to any contaminant release area must be denied during the release of contaminants to land and until the release area has dried.

Waste sludge is pumped to the anaerobic digester for digestion. Digested sludge is further dried in a sludge drying bed, situated next to the primary clarifier. Dried sludge is either removed from site and disposed of to landfill or composted and used in gardens as per the current EA conditions above.

The bed has an estimated area of 23 m². The overall sludge holding capacity is not high (1-2 m³), however during the site visit conducting by a Simmonds & Bristow Engineer on 19th July 2018 discussion with staff indicated that there is relatively small volume of sludge to be wasted from the system, generally resulting in only a small area around the discharge pipework being utilised. A photograph of the sludge drying bed area is shown in Figure 32.

The sludge drying bed complies with the above conditions, as the STP compound is gated and locked for access by authorised persons only.



Figure 31 Dried Sludge Disposal Area within STP Compound



Figure 32 Sludge Drying Bed



12. REQUIREMENT 8 – RFI – IMPACT OF RELEASE TO WATER

This states that the EE Notice required a consideration of the impact of the volume and frequency of wastewater proposed to be released to waters and measures to mitigate those impacts. Whilst the environmental report states the amount of rainfall at which a release will occur, it does not articulate the volumes that are expected to be released. You are requested to provide the following information;

- a) An assessment of the volume of treated sewage that is proposed to be released during wet weather events as a result of the proposed 40mm precipitation trigger and how this assessment was arrived at, showing all calculations and describing all assumptions made in these calculations/estimations.*
- b) Outline the irrigation management measures that are proposed to minimise the potential for releases to the creek, such as the use of soil moisture sensors, rain gauges, automated controls, etc.*

12.1 Changes to considerations

Based upon the information from DES that deep drainage above that normally considered suitable within a MEDLI models would be acceptable in preference to release of treated effluent to waters, the management strategy has been reviewed and revised.

Instead of a rainfall threshold to release as originally proposed in the EE report, incidental release to waters would only occur via controlled overflow from the wet weather storage. The statistics generated from the MEDLI models are presented in Table 14 on page 36.

As such, the system would require an overflow from the WWS that would join the stormwater drain during very high rainfall, but the bulk of the treated water (97.5 - 99.8%) would be directed to either the irrigation field or the wet weather storage.

12.2 Rainfall Thresholds

With the revised management strategy of full application any references to a second rainfall threshold of 40mm have been removed.

One rainfall threshold of 20 mm remains to restrict irrigation when rainfall exceeds 20 mm.

12.3 Volume of Treated Sewage released to waters

Table 14 on page 36 indicates that overflows from wet weather storage are up to an average of 343 kL/year. This is a significant reduction on the current releases approved to occur of 100 kL/day during dry weather and 250 kL/day during wet weather.

The estimated average overflow of 343 kL/year for the maximum effluent release scenario (50 kL/day) represents approximately 14 days of release at the current daily average (23.7 kL/day).

In Section 2.4 of the EE Report it stated the catchment associated with the tributary of the Coolnwynpin Creek where the treated effluent release point is located, is approximately 120 ha (Figure 4 EE Report).

The catchment is somewhat developed and could be expected to have a gross runoff coefficient of 0.6-0.7 in most significant storm events.

It would be expected that for a 40-50mm storm event that 28,000 m³ – 36,000 m³ would be expected to flow out of the catchment into the creek line.

The overflows predicted through modelling are highly likely to occur during or immediately after high rainfall, which stops irrigation from occurring and sends treated effluent to the wet weather storage tanks; i.e. an overflow of the wet weather storage is only likely to occur during a period where the irrigation system has been shut-down for multiple days.

12.4 Management measures to minimise release to creek

Figure 33 below demonstrates the proposed management measures to minimise treated wastewater release to the creek if a release to land strategy is implemented. This is also documented in the Irrigation Management Plan (IMP) attached in **Appendix D**.

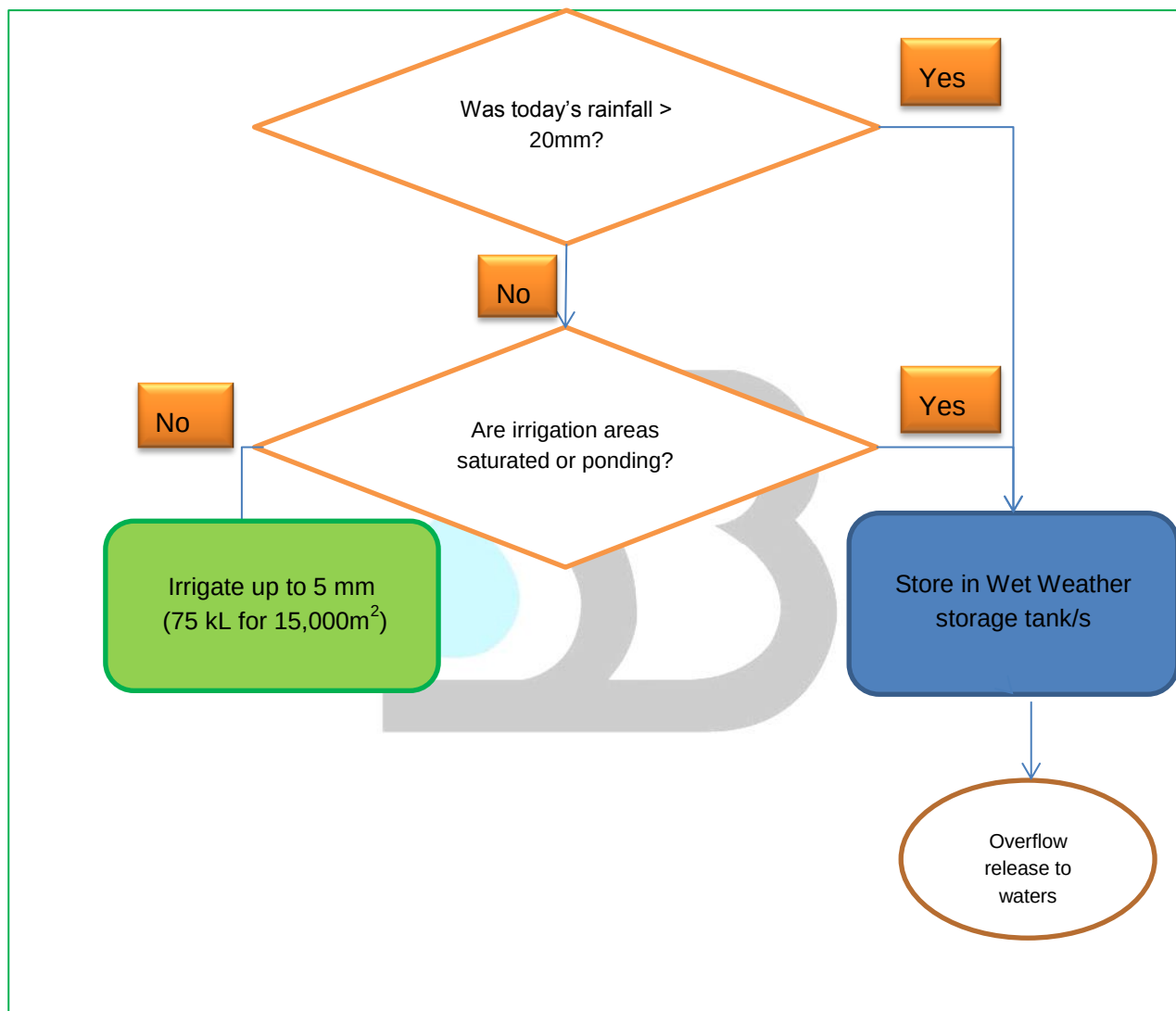


Figure 33 Wastewater release management strategy flow diagram

If a significant increase in flows (for example greater than 50 kL/day) generated by the site occurs, an increase in the wet weather storage tank volume may be required (for example an increase from 90 – 135 kL) to allow an increase in the number of equivalent days of wet weather storage provided.

13. REQUIREMENT 9 – RFI – SPECIFIC MEDLI QUERIES

- a) *It is noted that the proposed treated sewage management strategy comprises a trigger of 40mm. However on page 47 of 50 of the EE Report it is stated “with the proposed irrigation cut off 20mm of rainfall”. This appears to contradict the recommendation using 40mm precipitation as a trigger. Also it is noted that MEDLI modelling used a cut of 20mm. Please explain why this value was used and not 40mm.*
- b) *Please explain how the treated sewage TN fractions used in the MEDLI modelling provided to DES were arrived at. See figure below from EE.*
- c) *Please explain in one instance in “Irrigation Override” – “No irrigation if Irrigation Day rainfall exceeds (mm)” “40mm” has been inserted (see figure below) but in another scenario “20mm” was used.*

13.1 Irrigation cut off – EE Report

The 40mm trigger was part of the originally proposed release of effluent to waters. When the 40mm rainfall threshold was triggered, this allowed the release of treated effluent to the stormwater drain. The reason for keeping treated effluent stored until 40mm of rainfall, allowed for an increase in stormwater run-off to the creek to provide dilution to the treated effluent upon release that would not have been available at lower rainfall.

It was distinct from the 20mm trigger, which halted irrigation and caused treated effluent to be directed to the wet weather storage.

With the removal of the release to water scenario, the only rainfall trigger remaining in the management plan is the 20mm of rainfall trigger for cessation of irrigation on a rain day.

13.2 Irrigation cut off – Revised strategy

A revised Irrigation strategy is presented. This is outlined in the Irrigation Management Plan (IMP) attached in **Appendix D**.

In this case, the rainfall threshold for irrigation cessation remains at 20 mm.

In the revised irrigation strategy, there is an increase in the irrigation area as well as an increase in the irrigation rate.. A release to waters will now only occur due to the controlled overtopping of the wet weather storage.

This significantly reduces the volume of treated effluent release to waters.

13.3 TN fractions in MEDLI modelling

The MEDLI TN fractions indicated in Figure 2 of the RFI Notice are the default fractions found within the parameters of the MEDLI program.

In the data provided by Greenacres Caravan Park there were no fractions of TN analysed (Total Nitrogen is analysed each month but not Ammonia, Oxidised nitrogen, etc) as these are not a requirement of the Environmental Authority.

One set of data from July 2018 contained the required information for nitrogen fractions to be calculated, however it is from a period where the plant was not operating effectively and investigation into the root cause was occurring. Improvements to the treatment plant have occurred since that time and, as such, the sampling conducted in July 2018 may not be representative of the current and future nitrogen fractions achieved by the treatment plant.

The analysis conducted in June 2019 and July 2019 included Ammonia and Oxidised Nitrogen (NOx) and the following nitrogen fractions outlined in Table 23 are derived from that data.

This indicates that the bulk of the nitrogen present in the treated effluent is oxidised nitrogen, in contrast to the results from July 2018, which indicated the majority of nitrogen was in the form of Ammonia.

Improvements in plant performance have seen a reduction in the ammonia in the treated effluent, as well as overall the total nitrogen.

Table 23 Nitrogen component results and ratios in treated effluent

Parameter	Ammonia	Ammonia ratio	Oxidised Nitrogen (NOx)	NOx ratio	Organic Nitrogen	Organic Nitrogen ratio
Units	mg/L	-	mg/L	-	mg/L	-
MEDLI Default	-	0.4	-	0.4	-	0.2
July 2018	22	0.5	10	0.2	15	0.3
June 2019	8.2	0.2	26	0.7	5.8	0.1
04/07/2019	5.8	0.2	22	0.7	3.2	0.1
08/07/2019	2.9	0.1	17	0.7	5.1	0.2
MEDLI ratios used	-	0.2		0.7		0.1

13.4 Irrigation override

The MEDR files on our system all include a rainfall threshold of 20 mm used. The MEDLI team were contacted (Ernst Bruynius) who were helpful in trying to pin point how these values could have been confused.

The MEDR files provided by Simmonds & Bristow all had an irrigation rainfall threshold of 20 mm, however it seems that with the confusion within DES of the thresholds presented in the EE Report, a file was adjusted within DES/DSITI to 40 mm and saved with the suffix _40mm irrigation cut-off.

This was not a file provided by Simmonds & Bristow.

No action is required as all files provided by Simmonds & Bristow on the 7th May, 2019 had an irrigation rainfall threshold of 20 mm as MEDLI inputs.

Updated MEDLI files for the other inputs that have been updated have been provided with this RFI Response and are attached in **Appendix G**. MEDR files will be provided separately on request.

14. ADDITIONAL INFORMATION – POTENTIAL FUTURE EA AMENDMENT

If a change to the release of treated effluent is required, an Environmental Authority amendment will also be required.

14.1 Potential versus current release limits

Table 24 below indicates the current Environmental Authority release limits to waters.

Table 24 Current Environmental Authority Release Limits

Parameter	Release Limit	Units	Limit Type
BOD5	20	mg/L	80 th Percentile
BOD5	40	mg/L	Maximum
Suspended Solids	30	mg/L	80 th Percentile
Suspended Solids	60	mg/L	Maximum
pH	6.5 – 8.5	pH	Range
Dissolved Oxygen	2	mg/L	Minimum
Free Residual Chlorine	0.7	mg/L	Maximum
Faecal Coliforms	1000	Org/100mL	Median of 5 taken at half hourly intervals
Faecal Coliforms	4000	Org/100mL	4 out of 5 samples must contain less than 4000
Total Nitrogen	-	mg/L	Monitored monthly but no limits set.
Total Phosphorus	-	mg/L	Monitored monthly but no limits set.

14.2 Current Sample point location

The Current EA sample point location is described as *‘Determinations of the quality of contaminants released to waters to check conformity with the release quality characteristics specified in Schedule C of this development approval must be undertaken at the sampling and in-situ measurement point described as immediately prior to entering the chlorine contact tank, apart from the determination of either Free Chlorine Residual or microbiological quality, which shall be performed immediately before departure from the chlorine contact tank.’*

14.3 Proposed release limits

The change in the type of release to release to land also necessitates a change in the release limits. Table 25 below proposes new Environmental Authority release limits.

Eligibility Criteria and standard conditions for sewage treatment works (ERA 63) indicate the following nutrient parameters for application to land, with a change in the pH range and microbiological parameters used as indicators.

Table 25 Potential Environmental Authority Release Limits

Parameter	Release Limit	Units	Limit Type	Source
Suspended Solids	60	mg/L	Maximum	No change proposed
pH	5.0 - 8.5	pH	Range	Eligibility Criteria
Free Residual Chlorine	1.0	mg/L	Maximum	Eligibility Criteria
E.coli	1000	cfu/100mL	Maximum	Eligibility Criteria
Total Nitrogen	60	mg/L	Maximum	Eligibility Criteria
Total Nitrogen	35	mg/L	50 th Percentile	Eligibility Criteria (30), adjusted to model inputs
Total Phosphorus	20	mg/L	Maximum	Eligibility Criteria
Total Phosphorus	10	mg/L	50 th Percentile	Eligibility Criteria
Electrical Conductivity	1600	µS/cm	Maximum	Model Operating Conditions

14.4 Proposed Sample point location

To simplify the sampling point location is proposed to be at the discharge of the chlorine contact chamber as such wording proposed is *'Determinations of the quality of contaminants released to waters to check conformity with the release quality characteristics specified in Table 25 must be undertaken at the sampling and in-situ measurement point described as immediately before departure from the chlorine contact tank.'*

15. CONCLUSIONS AND RECOMMENDATIONS

15.1 STP Improvements

A basic process review was conducted in July 2018 and a number of modifications and rectifications were recommended.

Most modifications to the plant have been conducted between late 2018 and early 2019 and have resulted in significant improvement to the treated effluent quality.

Total Nitrogen removal is still limited by lack of de-nitrification and carbon dosing may be required for improved de-nitrification performance and total nitrogen removal.

Phosphorus removal was not previously recommended as there are currently no limits for nutrients in the EA. Chemical dosing to remove phosphorus is recommended whilst the management strategy is release to waters, to improve the water quality in the tributary of Coolnwynpin Creek.

15.2 EA compliance

After modifications to the plant in late 2018 and early 2019, the treated effluent at Greenacres Caravan Park has been fully compliant with the Environmental Authority conditions from May 2019 to date.

15.3 Proposed Management Strategy

It is the preference of Greenacres Caravan Park to continue under the current Environmental Authority, with release to waters, and modifications to the plant have been performed with compliance to current EA conditions in recent months.

Improvements in the treated effluent via chemical dosing for the removal of phosphorus and carbon dosing to improve the nitrogen removal have been recommended and are planned to be implemented.

If a change in management strategy from release to waters to release to land is required Greenacres Caravan Park require time to provide the significant financial resources for a groundwater monitoring bore installation and analysis, prior to an EA amendment and then further significant financial outlay to install and commission an irrigation system.

The management strategy proposed for release to land is via multiple irrigation areas up to an irrigation rate of 5 mm/day. This is a revised management strategy from that provided previously in the EE Report.

Supply of land for the purpose of irrigation is limited in the urban environment and an increase in irrigation rate has been proposed and supported by modelling within this RFI. This strategy results in an increase to deep drainage, which has been indicated to be preferable over a combination of release to land and release to waters.

The Greenacres Caravan Park STP can comply with likely and proposed EA release limits for application of treated effluent to land.

15.4 Timeline of proposed events

The following table is provided as a summary of proposed actions or events listed within this RFI Response.

Table 26 Proposed Timeframe for completion of actions

Action	Estimated timeframe for completion
Release to Waters	
Chemical dosing for TP removal	November 2019
Complete Trickling filter refit & optimise recycle rates within STP	November 2019
Install carbon dosing for improved TN removal	January 2020, if still required after above optimisation.
Release to Land (if required)	
Groundwater Level Assessment and Bore Installation	March 2020
Environmental Authority Amendment application pre-lodgement, if required	May 2020
Environmental Authority Amendment application	September 2020
Installation & Commissioning of Irrigation Areas including; • Wet Weather Storage tank Purchase • Main irrigation Area installed • Southern Gardens Irrigation Area Installed • South-east Green Space Irrigation Area installed • Irrigation system and rainfall cut off installed • System online	March 2021

16. REFERENCES

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GLOSSARY OF TERMS

Term	Definition
ADWF	Average dry weather flow
Alum	Aluminium sulphate ($\text{Al}_2\text{SO}_4 \cdot 14\text{H}_2\text{O}$)
BOD ₅	5-day biochemical oxygen demand
CCP	Critical control point
Coagulation	The act of breaking a colloid emulsion using a coagulant chemical. Generally achieved by charge neutralisation, which allows smaller particles to 'clump' together via van-der-waals forces.
Coagulant	A chemical that causes coagulation.
COD	Chemical oxygen demand – a measure of all oxidisable material within a sample of water.
Conductivity	A measure of the salt content of a water sample
CST	Capillary suction time
DAF	Dissolved air floatation
DCS	Distributed control system
DO	Dissolved oxygen
<i>E. coli</i>	<i>Escherichia coli</i> , a Gram-negative, facultatively anaerobic, rod-shaped bacterium of the genus <i>Escherichia</i> that is commonly found in the lower intestine of warm-blooded animals (e.g. Humans). Used as an indicator of faecal contamination
EE Notice	Notice to commission an Environmental Evaluation
EE Report	C1903-004 Greenacres Caravan Park Environmental Evaluation of Treated Effluent Application to Land
EIS	Environmental impact assessment
EMPs	Environmental management programs
EPPs	Environmental protection policies
ERA	Environmentally relevant activity (Specific to Queensland legislation, may also be used for Environmental Risk Assessment)
ES	Effective size (of granular media)

Term	Definition
Thermotolerant Coliforms	A range of coliform bacteria generally used as an indicator of faecal contamination.
Flocculate/ Flocculation	The act of solid particles clumping together to form larger settleable aggregates, often referred to as 'flocs'.
Flocculant Aid	A polymer based chemical utilised to enhance flocculation. The polymer forms a 'net' like complex when diluted, which acts to capture many smaller particles, creating a larger, generally more stable floc. Various flocculant aid exist, generally grouped based upon charge (Cationic, Anionic or Non-ionic). Best type of flocculant aid is usually selected via jar test.
FRP	Filterable reactive phosphorus
Jar Testing	Jar Testing, sometimes referred to as coagulation testing or flocculation testing (depending upon what is being optimised) is a scaled-down lab test simulating the coagulation and flocculation reactions occurring within the clarifier of a water plant. This test allows for the evaluation of new flocculant aids, new coagulants, or the assessment of varied dose rates.
MCRT	Mean cell residence time. The average time a bacterial cell can expect to remain within the process. Another measure of 'sludge age'.
ML	Mixed liquor
MLSS	Mixed liquor suspended solids – a measure of the biomass within a treatment plant using total solids as a proxy.
NFR	Non filterable residue, analogous to total suspended solids.
Nitrate	An oxide of nitrogen with the molecular formula NO_3^-
Nitrite	An oxide of nitrogen with the molecular formula NO_2^-
Nm^3/hr	"Normal" cubic meters per hour – a measure of air flow normalised to 20°C and one atmosphere of pressure
Orthophosphate	A form of phosphorus with the formula PO_4 . It is biologically available for use by plants, algae and bacterium.
PAC	Powdered activated carbon
PDWF	Peak dry weather flow – the peak flow that is expected to enter the plant during dry weather. Is often assumed to be 3x the ADWF.
PLC	Programmable logic controller - an electronic device that allows for logical control over a piece of equipment.

Term	Definition
PWWF	Peak wet weather flow – the flow that is expected to enter the plant during a wet-weather event. Is often assumed to be 5x the ADWF
REF	Review of environmental factors
RFI	Request for Further Information
RTU	Remote telemetry unit
SBR	Sequencing batch reactor – a form of suspended growth wastewater treatment technology
SCADA	Supervisory control and data acquisition. A system operating with coded signals over communication channels to provide control of remote equipment and the acquisition of equipment and sensor data.
SDS	Safety data sheet
Sludge Age	Refers to the average 'age' of the sludge in an activated sludge wastewater treatment system. The sludge within the system will, on average, be refreshed once every sludge age.
SOP	Standard operating procedure
SRT	Sludge/solids retention time. Also referred to as the 'sludge age'.
STP	Sewage treatment plant (may also refer to Standard Temperature and Pressure)
TDS	Total dissolved solids. Generally a measure of salt concentration or salinity. May be converted to conductivity using a conversion factor
TKN	Total kjeldahl nitrogen – a measure of the Organic nitrogen plus Ammonia nitrogen
TN	Total nitrogen - the concentration of organic plus inorganic nitrogen
TOG/FOG	Total oil and grease/ Fats, oil and grease
TP	Total phosphorus - the concentration of organic plus inorganic phosphorous
TSS	Total suspended solids
UV	Ultra violet light – an invisible light at a wavelength ranging between 10nm to 400nm
VSS	Volatile suspended solids
WWTP/WwTP	Wastewater treatment plant

APPENDIX A:
**Notice to conduct or commission an
environmental evaluation (EE)**

Notice

Environmental Protection Act 1994

Environmental Evaluation

Notice to conduct or commission an environmental evaluation

This notice to conduct or commission an environmental evaluation is issued by the administering authority pursuant to section 326B of the Environmental Protection Act 1994.

Aquarium Avenue Pty Ltd
Unit 3, 38 Wambool Street
BULIMBA QLD 4171

Your reference:

Our reference: CA50774, COMP01252

X October 2018

Take notice: that under the *Environmental Protection Act 1994* (the Act) a notice to conduct or commission an environmental investigation is issued to Aquarium Avenue Pty Ltd ACN 097 471 666 (you) by the administering authority. The administering authority is the Chief Executive of the Department of Environment and Science (the department).

The notice to conduct or commission an environmental investigation is issued with respect of the activities of Aquarium Avenue Pty Ltd ACN 097 471 666 at the Greenacres Caravan Park on land described as Lot 3 on RP123875 at 508-520 Mt Cotton Road, Capalaba QLD 4157 (the premises).

A. Grounds

The department can under section 326B of the *Environmental Protection Act 1994* (the Act) require an environmental investigation if it is satisfied on reasonable grounds that:

1. An activity or proposed activity is causing, or is likely to cause environmental harm.

The facts and circumstances forming the basis for these grounds are:

1. You operate the Greenacres Caravan Park and operate a sewage treatment plant under an environmental authority EPPR00754013 (also known as IPDE01001008 and SR0077) which authorises Environmentally Relevant Activity (ERA) 63 Sewage Treatment 1(b) (ii) >100>1500EP- (no discharge to an infiltration trench or irrigation scheme) at the premises.
2. As part of carrying out this activity you are releasing treated effluent to a stormwater inlet at the premises. The treated effluent moves along the stormwater drain and releases to a tributary of the Coolnwynpin Creek.
3. The waters are then discharged to Tingalpa Creek and then into Moreton Bay.

Notice to conduct or commission an environmental evaluation

4. The tributary is ephemeral, only flowing after periods of rainfall. This indicates that there is little to no dilution of the treated effluent occurring in the receiving waterway during dry periods.
5. On 1 January 2018 you provided flow meter records for the period between 1 January 2018 and 8 July 2018 which show an average of 32,571 litres of treated effluent is discharged from the premises per day.
6. Based on your monthly monitoring records of the treated effluent since November 2016, the average Total Nitrogen in the treated effluent is 23.76 mg/L and for Total Phosphorous is 6.38 mg/L.
7. On 5 July 2018, authorised officers of the department collected water samples which returned the following results:
 - a. The stormwater outlet releasing into the tributary of Coolnwynpin Creek contained 13mg/L of Total Nitrogen and 6.2mg/l of Ammonia; and
 - b. 120m downstream in the tributary of Coolnwynpin Creek contained 15mg/l of Total Nitrogen and 13mg/L of Ammonia.
8. Environmental Harm is defined in section 14 of the Act as *any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.*
9. Environmental value is defined in section 9 of the Act as *(a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety; or (b) another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.*
10. The relevant Water Quality Objectives (WQOs) specified under the *Environmental Protection (Water) Policy* for the lowland freshwaters of Redland Creeks (including Coolnwynpin Creek) for Ammonia is <0.02 mg/L and for Total Nitrogen is 0.5mg/L. (Refer to "Redland Creeks environmental values and water quality objectives – Basin No. 145 (part), including Coolnwynpin, Erapah, Hilliards, Lota, Moogurrapum, Tarradarrapin, Tingalpa and Wynnum creeks." July 2010.)
11. "The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council – ANZECC, 2000) (the ANZECC guidelines) lists ammonia as a toxicant in freshwater and suggest a trigger value of 0.9mg/L ammonia for 95% species protection (relevant for a slightly to moderately disturbed system).
12. The instream water quality in the tributary of Coolnwynpin Creek is above WQOs and 6 to 13 times the toxicant trigger value for ammonia under the ANZECC guidelines.
13. The department considers that the discharge of treated effluent from your premises has the potential to cause environmental harm to the receiving waters due to the release of high levels of nutrients.
14. You are in non-compliance with your EA release limits for faecal coliforms in treated effluent (which is 1,000 organisms per 100 mL as a median value of a minimum of five samples and four out of five samples containing less than 4,000 organisms per 100 mL) as follows:
 - a. May 2018: 4 out of 5 samples at >6000 cfu/100ml with one sample at 280 cfu/100ml;
 - b. Early June 2018: Median value at 1200 cfu/100ml;
 - c. Late June 2018: 4 out of 5 samples at >6000 cfu/100ml with one sample at 5900 cfu/100ml; and
 - d. July 2018: 4 out of 5 samples at >6000 cfu/100ml with one sample at 4000 cfu/100ml.

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15. The department considers that because people can access the receiving waterway, the high level of faecal coliforms being released from the premises has the potential to cause environmental harm as it is likely to adversely effect recreational use of the area. An indicator organism shows the possible presence of disease-causing microorganisms (pathogens) and there is a potential risk of infection upon contact.
16. Section 4(5) of the Act explains that effective environmental strategies will be developed and that this is achieved by developing environmental policies. In particular, the *Environmental Protection (Water) Policy 2009* (Water EPP) details the management hierarchy for surface or ground water in section 13:

13 Management hierarchy for surface or ground water

- (1) *This section states the management hierarchy for an activity that may affect water.*
- (2) *To the extent it is reasonable to do so, release of waste water or contaminants to waters must be dealt with using the following hierarchy of preferred procedures—*
- (a) *step 1—evaluate water conservation measures to reduce the use of water and the production of waste water or contaminants;*
 - (b) *step 2—evaluate waste prevention options and implement appropriate waste prevention measures;*
 - (c) *step 3—if waste prevention does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate treatment and recycling options and implement appropriate treatment and recycling;*
 - (d) *step 4—if treatment and recycling does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate the following options for waste water or contaminants, in the order in which they are listed—*
 - (i) *appropriate treatment and release to a waste facility or sewer;*
 - (ii) *appropriate treatment and release to land;*
 - (iii) *appropriate treatment and release to surface waters or ground waters.*
- (3) *In this section—*
- appropriate treatment**, of waste water or contaminants, means—
- (a) *for release to a sewerage service provider's waste facility or sewer—treatment that meets the service provider's requirements for the release to the waste facility or sewer; or*
 - (b) *for release to land—treatment that ensures the release to land is ecologically sustainable; or*
 - (c) *for release to surface waters or ground waters—treatment that ensures the release will not affect the environmental values for the waters.*
- waste facility** means a facility for the recycling, reprocessing, treatment, storage, incineration, conversion to energy or disposal of waste.

17. As detailed above, the Water EPP water sets out a preferred management hierarchy, which is as follows:
- a. Water conservation measures to minimise the generation of waste water; then
 - b. Appropriate treatment of waste water and release to a waste facility or sewer; then
 - c. Appropriate treatment of waste water and release to land; and then
 - d. Appropriate treatment of waste water and release to surface waters or ground waters (as the least desirable option).

Notice to conduct or commission an environmental evaluation

18. As detailed above, the Water EPP defines appropriate treatment for releases to waters to protect receiving waters which is of a higher standard of treatment than for releases to sewage or releases to land.
19. The department considers that waters and the recreational use of those waters are environmental values that should be protected from treated effluent with high levels of nutrients and faecal coliforms.
20. The department is satisfied that the sample results detailed above demonstrate that the sewage treatment activity conducted at the premises, is causing or is likely to cause environmental harm and that it is appropriate to require you to conduct or commission an environmental investigation about the activity and submit a report about the investigation to the department.

B. Requirements

The report on the environmental investigation must address the following relevant matters:

1. By **Friday 16 November 2018** you must review the current performance of the sewage treatment plant and:
 - a. Provide specific recommendations about the measures required to meet the treated effluent release limits for faecal coliforms whilst ensuring all other release limits for quality characteristics also continue to be met; and
 - b. Implement these measures.
2. Conduct an investigation into the following options for the release of waste water from the sewage treatment plant at the premises and evaluate each option against section 13 of the EPP Water.
 - a. A release of waste water to sewer;
 - b. If the release of waste water to sewer is not viable, the appropriate treatment required for the release of waste water to land;
 - c. If only a portion of the waste water generated is able to be released to land, the appropriate treatment required for the release of the remaining waste water to waters.
3. The investigation and evaluation required for requirement 2.a. must outline:
 - a. Any approvals required from Redland City Council including all associated application requirements;
 - b. Actual costs associated with the sewer connection and any other relevant approvals;
 - c. Any other relevant requirements for the waste water to be released to sewer such as a level of treatment of the waste water required by Redland City Council if applicable;
 - d. Details of any advice received Redland City Council about the development application requirements, application process and likelihood of obtaining the approval; and
 - e. A detailed summary of how you are going to obtain any relevant approvals, meet costs (including any financing) or any other requirements.
4. The investigation and evaluation required for requirement 2.b. must model the sustainable irrigation of waste water from the sewage treatment plant at the premises to Lot 5 on RP123875 using daily time step modelling (preferably MEDLI version 2) and using climate data for the local area to simulate the material mass balance for wastewater and nutrients. The modelling must use appropriate inputs based on:

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- a. Actual waste water quality and quantity produced by the sewage treatment plant at the premises;
 - b. Any wet weather storage to be provided;
 - c. The irrigation strategy, management and methods to be used; and
 - d. The available land area, soil characteristics in the irrigation area and crop type (grass or trees etc).
5. The investigation and evaluation required for requirement 2.b. must also consider:
 - a. Any available information on groundwater and groundwater use in the local area; and
 - b. The management of irrigation to prevent impacts on neighbouring landholders.
6. The investigation and evaluation required for requirement 2.c must outline:
 - a. Augmentation of the sewage treatment plant to achieve improved nutrient removal for periodic releases to waters;
 - b. The amount of rainfall required within a specific duration to achieve and maintain adequate dilution of the treated effluent being released to the receiving waterway so that the risk of environmental harm to the receiving waterway is minimised;
 - c. The volume of storage required to capture and hold treated effluent prior to implement the release during times when the receiving waterway can support the release; and
 - d. A water balance model demonstrating the sustainability of the effluent release strategy.
7. Depending on the volume and frequency of waste water proposed to be discharged to waters and the level of dilution able to be achieved, the investigation and evaluation required for requirement 2.c must also include a risk based assessment in accordance with the "Technical guideline; Licensing; Wastewater release to Queensland water" (Document number ESR/2015/1654 Version 2.01, Effective 12 Sep 2016) available at <https://www.ehp.qld.gov.au/assets/documents/regulation/pr-gl-wastewater-to-waters.pdf>. The risk based assessment must determine:
 - a. The waste water quality to be achieved by the sewage treatment plant at the premises in order to protect the relevant Environmental Values and Water Quality Objectives stated in "Redland Creeks environmental values and water quality objectives – Basin No. 145 (part), including Coolnwynpin, Eprapah, Hilliards, Lota, Moogurrapum, Tarradarrapin, Tingalpa and Wynnum creeks." July 2010, as referenced by the EPP Water; and
 - b. Any release management measures which must be utilised to protect the relevant Environmental Values and Water Quality Objectives.
8. The environmental investigation and report must be carried out by an **appropriately qualified person**. You must provide details of the appropriately qualified person(s) who will be undertaking the investigation to the department on or before **Friday 9 November 2018**.
9. The environmental report must be submitted to the department on or before **Friday 26 April 2019**.

Appropriately qualified person is a person (or persons) who has demonstrated professional qualifications, training, skills or experience relevant to the requirements of the environmental investigation, who can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.

Notice

Notice to conduct or commission an environmental evaluation

As the recipient of this notice, you are also required to provide a statutory declaration in the form attached, to accompany the environmental report submitted to the department.

Take notice:

- The requirements of the notice to conduct or commission an environmental investigation take effect immediately upon service of this notice;
- This notice remains in force until further notice from the department; and
- You are responsible for meeting the costs of conducting or commissioning the environmental evaluation, preparing the environmental report and providing any further information as requested by the department.

C. Reviews and appeals

The provisions regarding reviews of decisions and appeals are found in sections 519 to 539 of the Act.

A person who is dissatisfied with certain decisions of the department, may be able to apply to have the department review that original decision.

Generally, a request to have a decision reviewed must:

- be made within 10 business days of the decision being notified to the person;
- be supported by enough information to enable the department to decide the application for review; and
- be made using the application form, Application for review of original decision ([ESR/2015/1573](#)) available on the Queensland Government website at www.qld.gov.au, using the publication number (ESR/2015/1573) as a search term.

Where an application has been made for a decision to be reviewed, the applicant may also apply to the relevant court for a stay of the decision to secure the effectiveness of the review.

Once the original decision has been reviewed, a person who is dissatisfied with the review decision may be able to appeal against that decision to the relevant court within 22 business days after receiving notice of the review decision.

A person whose interests are or would be adversely affected by a decision of the department may also be able to request a statement of reasons for a decision or a statutory order review under the *Judicial Review Act 1991*.

For further information about reviews and appeals see the information sheet, Internal review and appeals ([ESR/2015/1742](#)) available on the Queensland Government website at www.qld.gov.au, using the publication number (ESR/2015/1742) as a search term.

The information sheets are available on the Queensland Government website at www.qld.gov.au, using the publication number as a search term.

You may have other legal rights or obligations and should seek your own legal advice.

D. Penalty

Failure to comply with a notice to conduct or commission an environmental evaluation is an offence.

- The maximum penalty for an individual is 300 penalty units, totalling \$39, 165.
- The maximum penalty for a corporation is 1500 penalty units, totalling \$195, 825.

Notice to conduct or commission an environmental evaluation

Should you have any queries in relation to this notice, please contact Hayley McGuire of the department on telephone number 07 5526 6865.

Signature

Date

Kate Harbert
 Manager Compliance
 Delegate of the Chief Executive
 Department of Environment and Science
Environmental Protection Act 1994

Enquiries:

Robina Compliance Centre
 Level 1, APVC Building, 14 Edgewater Court,
 Robina QLD 4230
 Ph: (07) 5526 6865
 Email: hayley.mcguire@des.qld.gov.au

APPENDIX B:
Notice Requesting Further Information
(RFI)

Notice

Environmental Protection Act 1994 Environmental Evaluation

Notice requesting further information

This notice requesting further information in response to receiving an environmental report about an environmental investigation is issued by the administering authority pursuant to section 326F(2) of the Environmental Protection Act 1994.

Aquarium Avenue Pty Ltd
Unit 3, 38 Wambool Street
BULIMBA QLD 4171

Your reference:

Our Reference: CA50774, CR84410, STAT1317

Monday, 13 May 2019

Take notice: that under the *Environmental Protection Act 1994* (the Act), a notice requesting further information on an environmental report is issued to Aquarium Avenue Pty Ltd ACN 097 471 666 (you) by the administering authority. The administering authority is the Chief Executive of the Department of Environment and Science (the department).

This notice requesting further information is issued in respect of the activities conducted by you at Greenacres Caravan Park on land described as Lot 3 on RP123875 situated at 508-520 Mt Cotton Road, Capalaba Qld 4157 the premises).

The further information is required in regard to a report on an environmental investigation submitted by you to the department on Monday, 29 April 2019.

A. Grounds

The notice requesting further information is issued on the following grounds:

1. A Notice to conduct or commission an environmental evaluation was given to you by the department on 24 October 2018.
2. An environmental report was submitted to the department on your behalf on 29 April 2019.
3. The department is satisfied that further information is required regarding the environmental evaluation and/or the report.
4. The department requires you to provide the further information as requested in the requirements below.

B. Facts and Circumstances

The facts and circumstances forming the basis for these grounds are:

1. A notice to conduct or commission an environmental investigation was issued to you on the grounds that an activity or proposed activity is causing, or is likely to cause environmental harm.
2. The environmental report submitted to the department on your behalf on 29 April 2019 does not provide sufficient information for the department to decide whether to approve the report, as explained in the requirements below.

C. Requirements

The further information you are required to provide is as follows:

1. "Requirement 2" of the EE Notice required that you conduct an investigation and evaluation into a number of options for the release of waste water from the Greenacres Caravan Park Sewage Treatment Plant and evaluate each option against section 13 of the EPP Water. The first option you were required to investigate ("Requirement 2a") was "A release of waste water to sewer". The environmental report states in the executive summary that *"sewer connection is not feasible"*. The report does not provide any justification for this statement and does not provide an evaluation against section 13 of the EPP Water. You are therefore requested to address queries raised in Section 3 of the environmental report, specifically 3.a., 3.b., 3.c., 3.d., and 3.e. Note "Requirement 3" clearly outlines the full requirements for investigation of disposal of waste water to sewer. You are requested to provide a full response to "Requirement 3".
2. "Requirement 4" of the EE Notice required *"...daily time step modelling (preferably MEDLI version 2) and using climate data for the local area to simulate material changes for wastewater and nutrients...The modelling must use appropriate inputs based on a. Actual waste water quality and quantity produced by the sewage treatment plant at the premises."* The environmental report does not list the daily flow data (preferably in Excel format) for treated sewage discharged from the Greenacres Caravan Park Sewage Treatment Plant. Providing flow graphs is not sufficient. You are requested to please provide the MEDLI input data in Excel format.
3. "Requirement 4.c." of the EE Notice required modelling based on *"... the irrigation strategy, management and methods to be used..."*. Whilst the environmental report provides a proposed irrigation strategy, specific management measures to ensure the strategy is sustainably implemented have not been provided. The environmental report does not adequately address this query as it is considered a Treated Sewage Irrigation Management Plan should be provided which clearly addresses the previous criteria. Merely stating *"... the drip irrigation system needs to be installed..."* (Page 50 of Page 50) provides insufficient details regarding any *"management and methods to be used..."*, especially if it is proposed to have co-disposal of treated sewage, i.e. when precipitation exceeds 40 mm there is a proposed discharge to surface waters at the existing discharge site, and less than 40 mm precipitation, then effluent irrigation is proposed at this stage. No details have been provided as to how this management proposal will be achieved practically. Indeed, it is stated on Page 54 of 50 of the environmental report, *"...An irrigation management plan is also recommended..."*
4. "Requirement 4 d" of the EE Notice required modelling based on *"... the available land..."*. The environmental report proposes irrigation to only around 1ha of land on the adjacent lot 5 on RP123875. No explanation has been provided in the environmental report as to why only around 1 ha is being proposed for irrigation purposes as there appears to be further land available (at least around 1.2 ha if not more) for effluent irrigation, see figure 1 below. Increased land for effluent irrigation will decrease the amount of "deep drainage" and possible groundwater contamination and the possibility of "environmental harm" being caused as a result of the proposed effluent irrigation. You are requested to provide an assessment of irrigation to a larger area that will minimise the volumes required to be released during rainfall events. In the event that a larger area cannot be

utilised you are requested to provide the reasons why further land at the site cannot be utilised for effluent irrigation.

Figure 1, vacant land area on Lot 5 on RP123875, adjacent to lot 3 on RP123875



5. "Requirement 5" of the EE Notice required among other things a consideration of any available information on groundwater. The report states that there is 36m to groundwater (reference is "Page 48 of 50" in the environmental report). You are requested to provide the source of this data for the proposed treated sewage irrigation area and an assessment of the relevance to the site with respect to groundwater water contamination due to the proposed treated sewage irrigation and any associated "environmental harm" of groundwater at the site.
6. "Requirement 6" of the EE Notice required information on the "*augmentation of the sewage treatment plant to achieve nutrient removal for periodic releases to waters*". Please list all existing and **additional proposed forthcoming** augmentation measures to "*achieve nutrient removal for periodic release to waters*". This could reasonably include any training in the efficient operation of the on-site sewage treatment plant to optimise nutrient reduction. Please explain why the chemical reduction of Phosphorous (such as the use of Alum) at the on-site sewage treatment plant is not a viable option as this is a very common form of phosphorus reduction at sewage treatment plants.
7. Also "Requirement 6" of the EE Notice requires a number of considerations to be outlined in order to evaluate the viability of a release strategy involving irrigation of effluent to land combined with a release to waters. The department acknowledges that the strategy proposed will result in an improvement to the potential environmental impact from the release of treated sewage from the

Greenacres Caravan Park as a result of the activity. The department requests further information to ascertain the extent of environmental harm that may be caused by the proposed strategy. You are requested to provide the following additional information:

- a) The GPS coordinates of the location of the release point W1.
 - b) Outline a management strategy taking into account soil saturation, precipitation, and the potential lag time between rainfall events and when ordinary irrigation to land is to recommence, especially if a trigger of 40 mm precipitation is suggested whereby treated sewage is proposed to be discharged to surface waters.
 - c) Outline what type of treated sewage release system is proposed i.e. passive, and or manual and or automated release of treated sewage in the event of rainfall, especially when precipitation exceeds 40 mm.
 - d) Provide the location of the area dedicated to the disposal of dried sludge as permitted in the EA.
8. "Requirement 7" of the EE Notice required a consideration of the impact of the volume and frequency of waste water proposed to be released to waters and measures to mitigate those impacts. Whilst the environmental report states the amount of rainfall at which a release will occur, it does not articulate the volumes that are expected to be released. You are requested to provide the following information:
- a) An assessment of the volume of treated sewage that is proposed to be released during wet weather events as a result of the proposed 40 mm precipitation trigger and how this assessment was arrived at, showing all calculations and describing all assumptions made in these calculations/estimations.
 - b) Outline the irrigation management measures that are proposed to minimise the potential for releases to the creek, such as the use of soil moisture sensors, rain gauges, automated controls, etc.
9. Specific MEDLI modelling queries:
- a) It is noted that the proposed treated sewage management strategy comprises a trigger of 40 mm. However, on Page 47 of 50 of the environment report it is stated "*...with the proposed irrigation cut off of 20 mm rainfall...*". This appears to contradict the recommendation using 40 mm precipitation as a trigger. Also it is noted that MEDLI modelling used a cut off of 20 mm. Please explain why this value was used and not 40 mm.
 - b) Please explain how the treated sewage TN fractions used in the MEDLI modelling provided to DES were arrived at. See figure 2 below taken from environmental report.

Figure 2. MEDLI TN fractions as shown in the environmental report

Nitrogen Fractions in the Last (Irrigation) Pond	
Nitrate-Nitrogen (fraction)	0.4
Ammonium-Nitrogen (fraction)	0.4
Organic-Nitrogen (fraction)	0.2

- c) Please explain in one instance in "Irrigation Overrides" - "No irrigation if Irrigation Day Rainfall Exceeds (mm)" "40 mm" has been inserted (See figure 3 below) but in another scenario "20 mm" was used (see figure 4 below).

Figure 3. MEDLI input from environmental report

The screenshot shows the MEDLI software interface with the 'Paddock' tab selected. The 'Irrigation Overrides' section is visible, showing the setting 'No irrigation if Irrigation Day Rainfall Exceeds (mm)' set to 40. Other sections include 'Paddock Definition', 'Irrigation Scheduling Window', 'Trigger Irrigation', 'Apply Irrigation', and 'Irrigation Method'.

Figure 4. MEDLI input from environmental report

The screenshot shows the MEDLI software interface with the 'Paddock' tab selected. The 'Irrigation Overrides' section is visible, showing the setting 'No irrigation if Irrigation Day Rainfall Exceeds (mm)' set to 20. Other sections include 'Paddock Definition', 'Irrigation Scheduling Window', 'Trigger Irrigation', 'Apply Irrigation', and 'Irrigation Method'.

The further information must be submitted to the department on or before Thursday, 11 July 2019.

Take notice:

1. The requirements of this Notice to provide further information take effect immediately upon service of this Notice.
2. This Notice remains in force until further notice from the department
3. You are responsible for meeting the costs of providing the further information to the department.

C. Reviews and appeals

There are no review or appeal rights under the *Environmental Protection Act* for a request for further information made under section 326F(2).

A person whose interests are or would be adversely affected by a decision of the department may be able to request a statement of reasons for a decision or a statutory order review under the *Judicial Review Act 1991*.

Under the *Judicial Review Act 1991*, a person whose interests are, or would be adversely affected by a decision of the department is able to:

- Request a statement of reasons from the department explaining the decision
- Apply to the Supreme Court for a statutory order of review of the decision if the person is not satisfied with the statement of reasons.

You may have other legal rights or obligations and should seek your own legal advice.

If you fail to provide the further information, the department will make a decision about the environmental report on the information already submitted.

Should you have any queries in relation to this notice, please contact Yvette Morgan of the department on telephone number 5626 6865.



Signature



Date

Tim Brain
Manager (compliance)
Delegate of the Chief Executive
Department of Environment and Science
Environmental Protection Act 1994

Enquiries:

Robina Compliance Centre
Level1, 14 Edgewater Court,
Robina QLD 4230
Ph: (07) 5626 6865
Email: goldcoast.es@des.qld.gov.au

APPENDIX C:
Excel Document – Flow Data

APPENDIX D:
Irrigation Management Plan (IMP)

Greenacres Caravan Park

Irrigation Management Plan



August 2019

Document Control

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Document Number:	C1903-004_IMP				
Client:	Greenacres Caravan Park				
Client Contact:	Glenn Cross				

	Name	Signed	Date
Written by:	Fiona Milnes Environmental Scientist		23/08/19
Reviewed by:	Terrence Allen Process Engineer		23/08/19
Authorised for release by:	David Bristow Managing Director		23/08/19

Revision History

Rev No.	Date	Author	Description of Revision	Status
0.1	06/08/2019	FM	Initial Draft	Internal Draft,
0.2	20/08/2019	FM	Internal Draft	Internal Draft
1.0	20/08/2019	FM	Draft for Client review	External Draft
2.0	23/08/2019	FM	Final	Final

Disclaimer

The information contained in this document has been prepared specifically for our client named above and as such its use is limited to the above project. Simmonds & Bristow accepts no responsibility to any third party who may use or rely upon this document or the information contained in it.

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Greenacres Caravan Park Irrigation Management Plan

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1. INTRODUCTION

This Irrigation Management Plan has been prepared for Greenacres Caravan Park in preparation for the disposal of treated effluent using land application.

The disposal method employed for the disposal for treated effluent at the time of writing is via release to waters.

The Department of Environment and Science (DES) has indicated that the preferred method for the release of treated effluent is via land application. As such, this document outlines the proposed irrigation area, risks and management required for the system once it is installed.

As the system has yet to be installed, this report will need to be updated to reflect the final equipment selection, as slight variations in instrumentation, sizing, brands or other factors may occur during construction.

A glossary of terms used throughout this report can be found on page 21.



2. THE SITE

2.1 Land Use

This irrigation management plan applies to the Greenacres Caravan Park, located on Lot 3/RP123875 and the adjacent Lot 5/RP123875.

The site is elevated from local drainage and creek lines, and according to Redlands Planning Scheme is not in a flood prone area.



Figure 1 Greenacres Caravan Park Site Layout with STP Area circled

2.2 Sewage Treatment Plant Location

The sewage treatment plant compound is located on the North West corner of Lot 3/RP123875, indicated by the red circle in Figure 1.

2.3 Irrigation Area Location

The irrigation area is proposed to be located as per the figures below.



Figure 2 Main Irrigation Area Location



Figure 3 South East Green Space Irrigation Area



Figure 4 Southern Gardens Irrigation Area



2.4 Setbacks/Buffers

The following setbacks/buffers are provided and demonstrated against the *AS1547:2012 Onsite Domestic Wastewater Management standard*.

The buffer area on the northern and western boundary of Lot 5/RP123875 provides a 5 metre setback for both the property boundary, as well as potential buildings or tanks on neighbouring properties. The gentle slope down towards these properties indicates that this higher setback should be used rather than the minimum 1.5 metre setback.

Table 1: Setback distances for Main Irrigation Area on Lot 5/RP123875 irrigation area

Setback distances for Subsurface land application area for on-site STP's (metres)			
Feature	Guideline (Low - High Risk)	Provided	Comments
Property boundaries	1.5 - 50	5	-
Buildings	2 - 6	2 - 5	Future use zone can be 2 m as it is up-gradient from irrigation area
Surface Water	15 - 100	>100	To tributary of Coonwylpin creek
Bore, well	15 - 50	>300 ¹	Nil on property, provision to closest active bore from Qld Globe mapping
In ground water tank ²	4 - 15	>5	Nil on property
Retaining walls, embankments, escarpments, cuttings	3	>5	Nil on property
Groundwater	0.6 - 1.5	>30 ³	To be confirmed
Hardpan or bedrock	0.5 - 1.5	>0.5	-

¹ Registered bores (may or may not be in use)

² No tanks were observed during site inspection, however as these are in-ground they may be present.

³ Estimated based on local bore logs

Table 2 Setback distances for Lot 3/RP123875 irrigation areas

Setback distances for Subsurface land application area for on-site STP's (metres)			
Feature	Guideline (Low - High Risk)	Provided	Comments
Property boundaries	1.5 - 50	1.5 - 5	Flat or downgradient from Mt Cotton Rd,
Buildings	2 - 6	>2	Office from South-East, or across road for southern gardens
Surface Water	15 - 100	>100	Nil on property
Bore, well	15 - 50	>300 ⁴	Nil on property, provision to closest active bore from Qld Globe mapping
In ground water tank ⁵	4 - 15	>4	Nil on property
Retaining walls, embankments, escarpments, cuttings	3	3	Nil on property
Groundwater	0.6 - 1.5	>30 ⁶	To be confirmed
Hardpan or bedrock	0.5 - 1.5	>0.5	-

The setback provided for the southern boundary of Lot 3/RP123875 uses the minimum 1.5 metre setback, as the boundary is up-gradient from the irrigation area, and is against a road, rather than any sensitive receptors.

2.5 Irrigation Area protection

The irrigation area must be protected from potential run-on and stormwater by building an upslope diversion drain or berm.

As this site has a sub-surface stormwater drain easement that currently exists on the western boundary of Lot 5/RP123875, stormwater currently directed overland on the proposed irrigation area will be directed and connected to this stormwater easement.

Alternatively the stormwater can be directed around the irrigation area in the buffer areas to discharge on-grade in the north-west corner.

For the south-eastern green space, stormwater will be directed around the grassed irrigation area to existing stormwater gutters on the eastern boundary near Greenfield Rd.

⁴ Registered bores (may or may not be in use)

⁵ No tanks were observed during site inspection, however as these are in-ground they may be present.

⁶ Estimated based on local bore logs

3. IRRIGATION MANAGEMENT

The following items provide detail for the management of the irrigation system.

3.1 Irrigation Method

The irrigation method is via sub-surface pressure compensated drip line or drip emitters. Pressure compensated line is required to ensure even distribution of effluent at low application rates across a variety of gradients.

The use of sub-surface irrigation significantly reduces the public health risk as access to the irrigated effluent is restricted, and reduces the risk of surface saturation and potential effluent runoff, whilst placing the treated effluent in the root zone of the plants in the area.

3.2 Irrigation Control and Timing

The effluent irrigation area will need to be split into a number of zones, with irrigation application controlled via automatic distribution or sequencing valves. This assists with pressure, allows even control of watering and allows for increased control of timing and application rates in different zones (if required).

Irrigation application will be controlled via an automatic irrigation controller. The irrigation controller will rotate through the irrigation zones to ensure even distribution of treated effluent across all irrigation areas.

Program irrigation must ensure even delivery of treated effluent to the various zones.

Pressure will be provided via a set of irrigation pumps, drawing irrigation water from the wet weather storage. A standard set of pressure boosting pumps, controlled via pressure in the irrigation distribution system should be sufficient and are recommended for use.

3.3 Water Source Quantity

The flows to the irrigation area must be recorded on a daily basis. This will be conducted manually by the treatment plant operator, with flows recorded in a logbook.

3.4 Rainfall

An automatic rainfall irrigation shut off will be required for the irrigation controller, shutting the system down if more than 20mm of rainfall is detected. A tipping gauge or similar rain sensor that can be adjusted will be required.

3.5 Wet Weather Storage

At least 90 kL of wet weather storage is required to store treated effluent when irrigation cannot proceed due to rainfall.

3.6 Manual override

When the soil profiles are at or near saturation effluent irrigation should be manually overridden and treated effluent sent to wet weather storage.

Visual indications of saturation are when the irrigation area is waterlogged or surface ponding is observed.

3.7 Management Strategy Summary

Follow the flow chart in Figure 5 below to determine if irrigation should proceed for the day.

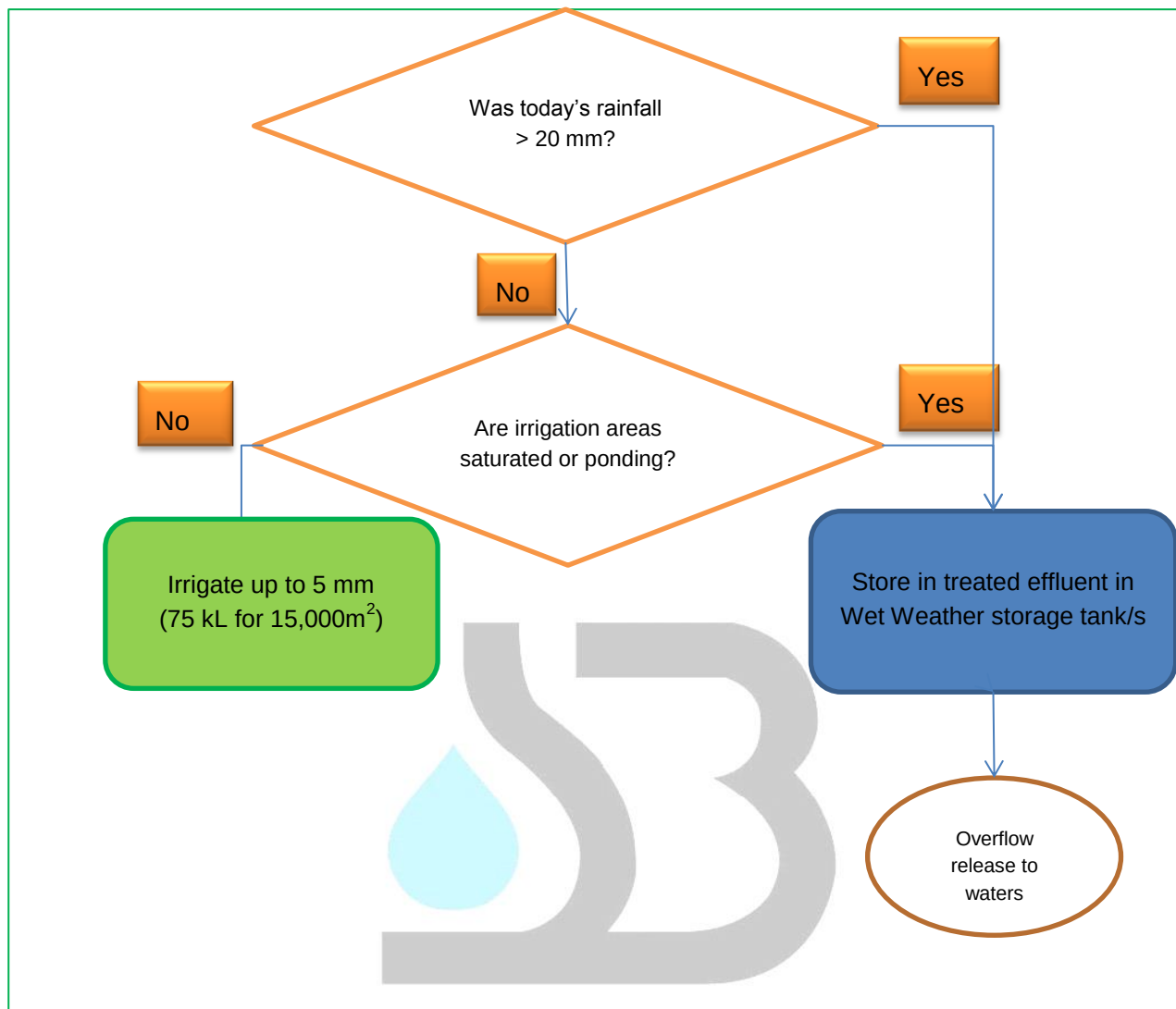


Figure 5 Irrigation Management Strategy

4. MAINTENANCE

The irrigation system requires routine maintenance and checking. The following table provides a general overview of the required maintenance, including frequencies and actions. More detailed maintenance log sheets will need to be developed after the installation of the irrigation system based upon the requirements of the equipment manufacturers.

Table 3 Irrigation System Maintenance Requirements

Check Item	Frequency	Action
Irrigation System Distribution Pipework and Irrigation Area		
Uniformity	Weekly	Ensure flow and visual observations indicate irrigation is distributed uniformly over irrigation areas.
Check for Leaks or Breaks	Weekly	Waterlogged patches or dead patches in the irrigation area must be rectified quickly
Landscaping	Monthly	Visually inspect berms and landscape features for damage. Repair damage noted as soon as practical.
Ensure Pipework protected from damage	Quarterly	Ensure lines are buried 100-150(check) mm below ground level to ensure in root zone, protect against UV damage and lawn mower damage.
Best practice water efficiency	Quarterly	Use rates and flow meter readings to determine if any improvements in water use can be implemented
Check for Blockages	Annual	Ensure a field flush valve is installed on the return line to facilitate flushing back to the treatment system Ensure that chlorinated effluent is not returned to the primary chamber of the treatment system where the chlorine may adversely affect the biological treatment processes.
Stormwater Diversion	Annually	Ensure stormwater diversion berms, pipes or other landscaping features are appropriate to avoid stormwater run-on to the irrigation areas.
Vegetation		
Nutrient Removal/ Harvesting	Quarterly or more in turfed areas	Remove grass clippings and garden waste from the irrigation areas.
Plant death checks	Quarterly	Check any areas of plant death, Investigate why this may have occurred and re-seed with Kikuyu/Ryegrass blend
Signage/Exclusion		
Check of Signage	Annually	Ensure signage is legible and up to date. Notices must be in a prominent position showing area is irrigated

Check Item	Frequency	Action
		with effluent and advising not to drink the water.
Check of Public Access	Annually	Ensure lockable valves are locked and/or taps with removable handles are used for release pipes in any public access areas.
Pumps		
Service	As per manufacture requirements	Check and service pump as per manufacturers requirements
Check Operation	Weekly	Check pressure reading on discharge line. Open flush valve and ensure pumps start once pressure in the manifold drops.
Valves		
Check Operation	Monthly	Open and close all manual valves through full range to ensure that they open and close
	Monthly	Trigger automatic valves from controls system and ensure they actuate.
Irrigation Filter		
Filter blockage	Weekly	Check pressure gauge on filters. If gauge reads above manufacturers recommended drop, ensure filter element is cleaned (may require dismantling of filter)
	Quarterly	Open down-stream flush valve and check for flow
Check Operation	Weekly	If an automatic filter is used, initiate a cleaning cycle
Flowmeter		
Check Operation	Annual	Check calibration of flowmeter.

5. IMPACT ASSESSMENT

5.1 Soil

Sustainable irrigation relies on maintaining the sustainability of the soil in the area.

The following items may indicate a problem with the soil in the irrigation area, and should be investigated;

5.1.1 Waterlogging

Waterlogging within the irrigation area indicates the permeability of the soil is not sufficient to cope with the volume or load of irrigation water applied. If waterlogging is patchy, it could indicate a break or damage to an irrigation emitter or distributor, which should be investigated and repaired as soon as possible.

Waterlogging over a large area indicates hydraulic overloading of the irrigation field and a water reduction scheme or assessment of the treated effluent volume generation on site should be conducted.

5.1.2 Sodicty/Salinity/Nutrient assimilation

Baseline analysis of soil in the main irrigation area was conducted in 2019. Results are attached in **Appendix A**. These can be used for comparison with annual soil analysis to conduct an impact assessment for soil structure, stability and nutrients using monitoring outlined in Section 6.

Modelling of the irrigation area indicated that there is no expected increase in salinity or sodicty and low nutrient leaching under the management strategy outlined in this IMP.

Soil structure and health will be monitored for unexpected changes in the parameters outlined within the soil analysis proposed in Section 6.3, such as;

- Salinity from Electrical Conductivity;
- Sodicty from Emerson Aggregate Dispersion, CEC and Exchangeable Cations;
- Soil fertility/nutrient assimilation from nitrogen, phosphorus and soil carbon.

5.2 Groundwater

The risk of deep drainage is considered lower than the release of treated effluent to surface waters at the tributary of Coolnwynpin Creek.

As such, modelling was conducted to determine if an increased irrigation rate with a reciprocal increase in deep drainage would result in nutrient leaching to groundwater.

Modelling indicated that the leaching below the root zone was considered low and as such, sustainable for the irrigation area.

Groundwater monitoring will provide data to determine if the system is operating as modelled and provide indication of any impact resulting from the release of treated effluent to the irrigation areas.

The groundwater at the site is predicted to be greater than 30 m below the natural ground level based upon the bore log data for registered bores in the surrounding area. Ground water level assessment or monitoring of groundwater levels have not yet been conducted at the time of writing of this Irrigation Management Plan.

5.3 Surface Water

Overflows from the STP wet weather storage (WWS minimum volume 90 kL) will be released to the subsurface stormwater drain on the western edge of Lot 5/RP123875, which eventually releases to point W1 on the tributary of Coonwylpin Creek.

This overflow has been modelled using MEDLI (Model for Effluent Disposal via Land Irrigation) water balance, which requires overflow only when rainfall prevents irrigation to the proposed irrigation area and the wet weather storage has been completely filled. Modelling indicates that this is likely to be < 2.51% of total effluent volume generated.

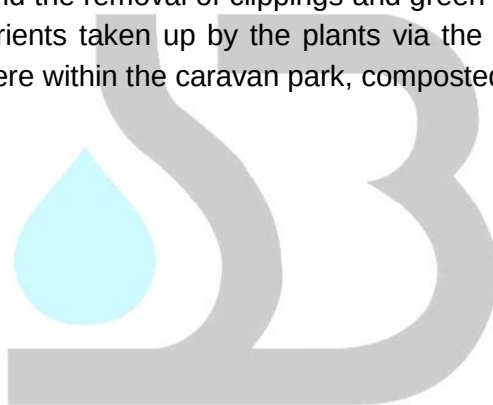
The excess treated effluent will mix with the stormwater flows from Greenacres Caravan Park, Tipuana Drive and surrounding houses in the sub surface stormwater drain.

Any overflows from the wet weather storage directed to stormwater should be monitored and recorded.

5.4 Vegetation

The vegetation in the irrigation area is used for the uptake of nutrients and evapotranspiration of treated effluent.

Regular mowing or slashing and the removal of clippings and green waste from the irrigation areas is required to remove the nutrients taken up by the plants via the application of treated effluent. Clippings can be used elsewhere within the caravan park, composted or disposed of to landfill.



6. MONITORING AND COMPLIANCE

6.1 Water Quality

The quality of the treated effluent should be monitored in accordance with the Environmental Authority.

The following additional operational monitoring (as well as that conducted for routine monitoring) may be performed to assist in troubleshooting any potential problems, if they are encountered within the irrigation area;

Table 4 Additional Recommended Operational Monitoring

Parameter	Sample	Comment
Major Cations & Anions (Ca, Mg, Na, K, Cl, Alkalinity, SO ₄)	Treated Effluent	Effluent characterisation
Sodium Absorption Ratio (SAR)	Treated Effluent	Risk Assessment for irrigation
Residual Alkali Hazard (RAH)	Treated Effluent	Risk Assessment for irrigation

6.2 Water Quantity

The daily flows directed to the irrigation area or to the stormwater overflow must be monitored and recorded.

6.3 Soil Quality

Soil analysis for determination of the sustainability of the irrigation scheme should be conducted annually. This will assess changes to soil structure and chemistry as a result of the irrigation of treated effluent.

Testing should be conducted on at least one composite sample, and it is recommended that the composite comprise of a representative cross-section of each irrigation areas. Composites should only include soils of similar structure. If distinctly different soil types are observed then multiple composites should only be analysed to obtain representative samples for the irrigation area.

It is also recommended that a baseline sample of a soil of similar structure, that has not been irrigated, be performed at the same time to allow for comparison.

Table 5 Soil Sampling Plan

Parameter	Size (m ²)	Samples	Composite for Analysis
Main Irrigation Area	~12,250	12	1 or more dependent on soil types observed
Southern Garden Area	~950	1	
South East Green Space	2,250	2	
Baseline sample from non-irrigated area of similar soil type	-	1	1

Table 6 Soil Analysis Parameters

Parameter	Units	Reason
pH	pH	Soil characterisation
Conductivity	dS/m	Soil characterisation
Emerson Aggregate Dispersion	-	Indicator of dispersion
Exchangeable Cations	cmol/kg or meq/100g	Capacity of soil to store and exchange essential salts
Cation Exchange Capacity	cmol/kg or meq/100g	
Exchangeable Sodium Percentage (ESP)	Calculation from above two sets of parameters	Indicator of sodicity
Nitrogen	mg/kg	Soil Nutrients
Colwell Phosphorus	mg/kg	Soil Nutrients
Texture	-	Classification & Indicator of Permeability
Organic Matter & Organic Carbon	mg/kg or %	Soil carbon store

6.4 Biomass Removal

It is recommended to keep records of estimated quantities of clippings removed from the irrigation areas. This can assist in determination of the nutrient removal in these areas in future sustainability assessments.

6.5 Other Records

Record any incidents, including but not limited to the following as a means of self-managing risk;

- Treated effluent escape or pipeline breakages;
- Odour or other complaints from residents or neighbours;
- Maintenance issues and fixes performed;
- Any changes to normal disposal practises.

Be sure to include dates and any actions taken.

6.6 Groundwater

Monitoring of groundwater may be required in the proposed Environmental Authority (EA). This document should be updated on completion of any amendment to the EA to ensure the monitoring and parameter list is up to date with Environmental Authority conditions.

Usually three (3) groundwater monitoring bores are required, with at least one (1) being up-gradient from the irrigation areas and two (2) being down-gradient of irrigation areas.

Table 7 includes a list of recommended groundwater monitoring parameters for treated effluent irrigation systems, this list will need to be updated with any future EA amendment.

Table 7 Common Groundwater Monitoring Parameters

Parameter	Units	Frequency
pH	pH	6 monthly
Electrical Conductivity	μS/cm	6 monthly
Suspended Solids	mg/L	6 monthly
CBOD ₅	mg/L	6 monthly
Total Nitrogen	mg/L	6 monthly
Total Phosphorus	mg/L	6 monthly
Ammonia	mg/L	6 monthly
Nitrate + Nitrite (NO _x)	mg/L	6 monthly
<i>E. coli</i> <u>or</u>	cfu/100mL	6 monthly
Enterococci	cfu/100mL	6 monthly
Reduced Standing Water Level (RSWL) <u>or</u>	mAHD	6 monthly
Standing Water Level (SWL)	m below TOC/surface	6 monthly

7. REFERENCES

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GLOSSARY OF TERMS

Term	Definition
Conductivity	A measure of the salt content of a water sample
EPPs	Environmental protection policies
ERA	Environmentally relevant activity (Specific to Queensland legislation, may also be used for Environmental Risk Assessment)
Thermotolerant Coliforms	A range of coliform bacteria generally used as an indicator of faecal contamination.
SOP	Standard operating procedure
STP	Sewage treatment plant
TKN	Total kjeldahl nitrogen – a measure of the Organic nitrogen plus Ammonia nitrogen
TN	Total nitrogen - the concentration of organic plus inorganic nitrogen
TP	Total phosphorus - the concentration of organic plus inorganic phosphorous
WWTP/WwTP	Wastewater treatment plant

APPENDIX A:
Baseline Soil Analysis 2019

MEDLI P ADSORPTION ISOTHERM PARAMETER CALCULATOR

Algorithms from HSPF (Johnson et al., 1984) and described fully in the MEDLI Version 2.0 Manual

Excel version by Alison Vieritz, NRS, NR&M [09/2002]

1 Colwell P

Analyse the sample for sodium bicarbonate extractable P (Colwell-P) in a solution to soil mixture. Enter the Colwell P in mg/kg solution and the solution to soil ratio used.

2 Isotherm Data

P sorption curve is performed on dried (40°C) soil samples ground to <2mm. The soil is then equilibrated with a solution containing 0.01 M CaCl₂ and phosphorus (added as KH₂PO₄) ranging in concentration from 20 to 1600 mgP/kg (six data points on the curve). A soil to solution ratio of 1:10 is used and each sample is shaken end-over-end at 30 rpm for 18 hr at 25°C, before centrifuging at 2000 g for 30 minutes. The supernatant solution P concentration is then read by Auto Analyser using the procedure of Warrell and Moody (1984). This measure is then used to calculate the amount of extra phosphorus (mg/kg) that can be adsorbed by the soil at each equilibrium solution P concentration (Padded ads). For each equilibrium solution P concentration (mg/L):

$$\text{Total sorbed P (mg/kg)} = P_{\text{added ads}} + \text{Colwell-P}$$

3 Linear regression of Ln(X) and Ln(Y)

The X (P Equilibrium concentration in mg/L) and Y (P sorbed in mg/kg) data is then fitted to the equation:

$$Y = AX^B \text{ by linear regression of } \ln(Y) = a\ln(X) + b$$

where $b = \ln(A)$ and $a=B$.

A = MEDLI adsorption coefficient

B = MEDLI adsorption exponent

Check the fit shown by the graph.

4 MEDLI Parameters

The MEDLI adsorption coefficient, adsorption exponent, desorption exponent are then estimated. In the absence of a desorption isotherm the desorption exponent is assumed to be 95% of the adsorption exponent to allow conservatively a very minor hysteresis effect.

MEDLI P ADSORPTION ISOTHERM PARAMETER CALCULATOR

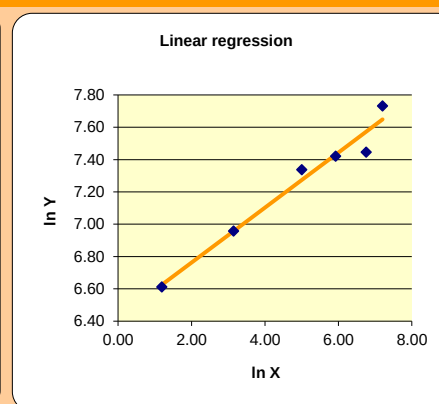
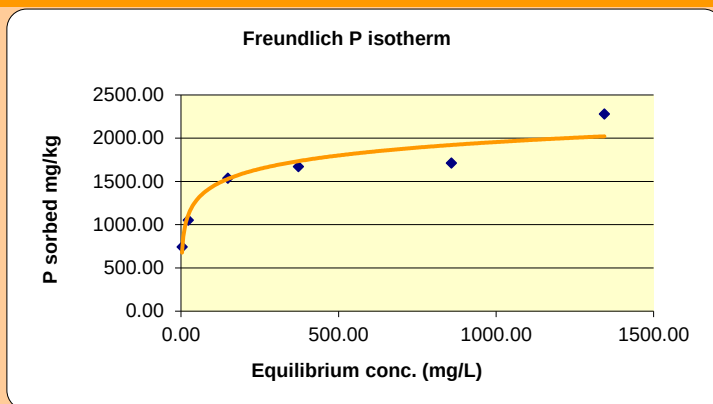
Input data in white cells only

1 Colwell P

Colwell P mg/kg solution	Solution:soil ratio
23	10

2 Isotherm Data

Std Conc mg/L	Equil Conc mg/L X	P Sorbed mg/kg Y
54.74	3.30	744.48
105.30	23.13	1051.64
279.44	148.76	1536.88
517.04	372.92	1671.15
1006.58	858.29	1712.88
1548.91	1343.91	2280.00



3 Linear regression of Ln(X) and Ln(Y)

The linear regression equation uses the form $y=ax+b$

a	b	Equation is	r^2
0.1702	6.4223	$y = 0.1702x + 6.4223$	0.9660

4 MEDLI Parameters

MEDLI's isotherm equation $Y=AX^B$ is shown on the graph above.

Adsorption Coefficient (A)	615.43
Adsorption Exponent (B)	0.1702
Desorption Exponent	0.1617

Example 1 Orig soln	Soln dilution	soln:soil ratio ?
50	54.74	0.913355449
100	105.30	0.949701889
250	279.44	0.89463459
500	517.04	0.9670456
1000	1006.58	0.993464296
1500	1548.91	0.968425331
	avg	0.947771193

MEDLI P ADSORPTION ISOTHERM PARAMETER CALCULATOR

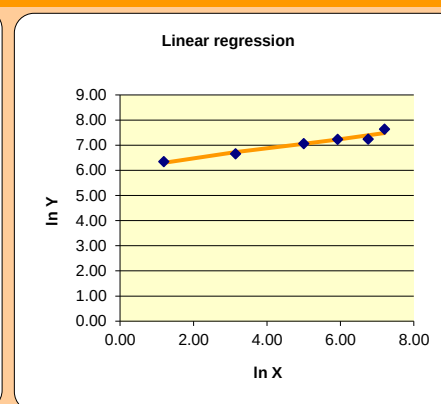
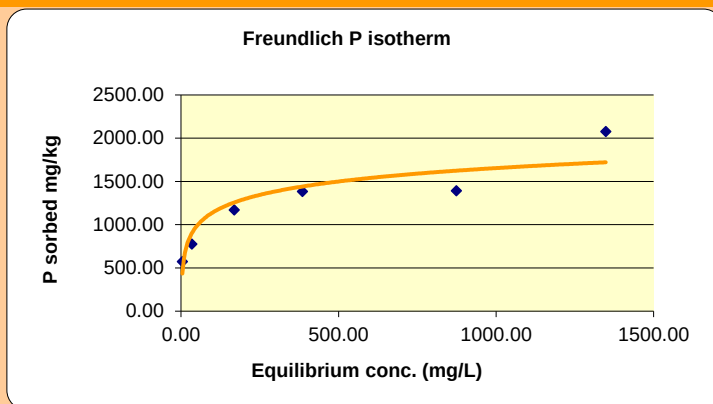
Input data in white cells only

1 Colwell P

Colwell P mg/kg solution	Solution:soil ratio
6.9	10

2 Isotherm Data

Std Conc mg/L	Equil Conc mg/L X	P Sorbed mg/kg Y
54.74	4.29	573.53
105.30	34.46	777.38
279.44	169.15	1171.90
517.04	385.43	1385.10
1006.58	874.16	1393.16
1548.91	1348.01	2078.00



3 Linear regression of Ln(X) and Ln(Y)

The linear regression equation uses the form $y=ax+b$

a	b	r^2
0.2058	5.9998	0.9467

Equation is $y = 0.2058x + 5.9998$

4 MEDLI Parameters

MEDLI's isotherm equation $Y=AX^B$ is shown on the graph above.

Adsorption Coefficient (A)	403.33
Adsorption Exponent (B)	0.2058
Desorption Exponent	0.1955

Example 1 Orig soln	Soln dilution	soln:soil ratio ?
50	54.74	0.913355449
100	105.30	0.949701889
250	279.44	0.89463459
500	517.04	0.9670456
1000	1006.58	0.993464296
1500	1548.91	0.968425331
	avg	0.947771193

MEDLI P ADSORPTION ISOTHERM PARAMETER CALCULATOR

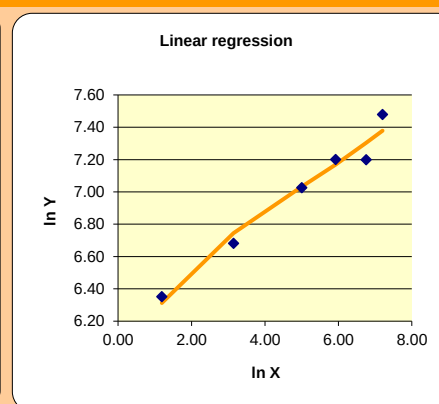
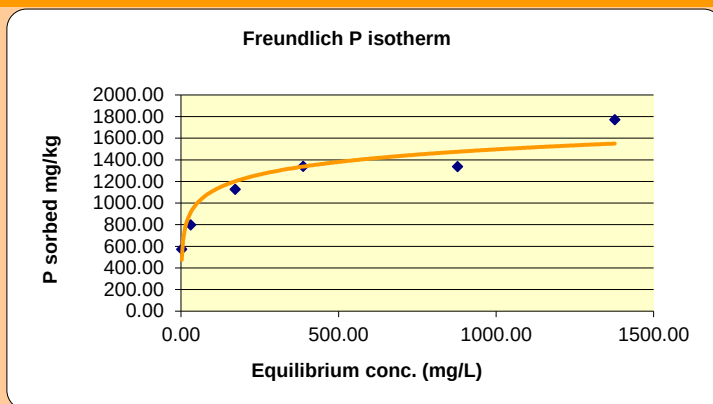
Input data in white cells only

1 Colwell P

Colwell P mg/kg solution	Solution:soil ratio
4.9	10

2 Isotherm Data

Std Conc mg/L	Equil Conc mg/L X	P Sorbed mg/kg Y
54.74	2.25	573.93
105.30	30.37	798.28
279.44	171.72	1126.28
517.04	387.89	1340.50
1006.58	877.67	1338.11
1548.91	1376.71	1771.00



3 Linear regression of Ln(X) and Ln(Y)

The linear regression equation uses the form $y=ax+b$

a	b	r^2
0.1661	6.1778	0.9666

Equation is $y = 0.1661x + 6.1778$

4 MEDLI Parameters

MEDLI's isotherm equation $Y=AX^B$ is shown on the graph above.

Adsorption Coefficient (A)	481.92
Adsorption Exponent (B)	0.1661
Desorption Exponent	0.1578

Example 1 Orig soln	Soln dilution	soln:soil ratio ?
50	54.74	0.913355449
100	105.30	0.949701889
250	279.44	0.89463459
500	517.04	0.9670456
1000	1006.58	0.993464296
1500	1548.91	0.968425331
	avg	0.947771193

REFERENCES

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AGRICULTURAL SOIL ANALYSIS REPORT

10(22) samples supplied by Simmonds and Bristow on . Lab Job No.H9856

Analysis requested by Fiona Milnes. Your Job: PO C903004a

Unit 2A 40 Reginald St ROCKLEA QLD 4106

Analysis requested by Fiona Milnes. Your Job: PO C903004a		Sample ID:	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10		
Unit 2A 40 Reginald St ROCKLEA QLD 4106			Site A Top Soil 0-100mm	Site A Sub Soil 100-200mm	Site A Top Soil 400-500mm	Site B Top Soil 0-100mm	Site B Sub Soil 400-500mm	Site C Sub Soil 200-300mm	Site C Sub Soil 300-400mm	Site D Top Soil 0-100mm	Site D Sub Soil 200-300mm	Site D Sub Soil 300-400mm		
			Crop:	--	--	--	--	--	--	--	--	--		
			Client:	F.Milnes	F.Milnes	F.Milnes	F.Milnes	F.Milnes	F.Milnes	F.Milnes	F.Milnes	F.Milnes		
	Parameter		Method reference		H9856/1	H9856/2	H9856/5	H9856/6	H9856/10	H9856/13	H9856/14	H9856/15	H9856/17	H9856/18
	Colour (Munsell Soil Colour Classification) - Hue/Colour, Value/Chroma	**Inhouse		2.5YR 4/8	10YR 4/2	10YR 6/6	7.5YR 3/4	10YR 6/3	2.5YR 5/3	2.5YR 6/4	7.5YR 3/1	10YR 4/2	2.5YR 6/4	

Notes:

1. ** NATA accreditation does not cover the performance of this service.
2. Analysis conducted between sample arrival date and reporting date.
3. This report is not to be reproduced except in full. Results only relate to the item tested.
4. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions.
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Quality Checked: Kris Saville
 Agricultural Co-Ordinator

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AGRICULTURAL SOIL ANALYSIS REPORT

3 samples supplied by Simmonds and Bristow on 21st March, 2019. Lab Job No.H9856

Analysis requested by Fiona Milnes. Your Job: PO C903004a

Unit 2A 40 Reginald St ROCKLEA QLD 4106

		Sample ID:	Sample 1 Top soil Composite (Sites A-E)	Sample 2 Sub soil Composite X	Sample 3 Sub soil Composite Y
		Crop:	--	--	--
		Client:	F.Milnes	F.Milnes	F.Milnes
Parameter		Method reference	H9856/C1	H9856/C2	H9856/C3
Phosphorus (mg/kg P)		**Rayment & Lyons 2011 - 9B2 (Colwell)	23	6.9	4.9
Nitrate Nitrogen (mg/kg N)		APHA 4500 NO ₃ -F	12	--	--
Ammonium Nitrogen (mg/kg N)		APHA 4500 NH ₃ -H	22	--	--
Phosphate (mg/L P)		APHA 4500 P-G	6.3	--	--
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.02	--	--
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.201	--	--
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	129	--	--
Exchangeable Calcium	(cmol _e /kg)	**Rayment & Lyons 2011 - 15A1 (1M NH ₄ Cl)	12.47	2.63	0.57
	(kg/ha)		5600	1179	255
	(mg/kg)		2500	526	114
Exchangeable Magnesium	(cmol _e /kg)		1.77	1.16	1.24
	(kg/ha)		483	315	337
	(mg/kg)		216	141	150
Exchangeable Potassium	(cmol _e /kg)		0.34	<0.12	<0.12
	(kg/ha)		301	<112	<112
	(mg/kg)		134	<50	<50
Exchangeable Sodium	(cmol _e /kg)		0.38	0.30	0.58
	(kg/ha)		197	155	296
	(mg/kg)		88	69	132
Effective Cation Exchange Capacity (ECEC) (cmol _e /kg)		**Calculation: Sum of Ca,Mg,K,Na (cmol _e /kg)	14.97	4.20	2.46
Calcium (%)		**Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100	83.3	62.5	23.1
Magnesium (%)			11.9	27.6	50.4
Potassium (%)			2.3	2.8	3.1
Sodium - ESP (%)			2.6	7.2	23.4
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol _e /kg)	7.0	2.3	0.5
Total Nitrogen (%)		Inhouse S4a (LECO Trumac Analyser)	0.18	--	--
Total Organic Carbon (%)		LECO Trumac Analyser - Inhouse S15b	3.55	--	--
Estimated Organic Matter (% OM)		**Calculation: Total Organic Carbon x 1.75	6.2	--	--
Soil Texture		**AS1547-2012 (Based on Northcote 1979)	Clay Loam	Fine Sandy Clay Loam	Clay Loam
Moisture Content (%)		**Inhouse S2 (105°C)	23.78	14.86	14.07
Moisture Content (%)		**Inhouse (40°C)	20.25	12.76	13.68
Bulk Density (t/m ³)		**AS4419-2003	1.36	1.63	1.60

AGRICULTURAL SOIL ANALYSIS REPORT

3 samples supplied by Simmonds and Bristow on 21st March, 2019. Lab Job No.H9856

Analysis requested by Fiona Milnes. Your Job: PO C903004a

Unit 2A 40 Reginald St ROCKLEA QLD 4106

Sample ID:	Sample 1 Top soil Composite (Sites A-E)	Sample 2 Sub soil Composite X	Sample 3 Sub soil Composite Y
Crop:	--	--	--
Client:	F.Milnes	F.Milnes	F.Milnes
	H9856/C1	H9856/C2	H9856/C3

Parameter	Method reference	H9856/C1	H9856/C2	H9856/C3
-----------	------------------	----------	----------	----------

Notes:

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils.
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
- Total Acid Extractable Nutrients indicate a store of nutrients.
- National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
- Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
- Conversions for 1 cmol./kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
- Conversions to kg/ha = mg/kg x 2.24
- The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
- ** NATA accreditation does not cover the performance of this service.
- Analysis conducted between sample arrival date and reporting date.
- This report is not to be reproduced except in full. Results only relate to the item tested.
- All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

Quality Checked: Kris Saville
 Agricultural Co-Ordinator

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AGRICULTURAL SOIL ANALYSIS REPORT

3 samples supplied by Simmonds and Bristow on 21st March, 2019. Lab Job No.H9856

Analysis requested by Fiona Milnes. Your Job: PO C903004a

Unit 2A 40 Reginald St ROCKLEA QLD 4106

Sample ID:	Heavy Soil	Medium Soil	Light Soil	Sandy Soil
Crop:				
Client:	Clay	Clay Loam	Loam	Loamy Sand

Parameter		Method reference	Indicative guidelines - refer to Notes 6 and 8			
Phosphorus (mg/kg P)		**Rayment & Lyons 2011 - 9B2 (Colwell)	80	50	45	35
Nitrate Nitrogen (mg/kg N)		APHA 4500 NO ₃ -F	15	13	10	10
Ammonium Nitrogen (mg/kg N)		APHA 4500 NH ₃ -H	20	18	15	12
Phosphate (mg/L P)		APHA 4500 P-G	10.0	8.0	8.0	7.0
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.5	6.5	6.3	6.3
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.200	0.150	0.120	0.100
Chloride Estimate (equiv. mg/kg)		**Calculation: Electrical Conductivity x 640	..	..	..	..
Exchangeable Calcium	(cmol _e /kg)	**Rayment & Lyons 2011 - 15A1 (1M NH ₄ Cl)	15.6	10.8	5.0	1.9
	(kg/ha)		7000	4816	2240	840
	(mg/kg)		3125	2150	1000	375
Exchangeable Magnesium	(cmol _e /kg)		2.4	1.7	1.2	0.60
	(kg/ha)		650	448	325	168
	(mg/kg)		290	200	145	75
Exchangeable Potassium	(cmol _e /kg)		0.60	0.50	0.40	0.30
	(kg/ha)		526	426	336	224
	(mg/kg)		235	190	150	100
Exchangeable Sodium	(cmol _e /kg)		0.3	0.26	0.22	0.11
	(kg/ha)		155	134	113	57
	(mg/kg)		69	60	51	25
Effective Cation Exchange Capacity (ECEC) (cmol _e /kg)		**Calculation: Sum of Ca,Mg,K,Na (cmol _e /kg)	20.1	14.3	7.8	3.3
Calcium (%)		**Base Saturation Calculations - Cation cmol _e /kg / ECEC x 100	77.6	75.7	65.6	57.4
Magnesium (%)			11.9	11.9	15.7	18.1
Potassium (%)			3.0	3.5	5.2	9.1
Sodium - ESP (%)			1.5	1.8	2.9	3.3
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol _e /kg)	6.5	6.4	4.2	3.2
Total Nitrogen (%)		Inhouse S4a (LECO Trumac Analyser)	> 0.30	> 0.25	> 0.20	> 0.15
Total Organic Carbon (%)		LECO Trumac Analyser - Inhouse S15b	< 0.5 (Very Low); 0.5-1.5 (Low); 1.5-2.5 (Medium); 2.5-5.0 (High); > 5.0 (Very High)			
Estimated Organic Matter (% OM)		**Calculation: Total Organic Carbon x 1.75	> 5.5	> 4.5	> 3.5	> 2.5
Soil Texture		**AS1547-2012 (Based on Northcote 1979)	..			
Moisture Content (%)		**Inhouse S2 (105°C)	..			
Moisture Content (%)		**Inhouse (40°C)				
Bulk Density (t/m ³)		**AS4419-2003	> 0.7			

AGRICULTURAL SOIL ANALYSIS REPORT

3 samples supplied by Simmonds and Bristow on 21st March, 2019. Lab Job No.H9856

Analysis requested by Fiona Milnes. Your Job: PO C903004a

Unit 2A 40 Reginald St ROCKLEA QLD 4106

Sample ID:	Heavy Soil	Medium Soil	Light Soil	Sandy Soil
Crop:				
Client:	Clay	Clay Loam	Loam	Loamy Sand

Parameter	Method reference	Indicative guidelines - refer to Notes 6 and 8
-----------	------------------	--

Notes:

- All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
- Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.
- Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
- 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
- Guidelines for phosphorus have been reduced for Australian soils.
- Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
- Total Acid Extractable Nutrients indicate a store of nutrients.
- National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
- Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
- Conversions for 1 cmol_e/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
- Conversions to kg/ha = mg/kg x 2.24
- The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
- ** NATA accreditation does not cover the performance of this service.
- Analysis conducted between sample arrival date and reporting date.
- This report is not to be reproduced except in full. Results only relate to the item tested.
- All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.



Quality Checked: Kris Saville
 Agricultural Co-Ordinator

KS

SOIL HYDRAULIC PROPERTIES

3 samples supplied by Simmonds and Bristow on 21st March, 2019. Lab Job No.H9856

Analysis requested by Fiona Milnes. Your Job: PO C903004a

Unit 2A 40 Reginald St ROCKLEA QLD 4106

Client id	EAL lab code	Worksheet id to view soil moisture retention curve	Bulk Density (t DW/m³)	USDA			van Genuchten parameters								Available water capacity assuming FC is at 10 kPa	Available water capacity assuming FC is at 33 kPa
				%Sand	%Silt	%Clay	(for WAVES, HYDRUS etc)					Field capacity (10 kPa)	Field capacity (33 kPa)	Permanent wilting point (1500 kPa)		
				from hydrometer determinations			thetaR	thetaS	alpha	n	Ksat (cm/day)					
				from Rosetta pedotransfer functions in RETC												
Top soil Composite (Sites A-E)	H9856/C1	1	1.36	37.2	39.5	23.2	0.0693	0.4218	0.0091	1.5301	14.24	35%	25%	10%	26%	16%
Sub soil Composite X	H9856/C2	2	1.63	44.6	40.7	14.7	0.0442	0.3393	0.0161	1.3967	9.29	26%	19%	8%	18%	11%
Sub soil Composite Y	H9856/C3	3	1.60	32.3	49.9	17.8	0.0532	0.3511	0.009	1.4962	7.05	29%	22%	8%	22%	14%

Notes:

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay under the USDA soil classification, based on SOP meth004 (California Dept of Pesticide Regulation), using hydrometer method of Gee & Bauder. Reference:

Gee GW & Bauder JW (1986) Particle-size Analysis. In *Methods of Soil Analysis, Part 1. Physical and Mineralogical Methods*

- Agronomy monograph no. 9 (Second Edition), American Society of Agronomy-Soil Science Society of America, WI

2. Predicted van Genuchten soil water retention curve (SWRC) parameters are derived from Rosetta pedotransfer routines within RETC. References:

Rosetta: Schaap MG (2001) 'ROSETTA', Version 1.2, US Salinity Laboratory ARS-USDA, Riverside CA.

Rosetta software is incorporated into RETC software: van Genuchten, M. T., Simunek, J., Leij, F. J. & Sejna, M. (2000). RETC ("RETention Curve")

- Code for Quantifying the Hydraulic Functions of Unsaturated Soils. Riverside, CA, US Salinity Laboratory, USDA, ARS.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked:
Graham Lancaster
Laboratory Manager



APPENDIX E:

Bore log data

Report Date: 02/04/2019 09:27

Queensland Government
Groundwater Information
Bore Report

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
133760	Sub-Artesian Facility	Abandoned and Destroyed	25/02/2006	Brisbane	6250 - REDLAND
Details			Location		
Description	MARK FINNEGAN		Latitude	27-33-30	Basin 1450
Parish	947 - CAPALABA		Longitude	153-12-06	Sub-area
Original Name			GIS Latitude	-27.5582116	Lot 17
			GIS Longitude	153.2017712	Plan RP200676
			Easting	519919	
Driller Name	COOPER, PATRICK		Northing	6951719	Map Scale
Drill Company	BUSHMENS DRILLING		Zone	56	Map Series
Const Method	ROTARY AIR		Accuracy	GPS	Map No
Bore Line			GPS Accuracy	10	Map Name
D/O File No	Polygon		Checked	Yes	Prog Section
R/O File No	Equipment				
H/O File No	RN of Bore Replaced				
Log Received Date	05/04/2006	Data Owner			
Roles	Water Supply				

Casing									2 records for RN 133760
Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)	
A	25/02/2006	1	5.00	75.00	Cuttings or other fill between casing and hole wall				
A	25/02/2006	2	0.00	5.00	Grout				200

Strata Logs					5 records for RN 133760
Rec	Top (m)	Bottom (m)	Strata Description		

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Report Date: 02/04/2019 09:27

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	2.00	BROWN CLAY
2	2.00	8.00	SANDY LOAM
3	8.00	27.00	YELLOW RED WHITE SANDSTONE
4	27.00	45.40	GREY GRAVELLY CLAY
5	45.40	75.00	DECO ROCK *

Stratigraphies

0 records for RN 133760

Aquifers

1 records for RN 133760

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	70.00		XXXX - Unknown	25/02/2006	-69.00	N	POTABLE	0.05	Y	UC	

Pump Tests Part 1

1 records for RN 133760

Pipe	Date	Rec	RN of Pumped Bore	Top (m)	Bottom (m)	Dist (m)	Meth	Test Types	Pump Type	Suction Set (m)	Q Prior to Test (l/s)	Dur of Q PR (mins)	Pres on Arriv (m)	Q on Arriv (l/s)
A	25/02/2006	1	133760				PUM		AIR					

Pump Tests Part 2

1 records for RN 133760

Pipe	Date	Rec	Test Dur (mins)	SWL(m)	Recov Time (mins)	Resid DD (m)	Max DD or P RED (m)	Q at Max DD (l/s)	Time to Max DD (mins)	Max Q (l/s)	Calc Stat HD (m)	Design Yield (l/s)	Design BP (m)	Suct. Set (m)	Tmsy (m2/Day)	Stor
A	25/02/2006	1	60									0.05				

Bore Conditions

0 records for RN 133760

Elevations

0 records for RN 133760

From Year:

Water Analysis Part 1	0 records for RN 133760
Water Analysis Part 2	0 records for RN 133760
Water Levels	0 records for RN 133760
Wire Line Logs	0 records for RN 133760
Field Measurements	0 records for RN 133760
Special Water Analysis	0 records for RN 133760

From Year:

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
133759	Sub-Artesian Facility	Existing	24/02/2006	Brisbane	6250 - REDLAND
Details			Location		
Description			Latitude	27-33-35	Basin 1450
Parish	947 - CAPALABA		Longitude	153-12-06	Sub-area
Original Name			GIS Latitude	-27.5597555	Lot 21
			GIS Longitude	153.2016525	Plan RP200676
			Easting	519907	
Driller Name	COOPER, PATRICK		Northing	6951548	Map Scale
Drill Company	BUSHMENS DRILLING		Zone	56	Map Series
Const Method	ROTARY AIR		Accuracy	GPS	Map No
Bore Line			GPS Accuracy	10	Map Name
D/O File No	Polygon		Checked	Yes	Prog Section
R/O File No	Equipment				
H/O File No	RN of Bore Replaced				
Log Received Date	05/04/2006	Data Owner			
Roles	Water Supply				

Casing 7 records for RN 133759

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	24/02/2006	1	0.00	60.60	Polyvinyl Chloride	6.000	WT - Wall Thickness	125
A	24/02/2006	2	30.60	36.60	Perforated or Slotted Casing	3.000	AP - Aperture Size	150
A	24/02/2006	3	48.60	60.60	Perforated or Slotted Casing	3.000	AP - Aperture Size	150
A	24/02/2006	4	29.00	60.60	Gravel Pack	5.000	GR - Gravel Size	
A	24/02/2006	5	5.00	28.00	Cuttings or other fill between casing and hole wall			

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Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	24/02/2006	6	0.00	5.00	Grout			200
A	24/02/2006	7	28.00	29.00	Grout			200

Strata Logs 6 records for RN 133759

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.00	BROWN CLAY
2	1.00	5.00	SANDY COAL
3	5.00	20.00	YELLOW SANDSTONE
4	20.00	27.00	GREY GRAVELLY CLAY *
5	27.00	56.00	DECO ROCK
6	56.00	60.60	GRAVEL *

Stratigraphies 0 records for RN 133759

Aquifers 2 records for RN 133759

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	30.00		XXXX - Unknown	24/02/2006	-27.00	N	POTABLE	0.05	Y	UC	
2	56.00		GRAV - Gravel	24/02/2006	-52.00	N	POTABLE	0.23	Y	UC	

Pump Tests Part 1 1 records for RN 133759

Pipe	Date	Rec	RN of Pumped Bore	Top (m)	Bottom (m)	Dist (m)	Meth	Test Types	Pump Type	Suction Set (m)	Q Prior to Test (l/s)	Dur of Q PR (mins)	Pres on Arriv (m)	Q on Arriv (l/s)
A	24/02/2006	1	133759				PUM		AIR	59.60				

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From Year:

Pump Tests Part 2

1 records for RN 133759

Pipe	Date	Rec	Test Dur (mins)	SWL(m)	Recov Time (mins)	Resid DD (m)	Max DD or P RED (m)	Q at Max DD (l/s)	Time to Max DD (mins)	Max Q (l/s)	Calc Stat HD (m)	Design Yield (l/s)	Design BP (m)	Suct. Set (m)	Tmsy (m2/Day)	Stor
A	24/02/2006	1	60	-8.00			51.00					0.29		59.60		

Bore Conditions

0 records for RN 133759

Elevations

0 records for RN 133759

Water Analysis Part 1

0 records for RN 133759

Water Analysis Part 2

0 records for RN 133759

Water Levels

0 records for RN 133759

Wire Line Logs

0 records for RN 133759

Field Measurements

0 records for RN 133759

Special Water Analysis

0 records for RN 133759

From Year:

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Report Date: 02/04/2019 09:25

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
134769	Sub-Artesian Facility	Abandoned and Destroyed	22/01/2007	Brisbane	6250 - REDLAND
Details			Location		
Description			Latitude	27-33-35	Basin 1450
Parish	947 - CAPALABA		Longitude	153-12-38	Sub-area
Original Name			GIS Latitude	-27.5597172	Lot 10
			GIS Longitude	153.2106523	Plan RP123875
			Easting	520795	
			Northing	6951551	Map Scale
Driller Name	SCHUMACHER, EVAN L		Zone	56	Map Series
Drill Company	DRILLPOWER		Accuracy	GPS	Map No
Const Method	ROTARY AIR		GPS Accuracy	10	Map Name
Bore Line			Checked	Yes	Prog Section
D/O File No		Polygon			
R/O File No		Equipment			
H/O File No		RN of Bore Replaced			
Log Received Date	01/03/2007	Data Owner			
Roles	Water Supply				

Casing									2 records for RN 134769
Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)	
A	22/01/2007	1	5.00	54.00	Cuttings or other fill between casing and hole wall				
A	22/01/2007	2	0.00	5.00	Grout				200

Strata Logs					6 records for RN 134769
Rec	Top (m)	Bottom (m)	Strata Description		

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.00	SANDY TOP SOIL
2	1.00	5.00	HARD RED CLAY
3	5.00	8.00	RED SANDSTONE
4	8.00	15.00	WHITE CLAY
5	15.00	35.00	GREY SANDSTONE
6	35.00	54.00	GREY SHALE CLAY

Stratigraphies 0 records for RN 134769**Aquifers** 0 records for RN 134769**Pump Tests Part 1** 0 records for RN 134769**Pump Tests Part 2** 0 records for RN 134769**Bore Conditions** 0 records for RN 134769**Elevations** 0 records for RN 134769**Water Analysis Part 1** 0 records for RN 134769**Water Analysis Part 2** 0 records for RN 134769**Water Levels** 0 records for RN 134769**Wire Line Logs** 0 records for RN 134769**Field Measurements** 0 records for RN 134769**Special Water Analysis** 0 records for RN 134769

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Report Date: 18/06/2019 08:47

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
145366	Sub-Artesian Facility	Abandoned and Destroyed	21/09/2007	Brisbane	6250 - REDLAND
Details			Location		
Description			Latitude	27-33-22	Basin 1450
Parish	947 - CAPALABA		Longitude	153-12-24	Sub-area
Original Name			GIS Latitude	-27.5560314	Lot 30
			GIS Longitude	153.2065411	Plan RP230530
			Easting	520390	
Driller Name	STEVEN MATHAMS		Northing	6951960	Map Scale
Drill Company	DRILLPOWER		Zone	56	Map Series
Const Method	ROTARY AIR		Accuracy		Map No
Bore Line			GPS Accuracy		Map Name
D/O File No	Polygon		Checked	Yes	Prog Section
R/O File No	Equipment				
H/O File No	RN of Bore Replaced				
Log Received Date	05/10/2007	Data Owner			
Roles	Water Supply				

Casing 2 records for RN 145366

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	21/09/2007	1	0.00	5.00	Grout			
A	21/09/2007	2	5.00	66.00	Cuttings or other fill between casing and hole wall			

Strata Logs 4 records for RN 145366

Rec	Top (m)	Bottom (m)	Strata Description
-----	---------	------------	--------------------

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	7.00	CLAY, RED-WHITE
2	7.00	9.00	COAL SEAM
3	9.00	27.00	SANDSTONE, WHITE
4	27.00	66.00	CLAY, GREY; SANDSTONE

Stratigraphies	0 records for RN 145366
Aquifers	0 records for RN 145366
Pump Tests Part 1	0 records for RN 145366
Pump Tests Part 2	0 records for RN 145366
Bore Conditions	0 records for RN 145366
Elevations	0 records for RN 145366
Water Analysis Part 1	0 records for RN 145366
Water Analysis Part 2	0 records for RN 145366
Water Levels	0 records for RN 145366
Wire Line Logs	0 records for RN 145366
Field Measurements	0 records for RN 145366
Special Water Analysis	0 records for RN 145366

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Report Date: 02/04/2019 09:28

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
152692	Sub-Artesian Facility	Existing	23/05/2014	Brisbane	6250 - REDLAND
Details			Location		
Description			Latitude	27-34-12	Basin 1450
Parish	947 - CAPALABA		Longitude	153-12-29	Sub-area
Original Name			GIS Latitude	-27.56999514	Lot 125
			GIS Longitude	153.208041	Plan RP86470
			Easting	520536	
			Northing	6950413	Map Scale 253 - 1: 25 000
Driller Name	BEIL, GARRY IAN		Zone	56	Map Series M - Metric Series
Drill Company	JUST DRILLING		Accuracy	GPS	Map No 9542-41
Const Method	ROTARY AIR		GPS Accuracy	10	Map Name
Bore Line			Checked	Yes	Prog Section
D/O File No	Polygon				
R/O File No	Equipment				
H/O File No	RN of Bore Replaced				
Log Received Date	19/06/2014	Data Owner			
Roles	Water Supply				

Casing 5 records for RN 152692

Pipe	Date	Rec	Top (m)	Bottom (m)	Material Description	Mat Size (mm)	Size Desc	Outside Diameter (mm)
A	23/05/2014	1	0.00	54.00	Polyvinyl Chloride	5.000	WT - Wall Thickness	125
A	23/05/2014	2	36.00	42.00	Perforated or Slotted Casing	1.000	AP - Aperture Size	125
A	23/05/2014	3	48.00	54.00	Perforated or Slotted Casing	1.000	AP - Aperture Size	125
X	23/05/2014	4	0.00	5.00	Grout			175
X	23/05/2014	5	5.00	54.00	Gravel Pack	5.000	GR - Gravel Size	175

From Year:

Strata Logs

11 records for RN 152692

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	1.00	TOPSOIL
2	1.00	4.00	BROWN CLAY
3	4.00	6.00	SANDY LOAM
4	6.00	12.00	SANDY LOAM
5	12.00	18.00	GREY SANDSTONE & COAL LAYERS
6	18.00	24.00	GREY SANDSTONE
7	24.00	30.00	GREY SANDSTONE
8	30.00	36.00	GREY SANDSTONE
9	36.00	42.00	DECOMPOSED SANDSTONE WITH SOME WATER
10	42.00	48.00	DECOMPOSED SANDSTONE WITH MORE WATER
11	48.00	54.00	GREY SANDSTONE

Stratigraphies

2 records for RN 152692

Source	Rec	Top (m)	Bottom (m)	Strata Description
DNR	1	0.00	12.00	QUATERNARY - UNDEFINED
DNR	2	12.00	54.00	NERANLEIGH-FERNVALE BEDS

Aquifers

1 records for RN 152692

Rec	Top (m)	Bottom (m)	Lithology	Date	SWL (m)	Flow	Quality	Yield (L/s)	Contr	Cond	Formation Name
1	48.00		XXXX - Unknown	23/05/2014	-12.00	N	POTABLE	0.50	Y	FR	NERANLEIGH-FERNVALE BEDS

Pump Tests Part 1

0 records for RN 152692

Pump Tests Part 2

0 records for RN 152692

Report Date: 02/04/2019 09:28

Queensland Government
Groundwater Information
Bore Report

Page: 3 of 4
GWDB8250

From Year:

Bore Conditions 0 records for RN 152692

Elevations 0 records for RN 152692

Water Analysis Part 1 0 records for RN 152692

Water Analysis Part 2 0 records for RN 152692

Water Levels 1 records for RN 152692

Pipe	Date	Time	Measure (m)	Meas	Point	Remark	Meas	Type	Coll Auth	Coll	Method	Project	Quality
A	23/05/2014		-12.00	R	Reference Point		NR	Not Recorded	NR	NR	Not Recorded		130 Data is of unknown quality

Wire Line Logs 0 records for RN 152692

Field Measurements 0 records for RN 152692

Special Water Analysis 0 records for RN 152692

From Year:

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From Year:

Registered Number	Facility Type	Facility Status	Drilled Date	Office	Shire
79904	Sub-Artesian Facility	Existing	03/01/1996	Brisbane	6250 - REDLAND
Details			Location		
Description			Latitude	27-33-38	Basin1450
Parish	947 - CAPALABA		Longitude	153-12-40	Sub-area
Original Name			GIS Latitude	-27.56052095	Lot48
			GIS Longitude	153.2110123	PlanRP201982
			Easting	520841	
Driller Name	P.COX		Northing	6951458	Map Scale253 - 1: 25 000
Drill Company	COX DRILLING		Zone	56	Map SeriesM - Metric Series
Const Method	ROTARY		Accuracy	INSP	Map No9542-41
Bore Line			GPS Accuracy		Map Name
D/O File No	1	Polygon	Checked	Yes	Prog Section
R/O File No		Equipment			
H/O File No		RN of Bore Replaced			
Log Received Date		Data Owner			
Roles	Water Supply				

Casing 0 records for RN 79904

Strata Logs 7 records for RN 79904

Rec	Top (m)	Bottom (m)	Strata Description
1	0.00	9.00	COLOURED SANDSTONE
2	9.00	24.00	GREY SANDSTONE
3	24.00	36.00	BLACK SHALE
4	36.00	51.00	GREY SHALE

From Year:

Rec	Top (m)	Bottom (m)	Strata Description
5	51.00	53.00	BLACK SHALE
6	53.00	64.00	WATER BEARING SHALE
7	64.00	66.00	GREY ROCK

Stratigraphies	0 records for RN 79904
Aquifers	0 records for RN 79904
Pump Tests Part 1	0 records for RN 79904
Pump Tests Part 2	0 records for RN 79904
Bore Conditions	0 records for RN 79904
Elevations	0 records for RN 79904
Water Analysis Part 1	0 records for RN 79904
Water Analysis Part 2	0 records for RN 79904
Water Levels	0 records for RN 79904
Wire Line Logs	0 records for RN 79904
Field Measurements	0 records for RN 79904
Special Water Analysis	0 records for RN 79904

From Year:

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APPENDIX F:
Quotation for Groundwater Monitoring
Bore Installation



ABN 52 112 248 530



ABN 92 146 427 545

Simmonds & Bristow
Email; FionaM@simmondsbristow.com.au

28th May, 2019

Dear Fiona,

Thank you for your invitation to provide rates for drilling and groundwater well installation at Sheldon.

We understand the scope of work includes 2-3 boreholes to nominal 30m depth.

Drilling will be carried out using 120mm diameter rotary air. Should unstable surface materials be encountered, 125mm diameter sacrificial PVC pre-collar will be used.

Monitoring wells would be installed using 50mm Class 18 PVC in accordance with *Minimum Construction Requirements for Water Bores in Australia, Edition 3 (2012)*.

We can provide either a truck or track mounted rig depending on available access and subject to availability at the time of the work. All rigs and support vehicles are equipped with standard safety equipment and carry full H&S documentation and maintenance records.

Our drillers are highly experienced in geotechnical environment drilling and have, as a minimum, Cert III in drilling, Qld drillers licence, construction industry white card and fit for work medical.

Attached are our rates for the proposed drilling. We would carry out the drilling on a daily rate basis and would expect to complete the work in 2 days assuming drive on access and no unforeseen delays.

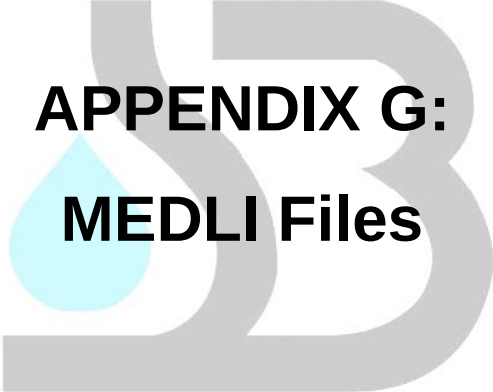
Should you have any questions or require any further information please do not hesitate to contact us.

Kind regards

Julian Irons

**Schedule of Rates
Simmonds & Bristow - Sheldon
May 2019**

Mob/demob, travel & accommodation	
Mobilise rig, equipment & crew	\$500
Accommodation and meals	Not applicable
Drilling	
Daily Rate – Drilling Rotary air to nominal 30m depth	\$4000 per day (Based on 10hr day)
Standby Rate – inductions, inspections, audits, access or other delays, client request etc	\$325 per hour
Consumables	
Standard drilling consumables – fuel, muds, normal bit wear etc	Included in day rate
125mm PVC pre-collar (if required)	\$30 per meter
Monitoring well materials – Class 18 PVC, gravel pack, bentonite seals and grout backfill	\$45 per meter
Lockable well cover	\$150 each
Other materials for hole completion and reinstatement if required	Cost + 10%
Other Services	
Creation of access, service location, traffic management, spoil containment & disposal, reinstatement etc	Cost + 10%
All equipment lost or damaged due to adverse ground conditions and/or unforeseen circumstances will be replaced or repaired at the Client's expense All prices are exclusive of GST – Valid for 3 months only	



APPENDIX G:

MEDLI Files

Title:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Climate data location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days

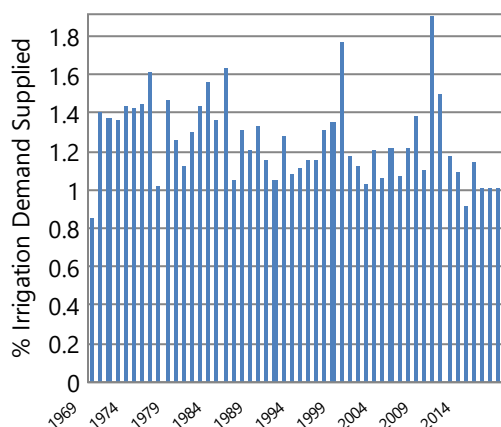
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	6602.3
Annual irrigation predicted for defined scenario (mm/year)	660.2
Average annual irrigation demand supplied (fraction)	1.2

Or for 1.50 ha: **8122 kL/year**

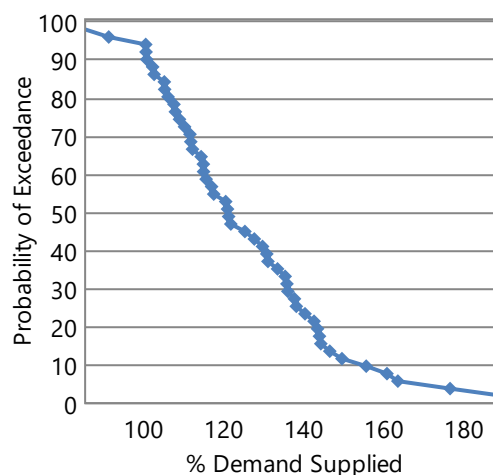
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



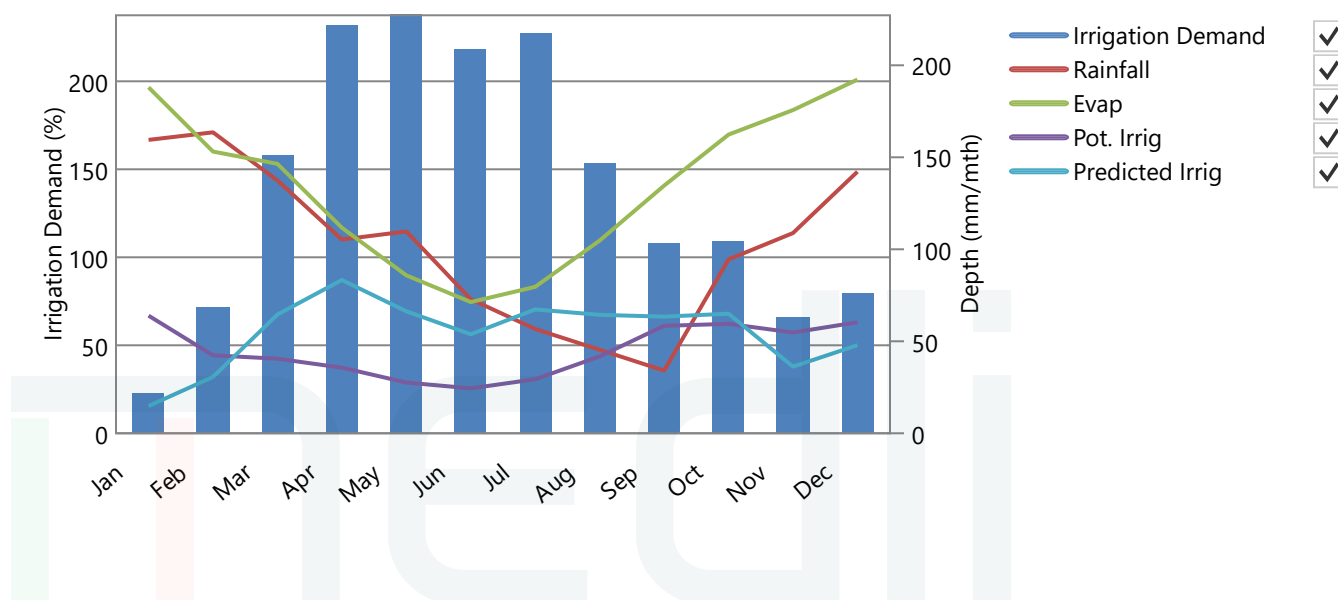
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

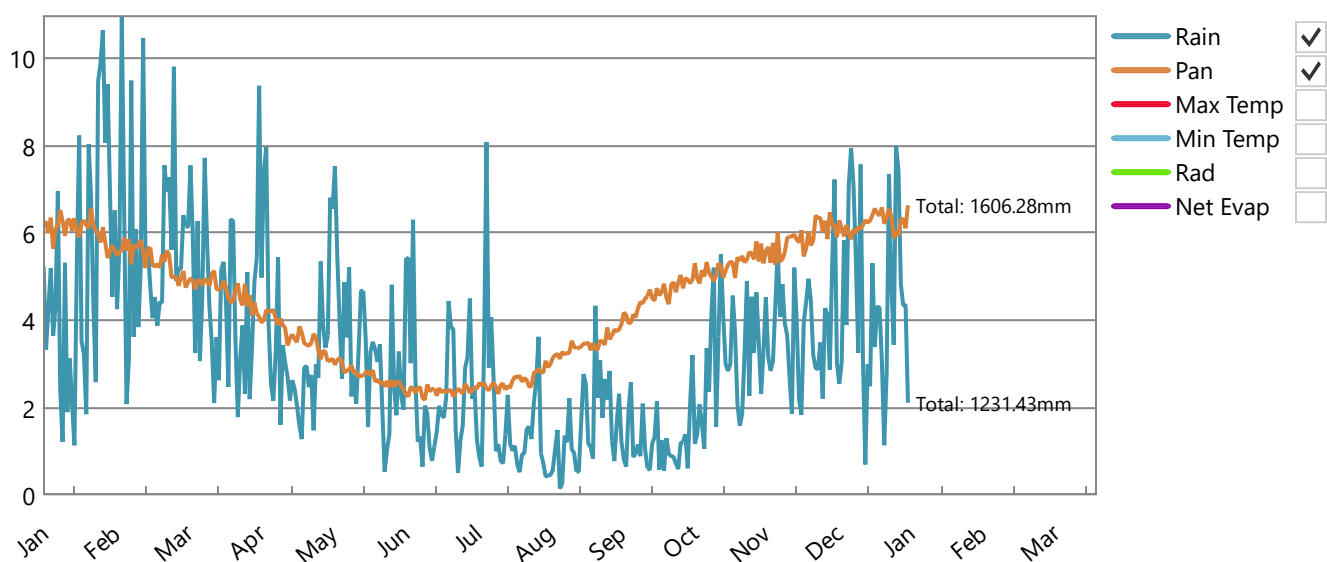
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



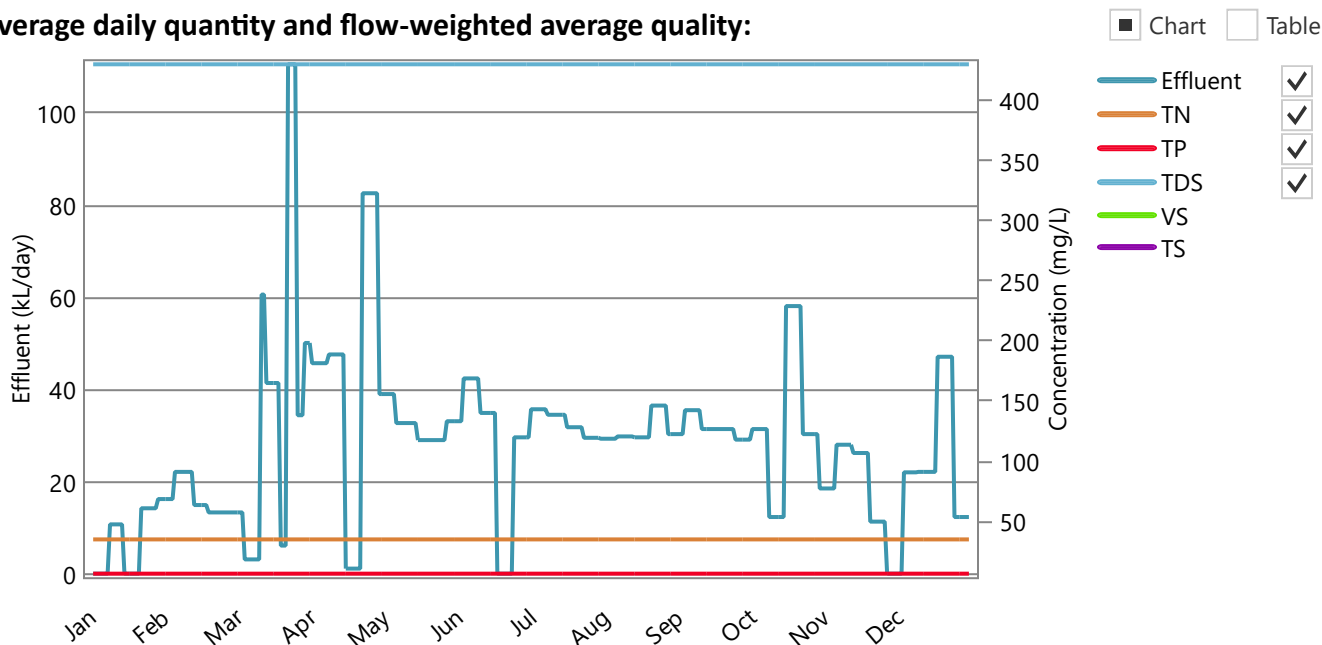
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **10158.05 kL/year** or 27.81 kL/day (Min-Max: 0.00 - 110.60)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	355.53 (355.43 - 355.86)
Total Phosphorus	6.50 (0.00 - 6.50)	66.03 (66.01 - 66.09)
Total Dissolved Salts	430.00 (0.00 - 430.00)	4367.96 (4366.69 - 4371.98)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

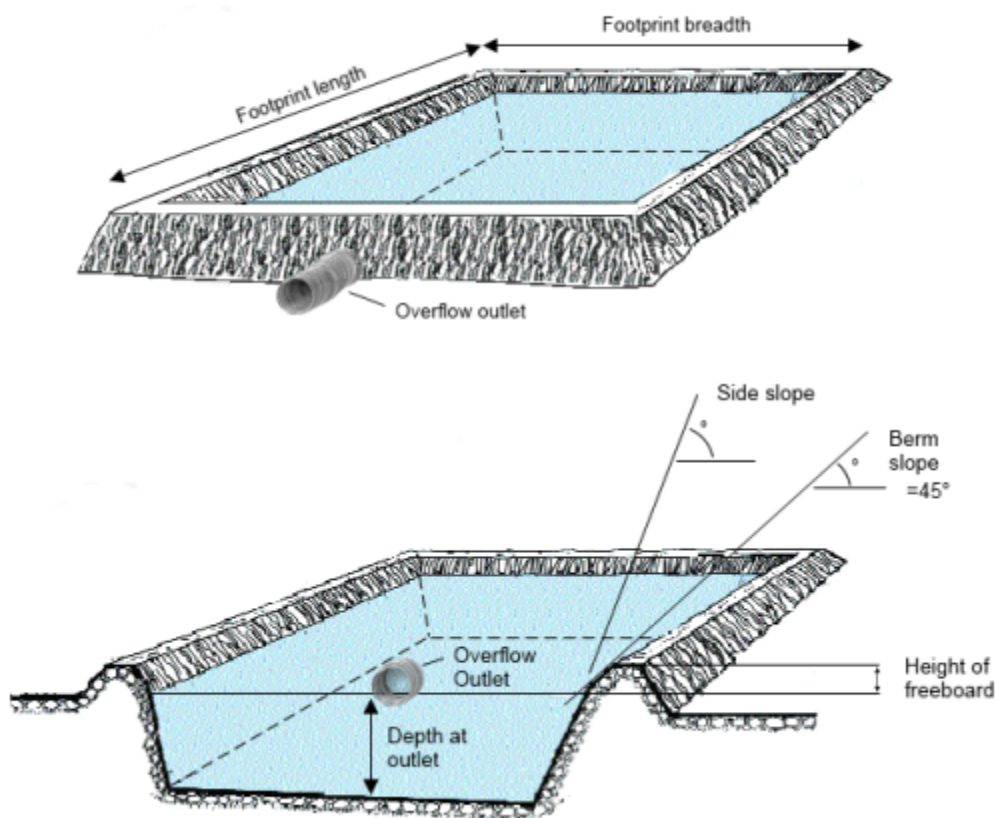
DESCRIPTION

medli

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	3.06



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

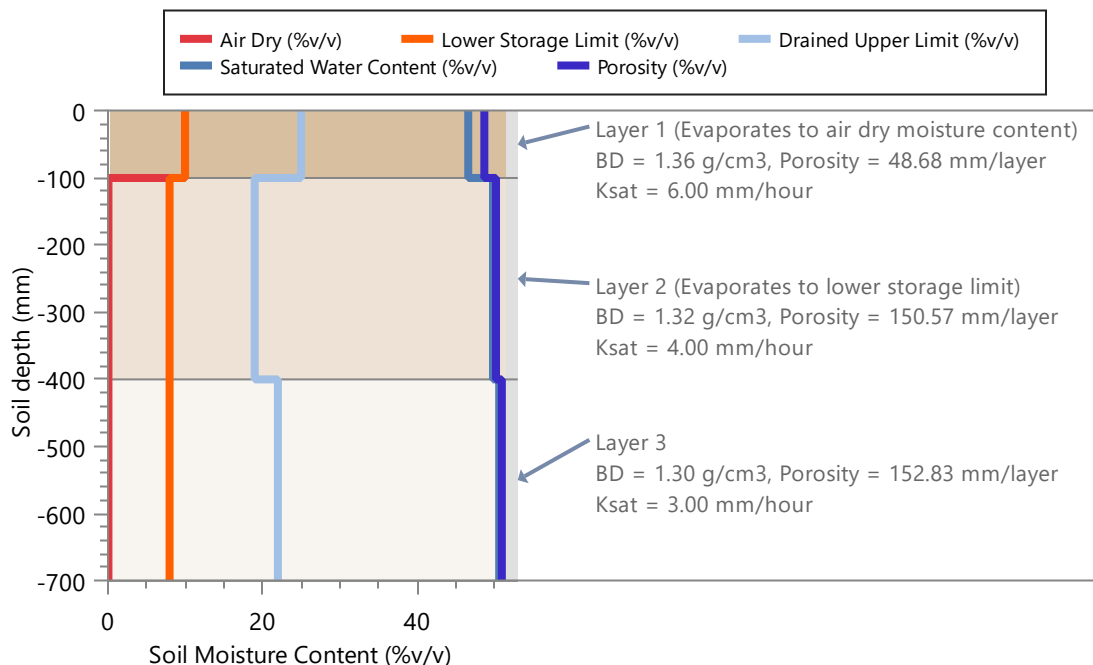
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

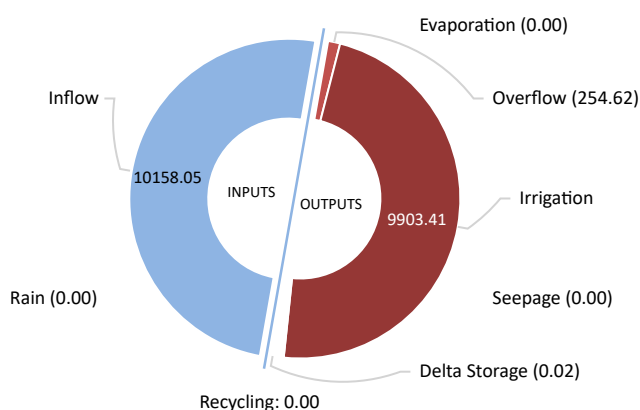
Average monthly cover (fraction) (minimum - maximum)	0.65 (0.63 - 0.67)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

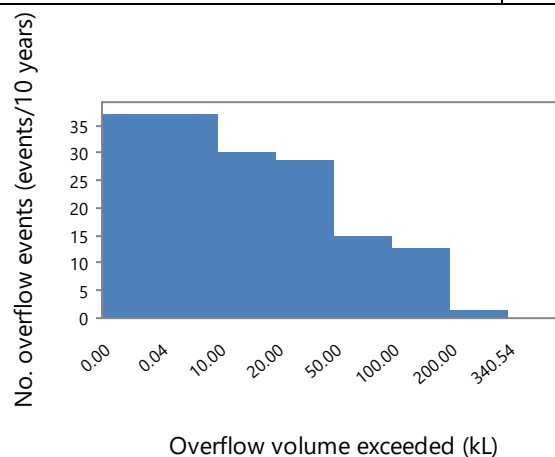
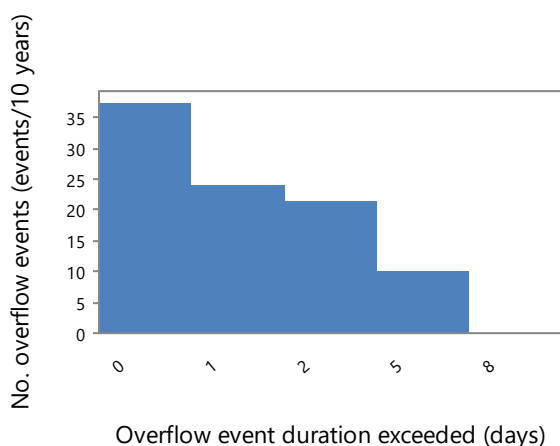
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	10158.05
Recycling	0.00
Evaporation	0.00
Overflow	254.62
Irrigation	9903.41
Seepage	0.00
Delta Storage	0.02

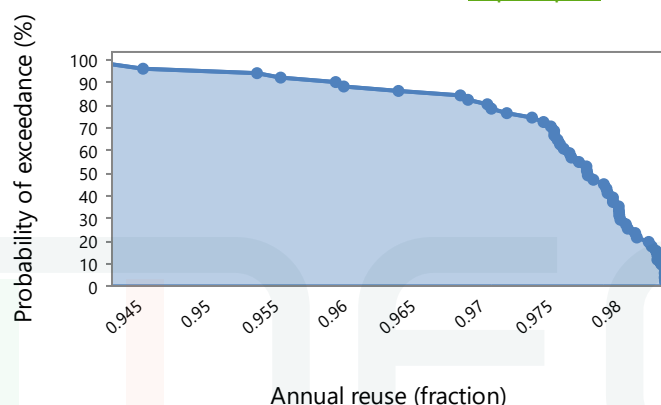
Overflow Diagnostics

Volume of overflow (kL/year)	254.62
No. days pond overflows (days/year)	12.54
Average duration of overflow (days)	3.37
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.97
Probability of at least 90% reuse (fraction)	1.00



[Export plot](#)

[Export plot](#)

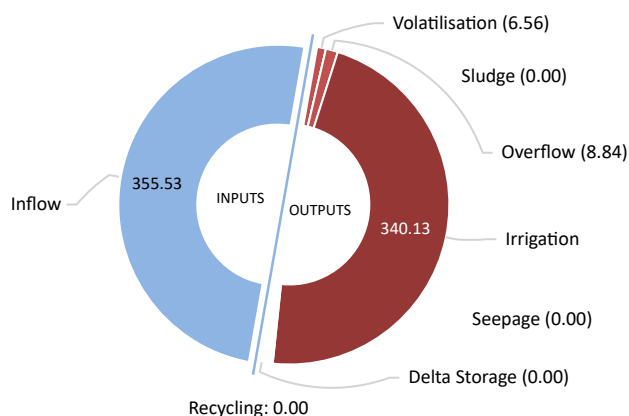


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

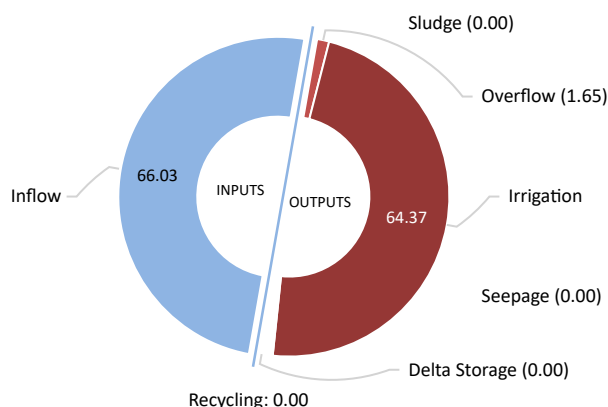
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



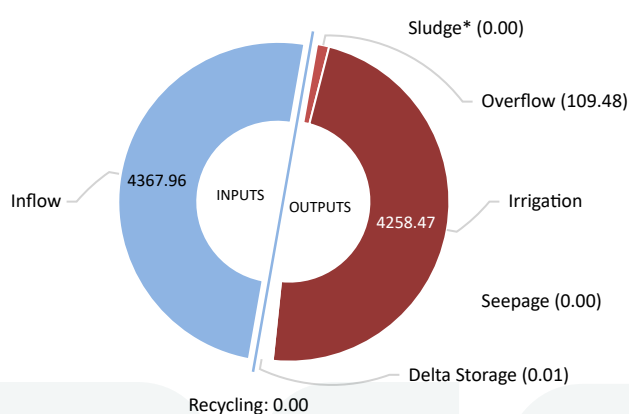
Name	Value
Inflow	355.53
Recycling	0.00
Volatilisation	6.56
Sludge	0.00
Overflow	8.84
Irrigation	340.13
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	66.03
Recycling	0.00
Sludge	0.00
Overflow	1.65
Irrigation	64.37
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	4367.96
Recycling	0.00
Sludge*	0.00
Overflow	109.48
Irrigation	4258.47
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	27.44
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.16
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

medli

Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	9903.41
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	9903.41
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.34
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.66
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days pond volume below min. vol. for irrigation (fraction)	0.06
Proportion of Days irrigation occurs (fraction)	0.89



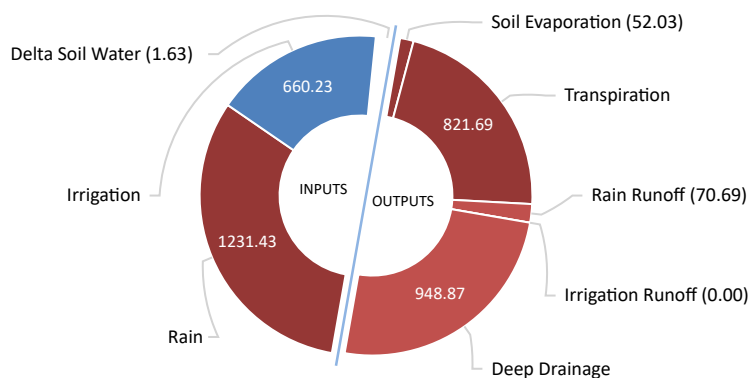
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

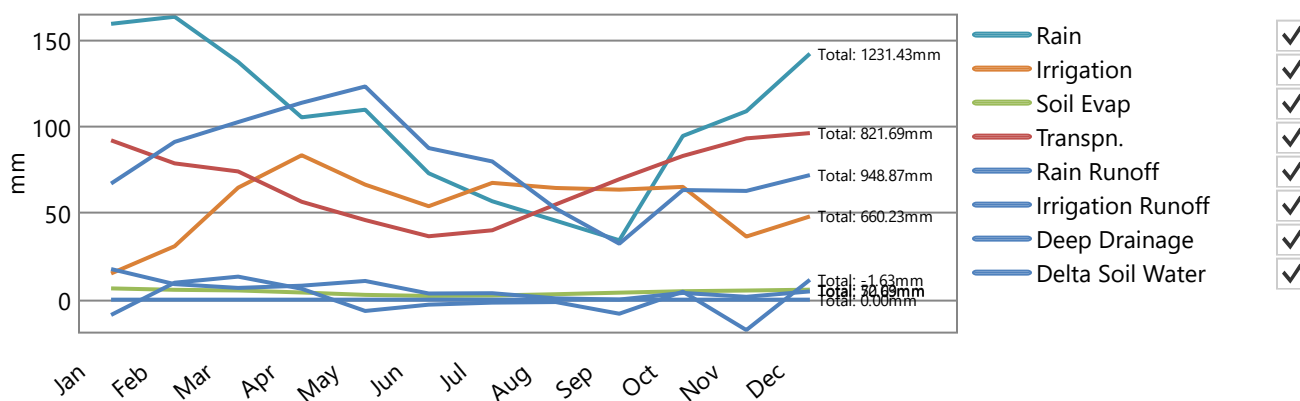
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	660.23
Soil Evaporation	52.03
Transpiration	821.69
Rain Runoff	70.69
Irrigation Runoff	0.00
Deep Drainage	948.87
Delta Soil Water	-1.63

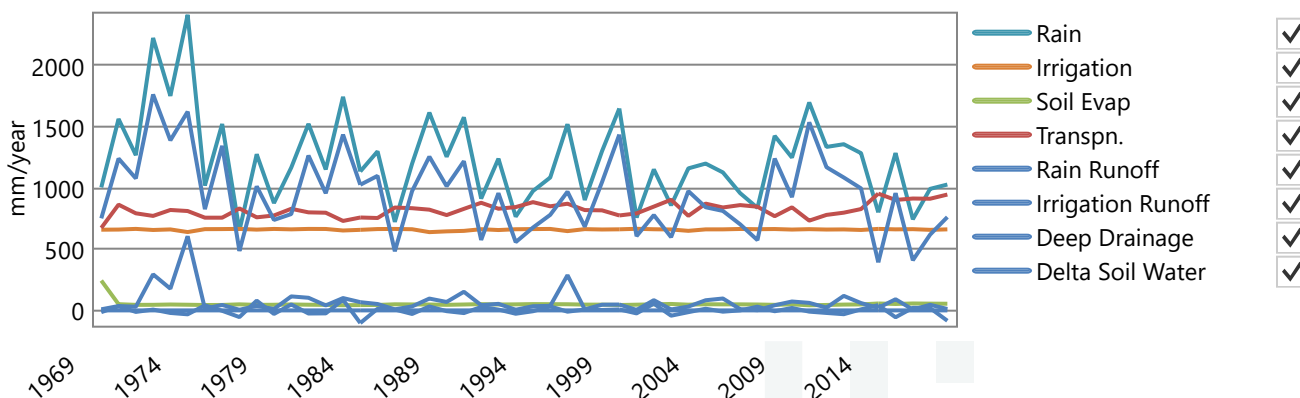
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



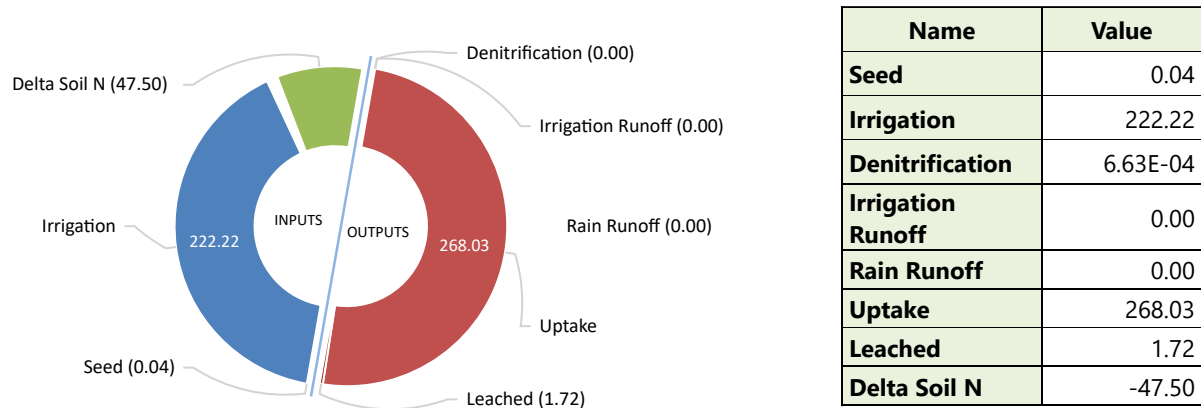
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

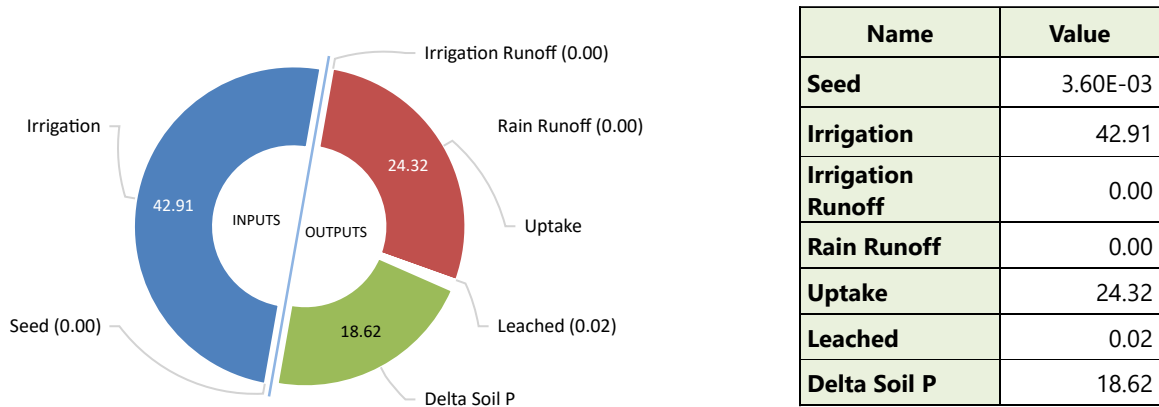
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 4.54
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)



PERFORMANCE

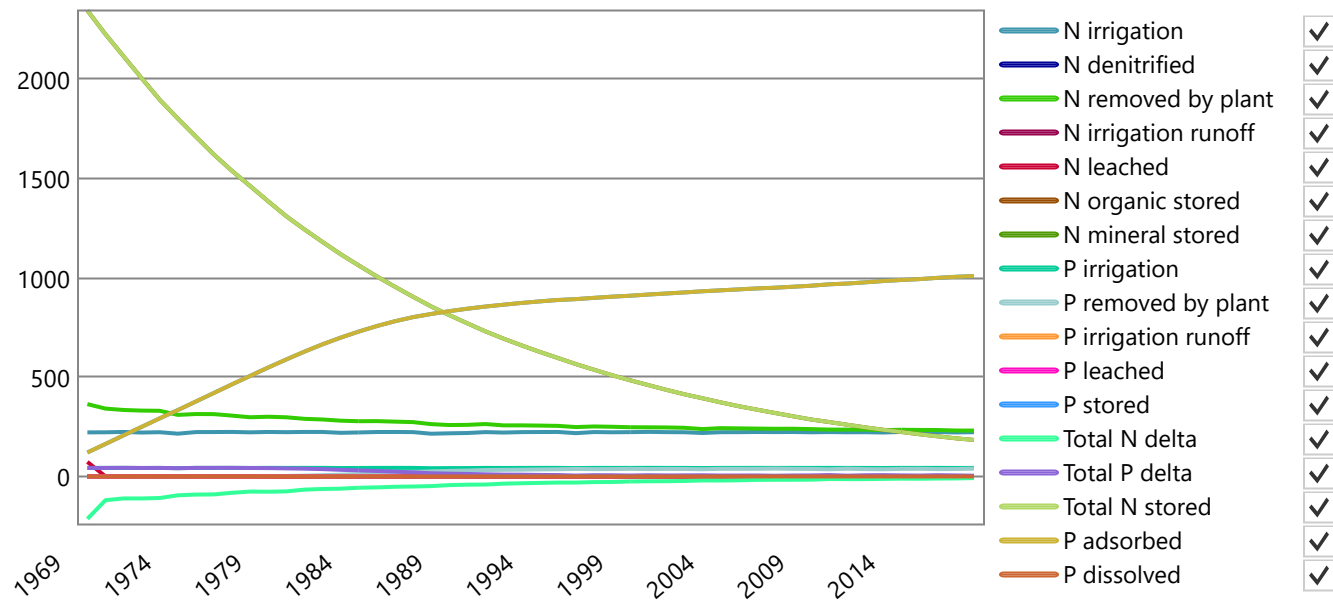


Land Performance - Soil Nutrient

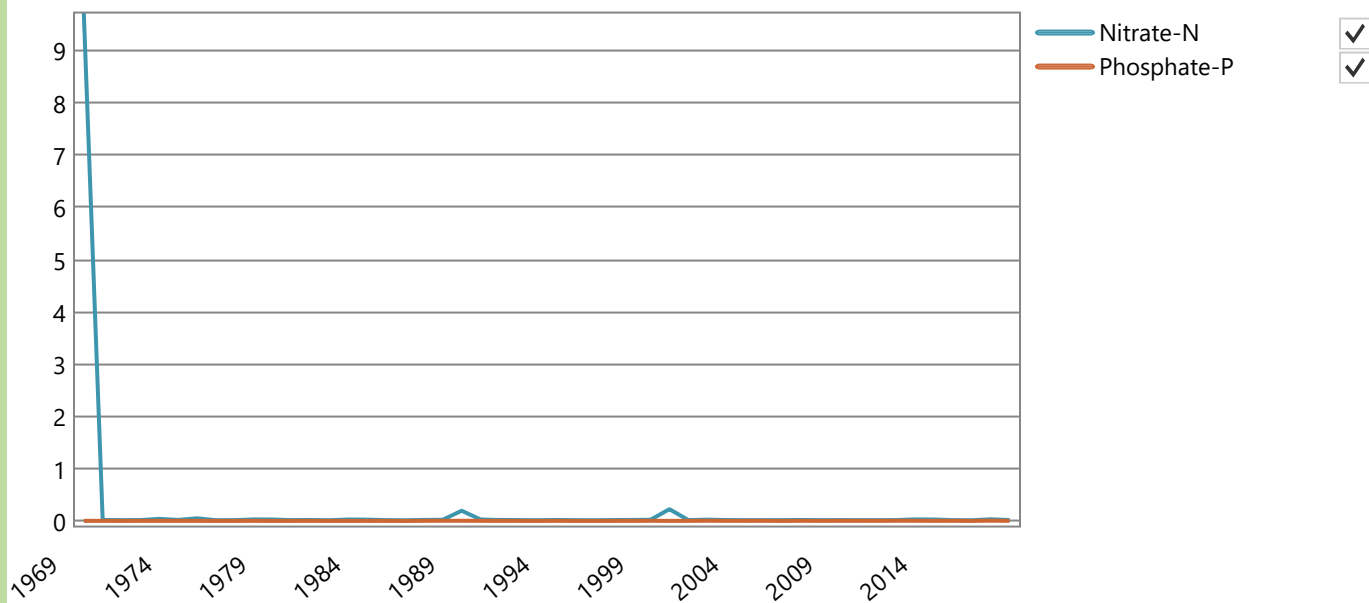
Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

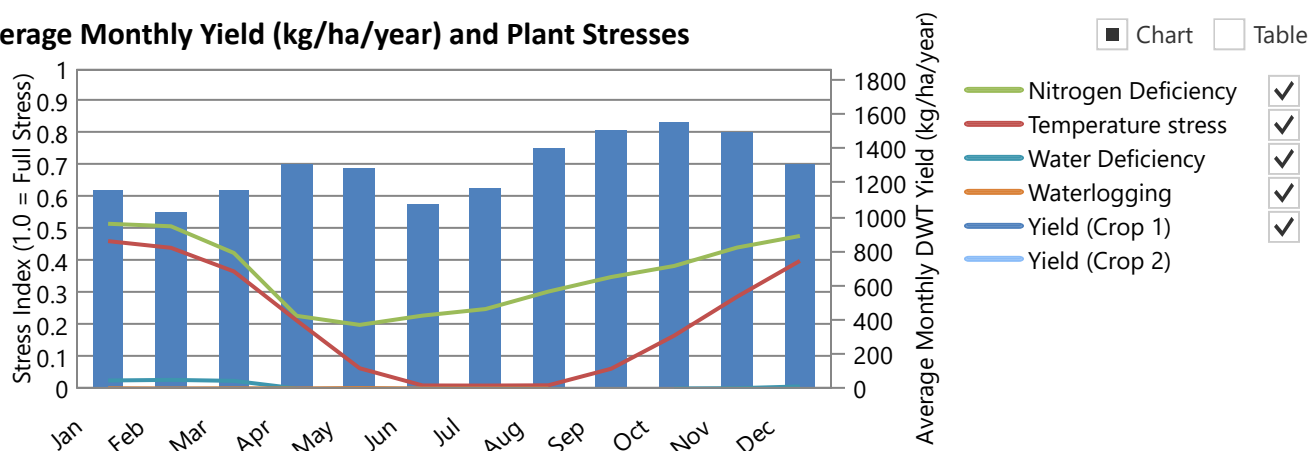
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	15438.47 (13884.54 - 17287.08)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.65 (0.63 - 0.67)
Average monthly root depth (mm) (minimum - maximum)	597.67 (591.08 - 599.98)

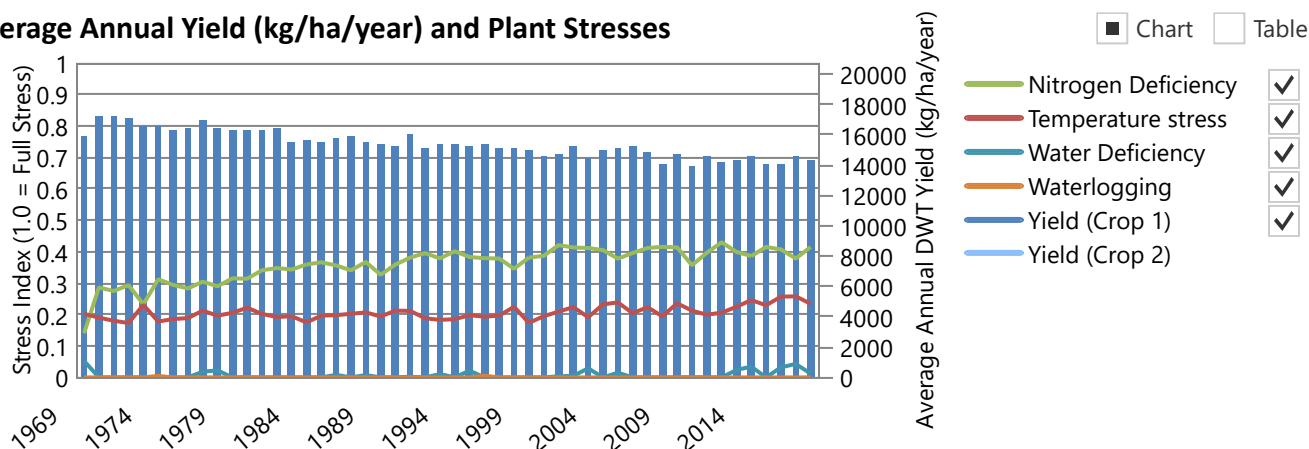
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	268.03 (230.88 - 364.07)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	24.32 (0.00 - 39.57)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 3.98 (normal), 0.02 (forced by crop death due to water stress (0.02))

No. days without crop/year (days/year): 0.16 due to water stress (0.16)



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

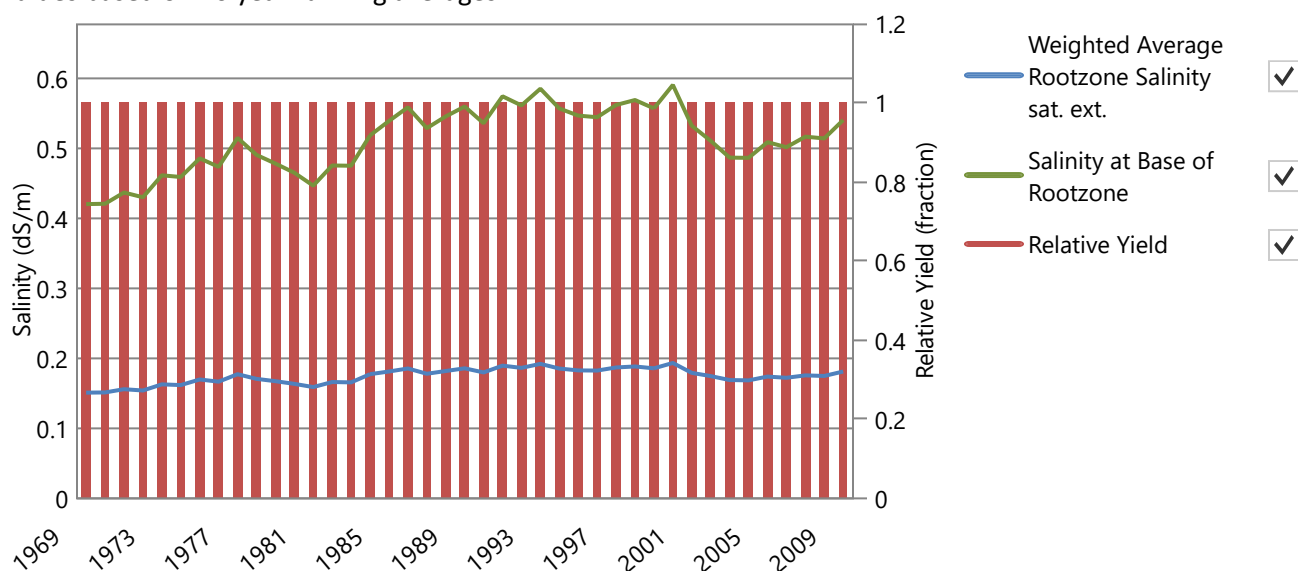
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.26
Salt added by rainfall (kg/ha/year)	222.86
Average annual effluent salt added & leached at steady state (kg/ha/year)	3061.84
Average leaching fraction based on 10 year running averages (fraction)	0.69
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.17
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.51
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



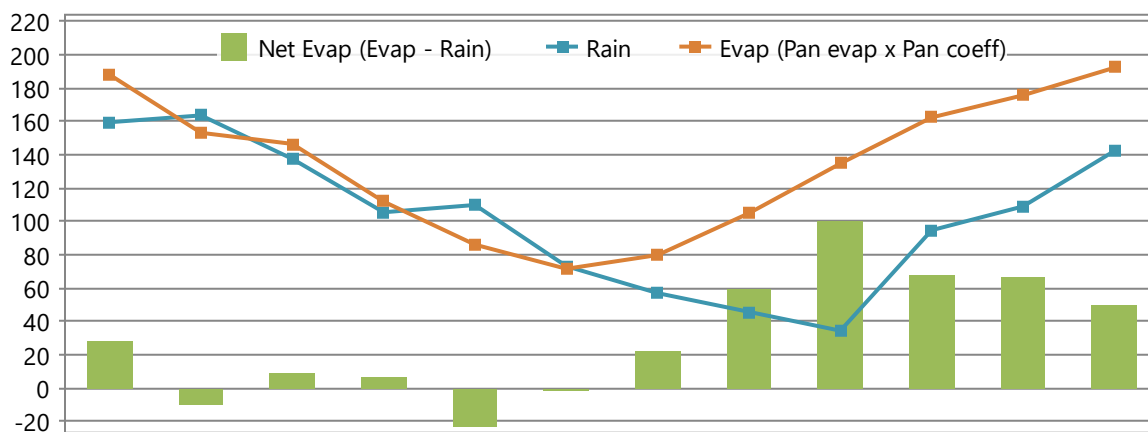
Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

medli

Sustainability Diagnostics:**Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC****Pond System: 1 closed storage tank****New Generic System - 10158.05 kL/year or 27.81 kL/day generated on average****Effluent entering pond system after any pretreatment and recycling**

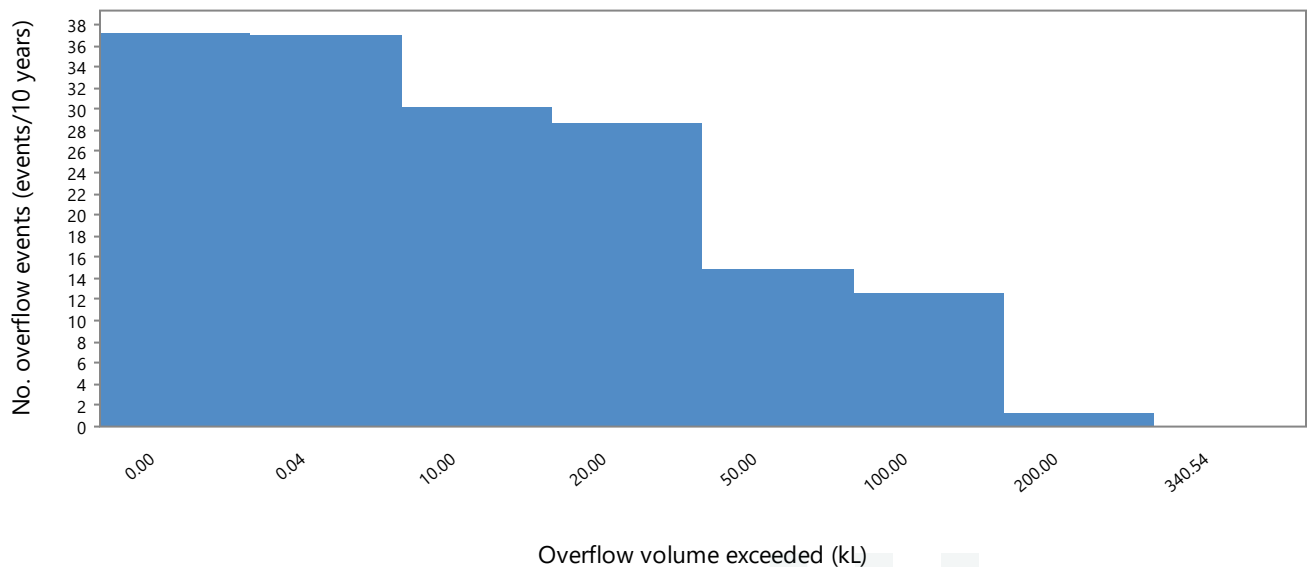
Average (Minimum-Maximum) influent quality calculated for 337.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	355.53 (355.43 - 355.86)
Total Phosphorus	6.50 (0.00 - 6.50)	66.03 (66.01 - 66.09)
Total Dissolved Salts	430.00 (0.00 - 430.00)	4367.96 (4366.69 - 4371.98)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.24
Average volume of overflow (kL/year)	254.62
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	3.70
Average duration of overflow (days)	3.37
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.97
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	7.95

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:
☒ Chart
 ☐ Table
[Export plot](#)

Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	9903.41	6602.27
Total nitrogen applied (kg)	333.32	222.22
Total phosphorus applied (kg)	64.37	42.91
Total salts applied (kg)	4258.47	2838.98

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.11
Proportion of Days irrigation occurs (fraction)	0.89

Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	15.1	30.9	64.7	83.5	66.5	54.0	67.5	64.6	63.6	65.2	36.5	48.1	660.2
Soil Evap	6.5	5.7	5.3	4.1	2.8	2.1	2.4	3.1	4.0	4.9	5.3	5.8	52.0
Transpn.	92.1	78.8	74.1	56.6	46.0	36.7	40.1	55.1	69.6	83.1	93.2	96.3	821.7
Rain Runoff	17.7	9.0	6.8	8.1	10.8	3.6	3.7	0.7	0.1	3.9	1.6	4.8	70.7
Irr. Runoff	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
Drainage	67.1	91.2	102.7	113.8	123.2	87.6	79.9	52.7	32.3	63.4	62.9	72.0	948.9
Delta	-8.9	9.8	13.3	6.3	-6.5	-2.9	-1.7	-1.4	-8.1	4.6	-17.6	11.5	-1.6

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	222.22
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	268.03
Average annual soil nitrogen removed by denitrification (kg/ha/year)	6.63E-04
Average annual soil nitrogen leached (kg/ha/year)	1.72
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.72
Soil organic-N kg/ha (Initial - Final)	2448.00 - 183.79
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.18
Max. annual nitrate-N concentration of deep drainage (mg/L)	9.72

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	42.91
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	24.32
Average annual soil phosphorus leached (kg/ha/year)	0.02
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 1.50E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1008.70
Average phosphate-P concentration in rootzone (mg/L)	3.96E-03
Average phosphate-P concentration of deep drainage (mg/L)	2.59E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.36 mg/L (years)	116.10

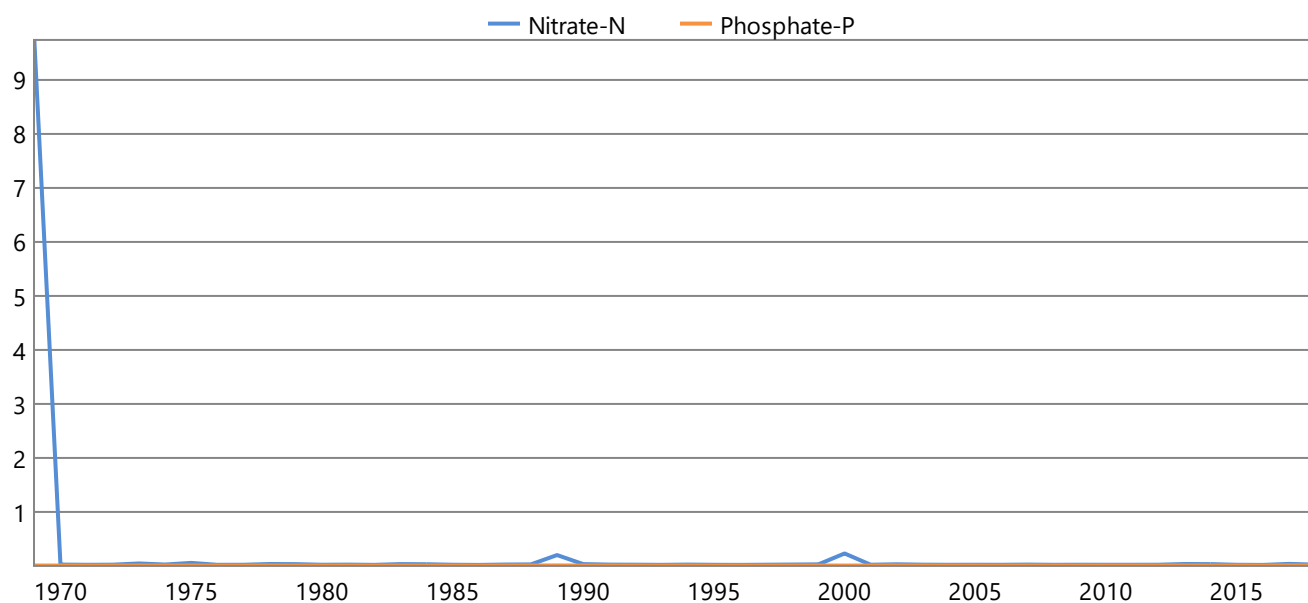
Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

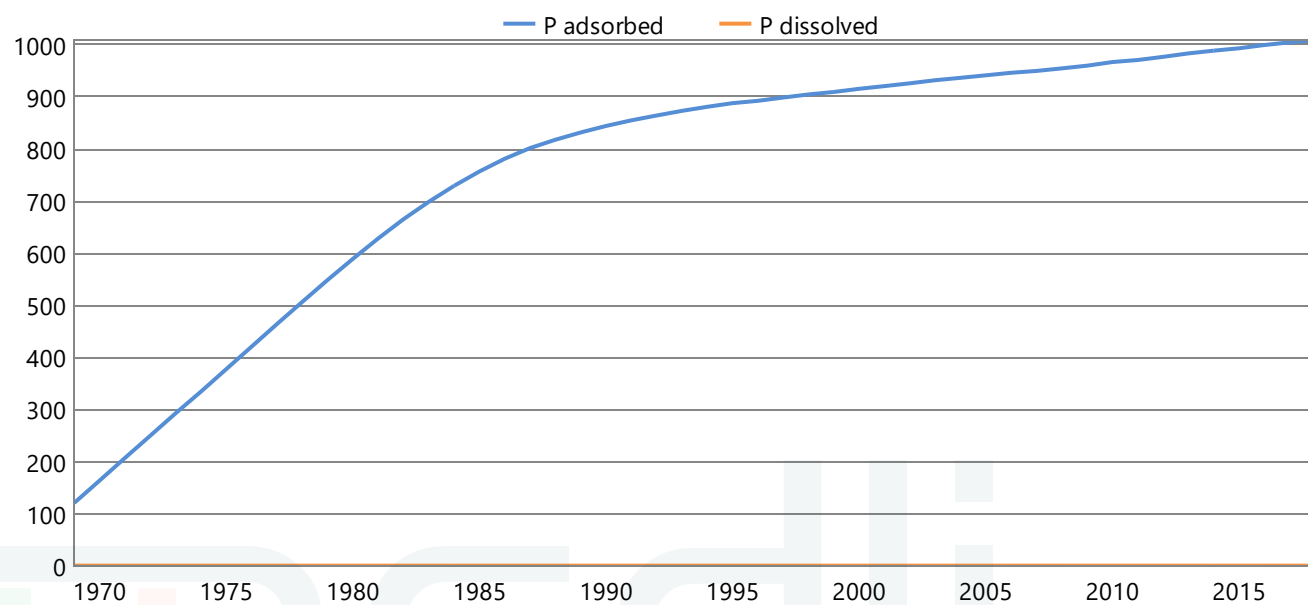
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	15438.47 (13884.54 - 17287.08)
Average monthly plant (green) cover (fraction)	0.65 (0.63 - 0.67)
Average monthly crop factor (fraction)	0.52 (0.51 - 0.54)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	597.67 (591.08 - 599.98)
Average number of normal harvests per year (no./year)	3.98 (3.00 - 5.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.02 (0.00 - 1.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.36 (0.14 - 0.43)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.03)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.16

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.26
Salt added by rainfall (kg/ha/year)	222.86
Average annual effluent salt added & leached at steady state (kg/ha/year)	3061.84
Average leaching fraction based on 10 year running averages (fraction)	0.69
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.17
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.51
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

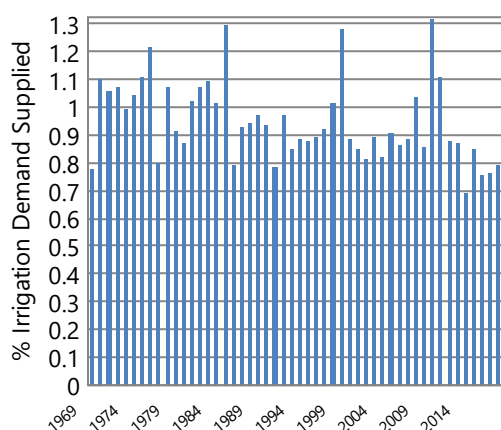
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	6602.3
Annual irrigation predicted for defined scenario (mm/year)	660.2
Average annual irrigation demand supplied (fraction)	0.9

Or for 1.50 ha: 10668 kL/year

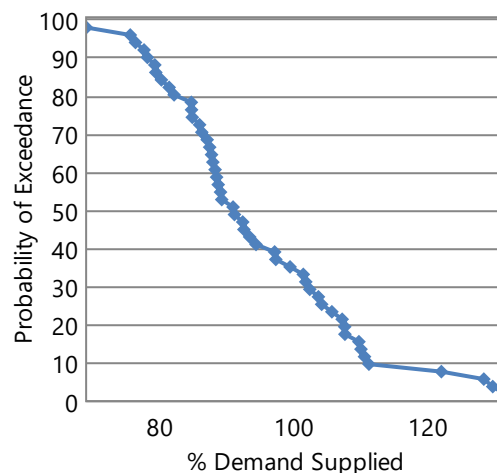
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



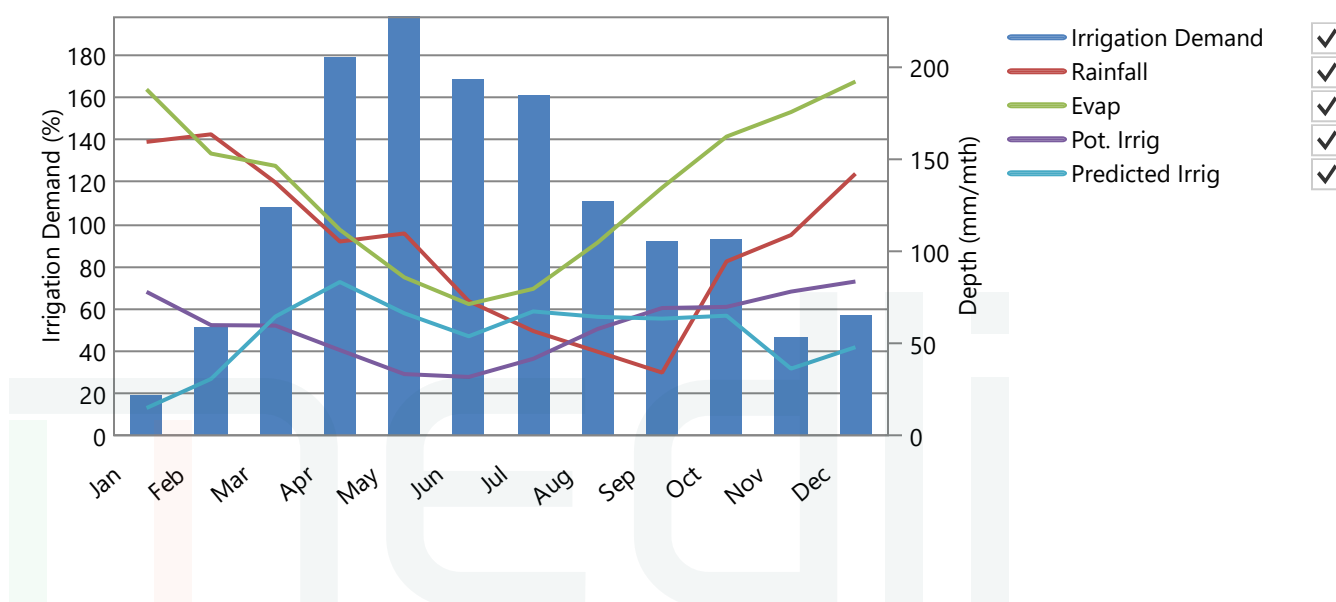
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

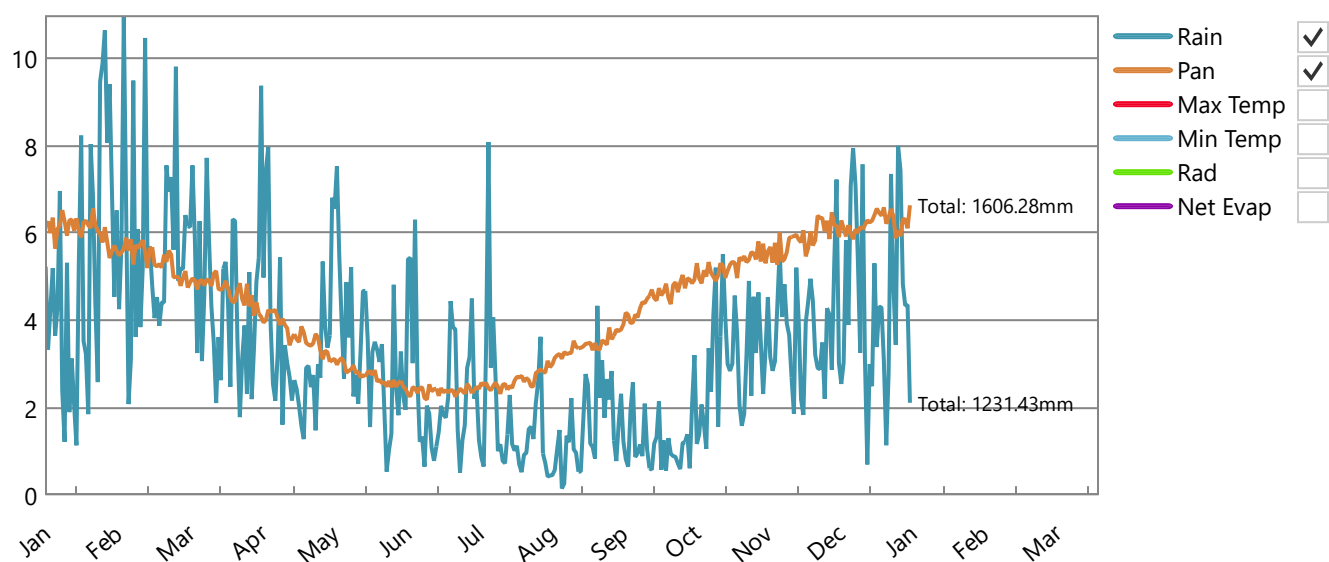
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



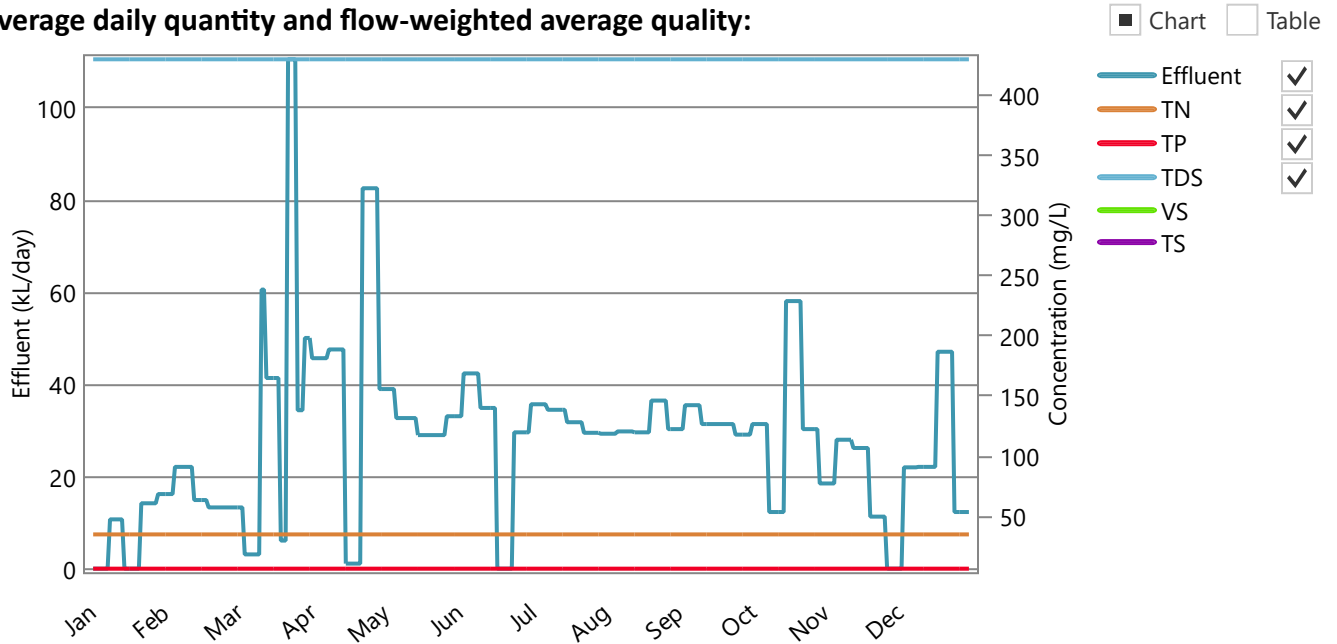
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **10158.05 kL/year** or 27.81 kL/day (Min-Max: 0.00 - 110.60)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	355.53 (355.43 - 355.86)
Total Phosphorus	6.50 (0.00 - 6.50)	66.03 (66.01 - 66.09)
Total Dissolved Salts	430.00 (0.00 - 430.00)	4367.96 (4366.69 - 4371.98)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

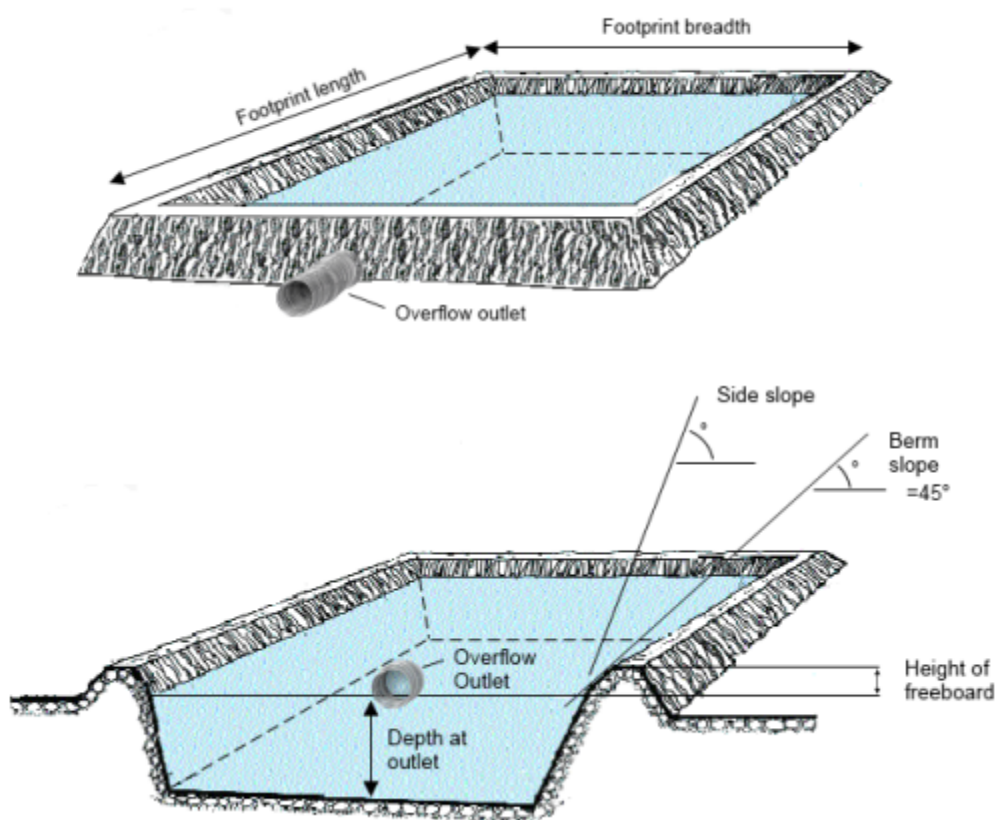
DESCRIPTION

medli

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	3.06



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

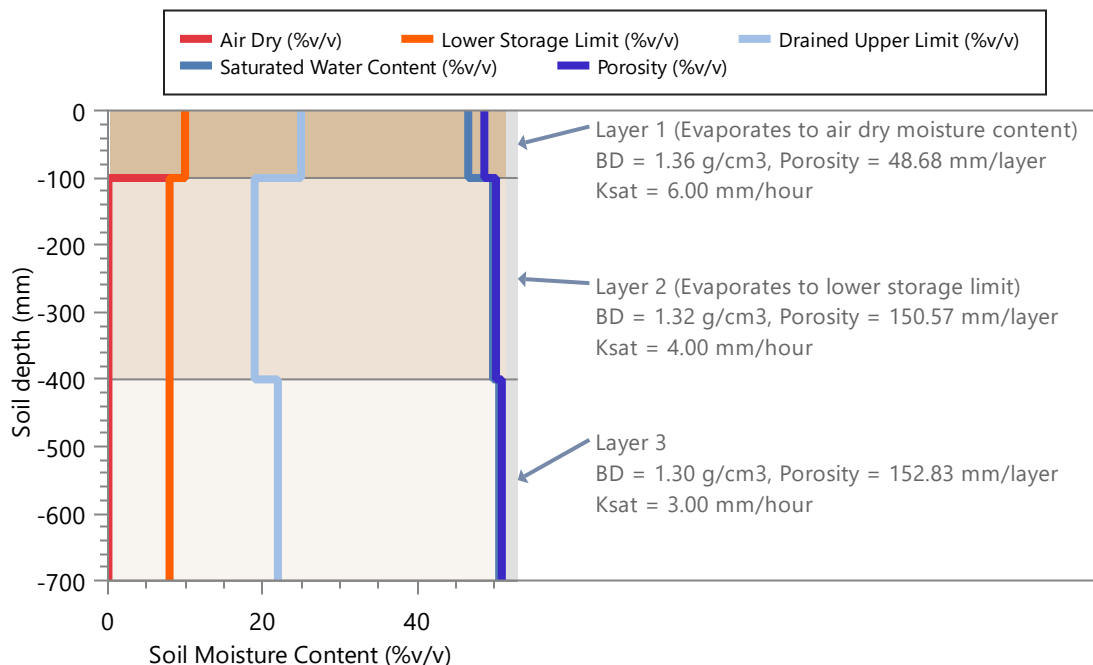
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

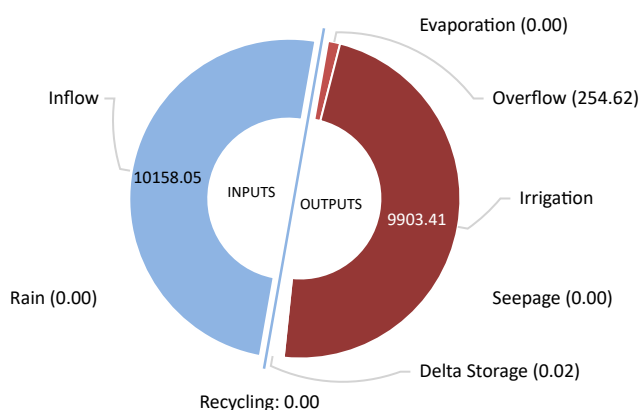
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.83 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

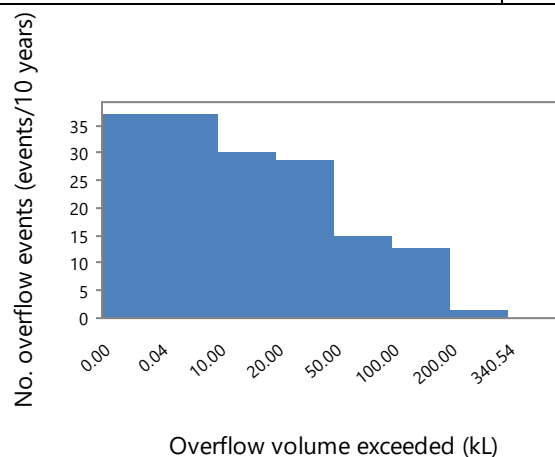
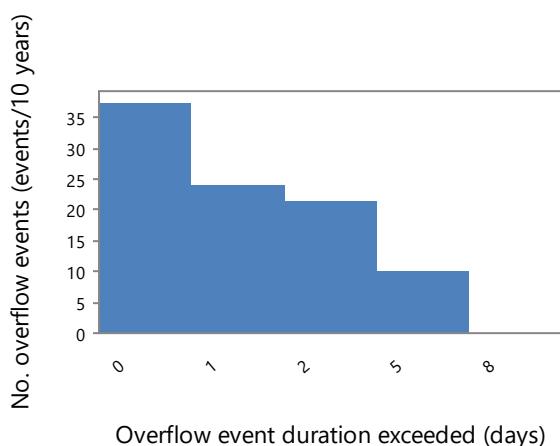
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	10158.05
Recycling	0.00
Evaporation	0.00
Overflow	254.62
Irrigation	9903.41
Seepage	0.00
Delta Storage	0.02

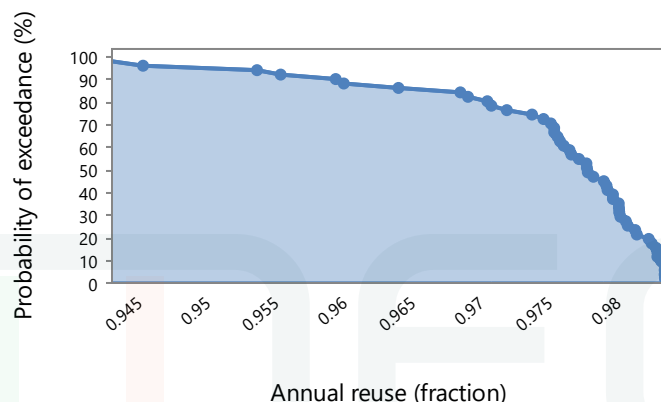
Overflow Diagnostics

Volume of overflow (kL/year)	254.62
No. days pond overflows (days/year)	12.54
Average duration of overflow (days)	3.37
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.97
Probability of at least 90% reuse (fraction)	1.00



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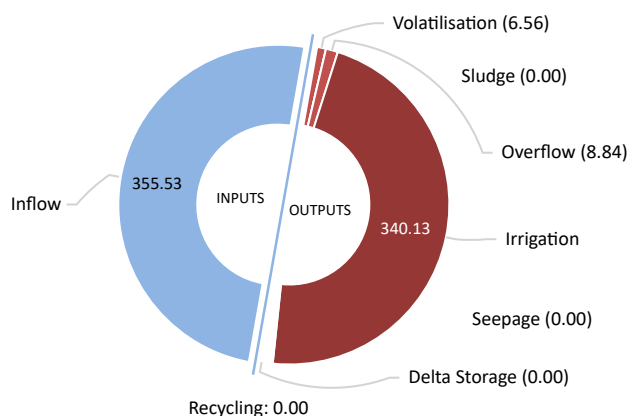


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

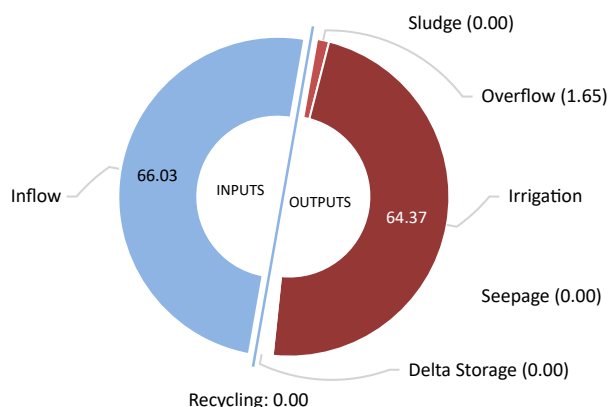
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



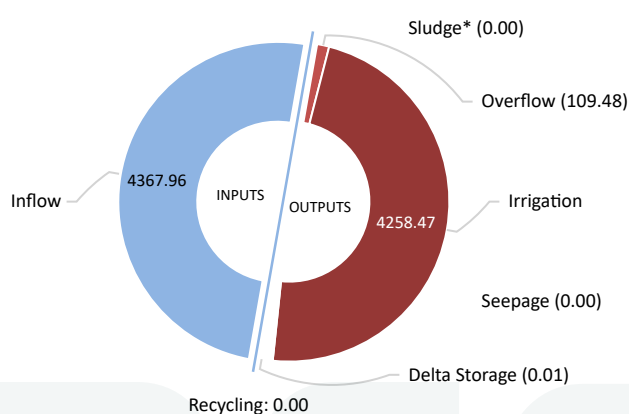
Name	Value
Inflow	355.53
Recycling	0.00
Volatilisation	6.56
Sludge	0.00
Overflow	8.84
Irrigation	340.13
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	66.03
Recycling	0.00
Sludge	0.00
Overflow	1.65
Irrigation	64.37
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	4367.96
Recycling	0.00
Sludge*	0.00
Overflow	109.48
Irrigation	4258.47
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	27.44
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.16
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	9903.41
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	9903.41
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.34
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.66
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days pond volume below min. vol. for irrigation (fraction)	0.06
Proportion of Days irrigation occurs (fraction)	0.89

PERFORMANCE

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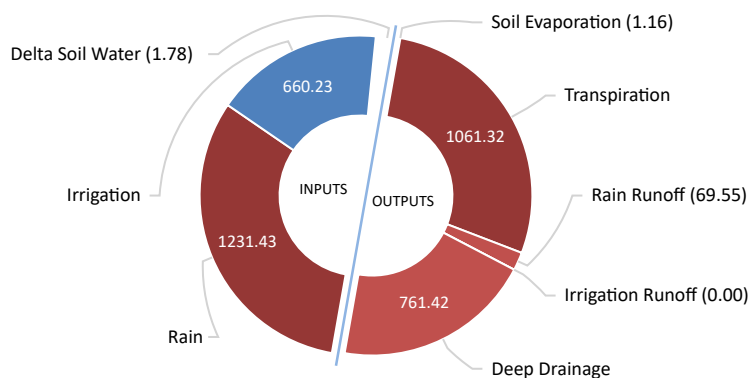
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

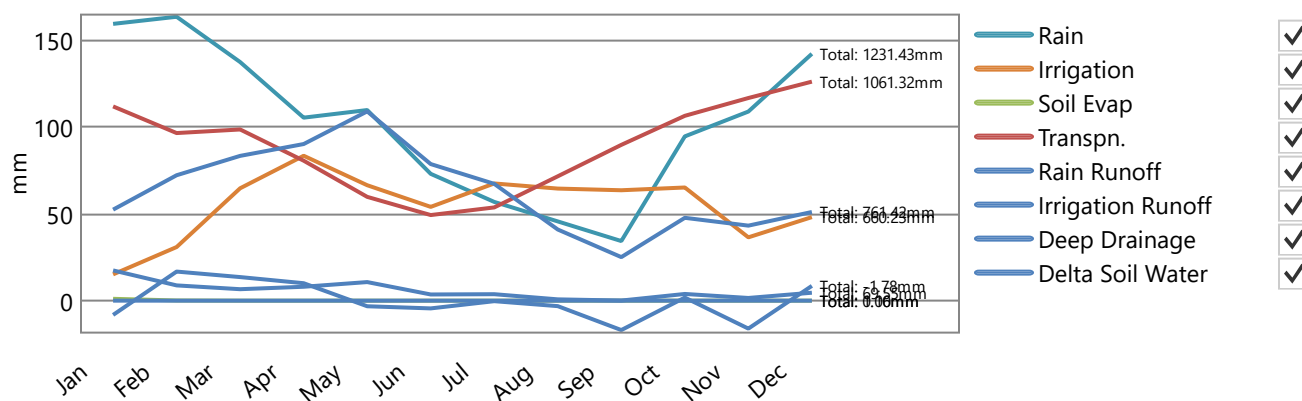
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	660.23
Soil Evaporation	1.16
Transpiration	1061.32
Rain Runoff	69.55
Irrigation Runoff	0.00
Deep Drainage	761.42
Delta Soil Water	-1.78

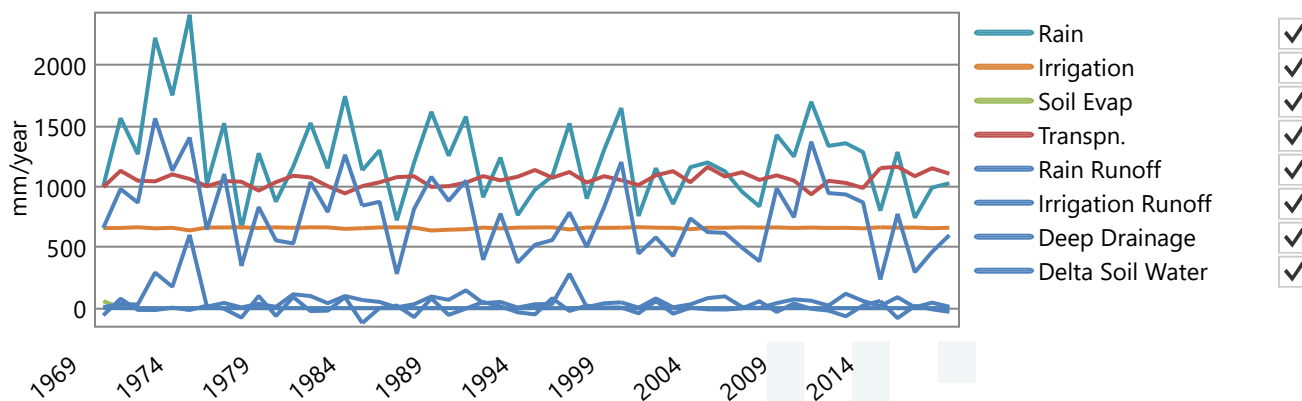
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



PERFORMANCE

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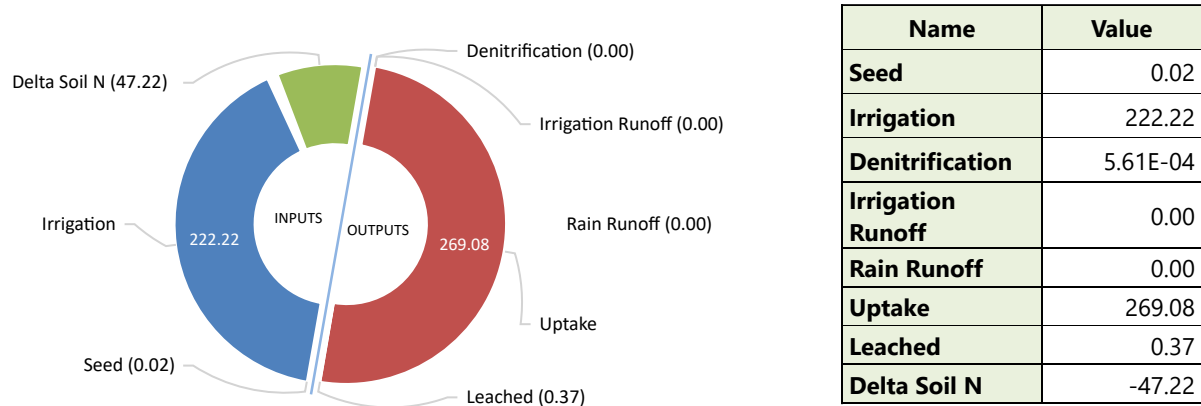
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

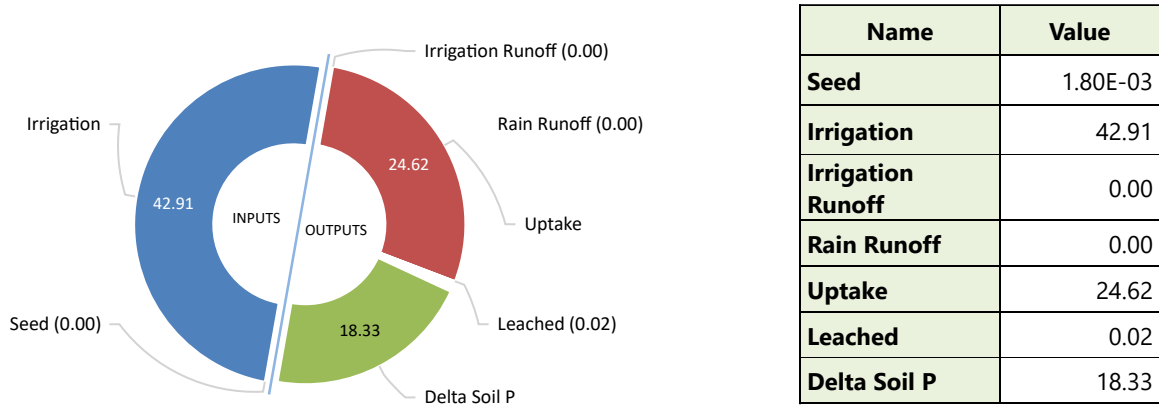
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 4.54
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)

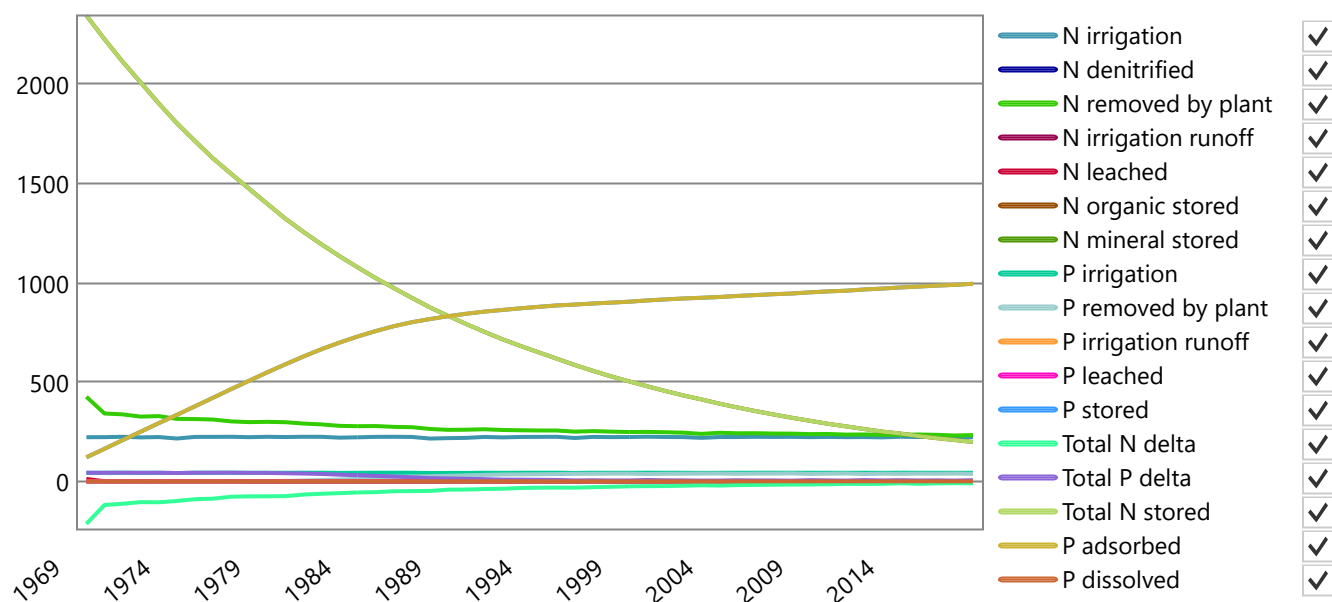


Land Performance - Soil Nutrient

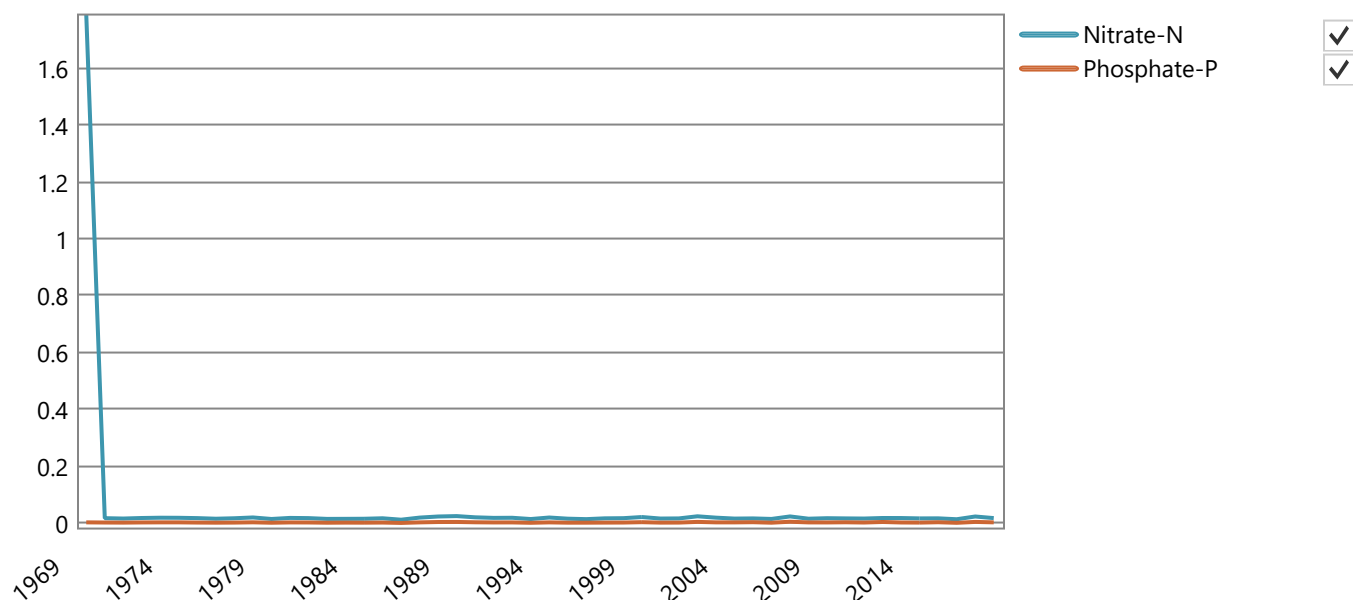
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE

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Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

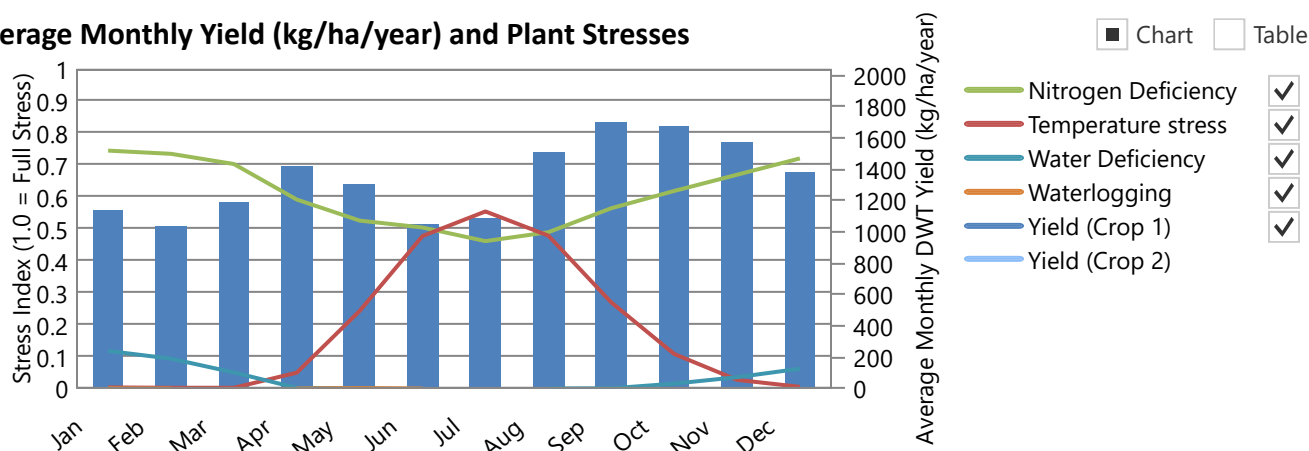
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	16094.75 (14280.12 - 22328.48)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.83 - 0.90)
Average monthly root depth (mm) (minimum - maximum)	699.61 (695.27 - 700.00)

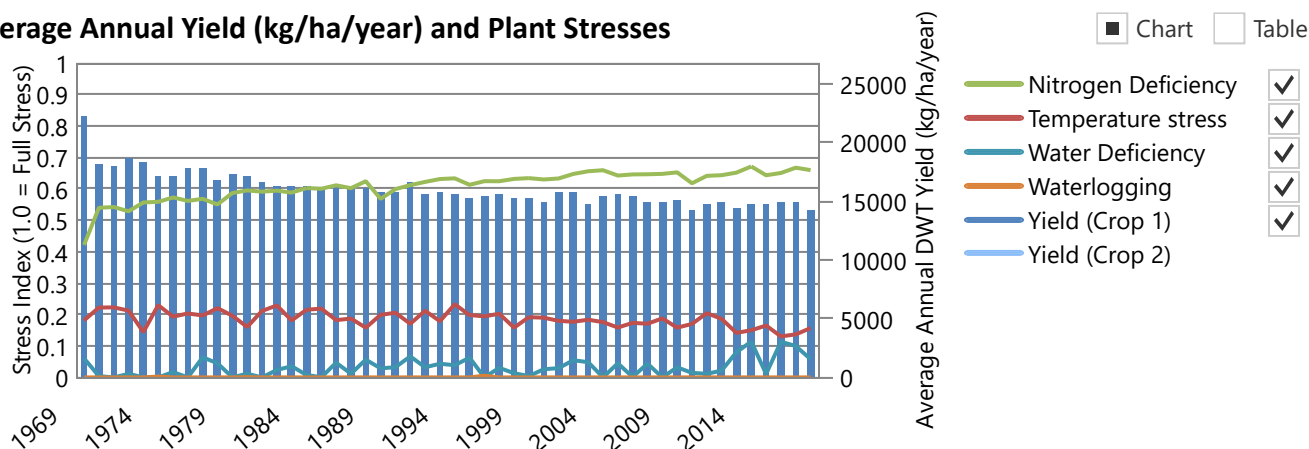
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	269.08 (230.61 - 425.42)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	24.62 (0.00 - 39.90)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 2.90 (normal)

No. days without crop/year (days/year): 0.00

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Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

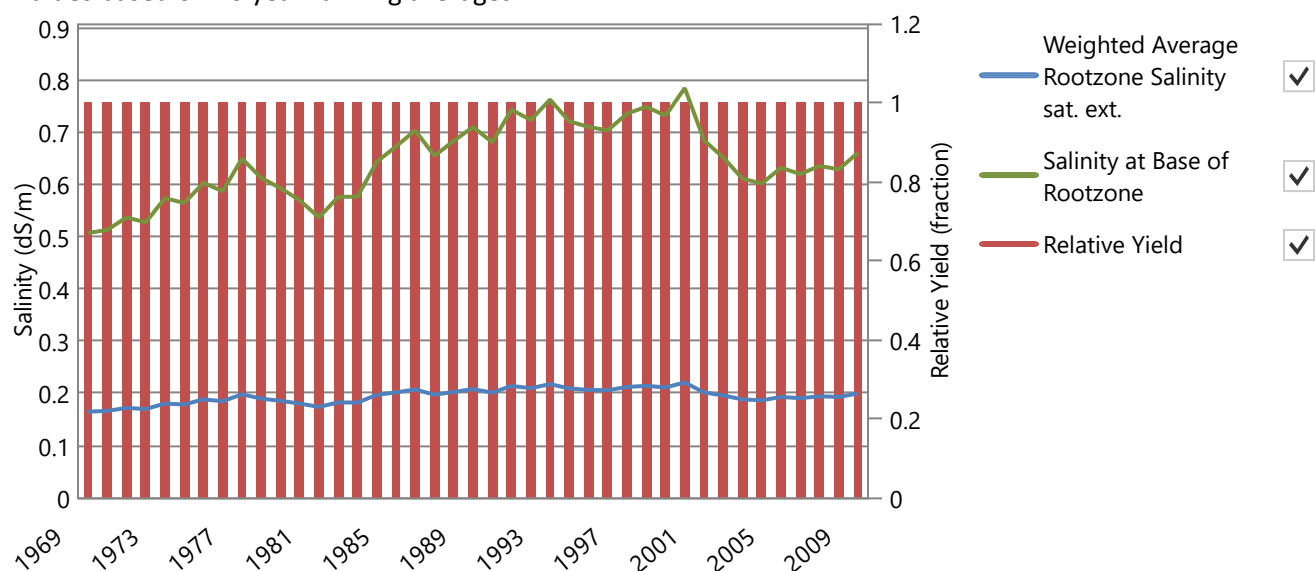
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.26
Salt added by rainfall (kg/ha/year)	223.08
Average annual effluent salt added & leached at steady state (kg/ha/year)	3062.06
Average leaching fraction based on 10 year running averages (fraction)	0.62
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.64
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



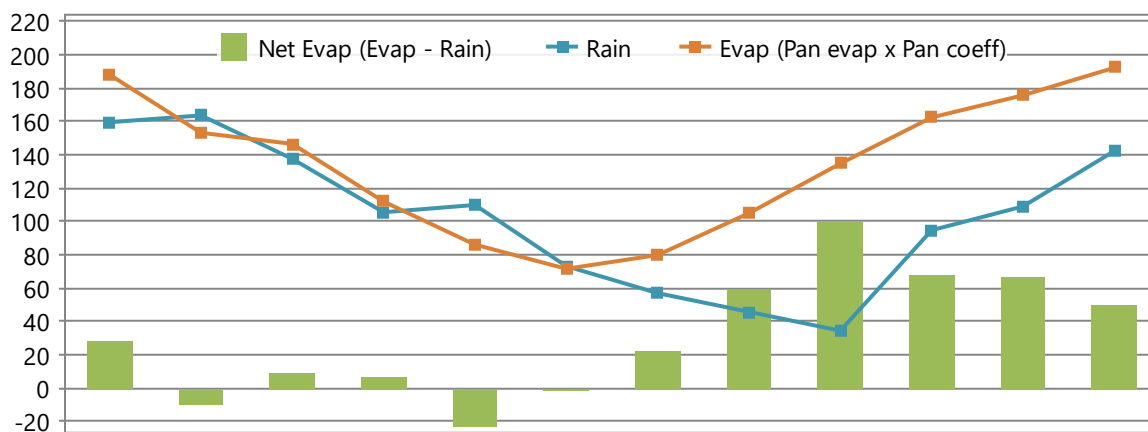
Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 10158.05 kL/year or 27.81 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 337.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	355.53 (355.43 - 355.86)
Total Phosphorus	6.50 (0.00 - 6.50)	66.03 (66.01 - 66.09)
Total Dissolved Salts	430.00 (0.00 - 430.00)	4367.96 (4366.69 - 4371.98)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

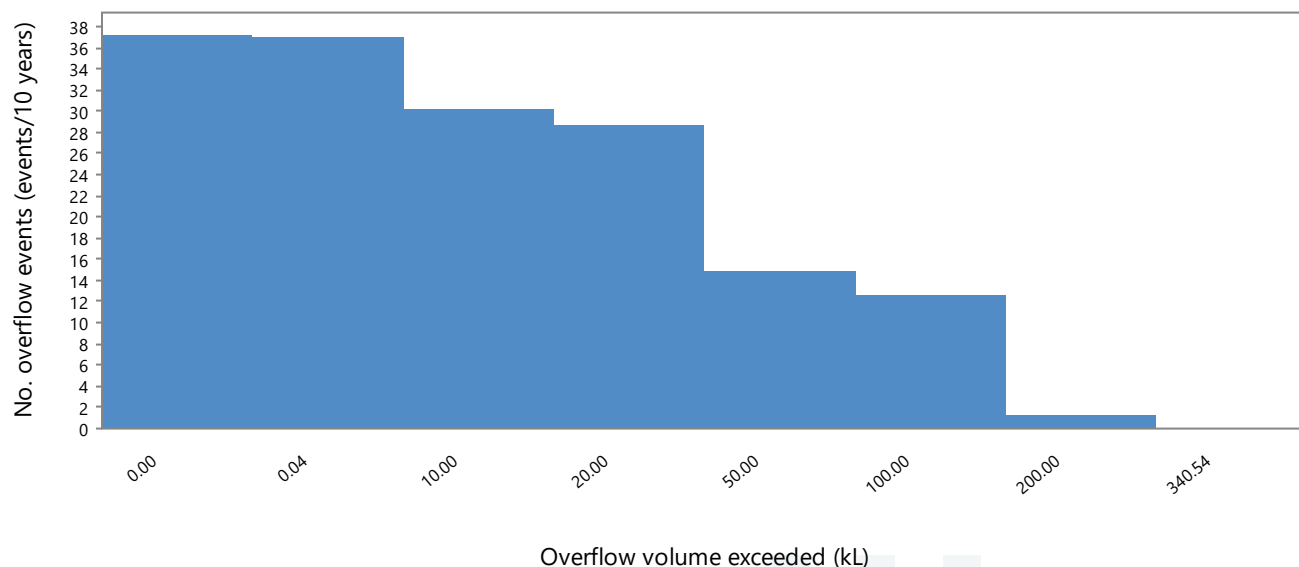
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.24
Average volume of overflow (kL/year)	254.62
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	3.70
Average duration of overflow (days)	3.37
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.97
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	7.95

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



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Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	9903.41	6602.27
Total nitrogen applied (kg)	333.32	222.22
Total phosphorus applied (kg)	64.37	42.91
Total salts applied (kg)	4258.47	2838.98

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.11
Proportion of Days irrigation occurs (fraction)	0.89

Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	15.1	30.9	64.7	83.5	66.5	54.0	67.5	64.6	63.6	65.2	36.5	48.1	660.2
Soil Evap	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
Transpn.	111.9	96.6	98.6	80.6	59.8	49.3	53.7	71.6	89.7	106.5	116.7	126.2	1061.3
Rain Runoff	17.4	8.8	6.6	8.0	10.7	3.6	3.7	0.7	0.0	3.9	1.6	4.6	69.5
Irr. Runoff	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
Drainage	52.4	72.2	83.4	90.2	109.0	78.7	67.3	41.0	25.1	47.7	43.2	51.1	761.4
Delta	-8.2	16.8	13.6	10.0	-3.2	-4.5	-0.3	-3.2	-16.9	1.8	-16.1	8.5	-1.8

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	222.22
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	269.08
Average annual soil nitrogen removed by denitrification (kg/ha/year)	5.61E-04
Average annual soil nitrogen leached (kg/ha/year)	0.37
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.37
Soil organic-N kg/ha (Initial - Final)	2448.00 - 197.77
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.05
Max. annual nitrate-N concentration of deep drainage (mg/L)	1.79

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	42.91
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	24.62
Average annual soil phosphorus leached (kg/ha/year)	0.02
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 1.10E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 994.24
Average phosphate-P concentration in rootzone (mg/L)	3.07E-03
Average phosphate-P concentration of deep drainage (mg/L)	2.61E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	4.98E-03
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.36 mg/L (years)	116.10

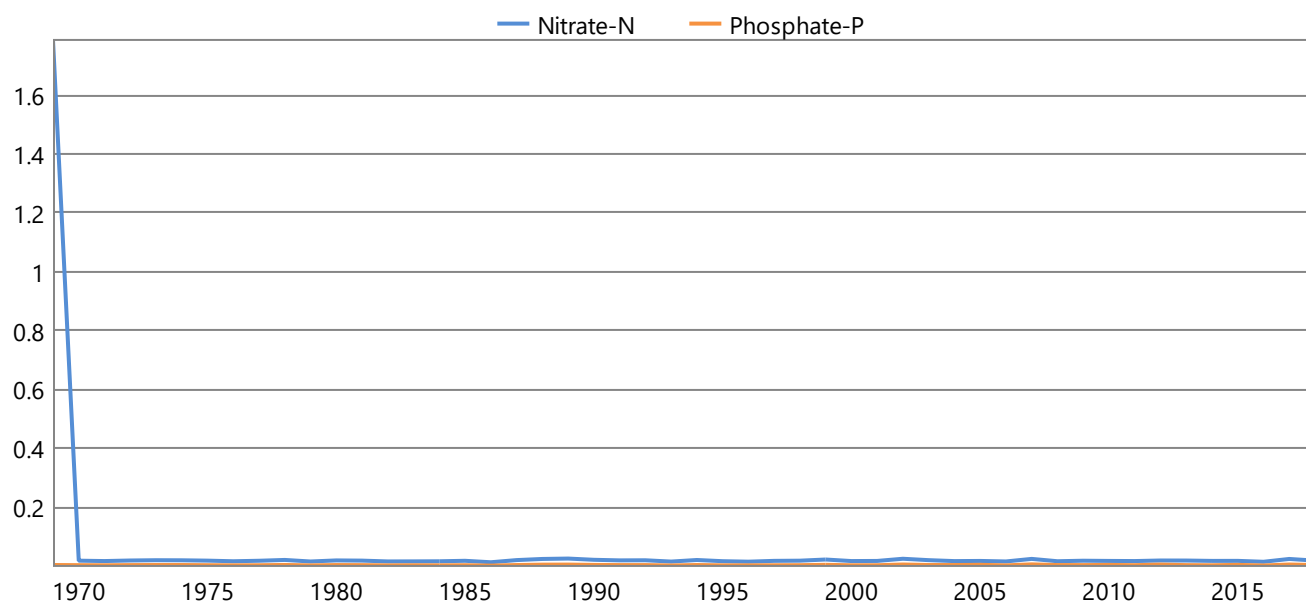
Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

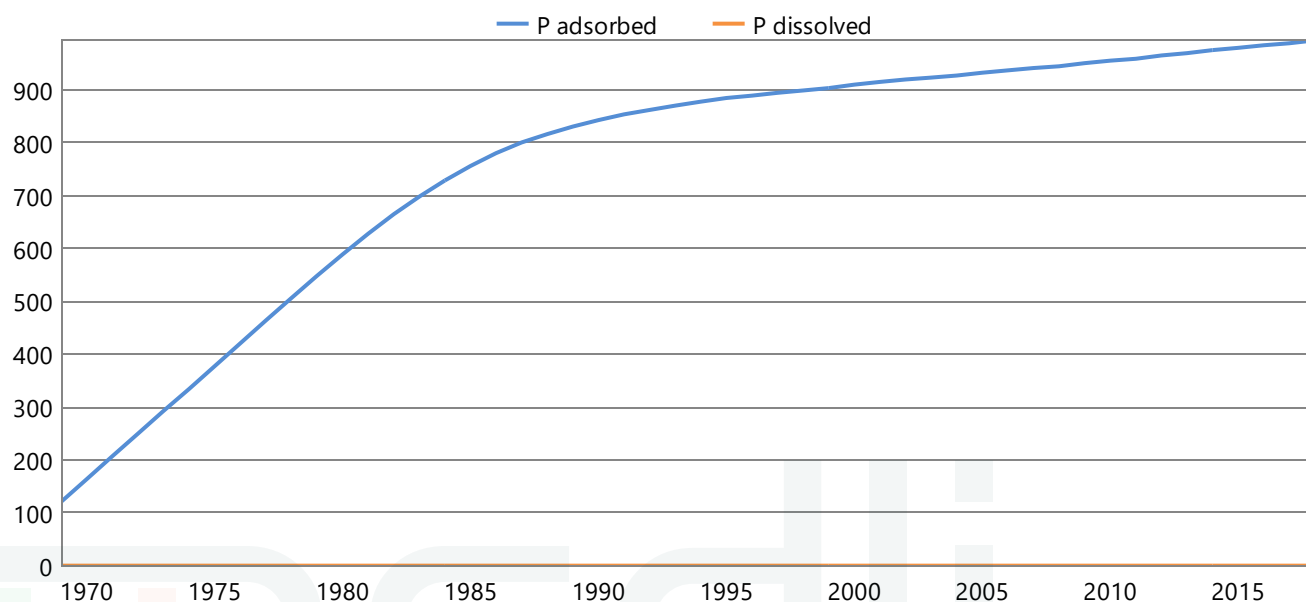
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_FVarE_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	16094.75 (14280.12 - 22328.48)
Average monthly plant (green) cover (fraction)	0.87 (0.83 - 0.90)
Average monthly crop factor (fraction)	0.69 (0.66 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.61 (695.27 - 700.00)
Average number of normal harvests per year (no./year)	2.90 (2.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	2.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.42 - 0.67)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.03 (0.00 - 0.12)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.26
Salt added by rainfall (kg/ha/year)	223.08
Average annual effluent salt added & leached at steady state (kg/ha/year)	3062.06
Average leaching fraction based on 10 year running averages (fraction)	0.62
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.64
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

Title:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Climate data location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days

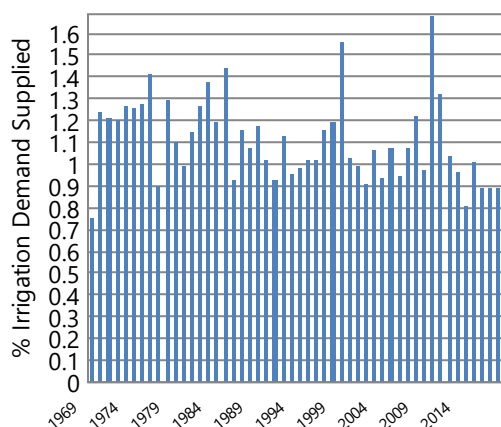
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	5822.2
Annual irrigation predicted for defined scenario (mm/year)	582.2
Average annual irrigation demand supplied (fraction)	1.1

Or for 1.50 ha: **8122 kL/year**

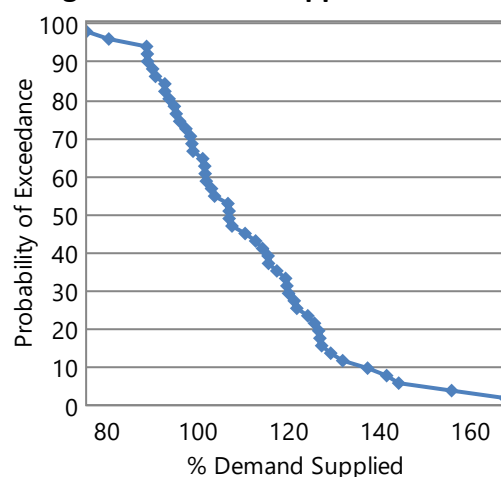
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



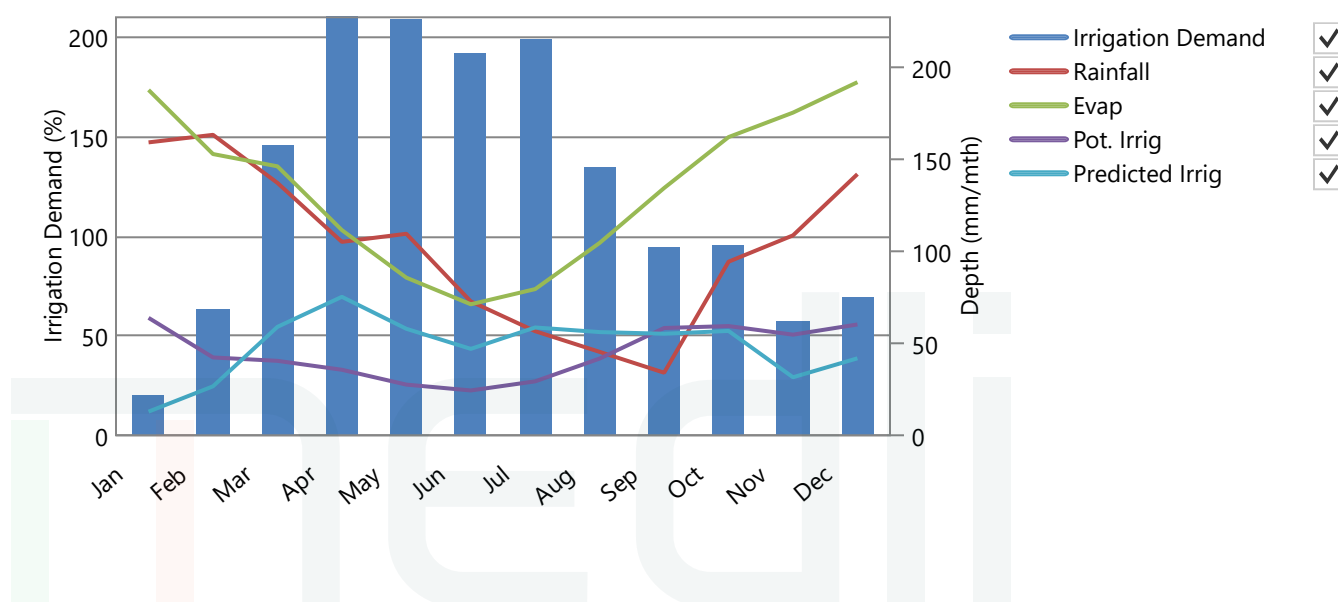
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

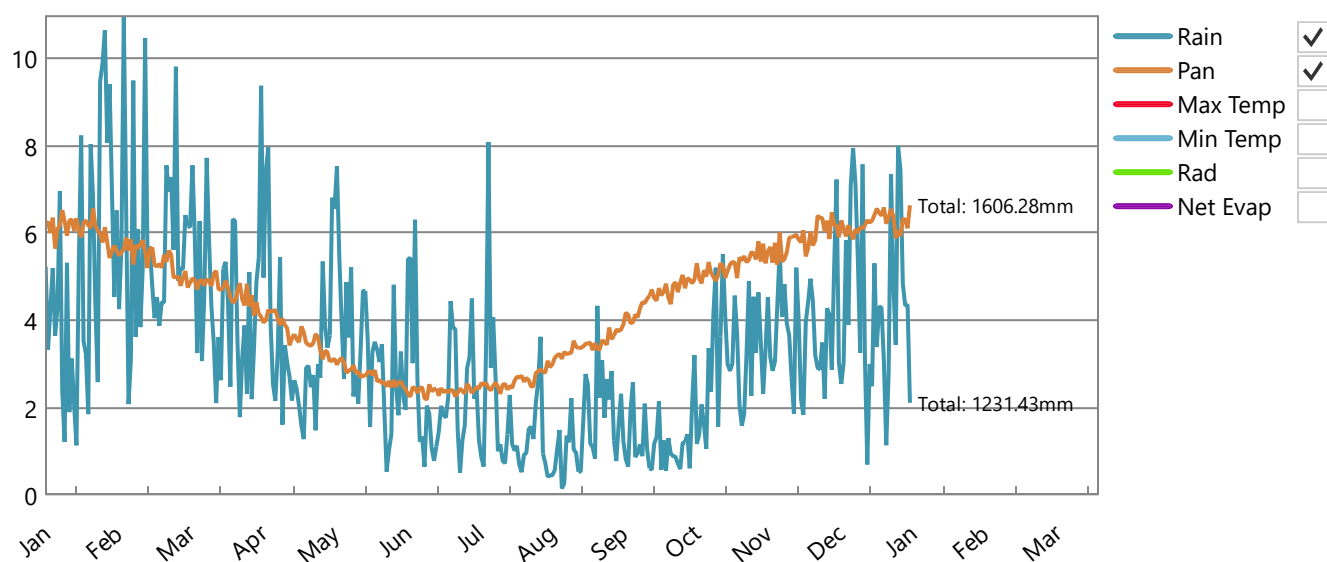
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



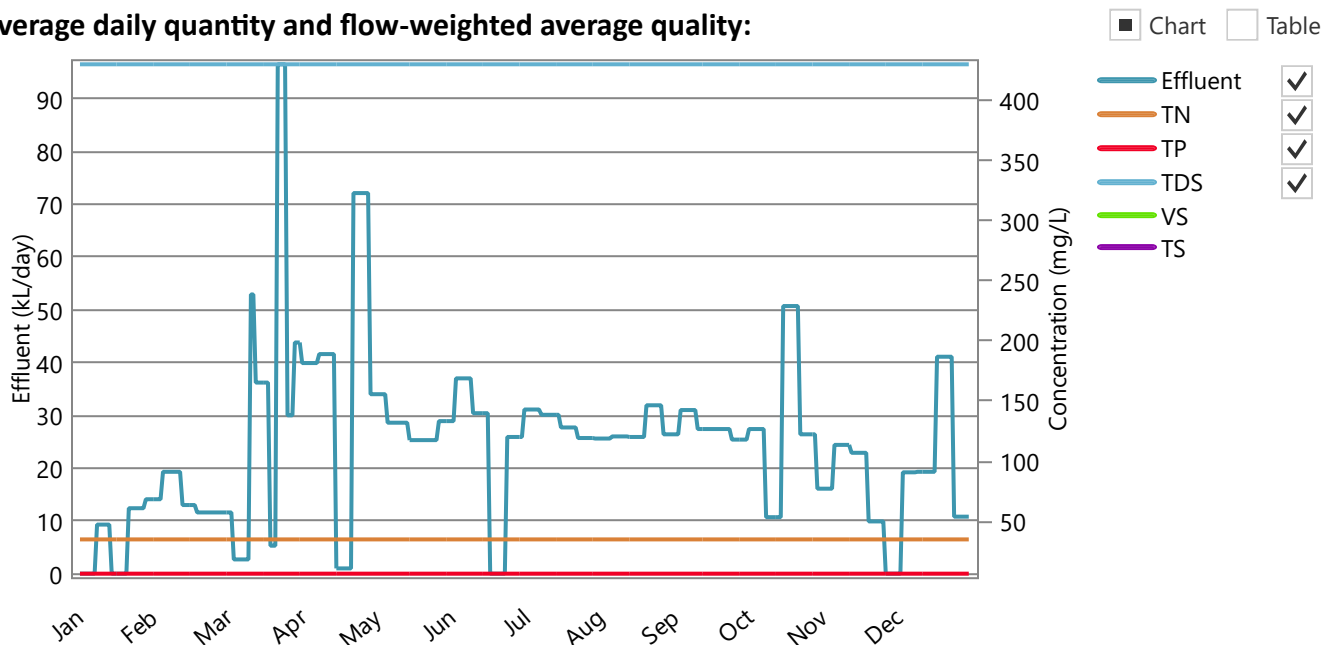
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **8865.79 kL/year** or 24.27 kL/day (Min-Max: 0.00 - 96.50)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	310.30 (310.21 - 310.59)
Total Phosphorus	6.50 (0.00 - 6.50)	57.63 (57.61 - 57.68)
Total Dissolved Salts	430.00 (0.00 - 430.00)	3812.29 (3811.18 - 3815.82)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

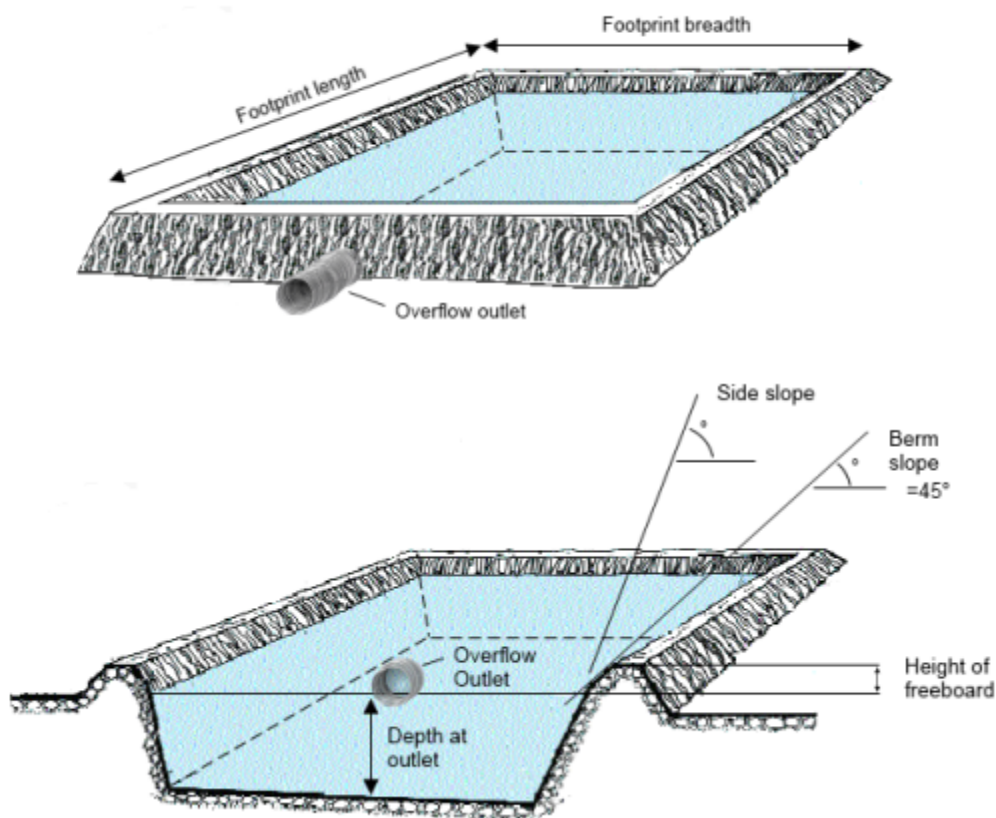
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	2.66



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

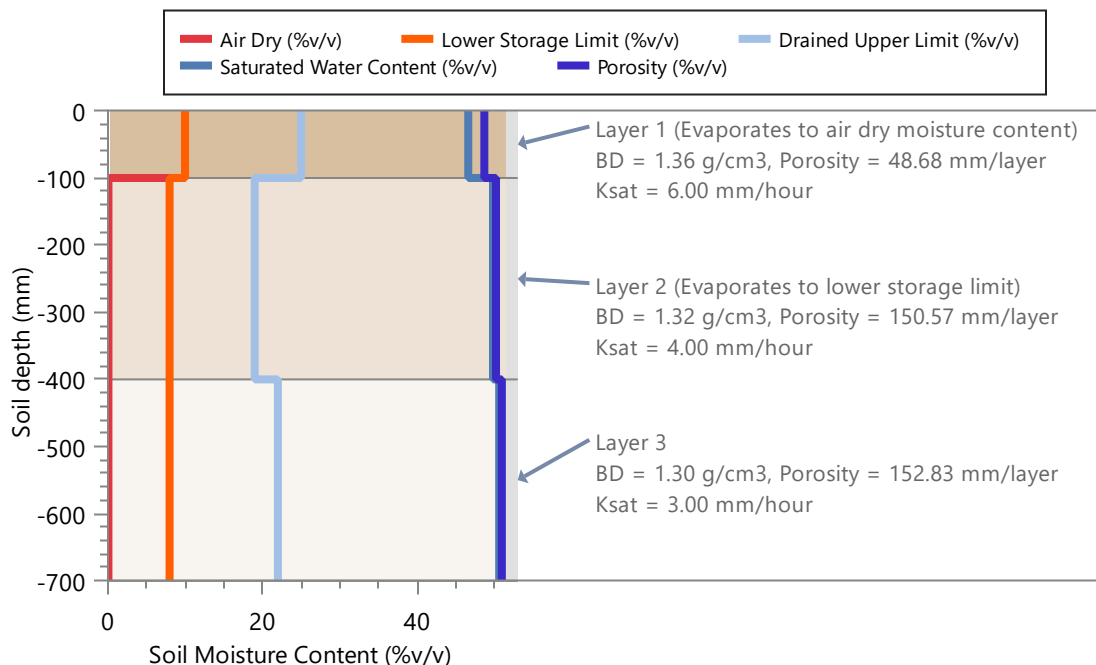
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

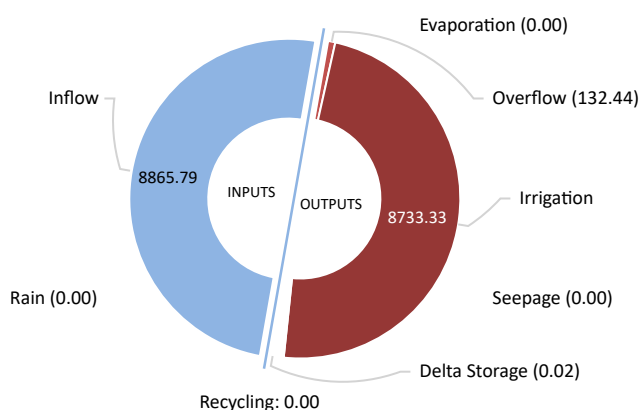
Average monthly cover (fraction) (minimum - maximum)	0.65 (0.62 - 0.67)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

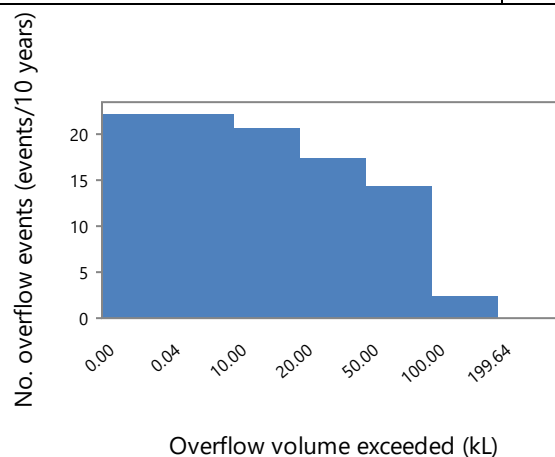
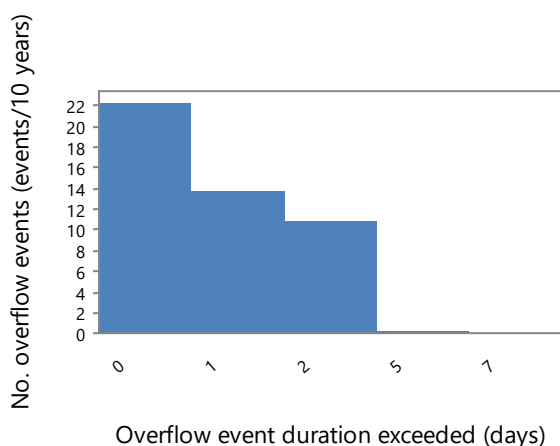
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	8865.79
Recycling	0.00
Evaporation	0.00
Overflow	132.44
Irrigation	8733.33
Seepage	0.00
Delta Storage	0.02

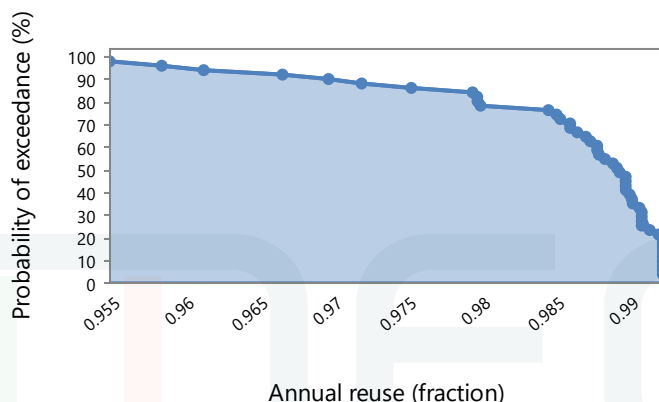
Overflow Diagnostics

Volume of overflow (kL/year)	132.44
No. days pond overflows (days/year)	5.82
Average duration of overflow (days)	2.62
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% reuse (fraction)	1.00



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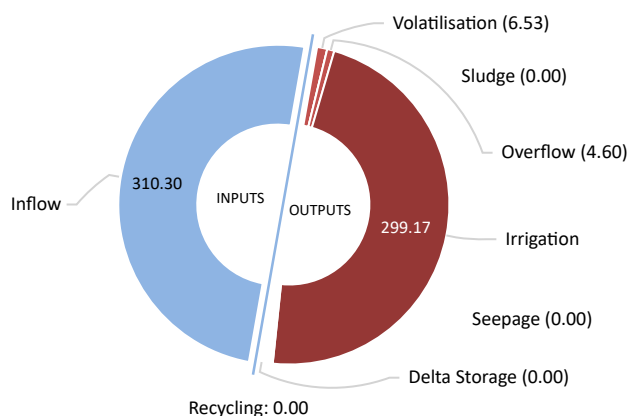


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

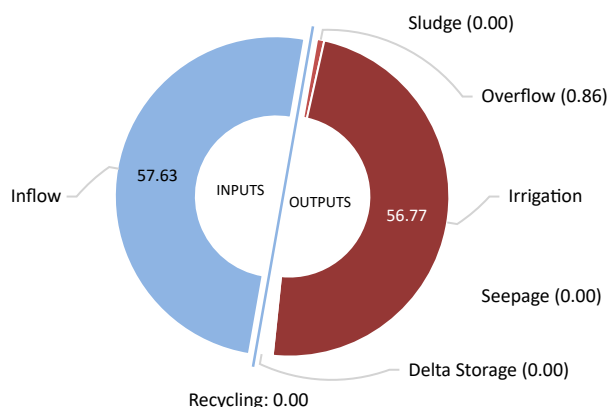
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



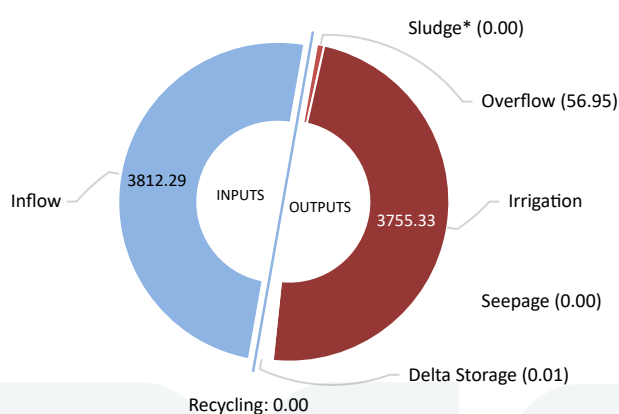
Name	Value
Inflow	310.30
Recycling	0.00
Volatilisation	6.53
Sludge	0.00
Overflow	4.60
Irrigation	299.17
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	57.63
Recycling	0.00
Sludge	0.00
Overflow	0.86
Irrigation	56.77
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	3812.29
Recycling	0.00
Sludge*	0.00
Overflow	56.95
Irrigation	3755.33
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	26.29
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.05
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE



Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	8733.33
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	8733.33
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.26
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.57
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days pond volume below min. vol. for irrigation (fraction)	0.06
Proportion of Days irrigation occurs (fraction)	0.89

PERFORMANCE

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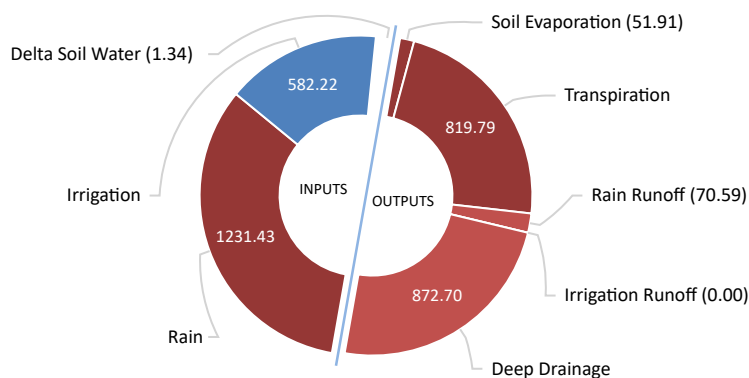
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

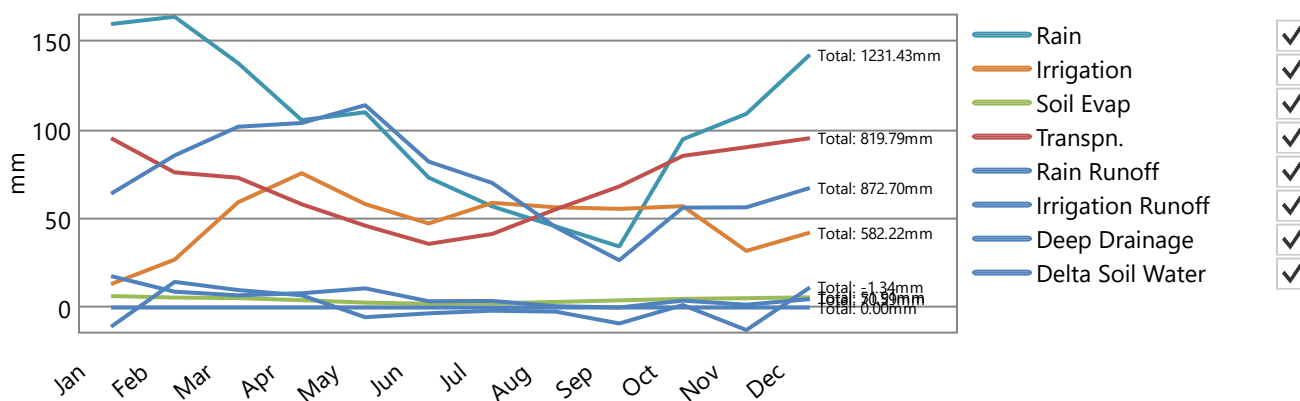
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	582.22
Soil Evaporation	51.91
Transpiration	819.79
Rain Runoff	70.59
Irrigation Runoff	0.00
Deep Drainage	872.70
Delta Soil Water	-1.34

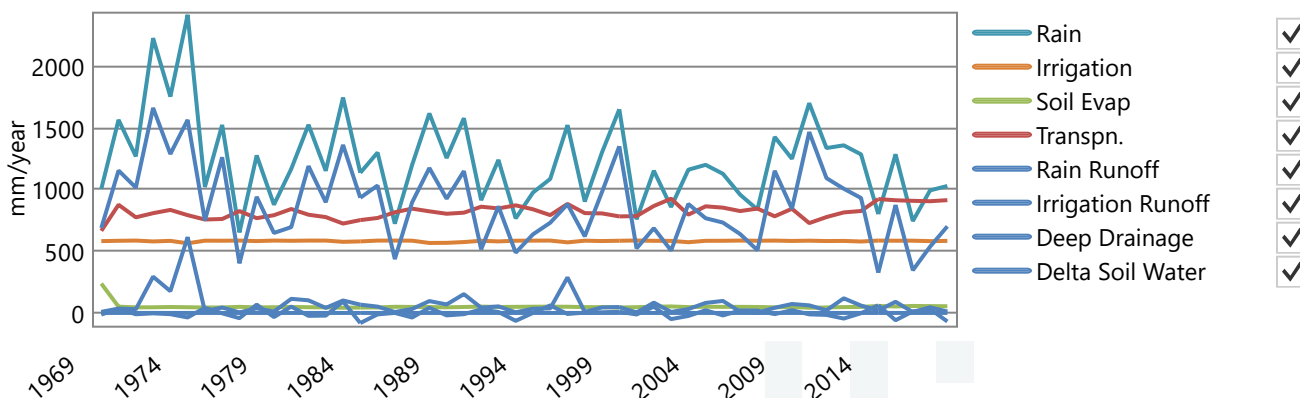
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



PERFORMANCE

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Land Performance - Soil Nutrient

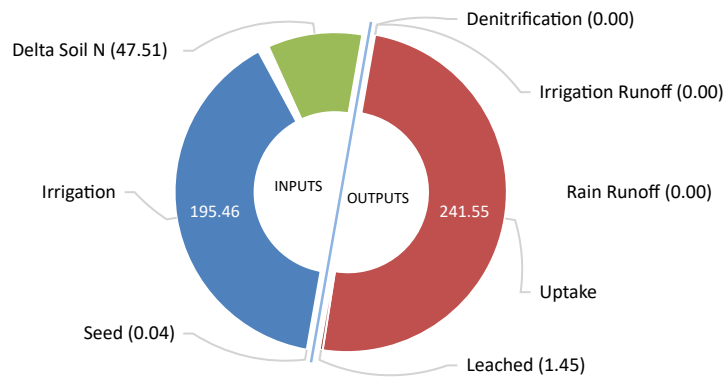
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 3.99

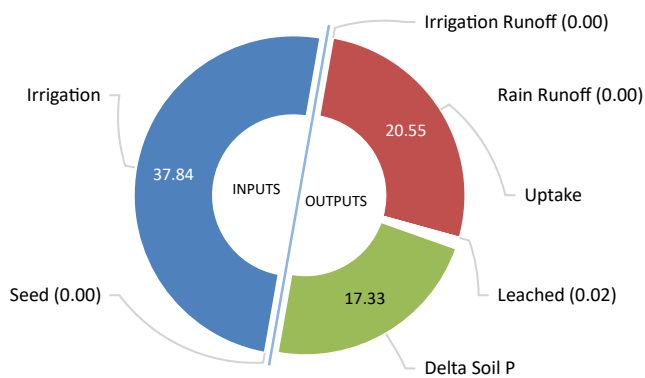
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	0.04
Irrigation	195.46
Denitrification	5.34E-04
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	241.55
Leached	1.45
Delta Soil N	-47.51

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	3.60E-03
Irrigation	37.84
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	20.55
Leached	0.02
Delta Soil P	17.33

PERFORMANCE

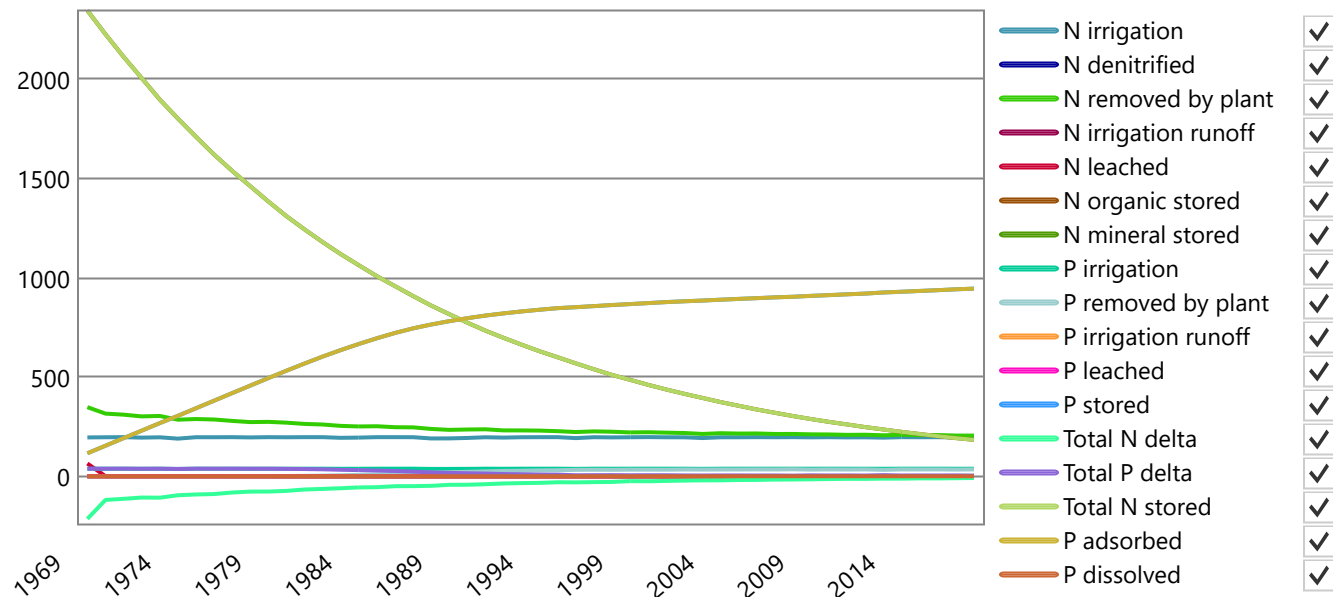


Land Performance - Soil Nutrient

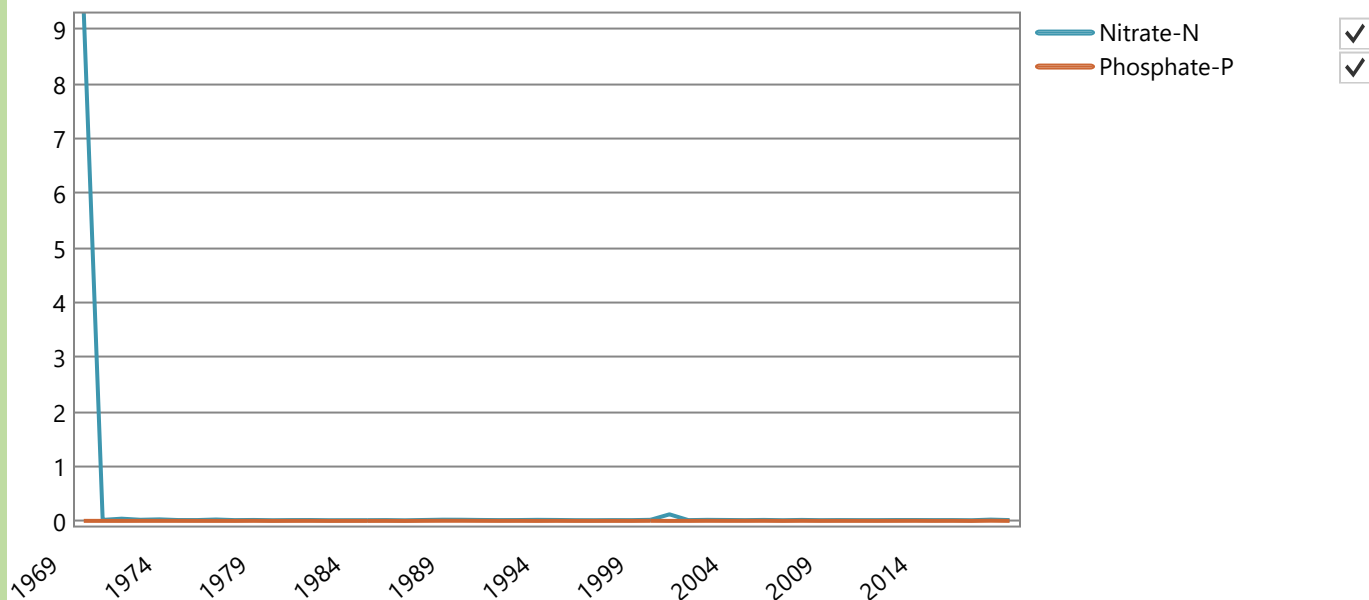
Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

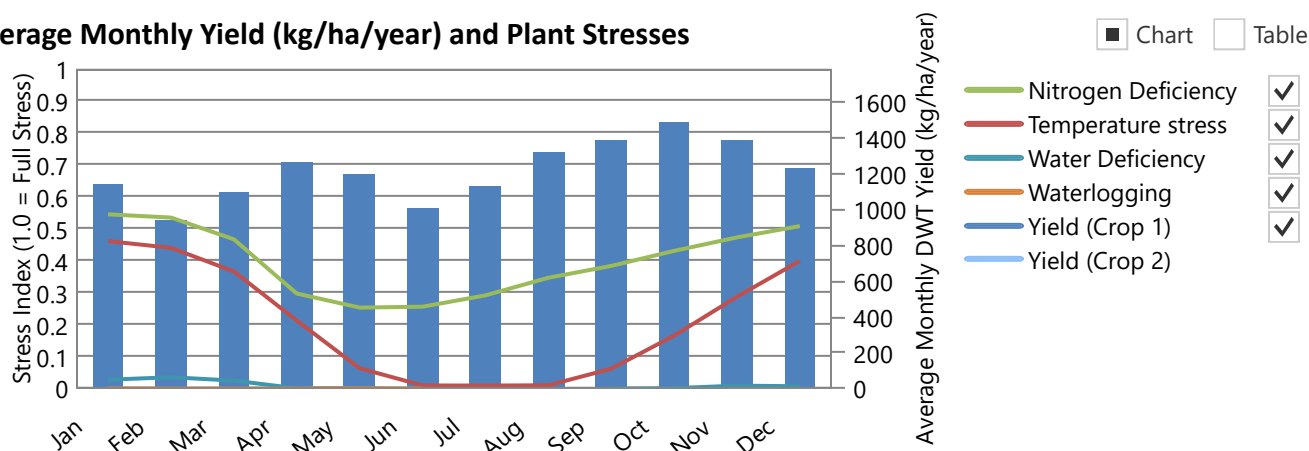
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	14633.17 (12635.58 - 16941.45)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.65 (0.62 - 0.67)
Average monthly root depth (mm) (minimum - maximum)	597.66 (591.07 - 599.97)

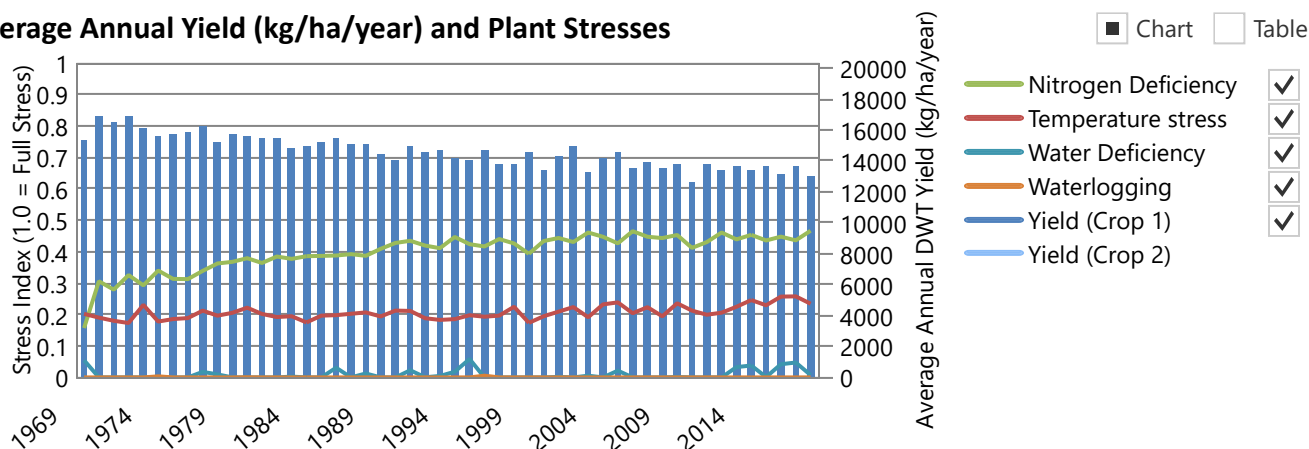
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	241.55 (204.59 - 347.70)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	20.55 (0.00 - 35.08)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 3.78 (normal), 0.02 (forced by crop death due to water stress (0.02))

No. days without crop/year (days/year): 0.16 due to water stress (0.16)



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

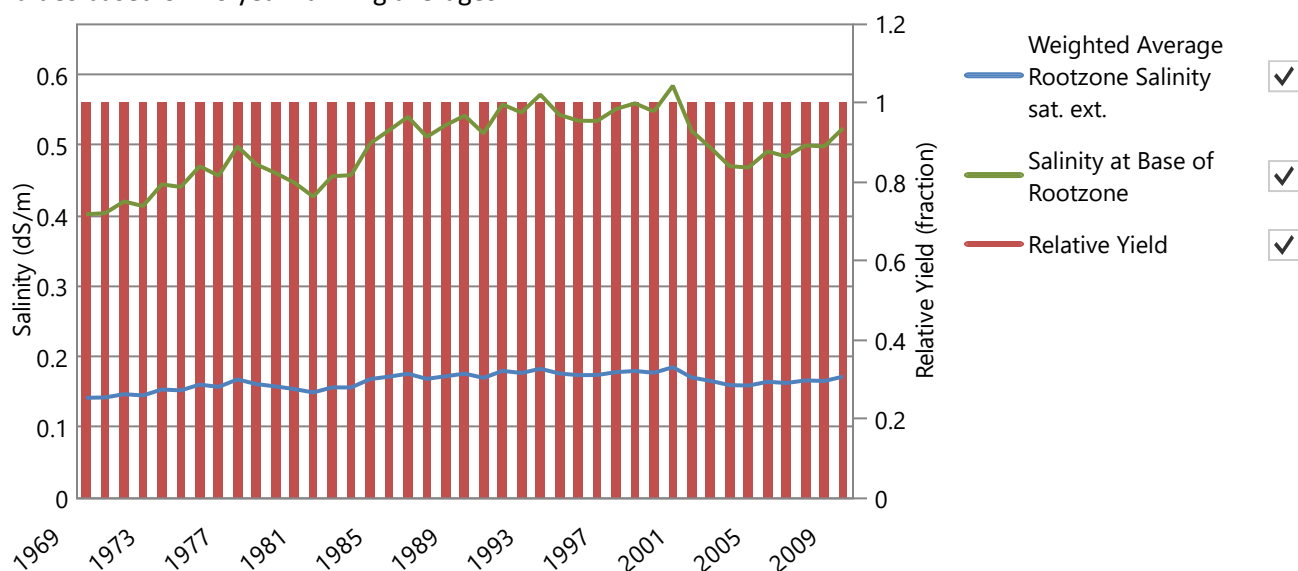
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	222.88
Average annual effluent salt added & leached at steady state (kg/ha/year)	2726.44
Average leaching fraction based on 10 year running averages (fraction)	0.68
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.17
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.50
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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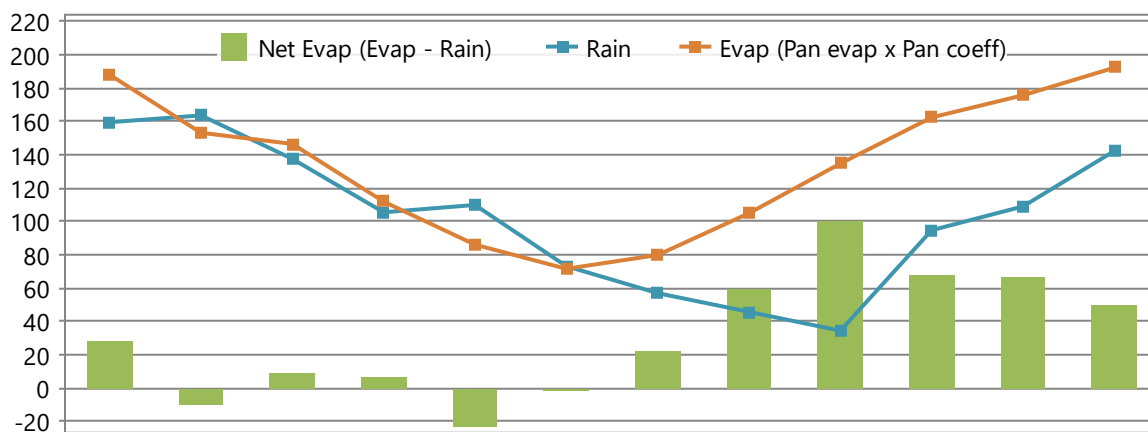
Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 8865.79 kL/year or 24.27 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 337.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	310.30 (310.21 - 310.59)
Total Phosphorus	6.50 (0.00 - 6.50)	57.63 (57.61 - 57.68)
Total Dissolved Salts	430.00 (0.00 - 430.00)	3812.29 (3811.18 - 3815.82)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

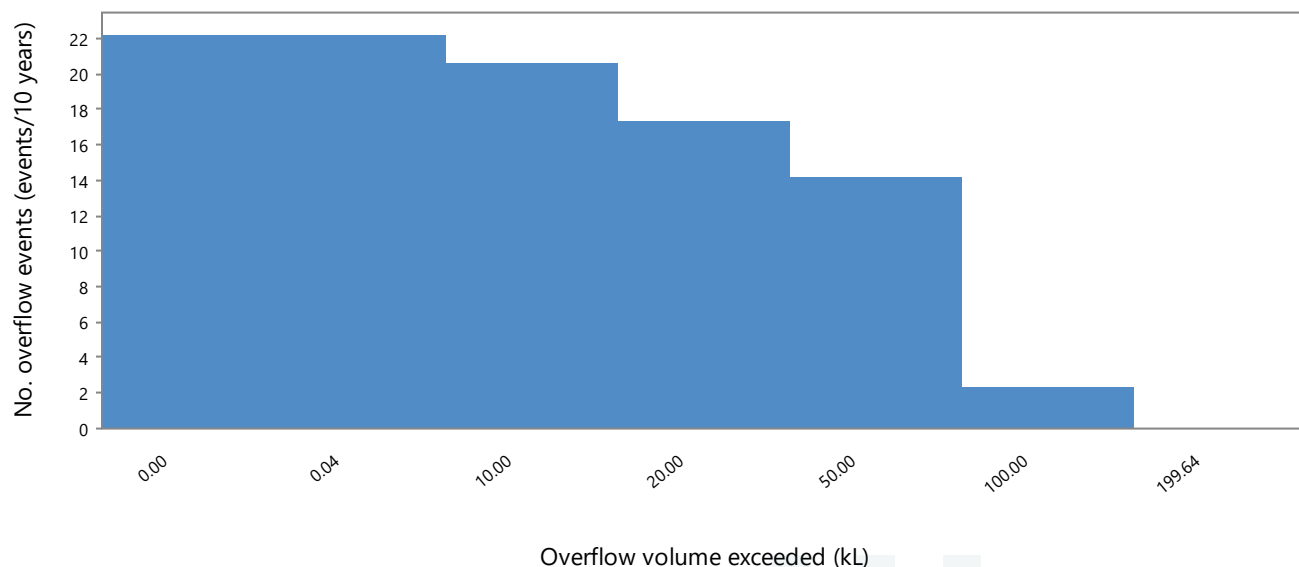
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.71
Average volume of overflow (kL/year)	132.44
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	2.22
Average duration of overflow (days)	2.62
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	7.92

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	8733.33	5822.22
Total nitrogen applied (kg)	293.19	195.46
Total phosphorus applied (kg)	56.77	37.84
Total salts applied (kg)	3755.33	2503.55

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.11
Proportion of Days irrigation occurs (fraction)	0.89

Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	13.2	26.9	59.2	75.6	58.2	47.3	58.9	56.4	55.5	57.0	31.9	42.2	582.2
Soil Evap	6.5	5.6	5.3	4.1	2.8	2.1	2.4	3.1	4.0	4.9	5.3	5.8	51.9
Transpn.	95.3	76.0	73.0	58.1	46.0	35.8	41.4	55.3	68.1	85.3	90.2	95.3	819.8
Rain Runoff	17.7	8.9	6.9	8.0	10.8	3.6	3.7	0.7	0.0	3.9	1.6	4.8	70.6
Irr. Runoff	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
Drainage	64.0	85.5	101.7	103.8	113.8	82.1	70.1	45.2	26.6	56.2	56.4	67.3	872.7
Delta	-10.8	14.4	9.8	6.9	-5.4	-3.3	-1.8	-2.3	-8.9	1.4	-12.7	11.3	-1.3

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	195.46
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	241.55
Average annual soil nitrogen removed by denitrification (kg/ha/year)	5.34E-04
Average annual soil nitrogen leached (kg/ha/year)	1.45
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.45
Soil organic-N kg/ha (Initial - Final)	2448.00 - 183.15
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.17
Max. annual nitrate-N concentration of deep drainage (mg/L)	9.30

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	37.84
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	20.55
Average annual soil phosphorus leached (kg/ha/year)	0.02
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 1.80E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 944.31
Average phosphate-P concentration in rootzone (mg/L)	2.54E-03
Average phosphate-P concentration of deep drainage (mg/L)	2.18E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	4.92E-03
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.17 mg/L (years)	129.55

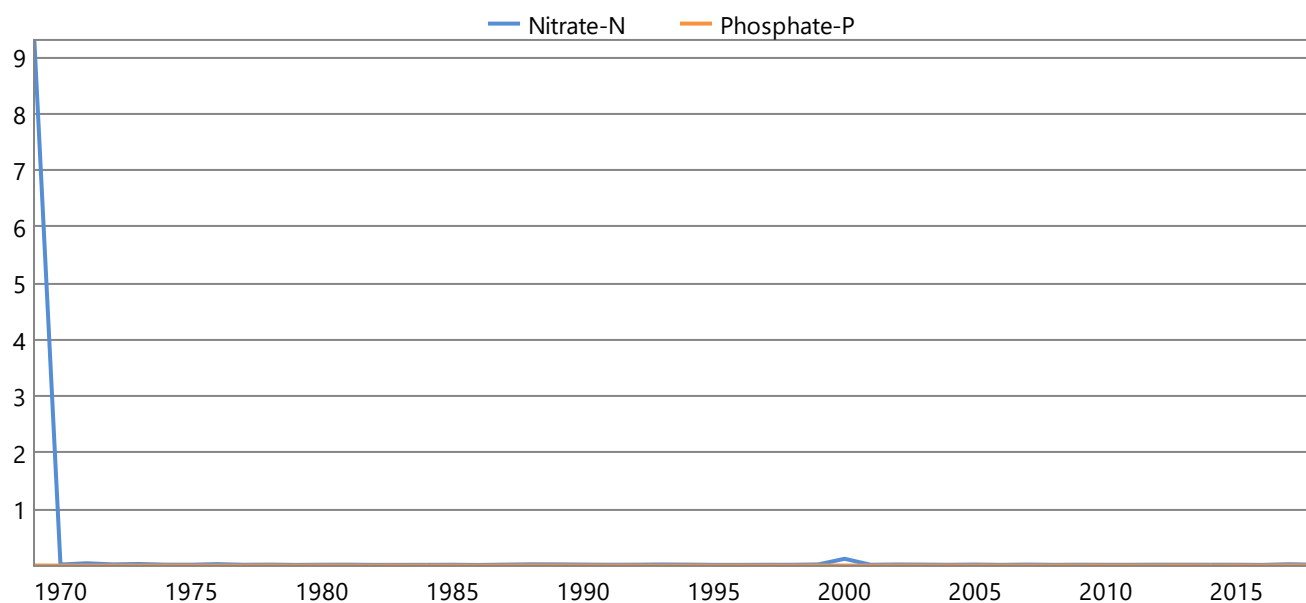
Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

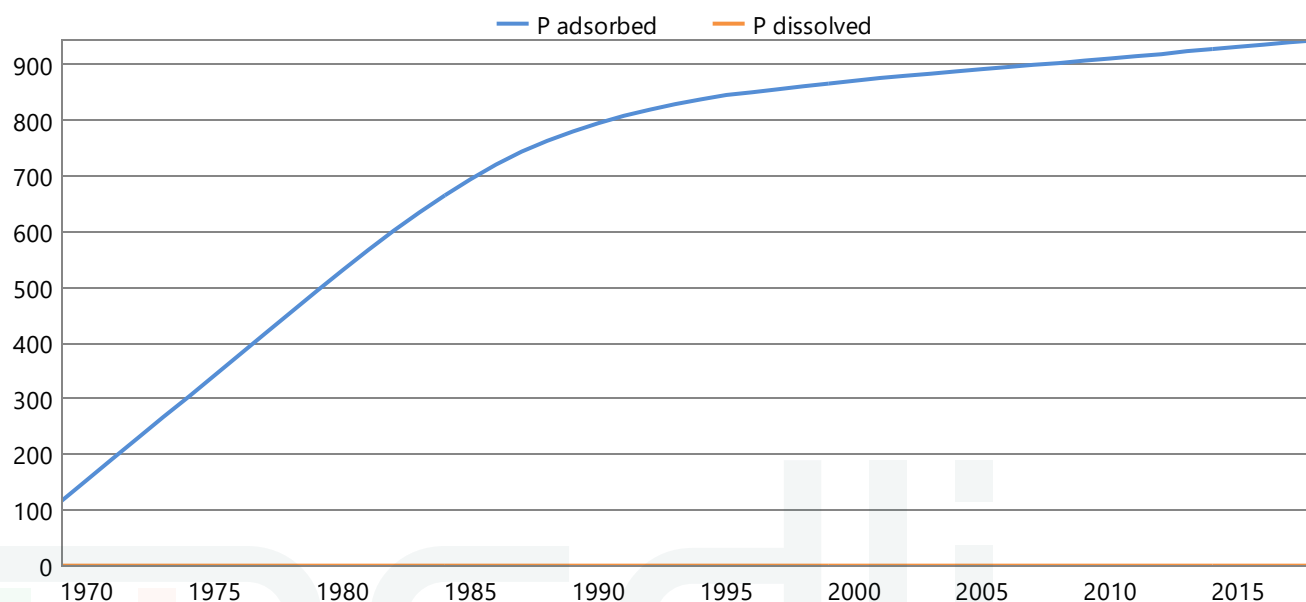
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	14633.17 (12635.58 - 16941.45)
Average monthly plant (green) cover (fraction)	0.65 (0.62 - 0.67)
Average monthly crop factor (fraction)	0.52 (0.50 - 0.54)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	597.66 (591.07 - 599.97)
Average number of normal harvests per year (no./year)	3.78 (3.00 - 5.00)
Average number of normal harvests for last five years only (no./year)	3.40
Average number of crop deaths per year (no./year)	0.02 (0.00 - 1.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.40 (0.16 - 0.47)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.16

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	222.88
Average annual effluent salt added & leached at steady state (kg/ha/year)	2726.44
Average leaching fraction based on 10 year running averages (fraction)	0.68
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.17
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.50
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

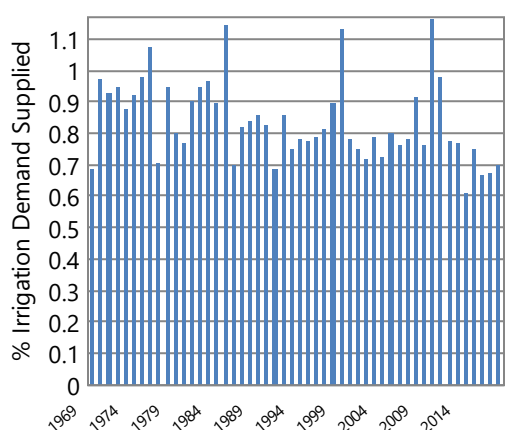
Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Average Annual %Irrigation Demand Supplied:

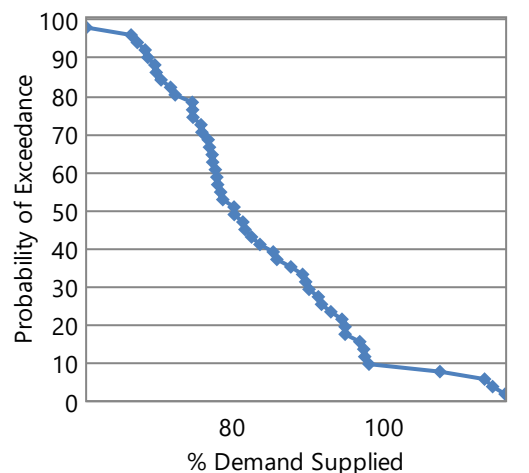
Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	5822.2
Annual irrigation predicted for defined scenario (mm/year)	582.2
Average annual irrigation demand supplied (fraction)	0.8

Or for 1.50 ha: 10668 kL/year

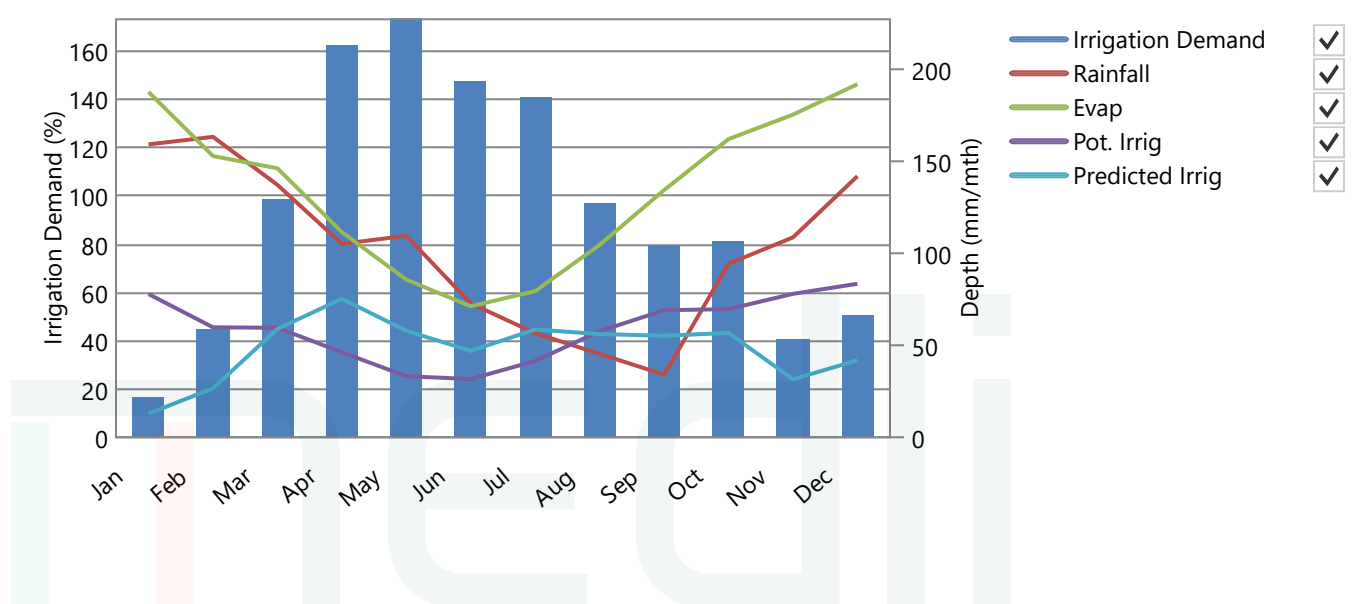
Annual % Irrigation Demand Supplied



Probability of exceeding the % Irrigation Demand Supplied



Monthly % Irrigation Demand Supplied



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

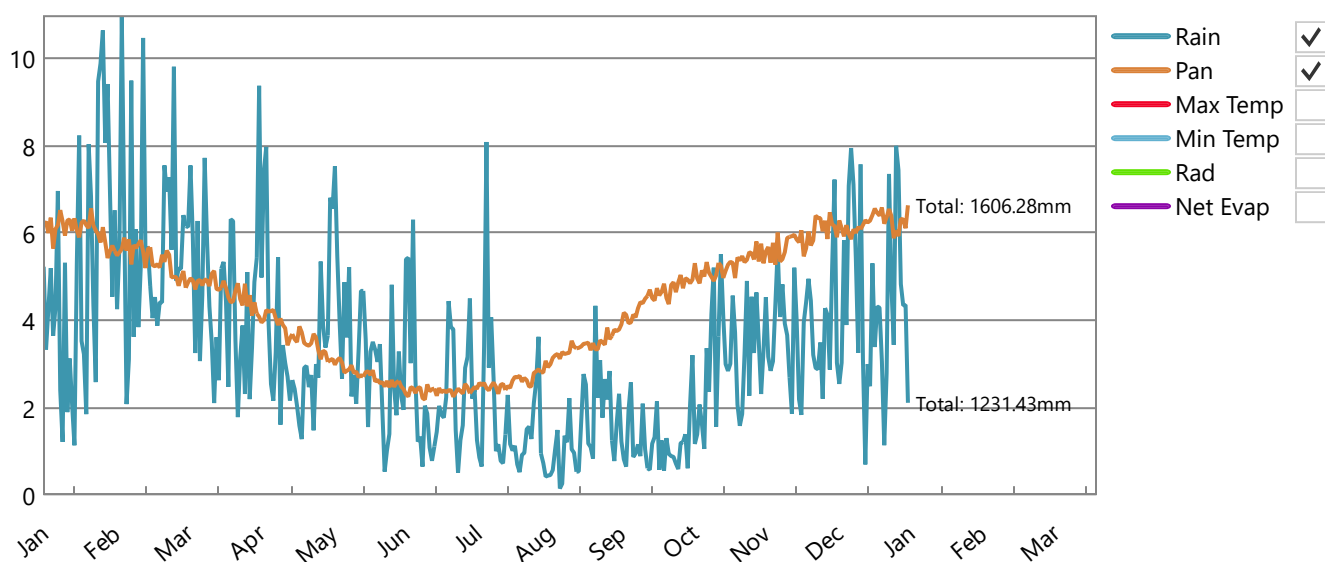
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



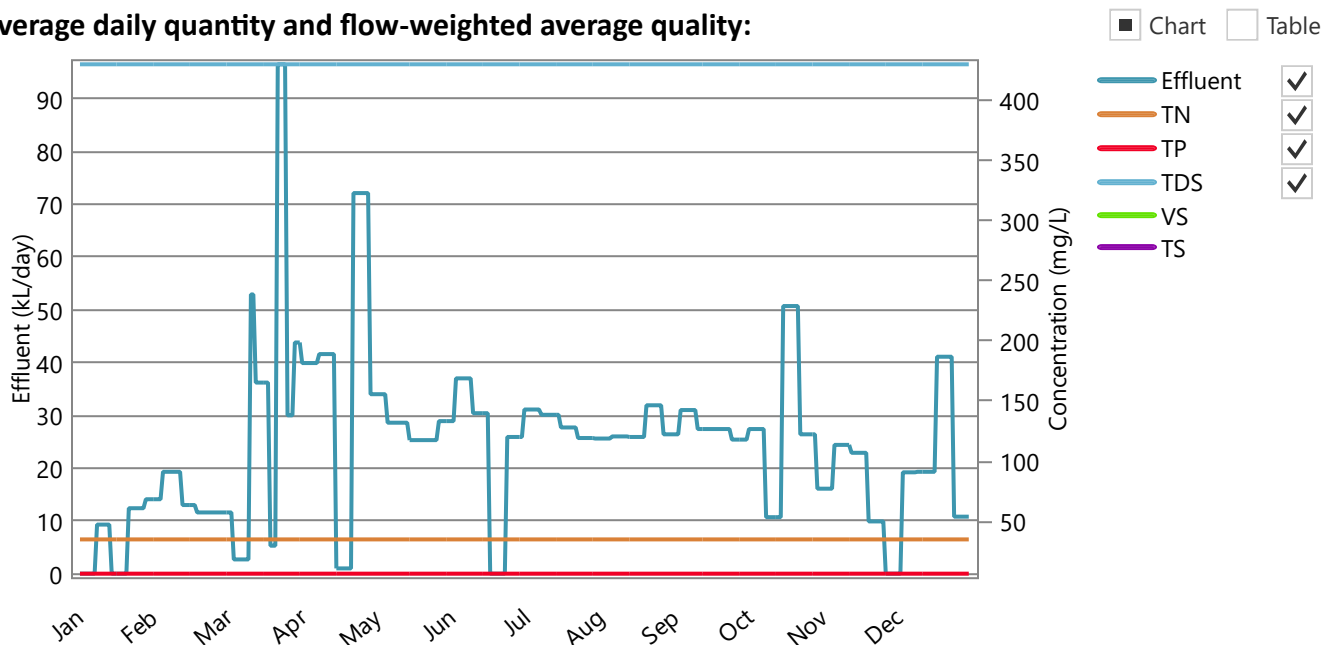
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **8865.79 kL/year** or 24.27 kL/day (Min-Max: 0.00 - 96.50)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	310.30 (310.21 - 310.59)
Total Phosphorus	6.50 (0.00 - 6.50)	57.63 (57.61 - 57.68)
Total Dissolved Salts	430.00 (0.00 - 430.00)	3812.29 (3811.18 - 3815.82)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

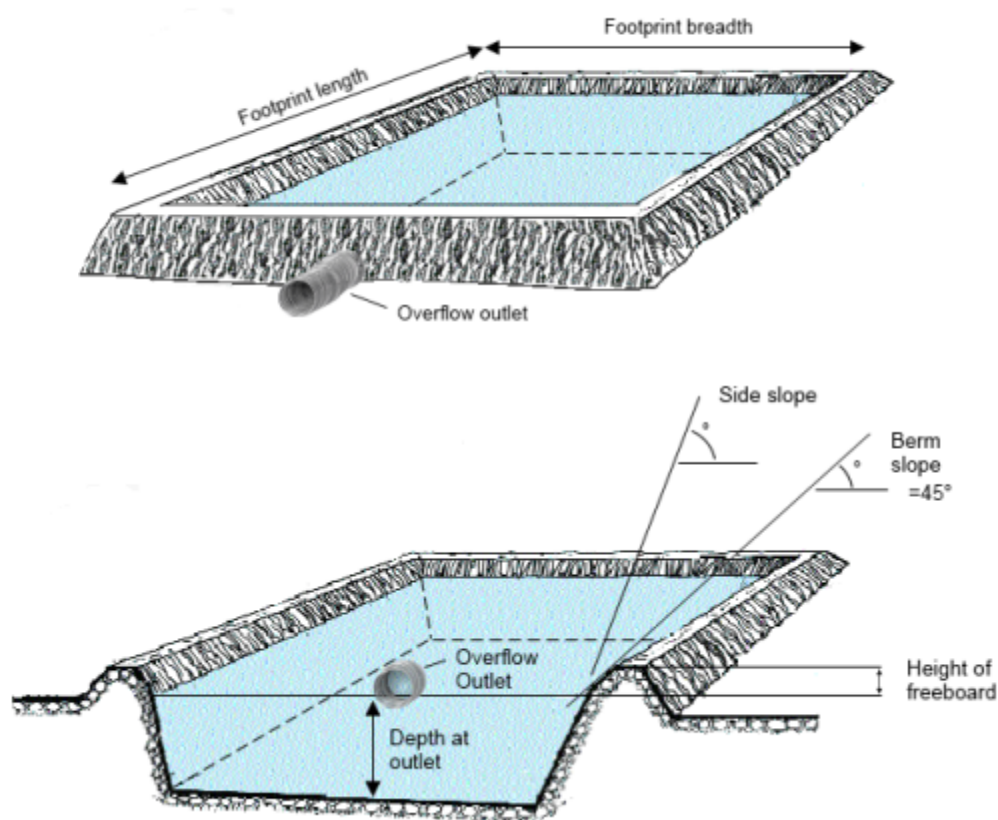
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	2.66



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

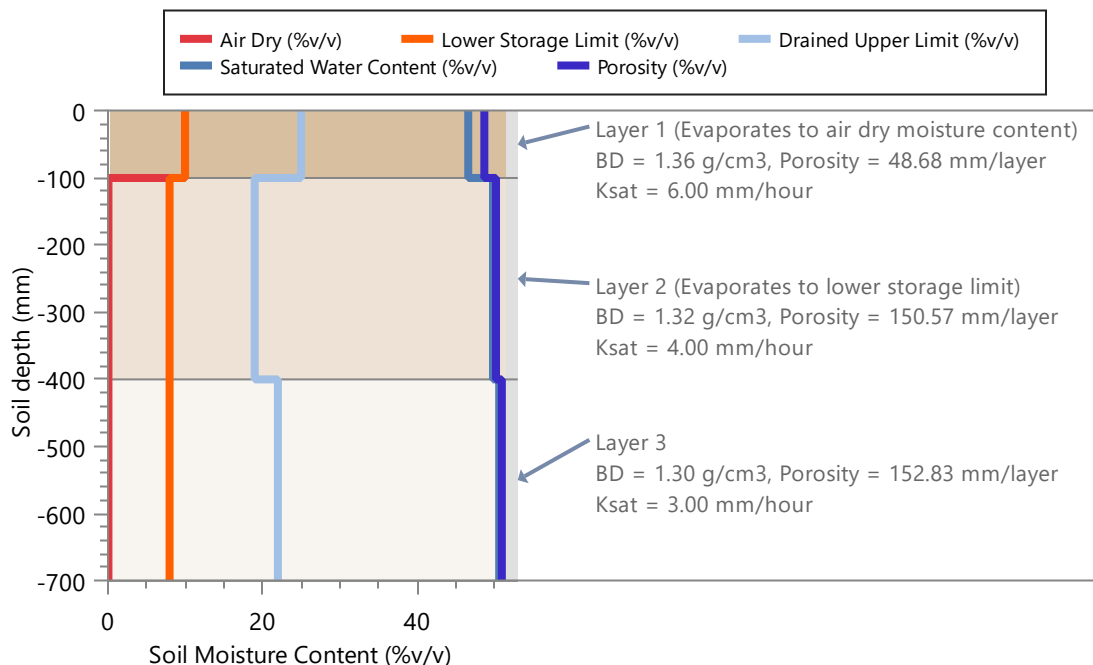
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

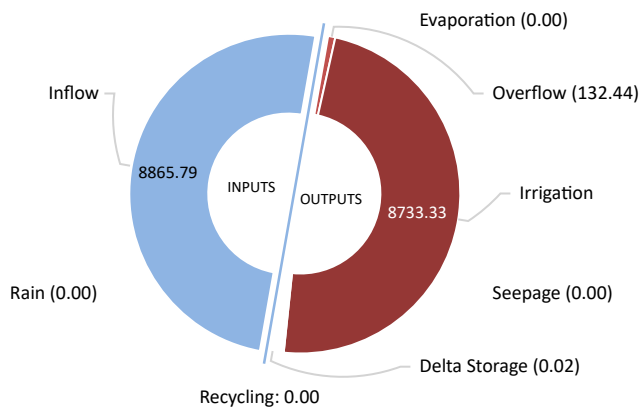
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.82 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

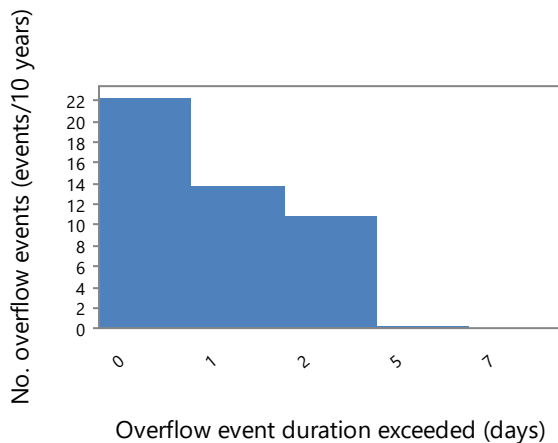
Pond System Water Balance (kL/year)



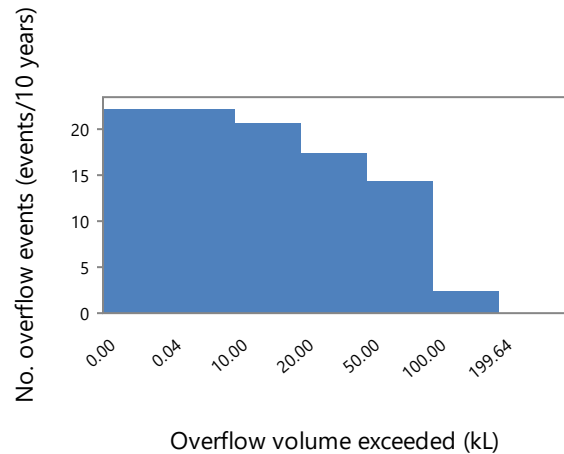
Name	Value
Rain	0.00
Inflow	8865.79
Recycling	0.00
Evaporation	0.00
Overflow	132.44
Irrigation	8733.33
Seepage	0.00
Delta Storage	0.02

Overflow Diagnostics

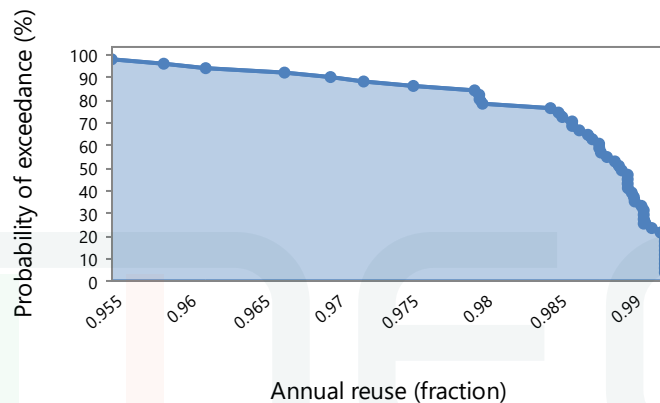
Volume of overflow (kL/year)	132.44
No. days pond overflows (days/year)	5.82
Average duration of overflow (days)	2.62
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% reuse (fraction)	1.00



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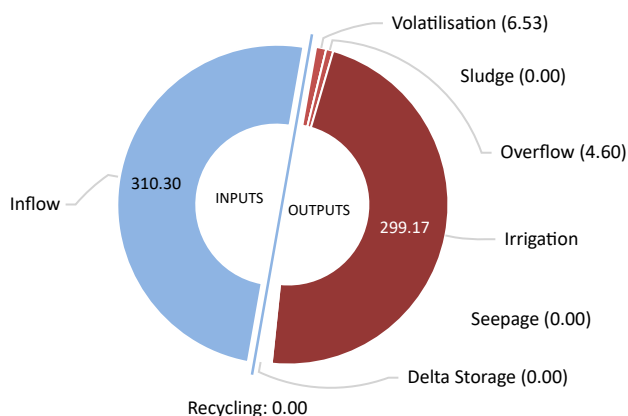


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

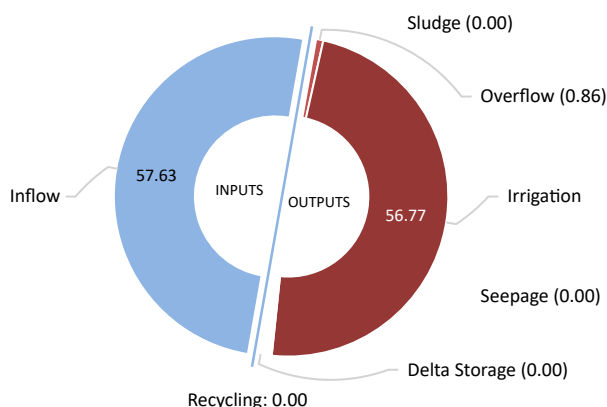
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



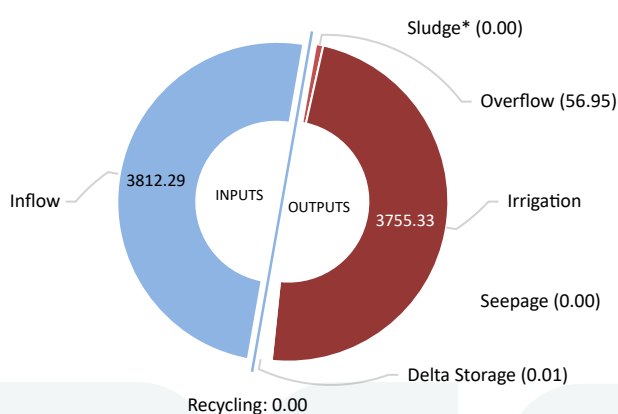
Name	Value
Inflow	310.30
Recycling	0.00
Volatilisation	6.53
Sludge	0.00
Overflow	4.60
Irrigation	299.17
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	57.63
Recycling	0.00
Sludge	0.00
Overflow	0.86
Irrigation	56.77
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	3812.29
Recycling	0.00
Sludge*	0.00
Overflow	56.95
Irrigation	3755.33
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank**Pond Nutrient Concentrations and Salinity:**

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	26.29
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.05
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	8733.33
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	8733.33
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.26
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.57
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days pond volume below min. vol. for irrigation (fraction)	0.06
Proportion of Days irrigation occurs (fraction)	0.89

PERFORMANCE

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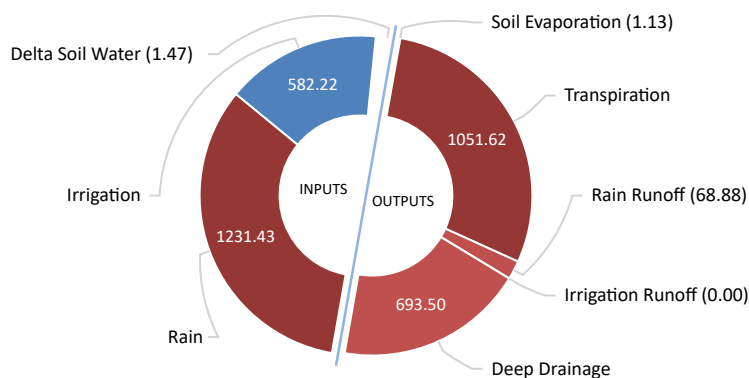
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

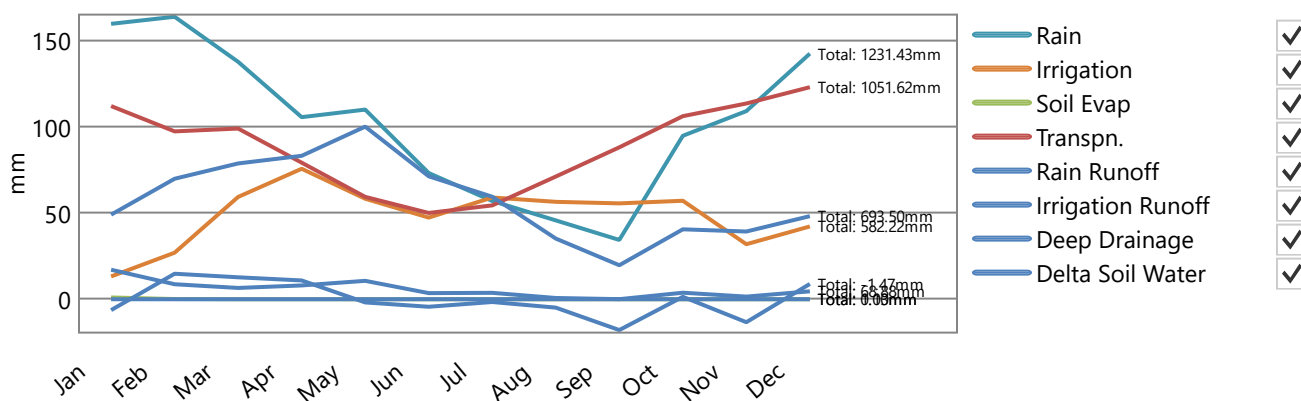
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	582.22
Soil Evaporation	1.13
Transpiration	1051.62
Rain Runoff	68.88
Irrigation Runoff	0.00
Deep Drainage	693.50
Delta Soil Water	-1.47

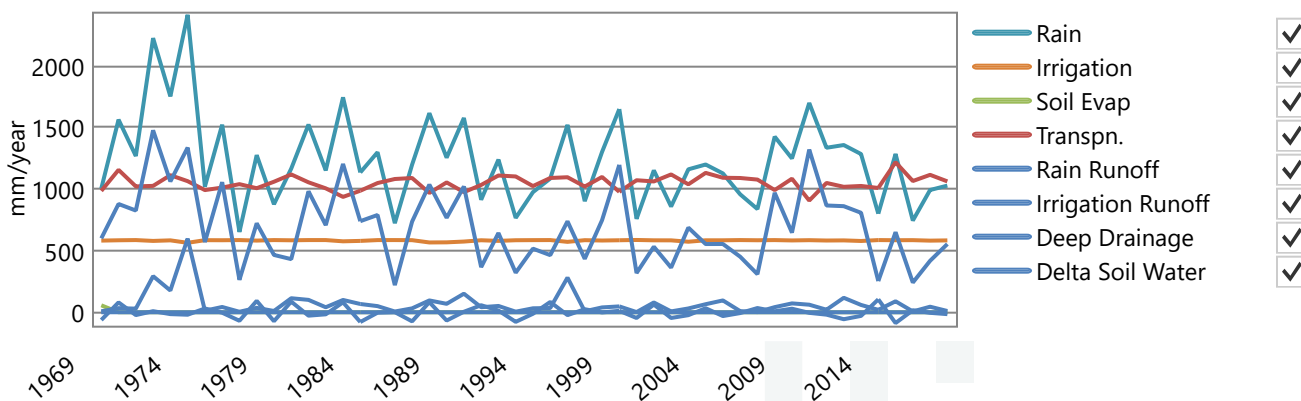
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



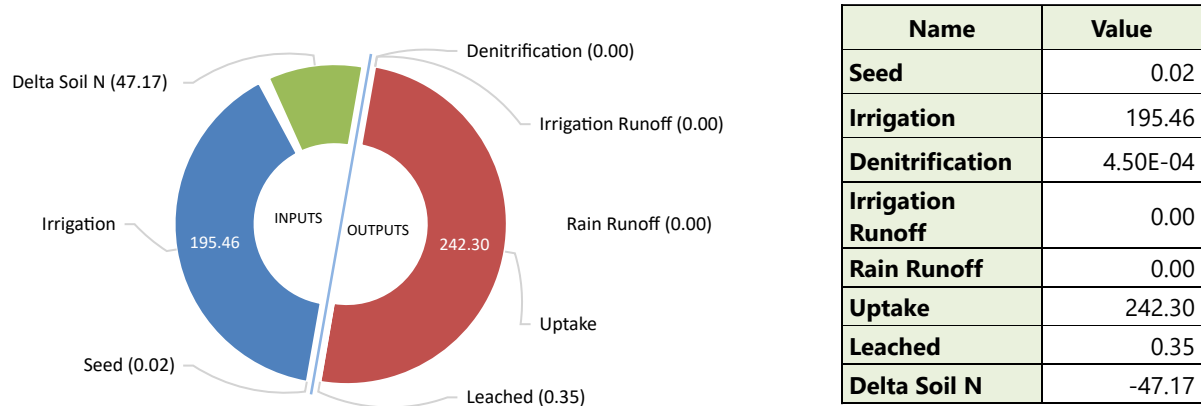
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

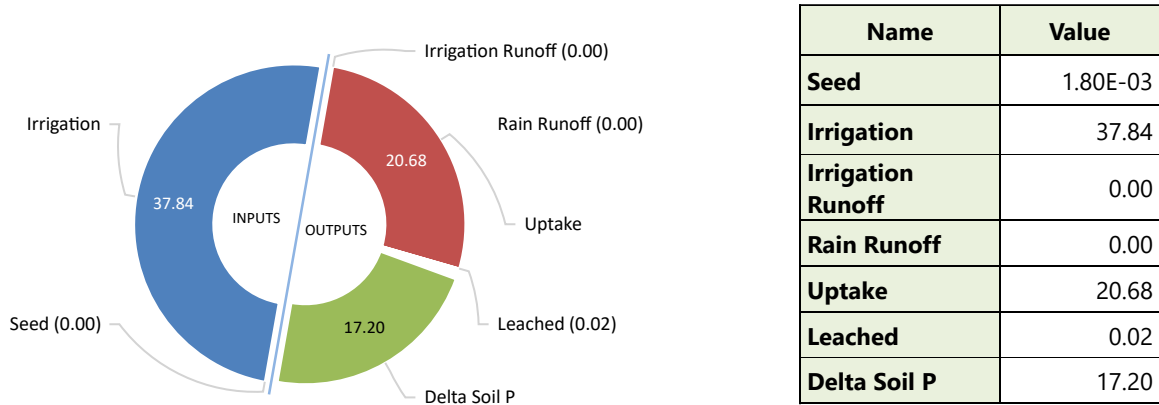
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 3.99
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)



PERFORMANCE

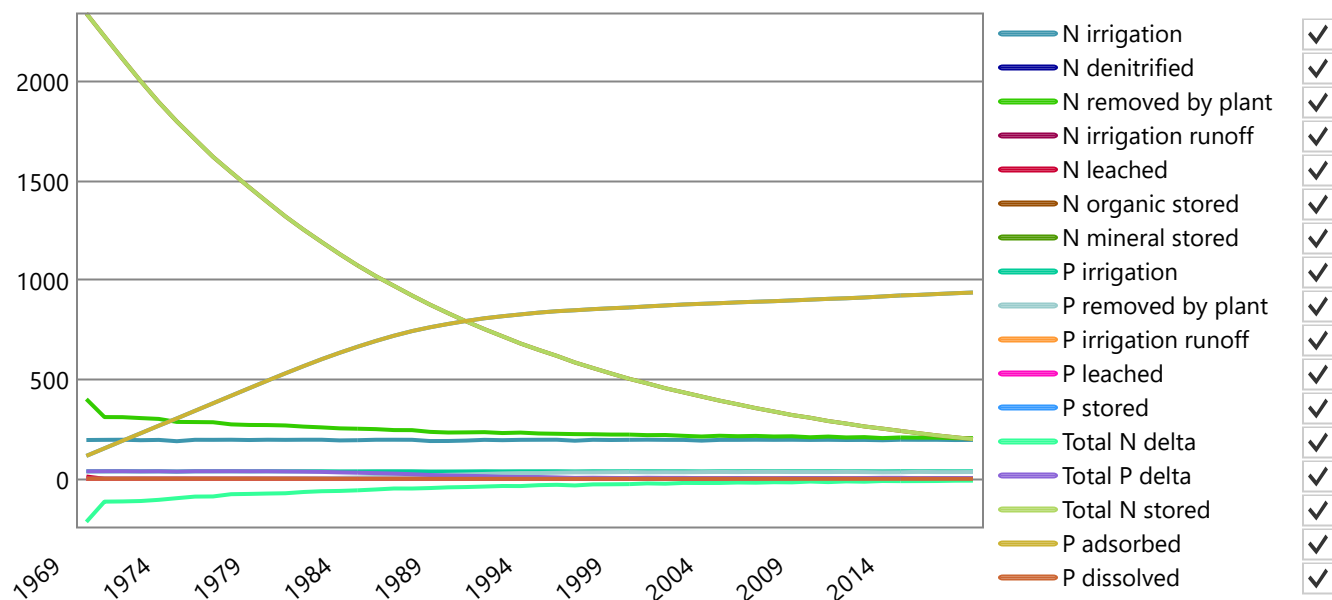


Land Performance - Soil Nutrient

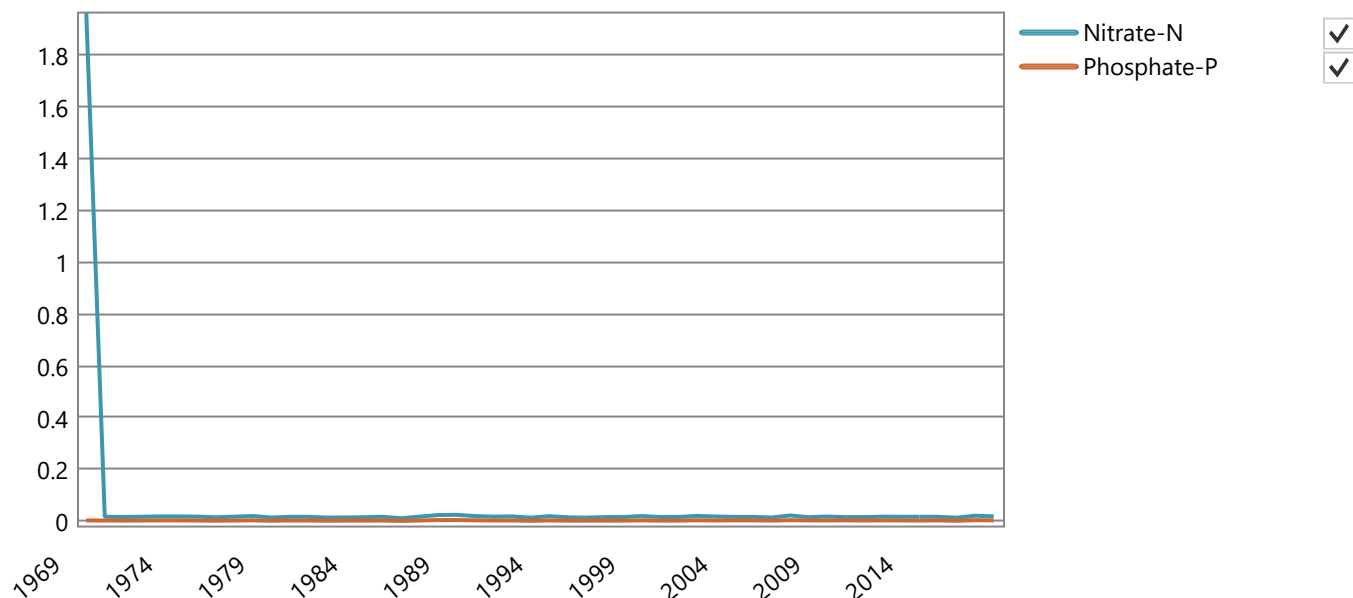
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE

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Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

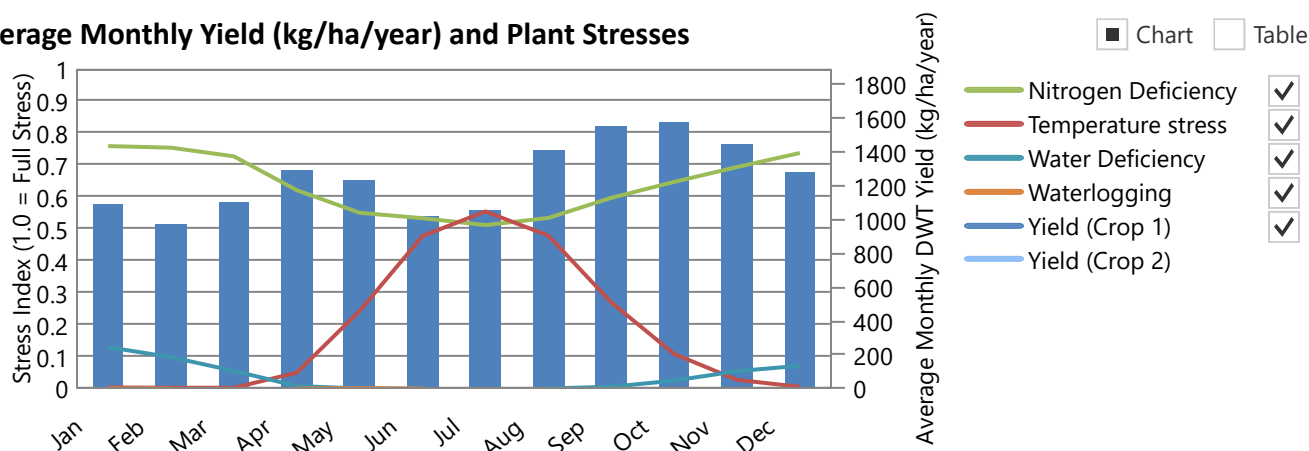
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	15053.47 (12863.05 - 21487.66)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.82 - 0.90)
Average monthly root depth (mm) (minimum - maximum)	699.61 (695.27 - 700.00)

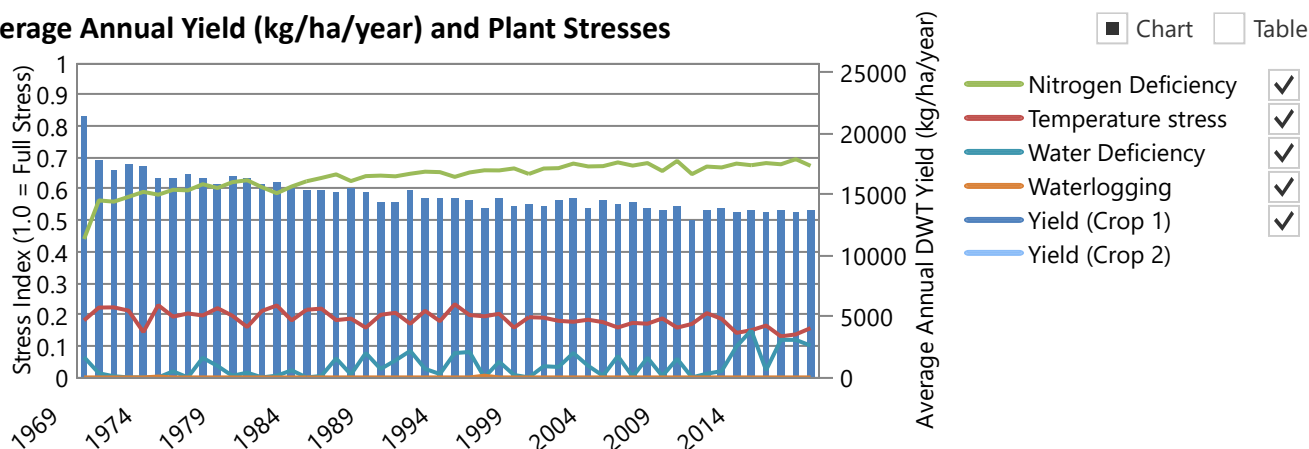
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	242.30 (204.53 - 401.23)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	20.68 (0.00 - 35.25)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.01 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 2.72 (normal)

No. days without crop/year (days/year): 0.00



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

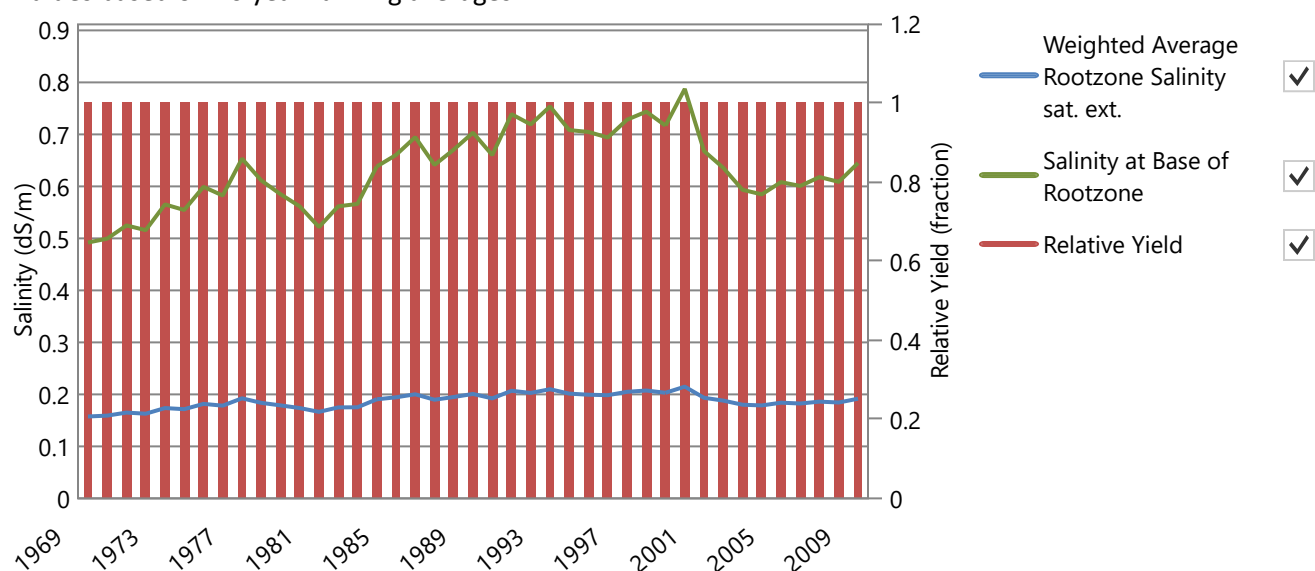
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	223.21
Average annual effluent salt added & leached at steady state (kg/ha/year)	2726.76
Average leaching fraction based on 10 year running averages (fraction)	0.60
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.63
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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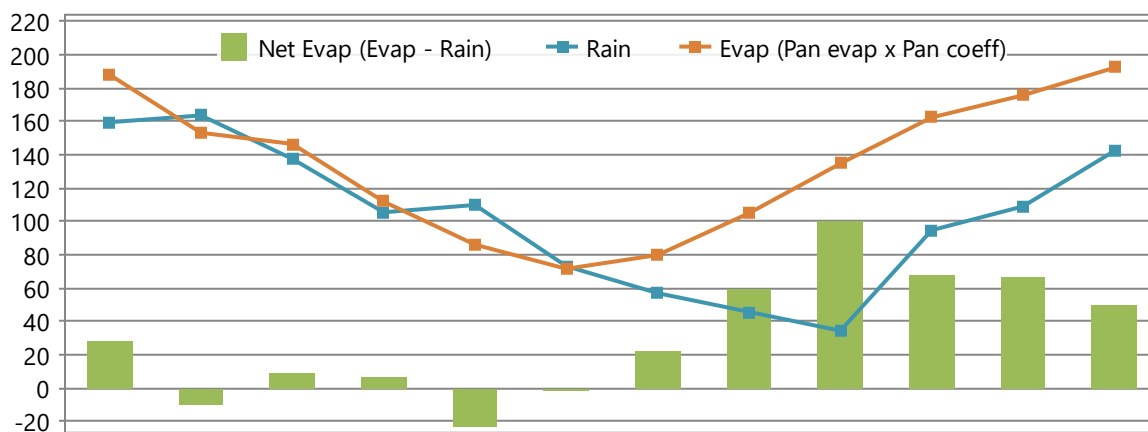
Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 8865.79 kL/year or 24.27 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 337.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (0.00 - 35.00)	310.30 (310.21 - 310.59)
Total Phosphorus	6.50 (0.00 - 6.50)	57.63 (57.61 - 57.68)
Total Dissolved Salts	430.00 (0.00 - 430.00)	3812.29 (3811.18 - 3815.82)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

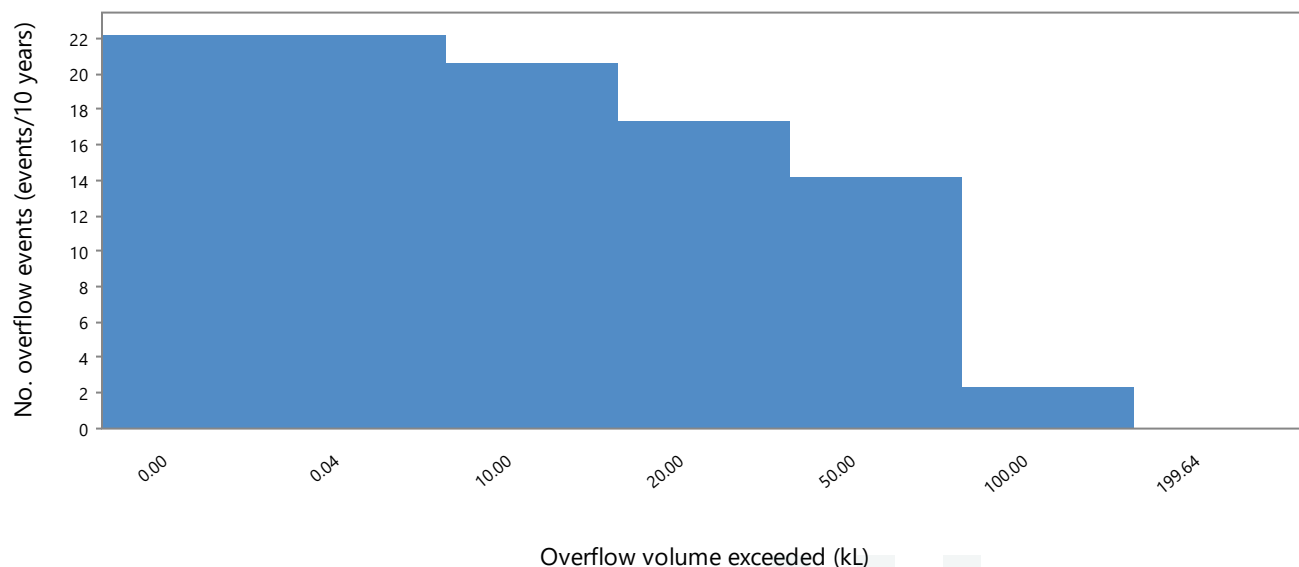
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.71
Average volume of overflow (kL/year)	132.44
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	2.22
Average duration of overflow (days)	2.62
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	7.92

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	8733.33	5822.22
Total nitrogen applied (kg)	293.19	195.46
Total phosphorus applied (kg)	56.77	37.84
Total salts applied (kg)	3755.33	2503.55

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.11
Proportion of Days irrigation occurs (fraction)	0.89

Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	13.2	26.9	59.2	75.6	58.2	47.3	58.9	56.4	55.5	57.0	31.9	42.2	582.2
Soil Evap	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1
Transpn.	111.9	97.2	98.8	79.1	59.3	50.0	54.3	71.0	87.9	106.0	113.3	122.8	1051.6
Rain Runoff	17.1	8.7	6.5	8.0	10.7	3.5	3.7	0.7	0.0	3.8	1.5	4.6	68.9
Irr. Runoff	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
Drainage	49.0	69.8	78.6	83.0	99.9	71.2	59.3	35.1	19.7	40.5	39.2	48.1	693.5
Delta	-6.3	14.8	12.7	10.9	-1.9	-4.4	-1.6	-4.9	-17.9	1.4	-13.3	8.9	-1.5

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	195.46
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	242.30
Average annual soil nitrogen removed by denitrification (kg/ha/year)	4.50E-04
Average annual soil nitrogen leached (kg/ha/year)	0.35
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.35
Soil organic-N kg/ha (Initial - Final)	2448.00 - 200.12
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.05
Max. annual nitrate-N concentration of deep drainage (mg/L)	1.96

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	37.84
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	20.68
Average annual soil phosphorus leached (kg/ha/year)	0.02
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 1.73E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 937.75
Average phosphate-P concentration in rootzone (mg/L)	2.40E-03
Average phosphate-P concentration of deep drainage (mg/L)	2.22E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	4.02E-03
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.17 mg/L (years)	129.40

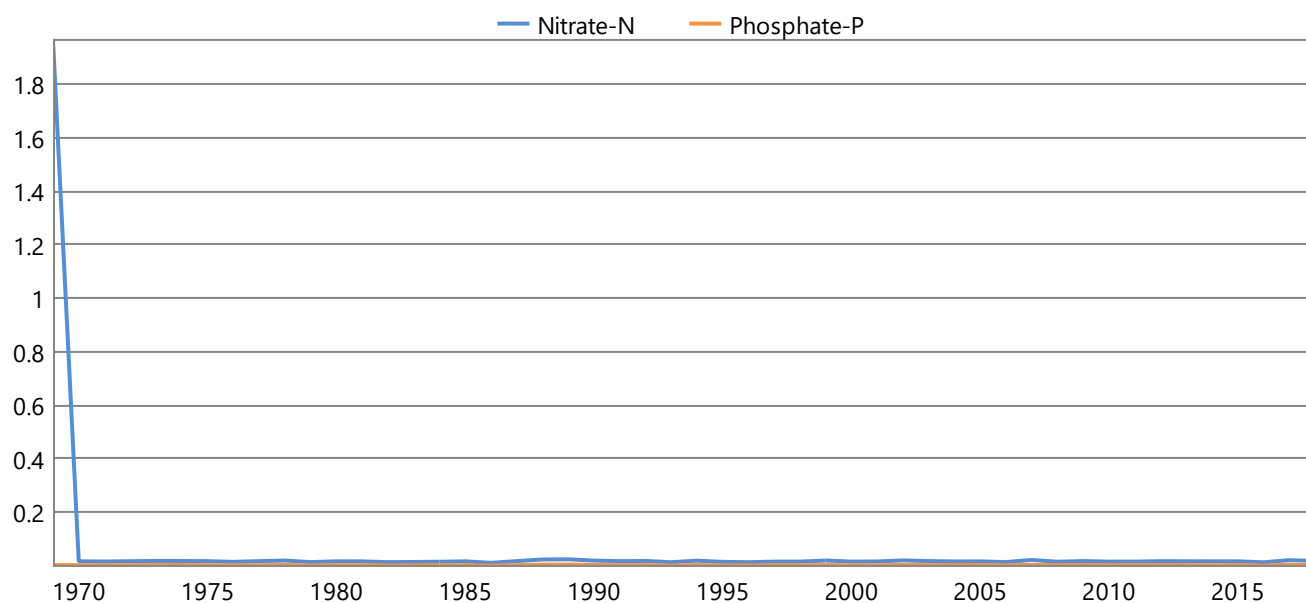
Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

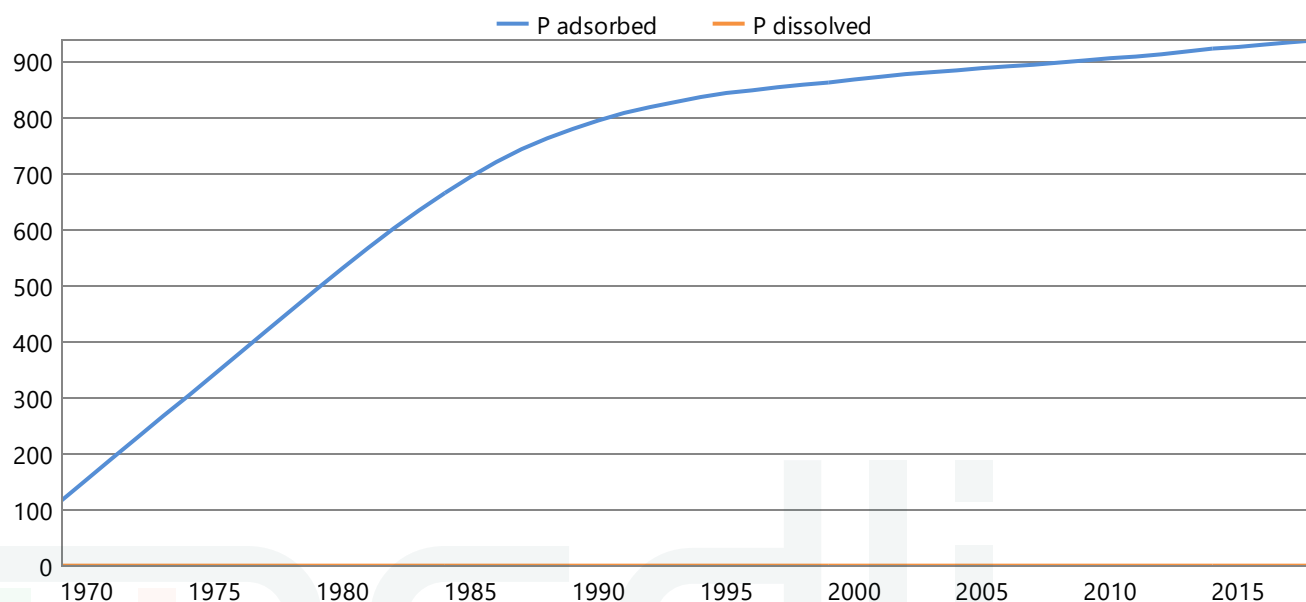
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_FVar_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	15053.47 (12863.05 - 21487.66)
Average monthly plant (green) cover (fraction)	0.87 (0.82 - 0.90)
Average monthly crop factor (fraction)	0.69 (0.66 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.61 (695.27 - 700.00)
Average number of normal harvests per year (no./year)	2.72 (2.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	2.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.64 (0.44 - 0.69)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.04 (0.00 - 0.13)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	223.21
Average annual effluent salt added & leached at steady state (kg/ha/year)	2726.76
Average leaching fraction based on 10 year running averages (fraction)	0.60
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.63
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

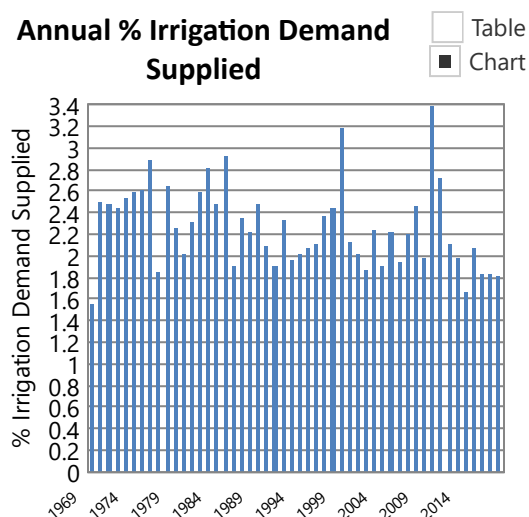
Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Average Annual %Irrigation Demand Supplied:

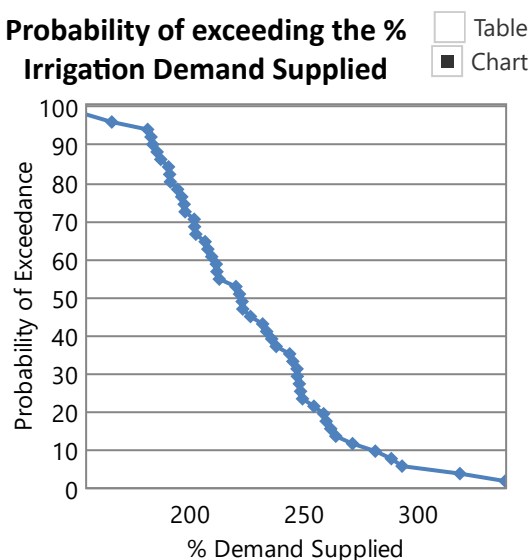
Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	11946.2
Annual irrigation predicted for defined scenario (mm/year)	1194.6
Average annual irrigation demand supplied (fraction)	2.2

Or for 1.50 ha: 8122 kL/year

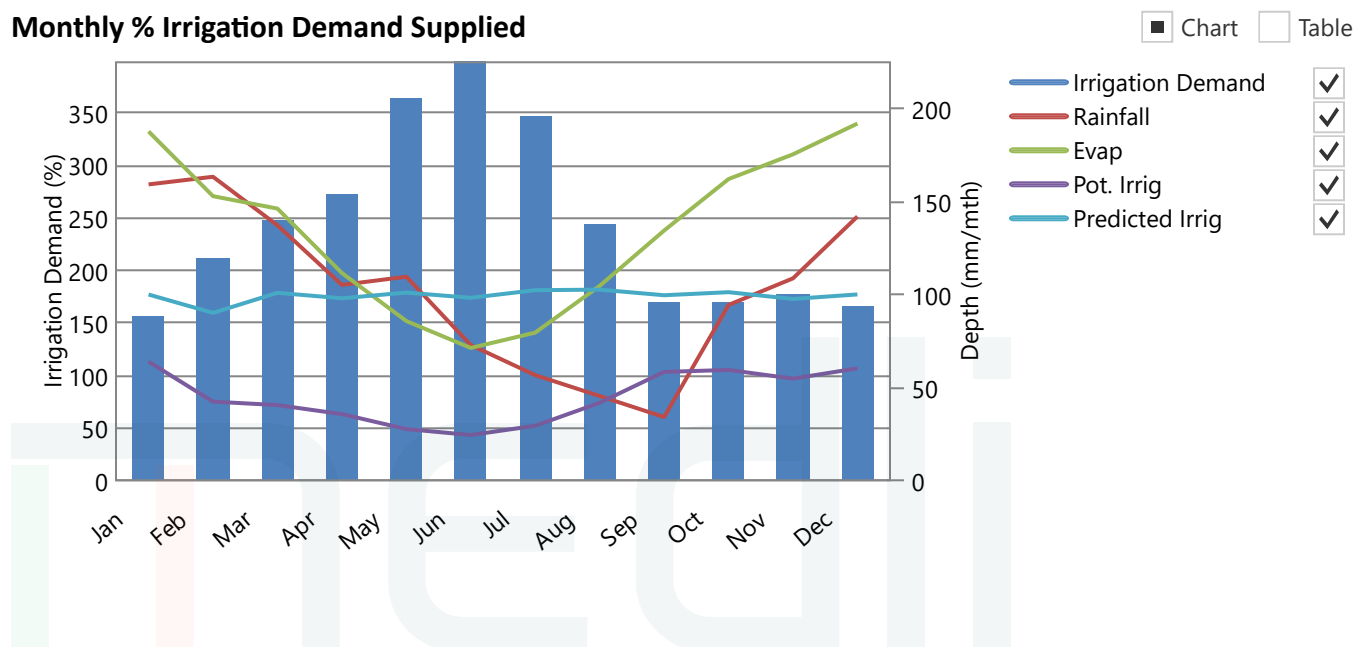
Annual % Irrigation Demand Supplied



Probability of exceeding the % Irrigation Demand Supplied



Monthly % Irrigation Demand Supplied



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

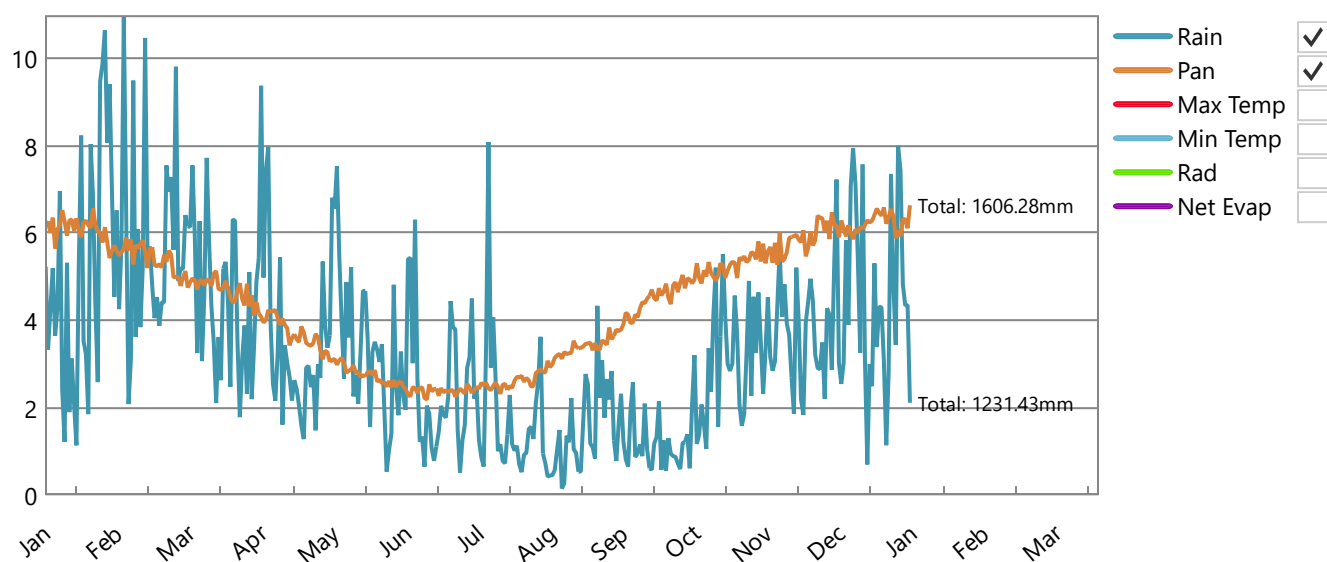
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



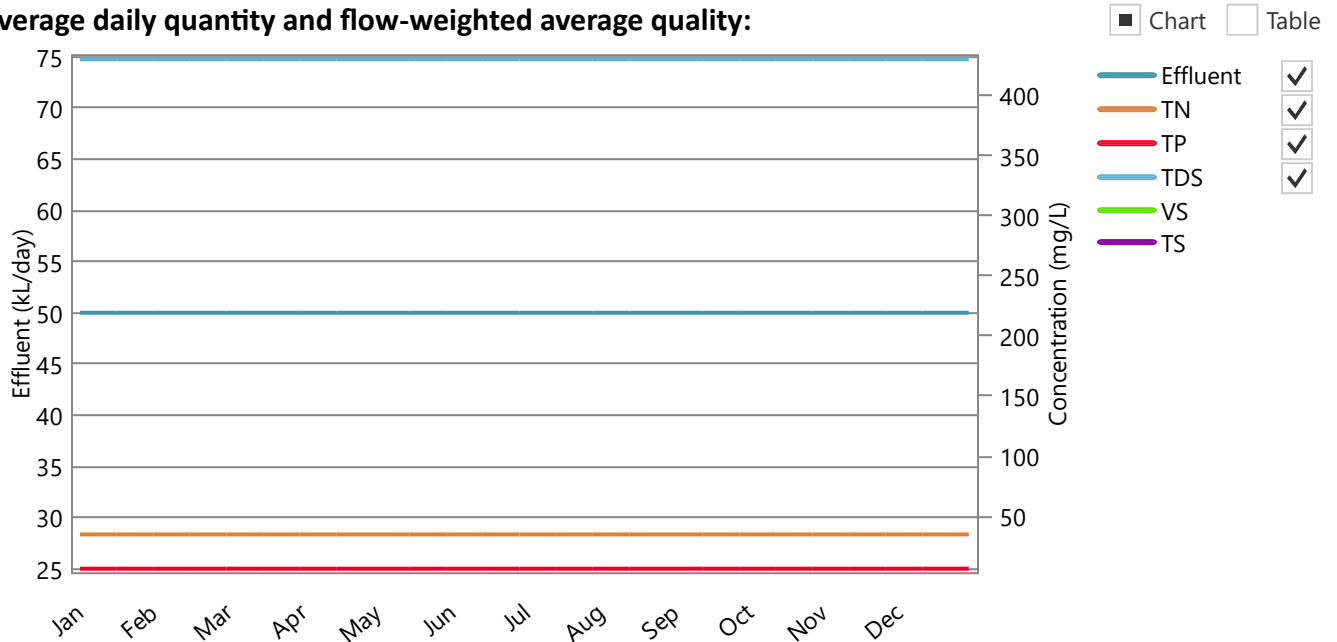
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **18262.00 kL/year** or 50.00 kL/day (Min-Max: 50.00 - 50.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	639.17 (638.75 - 640.50)
Total Phosphorus	6.50 (6.50 - 6.50)	118.70 (118.63 - 118.95)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7852.66 (7847.50 - 7869.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

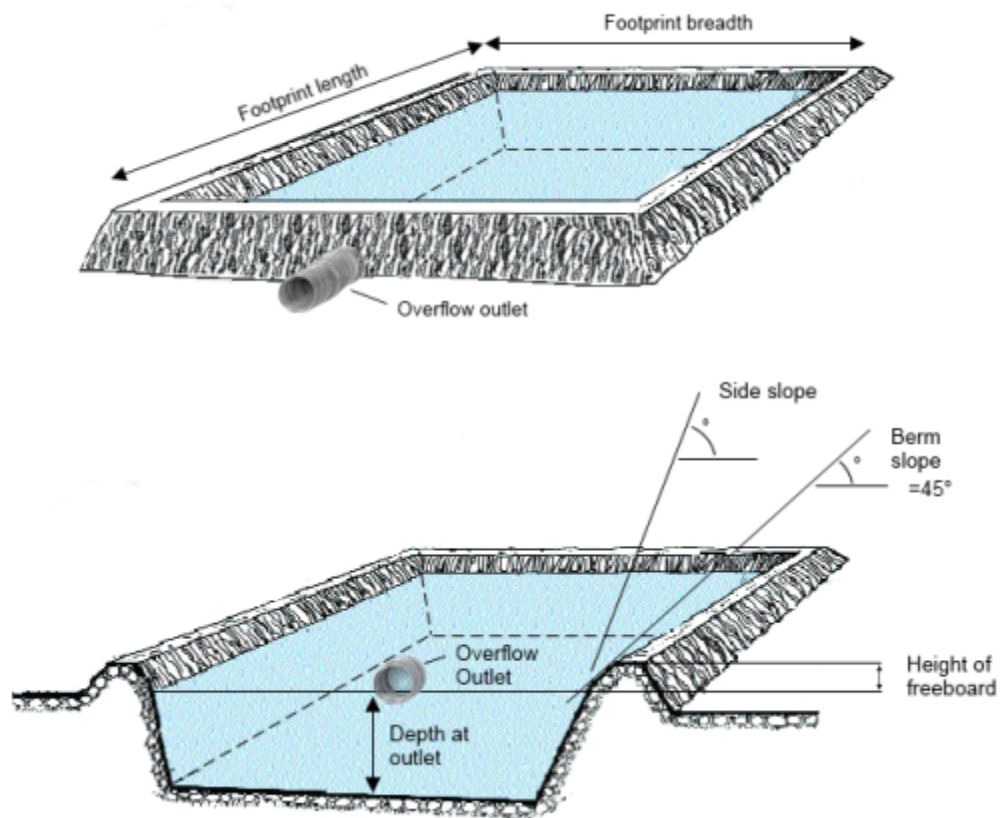
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	4.36



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

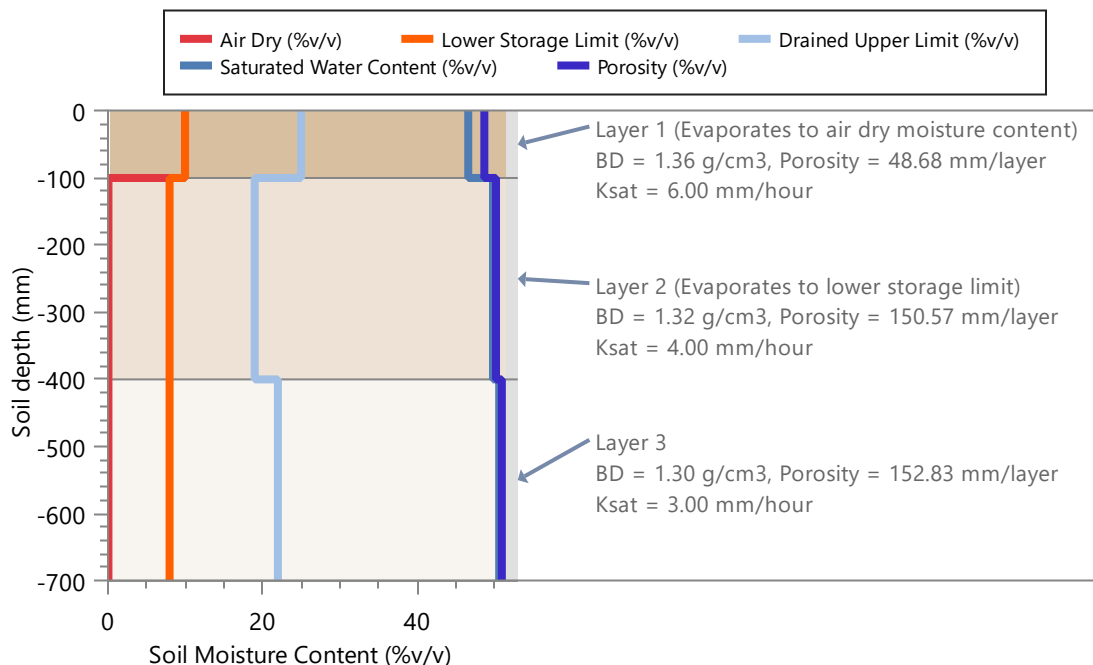
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

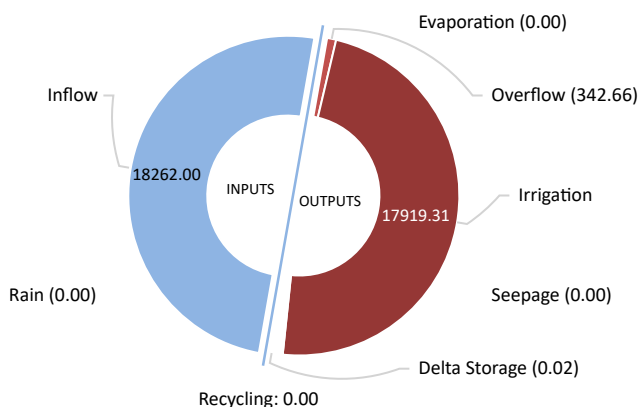
Average monthly cover (fraction) (minimum - maximum)	0.64 (0.62 - 0.67)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08

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Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

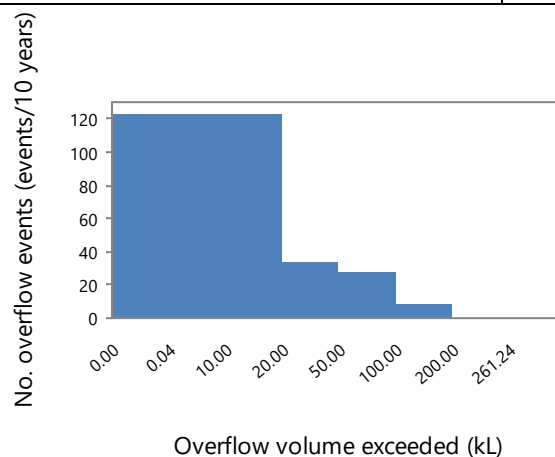
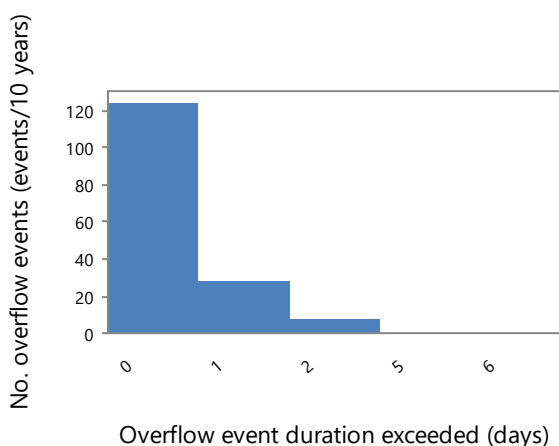
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	18262.00
Recycling	0.00
Evaporation	0.00
Overflow	342.66
Irrigation	17919.31
Seepage	0.00
Delta Storage	0.02

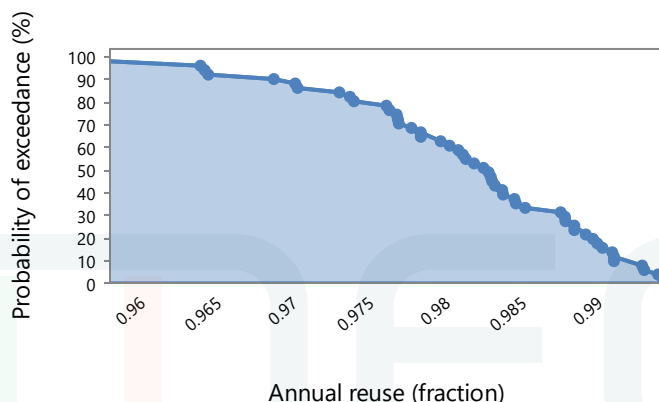
Overflow Diagnostics

Volume of overflow (kL/year)	342.66
No. days pond overflows (days/year)	16.20
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.98
Probability of at least 90% reuse (fraction)	1.00



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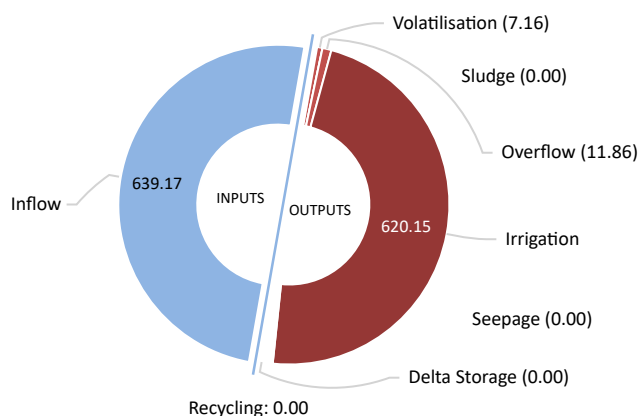


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

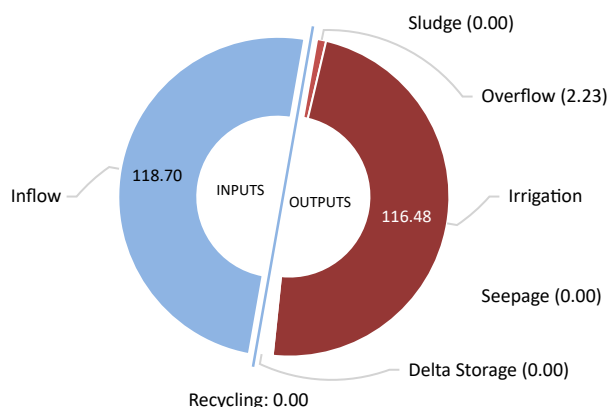
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



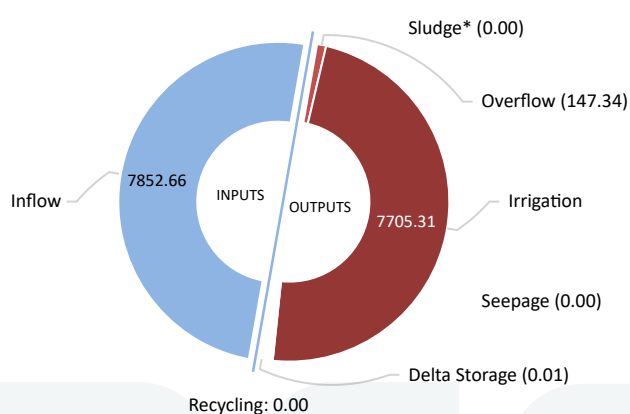
Name	Value
Inflow	639.17
Recycling	0.00
Volatilisation	7.16
Sludge	0.00
Overflow	11.86
Irrigation	620.15
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	118.70
Recycling	0.00
Sludge	0.00
Overflow	2.23
Irrigation	116.48
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	7852.66
Recycling	0.00
Sludge*	0.00
Overflow	147.34
Irrigation	7705.31
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	30.11
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.78
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	17919.31
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	17919.31
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.61
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.92
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

PERFORMANCE



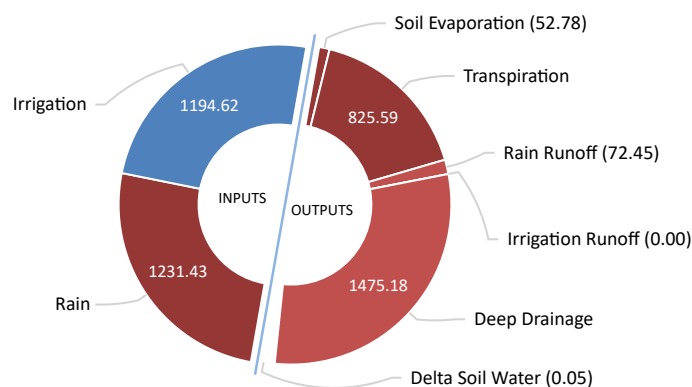
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

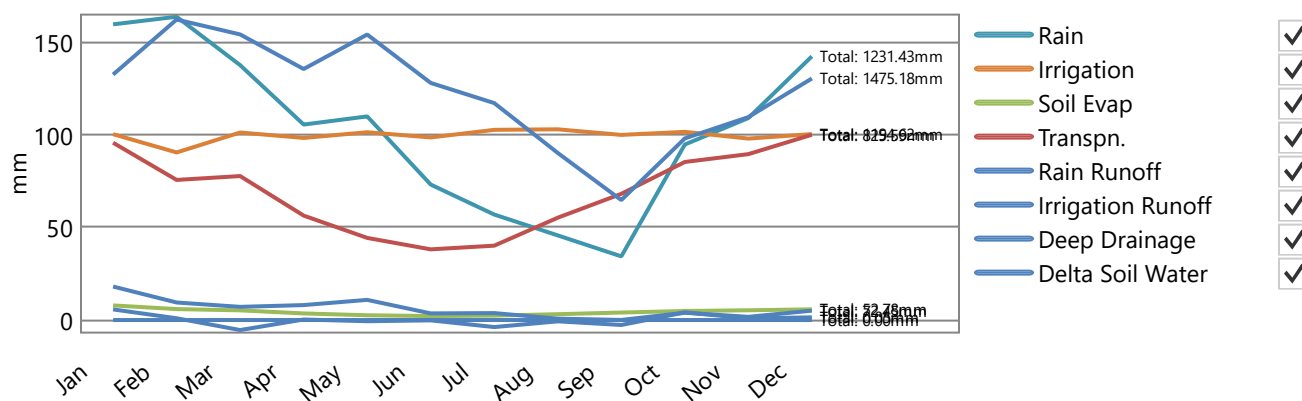
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	1194.62
Soil Evaporation	52.78
Transpiration	825.59
Rain Runoff	72.45
Irrigation Runoff	0.00
Deep Drainage	1475.18
Delta Soil Water	0.05

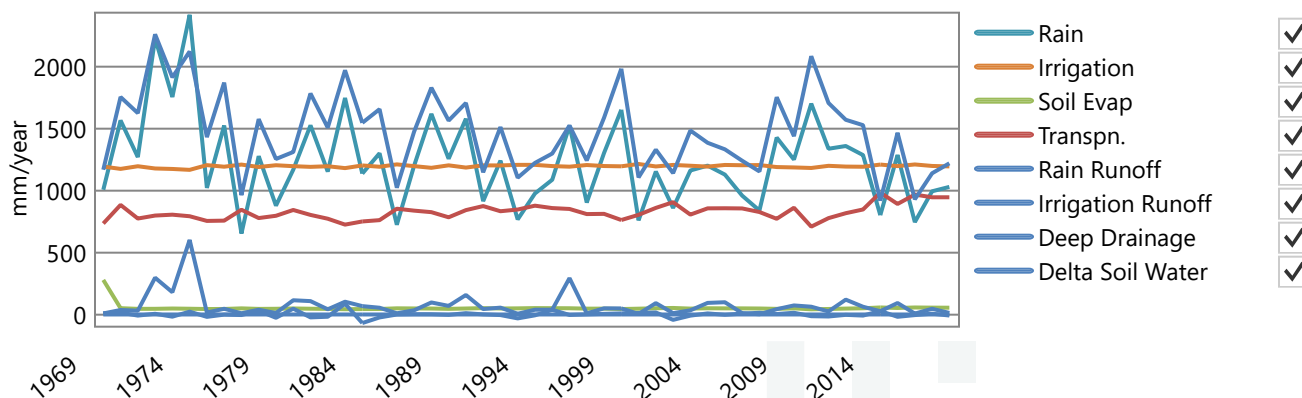
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



PERFORMANCE

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Land Performance - Soil Nutrient

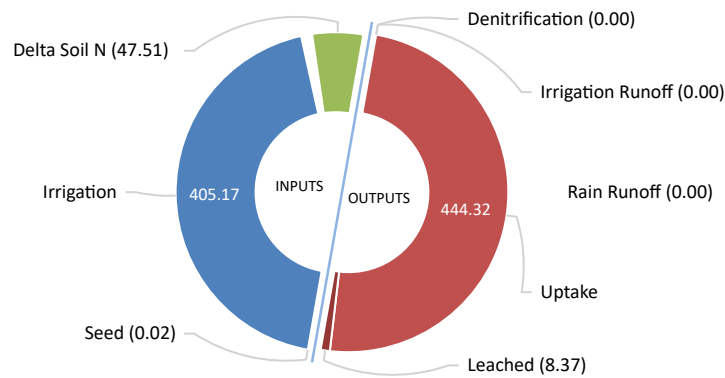
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 8.27

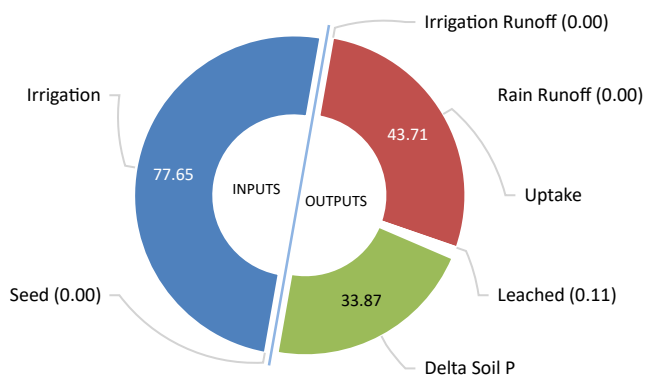
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	0.02
Irrigation	405.17
Denitrification	2.32E-03
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	444.32
Leached	8.37
Delta Soil N	-47.51

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	1.80E-03
Irrigation	77.65
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	43.71
Leached	0.11
Delta Soil P	33.87

PERFORMANCE

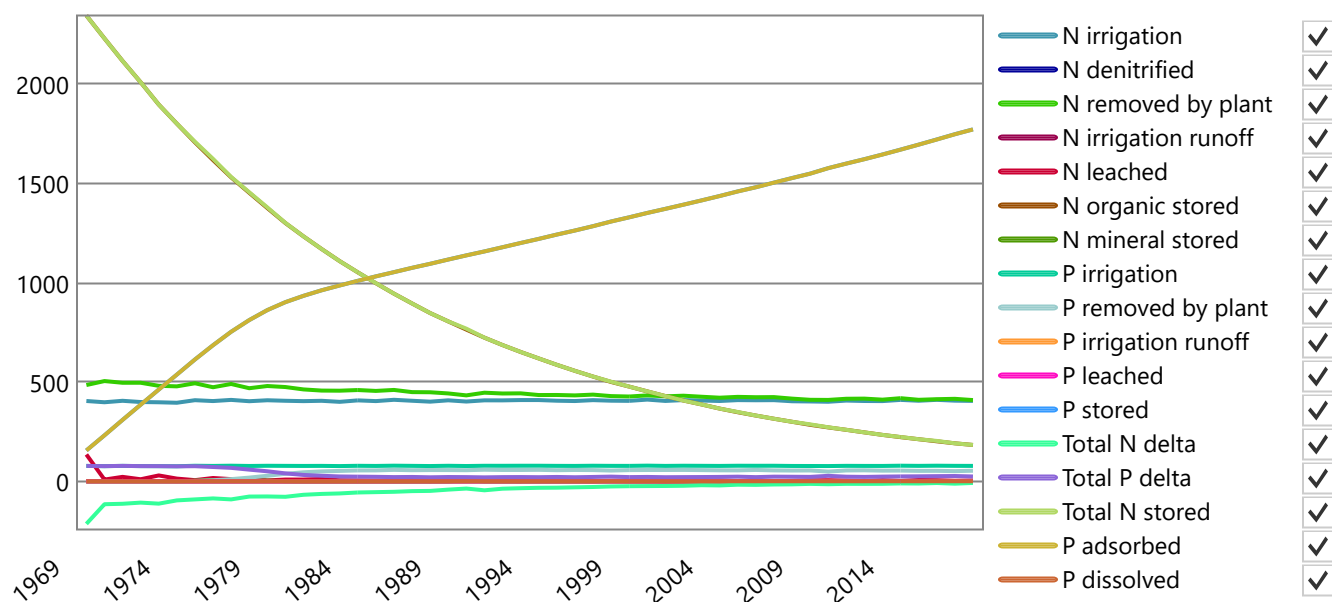


Land Performance - Soil Nutrient

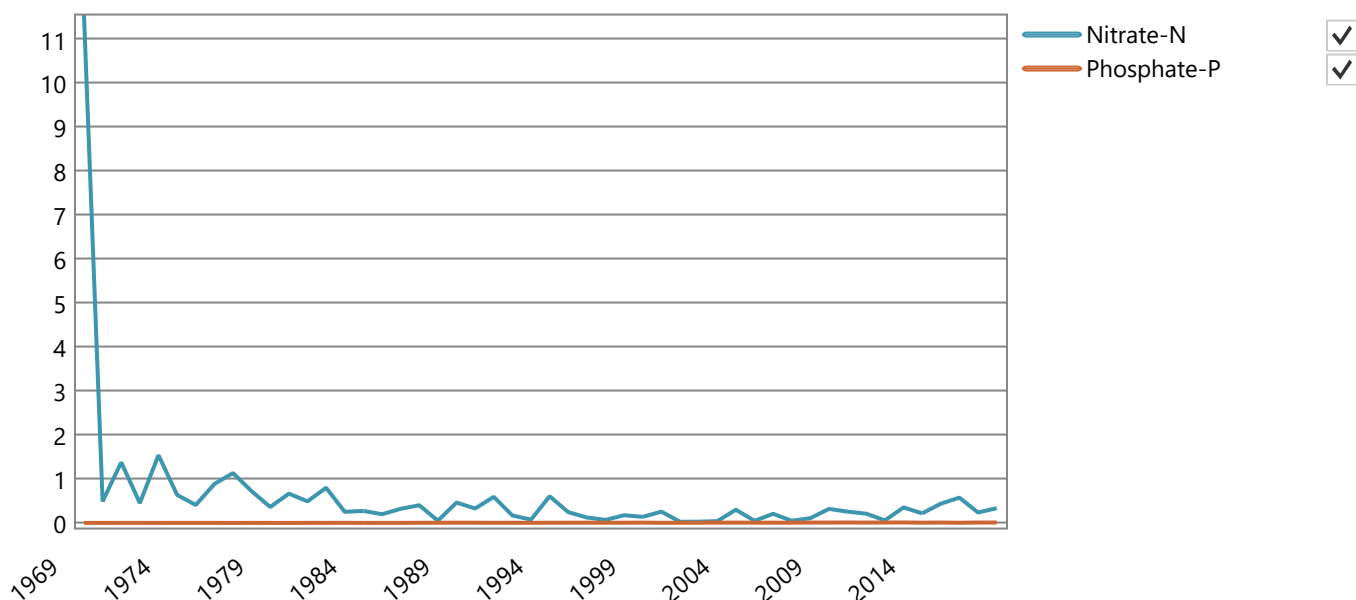
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

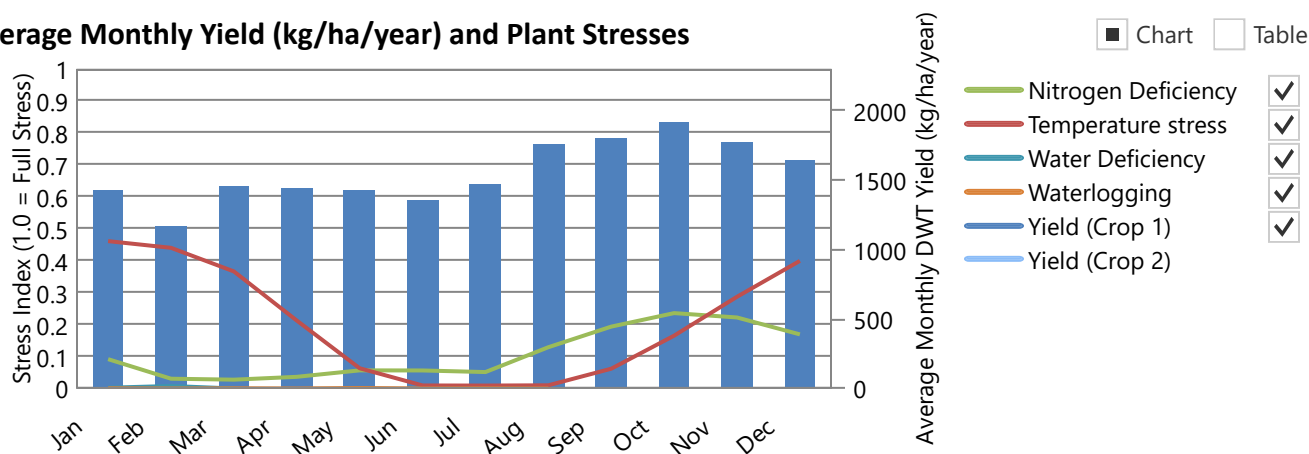
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	18656.22 (16321.01 - 20148.03)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.64 (0.62 - 0.67)
Average monthly root depth (mm) (minimum - maximum)	598.51 (593.24 - 599.99)

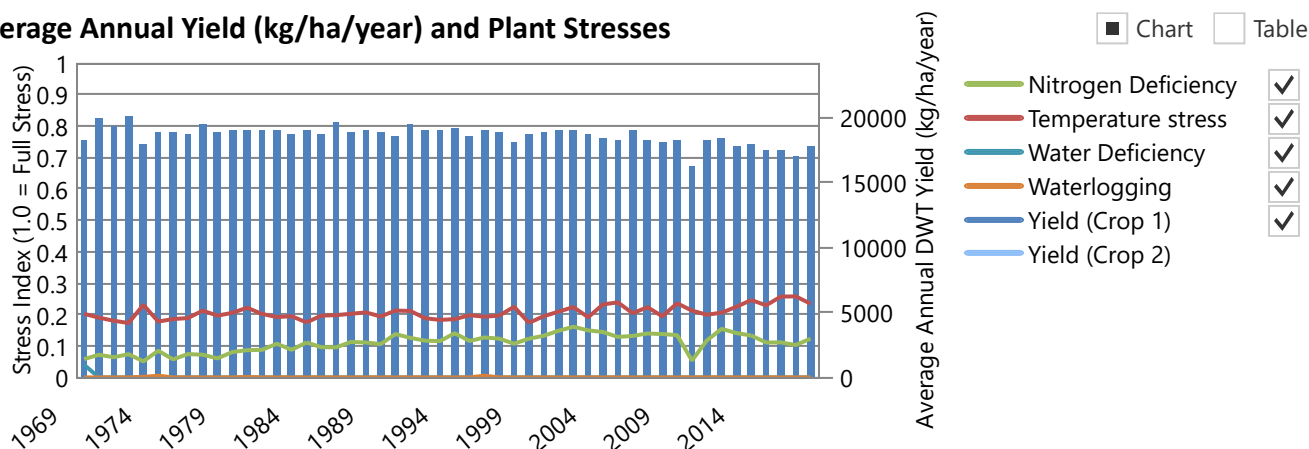
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	444.32 (408.84 - 504.52)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	43.71 (0.00 - 58.21)
Average annual shoot nitrogen concentration (fraction dwt)	0.03 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 4.82 (normal)

No. days without crop/year (days/year): 0.00

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Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

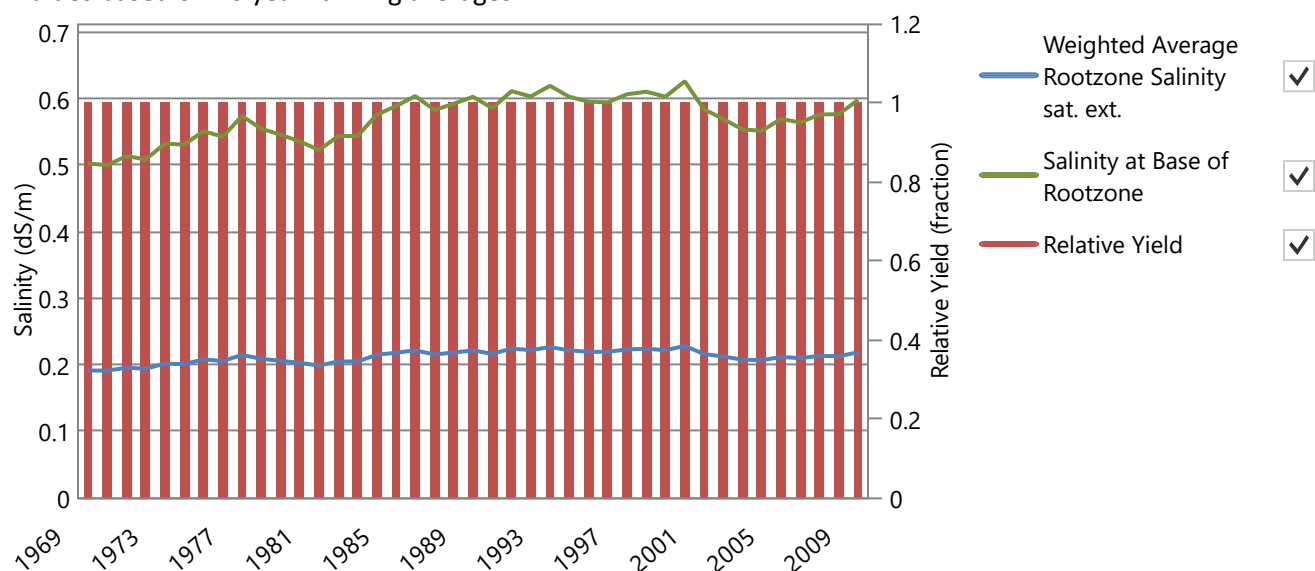
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.36
Salt added by rainfall (kg/ha/year)	222.52
Average annual effluent salt added & leached at steady state (kg/ha/year)	5359.40
Average leaching fraction based on 10 year running averages (fraction)	0.77
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.57
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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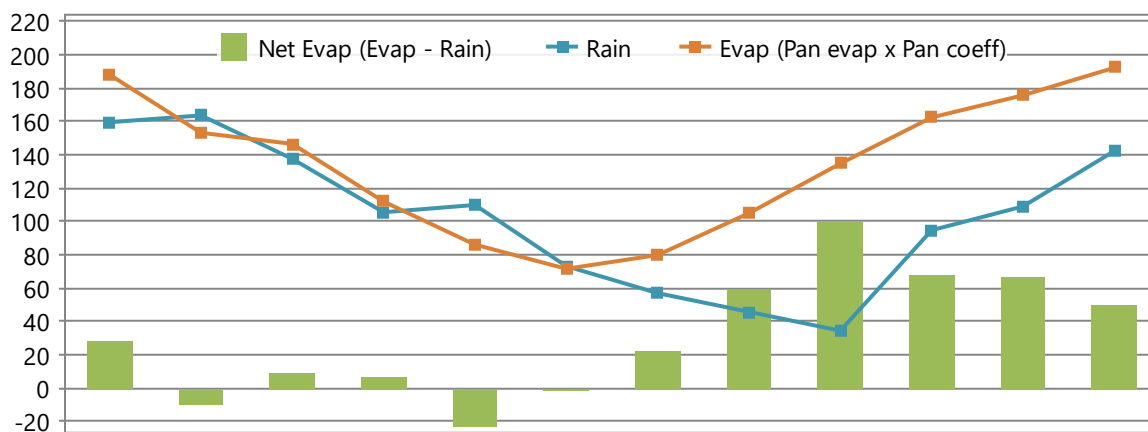
Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 18262.00 kL/year or 50.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	639.17 (638.75 - 640.50)
Total Phosphorus	6.50 (6.50 - 6.50)	118.70 (118.63 - 118.95)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7852.66 (7847.50 - 7869.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

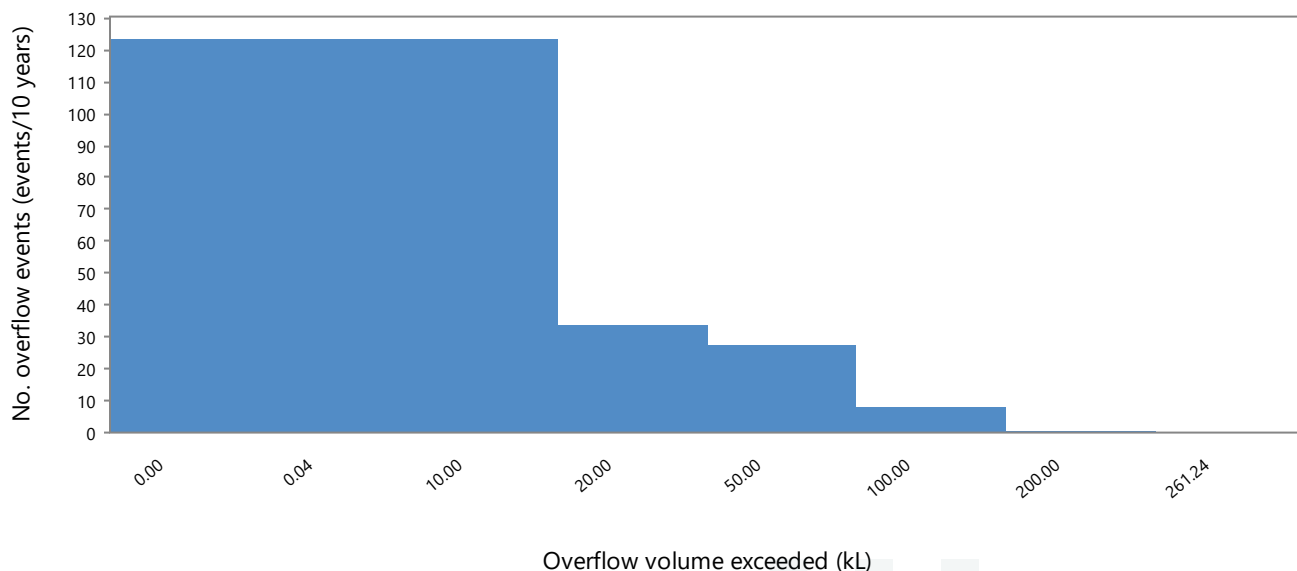
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	1.80
Average volume of overflow (kL/year)	342.66
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	12.34
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.98
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.67

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



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Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	17919.31	11946.21
Total nitrogen applied (kg)	607.75	405.17
Total phosphorus applied (kg)	116.48	77.65
Total salts applied (kg)	7705.31	5136.87

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	100.2	90.4	101.1	98.2	101.3	98.5	102.6	102.9	99.8	101.5	97.9	100.3	1194.6
Soil Evap	7.9	5.9	5.2	3.6	2.6	2.1	2.4	3.1	4.0	4.9	5.3	5.8	52.8
Transpn.	95.6	75.6	77.6	56.3	44.3	38.1	40.1	55.2	68.1	85.3	89.5	99.9	825.6
Rain Runoff	18.1	9.5	7.1	8.1	10.9	3.6	3.7	0.8	0.1	3.9	1.7	5.1	72.4
Irr. Runoff	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
Drainage	132.4	162.1	154.0	135.4	154.0	127.9	117.0	90.1	64.7	98.0	109.4	130.3	1475.2
Delta	5.7	1.0	-5.4	0.3	-0.6	-0.2	-3.8	-0.7	-2.7	4.1	0.9	1.5	0.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	405.17
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	444.32
Average annual soil nitrogen removed by denitrification (kg/ha/year)	2.32E-03
Average annual soil nitrogen leached (kg/ha/year)	8.37
Average annual nitrate-N loading to groundwater (kg/ha/year)	8.37
Soil organic-N kg/ha (Initial - Final)	2448.00 - 182.92
	110.64 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.57
Max. annual nitrate-N concentration of deep drainage (mg/L)	11.57

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	77.65
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	43.71
Average annual soil phosphorus leached (kg/ha/year)	0.11
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 0.31
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1771.00
Average phosphate-P concentration in rootzone (mg/L)	0.08
Average phosphate-P concentration of deep drainage (mg/L)	0.01
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 3.30 mg/L (years)	68.06

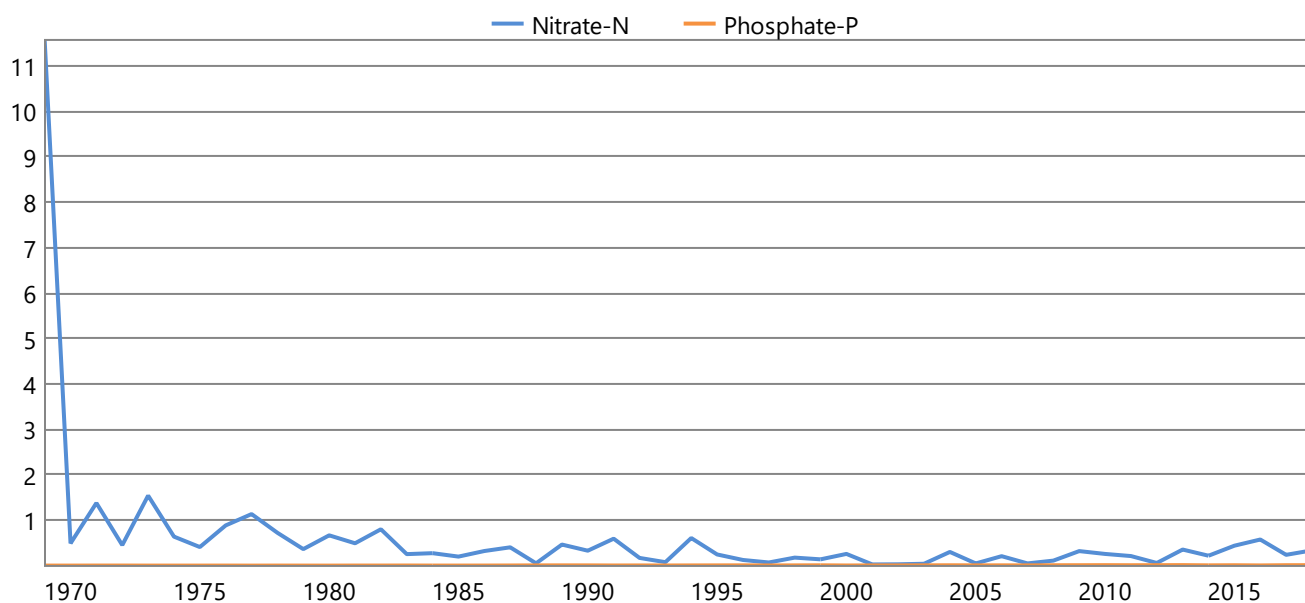
Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

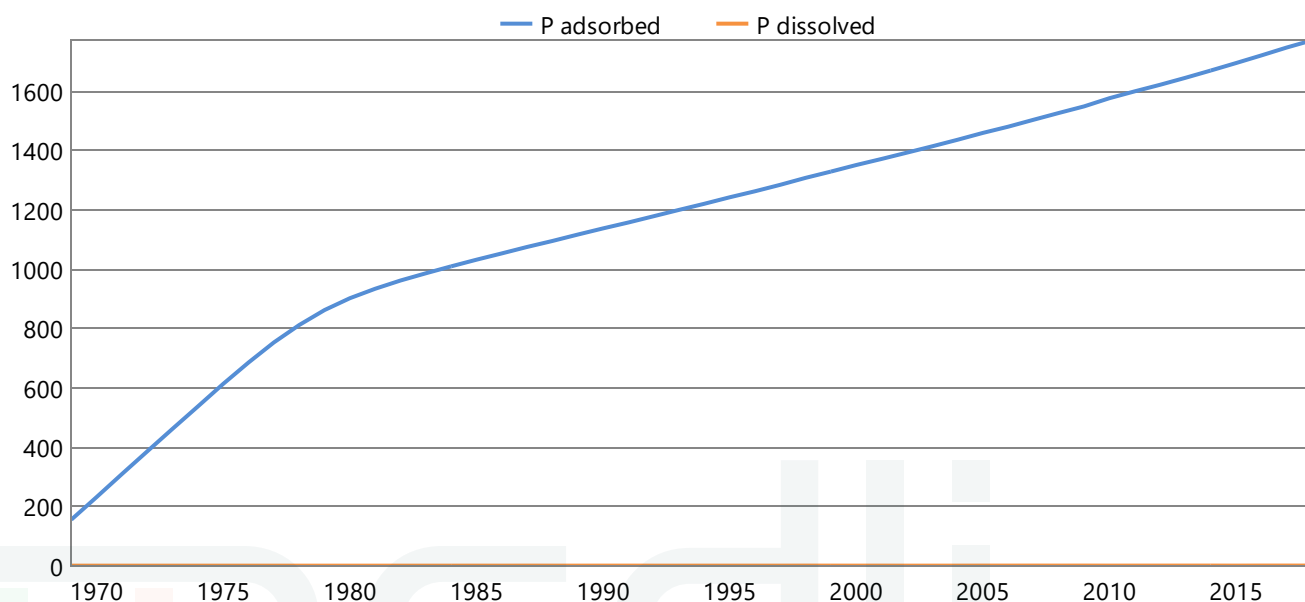
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_RyeGrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	18656.22 (16321.01 - 20148.03)
Average monthly plant (green) cover (fraction)	0.64 (0.62 - 0.67)
Average monthly crop factor (fraction)	0.51 (0.50 - 0.53)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	598.51 (593.24 - 599.99)
Average number of normal harvests per year (no./year)	4.82 (4.00 - 6.00)
Average number of normal harvests for last five years only (no./year)	4.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.05 - 0.16)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.36
Salt added by rainfall (kg/ha/year)	222.52
Average annual effluent salt added & leached at steady state (kg/ha/year)	5359.40
Average leaching fraction based on 10 year running averages (fraction)	0.77
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.57
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title: Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

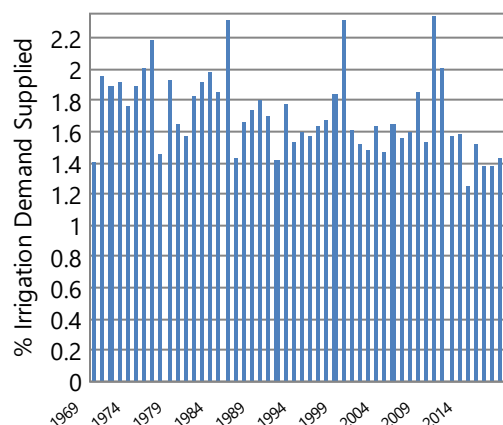
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	11946.2
Annual irrigation predicted for defined scenario (mm/year)	1194.6
Average annual irrigation demand supplied (fraction)	1.7

Or for 1.50 ha: 10668 kL/year

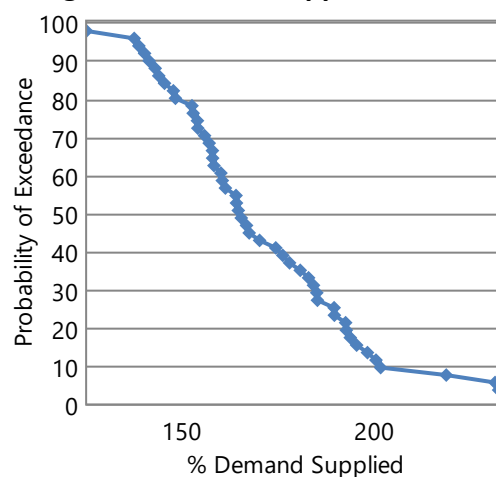
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



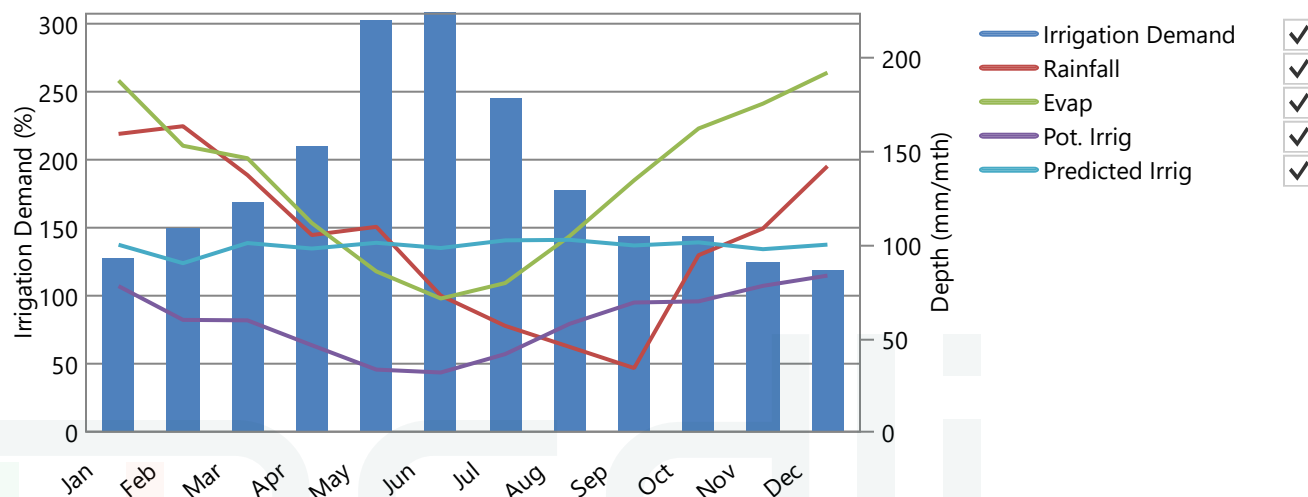
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

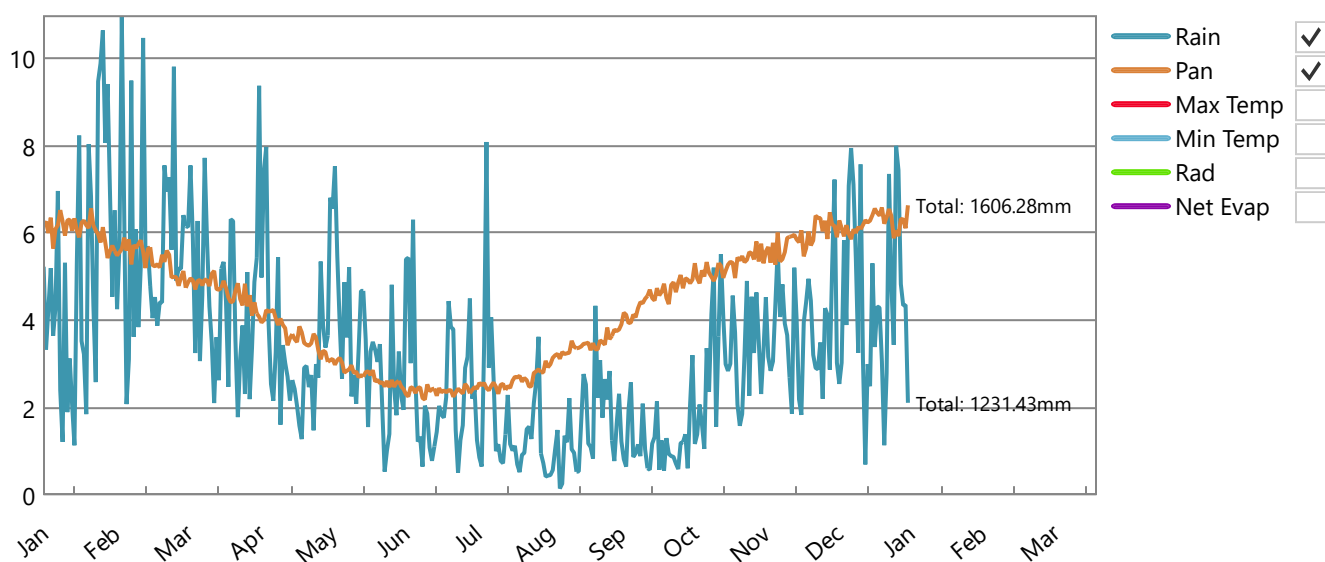
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



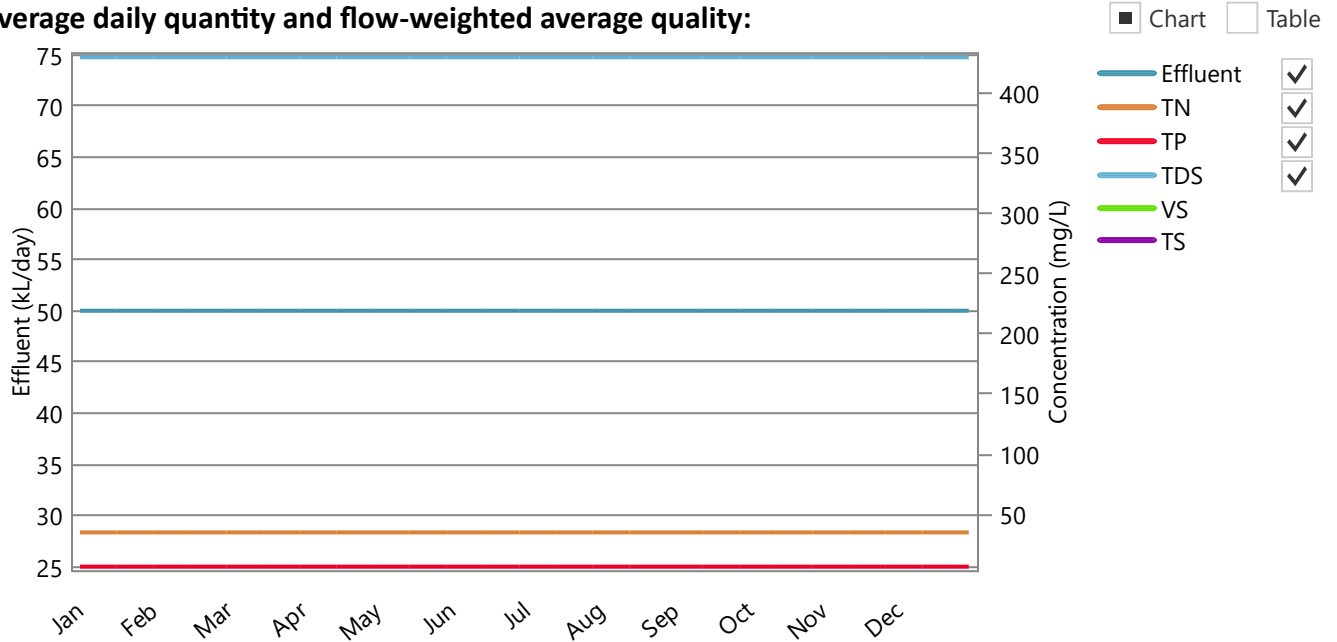
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **18262.00 kL/year** or 50.00 kL/day (Min-Max: 50.00 - 50.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	639.17 (638.75 - 640.50)
Total Phosphorus	6.50 (6.50 - 6.50)	118.70 (118.63 - 118.95)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7852.66 (7847.50 - 7869.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

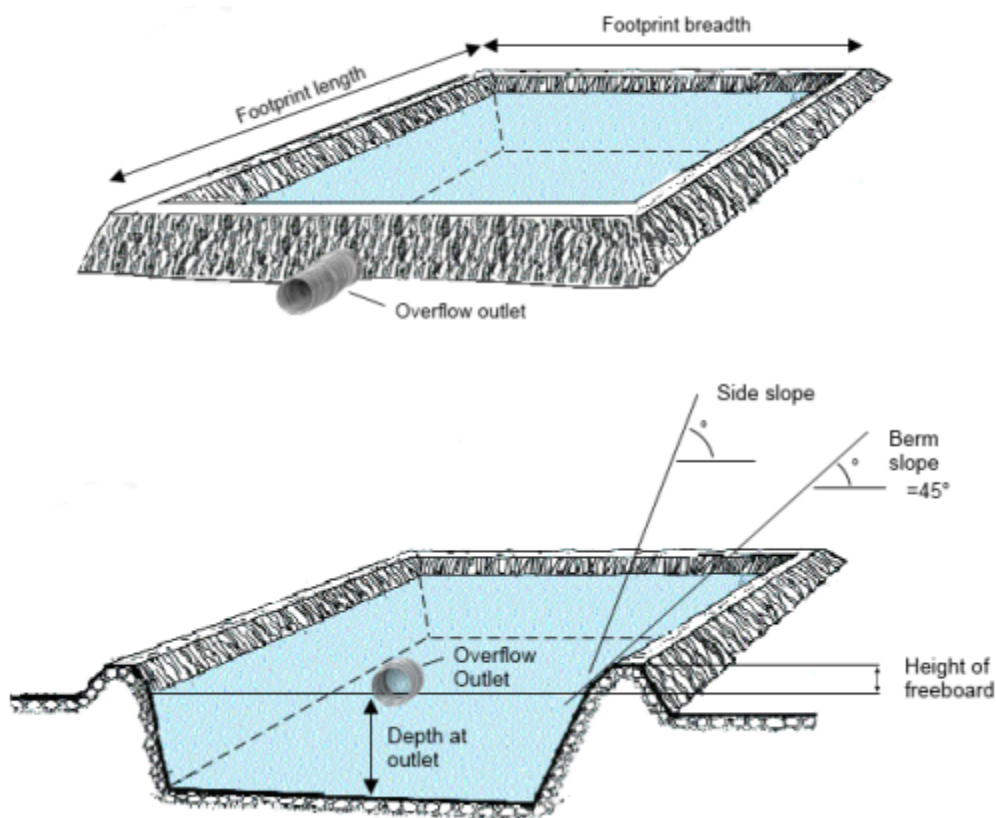
DESCRIPTION

medli

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	4.36



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

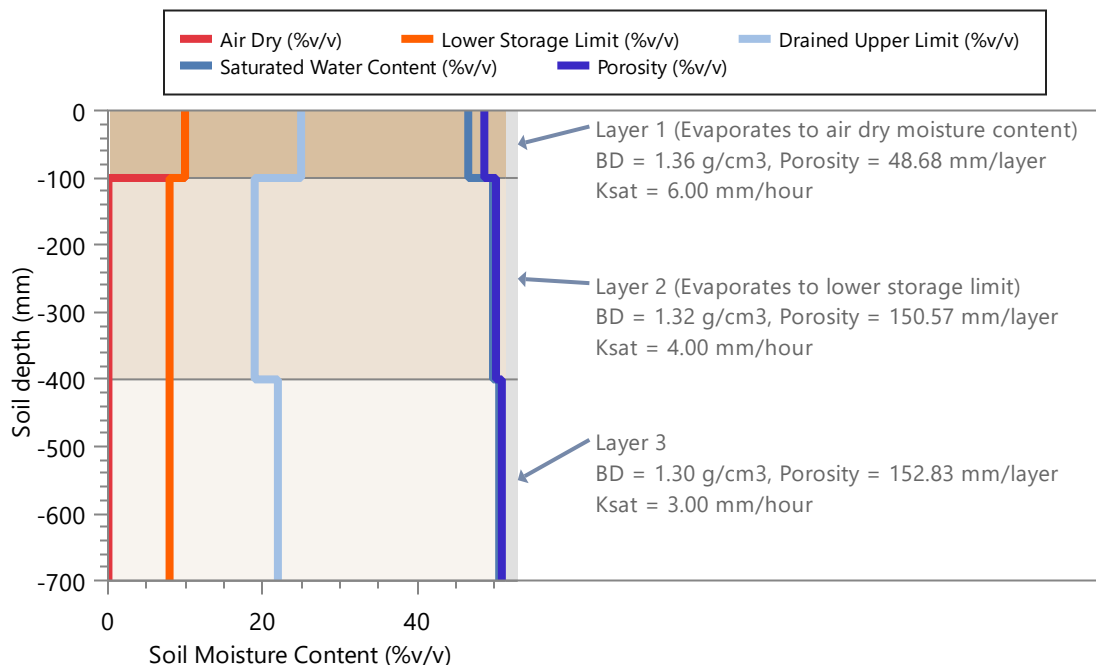
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

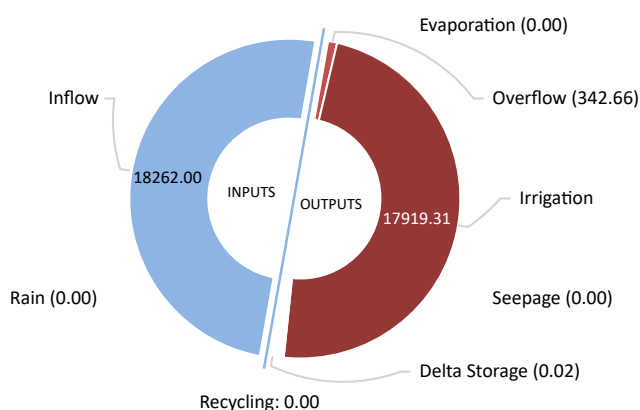
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.80 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

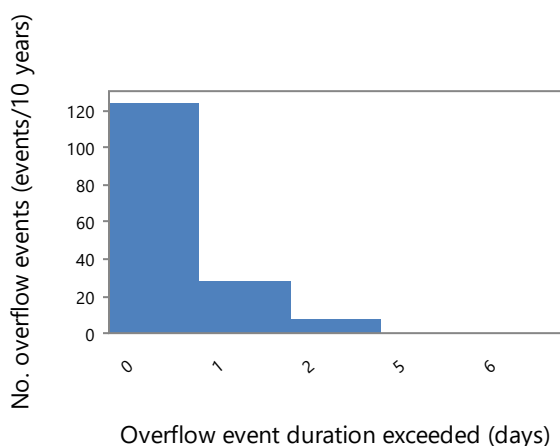
Pond System Water Balance (kL/year)



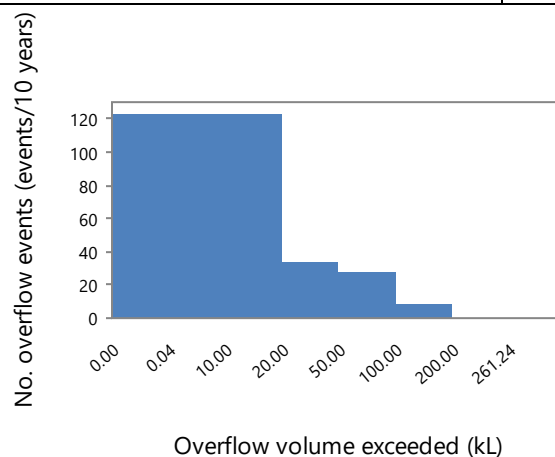
Name	Value
Rain	0.00
Inflow	18262.00
Recycling	0.00
Evaporation	0.00
Overflow	342.66
Irrigation	17919.31
Seepage	0.00
Delta Storage	0.02

Overflow Diagnostics

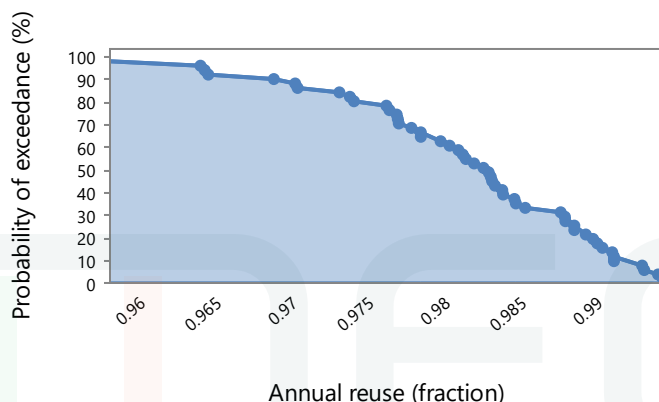
Volume of overflow (kL/year)	342.66
No. days pond overflows (days/year)	16.20
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.98
Probability of at least 90% reuse (fraction)	1.00



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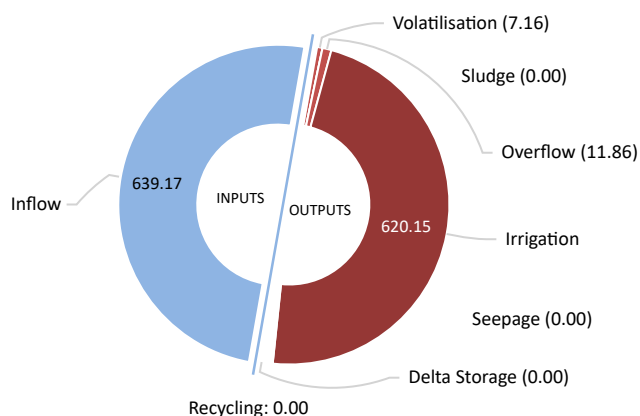


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

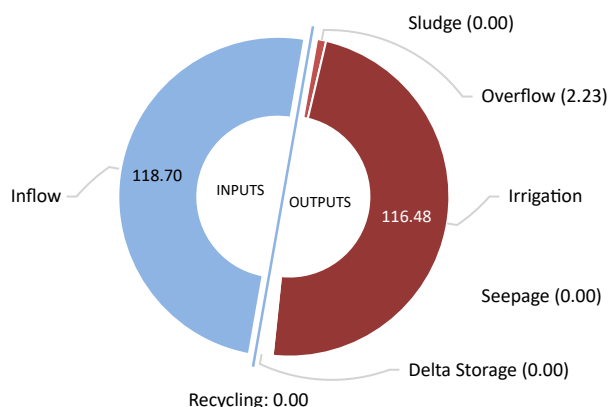
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



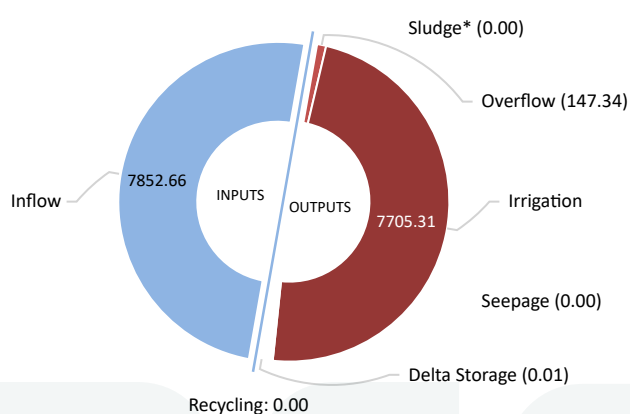
Name	Value
Inflow	639.17
Recycling	0.00
Volatilisation	7.16
Sludge	0.00
Overflow	11.86
Irrigation	620.15
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	118.70
Recycling	0.00
Sludge	0.00
Overflow	2.23
Irrigation	116.48
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	7852.66
Recycling	0.00
Sludge*	0.00
Overflow	147.34
Irrigation	7705.31
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	30.11
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.78
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE



Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	17919.31
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	17919.31
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.61
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.92
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96



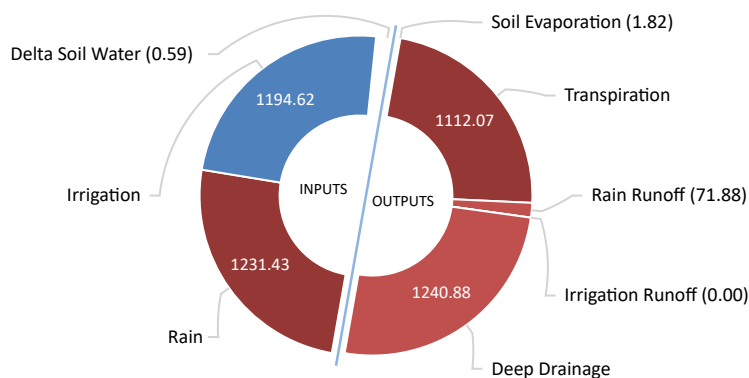
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

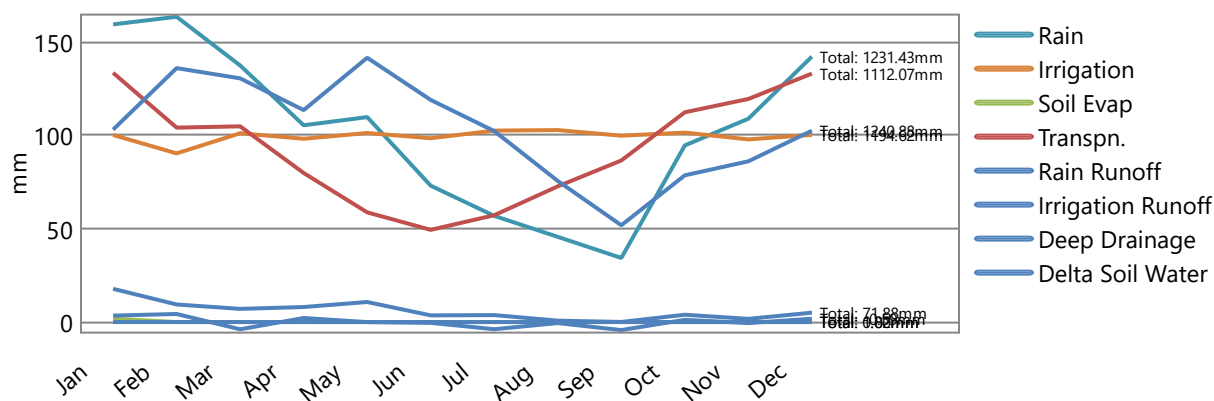
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	1194.62
Soil Evaporation	1.82
Transpiration	1112.07
Rain Runoff	71.88
Irrigation Runoff	0.00
Deep Drainage	1240.88
Delta Soil Water	-0.59

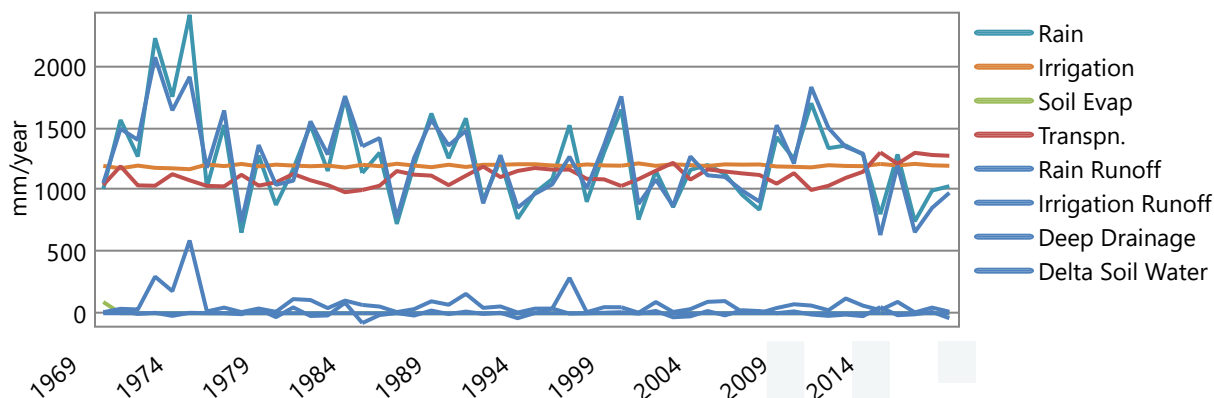
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



PERFORMANCE

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Land Performance - Soil Nutrient

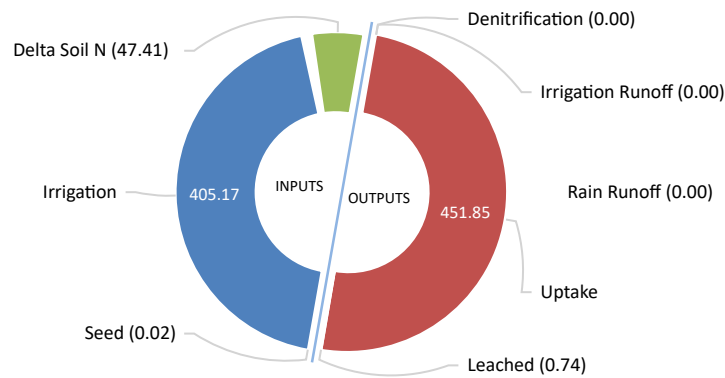
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 8.27

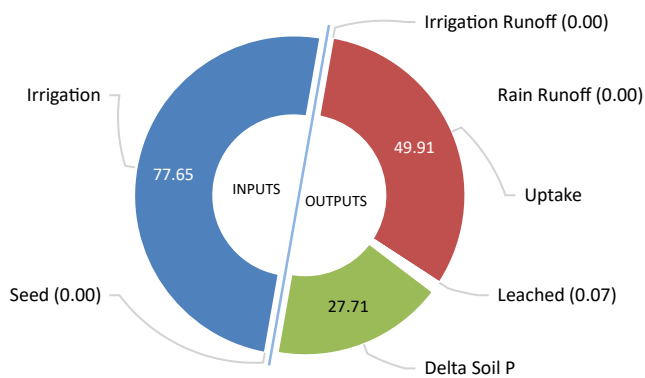
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	0.02
Irrigation	405.17
Denitrification	1.42E-03
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	451.85
Leached	0.74
Delta Soil N	-47.41

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	1.80E-03
Irrigation	77.65
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	49.91
Leached	0.07
Delta Soil P	27.71

PERFORMANCE

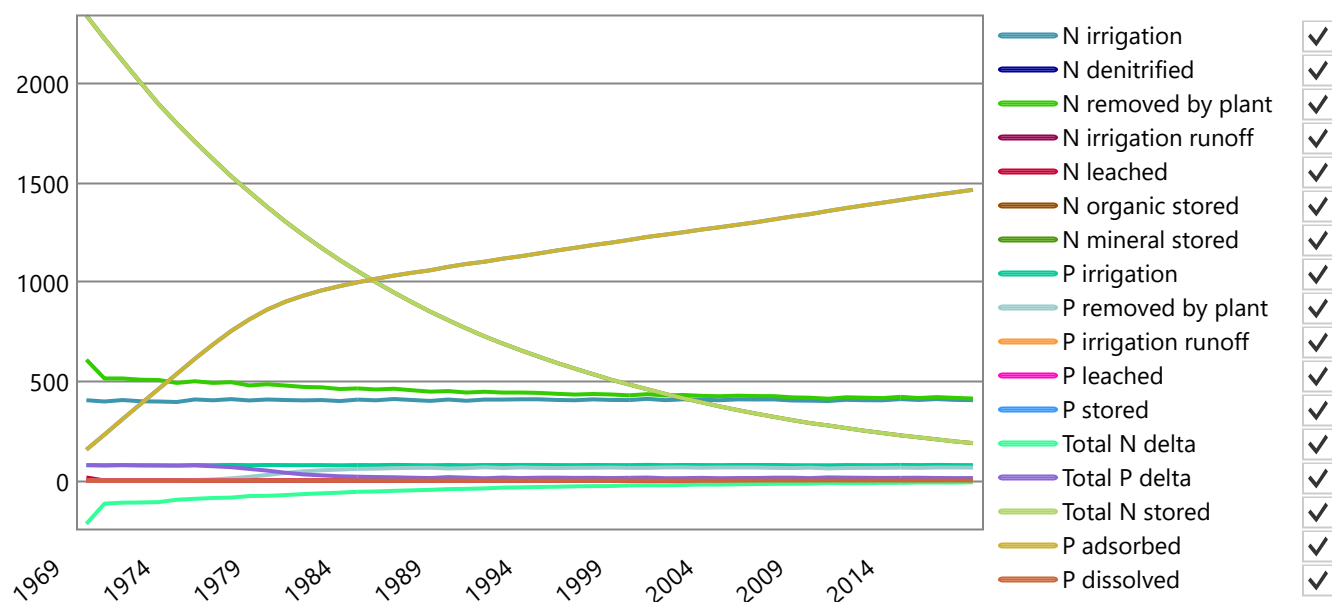


Land Performance - Soil Nutrient

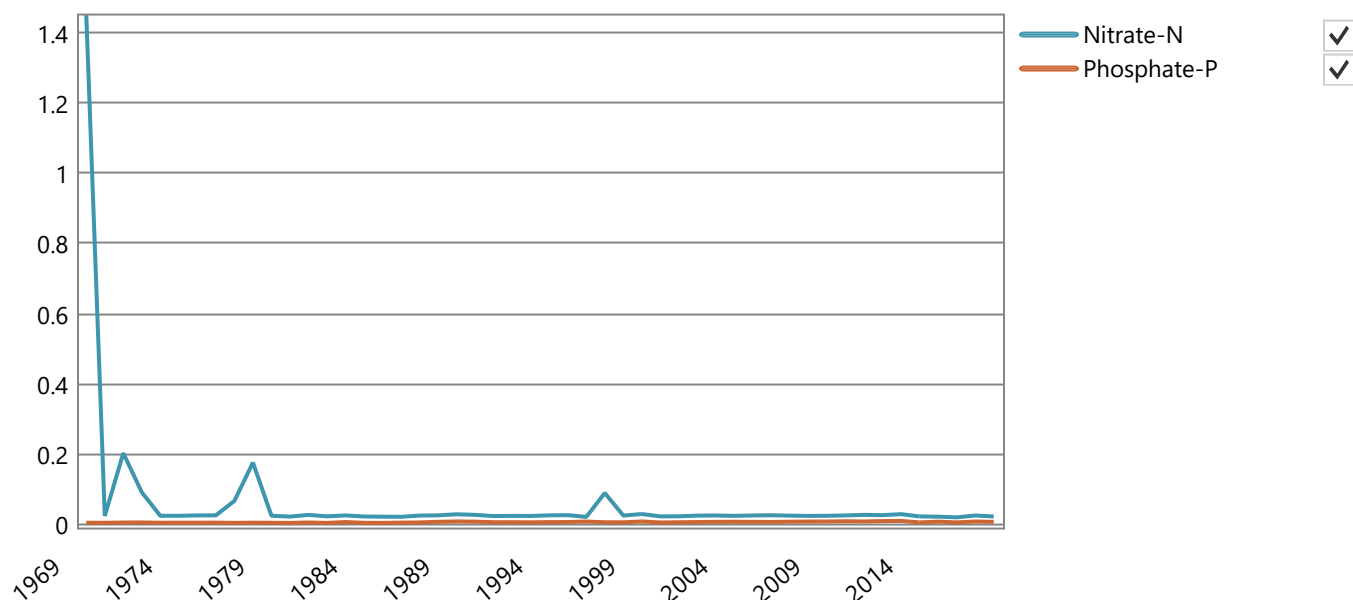
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

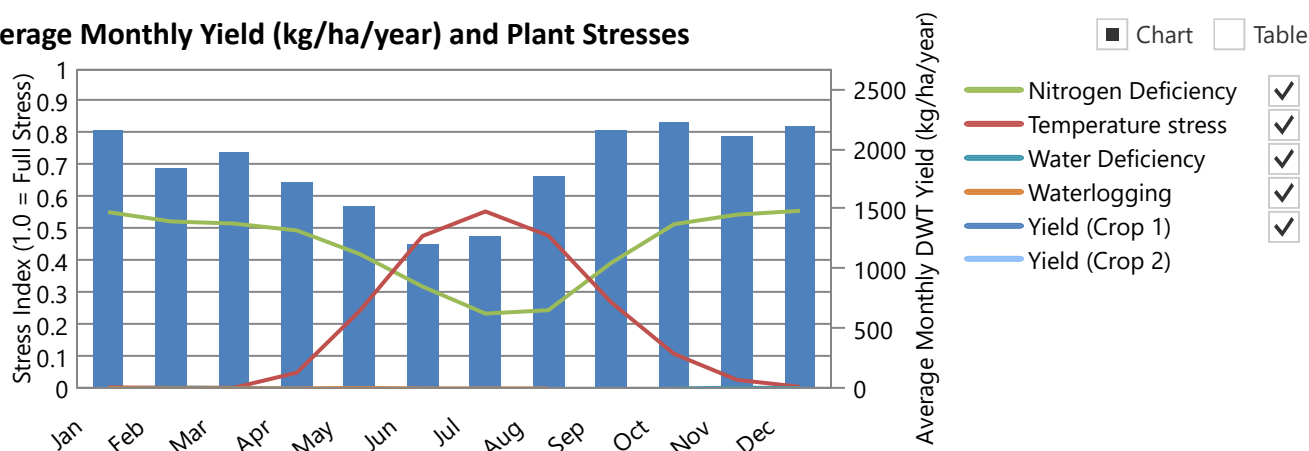
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	22172.68 (20254.49 - 26200.17)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.80 - 0.90)
Average monthly root depth (mm) (minimum - maximum)	699.64 (695.70 - 700.00)

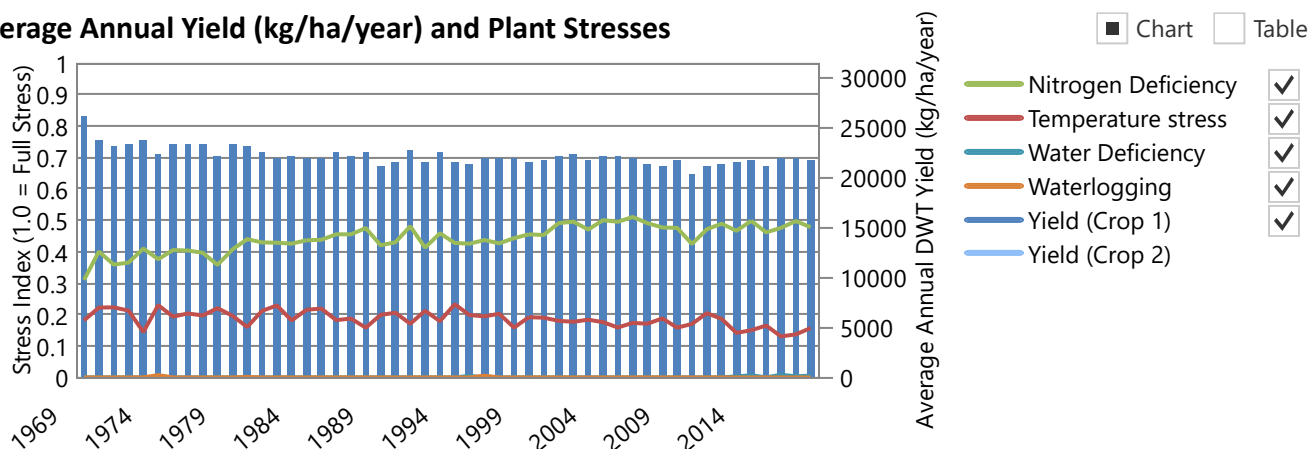
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	451.85 (411.80 - 608.10)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	49.91 (0.00 - 66.78)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 4.00 (normal)

No. days without crop/year (days/year): 0.00



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

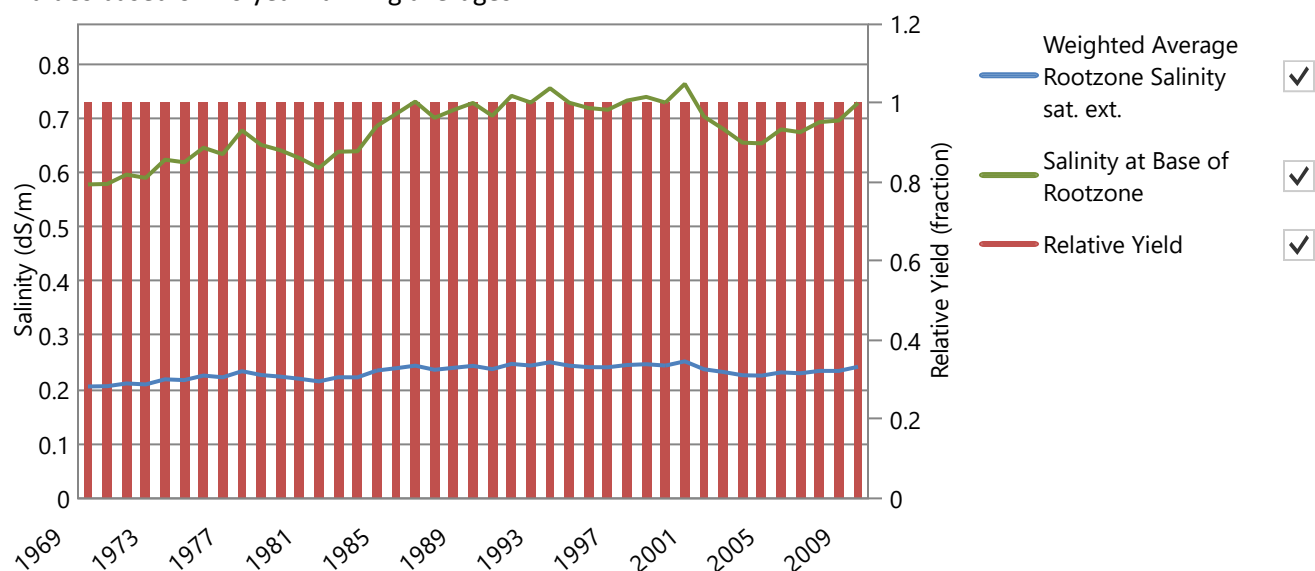
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.36
Salt added by rainfall (kg/ha/year)	222.63
Average annual effluent salt added & leached at steady state (kg/ha/year)	5359.50
Average leaching fraction based on 10 year running averages (fraction)	0.70
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.23
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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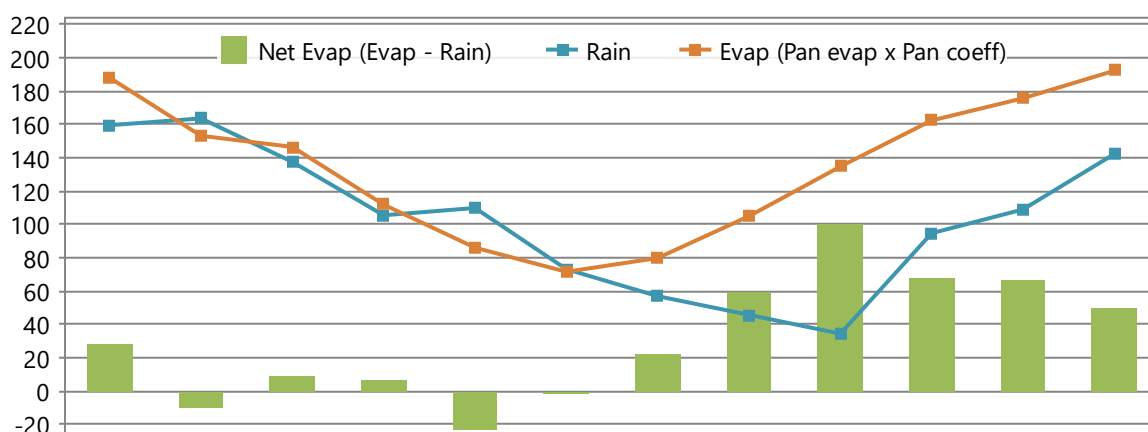
Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 18262.00 kL/year or 50.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	639.17 (638.75 - 640.50)
Total Phosphorus	6.50 (6.50 - 6.50)	118.70 (118.63 - 118.95)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7852.66 (7847.50 - 7869.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

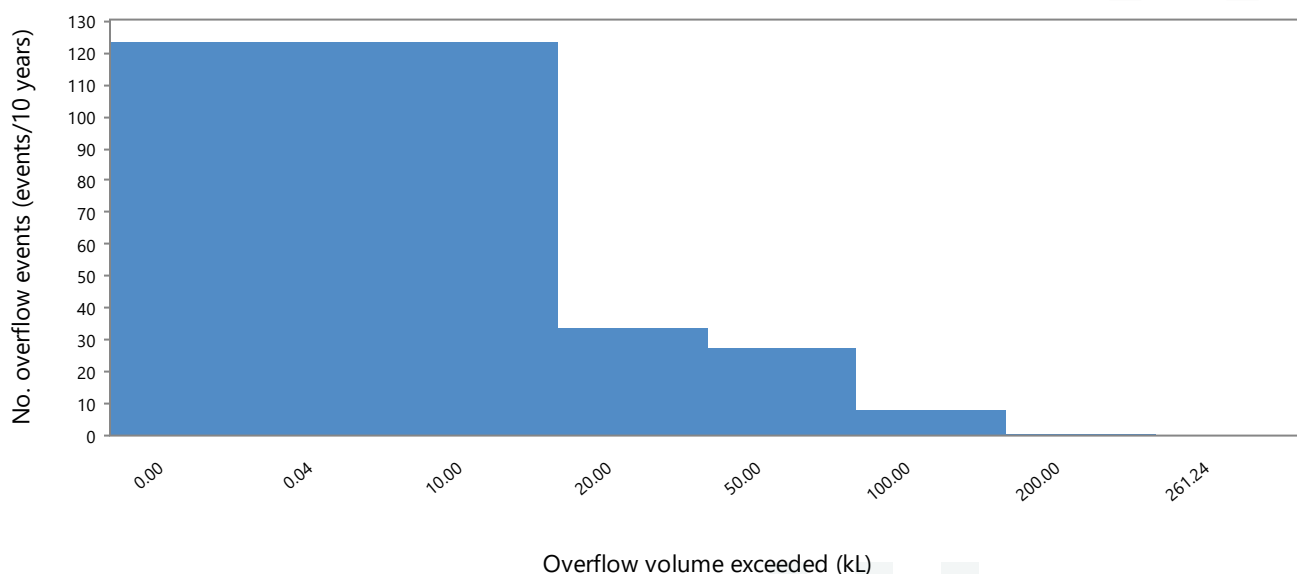
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	1.80
Average volume of overflow (kL/year)	342.66
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	12.34
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.98
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.67

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	17919.31	11946.21
Total nitrogen applied (kg)	607.75	405.17
Total phosphorus applied (kg)	116.48	77.65
Total salts applied (kg)	7705.31	5136.87

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	100.2	90.4	101.1	98.2	101.3	98.5	102.6	102.9	99.8	101.5	97.9	100.3	1194.6
Soil Evap	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8
Transpn.	133.5	104.2	104.9	79.9	58.8	49.4	57.2	72.7	86.6	112.4	119.5	133.1	1112.1
Rain Runoff	17.8	9.4	7.1	8.1	10.7	3.6	3.7	0.8	0.1	3.9	1.7	5.0	71.9
Irr. Runoff	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
Drainage	103.1	136.0	130.6	113.5	141.6	119.0	102.3	75.6	51.9	78.6	86.1	102.5	1240.9
Delta	3.5	4.3	-3.9	2.2	0.0	-0.4	-3.8	-0.5	-4.3	1.2	-0.6	1.8	-0.6

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	405.17
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	451.85
Average annual soil nitrogen removed by denitrification (kg/ha/year)	1.42E-03
Average annual soil nitrogen leached (kg/ha/year)	0.74
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.74
Soil organic-N kg/ha (Initial - Final)	2448.00 - 188.38
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.06
Max. annual nitrate-N concentration of deep drainage (mg/L)	1.45

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	77.65
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	49.91
Average annual soil phosphorus leached (kg/ha/year)	0.07
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 0.03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1463.27
Average phosphate-P concentration in rootzone (mg/L)	0.02
Average phosphate-P concentration of deep drainage (mg/L)	0.01
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 3.30 mg/L (years)	68.10



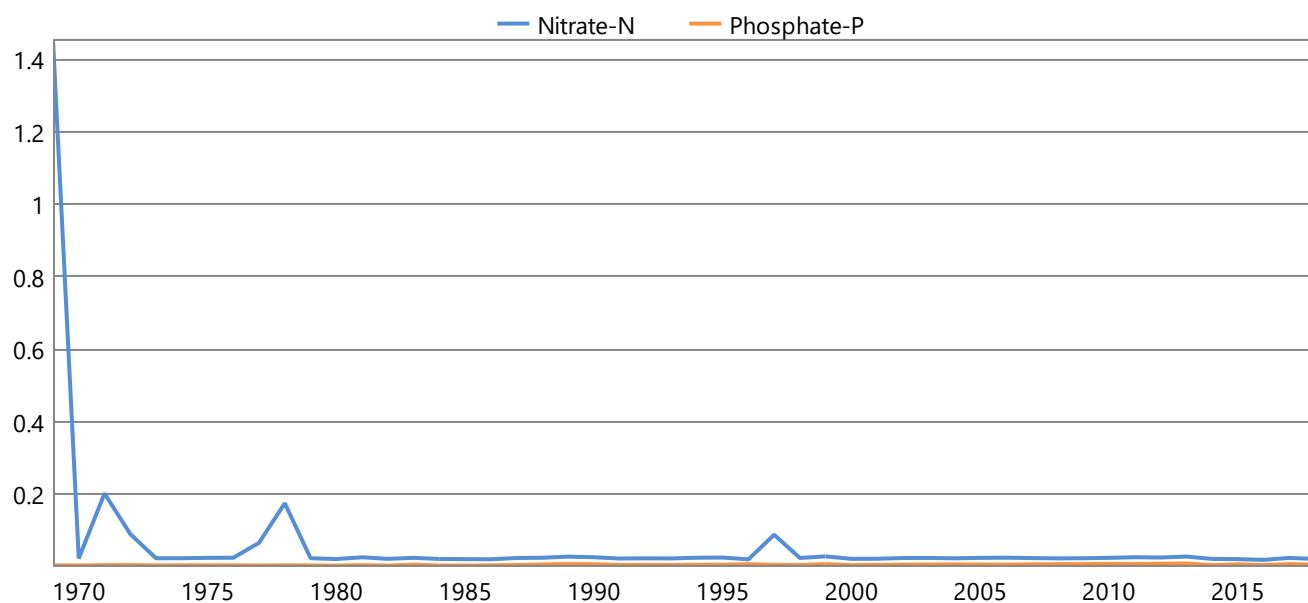
Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

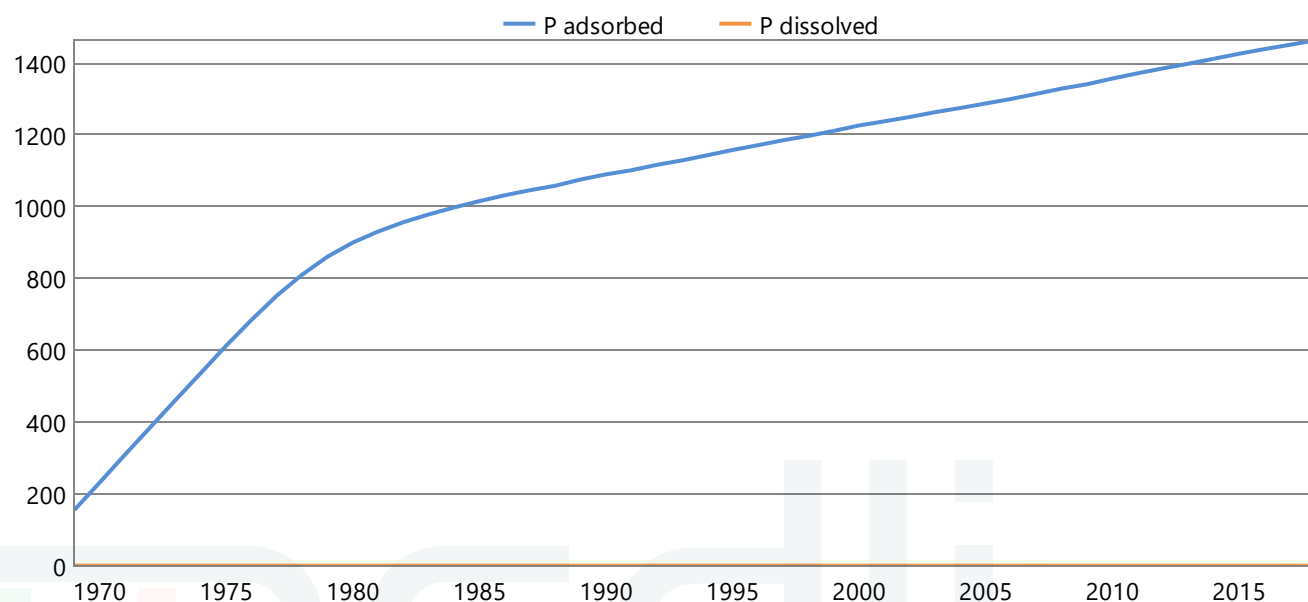
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F50_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	22172.68 (20254.49 - 26200.17)
Average monthly plant (green) cover (fraction)	0.87 (0.80 - 0.90)
Average monthly crop factor (fraction)	0.69 (0.64 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.64 (695.70 - 700.00)
Average number of normal harvests per year (no./year)	4.00 (3.00 - 5.00)
Average number of normal harvests for last five years only (no./year)	4.00
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.44 (0.31 - 0.51)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.36
Salt added by rainfall (kg/ha/year)	222.63
Average annual effluent salt added & leached at steady state (kg/ha/year)	5359.50
Average leaching fraction based on 10 year running averages (fraction)	0.70
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.23
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS



Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

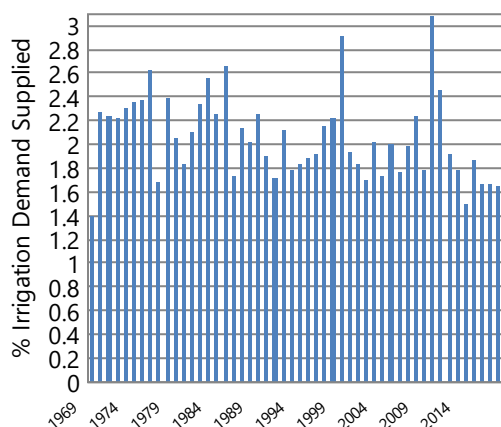
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	10823.9
Annual irrigation predicted for defined scenario (mm/year)	1082.4
Average annual irrigation demand supplied (fraction)	2.0

Or for 1.50 ha: 8122 kL/year

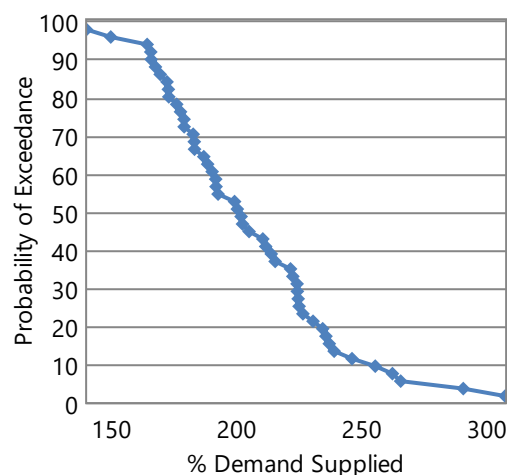
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



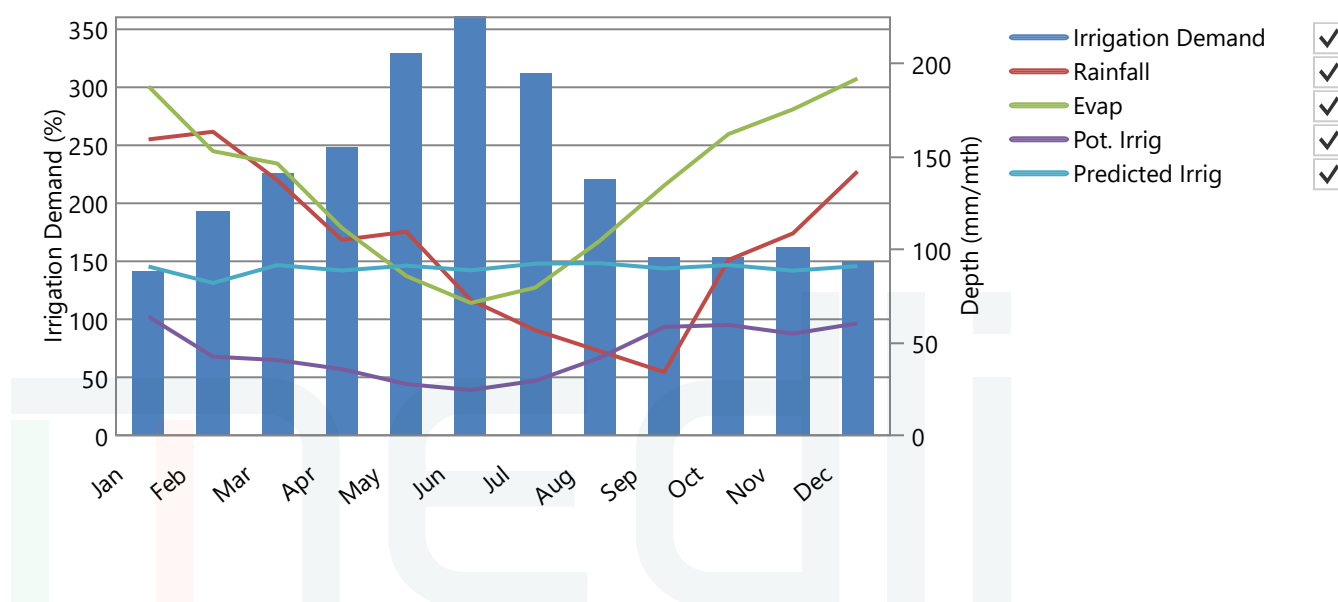
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

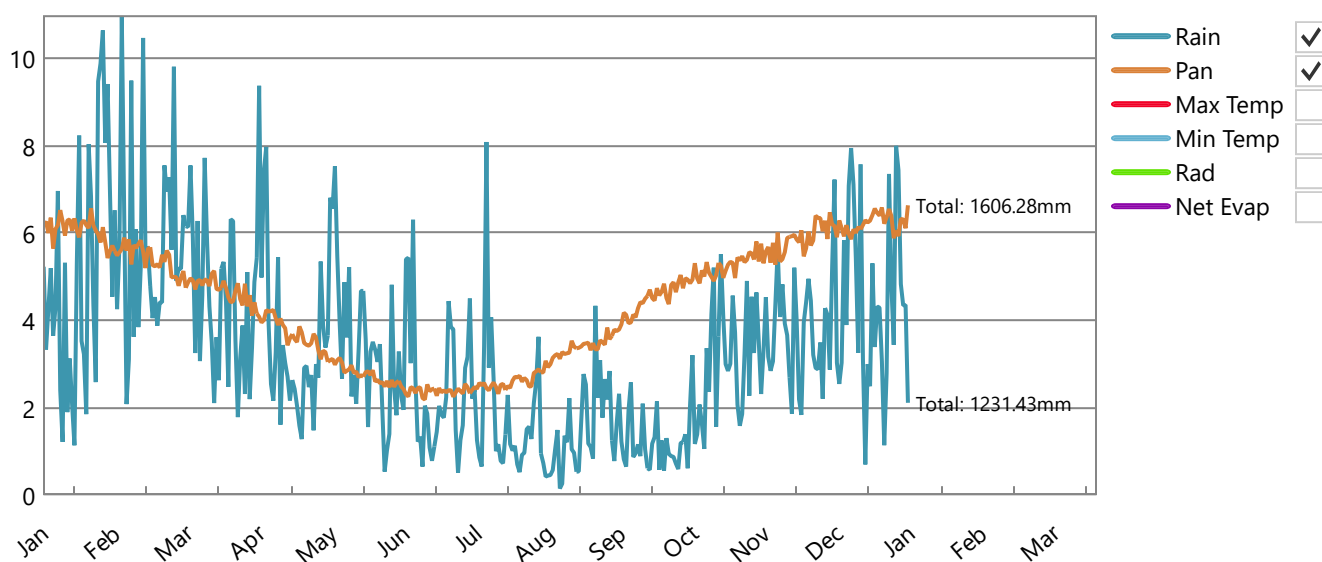
	5th ▾ Percentile	50th Percentile	95th ▾ Percentile
Rainfall (mm/year)	734	1199	1749
Pan Evaporation (mm/year)	1434	1607	1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



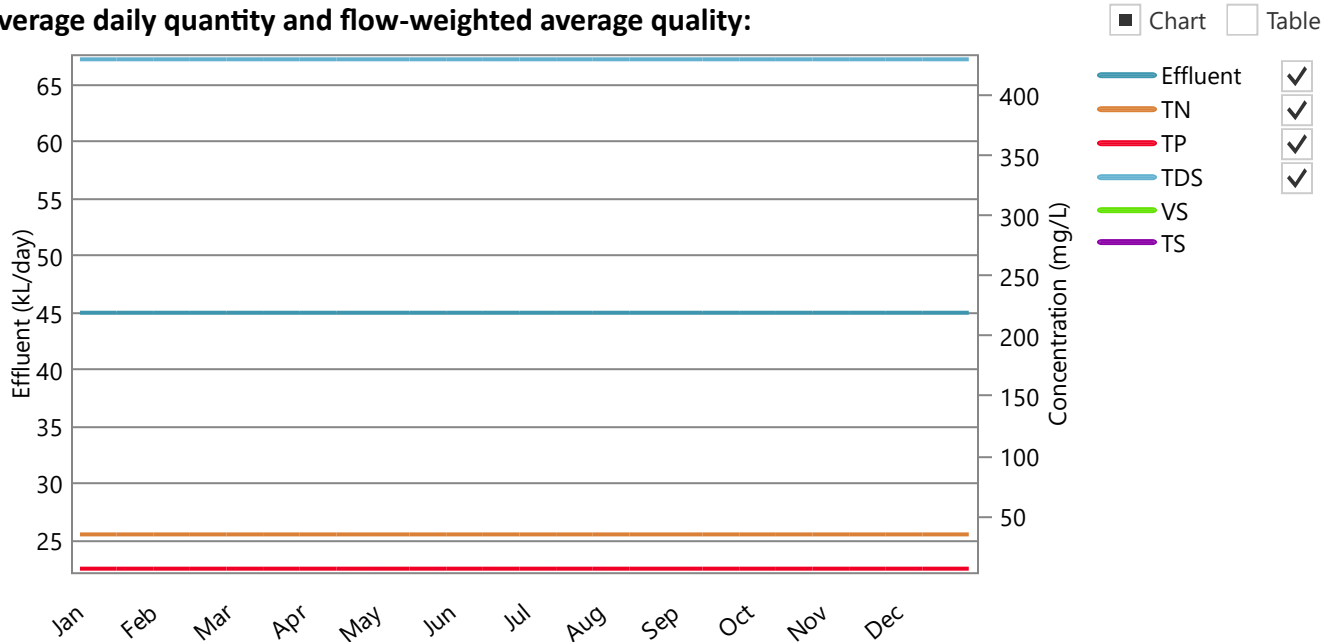
DESCRIPTION

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Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **16435.80 kL/year** or 45.00 kL/day (Min-Max: 45.00 - 45.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	575.25 (574.87 - 576.45)
Total Phosphorus	6.50 (6.50 - 6.50)	106.83 (106.76 - 107.06)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7067.39 (7062.75 - 7082.10)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

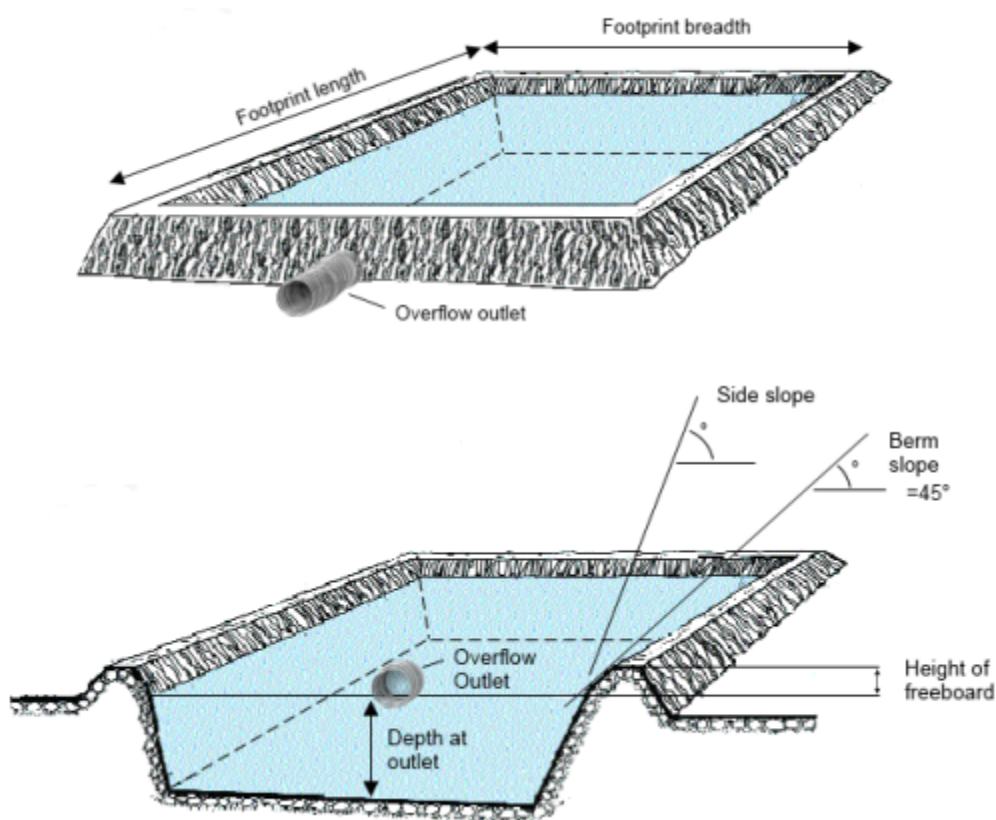
DESCRIPTION



Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	4.19



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

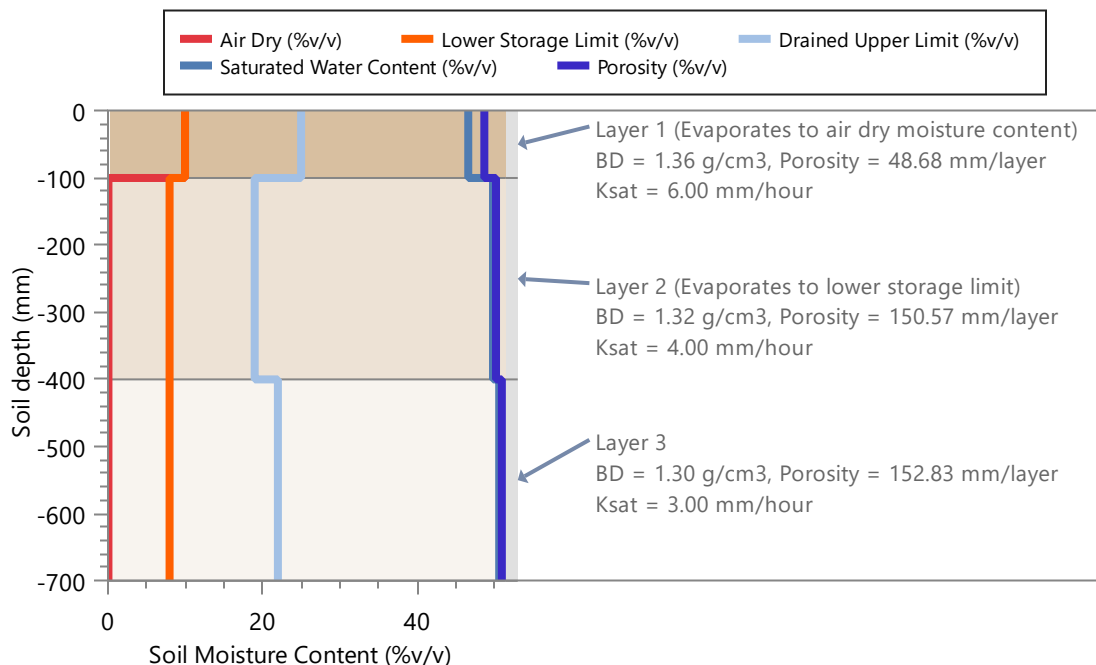
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

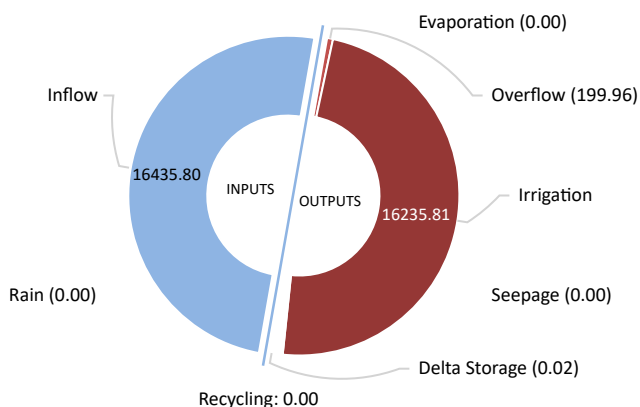
Average monthly cover (fraction) (minimum - maximum)	0.64 (0.63 - 0.66)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08

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Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

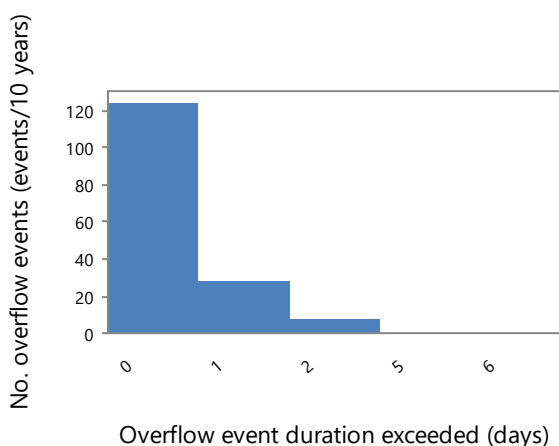
Pond System Water Balance (kL/year)



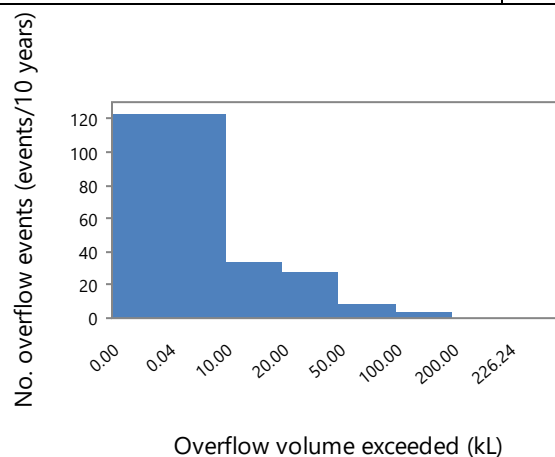
Name	Value
Rain	0.00
Inflow	16435.80
Recycling	0.00
Evaporation	0.00
Overflow	199.96
Irrigation	16235.81
Seepage	0.00
Delta Storage	0.02

Overflow Diagnostics

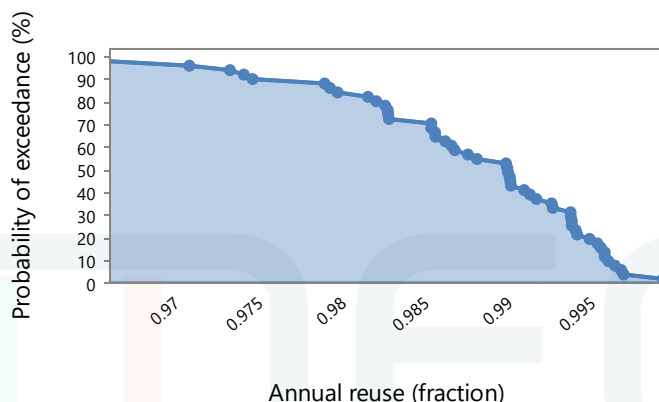
Volume of overflow (kL/year)	199.96
No. days pond overflows (days/year)	16.20
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% reuse (fraction)	1.00



[Export plot](#)



[Export plot](#)

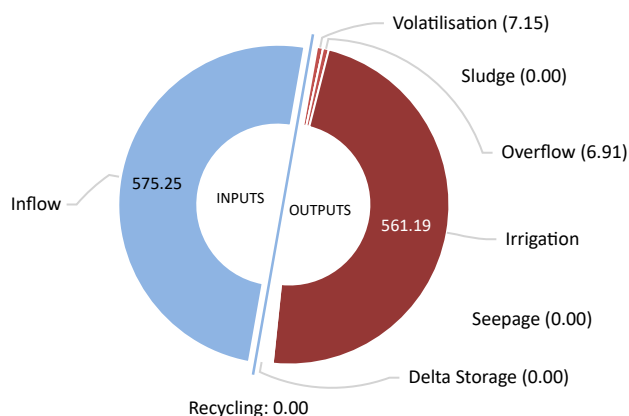


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

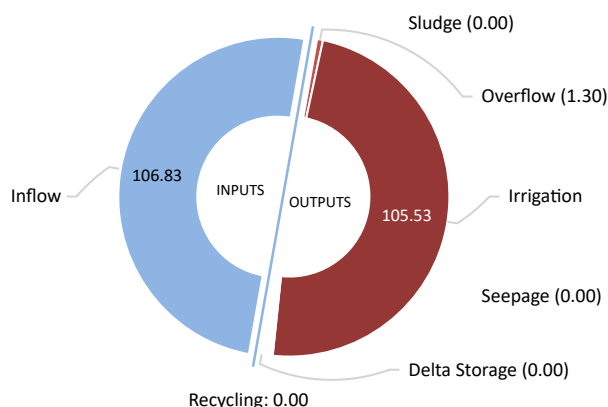
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



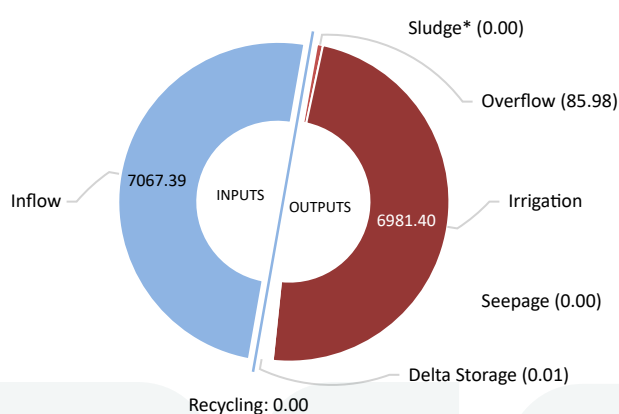
Name	Value
Inflow	575.25
Recycling	0.00
Volatilisation	7.15
Sludge	0.00
Overflow	6.91
Irrigation	561.19
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	106.83
Recycling	0.00
Sludge	0.00
Overflow	1.30
Irrigation	105.53
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	7067.39
Recycling	0.00
Sludge*	0.00
Overflow	85.98
Irrigation	6981.40
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	29.90
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.76
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	16235.81
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	16235.81
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.57
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.87
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96



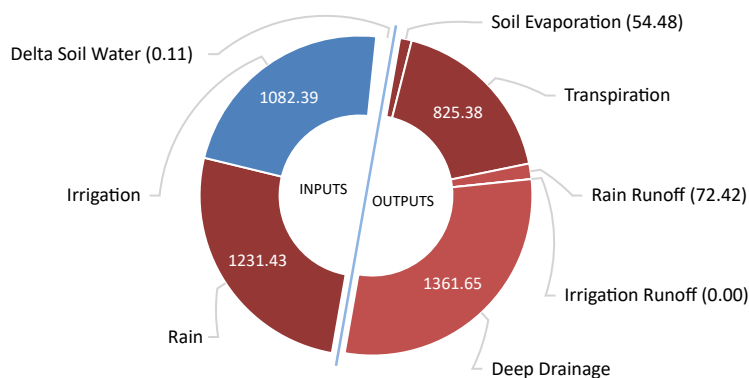
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

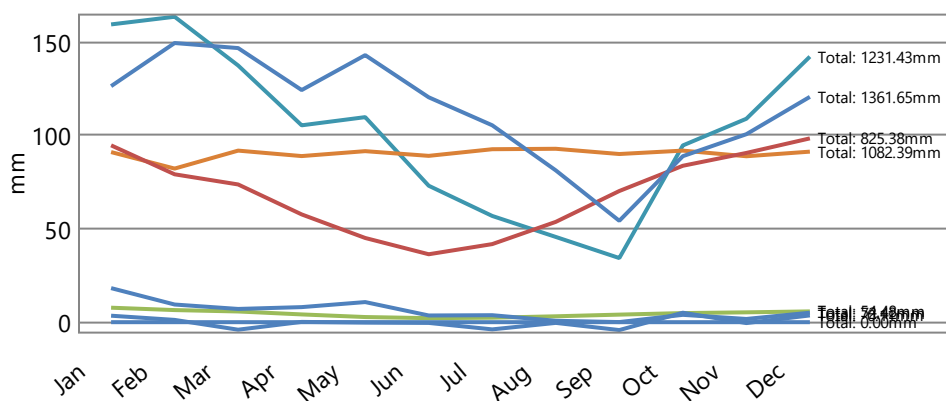
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	1082.39
Soil Evaporation	54.48
Transpiration	825.38
Rain Runoff	72.42
Irrigation Runoff	0.00
Deep Drainage	1361.65
Delta Soil Water	-0.11

Average Monthly Totals (mm):

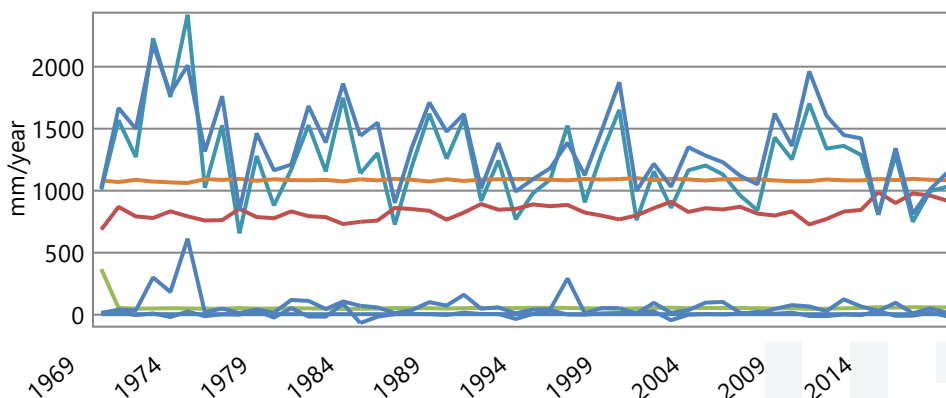
☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE

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Land Performance - Soil Nutrient

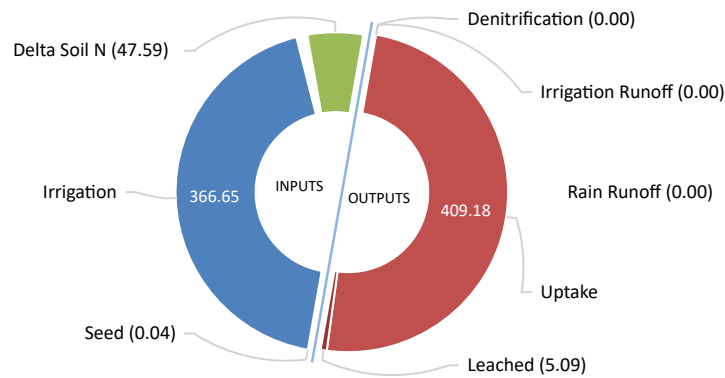
Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Irrigation ammonium volatilisation losses (kg/ha/year): 7.48

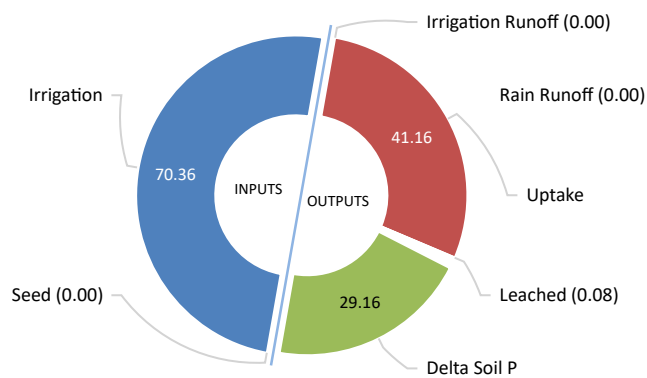
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	0.04
Irrigation	366.65
Denitrification	1.72E-03
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	409.18
Leached	5.09
Delta Soil N	-47.59

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	3.60E-03
Irrigation	70.36
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	41.16
Leached	0.08
Delta Soil P	29.16

PERFORMANCE

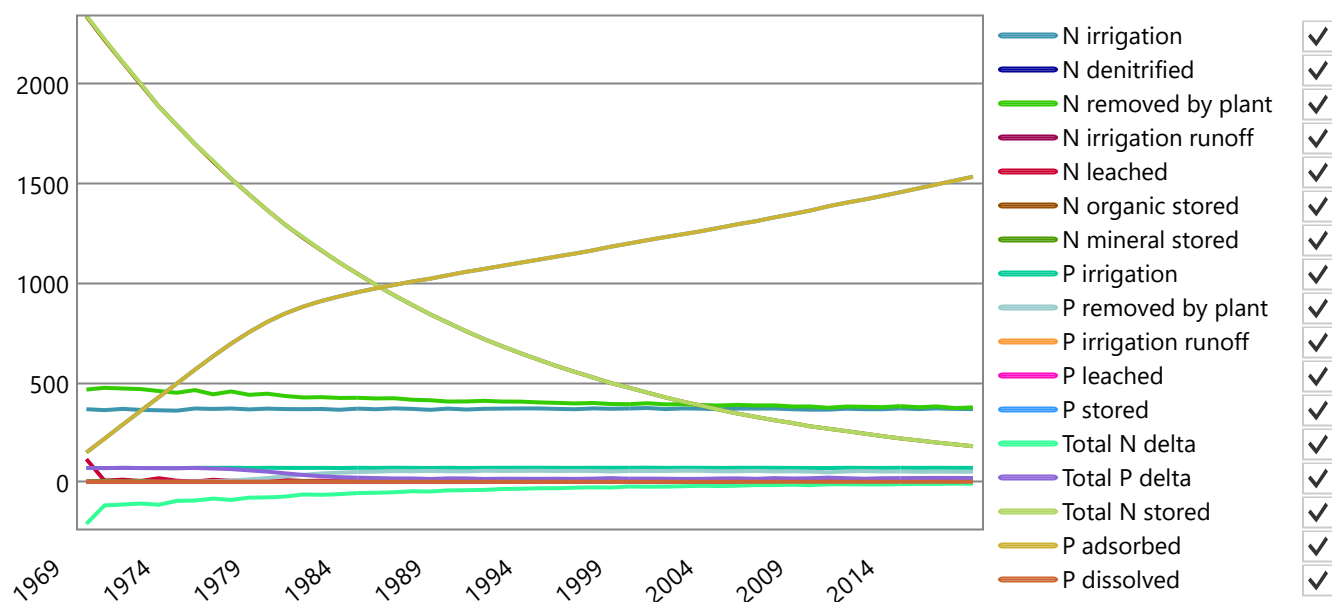


Land Performance - Soil Nutrient

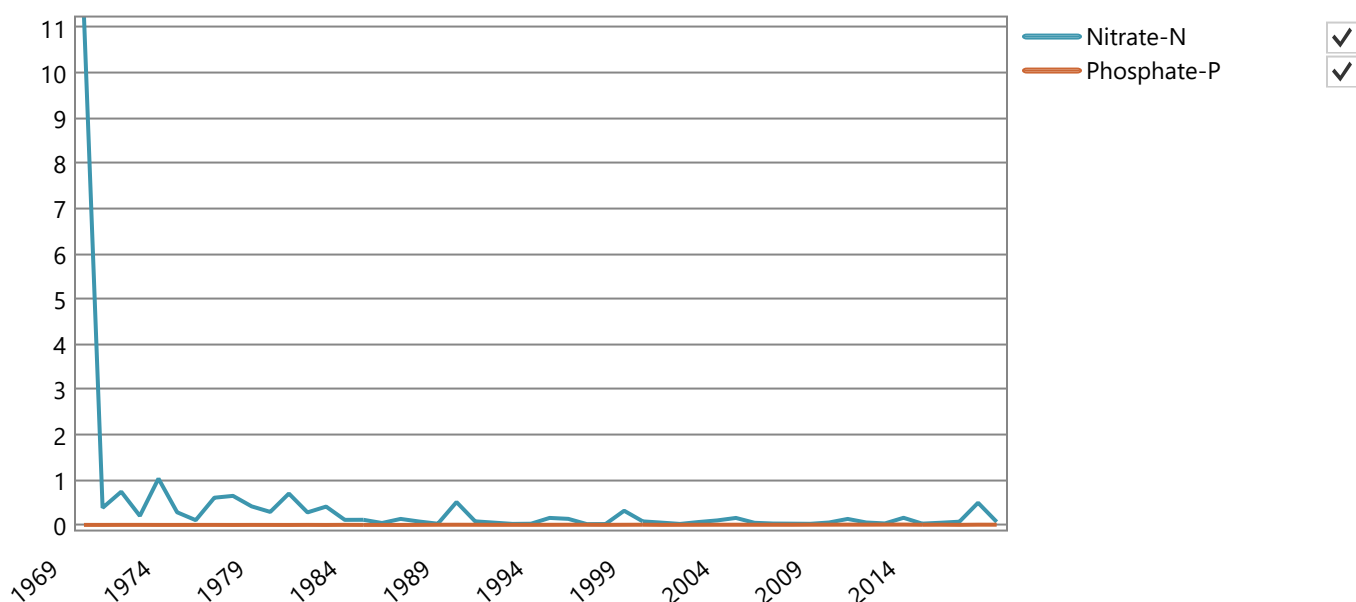
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

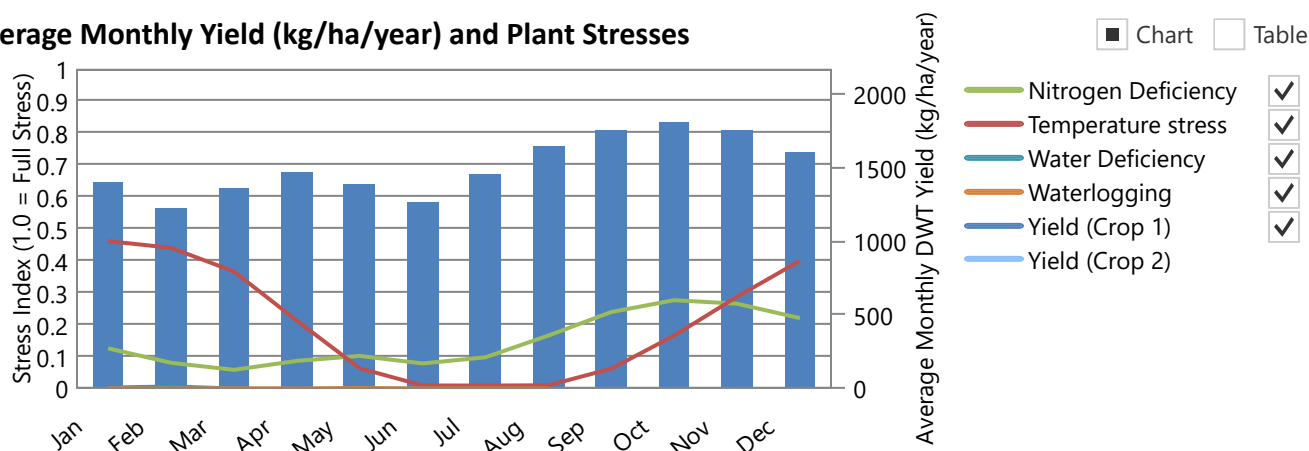
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	18150.58 (16071.24 - 19488.32)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.64 (0.63 - 0.66)
Average monthly root depth (mm) (minimum - maximum)	597.77 (592.12 - 599.99)

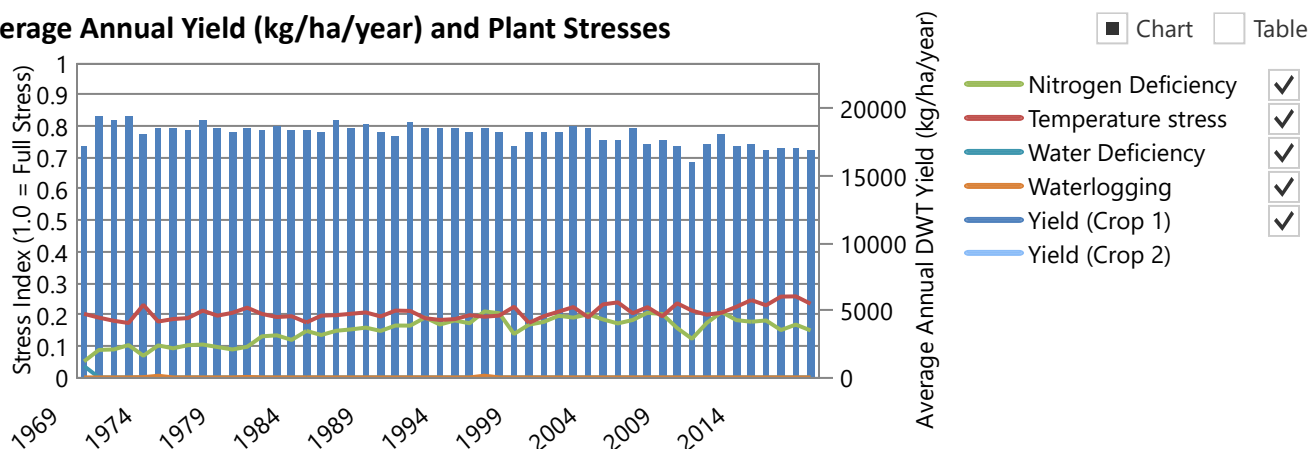
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	409.18 (371.28 - 473.15)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	41.16 (0.00 - 56.14)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 4.68 (normal), 0.02 (forced by crop death due to water stress (0.02))

No. days without crop/year (days/year): 0.08 due to water stress (0.08)



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

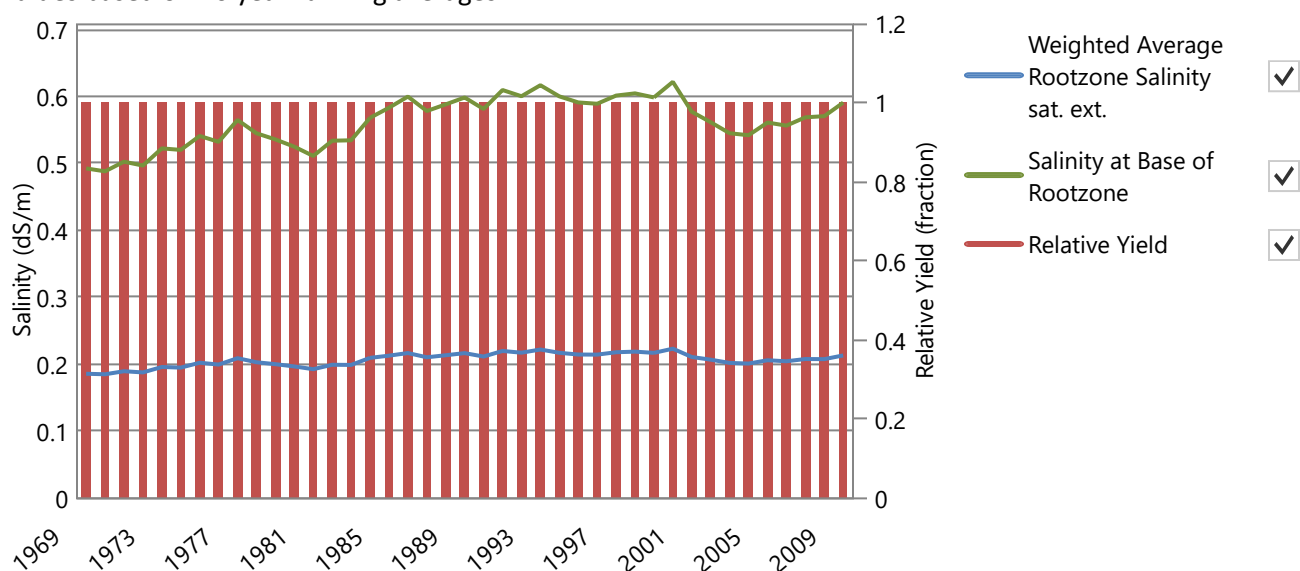
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	222.53
Average annual effluent salt added & leached at steady state (kg/ha/year)	4876.80
Average leaching fraction based on 10 year running averages (fraction)	0.75
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.56
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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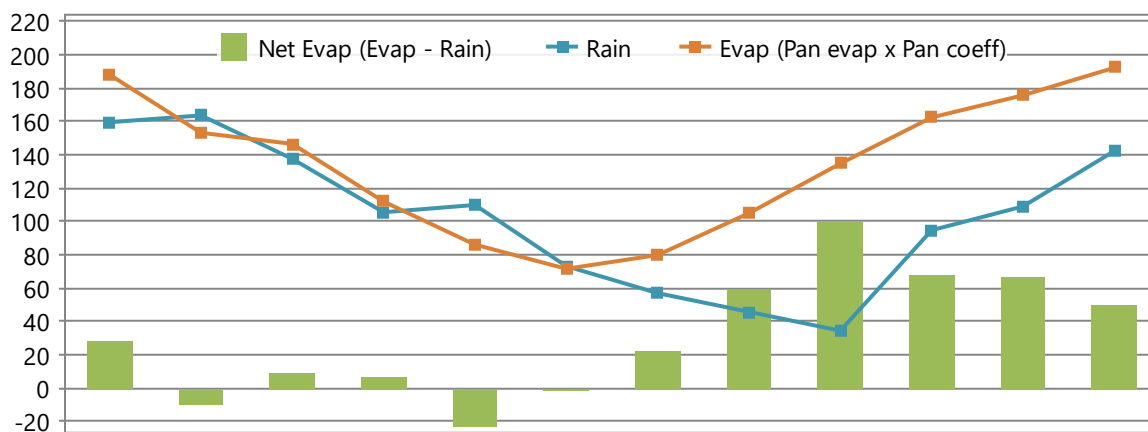
Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 16435.80 kL/year or 45.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	575.25 (574.87 - 576.45)
Total Phosphorus	6.50 (6.50 - 6.50)	106.83 (106.76 - 107.06)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7067.39 (7062.75 - 7082.10)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

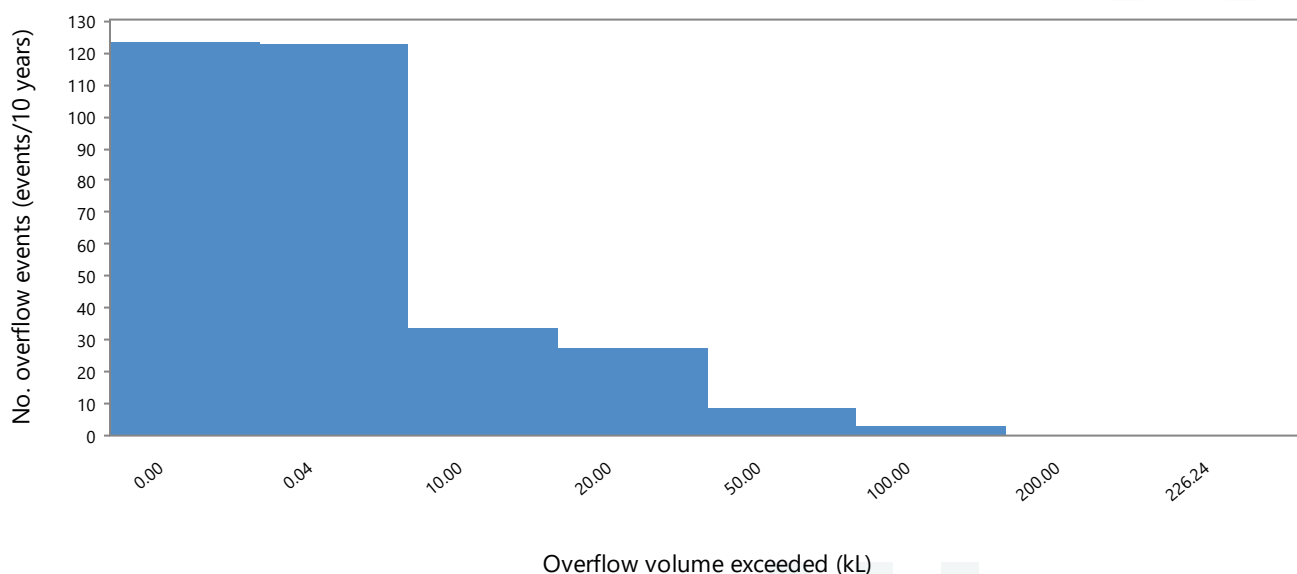
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	2.00
Average volume of overflow (kL/year)	199.96
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	12.32
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.66

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	16235.81	10823.88
Total nitrogen applied (kg)	549.97	366.65
Total phosphorus applied (kg)	105.53	70.36
Total salts applied (kg)	6981.40	4654.27

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	91.1	82.3	91.9	88.9	91.6	89.1	92.6	92.9	90.1	91.9	88.9	91.3	1082.4
Soil Evap	7.8	6.5	5.7	4.1	2.7	2.1	2.4	3.1	4.0	4.9	5.3	5.8	54.5
Transpn.	94.7	79.2	73.8	57.7	45.1	36.4	41.8	53.7	70.2	83.8	90.6	98.4	825.4
Rain Runoff	18.2	9.4	7.1	8.1	10.8	3.6	3.7	0.7	0.1	3.9	1.7	5.1	72.4
Irr. Runoff	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
Drainage	126.4	149.5	146.8	124.3	143.0	120.4	105.4	81.3	54.3	88.9	100.7	120.7	1361.7
Delta	3.5	1.2	-4.0	0.1	-0.2	-0.4	-3.9	-0.4	-4.2	5.1	-0.5	3.6	-0.1

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	366.65
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	409.18
Average annual soil nitrogen removed by denitrification (kg/ha/year)	1.72E-03
Average annual soil nitrogen leached (kg/ha/year)	5.09
Average annual nitrate-N loading to groundwater (kg/ha/year)	5.09
Soil organic-N kg/ha (Initial - Final)	2448.00 - 179.15
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.37
Max. annual nitrate-N concentration of deep drainage (mg/L)	11.24

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	70.36
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	41.16
Average annual soil phosphorus leached (kg/ha/year)	0.08
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 0.18
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1535.51
Average phosphate-P concentration in rootzone (mg/L)	0.05
Average phosphate-P concentration of deep drainage (mg/L)	0.01
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 3.14 mg/L (years)	74.50

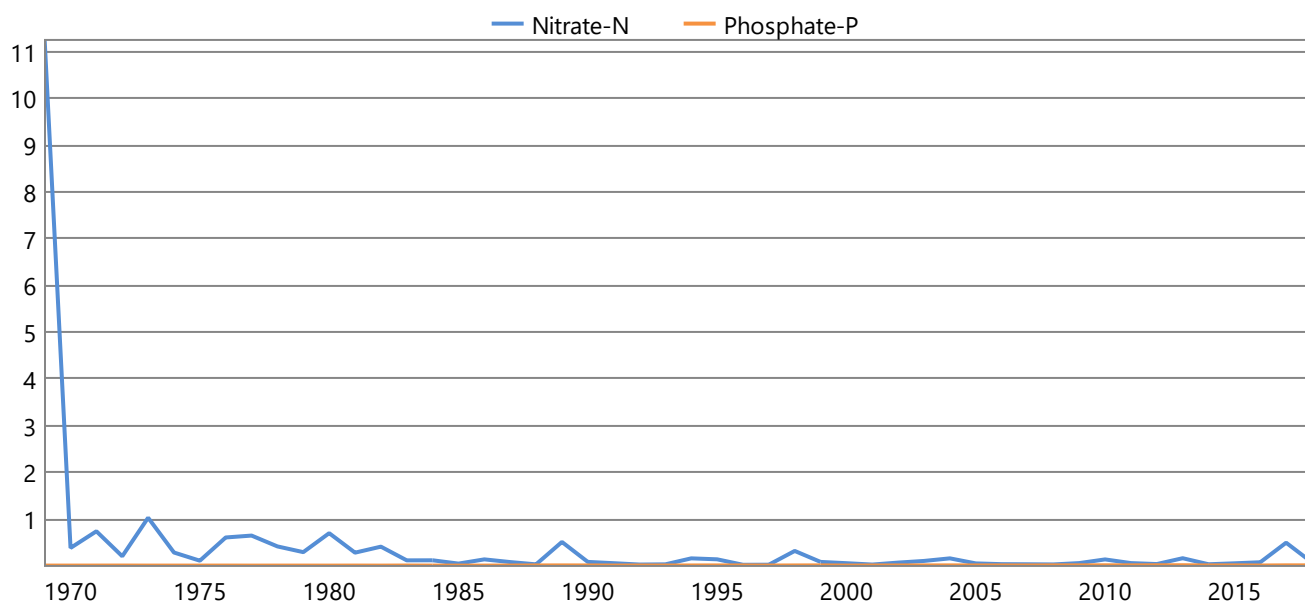
Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

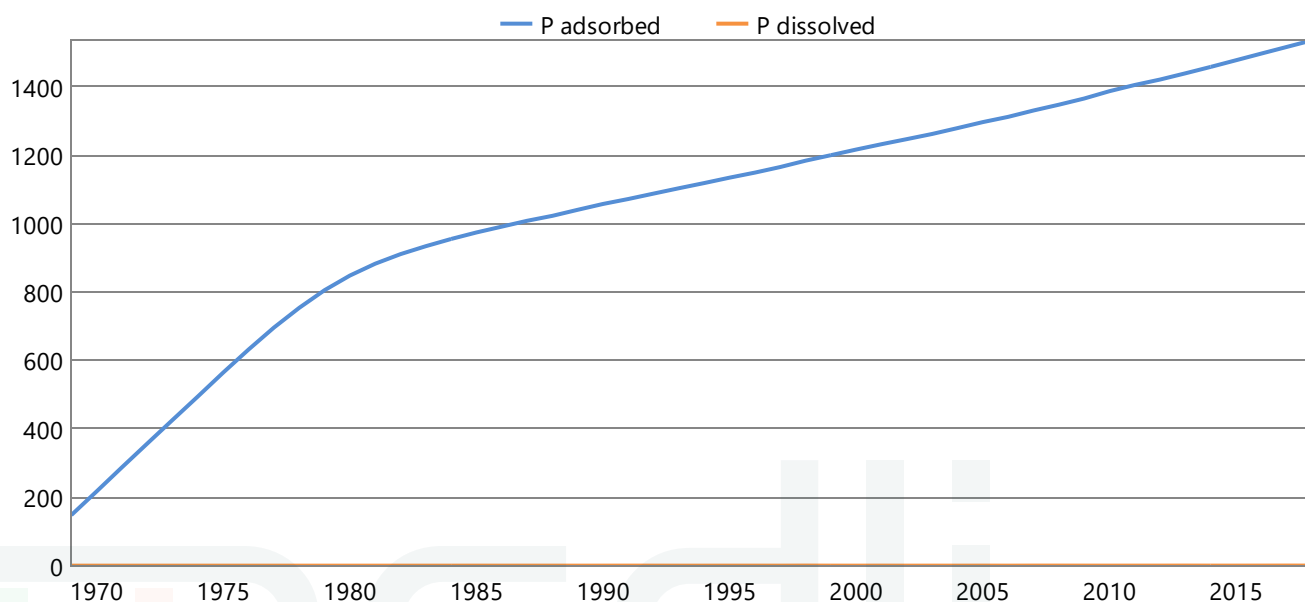
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	18150.58 (16071.24 - 19488.32)
Average monthly plant (green) cover (fraction)	0.64 (0.63 - 0.66)
Average monthly crop factor (fraction)	0.52 (0.50 - 0.52)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	597.77 (592.12 - 599.99)
Average number of normal harvests per year (no./year)	4.68 (4.00 - 5.00)
Average number of normal harvests for last five years only (no./year)	4.40
Average number of crop deaths per year (no./year)	0.02 (0.00 - 1.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.15 (0.05 - 0.21)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.08

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	222.53
Average annual effluent salt added & leached at steady state (kg/ha/year)	4876.80
Average leaching fraction based on 10 year running averages (fraction)	0.75
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.56
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00



Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title: Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

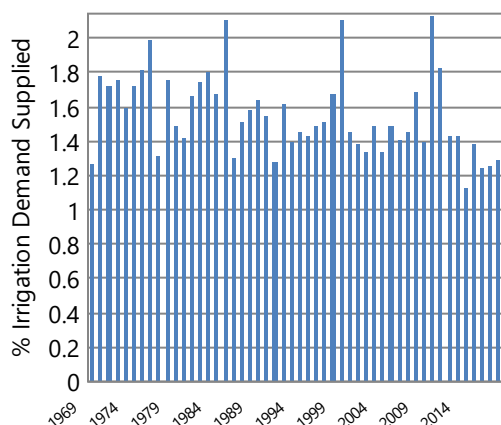
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	10823.9
Annual irrigation predicted for defined scenario (mm/year)	1082.4
Average annual irrigation demand supplied (fraction)	1.5

Or for 1.50 ha: 10668 kL/year

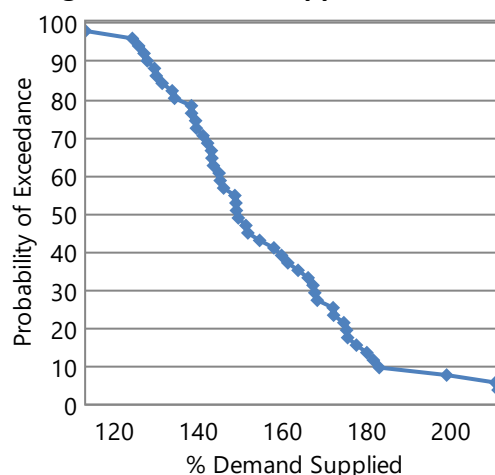
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



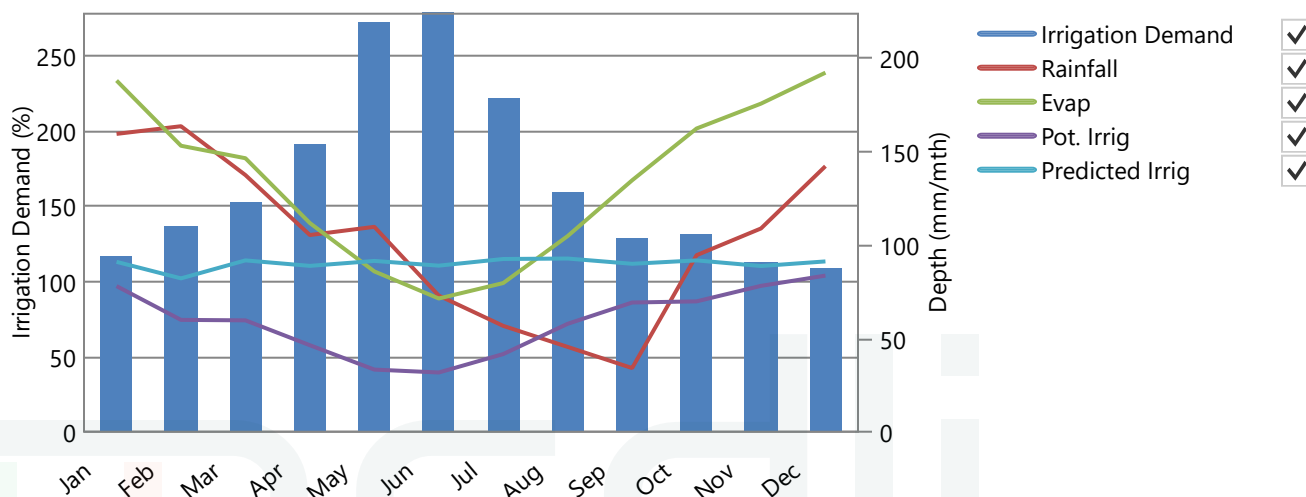
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

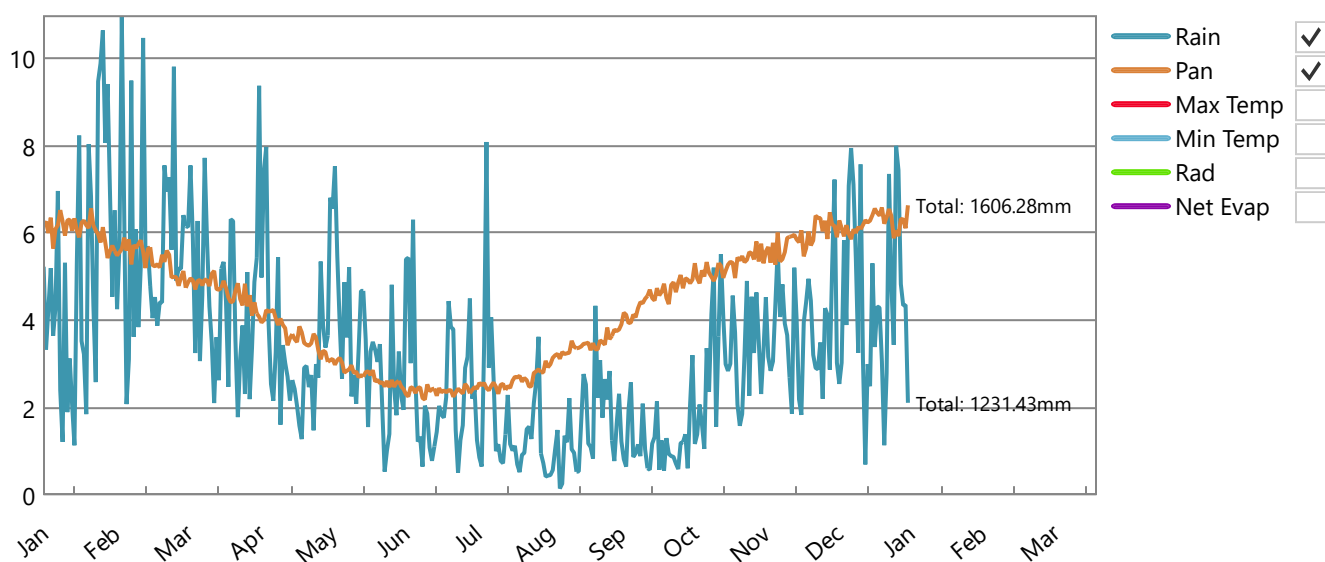
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



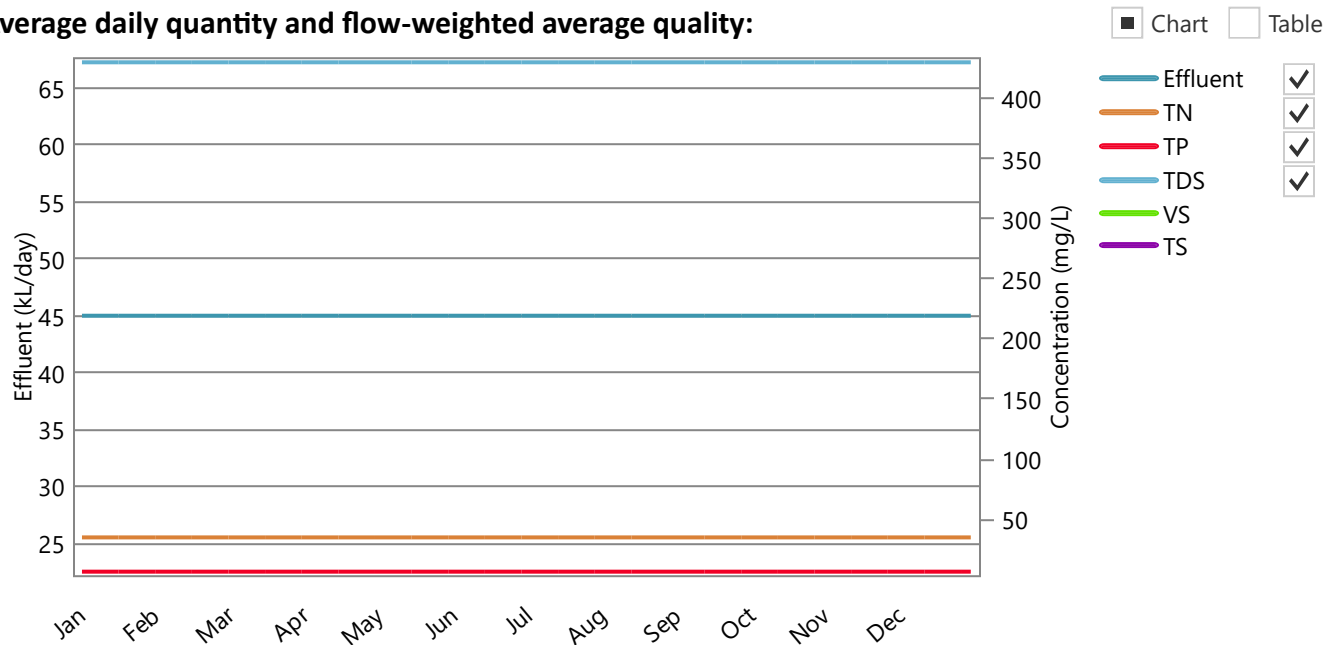
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **16435.80 kL/year** or 45.00 kL/day (Min-Max: 45.00 - 45.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	575.25 (574.87 - 576.45)
Total Phosphorus	6.50 (6.50 - 6.50)	106.83 (106.76 - 107.06)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7067.39 (7062.75 - 7082.10)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

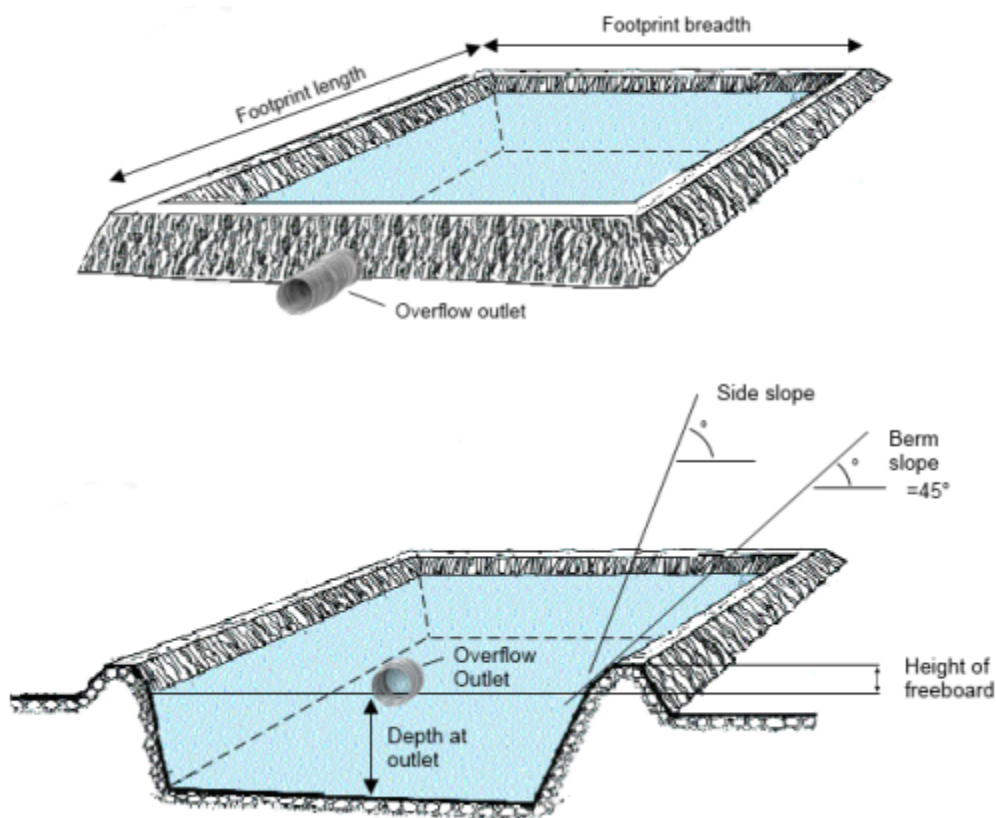
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	4.19



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

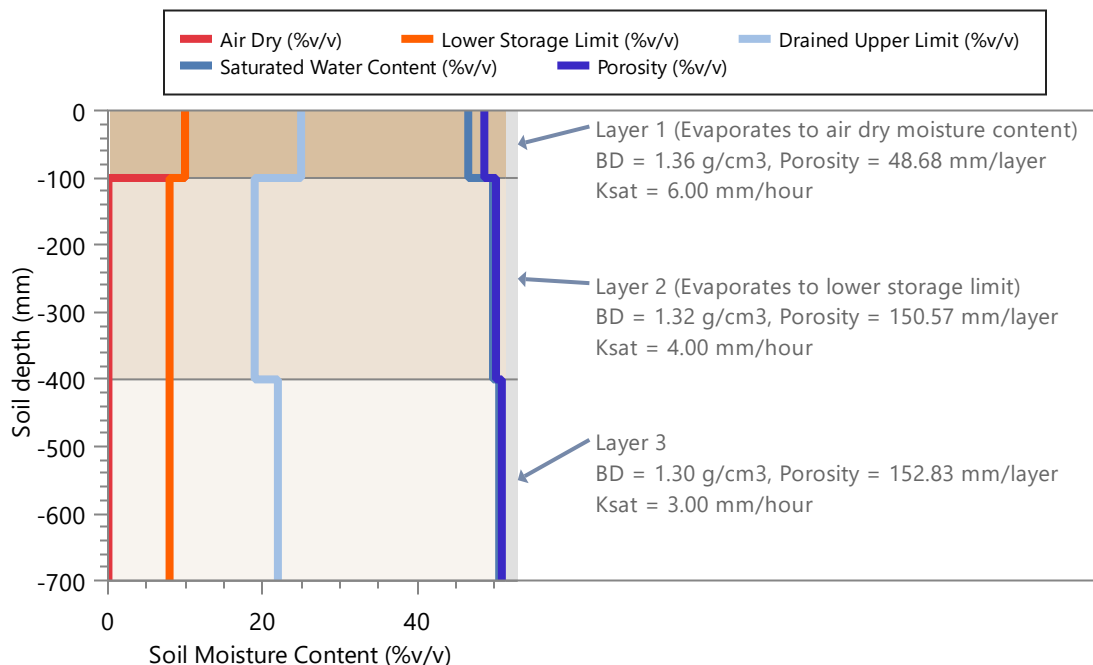
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

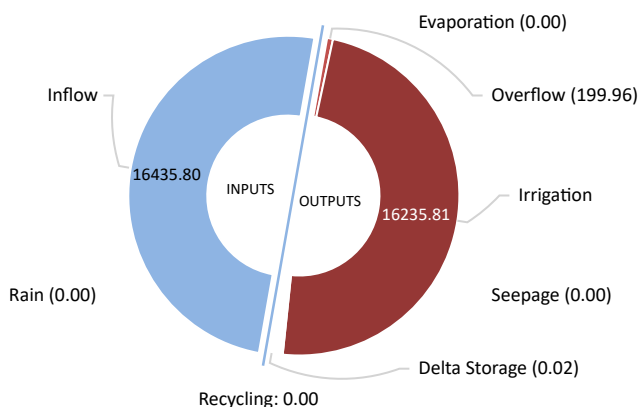
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.81 - 0.91)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

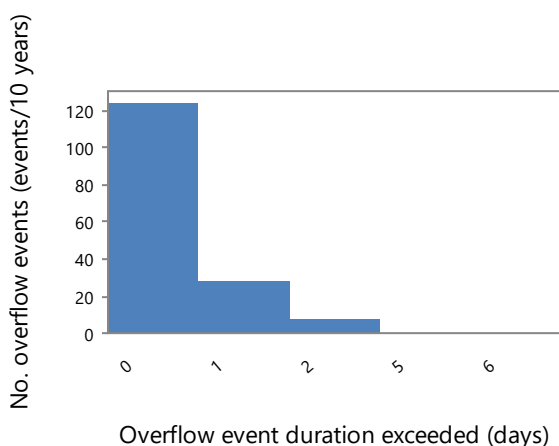
Pond System Water Balance (kL/year)



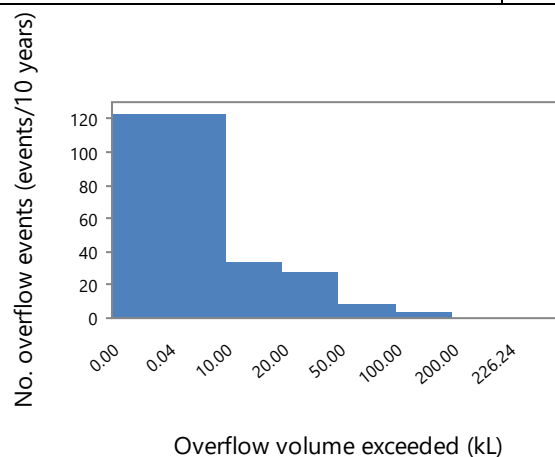
Name	Value
Rain	0.00
Inflow	16435.80
Recycling	0.00
Evaporation	0.00
Overflow	199.96
Irrigation	16235.81
Seepage	0.00
Delta Storage	0.02

Overflow Diagnostics

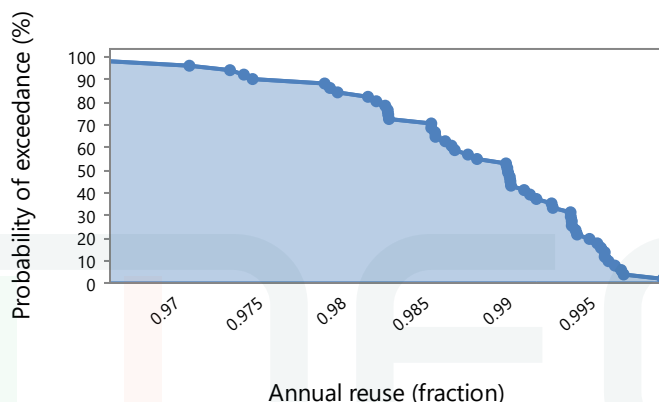
Volume of overflow (kL/year)	199.96
No. days pond overflows (days/year)	16.20
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% reuse (fraction)	1.00



[Export plot](#)



[Export plot](#)

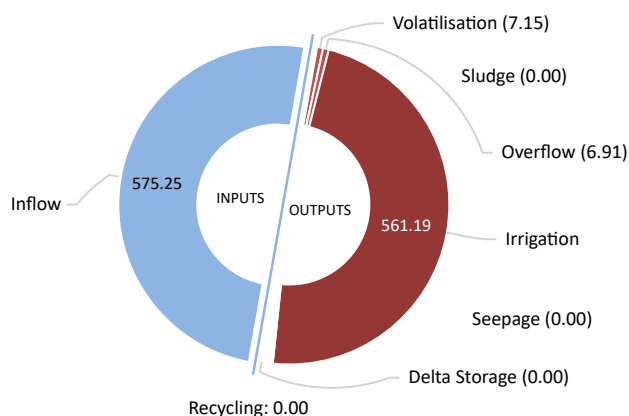


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

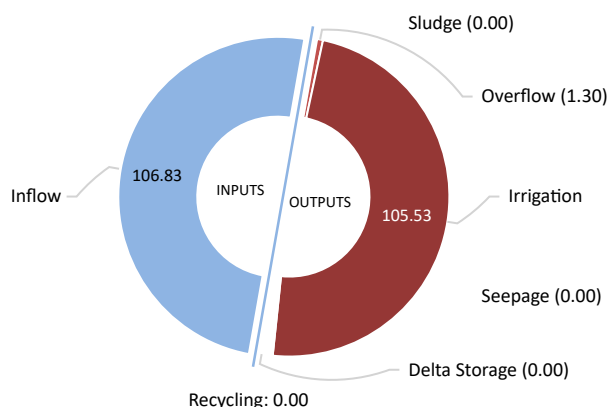
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



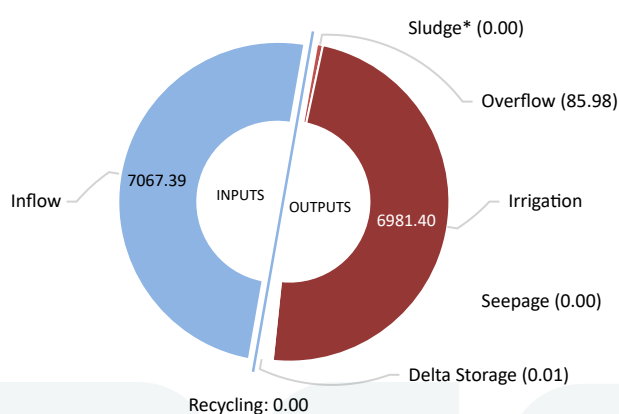
Name	Value
Inflow	575.25
Recycling	0.00
Volatilisation	7.15
Sludge	0.00
Overflow	6.91
Irrigation	561.19
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	106.83
Recycling	0.00
Sludge	0.00
Overflow	1.30
Irrigation	105.53
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	7067.39
Recycling	0.00
Sludge*	0.00
Overflow	85.98
Irrigation	6981.40
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	29.90
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.76
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	16235.81
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	16235.81
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.57
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.87
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96



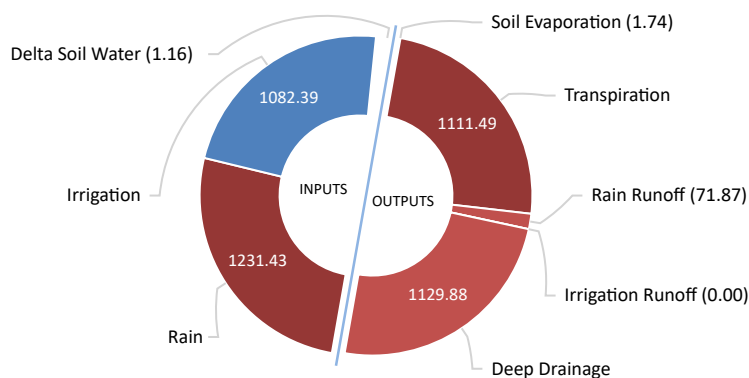
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

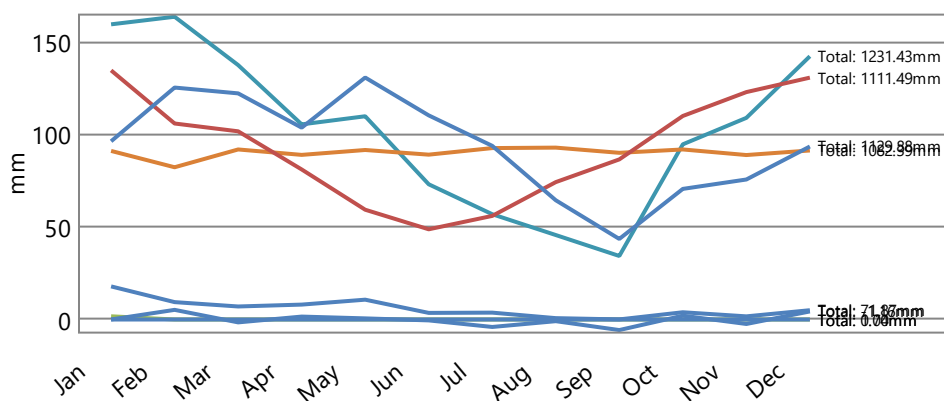
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	1082.39
Soil Evaporation	1.74
Transpiration	1111.49
Rain Runoff	71.87
Irrigation Runoff	0.00
Deep Drainage	1129.88
Delta Soil Water	-1.16

Average Monthly Totals (mm):

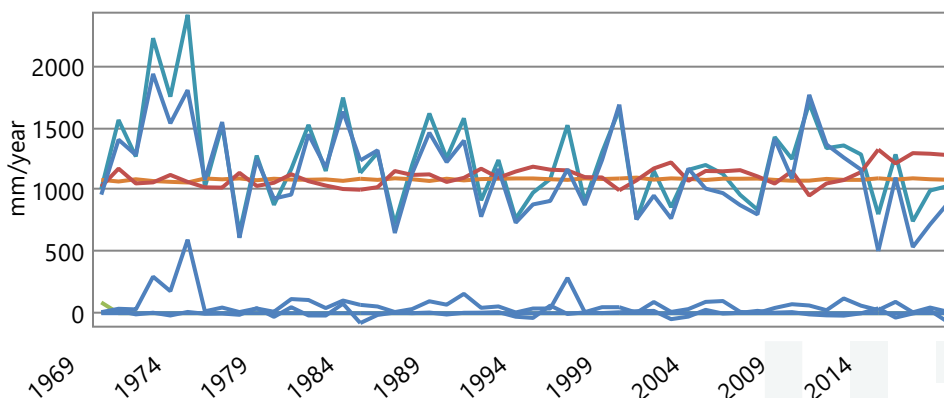
☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE

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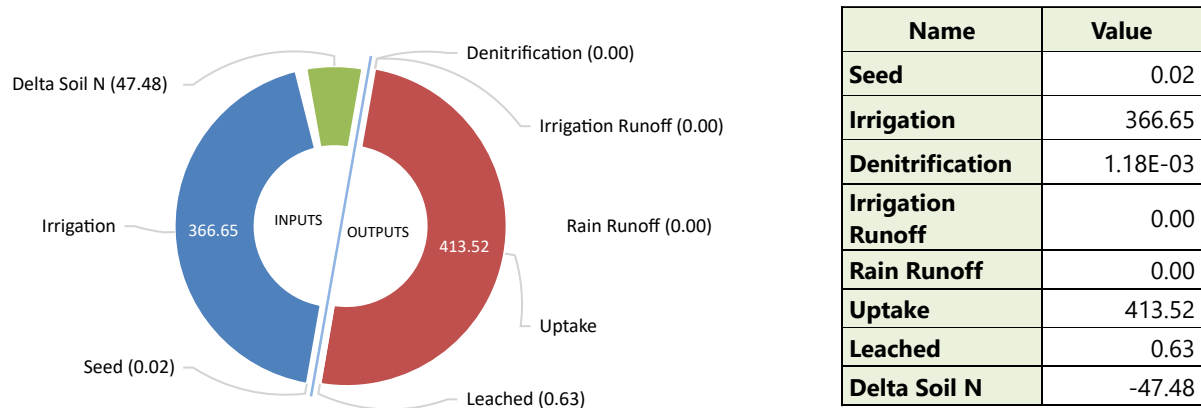
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

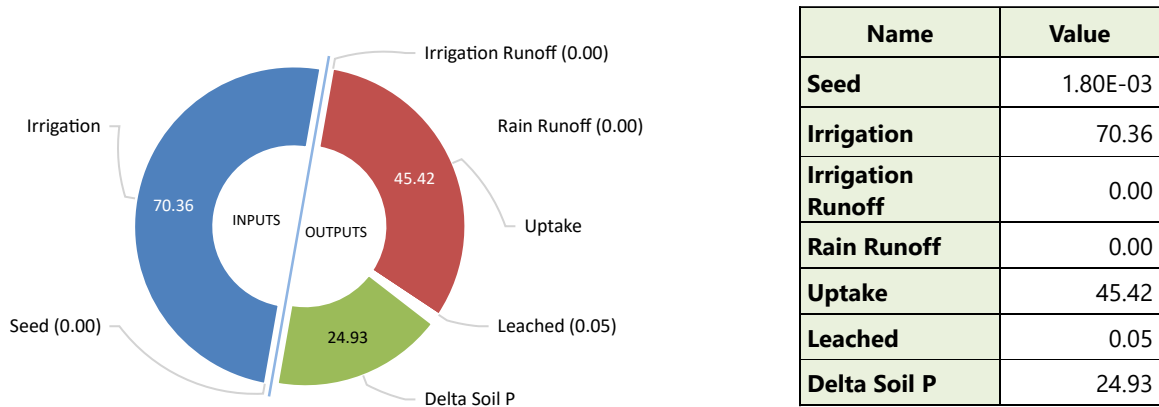
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 7.48
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)

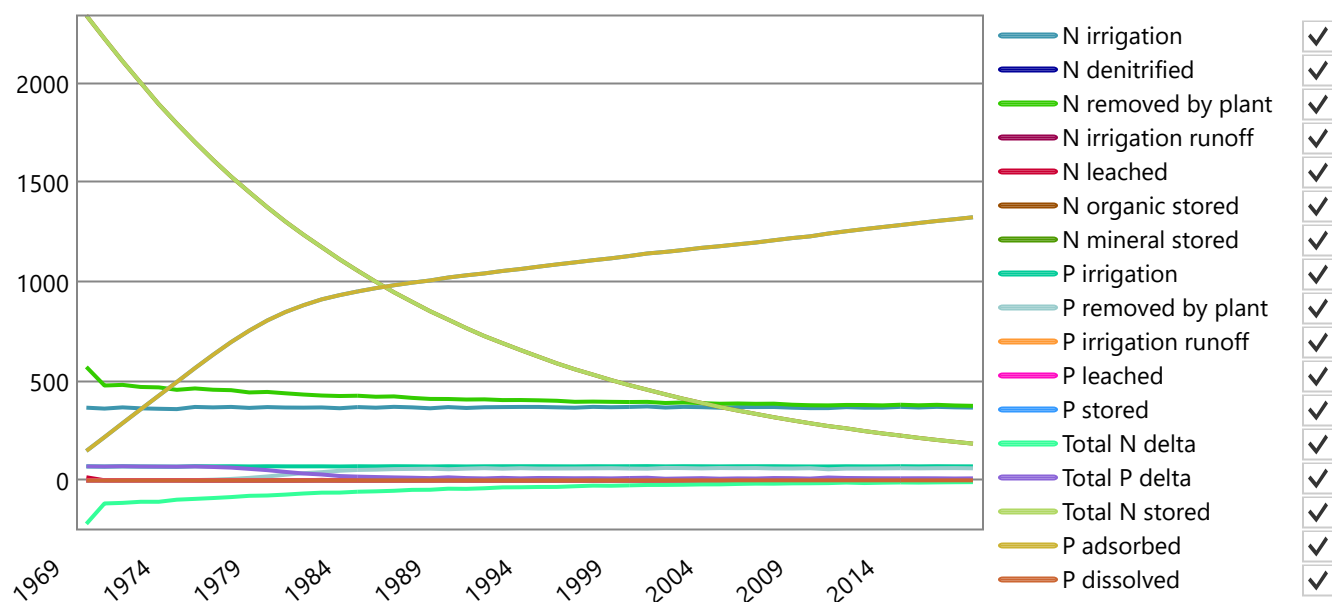


Land Performance - Soil Nutrient

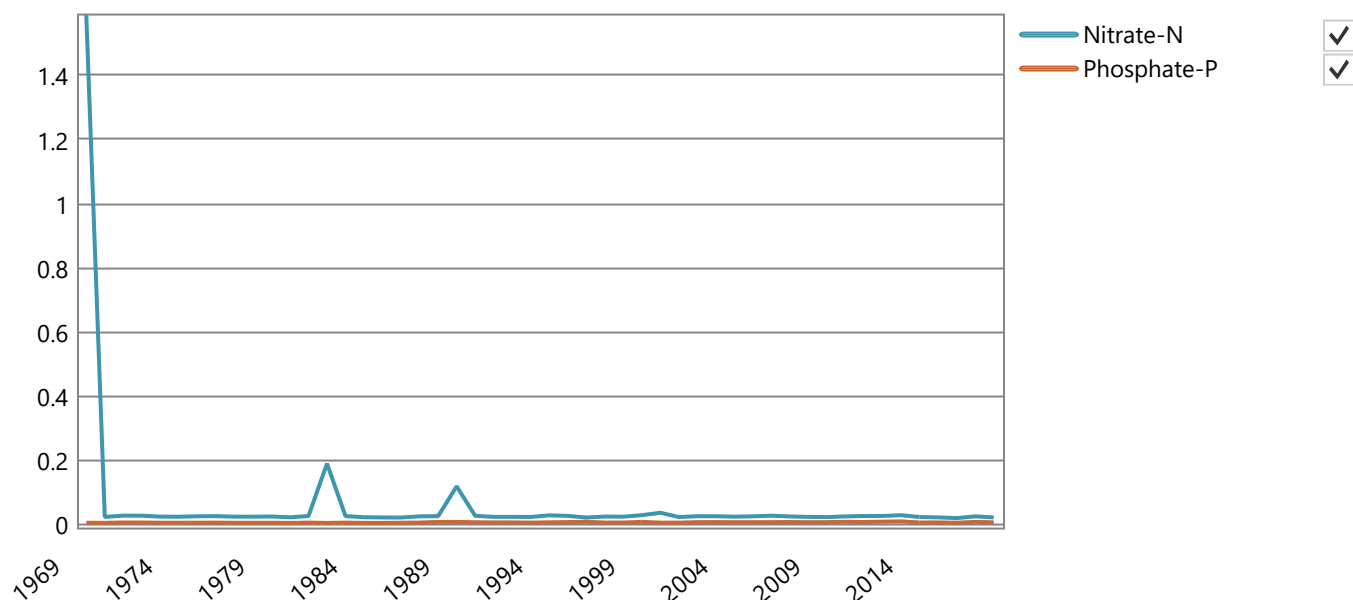
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

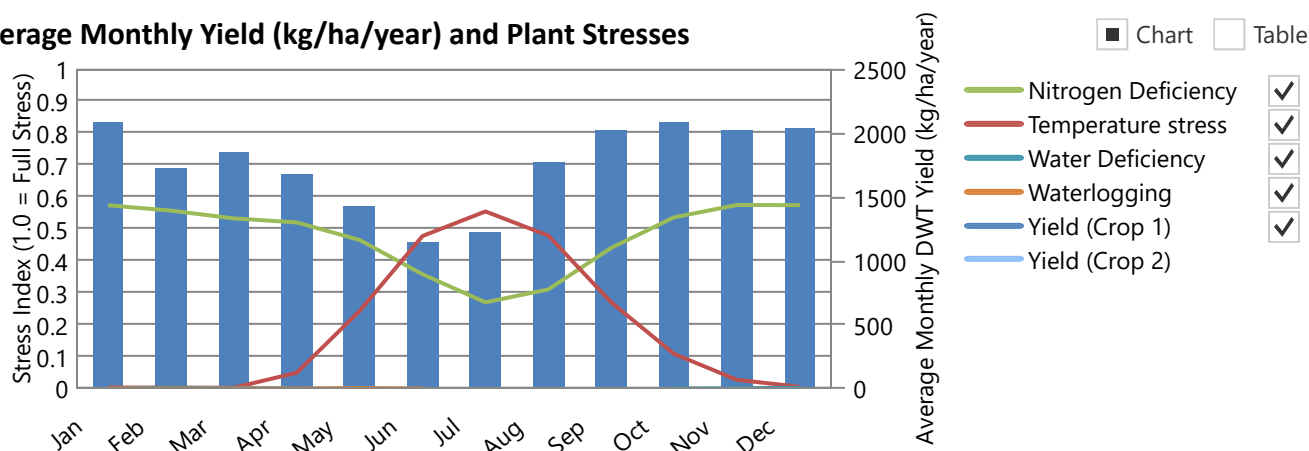
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	21136.56 (18690.84 - 25402.63)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.81 - 0.91)
Average monthly root depth (mm) (minimum - maximum)	699.64 (695.70 - 700.00)

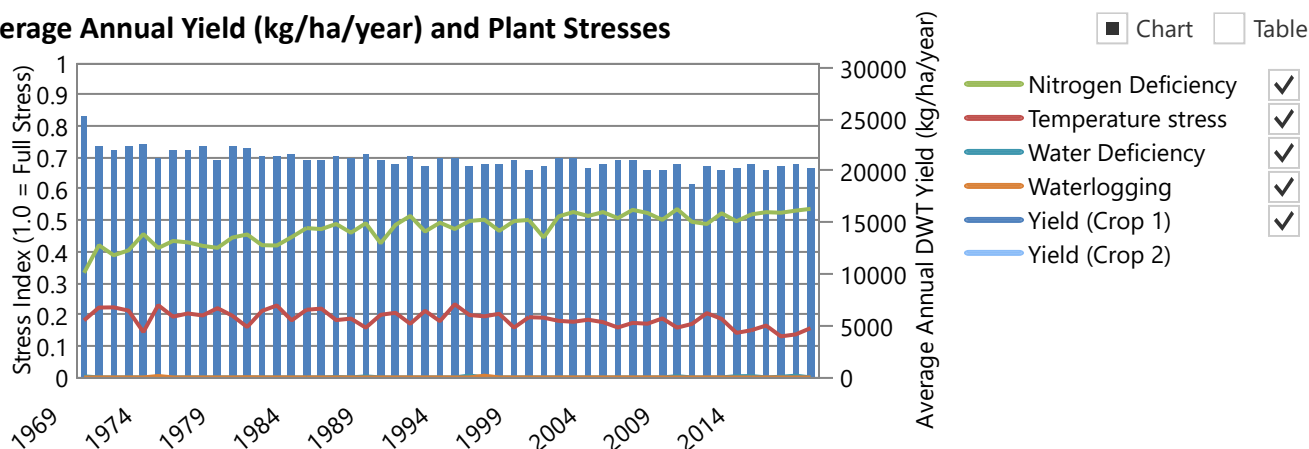
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	413.52 (374.82 - 570.59)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	45.42 (0.00 - 62.28)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses

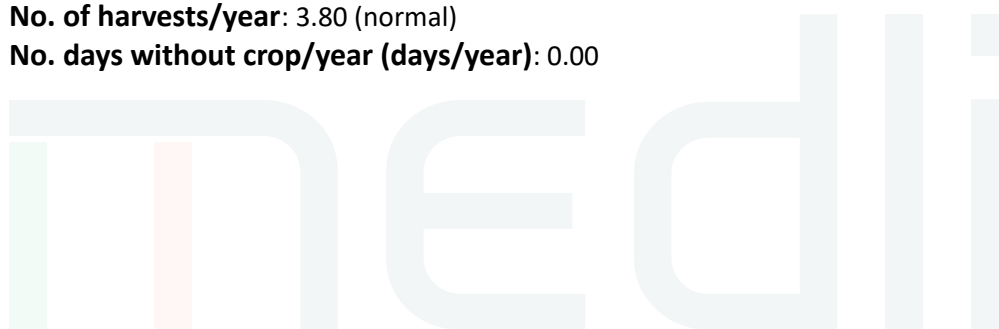


Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 3.80 (normal)

No. days without crop/year (days/year): 0.00



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

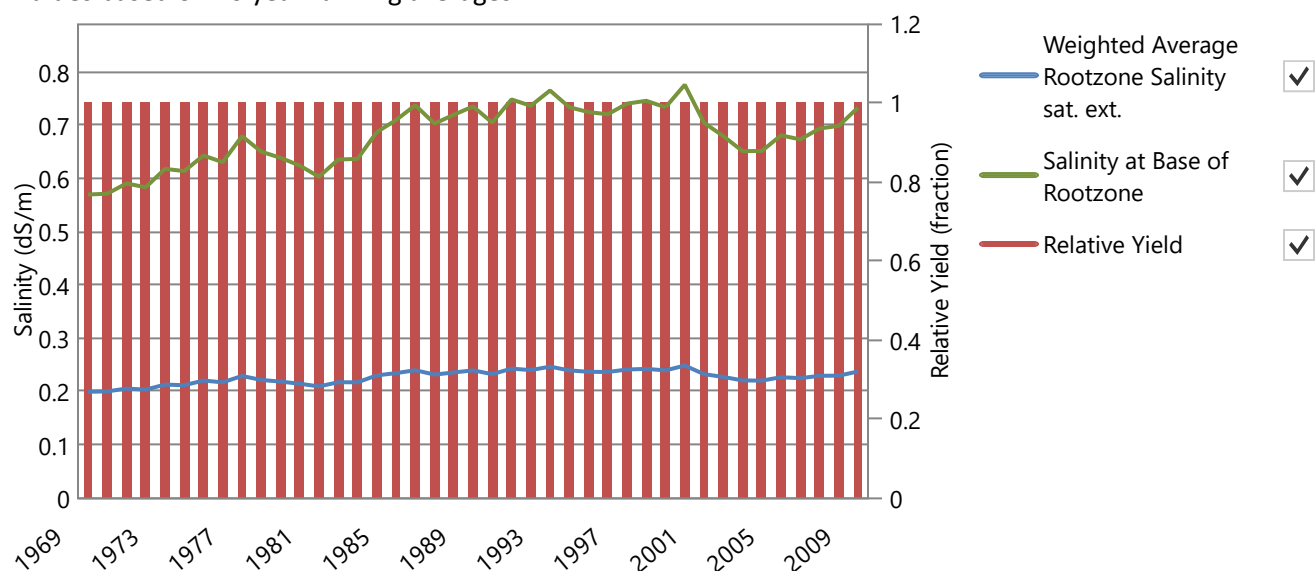
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	222.64
Average annual effluent salt added & leached at steady state (kg/ha/year)	4876.90
Average leaching fraction based on 10 year running averages (fraction)	0.69
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.23
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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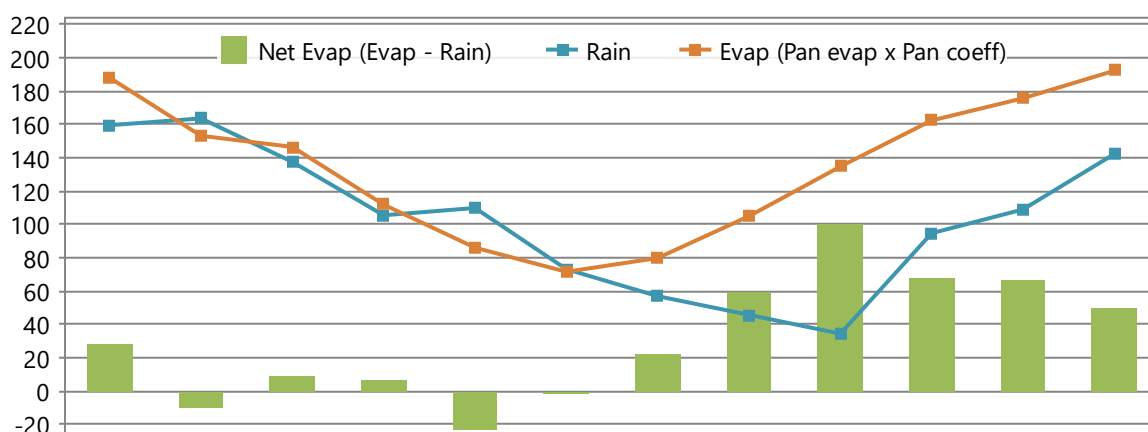
Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 16435.80 kL/year or 45.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	575.25 (574.87 - 576.45)
Total Phosphorus	6.50 (6.50 - 6.50)	106.83 (106.76 - 107.06)
Total Dissolved Salts	430.00 (430.00 - 430.00)	7067.39 (7062.75 - 7082.10)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

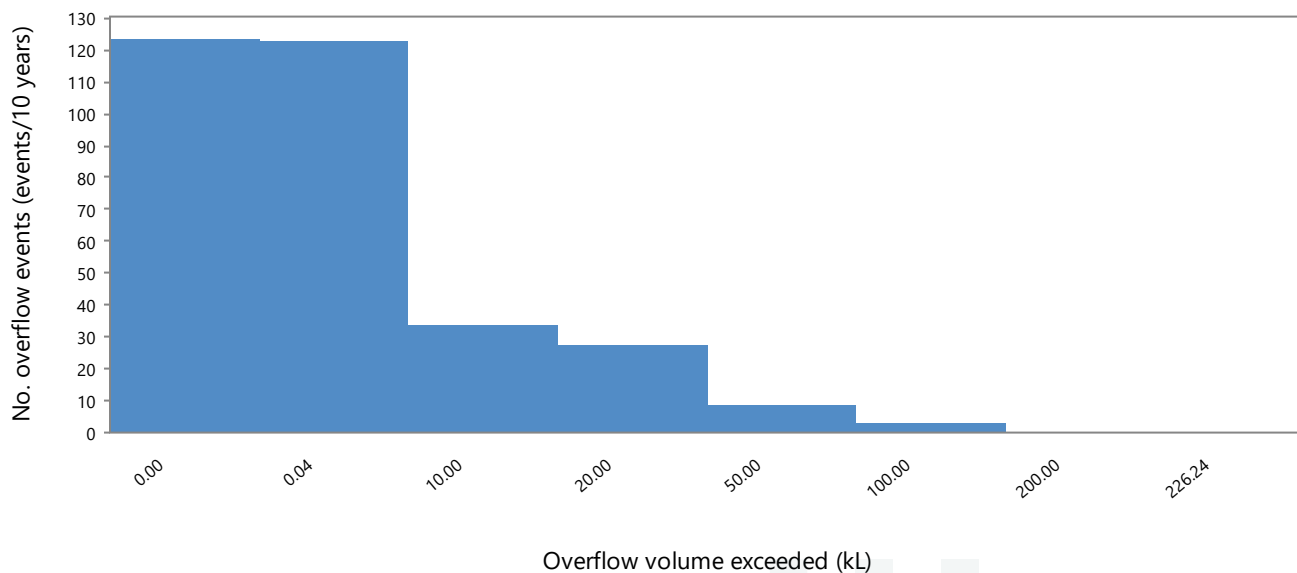
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	2.00
Average volume of overflow (kL/year)	199.96
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	12.32
Average duration of overflow (days)	1.31
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.66

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	16235.81	10823.88
Total nitrogen applied (kg)	549.97	366.65
Total phosphorus applied (kg)	105.53	70.36
Total salts applied (kg)	6981.40	4654.27

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96



Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	91.1	82.3	91.9	88.9	91.6	89.1	92.6	92.9	90.1	91.9	88.9	91.3	1082.4
Soil Evap	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
Transpn.	134.6	105.9	101.7	81.1	59.3	48.7	56.0	74.2	86.5	110.0	122.9	130.7	1111.5
Rain Runoff	17.9	9.4	7.0	8.1	10.7	3.6	3.7	0.7	0.1	3.9	1.7	5.0	71.9
Irr. Runoff	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
Drainage	96.3	125.3	122.2	103.7	130.7	110.3	93.8	64.4	43.5	70.6	75.6	93.5	1129.9
Delta	0.0	5.2	-1.5	1.6	0.6	-0.5	-4.0	-0.9	-5.7	2.1	-2.4	4.4	-1.2

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	366.65
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	413.52
Average annual soil nitrogen removed by denitrification (kg/ha/year)	1.18E-03
Average annual soil nitrogen leached (kg/ha/year)	0.63
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.63
Soil organic-N kg/ha (Initial - Final)	2448.00 - 184.58
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.06
Max. annual nitrate-N concentration of deep drainage (mg/L)	1.59

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	70.36
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	45.42
Average annual soil phosphorus leached (kg/ha/year)	0.05
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 2.90E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1323.99
Average phosphate-P concentration in rootzone (mg/L)	0.02
Average phosphate-P concentration of deep drainage (mg/L)	4.76E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 3.14 mg/L (years)	74.68

Sustainability Diagnostics:

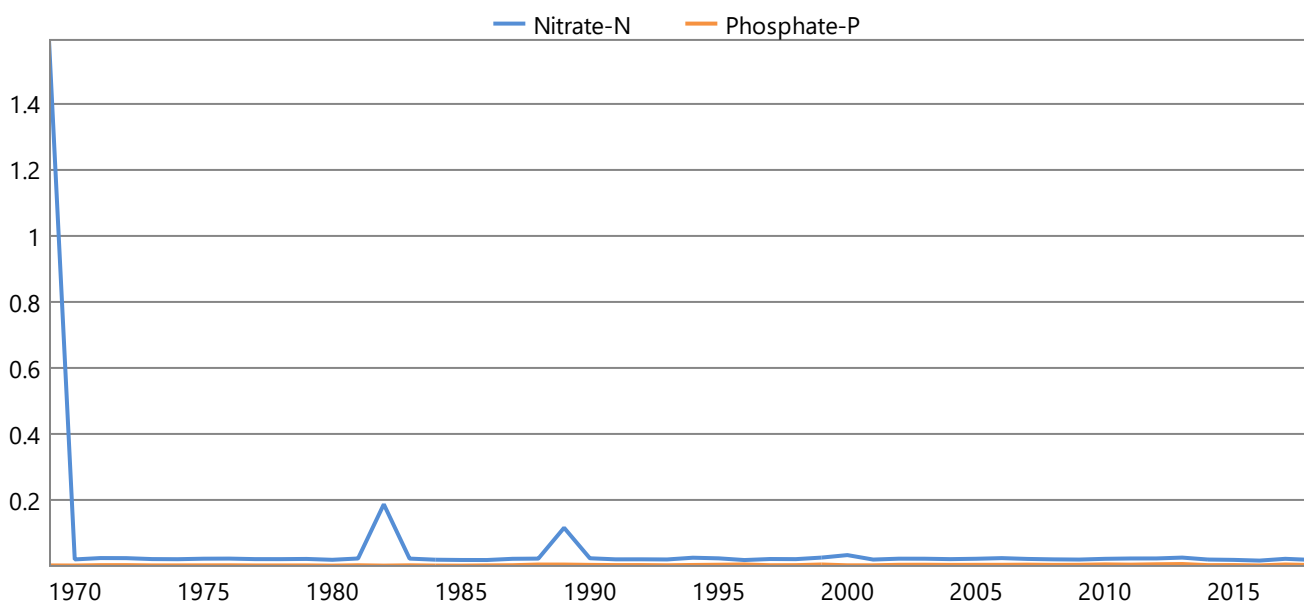
Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

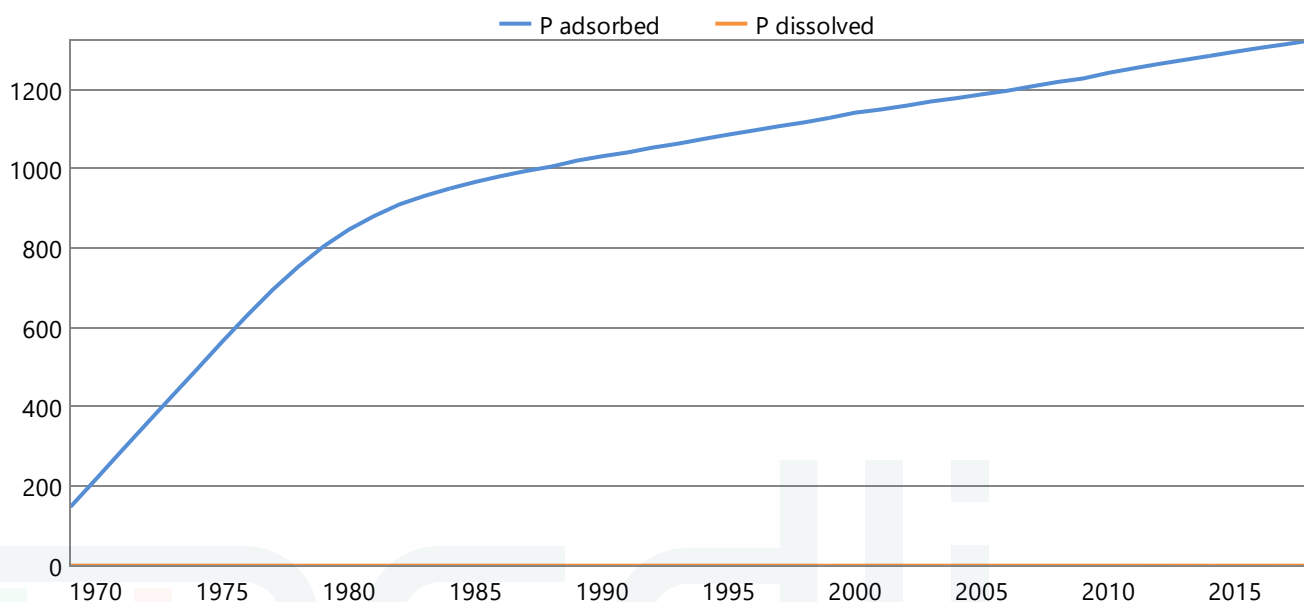
Irrigation: Flood with 0.1% ammonium loss during irrigation

DIAGNOSTICS

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F45_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	21136.56 (18690.84 - 25402.63)
Average monthly plant (green) cover (fraction)	0.87 (0.81 - 0.91)
Average monthly crop factor (fraction)	0.69 (0.64 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.64 (695.70 - 700.00)
Average number of normal harvests per year (no./year)	3.80 (3.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.47 (0.33 - 0.54)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	222.64
Average annual effluent salt added & leached at steady state (kg/ha/year)	4876.90
Average leaching fraction based on 10 year running averages (fraction)	0.69
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.23
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS



Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

Title:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

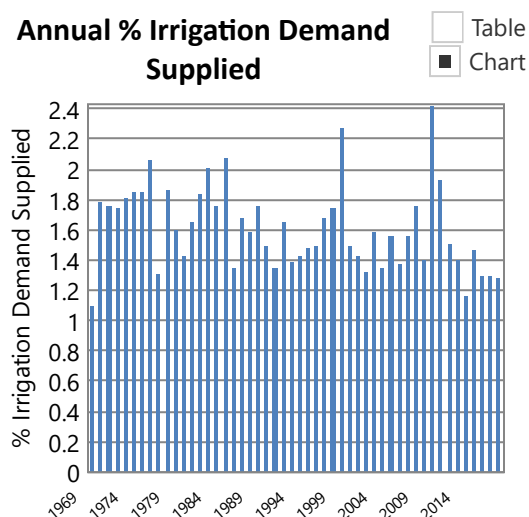
Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Average Annual %Irrigation Demand Supplied:

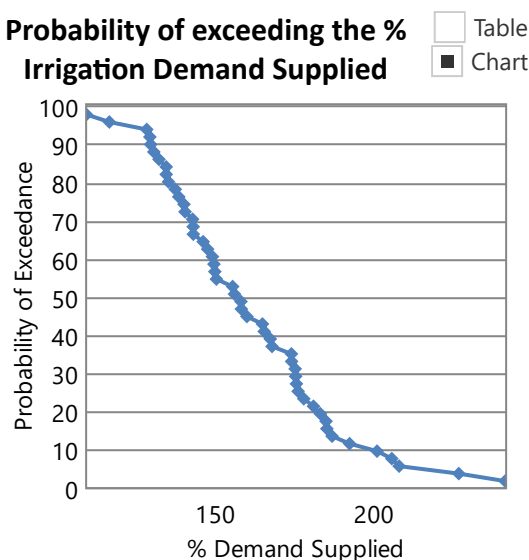
Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	8466.6
Annual irrigation predicted for defined scenario (mm/year)	846.7
Average annual irrigation demand supplied (fraction)	1.6

Or for 1.50 ha: 8122 kL/year

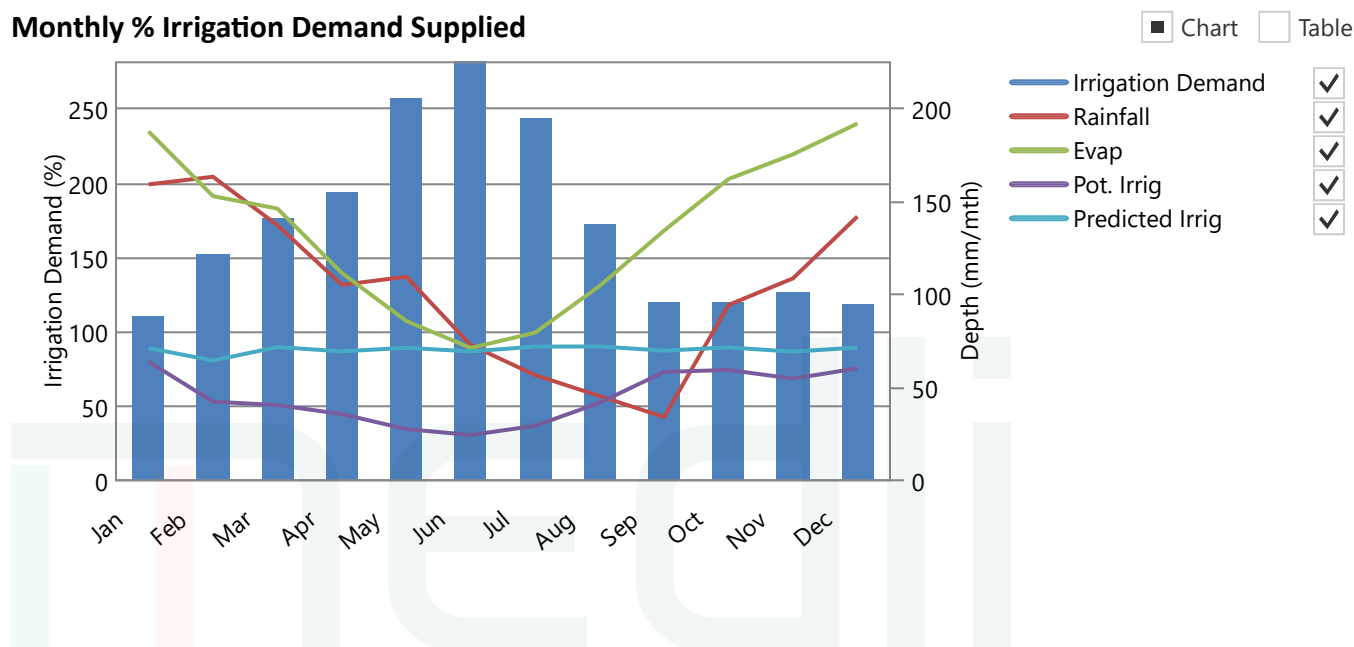
Annual % Irrigation Demand Supplied



Probability of exceeding the % Irrigation Demand Supplied



Monthly % Irrigation Demand Supplied



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

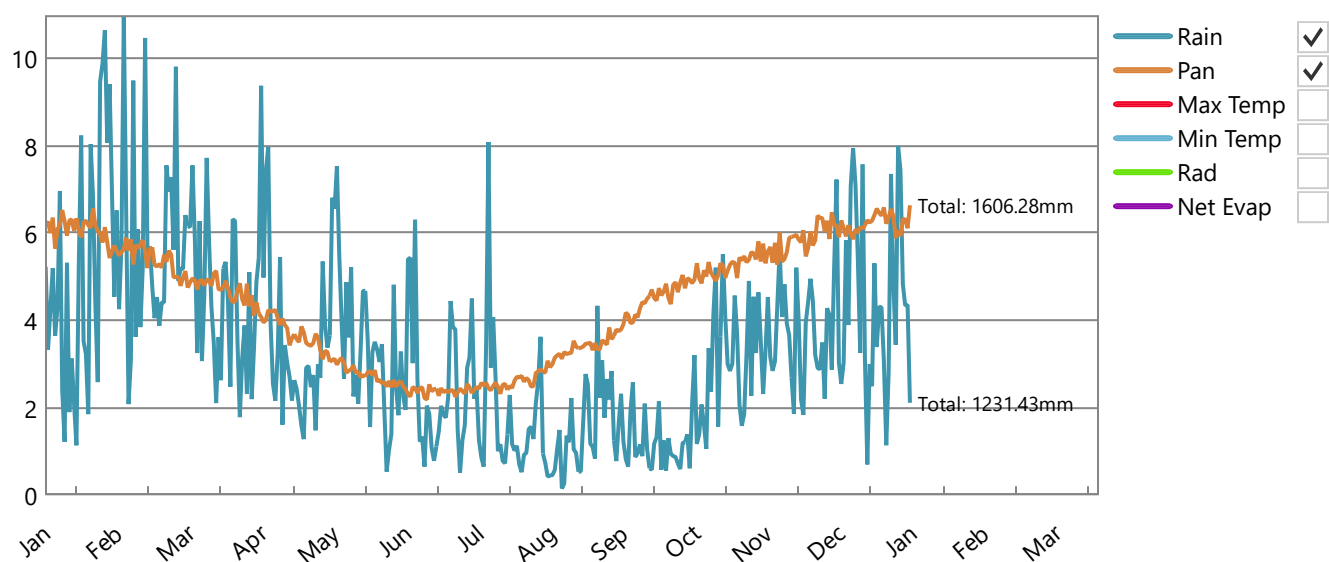
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



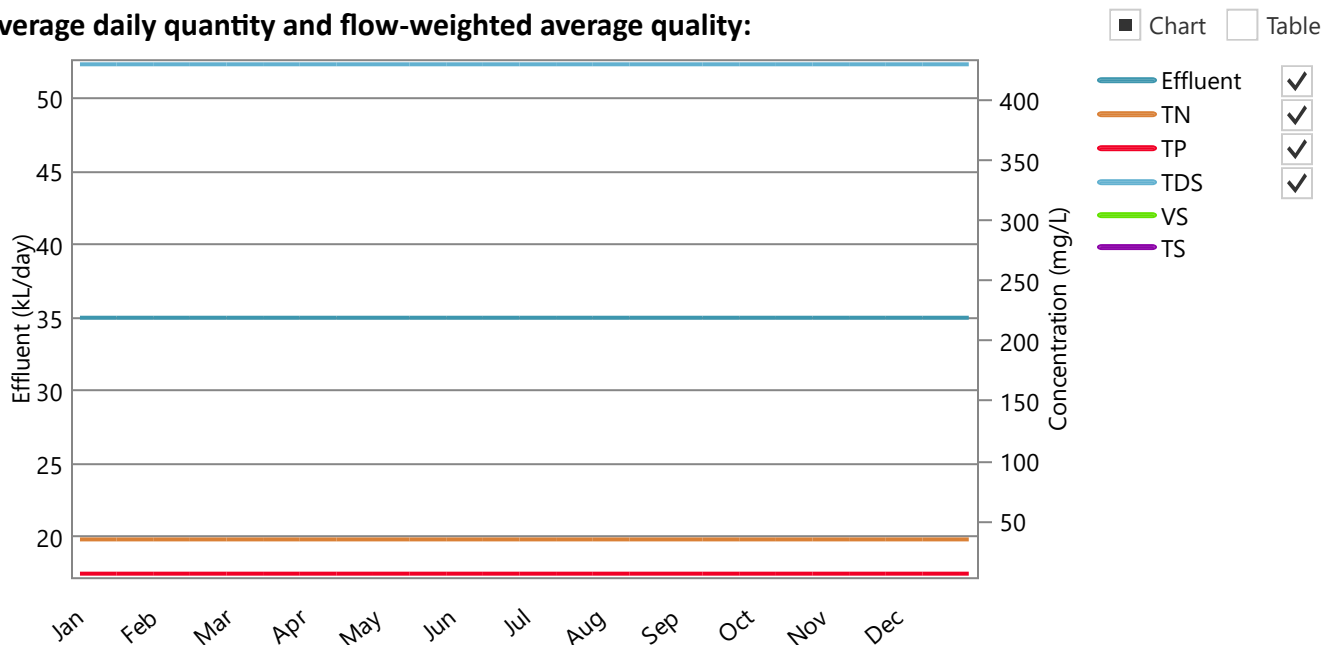
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **12783.40 kL/year** or 35.00 kL/day (Min-Max: 35.00 - 35.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	447.42 (447.13 - 448.35)
Total Phosphorus	6.50 (6.50 - 6.50)	83.09 (83.04 - 83.27)
Total Dissolved Salts	430.00 (430.00 - 430.00)	5496.86 (5493.25 - 5508.30)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

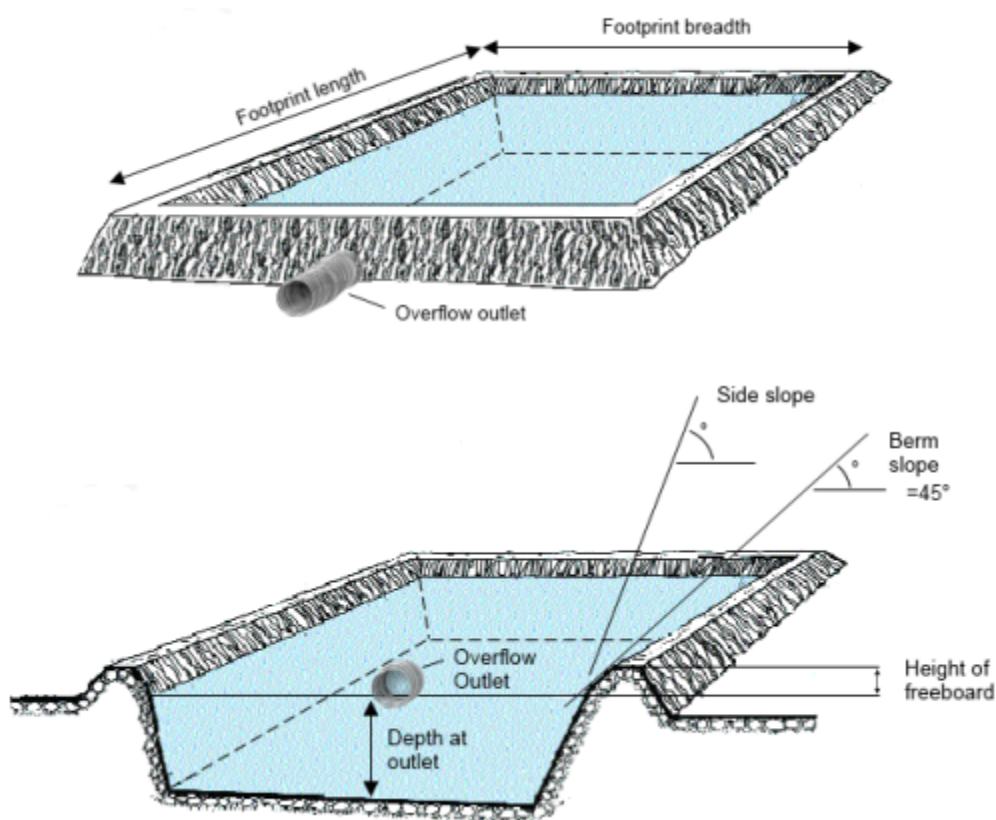
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	3.33



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

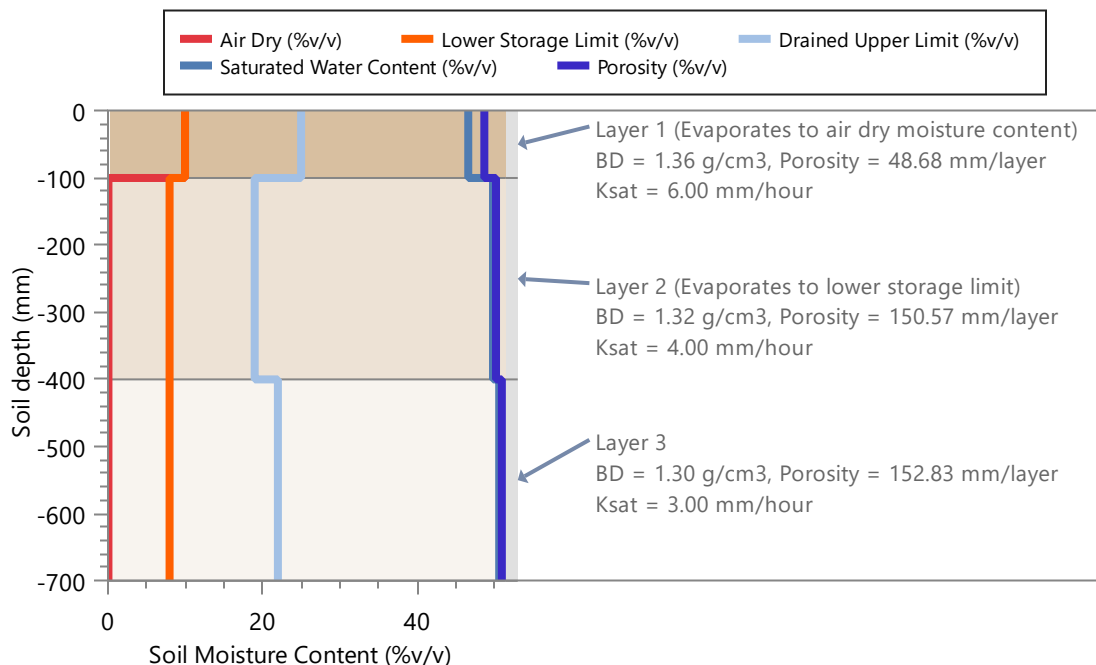
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

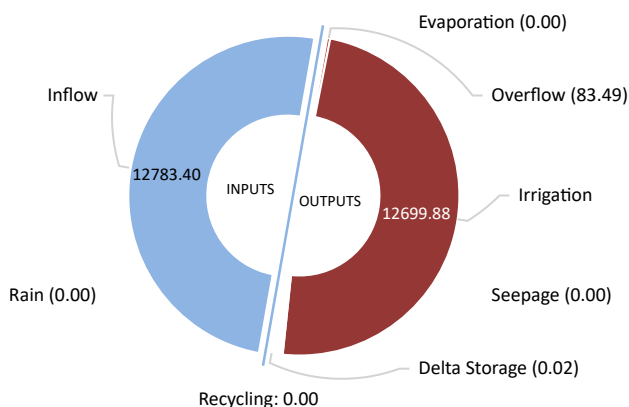
Average monthly cover (fraction) (minimum - maximum)	0.64 (0.63 - 0.66)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

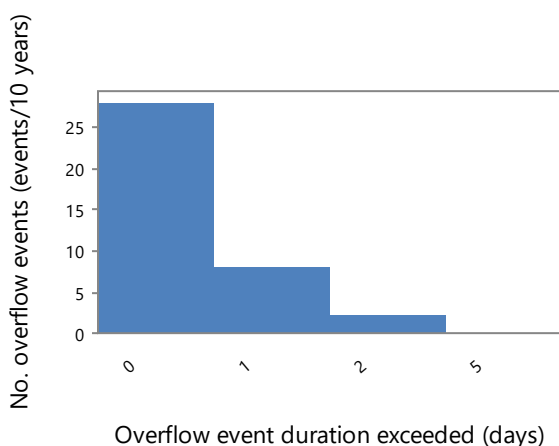
Pond System Water Balance (kL/year)



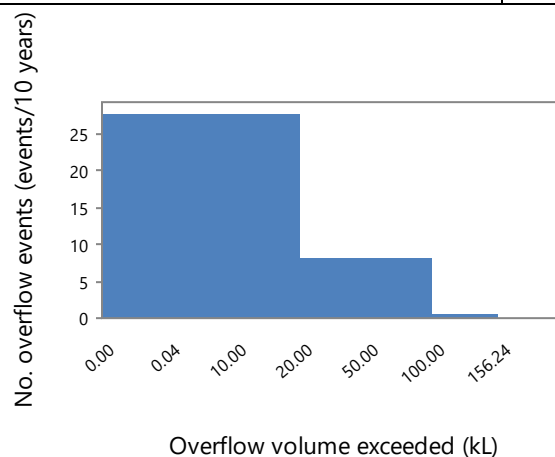
Name	Value
Rain	0.00
Inflow	12783.40
Recycling	0.00
Evaporation	0.00
Overflow	83.49
Irrigation	12699.88
Seepage	0.00
Delta Storage	0.02

Overflow Diagnostics

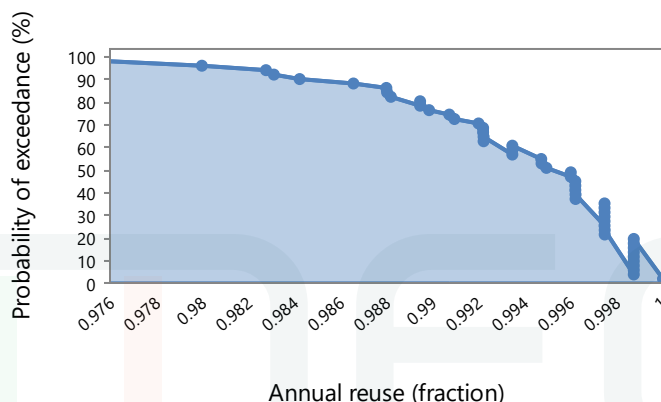
Volume of overflow (kL/year)	83.49
No. days pond overflows (days/year)	3.86
Average duration of overflow (days)	1.39
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% reuse (fraction)	1.00



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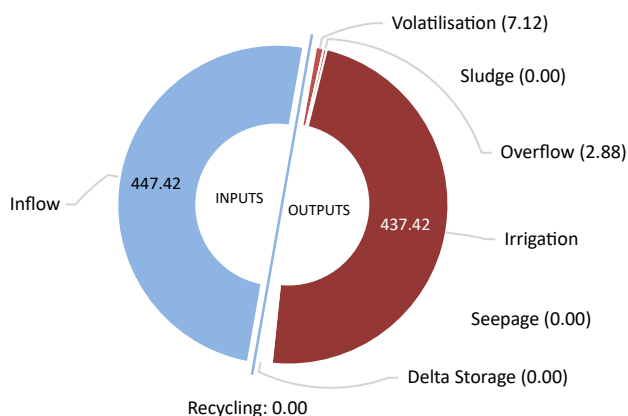


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

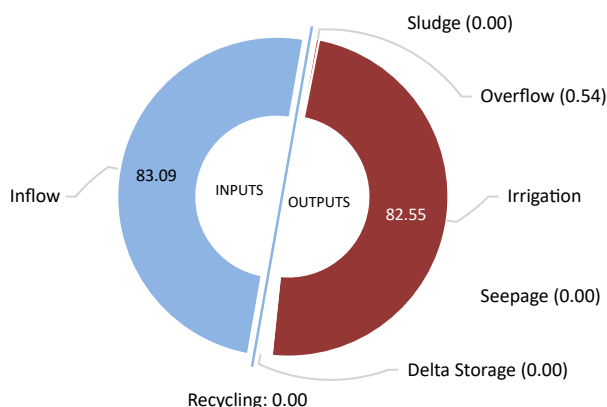
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



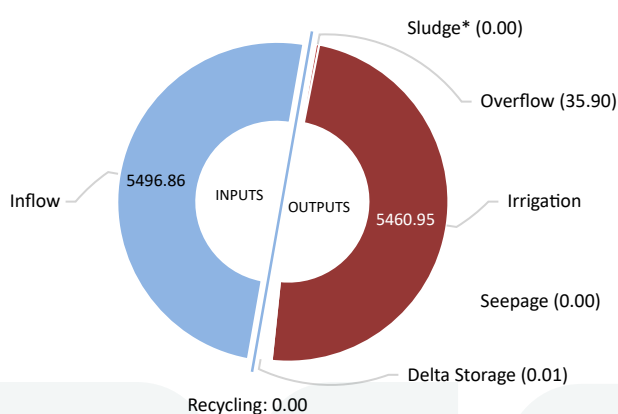
Name	Value
Inflow	447.42
Recycling	0.00
Volatilisation	7.12
Sludge	0.00
Overflow	2.88
Irrigation	437.42
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	83.09
Recycling	0.00
Sludge	0.00
Overflow	0.54
Irrigation	82.55
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	5496.86
Recycling	0.00
Sludge*	0.00
Overflow	35.90
Irrigation	5460.95
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank**Pond Nutrient Concentrations and Salinity:**

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	28.58
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.69
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	12699.88
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	12699.88
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.44
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.75
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

PERFORMANCE

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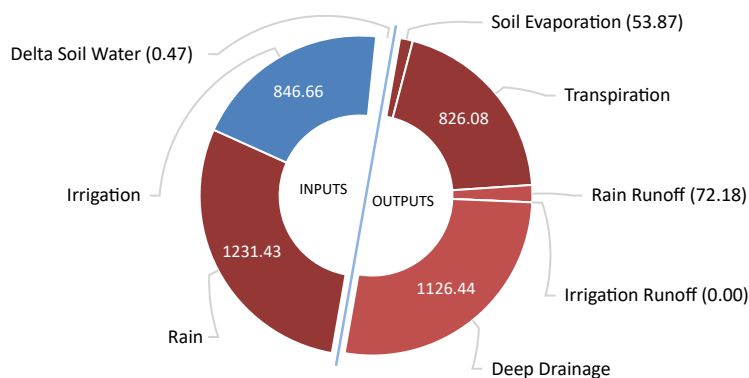
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

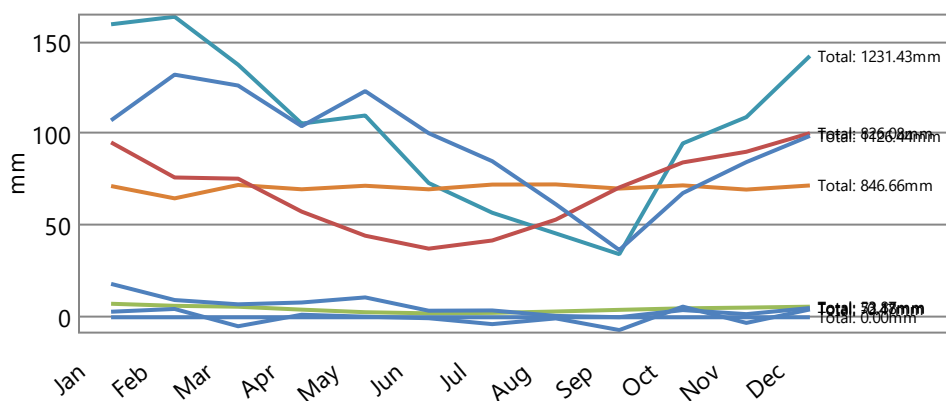
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	846.66
Soil Evaporation	53.87
Transpiration	826.08
Rain Runoff	72.18
Irrigation Runoff	0.00
Deep Drainage	1126.44
Delta Soil Water	-0.47

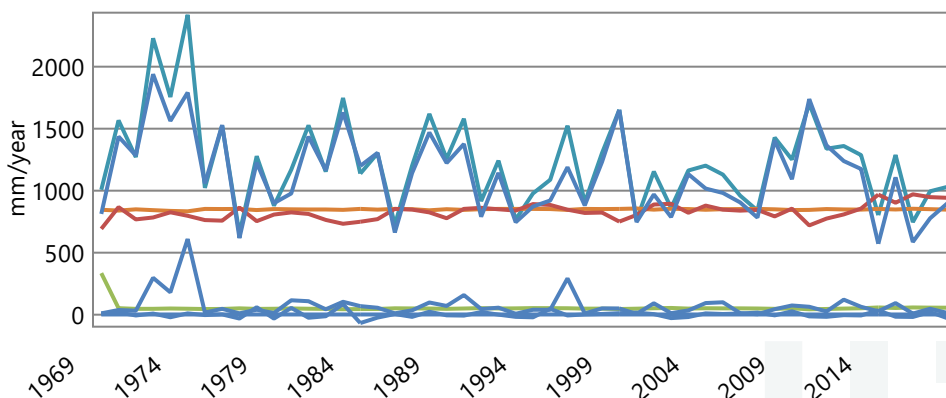
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



PERFORMANCE

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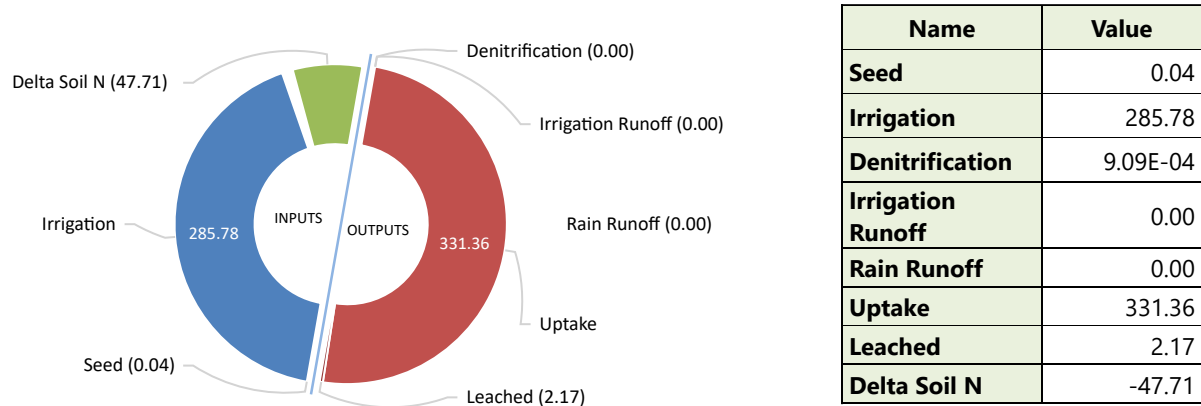
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

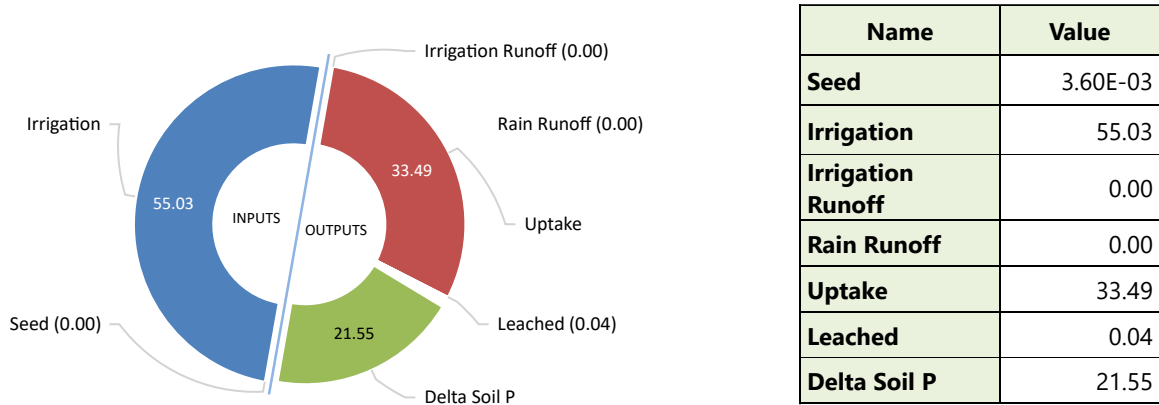
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 5.83
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)

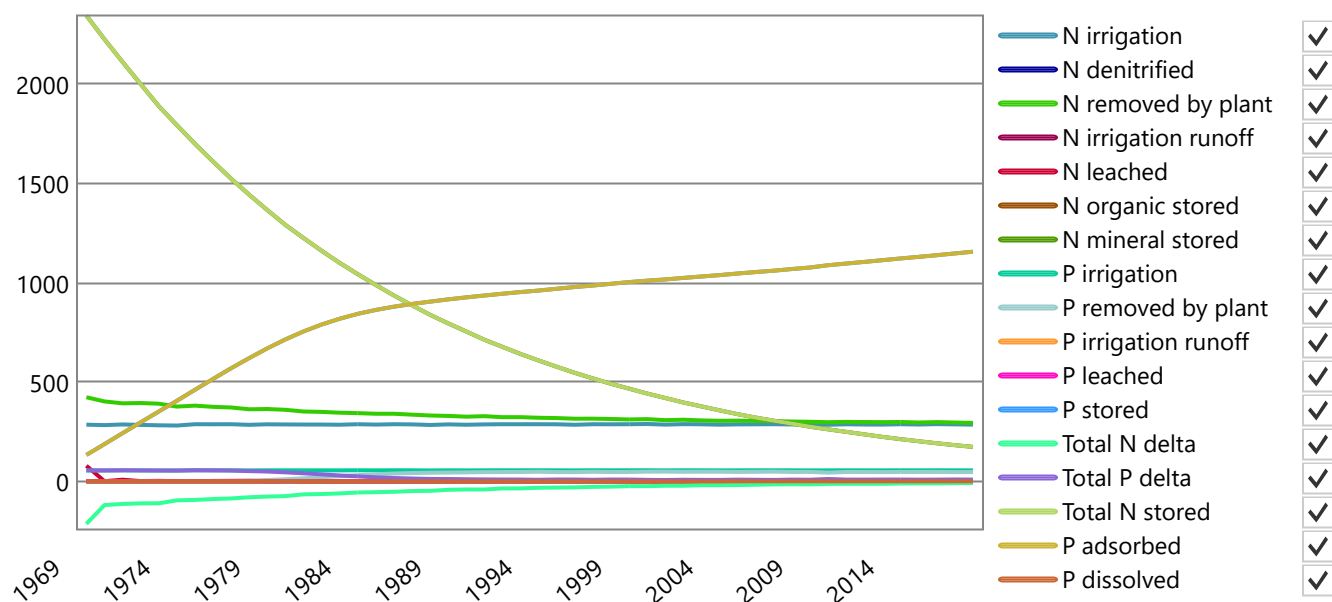


Land Performance - Soil Nutrient

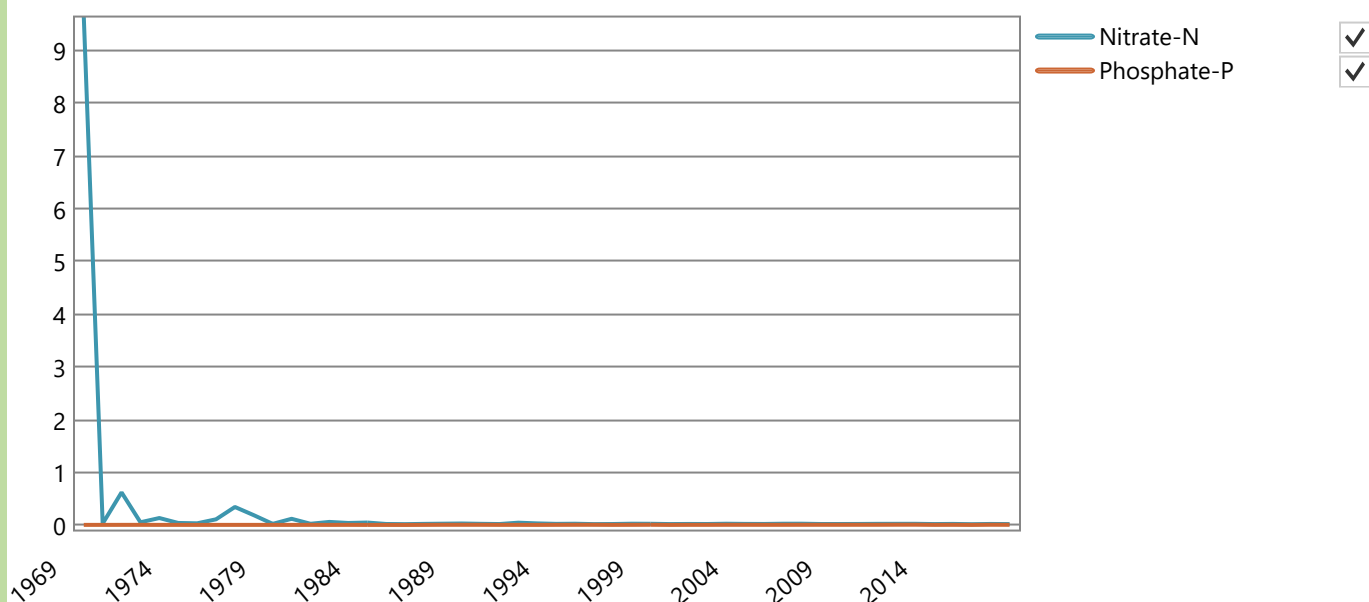
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

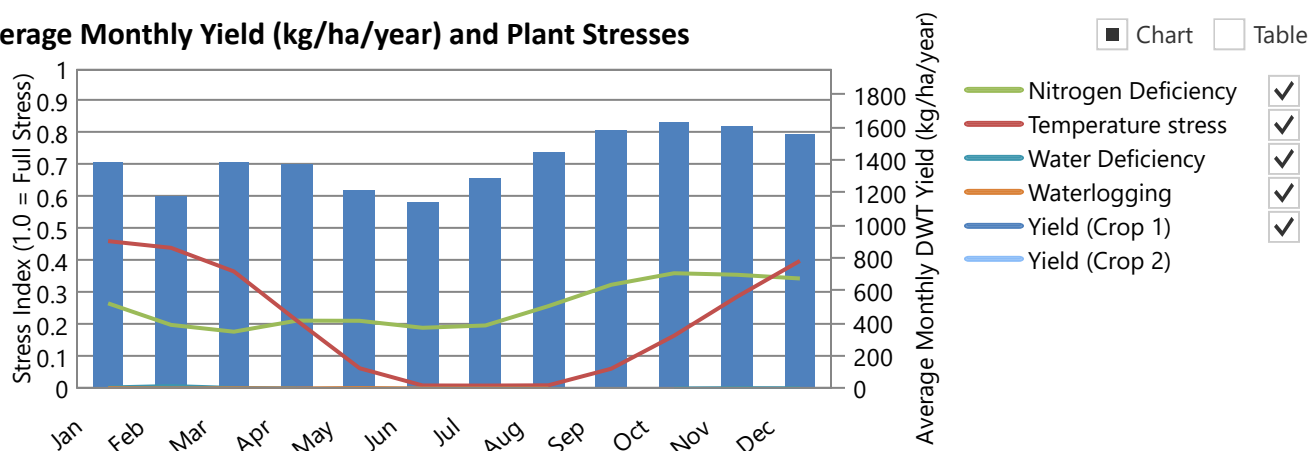
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	16842.05 (14584.89 - 18577.37)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.64 (0.63 - 0.66)
Average monthly root depth (mm) (minimum - maximum)	597.77 (592.12 - 599.98)

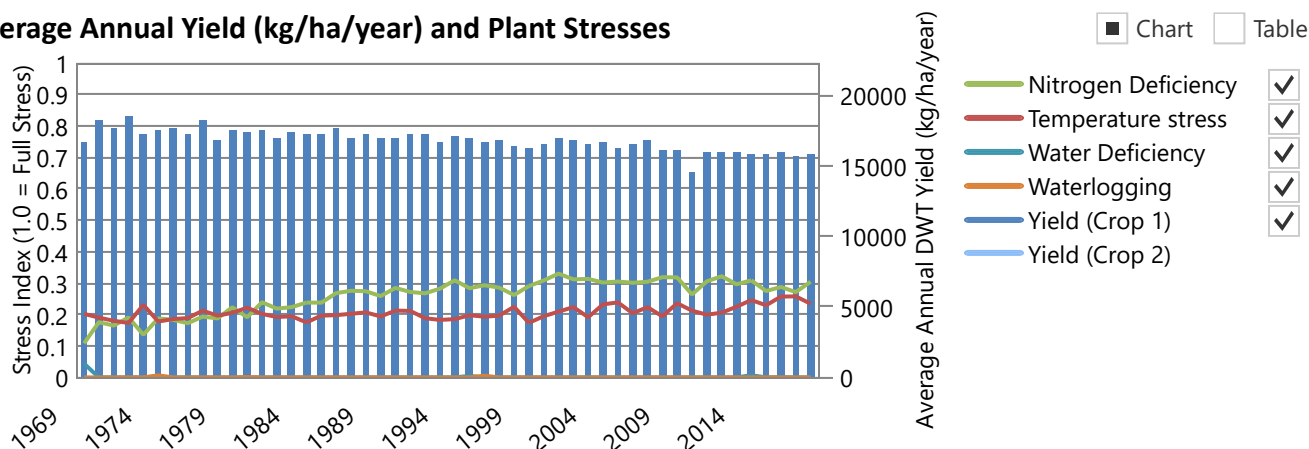
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	331.36 (293.68 - 422.90)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	33.49 (0.00 - 48.64)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 4.34 (normal), 0.02 (forced by crop death due to water stress (0.02))

No. days without crop/year (days/year): 0.08 due to water stress (0.08)



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

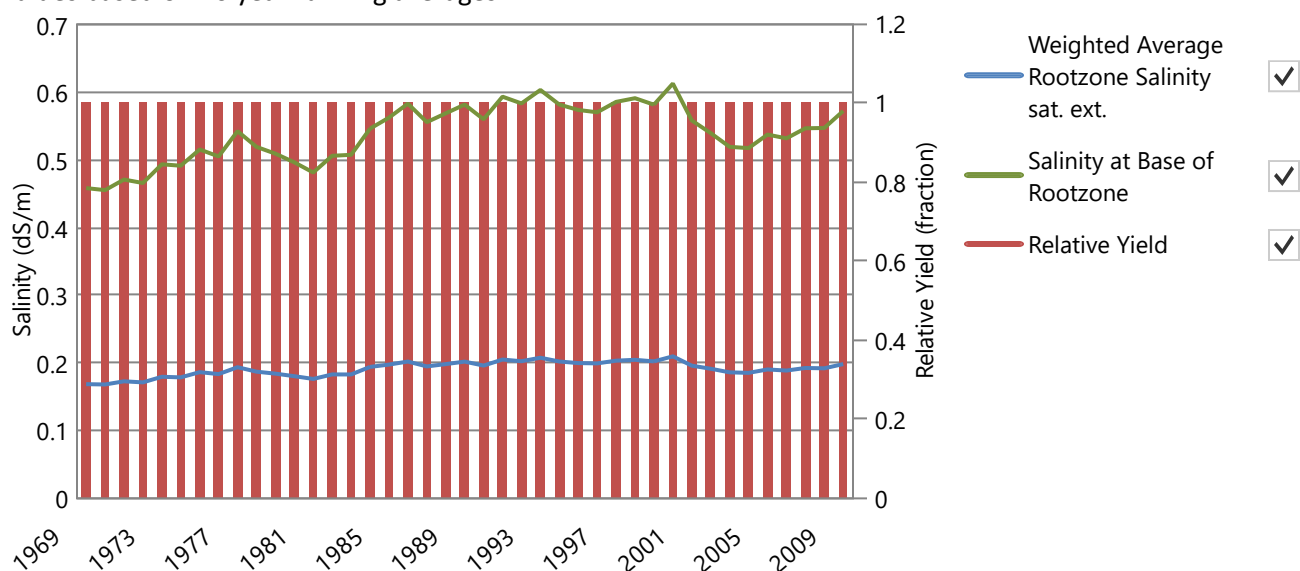
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.30
Salt added by rainfall (kg/ha/year)	222.58
Average annual effluent salt added & leached at steady state (kg/ha/year)	3863.21
Average leaching fraction based on 10 year running averages (fraction)	0.72
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.54
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



PERFORMANCE



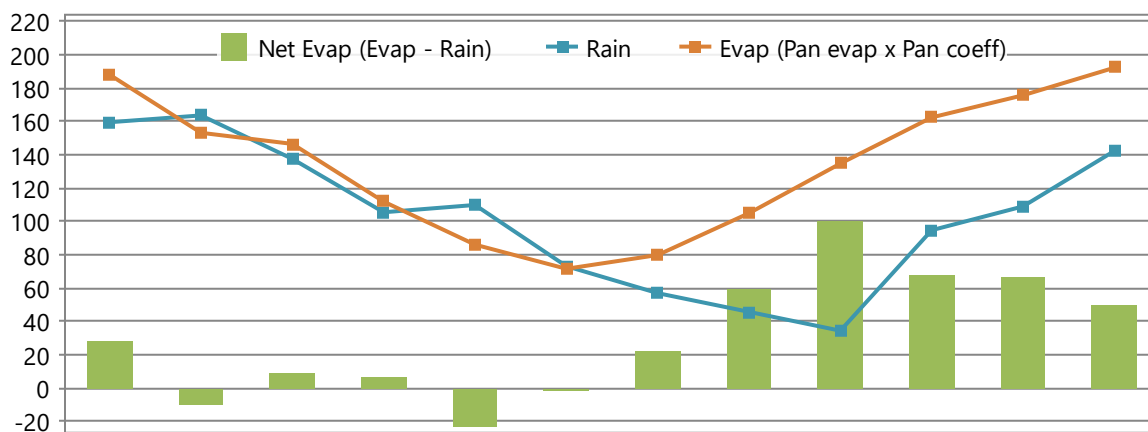
Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 12783.40 kL/year or 35.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	447.42 (447.13 - 448.35)
Total Phosphorus	6.50 (6.50 - 6.50)	83.09 (83.04 - 83.27)
Total Dissolved Salts	430.00 (430.00 - 430.00)	5496.86 (5493.25 - 5508.30)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

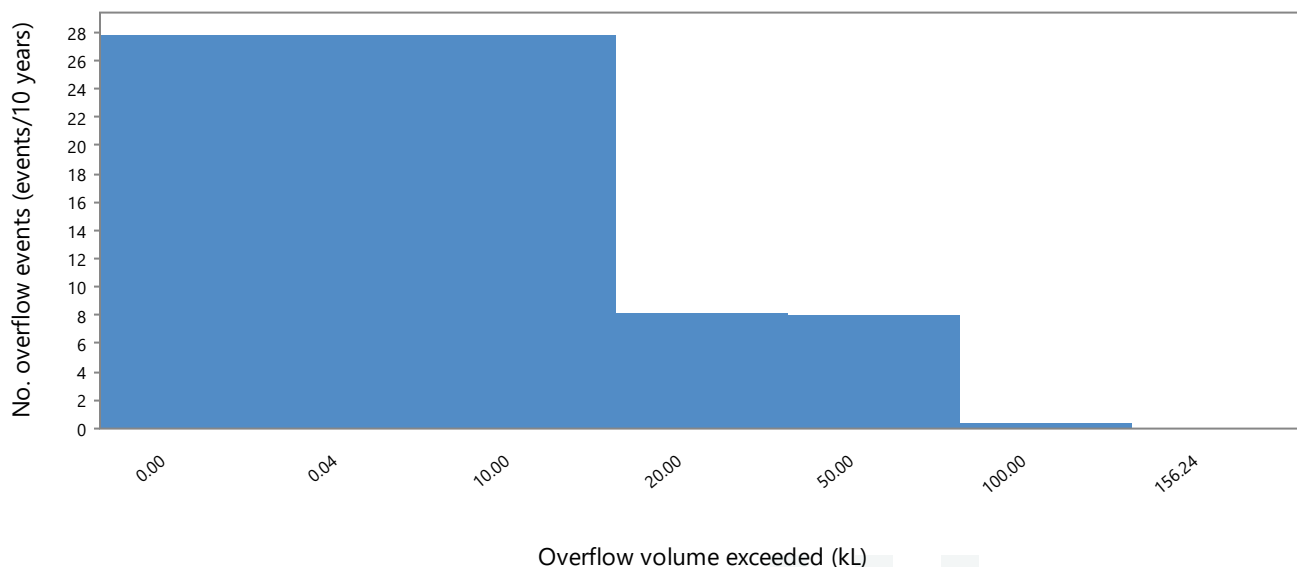
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	2.57
Average volume of overflow (kL/year)	83.49
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	2.78
Average duration of overflow (days)	1.39
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.63

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	12699.88	8466.59
Total nitrogen applied (kg)	428.67	285.78
Total phosphorus applied (kg)	82.55	55.03
Total salts applied (kg)	5460.95	3640.63

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	71.4	64.7	72.0	69.7	71.6	69.6	72.2	72.3	70.0	71.8	69.5	71.7	846.7
Soil Evap	7.4	6.2	5.7	4.2	2.8	2.1	2.4	3.1	4.0	4.9	5.3	5.8	53.9
Transpn.	95.2	76.1	75.4	57.5	44.4	37.3	41.8	53.1	70.6	84.3	90.1	100.2	826.1
Rain Runoff	18.2	9.4	7.1	8.0	10.8	3.6	3.7	0.7	0.1	3.9	1.7	5.0	72.2
Irr. Runoff	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
Drainage	107.2	132.1	126.1	104.0	123.1	100.2	84.9	61.5	36.6	67.6	84.5	98.7	1126.4
Delta	3.0	4.5	-4.9	1.4	0.3	-0.5	-3.7	-0.6	-7.0	5.8	-3.1	4.3	-0.5

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	285.78
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	331.36
Average annual soil nitrogen removed by denitrification (kg/ha/year)	9.09E-04
Average annual soil nitrogen leached (kg/ha/year)	2.17
Average annual nitrate-N loading to groundwater (kg/ha/year)	2.17
Soil organic-N kg/ha (Initial - Final)	2448.00 - 173.04
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.19
Max. annual nitrate-N concentration of deep drainage (mg/L)	9.64

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	55.03
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	33.49
Average annual soil phosphorus leached (kg/ha/year)	0.04
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 2.52E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1155.37
Average phosphate-P concentration in rootzone (mg/L)	0.01
Average phosphate-P concentration of deep drainage (mg/L)	3.77E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.74 mg/L (years)	93.06

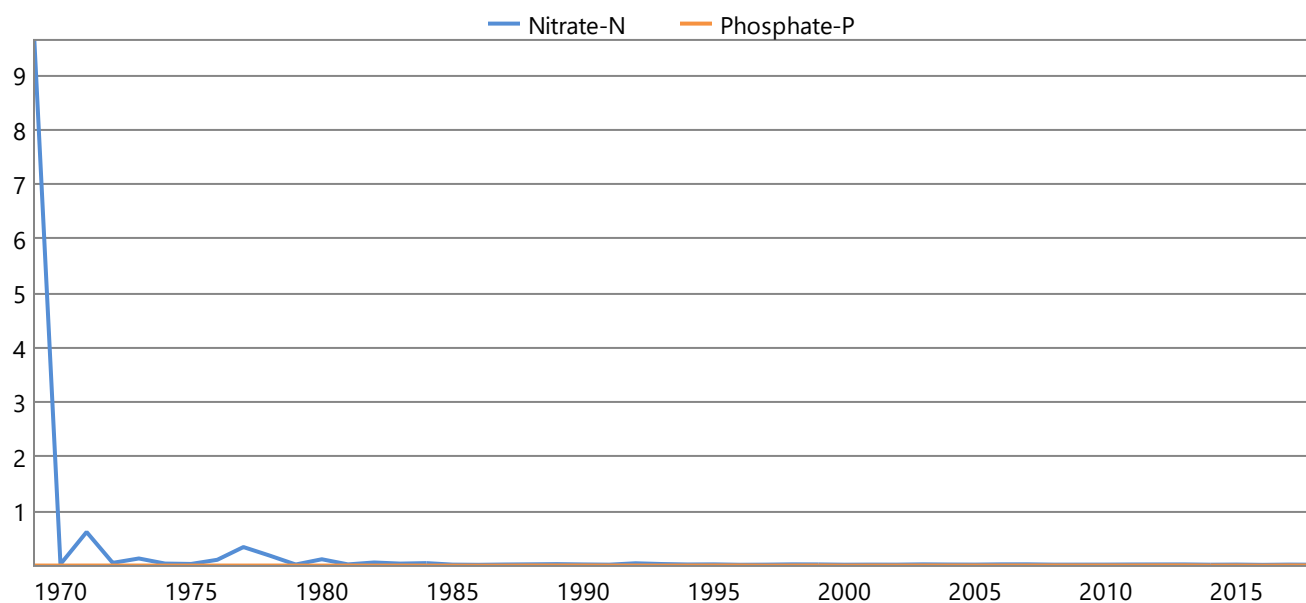
Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

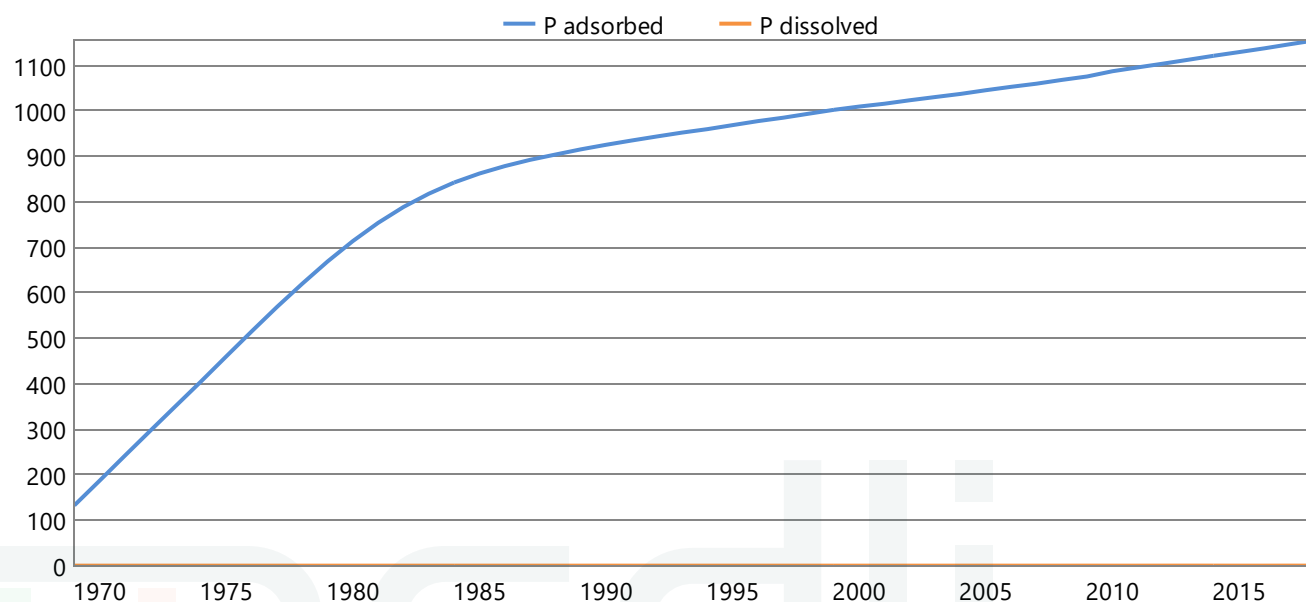
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	16842.05 (14584.89 - 18577.37)
Average monthly plant (green) cover (fraction)	0.64 (0.63 - 0.66)
Average monthly crop factor (fraction)	0.52 (0.50 - 0.53)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	597.77 (592.12 - 599.98)
Average number of normal harvests per year (no./year)	4.34 (3.00 - 5.00)
Average number of normal harvests for last five years only (no./year)	4.00
Average number of crop deaths per year (no./year)	0.02 (0.00 - 1.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.26 (0.11 - 0.33)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.08

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.30
Salt added by rainfall (kg/ha/year)	222.58
Average annual effluent salt added & leached at steady state (kg/ha/year)	3863.21
Average leaching fraction based on 10 year running averages (fraction)	0.72
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.54
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00



Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title: Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

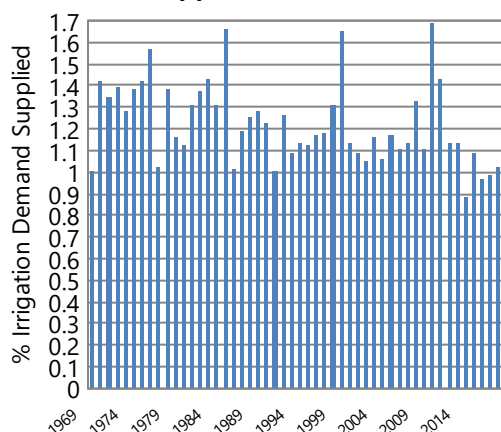
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	8522.3
Annual irrigation predicted for defined scenario (mm/year)	852.2
Average annual irrigation demand supplied (fraction)	1.2

Or for 1.50 ha: 10668 kL/year

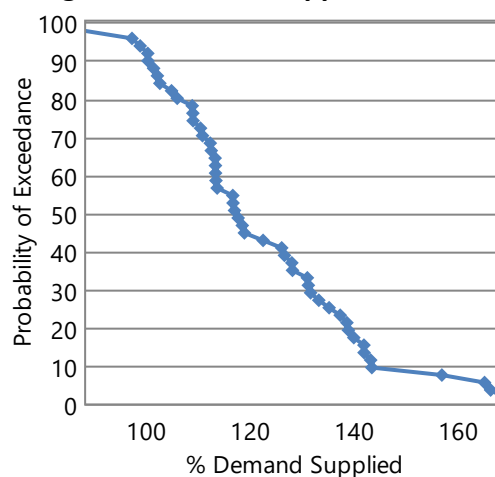
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



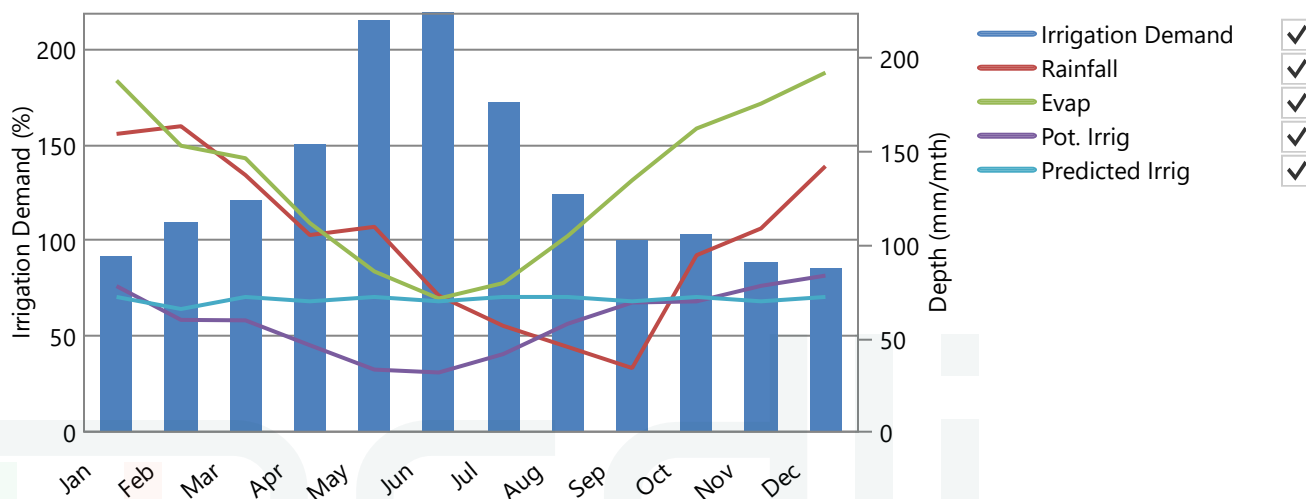
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

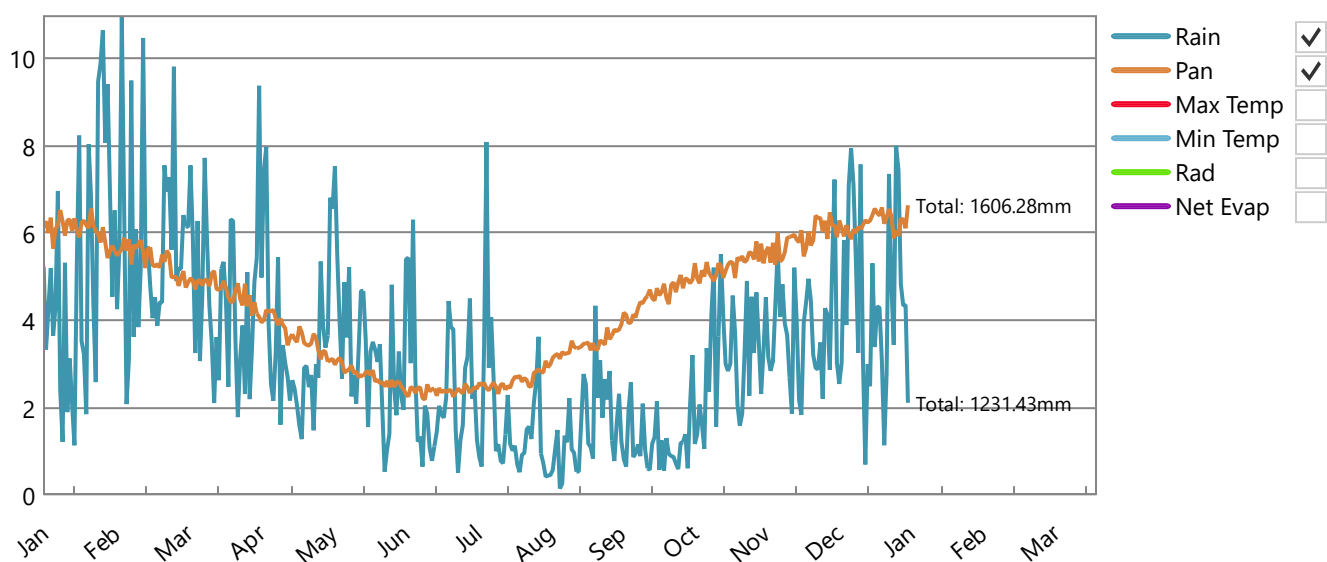
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



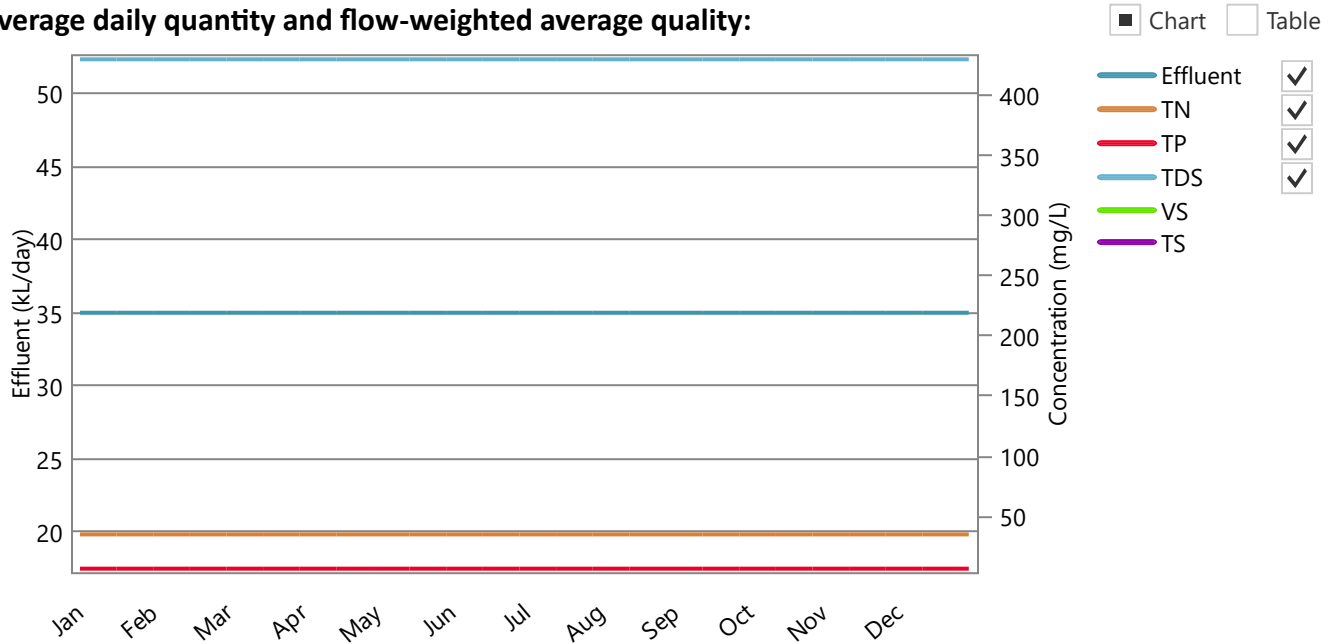
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **12783.40 kL/year** or 35.00 kL/day (Min-Max: 35.00 - 35.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	447.42 (447.13 - 448.35)
Total Phosphorus	6.50 (6.50 - 6.50)	83.09 (83.04 - 83.27)
Total Dissolved Salts	430.00 (430.00 - 430.00)	5496.86 (5493.25 - 5508.30)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

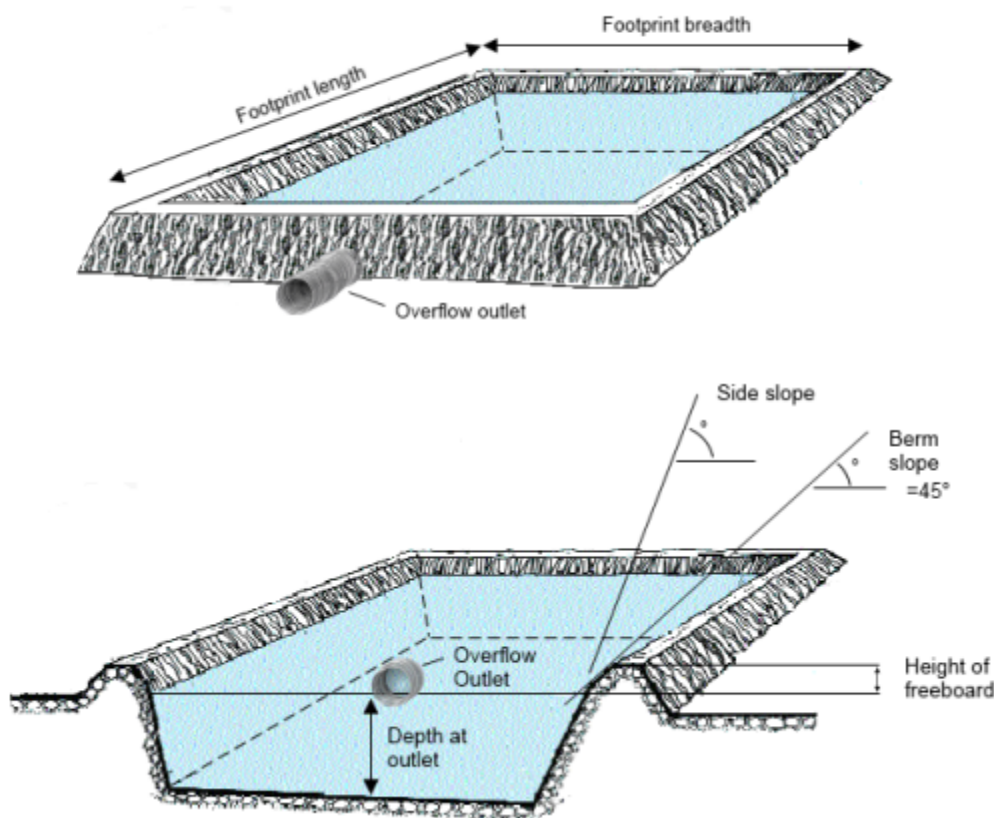
DESCRIPTION

medli

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	1.24



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

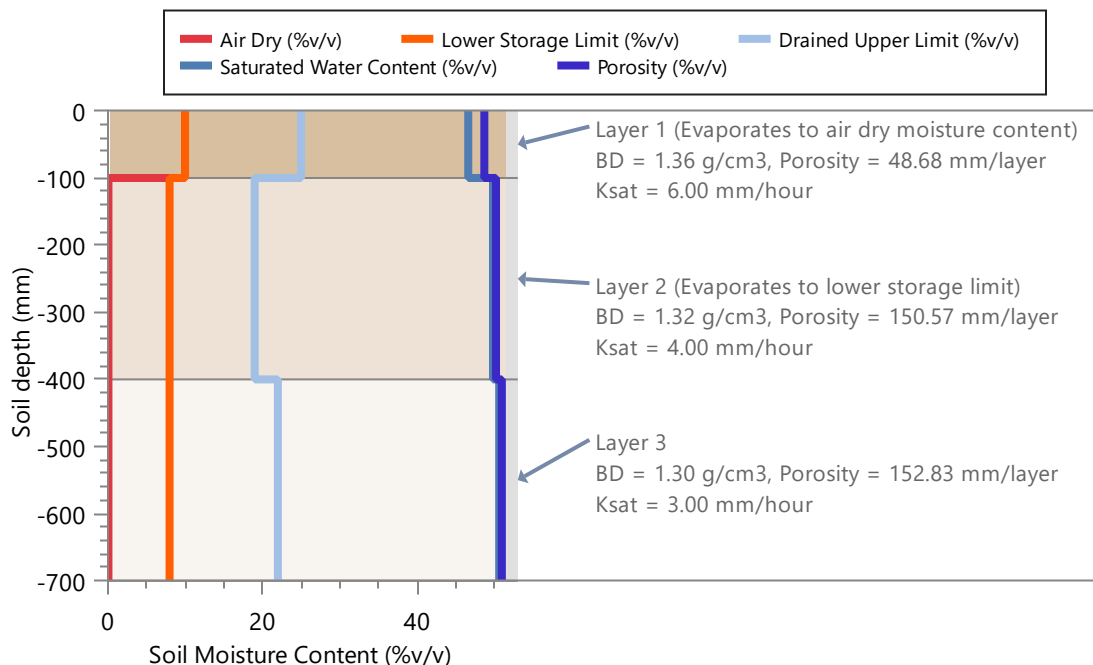
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

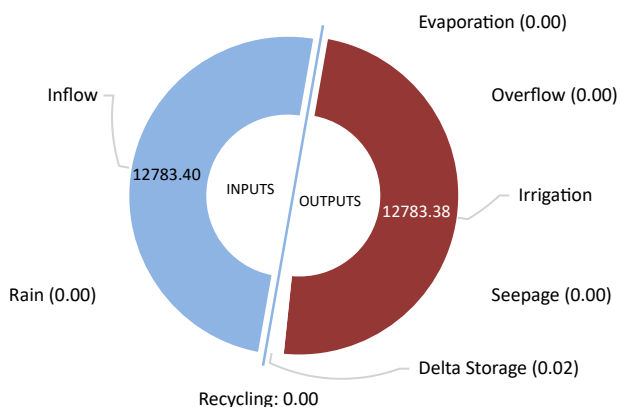
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.82 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

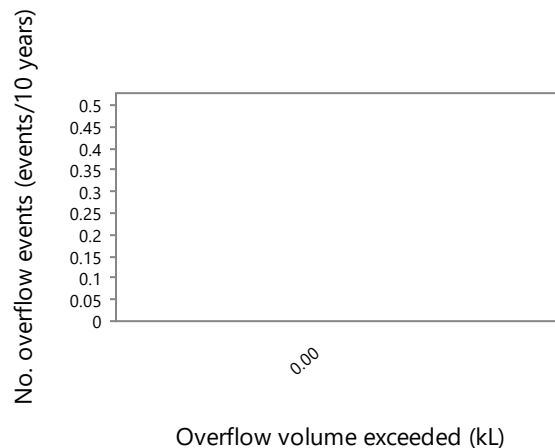
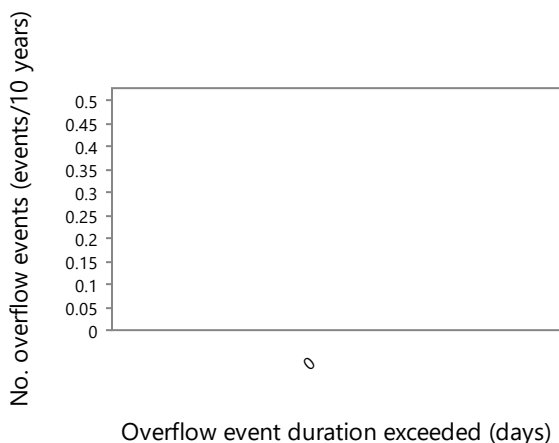
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	12783.40
Recycling	0.00
Evaporation	0.00
Overflow	0.00
Irrigation	12783.38
Seepage	0.00
Delta Storage	0.02

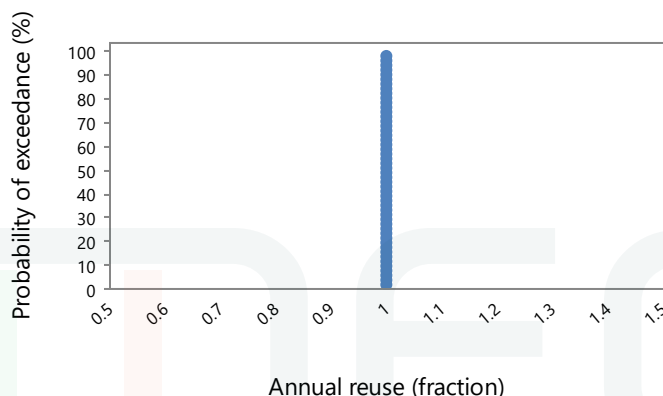
Overflow Diagnostics

Volume of overflow (kL/year)	0.00
No. days pond overflows (days/year)	0.00
Average duration of overflow (days)	0.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% reuse (fraction)	1.00



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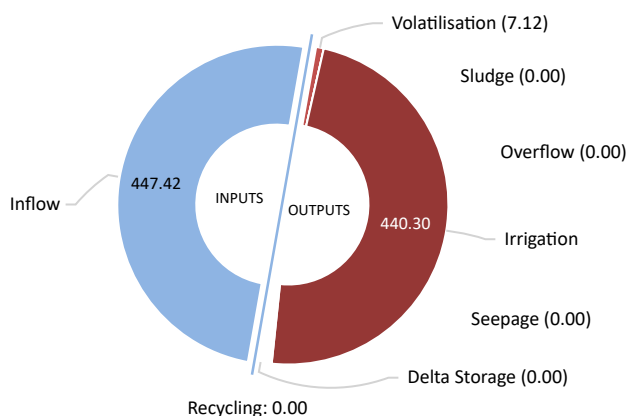


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

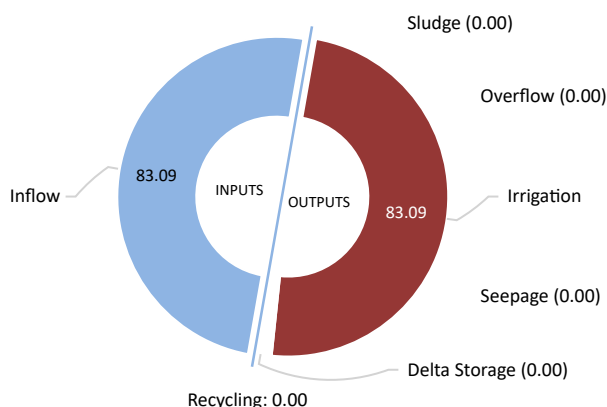
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



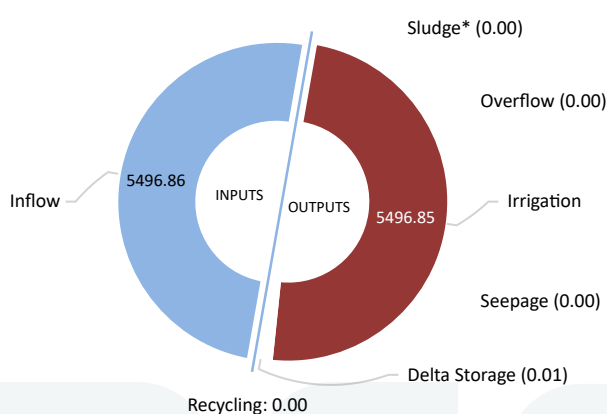
Name	Value
Inflow	447.42
Recycling	0.00
Volatilisation	7.12
Sludge	0.00
Overflow	0.00
Irrigation	440.30
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	83.09
Recycling	0.00
Sludge	0.00
Overflow	0.00
Irrigation	83.09
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	5496.86
Recycling	0.00
Sludge*	0.00
Overflow	0.00
Irrigation	5496.85
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	18.69
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.69
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	12783.38
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	12783.38
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.44
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.75
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days irrigation occurs (fraction)	1.00
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PERFORMANCE



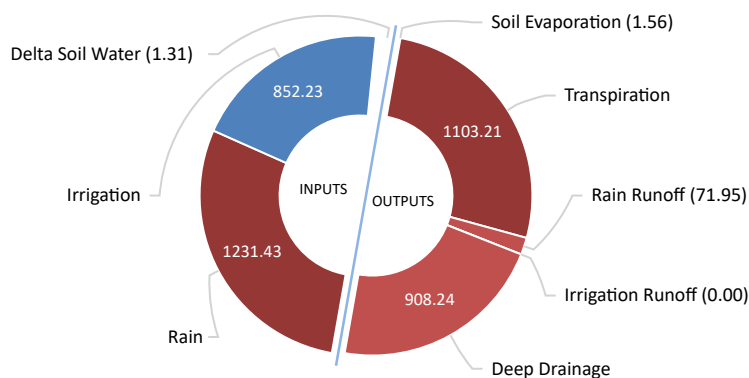
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

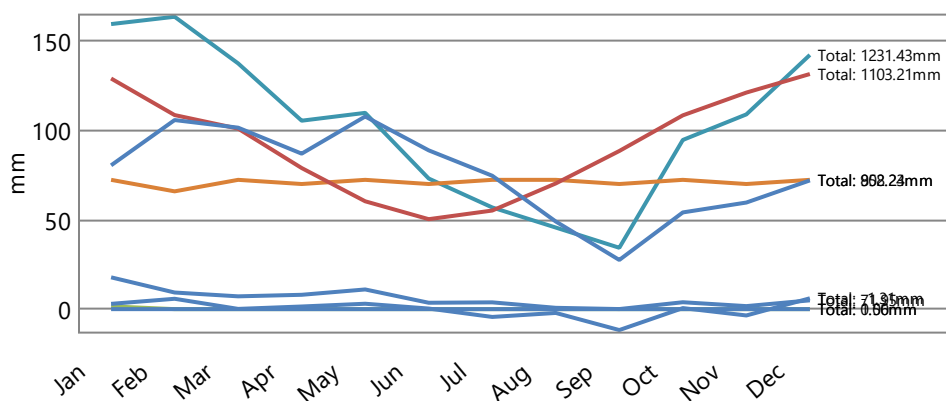
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	852.23
Soil Evaporation	1.56
Transpiration	1103.21
Rain Runoff	71.95
Irrigation Runoff	0.00
Deep Drainage	908.24
Delta Soil Water	-1.31

Average Monthly Totals (mm):

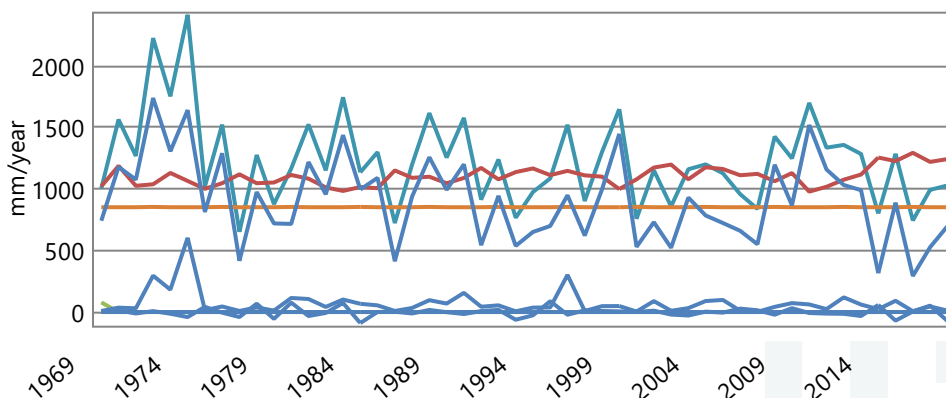
☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE

MEDLI

Land Performance - Soil Nutrient

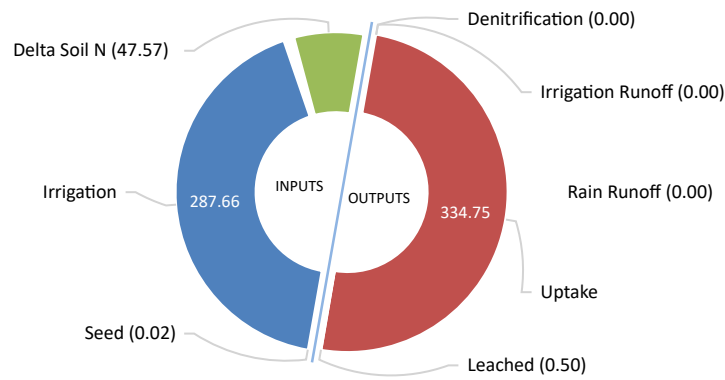
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 5.87

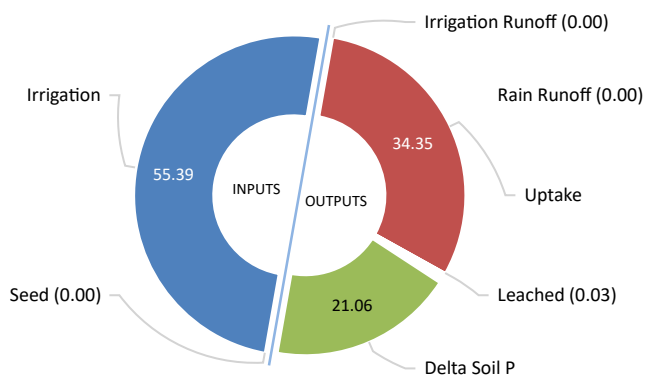
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	0.02
Irrigation	287.66
Denitrification	1.59E-03
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	334.75
Leached	0.50
Delta Soil N	-47.57

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	1.80E-03
Irrigation	55.39
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	34.35
Leached	0.03
Delta Soil P	21.06

PERFORMANCE

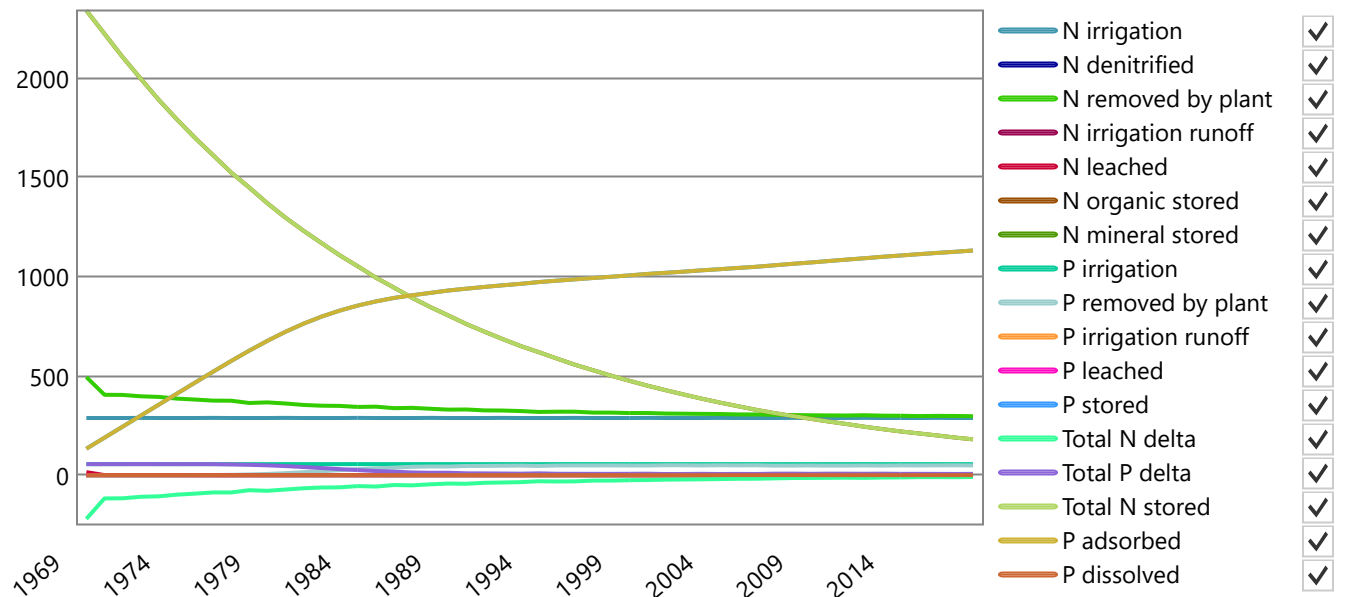


Land Performance - Soil Nutrient

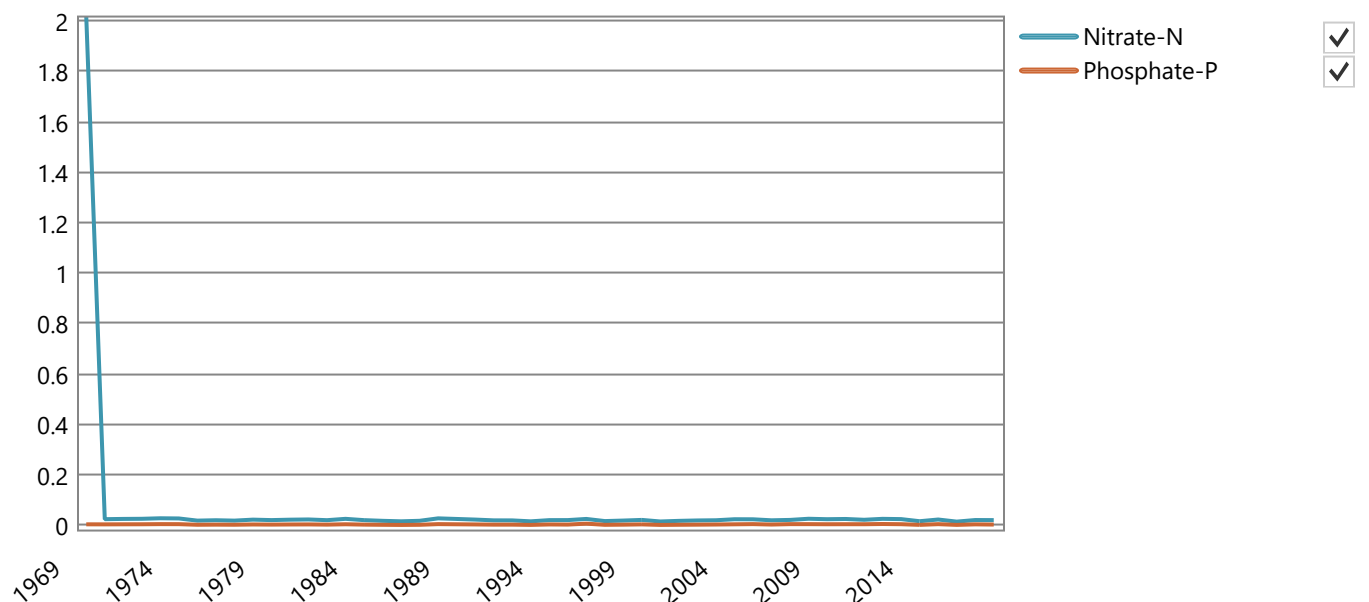
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

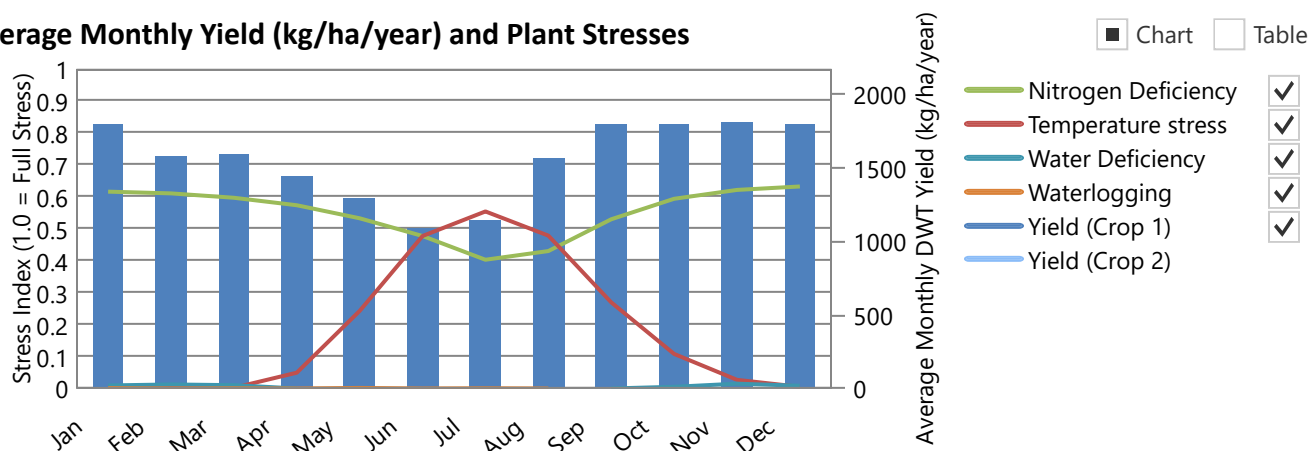
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	18748.94 (16776.29 - 23720.00)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.82 - 0.90)
Average monthly root depth (mm) (minimum - maximum)	699.64 (695.70 - 700.00)

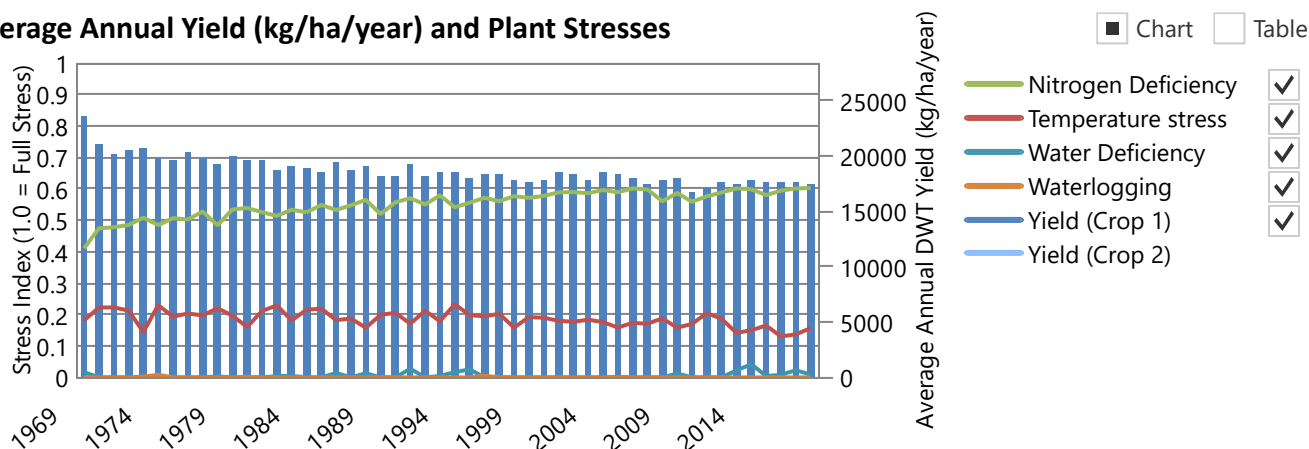
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	334.75 (296.52 - 493.67)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	34.35 (0.00 - 49.79)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 3.38 (normal)

No. days without crop/year (days/year): 0.00

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Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

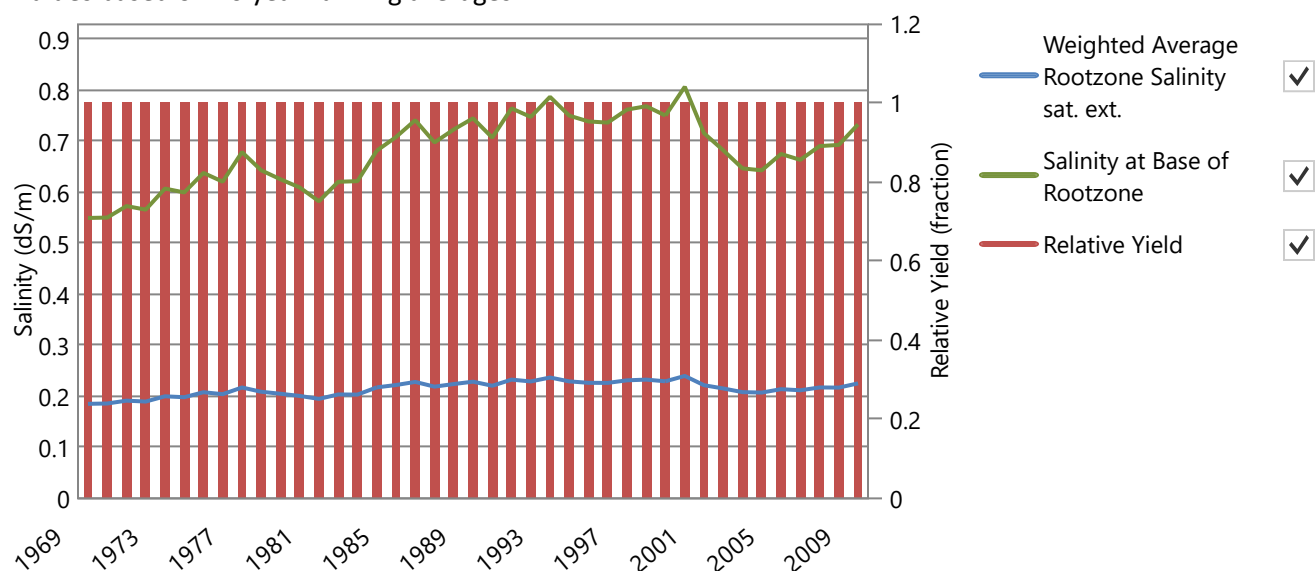
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.30
Salt added by rainfall (kg/ha/year)	222.62
Average annual effluent salt added & leached at steady state (kg/ha/year)	3887.19
Average leaching fraction based on 10 year running averages (fraction)	0.65
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



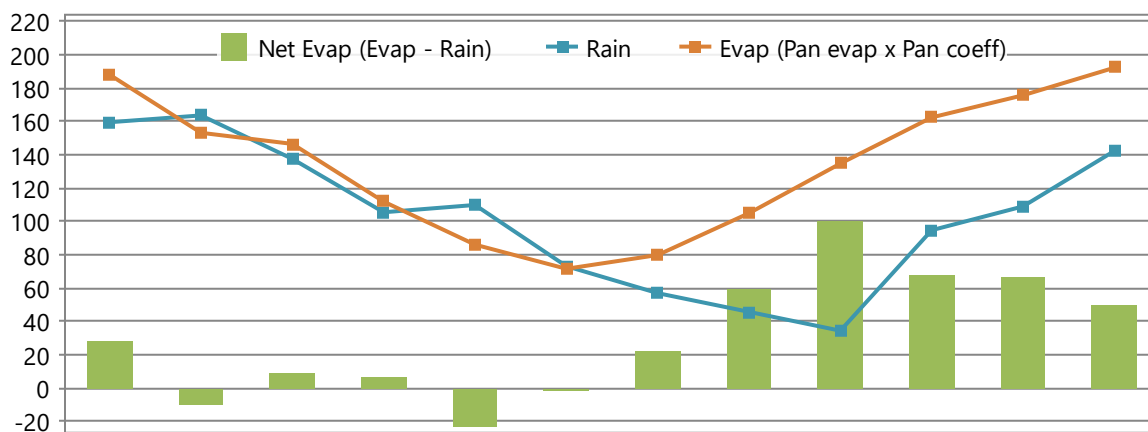
Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

Pond System: 1 closed storage tank

New Generic System - 12783.40 kL/year or 35.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	447.42 (447.13 - 448.35)
Total Phosphorus	6.50 (6.50 - 6.50)	83.09 (83.04 - 83.27)
Total Dissolved Salts	430.00 (430.00 - 430.00)	5496.86 (5493.25 - 5508.30)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

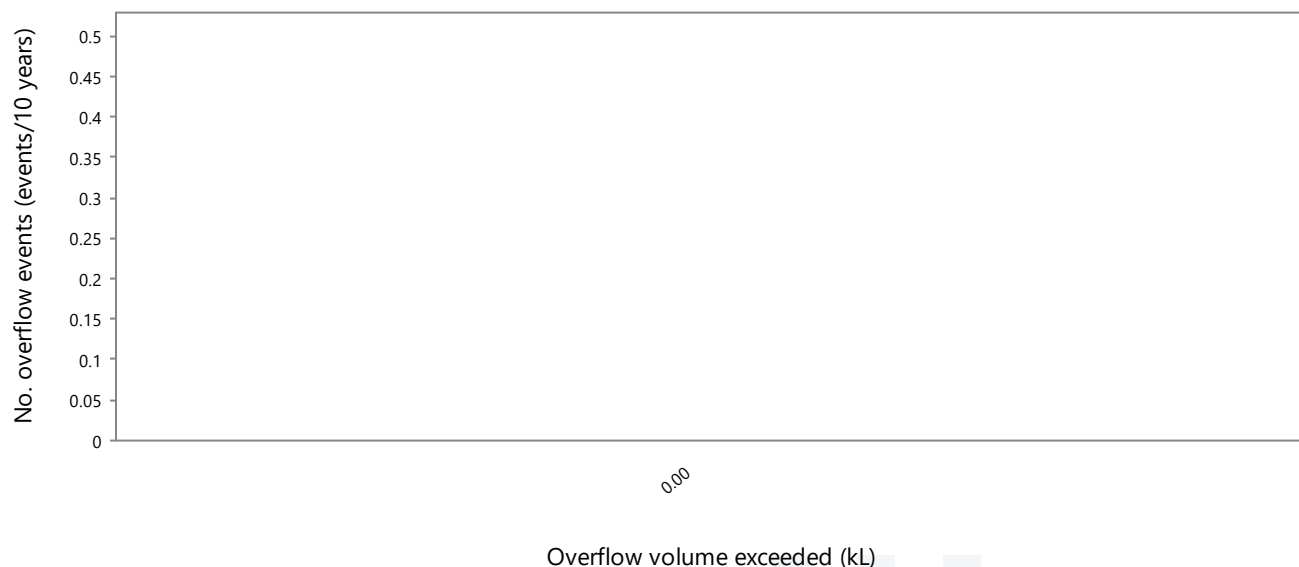
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	2.57
Average volume of overflow (kL/year)	0.00
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	0.00
Average duration of overflow (days)	0.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.63

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	12783.38	8522.25
Total nitrogen applied (kg)	431.49	287.66
Total phosphorus applied (kg)	83.09	55.39
Total salts applied (kg)	5496.85	3664.57

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation occurs (fraction)	1.00
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Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered every 1 days
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	72.3	65.9	72.3	70.0	72.3	70.0	72.3	72.3	70.0	72.3	70.0	72.3	852.2
Soil Evap	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Transpn.	129.0	108.6	101.0	78.9	60.3	50.3	55.2	70.3	88.5	108.4	121.1	131.5	1103.2
Rain Runoff	17.8	9.3	7.2	8.0	11.0	3.6	3.8	0.7	0.0	3.9	1.7	4.9	72.0
Irr. Runoff	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
Drainage	80.5	105.8	101.5	87.0	107.8	88.8	74.6	49.0	27.5	54.1	59.6	72.0	908.2
Delta	3.0	5.8	0.1	1.5	3.0	0.3	-4.4	-2.1	-11.7	0.6	-3.5	6.1	-1.3

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	287.66
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	334.75
Average annual soil nitrogen removed by denitrification (kg/ha/year)	1.59E-03
Average annual soil nitrogen leached (kg/ha/year)	0.50
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.50
Soil organic-N kg/ha (Initial - Final)	2448.00 - 180.22
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.06
Max. annual nitrate-N concentration of deep drainage (mg/L)	2.02

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	55.39
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	34.35
Average annual soil phosphorus leached (kg/ha/year)	0.03
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 2.59E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1130.65
Average phosphate-P concentration in rootzone (mg/L)	0.01
Average phosphate-P concentration of deep drainage (mg/L)	3.78E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.75 mg/L (years)	92.47

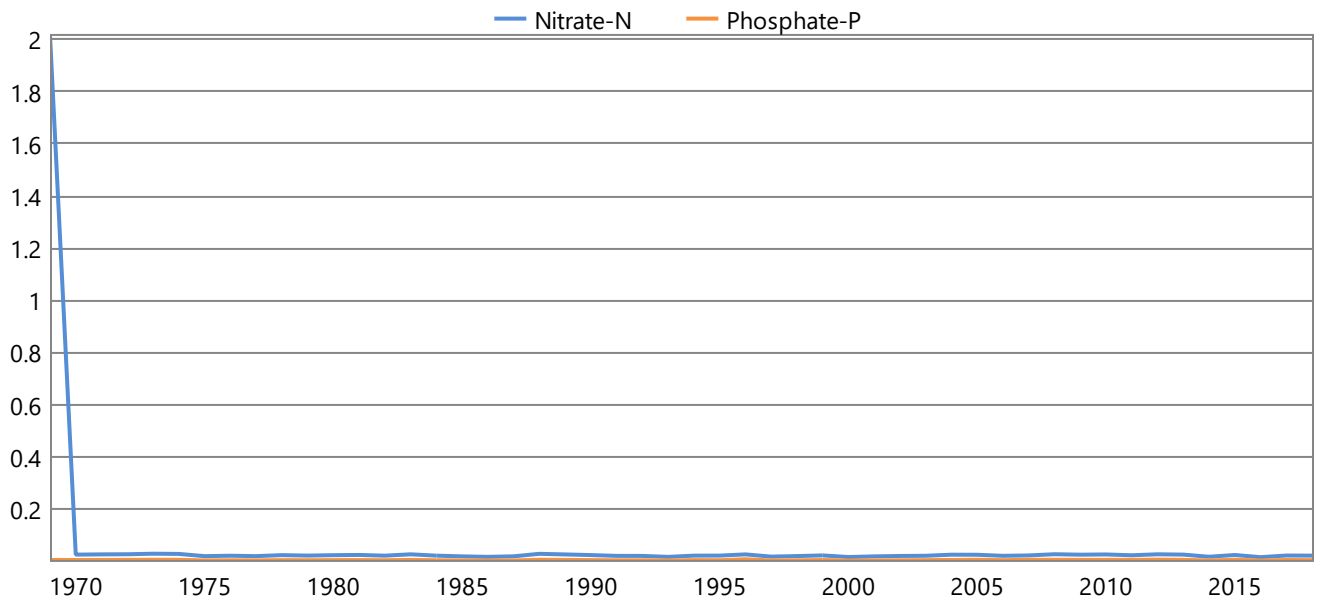
Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

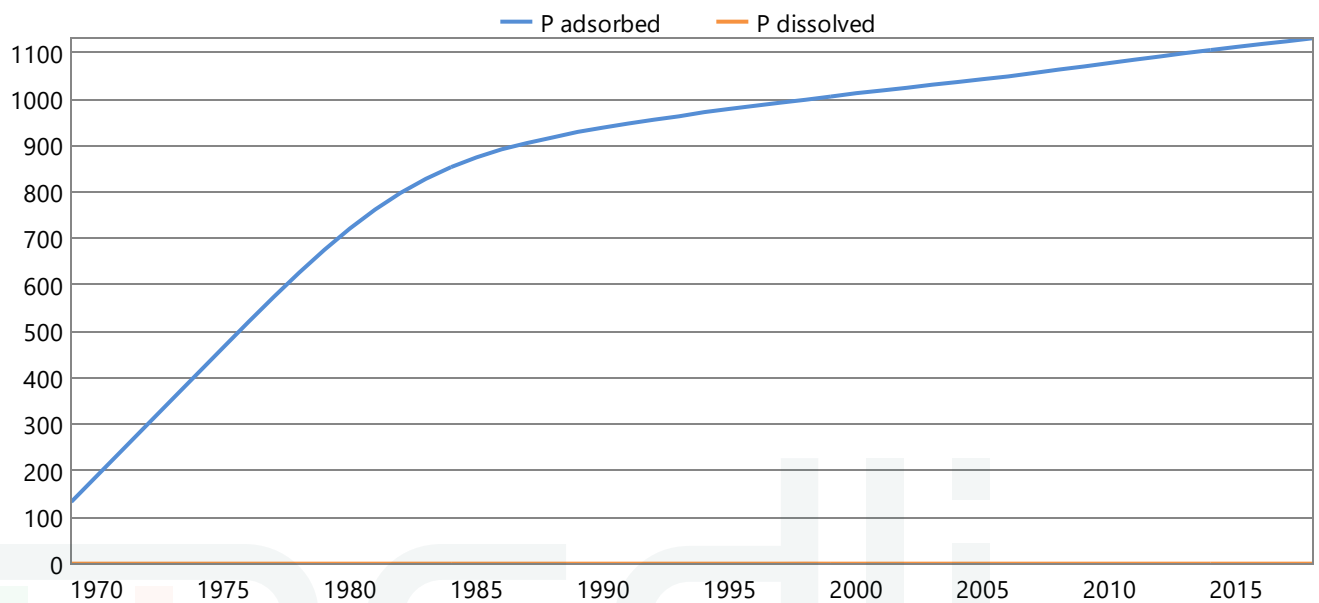
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_NoRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	18748.94 (16776.29 - 23720.00)
Average monthly plant (green) cover (fraction)	0.87 (0.82 - 0.90)
Average monthly crop factor (fraction)	0.69 (0.66 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.64 (695.70 - 700.00)
Average number of normal harvests per year (no./year)	3.38 (3.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	3.20
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.41 - 0.60)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.02)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.30
Salt added by rainfall (kg/ha/year)	222.62
Average annual effluent salt added & leached at steady state (kg/ha/year)	3887.19
Average leaching fraction based on 10 year running averages (fraction)	0.65
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS



Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

Title: Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

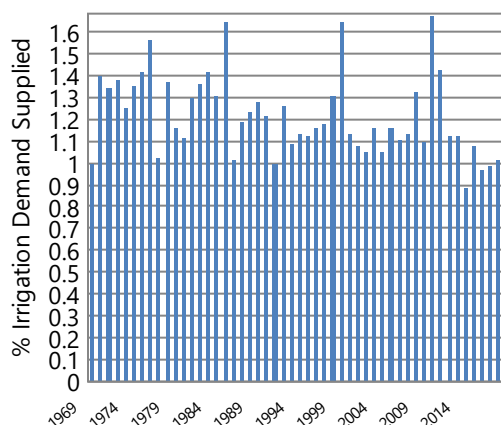
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	8466.6
Annual irrigation predicted for defined scenario (mm/year)	846.7
Average annual irrigation demand supplied (fraction)	1.2

Or for 1.50 ha: 10668 kL/year

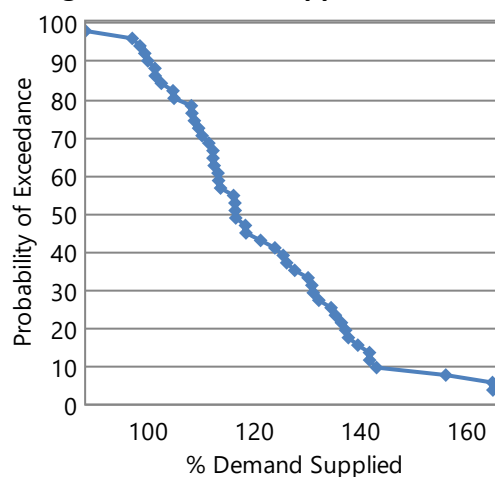
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



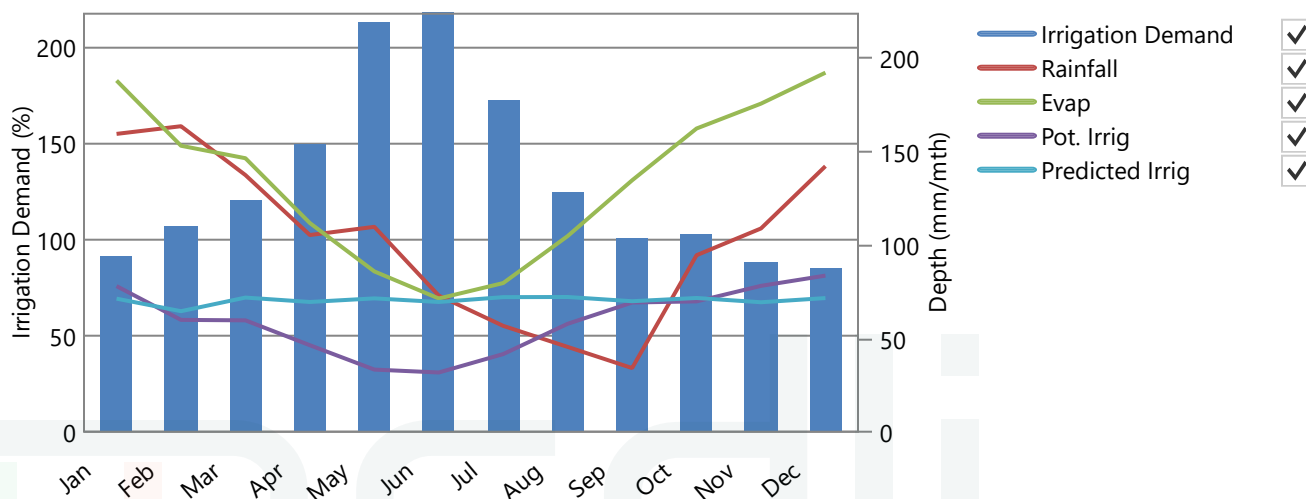
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

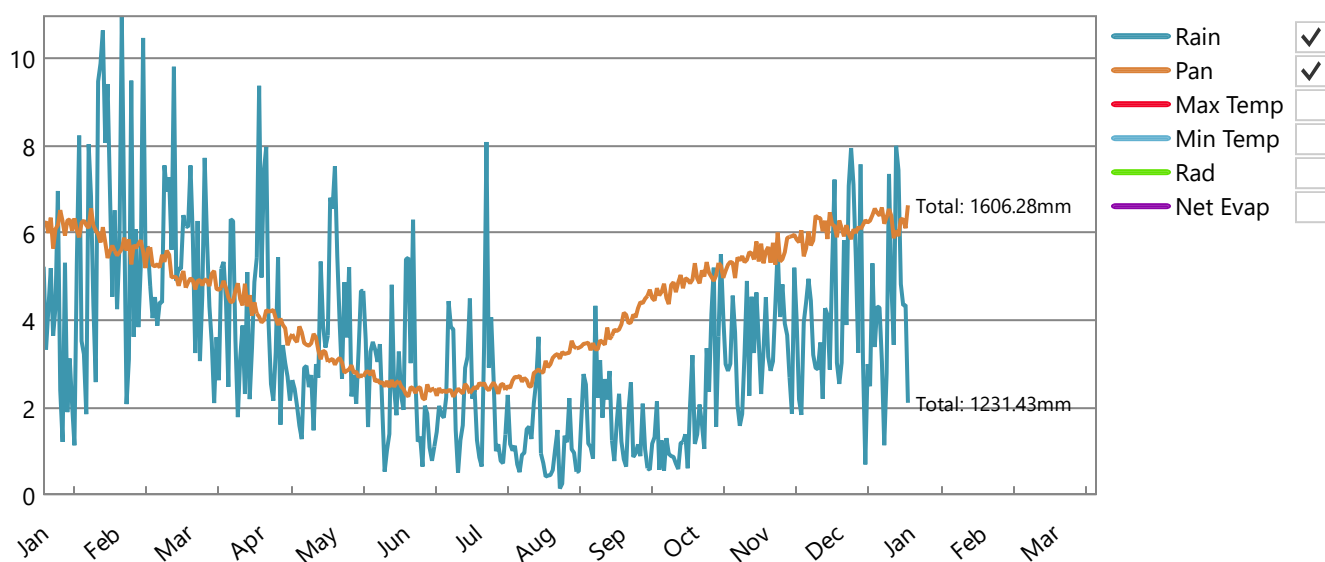
	5th ▾ Percentile	50th Percentile	95th ▾ Percentile
Rainfall (mm/year)	734	1199	1749
Pan Evaporation (mm/year)	1434	1607	1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



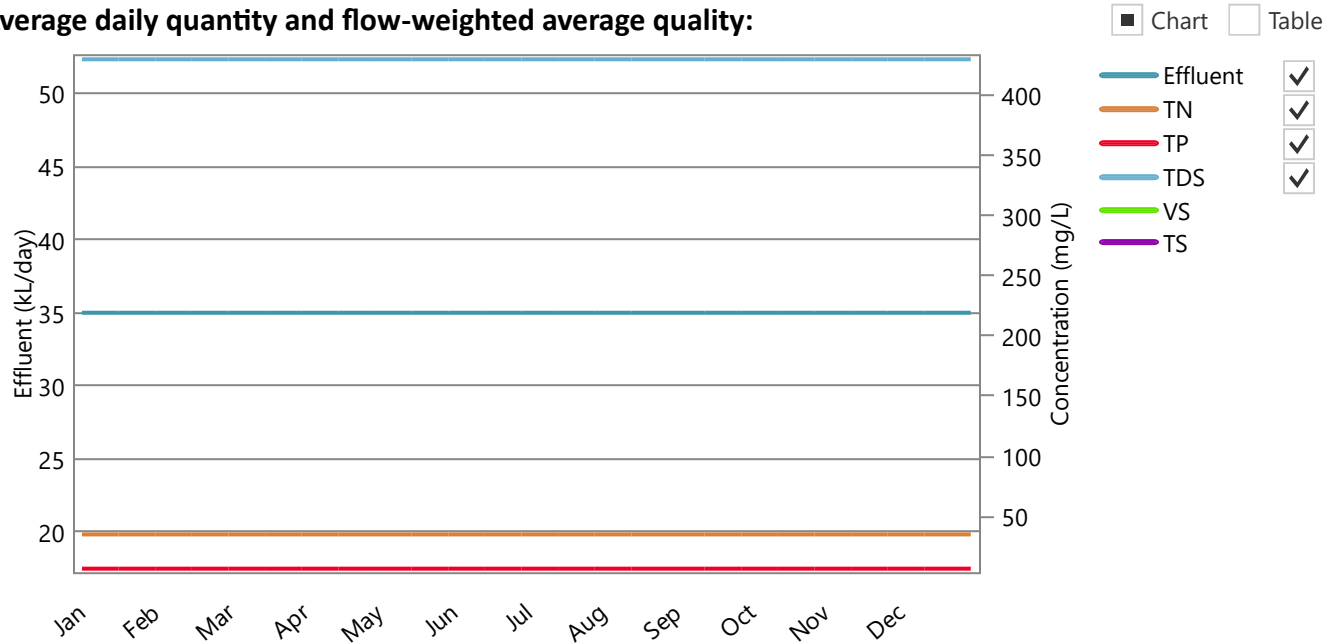
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **12783.40 kL/year** or 35.00 kL/day (Min-Max: 35.00 - 35.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	447.42 (447.13 - 448.35)
Total Phosphorus	6.50 (6.50 - 6.50)	83.09 (83.04 - 83.27)
Total Dissolved Salts	430.00 (430.00 - 430.00)	5496.86 (5493.25 - 5508.30)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

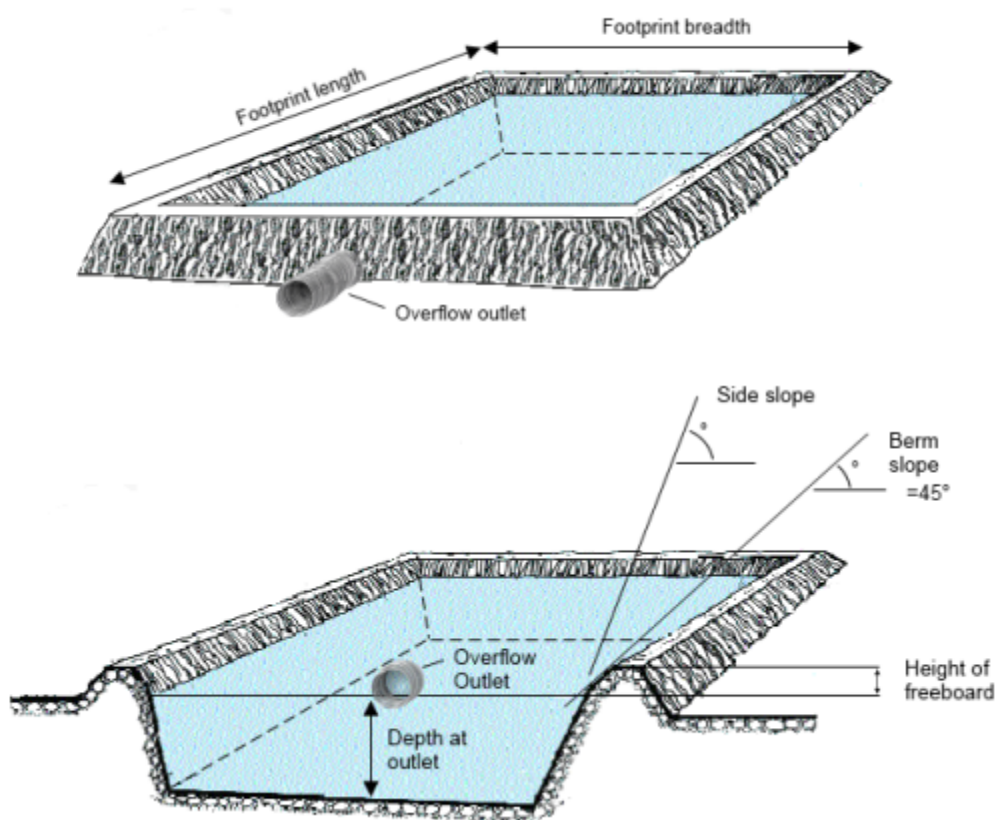
DESCRIPTION

medli

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	3.33



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

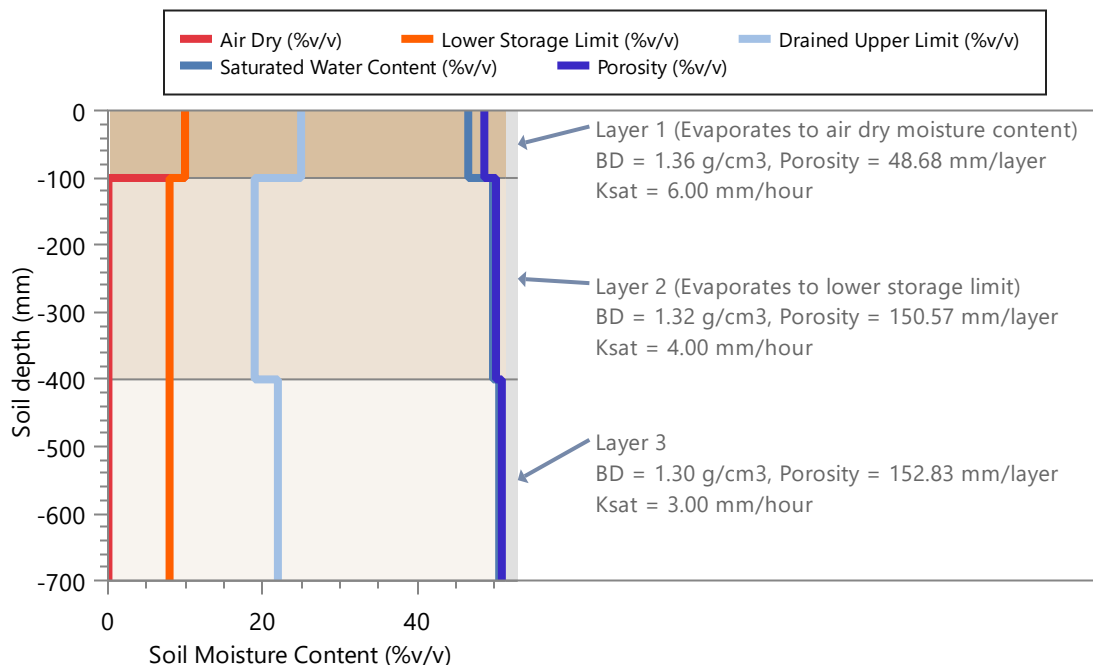
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

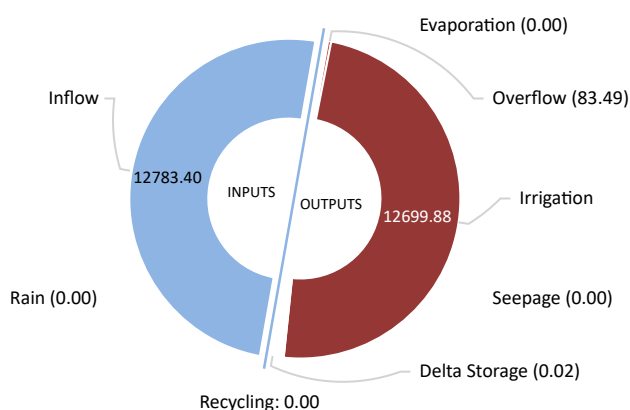
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.83 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

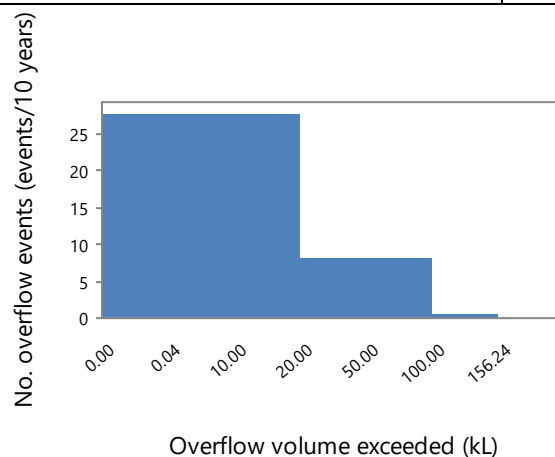
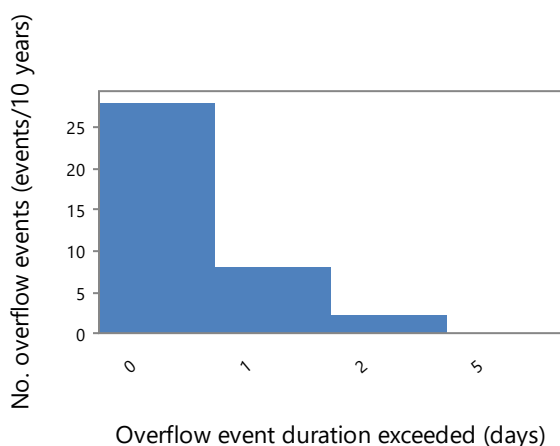
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	12783.40
Recycling	0.00
Evaporation	0.00
Overflow	83.49
Irrigation	12699.88
Seepage	0.00
Delta Storage	0.02

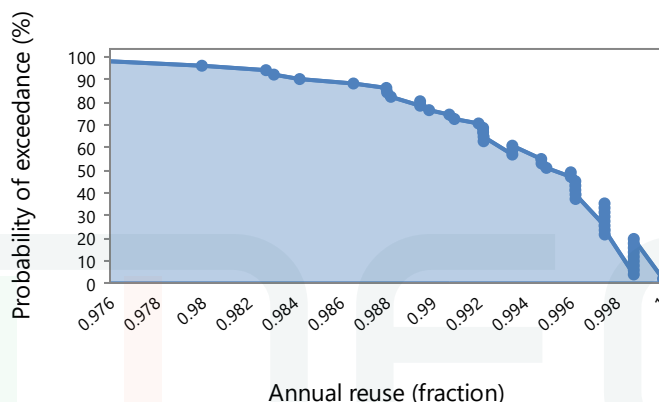
Overflow Diagnostics

Volume of overflow (kL/year)	83.49
No. days pond overflows (days/year)	3.86
Average duration of overflow (days)	1.39
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% reuse (fraction)	1.00



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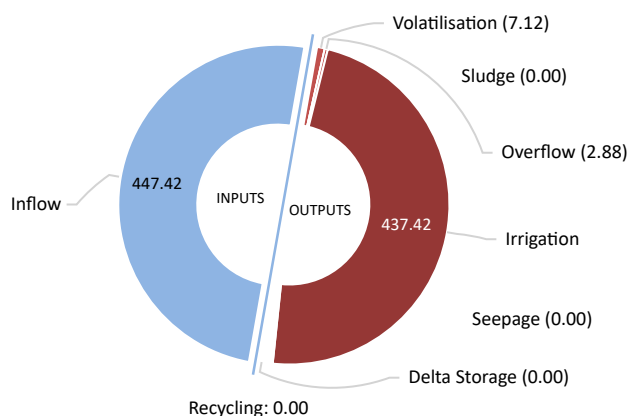


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

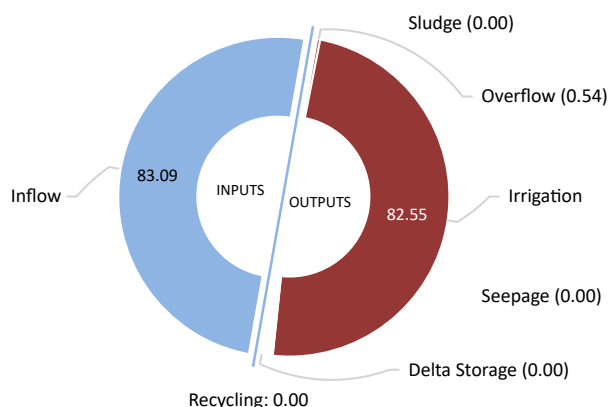
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



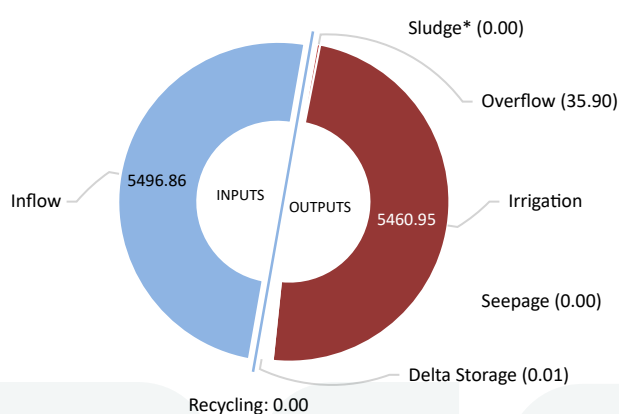
Name	Value
Inflow	447.42
Recycling	0.00
Volatilisation	7.12
Sludge	0.00
Overflow	2.88
Irrigation	437.42
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	83.09
Recycling	0.00
Sludge	0.00
Overflow	0.54
Irrigation	82.55
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	5496.86
Recycling	0.00
Sludge*	0.00
Overflow	35.90
Irrigation	5460.95
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	28.58
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.69
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	12699.88
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	12699.88
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.44
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.75
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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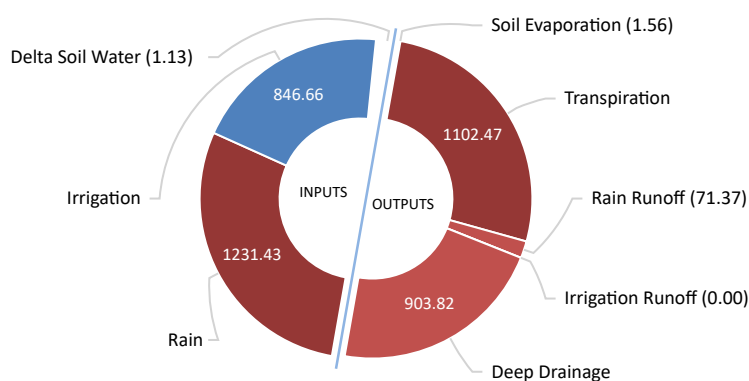
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

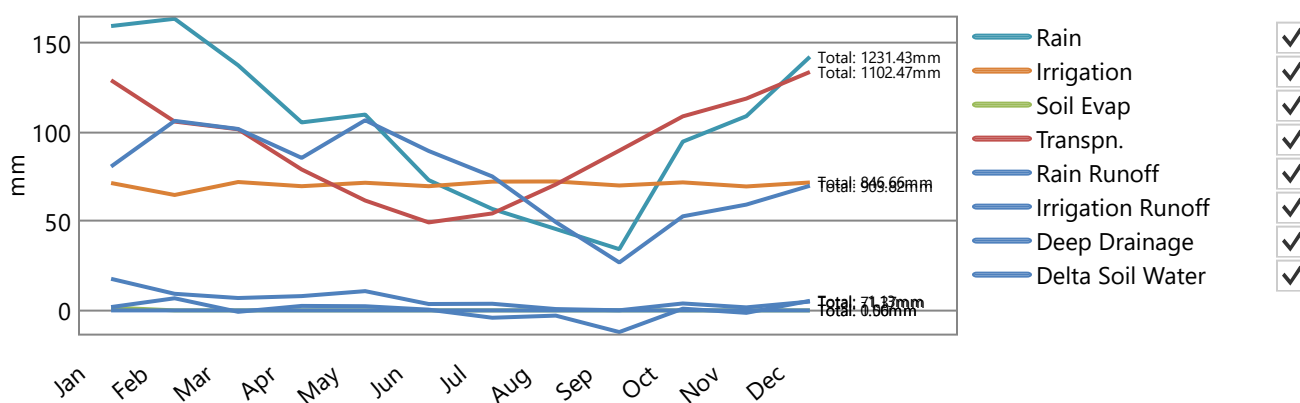
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	846.66
Soil Evaporation	1.56
Transpiration	1102.47
Rain Runoff	71.37
Irrigation Runoff	0.00
Deep Drainage	903.82
Delta Soil Water	-1.13

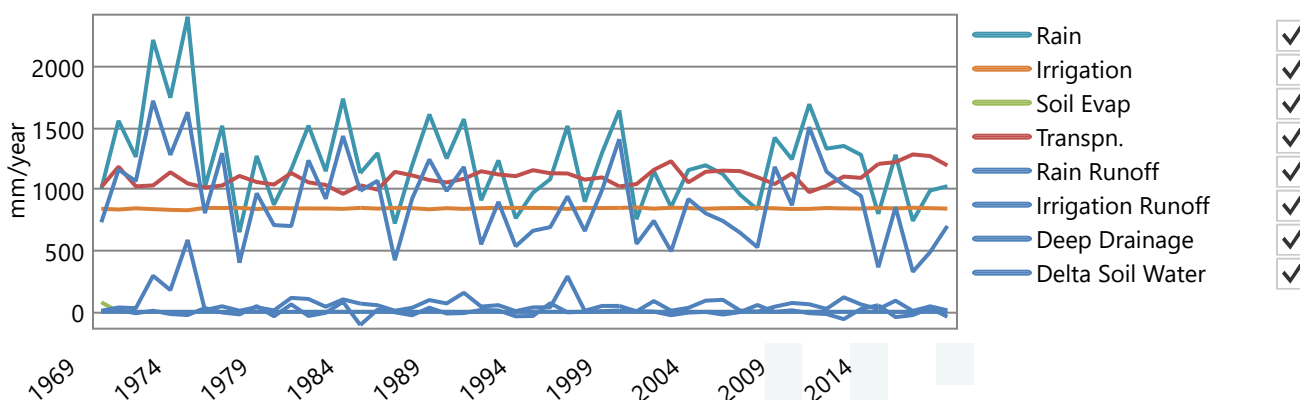
Average Monthly Totals (mm):

☒ Chart ☐ Table



Average Annual Totals (mm/year):

☒ Chart ☐ Table



PERFORMANCE

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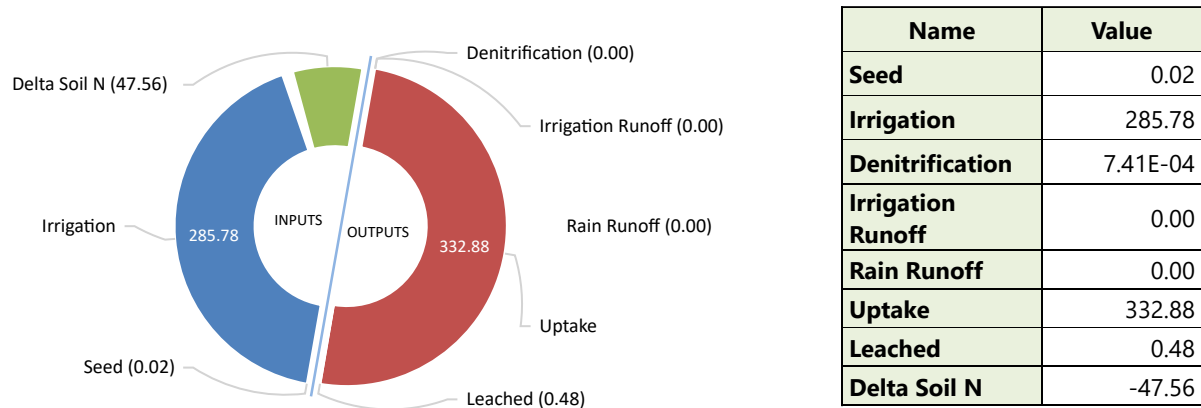
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

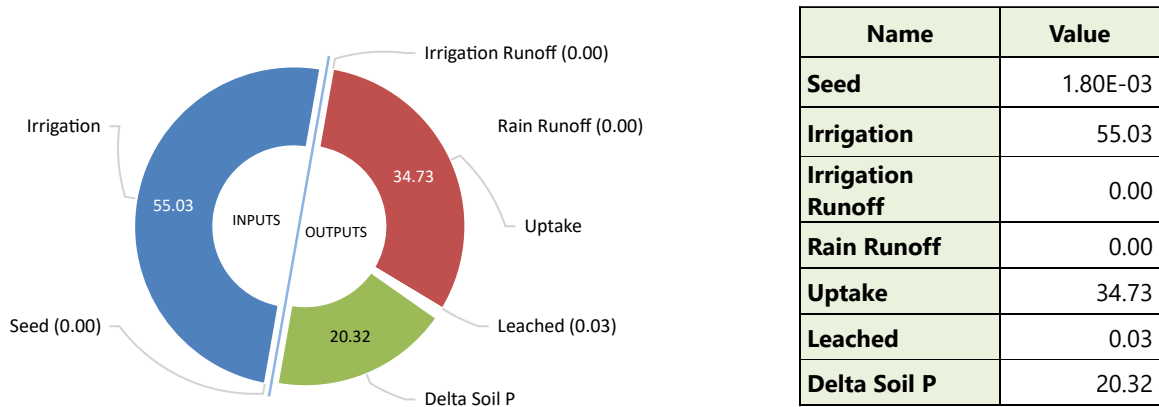
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 5.83
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)

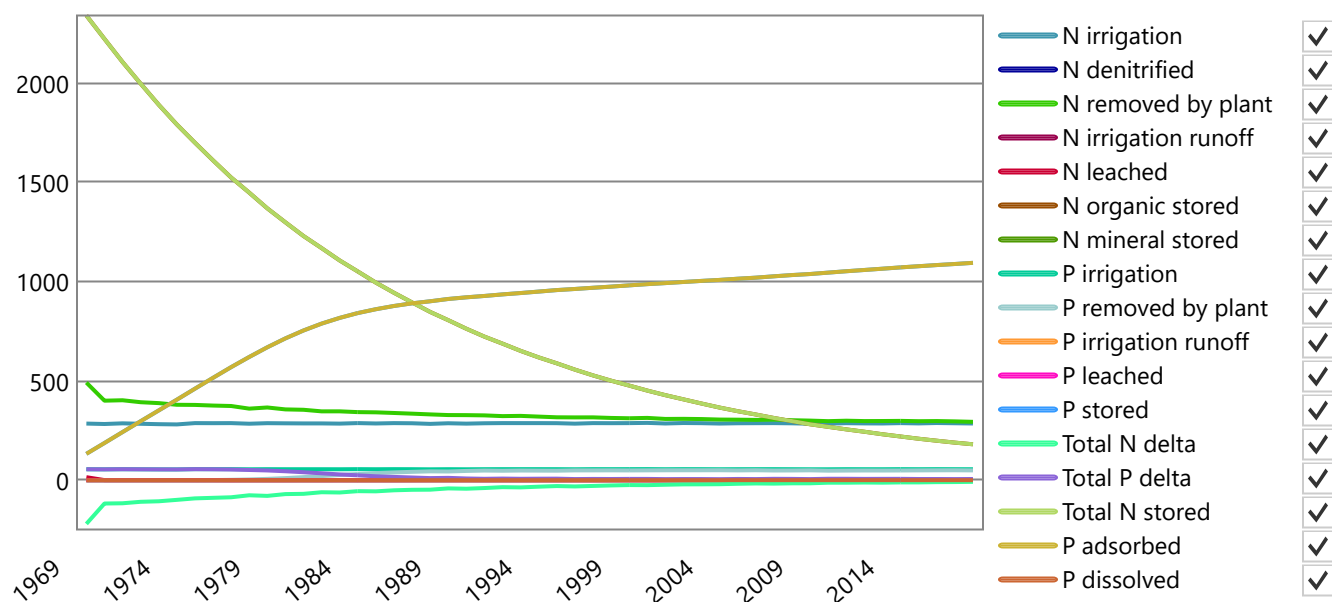


Land Performance - Soil Nutrient

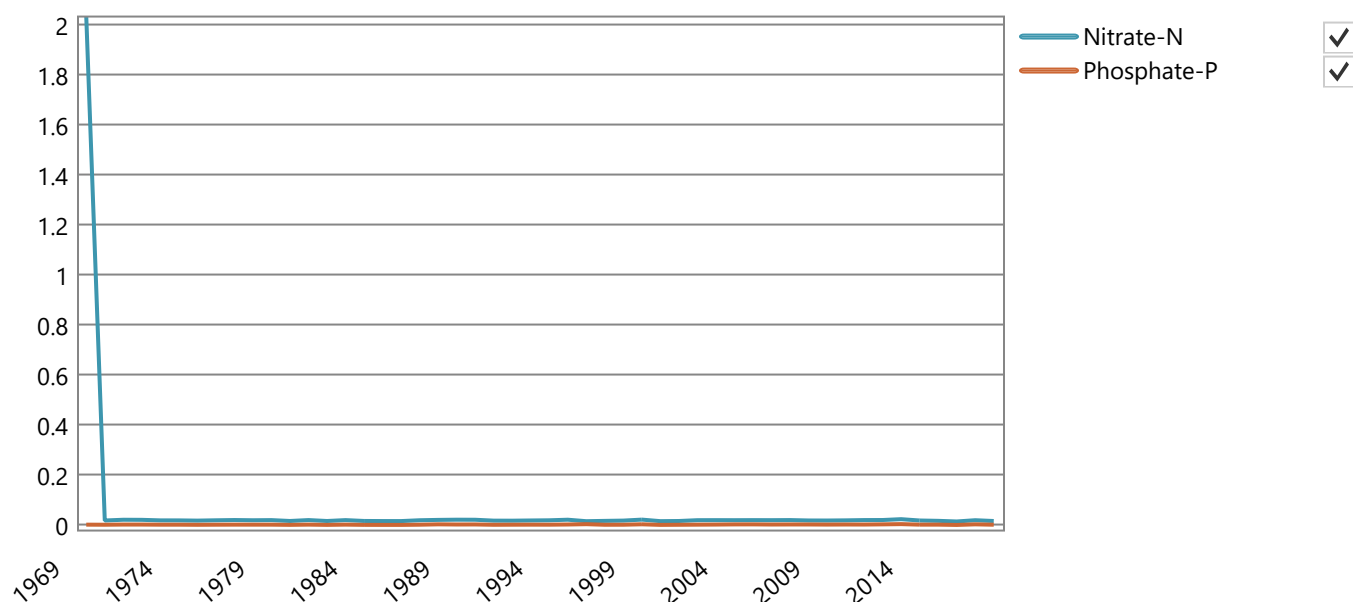
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

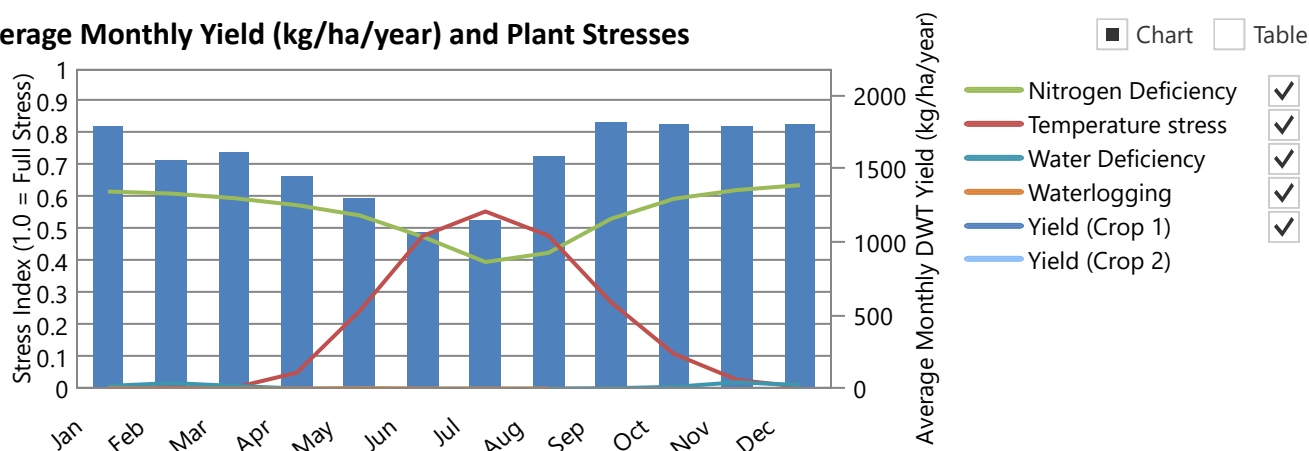
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	18721.45 (16738.97 - 23661.24)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.83 - 0.90)
Average monthly root depth (mm) (minimum - maximum)	699.64 (695.70 - 700.00)

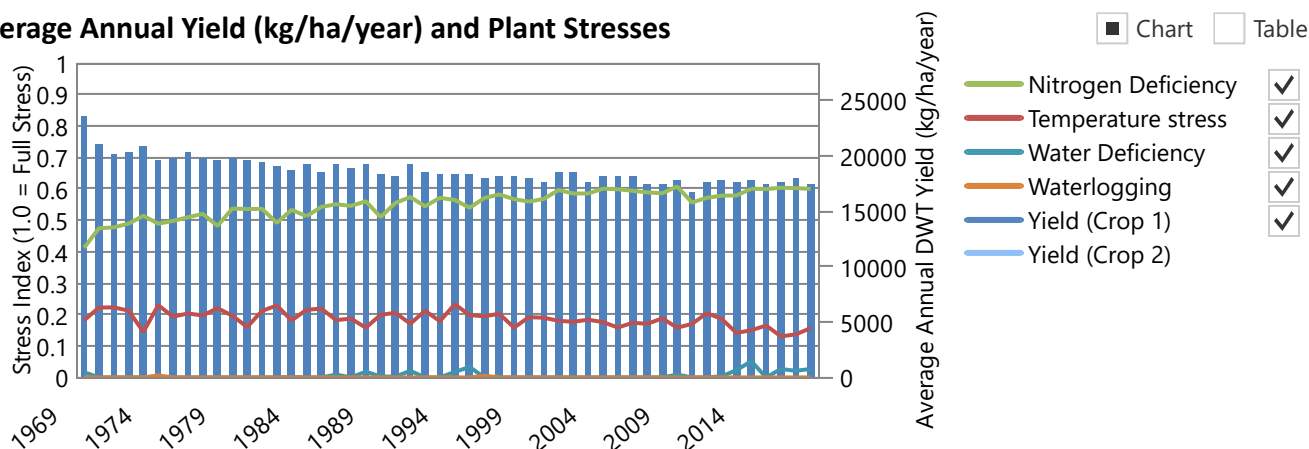
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	332.88 (293.49 - 490.98)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	34.73 (0.00 - 49.96)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses

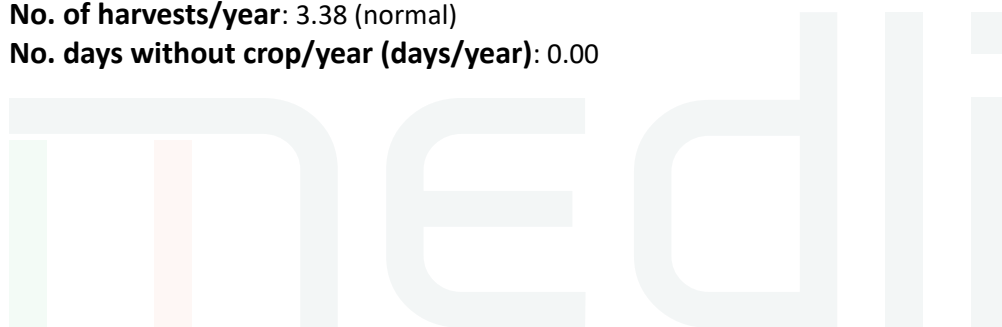


Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 3.38 (normal)

No. days without crop/year (days/year): 0.00



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

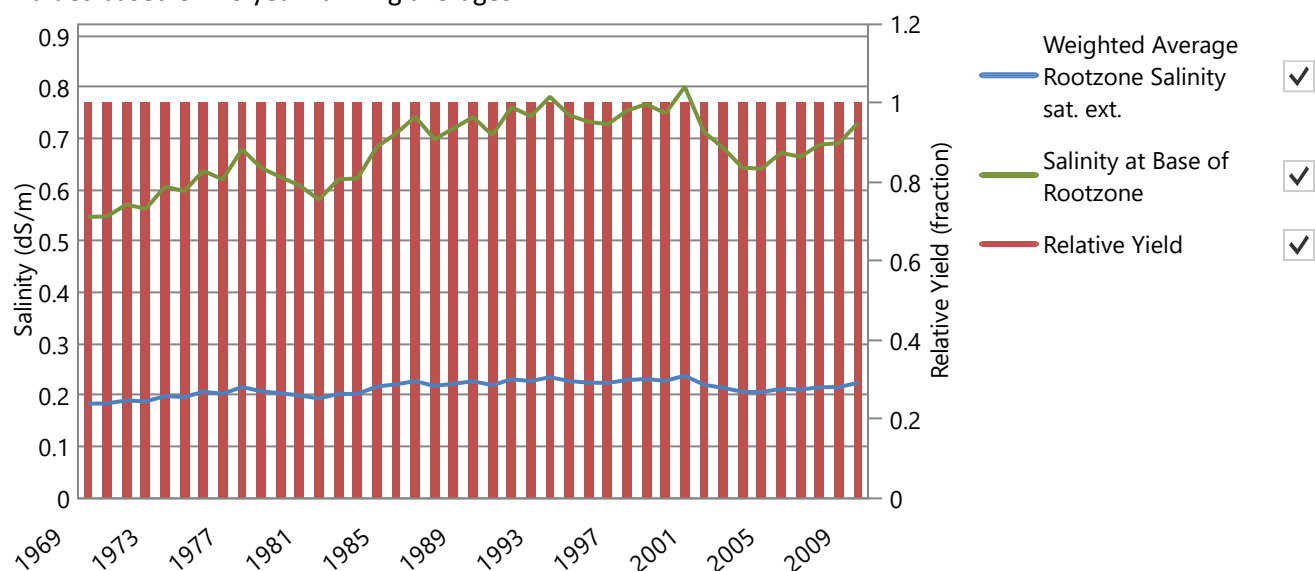
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.30
Salt added by rainfall (kg/ha/year)	222.73
Average annual effluent salt added & leached at steady state (kg/ha/year)	3863.37
Average leaching fraction based on 10 year running averages (fraction)	0.65
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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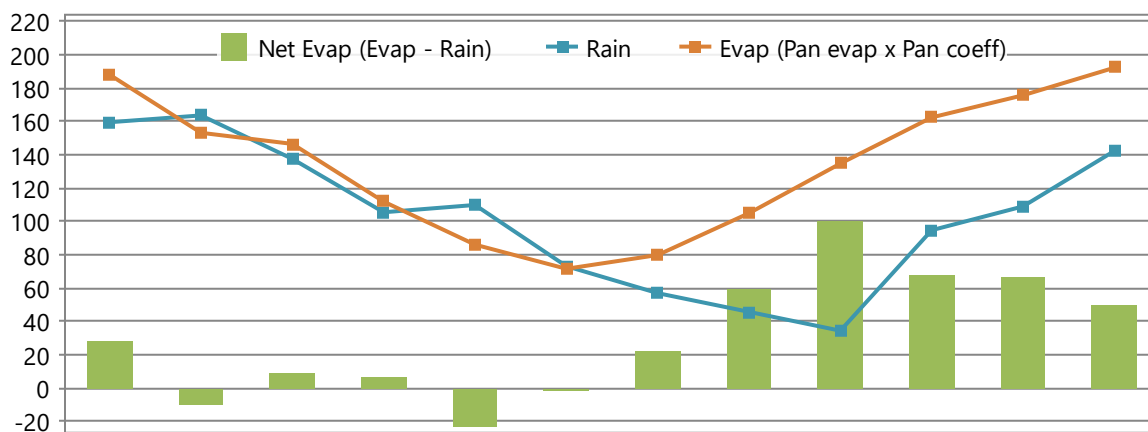
Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 12783.40 kL/year or 35.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	447.42 (447.13 - 448.35)
Total Phosphorus	6.50 (6.50 - 6.50)	83.09 (83.04 - 83.27)
Total Dissolved Salts	430.00 (430.00 - 430.00)	5496.86 (5493.25 - 5508.30)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

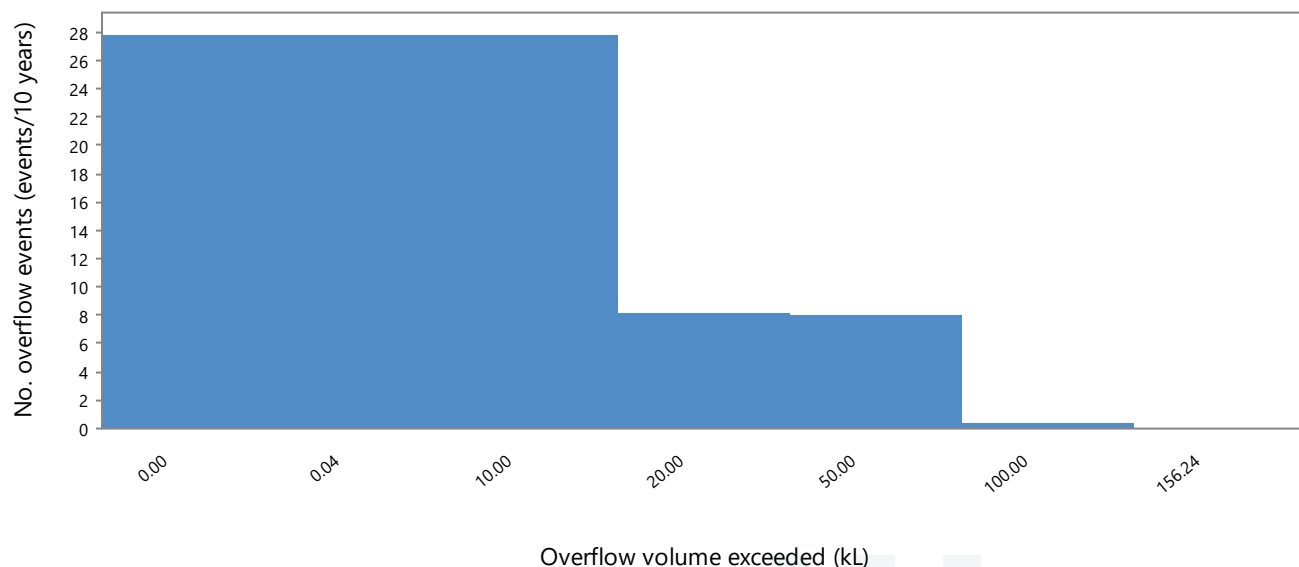
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	2.57
Average volume of overflow (kL/year)	83.49
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	2.78
Average duration of overflow (days)	1.39
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.99
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.63

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	12699.88	8466.59
Total nitrogen applied (kg)	428.67	285.78
Total phosphorus applied (kg)	82.55	55.03
Total salts applied (kg)	5460.95	3640.63

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	71.4	64.7	72.0	69.7	71.6	69.6	72.2	72.3	70.0	71.8	69.5	71.7	846.7
Soil Evap	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Transpn.	129.1	105.9	101.6	79.0	61.6	49.3	54.4	70.6	89.6	108.8	118.8	133.7	1102.5
Rain Runoff	17.7	9.3	6.9	8.0	10.8	3.6	3.7	0.7	0.1	3.9	1.7	4.9	71.4
Irr. Runoff	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
Drainage	80.7	106.3	101.7	85.5	106.6	89.4	75.1	49.5	26.9	52.8	59.3	69.9	903.8
Delta	1.9	6.8	-0.8	2.5	2.3	0.4	-4.1	-2.9	-12.2	1.0	-1.4	5.4	-1.1

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	285.78
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	332.88
Average annual soil nitrogen removed by denitrification (kg/ha/year)	7.41E-04
Average annual soil nitrogen leached (kg/ha/year)	0.48
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.48
Soil organic-N kg/ha (Initial - Final)	2448.00 - 180.49
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.05
Max. annual nitrate-N concentration of deep drainage (mg/L)	2.03

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	55.03
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	34.73
Average annual soil phosphorus leached (kg/ha/year)	0.03
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 2.52E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 1093.75
Average phosphate-P concentration in rootzone (mg/L)	0.01
Average phosphate-P concentration of deep drainage (mg/L)	3.43E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	0.01
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.74 mg/L (years)	92.86

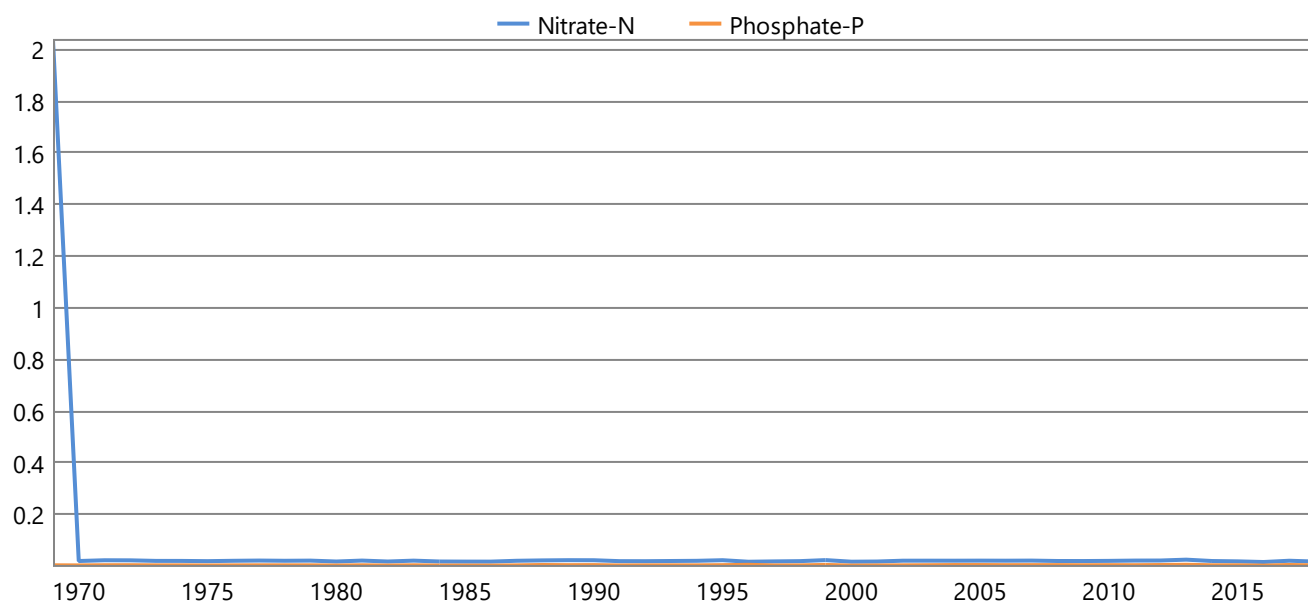
Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

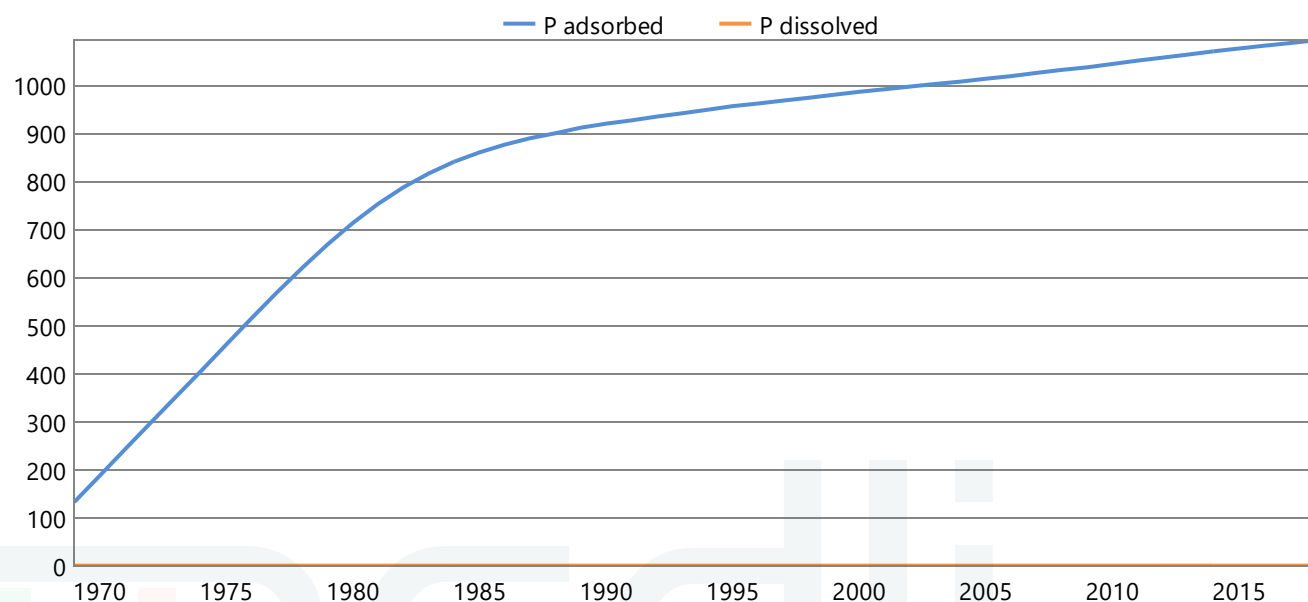
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F35_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	18721.45 (16738.97 - 23661.24)
Average monthly plant (green) cover (fraction)	0.87 (0.83 - 0.90)
Average monthly crop factor (fraction)	0.69 (0.67 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.64 (695.70 - 700.00)
Average number of normal harvests per year (no./year)	3.38 (3.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	3.20
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.41 - 0.61)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.02)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.30
Salt added by rainfall (kg/ha/year)	222.73
Average annual effluent salt added & leached at steady state (kg/ha/year)	3863.37
Average leaching fraction based on 10 year running averages (fraction)	0.65
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.68
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

Title:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Climate data location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days

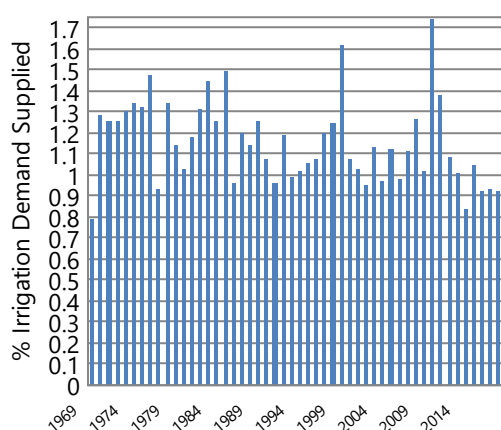
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	6076.7
Annual irrigation predicted for defined scenario (mm/year)	607.7
Average annual irrigation demand supplied (fraction)	1.1

Or for 1.50 ha: **8122 kL/year**

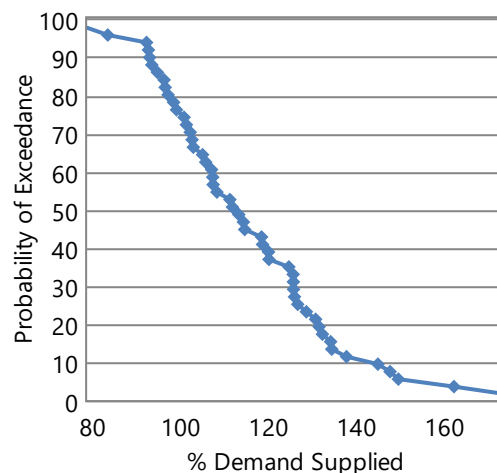
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



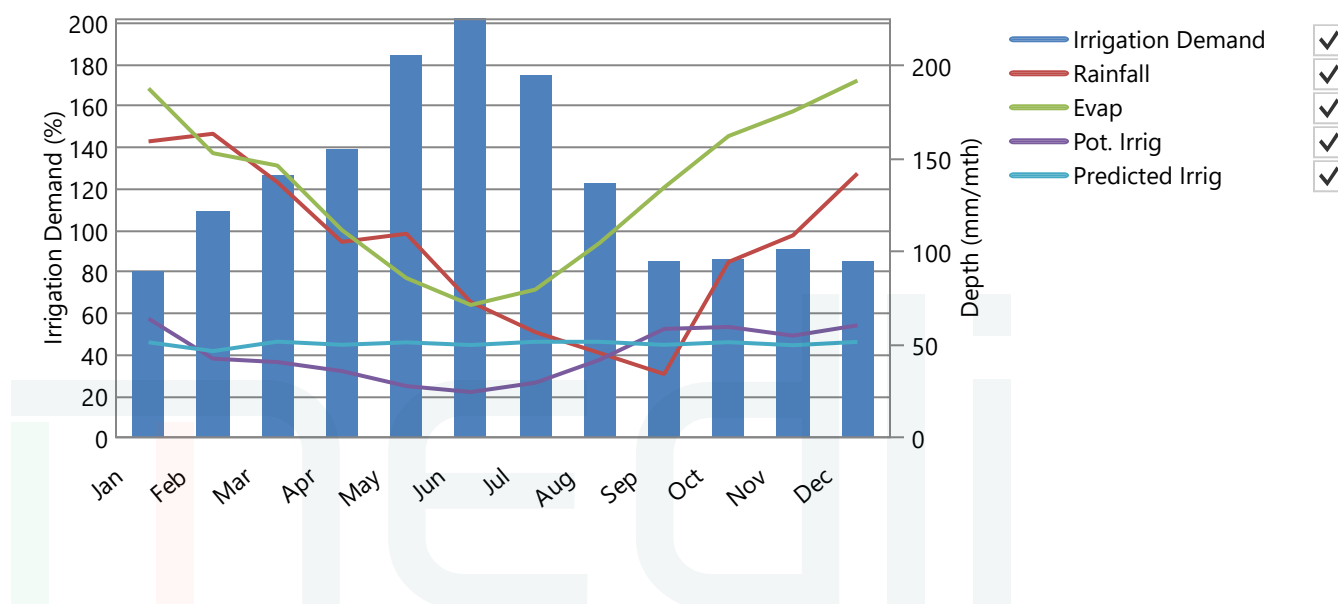
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

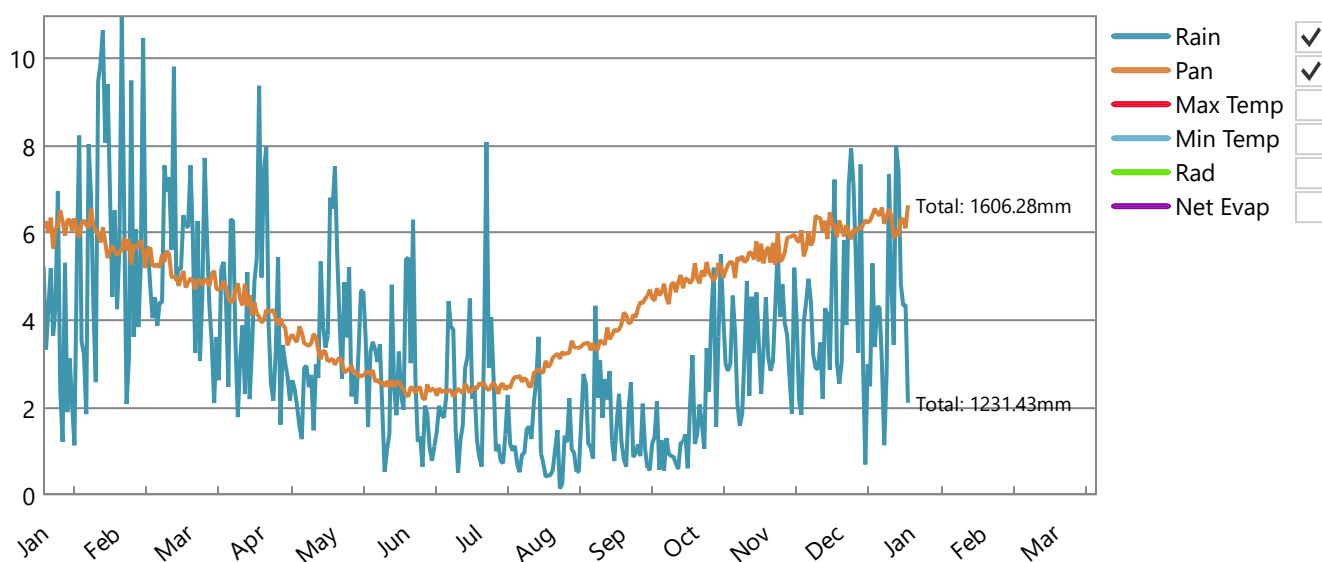
	5th ▾ Percentile	50th Percentile	95th ▾ Percentile
Rainfall (mm/year)	734	1199	1749
Pan Evaporation (mm/year)	1434	1607	1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



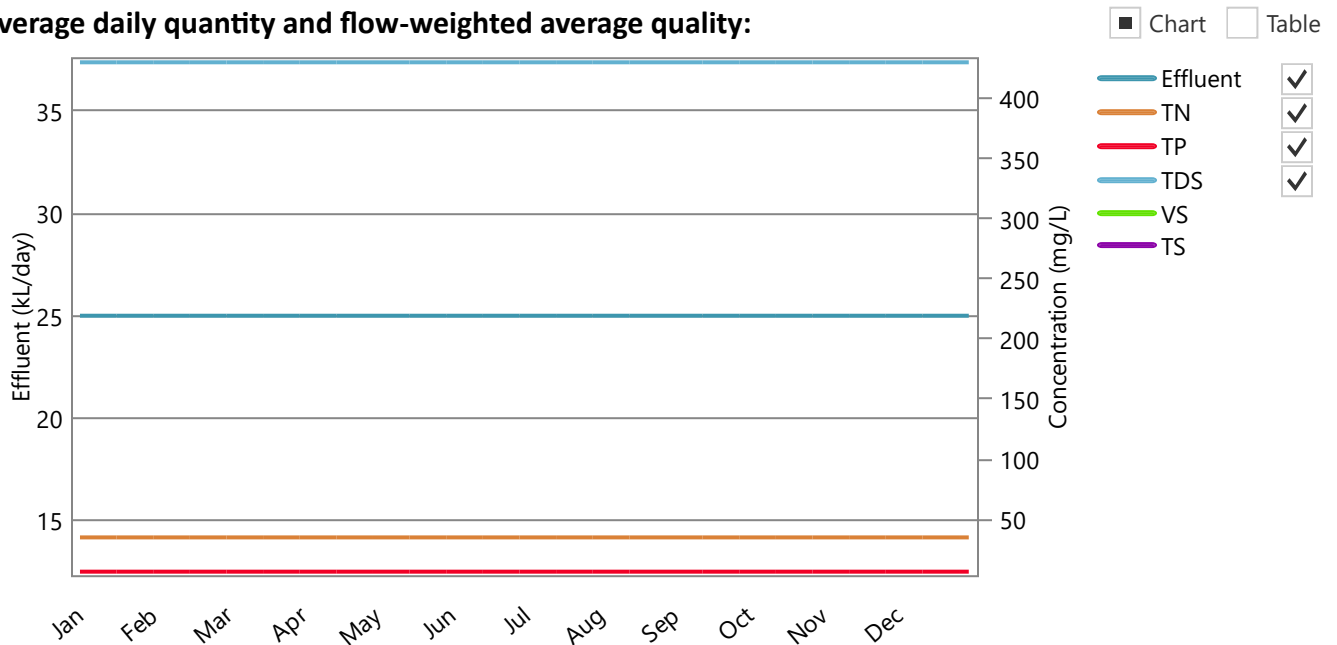
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **9131.00 kL/year** or 25.00 kL/day (Min-Max: 25.00 - 25.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

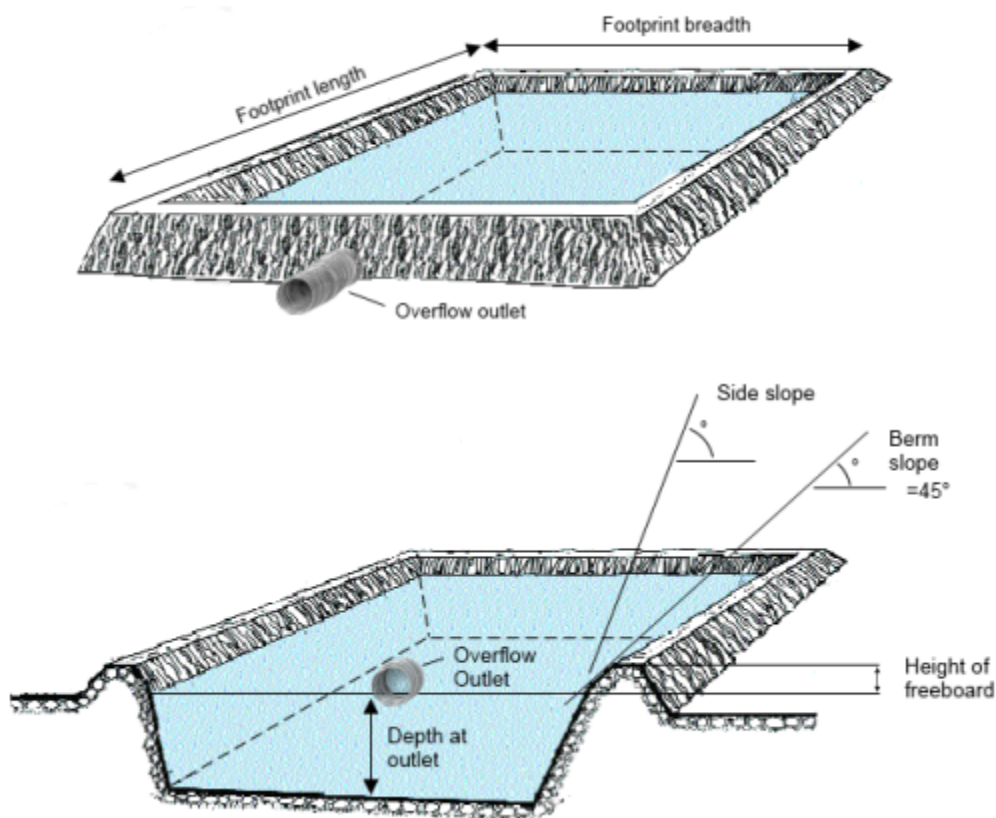
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	2.73



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

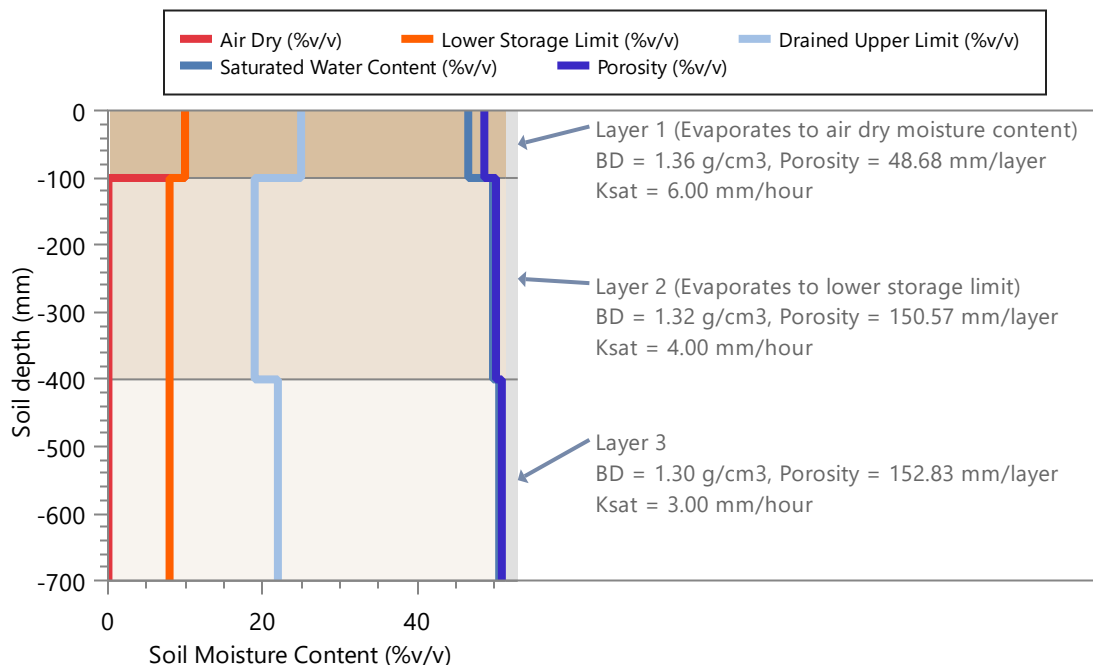
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

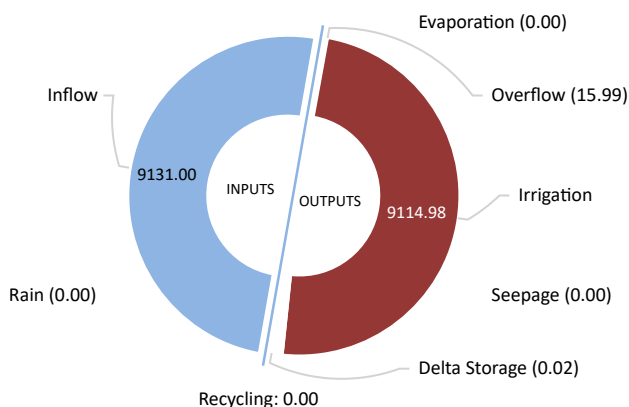
Average monthly cover (fraction) (minimum - maximum)	0.65 (0.62 - 0.67)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

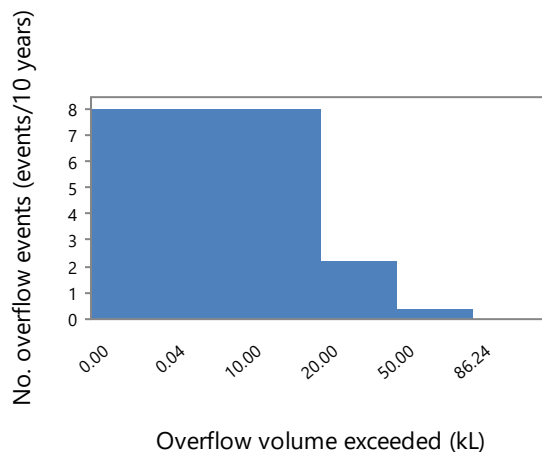
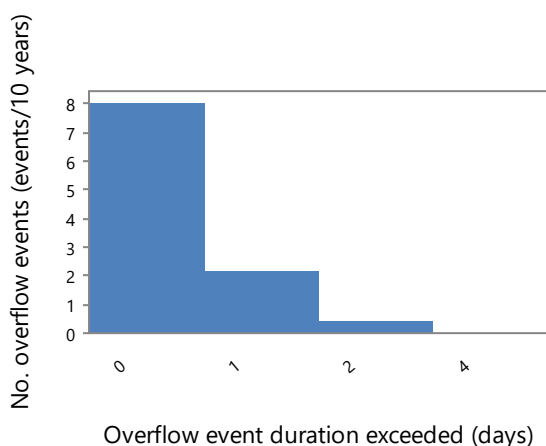
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	9131.00
Recycling	0.00
Evaporation	0.00
Overflow	15.99
Irrigation	9114.98
Seepage	0.00
Delta Storage	0.02

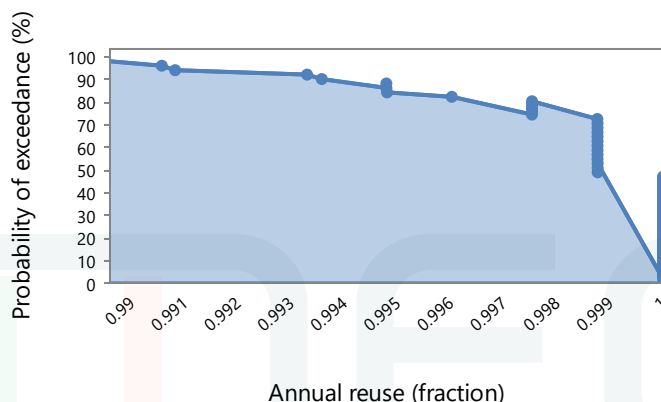
Overflow Diagnostics

Volume of overflow (kL/year)	15.99
No. days pond overflows (days/year)	1.08
Average duration of overflow (days)	1.35
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% reuse (fraction)	1.00



[Export plot](#)

[Export plot](#)

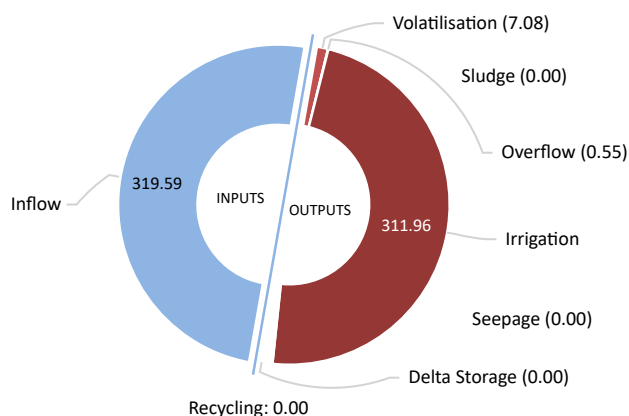


[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

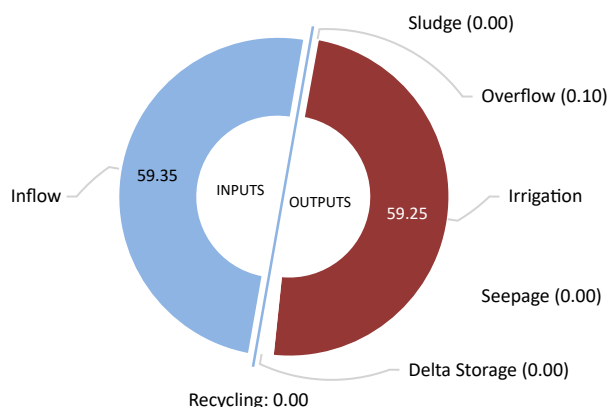
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



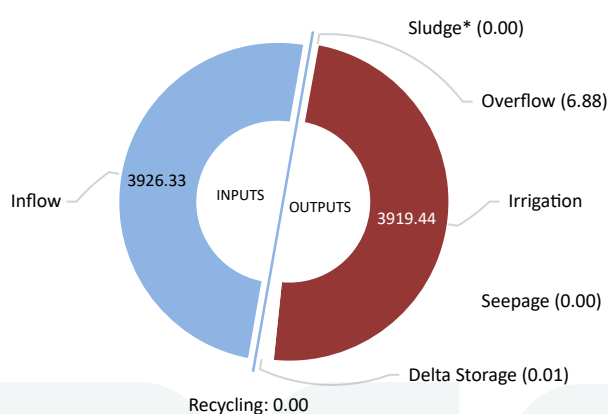
Name	Value
Inflow	319.59
Recycling	0.00
Volatilisation	7.08
Sludge	0.00
Overflow	0.55
Irrigation	311.96
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	59.35
Recycling	0.00
Sludge	0.00
Overflow	0.10
Irrigation	59.25
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	3926.33
Recycling	0.00
Sludge*	0.00
Overflow	6.88
Irrigation	3919.44
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	27.12
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.57
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	9114.98
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	9114.98
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.23
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.54
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

PERFORMANCE



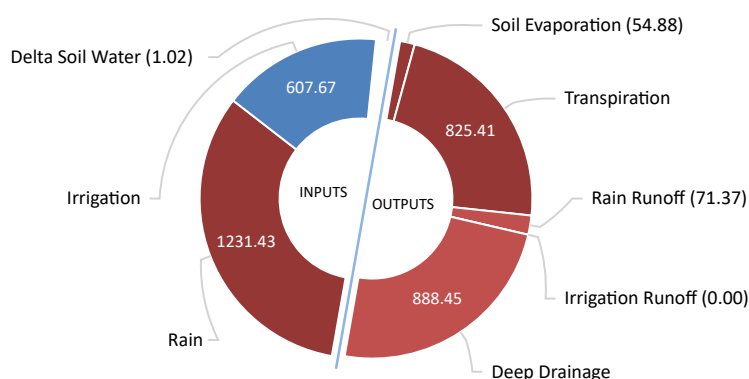
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

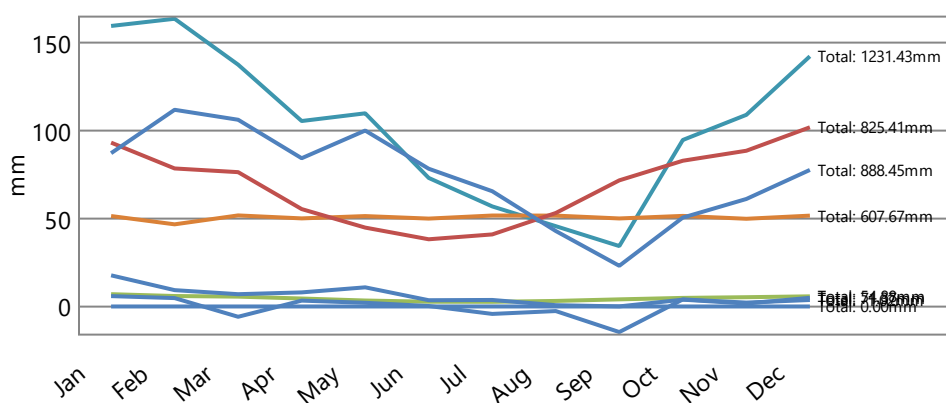
■ mm/year □ % Total inputs



Name	Value
Rain	1231.43
Irrigation	607.67
Soil Evaporation	54.88
Transpiration	825.41
Rain Runoff	71.37
Irrigation Runoff	0.00
Deep Drainage	888.45
Delta Soil Water	-1.02

Average Monthly Totals (mm):

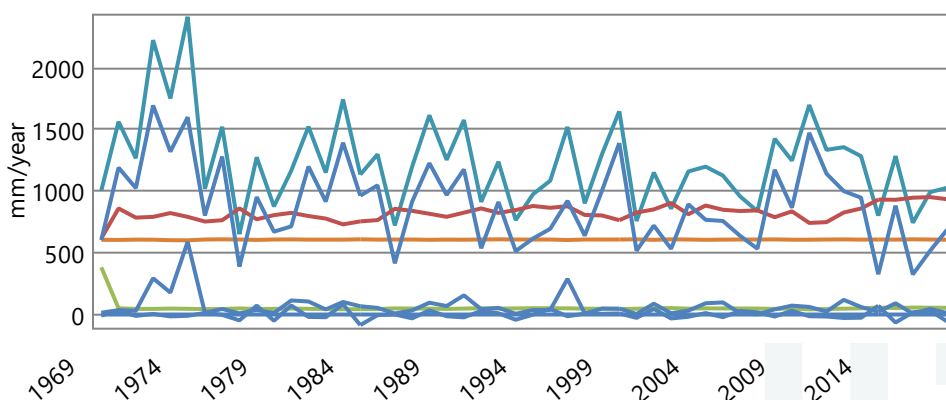
■ Chart □ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

■ Chart □ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE



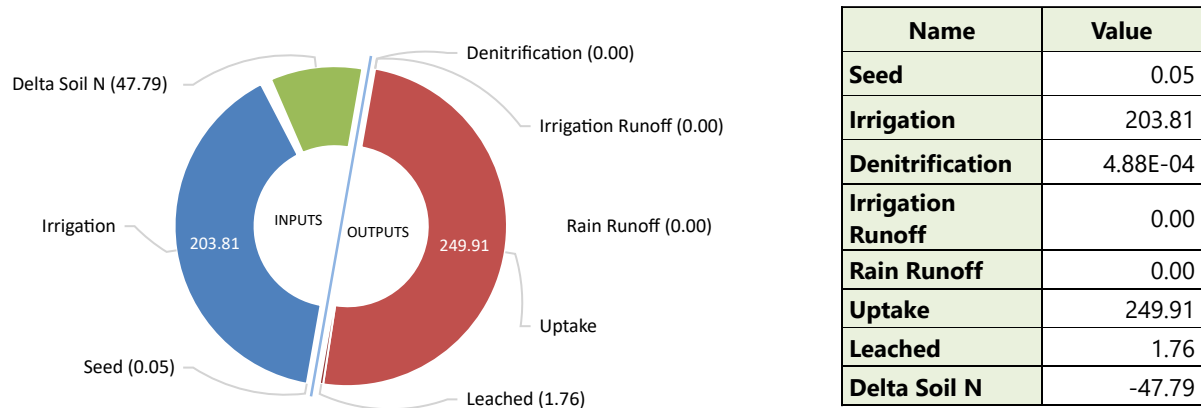
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

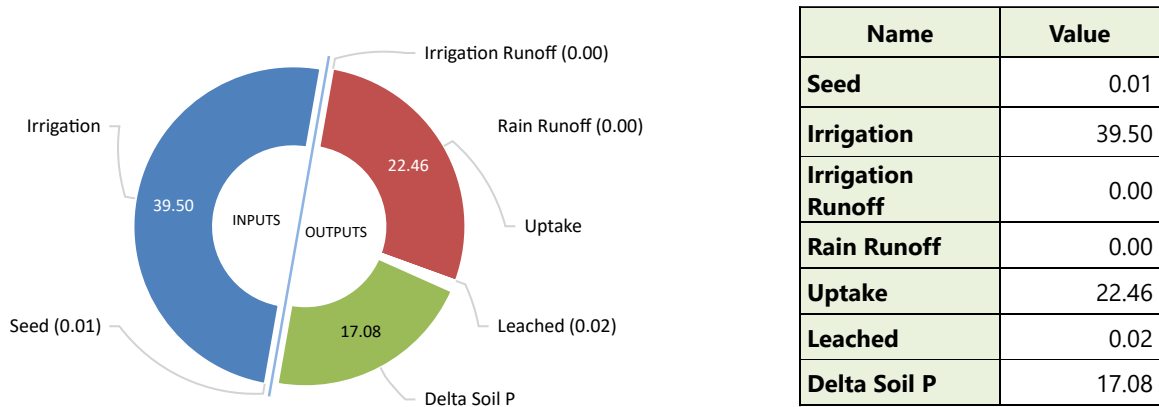
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 4.16
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)



PERFORMANCE



Soil Type: Greenacres Caravan Park

The graph displays the following metrics over time:

- N irrigation (teal line)
- N denitrified (dark blue line)
- N removed by plant (green line)
- N irrigation runoff (purple line)
- N leached (red line)
- N organic stored (brown line)
- N mineral stored (olive line)
- P irrigation (cyan line)
- P removed by plant (light blue line)
- P irrigation runoff (orange line)
- P leached (magenta line)
- P stored (blue line)
- Total N delta (bright green line)
- Total P delta (purple line)
- Total N stored (light green line)
- P adsorbed (yellow line)
- P dissolved (orange line)

The graph displays two data series over time from 1969 to 2014. The Y-axis represents concentration in mg/L, ranging from 0 to 12. The X-axis represents years, with labels every five years from 1969 to 2014. The 'Nitrate-N' series (blue line) starts at a high concentration of approximately 13 mg/L in 1969, drops sharply to near zero by 1974, and remains stable at that level until 2014. The 'Phosphate-P' series (orange line) remains consistently near zero throughout the entire period.

Year	Nitrate-N (mg/L)	Phosphate-P (mg/L)
1969	~13	~0.1
1974	~0.1	~0.1
1979	~0.1	~0.1
1984	~0.1	~0.1
1989	~0.1	~0.1
1994	~0.1	~0.1
1999	~0.1	~0.1
2004	~0.1	~0.1
2009	~0.1	~0.1
2014	~0.1	~0.1

Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

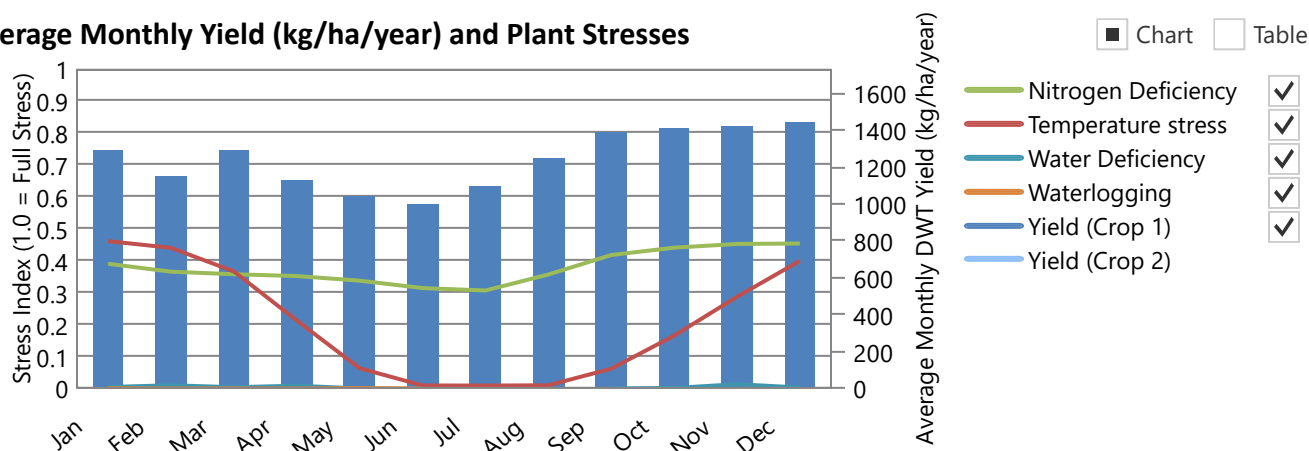
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	14920.52 (13329.86 - 17073.34)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.65 (0.62 - 0.67)
Average monthly root depth (mm) (minimum - maximum)	596.68 (592.10 - 599.92)

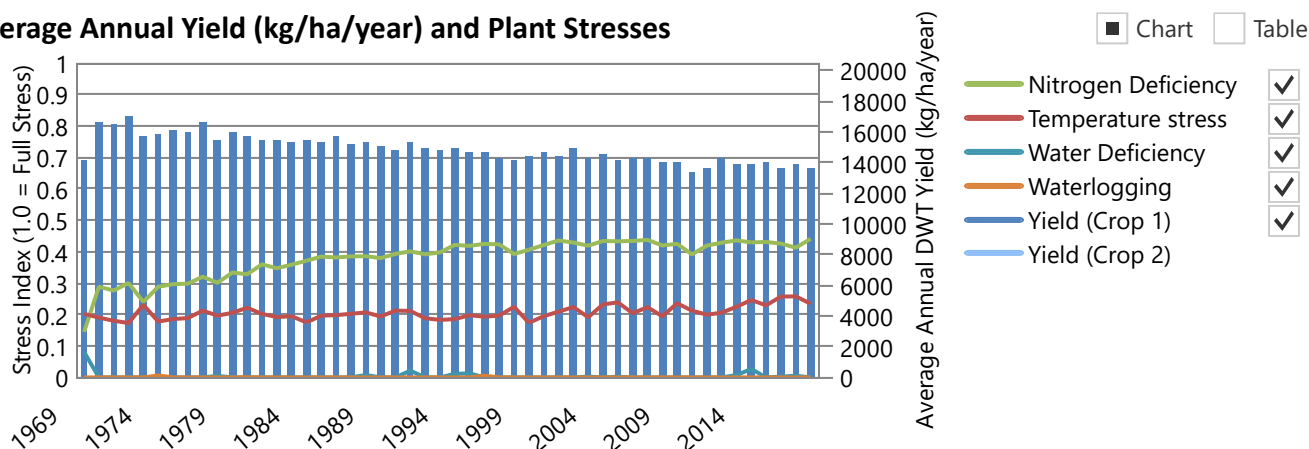
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	249.91 (212.57 - 339.79)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	22.46 (0.00 - 36.74)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.03)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 3.84 (normal), 0.04 (forced by crop death due to water stress (0.04))

No. days without crop/year (days/year): 0.12 due to water stress (0.12)



Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

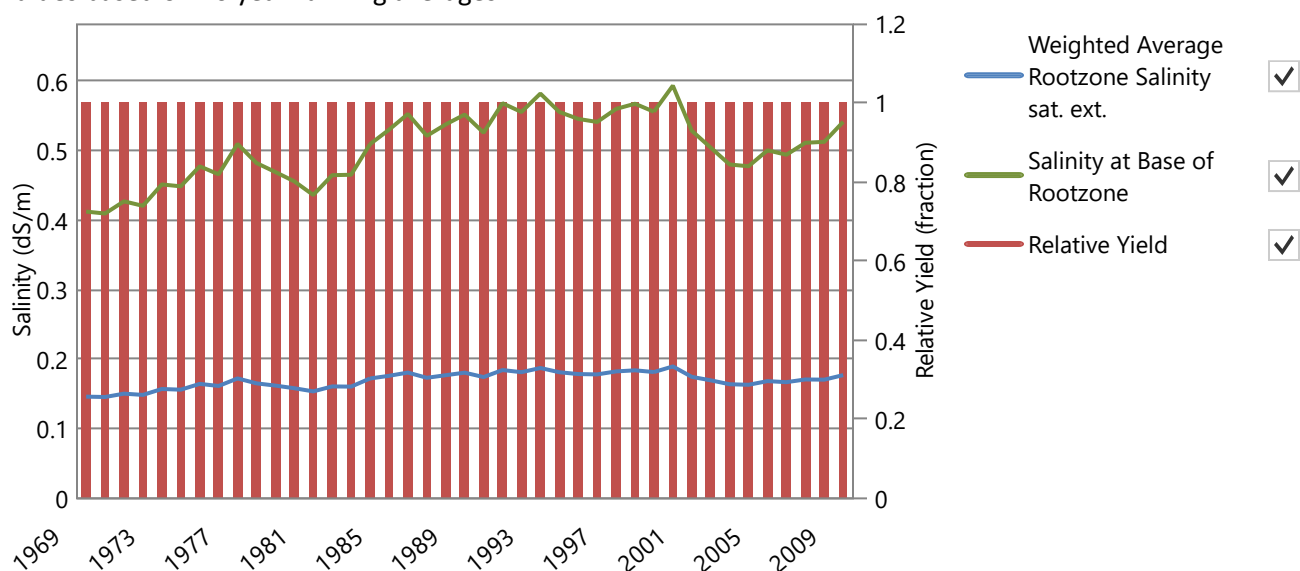
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	222.73
Average annual effluent salt added & leached at steady state (kg/ha/year)	2835.69
Average leaching fraction based on 10 year running averages (fraction)	0.68
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.17
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.50
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



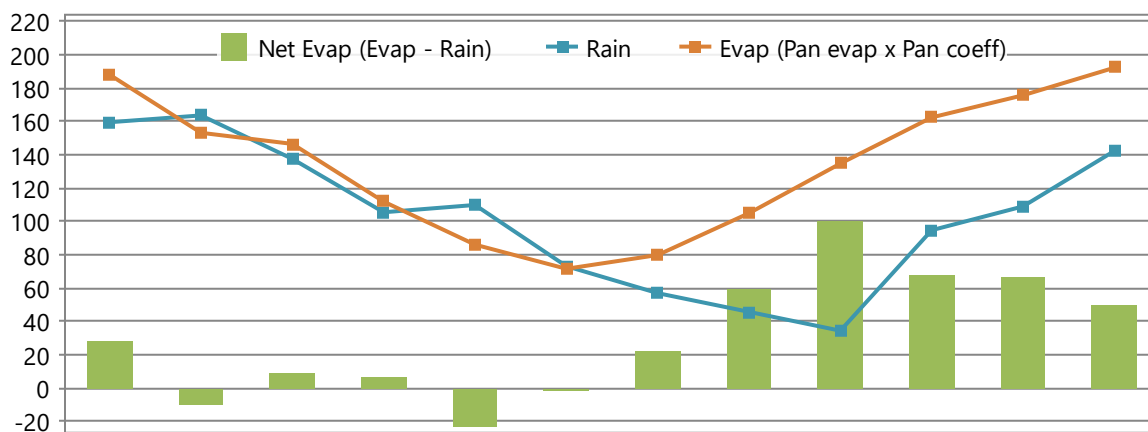
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 9131.00 kL/year or 25.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

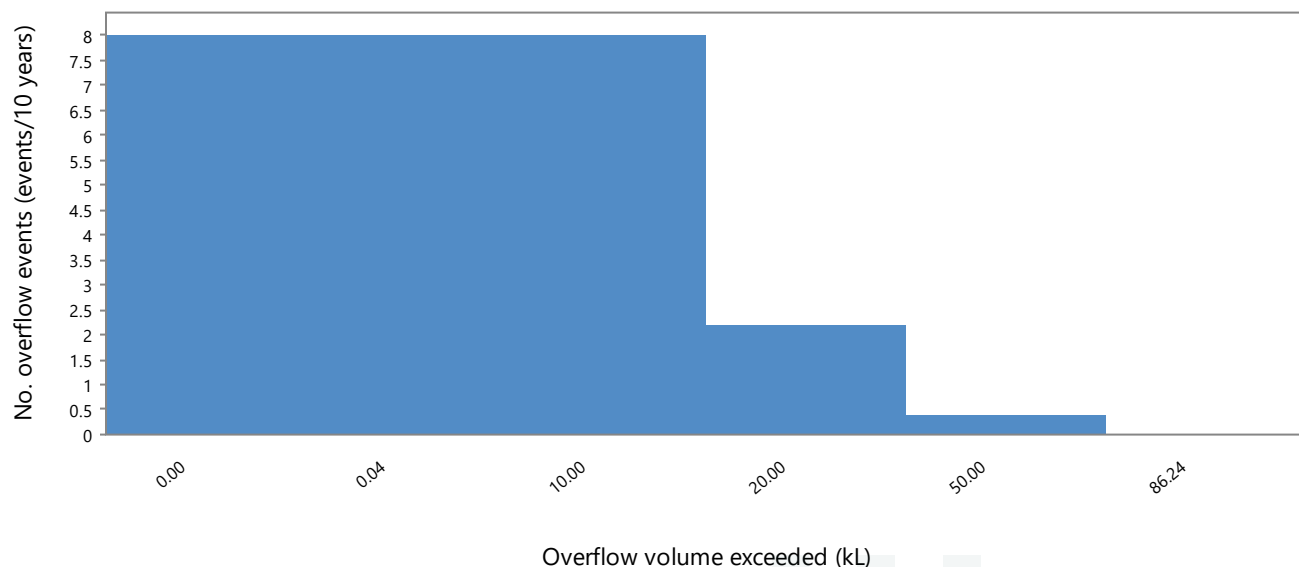
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.60
Average volume of overflow (kL/year)	15.99
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	0.80
Average duration of overflow (days)	1.35
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.57

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	9114.98	6076.66
Total nitrogen applied (kg)	305.72	203.81
Total phosphorus applied (kg)	59.25	39.50
Total salts applied (kg)	3919.44	2612.96

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	51.4	46.7	51.8	50.1	51.4	50.0	51.7	51.7	50.0	51.5	49.9	51.6	607.7
Soil Evap	7.0	5.9	5.6	4.5	3.4	2.7	2.6	3.1	4.0	4.9	5.3	5.8	54.9
Transpn.	93.1	78.5	76.4	55.4	44.8	38.2	41.0	53.1	71.7	82.9	88.5	101.9	825.4
Rain Runoff	17.7	9.3	7.0	8.0	10.9	3.6	3.7	0.7	0.0	3.9	1.7	4.9	71.4
Irr. Runoff	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
Drainage	87.1	111.8	106.1	84.3	100.0	78.3	65.5	42.9	23.1	50.5	61.1	77.6	888.5
Delta	5.9	4.8	-5.9	3.3	2.1	0.3	-4.2	-2.6	-14.5	4.0	2.2	3.7	-1.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	203.81
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	249.91
Average annual soil nitrogen removed by denitrification (kg/ha/year)	4.88E-04
Average annual soil nitrogen leached (kg/ha/year)	1.76
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.76
Soil organic-N kg/ha (Initial - Final)	2448.00 - 169.03
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.20
Max. annual nitrate-N concentration of deep drainage (mg/L)	13.20

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	39.50
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	22.46
Average annual soil phosphorus leached (kg/ha/year)	0.02
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 2.13E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 931.48
Average phosphate-P concentration in rootzone (mg/L)	3.10E-03
Average phosphate-P concentration of deep drainage (mg/L)	2.41E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	3.66E-03
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.23 mg/L (years)	124.86

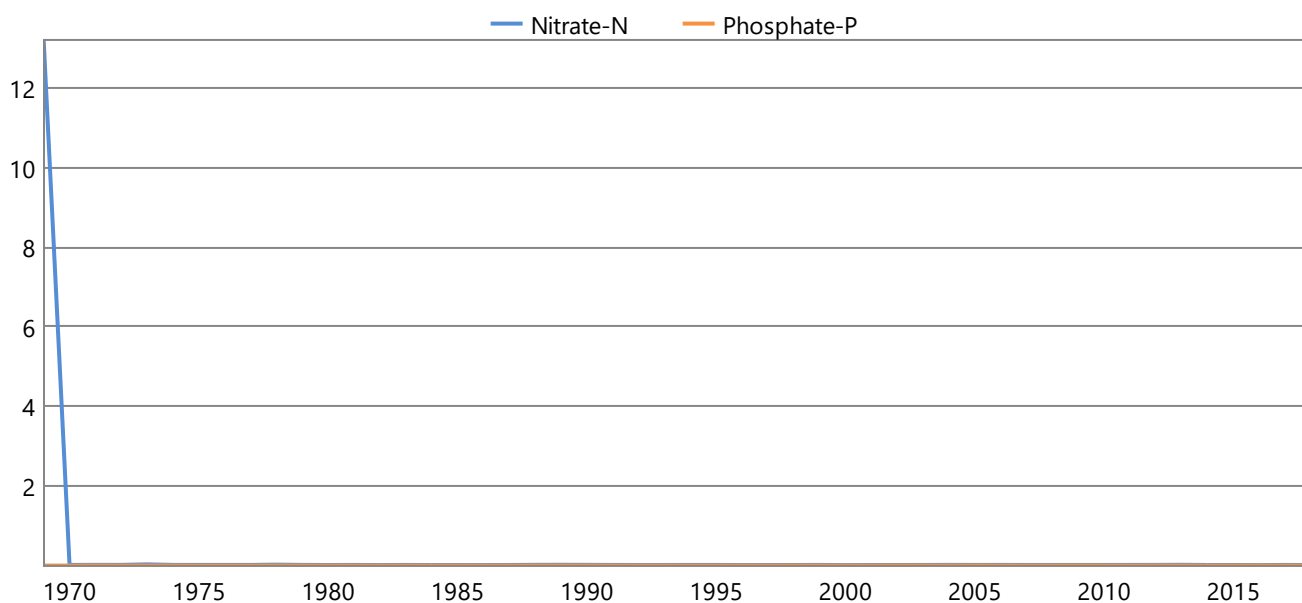
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

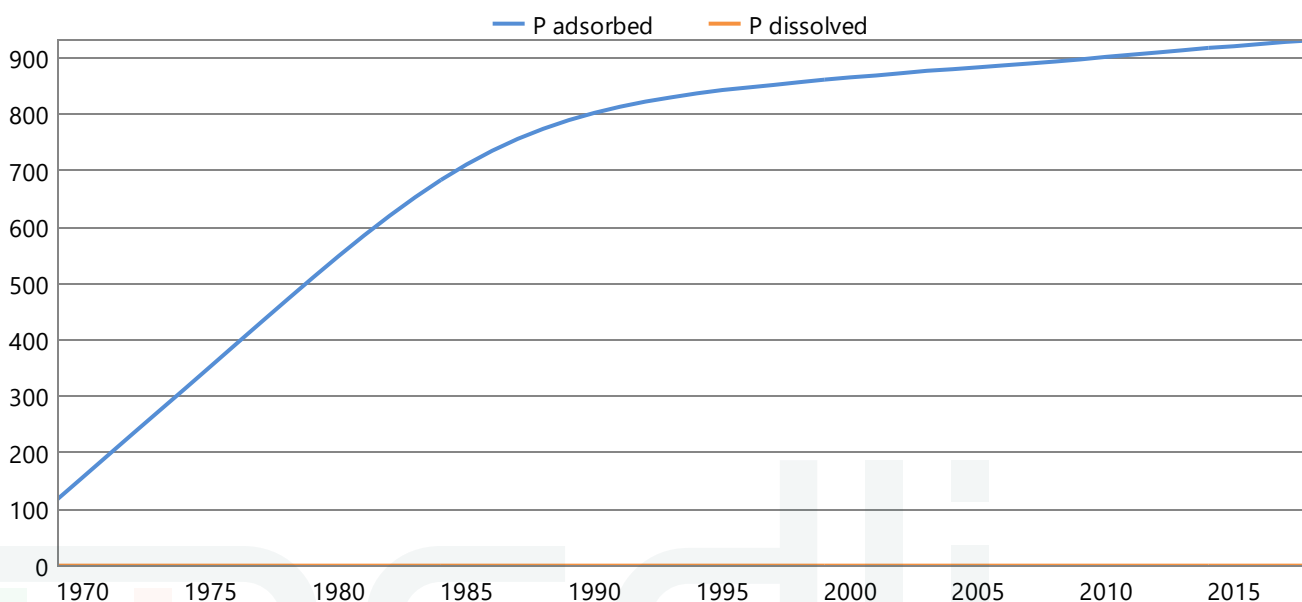
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	14920.52 (13329.86 - 17073.34)
Average monthly plant (green) cover (fraction)	0.65 (0.62 - 0.67)
Average monthly crop factor (fraction)	0.52 (0.50 - 0.54)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	596.68 (592.10 - 599.92)
Average number of normal harvests per year (no./year)	3.84 (3.00 - 5.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.04 (0.00 - 2.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.38 (0.14 - 0.44)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.12

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	222.73
Average annual effluent salt added & leached at steady state (kg/ha/year)	2835.69
Average leaching fraction based on 10 year running averages (fraction)	0.68
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.17
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.50
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off



Title: Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

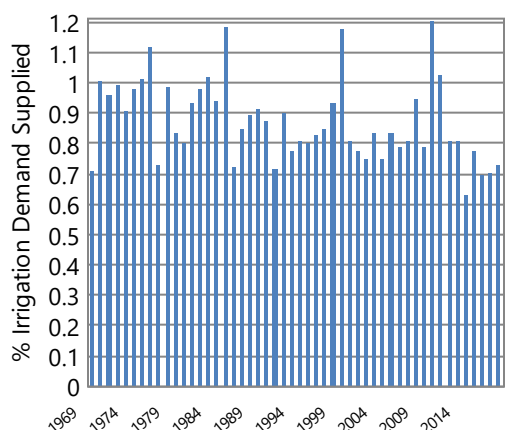
Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Average Annual %Irrigation Demand Supplied:

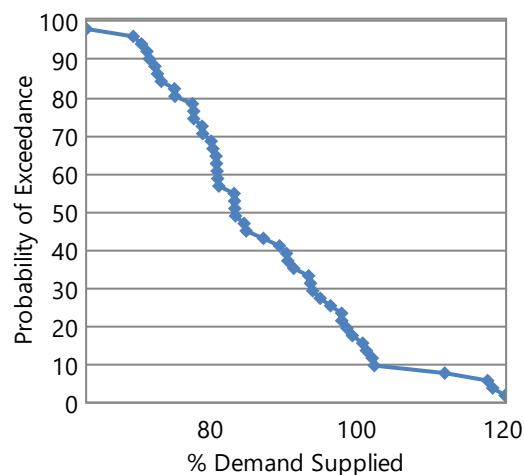
Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	6076.7
Annual irrigation predicted for defined scenario (mm/year)	607.7
Average annual irrigation demand supplied (fraction)	0.9

Or for 1.50 ha: 10668 kL/year

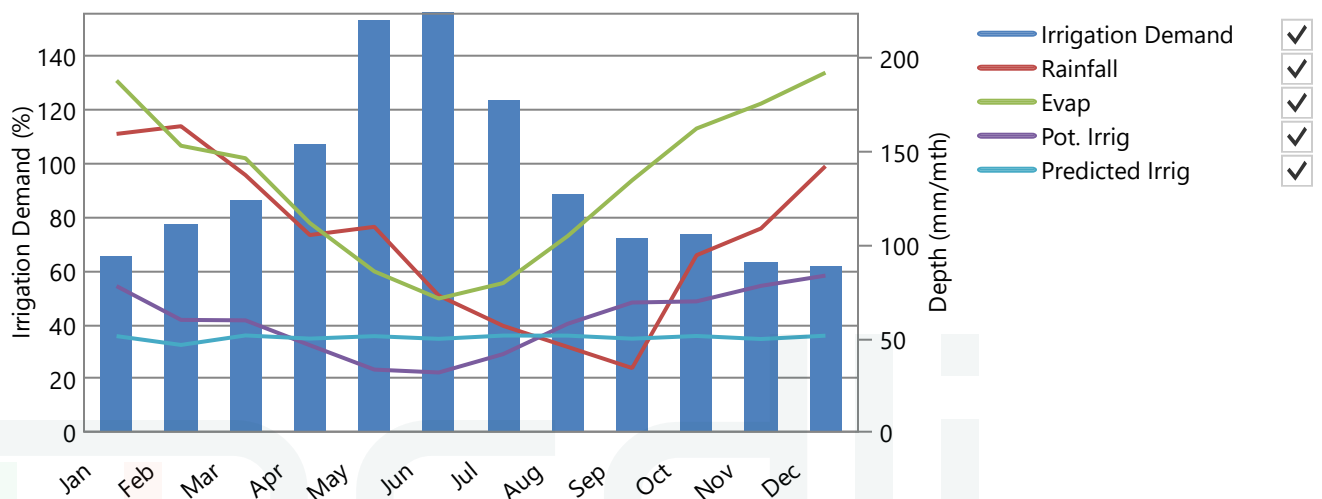
Annual % Irrigation Demand Supplied



Probability of exceeding the % Irrigation Demand Supplied



Monthly % Irrigation Demand Supplied



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

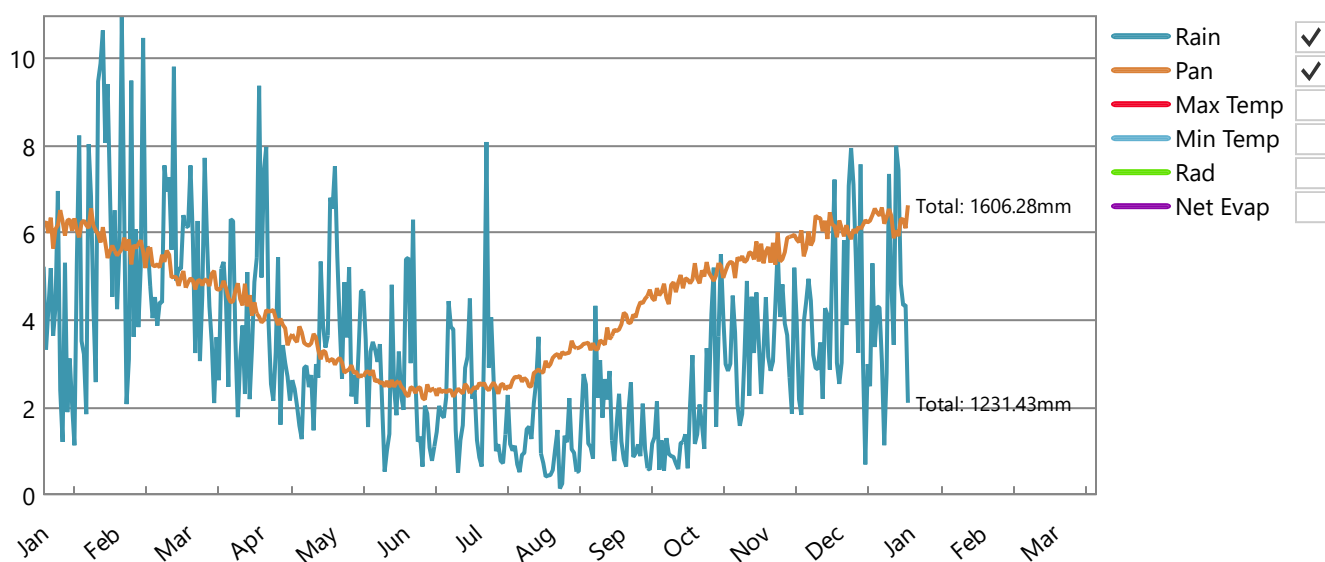
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



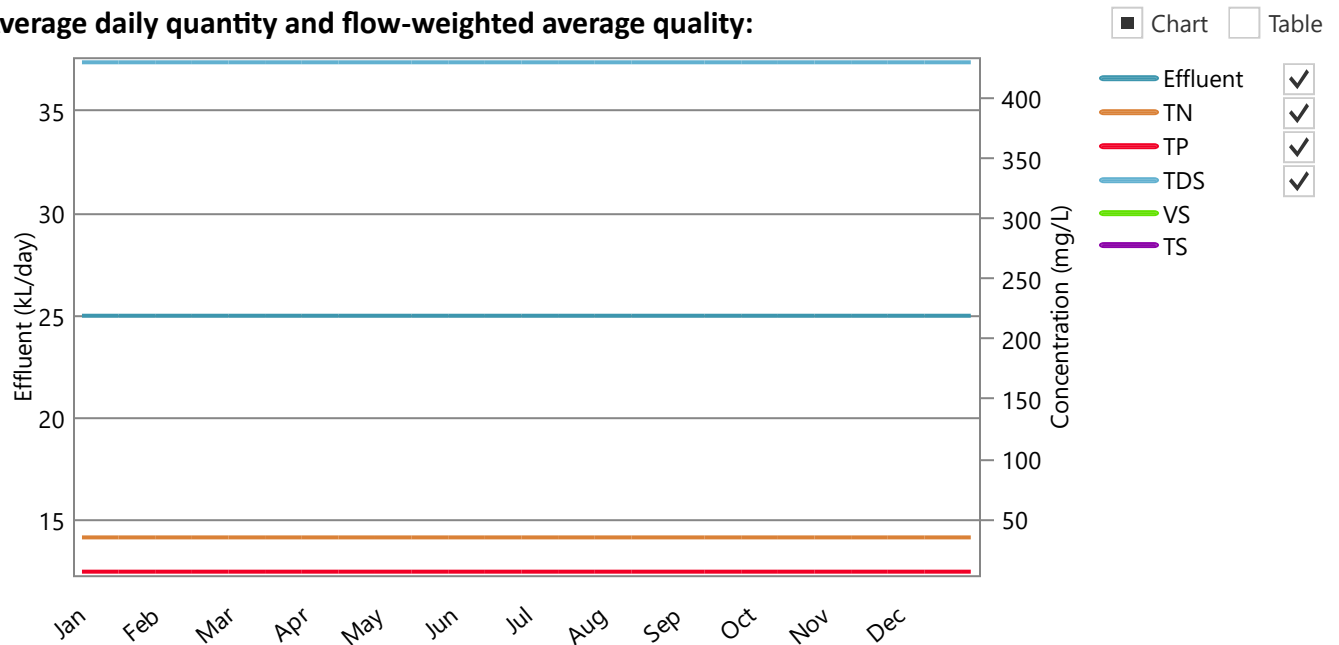
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **9131.00 kL/year** or 25.00 kL/day (Min-Max: 25.00 - 25.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

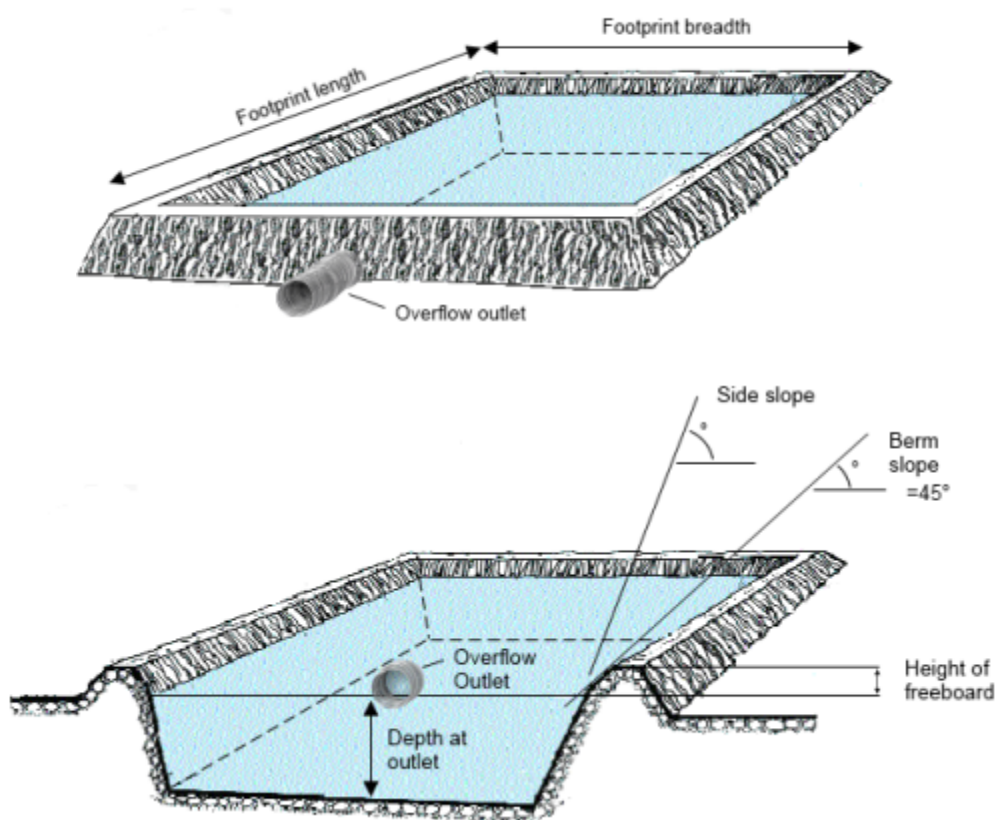
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	2.73



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

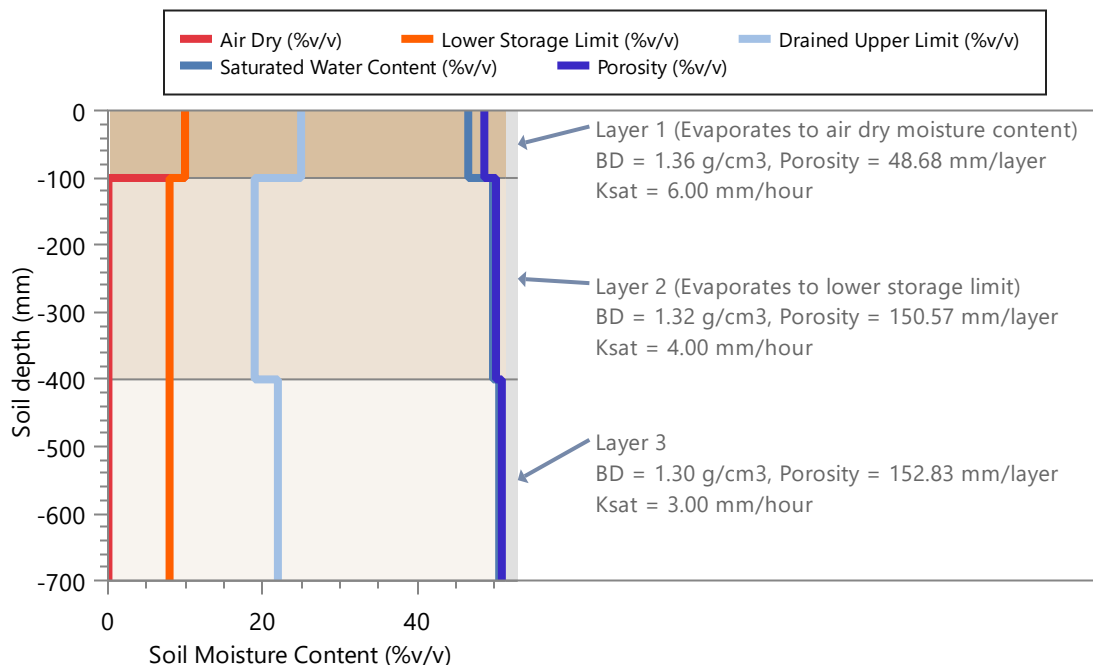
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

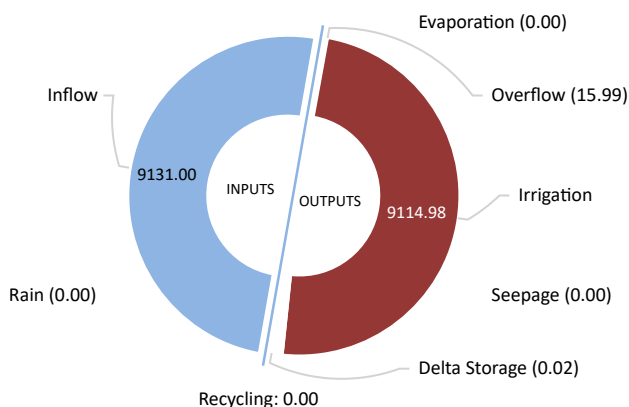
Average monthly cover (fraction) (minimum - maximum)	0.87 (0.80 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: 90 kL

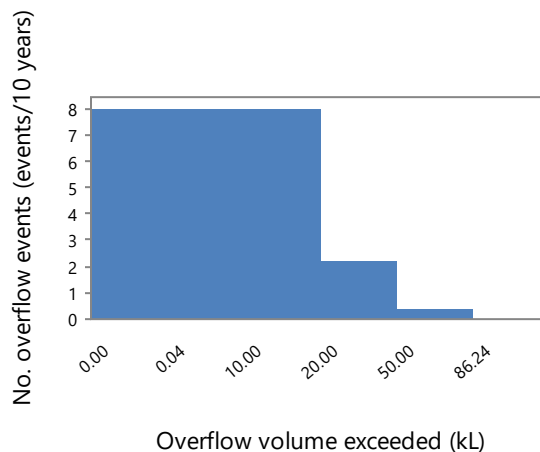
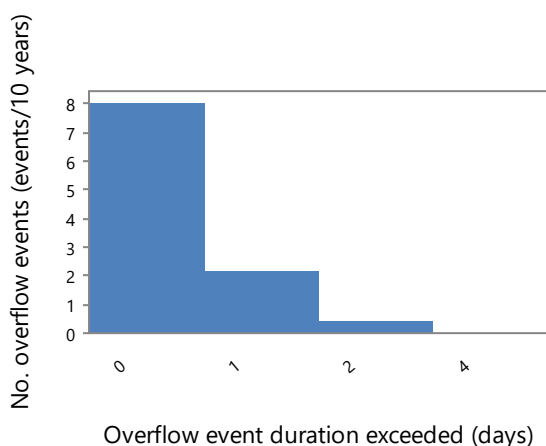
Pond System Water Balance (kL/year)



Name	Value
Rain	0.00
Inflow	9131.00
Recycling	0.00
Evaporation	0.00
Overflow	15.99
Irrigation	9114.98
Seepage	0.00
Delta Storage	0.02

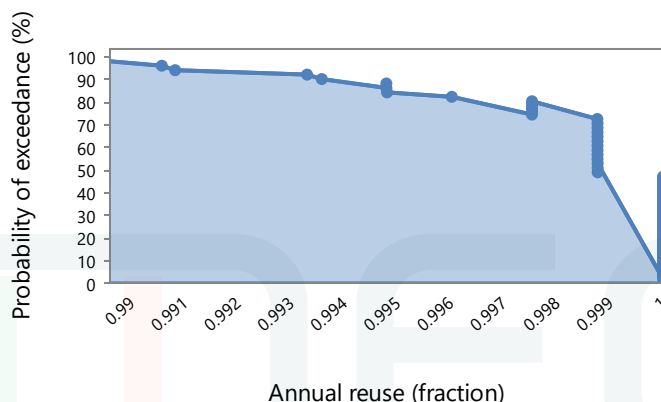
Overflow Diagnostics

Volume of overflow (kL/year)	15.99
No. days pond overflows (days/year)	1.08
Average duration of overflow (days)	1.35
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% reuse (fraction)	1.00



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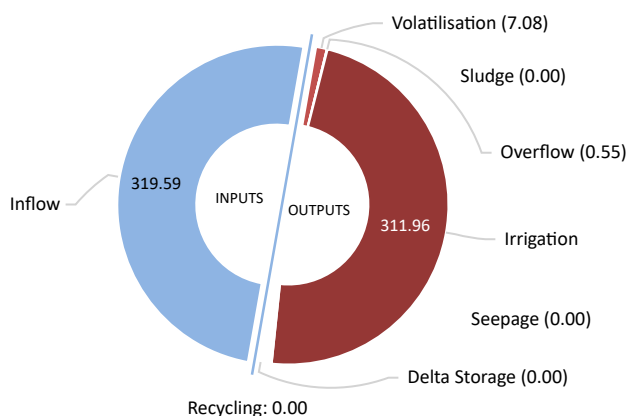


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Pond System Performance - Nutrient: 1 closed storage tank

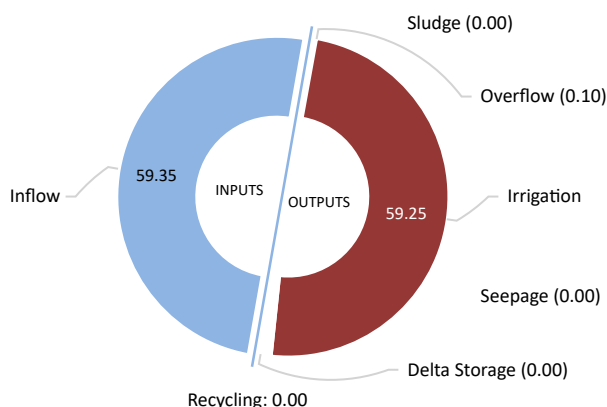
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



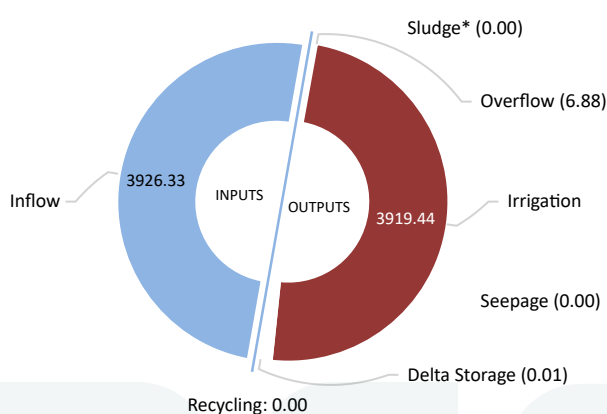
Name	Value
Inflow	319.59
Recycling	0.00
Volatilisation	7.08
Sludge	0.00
Overflow	0.55
Irrigation	311.96
Seepage	0.00
Delta Storage	0.00

Phosphorus Balance (kg/year)



Name	Value
Inflow	59.35
Recycling	0.00
Sludge	0.00
Overflow	0.10
Irrigation	59.25
Seepage	0.00
Delta Storage	0.00

Salt Balance (kg/year)



Name	Value
Inflow	3926.33
Recycling	0.00
Sludge*	0.00
Overflow	6.88
Irrigation	3919.44
Seepage	0.00
Delta Storage	0.01

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	27.12
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	18.57
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	9114.98
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	9114.98
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	34.23
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	33.54
Average phosphorus concentration of irrigation water (mg/L)	6.50
Average salinity of irrigation water (dS/m)	0.67

Irrigation Diagnostics:

Proportion of Days rain prevents irrigation (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96

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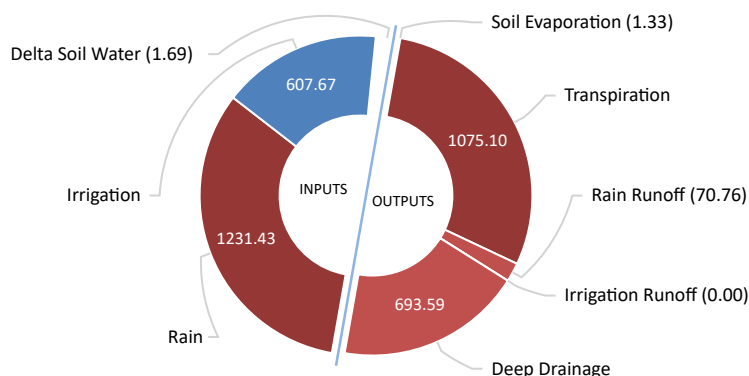
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

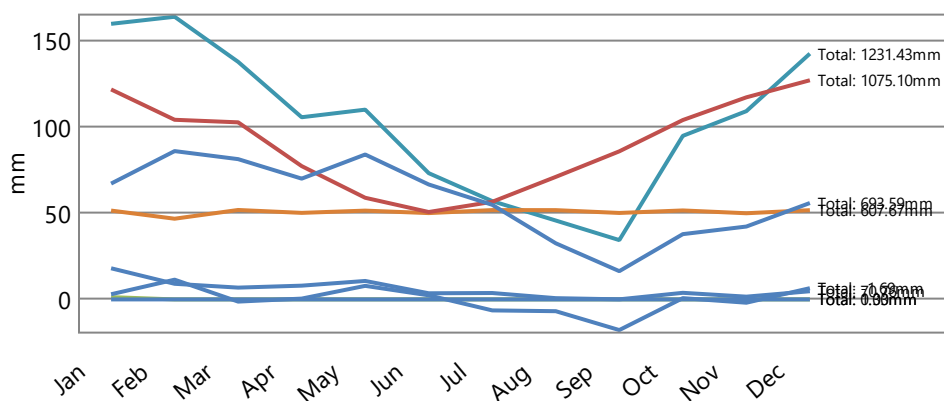
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	607.67
Soil Evaporation	1.33
Transpiration	1075.10
Rain Runoff	70.76
Irrigation Runoff	0.00
Deep Drainage	693.59
Delta Soil Water	-1.69

Average Monthly Totals (mm):

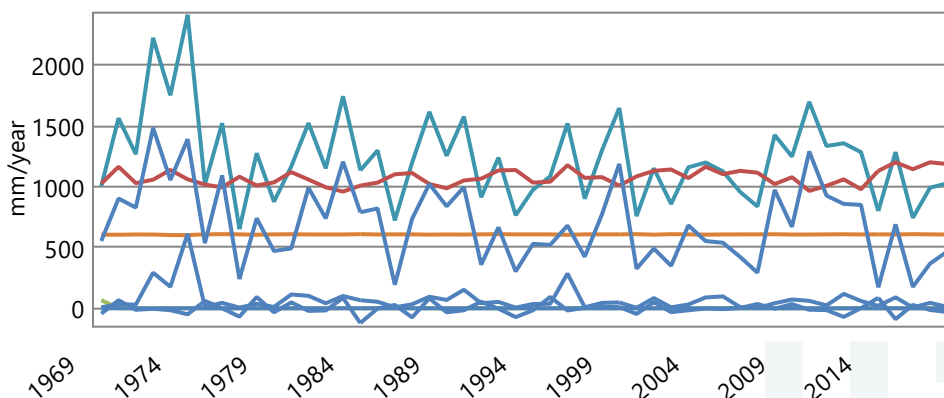
☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE

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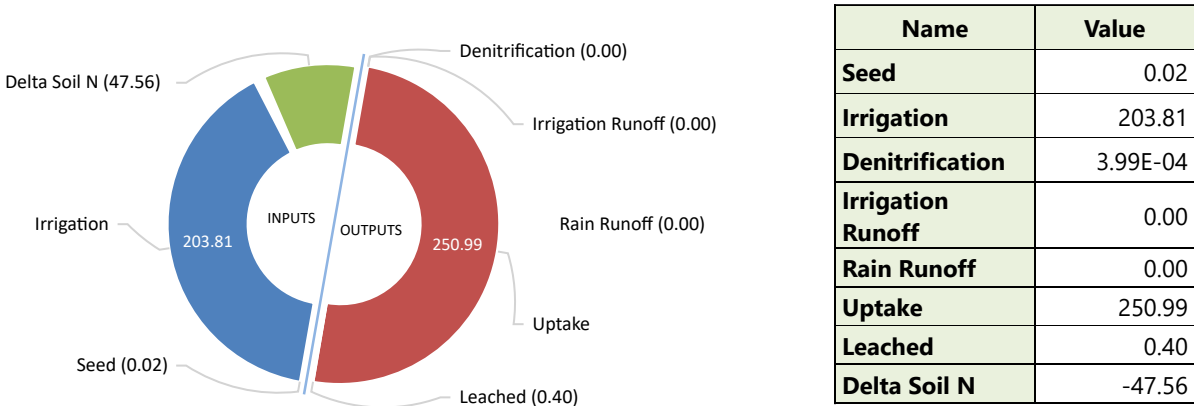
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

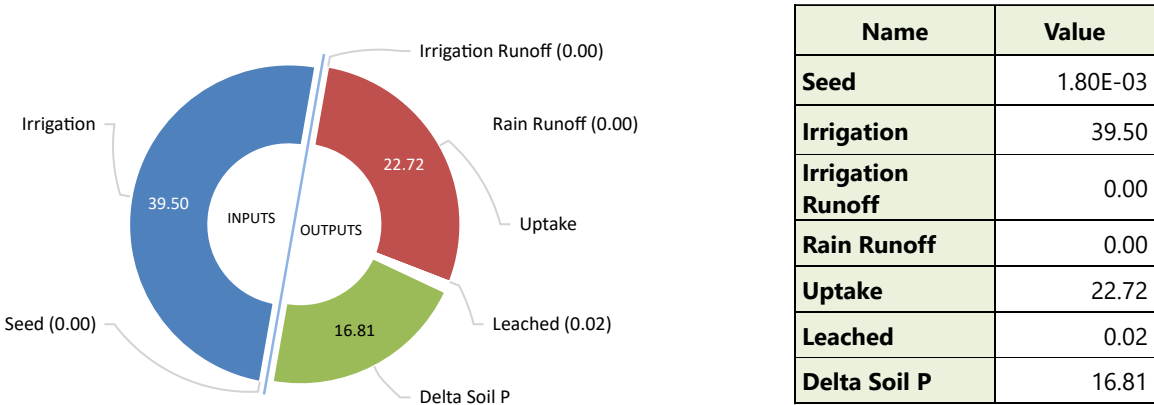
Soil Type: **Greenacres Caravan Park**

Irrigation ammonium volatilisation losses (kg/ha/year): 4.16
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Land Phosphorus Balance (kg/ha/year)

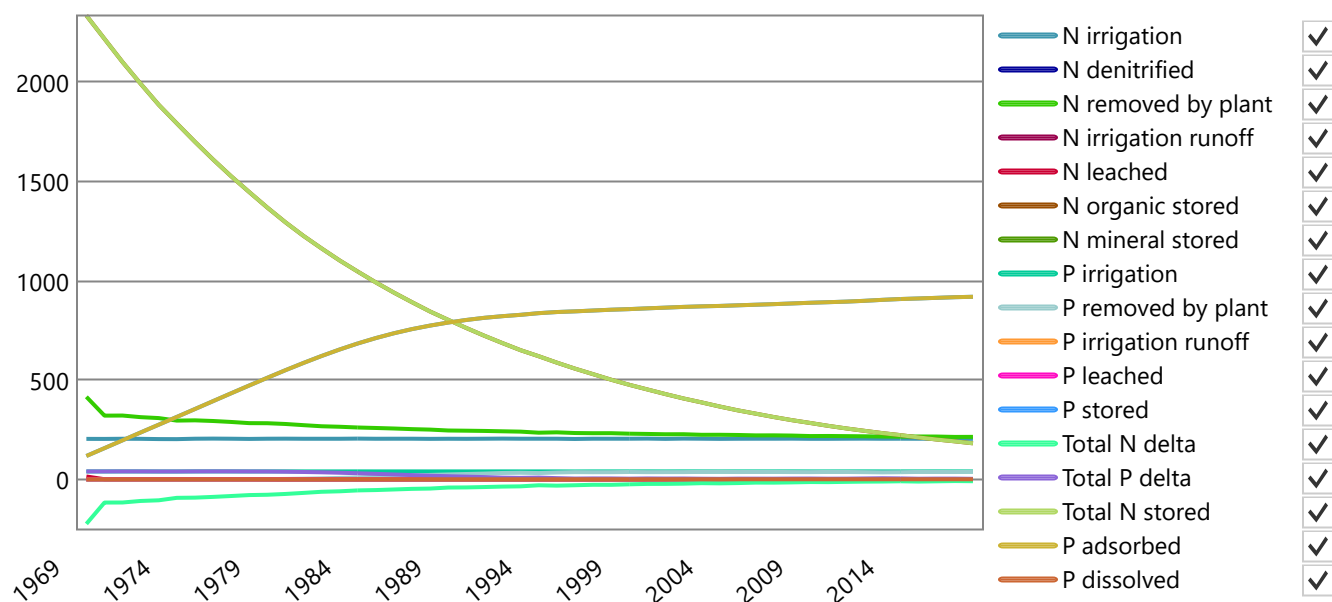


Land Performance - Soil Nutrient

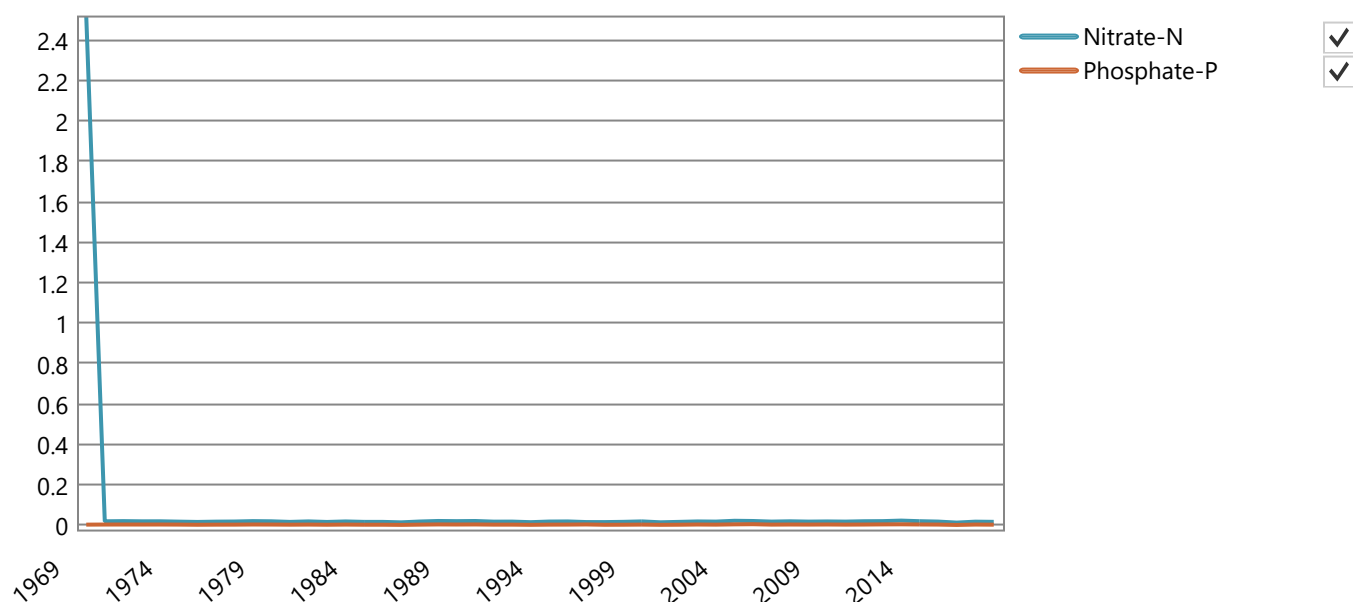
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE



Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

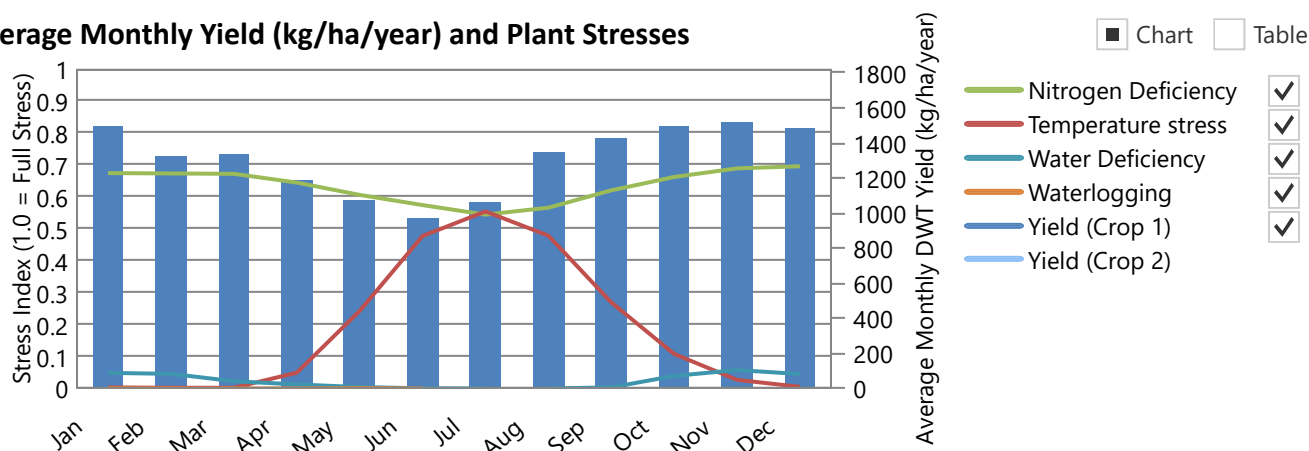
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	15750.98 (13749.84 - 21510.76)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.87 (0.80 - 0.90)
Average monthly root depth (mm) (minimum - maximum)	699.64 (695.70 - 700.00)

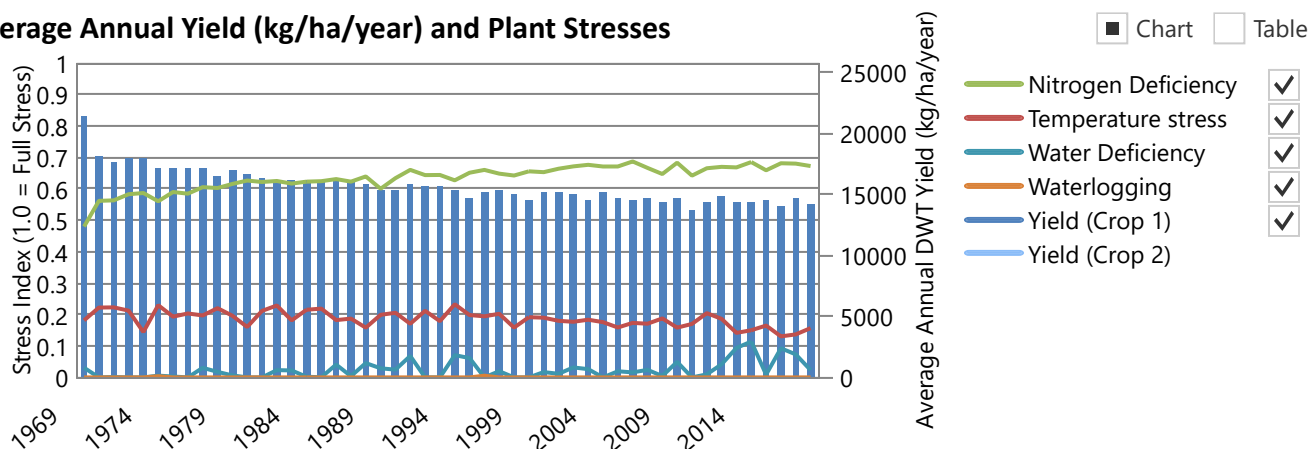
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	250.99 (213.10 - 414.90)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	22.72 (0.00 - 37.31)
Average annual shoot nitrogen concentration (fraction dwt)	0.02 (0.02 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.002 (0.000 - 0.003)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 2.84 (normal)

No. days without crop/year (days/year): 0.00

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Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

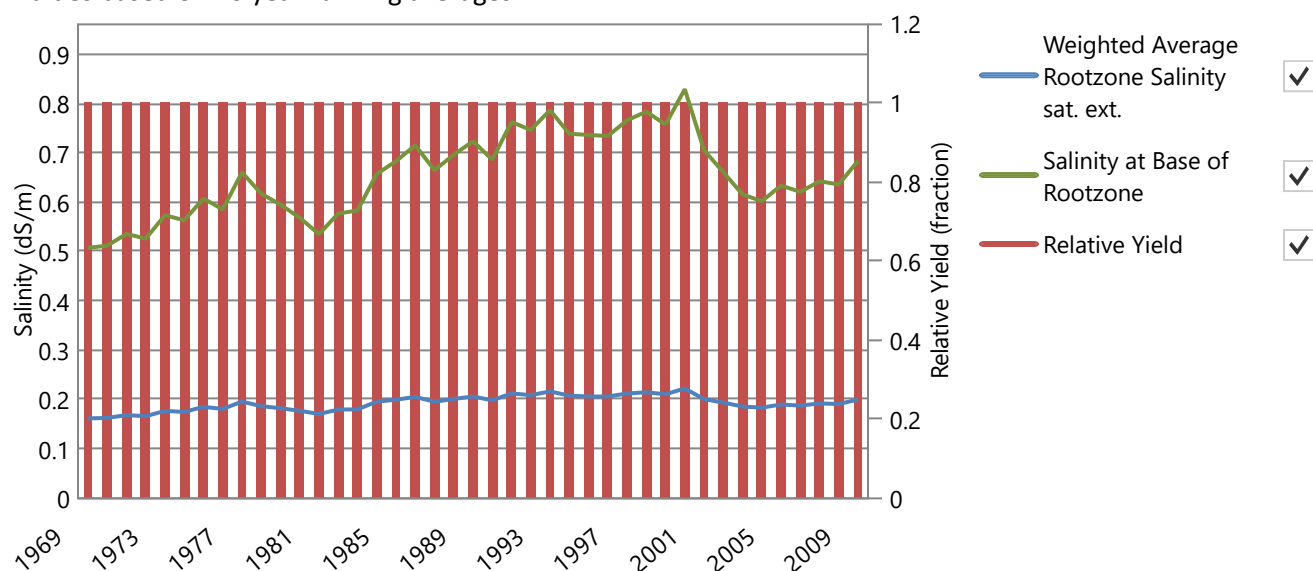
Soil Salinity:

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	222.85
Average annual effluent salt added & leached at steady state (kg/ha/year)	2835.81
Average leaching fraction based on 10 year running averages (fraction)	0.60
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.65
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Average Annual Rootzone Salinity and Relative Yield:

☒ Chart ☐ Table

All values based on 10 year running averages



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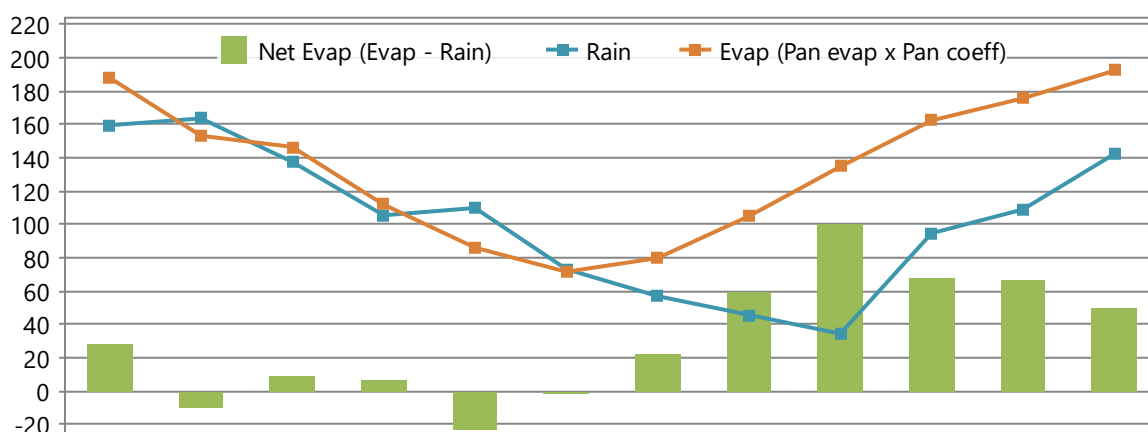
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 9131.00 kL/year or 25.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

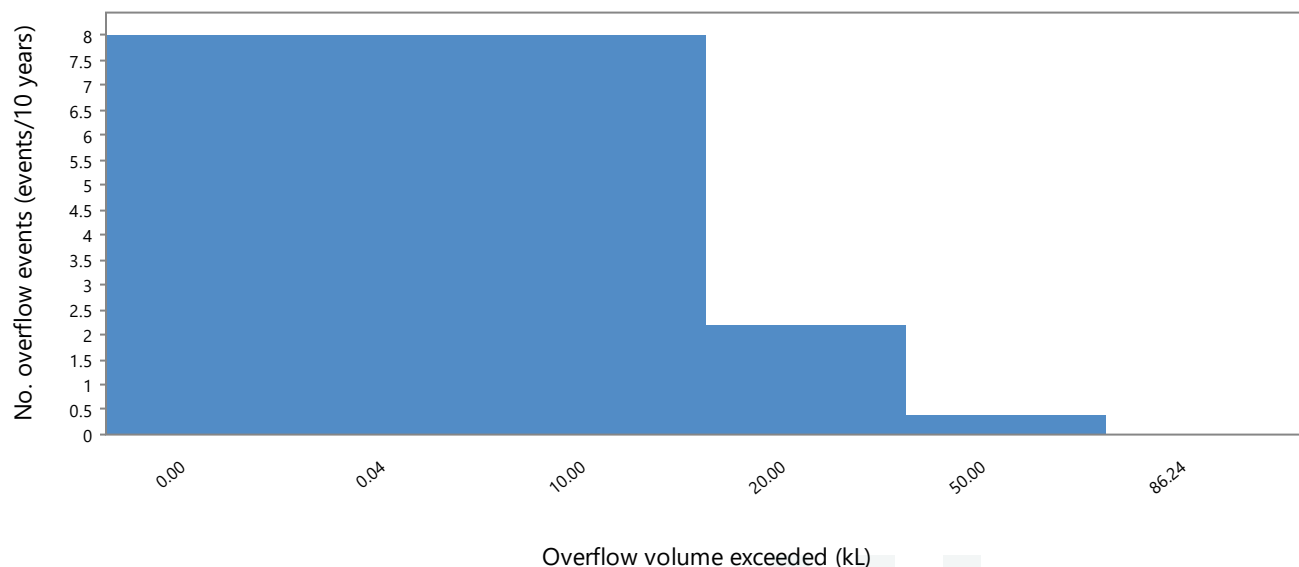
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.60
Average volume of overflow (kL/year)	15.99
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	0.80
Average duration of overflow (days)	1.35
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	1.00
Probability of at least 90% effluent reuse (fraction)	1.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.57

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	9114.98	6076.66
Total nitrogen applied (kg)	305.72	203.81
Total phosphorus applied (kg)	59.25	39.50
Total salts applied (kg)	3919.44	2612.96

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.04
Proportion of Days irrigation occurs (fraction)	0.96



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 5.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	51.4	46.7	51.8	50.1	51.4	50.0	51.7	51.7	50.0	51.5	49.9	51.6	607.7
Soil Evap	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
Transpn.	121.5	104.0	102.5	77.2	58.8	50.6	56.5	70.9	85.7	103.8	116.9	126.8	1075.1
Rain Runoff	18.0	9.0	6.8	8.0	10.7	3.6	3.7	0.7	0.0	3.8	1.6	4.7	70.8
Irr. Runoff	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
Drainage	67.0	85.8	81.2	69.9	83.8	66.5	54.7	32.5	16.4	37.8	42.2	55.8	693.6
Delta	3.0	11.4	-1.3	0.5	7.9	2.4	-6.4	-6.8	-17.7	0.7	-1.9	6.5	-1.7

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	203.81
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	250.99
Average annual soil nitrogen removed by denitrification (kg/ha/year)	3.99E-04
Average annual soil nitrogen leached (kg/ha/year)	0.40
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.40
Soil organic-N kg/ha (Initial - Final)	2448.00 - 180.86
	110.64 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.06
Max. annual nitrate-N concentration of deep drainage (mg/L)	2.52

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	39.50
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	22.72
Average annual soil phosphorus leached (kg/ha/year)	0.02
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 1.36E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 918.44
Average phosphate-P concentration in rootzone (mg/L)	2.34E-03
Average phosphate-P concentration of deep drainage (mg/L)	2.44E-03
Max. annual phosphate-P concentration of deep drainage (mg/L)	4.21E-03
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.23 mg/L (years)	124.89

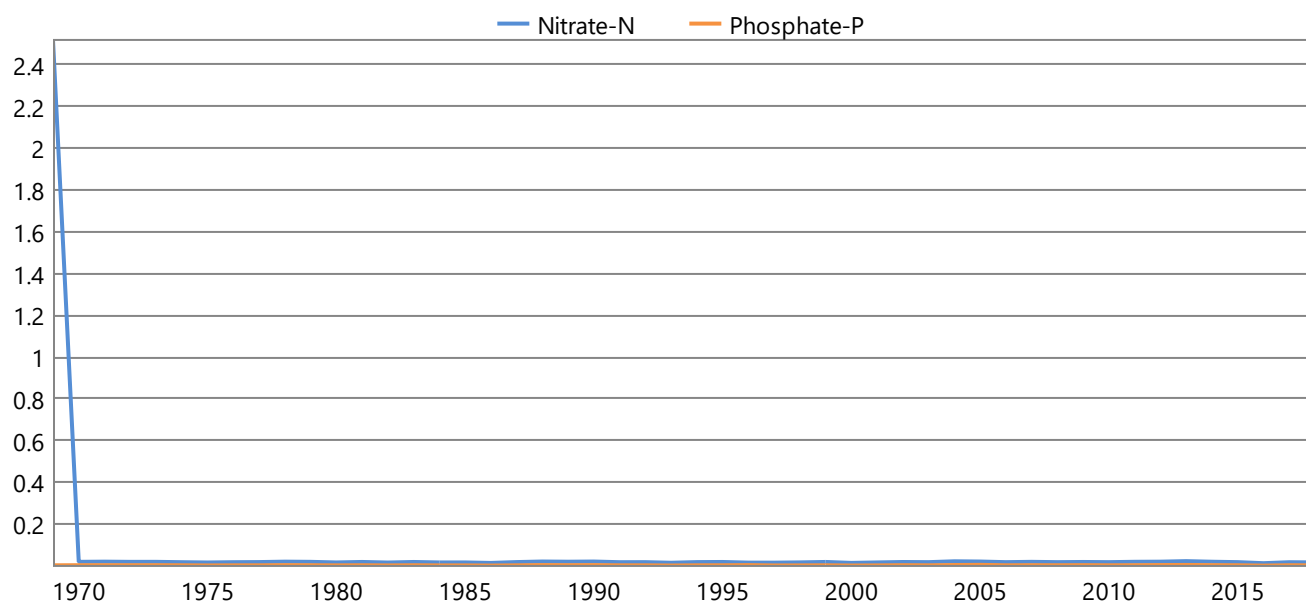
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

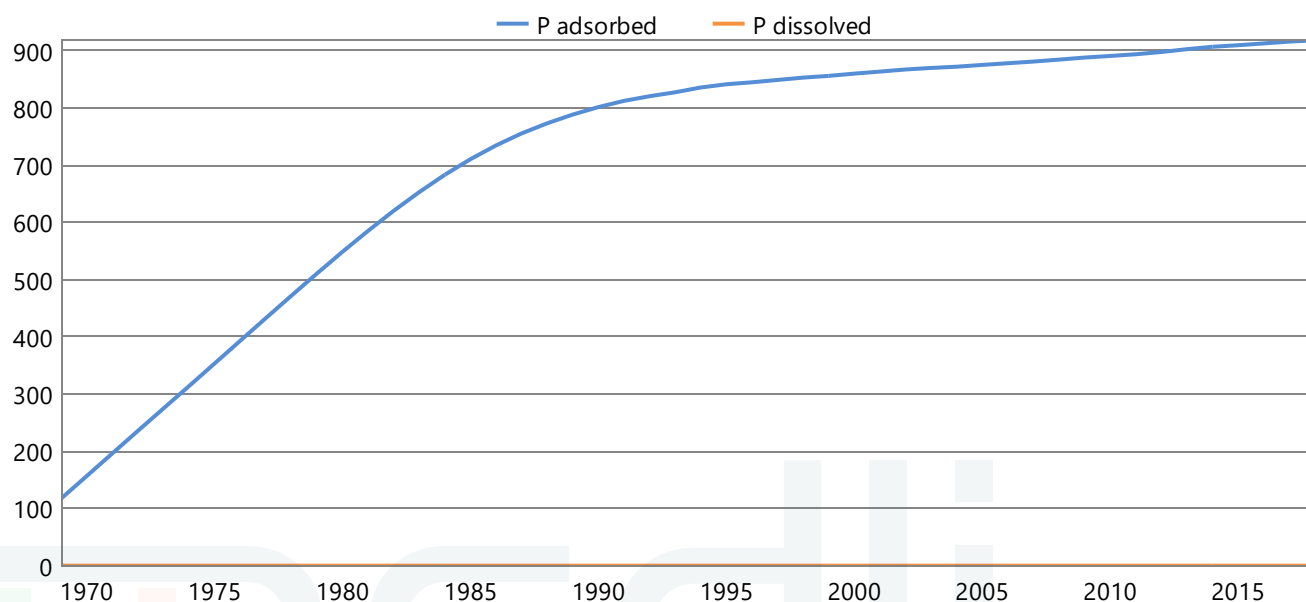
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr5_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	15750.98 (13749.84 - 21510.76)
Average monthly plant (green) cover (fraction)	0.87 (0.80 - 0.90)
Average monthly crop factor (fraction)	0.69 (0.64 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	699.64 (695.70 - 700.00)
Average number of normal harvests per year (no./year)	2.84 (2.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	2.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.63 (0.48 - 0.69)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.06)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.25
Salt added by rainfall (kg/ha/year)	222.85
Average annual effluent salt added & leached at steady state (kg/ha/year)	2835.81
Average leaching fraction based on 10 year running averages (fraction)	0.60
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.65
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

Run Messages

Messages generated when the scenario was run:

Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

Title:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

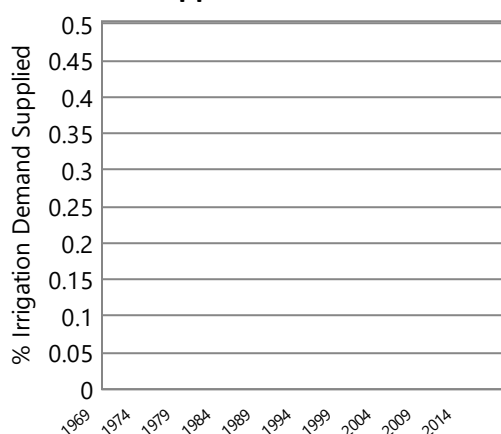
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	5414.8
Potential annual irrigation when water supply is unlimited (mm/year)	541.5
Annual irrigation predicted for defined scenario (kL/ha/year)	0.0
Annual irrigation predicted for defined scenario (mm/year)	0.0
Average annual irrigation demand supplied (fraction)	0.0

Or for 1.50 ha: 8122 kL/year

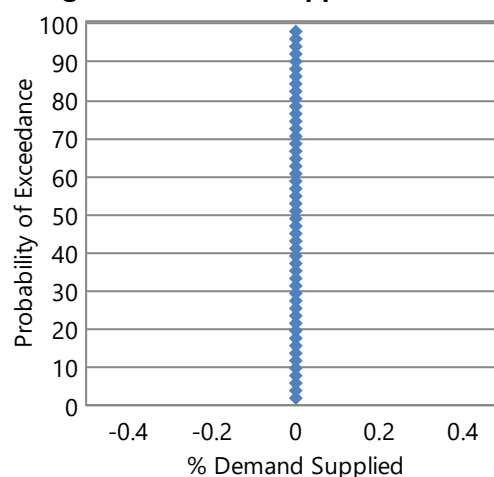
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



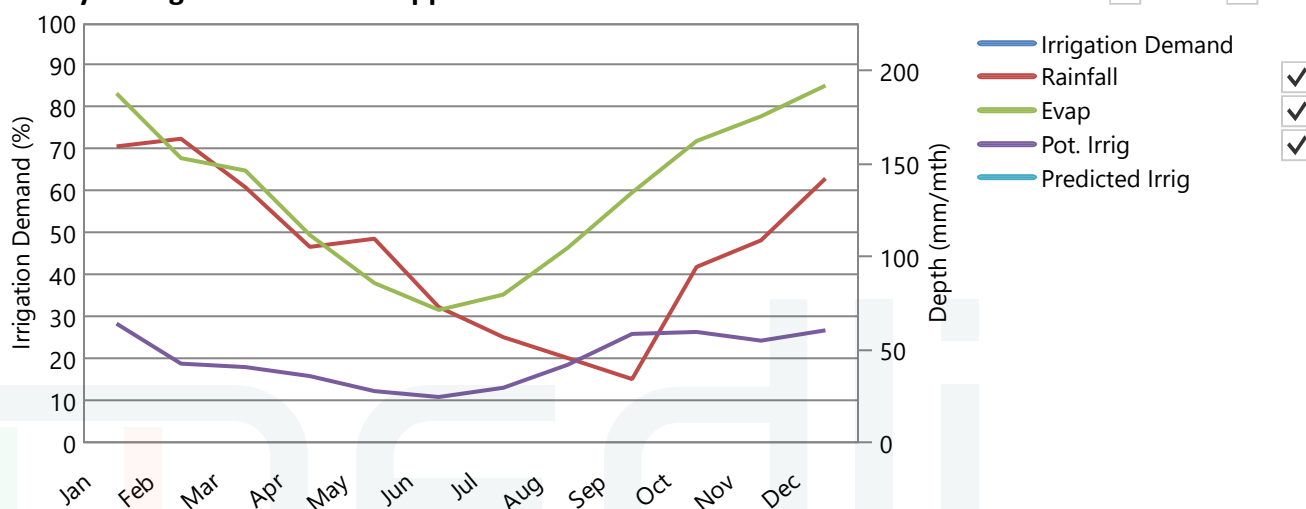
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

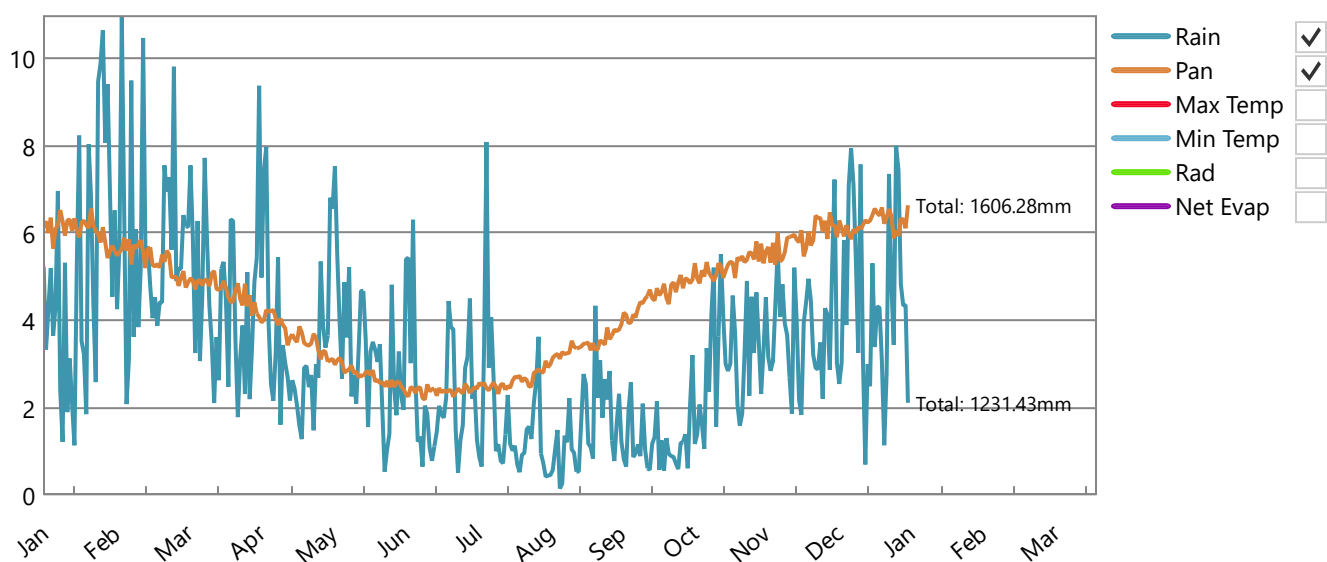
	5th ▾	Percentile	50th Percentile	95th ▾	Percentile
Rainfall (mm/year)		734	1199		1749
Pan Evaporation (mm/year)		1434	1607		1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



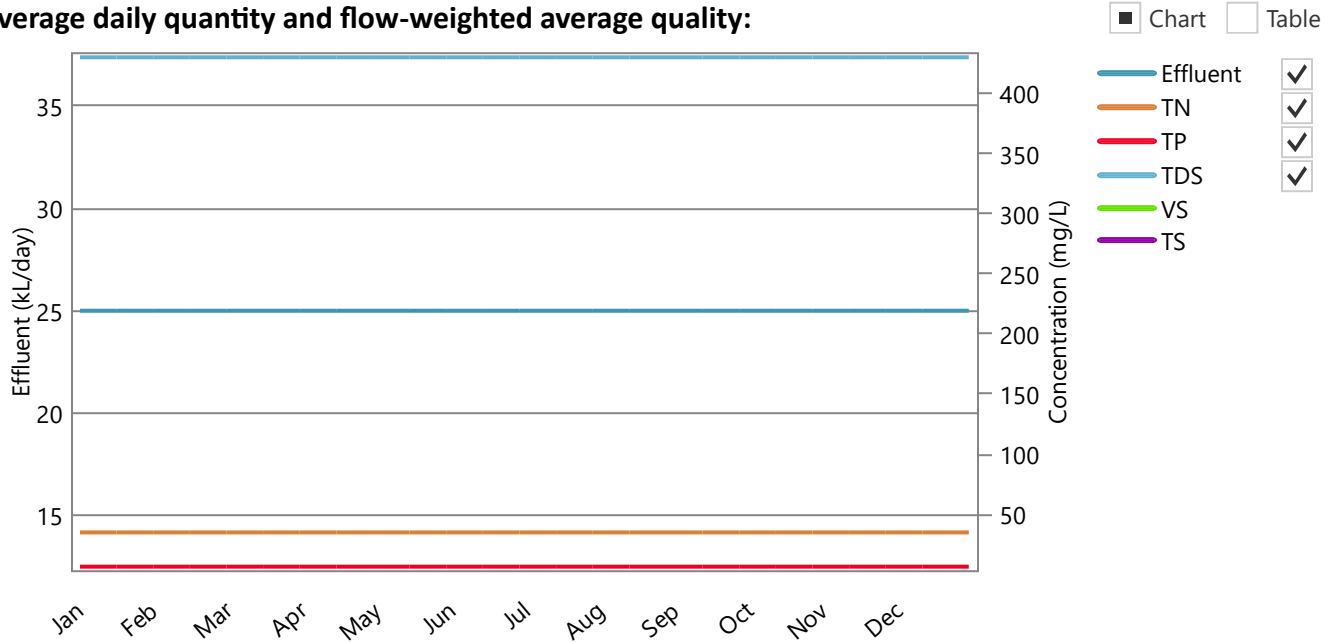
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **9131.00 kL/year** or 25.00 kL/day (Min-Max: 25.00 - 25.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

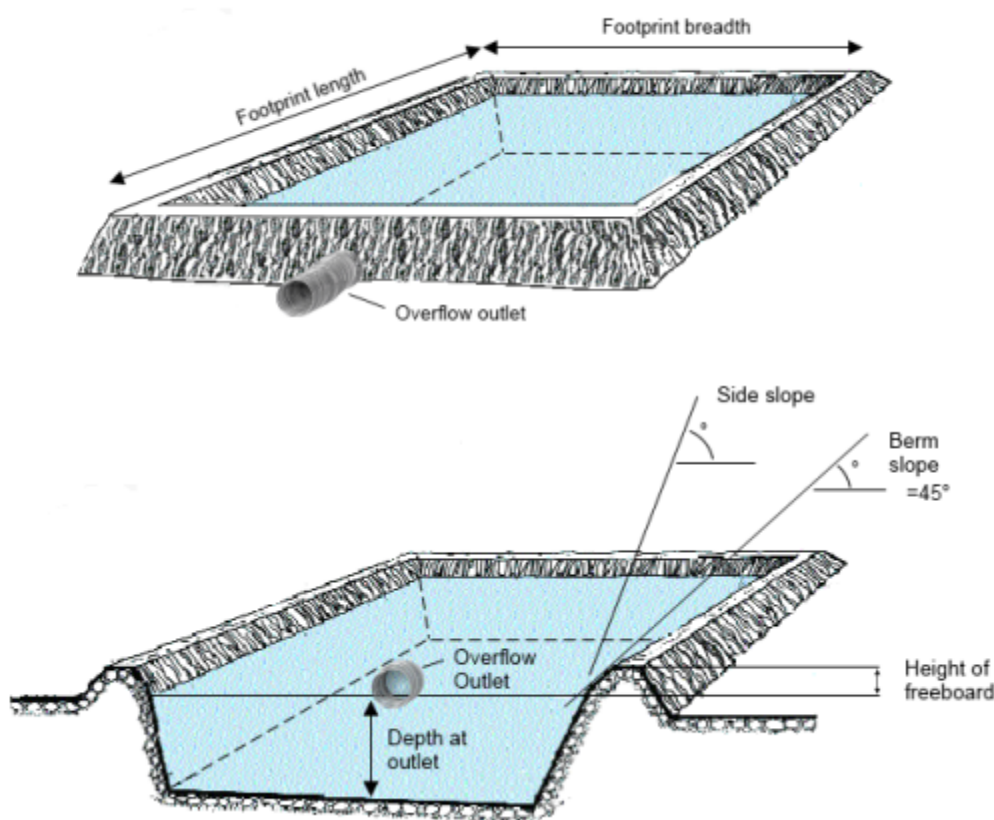
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	89.99



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

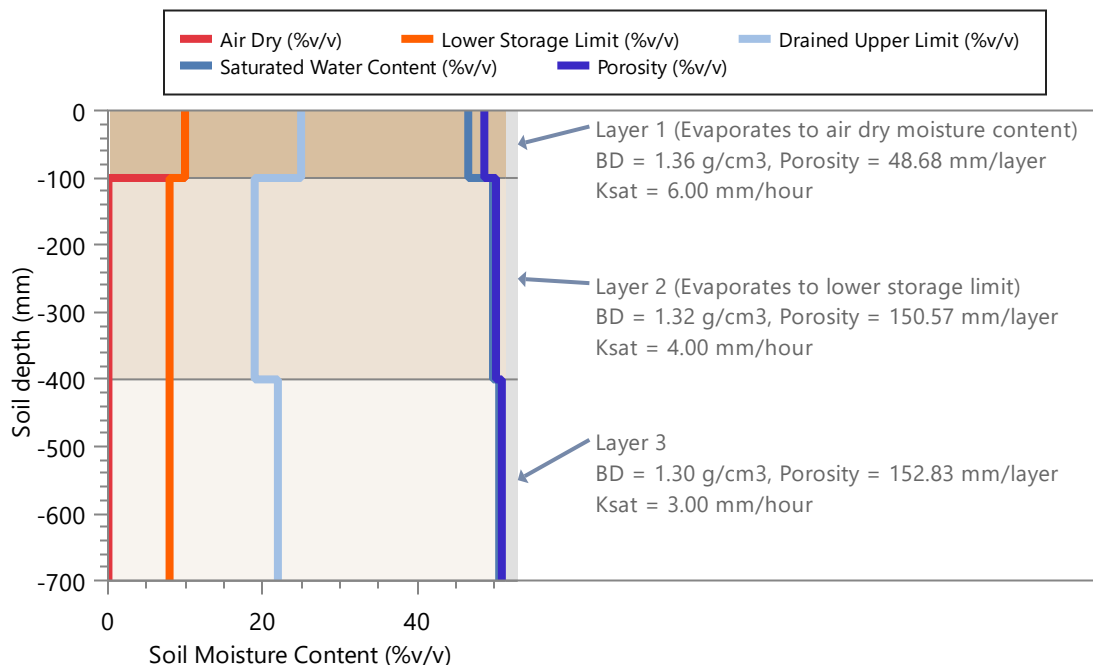
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Ryegrass 1 Pasture

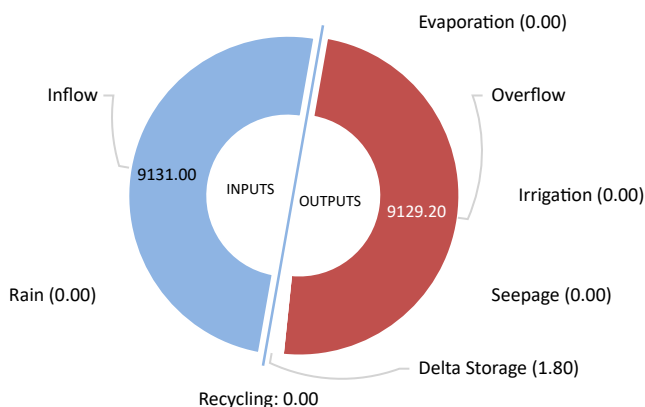
Average monthly cover (fraction) (minimum - maximum)	0.50 (0.38 - 0.55)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Maximum potential root depth in defined soil profile (mm)	600.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

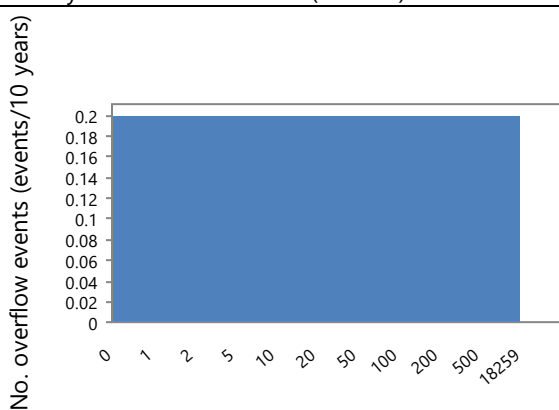
Pond System Water Balance (kL/year)



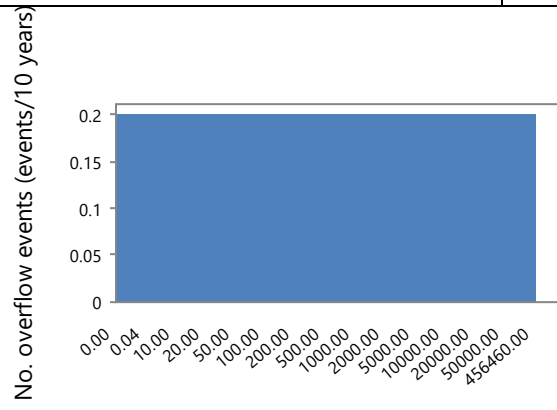
Name	Value
Rain	0.00
Inflow	9131.00
Recycling	0.00
Evaporation	0.00
Overflow	9129.20
Irrigation	0.00
Seepage	0.00
Delta Storage	1.80

Overflow Diagnostics

Volume of overflow (kL/year)	9129.20
No. days pond overflows (days/year)	365.18
Average duration of overflow (days)	18259.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.00
Probability of at least 90% reuse (fraction)	0.00



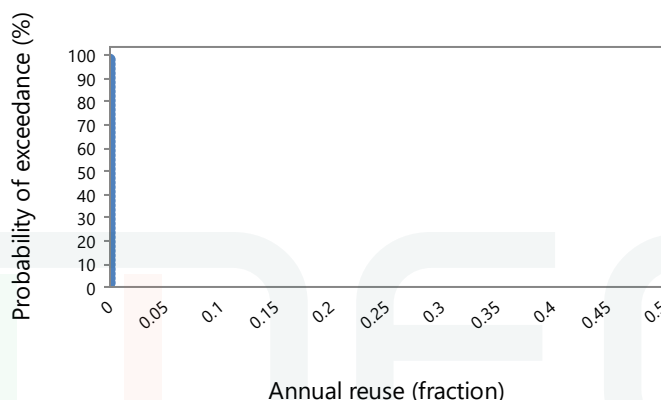
Overflow event duration exceeded (days)



Overflow volume exceeded (kL)

[Export plot](#)

[Export plot](#)



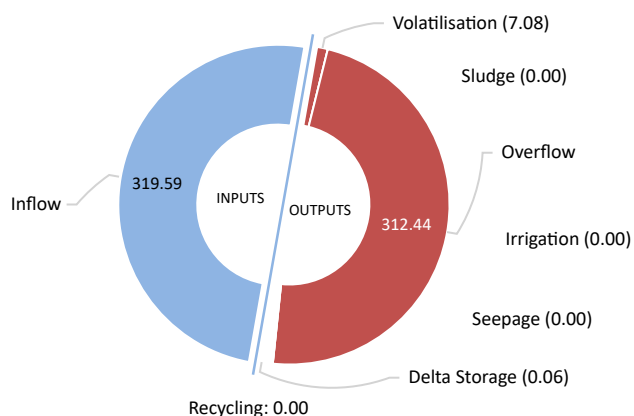
Annual reuse (fraction)

[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

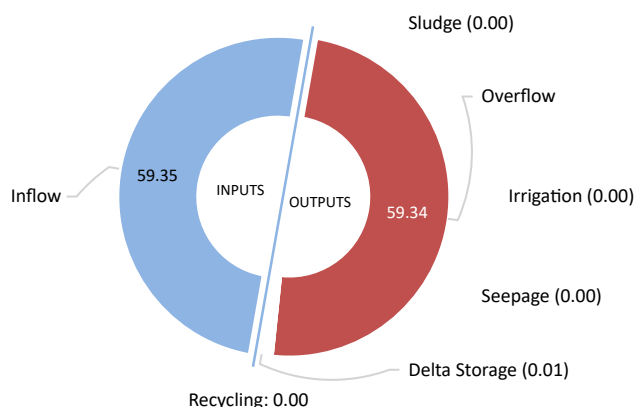
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



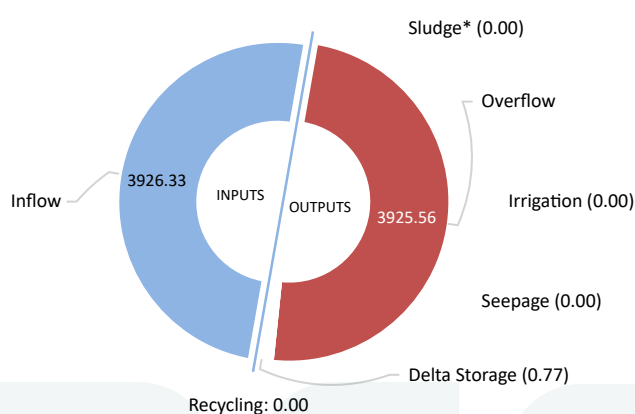
Name	Value
Inflow	319.59
Recycling	0.00
Volatilisation	7.08
Sludge	0.00
Overflow	312.44
Irrigation	0.00
Seepage	0.00
Delta Storage	0.06

Phosphorus Balance (kg/year)



Name	Value
Inflow	59.35
Recycling	0.00
Sludge	0.00
Overflow	59.34
Irrigation	0.00
Seepage	0.00
Delta Storage	0.01

Salt Balance (kg/year)



Name	Value
Inflow	3926.33
Recycling	0.00
Sludge*	0.00
Overflow	3925.56
Irrigation	0.00
Seepage	0.00
Delta Storage	0.77

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	34.01
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	34.01
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE

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Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	0.00
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	0.00
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	0.00
Average phosphorus concentration of irrigation water (mg/L)	0.00
Average salinity of irrigation water (dS/m)	0.00

Irrigation Diagnostics (No effluent irrigation occurred!):

Proportion Days Irrigation Turned Off (fraction)	1.00 (Hence no irrigation!)
Proportion of Days irrigation occurs (fraction)	0.00

PERFORMANCE



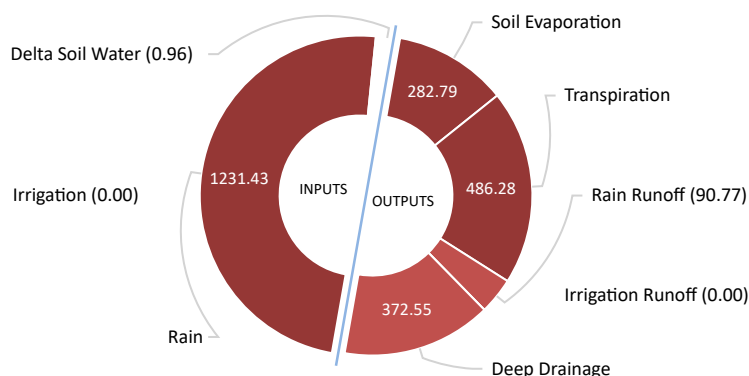
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

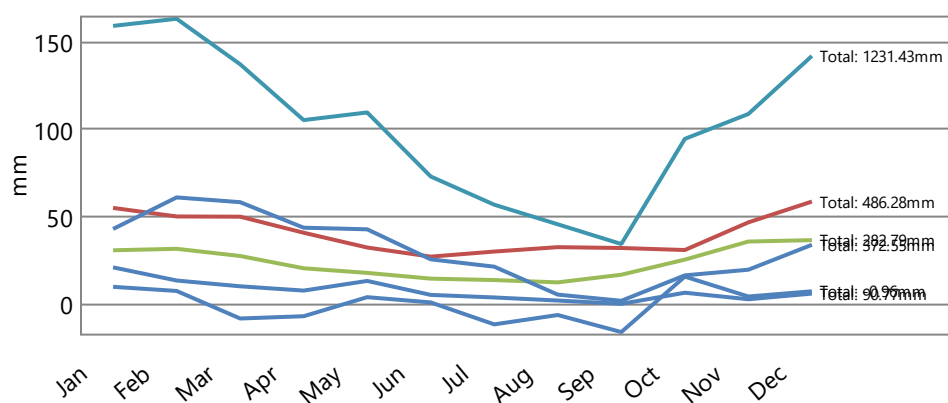
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	0.00
Soil Evaporation	282.79
Transpiration	486.28
Rain Runoff	90.77
Irrigation Runoff	0.00
Deep Drainage	372.55
Delta Soil Water	-0.96

Average Monthly Totals (mm):

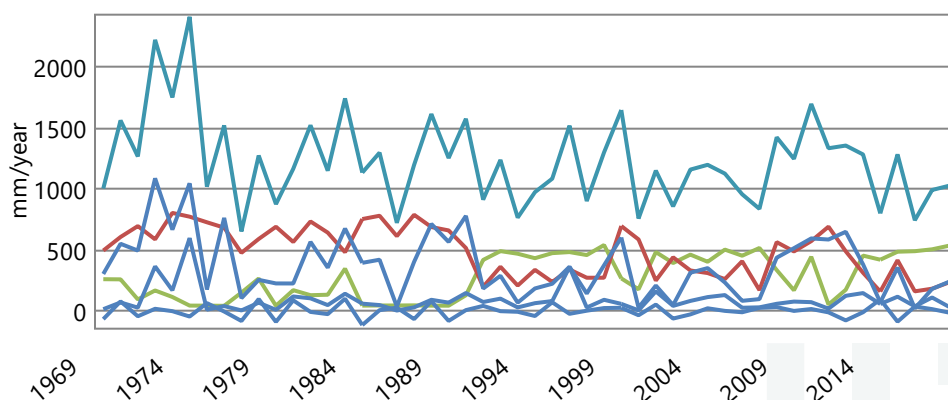
☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE

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Land Performance - Soil Nutrient

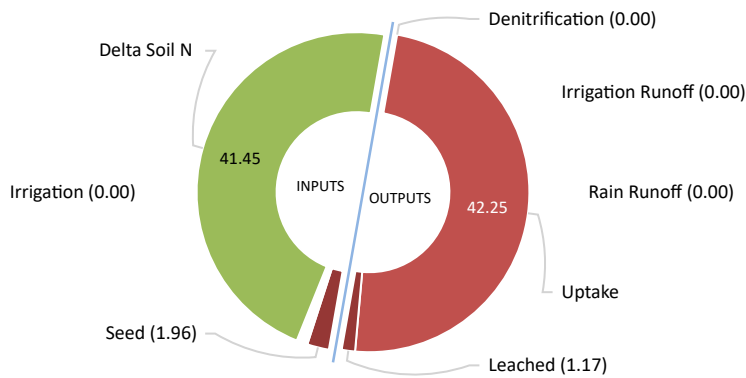
Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Irrigation ammonium volatilisation losses (kg/ha/year): 0.00

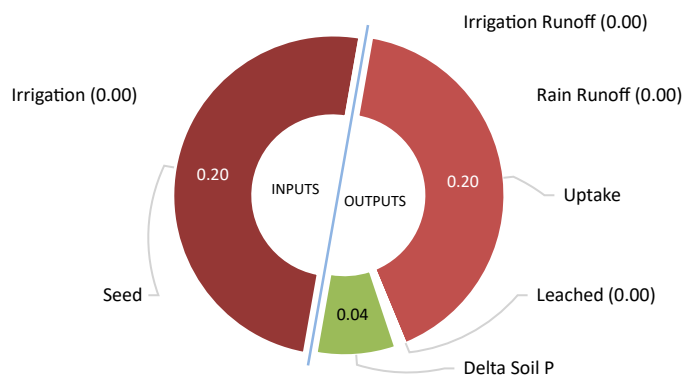
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	1.96
Irrigation	0.00
Denitrification	3.63E-05
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	42.25
Leached	1.17
Delta Soil N	-41.45

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	0.20
Irrigation	0.00
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	0.20
Leached	4.31E-05
Delta Soil P	0.04

PERFORMANCE

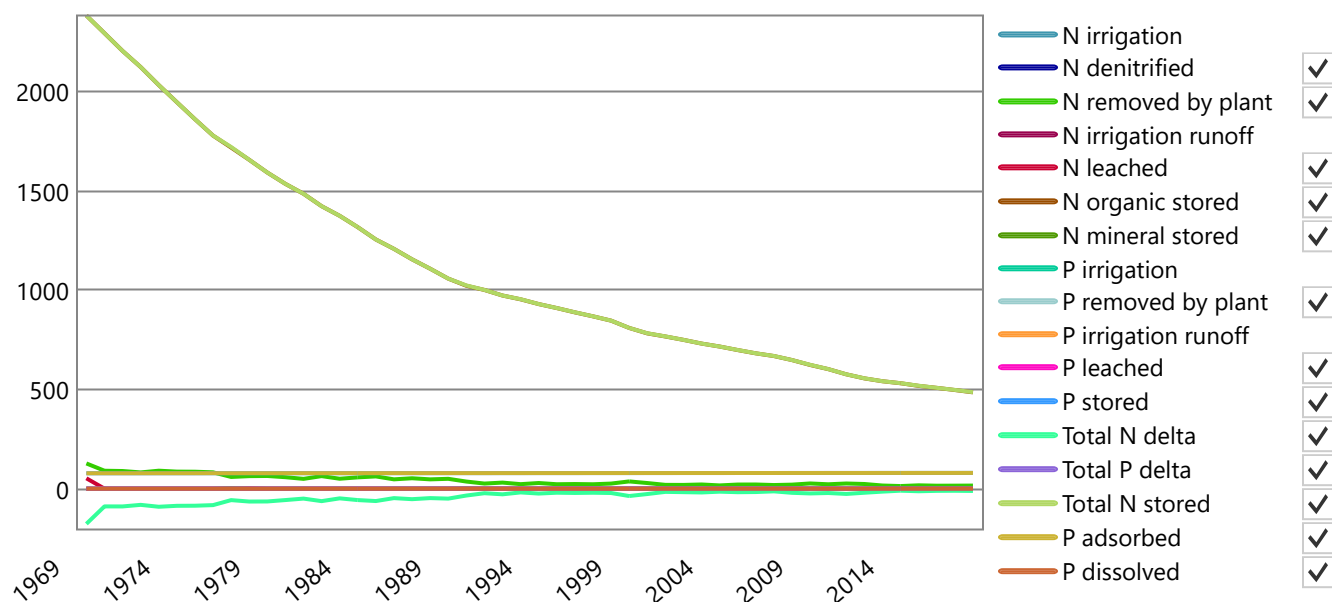


Land Performance - Soil Nutrient

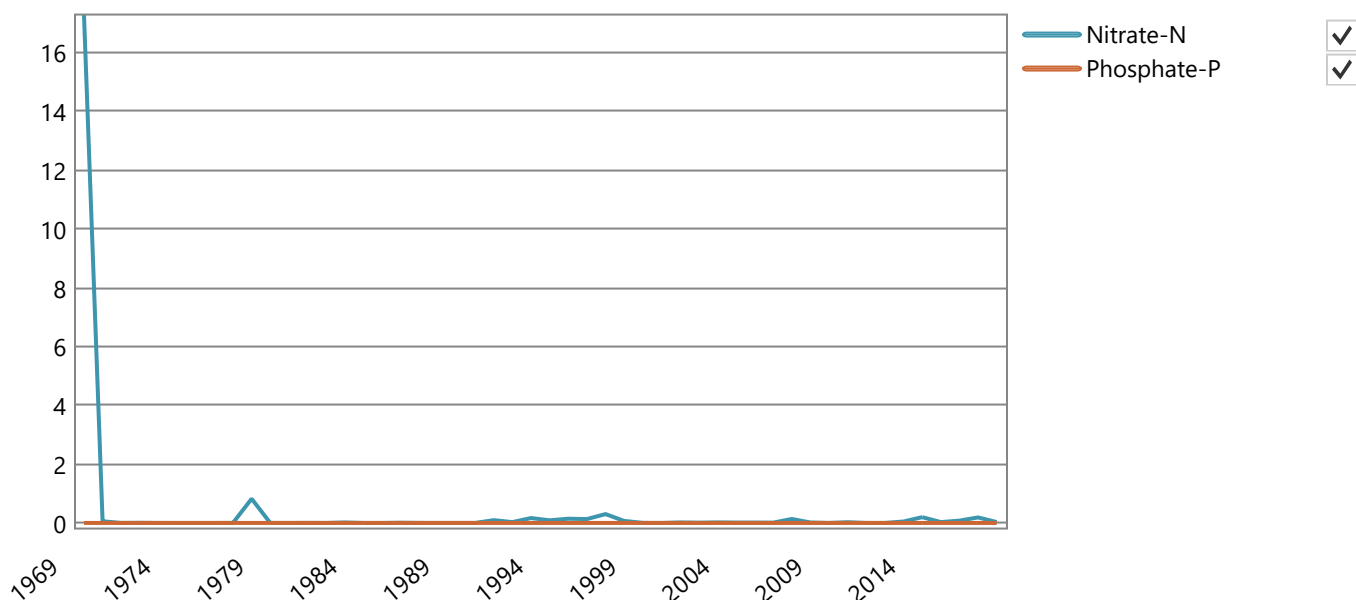
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE

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Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

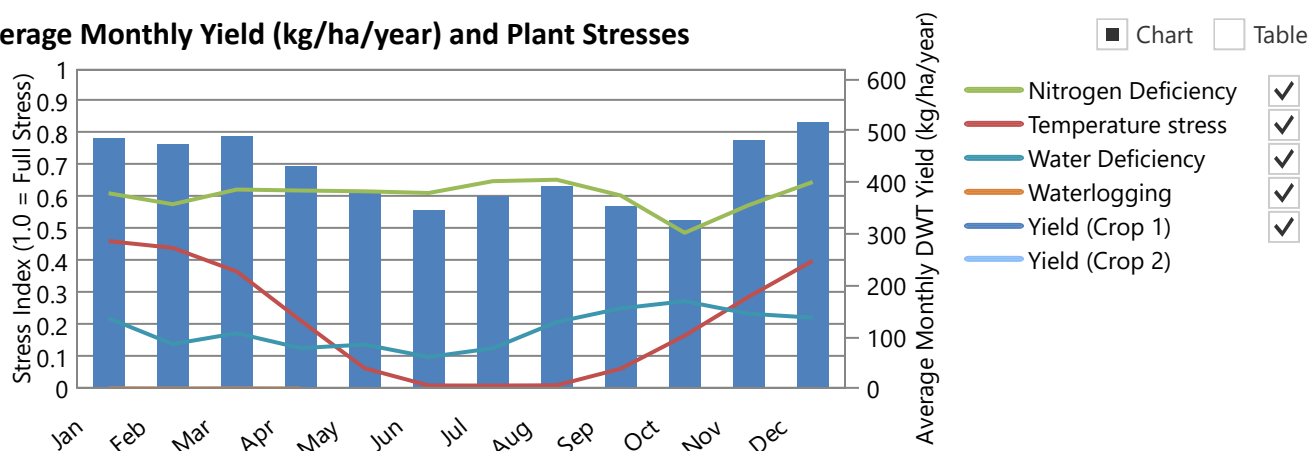
Plant: **Continuous Ryegrass 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	5113.00 (1924.18 - 8896.78)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.50 (0.38 - 0.55)
Average monthly root depth (mm) (minimum - maximum)	410.77 (329.31 - 447.76)

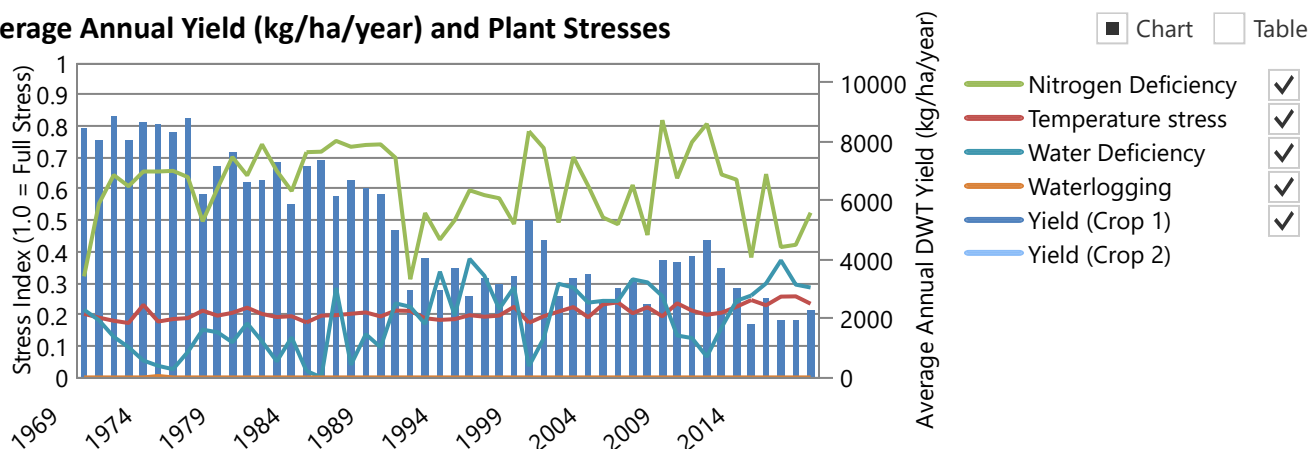
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	42.25 (13.45 - 127.21)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	0.20 (0.00 - 0.54)
Average annual shoot nitrogen concentration (fraction dwt)	0.01 (0.01 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.000 (0.000 - 0.000)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 0.86 (normal), 2.16 (forced by crop death due to water stress (2.16))

No. days without crop/year (days/year): 33.28 due to water stress (33.28)



Land Performance

Paddock: Default Paddock, 1.5 ha Soil Type: Greenacres Caravan Park

Plant: Continuous Ryegrass 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	5.60
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.08
No. years assumed for leaching to reach steady-state (years)	10.00

Soil Salinity:

Average Infiltrate Salinity (dS/m)	0.03
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Insufficient deep drainage to run steady state salinity calculations.

PERFORMANCE



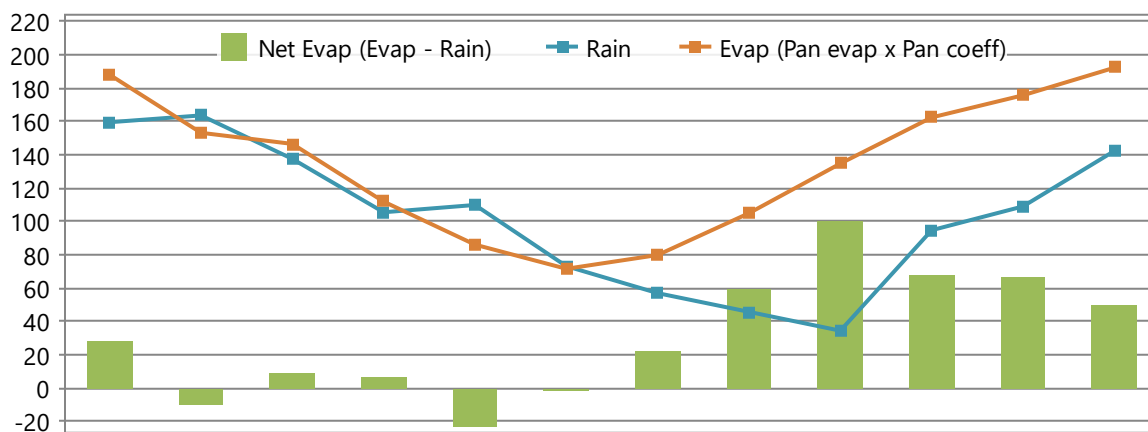
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: **Greenacres -27.55_153.20, -27.55°, 153.2°**

Run Period: **01/01/1969 to 31/12/2018** 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 9131.00 kL/year or 25.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

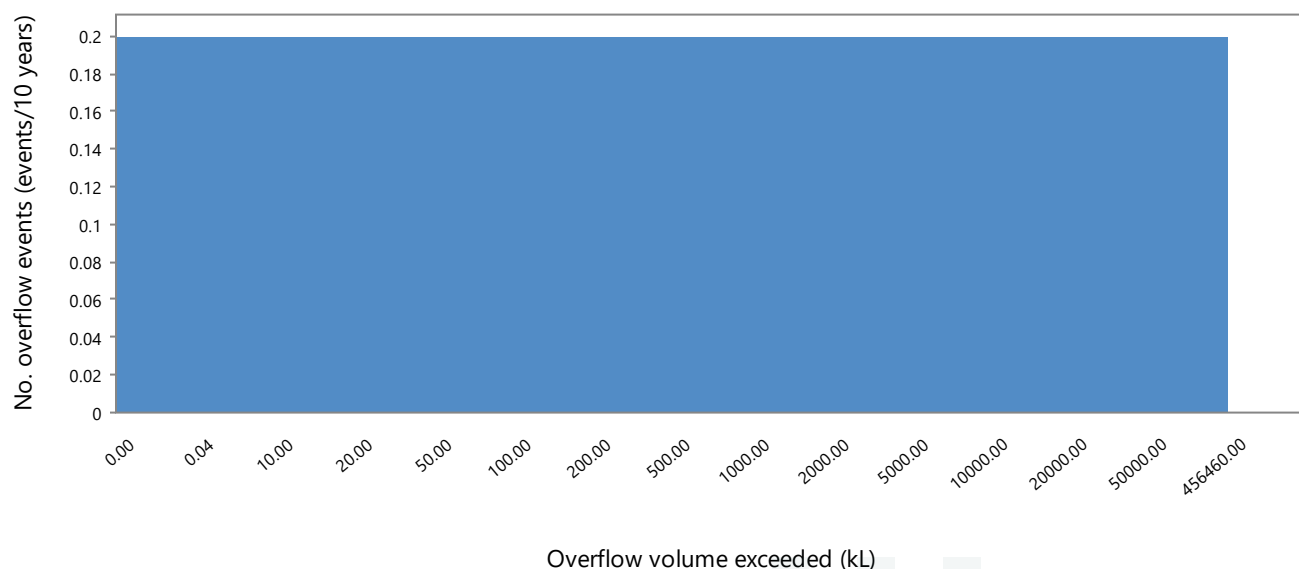
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.60
Average volume of overflow (kL/year)	9129.20
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	0.02
Average duration of overflow (days)	18259.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.00
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.57

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	0.00	0.00
Total nitrogen applied (kg)	0.00	0.00
Total phosphorus applied (kg)	0.00	0.00
Total salts applied (kg)	0.00	0.00

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is turned off (fraction)	1.00
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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 0.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 76.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	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
Soil Evap	30.7	31.6	27.5	20.4	17.8	14.5	13.6	12.3	16.7	25.4	35.8	36.6	282.8
Transpn.	55.0	50.1	50.0	40.8	32.3	27.1	30.0	32.5	32.0	30.9	46.7	58.7	486.3
Runoff	20.9	13.4	10.1	7.6	13.1	5.1	3.7	1.9	0.0	6.4	2.6	5.9	90.8
Drainage	43.0	61.1	58.3	43.7	42.8	25.5	21.3	5.3	1.8	16.3	19.6	33.9	372.6
Delta	9.8	7.4	-8.4	-7.1	3.8	0.8	-11.8	-6.4	-16.2	15.6	4.2	7.2	-1.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	0.00
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	42.25
Average annual soil nitrogen removed by denitrification (kg/ha/year)	3.63E-05
Average annual soil nitrogen leached (kg/ha/year)	1.17
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.17
Soil organic-N kg/ha (Initial - Final)	2448.00 - 485.06
	110.64 - 0.90
Average nitrate-N concentration of deep drainage (mg/L)	0.31
Max. annual nitrate-N concentration of deep drainage (mg/L)	17.29

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	0.00
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.20
Average annual soil phosphorus leached (kg/ha/year)	4.31E-05
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 3.00E-05
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 79.61
Average phosphate-P concentration in rootzone (mg/L)	2.99E-05
Average phosphate-P concentration of deep drainage (mg/L)	1.16E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	1.37E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.00 mg/L (years)	0.00

DIAGNOSTICS

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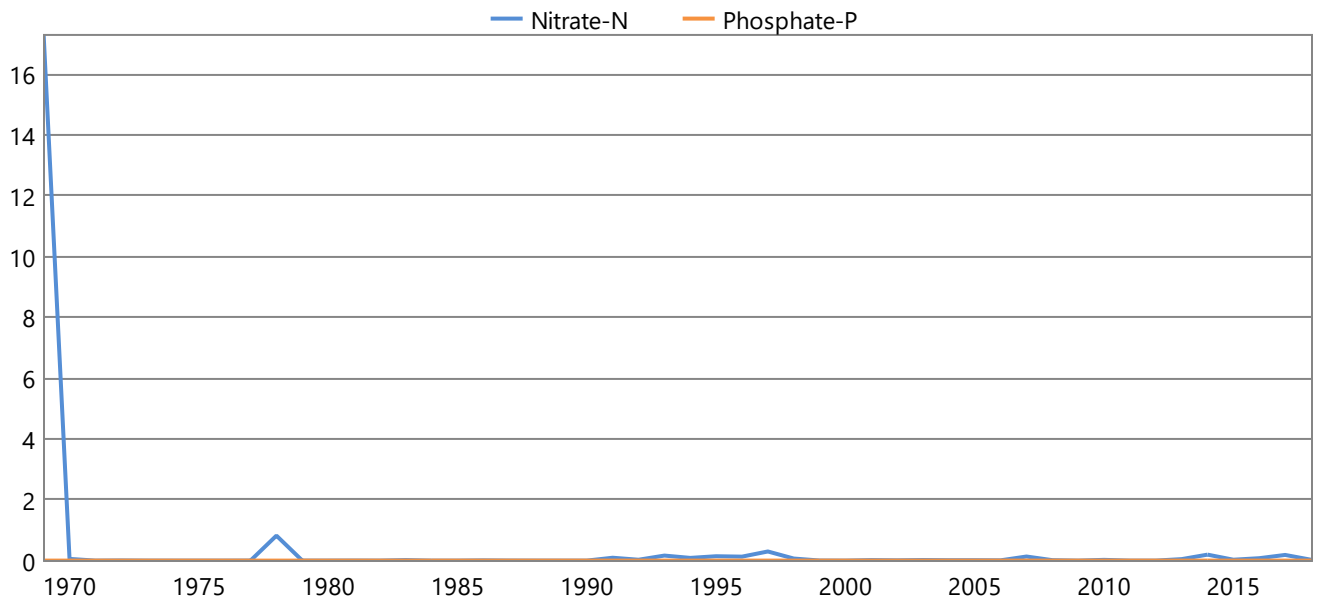
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

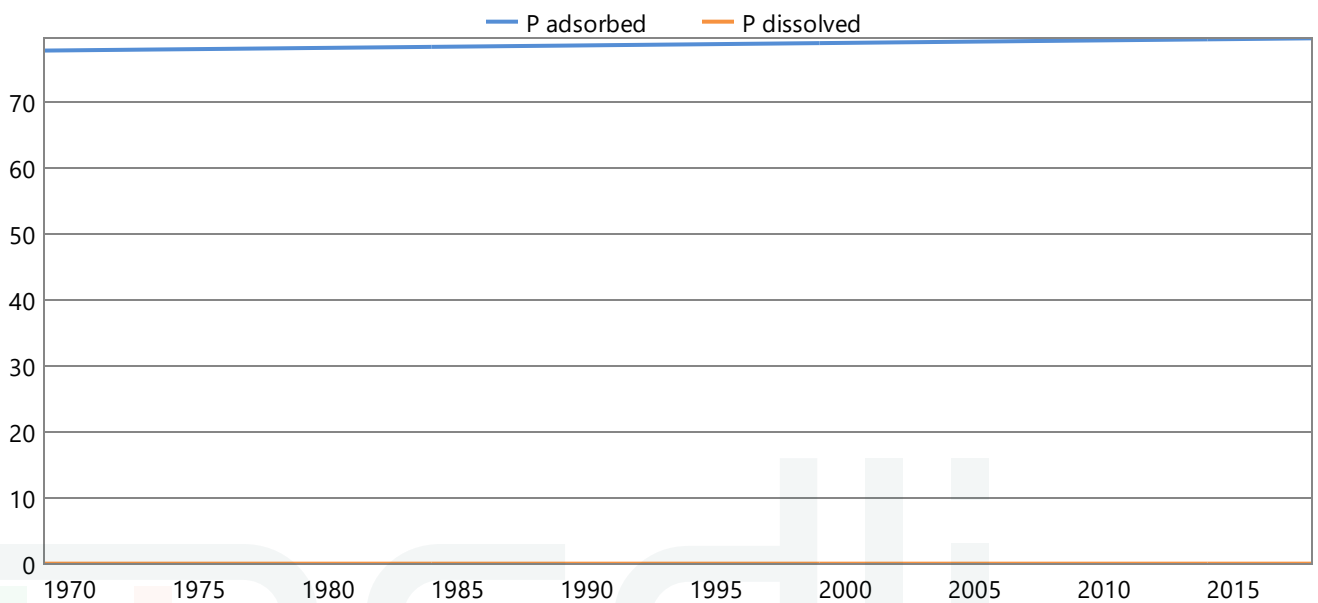
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Ryegrass_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Ryegrass 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	5113.00 (1924.18 - 8896.78)
Average monthly plant (green) cover (fraction)	0.50 (0.38 - 0.55)
Average monthly crop factor (fraction)	0.40 (0.30 - 0.44)
Total plant cover (both green and dead) left after harvest (fraction)	0.97
Average monthly root depth (mm)	410.77 (329.31 - 447.76)
Average number of normal harvests per year (no./year)	0.86 (0.00 - 3.00)
Average number of normal harvests for last five years only (no./year)	0.00
Average number of crop deaths per year (no./year)	2.16 (0.00 - 6.00)
Average number of crop deaths for last five years only (no./year)	4.80
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.31 - 0.82)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.46 (0.33 - 0.57)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.04)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.18 (0.10 - 0.27)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	33.28

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Insufficient deep drainage to run steady state salinity calculations.



Run Messages

Messages generated when the scenario was run:

This is a Dryland scenario
No effluent irrigation has occurred!
Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

Title: Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

Climate data location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

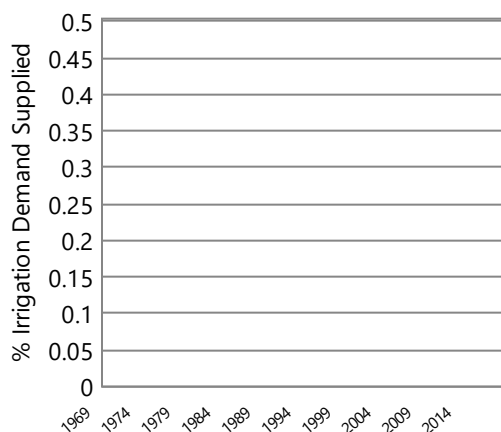
Average Annual %Irrigation Demand Supplied:

Potential annual irrigation when water supply is unlimited (kL/ha/year)	7112.1
Potential annual irrigation when water supply is unlimited (mm/year)	711.2
Annual irrigation predicted for defined scenario (kL/ha/year)	0.0
Annual irrigation predicted for defined scenario (mm/year)	0.0
Average annual irrigation demand supplied (fraction)	0.0

Or for 1.50 ha: 10668 kL/year

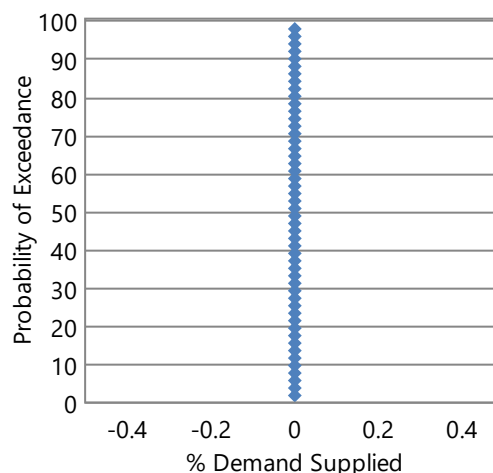
Annual % Irrigation Demand Supplied

☐ Table
☒ Chart



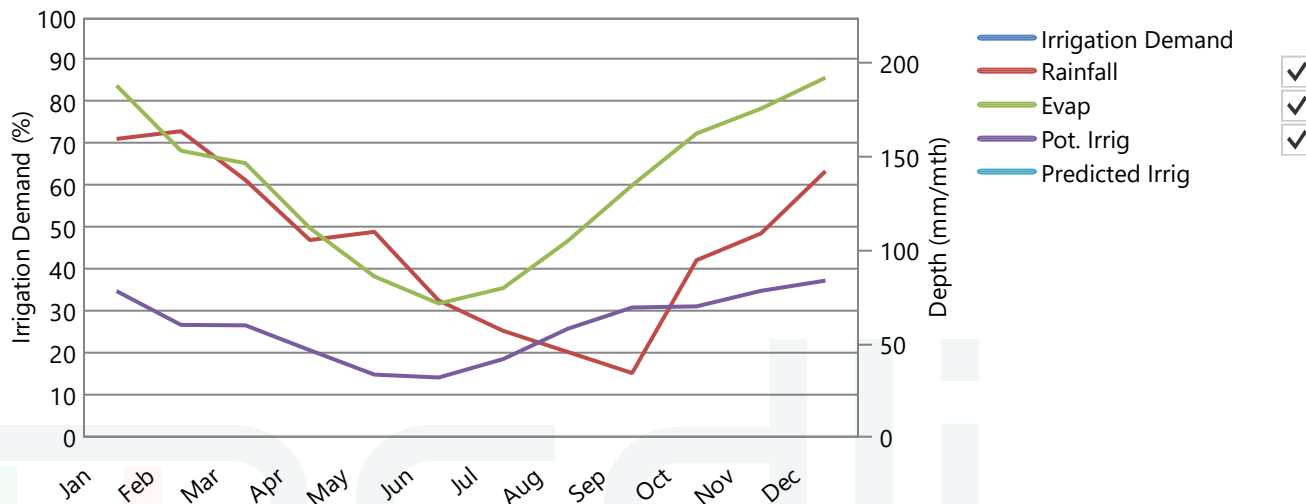
Probability of exceeding the % Irrigation Demand Supplied

☐ Table
☒ Chart



Monthly % Irrigation Demand Supplied

☒ Chart ☐ Table



Climate Data: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days

Climate Statistics:

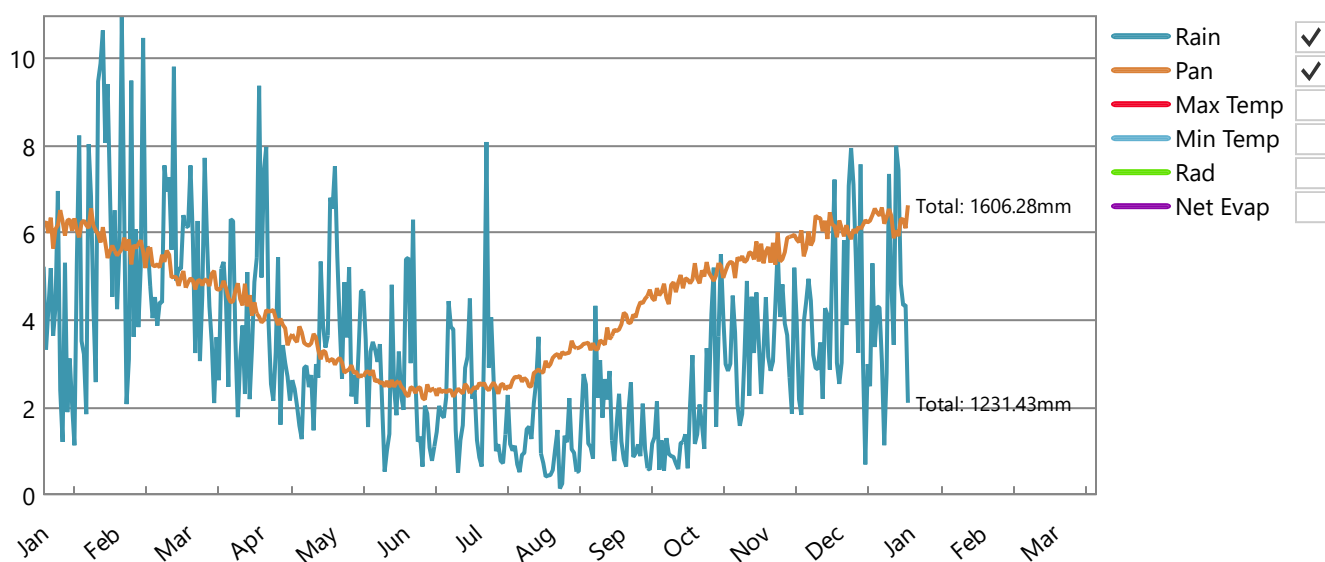
	5th ▾ Percentile	50th Percentile	95th ▾ Percentile
Rainfall (mm/year)	734	1199	1749
Pan Evaporation (mm/year)	1434	1607	1829

Climate Data:

☒ Chart ☐ Table

☐ Monthly ☒ Daily

Daily Average Across Run Period



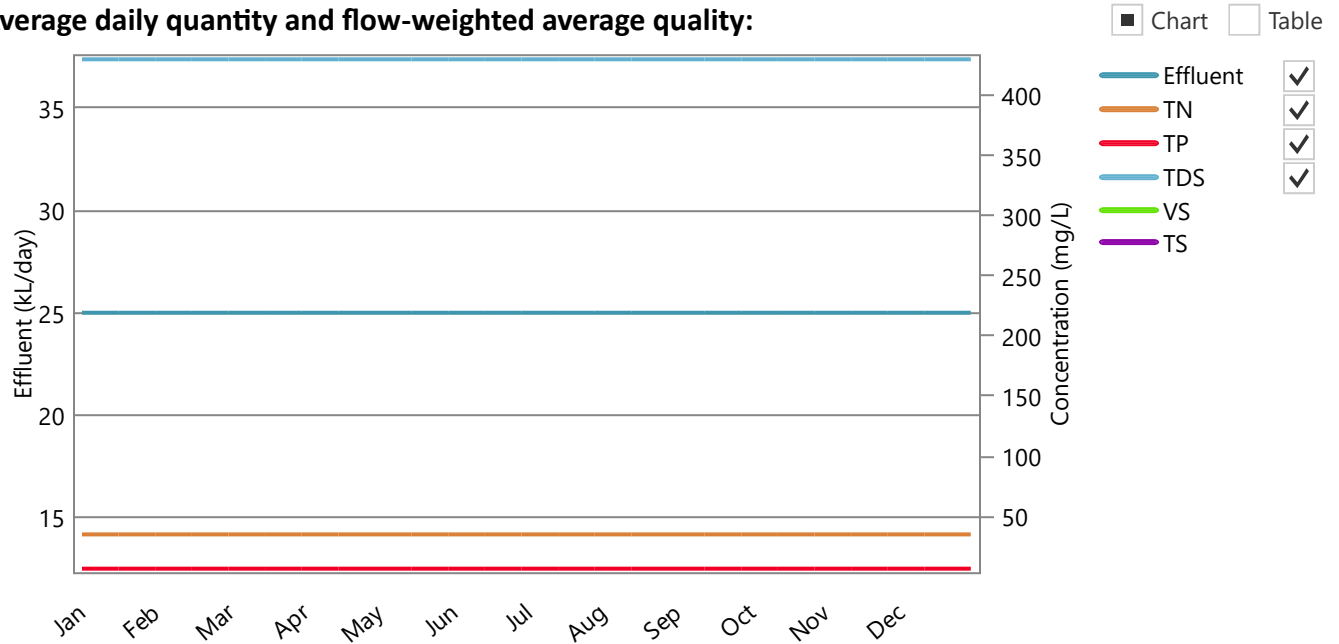
DESCRIPTION



Effluent type: New Generic System

Wastestream before any recycling or pretreatment

Average daily quantity and flow-weighted average quality:



Wastestream after any recycling and pretreatment if applicable

Effluent quantity: **9131.00 kL/year** or 25.00 kL/day (Min-Max: 25.00 - 25.00)

Flow-weighted average (minimum - maximum) daily effluent quality entering pond system:

	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

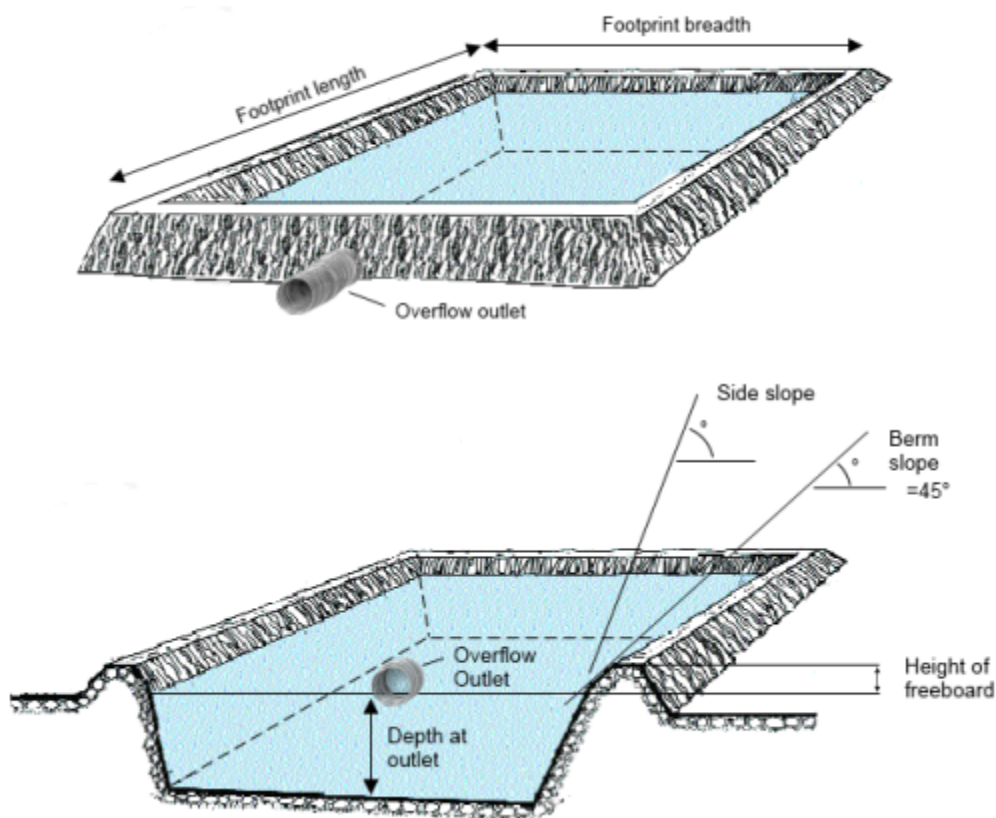
DESCRIPTION

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Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (kL)	90.00
Minimum allowable pond volume (kL)	1.24
Pond depth at overflow outlet (m)	2.18
Maximum water surface area (m2)	41.31
Pond footprint length (m)	7.63
Pond footprint width (m)	7.63
Pond catchment area (m2)	58.17
Average active volume (kL)	89.99



Irrigation pump limits:

Minimum pump rate per area limit (ML/day/ha)	0.00
Maximum pump rate per area limit (ML/day/ha)	1.00

Shandying water:

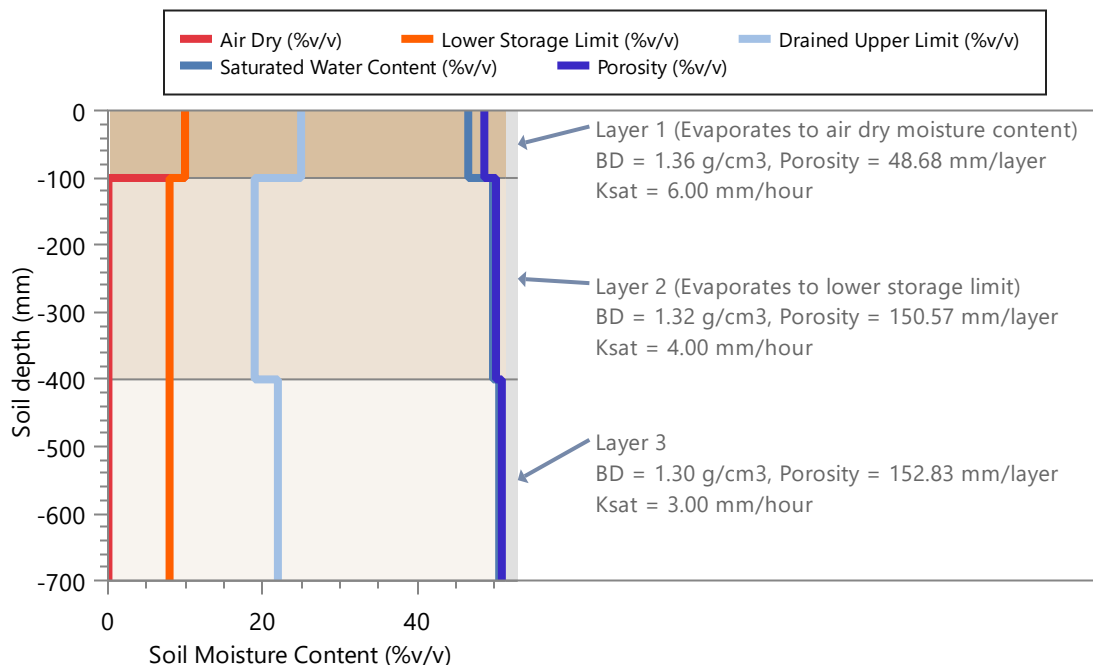
Annual allocation of fresh water available for shandying (kL/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

Land: Default Paddock

Area (ha): 1.50

Soil Type: Greenacres Caravan Park, 700.00 mm defined profile depth

Profile Porosity (mm)	352.08
Profile saturation water content (mm)	347.80
Profile drained upper limit (or field capacity) (mm)	148.00
Profile lower storage limit (or permanent wilting point) (mm)	58.00
Profile available water capacity (mm)	90.00
Profile limiting saturated hydraulic conductivity (mm/hour)	3.00
Surface saturated hydraulic conductivity (mm/hour)	6.00
Runoff curve number II (coefficient)	88.00
Soil evaporation U (mm)	9.00
Soil evaporation Cona (mm/sqrt day)	4.00



Plant Data: Continuous Kikuyu 1 Pasture

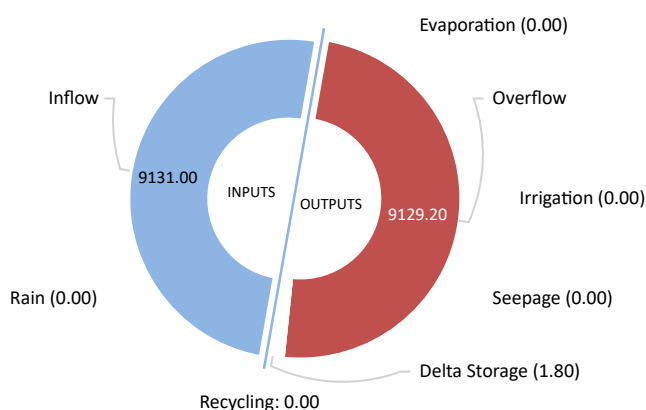
Average monthly cover (fraction) (minimum - maximum)	0.59 (0.34 - 0.70)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	700.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03



Pond System Water Performance - Overflow: 1 closed storage tank

Capacity of wet weather storage pond: **90 kL**

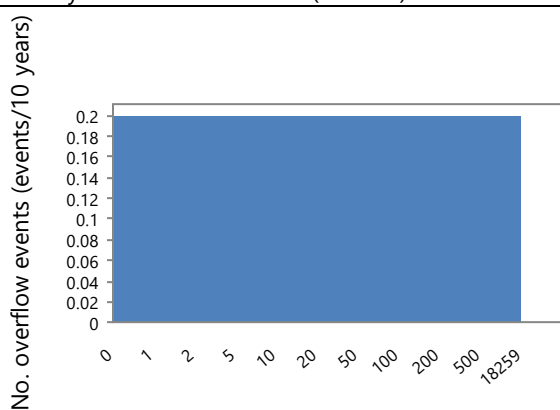
Pond System Water Balance (kL/year)



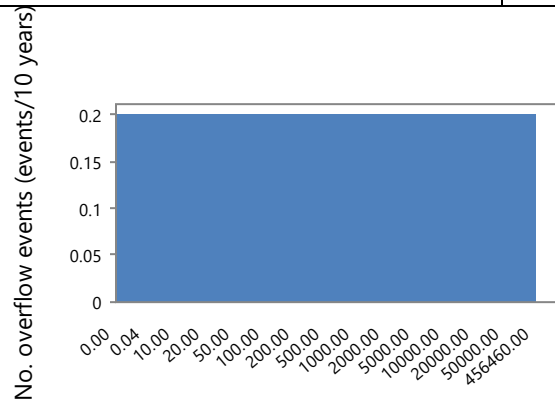
Name	Value
Rain	0.00
Inflow	9131.00
Recycling	0.00
Evaporation	0.00
Overflow	9129.20
Irrigation	0.00
Seepage	0.00
Delta Storage	1.80

Overflow Diagnostics

Volume of overflow (kL/year)	9129.20
No. days pond overflows (days/year)	365.18
Average duration of overflow (days)	18259.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.00
Probability of at least 90% reuse (fraction)	0.00



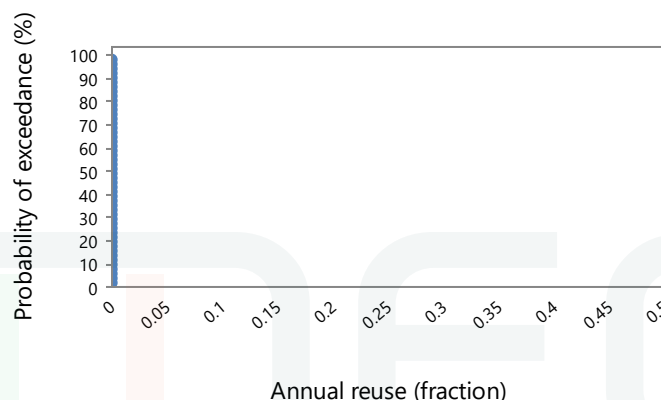
Overflow event duration exceeded (days)



Overflow volume exceeded (kL)

[Export plot](#)

[Export plot](#)



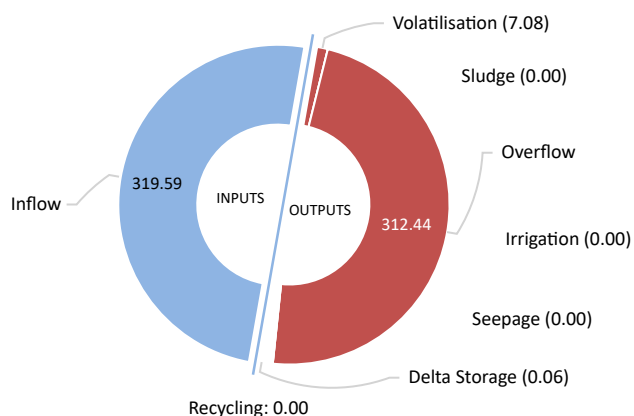
Annual reuse (fraction)

[Export plot](#)

Pond System Performance - Nutrient: 1 closed storage tank

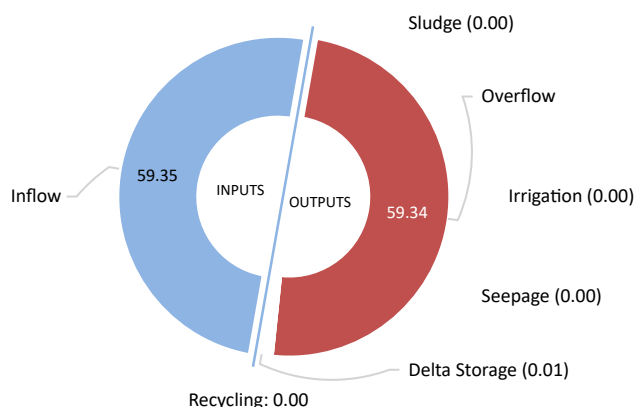
Pond System Nutrients and Salt Balance:

Nitrogen Balance (kg/year)



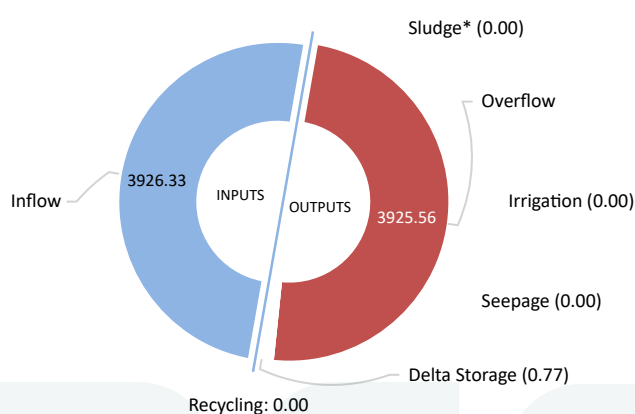
Name	Value
Inflow	319.59
Recycling	0.00
Volatilisation	7.08
Sludge	0.00
Overflow	312.44
Irrigation	0.00
Seepage	0.00
Delta Storage	0.06

Phosphorus Balance (kg/year)



Name	Value
Inflow	59.35
Recycling	0.00
Sludge	0.00
Overflow	59.34
Irrigation	0.00
Seepage	0.00
Delta Storage	0.01

Salt Balance (kg/year)



Name	Value
Inflow	3926.33
Recycling	0.00
Sludge*	0.00
Overflow	3925.56
Irrigation	0.00
Seepage	0.00
Delta Storage	0.77

* Salt removal in sludge is not calculated from the pond salt balance. However if salt could be assumed to be present in the sludge at the same concentration as in the pond supernatant (up to a maximum of salt added in inflow) - then salt accumulation in the sludge could be 0.00 kg/year

Pond System Sludge Accumulation: 0.00 kg dwt/year

Pond System Performance - Nutrient: 1 closed storage tank

Pond Nutrient Concentrations and Salinity:

Average across simulation period	Pond 1
Average nitrogen concentration of pond liquid (mg/L)	34.01
Average phosphorus concentration of pond liquid (mg/L)	6.50
Average salinity of pond liquid (dS/m)	0.67

Value on final day of simulation period	Pond 1
Final nitrogen concentration of pond liquid (mg/L)	34.01
Final phosphorus concentration of pond liquid (mg/L)	6.50
Final salinity of pond liquid (dS/m)	0.67

PERFORMANCE



Irrigation Performance:

Water Use: (assumes 100% Irrigation Efficiency)

Pond water irrigated (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Total water irrigated (kL/year)	0.00
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Proportion of years shandying water allocation of 0 kL/year is exceeded (fraction of years)	0.00
Average exceedance as a proportion of annual shandy water allocation (fraction of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)

Irrigation Quality:

Average nitrogen concentration of irrigation water - before ammonia loss during irrigation (mg/L)	0.00
Average nitrogen concentration of irrigation water - after ammonia loss during irrigation (mg/L)	0.00
Average phosphorus concentration of irrigation water (mg/L)	0.00
Average salinity of irrigation water (dS/m)	0.00

Irrigation Diagnostics (No effluent irrigation occurred!):

Proportion Days Irrigation Turned Off (fraction)	1.00 (Hence no irrigation!)
Proportion of Days irrigation occurs (fraction)	0.00



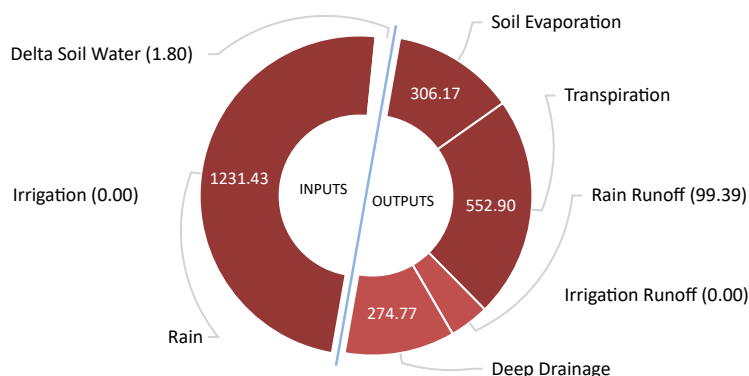
Land Performance - Soil Water

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth**

Land Water Balance (mm/year):

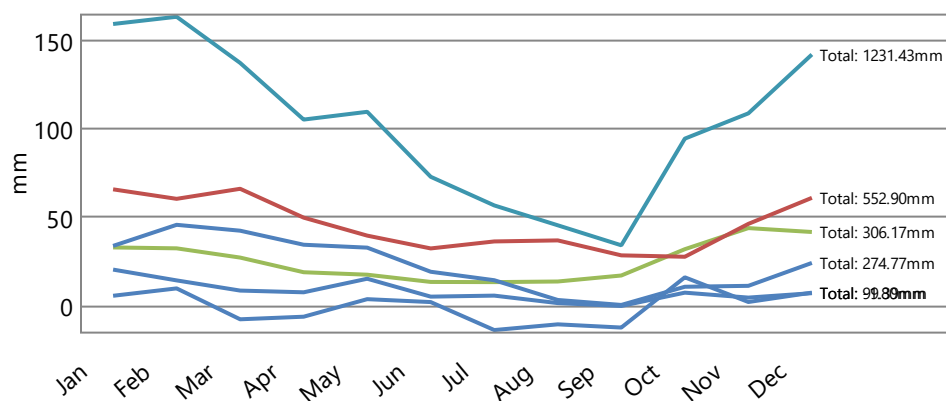
☒ mm/year ☐ % Total inputs



Name	Value
Rain	1231.43
Irrigation	0.00
Soil Evaporation	306.17
Transpiration	552.90
Rain Runoff	99.39
Irrigation Runoff	0.00
Deep Drainage	274.77
Delta Soil Water	-1.80

Average Monthly Totals (mm):

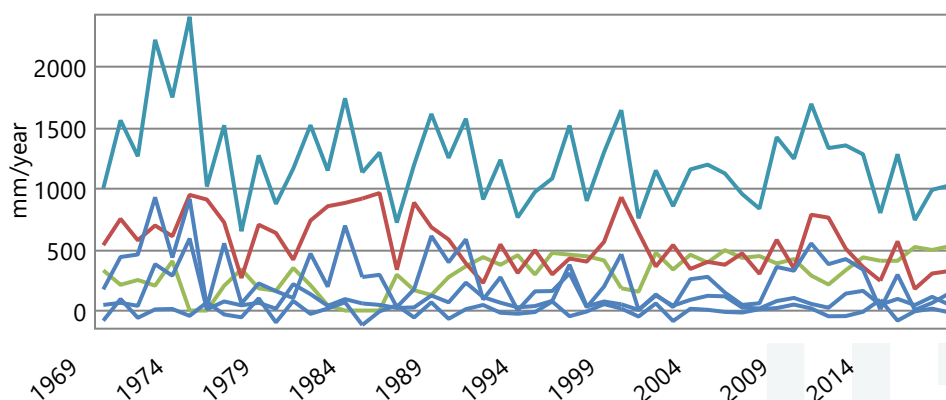
☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

Average Annual Totals (mm/year):

☒ Chart ☐ Table



- ☒ Rain
- ☒ Irrigation
- ☒ Soil Evap
- ☒ Transpn.
- ☒ Rain Runoff
- ☒ Irrigation Runoff
- ☒ Deep Drainage
- ☒ Delta Soil Water

PERFORMANCE

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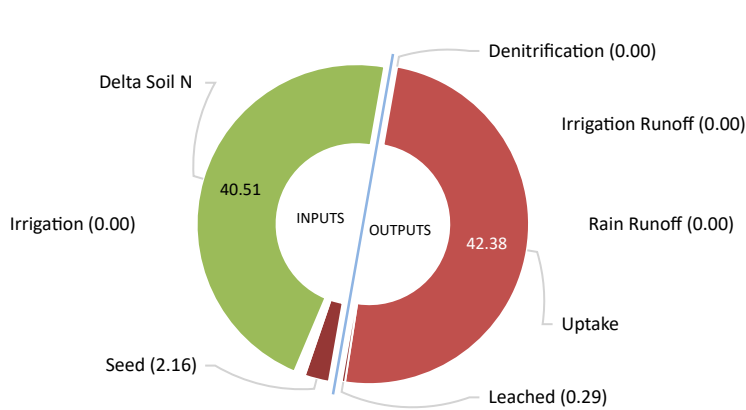
Land Performance - Soil Nutrient

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

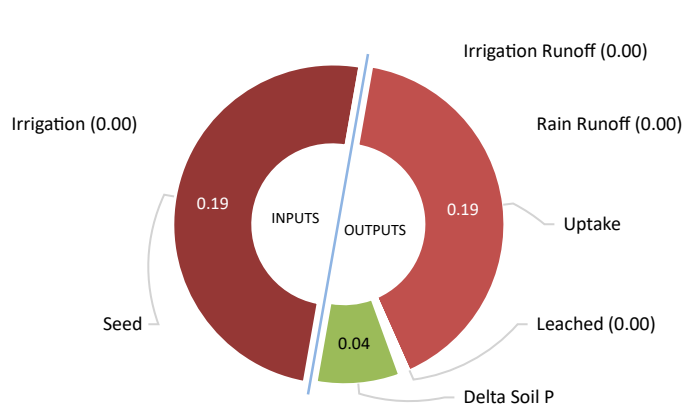
Irrigation ammonium volatilisation losses (kg/ha/year): 0.00
Proportion of total nitrogen in irrigated effluent as ammonium (fraction): 0.20

Land Nitrogen Balance (kg/ha/year)



Name	Value
Seed	2.16
Irrigation	0.00
Denitrification	2.94E-05
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	42.38
Leached	0.29
Delta Soil N	-40.51

Land Phosphorus Balance (kg/ha/year)



Name	Value
Seed	0.19
Irrigation	0.00
Irrigation Runoff	0.00
Rain Runoff	0.00
Uptake	0.19
Leached	3.15E-05
Delta Soil P	0.04

PERFORMANCE

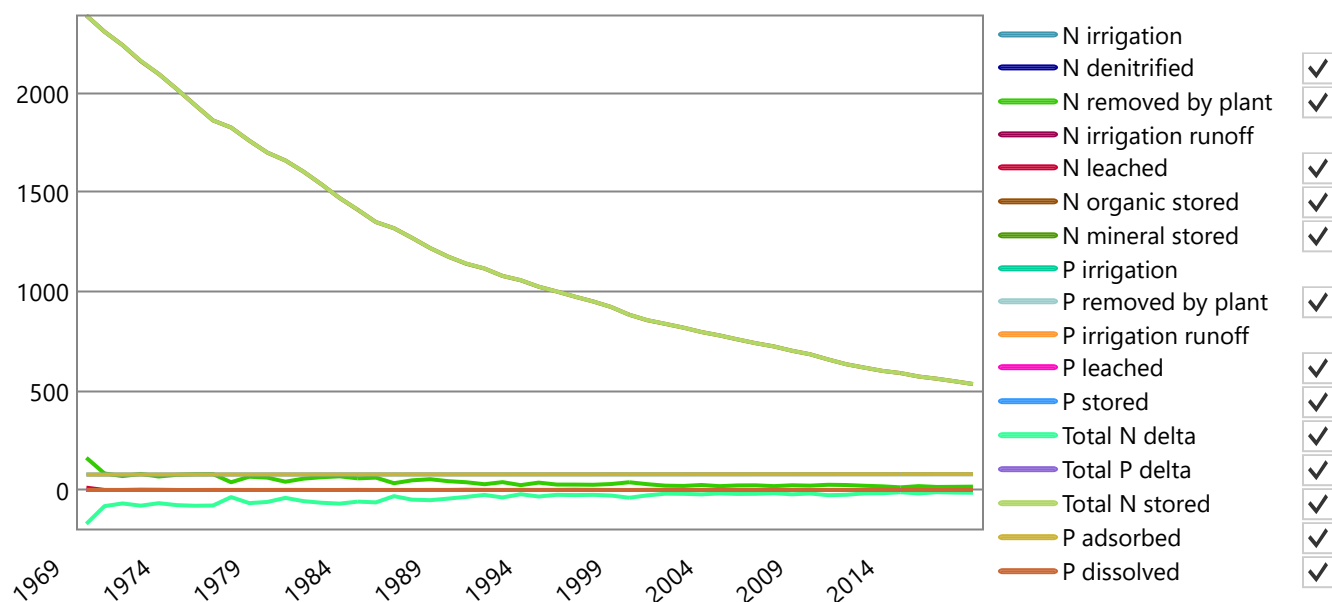


Land Performance - Soil Nutrient

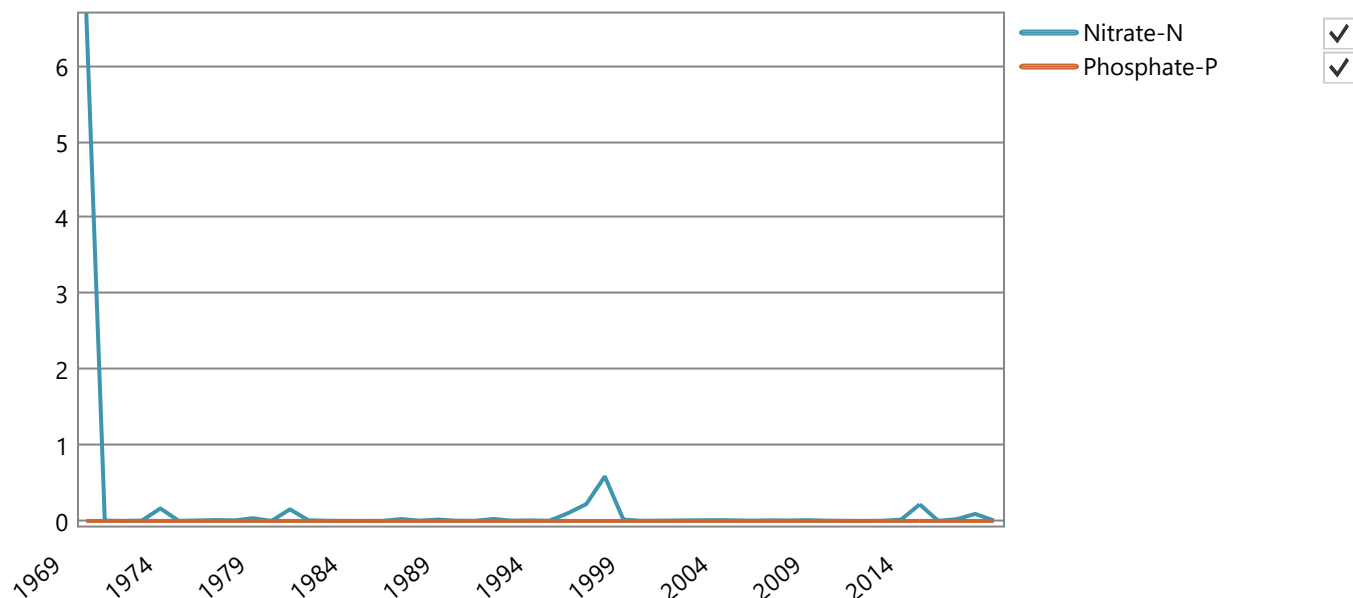
Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

Annual Nutrient Totals (kg/ha):



Annual Nutrient Leaching Concentration (mg/L):



PERFORMANCE

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Plant Performance and Nutrients

Paddock: **Default Paddock, 1.5 ha**

Soil Type: **Greenacres Caravan Park**

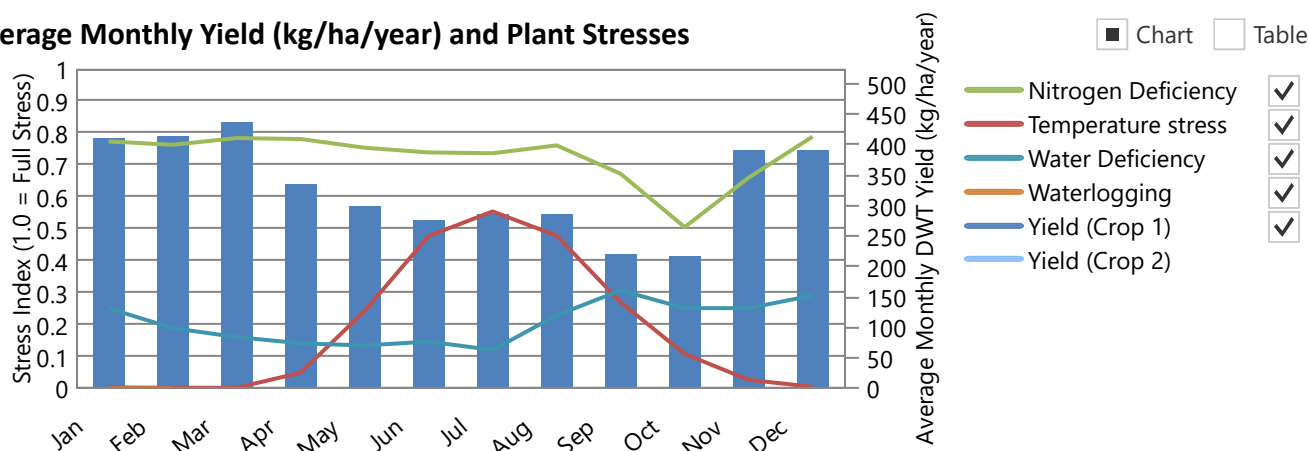
Plant: **Continuous Kikuyu 1 Pasture**

Average annual shoot dry matter yield (kg/ha/year)	4028.56 (1367.19 - 10366.03)
Average monthly plant (green) cover (fraction) (minimum - maximum)	0.59 (0.34 - 0.70)
Average monthly root depth (mm) (minimum - maximum)	557.64 (353.13 - 632.71)

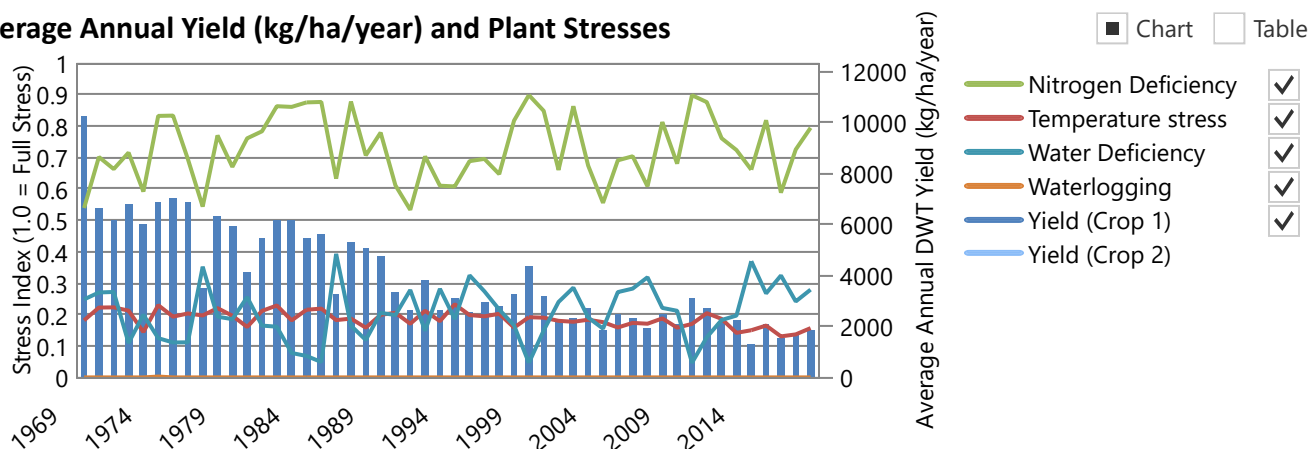
Nutrient Uptake (minimum - maximum):

Average annual net nitrogen removed by plant uptake (kg/ha/year)	42.38 (13.16 - 162.01)
Average annual net phosphorus removed by plant uptake (kg/ha/year)	0.19 (0.00 - 0.36)
Average annual shoot nitrogen concentration (fraction dwt)	0.01 (0.01 - 0.02)
Average annual shoot phosphorus concentration (fraction dwt)	0.000 (0.000 - 0.000)

Average Monthly Yield (kg/ha/year) and Plant Stresses



Average Annual Yield (kg/ha/year) and Plant Stresses



No. of harvests/year: 0.30 (normal), 2.04 (forced by crop death due to water stress (2.04))

No. days without crop/year (days/year): 30.52 due to temperature stress - not frost (0.02), water stress (30.50)

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Land Performance

Paddock: Default Paddock, 1.5 ha

Soil Type: Greenacres Caravan Park

Plant: Continuous Kikuyu 1 Pasture

Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03
No. years assumed for leaching to reach steady-state (years)	10.00

Soil Salinity:

Average Infiltrate Salinity (dS/m)	0.03
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Insufficient deep drainage to run steady state salinity calculations.

PERFORMANCE



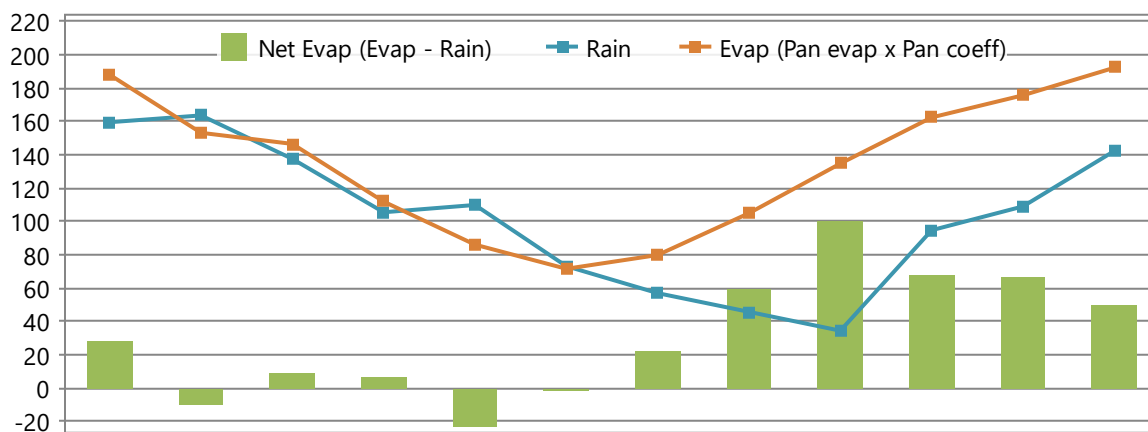
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

Averaged Historical Climate Data Used in Simulation (mm)

Location: Greenacres -27.55_153.20, -27.55°, 153.2°

Run Period: 01/01/1969 to 31/12/2018 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Evap	188.0	153.1	146.5	111.8	86.0	71.5	79.8	104.9	134.7	162.3	175.6	192.2	1606.3
Net Evap	28.5	-10.4	9.0	6.4	-23.8	-1.6	22.9	59.2	100.3	67.7	66.7	50.0	374.9
Net Evap/day	0.9	-0.4	0.3	0.2	-0.8	-0.1	0.7	1.9	3.3	2.2	2.2	1.6	1.0

DIAGNOSTICS

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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

Pond System: 1 closed storage tank

New Generic System - 9131.00 kL/year or 25.00 kL/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.24 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	35.00 (35.00 - 35.00)	319.59 (319.38 - 320.25)
Total Phosphorus	6.50 (6.50 - 6.50)	59.35 (59.31 - 59.48)
Total Dissolved Salts	430.00 (430.00 - 430.00)	3926.33 (3923.75 - 3934.50)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

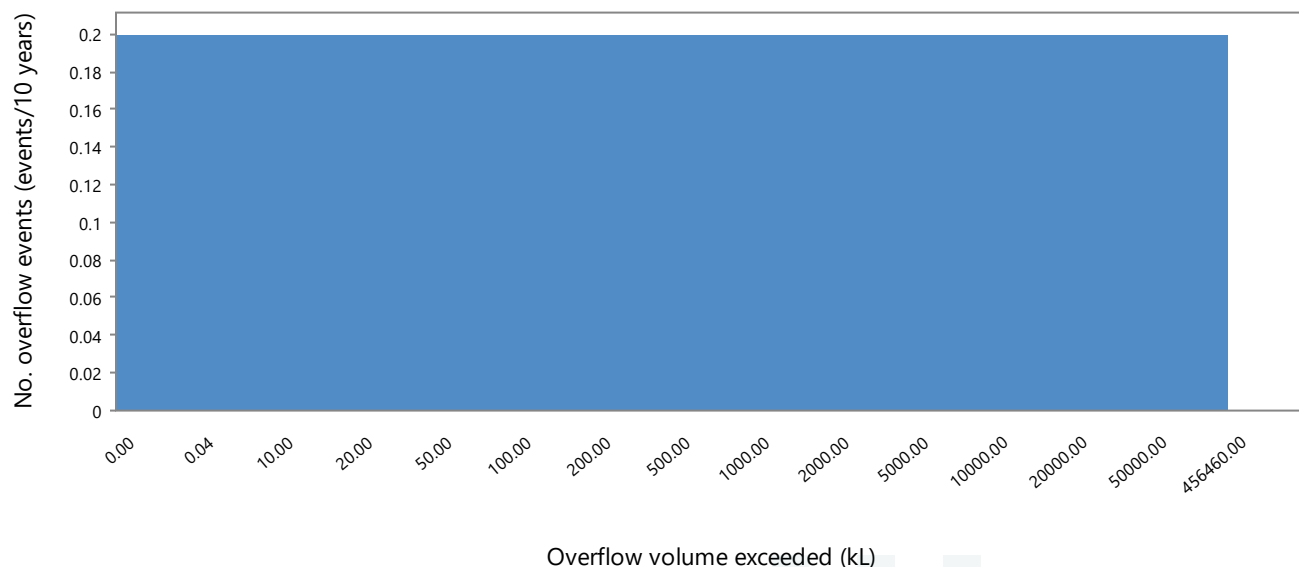
Last pond (Wet weather store): 90.00 kL

Theoretical hydraulic retention time (days)	3.60
Average volume of overflow (kL/year)	9129.20
No. overflow events per year exceeding threshold* of 0.04 kL (no./year)	0.02
Average duration of overflow (days)	18259.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.00
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.67
Ammonia loss from pond system water area (kg/m2/year)	8.57

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

☒ Chart ☐ Table



[Export plot](#)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

Irrigation Information

Irrigation: 1.5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (kL)	0.00	0.00
Total nitrogen applied (kg)	0.00	0.00
Total phosphorus applied (kg)	0.00	0.00
Total salts applied (kg)	0.00	0.00

Shandying

Annual allocation of fresh water for shandying (kL/year)	0.00
Average Shandy water irrigation (kL/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is turned off (fraction)	1.00
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Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 0.00 mm and rainfall is less than or equal to 20.00 mm
Irrigate a fixed amount of 0.00 mm each day
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Greenacres Caravan Park, 90.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	159.5	163.6	137.5	105.4	109.8	73.1	56.9	45.6	34.3	94.6	108.9	142.2	1231.4
Irrigation	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
Soil Evap	33.1	32.6	27.4	19.1	17.7	13.6	13.5	13.9	17.2	32.1	44.1	41.9	306.2
Transpn.	66.0	60.6	66.3	50.0	39.8	32.6	36.5	37.1	28.6	27.9	46.4	61.2	552.9
Runoff	20.6	14.5	8.7	7.8	15.4	5.3	5.9	1.6	0.0	7.6	4.8	7.3	99.4
Drainage	34.0	45.9	42.6	34.6	33.0	19.4	14.6	3.4	0.6	10.9	11.4	24.4	274.8
Delta	5.8	10.0	-7.5	-6.0	3.9	2.2	-13.6	-10.4	-12.2	16.2	2.3	7.6	-1.8

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	0.00
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	42.38
Average annual soil nitrogen removed by denitrification (kg/ha/year)	2.94E-05
Average annual soil nitrogen leached (kg/ha/year)	0.29
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.29
Soil organic-N kg/ha (Initial - Final)	2448.00 - 533.27
	110.64 - 0.10
Average nitrate-N concentration of deep drainage (mg/L)	0.10
Max. annual nitrate-N concentration of deep drainage (mg/L)	6.70

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	0.00
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.19
Average annual soil phosphorus leached (kg/ha/year)	3.15E-05
Dissolved phosphorus (kg/ha) (Initial - Final)	0.00 - 3.00E-05
Adsorbed phosphorus (kg/ha) (Initial - Final)	77.71 - 79.62
Average phosphate-P concentration in rootzone (mg/L)	2.93E-05
Average phosphate-P concentration of deep drainage (mg/L)	1.15E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	1.47E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.00 mg/L (years)	0.00

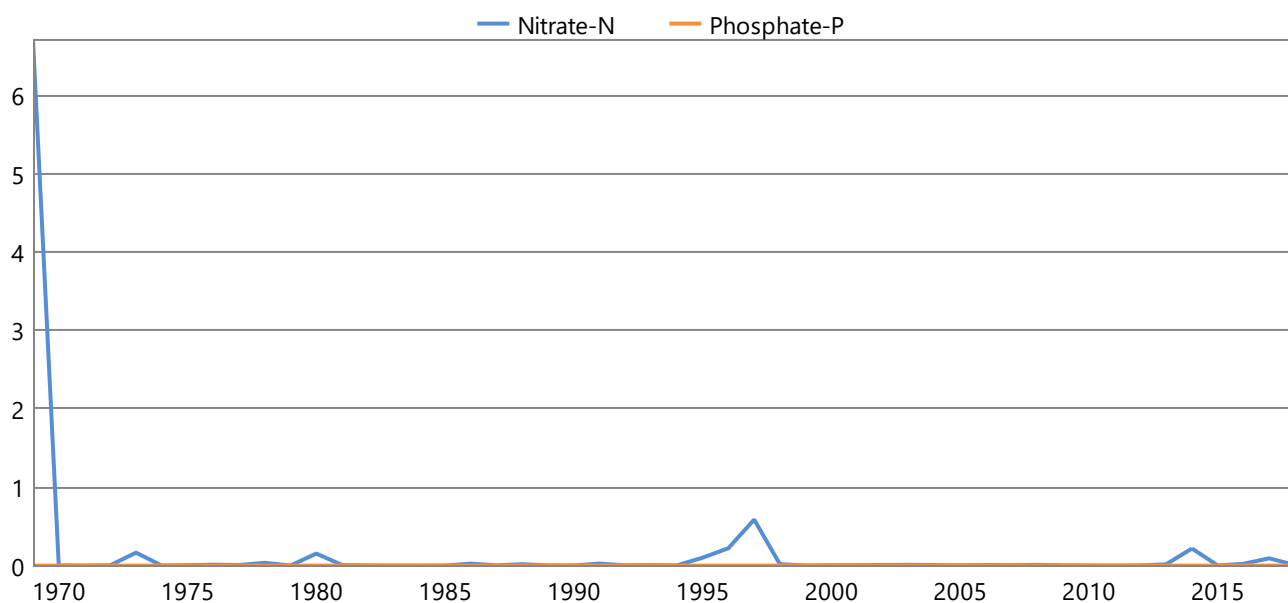
Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

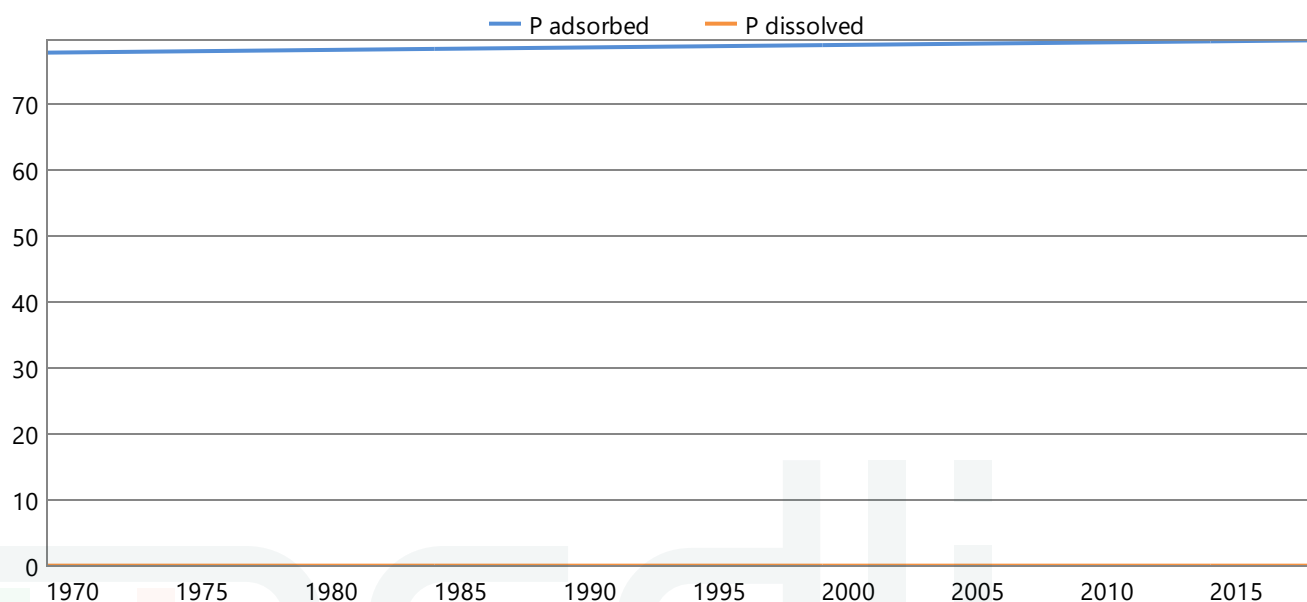
Paddock Land: Default Paddock: 1.5 ha

Irrigation: Flood with 0.1% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



Sustainability Diagnostics:

Greenacres_F25_TN35_TP65_Tank90_Irr0_Kikuyu_1-5ha_FM_190808_20mmRFC

Paddock Plant Performance: Default Paddock: 1.5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture

Average annual shoot dry matter yield (kg/ha/year)	4028.56 (1367.19 - 10366.03)
Average monthly plant (green) cover (fraction)	0.59 (0.34 - 0.70)
Average monthly crop factor (fraction)	0.47 (0.27 - 0.56)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	557.64 (353.13 - 632.71)
Average number of normal harvests per year (no./year)	0.30 (0.00 - 2.00)
Average number of normal harvests for last five years only (no./year)	0.00
Average number of crop deaths per year (no./year)	2.04 (0.00 - 4.00)
Average number of crop deaths for last five years only (no./year)	2.80
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.73 (0.53 - 0.90)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.55 (0.34 - 0.69)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.21 (0.12 - 0.31)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	30.52

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts

All values based on 10 year running averages

Insufficient deep drainage to run steady state salinity calculations.

DIAGNOSTICS



Run Messages

Messages generated when the scenario was run:

This is a Dryland scenario
No effluent irrigation has occurred!
Supply reliability run chosen
Pathogen module switched off
Supply reliability run chosen
Pathogen module switched off

APPENDIX H:
Redland City Council Email

From: [David Heape](#)
To: [Fiona Milnes](#)
Cc: [Daniel Hartshorn](#)
Subject: RE: Expansion of sewer network in Sheldon
Date: Thursday, June 27, 2019 9:48:30 AM
Attachments: [image001.png](#)
[image002.png](#)
[image003.png](#)
[Sewer Network Map - Redlands CC Red-e-map.png](#)

Hi Fiona

This is not exactly straight forward

Firstly – the caravan is outside our service area – so there are no plans to service it and there are currently no plans to extend the service area at the moment.

If he plans to build and operate a private line and connect to sewer (which will be at his cost) – we would have to see if the existing receiving line can take the load – which it may not..... but we would work hard to accommodate – so a restriction may come in what he does. No guarantee there - but worth doing a pre lodgement so we can figure out the loads and to see if there are any restrictions

The final hurdle is – can we treat it – Capalaba STP currently has no capacity at all at the moment – the up side is we are just about to plan to expand it – so if the pre lodgement is in we can take the caravan into account, but there may be a delay in the approval until Capalaba is upgraded (which could be about 3 to 4 years – all depending on the amount he will discharge).

There could be some trade waste charges on top of normal charges depending on what constitutes the sewer he wishes to discharge

So a summary would be

- It is worth talking – we will try and accommodate as much as possible
- Do not spend too much money yet – but to start a discussion we need to know what flows and what type of flows may be coming into the sewer system.
- If we are able to take the flow, and if there are any restrictions, then he can start spending money determining how much the rising main / or any other restrictions will cost etc....

Regards

David Heape

Principal Wastewater Engineer

Water & Waste Infrastructure | Wastewater Assets Engineering

Redland City Council

P +617 3829 8913

M +61 410 596 755



I acknowledge the traditional custodians of the lands and seas where I work. I pay my respects to Elders, past, present and future.

From: Fiona Milnes [mailto:fionaM@simmondsbristow.com.au]

Sent: Tuesday, 25 June 2019 12:28 PM

APPENDIX I:
S&B Process Review & Site Inspection
Reports

S&B Ref No: C1807-001

14th December 2018

Glenn Cross
Greenacres Caravan Park
508/520 Mount Cotton Rd
SHELDON, QLD, 4157

Attention: Glenn

Dear Sir,

RE: STP MODIFICATION & COMPLIANCE

1 INTRODUCTION

On the 19th of July Mr Terrence Allen of Simmonds attended the Greenacres Caravan Park in Sheldon to inspect the sewage treatment plant. Whilst the original intention of this visit was to examine possibilities for improving nitrogen removal, additional recommendations were sought in regards to improving TSS and Bacteriological compliance.

A report was submitted to Greenacres based upon the observations made during the site visit, providing a number of recommendations to improve treatment performance and effluent compliance.

Greenacres has been implementing a number of these recommendations over the intervening months in an effort to improve their effluent compliance.

On the 10th of December 2018 Mr Terrence Allen of Simmonds & Bristow inspected the progress of the modifications being made to the treatment plant to assess the adequacy of the equipment being installed and whether the improvements were likely to achieve effluent compliance.



2 CURRENT TREATMENT RESULTS

A summary of the analytical results and the respective release limits are presented in Table 1. These results represent averages over a period from November 2016 to Oct 2018.

Table 1: License Release Limits

Parameter	Limit type	Unit	Licence limit
BOD ₅	80 th percentile	mg/L	20
	Maximum		40
Suspended solids	80 th percentile	mg/L	30
	Maximum		60
pH	Range	units	6.5 to 8.5
Dissolved oxygen	Minimum	mg/L	> 2
Free chlorine residual	Maximum	mg/L	
<i>E. coli</i>	Median ¹	CFU/100mL	100
	Maximum		4000

Greenacres has provided historical testing results data to establish previous treatment performance.

Figure 1: Historical Testing Data – Physical & Chemical Parameters

Month	BOD	TSS	TN	TP
	mg/L	mg/L	mg/L	mg/L
Nov-16	22	75	22	7.6
Dec-16	14	28	22	7
Jan-17	15	35	18	6.6
Feb-17	8	32	19	6.9
Mar-17	11	29	20	6.6

¹ * Minimum of 5 samples taken at not less than half-hourly intervals in any one day

Month	BOD	TSS	TN	TP
	mg/L	mg/L	mg/L	mg/L
Apr-17	11	23	16	5.5
May-17	11	21	23	7.7
Jun-17	10	28	24	6.4
Jul-17	19	44	25	6.8
Aug-17	16	63	22	7.9
Sep-17	23	74	27	8.2
Oct-17	13	27	26	5.4
Jun-18	19	40	37	6.4
Aug-18	15	38	43	7.2
Oct-18	79	92	58	9

With the notable exception of October 2018, the BOD produced by the treatment plant is compliant with the maximum limit. The process was compliant with the 80th percentile for the majority of the data provided.

Compliance for TSS is less consistent than BOD compliance.

Figure 2: Historical Testing Results – Bacteriological Parameters

Month	Bacteriological Sample Results (cfu/100mL)						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Median	Maximum
Nov-16	10	80	320	490	1000	320	1000
Dec-16	10	30	340	30	10	30	340
Jan-17	70	2300	10	10	50	50	2300
Feb-17	20	20	80	40	10	20	80
Mar-17	160	50	100	110	30	100	160

Month	Bacteriological Sample Results (cfu/100mL)						
	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Median	Maximum
Apr-17	3100	390	1100	40	90	390	3100
May-17	230	50	270	60	40	60	270
Jun-17	30	10	160	100	210	100	210
Jul-17	310	200	360	390	800	360	800
Aug-17	170	390	300	360	100	300	390
Sep-17	1700	80	200	210	10	200	1700
Oct-17	10	10	10	20	10	10	20
Jun-18	6000	4000	6000	6000	6000	6000	6000
Aug-18	900	1400	800	6000	3000	1400	6000
Oct-18	6000	6000	6000	6000	6000	6000	6000

The treatment plant was generally compliant with the Maximum results for 2017, although recent compliance for the months provided for 2018 has been poor.

Compliance with the Median requirement of 100cfu/100mL has been generally poor for all of the data provided.

3 UPGRADES IMPLIMENTED

The following upgrades are in the process of being implemented by the site.

- a. Installation of a final effluent filter to reduce suspended solids
- b. Conversion of tablet chlorine to liquid chlorine dosing
- c. Baffling of the chlorine contact tank to improve contact time
- d. Installation of pre-anoxic tank to improve de-nitrification

Further upgrade to the trickling filter will be required to improve nitrogen removal. These are still in the process of being scoped and will be implemented as soon as possible.

These upgrades were in the process of being installed during the inspection; as such comments are made upon equipment selection. Further testing should be conducted once the upgrades are placed on-line to validate the system.

3.1 Final Effluent Filter

A glass media based pressure filter has been installed to provide filtration of the final effluent, to reduce solids entering the chlorine contact tank. This should help improve TSS compliance and lower the chlorine demand, helping to improve disinfection efficacy.

The filter installed is a Hayward S270T pressure filter, a 675mm diameter. It has been indicated that the filter is rated at 170L/min, a maximum daily throughput of 250m³/day.



Figure 3: Pressure Sand Filter

Based upon the filter diameter, the filter is more likely to be capable of between approximately 45 - 120L/min, based upon a loading rate of 120 - 320 L/m²/min, which is more typical for pressure filters operating with wastewater effluents.

The lower filter loading rates for wastewater operation result in a more conservative throughput of 65 - 190m³/day, with the lower value being above the historical flows seen during the initial inspection (approximately 30m³/day).

The filter should be suitably sized for the current plant throughput. A second filter may need to be added if flows increase above 65m³/day.

The filter is equipped with a manual backwash valve, with backwash water being returned to the primary settlement tank. The filter is not equipped with automatic backwash equipment, and operators should monitor filter differential pressure, with backwashes most likely required once per day for 10 – 30 mins.

The filter is fed via a small submersible pump, from a pump sump installed after the clarifier tank. The sump can overflow into the chlorine contact tank in the event of pump failure.

3.2 Installation of Liquid Chlorine Dosing

To improve chlorine dosing control and bacteriological compliance the treatment plant is being converted from tablet chlorination to using liquid sodium hypochlorite. The liquid chlorine dosing will be interlinked with the filter pump start to avoid over-dosing.



Figure 4: Chemical Metering Pump

Chlorine is dosed via an Iwaki chemical metering pump, which in our experience should be suitable for the duty. The pump is rated at a flow of 3.9L/hr. The pump doses through an injection quill into the pipework feeding the filter. Whilst this may increase chlorine demand, the chlorine dose will help to prevent the filter from growing biofilm and should be an appropriate configuration.

Based upon a 10% hypo concentration and an initial chlorine dose of 25mg/L, the dosing rate required would be 1.8L/hr, at a treated water flow through the filter of 120 L/min, which is within the pumps capacity.

3.3 Baffling of Chlorine Contact Tank

Additional baffling has been added to the chlorine contact tank to improve tank residence time and to decrease short-cutting.



Figure 5: Chlorine Contact Tank Baffling

The baffling was observed to improve flow-paths, although some improvements should be made to how the baffles are sealed against the walls. The baffle material may eventually need replacement with Plastic or painted steel, as the Wood utilised may be prone to rot in the long term.

The tank should be cleaned as the effluent appeared to be highly turbid.

3.4 Installation of Pre-Anoxic Tank

A pre-anoxic tank has been installed, which consists of a decommissioned treatment system, originally produced by Enviroflow. The equipment utilised consists of a 3.0 m x 1.5 m x 2.1 m cell equipped with bio-bloc tubing as packing media, resulting in a volume of approximately 9.45m³.



Figure 6: Pre-Anoxic Tank Packing

Based upon computerised modelling using the BioWin program, the pre-anoxic cell should achieve good nitrate removal, so long as the aeration within the trickling filter is rectified.

The tank is fed via a Flygt 3048 submersible pump, situated in the effluent well of the primary clarifier, and returns to the first cell of the primary clarifier, at the same point as the RAS recycle.

Once the pre-anoxic cell is brought online, the RAS rate may need to be adjusted to ensure sufficient nitrates are recycled back to the front-end of the system to achieve significant improvements in nitrification. Additional carbon may be required to be added to further improve de-nitrification and effluent TN.

As the license does not currently contain TN requirements this process is aimed at improving overall effluent quality.

3.5 Trickling Filter Rectification

The trickling filter requires additional work to improve aeration, to improve both Ammonia conversion to Nitrate and to improve the consistency of BOD removal.

The distributor arms need levelling and reinforcement, as the current PVC arms are suffering from some sag.

The air flow to the base of the rock filter needs attention, with at least location and exposure of the existing underdrains which have been restricted by the addition of corrugated iron to the outer shell. The under drains simply need to be located and air vents reopened in the iron sheet against each drain at both ends.



Figure 7: trickling Filter Distributor arm 'sag'

The Trickling Filter also requires inspection by a qualified structural engineer, as the integrity of the retaining structure is not known. Simmonds & Bristow are not able to provide engineering recommendations for structural rectification.

4 Recommendations

Based upon the size of the filter and the capacity of the chlorine pump the modifications should be capable of achieving the environmental authority limits for TSS and Bacteriological parameters.

As the equipment was not running at the time of the inspection, this statement assumes that the equipment is tuned and maintained correctly. The equipment will need adjustment to identify optimal settings for flows and dosing rates.

Additional verification testing should be conducted to assist in tuning the treatment plant. It would be expected that this should consist of weekly testing for bacteriological parameters, TSS and BOD over the course of a 4 to 8 week period.

Additional work is required on the Trickling Filter to improve its function. As historical sampling data indicates that the plant generally attains its BOD limits, trickling filter modifications will help to improve overall effluent quality and consistency.

Adjustments may be required to recycle rates once the pre-anoxic cell is brought online to optimise nitrogen removal rates.

We trust this summary is suitable for your requirements. Please do not hesitate to contact the undersigned should you have any enquires, or if we can be of further assistance to you.

Yours faithfully

SIMMONDS & BRISTOW PTY LTD

Approved by

Terrence Allen *BE(Chem)*

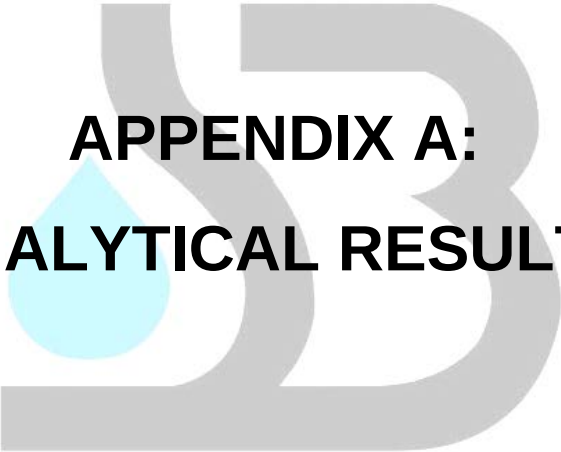
Process Engineer

David Bristow *BE(Chem), RPEQ, CPEng, MIEAust, AFIAM*

Managing Director & Chief Engineer

Revision History

Rev No.	Date	Author	Reviewer	Description of Revision	Status
0-1	14/12/18	TA	DJB	Draft for Internal Review	Draft
1-0	14/12/18	TA	DJB	Release to Client	Final



APPENDIX A: ANALYTICAL RESULTS

REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

Redland City Council
Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

DATE SAMPLED: 02-Nov-2016
ANALYSED FROM: 02-Nov-2016
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 3965
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

DOCUMENT NO.: ~

SAMPLE NUMBER		S58585	S58586	~	~	~	~		
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent		
SAMPLE TIME		7:00	9:50	7:00	7:30	8:00	8:30		
SAMPLE TYPE		Grab	Grab	Grab	Grab	Grab	Grab		
METHOD CODE	ANALYSIS	UNITS							
PR-RWSE-0052	pH	units	~	6.7	~	~	~		
PR-RWSE-0051	D.O.	mg/L	~	2.6	~	~	~		
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~		
refer comments	T.N.	mg/L	22	~	~	~	~		
refer comments	T.P.	mg/L	7.6	~	~	~	~		
refer comments	T.S.S.	mg/L	75	~	~	~	~		
refer comments	B.O.D.	mg/L	22	~	~	~	~		
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	< 10	80	320	490	1000

COMMENTS:
Nutrients by Scientific Analytical Services(Accreditation Number 11085)
on batch 16/11019, report date 08/11/16.
Thermotolerant coliforms by Scientific Analytical Services(Accreditation Number 11085)
on batch 16/11018, report date 04/11/16.



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except in full. Samples are analysed
"as received" by the laboratory.

SCIENTIFIC OFFICER:

C. Casey

RELEASE DATE: 09/11/16

No. 12412

RWSE-F18 MAY 14

REDLAND LABORATORY
GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 14-Dec-2016

ANALYSED FROM: 14-Dec-2016

REPORT NUMBER: 3987

RT NUMBER: 3987

DOCUMENT NO.: ~

COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

Redland City
Redland Water-Redland
233 Middle Street, CLEVELAND
PO Box 21 CLEVELAND
Tel: (07) 3822
Fax: (07) 3822

SAMPLE NUMBER	SAMPLE IDENTIFICATION	SAMPLE TIME	ANALYSIS	units
S58692	Greenacres Caravan Park Unchlorinated effluent	7:00 Grab	UNITS	PR-RWSE-0052 PH
S58693	Greenacres Caravan Park Chlorinated effluent	9:30 Grab		
~	Greenacres Caravan Park Chlorinated effluent	7:00 Grab		
~	Greenacres Caravan Park Chlorinated effluent	7:30 Grab		
~	Greenacres Caravan Park Chlorinated effluent	8:00 Grab		
~	Greenacres Caravan Park Chlorinated effluent	8:30 Grab		

PR-RWSE-0052		pH	units	PR-RWSE-0051	D.O.	mg/L	PR-RWSE-0050	CL2 Free	mg/L	refer comments	T.N.	mg/L	refer comments	T.P.	mg/L	refer comments	T.S.S.	mg/L	refer comments	B.O.D.	mg/L	refer comments	Thermotolerant Coliforms	cfu/100mL	refer comments
			~	~	6.7		~	2.7			0.2		~	7.0		28		14							
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COMMENTS:

Thermotolerant coforms by Scientific Analytical Services (Accreditation Number 110865) on batch 16/12562, report date 20/12/16.

C. Casey

RELEASE DATE : 21/12/16

Page 1 of 1

SCIENTIFIC OFFICER:



No. 12412

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RWSE-F-18 1000

REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 11-Jan-2017
ANALYSED FROM: 11-Jan-2017 TO 16-Jan-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4006
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

Redland City Council
Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

SAMPLE NUMBER	S58779	S58780	~	~	~	~	~
SAMPLE IDENTIFICATION	Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME	7:00	9:20	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE	Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS					
PR-RWSE-0052	pH	units	~	6.9	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	2.2	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~
refer comments	T.N.	mg/L	18	~	~	~	~
refer comments	T.P.	mg/L	6.6	~	~	~	~
refer comments	T.S.S.	mg/L	35	~	~	~	~
refer comments	B.O.D.	mg/L	15	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	#REF! ~	~	70	2300	10
							< 10
							50

COMMENTS: Nutrients by Scientific Analytical Services(Accreditation Number 11085)

on batch17/00474 , report date 13/01/17.
Thermotolerant coliforms by Scientific Analytical Services(Accreditation Number 11085)
on batch17/00474 , report date 13/01/17.



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RELEASE DATE : 16/01/17

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REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 11-Jan-2017
 ANALYSED FROM: 11-Jan-2017 TO 16-Jan-2017
 SAMPLED BY: Caravan Park staff.
 REPORT NUMBER: 4006
 COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
 DOCUMENT NO.: ~

Redland City Council
 Redland Water-Redland Laboratory
 233 Middle Street CLEVELAND 4163
 PO Box 21 CLEVELAND 4163
 Tel: (07) 3829 8386
 Fax: (07) 3829 8765

SAMPLE NUMBER	S58779	S58780	~	~	~	~	~
SAMPLE IDENTIFICATION	Greenacres Caravan Park Unchlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 9:20 Grab	Greenacres Caravan Park Chlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 7:30 Grab	Greenacres Caravan Park Chlorinated effluent 8:00 Grab	Greenacres Caravan Park Chlorinated effluent 8:30 Grab	Greenacres Caravan Park Chlorinated effluent 9:00 Grab
SAMPLE TIME	7:00	9:20	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE	Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS					
PR-RWSE-0052	pH	units	~	6.9	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	2.2	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~
refer comments	T.N.	mg/L	18	~	~	~	~
refer comments	T.P.	mg/L	6.6	~	~	~	~
refer comments	T.S.S.	mg/L	35	~	~	~	~
refer comments	B.O.D.	mg/L	15	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	#REF! ~	~	70	2300	10
							< 10
							50

COMMENTS: Nutrients by Scientific Analytical Services(Accreditation Number 11085)
 on batch17/00474 , report date 13/01/17.
 Thermotolerant coliforms by Scientific Analytical Services(Accreditation Number 11085)
 on batch17/00474 , report date 13/01/17.



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REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

Redland City Council

Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163

PO Box 21 CLEVELAND 4163

Tel: (07) 3829 8386

Fax: (07) 3829 8765

TO 06-Feb-2017

DATE SAMPLED: 01-Feb-2017
ANALYSED FROM: 01-Feb-2017

SAMPLED BY: Caravan Park staff.

REPORT NUMBER: 4019

COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171

DOCUMENT NO.: ~

SAMPLE NUMBER	S58840	S58841	~	~	~	~	~
SAMPLE IDENTIFICATION	Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME	7:00	9:15	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE	Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS					
PR-RWSE-0052	pH	units	~	7.0	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	2.8	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.2	~	~	~
refer comments	T.N.	mg/L	19	~	~	~	~
refer comments	T.P.	mg/L	6.9	~	~	~	~
refer comments	T.S.S.	mg/L	32	~	~	~	~
refer comments	B.O.D.	mg/L	8	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	20	20	80
							40
							< 10

COMMENTS: Nutrients by Scientific Analytical Services(Accreditation Number 11085)

on batch 17/01084, report date 03/02/17.

Thermotolerant coliforms by Scientific Analytical Services(Accreditation Number 11085)
on batch 17/01084, report date 03/02/17.



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RELEASE DATE: 06/02/17

RWSE-F18 MAY 14

REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

Redland City Council

DATE SAMPLED: 01-Mar-2017
ANALYSED FROM: 01-Mar-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4040
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

SAMPLE NUMBER	S58935	S58936	~	~	~	~	~
SAMPLE IDENTIFICATION	Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME	7:00	9:25	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE	Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS					
PR-RWSE-0052	pH	units	~	7.0	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	2.4	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~
refer comments	T.N.	mg/L	20	~	~	~	~
refer comments	T.P.	mg/L	6.6	~	~	~	~
PR-RWSE-00503	T.S.S.	mg/L	29	~	~	~	~
refer comments	B.O.D.	mg/L	11	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	160	50	100
							110
							30

COMMENTS:
Nutrients and BOD by Scientific Analytical Services(Accreditation Number 11085)
on batch 17/02205, report date 07/03/17.
Thermotolerant coliforms by Scientific Analytical Services(Accreditation Number 11085)
on batch 17/02205, report date 07/03/17.



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RELEASE DATE : 08/03/17

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REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 07-Jun-2017
ANALYSED FROM: 07-Jun-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4103
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
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Redland City Council
Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

SAMPLE NUMBER		S59294	S59295	~	~	~	~
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME		7:00	9:20	7:00	7:30	8:00	8:30
SAMPLE TYPE		Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS					
PR-RWSE-0052	pH	units	~	7.0	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	3.4	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~
refer comments	T.N.	mg/L	24	~	~	~	~
refer comments	T.P.	mg/L	6.4	~	~	~	~
PR-RWSE-0053	T.S.S.	mg/L	28	21	~	~	~
refer comments	B.O.D.	mg/L	<10	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	30	10	160
							100
							210

COMMENTS: Thermotolerant coliforms, BOD and nutrients by Scientific Analytical Services(Accreditation Number 11085) on batch 17/05716 , report date 17/6/2017 .

RELEASE DATE : 19/6/2017



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REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

Redland City Council
Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

DATE SAMPLED: 09-Aug-2017
ANALYSED FROM: 09-Aug-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4136
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

SAMPLE NUMBER		S59524	S59525	~	~	~	~	~	
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	
SAMPLE TIME		7:00	9:25	7:00	7:30	8:00	8:30	9:00	
SAMPLE TYPE		Grab	Grab	Grab	Grab	Grab	Grab	Grab	
METHOD CODE	ANALYSIS	UNITS							
PR-RWSE-0052	pH	units	~	7.1	~	~	~	~	
PR-RWSE-0051	D.O.	mg/L	~	2.7	~	~	~	~	
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~	~	
refer comments	T.N.	mg/L	22	~	~	~	~	~	
refer comments	T.P.	mg/L	7.9	~	~	~	~	~	
PR-RWSE-0053	T.S.S.	mg/L	63	43	~	~	~	~	
refer comments	B.O.D.	mg/L	16	~	~	~	~	~	
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	170	390	300	360	100

COMMENTS: Thermotolerant coliforms, BOD and nutrients by Scientific Analytical Services(Accreditation Number 11085)
on batch 17/07781 , report date 15/08/17.



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RWSE-F18 MAY 14

REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 13-Sep-2017
ANALYSED FROM: 13-Sep-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4156

TO 25-Sep-2017

COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

Redland City Council
Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

SAMPLE NUMBER	S59655	S59656	~	~	~	~	~
SAMPLE IDENTIFICATION	Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME	7:00	9:15	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE	Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS	~	~	~	~	~
PR-RWSE-0052	pH	units	~	~	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	2.2	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~
refer comments	T.N.	mg/L	27	~	~	~	~
refer comments	T.P.	mg/L	8.2	~	~	~	~
PR-RWSE-0053	T.S.S.	mg/L	74	29	~	~	~
PR-RWSE-0043	B.O.D.	mg/L	23	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	1700	80	200
							210
							< 10

COMMENTS: Thermotolerant coliforms and nutrients by Scientific Analytical Services/Accreditation Number 11085)
on batch 17/08832, report date 25/09/17.



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RELEASE DATE: 25/07/17

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REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 04-Oct-2017
ANALYSED FROM: 04-Oct-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4167
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~

Redland City Council
Redland Water-Redland Laboratory
233 Middle Street CLEVELAND 4163
PO Box 21 CLEVELAND 4163
Tel: (07) 3829 8386
Fax: (07) 3829 8765

SAMPLE NUMBER		S59752	S59753	~	~	~	~	~
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME		7:00	9:20	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE		Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS						
PR-RWSE-0052	pH	~	6.8	~	~	~	~	~
PR-RWSE-0051	D.O.	~	2.1	~	~	~	~	~
PR-RWSE-0050	CL2 Free	~	0.1	~	~	~	~	~
refer comments	T.N.	26	~	~	~	~	~	~
refer comments	T.P.	5.4	~	~	~	~	~	~
PR-RWSE-0053	T.S.S.	27	21	~	~	~	~	~
PR-RWSE-0043	B.O.D.	13	~	~	~	~	~	~
refer comments	Thermotolerant Coliforms	~	~	< 10	< 10	10	20	< 10

COMMENTS: Thermotolerant coliforms and nutrients by Scientific Analytical Services(Accreditation Number 11085) on batch 17/09389, report date 13/10/17.



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RELEASE DATE: 19/10/17

REDLAND LABORATORY
GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 05-Jul-2017 TO 10-Jul-2017
ANALYSED FROM: 05-Jul-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4115
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: ~ A2389380

Redland Water Treatment Plant
233 Middle Street CLIVEVILLE QLD 4163
PO Box 21 CLIVEVILLE QLD 4163
Tel: (07) 3020 0300
Fax: (07) 3020 0700

SAMPLE NUMBER		S59384	S59385	Greenacres Caravan Park Chlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 7:30 Grab	Greenacres Caravan Park Chlorinated effluent 8:00 Grab	Greenacres Caravan Park Chlorinated effluent 8:30 Grab	Greenacres Caravan Park Chlorinated effluent 9:00 Grab
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 9:30 Grab	Greenacres Caravan Park Chlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 7:30 Grab	Greenacres Caravan Park Chlorinated effluent 8:00 Grab	Greenacres Caravan Park Chlorinated effluent 8:30 Grab	Greenacres Caravan Park Chlorinated effluent 9:00 Grab
SAMPLE TIME		7:00	9:30	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE		Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS						
PR-RWSE-0052	pH	units	~	~	~	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	~	~	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	~	~	~	~	~
refer comments	T.N.	mg/L	25	~	~	~	~	~
refer comments	T.P.	mg/L	6.8	~	~	~	~	~
PR-RWSE-0053	T.S.S.	mg/L	44	~	~	~	~	~
PR-RWSE-0043	B.O.D.	mg/L	19	~	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	310	200	360	390	800

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COMMENTS: Thermotolerant coliforms and nutrients by Scientific Analytical Services (Accreditation Number 11085) on batch 17/06679, report date 10/07/17.

SCIENTIFIC OFFICER: C. Casey

RELEASE DATE : 11/07/17

RWSE-F18 MAY 14

REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

Redland Water Treatment Plant
233 Middle Street CLEVELAND 4103
PO Box 21 CLEVELAND 4103
Tel: (07) 3829 8300
Fax: (07) 3829 8765

DATE SAMPLED: 05-Apr-2017 TO 26-Apr-2017
ANALYSED FROM: 05-Apr-2017
SAMPLED BY: Caravan Park staff.
REPORT NUMBER: 4068
COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171
DOCUMENT NO.: 221321

SAMPLE NUMBER		S59109	S59110	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent	Greenacres Caravan Park Chlorinated effluent
SAMPLE TIME		7:00	9:15	7:00	7:30	8:00	8:30	9:00
SAMPLE TYPE		Grab	Grab	Grab	Grab	Grab	Grab	Grab
METHOD CODE	ANALYSIS	UNITS						
PR-RWSE-0052	pH	units	~	6.9	~	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	3.2	~	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~	~
refer comments	T.N.	mg/L	16	~	~	~	~	~
refer comments	T.P.	mg/L	5.5	~	~	~	~	~
PR-RWSE-0053	T.S.S.	mg/L	23	~	~	~	~	~
refer comments	B.O.D.	mg/L	11	~	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	3100	390	1100	40
								90

COMMENTS: Nutrients & BOD by Scientific Analytical Services(Accreditation Number 11085) on batch 17/03786 , report date 26/04/17.
Thermotolerant coliforms by Scientific Analytical Services(Accreditation Number 11085) on batch 17/03786 , report date 26/04/17.



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ACCREDITED FOR
TECHNICAL
COMPETENCE

No.12412

RELEASE DATE : 27/04/17

SCIENTIFIC OFFICER:

C. Casey

RWSE-F18 MAY 14

REDLAND LABORATORY GREENACRES CARAVAN PARK EFFLUENT REPORT

DATE SAMPLED: 03-May-2017

TO 10-May-2017

ANALYSED FROM: 03-May-2017

SAMPLED BY: Caravan Park staff.

REPORT NUMBER: 4084

COPIES TO: Greenacres Caravan Park, PO Box 97, Bulimba, QLD 4171

DOCUMENT NO.: ~

A2232462

Redland Water-Redland
233 Middle Street CLEVELAND
PO Box 21 CLEVELAND
Tel: (07) 3829 8386
Fax: (07) 3829 8765

SAMPLE NUMBER		S59185	S59186	Greenacres Caravan Park Chlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 7:30 Grab	Greenacres Caravan Park Chlorinated effluent 8:00 Grab	Greenacres Caravan Park Chlorinated effluent 8:30 Grab	Greenacres Caravan Park Chlorinated effluent 9:00 Grab
SAMPLE IDENTIFICATION		Greenacres Caravan Park Unchlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 9:25 Grab	Greenacres Caravan Park Chlorinated effluent 7:00 Grab	Greenacres Caravan Park Chlorinated effluent 7:30 Grab	Greenacres Caravan Park Chlorinated effluent 8:00 Grab	Greenacres Caravan Park Chlorinated effluent 8:30 Grab	Greenacres Caravan Park Chlorinated effluent 9:00 Grab
METHOD CODE	ANALYSIS	UNITS						
PR-RWSE-0052	pH	units	~	7.0	~	~	~	~
PR-RWSE-0051	D.O.	mg/L	~	2.9	~	~	~	~
PR-RWSE-0050	CL2 Free	mg/L	~	0.1	~	~	~	~
refer comments	T.N.	mg/L	23	~	~	~	~	~
refer comments	T.P.	mg/L	7.7	~	~	~	~	~
PR-RWSE-0053	T.S.S.	mg/L	21	~	~	~	~	~
PR-RWSE-0043	B.O.D.	mg/L	11	~	~	~	~	~
refer comments	Thermotolerant Coliforms	cfu/100mL	~	~	230	50	270	60
COMMENTS.		Thermotolerant coliforms and nutrients by Scientific Analytical Services (Accreditation Number 11085) on batch 17/04429, report date 10/05/17.						



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COMPETENCE

No. 12412

RELEASE DATE: 11/05/17

SCIENTIFIC OFFICER.

C. Casey

RWSE-F18 MAY 14

LABORATORY REPORT

Client: Glen Cross
Greenacres Caravan Park
508 Mount Cotton Road
Capalaba QLD 4157

Job Name: Greenacres Caravan Park

Sampled By: Client
Sampling Method: Grab
Sample Matrix: Aqueous
Batch Number: 18/05787
Registration Date: 3 July 2018
Date of Report: 11 July 2018
Sampled Date: 3/07/2018

Bruce Weatherill Sue Evans
Authorised Signatory Authorised Signatory

PLEASE NOTE:

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2. All sampling performed by SAS Laboratory is in accordance with In-house Method F.001.
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4. Method with * indicates NATA accreditation does not cover the performance of this service.

Client: Greenacres Caravan Park
Job Name: Greenacres Caravan Park

Batch Number: 18/05787
Report Date: 11/07/18

Method	Test	Units	18/05787/1 Sample 1 3/07/2018 07:00	18/05787/2 Sample 2 3/07/2018 07:30	18/05787/3 Sample 3 3/07/2018 08:00	18/05787/4 Sample 4 3/07/2018 08:30	18/05787/5 Sample 5 3/07/2018 09:00	18/05787/6 Sample 6 3/07/2018 09:30
4.404	Thermotolerant Coliforms (MF)	cfu/100mL	>6,000	4,000	>6,000	>6,000	>6,000	[NR]
1.003A	Free Chlorine	mg/L	[NR]	[NR]	[NR]	[NR]	[NR]	<0.1
1.002	pH	pH Unit	[NR]	[NR]	[NR]	[NR]	[NR]	7.3
1.004	Diss. Oxygen as O ₂	mg/L	[NR]	[NR]	[NR]	[NR]	[NR]	5.0 @19.5 oC
1.601	Suspended Solids	mg/L	40	[NR]	[NR]	[NR]	[NR]	44
1.604	BOD 5 days @ 20°C	mg/L	19	[NR]	[NR]	[NR]	[NR]	[NR]
FIA.013	Total Nitrogen as N	mg/L	37	[NR]	[NR]	[NR]	[NR]	[NR]
FIA.011B	Total Phosphorus as P	mg/L	6.4	[NR]	[NR]	[NR]	[NR]	[NR]

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

PLEASE NOTE:

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LABORATORY REPORT

Client: Glen Cross
Greenacres Caravan Park
508 Mount Cotton Road
Capalaba QLD 4157

Job Name: Greenacres Caravan Park

Sampled By: Client
Sampling Method: Grab
Sample Matrix: Aqueous
Batch Number: 18/07691
Registration Date: 4 September 2018
Date of Report: 10 September 2018
Sampled Date: 4/09/2018

Courtney Hamilton Sue Evans
Authorised Signatory Authorised Signatory

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Client: Greenacres Caravan Park
Job Name: Greenacres Caravan Park

Batch Number: 18/07691
Report Date: 10/09/18

Method	Test	Units	18/07691/1 Sample 1 4/09/2018 07:00	18/07691/2 Sample 2 4/09/2018 07:30	18/07691/3 Sample 3 4/09/2018 08:00	18/07691/4 Sample 4 4/09/2018 08:30	18/07691/5 Sample 5 4/09/2018 09:00	18/07691/6 Sample 6 4/09/2018 09:30
4.404	Thermotolerant Coliforms (MF)	cfu/100mL	900	1,400	800	>6,000	3,000	[NR]
1.003A	Free Chlorine	mg/L	[NR]	[NR]	[NR]	[NR]	[NR]	<0.1
1.002	pH	pH Unit	[NR]	[NR]	[NR]	[NR]	[NR]	7.4
1.004	Diss. Oxygen as O ₂	mg/L	[NR]	[NR]	[NR]	[NR]	[NR]	3.9 @ 16.5 C
1.601	Suspended Solids	mg/L	38	[NR]	[NR]	[NR]	[NR]	32
1.604	BOD 5 days @ 20°C	mg/L	15	[NR]	[NR]	[NR]	[NR]	[NR]
FIA.013	Total Nitrogen as N	mg/L	43	[NR]	[NR]	[NR]	[NR]	[NR]
FIA.011B	Total Phosphorus as P	mg/L	7.2	[NR]	[NR]	[NR]	[NR]	[NR]

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

PLEASE NOTE:

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2. All sampling performed by SAS Laboratory is in accordance with In-house Method F.001.
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LABORATORY REPORT

Client: Glen Cross
Greenacres Caravan Park
508 Mount Cotton Road
Capalaba QLD 4157

Job Name: Greenacres Caravan Park

Sampled By: Client
Sampling Method: Grab
Sample Matrix: Aqueous
Batch Number: 18/08766
Registration Date: 2 October 2018
Date of Report: 15 October 2018
Sampled Date: 2/10/2018

Courtney Hamilton Sue Evans
Authorised Signatory Authorised Signatory

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Client: Greenacres Caravan Park
Job Name: Greenacres Caravan Park

Batch Number: 18/08766
Report Date: 15/10/2018

Method	Test	Units	18/08766/1 Sample 1 2/10/2018 07:00	18/08766/2 Sample 2 2/10/2018 07:30	18/08766/3 Sample 3 2/10/2018 08:00	18/08766/4 Sample 4 2/10/2018	18/08766/5 Sample 5 2/10/2018	18/08766/6 Sample 6 2/10/2018
4.404	Thermotolerant Coliforms (MF)	cfu/100mL	>6,000	>6,000	>6,000	>6,000	>6,000	[NR]
1.003A	Free Chlorine	mg/L	[NR]	[NR]	[NR]	[NR]	[NR]	<0.1
1.002	pH	pH Unit	[NR]	[NR]	[NR]	[NR]	[NR]	7.0
1.004	Diss. Oxygen as O ₂	mg/L	[NR]	[NR]	[NR]	[NR]	[NR]	0.56 @ 19 oC
1.601	Suspended Solids	mg/L	92	[NR]	[NR]	[NR]	[NR]	100
1.604	BOD 5 days @ 20°C	mg/L	79	[NR]	[NR]	[NR]	[NR]	[NR]
FIA.013	Total Nitrogen as N	mg/L	58	[NR]	[NR]	[NR]	[NR]	[NR]
FIA.011B	Total Phosphorus as P	mg/L	9.0	[NR]	[NR]	[NR]	[NR]	[NR]

[ND] - Not Detected [NR] - Not Required [NT] - Not Tested

PLEASE NOTE:

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2. All sampling performed by SAS Laboratory is in accordance with In-house Method F.001.
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S&B Ref No: C1807-001
Lab Ref No: B692341



26th September 2018

Glenn Cross
Greenacres Caravan Park
508/520 Mount Cotton Rd
SHELDON, QLD, 4157

Attention: Glenn

Dear Sir/Madam,

NITROGEN INVESTIGATION REPORT

1. INTRODUCTION

On the 19th of July 2018 Terrence Allen of Simmonds & Bristow attended the Greenacres Caravan Park in Sheldon, Queensland to inspect the sewage treatment plant. The plant had been reported to be achieving poor nitrogen removal, and after further discussion with the client, the treatment plant was also achieving poor removal of suspended solids. In addition to inspecting the process units samples of raw sewage and final effluent were also collected for analysis.

Comments in this report are based on results presented in Symbio Alliance's Analytical Certificate No. B162341, which is attached in **Appendix A**.



2. SITE DESCRIPTION

The Greenacres Caravan Park is located in Sheldon, to the west of Brisbane, on Mt Cotton Road.

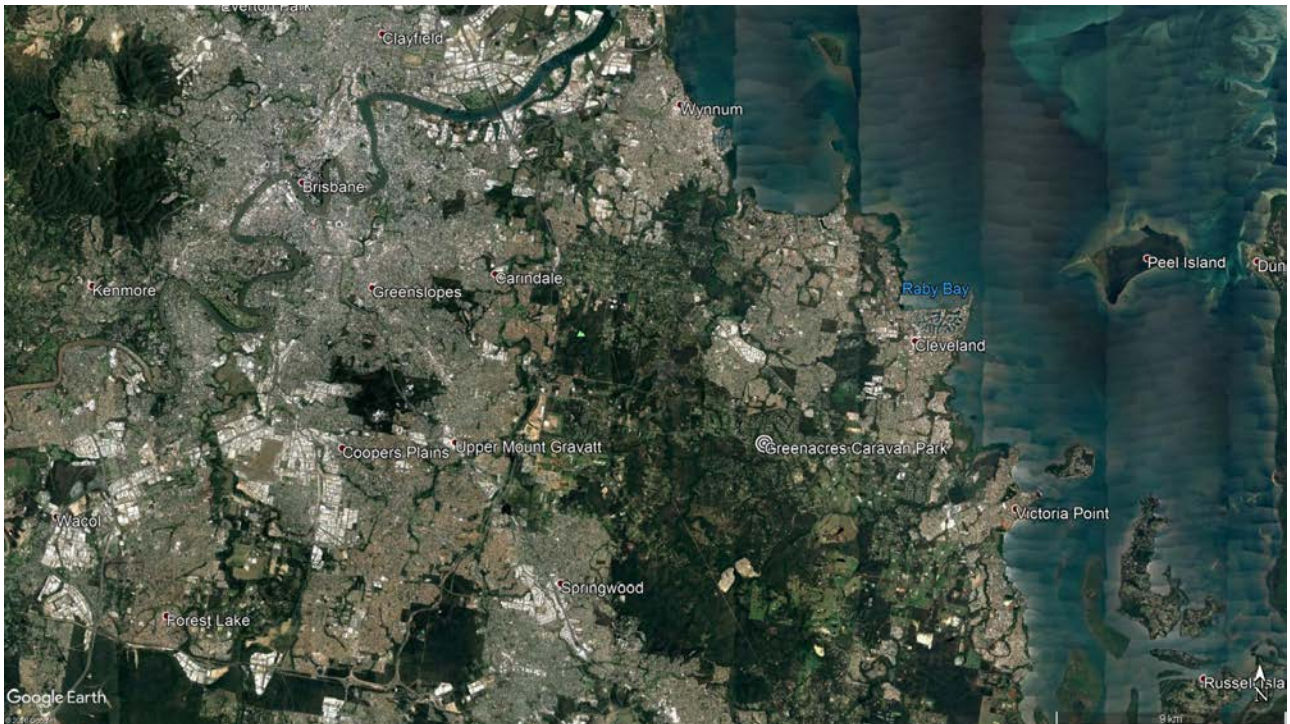


Figure 1: Greenacres Caravan Park Location

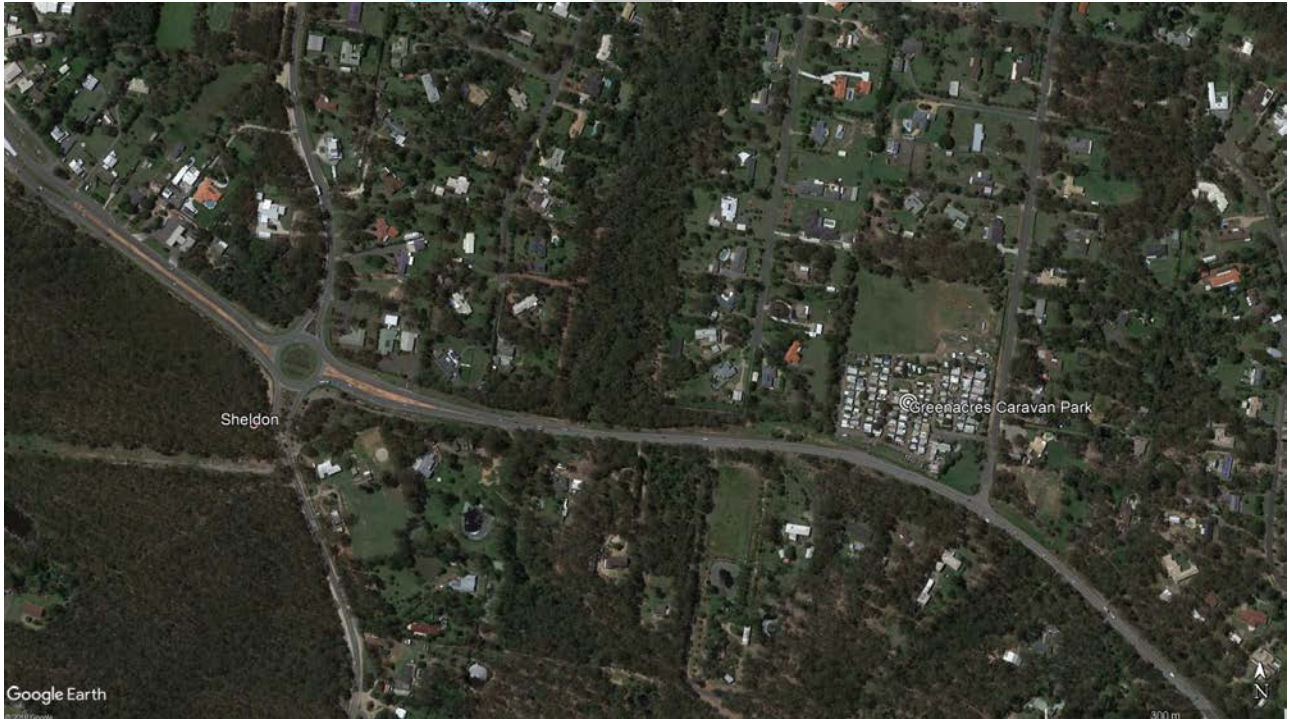


Figure 2: Greenacres Locality

3. PROCESS REVIEW

The site is located outside of the municipal sewage network, and as such, is required to treat all wastewater generated in an on-site wastewater treatment plant.

The treatment plant installed on site is based upon trickling filter technology and consists of the following units of process:

- Inlet Screen & Macerator
- Septic Tank/Anaerobic Digester
- 1 Primary clarifier tank, split into 2 cells
- Rock media trickling filter with 2-arm rotary distributor
- Secondary clarifier
- Chlorine contact chamber with tablet chlorinator

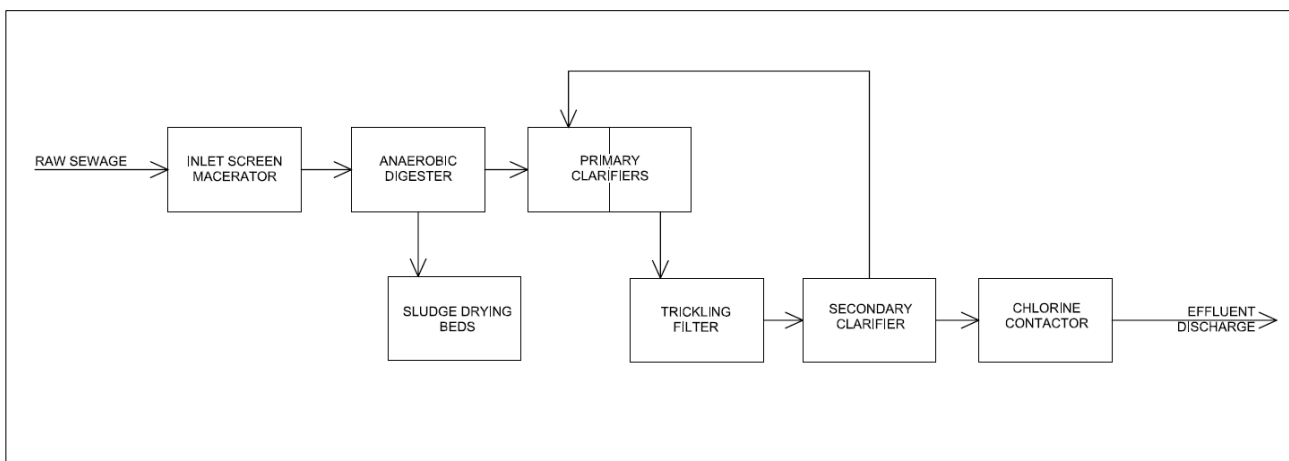


Figure 3: General Process Flow Diagram

3.1. Samples & Process Performance

Samples of the raw sewage and final effluent were taken as part of the site visit.

Table 1: Site Sampling Results

Parameter	Raw Sewage	Final Effluent
BOD (mg/L)	200	89
Total Suspended Solids (mg/L)	100	52
Ammonia (mg/L)	26	22
Nitrate + Nitrite (mg/L)	N/A	8.9
Total Nitrogen (mg/L)	46	47
Total Phosphorus (mg/L)	4.9	8.1

Parameter	Raw Sewage	Final Effluent
E.coli (MPN/100mL)		>110,000
Faecal Coliforms (MPN/100mL)		>110,000

Raw sewage concentrations received by the treatment plant conform well to standard domestic raw sewage concentrations; however the effluent quality indicates that the treatment plant is not performing adequately, with poor BOD, suspended solids and nitrogen removal.

While no EA has been provided at the time of writing, a BOD of less than 20mg/L and a TSS of less than 30mg/L would be expected from the technology installed on site. Based on the size of the trickling filter a TN of less than 20 should also be obtainable.

Table 2: General Raw Sewage Strengths (Metcalf & Eddy, 2014)

Parameter	Unit	Medium Strength	High Strength
BOD	mg/L	200	400
TSS	mg/L	195	390
TN	mg/L	35	70
Ammonia	mg/L	20	45
TP	mg/L	6	11
TDS	mg/L	560	1100
EC	µS/cm	950	1800
Oil & Grease	mg/L	75	150

Average flow figures were provided by the client, indicating an average daily flow of approximately 32kL/day. Based upon the size of the site, this flow appears appropriate, indicating that there are no excessive of fugitive discharges to the sewer network.

3.2. Inlet Screen & Macerator

Raw sewage initially enters an inlet channel equipped with a coarse bar screen and a macerator. Sewage is lifted from this inlet channel into an aerobic digester/settler tank.

These units were operating and appeared to be in acceptable condition. The pit is installed in the operators building and is protected by walkway mesh, which may be lifted to access the equipment. The arrangement utilised appeared to be appropriate.



Figure 4: Inlet Pit

3.3. Anaerobic Digester

The digester acts in a similar manner to a septic tank, providing settlement and digestion of solids, as well as flotation of scums. The anaerobic digester discharges to the primary settlement tanks, which provide further settlement of raw sewage.

The digester evidenced a very heavy scum layer, to the point of supporting significant plant growth. The thick scum layer appeared to be doing a good job of odour control, with no odour evident at the tank.



Figure 5: Anaerobic Digester



Figure 6: Digester “Scum” Layer

It is uncertain as to how much active volume remains within the digester, although it was reported during the site visit that the waste sludge removed from the digester runs clear after a short period of time, indicating that there is some active volume available within the tank.

The depth of the scum layer should be assessed via coring or digging into the layer, with care taken to minimally disturb the crust. Personnel should ensure that the area is well ventilated and that there is no danger of falling, as piercing the crust may release odour or gasses.

Once the depth is known the top portion of the layer (including the vegetation) should be removed. Ideally the scum layer should be maintained as it serves to help remove and reduce odours; breaking the scum layer in any significant fashion is likely to result in significant odour release.

Alternatively the entire sludge digester can be emptied, temporarily bypassed to the primary clarifier tanks, and fully cleaned out. This may require temporary odour capture measures, or the provision of a lid or cover, vented through a carbon filter. An exact process for this would require further design and costing.

3.4. Primary Clarifier Tanks

The sludge digester discharges to a set of primary clarifier tanks, configured as two rectangular tanks in series, with a single baffle cutting the tank in half.



Figure 7 Primary Clarifier Tank – Cell 1



Figure 8: Primary Clarifier Tank Cell 1 (baffle wall located under bridge)

Clarified effluent discharges from the primary clarifier via a baffled outlet, preventing scum and floating solids from entering the effluent channel. A mesh screen, fabricated from a basket, helps to prevent large solids from entering the trickling filter feed pumping station.



Figure 9: Clarifier Discharge Basket and trickling filter feed pump station



Figure 10: Trickling Filter Feed Pump

Settled solids are pumped back to the anaerobic digester, whilst clarified sewage is pumped forward to the trickling filter. The primary settler also accepts a RAS/trickling filter recycle from the secondary clarifier.



Figure 11 Clarifier RAS/TF Recycle Inlet

The primary clarifier is approximately 13m² in total area, resulting in a total loading rate of approximately 2.7m³/m²/day (approximately 5.4m³/m²/day per cell), well below the normal limits for a primary clarifier system (16 – 32m³/m²/day).

3.5. Trickling Filters

Clarified sewage is pumped to the single rock media trickling filter, which provides the majority of BOD and Ammonia removal capacity for the treatment plant. Effluent is distributed onto the top of the filter media via a two arm rotary distributor system. The filter media is supported via a corrugated iron shell, forming a 'double ring' style system, with an internal and external wall. It is not certain as to whether this has been installed to provide additional support or whether it is to prevent effluent spillage in the case the trickling filter floods. Air is provided to the base of the filter by 4x 100mm intake ports.



Figure 12: Trickling Filter & Rotary distributor

The site is equipped with a single rock media trickling filter, with a rotary distributor mechanism. The rock appears to be 50-100mm river rock and is typical of rock packing.

The filter is approximately 6m in diameter and 2m deep, resulting in a hydraulic loading rate of approximately $1.25 - 2.5 \text{ m}^3/\text{m}^2/\text{day}$ (factoring in the recycle), and an organic loading rate of approximately $0.125 \text{ kgBOD}/\text{m}^3/\text{day}$, based upon the average flow and test results obtained during the site visit. These rates appear to be appropriate for a low rate trickling filter or a rock trickling filter intended to achieve de-nitrification.

Table 3: Typical Trickling Filter Loading Rates

Parameter	Greenacres Site	Typical Low rate BOD	Typical BOD with de-nitrification
Hydraulic Loading ($\text{m}^3/\text{m}^2/\text{day}$)	1.25 to 2.5	1 to 4	5 to 16
Organic Loading ($\text{kgBOD}/\text{m}^3/\text{day}$)	0.125	0.09 to 0.3	0.08 to 0.4
Typical Depths (m)	1.8 to 2	1 to 2	1 to 2 (Rock) 3 to 12 (plastic)

Part of the filter support appears to have collapsed, leading to a 'dip' or hole in the filter packing, which may be impacting effluent percolation through the filter, which may be leading to short-circuiting of effluent. The collapsed section appears to be resting on the outer shell of the filter, and may eventually result in the failure of the external shell.



Figure 13: Collapsed Bed Area



Figure 14: Rock showing at base of unit, slight bulge to exterior corrugated steel wall

The rotary distributors do not appear to be providing even coverage of the rock filter media, with the ends of the units appearing to have a significantly higher flow from visual observation. Whilst it is normal to direct more flow to the outer edge of a trickling filter (as the distributor covers more area in a single pass) the distribution appears to be unbalanced. Additionally there is a notable colouration difference between the rocks in the centre and the rocks at the edge of the filter.



Figure 15: Rotary distributor arm showing poor flow distribution, and significant deflection and significant variance in colour of rock media

3.6. Secondary Clarifier

Effluent discharges from the trickling filter to a rectangular secondary clarifier. The clarifier provides settlement of humus (biomass material that sloughs off of the trickling filter) and also provides a pumping station for the trickling filter recycle.



Figure 16: Secondary Clarifier Tank

The clarifier is approximately 1.25m wide and 3.8m long, with an area of approximately 4.7m², resulting in a hydraulic loading of 6.7m³/m²/day, well within typical secondary clarifier loading rates (8 - 16m³/m²/day).



Figure 17: TF Recycle & Return Sludge pumping station

Effluent discharges from the clarifier via a linear weir situated at the end of the unit.



Figure 18: Effluent Weir and scum baffling

3.7. Chlorine Contact Chamber

Clarified effluent discharges to the chlorine contact chamber. The chlorine contact chamber is a small in-ground concrete chamber equipped with a tablet chlorinator unit. The contact chamber is covered with a lockable cover to prevent accidental ingress.



Figure 19: Chlorine Contact Tank

Estimated residence times are between 40 and 120mins based on the reported daily average flow, with site testing measuring a free chlorine concentration of 0.14mg/L and a total chlorine concentration of 0.25mg/L, which are within the generally accepted range of 0.1 to 0.3mg/L for effective disinfection.



Figure 20: Contact Chamber and Chlorinator

Chlorine is provided via a four tube tablet chlorinator, typical for this size of treatment plant, with Trichlor tablets utilised.

Effluent discharges via a low-level pipe (which loops from the base of the unit through the top wall) through a final flowmeter, and to the creek outfall for the treatment plant.



Figure 21: Effluent Discharge Flowmeter

While the calculated residence time (40-120min) and chlorine concentrations (free Cl_2 of 0.14mg/L, Total Cl_2 of 0.25mg/L) appeared to be adequate to achieve at least a measure of disinfection, the overall disinfection performance of the treatment plant appeared to be poor, with high faecal coliform and E. coli results from sampling.

As both the residence and concentrations appeared to be adequate, the poor performance is then likely to be due to short-circuiting within the contact tank. The tablet chlorinator is situated close to the wall between the chamber and the discharge, and whilst the draw for the discharge is at the base of the chamber, it is quite possible that chlorinated effluent will flow from the inlet to the base of the chamber directly, resulting in almost half of the contact chambers volume being unused.

Elevated total suspended solids concentrations in the effluent may also interfere with chlorine effectiveness; however significant solids interference usually results in little to no residual free chlorine in the effluent, which still indicates a residence time issue.

Trichlor tablets are based upon trichloroisocyanuric acid and are intended for pool sterilisation. In addition the tablets can also Bromine and (or) copper based additives. The cyanurate and bromine/copper additives help to stabilise the chlorine residual in a pool (especially a pool in direct sunlight, as the UV will tend to degrade the chlorine present), however this is not required in wastewater disinfection and generally ends up adding additional nitrogen (from the cyanurate) and Bromine or Copper to the effluent.

3.8. Sludge Drying Beds

Waste sludge is pumped back to the anaerobic digester for digestion, with eventual disposal to a sludge drying bed situated next to the primary clarifier.



Figure 22: Sludge Drying Bed

The bed has an estimated area of 23m^2 . The wall of the bed is comparatively shallow, with little height above the sand bed, indicating that the bed's overall sludge holding capacity is not particularly high (approximately $1\text{-}2\text{m}^3$). However discussions during the site visit indicates that there is a relatively small volume of sludge to be wasted from the system, generally only resulting in a small area around the discharge pipework being utilised.

4. RECOMMENDATIONS & CONCLUSION

Effluent results indicate that the treatment plant is not performing well, with poor BOD, TN, TSS removal and poor effluent disinfection.

A review of the process units indicates that they should be appropriately sized to achieve good effluent treatment; however some modifications or rectifications are required to repair damage or modify units for improved performance.

4.1. Trickling Filter Refit

Based upon size of the trickling filter and the calculated loading rates, the filter should be capable of good BOD removal and even partial Ammonia and TN removal; however the sampling results indicate that the unit is not performing well.

The poor performance is likely attributable to:

- Poor effluent dispersion,
- Collapsed section of media leading to short circuiting,
- Insufficient airflow / oxygen input.

Increasing airflow will require modification to the trickling filter, allowing either more air intakes in the outer shell, or by providing 'forced' aeration in the form of small side-channel blowers or fans that force air into the underside of the filter (preferably both). As the exact configuration of the trickling filter is not known this would require further design to provide a robust, workable solution.

The collapsed area of the filter would need to be un-packed, the shell repaired, and then re-packed. Depending upon the angle of repose of the rock, a significant portion of the filter is likely to require dismantling to access the shell to conduct repairs.

The rotary distributor appears to be sagging towards the ends of the distributor arms. The rotary distributor arms are supported by a set of tie-wires, and adjusting these supports so that the distributor is roughly level may be the simplest method of improving effluent application to the filter media.

While the distributor may be able to be repaired in-situ, repairing the collapsed section of the shell and improving airflow are likely to require significant (if not complete) the dismantling of the filter, and may take several weeks to complete.

Complete dismantling may require the provision of a second trickling filter, fitted with plastic packing, providing a short-term solution allowing the main filter to be rectified. Alternatively providing a permanent replacement using plastic packing can allow the existing filter to be decommissioned and removed. Identification of the best option, including price and complexity requires further design and costing.

4.2. Clarifier Upgrade

Based upon the size of the clarifier there should be sufficient settlement area available to achieve good removal of total suspended solids, however samples taken during the site audit, and discussions with the site owner indicate that the treatment plant struggles to comply with its TSS license, with a concentration of 52mg/l of TSS found in the effluent sample taken.

Rectifying the trickling filter may result in improved TSS removal, however if this is not the case either additional clarifier area or secondary filtration will need to be provided to improve solids removal.

An additional clarifier may be added next to the existing clarifier, with the discharge from the trickling filter split between the two units. The second clarifier would require additional return and recycle equipment to pump back to the primary clarifier.

However, as there is already significant settlement area within the existing clarifier for the flows processed by the treatment plant, the addition of a second clarifier may be of limited benefit, and the installation of a sand filter may prove to be more beneficial. It should also be simpler to install.

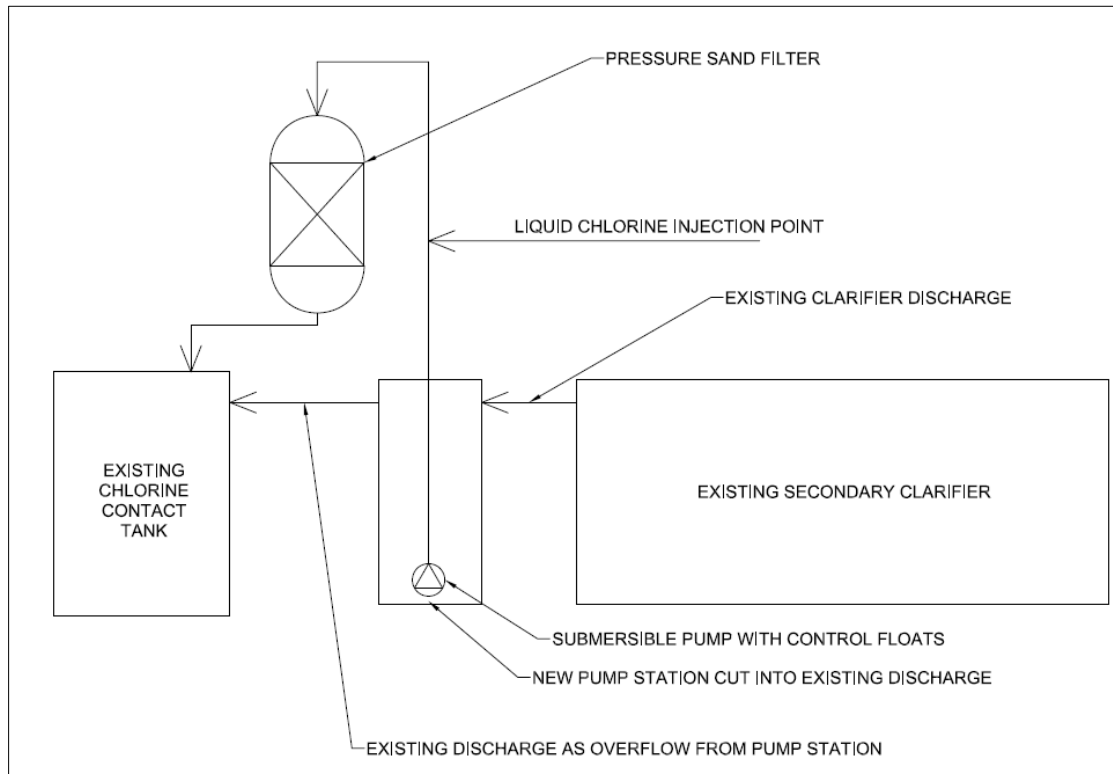


Figure 23: Clarifier Filter Upgrade

A pressure sand filter will require a pump, which in turn would require the installation of a small pumping station. This may be able to be cut into the existing discharge line from the clarifier, which can be maintained as a gravity overflow if the filter pump ever fails. A submersible pump can then pump through a pressure filter (or two), which removes solids. Backwash water may be able to be directed back into the secondary clarifier, or pumped back to the primary clarifier for processing. Chlorine may be injected into the pipework feeding the filter. This will improve filter performance by preventing colonisation of the filter media by bacteria. The chlorine pump may also be able to be interlocked with the filter pump to ensure there is no over-dosing of chlorine.

Due to the number of options available further design would be needed to configure an appropriate system.

4.3. Pre-Anoxic Cell

Based upon the trickling filter size and configuration, an improvement in its operation should also improve TN removal, with preliminary modelling predicting an effluent TN of below 20mg/L.

To gain additional Nitrogen removal however, additional anoxic removal capacity in the treatment system would be required. This would be most easily achieved by the addition of a pre-anoxic cell; a packed cell that provides a substrate for the growth of anoxic organisms.

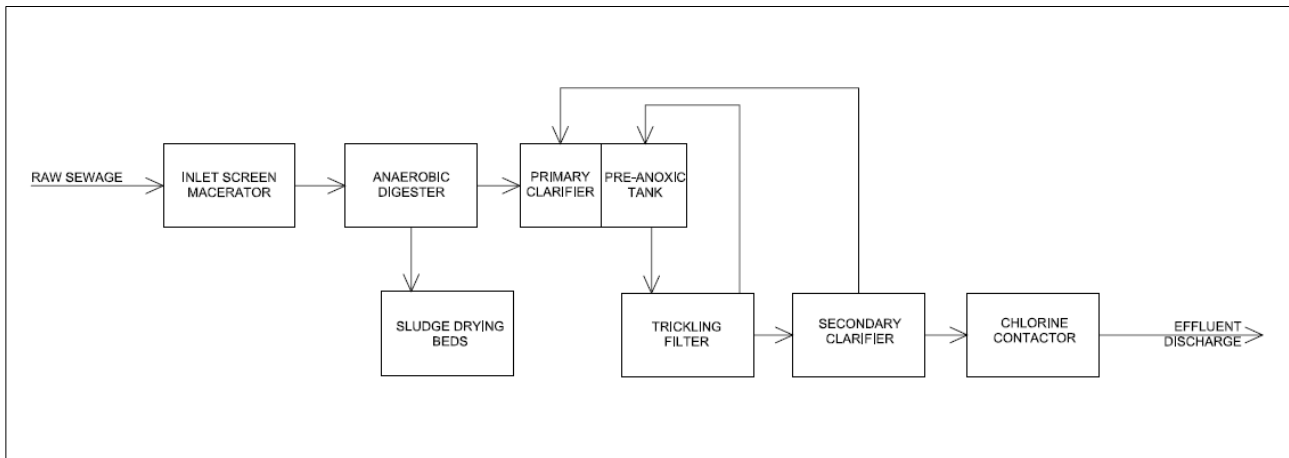


Figure 24: Pre-Anoxic Flow Diagram

A pre-anoxic cell should be able to be added to the second cell of the primary clarifier, partially or fully packing the cell with a plastic packing. This would increase the loading on the remaining clarifier cell to approximately $5.4\text{m}^3/\text{m}^2/\text{day}$, with a peak loading of approximately $16 - 25\text{m}^3/\text{m}^2/\text{day}$, which remains within the normal loading rates for primary clarifiers.

The pre-anoxic system would also require an air-scour system for cleaning the packing. An air scour simply consist of an air diffuser (generally drilled pipe will suffice), connected to a blower or compressor. Air is turned on occasionally which scours off excessive biomass, maintaining hydraulic conductivity of the packed bed.

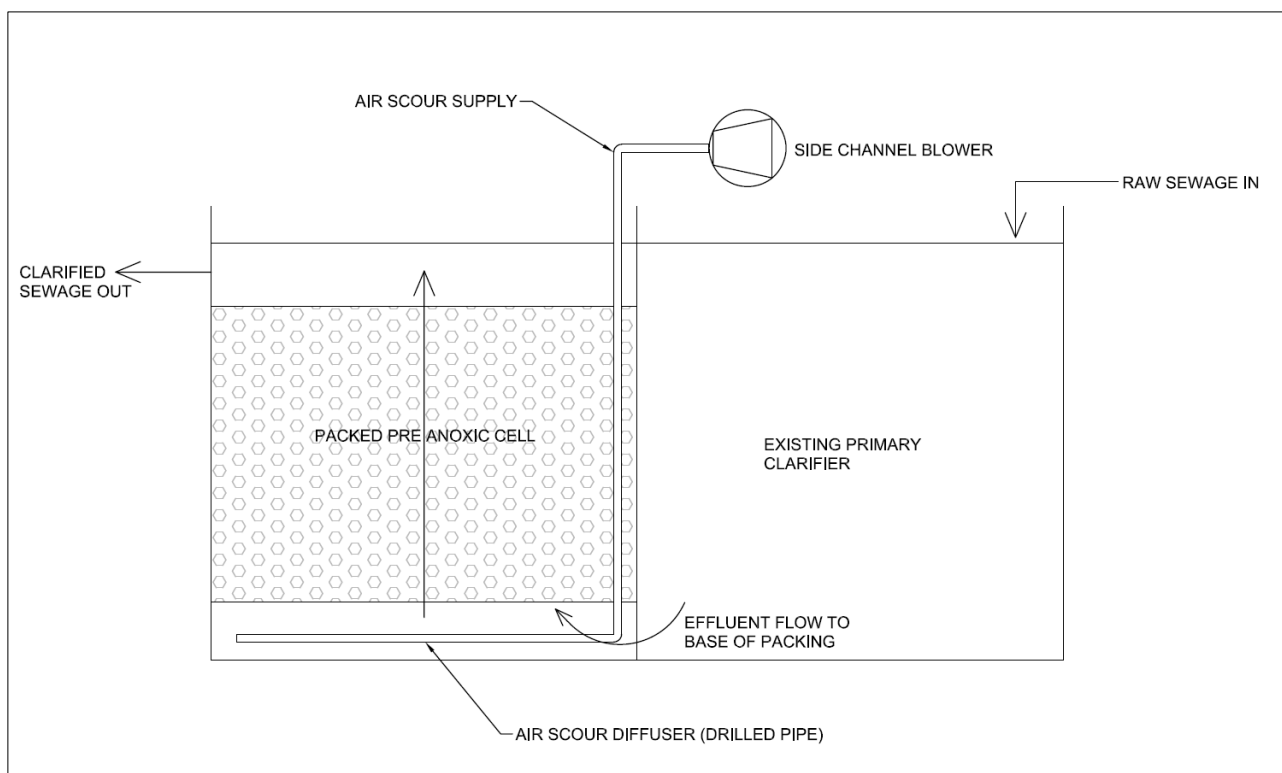


Figure 25: Pre Anoxic Cell General Arrangement

As the de-nitrification reaction requires BOD, the raw sewage BOD may be insufficient to achieve low effluent TN concentrations. This would require additional carbon or sugar dosing to achieve TN results of below 15mg/L. Based upon the raw sewage concentrations a mass of approximately 0.5 – 1kg per day of sugar would be required to support the de-nitrification reaction.

The sugar dosing and air scour systems would require further design to implement.

4.4. Type of Chlorine Used

As the current chlorine tablets are intended for use in pool disinfection, it is recommended that the system be changed to either liquid Sodium hypochlorite or Calcium hypochlorite tablets (e.g. Lonza's HTH disinfecting tablets (<http://www.lonzawatertreatment.com.au/products/oxidizing-biocides/calcium-hypochlorite>)).

This should help reduce the amount of additional additives entering the wastewater, including Nitrogen (in the form of cyanurate), Copper and/or Bromine.

4.5. Chlorine contact tank refit

The current configuration of the chlorine contact tank may lead to significant short-circuiting of the contact basin. While the residence time has been estimated to be sufficient, the configuration appears to favour short-circuiting of chlorinated effluent to the discharge.

The use of liquid sodium hypochlorite was discussed on site, and re-fitting the system with a liquid sodium hypo dosing system provides an opportunity to refit some of the pipework to improve residence time within the chamber.

Pipework should be altered to direct water to the rear of the chamber.

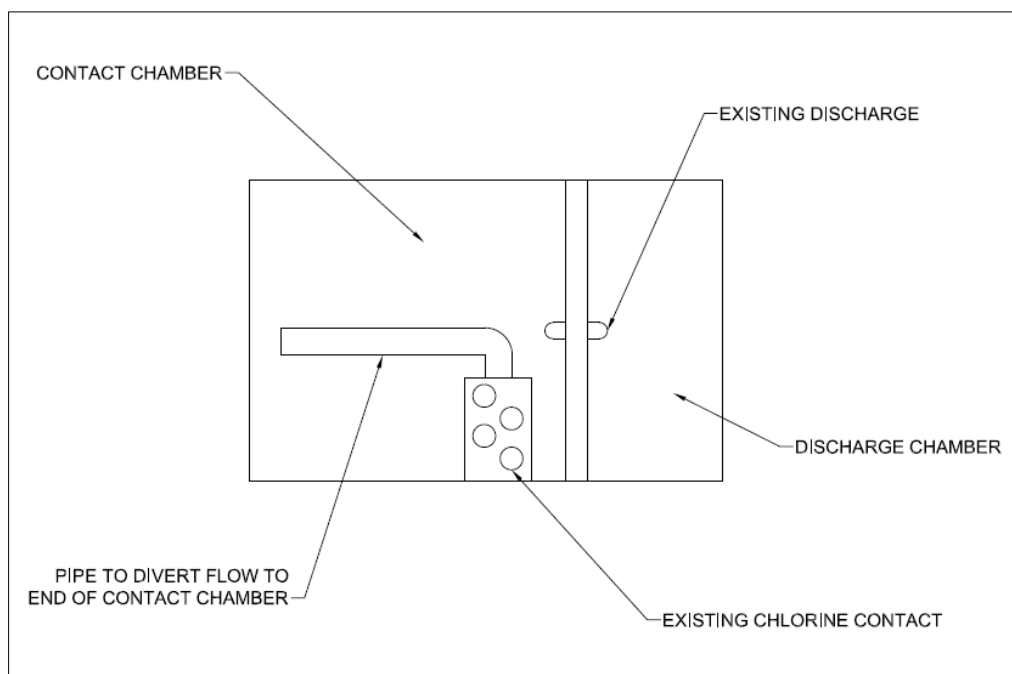


Figure 26: CCT Basic Modification Outline

The inclusion of a baffle plates may also help to ensure that more of the chambers volume is utilised.

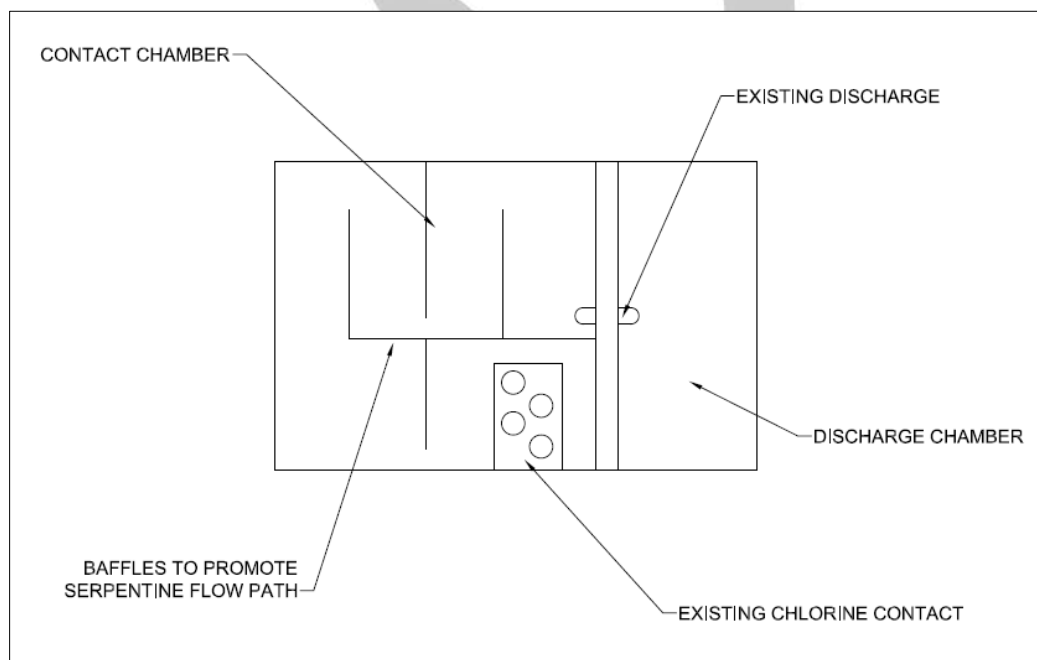


Figure 27CCT - Baffles

If a liquid sodium hypochlorite system is utilised it may be possible to use baffling or an additional discharge pipe to direct the discharge from the chlorinator to the rear of the contact chamber.

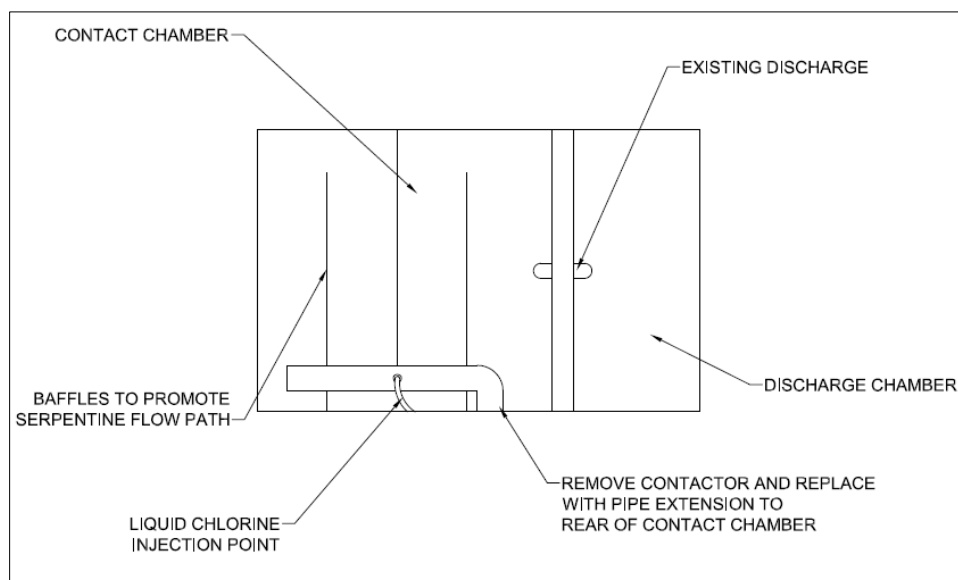


Figure 28: CCT – Chlorine Injection Modification

Ideally directing the flow to the rear of the chamber and providing a number of baffles is likely to provide the best outcome; this avoid complicated baffle arrangements that would be required if the inlet were not repositioned, but provides better utilisation of the available volume (re-directing the inlet without baffles may still result in some unused or dead volume within the tank).

4.6. Flowmeter Refit

The flowmeter as it is currently configured may not be providing accurate readings. Mechanical flowmeters can be sensitive to air entrainment, which can result in inaccurate readings. Ideally the flowmeter should be kept 'full', which would be best achieved by providing a 'kick' up in the pipework at the discharge.

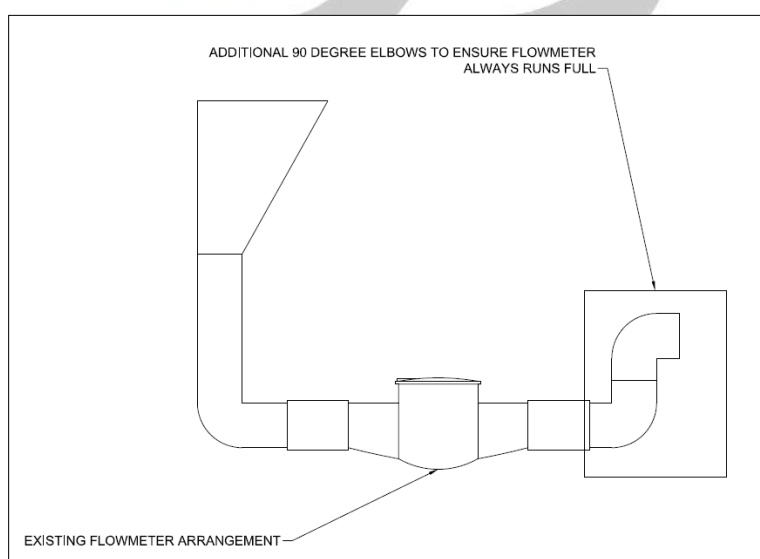


Figure 29: Flowmeter Modifications

We trust this summary is suitable for your requirements. Please do not hesitate to contact the undersigned should you have any enquires, or if we can be of further assistance to you.

Yours faithfully

SIMMONDS & BRISTOW PTY LTD

Approved by

Terrence Allen *BE(Chem)*

Process Engineer

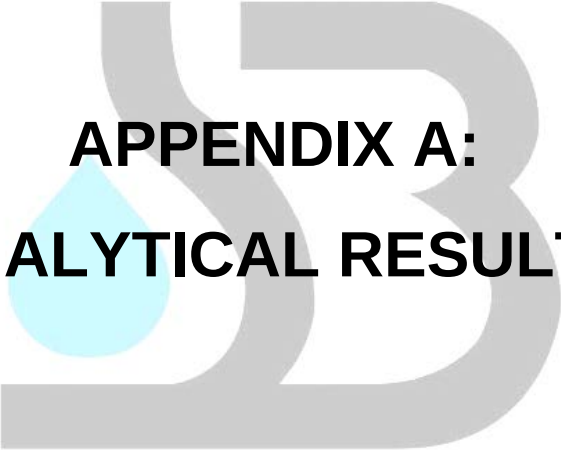
David Bristow *BE(Chem), RPEQ, CPEng, MIEAust*

Managing Director

Revision History

Rev No.	Date	Author	Reviewer	Description of Revision	Status
0.1	24/09/2018	TA	DJB	Internal Draft	Draft
1.0	26/09/2018	TA	DJB	Release to Client	Release





APPENDIX A: ANALYTICAL RESULTS

CERTIFICATE OF ANALYSIS

CERTIFICATE NO.: B692341 Page 1 of 2
ISSUE DATE: 30/07/18

REVISION NO: 00
 This certificate supersedes any previous revisions

CLIENT DETAILS: Debra Smith
 Simmonds & Bristow Pty Ltd
 PO Box 849
 Archfield QLD 4108
DATE RECEIVED: 19/07/2018 15:00
CLIENT REF. NO: C1807-001-a
ORDER NO: C1807-001-a

JOB INFORMATION: Water - C1807-001 Nitrogen Invest
RECEIVE CONDITION: 10 °C
STORAGE CONDITION: 4 °C
TEST DATE: Sample tested between date received and reported

RESULTS OF ANALYSIS:

Test	Method Code	LOR	Unit	B692341-1 Raw Sewage 19/07/2018 11:55	B692341-2 Final Effluent 19/07/2018 11:43
General Tests					
pH	EFF006		pH Unit	7.69	7.47
Electrical Conductivity	EFF007	5	µS/cm	650	670
Solids (Suspended)	EFF009	2	mg/L	100	52
BOD (5day)	EFF023	2	mg/L	200	89
Ammonia-Nitrogen	EFF044	0.005	mg/L	26	22
Nitrate (as N)	EFF004.1	0.005	mg/L	-	8.9
Nitrite (as N)	EFF005.1	0.005	mg/L	-	0.98
Total Nitrogen	EFF029.1	0.05	mg/L	46	47
Total Kjeldahl Nitrogen	EFF001	1	mg/L	42	31
Total Phosphorus	EFF029.1	0.01	mg/L	4.9	8.1
Common Water Micro Tests					
Thermotolerant Coliforms	M8_4_2	3	MPN/100mL	-	>110,000.0
Escherichia coli	M8_4_3	3	MPN/100mL	-	>110,000.0



The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
 Accredited for compliance with ISO/IEC 17025 – Testing.
 NATA Corporate Accreditation No.: 2455

Symbio Laboratories Pty Ltd
 ABN 82 079 645 015

Tel: 1300 703 166 Fax: +61 7 3219 0333
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- Rockhampton: Unit 3, 191 Berserker St, Berserker QLD 4701
- Wagga Wagga: Unit 5, 10-12 Koorngal Rd, Wagga Wagga NSW 2650

DEFINITIONS: < : Less than, > : Greater than, - : Not Tested, DWB : Dry Weight Basis, NA: not applicable, RP: Result Pending, - : Not received / requested, ~ : Estimated, TBA - to be advised

* Test not covered by NATA scope of accreditation

: The result is derived from a calculation and includes results equal to, or greater than the LOR. Where applicable, results are calculated as sum of reportable isomers.

Results were reported on an "as received" basis unless otherwise indicated.

Sampling was conducted by the customer and results reported pertain only to the samples submitted.

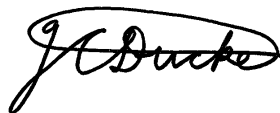
Responsibility for representative sampling rests with the customer.



Hoyun Jeong, Team Leader
Chemistry (Brisbane)



Maxim Kowal, Senior Lab Technician
Chemistry (Brisbane)



Julia Ducke, Laboratory Technician
Microbiology (Brisbane)



The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
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