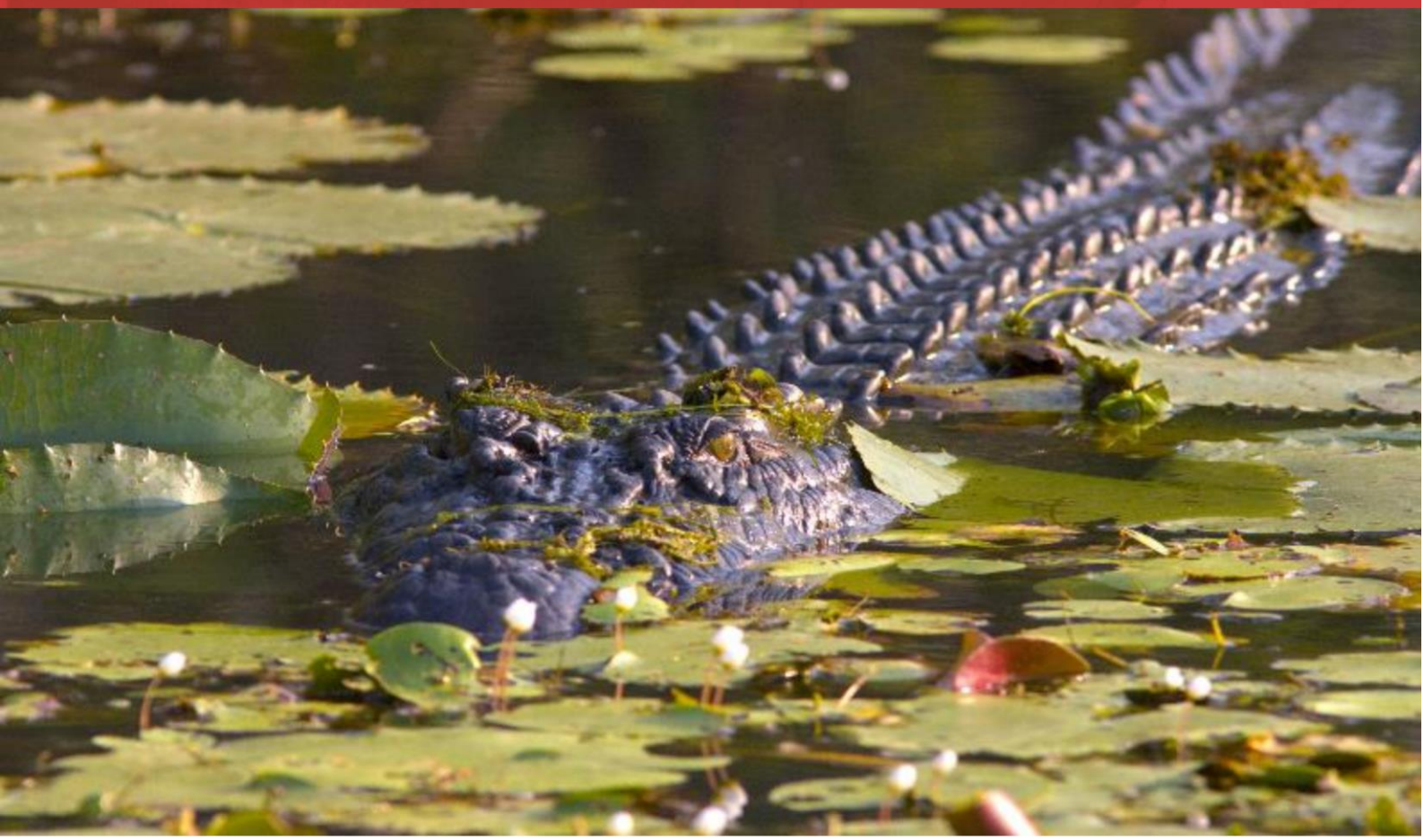
EPL320 Monitoring Report
Lambells Lagoon Crocodile Farm

Reporting period: 1 May 2023 – 30 April 2024

PRI Group Pty Ltd



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ACRONYMS

ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
BoM	Bureau of Meteorology
CFU	colony forming units
EC	electrical conductivity
EPL	Environment Protection Licence
GEL	groundwater extraction licence
LLCF	Lambells Lagoon Crocodile Farm
LOR	limit of reporting
mBTOC	meters below top of casing
NATA	National Association of Testing Authorities
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
SOCS	Site of Conservation Significance
SWL	standing water level
TBA	To be advised
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids

1 INTRODUCTION

PRI Group Pty Ltd (PRI) operate Lambells Lagoon Crocodile Farm (LLCF), on Section 1611 and 1688 Hundred of Guy, at the end of Alphatonia Road, 5.5 km north of the Arnhem Highway (Figure 1-1). Development of the farm occurred in two stages. Stage one became operational in early 2021 and includes the incubation, hatchery, and associated auxiliary infrastructure. Stage two became operational in early 2022 and includes the grow-out pens, finishing pens, auxiliary infrastructure, and water management infrastructure (Figure 1-2).

Surface water, groundwater, and soil monitoring are undertaken at LLCF to ensure that operations do not impact waterways downstream i.e. Black Jungle Swamp, Lambells Lagoon, and the Adelaide River. This monitoring is also a requirement of Environment Protection Licence 320-01 (EPL320-01), first issued to PRI Group Pty Ltd by the Northern Territory Environment Protection Authority (NT EPA) under the *Waste Management and Pollution Control Act* on 12 April 2021.

Monitoring Reports are required annually, as per Condition 54 of EPL320-01. These must be prepared in accordance with the NT EPA 'Guideline for Reporting on Environmental Monitoring'. Each report must include all requirements as set out in EPL320 Condition 55.

This particular Monitoring Report covers all water quality and soil monitoring undertaken for the reporting period starting 1 May 2023 and ending 30 April 2024 (herein referred to as the 'reporting period'), data from the previous reporting period will also be used to discuss possible trends in the results.

1.1 Purpose and scope

This Monitoring Report is prepared in accordance with the following EPL320-01 conditions:

Condition 54

The licensee must complete and provide to the NT EPA a Monitoring Report, as prescribed by this licence, by 31 May each year.

Condition 55

The licensee must ensure that each Monitoring Report:

55.1 is prepared in accordance with the requirements of the NT EPA 'Guideline for Reporting on Environmental Monitoring';

55.2 includes a tabulation of all monitoring data required as a condition of this licence. Data must be provided electronically in Microsoft Excel format;

55.3 calculations for maximum total annual loads of Nitrogen and Phosphorus required as a condition of this licence;

55.4 reports on all trigger value exceedances and investigations required as a condition of this licence;

55.5 includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity over a minimum period of three years (where the data is available). Data used in the analysis must be provided electronically in Microsoft Excel format; and

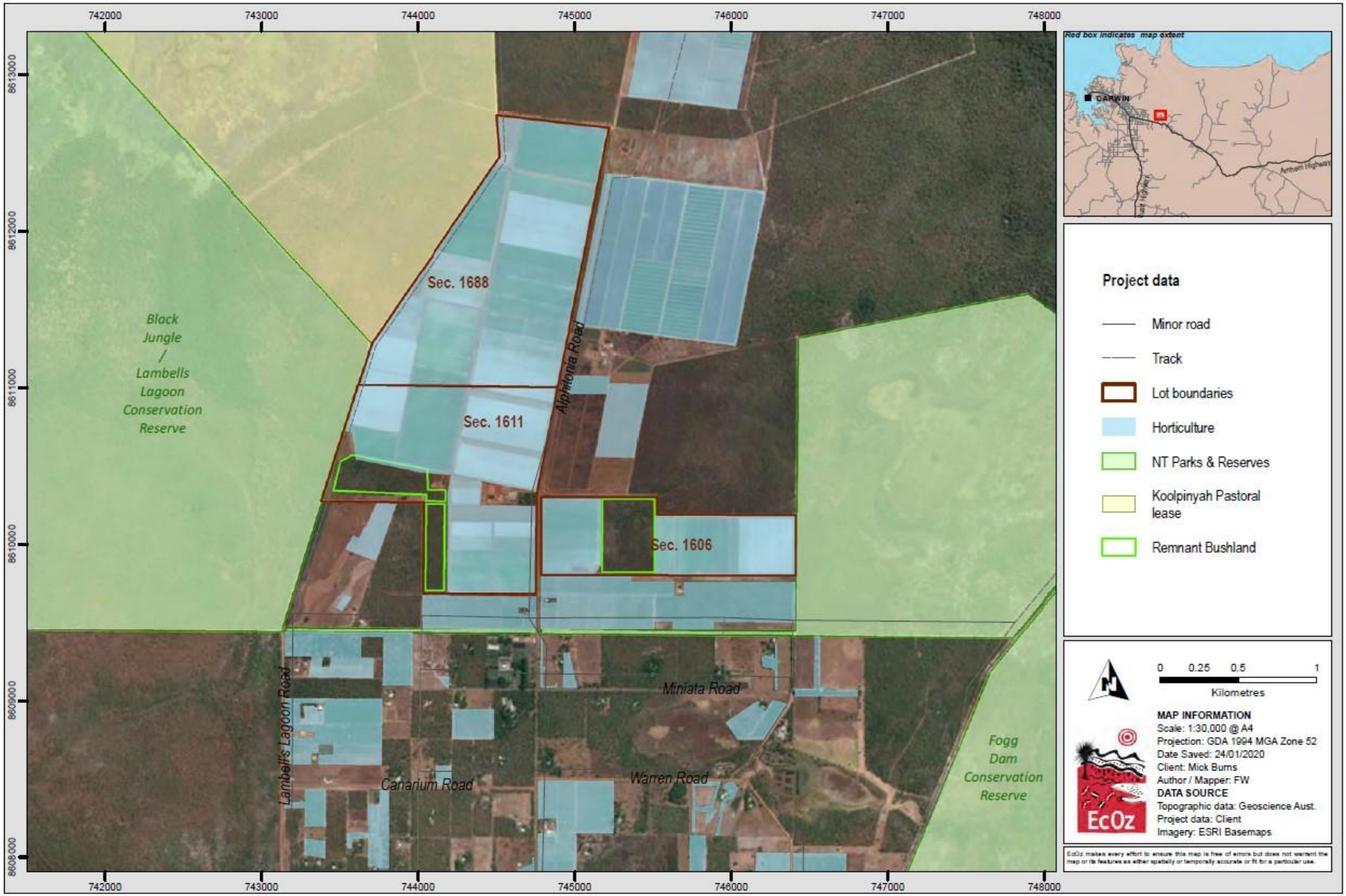
55.6 includes an assessment of environmental impact from the activity.

1.2 EPL320-01 compliance monitoring and reporting

EPL320-01 authorises discharge to land (irrigation) using wastewater from the two authorised discharge points, see Figure 1-3. The authorised discharge point for wastewater from Stage one operations is the pump station at ADP1, and from Stage two operations is the retention basin pump station at ADP2.

In order to monitor for potential environmental impacts from this activity, surface water, groundwater and soil monitoring at LLCF is undertaken in accordance with Attachment A of EPL320-01 and all monitoring-related

conditions of the licence, i.e. Conditions 41 to 46. The *LLCF Irrigation Management Plan* (EcOz 2021) details the monitoring sites, physical (field) and laboratory parameters measured, sampling methods and procedures. Monitoring site locations are shown below in Figure 1-3 and detailed in Table 4-1. Parameters to be measured, monitoring frequency and trigger values, taken from Attachment A of EPL320-01, are outlined below in Table 4-2, Table 4-3, Table 4-4, and Table 4-5. In addition to the above, the volumes and timing of irrigated water application must be recorded; as per EPL320-01 Condition 39.


742000
743000
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747000
748000
8613000
8612000
8611000
8610000
8609000
8608000
Sec. 1688
Sec. 1611
Sec. 1606
Black Jungle / Lambells Lagoon Conservation Reserve
Alpurrurra Road
Lambell's Lagoon Road
Miniata Road
Canarium Road
Warren Road
Fogg Dam Conservation Reserve
Red box indicates map extent
DARWIN
Arnhem Highway
Project data
Minor road
Track
Lot boundaries
Horticulture
NT Parks & Reserves
Koolpinyah Pastoral lease
Remnant Bushland
0 0.25 0.5 1
Kilometres
MAP INFORMATION
Scale: 1:30,000 @ A4
Projection: GDA 1994 MGA Zone 52
Date Saved: 24/01/2020
Client: Mick Burns
Author / Mapper: FW
DATA SOURCE
Topographic data: Geoscience Aust.
Project data: Client
Imagery: ESRI Basemaps
EcOz
EcOz makes every effort to ensure this map is free of errors but does not warrant the map or its features as either spatially or temporally accurate or fit for a particular use.

Figure 1-1. Map of LLCF location

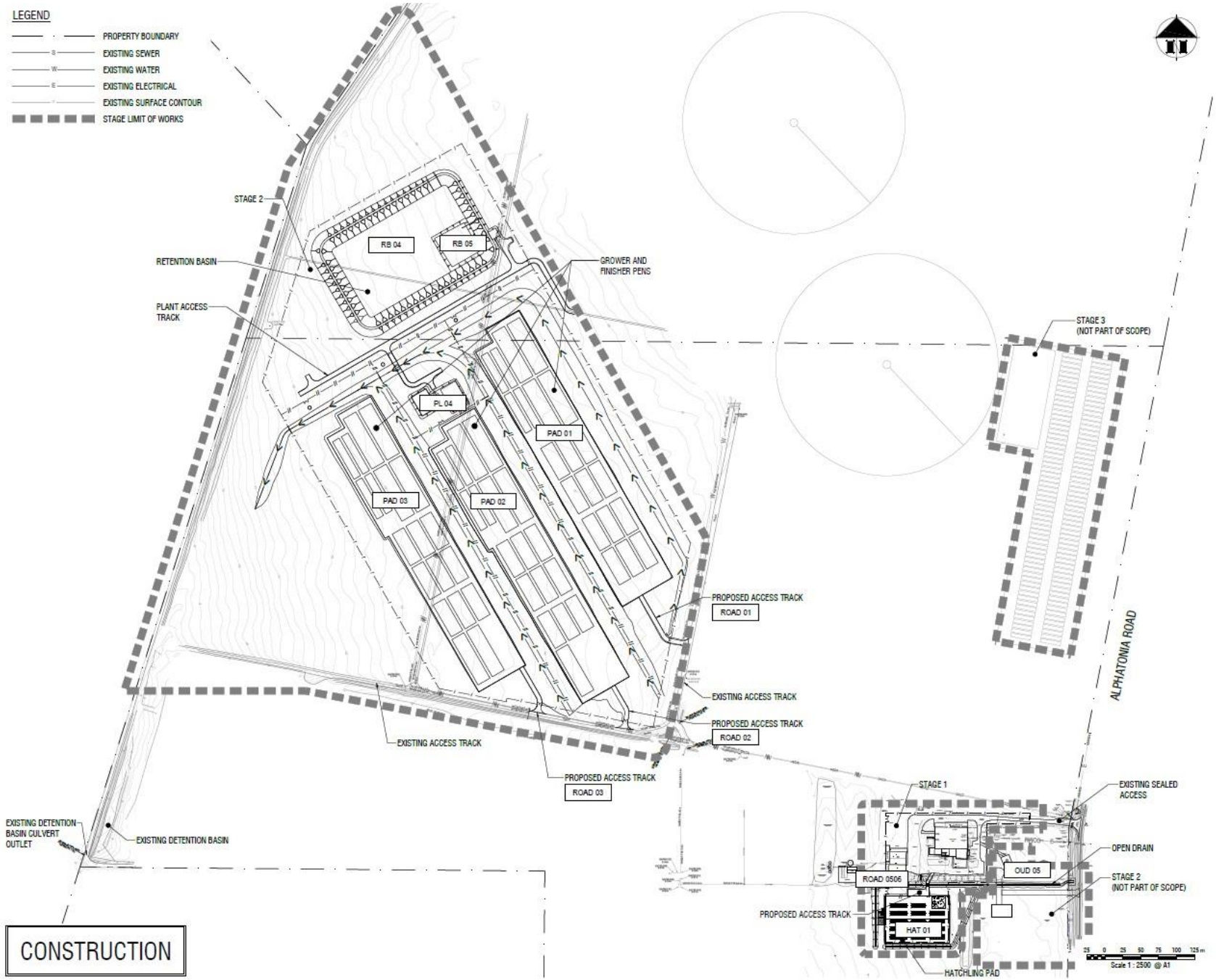
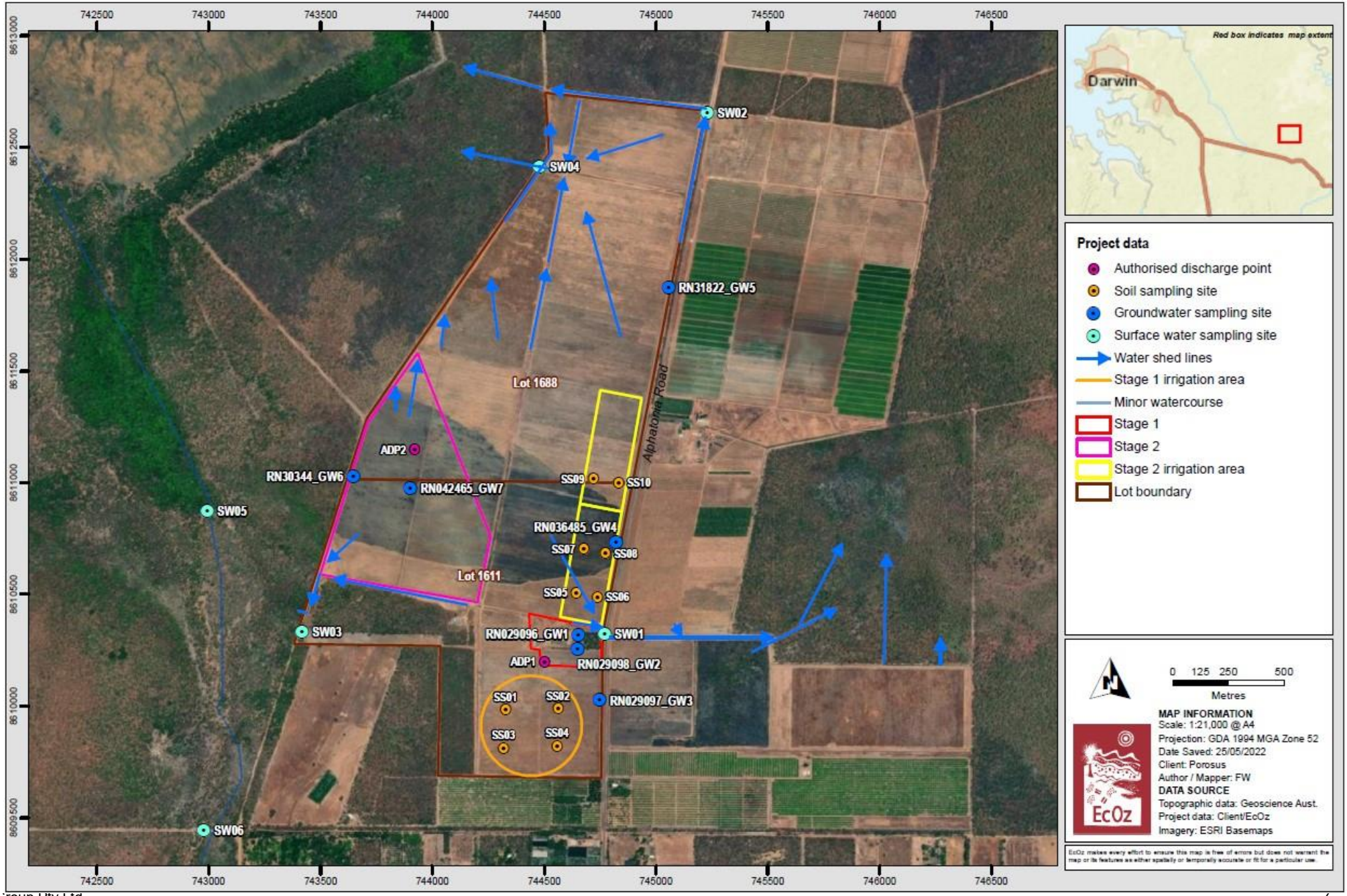

LEGEND
PROPERTY BOUNDARY
EXISTING SEWER
EXISTING WATER
EXISTING ELECTRICAL
EXISTING SURFACE CONTOUR
STAGE LIMIT OF WORKS
STAGE 2
RB 04
RB 05
RETENTION BASIN
GROWER AND FINISHER PENS
PLANT ACCESS TRACK
PL 04
PAD 01
PAD 03
PAD 02
STAGE 3 (NOT PART OF SCOPE)
ALPHATONIA ROAD
PROPOSED ACCESS TRACK
ROAD 01
EXISTING ACCESS TRACK
PROPOSED ACCESS TRACK
ROAD 02
EXISTING ACCESS TRACK
PROPOSED ACCESS TRACK
ROAD 03
STAGE 1
EXISTING SEALED ACCESS
OPEN DRAIN
OUD 05
ROAD 0506
STAGE 2 (NOT PART OF SCOPE)
PROPOSED ACCESS TRACK
HAT 01
HATCHLING PAD
EXISTING DETENTION BASIN CULVERT OUTLET
EXISTING DETENTION BASIN
Scale 1 : 2500 @ A1
CONSTRUCTION

Figure 1-2. Map of LLCF layout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744500
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745500
746000
746500
8613000
8612500
8612000
8611500
8611000
8610500
8610000
8609500
SW02
SW04
RN31822_GW5
Lot 1688
Alphatonia Road
ADP2
RN30344_GW6
RN042465_GW7
SS09
SS10
SW05
RN036485_GW4
SS07
SS08
Lot 1611
SS05
SS06
SW03
RN029096_GW1
SW01
ADP1
RN029098_GW2
SS01
SS02
RN029097_GW3
SS03
SS04
SW06
Red box indicates map extent
Darwin
Project data
Authorised discharge point
Soil sampling site
Groundwater sampling site
Surface water sampling site
Water shed lines
Stage 1 irrigation area
Minor watercourse
Stage 1
Stage 2
Stage 2 irrigation area
Lot boundary
0 125 250 500
Metres
MAP INFORMATION
Scale: 1:21,000 @ A4
Projection: GDA 1994 MGA Zone 52
Date Saved: 25/05/2022
Client: Porosus
Author / Mapper: FW
DATA SOURCE
Topographic data: Geoscience Aust.
Project data: Client/EcOz
Imagery: ESRI Basemaps
EcOz
EcOz makes every effort to ensure this map is free of errors but does not warrant the map or its features as either spatially or temporally accurate or fit for a particular use.

Figure 1-3. Map of LLCF surface water, groundwater, soil monitoring sites and surface drainage

2 LLCF OPERATIONS OVERVIEW

The information provided below is a brief overview of LLCF operations and environmental setting. For more detail, please refer to the following documents:

EcOz 2022, *Supporting information for the Lambells Lagoon Crocodile Farm EPL320 Amendment*, report prepared for PRI Farming Pty Ltd by EcOz Pty Ltd, January 2022

EcOz 2021, *Irrigation Management Plan, Lambells Lagoon Crocodile Farm*, report prepared for PRI Farming Pty Ltd by EcOz Pty Ltd, November 2021

2.1 Farm operations

Development of the farm occurred in two stages. Stage one included the incubation building refurbishment, hatchery pens, administration building refurbishment, water management infrastructure (water supply tank, effluent collection sump, wastewater storage tank, wastewater screening and an interim irrigation area), and associated infrastructure.

Stage two included the growers, finishers, and a large wastewater system.

The crocodile production process at LLCF is summarised as follows:

1. Eggs are collected from breeding pens (other farms) and the wild. The eggs are assessed and cleaned in egg laboratory, with viable eggs transferred to the incubator room
2. Animals hatch in the incubator then are immediately transferred to hatching pens
3. When animals are of suitable size, they are transferred from the hatchery to grower pens
4. Animals approaching a size suitable for market are transferred to finishing pens to ensure best possible skin and meat condition
5. Animals are harvested from the finishing pens when they are about two years of age.

2.2 Water supply and usage

The primary use of water on site is for regular flushing of the hatchery, grower and finishing pens to maintain crocodile hygiene and health. LLCF has a groundwater extraction entitlement of 3,216 ML/year (Groundwater Extraction Licence [GEL] HGS10000) from 11 existing bores. The bores are located within the LLCF property and extract from the Howard Groundwater system, comprising the Koolpinyah Dolostone.

Each water supply bore has an automated flow meter, and the volumes of water extracted must be reported to the NT Controller of Water Resources on a monthly basis. Table 2-1 below lists the bores used for water supply and also monitoring. The volume of water extracted from each bore during the 12-month period May 2023 to April 2024, inclusive, is provided. The total volume of water extracted over this period for all bores combined was 1,011 ML compared to 535 ML in the previous year.

Table 2-1. Groundwater bore details and water usage for May 2023 to April 2024 inclusive
GEL – Groundwater Extraction Licence HGS10000

Monitoring Bore ID	Bore (RN)	Year of completion	Depth (m)	Purpose	Water extracted May 23 – Apr 24 (ML)
N/A	029733	1994	87.5	Included in GEL. Water supply only	467.1

GW1	029096	1995	47.0	Included in GEL. Water supply and monitoring.	39.2
GW3	029097	1995	103.3	Included in GEL. Not currently used for water supply. Monitoring only.	0
GW2	029098	1995	44.5	Included in GEL. Water supply and monitoring.	2.8
GW6	030344	1995	36.5	Monitoring only/ NT Water Resources bore.	0
N/A	030410	1996	75.6	Included in GEL. Water supply only.	0
N/A	030412	1996	Backfilled	Included in GEL.	0
N/A	030418	1996	90.8	Included in GEL. Not currently used.	0
GW5	031822	1998	87.6	Included in GEL. Not currently used for water supply. Monitoring only.	0
N/A	031829	1998	84.9	Included in GEL. Water supply only	0
GW4	036485	2009	62.2	Included in GEL. Water supply and monitoring.	0
GW7	042465	2021	41.0	Included in GEL. Water supply and monitoring.	501.8

2.3 Wastewater flows, treatment, and irrigation

Wastewater from the hatchery (Stage one) is directed to the effluent collection sump prior to primary treatment through coarse screening of solids followed by fine screening. Wastewater is then directly irrigated to land. A Pierce C600 centre pivot system is used as the irrigation mechanisms for wastewater disposal over the Stage one irrigation area, where Jarrah grass is grown.

Wastewater from the growers and finishers (Stage two) is directed to the Stage two effluent collection sump prior to primary treatment through coarse screening of solids followed by fine screening. Wastewater is then pumped to the retention basin for irrigation to the Stage two irrigation area, where African Mahogany is grown. The irrigation mechanism used in the area is an in-line drip system.

2.4 Environmental setting

The region of the project area experiences a tropical climate with a distinct dry season (May to October) and wet season (November to April). Typically, for this region, humidity, maximum and minimum temperatures are highest in the wet season, and annual evaporation far exceeds annual rainfall.

Climate data is sourced from the Bureau of Meteorology (BoM) weather monitoring station at Middle Point Rangers (station number 014090) and McMinns Lagoon (station number 014219), given that no rainfall records are available for 2022 at Middle Point Rangers. Average annual rainfall at McMinns Lagoon (18 km west of the site) is 1,885 mm, with the highest rainfall occurring in January and the lowest in July.

Annual evaporation at Middle Point Rangers (7 km south-east of the site) is 2,191 mm, which exceeds the average annual rainfall. Evaporation is the highest in October and lowest in February.

Table 2-2. Average rainfall and evaporation (taken from BoM Station No. 14090 and 14219)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	465.3	381.2	326.8	104.4	17.2	1.2	0.8	3.4	15.7	79.3	183.4	309.3	1885.3
Evaporation (mm)	160.7	141.7	158.5	169.3	178.7	173.3	183.9	204.6	217.4	226.9	195.9	180	2190.9

LLCF is located on a relatively flat area, with a gradient of <2%. The area is moderately well-drained, allowing adequate infiltration and minimal surface water runoff. Existing constructed drains located on site, collect and direct overland flows towards the property boundaries (see Figure 1-3). Surface water drainage from the Stage one area sheds to the east through existing box culverts under Alphatonia road, flowing towards Lambells Lagoon.

The northern portion of the project area (section 1688) flows to the north-west into Black Jungle Swamp. The south-west section of 1688 and western portion of section 1611 (primarily Stage two) flows to the south-west into a drainage line flowing into Black Jungle Swamp. Overland flows in the eastern parts of sections 1611 and south-east corner of section 1688 drain to the east towards Lambells Lagoon.

The site is located within the lower Adelaide River catchment and is surrounded by the Adelaide River coastal floodplains. The Adelaide River floodplain is designated as a Site of Conservation Significance (SOCS) by the Northern Territory Government and encompasses the project area. However, the site area does not encompass habitats of recognised conservation value or significance within the SOCS due to pre-existing clearing and land use.

Agriculture and Conservation Reserves are the main land zones in the neighbouring land. The site is located between two Conservation Reserves, the Black Jungle to the west and Lambells Lagoon to the east. Northwest of the site the land is zoned as horticultural, where a fruit farming business (Darwin Fruit Farms) is located.

A nursery (Darwin Plant Wholesalers) and volunteer fire brigade station are located south of the site. In addition to the horticultural infrastructure, there are multiple buildings on neighbouring properties used for rural living, to the south of the irrigation and farming operations areas. Alphatonia Road is immediately to the east of section 1611 and 1688. Other surrounding land users accessing Alphatonia Road past the Project includes the Koolpinyah Station.

3 RAINFALL AND DISCHARGES

3.1 Rainfall

Figure 3-1 shows monthly rainfall totals for the reporting period taken from the McMinns Lagoon BoM station No. 14219. Average monthly rainfall totals are also shown for comparison. Rainfall was above average only in January and March 2024. In January, rainfall was almost twice as much as the average for that month. Total rainfall for the reporting period was 2,005.6 mm, which is above the annual average (1,888 mm).

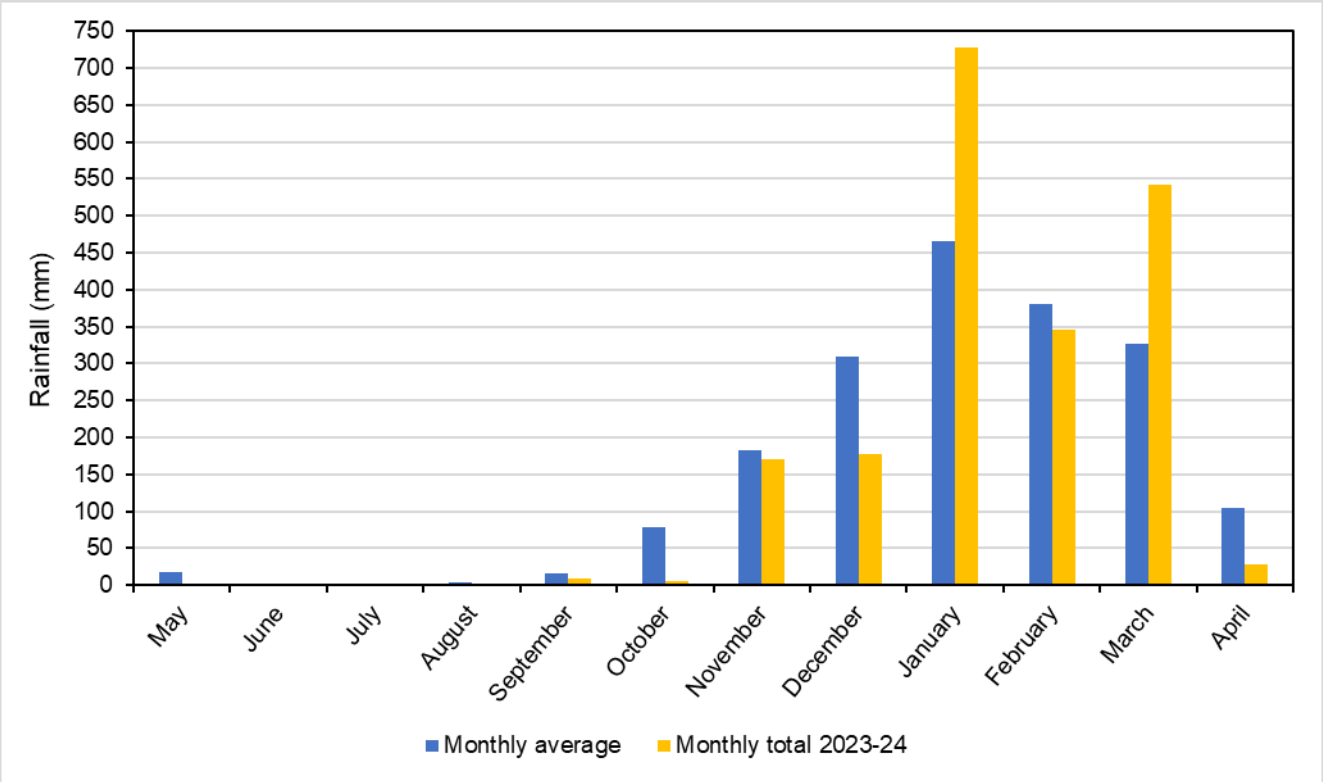

Figure 3-1. Monthly rainfall totals May 2023 to April 2024 (McMinns Lagoon BoM station No. 14219)

3.2 Reporting period discharge details

Irrigation volumes from the two authorised discharge points during the reporting period are provided in Table 3-1. As show, a total of 677.24 ML were irrigated during the reporting period. The highest volumes were irrigated from ADP2, where volumes have considerably increased as an additional 110 ha of syntropic plantation have been established in 2023.

Table 3-1. Irrigation discharges during the reporting period May 2023 –April 2024

Month	ADP1 pivot irrigation volumes (ML)	ADP2 plantation irrigation volumes (ML)
May 23	3.02	57.40
Jun 23	2.92	35.70
Jul 23	2.54	46.90
Aug 23	2.76	68.80
Sep 23	3.11	43.30
Oct 23	2.44	68.60
Nov 23	2.82	70.70
Dec 23	0.00	64.40
Jan 24	2.93	45.40
Feb 24	2.93	41.90
Mar 24	2.70	58.60

Apr 24	3.16	44.21
Total	**31.33**	**645.91**

4 MONITORING UNDERTAKEN

During the reporting period, monitoring was undertaken as per EPL320-01 requirements using the methods outlined in the LLCF *Irrigation Management Plan* (EcOz 2021) and summarised below.

4.1 Monitoring sites

Details for surface water, groundwater and soil monitoring sites as listed in EPL320-01 Appendix A are shown in Figure 1-3 and detailed below in Table 4-1.

Table 4-1. Surface water, groundwater, and soil monitoring site details

Site ID	Context and purpose	GPS Coordinates	
		Latitude	Longitude
Surface Water Sites			
ADP1 – Irrigation Pivot	'Authorised discharge point' listed in EPL320-01. Stage one wastewater pump station authorised discharge point. This site represents water applied to the Stage one pivot irrigation area, located on the southern portion of LLCF.	744501	8610198
ADP2 – Irrigation Plantation	'Authorised discharge point' listed in EPL320-01. Stage two wastewater pump station authorised discharge point. This site represents water applied to the Stage two plantation irrigation area located on the eastern portion of LLCF.	743920	8611147
SW01	Drainage line west of Alphatonia Rd. at Property entrance, receives runoff from Stage one – parcel 1611, flowing east to Lambells Lagoon.	744770	8610323
SW02	Drainage line west of Alphatonia Rd. at the north-east corner of parcel 1688. Receives surface water runoff from Alphatonia Rd flowing west along the northern boundary into Black Jungle Swamp.	745229	8612655
SW03	Drainage line on south-west boundary corner of parcel 1611 flowing west to Black Jungle Swamp. Downstream stormwater drainage from Stage two.	743417	8610332
SW04	Drainage line north-west of parcel 1688 flowing west to Black Jungle Swamp. Receives surface water runoff from Stage two plantation irrigation area.	744480	8612413
SW05	Drainage line on western side of LLCF that flows into Black Jungle Swamp. Site is located downstream of SW3 and the LLCF.	742993	8610872
SW06	Drainage line on western side of LLCF that flows into Black Jungle Swamp. Site is located upstream of SW3 and the LLCF.	742978	8609442
Groundwater Bores			
GW1	Bore located adjacent to the office facilities and east of incubation building. Water supply bore.	744654	8610320
GW2	Bore located adjacent to the hatchery for irrigation use.	744649	8610254
GW3	Bore located west of Alphatonia Rd. within south-east section of parcel 1611.	744748	8610026
GW4	Bore located west of Alphatonia Rd. within north-east section of parcel 1611. Water supply bore.	744823	8610734

GW5	Bore located west of Alphatonia Rd. within parcel 1688.	745056	8611871
GW6	Water Resources Bore equipped with water level logger. Located on the western side of LLCF on boundary, SW corner of parcel 1688 downstream of Stage two.	743648	8611027
GW7	Bore located in Stage two area near retention basin. Water supply bore for Stage two operations.	748905	8618978
Site ID	**Context and purpose**	**GPS Coordinates**	
		Latitude	**Longitude**
Soil Sites			
SS01	Stage one irrigation area (15 ha)	744326	8609983
SS02		744560	8609986
SS03		744317	8609812
SS04		744557	8609821
SS05	Stage two irrigation area (20 ha)	744683	8610449
SS06		744679	8610651
SS07		744772	8610801
SS08		744725	8610971
SS09		744811	8611124
SS10		744811	8611299

4.2 Monitoring frequency, parameters, and trigger values

Table 4-2, Table 4-3, Table 4-4 and Table 4-5 list the parameters to be measured at each site, the sampling frequency and trigger values currently specified in EPL320-01 Attachment A.

Table 4-2. Monitoring program and trigger values for irrigation water

Monitoring site	Parameter	Sampling frequency	Trigger value
Irrigation extraction points / authorised discharge points: ADP1 (-12.562519, 131.250281) ADP2 (-12.553989, 131.244869)	pH	Monthly when discharging and quarterly when not discharging	6 – 9[1]
	EC (electrical conductivity)		1,300 µs/cm[1]
	Total Phosphorus (TP)		12 mg/L[1]
	Total Nitrogen (TN)		125 mg/L[1]
	E. coli, Enterococci, Total coliforms		1,000 cfu/100mL (fodder)[1]
	Cations and anions (Ca, Mg, Na, K, SO_4, Cl, CO_3 + HCO_3)		N/A

[1]*Australian and New Zealand Guidelines for Fresh and Marine Water Quality – Volume 3 – Chapter 9 – Primary Industries (ANZECC, 2000)*

Table 4-3. Monitoring program and trigger values for groundwater sites

Monitoring sites	Parameter	Sampling frequency	Trigger value
GW1, GW2, GW3, GW4,	Standing water level (SWL)	Monthly	N/A

GW5, GW6[1] and GW7	pH	Quarterly	7.0 – 8.5[1]
	EC		400 µs/cm[1]
	TP		Any increase from previous monitoring round
	TN		
	E. coli, Enterococci, Total coliforms		
	Cations and anions (Ca, Mg, Na, K, SO_4, Cl, CO_3 + HCO_3)		N/A

[1] *Darwin Harbour Water Quality Objectives for groundwater (2010).*

Table 4-4. Monitoring program and trigger values for surface water sites

Monitoring sites	Parameter	Sampling frequency	Trigger value
SW01, SW02*, SW03, SW04, SW05 and SW06*	pH	3 times during the wet season (start, mid, end)	6.0 – 7.5[1]
	EC		200 µs/cm[1 2]
	TP		0.01 mg/L[1 2]
	TN		0.23 mg/L[1 2]
	E. coli, Enterococci, Total coliforms		Any increase from previous monitoring round

**Trigger values not applicable.*

[1] *Darwin Harbour Water Quality Objectives for freshwater rivers and streams.*

[2] *If the concentration at SW06 is greater than the trigger value then the concentration at SW06 becomes the trigger value for that monitoring round.*

Table 4-5. Monitoring program and trigger values for soil sites

Monitoring sites	Parameter	Sampling frequency	Trigger value*
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SS08, SS09 and SS10	pH	Annually	6 – 8
	EC		Any increase from the previous monitoring round
	TP		
	TN		
	E. coli, Enterococci, Total coliforms		

* *B horizon results.*

4.3 Sampling procedures

All sampling is undertaken in accordance with the LLCF *Irrigation Management Plan* (EcOz 2021) and the following standards and guidelines:

Australian/New Zealand Standard on Water Quality Sampling - *Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* (AS/NZS 5667.1:1998), Standards Australia, New South Wales.

[1] *NT Water Resources Bore – SWL only- accessed online.*

Australian Standard/New Zealand Standard on Water Quality Sampling - *Part 4: Guidance on sampling from lakes, natural and manmade* (AS/NZS 5667.4:1998), Standards Australia, New South Wales.

Australian/New Zealand Standard on Water Quality Sampling - *Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998), Standards Australia, New South Wales.

Australian Standard/New Zealand Standard on Water Quality Sampling – *Part 10: Guidance on sampling of waste waters* (AN/NZS 5667.10:1998), Standards Australia, New South Wales.

Australian/New Zealand Standard on Water Quality Sampling – *Part 11: Guidance on sampling of groundwater* (AN/NZS 5667.11:1998), Standards Australia, New South Wales.

Australian Standard on Contaminated Soil Sampling – *Guide to the sampling and investigation of potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds* (AS4482.1-2005), Standards Australia, New South Wales

ANZG (2018): *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.

Department of Environment and Conservation (2004): *Use of Effluent by Irrigation; Environmental Guidelines*, Department of Environment and Conservation (DEC), New South Wales Government, Sydney.

PRI Farming Pty Ltd (2024) *Standard Operating Procedure* (*SOP) – Groundwater and Wastewater Monitoring.*

Water sampling was carried out by LLCF staff, who have received on-site training in sampling methods from EcOz. All soil samples were collected by EcOz staff.

All laboratory samples were collected into ALS Laboratory-supplied sample bottles/jars; some of which contain preservative where required. Once collected, these samples were kept cold in an esky with ice bricks until dispatched to the ALS shopfront on the same day as sampling in order to meet analytical holding time limits.

All surface water monitoring sites were sampled into a laboratory-supplied sample bottle. Field parameters i.e. pH, electrical conductivity (EC) and total dissolved solids (TDS), are also measured in the laboratory.

Groundwater was purged for a minimum of 10 minutes, then, lab samples were collected directly into the labsupplied bottles. No parameters are measured in-situ and as such, all parameters, including pH, are measured at the laboratory.

Soil samples were collected from surface and the B horizon (around 0.4 to 0.5 m below ground surface) using a mechanical auger which was decontaminated between each sample site.

All laboratory results are stored in an Excel database updated and maintained by EcOz.

All laboratory documentation are stored in an online filing system maintained by EcOz (M-Files). PRI also maintain copies of all laboratory documentation.

4.4 Monitoring undertaken during the reporting period

Table 4-6 outlines the monitoring undertaken during the reporting period and compliance against EPL320-01 monitoring requirements. The following dot points explain the reasons for some non-compliances with the monitoring requirements:

- The LLCF site and surrounding areas are very flat and most runoff sheet flows into indistinct drainage lines that only flow during heavy rainfall. Sampling the six surface water sites has proved very difficult, as sampling needs to occur during heavy rain and at a time that allows the samples to be delivered to the interstate laboratory within the required analyte holding time i.e. must be delivered to laboratory shopfront in Darwin prior to 2 pm and only on Monday to Thursday.

PRI will endeavour to improve compliance with monitoring requirements by investigating how to achieve sampling of the surface water sites when they are flowing and still meet analytical holding time requirements.

Table 4-6. Monitoring undertaken during the reporting period

Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
ADP1 – Irrigation Pivot ADP2 – Irrigation Plantation	Monthly during discharge, quarterly when not discharging	15/05/2023 13/06/2023 12/07/2023 23/08/2023 12/09/2023 18/10/2023 15/11/2023 18/01/2023	Compliant, except in December 2023, February, March and April 2024.	Compliant.
SW01, SW02, SW03, SW04, SW05, SW06	Three times during wet season (start, mid and end)	18/01/2024 (SW05 only)	Sampling was attempted at all sites during the wet season; however, when visited, sites were not flowing, except for SW05 in January 20224.	Compliant.

Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
GW1, GW2, GW3, GW4, GW5, GW6, GW7	Standing water levels (SWL) monthly	01/02/2024 01/03/2024	Not compliant – SWLs only measured twice in the reporting period.	-
	Water quality quarterly	13/06/2024 (GW1, GW2, GW3, GW5) 12/09/2023 (GW1, GW2, GW3) 18/01/2023 (GW1, GW2, GW3, GW6)	Not compliant – GW1, GW2 and GW3 samples three out of the four times required. GW4 not sampled. GW5 and GW6 sampled once.	Compliant.

SS01, SS02, SS03, SS04, SS05, SS06, SS07, SS08, SS09, SS10	Annually	31/01/2024	Compliant	Compliant

5 RESULTS AND DISCUSSION

Monitoring results for the reporting period are presented and discussed in the sections below. Note that given annual monitoring for EPL320-01 begun in April 2021, data from the previous monitoring round will be referenced for comparison and to outline possible trends in the data. All historical data for parameters with a defined trigger value are graphed in Appendix A.

5.1 Authorised discharge points

Table 5-1 provides all water quality monitoring results for the two authorised discharge points, ADP1 (Irrigation Pivot) and ADP2 (Irrigation Plantation), for all sampling undertaken since monitoring began in May 2021.

All pH levels were below the trigger value at ADP1, where it ranged from 7.48 to 7.86. At ADP2, pH levels were above the trigger value in August, September, November and January, when it ranged from 9.04 to 9.45. Since January 2023, an increasing trend in pH levels is evidenced at ADP2.

All EC, TN and TP concentrations were below the trigger values at both ADP1 and ADP2. No increasing trend is observed in these parameters.

Total coliforms were almost always above the trigger value at both sampling sites. Enterococci and *E. coli* frequently exceeded the trigger value at ADP1 but were always below the guideline at ADP2. However, given the nature of the wastewater sampled at the ADP1 and ADP2 sites, high concentrations of pathogens are expected. Despite the concentration spikes recorded, no increasing trend is observed (see Appendix A). Historical data also indicates that the spikes recorded in this reporting period are higher than those reported in the 2022-23 monitoring, but lower than those observed in March 2022.

Given that Jarra grass grown at Stage One is used as fodder by a third person farmer. They were made aware of the high bacterial load of the water used to irrigate the crop.

The African Mahogany plantation on the Stage Two irrigation area is not to be used for consumption, as such bacterial concentrations should not pose an issue.

It is worth noting that water quality at the discharge points is expected to improve in the 2024/25 monitoring period, as a hydrogen peroxide injection system has been installed onsite to reduce the bacterial load in the wastewater irrigated.

5.2 Groundwater quality

Table 5-2 provides the groundwater quality results for all sampling undertaken during the reporting period, as well as historical data available for the monitoring bores. During the monitoring period, GW1 to GW3 were sampled three times, GW5 and GW6 once, and GW4 was not sampled. Given that it is the first time that GW6 is sampled, its results cannot be assessed against historical data from this bore.

pH levels at all bores sampled were always within the trigger values, with levels ranging from 7.03 to 7.88. No long-term increasing or decreasing trend in pH is evident in any of the five bores. However, a rainfall

seasonality is apparent, as pH tends to increase during the wet season and decrease during the dry season. It is worth noting that pH is not measured in-situ, which reduces the accuracy of the results obtained.

EC was also below the guideline at all monitoring bores. EC concentrations have always been well below the trigger value since monitoring began in February 2020 and no increasing trend is evident in any of the bores. Overall, EC at GW4 and GW3 appear to be commonly lower than at any other monitoring bore, potentially indicating a higher influence of surface water quality at these bores.

During the monitoring period, spikes in the concentration of nutrients (TP and TN) were recorded at the bores sampled; however, levels always decreased in the subsequent rounds. In September and June 2023, GW3 and GW5 recorded their highest TN concentration since monitoring started, but no increasing trend is observed at these bores. An increasing trend in TN is observed at GW1, where levels have been rising since 2022. TP at all bores remained within their historical range, with no trends observed.

Exceedances in concentration of total coliforms were recorded in the reporting period, although all concentrations decreased in the following samplings. No increasing trend is observed at any monitoring bore; however, a seasonal trend is observed at GW1, where concentrations tend to be the highest in the dry season, potentially due to a reduced dilution rate of the bacteria. Total coliforms reached their highest recorded levels at GW1 and GW3 in September 2023, and at GW2 in January 2024. High levels were also recorded at GW6, but the lack of historical data for this bore limits any trend identification.

As shown in Table 5-2*, E. coli* and enterococci concentrations in groundwater were mostly negligible in all bores, although concentration spikes were recorded in September 2023 and January 2024. The highest concentration of *E. coli* and enterococci during the reporting period was recorded at GW2 in January 2024, although these levels were within historical records at this bore. In September 2023, *E. coli* at GW1 and GW3 were the highest ever recorded, coinciding with spikes in total coliforms levels at these bores. Despite the spikes, no increasing trends are observed.

The *E. coli* level recorded at GW6 is the highest ever recorded at any monitoring bore since monitoring started. Since this is the first time that this bore is sampled and historical data are not available for the closest bore GW7, it is not possible to determine any concentration trends. However, it is likely that bore purging was not done adequately prior to sample collection, potentially impacting on the validity of the results obtained. To mitigate any inconsistencies in the sampling process, EcOz developed a Standard Operating Procedure (SOP) for PRI Group in March 2024. Furthermore, staff responsible for sampling will receive training on the fieldwork procedures outlined in the SOP.

The elevated bacterial load recorded at GW2, and the potential impact also observed at GW6, indicate that water contaminated with animal faeces is seeping into the aquifer.

The elevation of the bores relative to the Australian Height Datum is unknown, limiting the assessment of groundwater flow directions. However, groundwater flow in the Howard System primarily follows the topography (Northern Territory Government 2016), and as such, the results from GW3 (downgradient from GW2) would indicate a reduction in bacterial load. No monitoring bores are located down hydraulic gradient from GW6. Contaminant transport, particularly of bacteria, is influenced by factors such as aquifer porosity, which can lead to attenuation of bacteria through interactions with the solid phase of the aquifer. However, the monitored aquifer is a dolomite aquifer, which typically exhibits rapid recharge and groundwater flow through fractures; therefore, a low attenuation and rapid spread of contaminants (Xu & Feriancikova 2014) cannot be discarded.

5.2.1 Groundwater bore standing water levels

Figure 5-1 shows the standing water levels (SWLs) measured in all bores since monitoring started in October 2020. Table 5-3 provides SWL data from the May 23 – April 24 monitoring period. Data available for the monitoring period indicates that SWLs were within the normal historical range.

SWLs in mBTOC for GW6 were calculated adding the depth below ground reported in the NT Water Resources website (DEPWS 2022b) and the top of casing height (0.436 m; DEPWS 2022a). The groundwater levels for

GW6 were only recorded in October 2023 and March 2024 by NT Water Resources during the monitoring period.

5.3 Surface water sites

Table 5-4 provides the surface water quality results for sampling undertaken during the reporting period, as well as historical data.

The sample collected from SW05 in January was within the accepted guidelines for pH. However, pH in surface water at the site is commonly slightly acidic and generally below the trigger value range, which is typical of fresh rainwater in the tropics.

Since monitoring started, EC concentrations in surface water have been well below the trigger value, with concentrations always below 49 µS/cm. The result obtained in this monitoring period at SW05 complies with the adopted trigger value and is within the levels commonly recorded.

TN and TP concentrations are commonly above the very conservative Darwin Harbour water quality objectives. In the sample collected from SW05, both parameters exceeded the trigger value. Baseline conditions included in the *Supporting Information for the Lambells Lagoon Crocodile Farm EPL320 Amendment*, indicate that TN in surface water sites can range from 0.2 to 0.5 mg/L, while TP can be between <0.01 and 0.12 mg/L. The concentrations recorded in January at SW05 are within these values; therefore, the exceedance recorded is not of concern.

Total coliforms increased at SW05 when compared against the results obtained at the same site in January 2023. However, *E. coli* and enterococci levels decreased. Therefore, the results obtained at this site are not of concern.

Given the limited data available for all surface water sites, it is not possible to assess any concentration trends.

5.4 Soils

Table 5-5 provides the soil monitoring results for the reporting period and data from the previous monitoring rounds. Note that irrigation of the Stage one area only started in early 2021 and in the Stage two area in early 2022.

pH values were all within the accepted rage, although levels increased at all sites with respect to the previous monitoring round.

EC concentrations increased at all sites except SS4 and SS10, ranging from 48 to 182 µS/cm during the reporting period. An increasing trend in EC concentration is evident, likely influenced by the high EC levels in the irrigation water.

Nutrient concentrations in soil samples were higher than in the 2023 sampling round. TP levels varied across the two irrigation areas, ranging from 111 to 323 mg/kg. TN levels were higher in samples from the Stage One area (420 to 740 mg/kg) compared to Stage Two (320 to 490 mg/kg).

Total coliforms and enterococci levels increased in the 2024 sampling compared to 2023. Total coliforms were higher in the Stage One sites (3,500 – 28,000 MPN/g dry wt) than in Stage Two (12 – 2,000 MPN/g dry wt). Enterococci levels were variable across sampling sites. An increasing trend in total coliform levels is observed at most sites. The higher bacterial, and nitrogen, load in the Stage One sites is likely influenced by the higher levels of bacteria and nitrogen irrigated at Stage One (Irrigation Pivot).

E. coli was at or below the laboratory level of reporting at all monitoring sites in the reporting period.

The soil results obtained in this monitoring period can pose a risk for groundwater and surface water quality, as bacteria and nutrients have the potential to migrate off-site through surface water runoff, and vertically into the underlaying aquifer. Although an apparent localised impact on groundwater is observed in some monitoring bores, the impact on surface water is yet to be determined, as limited data is currently available. High levels

of bacteria and nutrients in soils increase the risks of surface water contamination during the wet season, as saturated soils have a reduced capacity to absorb irrigated wastewater, leading to higher surface runoff.

Table 5-1. Authorised discharge point (irrigation source) water quality monitoring results since May 2021.

Concentrations exceeding EPL320-01 trigger values for irrigation water highlighted in orange

Site ID	Date	pH	EC	TDS	Nitrite + Nitrate	TKN	TN	TP	E coli	Total Coliforms	Enterococci	Hydroxide Alkalinity as CaC03	Carbonate Alkalinity as CaC03	Bicarbonate Alkalinity as CaC03	Total Alkalinity as CaC03	Sulfate as S04	Chloride	Calcium	Magnesium	Sodium	Potassium	Total Anions	Total Cations
			µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	CFU/100mL	CFU/100mL	CFU/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/m3
Irrigation EPL320 trigger values		**6.0 - 9.0**	**1300**				**125**	**12**	**1000**	**1000**	**1000**												
Irrigation Pivot	13/05/2021	7.23	433	268	240	165	405.0	37.30	2200	30000	2500	<1	<1	180	180	6	33	30	16	23	4	-	-
Irrigation Pivot	25/05/2021	7.75	1120	507	1.05	109	110.0	4.65	8300000	~9100000	13000000	<1	<1	517	517	6	28	54	26	19	7	-	-
Irrigation Pivot	9/06/2021	6.65	344	206	<0.01	5.4	5.4	1.38	320000	~3200000	7100	<1	<1	168	168	8	19	32	17	14	3	-	-
Irrigation Pivot	6/07/2021	7.77	506	288	<0.01	20.6	20.6	4.18	~290000	130000	30000	<1	<1	216	216	2	28	46	21	19	3	-	-
Irrigation Pivot	12/08/2021	7.35	524	300	<0.01	16.8	16.8	2.30	25000	~50000	61000	<1	<1	234	234	4	37	26	16	26	3	-	-
Irrigation Pivot	16/09/2021	7.82	812	374	0.01	57.3	57.3	4.32	180000	450000	58000	<1	<1	392	392	8	28	34	20	20	8	-	-
Irrigation Pivot	20/10/2021	7.93	688	412	0.69	71.2	71.9	6.02	4100000	19000000	~1300000	<1	<1	317	317	7	34	40	21	26	12	-	-
Irrigation Pivot	30/11/2021	7.88	560	280	0.28	34.9	35.2	3.58	9800000	~12000000	~90000	<1	<1	252	252	7	27	33	19	22	7	5.94	4.35
Irrigation Pivot	20/12/2021	7.98	776	391	0.66	72.0	72.7	10.1	24000000	1.6E+08	4500000	<1	<1	347	347	14	32	36	21	30	16	8.13	5.24
Irrigation Pivot	24/01/2022	7.63	482	298	5.88	14.5	20.4	3.56	-	-	-	<1	<1	179	179	7	30	30	20	28	11	4.57	4.64
Irrigation Pivot	22/02/2022	7.67	325	163	<0.01	4.6	4.6	1.55	96000	140000	29000	<1	<1	157	157	4	13	29	15	11	3	3.59	0.17
Irrigation Plantation	22/02/2022	6.99	70	37	0.02	3.3	3.3	0.37	69000	~99000	5400	<1	<1	30	30	2	4	6	1	3	2	0.75	0.56
Irrigation Pivot	30/03/2022	7.66	564	329	0.65	63.2	63.8	5.50	1.4E+09	280000000	0 9500000	<1	<1	221	221	3	28	33	21	24	10	5.27	4.67
Irrigation Plantation	30/03/2022	8.61	217	110	0.02	11.4	11.4	2.08	<2	~28	420	<1	12	38	50	11	18	18	4	8	7	1.74	1.75
Irrigation Pivot	26/04/2022	7.95	679	352	0.97	46.4	57.4	3.68	1E+09	1.9E+09	59000000	<1	<1	295	295	5	29	29	19	21	9	6.82	7.47
Irrigation Plantation	26/04/2022	7.73	444	242	0.02	20.7	20.7	3.85	190000	~1100000	18000	<1	<1	136	136	30	31	30	7	15	15	4.22	4.59
Irrigation Pivot	13/07/2022	7.95	711	308	0.89	55.2	56.1	3.84	~9000000	1.1E+08	410000	<1	<1	294	294	6	20	37	20	15	7	6.56	8.27
Irrigation Plantation	13/07/2022	8.62	282	184	0.24	6.1	6.3	1.20	250	2500000	16	<1	29	105	134	7	12	29	15	8	1	3.16	----
Irrigation Pivot	16/08/2022	7.95	360	187	0.80	6.3	7.1	0.59	150000	200000	~70000	<1	<1	158	158	3	13	28	18	11	1	3.59	3.38
Irrigation Plantation	16/08/2022	8.98	311	196	0.19	9.2	9.4	2.00	720	~700000	1700	<1	22	88	110	5	34	31	10	20	2	3.26	3.29
Irrigation Pivot	26/09/2022	7.85	538	213	0.03	25.6	25.6	6.30	110000	540000	~110000	<1	<1	239	239	6	21	39	20	17	4	5.49	4.43
Irrigation Plantation	26/09/2022	8.10	288	165	<0.01	7.8	7.8	1.12	<2	~64	30	<1	<1	90	90	2	33	24	7	23	4	2.77	2.88
Irrigation Pivot	11/10/2022	7.80	728	254	<0.01	53.3	53.3	3.08	7700000	32000000	180000	<1	<1	341	341	9	20	30	22	16	7	7.56	8.05
Irrigation Plantation	11/10/2022	7.77	563	278	0.62	43.4	44.0	10.70	330000	3900000	~50000	<1	<1	233	233	23	24	35	20	17	6	6.15	7.39
Irrigation Pivot	24/11/2022	8.09	674	245	0.29	55.5	55.8	6.03	480000	3000000	110000	<1	<1	328	328	7	21	34	18	16	7	7.29	8.04
Irrigation Plantation	24/11/2022	8.52	315	186	0.26	7.1	7.4	1.91	1800	35000	10000	<1	<1	120	120	5	24	25	15	14	3	3.34	3.17
Irrigation Pivot	22/12/2022	7.95	545	225	1.20	33.8	35	3.99	570000	3600000	44000	<1	<1	296	296	6	15	34	18	10	5	6.46	6.38
Irrigation Plantation	22/12/2022	7.97	390	230	<0.01	11.1	11.1	3.31	~<2	~<2	28	<1	<1	194	194	<1	26	28	19	13	5	4.61	4.45
Irrigation Pivot	24/01/2023	7.42	484	228	<0.01	26.5	26.5	2.47	100000	22000000	230000	<1	<1	209	209	11	15	28	15	12	6	4.83	5.2
Irrigation Plantation	24/01/2023	7.49	308	184	0.01	8	8	2.02	100000	5800000	380000	<1	<1	120	120	5	24	22	10	14	5	3.18	3.23
Irrigation Pivot	15/02/2023	7.35	563	286	0.01	26.2	26.2	2.96				<1	<1	265	265	10	16	35	20	12	6	5.95	6.25
Irrigation Plantation	15/02/2023	7.09	758	268	<0.01	43.6	43.6	9.36				<1	<1	355	355	<1	23	36	20	15	8	7.74	7.93
Irrigation Pivot	15/03/2023	7.50	498	200	<0.01	21.8	21.8	2.23	81000	24000000	32000	<1	<1	224	224	4	21	27	16	18	5	5.15	5.13
Irrigation Plantation	15/03/2023	7.84	256	114	<0.01	7.3	7.3	2.45	720	8200	400	<1	<1	105	105	2	20	19	7	12	5	2.70	2.70
Irrigation Pivot	15/05/2023	7.71	376	193	0.35	7.8	8.2	0.89	340	41000	3900	<1	<1	178	178	4	14	30	17	8	<1	4.03	3.83
Irrigation Plantation	15/05/2023	8.67	300	214	0.57	8.2	8.8	1.63	60	98000	110	<1	17	99	116	7	27	22	9	13	5	3.22	3.16
Irrigation Pivot	13/06/2023	7.48	530	232	0.02	23.9	23.9	3.28	6000000	2E+08	650000	<1	<1	242	242	4	16	36	19	18	6	5.37	6
Irrigation Plantation	13/06/2023	7.99	372	230	0.19	12.9	13.1	1.93	280	5000000	100	<1	<1	154	154	5	27	33	16	18	4	3.94	3.85
Irrigation Pivot	12/07/2023	7.64	576	208	<0.01	27.7	27.7	2.14	10000000	14000000	590000	<1	<1	270	270	7	18	37	20	12	4	6.05	6.1
Irrigation Plantation	12/07/2023	8.43	376	212	0.44	4.7	5.1	1.46	1500	40000	100	<1	16	140	157	6	29	39	18	14	3	4.08	3.86
Irrigation Pivot	23/08/2023	7.44	630	246	<0.01	34.6	34.6	2.86	7300000	34000000	570000	<1	<1	296	296	7	15	36	20	11	7	6.48	6.57

Irrigation Plantation	23/08/2023	9.04	335	205	0.06	4	4.1	0.89	800	930000	110	<1	40	109	149	4	25	29	16	12	3	3.76	3.66
Irrigation Pivot	12/09/2023	7.79	461	220	0.02	24.6	24.6	1.32	1000000	23000000	150000	<1	<1	222	222	5	13	33	20	14	4	4.91	4
Irrigation Plantation	12/09/2023	9.45	278	190	0.09	4.2	4.3	0.76	73	1300	10	<1	56	76	133	2	20	30	15	9	2	3.26	3.17
Irrigation Pivot	18/10/2023	7.55	790	334	<0.01	43	43	3.45	1300000	24000000	240000	<1	<1	344	344	5	61	49	22	16	9	8.7	8.25
Irrigation Plantation	18/10/2023	8.51	342	232	0.08	3.3	3.4	0.79	200	3700	160	<1	17	133	150	3	19	30	15	8	3	3.6	3.4
Irrigation Pivot	15/11/2023	7.85	779	324	0.15	61.7	61.8	4.92	3300000	14000000	190000	<1	<1	356	356	15	26	31	19	19	10	8.16	8.61
Irrigation Plantation	15/11/2023	9.09	304	184	0.22	1.7	1.9	0.44	20	640	52	<1	39	97	136	3	20	29	17	8	3	3.34	3.27
Irrigation Pivot	18/01/2024	7.62	600	260	0.02	16.5	16.5	1.56	300000	4300000	36000	<1	<1	253	253	12	26	38	18	18	5	6.04	5.48
Irrigation Plantation	18/01/2024	9.21	217	138	0.4	5.4	5.8	1.04	10	1100	62	<1	40	62	102	1	13	22	12	6	2	2.42	2.4

Table 5-2. Groundwater quality monitoring results since February 2020.

Concentrations outside EPL320-01 trigger values for groundwater highlighted in orange

Site ID	Date	pH	EC	TDS	Nitrite + Nitrate	TKN	TN	TP	E coli	Total Coliforms	Enterococci	Hydroxide Alkalinity as CaC03	Carbonate Alkalinity as CaC03	Bicarbonate Alkalinity as CaC03	Total Alkalinity as CaC03	Sulfate as S04	Chloride	Calcium	Magnesium	Sodium	Potassium	Total Anions	Total Cations
			µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	CFU/100mL	CFU/100mL	CFU/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/m3
Groundwater EPL320 trigger values		**7.0 - 8.5**	**400**				any increase from previous	any increase from previous	any increase from previous	any increase from previous	any increase from previous												
GW1_RN029096	27/02/2020	7.53	291	189	1.49	0.2	1.7	0.11	-	-	-	<1	<1	136	136	<1	8	26	17	5	<1	2.94	2.91
GW3_RN029097	27/02/2020	7.55	302	196	1.67	0.2	1.9	0.19	-	-	-	<1	<1	130	130	1	13	23	16	8	<1	2.98	2.81
GW4_RN036485	27/02/2020	7.40	249	161	2.05	0.3	2.4	0.11	-	-	-	<1	<1	119	119	<1	2	23	15	3	<1	2.43	2.51
GW1_RN029096	9/07/2020	7.50	317	206	1.3	0.2	1.5	0.04	<1	-	<1	<1	<1	137	137	<1	12	24	18	7	<1	3.08	2.98
GW2_RN029098	9/07/2020	5.63	76	50	3.55	0.5	4.0	<0.01	<1	-	~2	<1	<1	15	15	<1	7	2	4	3	<1	0.50	0.56
GW3_RN029097	9/07/2020	7.49	275	179	1.88	0.3	2.2	0.04	<1	-	<1	<1	<1	119	119	<1	11	20	15	7	<1	2.69	2.54
GW4_RN036485	9/07/2020	7.75	198	129	2.6	0.6	3.2	0.04	<1	-	<1	<1	<1	86	86	<1	3	15	11	3	<1	1.80	1.78
GW1_RN029096	28/10/2020	7.36	291	180	1.32	-	-	-	<1	~1	-	<1	<1	143	143	1	12	27	18	7	<1	3.22	3.13
GW2_RN029098	28/10/2020					-	-	-			-												
GW3_RN029097	28/10/2020	7.41	294	178	1.5	-	-	-	34	120	-	<1	<1	152	152	2	15	26	17	8	<1	3.50	3.04
GW4_RN036485	28/10/2020	7.30	193	101	2.22	-	-	-	~5	130	-	<1	<1	110	110	<1	3	20	13	3	<1	2.28	2.20
GW5_RN031822	28/10/2020	7.43	303	194	1.03	-	-	-	<1	~3	-	<1	<1	164	164	<1	3	31	20	3	<1	3.38	3.32
GW1_RN029096	3/11/2020	7.39	326	212	1.4	0.1	1.5	0.01	-	-	-	<1	<1	151	151	1	13	26	18	7	<1	3.40	3.08
GW2_RN029098	3/11/2020	6.97	228	148	2.21	0.3	2.5	<0.01	-	-	-	<1	<1	87	87	1	14	15	13	8	<1	2.15	2.17
GW3_RN029097	3/11/2020	7.54	298	196	1.62	0.1	1.7	0.03	-	-	-	<1	<1	138	138	1	12	24	16	7	<1	3.12	2.82
GW4_RN036485	3/11/2020	7.70	237	154	2.31	0.2	2.5	0.02	-	-	-	<1	<1	114	114	<1	3	20	13	3	<1	2.36	2.20
GW1_RN029096	6/07/2021	8.01	283	159	1.41	<0.1	1.4	<0.01	<2	<2	<2	<1	<1	143	143	1	14	30	18	8	<1	-	-
GW2_RN029098	6/07/2021	8.00	244	142	1.98	<0.1	2.0	<0.01	<2	~6	<2	<1	<1	110	110	1	16	24	15	8	<1	-	-
GW4_RN036485	6/07/2021	8.00	178	101	2.23	0.1	2.3	0.01	<2	<2	<2	<1	<1	96	96	<1	3	21	14	4	<1	-	-
GW1_RN029096	12/08/2021	7.08	272	158	1.44	<0.1	1.4	0.01	<1	~1	<1	<1	<1	138	138	1	12	23	17	8	<1	-	-
GW2_RN029098	12/08/2021	6.85	188	114	2.31	0.4	2.7	<0.01	~<1	~300	<1	<1	<1	96	96	<1	11	17	12	6	<1	-	-
GW4_RN036485	12/08/2021	7.04	187	117	2.02	0.2	2.2	0.02	<1	~<1	<1	<1	<1	107	107	<1	3	15	11	3	<1	-	-
GW1_RN029096	16/09/2021	7.07	287	138	1.36	0.1	1.5	0.02	~<1	650	<1	<1	<1	135	135	1	12	25	17	7	<1	-	-
GW2_RN029098	16/09/2021	6.88	239	134	1.81	0.4	2.2	0.01	<1	14	<1	<1	<1	115	115	1	14	20	15	8	<1	-	-
GW4_RN036485	16/09/2021	6.86	200	128	1.30	0.1	1.4	0.02	<1	~1	<1	<1	<1	114	114	<1	4	20	13	3	<1	-	-
GW1_RN029096	30/11/2021	7.37	270	181	1.29	<0.1	1.3	0.02	~1	~4	<1	<1	<1	137	137	1	12	26	18	7	<1	3.10	3.08
GW2_RN029098	30/11/2021	7.77	270	179	1.54	0.2	1.7	0.04	~3	~<1	~3	<1	<1	140	140	1	13	27	18	8	<1	3.18	3.18
GW4_RN036485	30/11/2021	7.65	215	133	1.99	0.1	2.1	0.01	18	~<1	~1	<1	<1	122	122	<1	4	23	15	3	<1	2.55	2.51
GW1_RN029096	22/02/2022	7.72	270	145	1.26	<0.1	1.3	0.02	~2	~1	~3	<1	<1	135	135	<1	11	25	18	7	<1	3.01	3.03
GW2_RN029098	22/02/2022	7.60	247	127	0.81	0.2	1.0	0.07	~1	~<1	~6	<1	<1	118	118	<1	12	19	14	7	<1	2.70	2.40
GW4_RN036485	22/02/2022	7.54	147	82	2.54	0.3	2.8	0.05	~5	~9	<1	<1	<1	68	68	<1	3	13	9	3	<1	1.44	1.52
GW1_RN029096	14/06/2022	7.62	230	131	1.34	0.1	1.4	0.04	<1	<1	<1	<1	<1	134	134	<1	12	26	19	6	<1	3.02	3.12
GW2_RN029098	14/06/2022	6.96	125	86	1.60	0.3	1.9	0.02	~60	12000	2300	<1	<1	101	101	<1	13	19	15	5	<1	2.38	2.40
GW3_RN029097	14/06/2022	7.26	280	161	1.52	0.2	1.7	0.02	<1	~3	<1	<1	<1	125	125	<1	15	26	19	7	<1	2.92	3.16
GW4_RN036485	14/06/2022	6.75	126	82	2.64	0.5	3.1	0.06	~2	14	58	<1	<1	58	58	<1	4	12	9	1	<1	1.27	1.38
GW5_RN031822	14/06/2022	7.25	276	167	1.52	0.3	1.8	0.03	<1	~5	<1	<1	<1	124	124	<1	15	26	19	6	<1	2.90	3.12

GW1_RN029096	26/09/2022	7.68	293	159	1.49	0.3	1.8	0.02	<1	460	21	<1	<1	133	133	1	12	25	18	9	<1	3.02	3.12
GW2_RN029098	26/09/2022	7.59	260	150	1.72	0.4	2.1	0.02	~14	19000	<1	<1	<1	104	104	1	13	22	16	9	<1	2.46	2.81
GW3_RN029097	26/09/2022	7.74	295	152	1.58	0.3	1.9	0.02	~<1	~<1	<1	<1	<1	125	125	1	15	25	18	10	<1	2.94	3.16
GW4_RN036485	26/09/2022	7.62	161	101	0.58	0.9	1.5	0.15	<1	~43	~3	<1	<1	74	74	<1	4	15	11	4	<1	1.59	1.83
GW5_RN031822	26/09/2022	7.79	290	158	1.58	0.3	1.9	0.03	<1	~6	<1	<1	<1	117	117	1	14	25	18	10	<1	2.75	3.16
GW1_RN029096	22/12/2022	8.02	278	149	1.40	0.2	1.6	0.05	<1	<1	<1	<1	<1	144	144	<1	14	24	18	7	<1	3.27	-
GW2_RN029098	22/12/2022	7.93	224	126	<0.01	0.6	0.6	0.04	330	13000	53	<1	<1	107	107	<1	14	19	14	7	<1	2.53	-
GW3_RN029097	22/12/2022	8.12	281	147	1.63	0.3	1.9	0.04	~1	~14	~1	<1	<1	128	128	1	17	23	17	9	<1	3.06	-
GW1_RN029096	15/03/2023	7.76	292	132	1.45	0.4	1.8	0.02	<1	<1	<1	<1	<1	136	136	1	12	25	16	11	1	3.08	3.07
GW2_RN029098	15/03/2023	7.37	133	56	<0.01	1.0	1.0	0.10	~20	13000	560	<1	<1	57	57	<1	10	11	6	7	1	1.42	1.37
GW3_RN029097	15/03/2023	7.80	288	146	1.44	0.5	1.9	0.01	<1	<1	~1	<1	<1	134	134	1	12	21	16	8	<1	3.04	2.85
GW4_RN036485	15/03/2023	7.82	288	144	1.39	1.2	2.6	0.02	<1	~1	<1	<1	<1	134	134	1	12	22	15	8	<1	3.04	2.77
GW5_RN031822	15/03/2023	7.83	288	130	1.44	0.5	1.9	0.02	<1	<1	<1	<1	<1	133	133	1	13	23	15	7	<1	3.04	2.82
GW1 (Bore 4)	13/06/2023	7.42	288	150	1.54	0.8	2.3	0.02	<1	39	2	<1	<1	133	133	<1	13	24	16	8	<1	3.02	2.86
GW2 (Bore 10)	13/06/2023	7.15	235	118	1.49	0.4	1.9	0.02	2	550	<1	<1	<1	103	103	<1	13	19	13	8	<1	2.42	2.37
GW3 (Bore 2)	13/06/2023	7.37	287	146	1.74	0.9	2.6	0.03	<1	26	<1	<1	<1	127	127	1	15	25	16	9	<1	2.98	2.96
GW5 (Bore 6)	13/06/2023	7.41	291	147	1.75	1	2.8	0.02	<1	7	<1	<1	<1	128	128	1	15	24	16	8	<1	3	2.86
GW1 (Bore 4)	12/09/2023	7.33	225	148	1.90	0.4	2.3	0.04	37	740	<1	<1	<1	96	96	<1	12	20	13	7	<1	2.26	2.37
GW2 (Bore 10)	12/09/2023	7.88	269	170	1.58	0.3	1.9	0.04	<1	16	<1	<1	<1	127	127	1	12	25	17	7	<1	2.9	2.95
GW3 (Bore 2)	12/09/2023	7.11	203	131	2.58	0.6	3.2	0.03	28	240	<1	<1	<1	83	83	<1	11	17	12	6	<1	1.97	2.1
GW1 (Bore 4)	18/01/2024	7.79	279	168	1.4	0.3	1.7	0.02	<1	1	1	<1	<1	133	133	1	10	25	17	6	<1	2.96	2.91
GW2 (Bore 10)	18/01/2024	7.03	191	90	1.96	0.2	2.2	0.02	110	130000	68	<1	<1	89	89	<1	10	16	12	6	<1	2.06	2.05
GW3 (Bore 2)	18/01/2024	7.73	277	182	1.37	0.4	1.8	0.03	6	100	26	<1	<1	130	130	<1	13	25	17	7	<1	2.96	2.95
GW6 (Bore 11)	18/01/2024	7.53	278	184	1.4	0.3	1.7	0.05	1000	2800	17	<1	<1	146	146	<1	3	28	18	2	<1	3	2.96

Table 5-3. Bore standing water levels measured in metres below top of casing (mBTOC)

Date	GW1	GW2	GW3	GW4	GW5	GW6	GW7
01/05/2023	-	-	-	-	-	-	-
01/06/2023	-	-	-	-	-	-	-
01/07/2023	-	-	-	-	-	-	-
01/08/2023	-	-	-	-	-	-	-
01/09/2023	-	-	-	-	-	-	-
01/10/2023	-	-	-	-	-	10.1	-
01/11/2023	-	-	-	-	-	-	-
01/12/2023	-	-	-	-	-	-	-
01/01/2024	-	-	-	-	-	-	-
01/02/2024	6.1	7.1	6.4	6.1	10.5	-	11.3
01/03/2024	7.7	6.4	6.3	6.1	9.8	2.8	11.6
01/04/2024	-	-	-	-	-	-	-

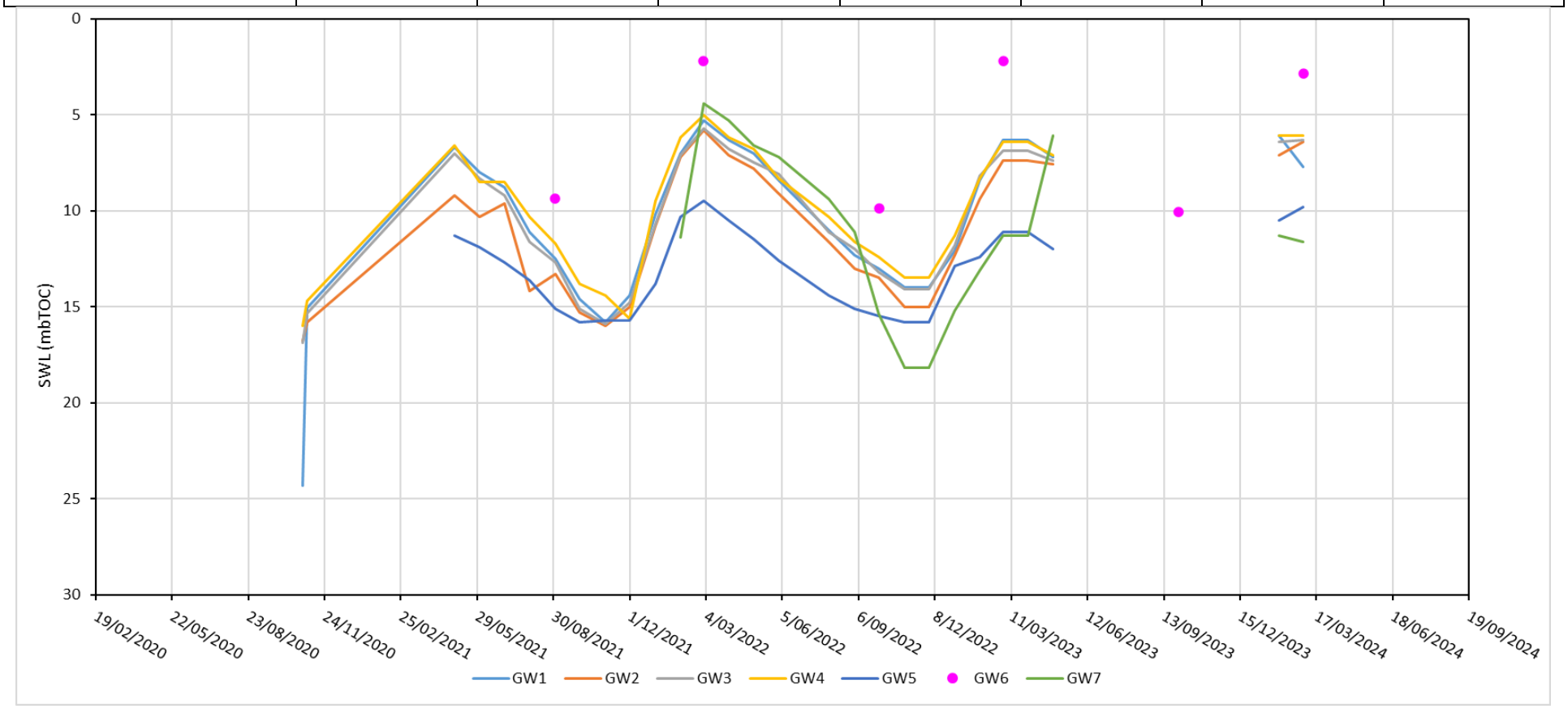

Figure 5-1. Graph of SWLs (mBTOC) from Oct 20 – May 23

Table 5-4. Surface water quality monitoring results since January 2020.

Concentrations in breach of EPL320-01 trigger values for surface water highlighted in orange.

Site ID	Date	pH	EC	TDS	Nitrite + Nitrate	TKN	TN	TP	E coli	Total Coliforms	Enterococci	Hydroxide Alkalinity as CaC03	Carbonate Alkalinity as CaC03	Bicarbonate Alkalinity as CaC03	Total Alkalinity as CaC03	Sulfate as S04	Chloride	Calcium	Magnesium	Sodium	Potassium	Total Anions	Total Cations
			µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	CFU/100mL	CFU/100mL	CFU/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/m3
Surface Water EPL320 trigger values		**6.0 - 7.5**	**200**				**0.23**	**0.01**	any increase from previous	any increase from previous	any increase from previous												
SW01	22/01/2020	5.64	17	13	0.04	0.2	0.2	0.09	~3000	-	23000	<1	<1	4	4	<1	<1	<1	<1	<1	1	0.08	0.02
SW02	22/01/2020	5.52	16	11	0.02	0.2	0.2	<0.01	~3000	-	3200	<1	<1	2	2	<1	<1	<1	<1	<1	<1	0.04	<0.01
SW03	22/01/2020	5.83	19	14	<0.01	0.5	0.5	0.06	~1100	-	7800	<1	<1	5	5	<1	<1	<1	<1	<1	2	0.10	0.05
SW04	22/01/2020	5.62	24	18	0.02	0.2	0.2	0.12	9000	-	2100	<1	<1	8	8	<1	<1	1	<1	<1	2	0.16	0.10
SW01	22/12/2020	-	-	-	0.36	0.3	0.7	0.09	4000	-	1100	<1	<1	9	9	<1	2	1	2	<1	<1	0.24	0.21
SW03	30/03/2022	6.56	49	25	<0.01	0.4	0.4	<0.01	~49	~2500	44	<1	<1	18	18	<1	3	3	2	3	<1	0.44	0.44
SW03	26/04/2022	5.52	31	25	<0.01	0.6	0.6	0.02	~310	10000	~80	<1	<1	16	16	<1	3	2	<1	1	<1	0.40	0.14
SW01	24/01/2023	5.88	33	98	0.85	<1.0	<1.0	0.39	12000	2200000	12000	<1	<1	6	6	<1	2	<1	<1	<1	5	0.18	-
SW05	24/01/2023	5.85	32	60	0.01	0.6	0.6	0.06	~560	38000	560	<1	<1	11	11	<1	3	2	1	2	<1	0.3	-
SW05	15/02/2023	5.99	28	26	<0.01	0.5	0.5	0.03	-	-	-	<1	<1	9	9	<1	3	2	<1	2	<1	0.26	0.19
SW05 (Black Jungle)	18/01/2024	6.11	40	74	<0.01	0.5	0.5	0.08	70	56000	100	<1	<1	10	10	<1	4	2	1	2	2	0.31	0.32

Table 5-5. Soil monitoring results since 2022.

Concentrations outside of EPL320-01 trigger values for groundwater highlighted in orange.

Site ID	Date	Depth	pH	EC	NOx	TKN	TN	TP	Enterococci	Total Coliforms	E.Coli
		m	pH Unit	µS/cm	mg/kg	mg/kg	mg/kg	mg/kg	MPN/g dry wt	MPN/g dry wt	MPN/g dry wt
EPL320 trigger values			6-8	Any increase from previous			Any increase from previous	Any increase from previous	Any increase from previous	Any increase from previous	Any increase from previous
SS1	24/01/2022	0.5	6.7	7	0.8	500	500	340	1900	600	<11
SS2	24/01/2022	0.5	5.9	10	3.3	330	330	120	13	<12	<12
SS3	24/01/2022	0.5	7.2	10	0.7	300	300	120	48	220	37
SS4	24/01/2022	0.5	7.0	12	2.0	500	500	120	140	190	<11
SS5	24/01/2022	0.5	6.7	24	1.8	790	790	290	520	50	13
SS6	24/01/2022	0.5	6.7	10	8.8	390	400	130	38	4900	<12
SS7	24/01/2022	0.5	6.2	11	3.6	230	240	120	72	47	<11
SS8	24/01/2022	0.5	6.9	10	7.5	370	380	110	260	660	<11
SS9	24/01/2022	0.5	5.9	14	7.9	230	240	120	<11	<11	<11
SS10	24/01/2022	0.5	7.4	11	7.2	330	340	180	97	480	<11
SS1	30/01/2023	0.5	6.1	43	3.2	190	190	94	63	1100	12
SS2	30/01/2023	0.5	5.5	32	2.7	160	160	93	<11	72	<11
SS3	30/01/2023	0.5	5.9	47	4.1	180	180	79	<11	72	<11
SS4	30/01/2023	0.5	5.9	65	4.3	400	400	103	47	97	<11
SS5	30/01/2023	0.5	6.6	68	5.0	300	300	105	47	750	<11
SS6	30/01/2023	0.5	6.7	40	1.1	380	380	134	23	3400	<12
SS7	30/01/2023	0.5	6.0	46	0.5	550	550	91	110	330	47
SS8	30/01/2023	0.5	5.2	19	0.6	300	300	91	11	23	<11
SS9	30/01/2023	0.5	5.6	71	0.4	80	80	95	<11	58	<11
SS10	30/01/2023	0.5	5.9	87	1.8	350	350	104	120	360	<12
SS1	31/01/2024	0.5	6.8	182	1.9	420	420	191	420	3500	11
SS2	31/01/2024	0.5	6.7	103	3.1	740	740	302	48	3800	<12
SS3	31/01/2024	0.5	6.8	101	2.2	450	450	158	62	4100	<12
SS4	31/01/2024	0.5	6.8	82	2.7	600	600	167	370	28000	<12
SS5	31/01/2024	0.5	7.2	144	2.2	470	470	304	74	2000	<12
SS6	31/01/2024	0.5	7.6	182	2.5	350	350	151	98	990	<11
SS7	31/01/2024	0.5	6.9	114	2.2	320	320	118	510	300	<12
SS8	31/01/2024	0.5	6.8	154	2.6	460	460	323	160	470	<12
SS9	31/01/2024	0.5	7.2	118	2.1	320	320	111	60	360	<12
SS10	31/01/2024	0.5	7.1	48	2.2	490	490	145	23	12	<12

6 TOTAL N AND TOTAL P LOADS

Condition 38 of EPL320-01 states that:

The licensee must ensure that the total annual loads of Total Nitrogen and Total Phosphorus applied to land from the authorised discharge point do not exceed the calculated maximum total annual loads:

38.1 The total annual load for total nitrogen must be calculated using the equations detailed in the NSW environmental guideline Use of Effluent by Irrigation and be based on the specific soil type and crop present in the irrigation area receiving wastewater from the authorised discharge point.

38.2 The total annual load of total phosphorus must be based on the annual maximum uptake of phosphorus for the specific crop type present as listed in Table 4.2 of the NSW environmental guideline Use of Effluent by Irrigation

Total annual loads of TN and TP applied to the Stage one irrigation area using water from the authorised discharge points (ADP1 and ADP2) are calculated below.

During the reporting period, the total volume of irrigated water was 31.33 ML and the median TN and TP concentrations of the irrigation water were 26.15 mg/L and 2.50 mg/L respectively. This equates to a total load

of 819.28 kg of TN and 78.32 kg of TP applied to the Stage one irrigation area, where Jarra grass is actually grown.

The total volume of irrigated water in the Stage two irrigation area was 645.91 ML and the median TN and TP concentrations of the irrigation water were 4.70 mg/L and 0.96 mg/L respectively. As a result, a total load of 3,035.8 kg of TN and 620.07 kg of TP were applied to the Stage two irrigation area, where 20 ha African Mahogany and 110 ha of syntropic plantation are stablished.

Table 4.2 in the *NSW Environmental Guidelines, Use of Effluent by Irrigation* (DEC 2004) lists grain crops only and thus information could not be used for any of the crops at the LLCF. However, the average yield for forage sorghum crop type was used to obtain an indicative value of nitrogen and phosphorus removal.

The average yield for forage sorghum is 15 tonnes/ha/dry matter, with a nutrient content of 1.8% nitrogen and 0.3% phosphorus. This equals a nitrogen removal of 270 kg/ha/year and phosphorus removal of 45 kg/ha/year. The total area of irrigation at the LLCF is approximately 145 ha (15 ha at Stage one and 130 ha at Stage two). Consequently, 39,150 kg of nitrogen and 6,525 kg of phosphorus would be removed through harvesting per year. These loads are above the current nitrogen and phosphorus loads (3,855.08 kg and 698.39 kg respectively) applied to the total irrigation area.

7 CONCLUSIONS

All monitoring was undertaken as per EPL320-01 Attachment A requirements, except for the non-compliances as listed in Table 4-6 and explained in Section 4.4.

Discharge points (ADP1 and ADP2) were compliant with EC, TN, and TP trigger values in the 2023- 2024 monitoring round but exceeded the trigger values for pH (at ADP2), *E. coli*, total coliforms, and enterococci (ADP1). Despite the exceedances reported, no increasing trend was observed in most of the parameters monitored, except for pH at ADP2, where pH has been increasing since 2023.

Groundwater monitoring results were largely compliant with trigger values, based on the monitoring of five (GW1, GW2, GW3, GW5, and GW6) of the seven bores requiring sampling. As evidenced in the previous monitoring period, bacteria levels at GW2 appear to indicate some groundwater contamination. In the reporting period, this bore recorded its highest level of total coliforms since monitoring started. However, the concentrations did not follow an increasing trend and it appears to decrease with distance from the source.

GW6, sampled for the first time, had an *E. coli* concentration well above those ever recorded at any bore. However, inconsistencies in the procedure followed to sample this bore may have led to the results obtained. The development of an SOP for the farm and training of staff responsible for sampling is expected to mitigate any inconsistencies in the sampling processes followed and the results obtained. However, further monitoring of this bore, and of GW7, is recommended to better assess any potential groundwater contamination on the western side of the farm and any potential impact on the receiving environment.

Increases in TN and TP levels were recorded at the monitoring bores during the reporting period. However, most concentrations decreased the following sampling round, except at GW1, where an increasing trend in TN levels has been observed since 2022.

Groundwater levels in February and March 2024 were comparable to those measured 12-months earlier.

Surface water monitoring was limited during the reporting period (see Section 4.4). TN, TP and total coliforms at SW05 were above those recorded at the same site in the previous monitoring period. However, further data from this and all other monitoring sites is required to complete a comprehensive assessment.

In the reporting period, levels of TN, TP, enterococci and total coliforms in soil samples were higher than those obtained in the previous monitoring period. Results indicate that higher total nitrogen and bacterial loads are

commonly observed at Stage 1 compared to Stage 2. This is likely due to the higher nutrient and bacterial loads in the wastewater irrigated at Stage 1 (ADP1/Irrigation Plantation).

The nitrogen and phosphorus removal by the current crops on site were not calculated as these are not listed in the NSW environmental guideline *Use of Effluent by Irrigation (DEC 2004)*. However, the calculation was done for forage sorghum to have an indicative value. The results obtained indicate that nutrient loads irrigated are sustainable; however, the exceedances recorded in this monitoring period suggest otherwise. Further monitoring will be required to determine any increasing trend in the parameters measured in soils.

The expansion of Stage 2, from 15 ha to 145 ha, as well as the implementation of a hydrogen peroxide injection system to treat wastewater for irrigation, are expected to be reflected in a reduction of nutrient and bacterial load in the monitoring sites. However, the following are also recommended:

- Include alternative surface water sites into the monitoring plan given the limited data available at all the surface water sites. The new monitoring sites are to be located in areas more accessible to field staff and where flowing is observed for longer periods of time than at the current monitoring sites.
- Measure pH and EC on-site, as these parameters usually have a short holding time which eventually impacts on the accuracy of the results provided by the laboratory.
- Reduce the volumes of wastewater irrigated during the wet season to prevent surface water runoff, and as such, lateral movement of contaminants from the site. A reduction in the volumes of water irrigated may also improve bacterial load and nutrients concentrations in Stage 1.
- Monitor SWLs monthly and survey current bores on site to better understand groundwater elevations and flows in the project area.
- Undertake groundwater sampling as per EPL320-01 Attachment A requirements to better assess groundwater quality within the site area.

8 REFERENCES

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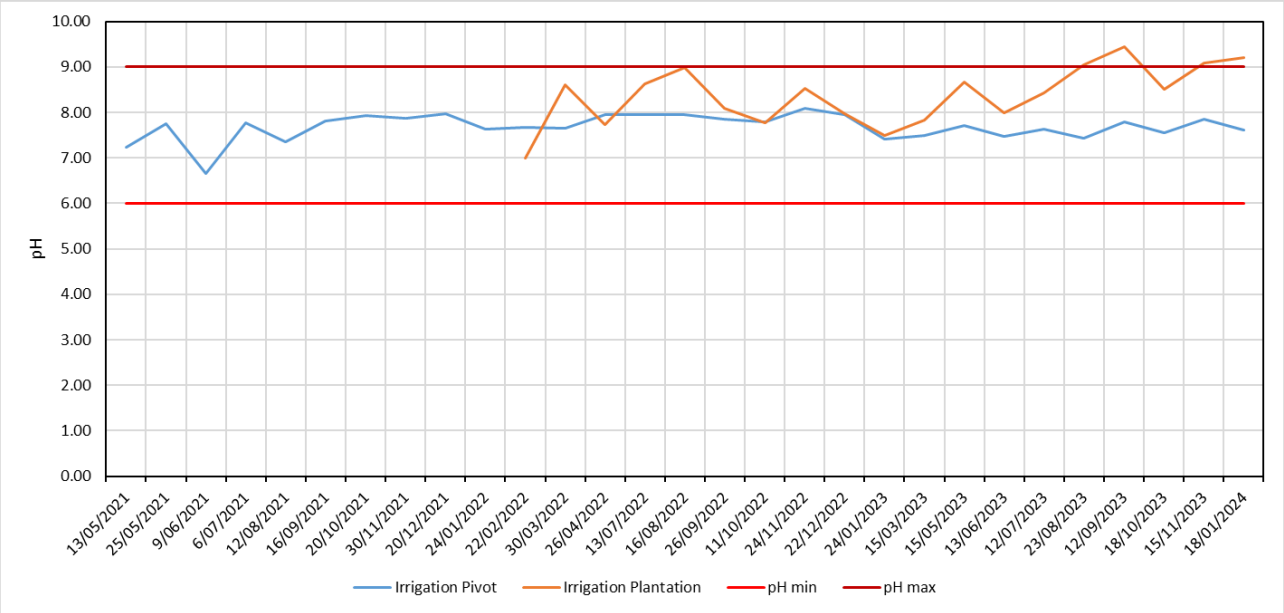
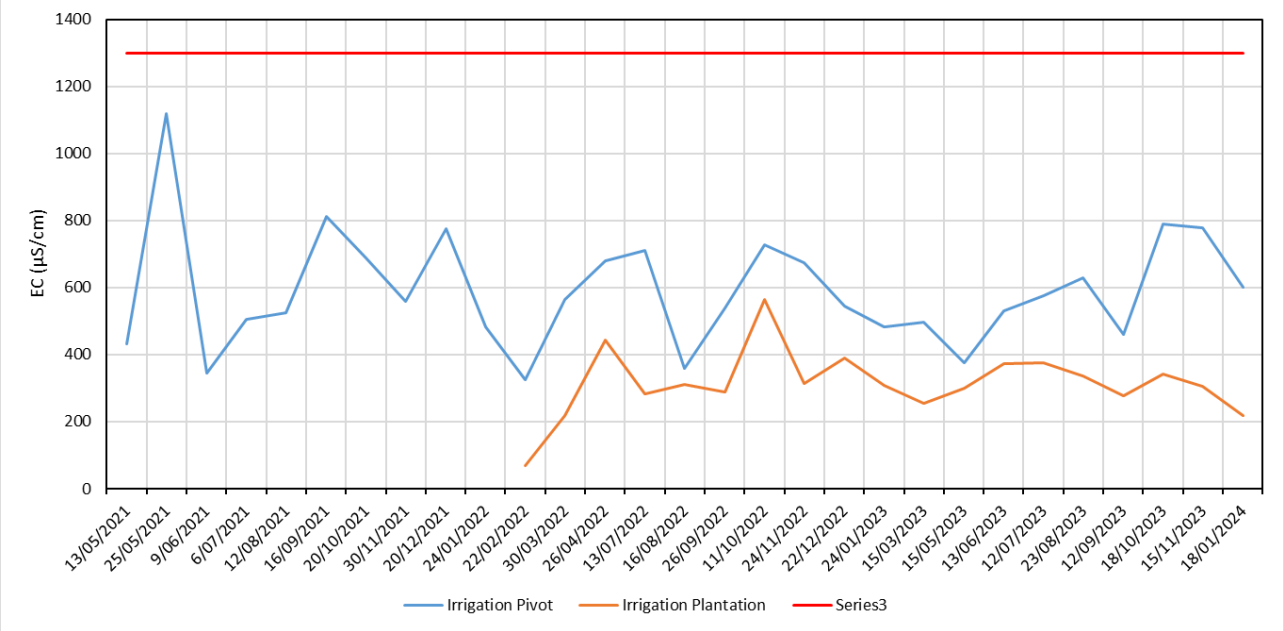
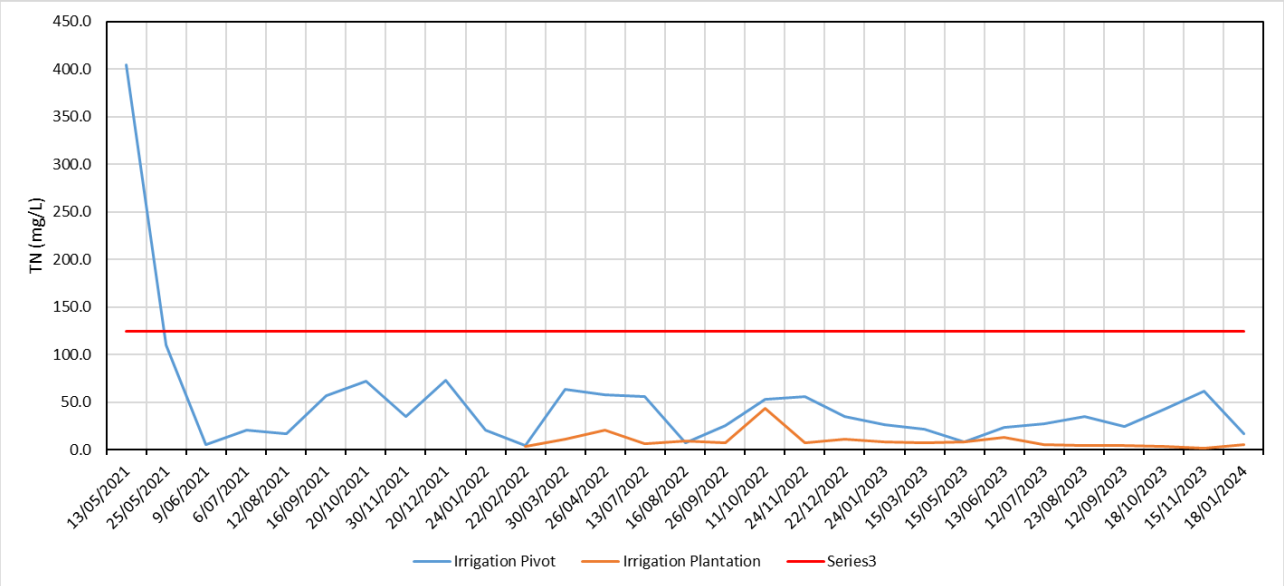
Xu, S. & Feriancikova, L. (2014) *Transport of manure-derived Escherichia coli within naturally fractured dolomite*. [online] Available at: chromeextension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.wri.wisc.edu/wpcontent/uploads/FinalWR12R003.pdf [Accessed 24 May 2024]

APPENDIX A HISTORICAL DATA PLOTS

Authorised Discharge Points


10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
13/05/2021
25/05/2021
9/06/2021
6/07/2021
12/08/2021
16/09/2021
20/10/2021
30/11/2021
20/12/2021
24/01/2022
22/02/2022
30/03/2022
26/04/2022
13/07/2022
16/08/2022
26/09/2022
11/10/2022
24/11/2022
22/12/2022
24/01/2023
15/03/2023
15/05/2023
13/06/2023
12/07/2023
23/08/2023
12/09/2023
18/10/2023
15/11/2023
18/01/2024
Irrigation Pivot
Irrigation Plantation
pH min
pH max


1400
1200
1000
800
600
400
200
0
EC (µS/cm)
13/05/2021
25/05/2021
9/06/2021
6/07/2021
12/08/2021
16/09/2021
20/10/2021
30/11/2021
20/12/2021
24/01/2022
22/02/2022
30/03/2022
26/04/2022
13/07/2022
16/08/2022
26/09/2022
11/10/2022
24/11/2022
22/12/2022
24/01/2023
15/03/2023
15/05/2023
13/06/2023
12/07/2023
23/08/2023
12/09/2023
18/10/2023
15/11/2023
18/01/2024
Irrigation Pivot
Irrigation Plantation
Series3


450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
TN (mg/L)
13/05/2021
25/05/2021
9/06/2021
6/07/2021
12/08/2021
16/09/2021
20/10/2021
30/11/2021
20/12/2021
24/01/2022
22/02/2022
30/03/2022
26/04/2022
13/07/2022
16/08/2022
26/09/2022
11/10/2022
24/11/2022
22/12/2022
24/01/2023
15/03/2023
15/05/2023
13/06/2023
12/07/2023
23/08/2023
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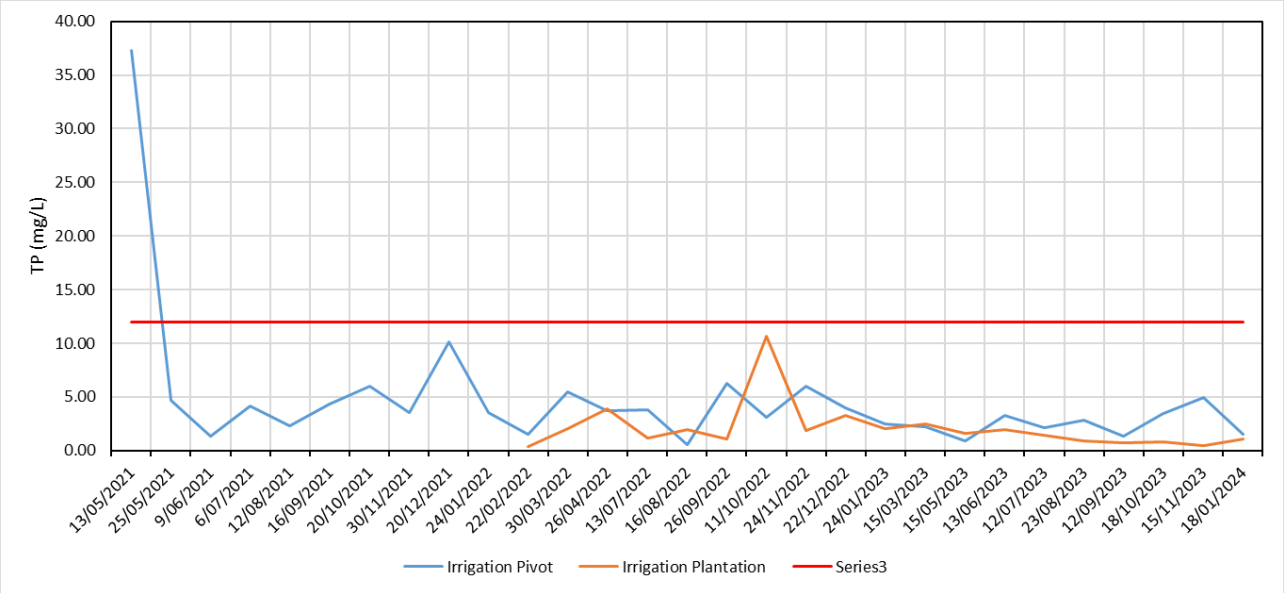
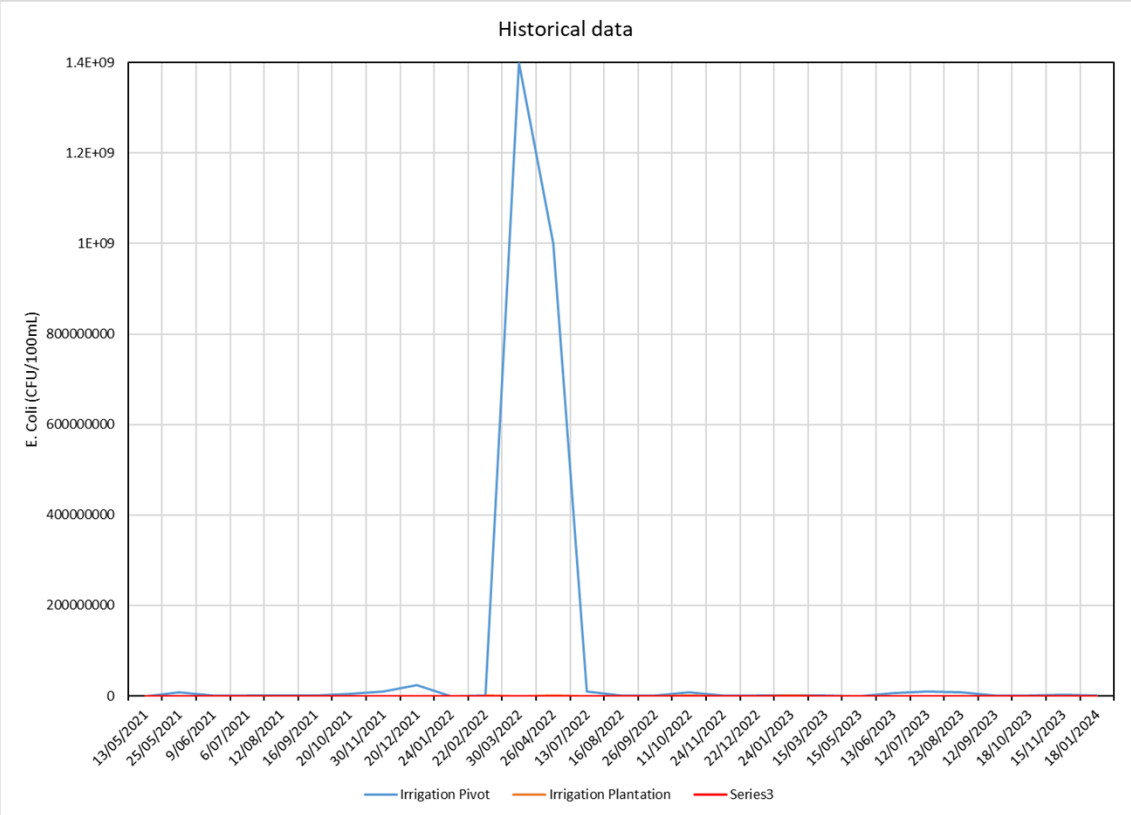
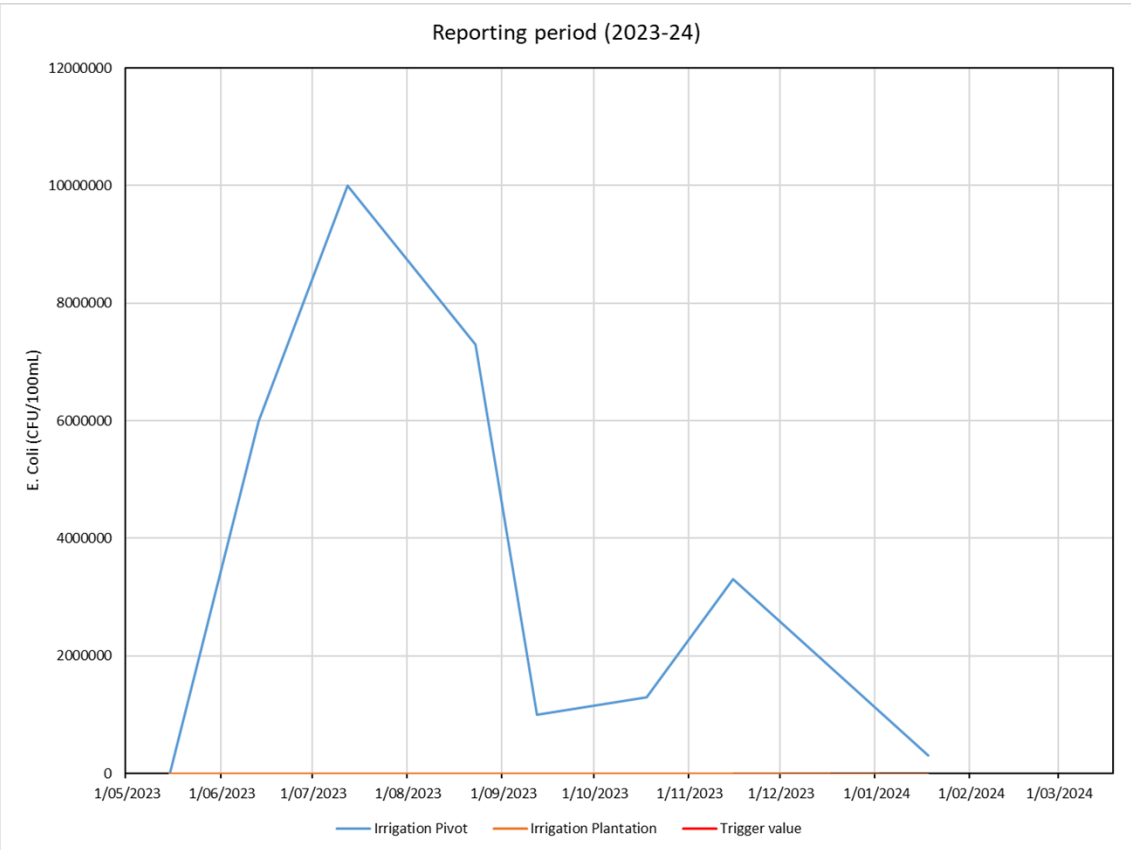
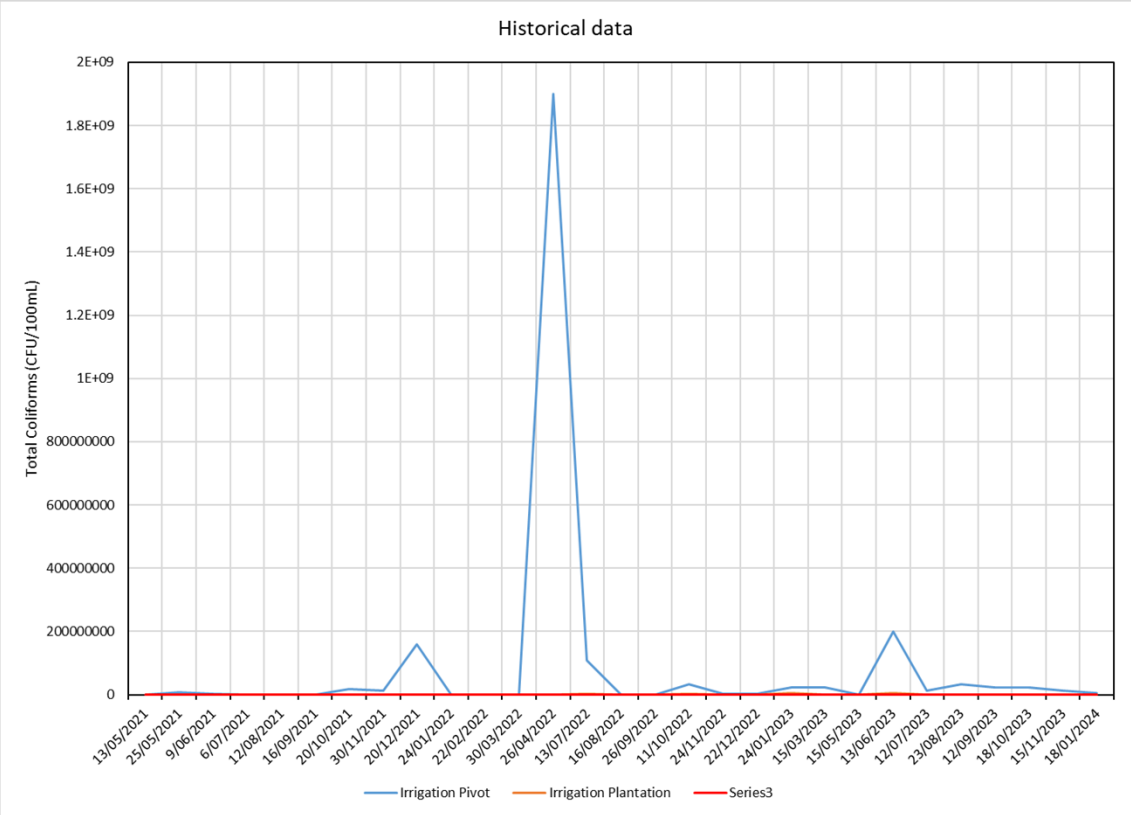
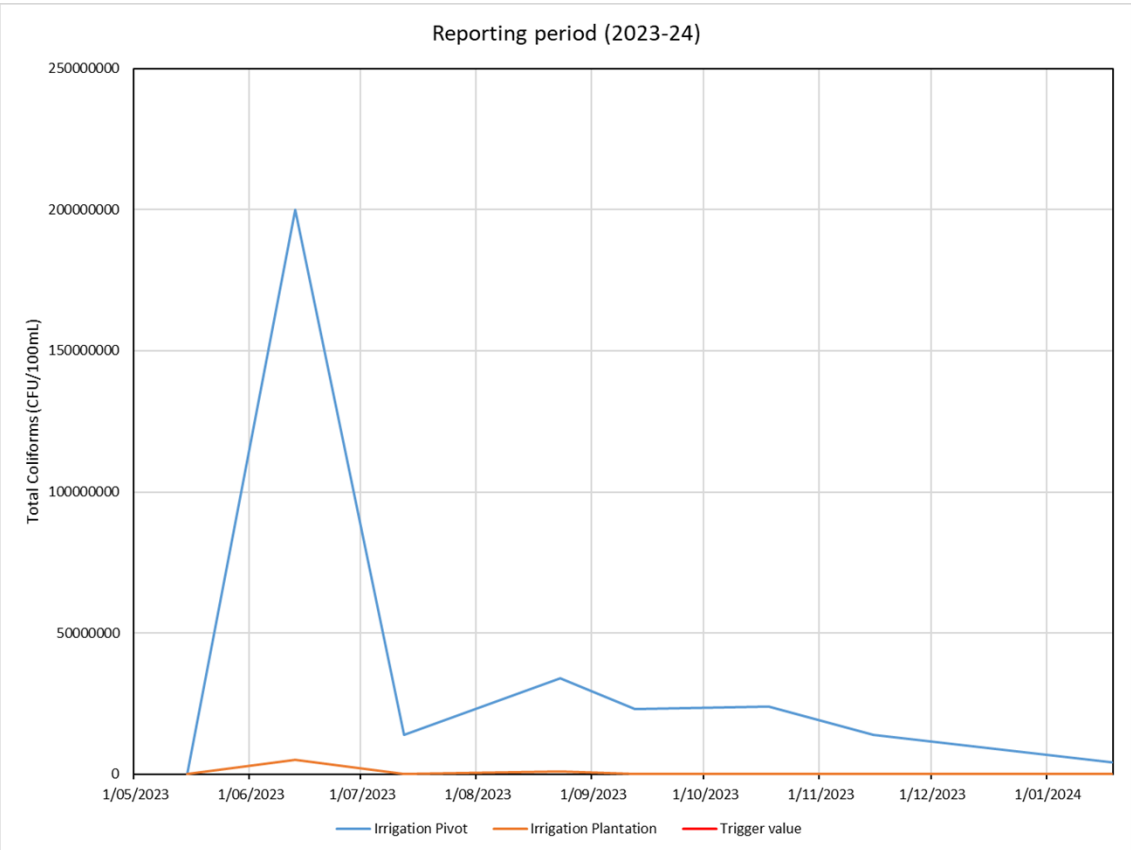
15/11/2023
18/01/2024
Irrigation Pivot
Irrigation Plantation
Series3


40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
TP (mg/L)
13/05/2021
25/05/2021
9/06/2021
6/07/2021
12/08/2021
16/09/2021
20/10/2021
30/11/2021
20/12/2021
24/01/2022
22/02/2022
30/03/2022
26/04/2022
13/07/2022
16/08/2022
26/09/2022
11/10/2022
24/11/2022
22/12/2022
24/01/2023
15/03/2023
15/05/2023
13/06/2023
12/07/2023
23/08/2023
12/09/2023
18/10/2023
15/11/2023
18/01/2024
Irrigation Pivot
Irrigation Plantation
Series3

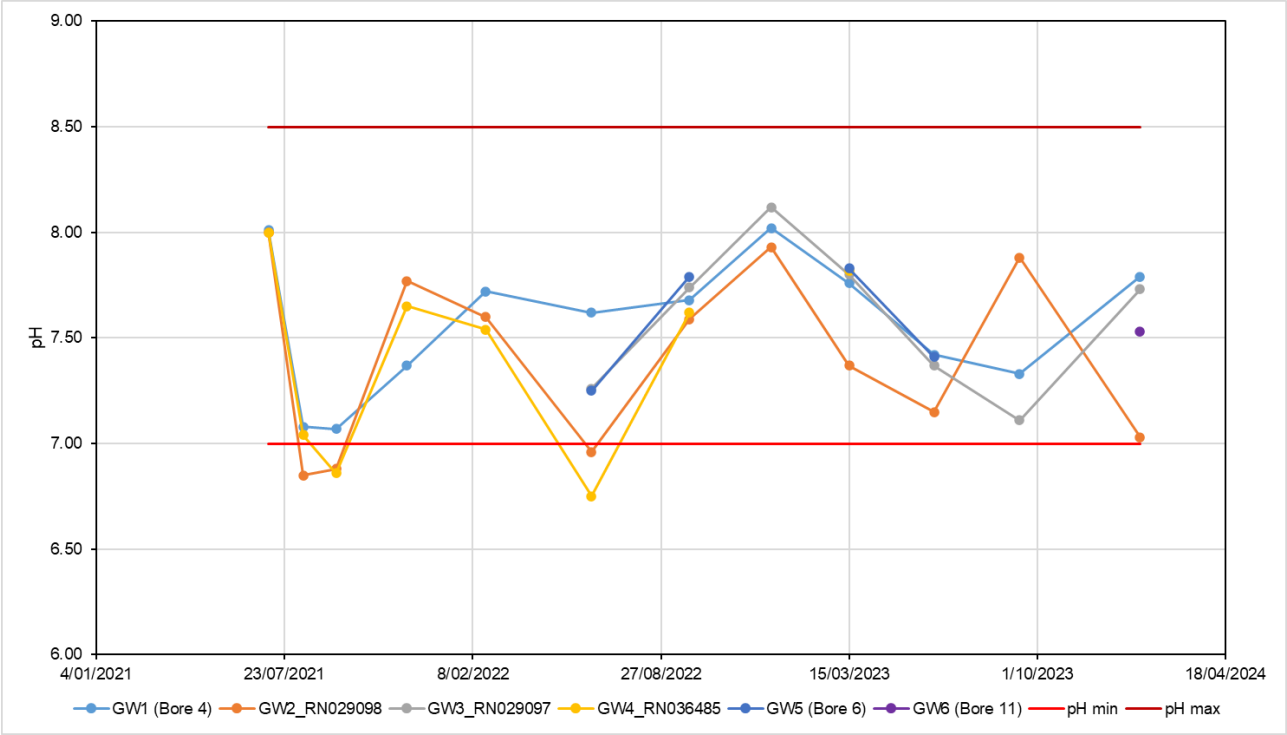

Historical data
E. Coli (CFU/100mL)
1.4E+09
1.2E+09
1E+09
800000000
600000000
400000000
200000000
0
13/05/2021
25/05/2021
9/06/2021
6/07/2021
12/08/2021
16/09/2021
20/10/2021
30/11/2021
20/12/2021
24/01/2022
22/02/2022
30/03/2022
26/04/2022
13/07/2022
16/08/2022
26/09/2022
11/10/2022
24/11/2022
22/12/2022
24/01/2023
15/03/2023
15/05/2023
13/06/2023
12/07/2023
23/08/2023
12/09/2023
18/10/2023
15/11/2023
18/01/2024
Irrigation Pivot
Irrigation Plantation
Series3

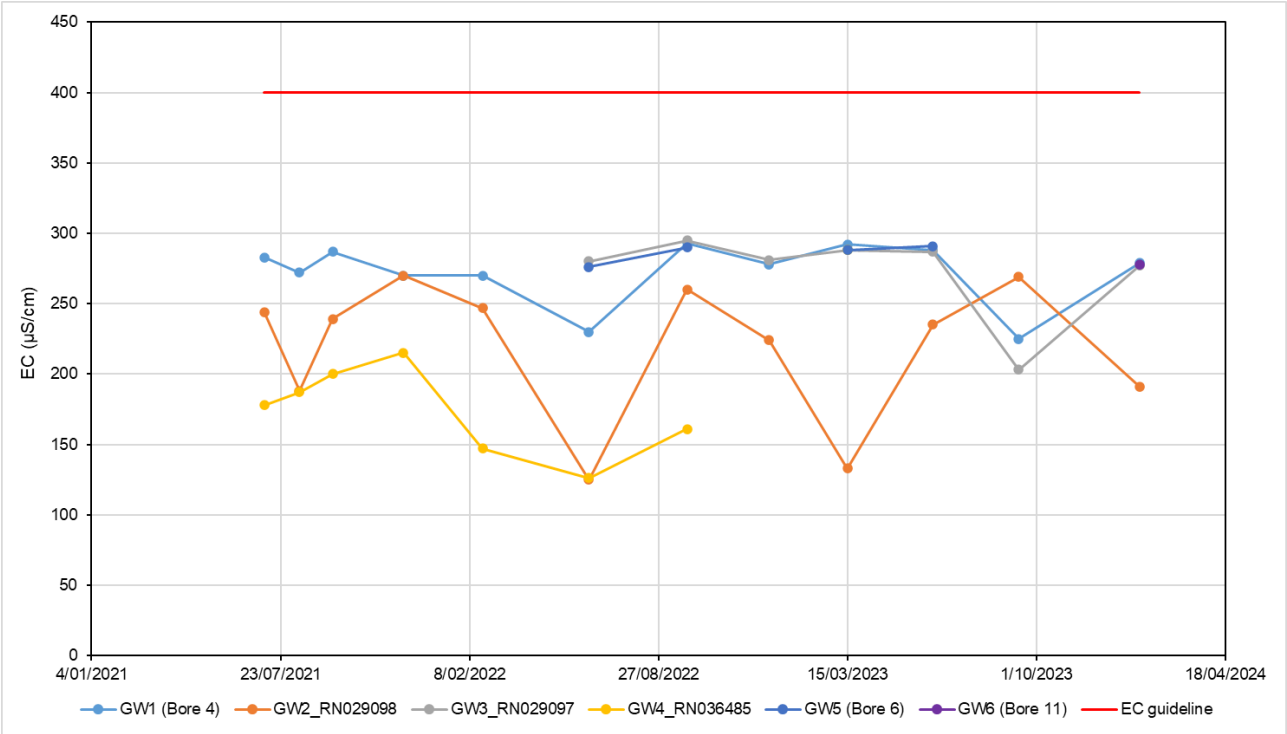

Reporting period (2023-24)
E. Coli (CFU/100mL)
12000000
10000000
8000000
6000000
4000000
2000000
0
1/05/2023
1/06/2023
1/07/2023
1/08/2023
1/09/2023
1/10/2023
1/11/2023
1/12/2023
1/01/2024
1/02/2024
1/03/2024
Irrigation Pivot
Irrigation Plantation
Trigger value



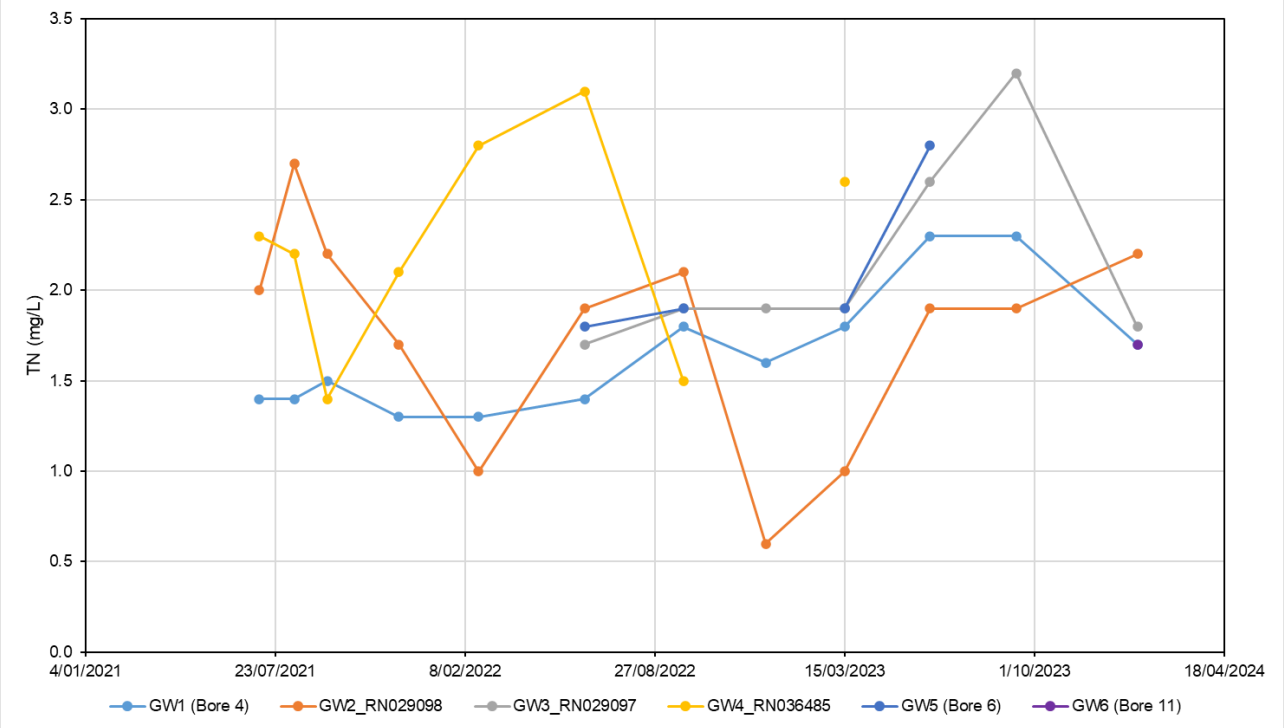


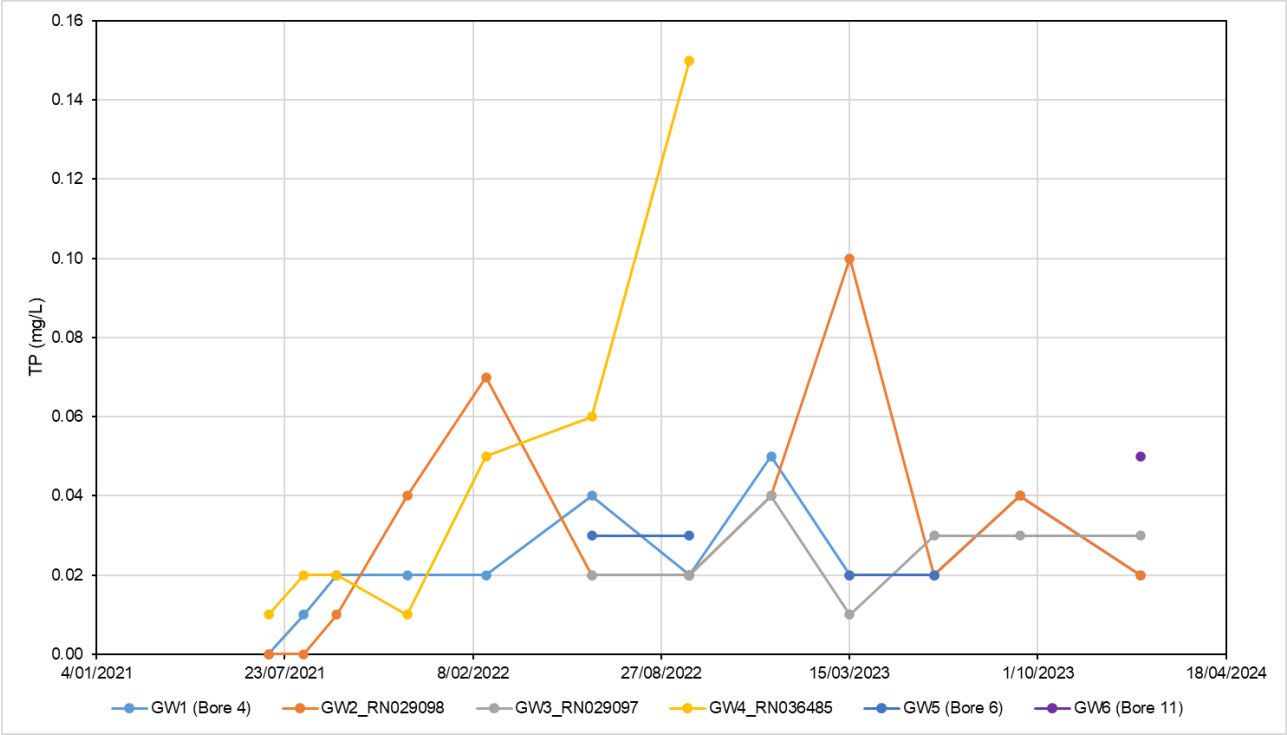
Groundwater

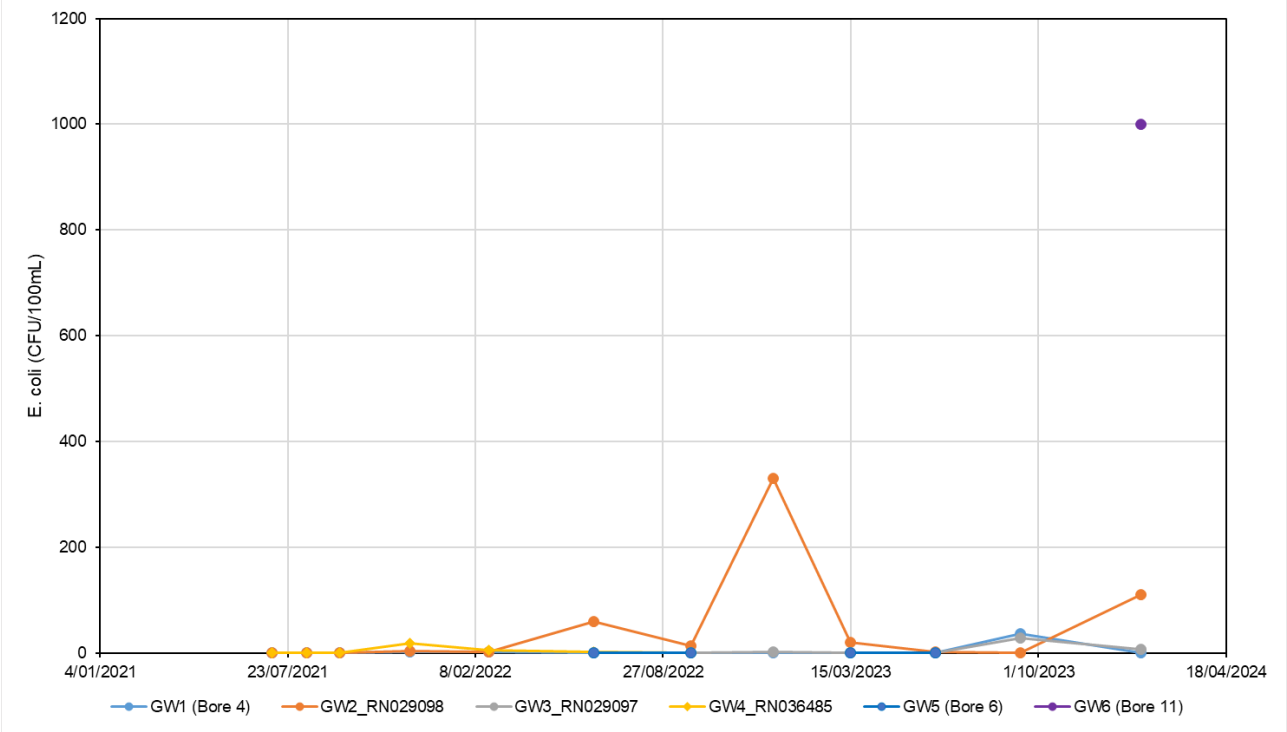

9.00
8.50
8.00
7.50
7.00
6.50
6.00
pH
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
GW1 (Bore 4)
GW2_RN029098
GW3_RN029097
GW4_RN036485
GW5 (Bore 6)
GW6 (Bore 11)
pH min
pH max

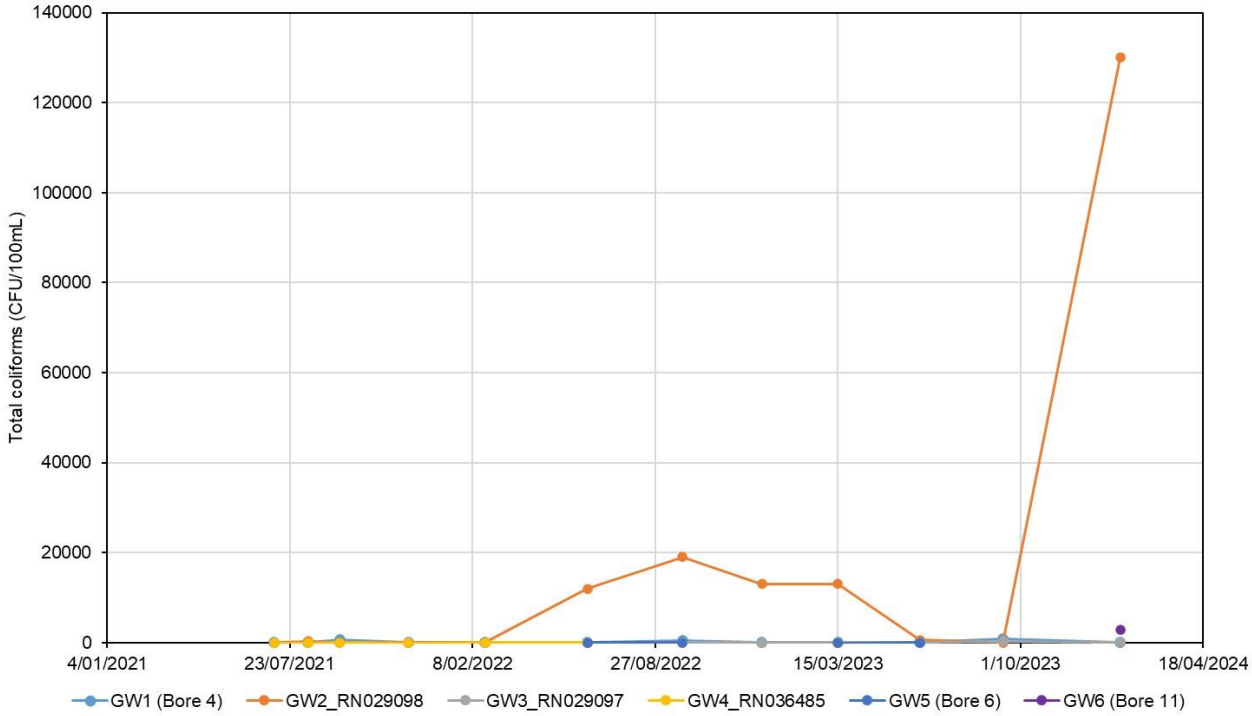

450
400
350
300
250
200
150
100
50
0
EC (µS/cm)
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
GW1 (Bore 4)
GW2_RN029098
GW3_RN029097
GW4_RN036485
GW5 (Bore 6)
GW6 (Bore 11)
EC guideline

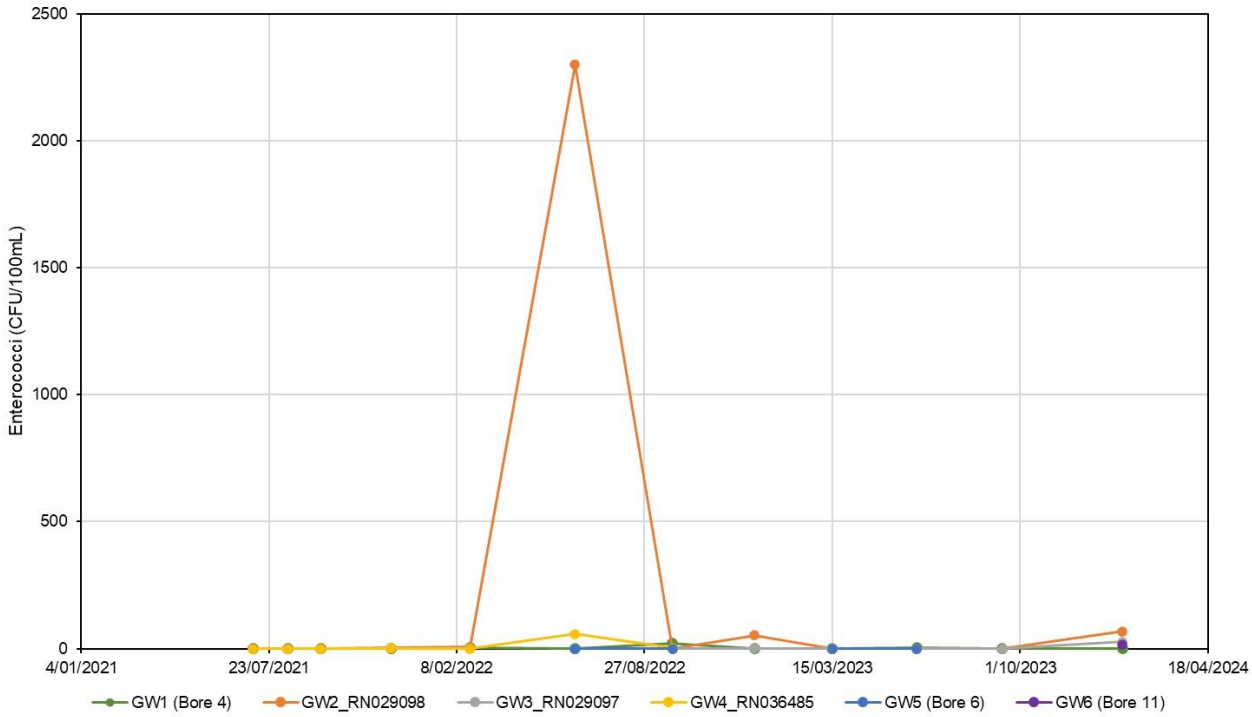

TDS (mg/L)
200
180
160
140
120
100
80
60
40
20
0
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
GW1 (Bore 4)
GW2_RN029098
GW3_RN029097
GW4_RN036485
GW5 (Bore 6)
GW6 (Bore 11)


TN (mg/L)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
GW1 (Bore 4)
GW2_RN029098
GW3_RN029097
GW4_RN036485
GW5 (Bore 6)
GW6 (Bore 11)

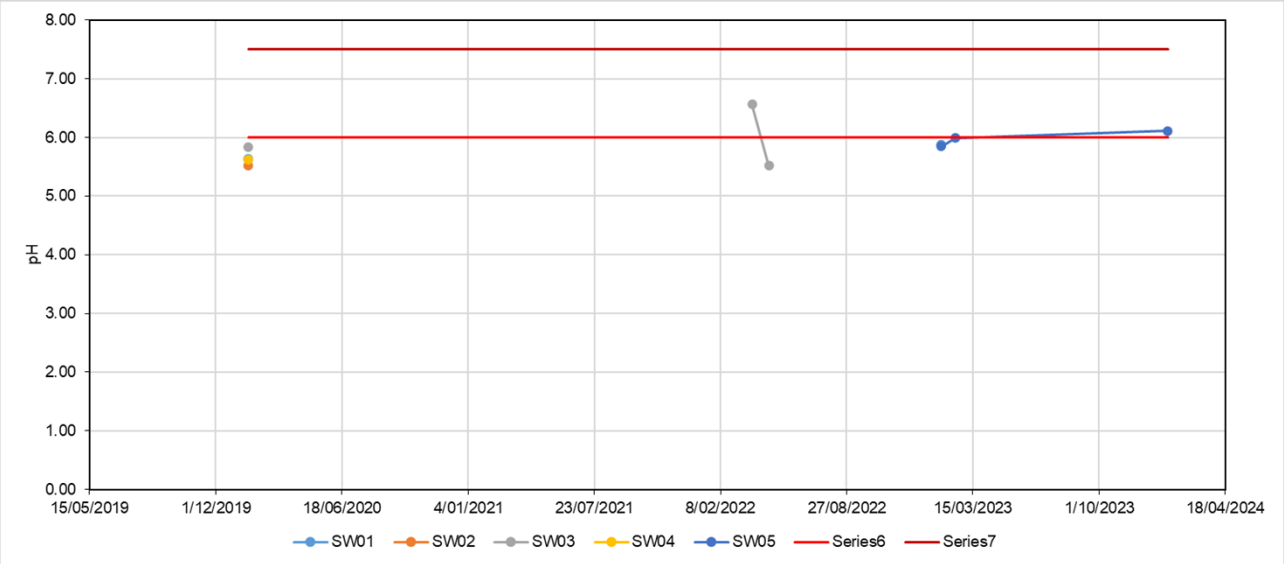

0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
TP (mg/L)
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
GW1 (Bore 4)
GW2_RN029098
GW3_RN029097
GW4_RN036485
GW5 (Bore 6)
GW6 (Bore 11)

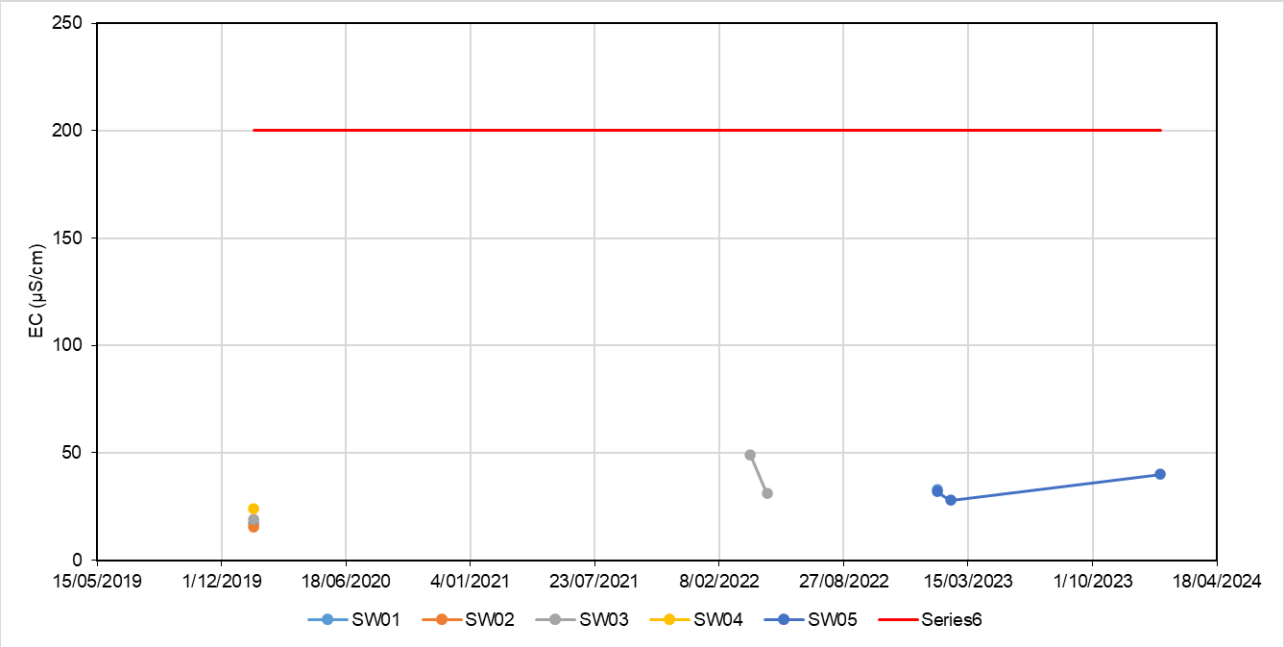

1200
1000
800
600
400
200
0
E. coli (CFU/100mL)
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
GW1 (Bore 4)
GW2_RN029098
GW3_RN029097
GW4_RN036485
GW5 (Bore 6)
GW6 (Bore 11)

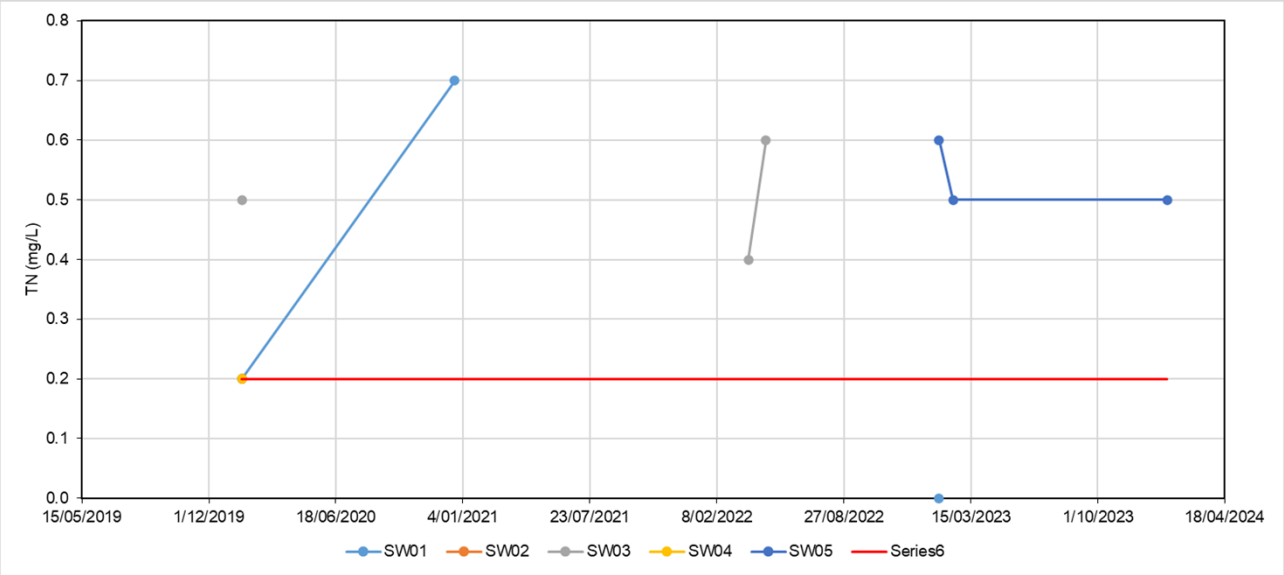


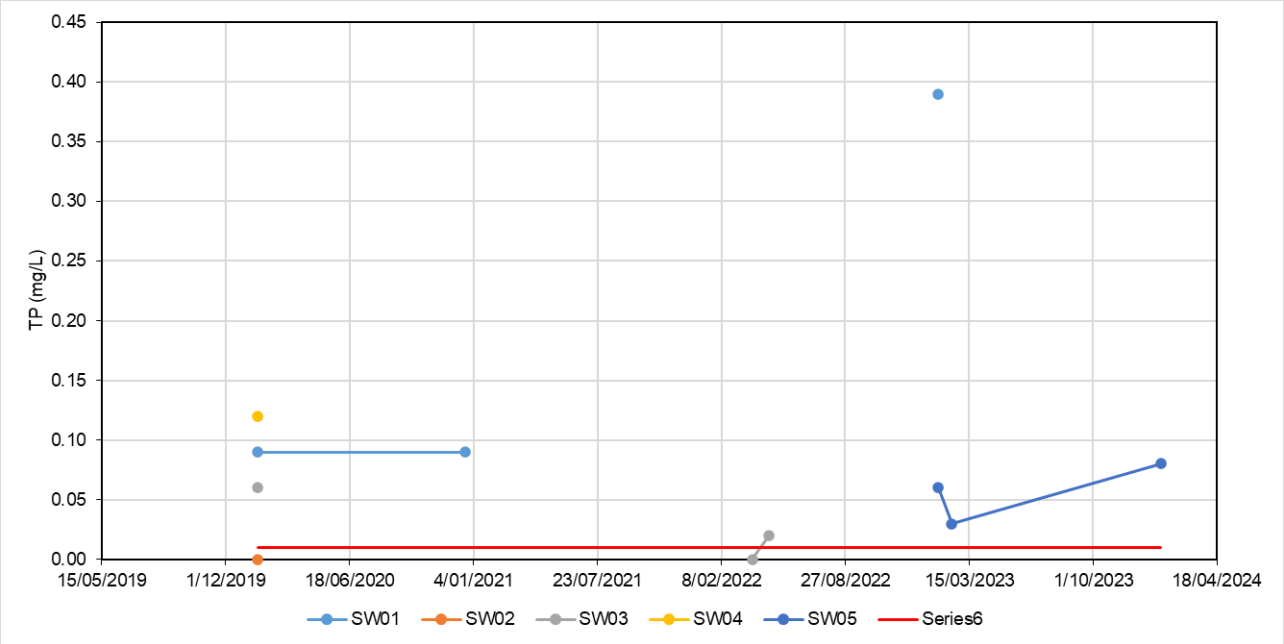


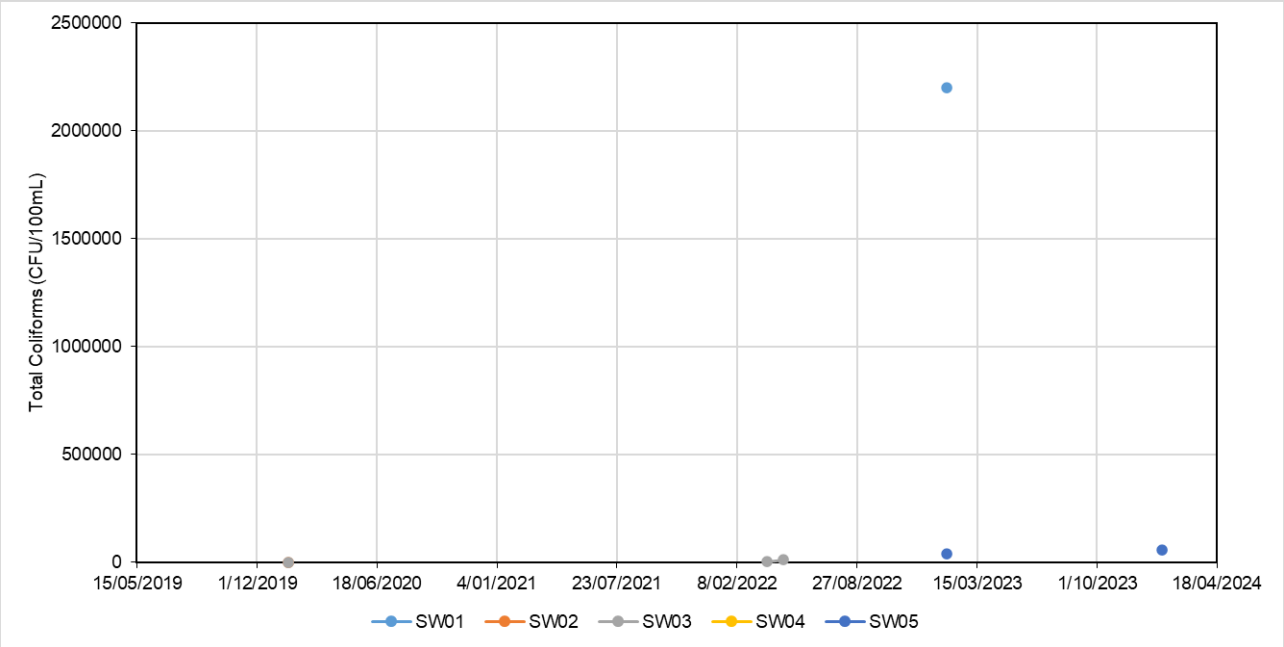
Surface water

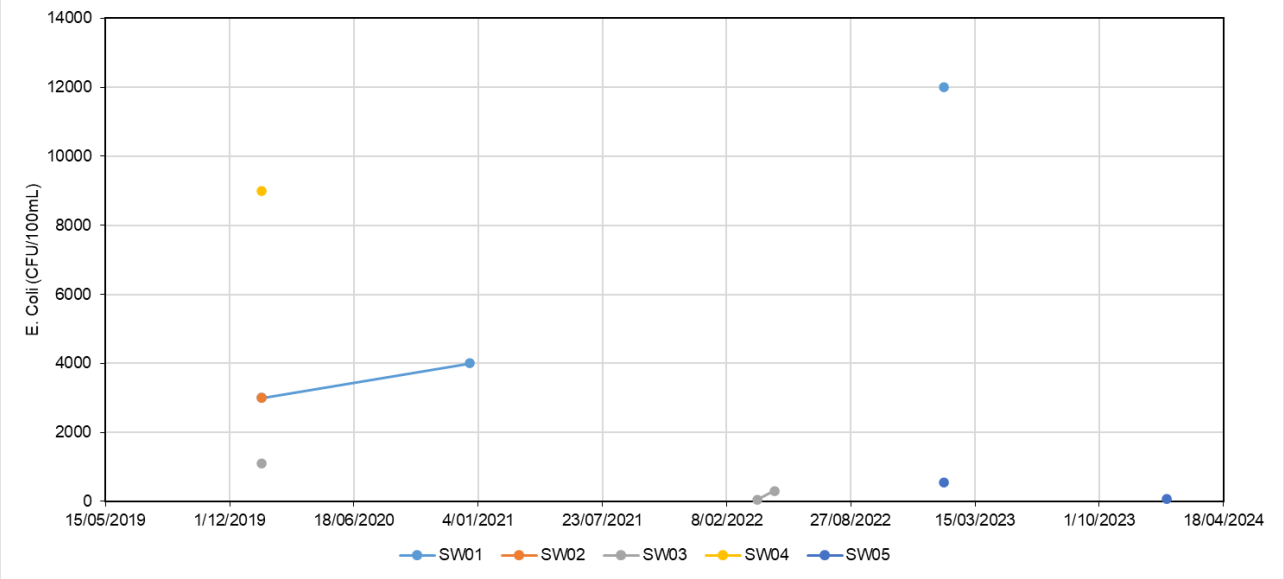

8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05
Series6
Series7

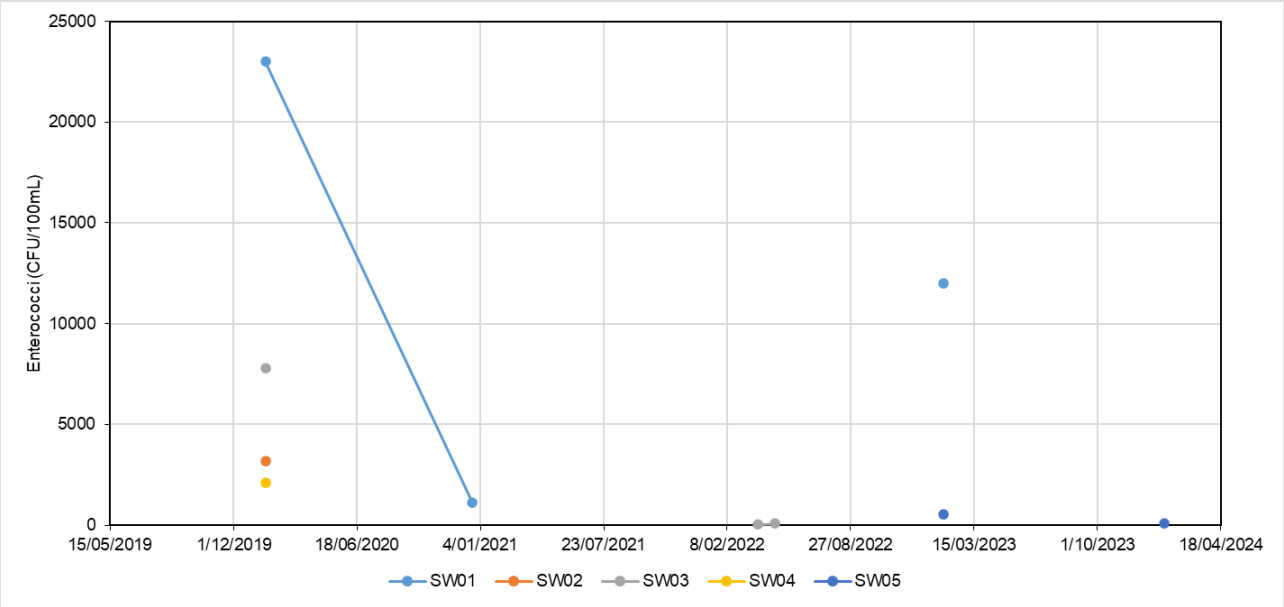

250
200
150
100
50
0
EC (µS/cm)
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05
Series6


0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
TN (mg/L)
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05
Series6

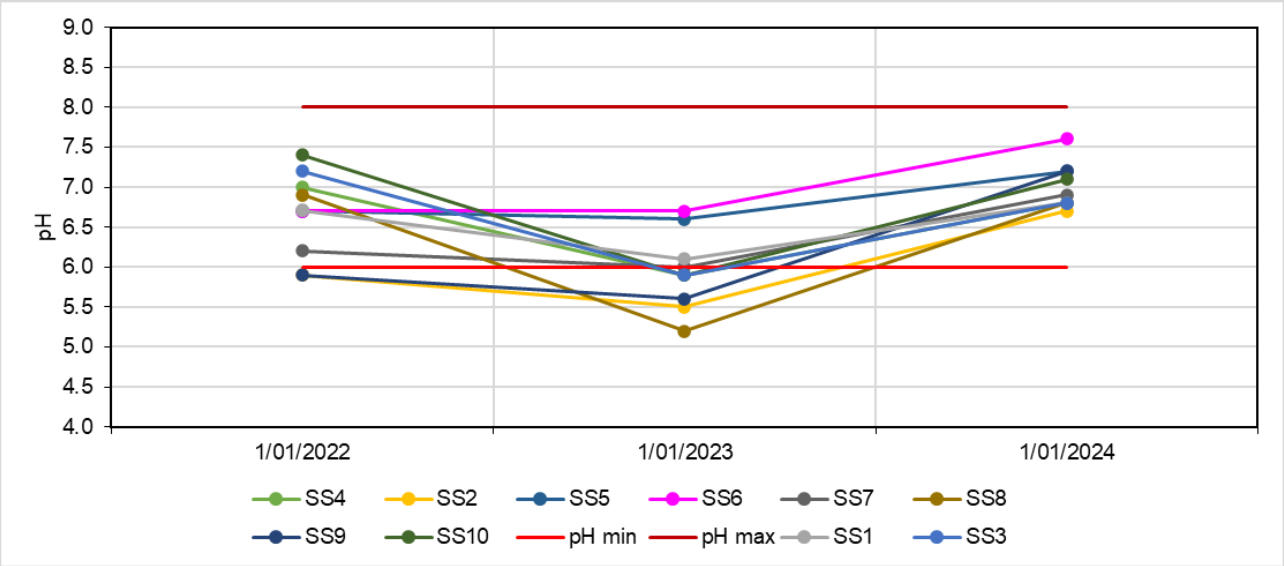

0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
TP (mg/L)
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05
Series6

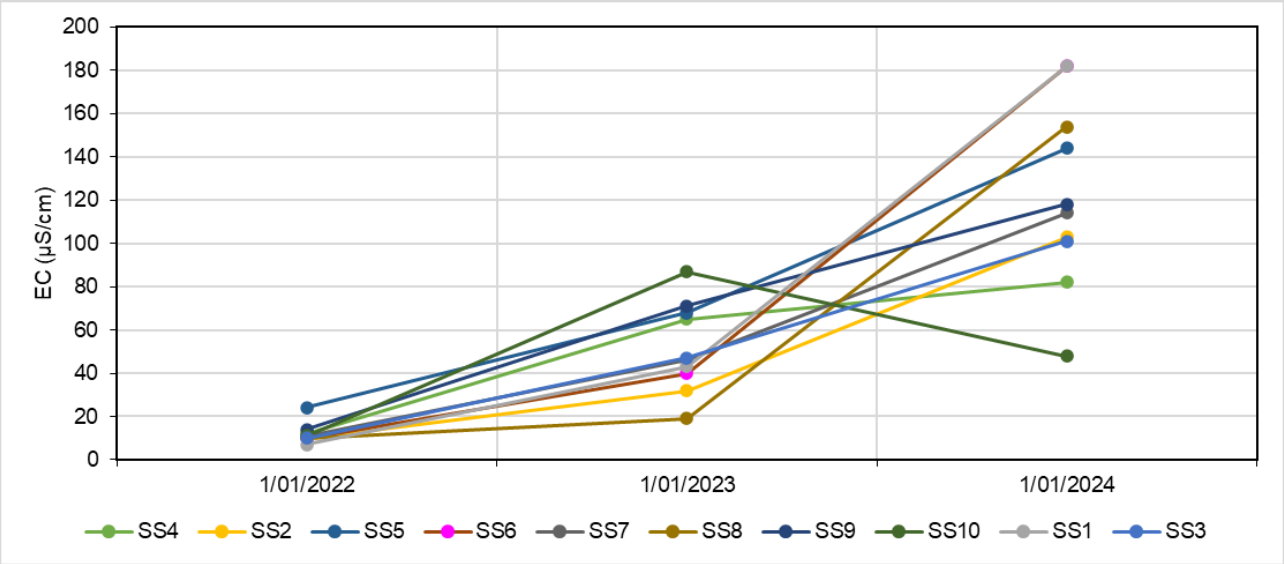

2500000
2000000
1500000
1000000
500000
0
Total Coliforms (CFU/100mL)
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05

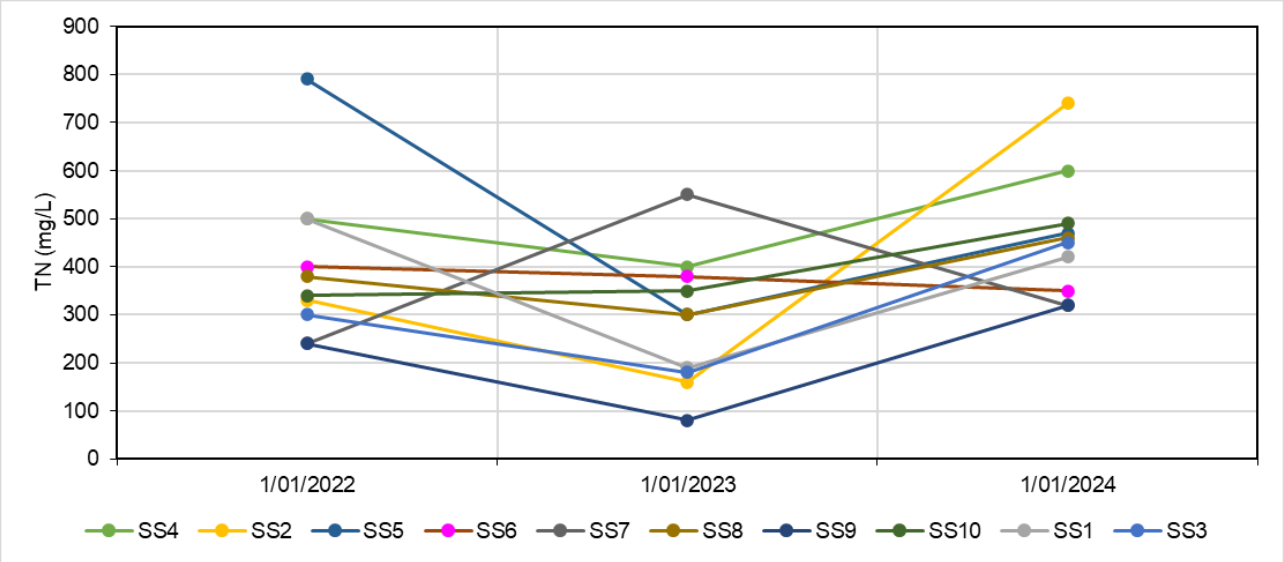

14000
12000
10000
8000
6000
4000
2000
0
E. Coli (CFU/100mL)
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05

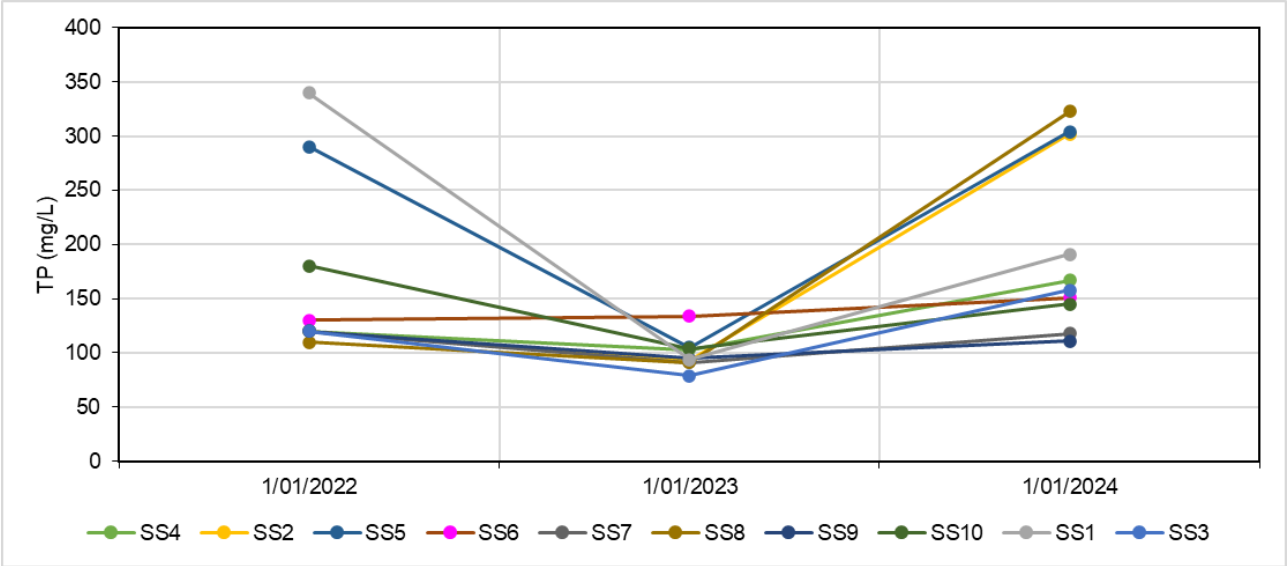

25000
20000
15000
10000
5000
0
Enterococci (CFU/100mL)
15/05/2019
1/12/2019
18/06/2020
4/01/2021
23/07/2021
8/02/2022
27/08/2022
15/03/2023
1/10/2023
18/04/2024
SW01
SW02
SW03
SW04
SW05

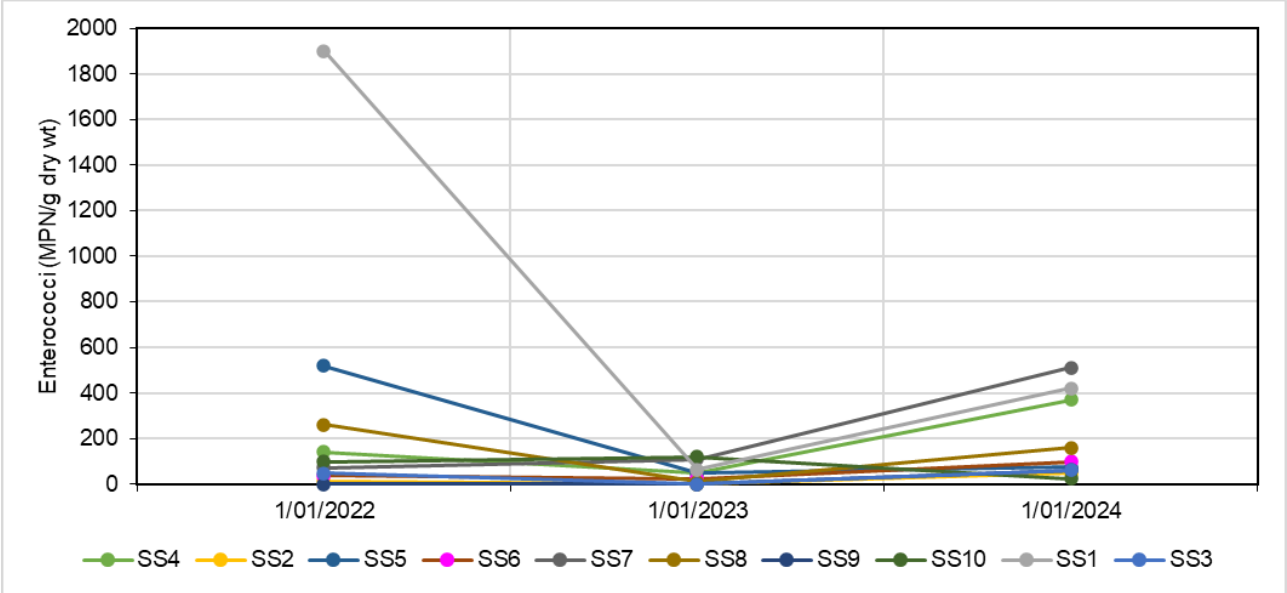
Soils

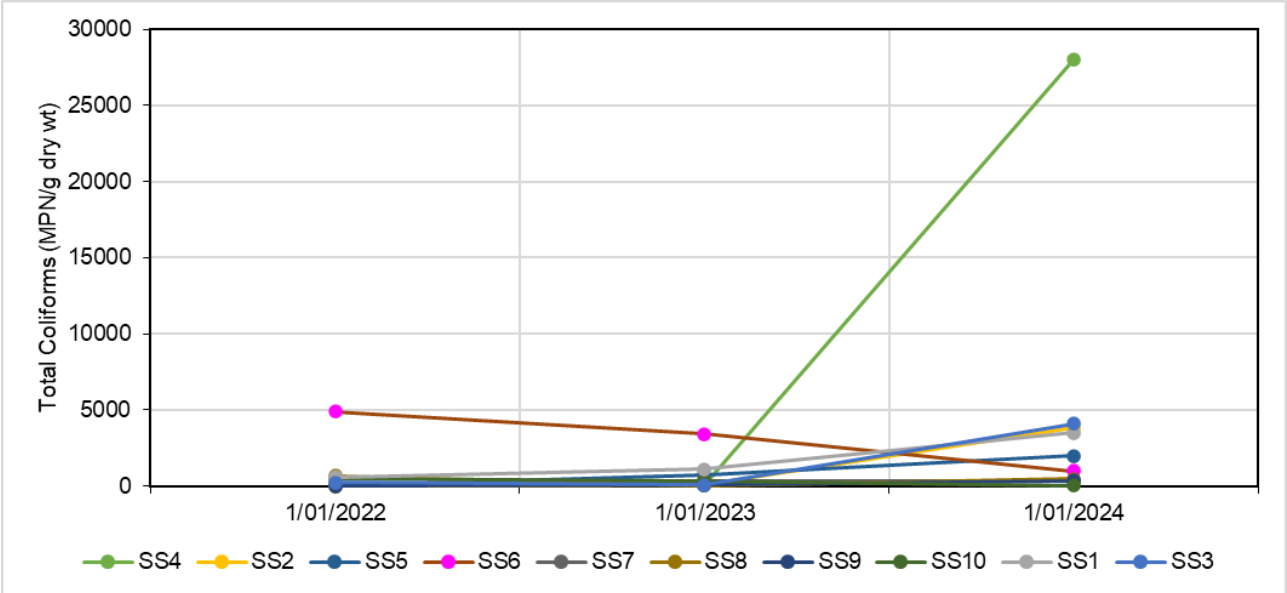

9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
pH
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
pH min
pH max
SS1
SS3

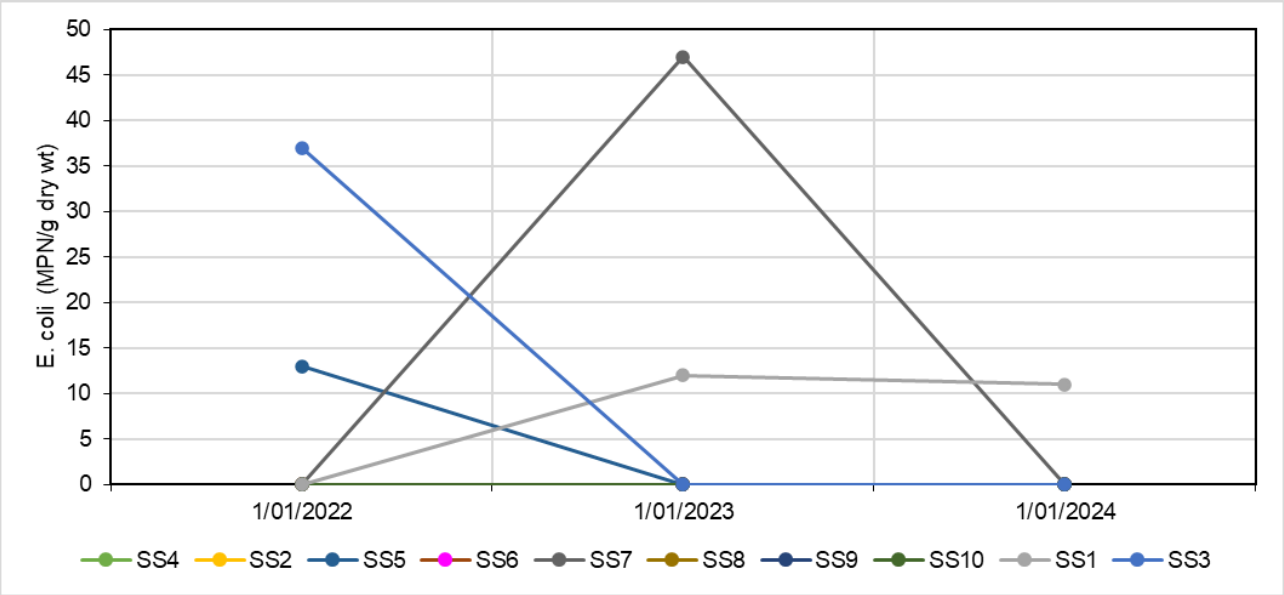

EC (µS/cm)
200
180
160
140
120
100
80
60
40
20
0
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
SS1
SS3


TN (mg/L)
900
800
700
600
500
400
300
200
100
0
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
SS1
SS3


TP (mg/L)
400
350
300
250
200
150
100
50
0
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
SS1
SS3


Enterococci (MPN/g dry wt)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
SS1
SS3


Total Coliforms (MPN/g dry wt)
30000
25000
20000
15000
10000
5000
0
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
SS1
SS3


50
45
40
35
30
25
20
15
10
5
0
E. coli (MPN/g dry wt)
1/01/2022
1/01/2023
1/01/2024
SS4
SS2
SS5
SS6
SS7
SS8
SS9
SS10
SS1
SS3

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