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# Coochiemudlo Island Former Landfill – Quarterly Report (Quarter 1, February 2020)

## Redland City Council Landfill Environmental Monitoring Program (LEMP)

**Elizabeth Street, Coochiemudlo Island, QLD 4184**

**Client: Redland City Council**



**Future-Plus Environmental**
4/40 Technology Drive, Warana QLD 4575

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Signed on behalf of
**Future-Plus Environmental**

Date: 6 April 2020

**Paul Wood**
Director

## DOCUMENT CONTROL INFORMATION

**Project Number:** 5329

**Project Manager:** Kaine Pritchard

**Client:** Redland City Council

**Report Title:** Coochiemudlo Island Former Landfill – Quarterly Report

**Project:** Redland City Council Landfill Environmental Monitoring Program (LEMP)

**Site Address:** Elizabeth Street, Coochiemudlo Island, QLD 4184

**Project Summary:** Quarterly reporting of environmental monitoring undertaken in accordance with the site Landfill Environmental Monitoring Plan (LEMP) at Coochiemudlo Island Former Landfill including groundwater and, surface water monitoring.

### Document Review

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## EXECUTIVE SUMMARY

Future-Plus Environmental (FPE) were commissioned by Redland City Council (RCC) to undertake environmental monitoring in accordance with the *RCC Landfill Environmental Monitoring Program* (LEMP) (GHD, December 2019) at Coochiemudlo Island Former Landfill, located at Elizabeth Street, Coochiemudlo Island (the site).

This report presents the quarterly sampling results of groundwater and surface water environmental monitoring conducted by FPE on 12 February 2020 for Quarter 1.

In summary, the Quarter 1 monitoring event identified the following:

Groundwater:

- Statistically significant results (where available) were not reported for any parameters at any of the groundwater monitoring locations. New maximums were however reported for the following locations and parameters:
  - GW1 for Aluminium and pH;
  - GW2 for Aluminium, Chromium (III+VI), Nitrate, Potassium and TOC; and
  - GW3 for pH.
- Ammonia continues to fluctuate across most groundwater wells; however remains within historical data and low concentrations. The adopted WQO was only exceeded at GW1 during the current event. Iron concentrations remained low at all upgradient and downgradient groundwater wells.
- No evidence of landfill leachate impacts was evident at down-gradient wells from February 2020 results.

Surface water:

- Ammonia was not detected during the current sampling event at any surface water locations.
- Iron, was detected at very low levels across all locations; with concentrations at the lowest recorded of all historical data.
- Most parameters have decreased since previous monitoring events, indicative of heavy rainfall and stormwater flowing through these locations and diluting metals and inorganics that might otherwise become concentrated under low flow/stagnant conditions; and
- Based on the current monitoring results, the landfill is considered to pose a low risk to downstream receivers.

Recommendations

Further surface water and groundwater monitoring is recommended to enable full trend analysis at some locations, and to support characterisation of potential risks over differing climatic and seasonal conditions.

# LIST OF ABBREVIATIONS

| Abbreviation | Term |
|---|---|
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| ARMCANZ | Agricultural and Resource Management Council of Australia and New Zealand |
| ANZG | Australian and New Zealand Guidelines for Fresh and Marine Water Quality |
| BOD | Biological Oxygen Demand |
| BOM | Bureau of Meteorology |
| COD | Chemical Oxygen Demand |
| DES | Department of Environment and Science |
| DNRME | Department of Natural Resources, Mines and Energy |
| DO | Dissolved Oxygen |
| EA | Environmental Authority |
| EC | Electrical Conductivity |
| EPP | Environmental Protection Policy |
| EV | Environmental Values |
| LEMP | Landfill Environmental Monitoring Program |
| LOR | Laboratory Limit of Reporting |
| µS | Micro-Siemens |
| Mbgl | Metres Below Ground Level |
| NATA | National Association of Testing Authorities |
| QA/QC | Quality Assurance/Quality Control |
| QWQG | Queensland Water Quality Guidelines |
| RCC | Redland City Council |
| SWL | Standing Water Level |
| TOC | Total Organic Carbon |
| TSS | Total Suspended Solids |
| WQO | Water Quality Objective |
| % S | Percent Saturation |

# TABLE OF CONTENTS

# LIST OF FIGURES



# LIST OF TABLES



# LIST OF APPENDICES

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

Future-Plus Environmental (FPE) were commissioned by Redland City Council (RCC) to undertake environmental monitoring at Coochiemudlo Island Former Landfill (referred to herein as Coochiemudlo landfill) located at Elizabeth Street, Coochiemudlo Island (the site), in accordance with the site's *Landfill Environmental Monitoring Program* (GHD, December 2016).

The Coochiemudlo landfill was utilised as the main disposal point for municipal waste, including inert/hardfill and green waste, servicing approx. 500 residents on the island from 1972 to 1994. The site is currently used as a waste transfer station and for recreational purposes, including a park, sports field and tennis courts. The site is surrounded by mixed land use, including nearby sensitive receptors (residential lots and a wetland).

## 1.2 REPORT STRUCTURE & CONTENT

This first quarter report summarises the groundwater and surface water environmental monitoring findings for sampling conducted by FPE on 12 February 2020.

This report has been prepared to meet the LEMP reporting requirements and includes the following:

- Details on the monitoring locations, methodology and data assessment adopted for the quarterly monitoring event;
- Details on the quality assurance/quality controls (QA/QC) for the field sampling;
- Weather and monitoring site conditions during the field sampling events;
- Details on the QA/QC for the monitoring results;
- Results of statistical analysis and exceedances of adopted water quality objectives (WQOs) for the groundwater and surface water sampling results; and
- Results, conclusions and recommendations for the ongoing management of groundwater and surface water at the site.

# 2.0 METHODOLOGY

## 2.1 OVERVIEW

RCC requires a regime of environmental monitoring at the Coochiemudlo Island Former Landfill to meet the requirements of the LEMP, including quarterly monitoring of groundwater and surface water.

Works undertaken during the Quarter 1 (February 2020) monitoring events, as per the LEMP requirements, were comprised of quarterly groundwater and surface water monitoring undertaken on 12 February 2020.

## 2.2 MONITORING LOCATIONS & REQUIREMENTS

Groundwater and surface water monitoring locations are presented in **Appendix A**.

The specific groundwater and surface water environmental monitoring requirements in accordance with the LEMP are presented in **Table 1**.

At each monitoring site field observations are completed and well condition is assessed at each groundwater monitoring site, noting any infrastructure damage, ground disturbance or unusual colour/odour of sampling location.

**Table 1. Environmental Monitoring Requirements**

| Monitoring Aspect | Monitoring Location | Field Analysis | Laboratory Analysis |
|---|---|---|---|
| Groundwater (Quarterly) | Downgradient: GW1, GW2, GW3<br><br>Upgradient: GW5, GW6 | pH (pH units)<br>Electrical Conductivity (µS/cm)<br>Standing water level (SWL) | Sulphate - (Turbidimetric) as $SO_4$<br>Major Cations (Na, Mg, K, Ca)<br>Ammonia as N<br>Nitrate<br>Total Phosphorus as P<br>Dissolved metals (Mn, As, Al, Cr, Cu, Cd, Pb, Zn, Fe, Hg, Ni)<br>Dissolved Mercury<br>Total Organic Carbon (TOC) |
| Surface Water (Quarterly) | Background: CISW2, CISW3, CISW4<br><br>Downstream: CISW1, CISW5 | pH (pH units)<br>Electrical Conductivity (µS/cm)<br>Dissolved Oxygen (ppm and % saturation) | Total Suspended Soils (TSS)<br>Sulphate - (Turbidimetric) as $SO_4$<br>Major Cations (Na, Mg, K, Ca)<br>Ammonia as N<br>Nitrate<br>Total Nitrogen<br>Total Phosphorus as P<br>Dissolved metals (Mn, As, Al, Cr, Cu, Cd, Pb, Zn, Fe, Hg, Ni)<br>Total Organic Carbon (TOC)<br>Chemical Oxygen Demand (COD)<br>Biochemical Oxygen Demand (BOD) |

### 2.2.1 Groundwater Monitoring Locations

Groundwater quality monitoring is required at two upgradient locations and three downgradient locations, which are presented in **Table 2**.

**Table 2. Groundwater Monitoring Sites**

| Location | GPS Coordinates (UTM GDA94) | |
|---|---|---|
| | Easting | Northing |
| **Upgradient Locations** | | |
| GW5 | 532940 | 6950507 |
| GW6 | 532940 | 6950407 |
| **Downgradient Locations** | | |
| GW1 | 533049 | 6950518 |
| GW2 | 533058 | 6950484 |
| GW3 | 533038 | 6950418 |

### 2.2.2 Surface Water Monitoring Locations

Surface water quality monitoring is required for three background and two downstream locations and these are presented in **Table 3**.

**Table 3. Surface Water Monitoring Sites**

| Location | GPS Coordinates (UTM GDA94) | |
|---|---|---|
| | Easting | Northing |
| **Background Locations** | | |
| CISW2 | 533157 | 6950606 |
| CISW3 | 533256 | 6950606 |
| CISW4 | 533255 | 6950351 |
| Downstream Locations | | |
| CISW1 | 533088 | 6950507 |
| CISW5 | 533068 | 6950440 |

## 2.3 MONITORING RESULTS DATABASE

Results of all groundwater and surface water monitoring field and laboratory analysis have been entered into the ESdat environmental monitoring database, which includes historical monitoring results and allows for comparison of results with adopted water quality objectives (WQOs).

## 2.4 ENVIRONMENTAL GUIDELINES

The *Environmental Protection (Water) Policy 2009 - Moreton Bay environmental values and water quality objectives* (Department of Environment and Resource Management (DERM)2, July 2010), [referred to henceforth as EPP (Water)] defines the environmental values (EVs) for surface and groundwater quality within the region. This document also identifies the water quality objectives (WQOs) associated with each EV.

As the Coochiemudlo Island Former Landfill and the Melaleuca Wetland are situated within the coastal freshwater area within Coochiemudlo Island, the site is classified as “Coochiemudlo Island” for the purpose of establishing EVs and associated WQOs (DERM, 2010).

The following EVs and their relevant guidelines apply (as specified in the EPP (water) for Coochiemudlo Island):

- Aquatic Ecosystems (include seagrass) (Groundwater/surface water);
- Irrigation (Groundwater);
- Stock Water (Groundwater);
- Human Consumer (include oystering) (Surface water only);
- Drinking water (Groundwater only);
- Primary/Secondary/Visual Recreation (Surface water only); and
- Cultural and Spiritual Values (Surface water only).

The above EVs represent potential receptors of any impacts from Coochiemudlo Island Former Landfill. An assessment of these potential receptors by GHD (GHD, 2019b) identified the following receptors as actual or likely receptors for further assessment, based on characterising actual water use in the area:

- Surface water: aquatic ecosystems (including Wallum frog habitat (GHD, 2018a)), cultural and spiritual values; and
- Groundwater: aquatic ecosystems.

As recommended in the EPP (water), the adopted WQOs were determined from a combination of documents, including the following:

- Environmental Protection (Water) Policy (Department of Natural Resource Management, 2010) corresponding to the following:
  - Physico-chemical WQOs for aquatic ecosystem lowland freshwater (comprising lowland streams, Wallum/tannin-stained streams and coastal streams)
  - Local WQOs for drinking water supply
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council [ANZECC]/Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ], 2000 and 2018 revision), corresponding to the following:
  - Protection of slightly to moderately disturbed ecosystems
    - Utilised as the site is in an urbanised environment
  - Protection of 99% species for surface water for metals only
    - Utilised as an indicator of metal concentrations elevated in relation to optimal concentrations for Wallum frog habitat

Site-specific WQOs have also been developed to improve the assessment of potential wallum frog habitats:

- GHD 2018 Coochiemudlo Island wetland guideline for the following parameters (GHD, 2018):
  - pH between 3.53 and 4.61 pH units;
  - EC < 90 µS/cm;
  - Tannin acid staining > 9.5 mg/L;
  - Calcium < 3.02 mg/L; AND
  - Low levels of monomeric aluminium consistent with siliceous sand and Wallum waters (refer to Aluminium guideline value from ANZECC FW 99%)

The results from the groundwater and surface water monitoring have been compared against the WQOs.

## 2.5 DATA ASSESSMENT

### 2.5.1 Groundwater

Data assessment for groundwater has been undertaken to determine if leachate generated at Coochiemudlo Island Former Landfill is potentially impacting on local groundwater. The following assessment approach has been adopted:

- Identification of statistically significant fluctuations in groundwater quality;
- Comparison of results with published WQOs (refer to Section 2.4);
- Comparison between up gradient and down gradient locations (refer to Section 2.5.2.1); and
- Evaluation of trends in indicator parameter concentrations.

### 2.5.2 Groundwater Statistical Assessment

Results from each monitoring well were compared to the mean (x) and multiples of standard deviations (x+1s, x+2s and x+3s) of historical results for each specific parameter. Historical data for the Coochiemudlo Island Former Landfill monitoring wells is based on the first eight sampling events conducted at the start of the landfill monitoring program (since June 2017 or April 2018, depending on location and parameter). As such, some locations and parameters require additional monitoring data before control lines can be determined.

The adopted assessment criteria consist of the following exceedances:

- Five consecutive observations greater than the x+1s control line;
- Two consecutive observations greater than the x+2s control line; and
- One observation greater than the x+3s control line

In the case of pH, the control line also applies when pH measurements are less than the mean (i.e. x-1s, x-2s, x-3s). Statistically significant results that are identified are discussed further, to provide comparison with background water quality and provide context regarding any potential impact on the receiving environment.

Each parameter for each groundwater well has been graphed and includes the above adopted assessment criteria (**Appendix C**)

#### 2.5.2.1 Upgradient & Downgradient Well Comparison

Comparison of up-gradient and down-gradient groundwater well data is undertaken by assessment of groundwater trend graphs provided in **Appendix D.**

### 2.5.3 Surface Water

Data assessment for surface water has been undertaken to determine if leachate generated at Coochiemudlo Island Former Landfill is potentially impacting on local surface water quality. The following assessment approach has been adopted:

- Identification of statistically significant fluctuations in groundwater quality;
- Comparison of results with adopted WQOs (refer to Section 2.4);
- Comparison between upstream and downstream monitoring locations (refer to Section 2.5.3.1); and
- Evaluation of trends in parameter concentrations at specific surface water monitoring locations.

#### 2.5.3.1 Upstream & Downstream Comparison

Comparison of up-stream and down-stream surface water data is undertaken by assessment of surface water trend graphs provided in **Appendix E.**

# 3.0 QUALITY ASSURANCE & QUALITY CONTROL – FIELD SAMPLING

## 3.1 GENERAL

The Quality Assurance /Quality Control (QA/QC) program for the field sampling component of the LEMP was undertaken in accordance with, but not limited to, the following:

- *Monitoring and Sampling Manual - Environmental Protection (Water) Policy 2009 (Version 2)* (DES, 2018);
- *ISO 5667-11 1993 and AS/NZ 5667.11:1998 Water Quality Sampling Guidance on Sampling of Groundwater;*
- *AS/NZS 5667.6: 1998 Water Quality – Sampling Guidance on Sampling of Rivers and Streams;*
- *Environmental Guidelines: Solid Waste Landfills, Second Edition 2016* (NSW EPA, 2016); and
- *Best Practice Environmental Management - Siting, Design, Operation and Rehabilitation of* Landfills (Publication 788.3) (EPA Victoria, 2015).

QA/QC procedures included:

- Monitoring of climatic conditions likely to be experienced at site;
- Calibration of TPS 90 FLT water meter prior to and following sampling;
- Triple rinse decontamination procedure of all equipment prior to sampling and between sampling points for all environmental monitoring;
- Use of nitrile disposable gloves for sample collection. Disposable gloves were replaced between sample locations;
- Collection of field duplicate, triple blank and rinsate blank samples;
- Review of QC reports generated by the laboratory of their internal procedures and checks including matrix spikes, surrogate spikes, duplicate analyses, reagent and method blanks;
- Correct cold storage of samples (target <6 degrees °C) and delivery to ALS Global NATA accredited laboratory within recommended holding times (target 24 hrs); and
- Record keeping of transport documentation and use of chain of custody procedures, including sample list forms submitted to the laboratory and laboratory sample receipt documentation.

## 3.2 FIELD & LABORATORY WATER QUALITY ANALYSIS

Analysis of field parameters was undertaken using a TPS 90FLT water quality meter. Laboratory analysis was undertaken by ALS Global (NATA accredited) laboratory in accordance with the laboratory methods and level of reporting detailed in **Table 4.**

**Table 4. Water Quality Laboratory Parameters & LOR**

| Parameter | LOR (mg/L or as indicated) |
|---|---|
| Sulphate – (Turbidimetric) as $SO_4$ | 1 |
| Major Cations: Ca, Mg, Na, K | 1 |
| Ammonia as N | 0.01 |
| Nitrate | 0.01 |
| Dissolved Metals (Mn, As, Al, Cr (III+VI), Cu, Cd, Pb, Zn, Fe, Hg) | Zn: 0.005<br>Hg: 0.0001<br>Others: 0.001 |
| Total Organic Carbon (TOC) | 1 |
| Chemical Oxygen Demand (COD) | 10 |
| Biological Oxygen Demand (COD) | 2 |
| Total Suspended Solids (TSS) | 5 |
| Total Phosphorus | 0.01 |

### 3.2.1 Field Data Quality Assessment

As part of the QA/QC program, field duplicates, field blank and rinsate samples were prepared and submitted for laboratory analysis.

FPE follow strict sample collection procedures to ensure representative samples are collected and high results integrity achieved.

### 3.2.2 Field blanks

Field blanks were used to assess the potential for cross contamination during field handling procedures and shipment of the samples to the laboratory and consisted of a sample of deionised water that was supplied by the laboratory.

Field blank samples were submitted for analysis with each batch / esky of samples collected during groundwater and surface water sampling events.

One field blank sample (Sample ID Blank) was analysed for the parameters specified in Appendix C: Coochiemudlo Island Closed Landfill of the *Environmental Monitoring Plan* for the Landfill Environmental Monitoring Program (FPE, 2019).

### 3.2.3 Rinsate

Equipment rinsate blanks were prepared in order to assess whether equipment decontamination procedures adequately prevented and/or minimised the potential for sample cross-contamination. A

rinsate sample was collected following completion of each sampling event during which sampling equipment (e.g. sampling jug) was utilised for sample collection.

One rinsate blank sample (Sample ID Rinsate) was prepared and submitted to the laboratory for analysis of analytes representative of the sampling undertaken during each sampling event (GW and SW inclusive).

### 3.2.4 Duplicates

A duplicate sample (SWQA) was taken during each monitoring event (GW and SW inclusive) for analysis and used to indicate if repeatable results are obtained and for the quality of data to be evaluated.

Duplicate samples were submitted for analysis with each batch of samples collected (primary sample CISW3).

A Precision assessment is reported as Relative Percent Difference (RPD) between the two results (sample and duplicate). Where the RPD value is greater than the adopted trigger value, it is identified as an exceedance.

# 4.0 WEATHER & MONITORING SITE CONDITIONS

## 4.1 SITE CONDITIONS

Heavy rainfall occurred on the day of monitoring and saturated ground conditions were noted whilst on site. Long grass around the perimeters of the landfill and vegetation adjoining access tracks was not maintained in some areas, which caused difficulty with accessing some of the monitoring sites. Maintenance of these areas by RCC is recommended to allow ongoing access and monitoring of these areas.

## 4.2 WEATHER CONDITIONS

Conditions at the time of monitoring on 12 February 2020 have been outlined below. All climate data (except rainfall) was extracted from the Redland (Alexandra Hills) Station No.140007 (Bureau of Meteorology [BOM] 2020). Temperatures ranged from 22.3 to 26.0 °C during sampling.

Annual rainfall statistics were utilised from the BOM Ormiston College Station No. 40770, which is 10.6km from the site and is the closest station with suitable long-term data. Large rainfall totals were received the week preceding (342.8mm in 7 days) and during monitoring on the 12 February 2020 (4mm).

Annual rainfall statistics (1988-present) from the Ormiston College Station No. 40770 are displayed in **Figure 1** below.

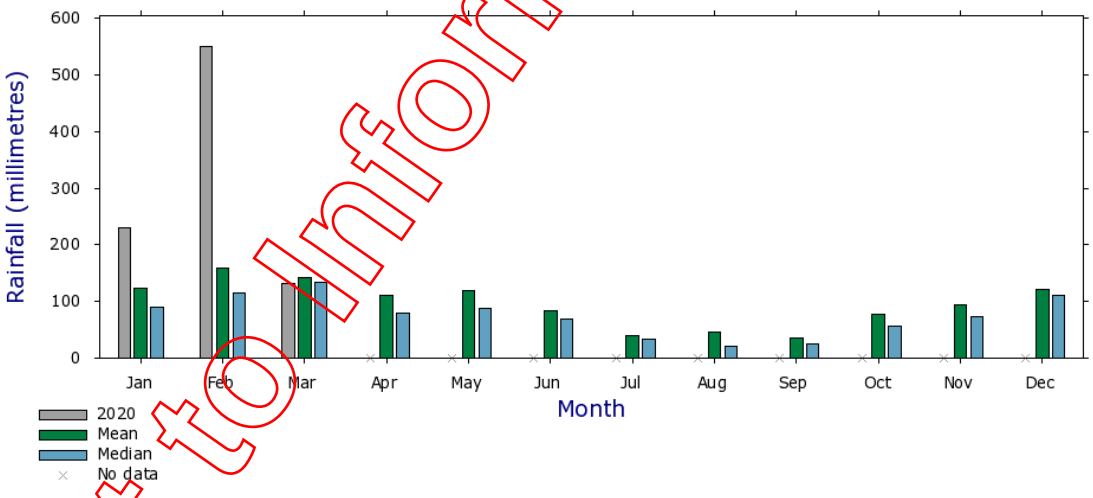


**Figure 1. Annual Rainfall Statistics (BOM, 2020)**

# 5.0 QUALITY ASSURANCE & QUALITY CONTROL - SAMPLING RESULTS

## 5.1 LABORATORY QA/QC RESULTS

As part of the QA/QC program, field duplicates, trip blank and rinsate samples were prepared and submitted for laboratory analysis. Laboratory QA/QC Results are provided in **Appendix F**.

FPE follow strict sample collection procedures to ensure representative samples are collected and high results integrity achieved.

The Relative Percentage Difference (RPD) for the field duplicate was acceptable based on the following:

- Below 50% if result was between 10 and 20 times LOR;
- Below 20% if result >20 times LOR; and
- No limit if result <10 times the LOR.

RPD were within acceptable limits outlined above for all field duplicates.

No traces of parameters were identified in the Blank or Rinsate samples.

Review of the laboratory QA/QC reporting identified the following:

- No Method Blank value outliers occur;
- No Duplicate outliers occur;
- No Laboratory Control outliers occur;
- No Matrix Spike outliers occur;
- No Surrogate recovery outliers occur;
- No Analysis Holding Time Outliers occur; and
- No Quality Control Sample Frequency Outliers occur.

Based on results above FPE has confidence that the sampling results are representative of the site conditions.

# 6.0 MONITORING RESULTS

All groundwater and surface water sampling locations were effectively sampled during the Quarter 1 monitoring event. All tabulated groundwater and surface water results from the first quarter monitoring event are provided in **Appendix B**.

## 6.1 GROUNDWATER RESULTS

### 6.1.1 Groundwater Levels

Groundwater levels (mAHD) for each groundwater bore are displayed in the **Figure 2** below, from 2017 to 2020. Upgradient bores at the site are GW5 and GW6, while downgradient bores are represented by GW1, GW2 and GW3.

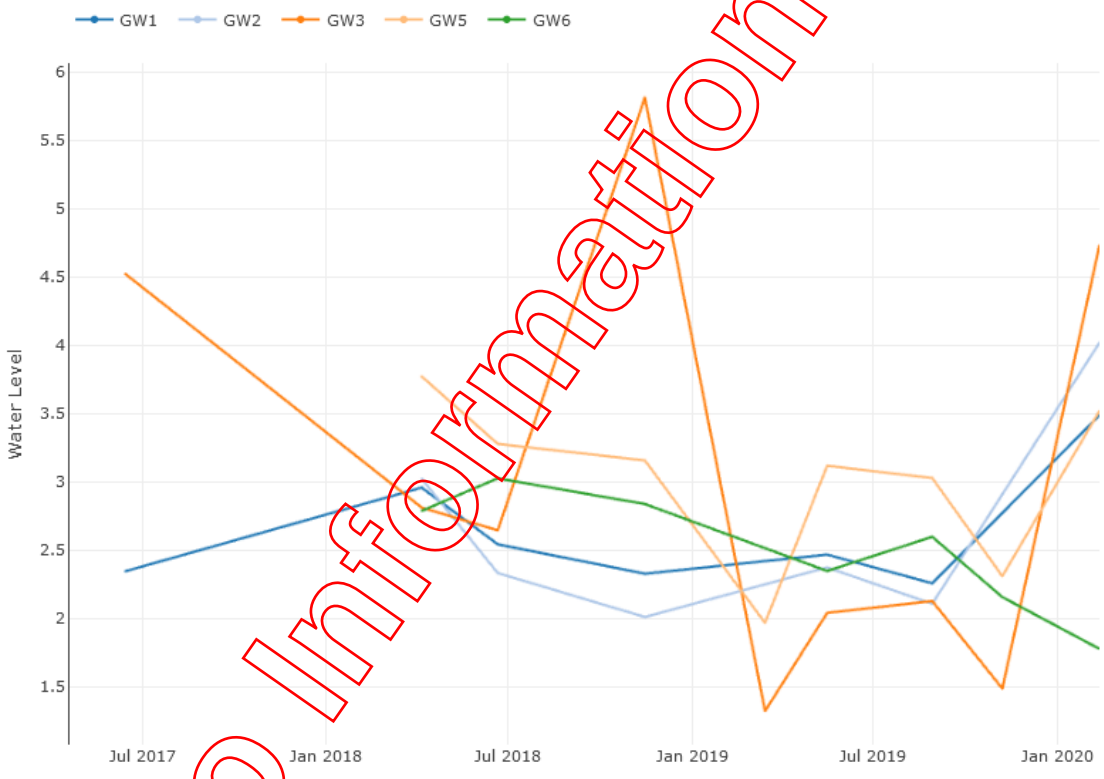


**Figure 2. Groundwater levels (mAHD) of monitoring wells at BWF for 2017 to 2020**

Groundwater levels all increased during the current monitoring event (except GW6) when compared to the previous monitoring even on 7 November 2019, which is attributed to the large rainfall events within the seven days prior to field monitoring (refer Section 4.2). Groundwater levels varied from 1.78mAHD (GW6) to 4.73mAHD (GW3) and are within the historical range of groundwater levels at GW3 and GW5, whilst GW1 and GW2 have increased above historical levels. Groundwater level at GW6 continues an overall decreasing trend during the current monitoring round.

The SWL at GW3 appears very responsive to rainfall events, as was noted from data recorded in November 2018 (GHD, 2019b), and is again during the current monitoring round following large rainfall events. GW5 typically responds similarly to rainfall events, although is not at apparent as GW3.

### 6.1.2 Well Condition Review

The condition of all groundwater wells during the most recent monitoring event is provided in **Table 5** below.

**Table 5. Groundwater Well Condition Review**

| Monitoring well ID | Condition as of February 2020 |
|---|---|
| **Upgradient bores** | |
| GW5 | Good |
| GW6 | Good |
| **Downgradient bores** | |
| GW1 | Good |
| GW2 | Good |
| GW3 | Good |

### 6.1.3 Field Observations

Visual observations of sample material retrieved from all groundwater wells is noted in **Table 6** below.

**Table 6. Groundwater well location and sample descriptions**

| Location ID | Location Description | Sample description |
|---|---|---|
| **Upgradient bores** | | |
| GW5 | Located 5 m east of the waste transfer station. | Moderately clear, no suspended solids, no odour and no sheen. |
| GW6 | Located 60 m south of the waste transfer station. | Moderate turbidity, no odour and no sheen. |
| **Downgradient bores** | | |
| GW1 | Located 10 m west of the waste transfer station. | Moderately clear, no suspended solids, no odour and no sheen. |
| GW2 | Located 10 m west of the closed landfill. | Moderately clear, no suspended solids, no odour and no sheen. |
| GW3 | Located 50 m south-west of the former landfill, adjacent to the tennis court. | Brown, high turbidity, no suspended solids, no odour or sheen |

### 6.1.4 Groundwater Statistical Analysis

An assessment of data for the current February 2020 monitoring round against available statistical Control Line data found there were no exceedances of parameters at any groundwater well locations[2]. Trend charts with analytes plotted against control line criteria are provided in **Appendix C**.

### 6.1.5 Upgradient Monitoring Well Results

WQO exceedances for upgradient sites GW5 and GW6 are summarised in **Table 7** below. WQO exceedances at GW5 and GW6 are considered to represent background conditions and are not considered to represent impact from the former landfill.

**Table 7. Exceedances of WQOs at Upgradient Monitoring Sites**

| Parameter | Units | EVs | WQOs | Current Result | |
|---|---|---|---|---|---|
| | | | | GW5 | GW6 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 4.82 | N/A |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 287 | 2,360 |
| | | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 626 | | |
| | | Schedule 1 EPP (water) - Drinking Water | 1,000 | | |
| Nitrate | mg/L | ANZECC FW Slight-mod disturbed system | 0.158 | 1.95 | N/A |
| Aluminium | mg/L | ANZECC FW Slight-mod disturbed system | 0.055 | N/A | 7.6 |
| Iron (Filtered) | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | N/A | 0.11 |
| Zinc | mg/L | ANZECC FW Slight-mod disturbed system | 0.008 | N/A | 0.022 |

*Note: N/A Indicates that the result from that sampling location did not exceed any guidelines and thus not included in the exceedance table.

### 6.1.6 Downgradient Monitoring Well Results

WQO exceedances for downgradient groundwater well sites GW1, GW2 and GW3 are summarised in **Table 8** below.

[2] Excluding GW2 - No Control Line data exists for GW2 as additional sample events are required before such data can be determined.

**Table 8. Exceedances of WQOs at Downgradient Monitoring Sites**

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | GW1 | GW2 | GW3 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 6.23 | 6.53 | 5.9 |
| | | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5 – 8 | | | |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 521 | 516 | N/A |
| Ammonia as N | mg/L | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.02 | 0.03 | N/A | N/A |
| Nitrate (as N) | mg/L | ANZECC FW Slight-mod disturbed system | 0.158 | 0.85 | 0.93 | N/A |
| Aluminium | mg/L | ANZECC FW Slight-mod disturbed system | 0.055 | 0.12 | 0.30 | 0.37 |
| Chromium (III+VI) | mg/L | ANZECC FW Slight-mod disturbed system | 0.001 | N/A | 0.002 | N/A |
| Iron (Filtered) | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | N/A | 0.16 | 0.13 |
| Zinc | mg/L | ANZECC FW Slight-mod disturbed system | 0.008 | N/A | 0.036 | N/A |

*Note: N/A Indicates that the result from that sampling location did not exceed any guidelines and thus not included in the exceedance table.

#### 6.1.6.1 Downgradient well – GW1

All monitored parameters at downgradient GW1 were within the statistical assessment criteria for this quarterly monitoring event.

Concentrations of parameters, including where WQOs were exceeded, were consistent with background concentration ranges and/or with recent concentration trends with the exception of:

- Aluminium (0.12mg/L) has was detected during the current monitoring event and has increased above historical data at this location, representing a new maximum concentration. Aluminium

levels were lower than upgradient well GW6. The adopted WQO is now exceeded at this location;

- Ammonia as N (0.03 mg/L) has increased since the previous monitoring event (29 August 2019) and is only slightly higher than upgradient well GW6. This parameter only just exceeds the adopted WQO and remains within historical data range for this location;
- Calcium (60mg/L) remains higher than all other upgradient and downgradient locations but is within the historical range of data; and
- pH (6.23) remains higher than downgradient locations and it just above historical data for this location, representing a new maximum value. pH has continued to gradually increase since November 2018 and remains outside of the adopted WQOs.

#### 6.1.6.2 Downgradient well – GW2

Concentrations of parameters, including where WQOs were exceeded, were consistent with background concentration ranges and/or with recent concentration trends with the exception of:

- Aluminium (0.3mg/L) was detected during the current monitoring event and has increased above historical data at this location, representing a new maximum concentration; however it is well below upgradient well GW6. The adopted WQO is now exceeded at this location;
- Chromium (III+VI) (0.002mg/L) has increased above all up-gradient and most down-gradient wells during the current monitoring event. Chromium has increased above historical levels, representing a new maximum at this location. However, the adopted WQO has not been exceeded;
- Nitrate (0.93 mg/L) has increased above historical levels, representing a new maximum at this location. The adopted WQO has been exceeded at this location. However, the Nitrate concentration remains below upgradient well GW5;
- Potassium (20mg/L) is above upgradient wells and has increased above historical levels, representing a new maximum concentration at this location; and
- TOC (10mg/L) is above upgradient wells and has increased above historical levels, representing a new maximum at this location.

#### 6.1.6.3 Downgradient well – GW3

All monitored parameters at downgradient GW3 were within the statistical assessment criteria for this quarterly monitoring event.

Concentrations of parameters, including where WQOs were exceeded, were consistent with background concentration ranges and/or with recent concentration trends with the exception of:

- pH (5.9) has increased since the previous event in November 2019 and is now above historical levels, representing a new maximum concentration at this location. The adopted WQOs have been exceeded at this location.

### 6.1.7 Summary of potential landfill impact on Groundwater

All wells were sampled in February 2020. New maximums were reported at downgradient locations for:

- GW1 for Aluminium and pH;
- GW2 for Aluminium, Chromium (III+VI), Nitrate, Potassium and TOC ; and
- GW3 for pH;

Whilst concentrations exceeding the adopted WQOs were reported, results were consistent with background data with the exception of:

- GW1 for Aluminium, Ammonia as N, Calcium and pH;
- GW2 for Aluminium, Chromium (III+VI), Nitrate, Potassium, TOC; and
- GW3 for pH.

Ammonia (a key leachate indictor) results continue to fluctuate across most groundwater wells however remain within historical data and low concentrations. The adopted WQO of 0.02mg/L was only exceeded at GW1 during the current event (0.03mg/L) and no other downgradient groundwater location results are indicative of landfill leachate impacts.

Iron (dissolved) concentrations remained low at all upgradient and downgradient groundwater wells. The variability of historical results at GW2 also returned to very low levels (0.16mg/L), exceeding the adopted WQO of 0.05mg/L. Whilst Iron is another key leachate indictor, these results, in conjunction with the Ammonia results across groundwater wells, are not considered representative of leachate impacts.

pH, an important consideration for acid frog habitat downstream of the former landfill, was noted to be higher at downgradient wells (5.9-6.53) than upgradient wells (3.64-4.82). Historical pH levels appear to fluctuate and be influenced by rainfall events at GW2 and GW3, and to a lesser extent at GW1, suggesting the soil profile at these locations may be more permeable to surface water inputs and/or impacted by historical landfilling on the site.

## 6.2 SURFACE WATER RESULTS

### 6.2.1 Monitoring location descriptions

The details of the surface water locations and field observation have been summarised in **Table 9**.

**Table 9. Surface water locations and sample descriptions**

| Location ID | Location Description | Sample description |
|---|---|---|
| **Background surface water monitoring locations** | | |
| CISW2 | Background, potential Wallum frog habitat | Clear, no suspended solids or odour. Tannin-stained colour. Water flow at sample location. |
| CISW3 | Background, potential Wallum frog habitat | Clear, no suspended solids or odour. Tannin-stained colour. Water flow at sample location. |
| CISW4 | Background | Clear, no suspended solids or odour. Tannin-stained colour. Water flow at sample location. |
| **Downstream surface water monitoring locations** | | |
| CISW1 | Downstream of former landfill | Moderately turbid, no suspended solids, odour. Turbid colour. |
| CISW5 | Downstream of former landfill | Moderately turbid, no suspended solids, odour. Turbid colour. |

### 6.2.2 Background Surface Water Results

#### 6.2.2.1 Surface Water Sites – CISW2, CISW3, CISW4

WQO exceedances for background sites CISW2, CISW3 and CISW4 are summarised in **Table 10** below. WQO exceedances at CISW2, CISW3 and CISW4 are considered to represent background conditions and are not considered to represent impact from the former landfill but are included for comparative purposes.

**Table 10. Exceedances of WQOs Upstream Surface Water Sites**

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | CISW2 | CISW3 | CISW4 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 5.8 | 5.44 | 6.41 |
| | | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5 – 8 | | | |
| DO | %Sat | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 85-110 | 40 | 78.3 | 48.9 |

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | CISW2 | CISW3 | CISW4 |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | N/A | 117.2 | 103.1 |
| Nitrogen (total) | mg/L | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.5 | 1.2 | 0.8 | 0.6 |
| Chromium (III+VI) | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.00001 | 0.002 | 0.002 | 0.002 |
| | | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.001 | | | |
| Iron | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | 0.37 | 0.31 | 0.27 |
| Zinc | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.0024 | 0.007 | N/A | 0.022 |
| | | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.008 | | | |

Note: * N/A Indicates that the result from that sampling location did not exceed any guidelines and thus not included in the exceedance table.

Comparison of the current surface water results at CISW2, CISW3 and CISW4 against recent data indicates all parameters were consistent, and were within ranges reported historically with the exception of:

- Nitrate increased above historical data at CISW2 (0.02mg/L) and CISW4 (0.07mg/L) and represent new maximums at these locations. It should be noted that only three previous monitoring results exist for CISW2 and four data points exist for CISW4;
- pH increased above historical data for CISW3 (5.44 pH units) and CISW4 (6.41 pH units) and represent new maximums at these locations. It should be noted that only three data points from monitoring events undertaken to date exist for this parameter at both sites. The adopted WQOs for pH were again exceeded at each location; and

- Potassium increased above historical data CISW4 (2mg/L) and represents a new maximum at this location. It should be noted that only three data points from monitoring events undertaken to date exist for this parameter at this site.

### 6.2.3 Downstream Surface Water Sampling Results

WQO exceedances for downstream surface sites CISW1 and CISW5 are summarised in **Table 11** below.

**Table 11. Exceedances of WQOs Downstream Surface Water Sites**

| Parameter | Units | EVs | WQOs | Current Result | |
|---|---|---|---|---|---|
| | | | | CISW1 | CISW5 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 6.45 | 6.14 |
| | | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5 – 8 | | |
| DO | %Sat | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 85-110 | 50.3 | 47.6 |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 92.6 | N/A |
| Nitrogen (total) | mg/L | Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.5 | 0.6 | N/A |
| Chromium (III+VI) | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.00001 | 0.002 | 0.003 |
| | | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.001 | | |
| Iron | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | 0.69 | 0.74 |
| Zinc | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.0024 | 0.008 | 0.007 |

#### 6.2.3.1 Surface Water Sites – CISW1 and CISW5

An assessment of the above results for surface water sites CISW1 and CISW5 reveal the following:

- Aluminium (1.83mg/L CISW5 and 1.85mg/L CISW1) is higher than background locations and in the case of CISW5, has increased above flat-line historical results from the previous five sample events but remains within historical results. The concentration at CISW1 also remains within historical levels;

- Chromium (III+VI) (0.003mg/L CISW5) increased above historical results and represents a new maximum concentration at this location; and
- DO (50.3% CISW1 and 47.6% CISW5) increased above historical levels, representing new maximum concentrations at both sites. The increases are likely associated with heavy rainfall and water flow at the time of sampling. These results still fall short of the adopted WQO criteria.

### 6.2.4 Summary of potential landfill impact on surface water

Ammonia (a key leachate indicator) was not detected during the current sampling event at any surface water locations. Another leachate indicator, Iron, was detected at very low levels across all locations; with concentrations at the lowest recorded of all historical data. Most parameters have decreased since previous monitoring events, indicative of heavy rainfall and stormwater flowing through these locations and diluting metals and inorganics that might otherwise become concentrated under low flow/stagnant conditions.

Contrary to previous reports (GHD, 2019b), there appears no impact of acid sulphate soils in the current monitoring results, due to the heavy rainfall and conditions onsite at the time of monitoring.

# 7.0 CONCLUSIONS

## 7.1 GROUNDWATER

All groundwater monitoring wells were sampled in February 2020, and results have been assessed for their potential for landfill leachate to impact groundwater by comparing results with the WQOs (as per the EVs in the *EPP (Water) 2009*), statistical assessment of the dataset and by comparing the (inferred) up gradient and down gradient groundwater quality results. Statistically significant results (where available) were not reported for any parameters at any of the groundwater monitoring locations.

Adopted WQOs were exceeded at both up and down gradient locations for pH, EC, Nitrate, Aluminium, Iron and Zinc. Ammonia and Chromium (III+VI) were the only parameters that exceeded the adopted WQOs only at down-gradient wells. These parameters will require continued monitoring in future events to determine if further investigations are required.

New maximums were reported for several parameters at the following wells:

- GW1 for Aluminium and pH;
- GW2 for Aluminium, Chromium (III+VI), Nitrate, Potassium and TOC; and
- GW3 for pH.

Ammonia (a key leachate indictor) continues to fluctuate across most groundwater wells; however remains within historical data and low concentrations. The adopted WQO of 0.02mg/L was only exceeded at GW1 during the current event (0.03mg/L) and no groundwater location results are indicative of landfill leachate impacts. Iron concentrations remained low at all upgradient and downgradient groundwater wells. The variable historical results at GW2 also returned to very low levels (0.16mg/L), exceeding the adopted WQO of 0.05mg/L. In light of the above assessment, results from the February 2020 monitoring event indicate a continued low risk of the landfill to identified receptors.

## 7.2 SURFACE WATER

All surface water locations were sampled in February 2020, and results have been assessed for their potential for landfill leachate by comparing results with the WQOs (as per the EVs in the *EPP (Water) 2009*) and by comparing the upstream and downstream surface water quality results.

Ammonia, a key leachate indicator, was not detected during the current sampling event at any surface water locations. Another leachate indicator, Iron, was detected at very low levels across all locations; with concentrations at the lowest recorded of all historical data. Most parameters have decreased since previous monitoring events, indicative of heavy rainfall and stormwater flowing through these locations and diluting metals and inorganics that might otherwise become concentrated under low flow/stagnant conditions.

Most parameters have been reported below the adopted WQO and/or background concentrations, and results generally very similar between background and downstream locations. Based on the current monitoring results, the landfill is considered to pose a low risk to downstream and downgradient receivers. Exceedances identified in surface water monitoring results will be monitored in the next quarterly monitoring report to determine if there are ongoing trends and if further investigations are warranted.

Unlike as was previously reported (GHD, 2019b), there appears no impact of acid sulphate soils to the current monitoring results, likely due to the heavy rainfall and conditions onsite at the time of monitoring.

## 8.0 RECOMMENDATIONS

Further surface water and groundwater monitoring is recommended to enable full trend analysis at some locations, and to support characterisation of potential risks over differing climatic and seasonal conditions.

## 9.0 REFERENCES

DES (2018) *Monitoring and Sampling Manual - Environmental Protection (Water) Policy 2009 (Version 2.* Brisbane: Department of Environment and Science, QLD Government), July 2018

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GHD (2019a). *Redland City Council LEMP Environmental Values and Water Quality Objectives*. Report Number: 41/27018. December 2019

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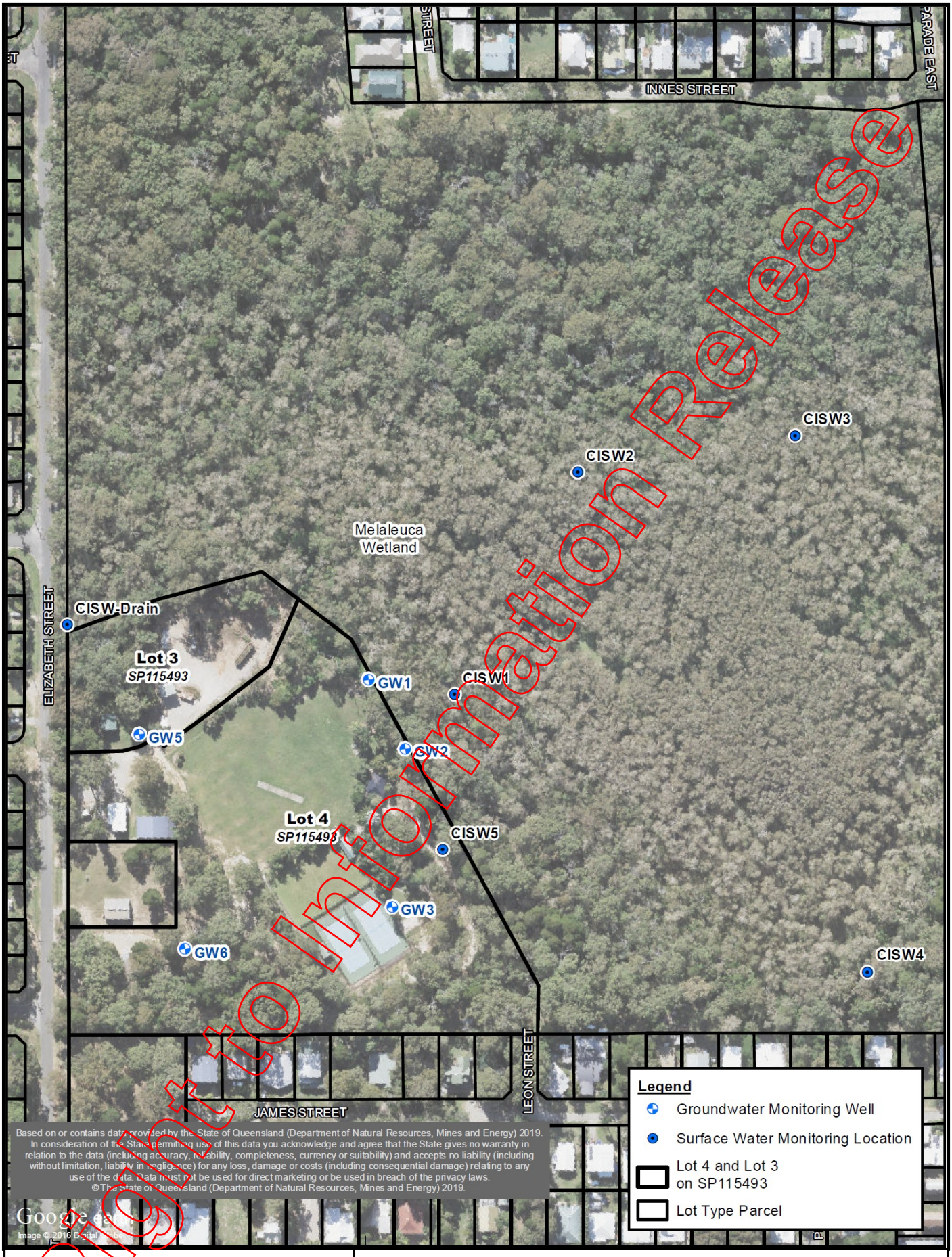
*ISO 5667-11 1993 and AS/NZ 5667.11:1998 Water Quality Sampling Guidance on Sampling of Groundwater* Standards of Australia/Standards of New Zealand Council, July 1998

Kemplay, P. (2015). *Birkdale Landfill Remediation* [Online]. Available at: https://news.redland.qld.gov.au/birkdale-landfill-remediation/ [Accessed 20 March 2020].

NSW EPA (2016) *Environmental Guidelines: Solid Waste Landfills, Second Edition 2016*, April 2016;

**Appendix A.**

**Monitoring Locations Plan**



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# GROUNDWATER & SURFACE WATER MONITORING LOCATIONS

PROJECT: COOCHIEMUDLO ISLAND FORMER LANDFILL

CLIENT: REDLAND CITY COUNCIL

FPE REF: 5329-200331-0.1

1:2,500 (at A4)

0 15 30 45 60 75 90

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

IMAGERY SOURCED FROM REDLAND CITY COUNCIL

**Appendix B.**

**Results Summary**

| | | | | Field | | Inorganics | | | | | Metals | | | | | | | | | | Inorganic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH (Field) | EC (field) | Ammonia as N | Chloride | Nitrate (as N) | Sodium (filtered) | TOC | Aluminium (filtered) | Calcium (filtered) | Chromium (hexavalent) (filtered) | Chromium (III+VI) (filtered) | Iron (filtered) | Lead (filtered) | Magnesium (filtered) | Nickel (filtered) | Potassium (filtered) | Zinc (filtered) | Sulfate as SO4 - Turbidimetric (filtered) |
| | | | | - | uS/cm | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | | 0.01 | 1 | 0.01 | 1 | 1 | 0.01 | 1 | 0.01 | 0.001 | 0.05 | 0.001 | 1 | 0.001 | 1 | 0.005 | 1 |
| *ANZECC 2000 Fresh water Slightly-moderate disturbed system* | | | | | | *0.9* | | *0.158* | | | *0.055* | | *0.001* | *0.001* | | *0.0034* | | *0.011* | | *0.008* | |
| GHD 2018 Coochiemudlo Island wetland | | | | 3.53-4.61 | 90 | | | | | | | | | | | | | | | | |
| Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | | | | 6.5-8 | 626 | 0.02 | | | | | | | | | | | | | | | |
| Schedule 1 EPP (water) - Drinking Water | | | | | 1,000 | | | | | | | | | | 0.05 | | | | | | |
| **Site ID** | **Monitoring Zone** | **Location Code** | **Date** | | | | | | | | | | | | | | | | | | |
| **Coochiemudlo Island** | **DG** | **GW1** | **12/02/2020** | 6.23 | 521 | 0.03 | 21 | *0.85* | 21 | 5 | *0.12* | 60 | <0.01 | <0.001 | <0.05 | <0.001 | 18 | <0.001 | 12 | <0.005 | 133 |
| **Coochiemudlo Island** | **DG** | **GW2** | **12/02/2020** | 6.53 | 516 | 0.02 | 77 | *0.93* | 45 | 10 | *0.30* | 29 | <0.01 | *0.002* | 0.16 | <0.001 | 12 | <0.001 | 20 | *0.036* | 38 |
| **Coochiemudlo Island** | **DG** | **GW3** | **12/02/2020** | 5.90 | 30.6 | <0.01 | 3 | 0.04 | 4 | 5 | *0.37* | <1 | <0.01 | 0.001 | 0.13 | <0.001 | <1 | <0.001 | <1 | <0.005 | 2 |
| **Coochiemudlo Island** | **UG** | **GW5** | **12/02/2020** | 4.02 | 287 | <0.01 | 61 | *1.95* | 48 | <1 | 0.02 | <1 | <0.01 | <0.001 | <0.05 | <0.001 | 4 | <0.001 | <1 | <0.005 | 19 |
| **Coochiemudlo Island** | **UG** | **GW6** | **12/02/2020** | 3.64 | 2,360 | 0.02 | 825 | <0.01 | 373 | <1 | *7.60* | 3 | <0.01 | 0.001 | 0.11 | <0.001 | 69 | 0.003 | 2 | *0.022* | 18 |
| **Statistics** | | | | | | | | | | | | | | | | | | | | | |
| **Number of Results** | | | | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** |
| **Number of Detects** | | | | **5** | **5** | **3** | **5** | **4** | **5** | **3** | **5** | **3** | **0** | **3** | **3** | **0** | **4** | **1** | **3** | **2** | **5** |
| **Minimum Concentration** | | | | **3.64** | **30.6** | **<0.01** | **3** | **<0.01** | **4** | **<1** | **0.02** | **<1** | **<0.01** | **0.001** | **<0.05** | **<0.001** | **<1** | **<0.001** | **<1** | **<0.005** | **2** |
| **Minimum Detect** | | | | **3.64** | **30.6** | **0.02** | **3** | **0.04** | **4** | **5** | **0.02** | **3** | **ND** | **0.001** | **0.11** | **ND** | **4** | **0.003** | **2** | **0.022** | **2** |
| **Maximum Concentration** | | | | **6.53** | **2,360** | **0.03** | **825** | **1.95** | **373** | **10** | **7.6** | **60** | **<0.01** | **0.002** | **0.16** | **<0.001** | **69** | **0.003** | **20** | **0.036** | **133** |
| **Maximum Detect** | | | | **6.53** | **2,360** | **0.03** | **825** | **1.95** | **373** | **10** | **7.6** | **60** | **ND** | **0.002** | **0.16** | **ND** | **69** | **0.003** | **20** | **0.036** | **133** |
| **Average Concentration *** | | | | **5.4** | **743** | **0.016** | **197** | **0.76** | **98** | **4.2** | **1.7** | **19** | **0.005** | **0.001** | **0.09** | **0.0005** | **21** | **0.001** | **7** | **0.013** | **42** |
| **Median Concentration *** | | | | **5.9** | **516** | **0.02** | **61** | **0.85** | **45** | **5** | **0.3** | **3** | **0.005** | **0.001** | **0.11** | **0.0005** | **12** | **0.0005** | **2** | **0.0025** | **19** |
| **Standard Deviation *** | | | | **1.2** | **926** | **0.011** | **352** | **0.8** | **155** | **3.9** | **3.3** | **26** | **0** | **0.00061** | **0.062** | **0** | **28** | **0.0011** | **8.7** | **0.015** | **52** |
| **95% UCL (Student's-t) *** | | | | **6.557** | **1,626** | **0.0263** | **533.1** | **1.515** | **245.7** | **7.963** | **4.839** | **43.46** | **0.005** | **0.00158** | **0.149** | **0.0005** | **47.25** | **0.00207** | **15.3** | **0.0277** | **92** |

* A Non Detect Multiplier of 0.5 has been applied.

| | | | | Field | | | | Inorganics | | | | | | | | | Metals | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH (Field) | EC (field) | Dissolved Oxygen | DO % Saturation (Field) | Ammonia as N | BOD | Chloride | COD | Nitrate (as N) | Nitrogen (Total) | Sodium (filtered) | TOC | TSS | Calcium (filtered) | Chromium (III+VI) (filtered) | Iron (filtered) | Lead (filtered) | Nickel (filtered) |
| | | | | - | uS/cm | mg/L | %Sat | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | | | | 0.01 | 2 | 1 | 10 | 0.01 | 0.1 | 1 | 1 | 5 | 1 | 0.001 | 0.05 | 0.001 | 0.001 |
| *ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only* | | | | | | | | *0.32* | | | | *4.9* | | | | | | *0.00001* | | *0.001* | *0.008* |
| *ANZECC 2000 Fresh water Slightly-moderate disturbed system* | | | | | | | | *0.9* | | | | *0.158* | | | | | | *0.001* | | *0.0034* | *0.011* |
| GHD 2018 Coochiemudlo Island wetland | | | | 3.53-4.61 | 90 | | | | | | | | | | | | | | | | |
| Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | | | | 6.5-8 | 626 | | 85-110 | 0.02 | | | | | 0.5 | | | | | | | | |
| Schedule 1 EPP (water) - Drinking Water | | | | | 1,000 | | | | | | | | | | | | | | 0.05 | | |
| **Site ID** | **Monitoring Zone** | **Location Code** | **Date** | | | | | | | | | | | | | | | | | | |
| **Coochiemudlo Island** | **DS** | **CISW1** | **12/02/2020** | 6.45 | 92.6 | 3.65 | 50.3 | <0.01 | <2 | 10 | 36 | 0.01 | 0.6 | 8 | 13 | 14 | 4 | *0.002* | 0.69 | <0.001 | <0.001 |
| **Coochiemudlo Island** | **BG** | **CISW2** | **12/02/2020** | 5.8 | 83.8 | 3.55 | 40 | <0.01 | 4 | 11 | 94 | 0.02 | 1.2 | 10 | 39 | 6 | 2 | *0.002* | 0.37 | <0.001 | <0.001 |
| **Coochiemudlo Island** | **BG** | **CISW3** | **12/02/2020** | 5.44 | 117.2 | 5.06 | 78.3 | <0.01 | 3 | 22 | 70 | <0.01 | 0.8 | 14 | 31 | <5 | 2 | *0.002* | 0.31 | <0.001 | <0.001 |
| **Coochiemudlo Island** | **BG** | **CISW4** | **12/02/2020** | 6.41 | 103.1 | 4.4 | 48.9 | 0.01 | 2 | 14 | 29 | 0.07 | 0.6 | 11 | 12 | 9 | 5 | *0.002* | 0.27 | <0.001 | <0.001 |
| **Coochiemudlo Island** | **DS** | **CISW5** | **12/02/2020** | 6.14 | 65.5 | 4.13 | 47.6 | <0.01 | 2 | 10 | 54 | <0.01 | 0.5 | 7 | 11 | 34 | 2 | *0.003* | 0.74 | <0.001 | <0.001 |
| **Statistics** | | | | | | | | | | | | | | | | | | | | | |
| **Number of Results** | | | | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** |
| **Number of Detects** | | | | **5** | **5** | **5** | **5** | **1** | **4** | **5** | **5** | **3** | **5** | **5** | **5** | **4** | **5** | **5** | **5** | **0** | **0** |
| **Minimum Concentration** | | | | **5.44** | **65.5** | **3.55** | **40** | **0.01** | **2** | **10** | **29** | **0.01** | **0.5** | **7** | **11** | **<5** | **2** | **0.002** | **0.27** | **<0.001** | **<0.001** |
| **Minimum Detect** | | | | **5.44** | **65.5** | **3.55** | **40** | **0.01** | **2** | **10** | **29** | **0.01** | **0.5** | **7** | **11** | **6** | **2** | **0.002** | **0.27** | **ND** | **ND** |
| **Maximum Concentration** | | | | **6.45** | **117.2** | **5.06** | **78.3** | **0.01** | **4** | **22** | **94** | **0.07** | **1.2** | **14** | **39** | **34** | **5** | **0.003** | **0.74** | **<0.001** | **<0.001** |
| **Maximum Detect** | | | | **6.45** | **117.2** | **5.06** | **78.3** | **0.01** | **4** | **22** | **94** | **0.07** | **1.2** | **14** | **39** | **34** | **5** | **0.003** | **0.74** | **ND** | **ND** |
| **Average Concentration *** | | | | **6** | **92** | **4.2** | **53** | **0.006** | **2.4** | **13** | **57** | **0.022** | **0.74** | **10** | **21** | **13** | **3** | **0.0022** | **0.48** | **0.0005** | **0.0005** |
| **Median Concentration *** | | | | **6.14** | **92.6** | **4.13** | **48.9** | **0.005** | **2** | **11** | **54** | **0.01** | **0.6** | **10** | **13** | **9** | **2** | **0.002** | **0.37** | **0.0005** | **0.0005** |
| **Standard Deviation *** | | | | **0.43** | **20** | **0.61** | **15** | **0.0022** | **1.1** | **5.1** | **26** | **0.028** | **0.28** | **2.7** | **13** | **12** | **1.4** | **0.00045** | **0.22** | **0** | **0** |
| **95% UCL (Student's-t) *** | | | | **6.456** | **111.1** | **4.742** | **67.02** | **0.00813** | **3.487** | **18.24** | **81.69** | **0.0482** | **1.006** | **12.61** | **33.53** | **24.94** | **4.348** | **0.00263** | **0.687** | **0.0005** | **0.0005** |

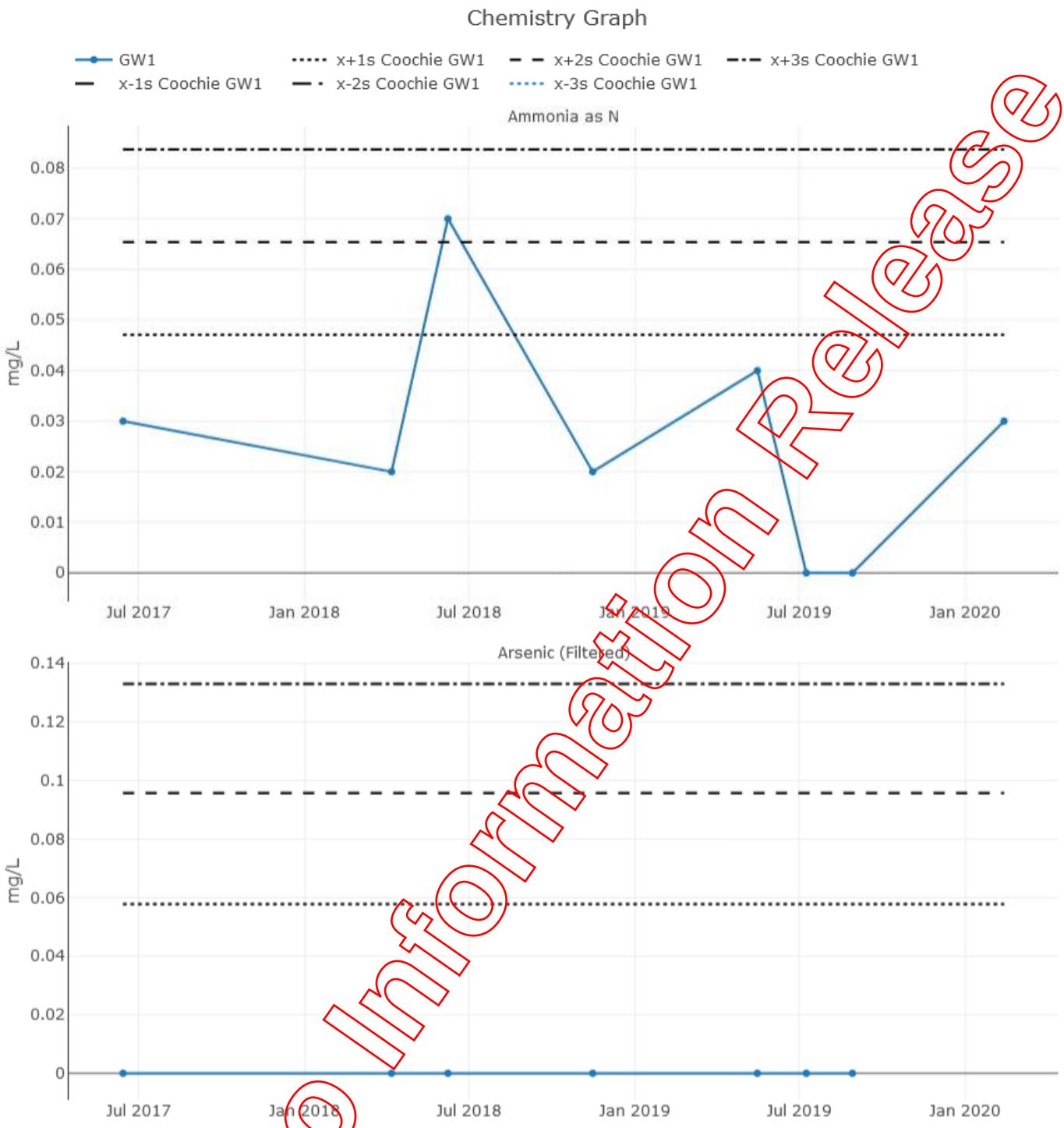
* A Non Detect Multiplier of 0.5 has been applied.

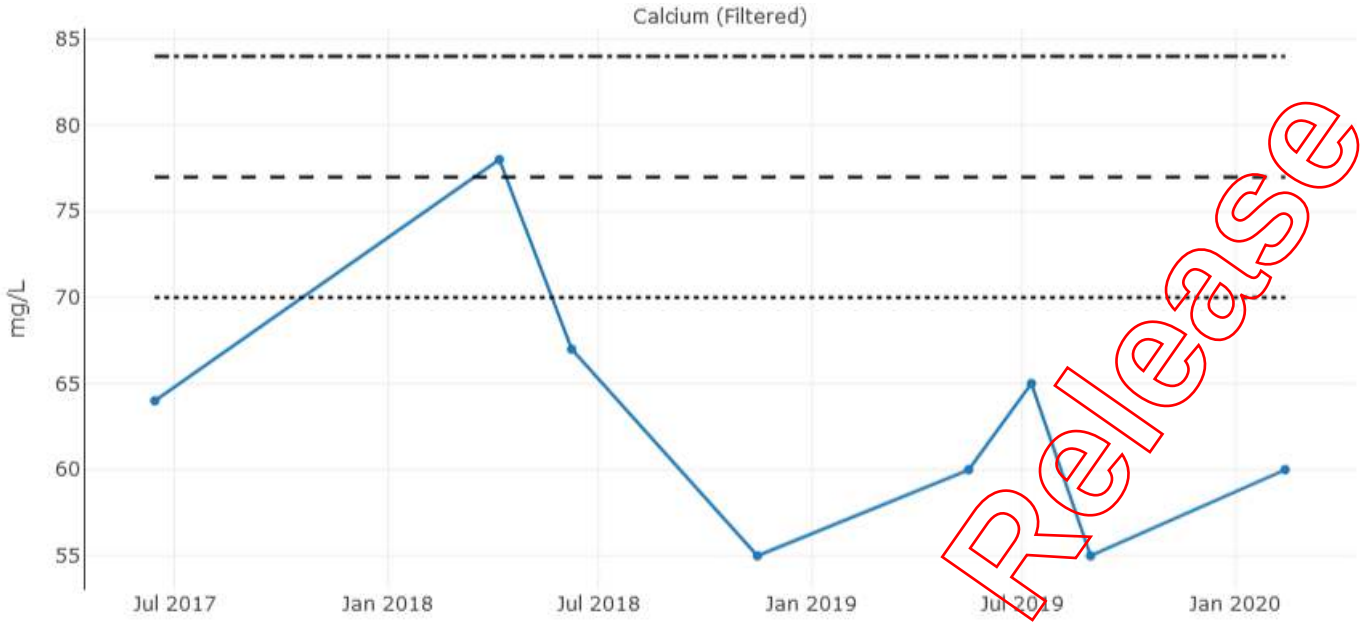
| | | | | | Inorganic |
|---|---|---|---|---|---|
| | | | | Zinc (filtered) | Sulfate as SO4 - Turbidimetric (filtered) |
| | | | | mg/L | mg/L |
| EQL | | | | 0.005 | 1 |
| *ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only* | | | | *0.0024* | |
| *ANZECC 2000 Fresh water Slightly-moderate disturbed system* | | | | *0.008* | |
| **GHD 2018 Coochiemudlo Island wetland** | | | | | |
| Morton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | | | | | |
| Schedule 1 EPP (water) - Drinking Water | | | | | |
| **Site ID** | **Monitoring Zone** | **Location Code** | **Date** | | |
| **Coochiemudlo Island** | **DS** | **CISW1** | **12/02/2020** | *0.008* | <1 |
| **Coochiemudlo Island** | **BG** | **CISW2** | **12/02/2020** | *0.007* | <1 |
| **Coochiemudlo Island** | **BG** | **CISW3** | **12/02/2020** | <0.005 | 6 |
| **Coochiemudlo Island** | **BG** | **CISW4** | **12/02/2020** | *0.022* | 5 |
| **Coochiemudlo Island** | **DS** | **CISW5** | **12/02/2020** | *0.007* | <1 |
| **Statistics** | | | | | |
| **Number of Results** | | | | **5** | **5** |
| **Number of Detects** | | | | **4** | **2** |
| **Minimum Concentration** | | | | **<0.005** | **<1** |
| **Minimum Detect** | | | | **0.007** | **5** |
| **Maximum Concentration** | | | | **0.022** | **6** |
| **Maximum Detect** | | | | **0.022** | **6** |
| **Average Concentration *** | | | | **0.0093** | **2.5** |
| **Median Concentration *** | | | | **0.007** | **0.5** |
| **Standard Deviation *** | | | | **0.0074** | **2.8** |
| **95% UCL (Student's-t) *** | | | | **0.0164** | **5.133** |

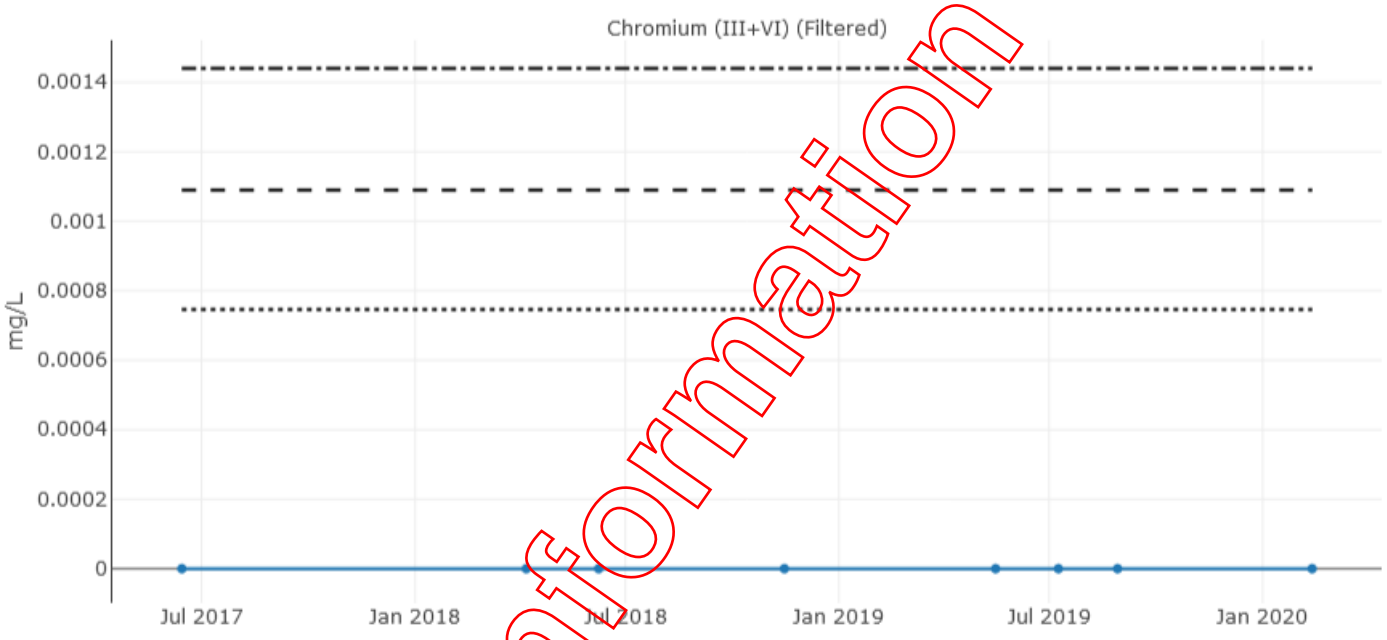
* A Non Detect Multiplier of 0.5 has been applied.

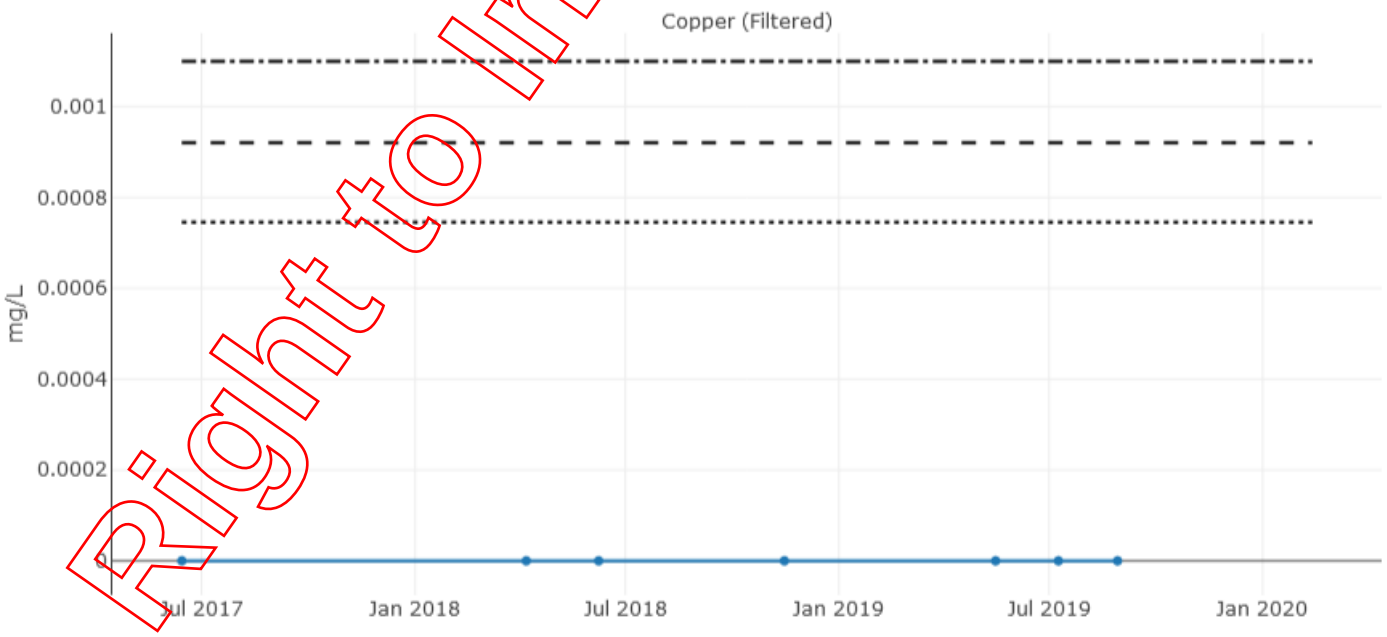
**Appendix C.**

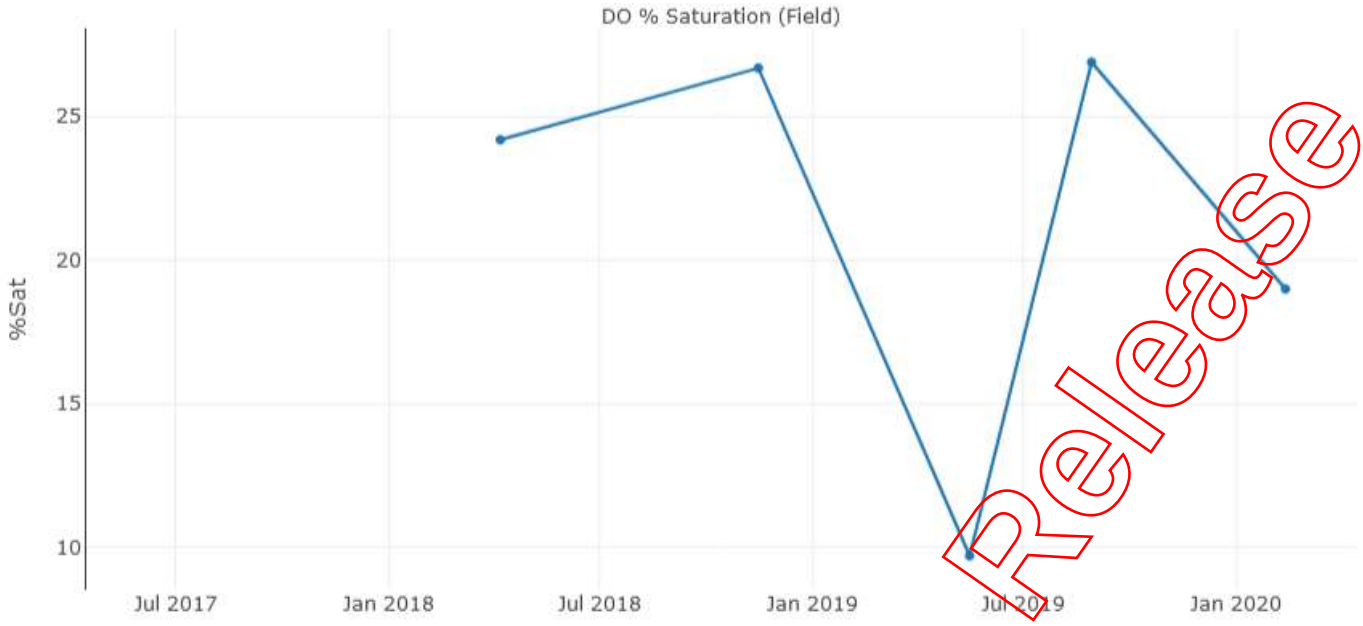
**Groundwater Statistical Charts**

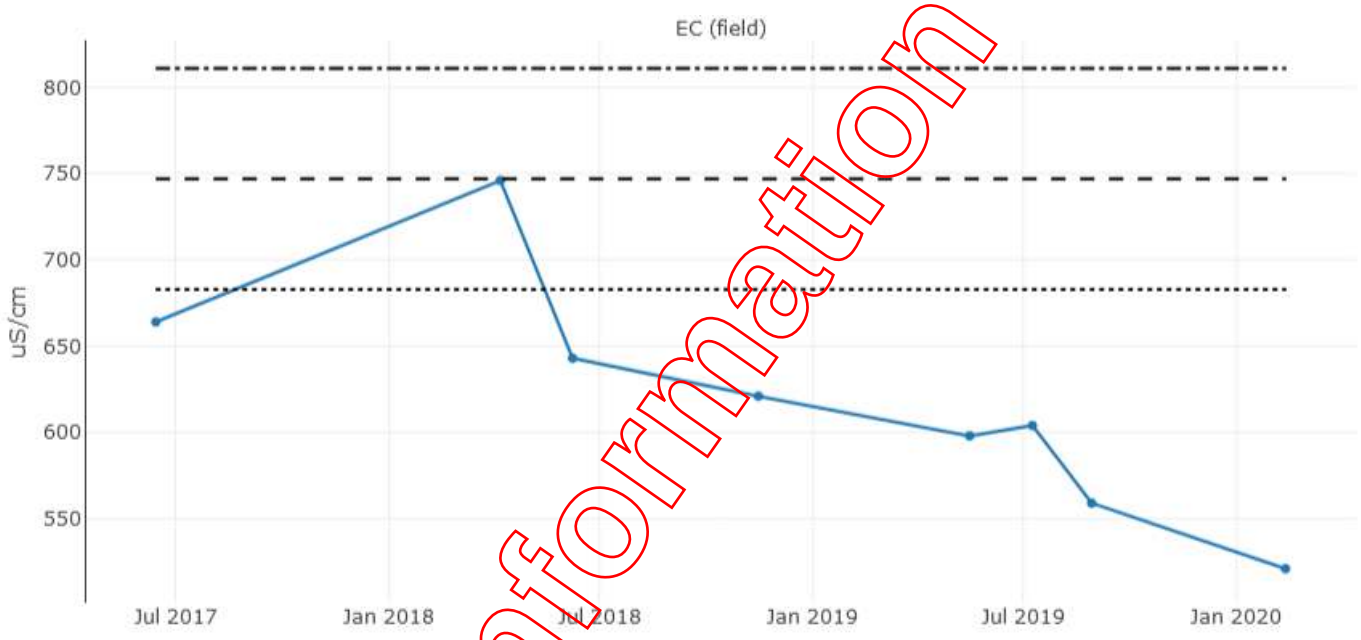


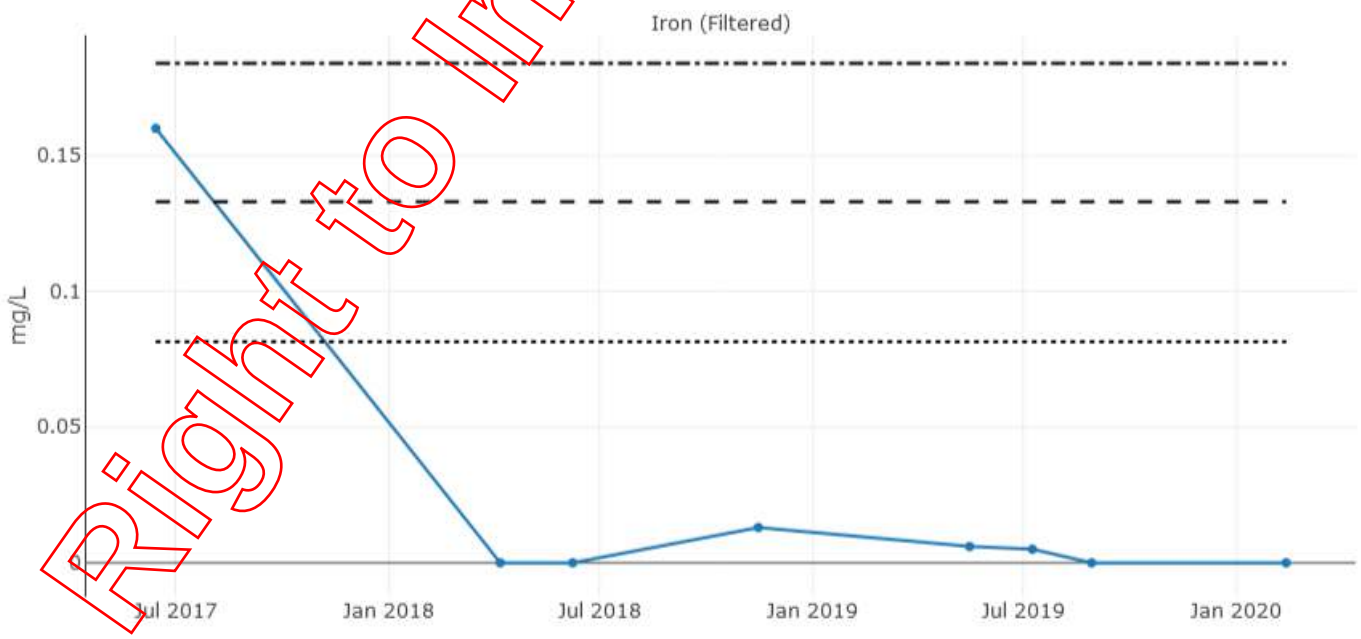


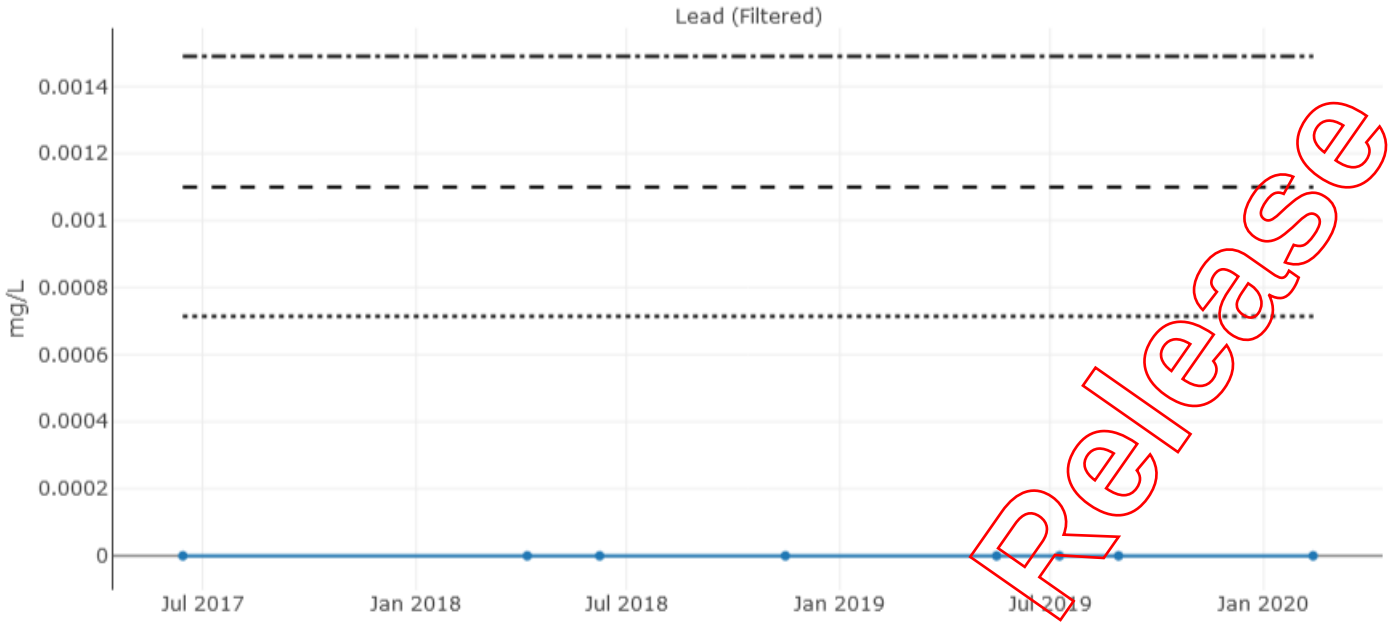



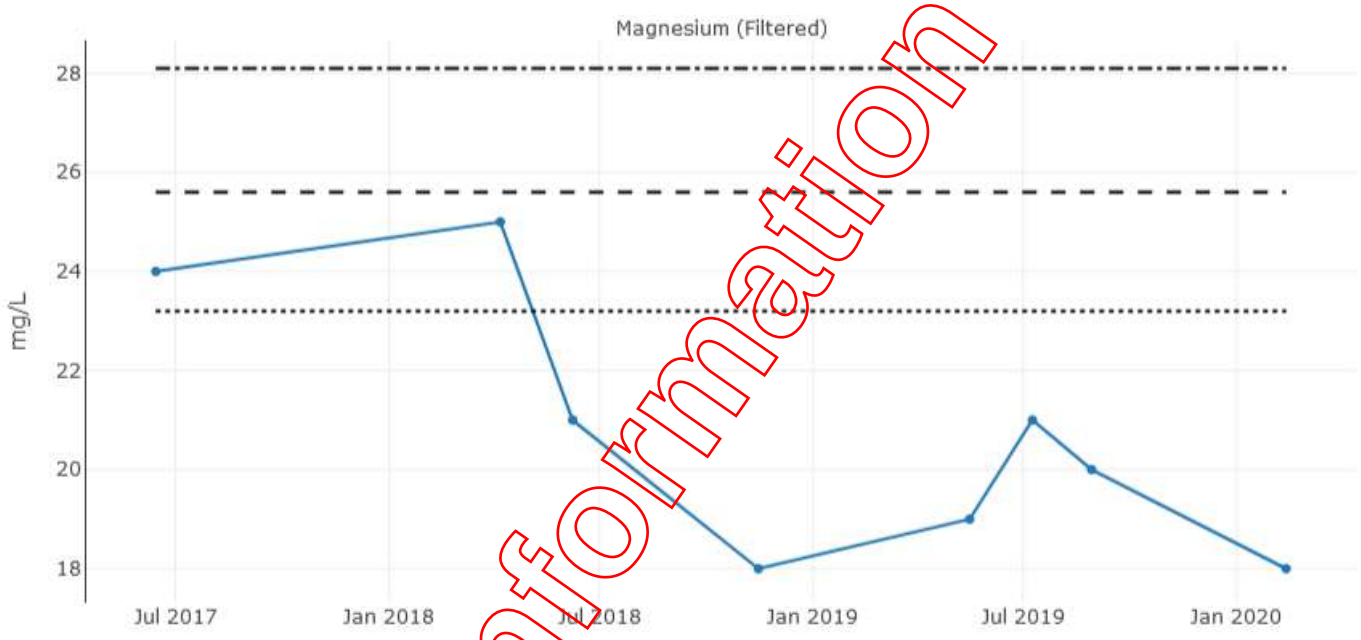



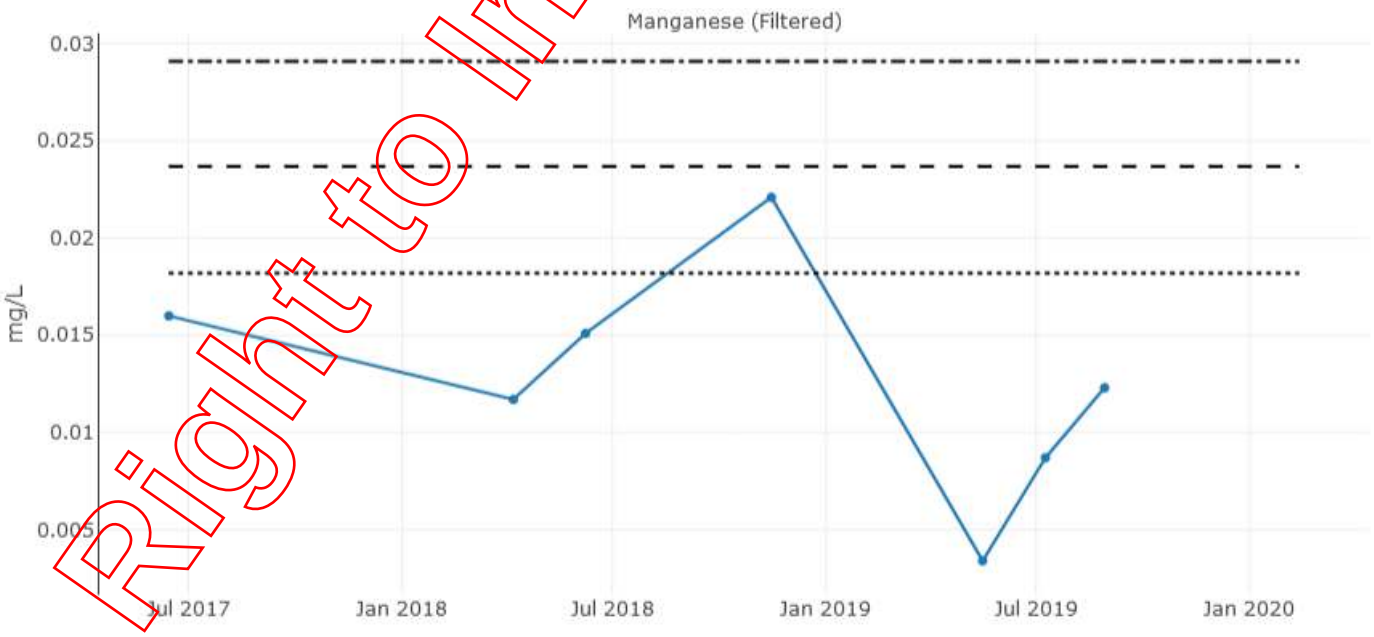


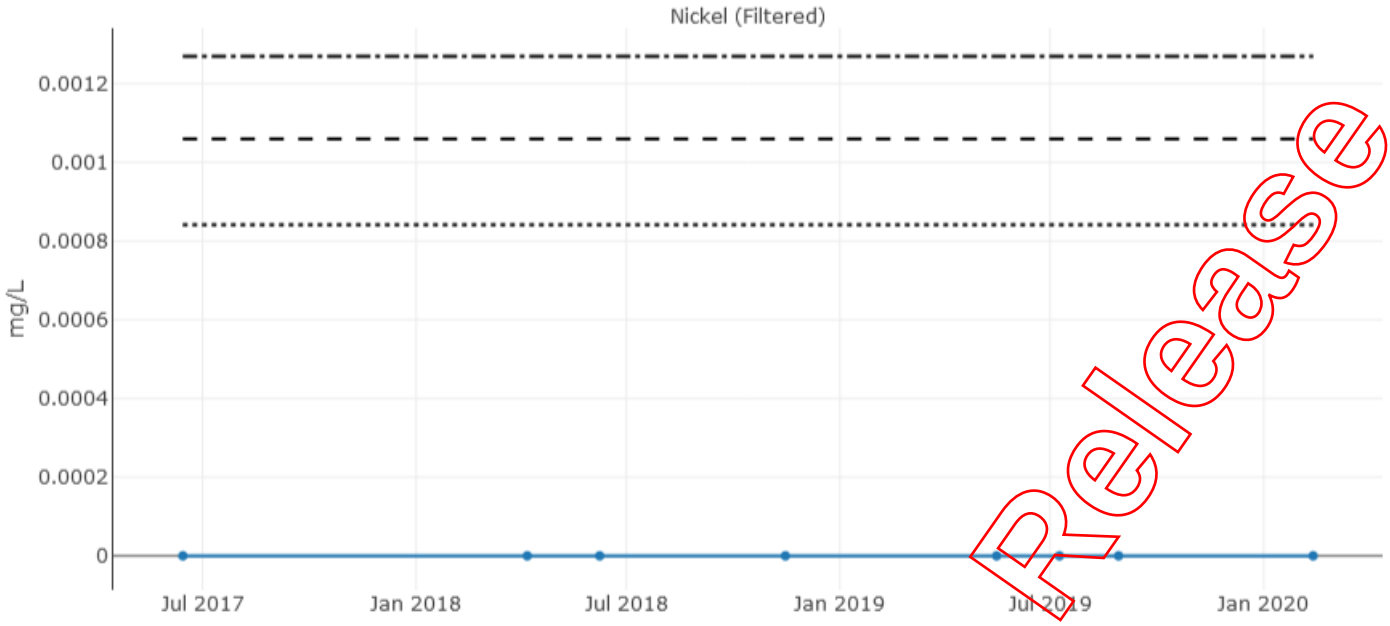



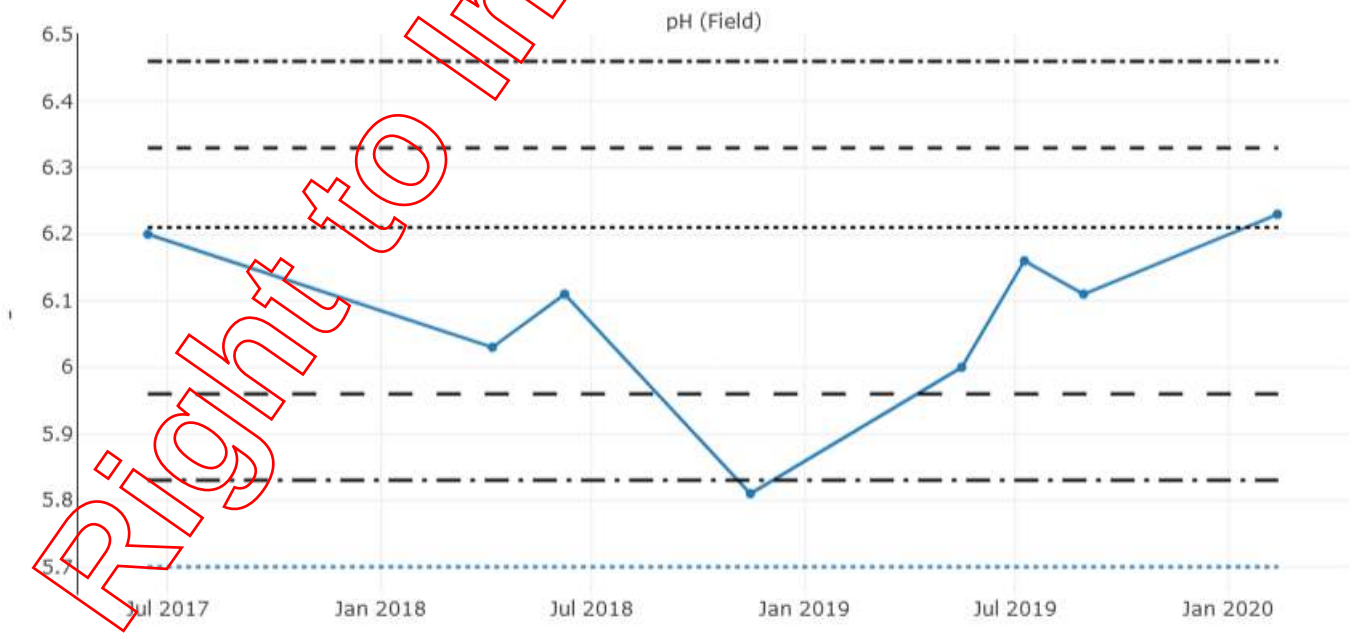


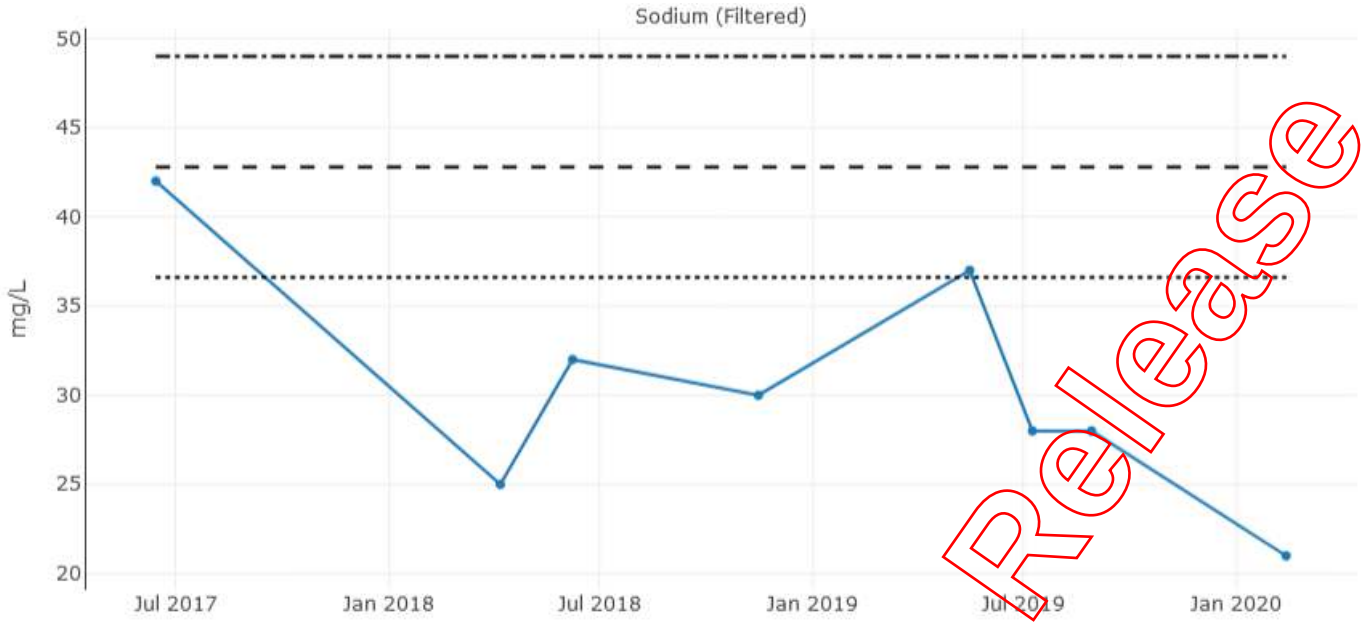













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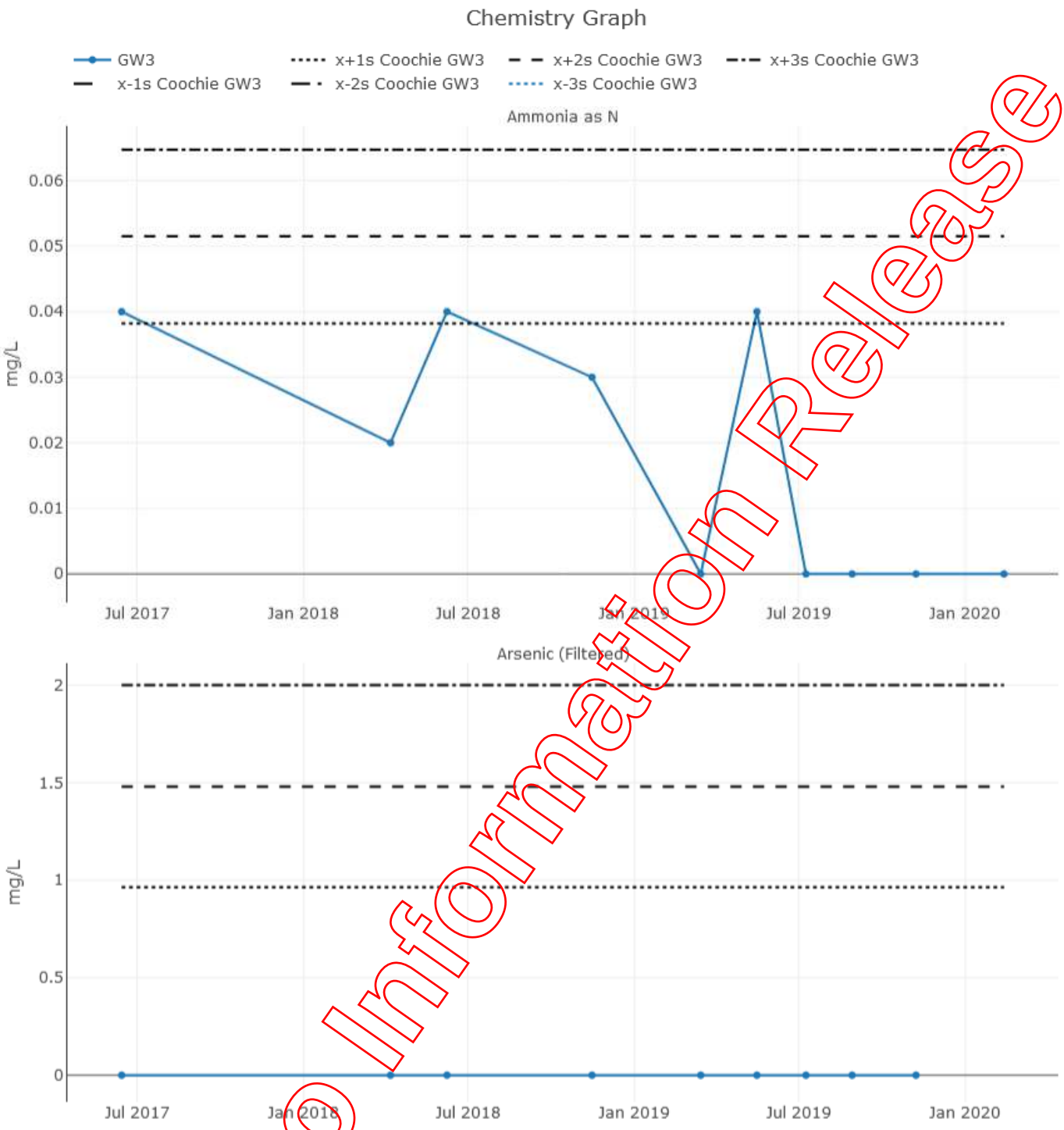
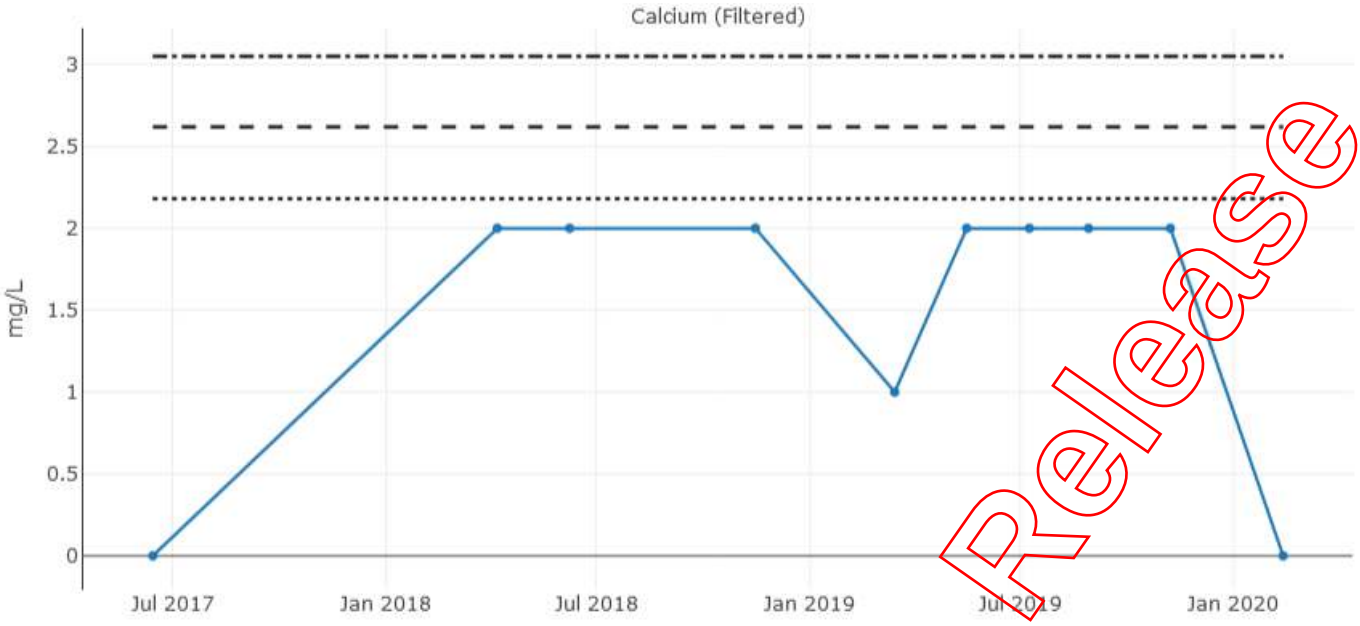
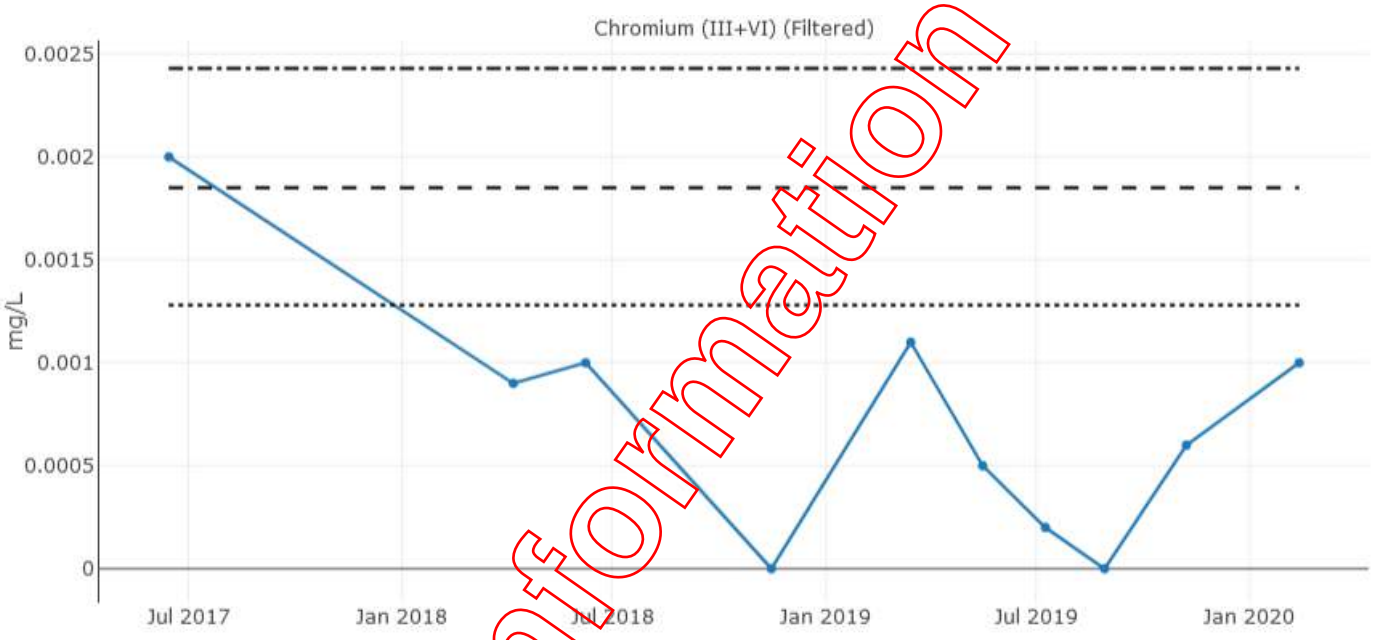
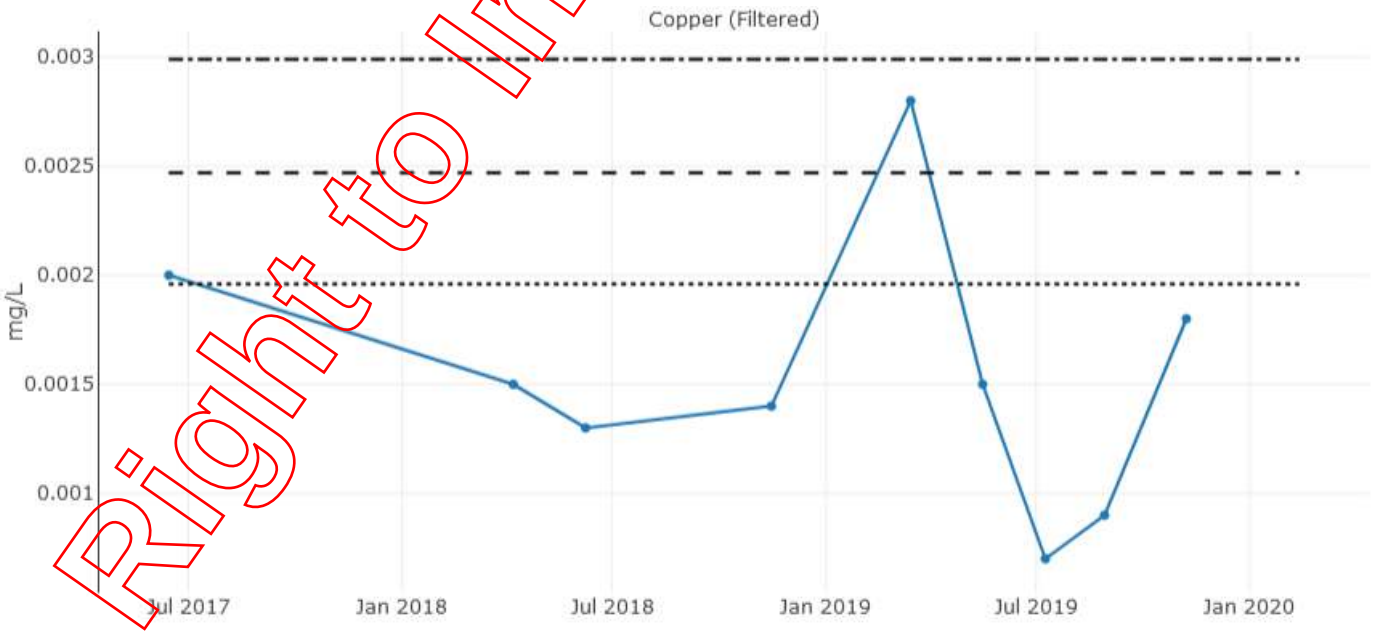
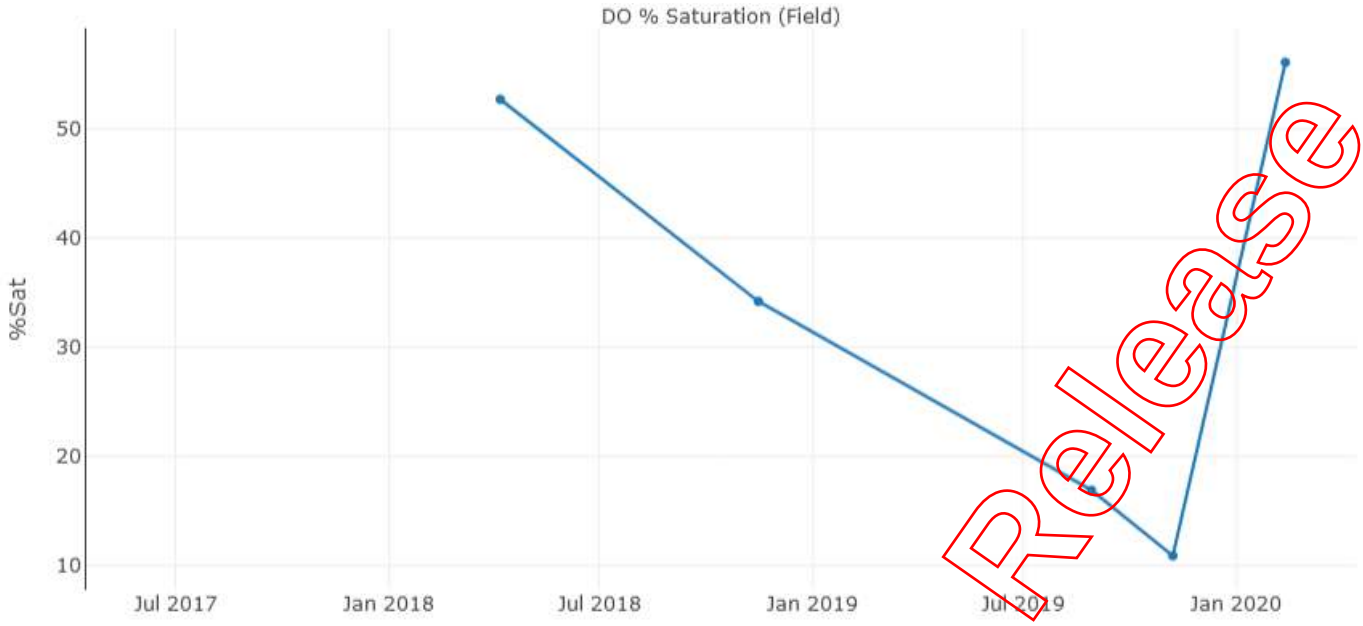
Publication Date: 06 Apr 2020

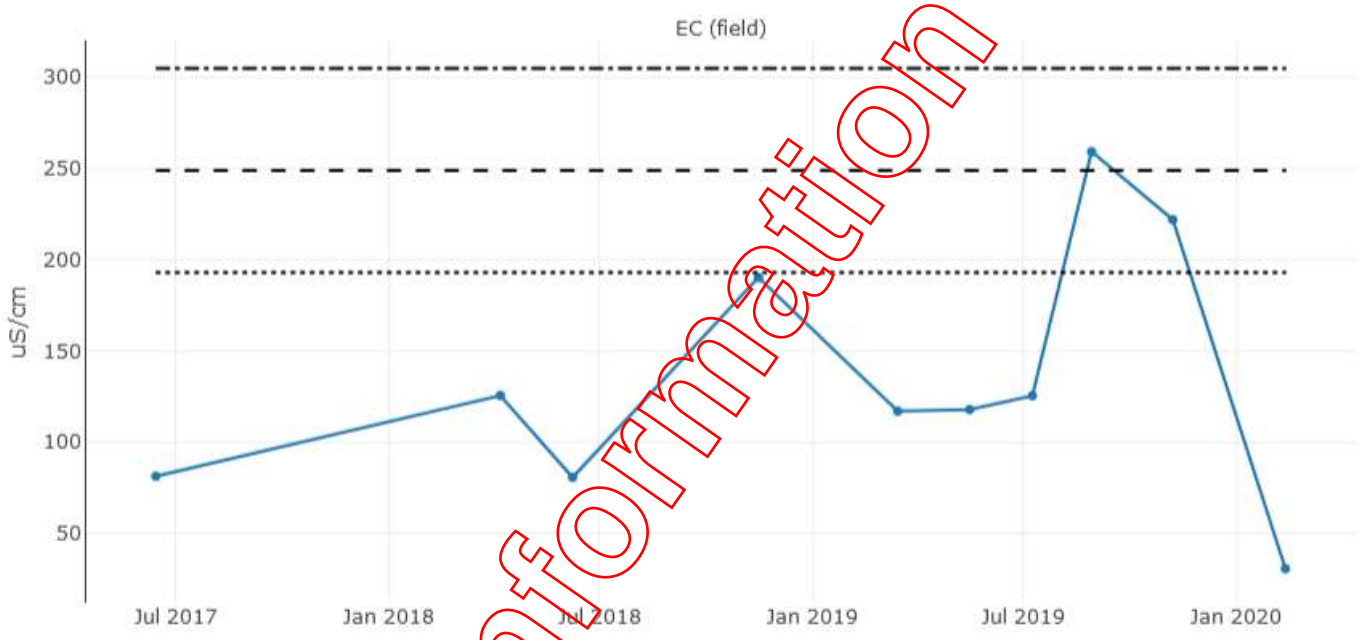


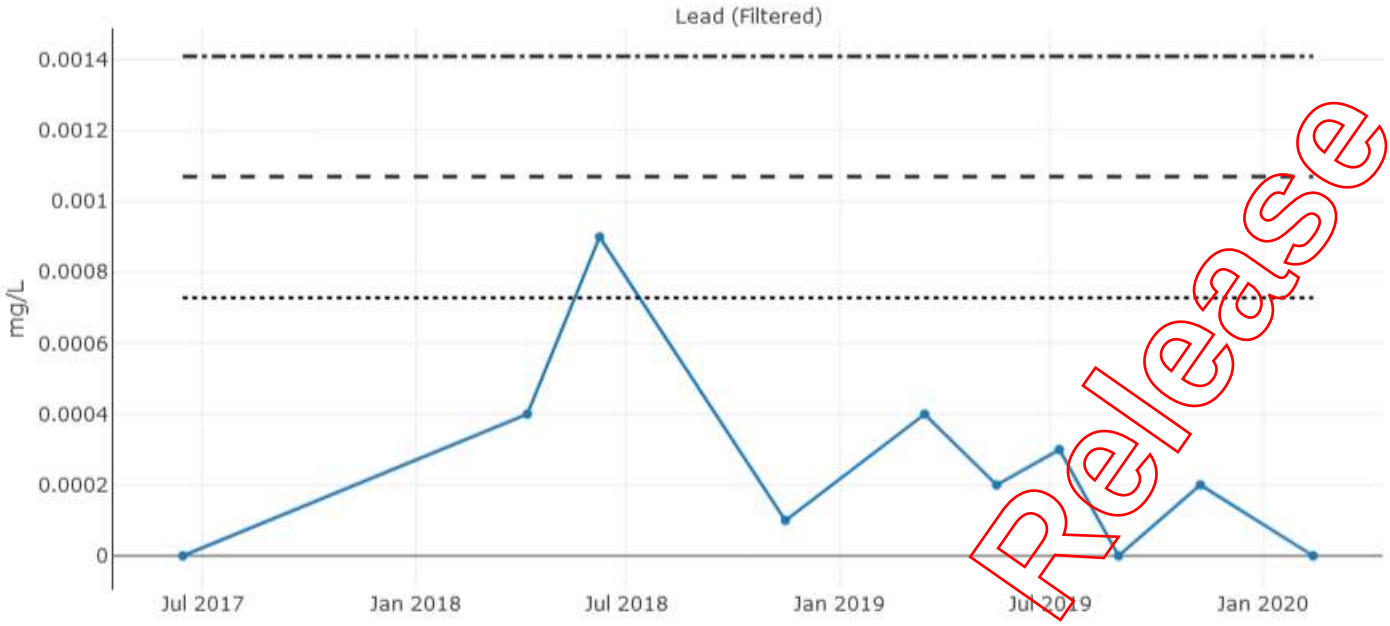


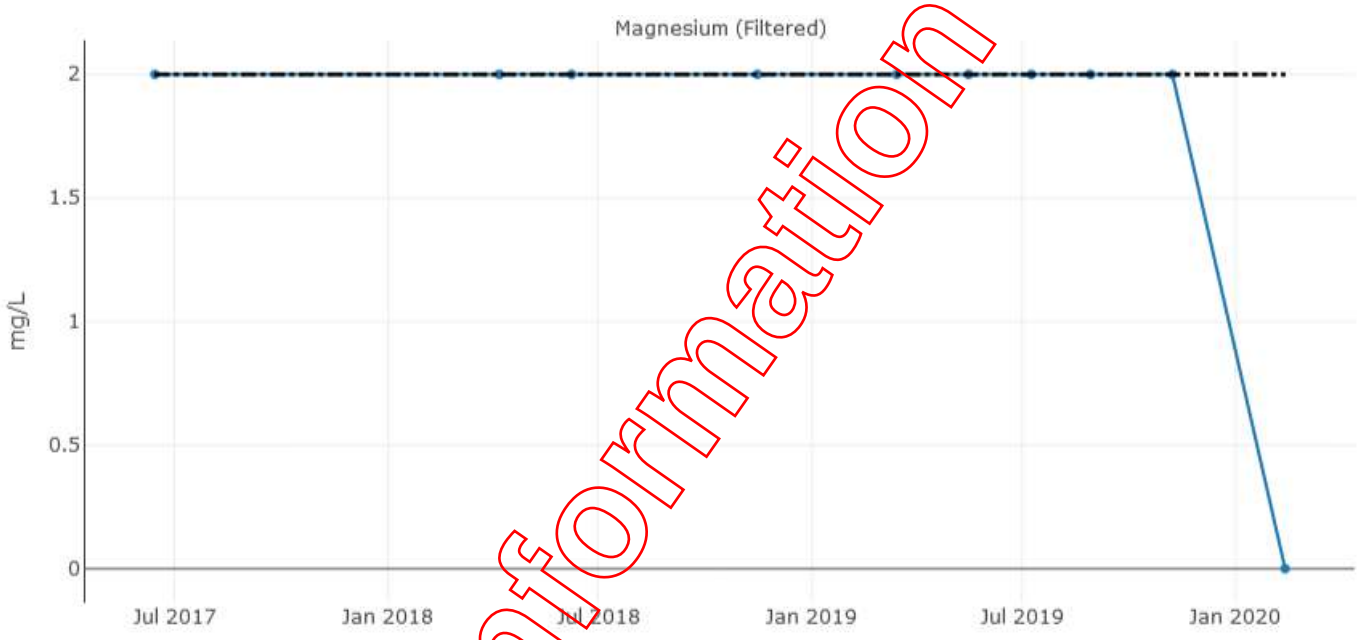



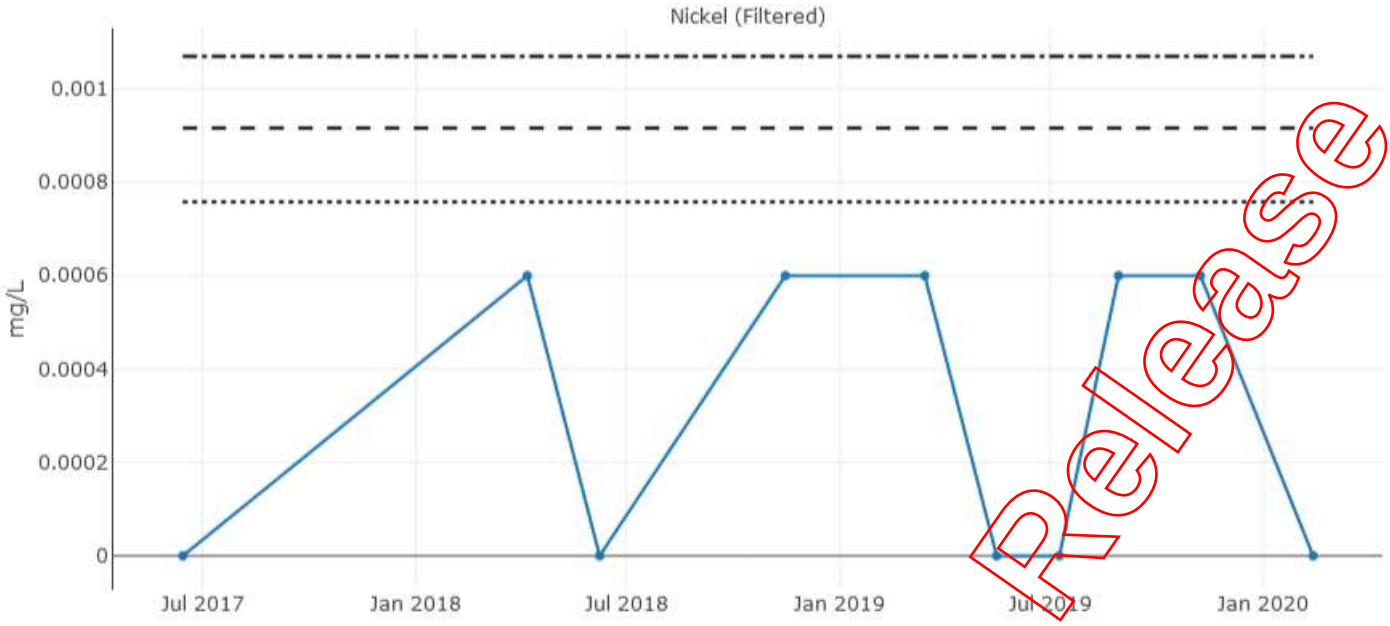





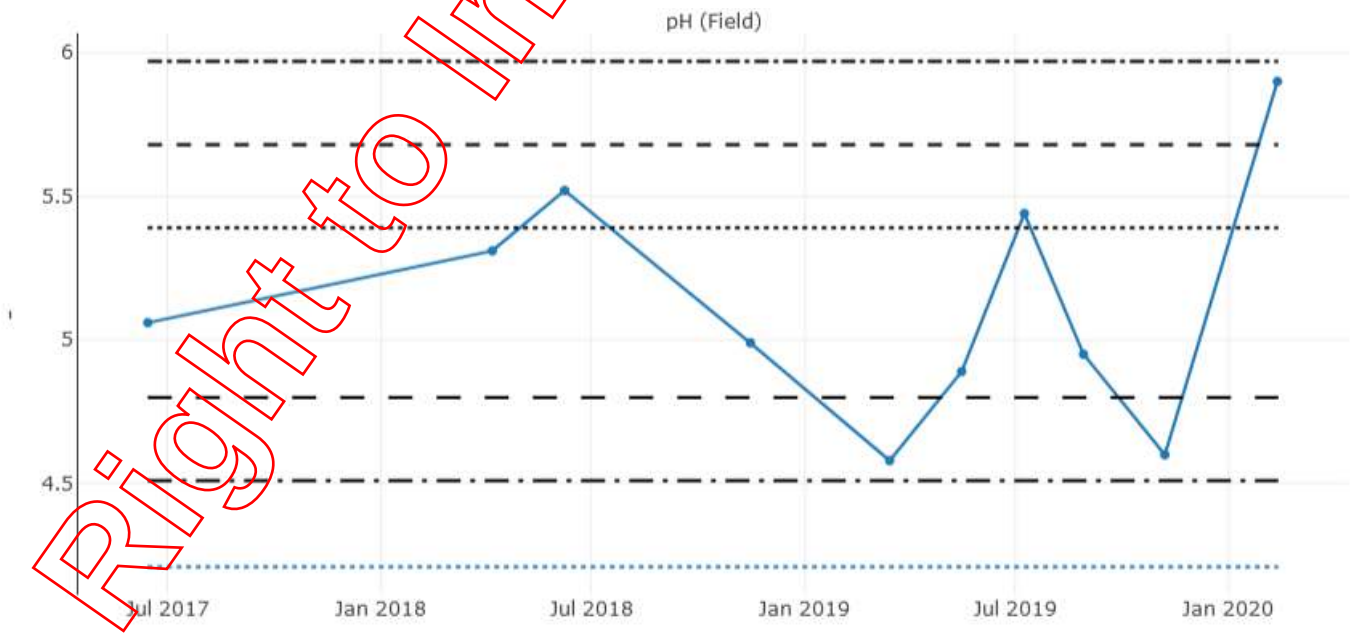



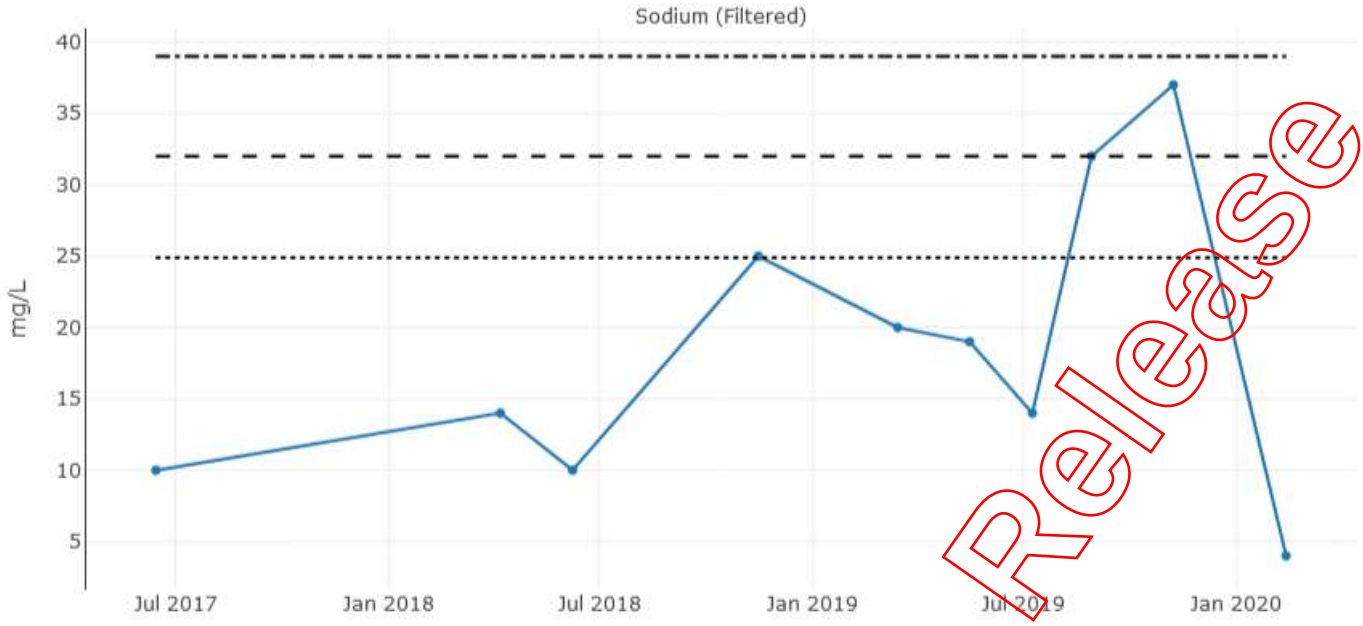











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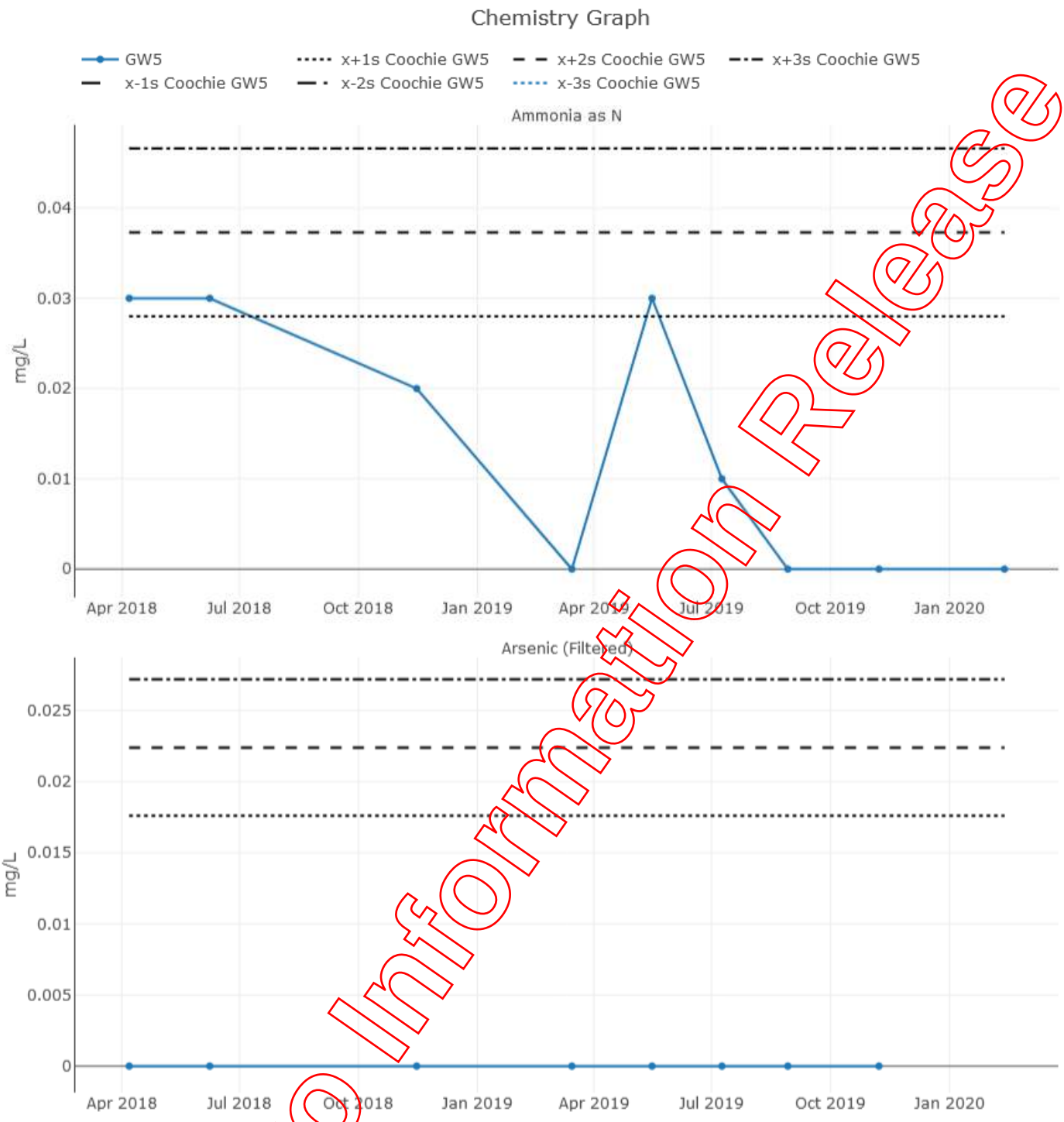

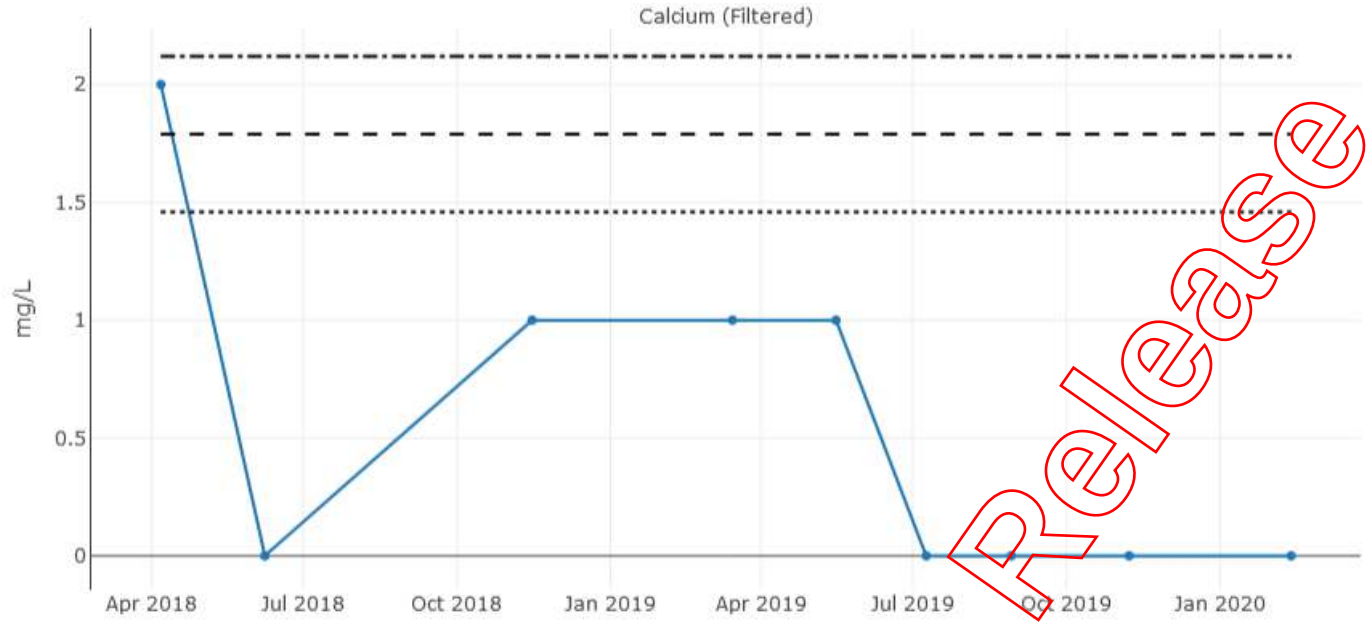



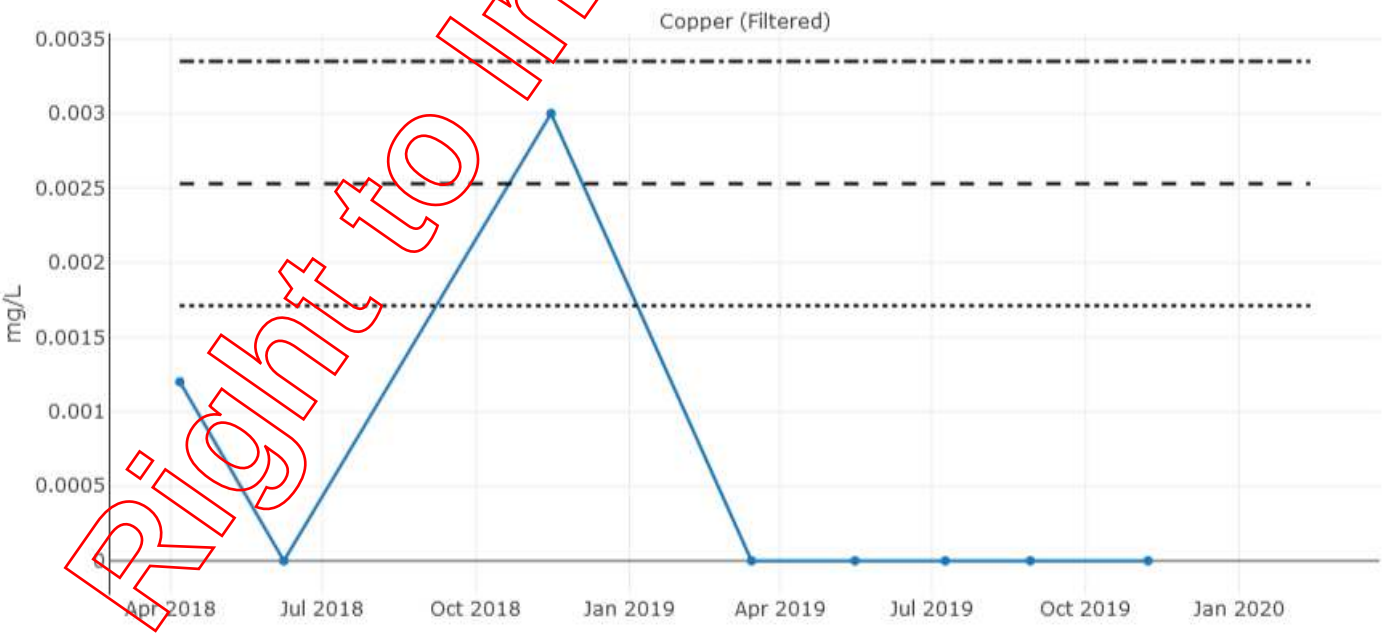

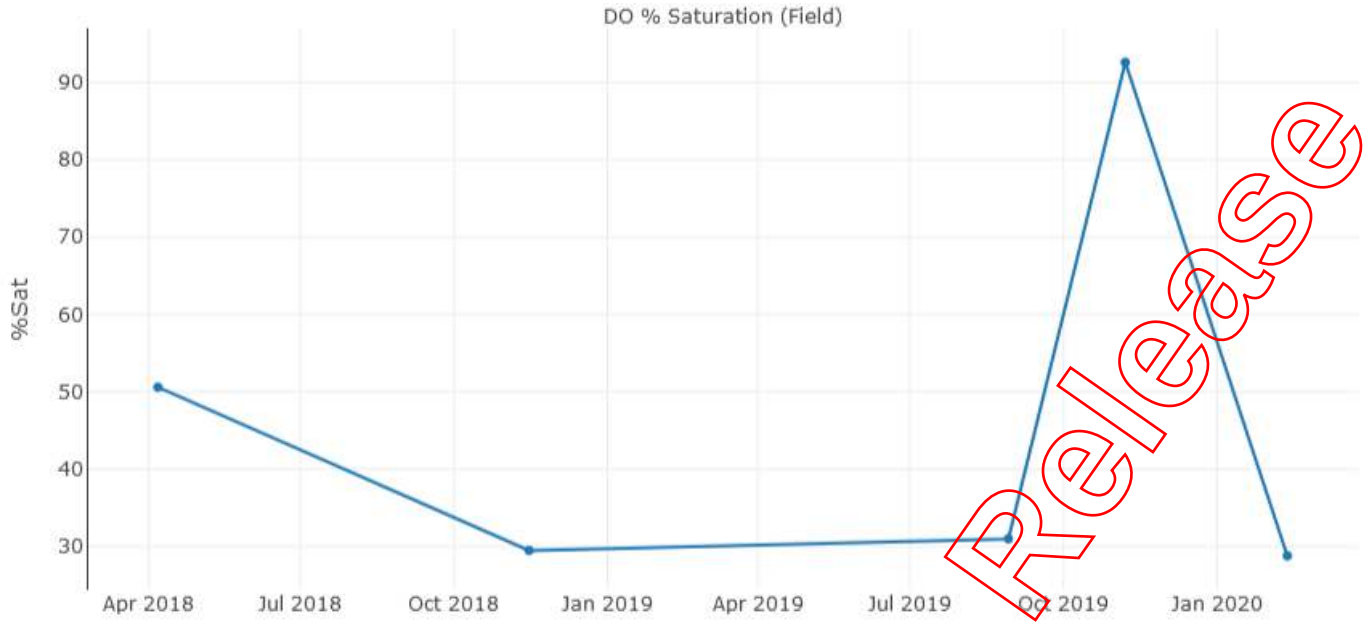



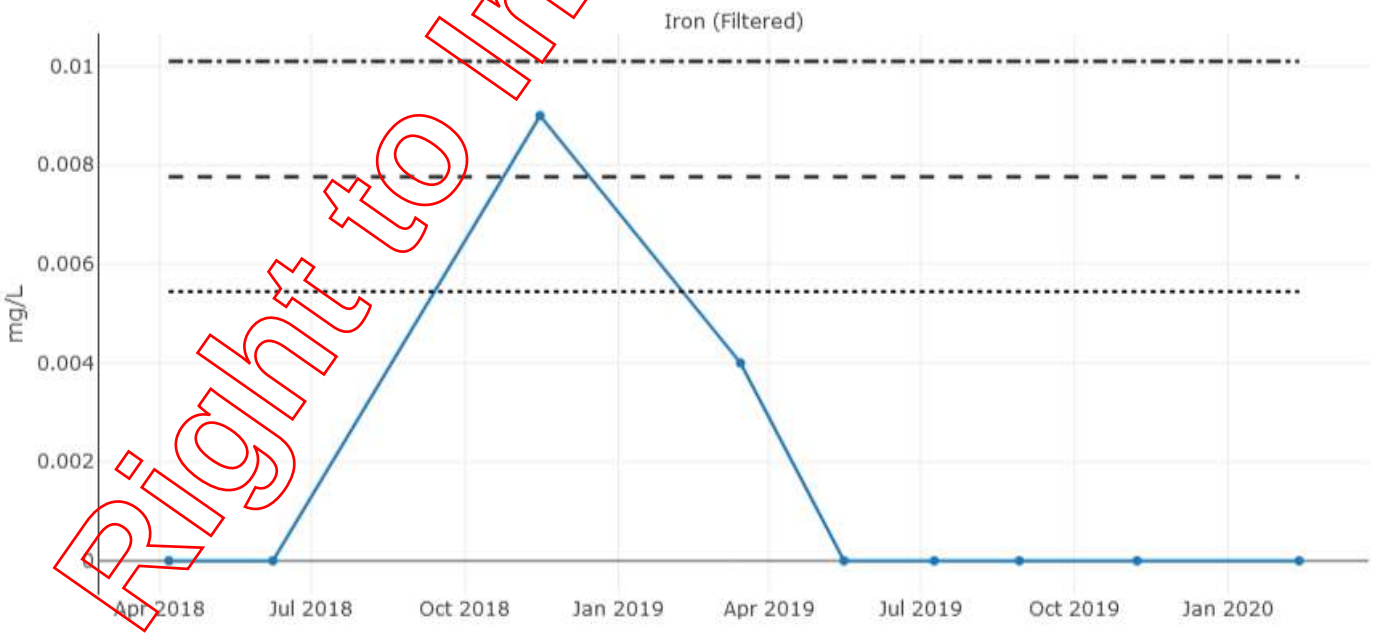

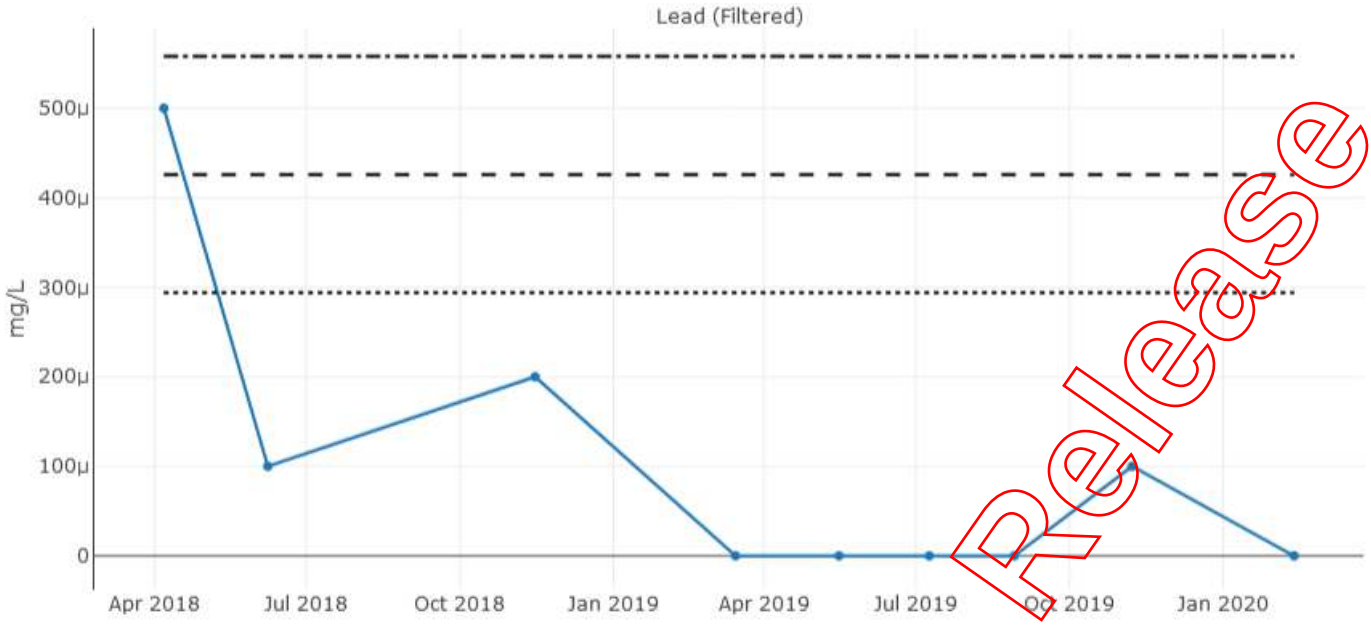


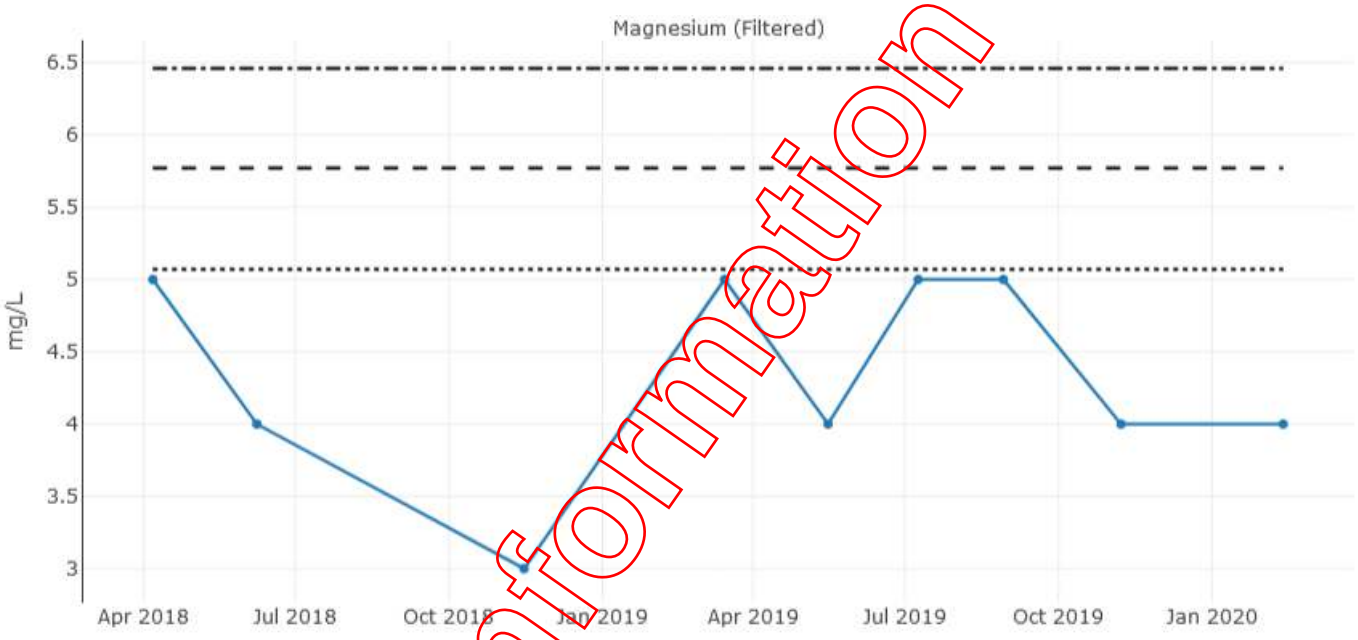


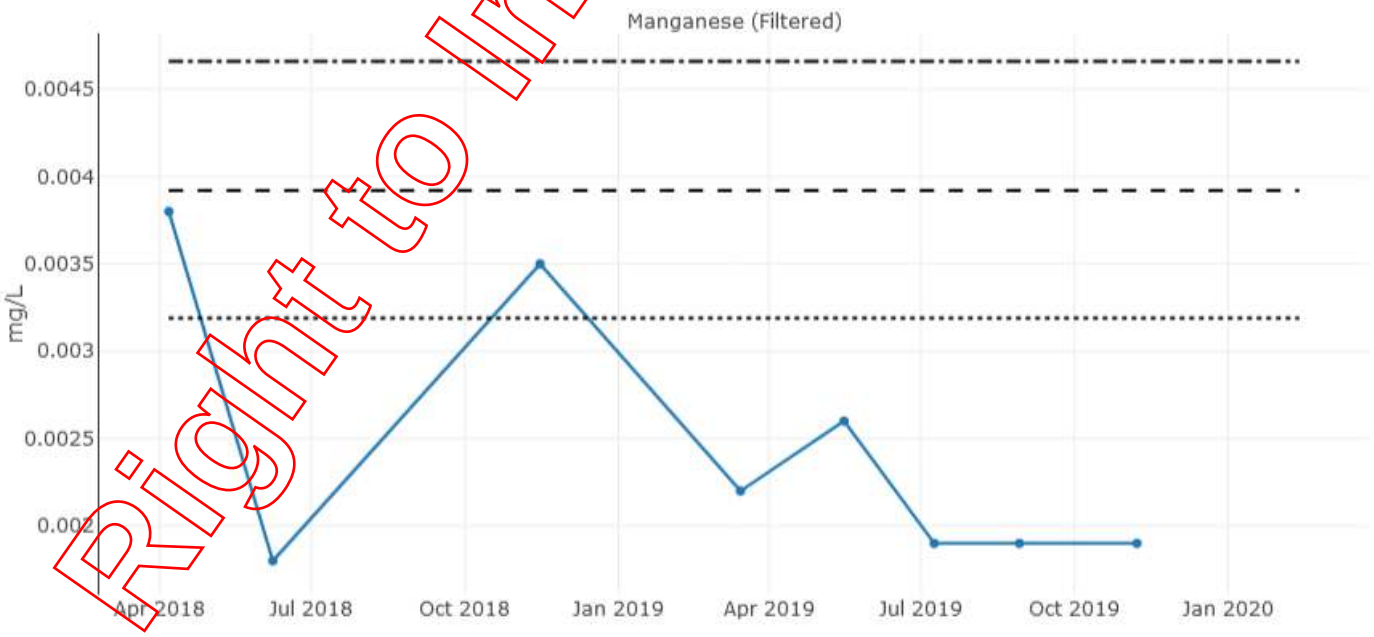

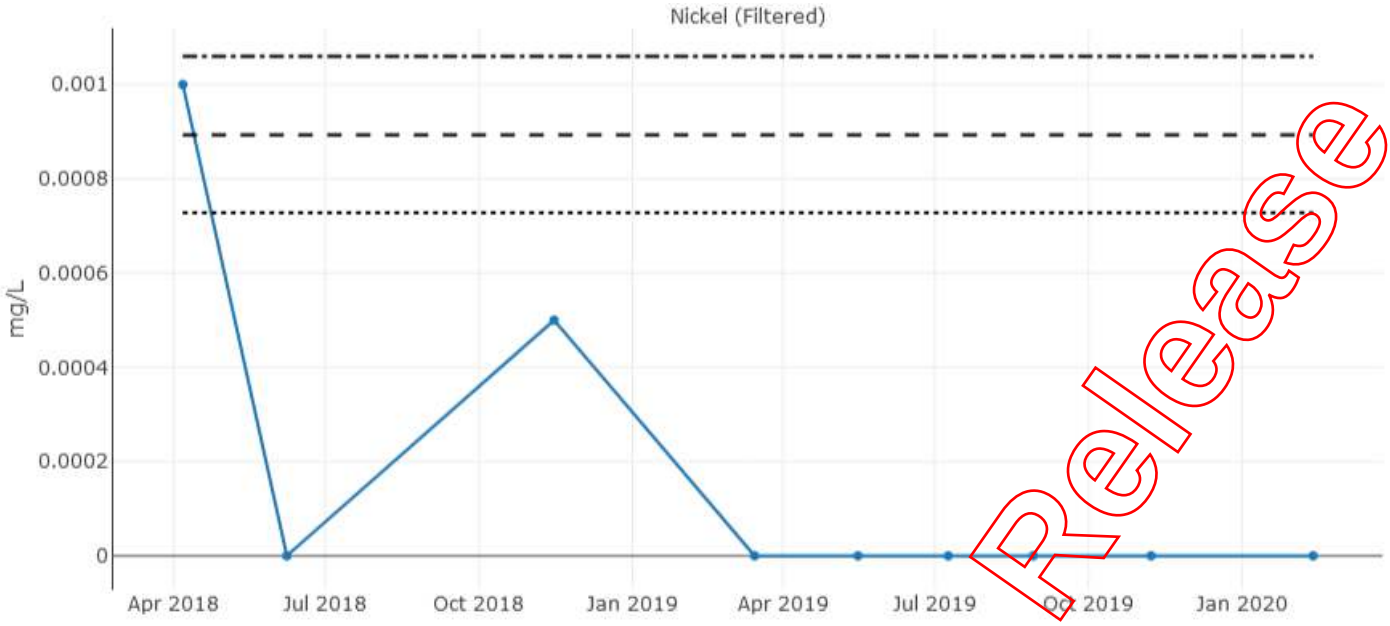


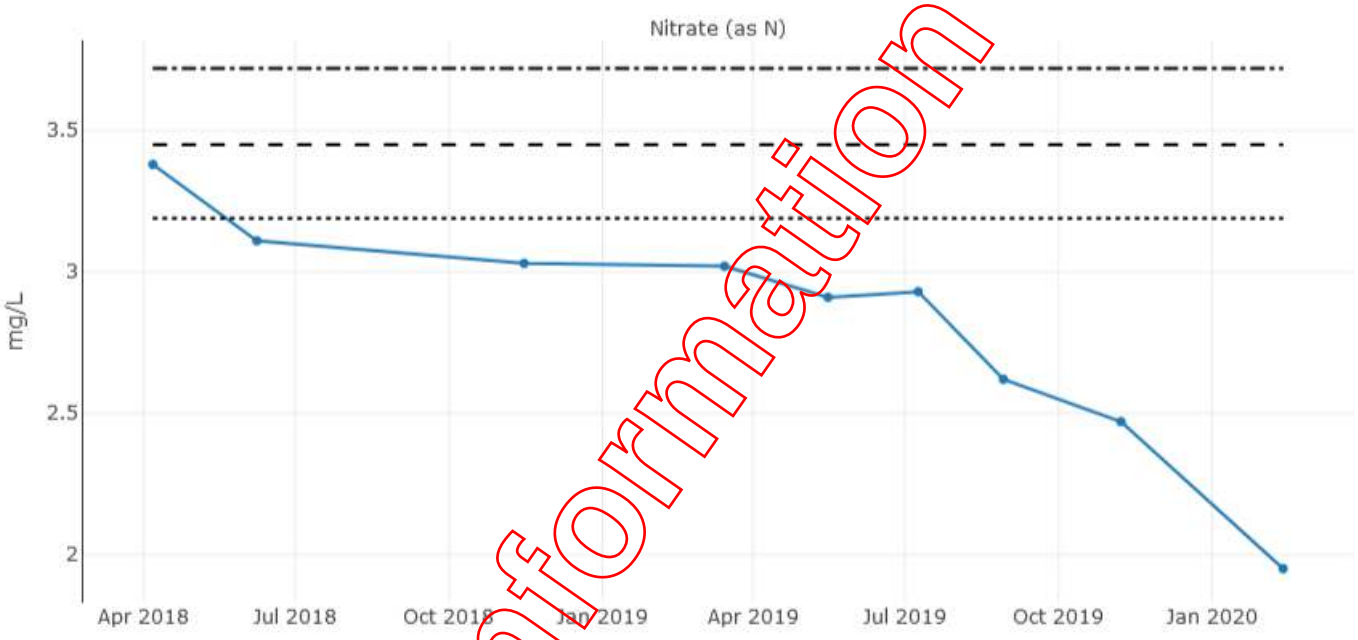


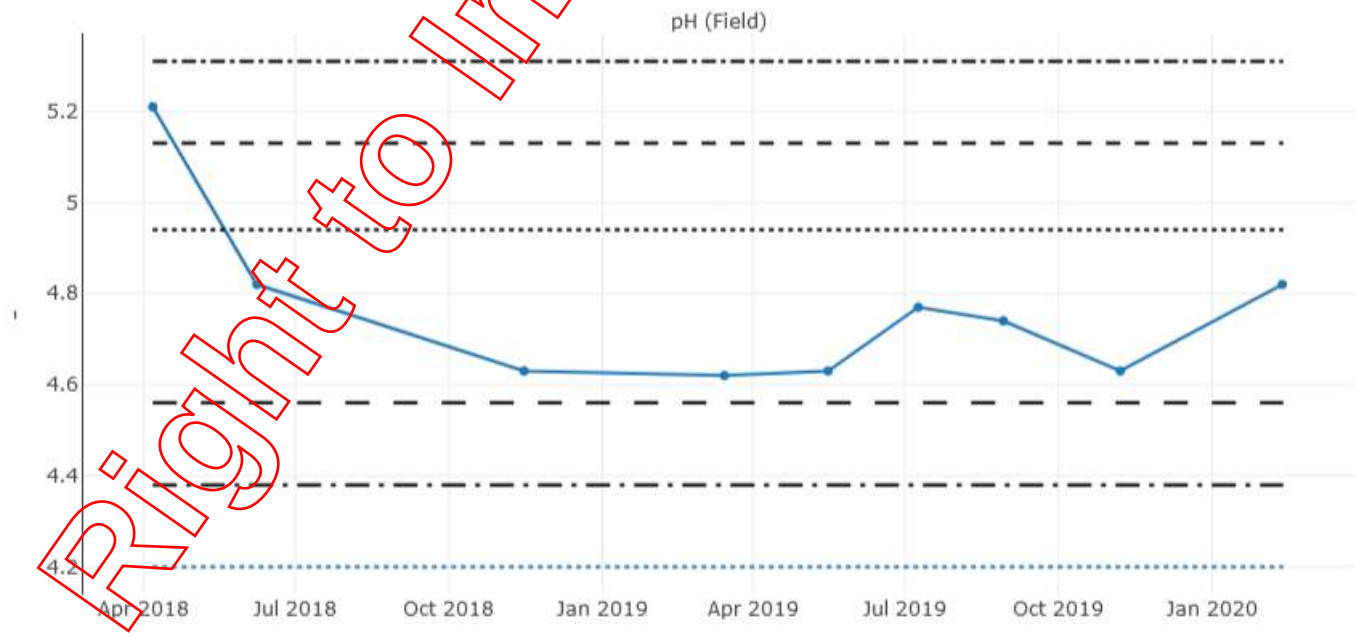



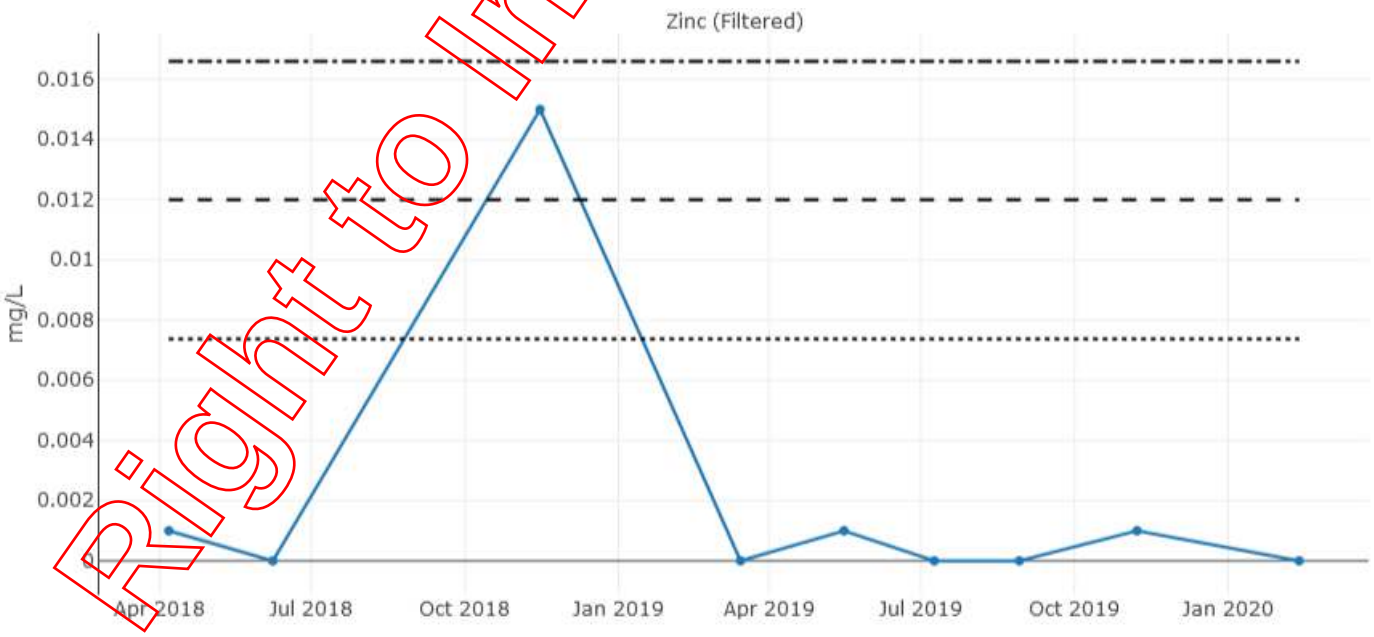

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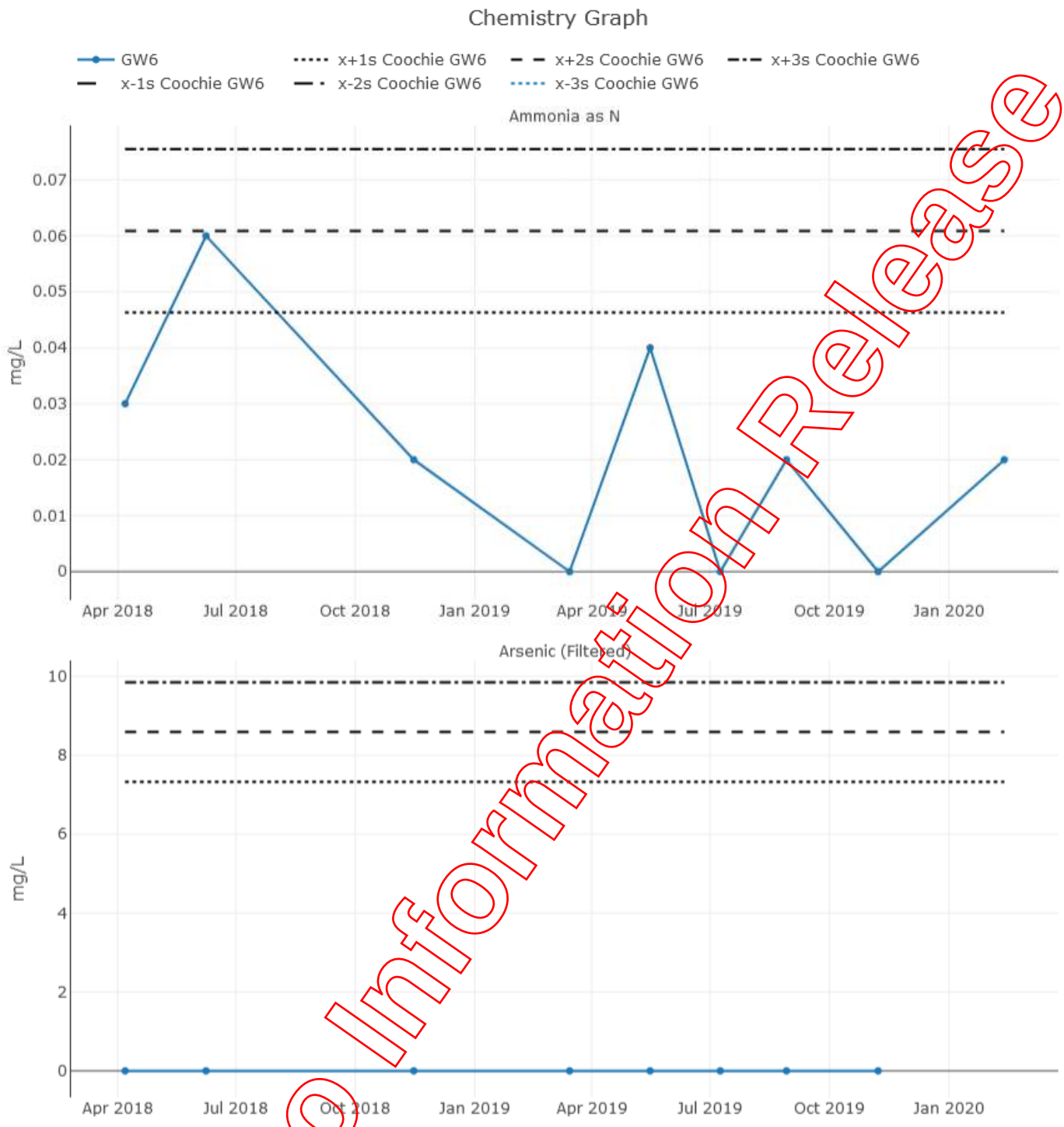
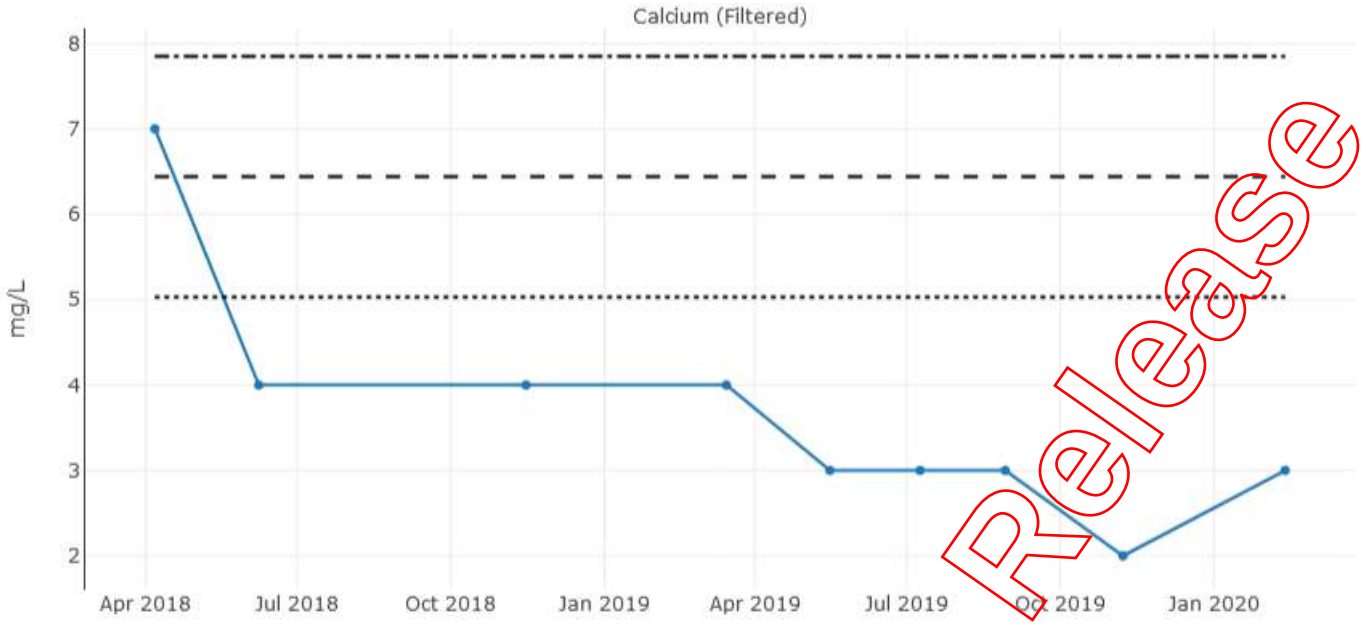
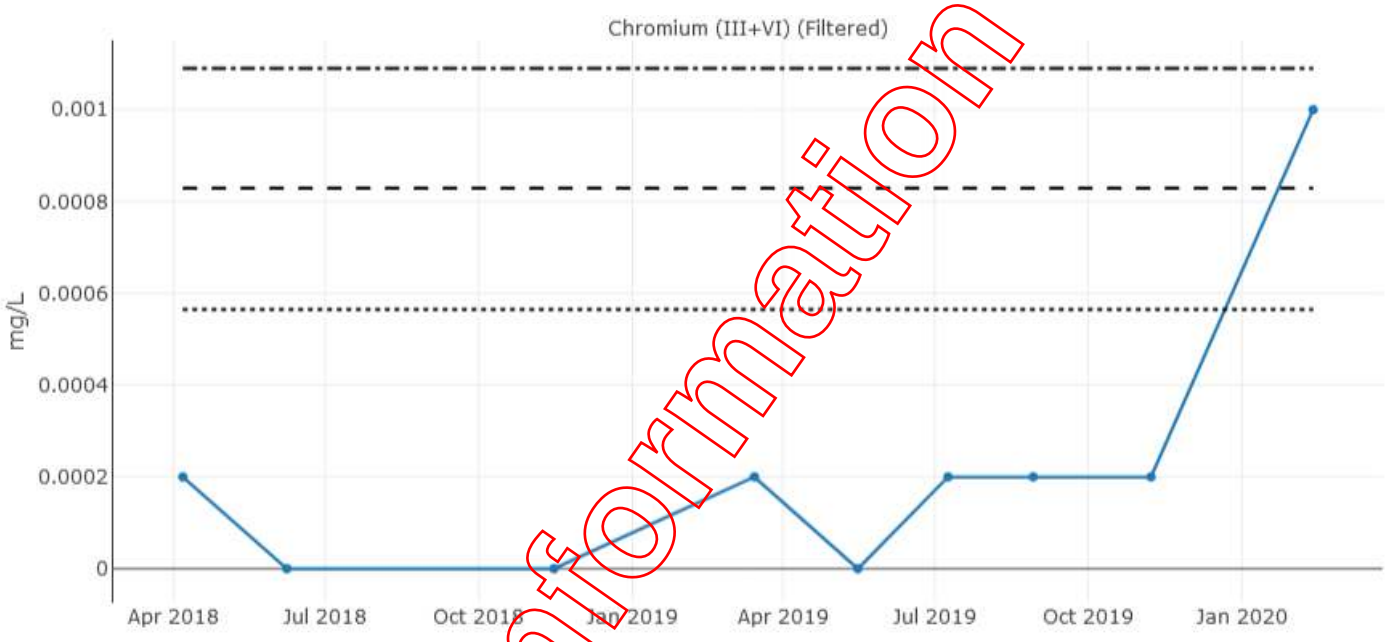
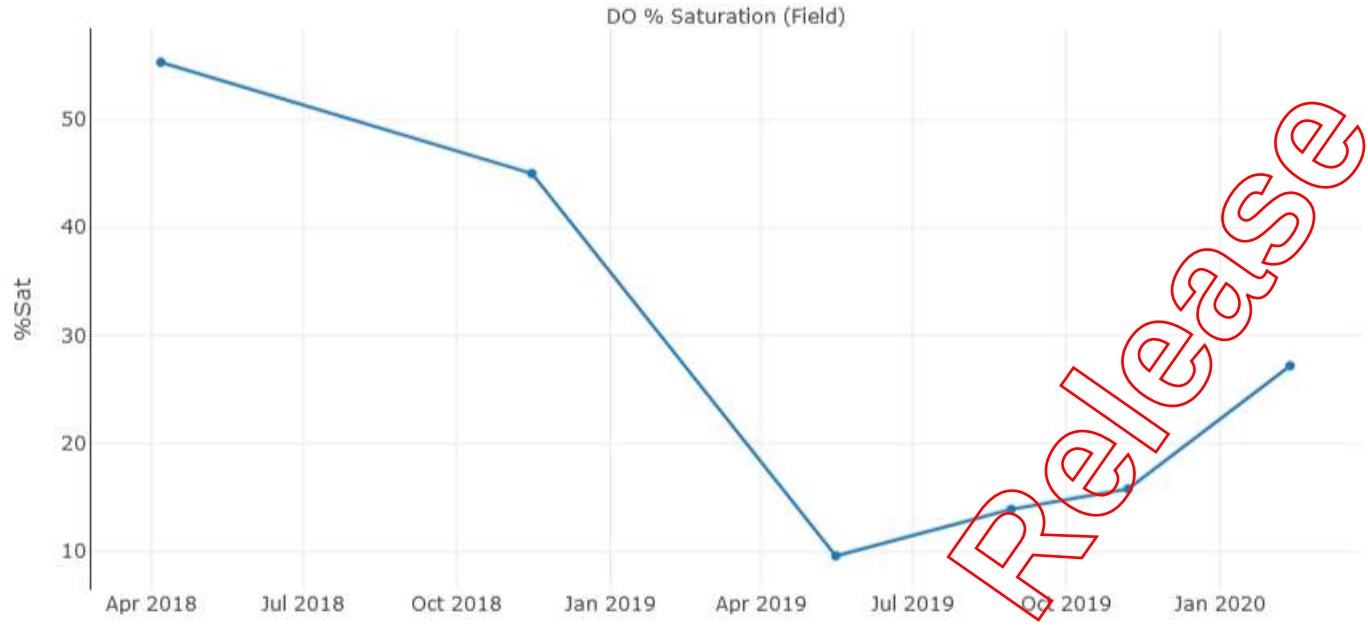
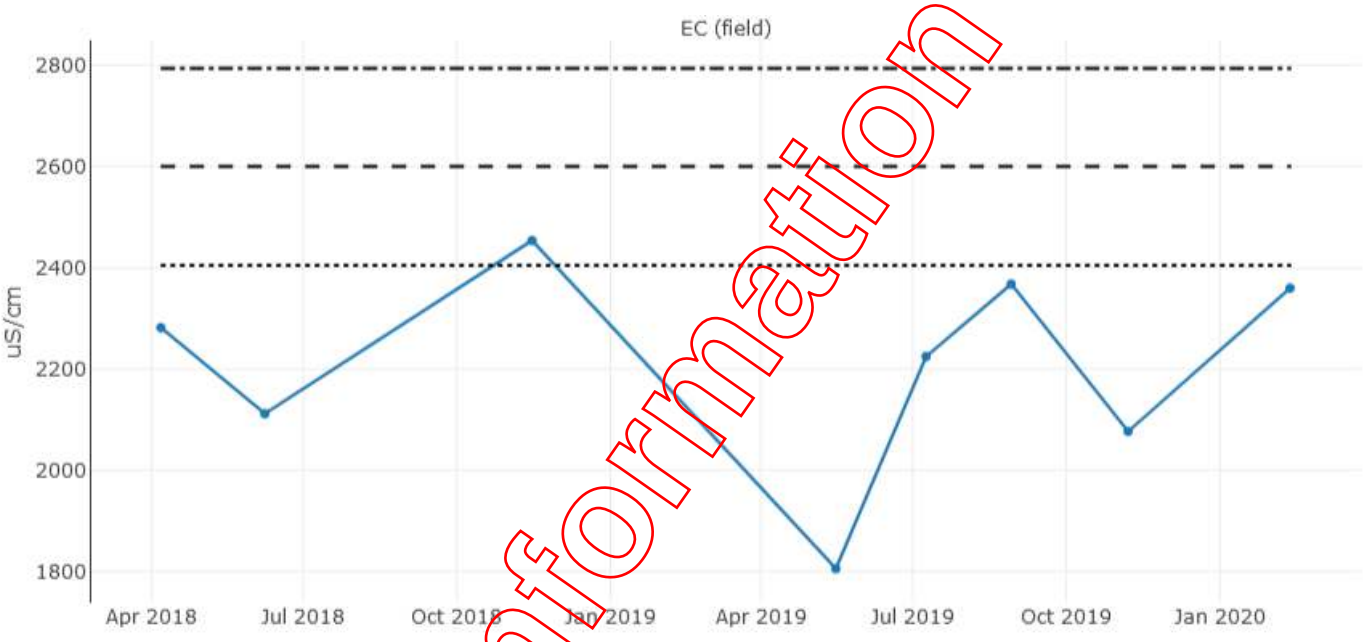
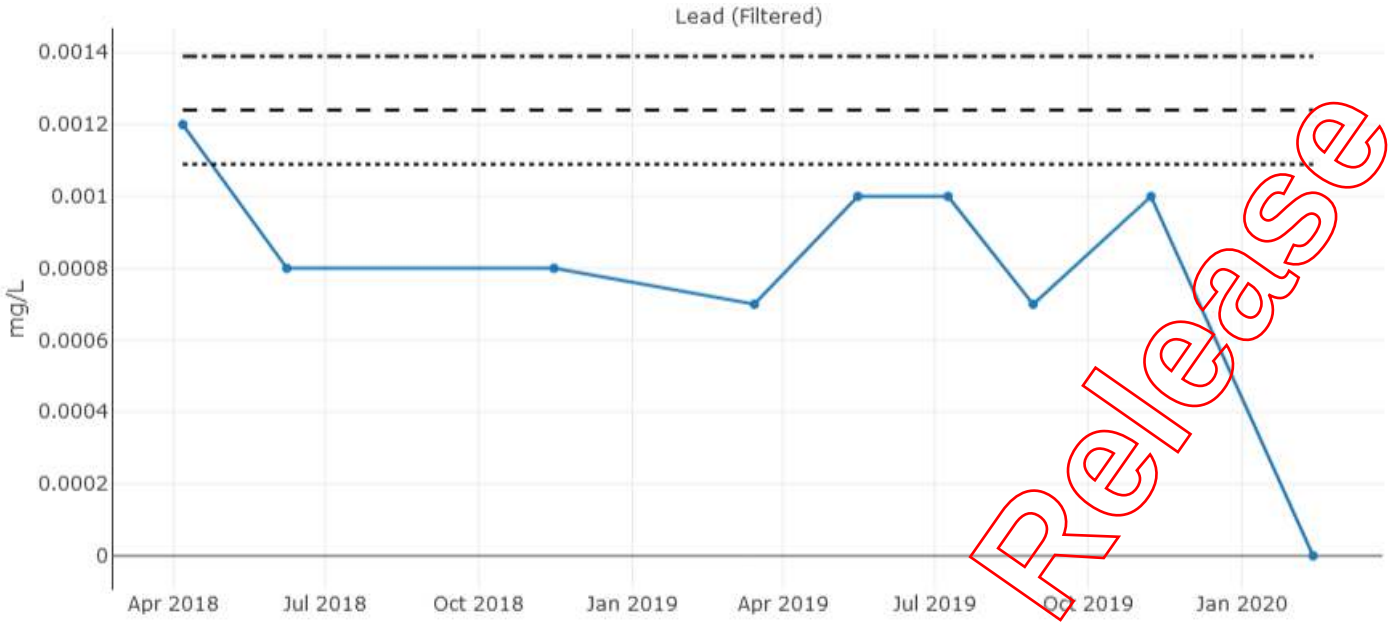




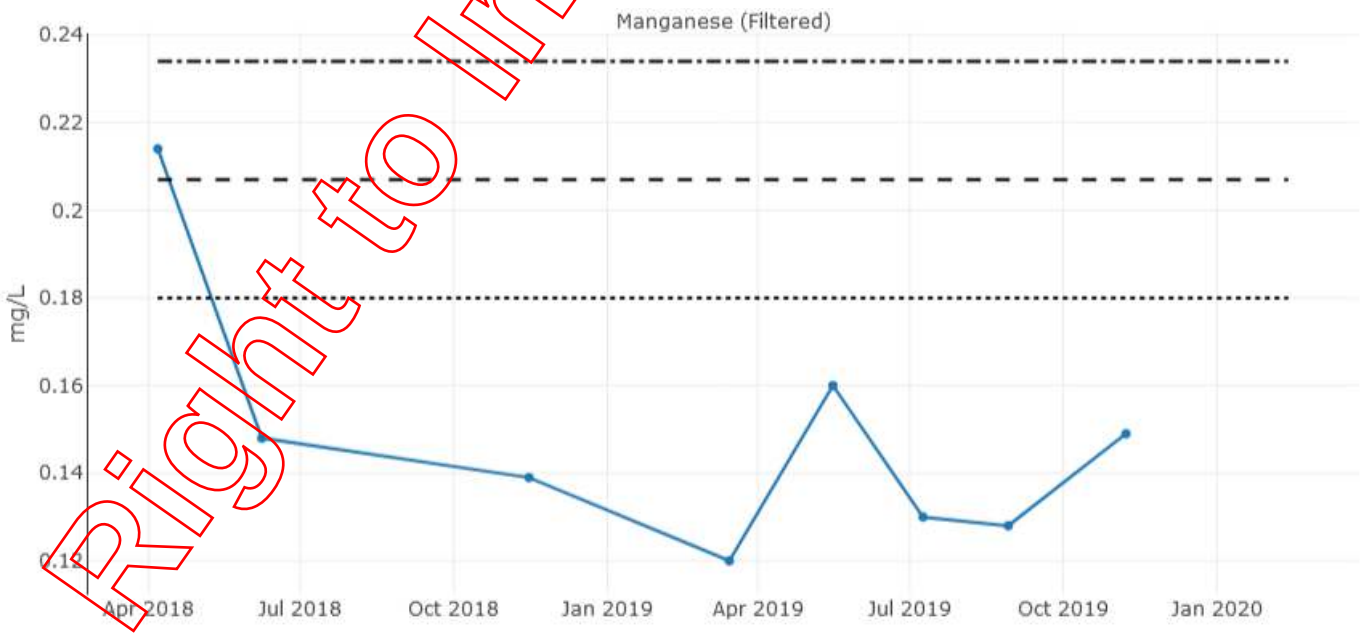



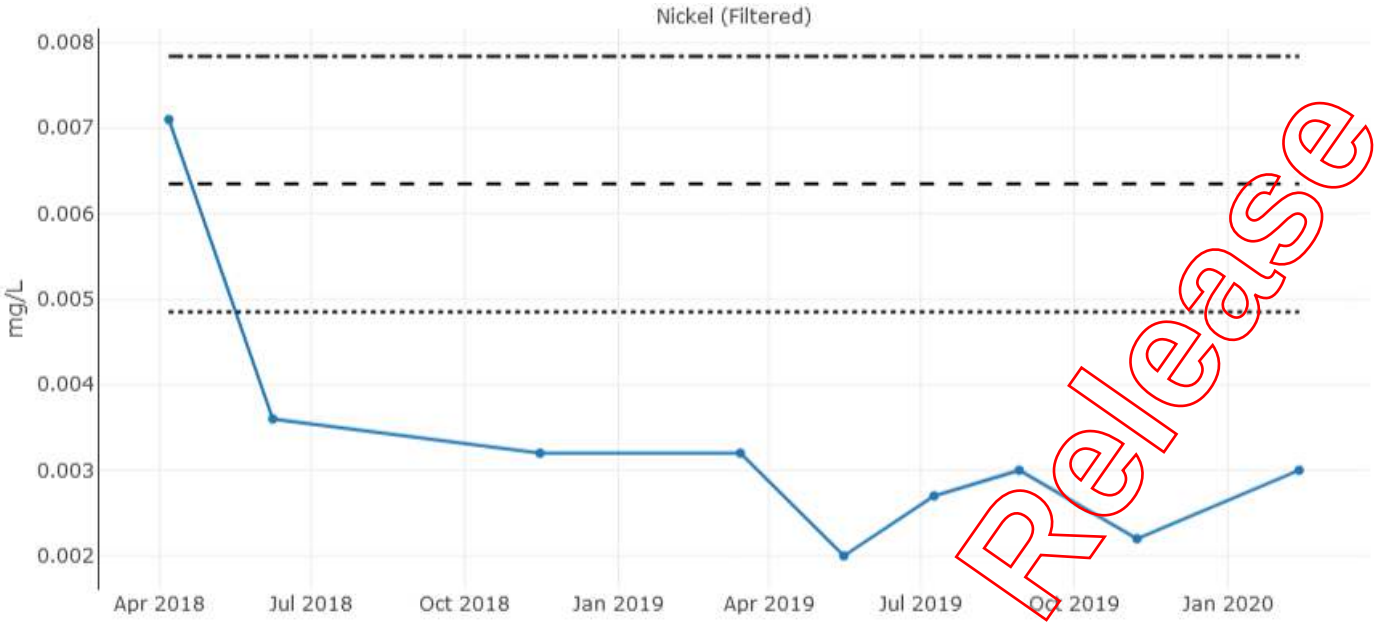



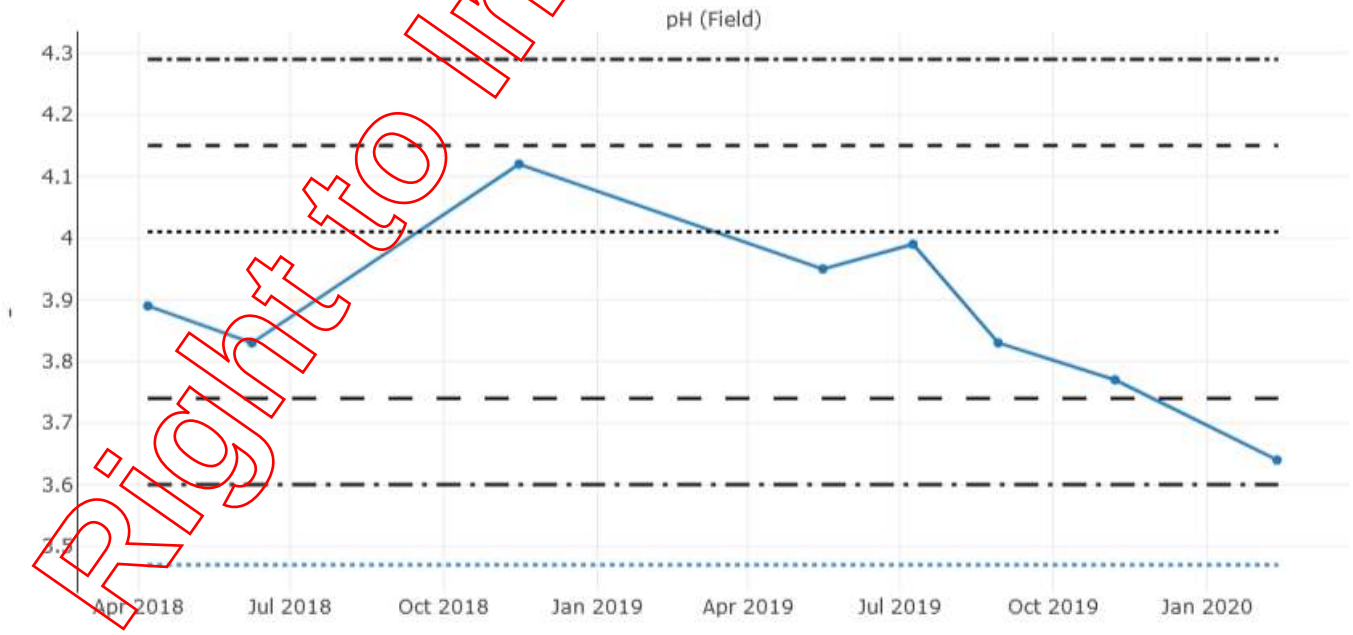



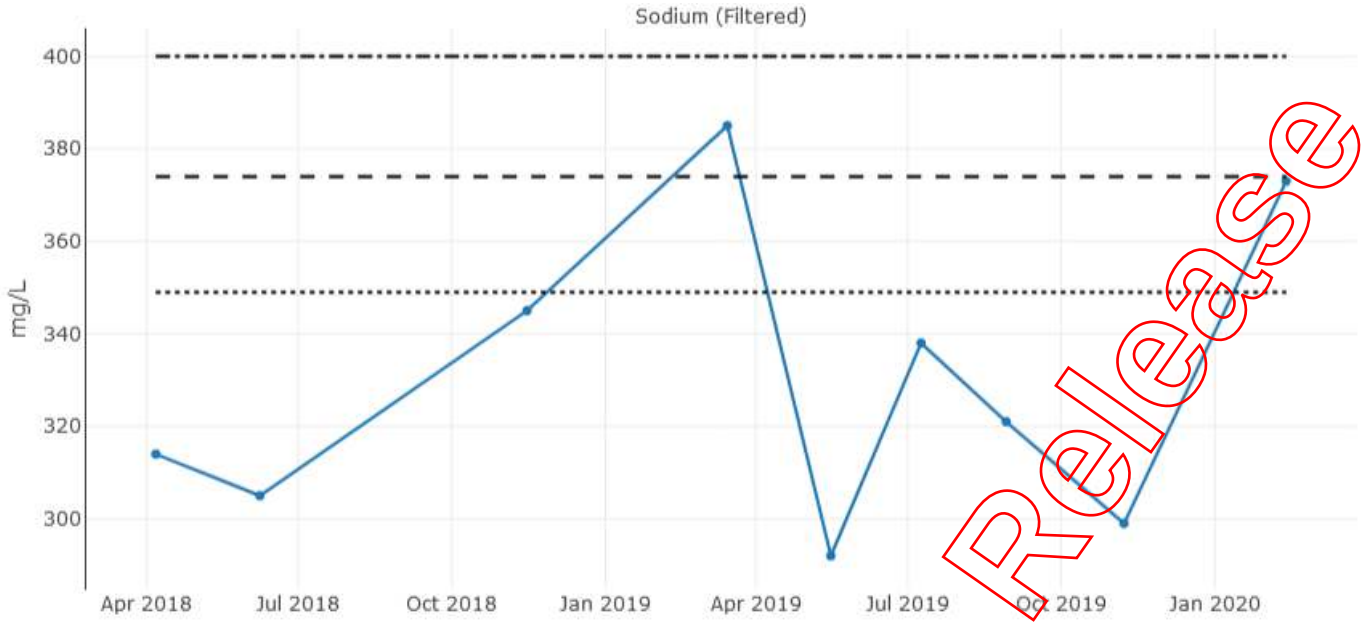


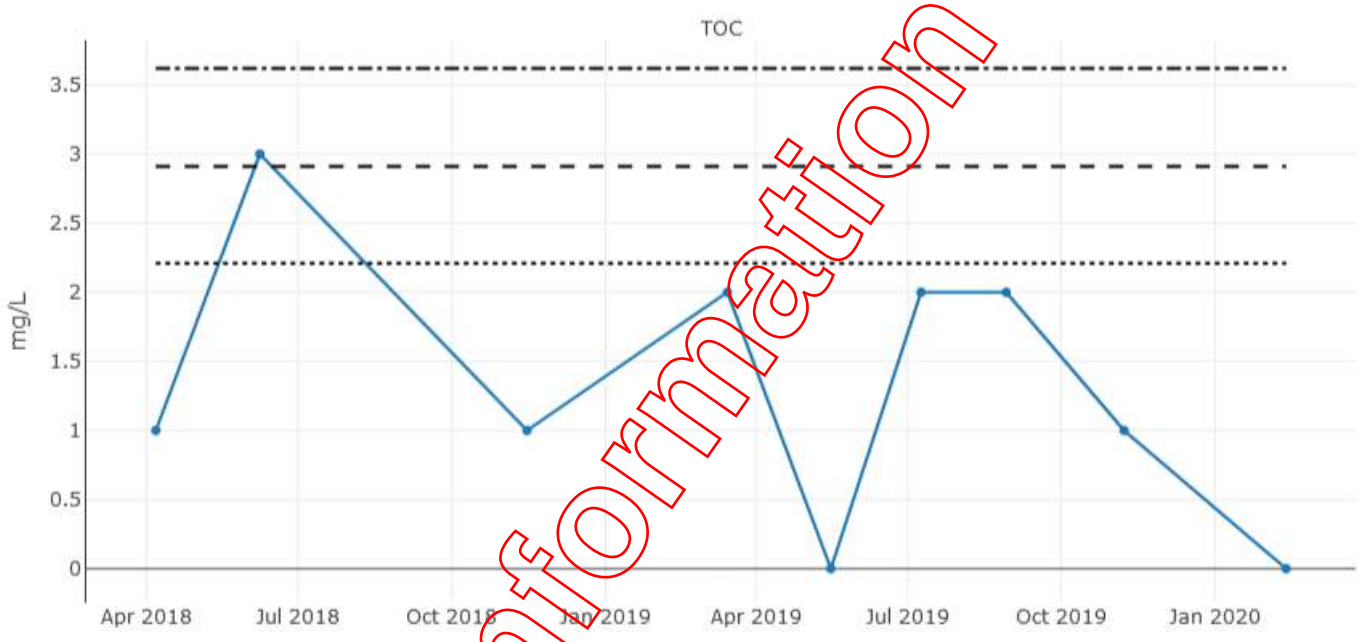










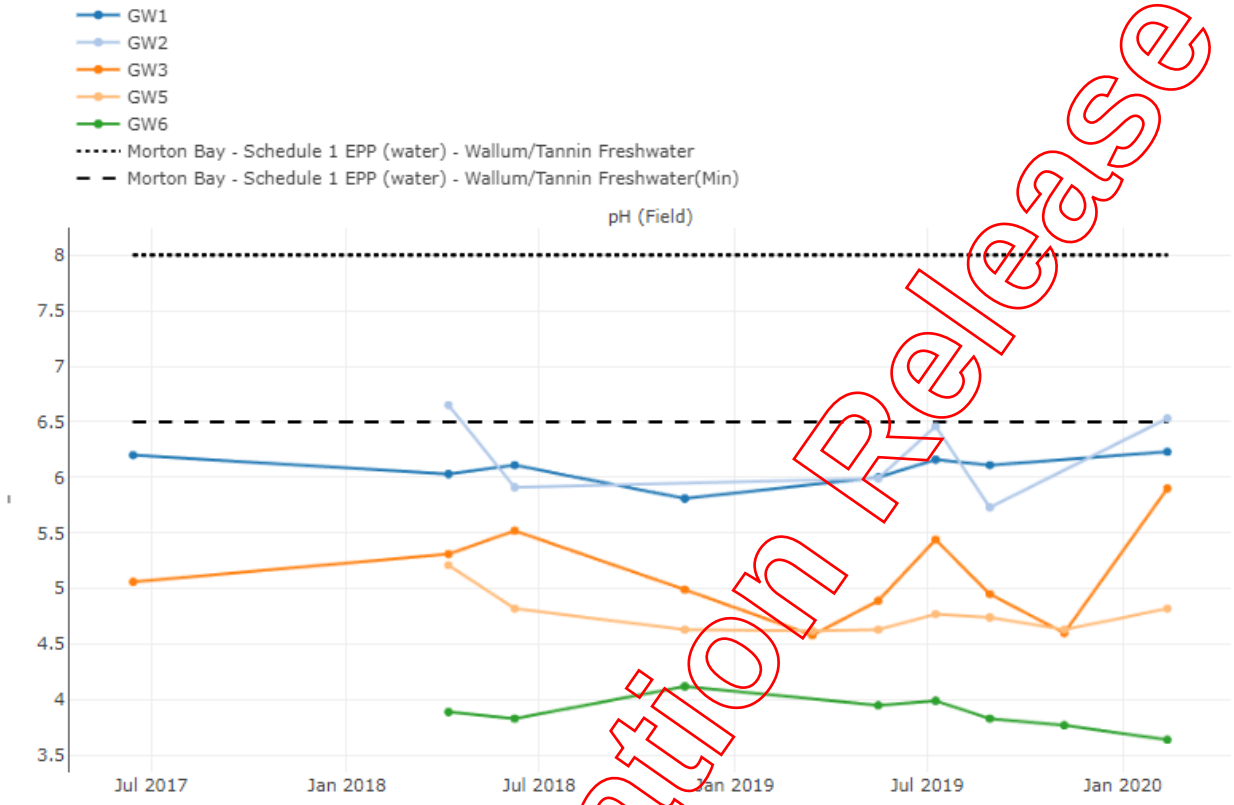



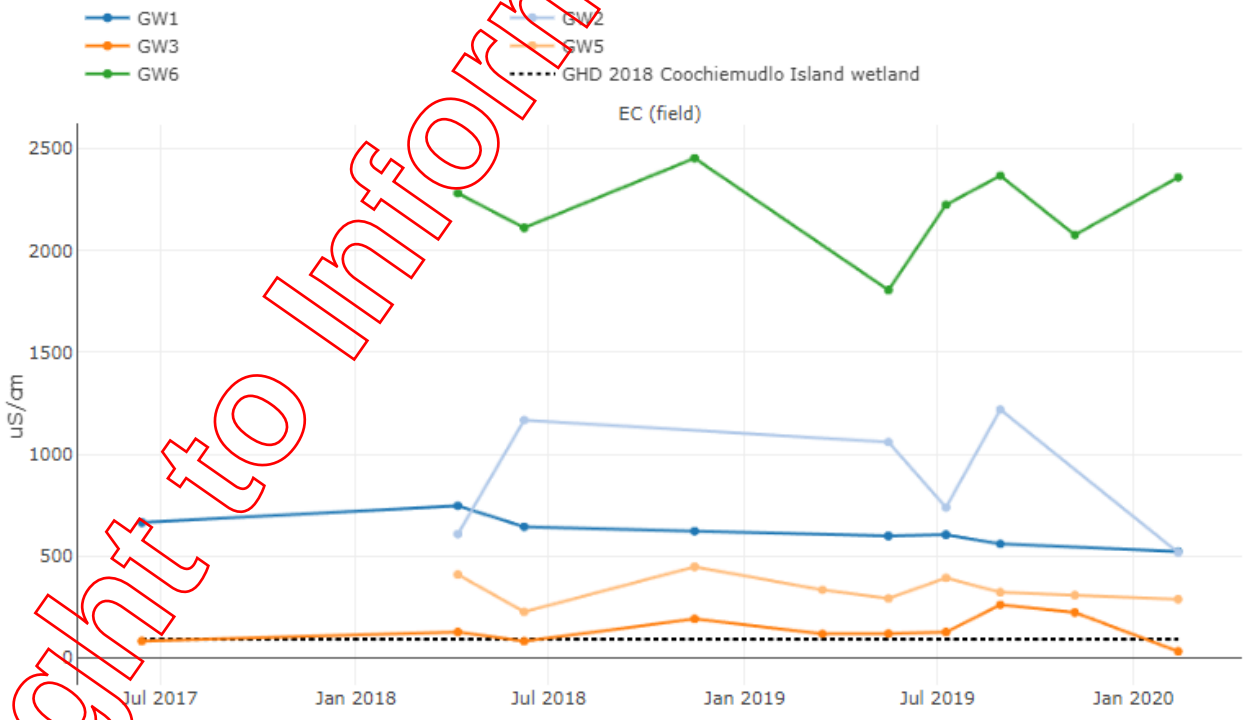

The report was generated based on the following filter:
Field or Lab Data "Both",
Chem Names In "EC (field),pH (Field),Ammonia as N,Nitrate (as N),Sodium,TOC,Arsenic,Chromium (III+VI),Calcium,Copper,Iron,Lead,Magnesium,Manganese,Zinc,Nickel,DO % Saturation (Field)",
Locations In "undefined"

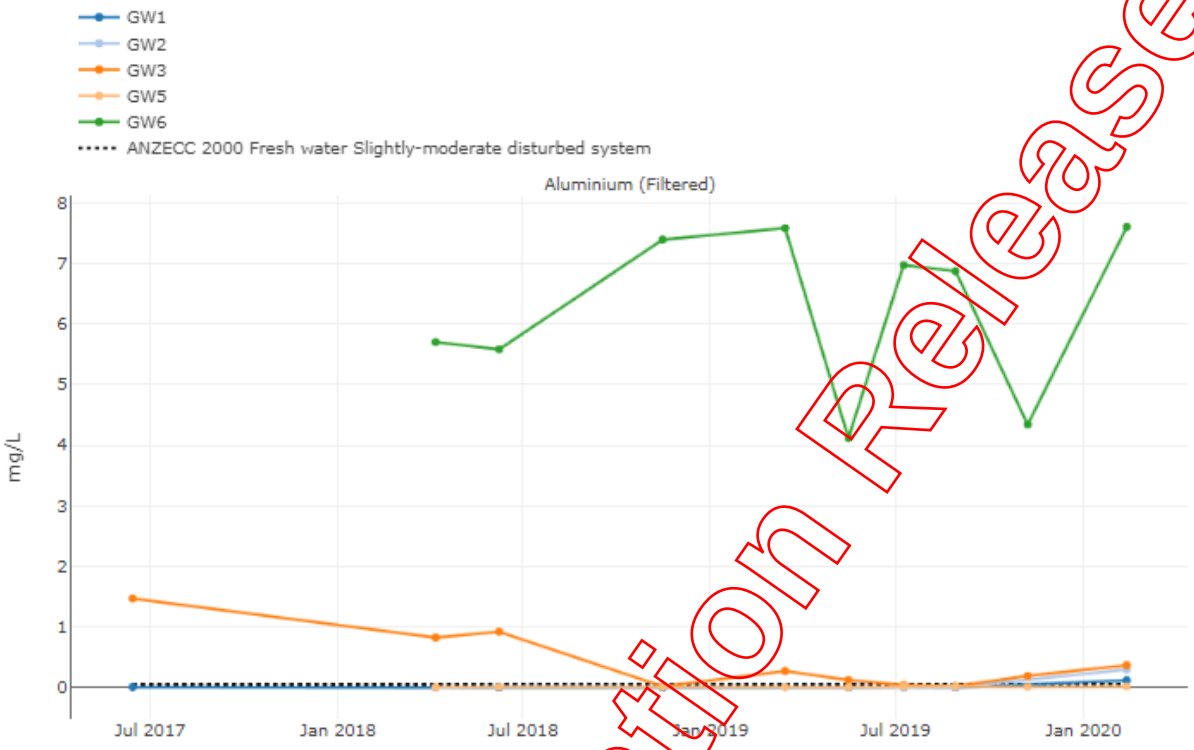
Publication Date: 06 Apr 2020

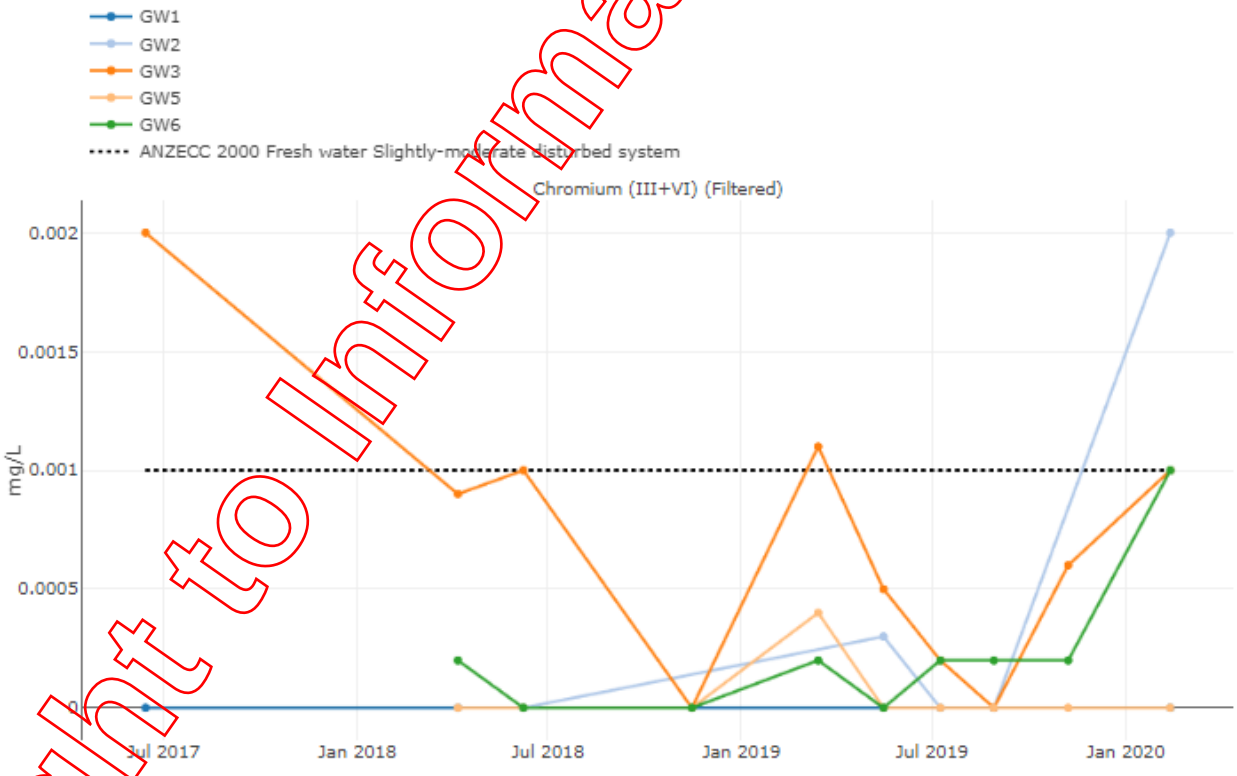
**Appendix D.**

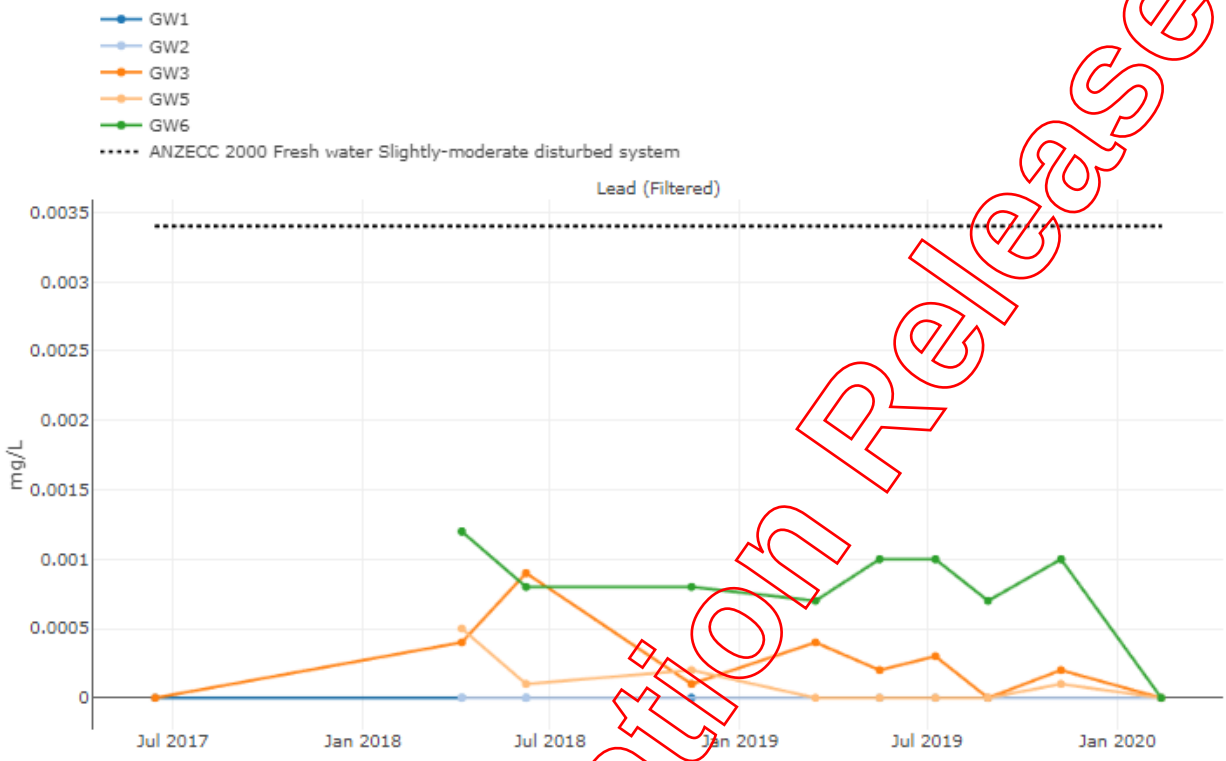
**Groundwater Graphs**

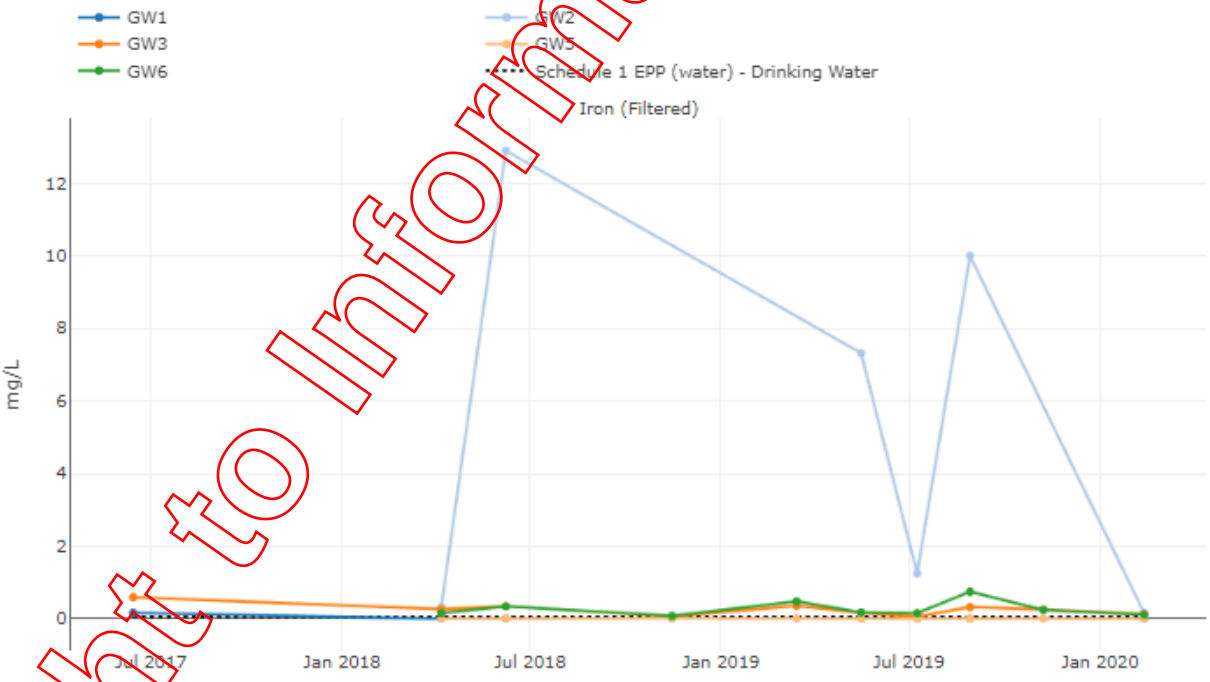


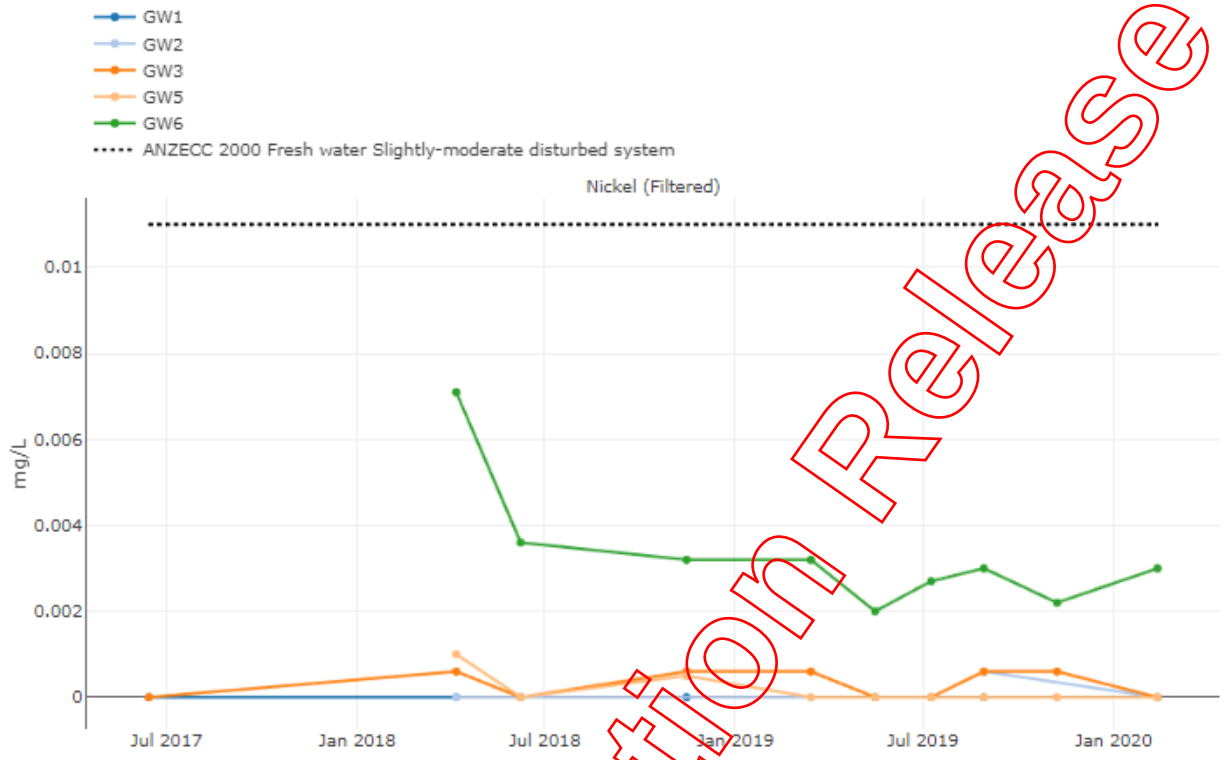



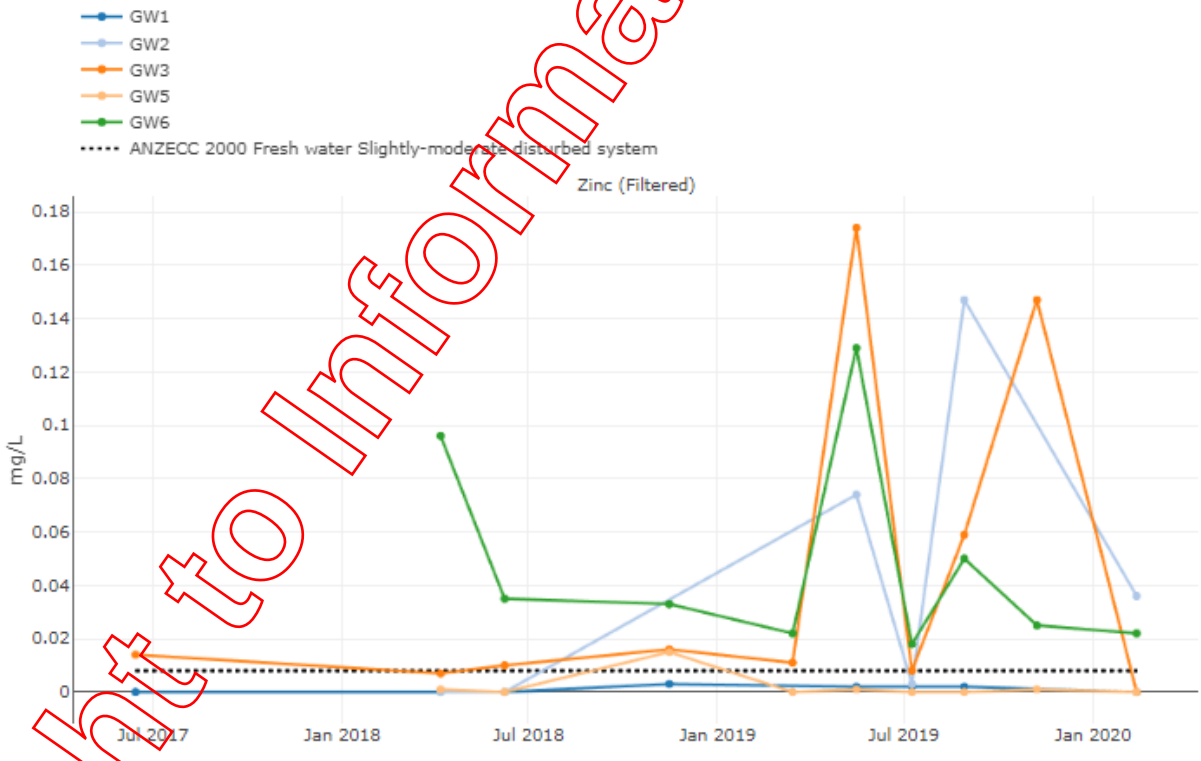


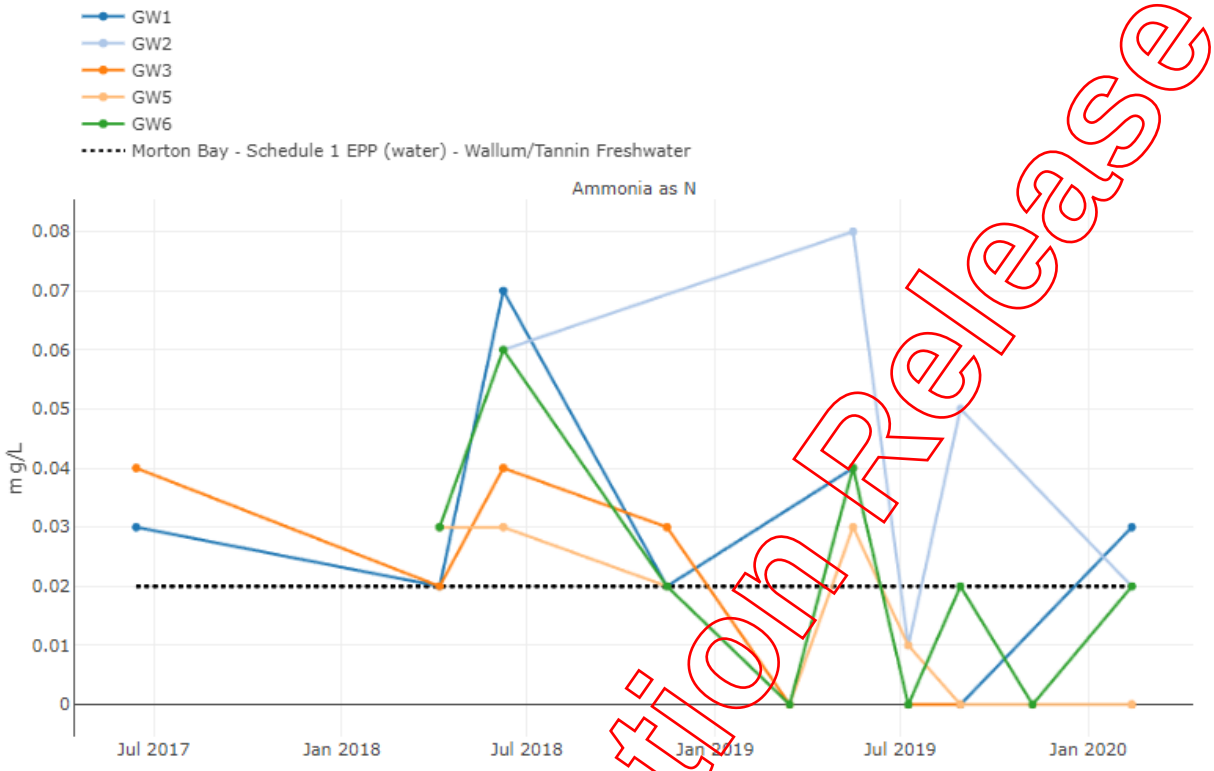



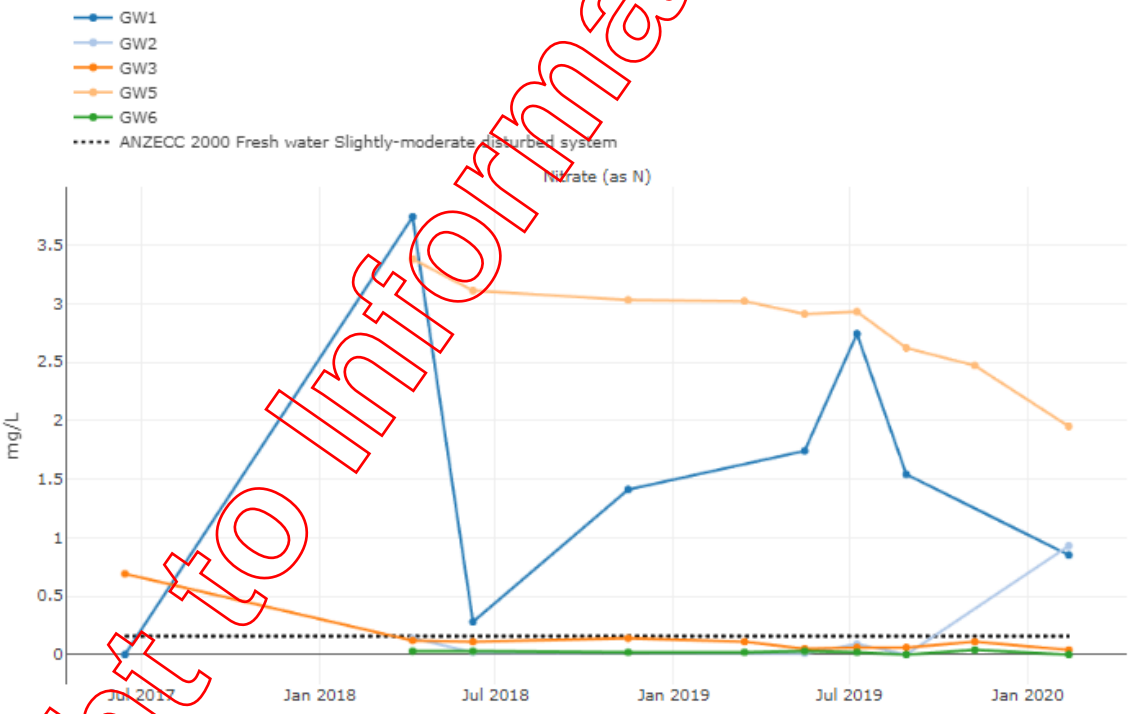


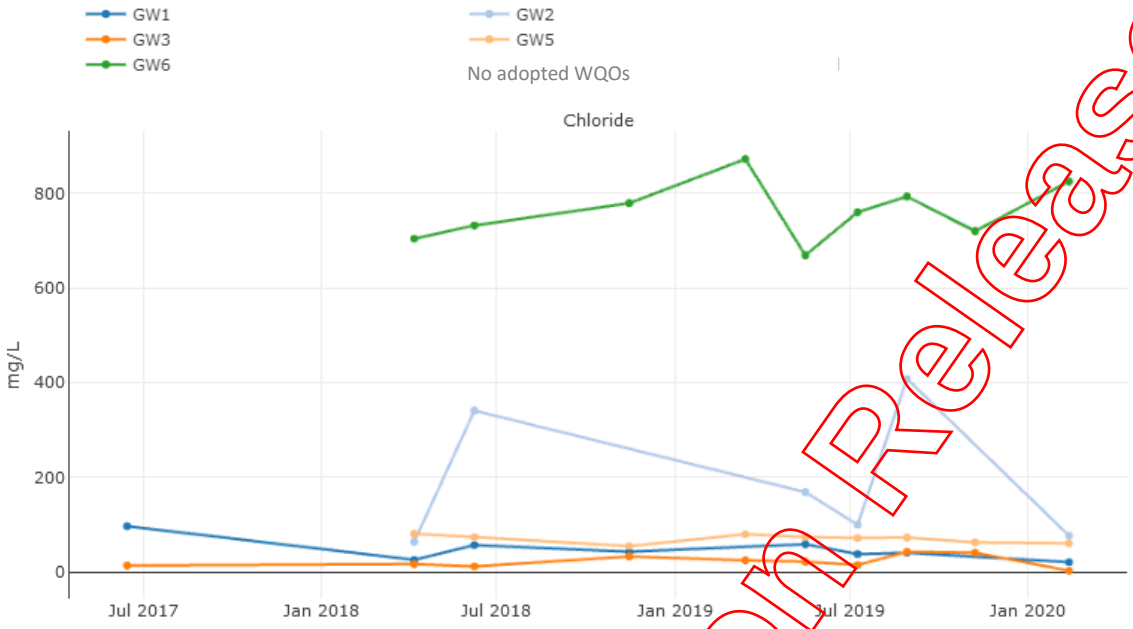



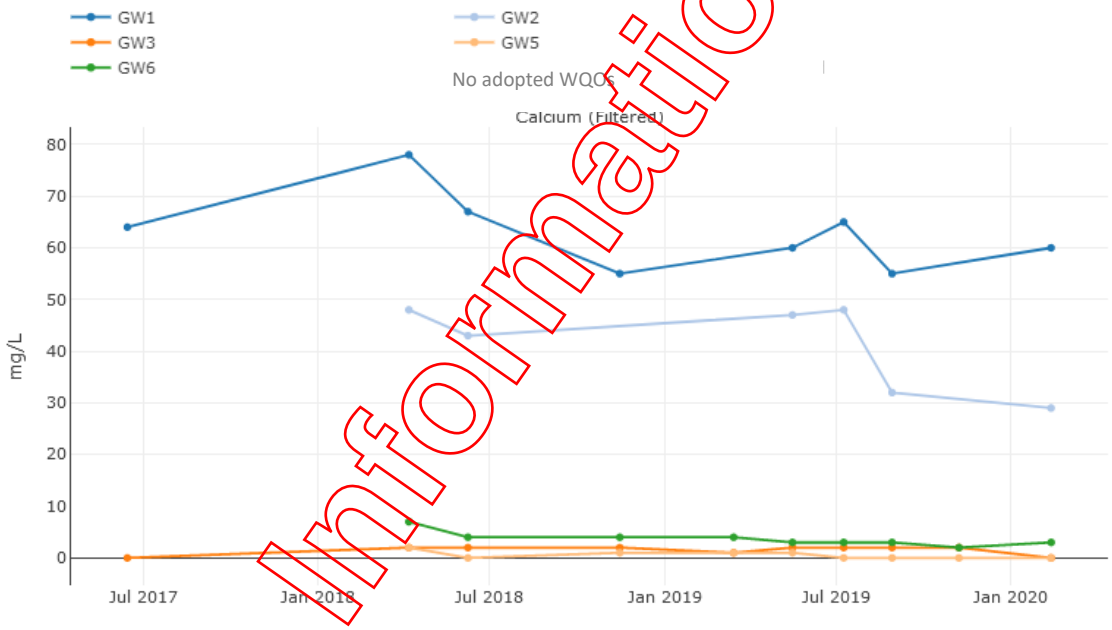


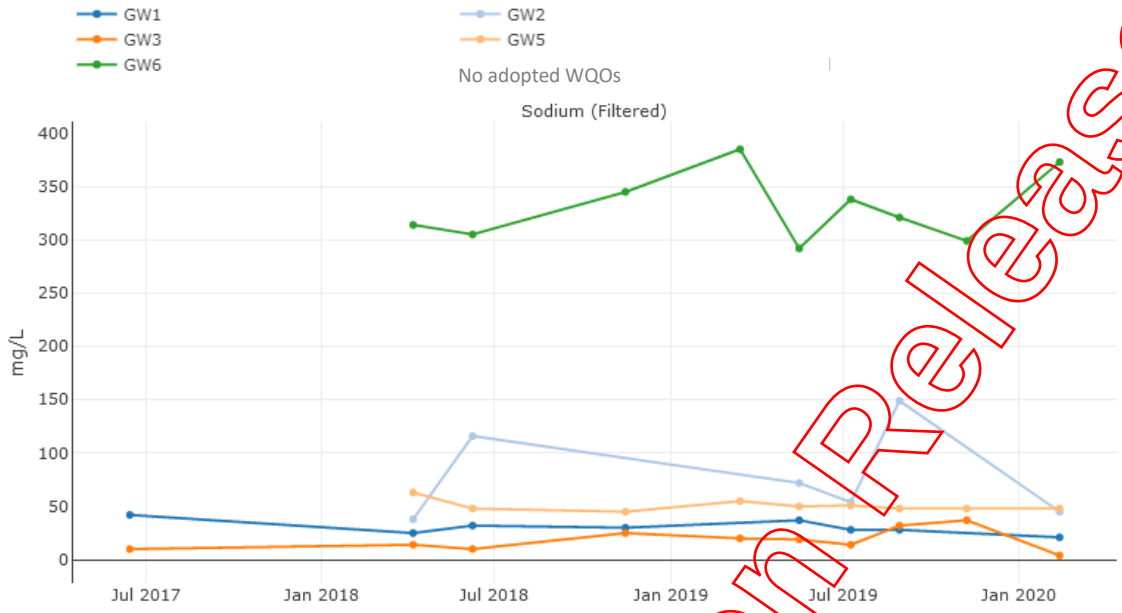





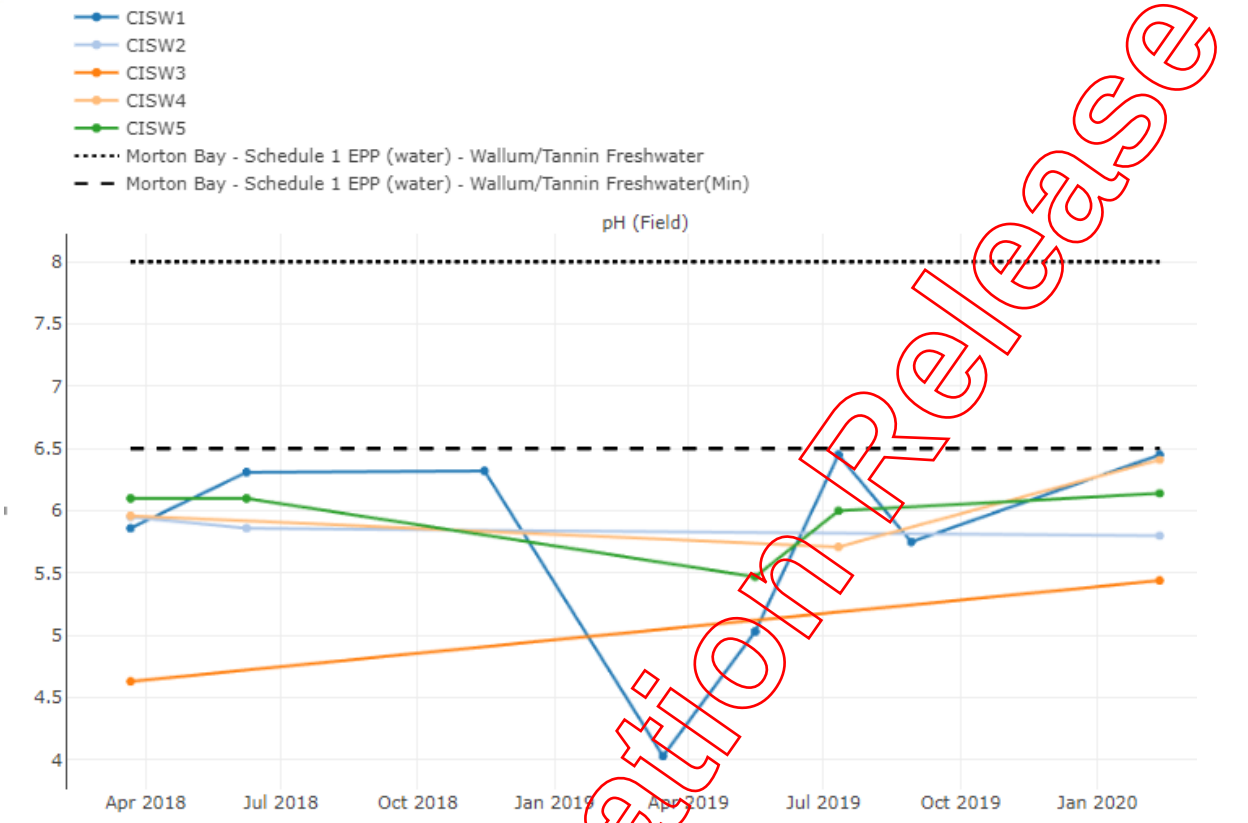


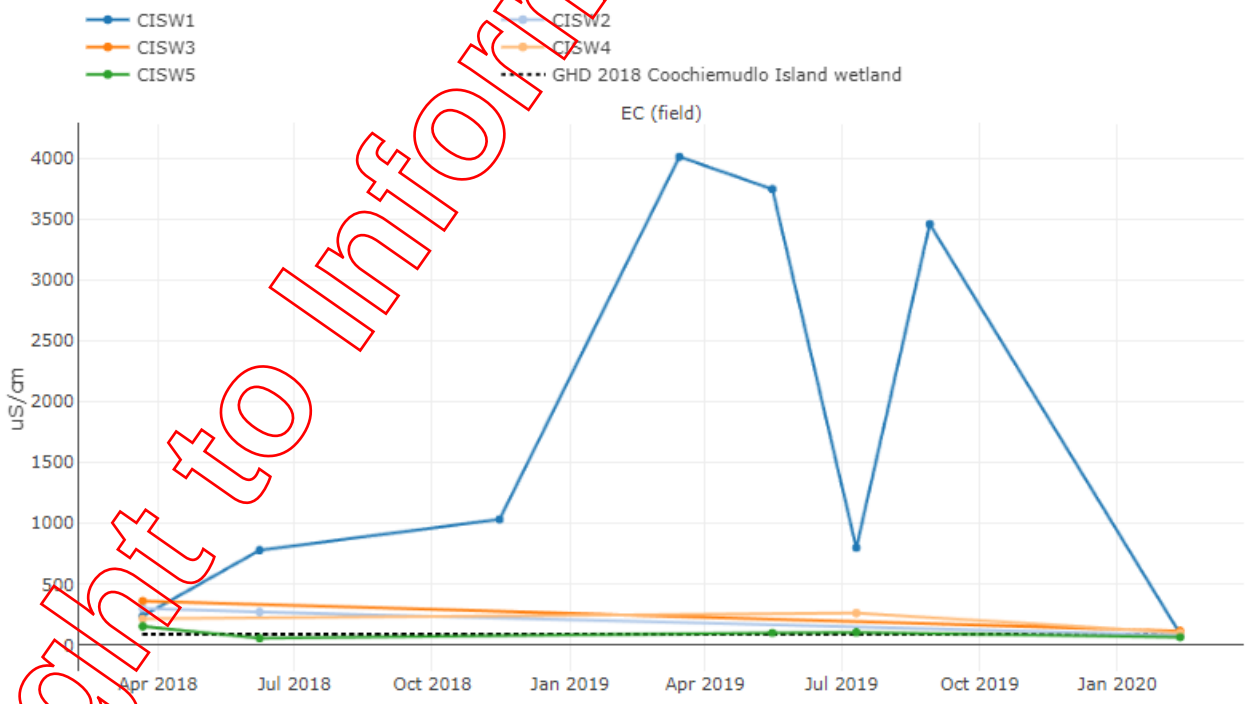



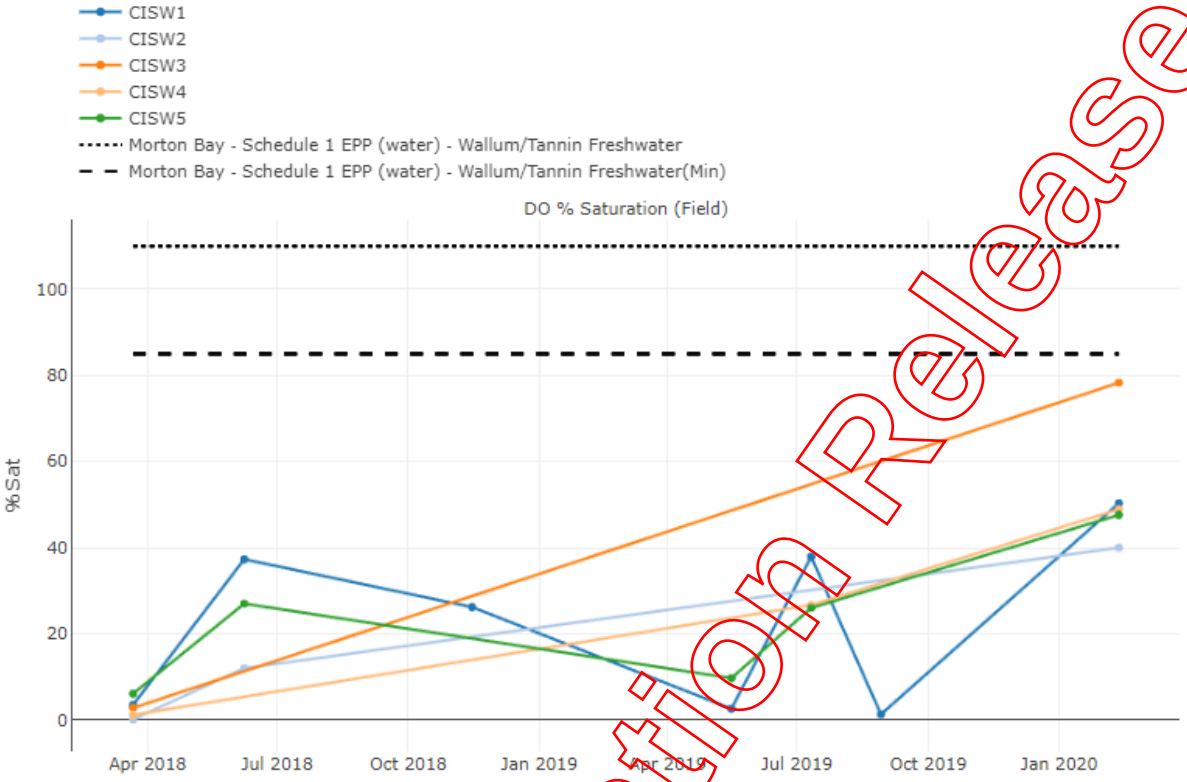


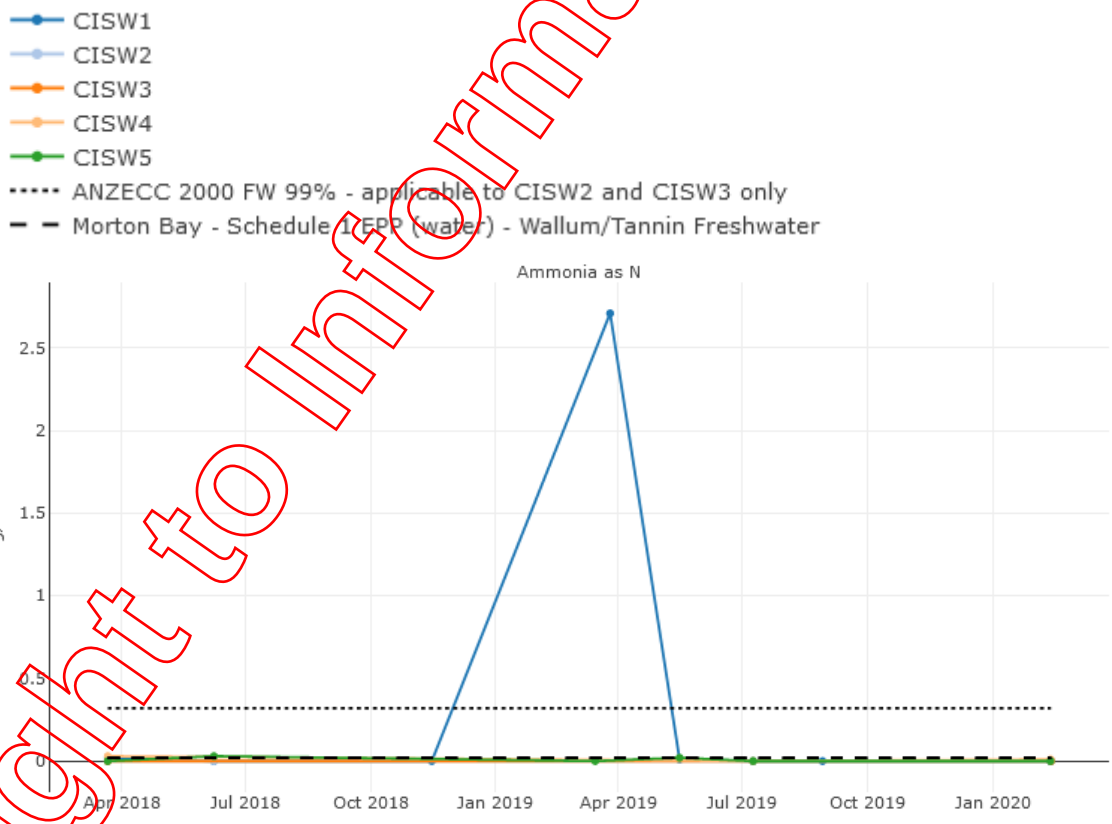
**Appendix E.**

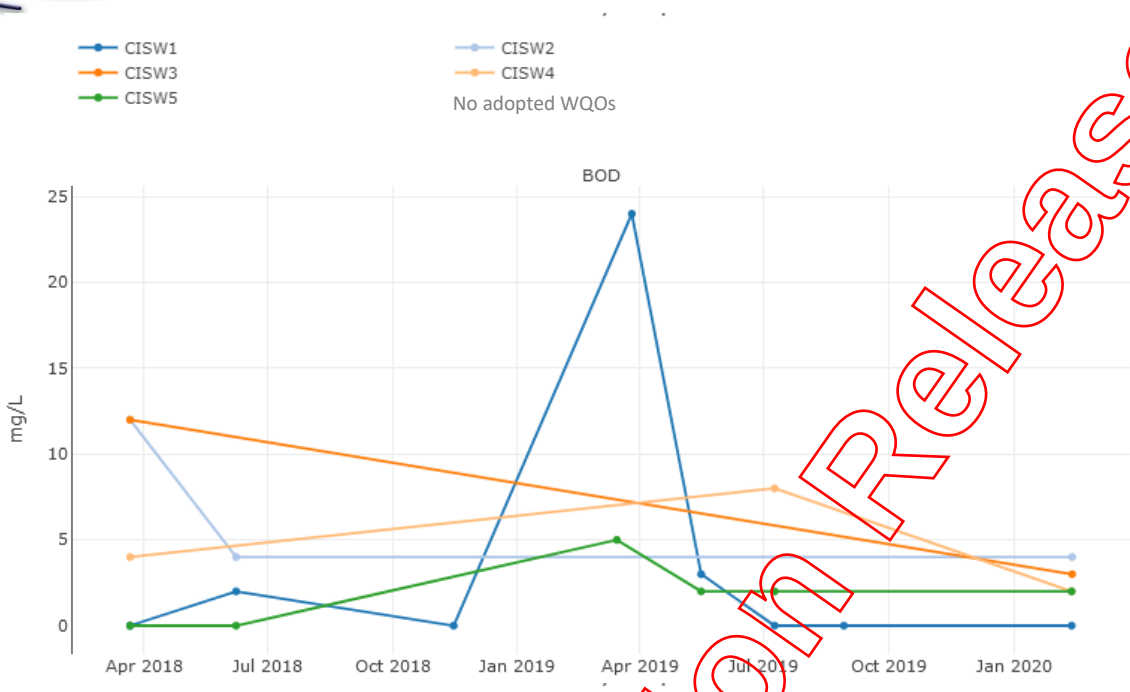
**Surface Water Graphs**

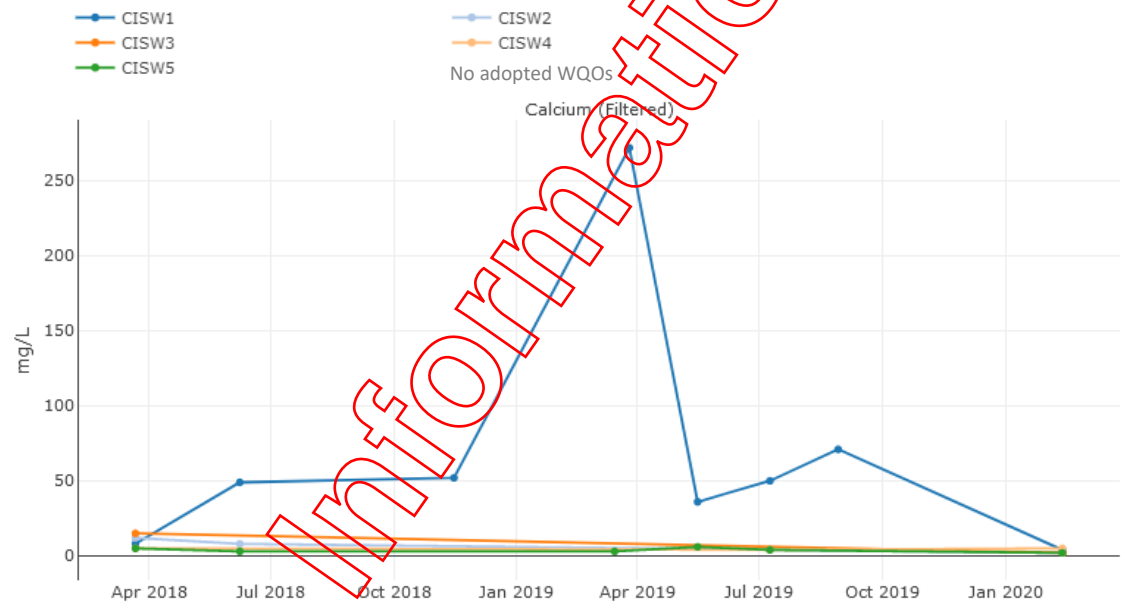


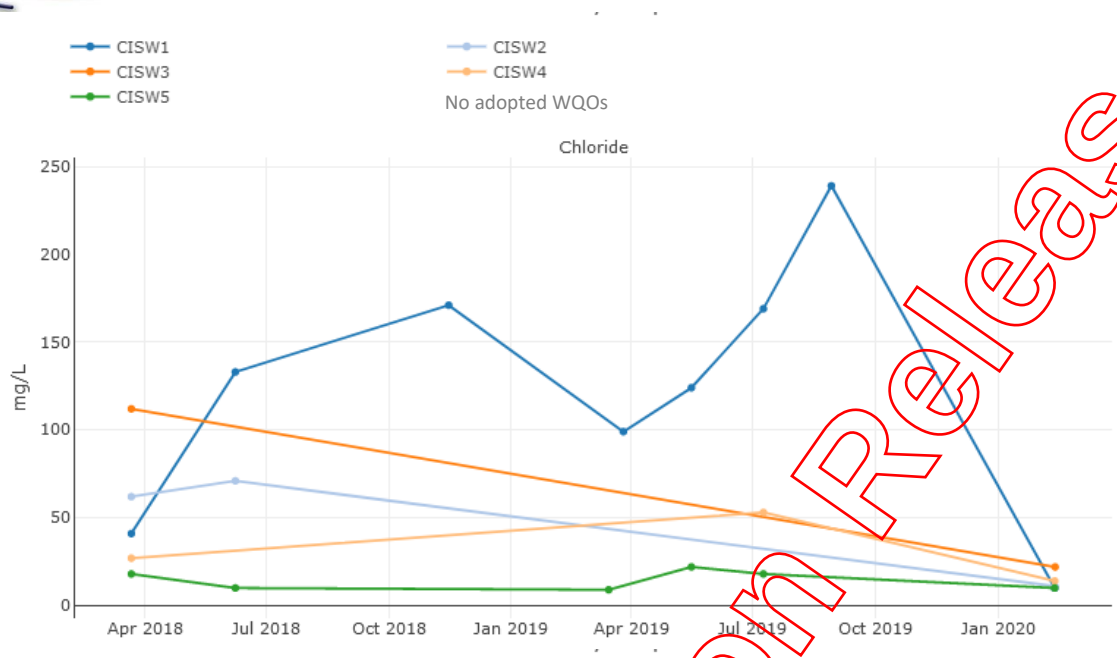



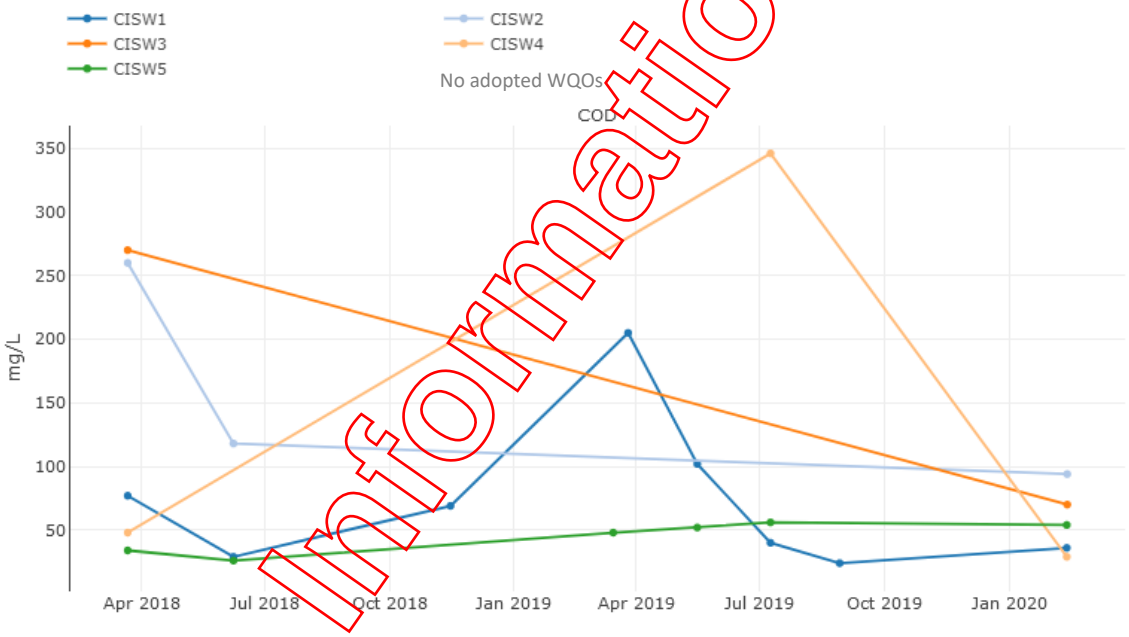


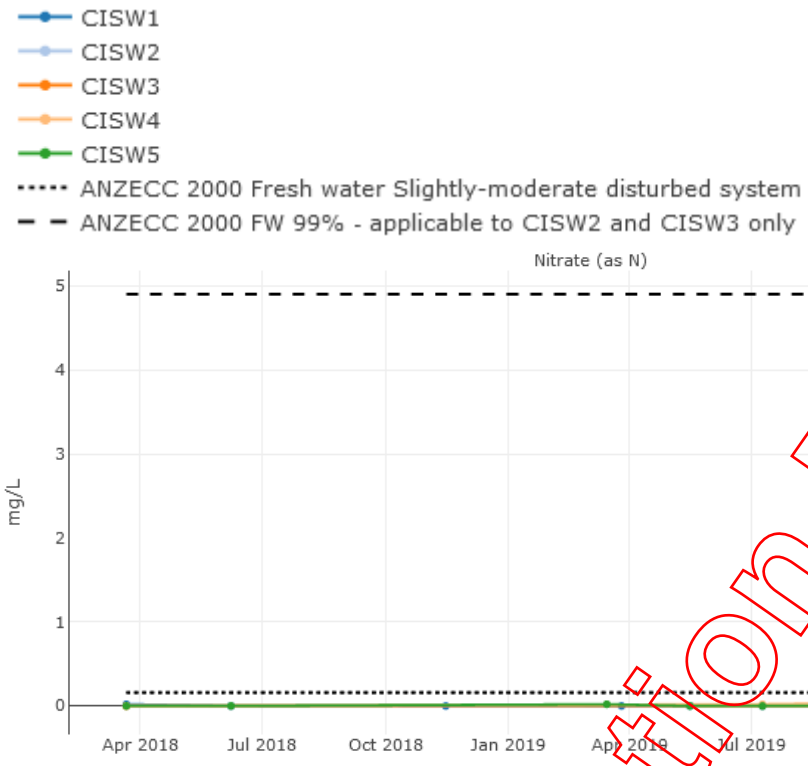



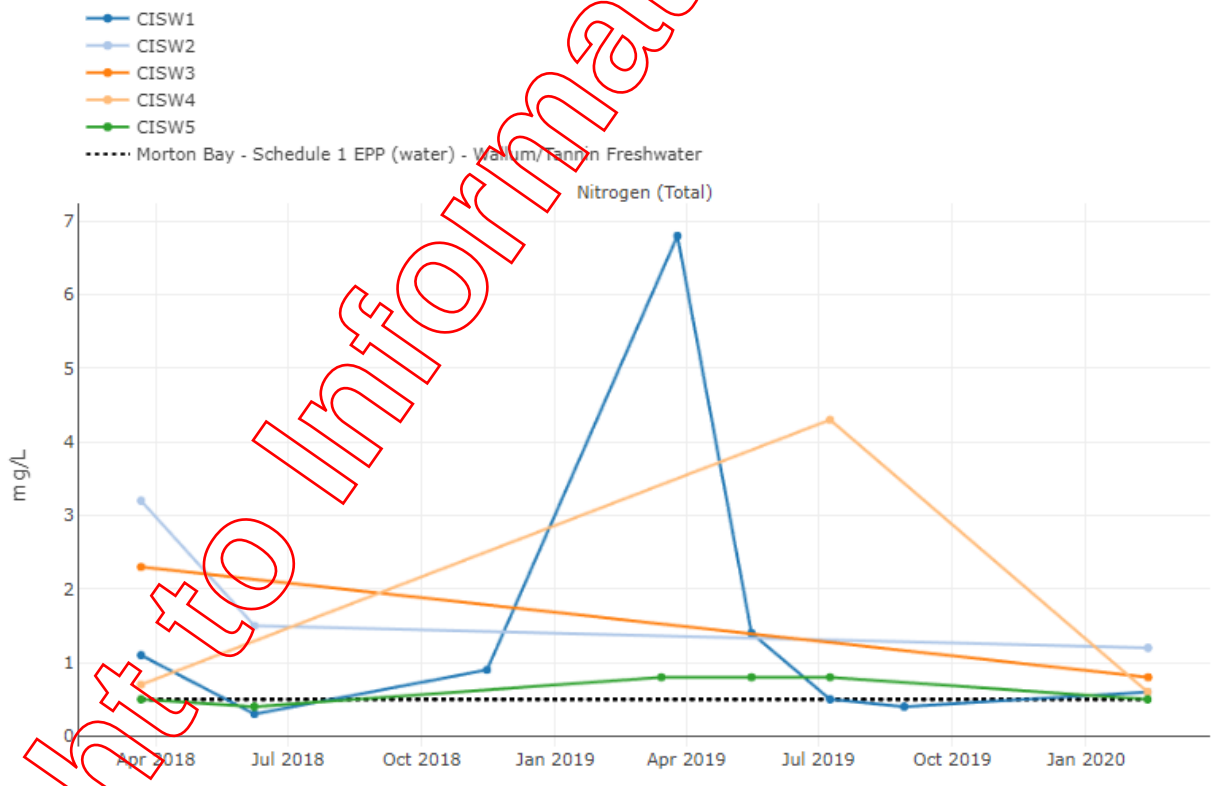


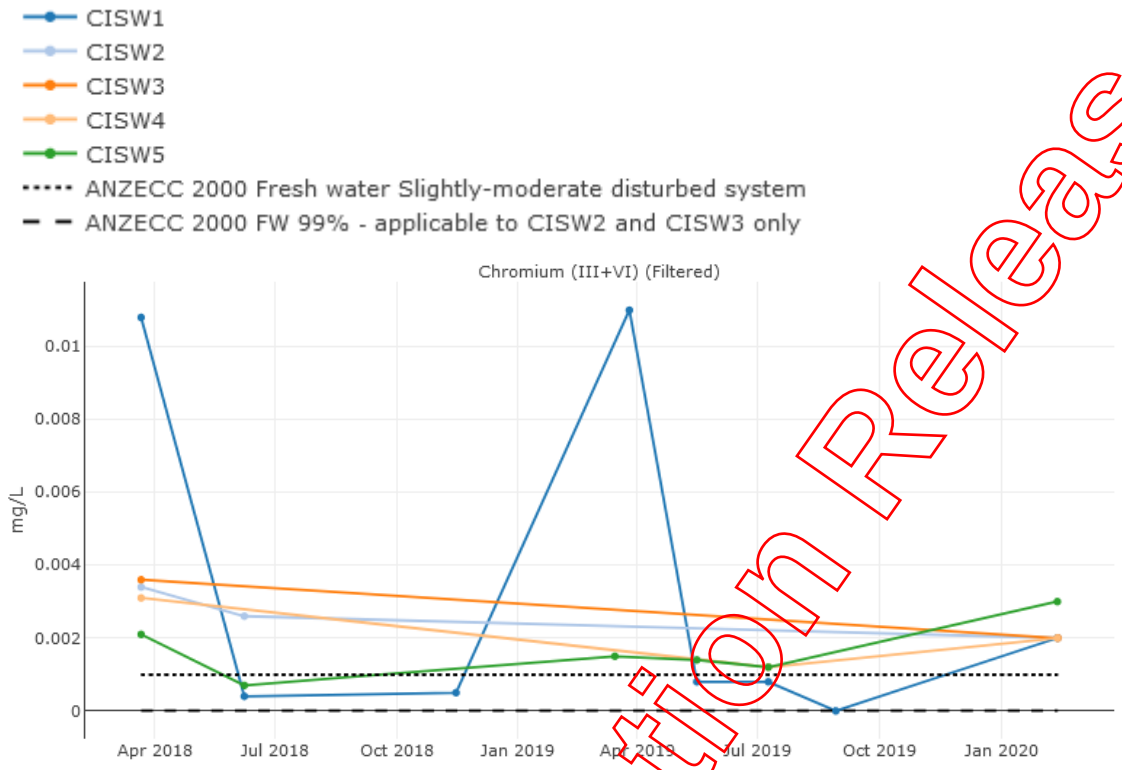



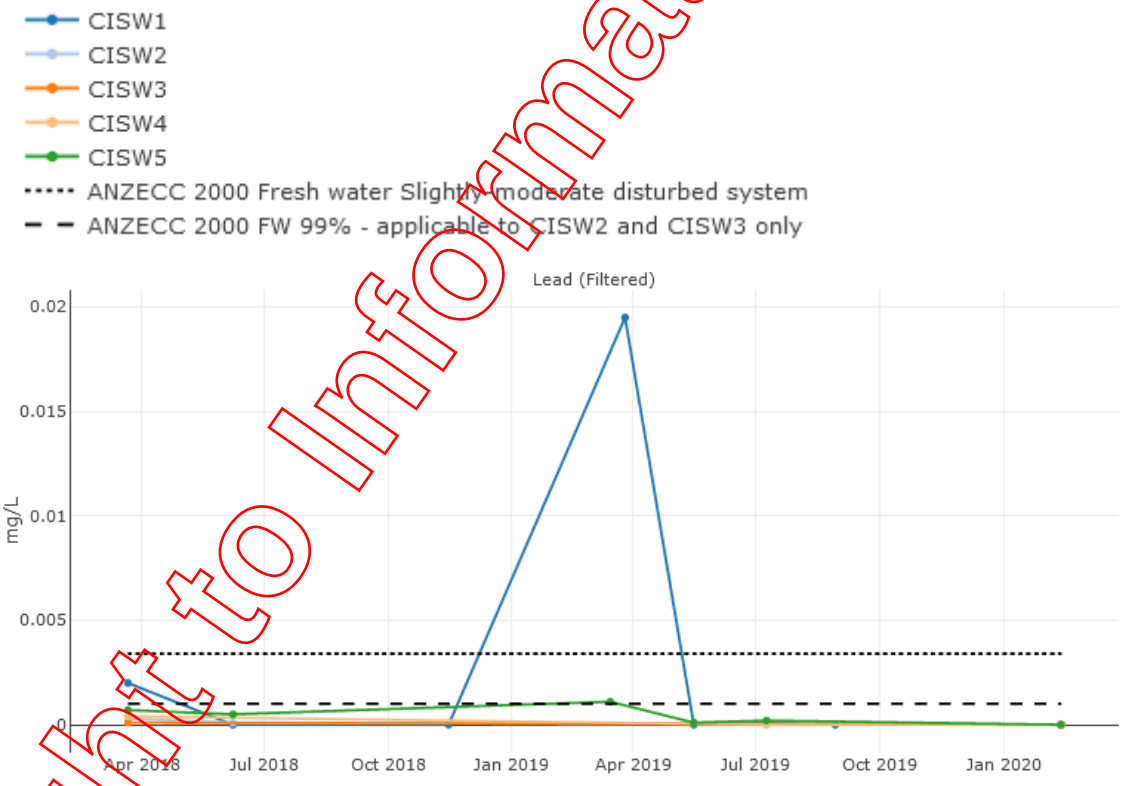


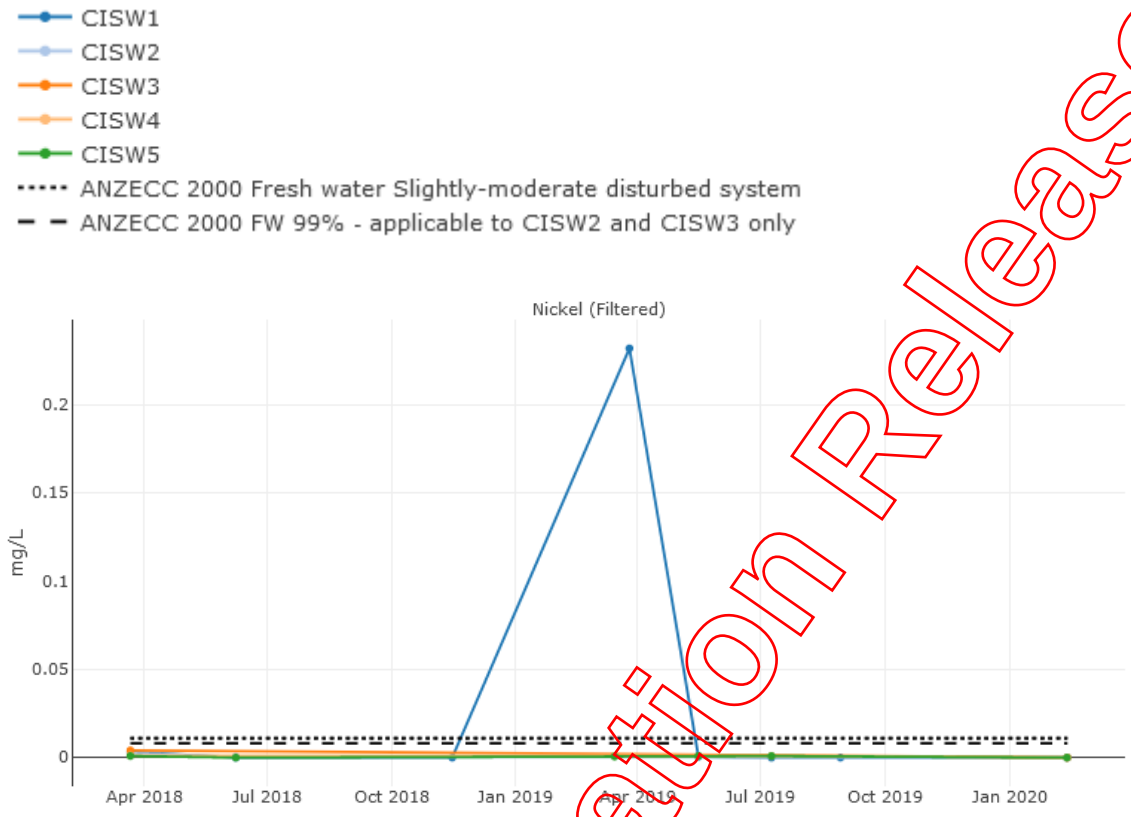



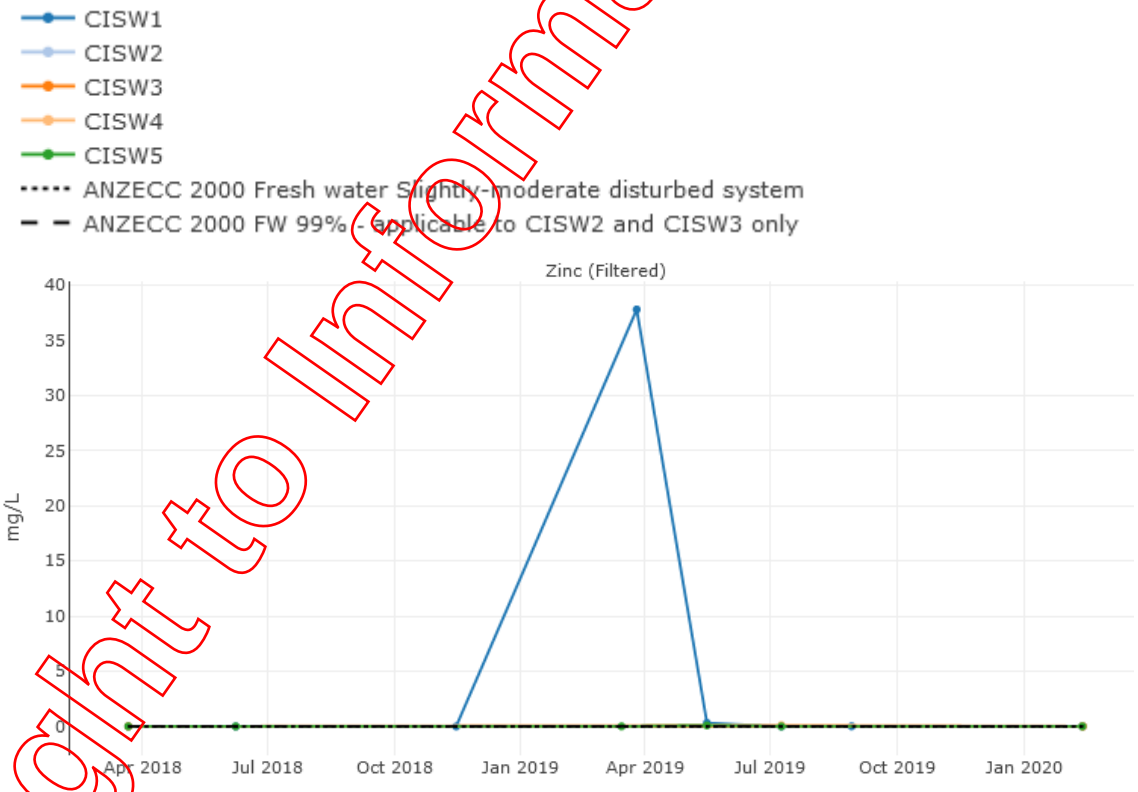






**Appendix F.**

**Laboratory Analysis Results and QA/QC Reports**

# SAMPLE RECEIPT NOTIFICATION (SRN)

**Work Order** : **EB2003894**

| | | | |
|---|---|---|---|
| Client | : **FUTURE-PLUS ENVIRONMENTAL** | Laboratory | : Environmental Division Brisbane |
| Contact | : NICHOLAS EVANS | Contact | : John Pickering |
| Address | : PO BOX 1250<br>BUDDINA QLD, AUSTRALIA 4575 | Address | : 2 Byth Street Stafford QLD Australia 4053 |
| E-mail | : | E-mail | : |
| Telephone | : +61 07 54502688 | Telephone | : +61 7 3552 8634 |
| Facsimile | : +61 07 54502686 | Facsimile | : +61-7-3243 7218 |
| Project | : 5329 Redlands | Page | : 1 of 3 |
| Order number | : | Quote number | : EB2019FUPE0003 (BN/235/18 B V7) |
| C-O-C number | : 8255 | QC Level | : NEPM 2013 B3 & ALS QC Standard |
| Site | : Coochiemudlo Is Closed LF -1 | | |
| Sampler | : KAINE PRITCHARD, NICHOLAS EVANS | | |

## Dates

| | | | |
|---|---|---|---|
| Date Samples Received | : 13-Feb-2020 10:15 | Issue Date | : 13-Feb-2020 |
| Client Requested Due Date | : 20-Feb-2020 | Scheduled Reporting Date | : **20-Feb-2020** |

## Delivery Details

| | | | |
|---|---|---|---|
| Mode of Delivery | : Carrier | Security Seal | : Intact. |
| No. of coolers/boxes | : 2 | Temperature | : 1.4°, 3.1°C - Ice present |
| Receipt Detail | : MEDIUM ESKY | No. of samples received / analysed | : 13 / 13 |

## General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised, in the absence of a metals container submitted as being indicated as field filtered, ALS has assumed these samples as filtered in-line with the analysis requested. If this is incorrect, please contact client services at ALSEnviro.Brisbane@alsglobal.com**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

## Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

## Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - ED045G Chloride by Discrete Analyser | WATER - EG020F Dissolved Metals by ICP/MS | WATER - EG049G-F Dissolved Trivalent Chromium by ICP & DA | WATER - EG050G-F Dissolved Hexavalent Chromium | WATER - EK055G Ammonia as N By Discrete Analyser | WATER - EK058G Nitrate as N by Discrete Analyser | WATER - EP005 Total Organic Carbon (TOC) |
|---|---|---|---|---|---|---|---|---|---|
| EB2003894-001 | 12-Feb-2020 14:02 | GW1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-002 | 12-Feb-2020 13:38 | GW2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-003 | 12-Feb-2020 14:51 | GW3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-004 | 12-Feb-2020 12:27 | GW5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-005 | 12-Feb-2020 15:42 | GW6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-006 | 12-Feb-2020 10:49 | CISW1 | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-007 | 12-Feb-2020 19:09 | CISW2 | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-008 | 12-Feb-2020 19:03 | CISW3 | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-009 | 12-Feb-2020 11:26 | CISW4 | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-010 | 12-Feb-2020 10:52 | CISW5 | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-011 | 12-Feb-2020 19:00 | Rinstate | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-012 | 12-Feb-2020 18:38 | Blank | ✓ | ✓ | ✓ | ✓ | | | ✓ |
| EB2003894-013 | 12-Feb-2020 19:06 | SWQA | ✓ | ✓ | ✓ | ✓ | | | ✓ |

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EA025H Suspended Solids - Standard Level | WATER - ED041G Sulfate (Turbidimetric) as SO4 2- by Discrete | WATER - EP026SP Chemical Oxygen Demand (COD) | WATER - EP030 BOD | WATER - EP075 SIM Phenols only SIM - Phenols only | WATER - NT-01 Major Cations (Ca, Mg, Na, K) | WATER - NT-07 Total Nitrogen + NO2 + NO3 + NH3 |
|---|---|---|---|---|---|---|---|---|---|
| EB2003894-001 | 12-Feb-2020 14:02 | GW1 | | ✓ | | | ✓ | ✓ | |
| EB2003894-002 | 12-Feb-2020 13:38 | GW2 | | ✓ | | | ✓ | ✓ | |
| EB2003894-003 | 12-Feb-2020 14:51 | GW3 | | ✓ | | | ✓ | ✓ | |
| EB2003894-004 | 12-Feb-2020 12:27 | GW5 | | ✓ | | | ✓ | ✓ | |
| EB2003894-005 | 12-Feb-2020 15:42 | GW6 | | ✓ | | | ✓ | ✓ | |
| EB2003894-006 | 12-Feb-2020 10:49 | CISW1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-007 | 12-Feb-2020 19:09 | CISW2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-008 | 12-Feb-2020 19:03 | CISW3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-009 | 12-Feb-2020 11:26 | CISW4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-010 | 12-Feb-2020 10:52 | CISW5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-011 | 12-Feb-2020 19:00 | Rinstate | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| | | | WATER - EA025H Suspended Solids - Standard Level | WATER - ED041G Sulfate (Turbidimetric) as SO4 2 by Discrete | WATER - EP026SP Chemical Oxygen Demand (COD) | WATER - EP030 BOD | WATER - EP075 SIM Phenols only SIM - Phenols only | WATER - NT-01 Major Cations (Ca, Mg, Na, K) | WATER - NT-07 Total Nitrogen + NO2 + NO3 + NH3 |
|---|---|---|---|---|---|---|---|---|---|
| EB2003894-012 | 12-Feb-2020 18:38 | Blank | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2003894-013 | 12-Feb-2020 19:06 | SWQA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

## Requested Deliverables

| | | |
|---|---|---|
| **INVOICES** | | |
| - A4 - AU Tax Invoice (INV) | Email | accounts@future-plus.com.au |
| **JONO HOOPER** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | |
| - A4 - AU Tax Invoice (INV) | Email | |
| - Chain of Custody (CoC) (COC) | Email | |
| - EDI Format - ENMRG (ENMRG) | Email | |
| - EDI Format - XTab (XTAB) | Email | |
| **KAINE PRITCHARD** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | |
| - A4 - AU Tax Invoice (INV) | Email | |
| - Chain of Custody (CoC) (COC) | Email | |
| - EDI Format - ENMRG (ENMRG) | Email | |
| - EDI Format - XTab (XTAB) | Email | |
| **NICHOLAS EVANS** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | |
| - A4 - AU Tax Invoice (INV) | Email | |
| - Chain of Custody (CoC) (COC) | Email | |
| - EDI Format - ENMRG (ENMRG) | Email | |
| - EDI Format - XTab (XTAB) | Email | |
| **SOPHIE BLOND** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | |
| - Chain of Custody (CoC) (COC) | Email | |
| - EDI Format - ENMRG (ENMRG) | Email | |
| - EDI Format - XTab (XTAB) | Email | |

ALS Environmental

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **EB2003894** | Page | : 1 of 9 |
| **Amendment** | : **1** | | |
| Client | : **FUTURE-PLUS ENVIRONMENTAL** | Laboratory | : Environmental Division Brisbane |
| Contact | : NICHOLAS EVANS | Contact | : John Pickering |
| Address | : PO BOX 1250<br>BUDDINA QLD, AUSTRALIA 4575 | Address | : 2 Byth Street Stafford QLD Australia 4053 |
| Telephone | : +61 07 54502688 | Telephone | : +61 7 3552 8634 |
| Project | : Redland LEMP 5329 | Date Samples Received | : 13-Feb-2020 10:15 |
| Order number | : | Date Analysis Commenced | : 13-Feb-2020 |
| C-O-C number | : 8255 | Issue Date | : 04-Mar-2020 16:59 |
| Sampler | : KAINE PRITCHARD, NICHOLAS EVANS | | |
| Site | : Coochiemudlo Is Closed LF -1 | | |
| Quote number | : BN/235/18 B V7 | | |
| No. of samples received | : 13 | | |
| No. of samples analysed | : 13 | | |

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Kim McCabe | Senior Inorganic Chemist | Brisbane Inorganics, Stafford, QLD |
| Minh Wills | 2IC Organic Chemist | Brisbane Organics, Stafford, QLD |
| Morgan Lennox | | Brisbane Organics, Stafford, QLD |

## General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Amendment (4/3/2020): This report has been amended to adjust the project reference for ESDAT purposes to Redland LEMP 5329 as per Jono Hooper.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

## Analytical Results

| Sub-Matrix: GROUNDWATER (Matrix: WATER) | | | | Client sample ID | GW1 | GW2 | GW3 | GW5 | GW6 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Feb-2020 14:02 | 12-Feb-2020 13:38 | 12-Feb-2020 14:51 | 12-Feb-2020 12:27 | 12-Feb-2020 15:42 |
| Compound | CAS Number | LOR | Unit | | EB2003894-001 | EB2003894-002 | EB2003894-003 | EB2003894-004 | EB2003894-005 |
| | | | | | Result | Result | Result | Result | Result |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | 133 | 38 | 2 | 19 | 18 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | 21 | 77 | 3 | 61 | 825 |
| **ED093F: Dissolved Major Cations** | | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | | 60 | 29 | <1 | <1 | 3 |
| Magnesium | 7439-95-4 | 1 | mg/L | | 18 | 12 | <1 | 4 | 69 |
| Sodium | 7440-23-5 | 1 | mg/L | | 21 | 45 | 4 | 48 | 373 |
| Potassium | 7440-09-7 | 1 | mg/L | | 12 | 20 | <1 | <1 | 2 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | 0.12 | 0.30 | 0.37 | 0.02 | 7.60 |
| Chromium | 7440-47-3 | 0.001 | mg/L | | <0.001 | 0.002 | 0.001 | <0.001 | 0.001 |
| Cobalt | 7440-48-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | 0.002 |
| Lead | 7439-92-1 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | 0.003 |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Tin | 7440-31-5 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | | <0.005 | 0.036 | <0.005 | <0.005 | 0.022 |
| Iron | 7439-89-6 | 0.05 | mg/L | | <0.05 | 0.16 | 0.13 | <0.05 | 0.11 |
| **EG049F: Dissolved Trivalent Chromium** | | | | | | | | | |
| Trivalent Chromium | 16065-83-1 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | 0.03 | 0.02 | <0.01 | <0.01 | 0.02 |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | 0.85 | 0.93 | 0.04 | 1.95 | <0.01 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | 0.85 | 0.94 | 0.04 | 1.95 | <0.01 |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | | 5 | 10 | 5 | <1 | <1 |

## Analytical Results

| Sub-Matrix: GROUNDWATER (Matrix: WATER) | | | | Client sample ID | GW1 | GW2 | GW3 | GW5 | GW6 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Feb-2020 14:02 | 12-Feb-2020 13:38 | 12-Feb-2020 14:51 | 12-Feb-2020 12:27 | 12-Feb-2020 15:42 |
| Compound | CAS Number | LOR | Unit | | EB2003894-001 | EB2003894-002 | EB2003894-003 | EB2003894-004 | EB2003894-005 |
| | | | | | Result | Result | Result | Result | Result |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | | |
| **Phenol** | 108-95-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2-Chlorophenol** | 95-57-8 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2-Methylphenol** | 95-48-7 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **3- & 4-Methylphenol** | 1319-77-3 | 2.0 | µg/L | | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **2-Nitrophenol** | 88-75-5 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2.4-Dimethylphenol** | 105-67-9 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2.4-Dichlorophenol** | 120-83-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2.6-Dichlorophenol** | 87-65-0 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **4-Chloro-3-methylphenol** | 59-50-7 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2.4.6-Trichlorophenol** | 88-06-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **2.4.5-Trichlorophenol** | 95-95-4 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| **Pentachlorophenol** | 87-86-5 | 2.0 | µg/L | | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| **Phenol-d6** | 13127-88-3 | 1.0 | % | | **28.0** | **30.2** | **28.3** | **30.2** | **30.8** |
| **2-Chlorophenol-D4** | 93951-73-6 | 1.0 | % | | **74.7** | **81.7** | **75.8** | **82.2** | **80.2** |
| **2.4.6-Tribromophenol** | 118-79-6 | 1.0 | % | | **102** | **113** | **93.6** | **103** | **108** |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 1.0 | % | | **71.2** | **75.4** | **71.7** | **74.2** | **75.4** |
| **Anthracene-d10** | 1719-06-8 | 1.0 | % | | **85.9** | **89.4** | **85.1** | **88.4** | **90.9** |
| **4-Terphenyl-d14** | 1718-51-0 | 1.0 | % | | **93.5** | **96.0** | **91.1** | **94.2** | **98.9** |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | CISW1 | CISW2 | CISW3 | CISW4 | CISW5 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Feb-2020 10:49 | 12-Feb-2020 19:09 | 12-Feb-2020 19:03 | 12-Feb-2020 11:26 | 12-Feb-2020 10:52 |
| Compound | CAS Number | LOR | Unit | | EB2003894-006 | EB2003894-007 | EB2003894-008 | EB2003894-009 | EB2003894-010 |
| | | | | | Result | Result | Result | Result | Result |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | | 14 | 6 | <5 | 9 | 34 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | <1 | <1 | 6 | 5 | <1 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | 10 | 11 | 22 | 14 | 10 |
| **ED093F: Dissolved Major Cations** | | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | | 4 | 2 | 2 | 5 | 2 |
| Magnesium | 7439-95-4 | 1 | mg/L | | 2 | 1 | 2 | 2 | 1 |
| Sodium | 7440-23-5 | 1 | mg/L | | 8 | 10 | 14 | 11 | 7 |
| Potassium | 7440-09-7 | 1 | mg/L | | 4 | 4 | 3 | 2 | 2 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | 1.85 | 0.89 | 0.44 | 0.36 | 1.83 |
| Chromium | 7440-47-3 | 0.001 | mg/L | | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 |
| Cobalt | 7440-48-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Lead | 7439-92-1 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Tin | 7440-31-5 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | | 0.008 | 0.007 | <0.005 | 0.022 | 0.007 |
| Iron | 7439-89-6 | 0.05 | mg/L | | 0.69 | 0.37 | 0.31 | 0.27 | 0.74 |
| **EG049F: Dissolved Trivalent Chromium** | | | | | | | | | |
| Trivalent Chromium | 16065-83-1 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | 0.01 | 0.02 | <0.01 | 0.07 | <0.01 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | 0.01 | 0.02 | <0.01 | 0.07 | <0.01 |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | CISW1 | CISW2 | CISW3 | CISW4 | CISW5 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Feb-2020 10:49 | 12-Feb-2020 19:09 | 12-Feb-2020 19:03 | 12-Feb-2020 11:26 | 12-Feb-2020 10:52 |
| Compound | CAS Number | LOR | Unit | | EB2003894-006 | EB2003894-007 | EB2003894-008 | EB2003894-009 | EB2003894-010 |
| | | | | | Result | Result | Result | Result | Result |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | 0.6 | 1.2 | 0.8 | 0.5 | 0.5 |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | 0.6 | 1.2 | 0.8 | 0.6 | 0.5 |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | | 13 | 39 | 31 | 12 | 11 |
| **EP026SP: Chemical Oxygen Demand (Spectrophotometric)** | | | | | | | | | |
| Chemical Oxygen Demand | ---- | 10 | mg/L | | 36 | 94 | 70 | 29 | 54 |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| Biochemical Oxygen Demand | ---- | 2 | mg/L | | <2 | 4 | 3 | 2 | 2 |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | | |
| Phenol | 108-95-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2-Chlorophenol | 95-57-8 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2-Methylphenol | 95-48-7 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 3- & 4-Methylphenol | 1319-77-3 | 2.0 | µg/L | | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| 2-Nitrophenol | 88-75-5 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4-Dimethylphenol | 105-67-9 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4-Dichlorophenol | 120-83-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.6-Dichlorophenol | 87-65-0 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 4-Chloro-3-methylphenol | 59-50-7 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4.6-Trichlorophenol | 88-06-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| 2.4.5-Trichlorophenol | 95-95-4 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Pentachlorophenol | 87-86-5 | 2.0 | µg/L | | <2.0 | <2.0 | <2.0 | <2.0 | <2.0 |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| Phenol-d6 | 13127-88-3 | 1.0 | % | | 33.1 | 29.0 | 27.5 | 25.5 | 24.8 |
| 2-Chlorophenol-D4 | 93951-73-6 | 1.0 | % | | 84.8 | 81.4 | 74.4 | 68.8 | 76.8 |
| 2.4.6-Tribromophenol | 118-79-6 | 1.0 | % | | 116 | 118 | 116 | 103 | 93.9 |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| 2-Fluorobiphenyl | 321-60-8 | 1.0 | % | | 80.6 | 79.1 | 66.4 | 69.4 | 74.3 |
| Anthracene-d10 | 1719-06-8 | 1.0 | % | | 96.9 | 89.4 | 86.5 | 88.1 | 87.4 |
| 4-Terphenyl-d14 | 1718-51-0 | 1.0 | % | | 105 | 97.0 | 95.2 | 99.5 | 99.2 |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | Rinstate | Blank | SWQA | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Feb-2020 19:00 | 12-Feb-2020 18:38 | 12-Feb-2020 19:06 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EB2003894-011 | EB2003894-012 | EB2003894-013 | -------- | -------- |
| | | | | | Result | Result | Result | ---- | ---- |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | | <5 | <5 | <5 | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | <1 | <1 | **6** | ---- | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | <1 | <1 | **21** | ---- | ---- |
| **ED093F: Dissolved Major Cations** | | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | | <1 | <1 | **2** | ---- | ---- |
| Magnesium | 7439-95-4 | 1 | mg/L | | <1 | <1 | **2** | ---- | ---- |
| Sodium | 7440-23-5 | 1 | mg/L | | <1 | <1 | **14** | ---- | ---- |
| Potassium | 7440-09-7 | 1 | mg/L | | <1 | <1 | **3** | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | <0.01 | <0.01 | **0.43** | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Cobalt | 7440-48-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Selenium | 7782-49-2 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| Silver | 7440-22-4 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Tin | 7440-31-5 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | | <0.005 | <0.005 | <0.005 | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | | <0.05 | <0.05 | **0.31** | ---- | ---- |
| **EG049F: Dissolved Trivalent Chromium** | | | | | | | | | |
| Trivalent Chromium | 16065-83-1 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | | | |
| Hexavalent Chromium | 18540-29-9 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | Rinstate | Blank | SWQA | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 12-Feb-2020 19:00 | 12-Feb-2020 18:38 | 12-Feb-2020 19:06 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EB2003894-011 | EB2003894-012 | EB2003894-013 | -------- | -------- |
| | | | | | Result | Result | Result | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | <0.1 | <0.1 | 0.8 | ---- | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | <0.1 | <0.1 | 0.8 | ---- | ---- |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | | <1 | <1 | 31 | ---- | ---- |
| **EP026SP: Chemical Oxygen Demand (Spectrophotometric)** | | | | | | | | | |
| Chemical Oxygen Demand | ---- | 10 | mg/L | | <10 | <10 | 74 | ---- | ---- |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| Biochemical Oxygen Demand | ---- | 2 | mg/L | | <2 | <2 | 4 | ---- | ---- |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | | | |
| Phenol | 108-95-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2-Chlorophenol | 95-57-8 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2-Methylphenol | 95-48-7 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 3- & 4-Methylphenol | 1319-77-3 | 2.0 | µg/L | | <2.0 | <2.0 | <2.0 | ---- | ---- |
| 2-Nitrophenol | 88-75-5 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2.4-Dimethylphenol | 105-67-9 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2.4-Dichlorophenol | 120-83-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2.6-Dichlorophenol | 87-65-0 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 4-Chloro-3-methylphenol | 59-50-7 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2.4.6-Trichlorophenol | 88-06-2 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| 2.4.5-Trichlorophenol | 95-95-4 | 1.0 | µg/L | | <1.0 | <1.0 | <1.0 | ---- | ---- |
| Pentachlorophenol | 87-86-5 | 2.0 | µg/L | | <2.0 | <2.0 | <2.0 | ---- | ---- |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | | | | | | | |
| Phenol-d6 | 13127-88-3 | 1.0 | % | | 26.4 | 28.8 | 23.4 | ---- | ---- |
| 2-Chlorophenol-D4 | 93951-73-6 | 1.0 | % | | 72.9 | 77.6 | 67.5 | ---- | ---- |
| 2.4.6-Tribromophenol | 118-79-6 | 1.0 | % | | 77.9 | 80.2 | 100 | ---- | ---- |
| **EP075(SIM)T: PAH Surrogates** | | | | | | | | | |
| 2-Fluorobiphenyl | 321-60-8 | 1.0 | % | | 73.5 | 75.5 | 70.2 | ---- | ---- |
| Anthracene-d10 | 1719-06-8 | 1.0 | % | | 83.1 | 87.9 | 82.4 | ---- | ---- |
| 4-Terphenyl-d14 | 1718-51-0 | 1.0 | % | | 91.5 | 99.0 | 93.1 | ---- | ---- |

## Surrogate Control Limits

| Sub-Matrix: GROUNDWATER | | Recovery Limits (%) | |
|---|---|---|---|
| Compound | CAS Number | Low | High |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | |
| Phenol-d6 | 13127-88-3 | 10 | 72 |
| 2-Chlorophenol-D4 | 93951-73-6 | 27 | 130 |
| 2.4.6-Tribromophenol | 118-79-6 | 19 | 181 |
| **EP075(SIM)T: PAH Surrogates** | | | |
| 2-Fluorobiphenyl | 321-60-8 | 14 | 146 |
| Anthracene-d10 | 1719-06-8 | 35 | 137 |
| 4-Terphenyl-d14 | 1718-51-0 | 36 | 154 |

| Sub-Matrix: SURFACE WATER | | Recovery Limits (%) | |
|---|---|---|---|
| Compound | CAS Number | Low | High |
| **EP075(SIM)S: Phenolic Compound Surrogates** | | | |
| Phenol-d6 | 13127-88-3 | 10 | 72 |
| 2-Chlorophenol-D4 | 93951-73-6 | 27 | 130 |
| 2.4.6-Tribromophenol | 118-79-6 | 19 | 181 |
| **EP075(SIM)T: PAH Surrogates** | | | |
| 2-Fluorobiphenyl | 321-60-8 | 14 | 146 |
| Anthracene-d10 | 1719-06-8 | 35 | 137 |
| 4-Terphenyl-d14 | 1718-51-0 | 36 | 154 |

ALS Environmental

# QA/QC Compliance Assessment to assist with Quality Review

| | | | |
|---|---|---|---|
| **Work Order** | : **EB2003894** | Page | : 1 of 9 |
| **Amendment** | : **1** | | |
| Client | : **FUTURE-PLUS ENVIRONMENTAL** | Laboratory | : Environmental Division Brisbane |
| Contact | : NICHOLAS EVANS | Telephone | : +61 7 3552 8634 |
| Project | : Redland LEMP 5329 | Date Samples Received | : 13-Feb-2020 |
| Site | : Coochiemudlo Is Closed LF -1 | Issue Date | : 04-Mar-2020 |
| Sampler | : KAINE PRITCHARD, NICHOLAS EVANS | No. of samples received | : 13 |
| Order number | : | No. of samples analysed | : 13 |

**This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.**

Brief method summaries and references are also provided to assist in traceability.

## Summary of Outliers

### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

### Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

### Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

## Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

| Quality Control Sample Type / Method | Count QC | Count Regular | Rate (%) Actual | Rate (%) Expected | Quality Control Specification |
|---|---|---|---|---|---|
| **Laboratory Duplicates (DUP)** | | | | | |
| PAH/Phenols (GC/MS - SIM) | 0 | 18 | 0.00 | 10.00 | NEPM 2013 B3 & ALS QC Standard |
| **Matrix Spikes (MS)** | | | | | |
| PAH/Phenols (GC/MS - SIM) | 0 | 18 | 0.00 | 5.00 | NEPM 2013 B3 & ALS QC Standard |

## Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others, 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation: Date extracted | Due for extraction | Evaluation | Analysis: Date analysed | Due for analysis | Evaluation |
|---|---|---|---|---|---|---|---|
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | |
| **Clear Plastic Bottle - Natural (EA025H)** | | | | | | | |
| CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **19-Feb-2020** | 19-Feb-2020 | ✓ |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED041G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **13-Feb-2020** | 11-Mar-2020 | ✓ |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (ED045G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **13-Feb-2020** | 11-Mar-2020 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **ED093F: Dissolved Major Cations** | | | | | | | |
| **Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **18-Feb-2020** | 11-Mar-2020 | ✓ |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **18-Feb-2020** | 10-Aug-2020 | ✓ |
| **EG050F: Dissolved Hexavalent Chromium** | | | | | | | |
| **Clear Plastic Bottle - NaOH Filtered (EG050G-F)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **14-Feb-2020** | 11-Mar-2020 | ✓ |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK055G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **13-Feb-2020** | 11-Mar-2020 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK057G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **13-Feb-2020** | 14-Feb-2020 | ✓ |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK059G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **13-Feb-2020** | 11-Mar-2020 | ✓ |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK061G)** | | | | | | | |
| CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **17-Feb-2020** | 11-Mar-2020 | ✓ | **17-Feb-2020** | 11-Mar-2020 | ✓ |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | |
| **Amber TOC Vial - Sulfuric Acid (EP005)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **14-Feb-2020** | 11-Mar-2020 | ✓ |
| **EP026SP: Chemical Oxygen Demand (Spectrophotometric)** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EP026SP)** | | | | | | | |
| CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | ---- | **17-Feb-2020** | 11-Mar-2020 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | |
| **BOD Bottle Unpreserved (EP030)** | | | | | | | |
| CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **----** | ---- | --- | **13-Feb-2020** | 14-Feb-2020 | ✓ |
| **EP075(SIM)A: Phenolic Compounds** | | | | | | | |
| **Amber Glass Bottle - Unpreserved (EP075(SIM))** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **12-Feb-2020** | **14-Feb-2020** | 19-Feb-2020 | ✓ | **14-Feb-2020** | 25-Mar-2020 | ✓ |

# Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Duplicates (DUP)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Biochemical Oxygen Demand (BOD) | EP030 | 4 | 32 | **12.50** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 2 | 14 | **14.29** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 2 | 16 | **12.50** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 4 | 33 | **12.12** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite B | EG020B-F | 2 | 14 | **14.29** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 2 | 17 | **11.76** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved | ED093F | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 18 | **11.11** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| PAH/Phenols (GC/MS - SIM) | EP075(SIM) | 0 | 18 | **0.00** | **10.00** | × | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 16 | **12.50** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Suspended Solids (High Level) | EA025H | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 15 | **13.33** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 2 | 19 | **10.53** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| **Laboratory Control Samples (LCS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Biochemical Oxygen Demand (BOD) | EP030 | 2 | 32 | **6.25** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 2 | 14 | **14.29** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 2 | 16 | **12.50** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 33 | **6.06** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite B | EG020B-F | 1 | 14 | **7.14** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 17 | **5.88** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved | ED093F | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 18 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| PAH/Phenols (GC/MS - SIM) | EP075(SIM) | 1 | 18 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 16 | **12.50** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Suspended Solids (High Level) | EA025H | 3 | 20 | **15.00** | **15.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 15 | **6.67** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 2 | 19 | **10.53** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| **Method Blanks (MB)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Biochemical Oxygen Demand (BOD) | EP030 | 2 | 32 | **6.25** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 1 | 14 | **7.14** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 1 | 16 | **6.25** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Method Blanks (MB) - Continued** | | | | | | | |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 33 | **6.06** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite B | EG020B-F | 1 | 14 | **7.14** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 17 | **5.88** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved | ED093F | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 18 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| PAH/Phenols (GC/MS - SIM) | EP075(SIM) | 1 | 18 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 16 | **6.25** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Suspended Solids (High Level) | EA025H | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 15 | **6.67** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 1 | 19 | **5.26** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| **Matrix Spikes (MS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 1 | 14 | **7.14** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 1 | 16 | **6.25** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 33 | **6.06** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | 1 | 17 | **5.88** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 18 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| PAH/Phenols (GC/MS - SIM) | EP075(SIM) | 0 | 18 | **0.00** | **5.00** | × | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 16 | **6.25** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 15 | **6.67** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 1 | 19 | **5.26** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |

## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Suspended Solids (High Level) | EA025H | WATER | In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3) |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | WATER | In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3) |
| Chloride by Discrete Analyser | ED045G | WATER | In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003 |
| Major Cations - Dissolved | ED093F | WATER | In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3)<br><br>Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3)<br><br>Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3) |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | WATER | In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Dissolved Metals by ICP-MS - Suite B | EG020B-F | WATER | In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Trivalent Chromium - Dissolved | EG049G-F | WATER | In house: Referenced to APHA 3500 Cr-B & 3120/3125. Trivalent Chromium is the difference between total dissolved and dissolved hexavalent chromium. |
| Hexavalent Chromium by Discrete Analyser - Dissolved | EG050G-F | WATER | In house: Referenced to APHA 3500 Cr-A & B. Samples are 0.45µm filtered prior to analysis. Hexavalent chromium is determined directly on water sample by Descrete Analyser as received by pH adjustment and colour development using dephenylcarbazide. Each run of samples is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) |
| Ammonia as N by Discrete analyser | EK055G | WATER | In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Nitrite as N by Discrete Analyser | EK057G | WATER | In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Nitrate as N by Discrete Analyser | EK058G | WATER | In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3) |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | WATER | In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | WATER | In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Nitrogen as N (TKN + Nox) By Discrete Analyser | EK062G | WATER | In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Organic Carbon | EP005 | WATER | In house: Referenced to APHA 5310 B. The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3) |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | WATER | In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloued and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents. |
| Biochemical Oxygen Demand (BOD) | EP030 | WATER | In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3) |
| PAH/Phenols (GC/MS - SIM) | EP075(SIM) | WATER | In house: Referenced to USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| TKN/TP Digestion | EK061/EK067 | WATER | In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3) |
| Separatory Funnel Extraction of Liquids | ORG14 | WATER | In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container. |

ALSCompass
SAMPLING *Intelligence*

20/2

ALS

Environmental Division
Brisbane
Work Order Reference
EB2003894

Telephone : +61-7-3243 7222

# Custody Document for Submissions via ALS Compass App

**Project:** REDLAND LANDFILLS **Client:** RCC - **Project Manager:** NICHOLAS EVANS

**Phone:** ( )

**ALS Compass COC Reference:** 8255 **# Samples:** 13 **Sampler:** NICHOLAS EVANS

**Phone:** ( )

**Turnaround Requirements:** Standard 5 DAY TAT Urgent

**Special Instructions:**

HT

**Custody:**

| Relinquished by: | Received by: | Relinquished by: | Received by: |
|---|---|---|---|
| NICHOLAS EVANS | M. Silva | | |
| Date / Time: 12/02/2020 | Date / Time: 10.15 13/2/2020 | Date / Time: | Date / Time: |

# CHAIN OF CUSTODY

COC#: **8255** *ALS Laboratory:* EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -1

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V7 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| SAMPLE DETAILS | | | | | | | ANALYSIS REQUIRED | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE | NAME | DESCRIPTION | DATE / TIME | MATRIX | TOTAL BOTTLES | ON HOLD | Table 18: Surface Water - Coochiemudlo Is - Quarterly WATER | Table 19: Groundwater - Coochiemudlo Is - Quarterly WATER | ALTERNATIVE ANALYSIS | ADDITIONAL INFORMATION |
| 001 | GW1 | | 12/02/2020 02:02 PM | Water | ALS: 6 Non ALS: 0 | No | | X | | |
| 002 | GW2 | | 12/02/2020 01:38 PM | Water | ALS: 6 Non ALS: 0 | No | | X | | |
| 003 | GW3 | | 12/02/2020 02:51 PM | Water | ALS: 6 Non ALS: 0 | No | | X | | |
| 004 | GW5 | | 12/02/2020 12:27 PM | Water | ALS: 6 Non ALS: 0 | No | | X | | |
| 005 | GW6 | | 12/02/2020 03:42 PM | Water | ALS: 6 Non ALS: 0 | No | | X | | |
| 006 | CISW1 | | 12/02/2020 10:49 AM | Water | ALS: 7 Non ALS: 0 | No | X | | | |
| 007 | CISW2 | | 12/02/2020 07:09 PM | Water | ALS: 7 Non ALS: 0 | No | X | | | |
| 008 | CISW3 | | 12/02/2020 07:03 PM | Water | ALS: 7 Non ALS: 0 | No | X | | | |
| 009 | CISW4 | | 12/02/2020 11:26 AM | Water | ALS: 7 Non ALS: 0 | No | X | | | |

# CHAIN OF CUSTODY

ALS COC#: 8255 *ALS Laboratory:* EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -1

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V7 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| SAMPLE DETAILS | | | | | | | ANALYSIS REQUIRED | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE | NAME | DESCRIPTION | DATE / TIME | MATRIX | TOTAL BOTTLES | ON HOLD | Table 18: Surface Water - Coochiemudlo Is - Quarterly WATER | Table 19: Groundwater - Coochiemudlo Is - Quarterly WATER | ALTERNATIVE ANALYSIS | ADDITIONAL INFORMATION |
| 010 | CISW5 | | 12/02/2020 10:52 AM | Water | ALS: 7 Non ALS: 0 | No | X | | | |
| 011 | Rinstate | | 12/02/2020 07:00 PM | Water | ALS: 7 Non ALS: 0 | No | X | | | |
| 012 | Blank | | 12/02/2020 06:38 PM | Water | ALS: 7 Non ALS: 0 | No | X | | | |
| 013 | SWQA | | 12/02/2020 07:06 PM | Water | ALS: 7 Non ALS: 0 | No | X | | | |

# CHAIN OF CUSTODY

ALS COC#: 8255 ALS Laboratory: EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -1

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V7 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| SAMPLE | SAMPLE NAME | BOTTLE NAME | VOLUME | BARCODE | TYPE | FILTERED | REASON |
|---|---|---|---|---|---|---|---|
| 001 | GW1 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019034110 | Purple | No | |
| 001 | GW1 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719042475 | Orange | No | |
| 001 | GW1 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022525 | Purple | No | |
| 001 | GW1 | Clear Plastic Bottle - Natural | 250 mL | 00070519194110 | Green | No | |
| 001 | GW1 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198009877 | Red | Yes | |
| 001 | GW1 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219013205 | Blue | No | |
| 002 | GW2 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198009866 | Red | Yes | |
| 002 | GW2 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012857 | Blue | No | |
| 002 | GW2 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033991 | Purple | No | |
| 002 | GW2 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022608 | Purple | No | |
| 002 | GW2 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043972 | Orange | No | |
| 002 | GW2 | Clear Plastic Bottle - Natural | 250 mL | 00070519194279 | Green | No | |
| 003 | GW3 | Clear Plastic Bottle - Natural | 250 mL | 00070519194144 | Green | No | |
| 003 | GW3 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719061824 | Orange | No | |
| 003 | GW3 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019034012 | Purple | No | |
| 003 | GW3 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022590 | Purple | No | |
| 003 | GW3 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198009925 | Red | Yes | |
| 003 | GW3 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219013185 | Blue | No | |
| 004 | GW5 | Amber Glass Bottle - Unpreserved | 100 mL | 00400219003895 | Orange | No | |
| 004 | GW5 | Clear Plastic Bottle - Natural | 250 mL | 00070519194195 | Green | No | |
| 004 | GW5 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198009842 | Red | Yes | |
| 004 | GW5 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033374 | Purple | No | |
| 004 | GW5 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219019234 | Blue | No | |
| 004 | GW5 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022605 | Purple | No | |
| 005 | GW6 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219013224 | Blue | No | |
| 005 | GW6 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198009929 | Red | Yes | |

# CHAIN OF CUSTODY

ALS COC#: 8255 *ALS Laboratory:* EB Brisbane

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -1

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V7 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 005 | GW6 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019034230 | Purple | No | |
| 005 | GW6 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022594 | Purple | No | |
| 005 | GW6 | Amber Glass Bottle - Unpreserved | 100 mL | 00400219003920 | Orange | No | |
| 005 | GW6 | Clear Plastic Bottle - Natural | 250 mL | 00070519194150 | Green | No | |
| 006 | CISW1 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012625 | Blue | No | |
| 006 | CISW1 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120199043617 | Red | Yes | |
| 006 | CISW1 | BOD Bottle Unpreserved | 250 mL | 00070519194224 | Green | No | |
| 006 | CISW1 | Clear Plastic Bottle - Natural | 250 mL | 00070519194120 | Green | No | |
| 006 | CISW1 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033459 | Purple | No | |
| 006 | CISW1 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022536 | Purple | No | |
| 006 | CISW1 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043991 | Orange | No | |
| 007 | CISW2 | BOD Bottle Unpreserved | 250 mL | 00070519194113 | Green | No | |
| 007 | CISW2 | Clear Plastic Bottle - Natural | 250 mL | 00070519194133 | Green | No | |
| 007 | CISW2 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012692 | Blue | No | |
| 007 | CISW2 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033400 | Purple | No | |
| 007 | CISW2 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120219047447 | Red | Yes | |
| 007 | CISW2 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022522 | Purple | No | |
| 007 | CISW2 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043870 | Orange | No | |
| 008 | CISW3 | BOD Bottle Unpreserved | 250 mL | 00070519194232 | Green | No | |
| 008 | CISW3 | Clear Plastic Bottle - Natural | 250 mL | 00070519194228 | Green | No | |
| 008 | CISW3 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120219047450 | Red | Yes | |
| 008 | CISW3 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033384 | Purple | No | |
| 008 | CISW3 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012698 | Blue | No | |
| 008 | CISW3 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022576 | Purple | No | |
| 008 | CISW3 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043925 | Orange | No | |
| 009 | CISW4 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012781 | Blue | No | |
| 009 | CISW4 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120219047457 | Red | Yes | |

# CHAIN OF CUSTODY

ALS COC#: 8255 ALS Laboratory: EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -1

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V7 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 009 | CISW4 | Clear Plastic Bottle - Natural | 250 mL | 00070519040285 | Green | No | |
| 009 | CISW4 | BOD Bottle Unpreserved | 250 mL | 00070519194185 | Green | No | |
| 009 | CISW4 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033083 | Purple | No | |
| 009 | CISW4 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719061817 | Orange | No | |
| 009 | CISW4 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022610 | Purple | No | |
| 010 | CISW5 | BOD Bottle Unpreserved | 250 mL | 00070519194286 | Green | No | |
| 010 | CISW5 | Clear Plastic Bottle - Natural | 250 mL | 00070519194258 | Green | No | |
| 010 | CISW5 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120219047520 | Red | Yes | |
| 010 | CISW5 | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012812 | Blue | No | |
| 010 | CISW5 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019057986 | Purple | No | |
| 010 | CISW5 | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043836 | Orange | No | |
| 010 | CISW5 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022544 | Purple | No | |
| 011 | Rinstate | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101018064008 | Purple | No | |
| 011 | Rinstate | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198018708 | Red | Yes | |
| 011 | Rinstate | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012833 | Blue | No | |
| 011 | Rinstate | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043987 | Orange | No | |
| 011 | Rinstate | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022597 | Purple | No | |
| 011 | Rinstate | BOD Bottle Unpreserved | 250 mL | 00070219096268 | Green | No | |
| 011 | Rinstate | Clear Plastic Bottle - Natural | 250 mL | 00070219096171 | Green | No | |
| 012 | Blank | BOD Bottle Unpreserved | 250 mL | 00070519194169 | Green | No | |
| 012 | Blank | Clear Plastic Bottle - Natural | 250 mL | 00070219096065 | Green | No | |
| 012 | Blank | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012436 | Blue | No | |
| 012 | Blank | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198018632 | Red | Yes | |
| 012 | Blank | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101018064083 | Purple | No | |
| 012 | Blank | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019003893 | Purple | No | |
| 012 | Blank | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043574 | Orange | No | |
| 013 | SWQA | BOD Bottle Unpreserved | 250 mL | 00070219096130 | Green | No | |

# CHAIN OF CUSTODY

COC#: 8255 *ALS Laboratory:* EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -1

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V7 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: C

Other comments:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 013 | SWQA | Clear Plastic Bottle - Natural | 250 mL | 00070219096264 | Green | No | |
| 013 | SWQA | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00101019033188 | Purple | No | |
| 013 | SWQA | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00120198018716 | Red | Yes | |
| 013 | SWQA | Clear Plastic Bottle - NaOH Filtered | 60 mL | 00140219012650 | Blue | No | |
| 013 | SWQA | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019022581 | Purple | No | |
| 013 | SWQA | Amber Glass Bottle - Unpreserved | 100 mL | 00400719043809 | Orange | No | |

**Total Bottle Count: ALS: 86, Non ALS: 0**

**Appendix G.**

**Fieldnotes**

Client: RCC

Date: 12/2/20

Job No.: 5329

Project: Redlands Landfill - Geochemistry

$v=\pi r^2 \times L \times 1000$

| Time | Site | SWL | Depth | Well Volume | Volume Purged | Temp. (°C) | Turbidity (NTU) | Conductivity (uS/cm) | TDS (ppm) | Dissolved Oxygen (ppm) | pH | Redox (mV) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CISW5 | – | – | – | – | 23.5 | 137.6 | 65.5 | 42.7 | 4.13/47.6 | 6.14 | 243 | |
| | CISW1 | – | – | – | – | 23.4 | 73.7 | 92.6 | 60 | 3.69/30.3 | 6.45 | 222 | |
| | CISW4 | – | – | – | – | 23.6 | 20.6 | 103.1 | 67.1 | 4.42/48.2 | 6.41 | 185 | |
| | GW5 | 4.01 | 12.06 | 47.33 | 1 | 23.7 | 6.1 | 285 | 186 | 3.22/47.6 | 5.35 | 203 | |
| | | | | | 10 | 23.8 | 10.6 | 272 | 177 | 2.79/27.4 | 5.01 | 233 | |
| | | | | | 20 | 24.1 | 11.0 | 206 | 183 | 2.16/34.4 | 4.87 | 284 | |
| | | | | | 30 32 | 24 | 22.6 | 286 | 186 | 3.43/28.6 | 4.81 | 256 | |
| | | | | | 40 | 23.8 | 56.6 | 287 | 186 | 2.87/43.1 | 4.8 | 262 | |
| | | 4.02 | | (sample) | 47 | 23.8 | 3.5 | 287 | 187 | 2.79/28.8 | 4.82 | 266 | |
| | GW2 | 0.75 | 3.34 | 15 | 1 | 23.8 | 17.1 | 299 | 194 | 3.58/46.1 | 6.04 | 208 | |
| | | | | | 7 | 24.7 | 91.2 | 502 | 328 | 3.16/31.5 | 6.31 | 186 | |
| | | | | (sample) | 15 | 24.8 | 84.2 | 516 | 336 | 2.97/42.0 | 6.53 | 144 | |
| | GW1 | 0.69 | 3 | 13.6 | 1 | 25.3 | 19.0 | 387 | 251 | 4.13/44.8 | 6.39 | 157 | No lock |
| | | | | | 6 | 25.6 | 5.2 | 521 | 340 | 1.67/21.9 | 6.22 | 164 | |
| | | | | (sample) | 13 | 25.8 | 4.0 | 542 | 351 | 2 /19.2 | 6.23 | 165 | |
| | GW3 | 2.56 | 11.42 | 52 | 1 | 34.7 | 848 | 30.9 | 20.7 | 4.48/67.3 | 6.62 | 100 | |
| | | | | | 10 | 29.1 | 74.8 | 31.4 | 20 | 4.06/47.5 | 6.07 | 137 | |
| | | | | | 20 | 29.2 | 42.9 | 32.6 | 21.6 | 3.51/48.2 | 5.93 | 143 | |
| | | | | | 30 | 29.0 | 52.8 | 33.2 | 21.4 | 4.77/53.2 | 5.90 | 137 | |
| | | | | | 40 | 28.5 | 674 | 28.8 | 19.0 | 3.72/57.2 | 5.78 | 149 | |
| | | | | | 50 | 29.2 | 662 | 30.6 | 19.7 | 4.45/58.1 | 5.90 | 154 | |
| | | 4.69 | | (sample) | 57 | 27.6 | 937 | 35.8 | 22.8 | 4.43/62.8 | 5.97 | 162 | |
| | GW6 | 9.10 | 16.53 | 44 | 1 | 27.6 | 41.2 | 2233 | 1479 | 2.83/27.7 | 3.55 | 252 | |
| | | | | | 10 | 25.4 | 24.1 | 2296 | 1522 | 1.09/15.5 | 3.55 | 241 | |
| | | | | | 20 | 25.1 | 24.2 | 2332 | 1498 | 1.90/17.9 | 3.58 | 312 | |
| | | | | | 30 | 25.6 | 112.9 | 2.34ms | 1.53ppk | 1.89/24.7 | 3.63 | 356 | |
| | | 15.7 | | | 31 | 25.5 | 103.5 | 2.36ms | 1.53ppk | 2.18/27.2 | 3.64 | 363 | 31-dry recharge sample |
| | CISW2 | – | – | – | – | 25.6 | 14.4 | 83.8 | 54.3 | 3.55/40.0 | 5.8 | 216 | |
| | CISW3 | – | – | – | – | 24.7 | 3.6 | 117.2 | 76.1 | 5.04/78.3 | 5.44 | 247 | |

CLR21

# Coochiemudlo Island Closed Landfill

## Groundwater & Surface Water Quarterly LEMP Report

Our Ref: 5329

June 2020

Version 0.3

**Client: Redland City Council**

**Future-Plus Environmental**
4/40 Technology Drive, Warana QLD 4575

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Signed on behalf of
**Future-Plus Environmental**

Date: 15 July 2020

**Paul Wood**
Director

## DOCUMENT CONTROL INFORMATION

**Project Number:** 5329

**Project Manager:** Kaine Pritchard

**Client:** Redland City Council

**Report Title:** CLR21 Coochiemudlo Island Closed Landfill - Groundwater & Surface Water Quarterly LEMP Report, June 2020 - Version 0.3

**Project:** Redland City Council Landfill Environmental Monitoring Program (LEMP)

**Site Address:** Elizabeth Street, Coochiemudlo Island, QLD 4184

**Project Summary:** Quarterly reporting of environmental monitoring undertaken in accordance with the site Landfill Environmental Monitoring Plan (LEMP) at Coochiemudlo Island Closed Landfill including groundwater and, surface water monitoring.

### Document Review

| Document Version | Document Status | Author | Reviewed By | Approved By |
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| 5329-200402-0.1 | Draft | Charlotte-Bree Williams | Camille Oliver<br>Jono Hooper | Paul Wood |
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## EXECUTIVE SUMMARY

Future-Plus Environmental (FPE) were commissioned by Redland City Council (RCC) to undertake environmental monitoring in accordance with the *RCC Landfill Environmental Monitoring Program* (LEMP) (GHD, December 2019) at Coochiemudlo Island Former Landfill, located at Elizabeth Street, Coochiemudlo Island (the site).

This report presents the quarterly sampling results of groundwater and surface water environmental monitoring conducted by FPE on 20 May 2020 for Quarter 2, 2020.

In summary, the Quarter 2 monitoring event identified the following:

Groundwater:

- Statistically significant results (where available) were not reported for any parameter at any of the groundwater monitoring locations. New maximums were reported for the following locations and parameters:
  - GW1 for EC;
  - GW2 for EC and Ammonia; and
  - GW3 for Copper.
- Ammonia as N displayed a sharp increase in downgradient well GW2 when compared to upgradient wells; reaching a new maximum concentration. The adopted WQO was only exceeded at GW2 during the current event;
- Iron (filtered) displayed sharp increase at downgradient well GW2 when compared to other downgradient wells and results of upgradient wells GW5 and GW6;
- Iron levels in conjunction with the Ammonia results at GW2 may indicate potential leachate impact at this location;
- Further in-depth statistical analysis is required to determine if elevated levels of parameters at downgradient locations are statistically different to background levels at upgradient locations. This further analysis is outside the current scope of works; and
- All other results are consistent with historical levels.

Surface water:

- Ammonia (a key leachate indicator) was detected during the current sampling at one downstream surface water location CISW1;

- Ammonia levels were also recorded at upstream locations, indicating that the elevated levels at both upstream and downstream locations could be related to external factors rather than landfill impacts;
- Iron was detected at very low levels across all locations with concentrations increasing slightly when compared to the previous monitoring period;
- Most parameters displayed a slight increase since previous monitoring events, indicative of decreased rainfall that may increase the concentrations of metals and inorganics due to the low flow/stagnant conditions; and
- Based on the current monitoring results, the landfill is considered to pose a low risk to downstream surface water receivers.

Recommendations

Further statistical analysis of the exceedances of key leachate parameters identified in terms of groundwater are recommended to determine if there are significant differences between upgradient and downgradient sampling results and if leachate from the site is potentially impacting on groundwater. Further investigations may be warranted if leachate is found to be impacting on downgradient monitoring locations.

# LIST OF ABBREVIATIONS

| Abbreviation | Term |
|---|---|
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| ARMCANZ | Agricultural and Resource Management Council of Australia and New Zealand |
| ANZG | Australian and New Zealand Guidelines for Fresh and Marine Water Quality |
| BOD | Biological Oxygen Demand |
| BOM | Bureau of Meteorology |
| COD | Chemical Oxygen Demand |
| DES | Department of Environment and Science |
| DNRME | Department of Natural Resources, Mines and Energy |
| DO | Dissolved Oxygen |
| EA | Environmental Authority |
| EC | Electrical Conductivity |
| EPP | Environmental Protection Policy |
| EV | Environmental Values |
| LEMP | Landfill Environmental Monitoring Program |
| LOR | Laboratory Limit of Reporting |
| µS | Micro-Siemens |
| mBGL | Metres Below Ground Level |
| NATA | National Association of Testing Authorities |
| QA/QC | Quality Assurance/Quality Control |
| QWQG | Queensland Water Quality Guidelines |
| RCC | Redland City Council |
| SWL | Standing Water Level |
| TOC | Total Organic Carbon |
| TSS | Total Suspended Solids |
| WQO | Water Quality Objective |
| % S | Percent Saturation |

# TABLE OF CONTENTS

# LIST OF FIGURES



# LIST OF TABLES



# LIST OF APPENDICES

# 1.0 INTRODUCTION

## 1.1 BACKGROUND

Future-Plus Environmental (FPE) were commissioned by Redland City Council (RCC) to undertake environmental monitoring at Coochiemudlo Island Former Landfill (referred to herein as the site) located at Elizabeth Street, Coochiemudlo Island (the site), in accordance with the site's *Landfill Environmental Monitoring Program* (GHD, December 2016).

The site was utilised as the main disposal point for municipal waste, including inert/hardfill and green waste. It has been recorded that there were 500 residents on the island from 1972 to 1994. As of today, the site is currently used as a waste transfer station and for recreational purposes, including a park, sports field and tennis courts. The surrounding area of the site is mixed land use, including nearby sensitive receptors, which includes a substantial residential area and wetlands.

## 1.2 REPORT STRUCTURE & CONTENT

This Quarter 2, 2020 report summarises the groundwater and surface water environmental monitoring findings for sampling conducted by FPE on 20 May 2020.

This report has been prepared to meet the LEMP reporting requirements and includes the following:

- Details on the monitoring locations, methodology and data assessment adopted for the quarterly monitoring event;
- Details on the quality assurance/quality controls (QA/QC) for the field sampling;
- Weather and monitoring site conditions during the field sampling events;
- Details on the QA/QC for the monitoring results;
- Results of statistical analysis and exceedances of adopted water quality objectives (WQOs) for the groundwater and surface water sampling results; and
- Results, conclusions and recommendations for the ongoing management of groundwater and surface water at the site.

# 2.0 METHODOLOGY

## 2.1 OVERVIEW

RCC requires a regime of environmental monitoring at the site to meet the requirements of the LEMP, including quarterly monitoring of groundwater and surface water.

Works undertaken during the Quarter 2 (May 2020) monitoring events, as per the LEMP requirements, were comprised of quarterly groundwater and surface water monitoring undertaken on 20 May 2020.

## 2.2 MONITORING LOCATIONS & REQUIREMENTS

Groundwater and surface water monitoring locations are presented in **Appendix A**.

The specific groundwater and surface water environmental monitoring requirements in accordance with the LEMP are presented in **Table 1**.

At each monitoring site field observations are completed and well condition is assessed at each groundwater monitoring site, noting any infrastructure damage, ground disturbance or unusual colour/odour of sampling location.

**Table 1. Environmental Monitoring Requirements**

| Monitoring Aspect | Monitoring Location | Field Analysis | Laboratory Analysis |
|---|---|---|---|
| Groundwater (Quarterly) | Upgradient: GW5, GW6<br><br>Downgradient: GW1, GW2, GW3 | pH (pH units)<br>Electrical Conductivity (µS/cm)<br>Standing water level (SWL) | Sulphate - (Turbidimetric) as $SO_4$<br>Major Cations (Na, Mg, K, Ca)<br>Ammonia as N<br>Nitrate<br>Total Phosphorus as P<br>Dissolved metals (Mn, As, Al, Cr, Cu, Cd, Pb, Zn, Fe, Hg, Ni)<br>Dissolved Mercury<br>Total Organic Carbon (TOC) |
| Surface Water (Quarterly) | Upstream (Background): CISW2, CISW3, CISW4<br><br>Downstream: CISW1, CISW5 | pH (pH units)<br>Electrical Conductivity (µS/cm)<br>Dissolved Oxygen (ppm and % saturation) | Total Suspended Soils (TSS)<br>Sulphate - (Turbidimetric) as $SO_4$<br>Major Cations (Na, Mg, K, Ca)<br>Ammonia as N<br>Nitrate<br>Total Nitrogen<br>Total Phosphorus as P<br>Dissolved metals (Mn, As, Al, Cr, Cu, Cd, Pb, Zn, Fe, Hg, Ni)<br>Total Organic Carbon (TOC)<br>Chemical Oxygen Demand (COD)<br>Biochemical Oxygen Demand (BOD) |

### 2.2.1 Groundwater Monitoring Locations

Groundwater quality monitoring is required at two upgradient locations and three downgradient locations, which are presented in **Table 2**.

**Table 2. Groundwater Monitoring Sites**

| Location | GPS Coordinates (UTM GDA94) | |
|---|---|---|
| | Easting | Northing |
| **Upgradient Locations** | | |
| GW5 | 532940 | 6950507 |
| GW6 | 532940 | 6950407 |
| **Downgradient Locations** | | |
| GW1 | 533049 | 6950518 |
| GW2 | 533058 | 6950484 |
| GW3 | 533038 | 6950418 |

### 2.2.2 Surface Water Monitoring Locations

Surface water quality monitoring is required for three upstream (background) and two downstream locations and these are presented in **Table 3**.

**Table 3. Surface Water Monitoring Sites**

| Location | GPS Coordinates (UTM GDA94) | |
|---|---|---|
| | Easting | Northing |
| **Upstream (Background) Locations** | | |
| CISW2 | 533157 | 6950606 |
| CISW3 | 533256 | 6950606 |
| CISW4 | 533255 | 6950351 |
| Downstream Locations | | |
| CISW1 | 533088 | 6950507 |
| CISW5 | 533068 | 6950440 |

## 2.3 MONITORING RESULTS DATABASE

Results of all groundwater and surface water monitoring field and laboratory analysis have been entered into the ESdat environmental monitoring database, which includes historical monitoring results and allows for comparison of results with adopted WQOs.

## 2.4 ENVIRONMENTAL GUIDELINES

The *Environmental Protection (Water) Policy 2009 - Moreton Bay environmental values and water quality objectives* (Department of Environment and Resource Management (DERM)2, July 2010), [referred to henceforth as EPP (Water)] defines the environmental values (EVs) for surface and groundwater quality within the region. This document also identifies the WQOs associated with each EV.

As the site and the Melaleuca Wetland are situated within the coastal freshwater area within Coochiemudlo Island, the site is classified as "Coochiemudlo Island" for the purpose of establishing EVs and associated WQOs (DERM, 2010).

The following EVs and their relevant guidelines apply (as specified in the EPP (water) for Coochiemudlo Island):

- Aquatic Ecosystems (include seagrass) (Groundwater/surface water);
- Irrigation (Groundwater);
- Stock Water (Groundwater);
- Human Consumer (include oystering) (Surface water only);
- Drinking water (Groundwater only);
- Primary/Secondary/Visual Recreation (Surface water only); and
- Cultural and Spiritual Values (Surface water only).

The above EVs represent potential receptors of any impacts from Coochiemudlo Island Former Landfill. An assessment of these potential receptors by GHD (GHD, 2019b) identified the following receptors as actual or likely receptors for further assessment, based on characterising actual water use in the area:

- Surface water: aquatic ecosystems (including Wallum frog habitat (GHD, 2018a), cultural and spiritual values; and
- Groundwater: aquatic ecosystems.

As recommended in the EPP (water), the adopted WQOs were determined from a combination of documents, including the following:

- Environmental Protection (Water) Policy (Department of Natural Resource Management, 2010) corresponding to the following:
  - Physico-chemical WQOs for aquatic ecosystem lowland freshwater (comprising lowland streams, Wallum/tannin-stained streams and coastal streams)
  - Local WQOs for drinking water supply
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council [ANZECC]/Agriculture and Resource Management Council of Australia and New Zealand [ARMCANZ], 2000 and 2018 revision), corresponding to the following:
  - Protection of slightly to moderately disturbed ecosystems
    - Utilised as the site is in an urbanised environment
  - Protection of 99% species for surface water for metals only
    - Utilised as an indicator of metal concentrations elevated in relation to optimal concentrations for Wallum frog habitat

Site-specific WQOs have also been developed to improve the assessment of potential wallum frog habitats:

- GHD 2018 Coochiemudlo Island wetland guideline for the following parameters (GHD, 2018):
  - pH between 3.53 and 4.61 pH units;
  - EC < 90 µS/cm;
  - Tannin acid staining > 9.5 mg/L;
  - Calcium < 3.02 mg/L; AND
  - Low levels of monomeric aluminium consistent with siliceous sand and Wallum waters (refer to Aluminium guideline value from ANZECC FW 99%)

The results from the groundwater and surface water monitoring have been compared against the WQOs.

## 2.5 DATA ASSESSMENT

### 2.5.1 Groundwater

Data assessment for groundwater has been undertaken to determine if leachate generated at the site is potentially impacting on local groundwater. The following assessment approach has been adopted:

- Identification of statistically significant fluctuations in groundwater quality;
- Comparison of results with published WQOs (refer to Section 2.4);
- Comparison between up gradient and down gradient locations (refer to Section 2.5.2.1); and
- Evaluation of trends in indicator parameter concentrations.

### 2.5.2 Groundwater Statistical Assessment

Results from each monitoring well were compared to the mean (x) and multiples of standard deviations (x+1s, x+2s and x+3s) of historical results for each specific parameter. Historical data for the site monitoring wells is based on the first eight sampling events conducted at the start of the landfill monitoring program (since June 2017 or April 2018, depending on location and parameter). As such, some locations and parameters require additional monitoring data before control lines can be determined.

The adopted assessment criteria consist of the following exceedances:

- Five consecutive observations greater than the x+1s control line;
- Two consecutive observations greater than the x+2s control line; and
- One observation greater than the x+3s control line

In the case of pH, the control line also applies when pH measurements are less than the mean (i.e. x-1s, x-2s, x-3s). Statistically significant results that are identified are discussed further, to provide comparison with background water quality and provide context regarding any potential impact on the receiving environment.

Each parameter for each groundwater well has been graphed and includes the above adopted assessment criteria (**Appendix C**).

#### 2.5.2.1 Upgradient & Downgradient Well Comparison

Comparison of up-gradient and down-gradient groundwater well data is undertaken by assessment of groundwater trend graphs provided in **Appendix D.**

### 2.5.3 Surface Water

Data assessment for surface water has been undertaken to determine if leachate generated at the site is potentially impacting on local surface water quality. The following assessment approach has been adopted:

- Identification of statistically significant fluctuations in groundwater quality;

- Comparison of results with adopted WQOs (refer to Section 2.4);
- Comparison between upstream and downstream monitoring locations (refer to Section 2.5.3.1); and
- Evaluation of trends in parameter concentrations at specific surface water monitoring locations.

#### 2.5.3.1 Upstream & Downstream Comparison

Comparison of up-stream and down-stream surface water data is undertaken by assessment of surface water trend graphs provided in **Appendix E.**

# 3.0 QUALITY ASSURANCE & QUALITY CONTROL – FIELD SAMPLING

## 3.1 GENERAL

The Quality Assurance /Quality Control (QA/QC) program for the field sampling component of the LEMP was undertaken in accordance with, but not limited to, the following:

- *Monitoring and Sampling Manual - Environmental Protection (Water) Policy 2009 (Version 2)* (DES, 2018);
- *ISO 5667-11 1993 and AS/NZ 5667.11:1998 Water Quality Sampling Guidance on Sampling of Groundwater;*
- *AS/NZS 5667.6: 1998 Water Quality – Sampling Guidance on Sampling of Rivers and Streams;*
- *Environmental Guidelines: Solid Waste Landfills, Second Edition 2016* (NSW EPA, 2016); and
- *Best Practice Environmental Management - Siting, Design, Operation and Rehabilitation of* Landfills (Publication 788.3) (EPA Victoria, 2015).

QA/QC procedures included:

- Monitoring of climatic conditions likely to be experienced at site;
- Calibration of TPS 90 FLT water meter prior to and following sampling;
- Triple rinse decontamination procedure of all equipment prior to sampling and between sampling points for all environmental monitoring;
- Use of nitrile disposable gloves for sample collection. Disposable gloves were replaced between sample locations;
- Collection of field duplicate, triple blank and rinsate blank samples;
- Review of QC reports generated by the laboratory of their internal procedures and checks including matrix spikes, surrogate spikes, duplicate analyses, reagent and method blanks;
- Correct cold storage of samples (target <6 degrees °C) and delivery to ALS Global NATA accredited laboratory within recommended holding times (target 24 hrs); and
- Record keeping of transport documentation and use of chain of custody procedures, including sample list forms submitted to the laboratory and laboratory sample receipt documentation.

## 3.2 FIELD & LABORATORY WATER QUALITY ANALYSIS

Analysis of field parameters was undertaken using a TPS 90FLT water quality meter. Laboratory analysis was undertaken by ALS Global (NATA accredited) laboratory in accordance with the laboratory methods and level of reporting detailed in **Table 4.**

**Table 4. Water Quality Laboratory Parameters & LOR**

| Parameter | LOR (mg/L or as indicated) |
|---|---|
| Sulphate – (Turbidimetric) as $SO_4$ | 1 |
| Major Cations: Ca, Mg, Na, K | 1 |
| Ammonia as N | 0.01 |
| Nitrate | 0.01 |
| Dissolved Metals (Mn, As, Al, Cr (III+VI), Cu, Cd, Pb, Zn, Fe, Hg) | Zn: 0.005<br>Hg: 0.0001<br>Others: 0.001 |
| Total Organic Carbon (TOC) | 1 |
| Chemical Oxygen Demand (COD) | 10 |
| Biological Oxygen Demand (COD) | 2 |
| Total Suspended Solids (TSS) | 5 |
| Total Phosphorus | 0.01 |

### 3.2.1 Field Data Quality Assessment

As part of the QA/QC program, field duplicates, field blank and rinsate samples were prepared and submitted for laboratory analysis.

FPE follow strict sample collection procedures to ensure representative samples are collected and high results integrity achieved.

### 3.2.2 Field blanks

Field blanks were used to assess the potential for cross contamination during field handling procedures and shipment of the samples to the laboratory and consisted of a sample of deionised water that was supplied by the laboratory.

Field blank samples were submitted for analysis with each batch / esky of samples collected during groundwater and surface water sampling events.

One field blank sample (Sample ID Blank) was analysed for the parameters specified in *Appendix C: Coochiemudlo Island Closed Landfill of the Environmental Monitoring Plan for the Landfill Environmental Monitoring Program* (FPE, 2019).

### 3.2.3 Rinsate

Equipment rinsate blanks were prepared in order to assess whether equipment decontamination procedures adequately prevented and/or minimised the potential for sample cross-contamination. A rinsate sample was collected following completion of each sampling event during which sampling equipment (e.g. sampling jug) was utilised for sample collection.

One rinsate blank sample (Sample ID Rinsate) was prepared and submitted to the laboratory for analysis of analytes representative of the sampling undertaken during each sampling event (GW and SW inclusive).

### 3.2.4 Duplicates

A duplicate sample (SWQA) was taken during each monitoring event (GW and SW inclusive) for analysis and used to indicate if repeatable results are obtained and for the quality of data to be evaluated.

Duplicate samples were submitted for analysis with each batch of samples collected (primary sample CISW4).

A Precision assessment is reported as Relative Percent Difference (RPD) between the two results (sample and duplicate). Where the RPD value is greater than the adopted trigger value, it is identified as an exceedance.

# 4.0 WEATHER & MONITORING SITE CONDITIONS

## 4.1 SITE CONDITIONS

Light rainfall occurred on the day of monitoring; however, the ground conditions were not saturated. Surface water points CISW1 and CISW2 were difficult to access due to long vegetation within the wetland. The remaining sample locations were readily accessible.

## 4.2 WEATHER CONDITIONS

Conditions at the time of monitoring on 20 May 2020 have been outlined below. All climate data (except rainfall) was extracted from the Redland (Alexandra Hills) Station No.149007 (Bureau of Meteorology [BOM] 2020). Temperatures ranged from 15.4 to 22.8 ºC during sampling.

Annual rainfall statistics were utilised from the BOM Ormiston College Station No. 40770, which is 10.6km from the site and is the closest station with suitable long-term data. Minor rainfall totals were received the week preceding (13.6 mm in 7 days) and during monitoring event on the 20 May 2020 (6.0 mm).

Annual rainfall statistics (1988-present) from the Ormiston College Station No. 40770 are displayed in **Figure 1** below.

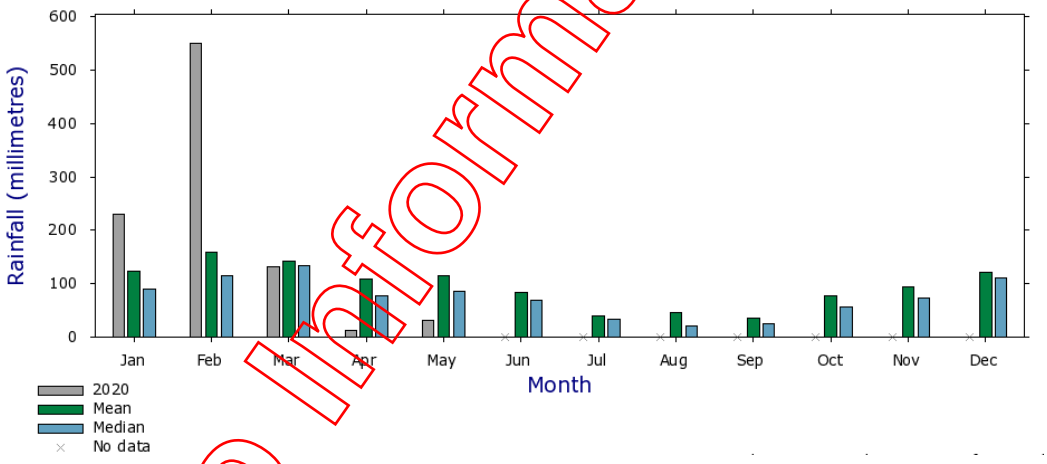


**Figure 1. Annual Rainfall Statistics (BOM, 2020).**

# 5.0 QUALITY ASSURANCE & QUALITY CONTROL - SAMPLING RESULTS

## 5.1 LABORATORY QA/QC RESULTS

As part of the QA/QC program, field duplicates, trip blank and rinsate samples were prepared and submitted for laboratory analysis. Laboratory QA/QC Results are provided in **Appendix F**.

FPE follow strict sample collection procedures to ensure representative samples are collected and high results integrity achieved.

The Relative Percentage Difference (RPD) for the field duplicate was acceptable based on the following:

- Below 50% if result was between 10 and 20 times LOR;
- Below 20% if result >20 times LOR; and
- No limit if result <10 times the LOR.

RPD were within acceptable limits outlined above for all field duplicates.

Traces of parameters TOC, COD and BOD were identified in the Blank sample, whilst traces of BOD was detected in the Rinsate sample, however this is not considered to impact the outcome of results.

Review of the laboratory QA/QC reporting identified the following:

- No Method Blank value outliers occur;
- No Duplicate outliers occur;
- No Laboratory Control outliers occur;
- Matrix Spike outliers exist for Phosphorus, as the background level was greater than or equal to 4x spike level;
- No Surrogate recovery outliers occur;
- No Analysis Holding Time Outliers occur; and
- No Quality Control Sample Frequency Outliers occur.

Based on results above FPE has confidence that the sampling results are representative of the site conditions.

# 6.0 MONITORING RESULTS

All groundwater and surface water sampling locations were effectively sampled during the Quarter 2 monitoring event. All tabulated groundwater and surface water results from the Quarter 2 monitoring event are provided in **Appendix B**.

## 6.1 GROUNDWATER RESULTS

### 6.1.1 Groundwater Levels

Groundwater levels (mAHD) for each groundwater bore are displayed in the **Figure 2** below, from 2017 to 2020. Upgradient bores at the site are GW5 and GW6, while downgradient bores are represented by GW1, GW2 and GW3.

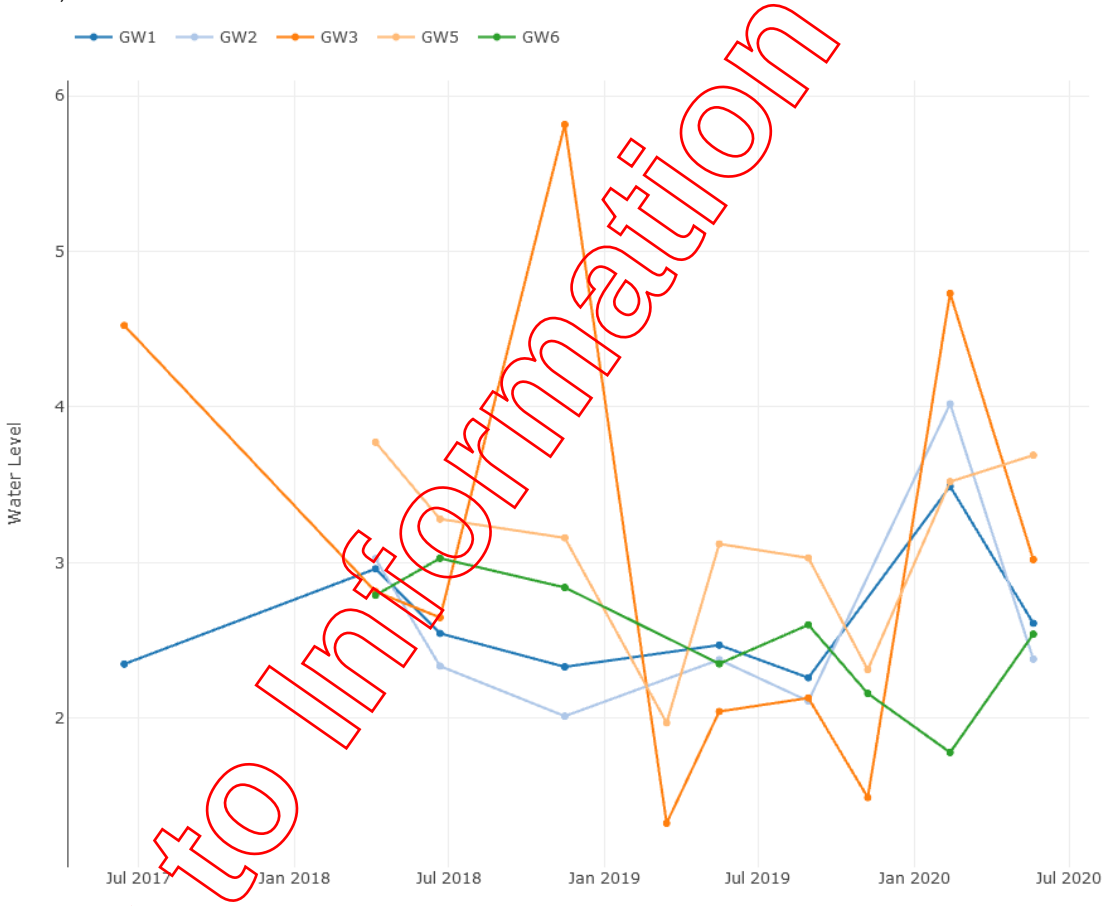


**Figure 2. Groundwater levels (mAHD) of monitoring wells at Coochiemudlo Island Closed Landfill from 2017 to 2020**

Groundwater levels have decreased at all downgradient locations during the current monitoring event when compared to the previous monitoring event, which is likely attributed to the less than average rainfall during the months April and May 2020 (refer Section 4.2). Groundwater levels slightly increased at upgradient locations GW5 and GW6 during the May 2020 sampling event. Groundwater levels varied from

2.38mAHD (GW2) to 3.69mAHD (GW5) and all locations are within the historical range of groundwater levels.

### 6.1.2 Well Condition Review

The condition of all groundwater wells during the most recent monitoring event is provided in **Table 5** below.

**Table 5. Groundwater Well Condition Review**

| Monitoring well ID | Condition as of May 2020 |
|---|---|
| **Upgradient bores** | |
| GW5 | Good |
| GW6 | Good |
| **Downgradient bores** | |
| GW1 | Good |
| GW2 | Good |
| GW3 | Good |

### 6.1.3 Field Observations

Visual observations of sample material retrieved from all groundwater wells is noted in **Table 6** below.

**Table 6. Groundwater well location and sample descriptions**

| Location ID | Location Description | Sample description |
|---|---|---|
| **Upgradient bores** | | |
| GW5 | Located 5 m east of the waste transfer station. | Clear, no suspended solids or odour. |
| GW6 | Located 60 m south of the waste transfer station. | Organic/Sulphur odour, cloudy with small particles. |
| **Downgradient bores** | | |
| GW1 | Located 10 m west of the waste transfer station. | Clear, small particles present and no odour. |
| GW2 | Located 10 m west of the closed landfill. | Strong odour of Sulphur and Hydrocarbons. |
| GW3 | Located 50 m south-west of the former landfill, adjacent to the tennis court. | Orange/brown in colour, highly turbid and no odour. |

### 6.1.4 Groundwater Statistical Analysis

| Monitoring Well | Parameter | Units | Sampling Date | | | | | X+ 1s | X+2s | X+3s |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 14/05/19 | 20/08/19 | 13/11/19 | 17/02/20 | 19/05/20 | | | |
| GW5 | TOC | mg/L | 1 | <1 | 1 | <1 | 2 | 1 | 1 | 1 |
| GW3 | Copper | mg/L | 0.007 | 0.0009 | 0.0018 | N/A | 0.012 | 0.00196 | 0.00247 | 0.002987 |
| GW6 | Iron | mg/L | 0.153 | 0.745 | 0.241 | 0.11 | 1.49 | 0.45126 | 0.65352 | 0.855790 |

Note: N/A – parameter not analysed in February 2020

A review of the statistically significant results and WQO exceedances reported during the May 2020 monitoring period within up and down gradient monitoring wells is summarised in the following sections.

Trend charts with analytes plotted against control line criteria are provided in **Appendix C**.

### 6.1.5 Upgradient Monitoring Well Results

WQO exceedances for upgradient sites GW5 and GW6 are summarised in **Table 7** below. WQO exceedances at GW5 and GW6 are considered to represent background conditions and are not considered to represent impact from the former landfill.

**Table 7. Exceedances of WQOs at Upgradient Monitoring Sites**

| Parameter | Units | EVs | WQOs | Current Result | |
|---|---|---|---|---|---|
| | | | | GW5 | GW6 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 4.73 | 3.72 |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5-8 | | |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 334 | 2724 |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 626 | | |
| | | Schedule 1 EPP (water) - Drinking Water | 1,000 | | |

| Parameter | Units | EVs | WQOs | Current Result | |
|---|---|---|---|---|---|
| | | | | GW5 | GW6 |
| Nitrate | mg/L | ANZECC FW Slight-mod disturbed system | 0.158 | 1.56 | N/A |
| Aluminium | mg/L | ANZECC FW Slight-mod disturbed system | 0.055 | N/A | 6.05 |
| Iron (Filtered) | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | N/A | 1.49 |
| Manganese | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | N/A | 0.138 |
| Phosphorus | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.05 | N/A | 0.16 |
| Zinc | mg/L | ANZECC FW Slight-mod disturbed system | 0.008 | N/A | 0.014 |

*Note: N/A Indicates that the result from that sampling location did not exceed any guidelines and thus not included in the exceedance table.

The majority of monitored parameters at both upgradient locations did not exceed the statistical assessment criteria, except for the following:

- GW5 – TOC (2 mg/l) exceeded the X+2s and X+3s control line criteria;
- GW6 – Iron (1.49 mg/l) exceeded the X+3s control line criteria.

### 6.1.6 Downgradient Monitoring Well Results

WQO exceedances for downgradient groundwater well sites GW1, GW2 and GW3 are summarised in **Table 8** below.

**Table 8. Exceedances of WQOs at Downgradient Monitoring Sites**

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | GW1 | GW2 | GW3 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 6.33 | 6.07 | 5.4 |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5 – 8 | | | |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 751 | 1403 | N/A |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 626 | | | |

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | GW1 | GW2 | GW3 |
| | | Schedule 1 EPP (water) - Drinking Water | 1000 | | | |
| Ammonia as N | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.02 | N/A | 0.1 | N/A |
| Nitrate (as N) | mg/L | ANZECC FW Slight-mod disturbed system | 0.158 | 0.36 | N/A | N/A |
| Aluminium | mg/L | ANZECC FW Slight-mod disturbed system | 0.055 | N/A | 0.06 | 0.21 |
| Copper | mg/L | ANZECC FW Slight-mod disturbed system | 0.0014 | N/A | N/A | 0.012 |
| Iron (Filtered) | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | N/A | 9.99 | 0.11 |
| Phosphorus | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.05 | N/A | 0.17 | 1.35 |
| Zinc | mg/L | ANZECC FW Slight-mod disturbed system | 0.008 | N/A | N/A | 0.012 |

*Note: N/A Indicates that the result from that sampling location did not exceed any guidelines and thus not included in the exceedance table.

#### 6.1.6.1 Downgradient well – GW1

All monitored parameters at downgradient GW1 were within the statistical assessment criteria for this quarterly monitoring event.

Concentrations of parameters, including where WQOs were exceeded, were consistent with background concentration ranges and/or with recent concentration trends with the exception of:

- pH levels (6.33 pH units) slightly increased during the current monitoring event when compared to February 2020 (6.23 pH units). pH has continued to gradually increase since November 2018 and exceeded the adopted WQOs;
- EC levels (751 µ/S) increased during the current sampling event when compared to the February 2020 (521 µ/S). This result is a new maximum concentration event and exceeded the adopted WQOs;

- Nitrate levels (0.36 mg/L) remained higher than the background levels of GW6 (0.0mg/L) and below background levels of GW5 (1.56 mg/L). However, the result is within the historical range of data.

#### 6.1.6.2 Downgradient well – GW2

All monitored parameters at downgradient GW2 were within the statistical assessment criteria for this quarterly monitoring event.

Concentrations of parameters, including where WQOs were exceeded, were consistent with background concentration ranges and/or with recent concentration trends with the exception of:

- pH levels (6.07 pH units) slightly decreased during the current monitoring event when compared to February 2020 (6.53 pH units), however, exceeded the adopted WQOs;
- EC levels (1403 µ/S) sharply increased during the current sampling event when compared to the February 2020 (516 µ/S). This result is a new maximum concentration event and exceeded the adopted WQOs, however, remained below the background levels of GW6 (2724 µ/S);
- Ammonia levels (0.1 mg/L) sharply increased during the current sampling event, reaching a new maximum concentration and exceeding the adopted WQOs and background levels at both upgradient locations;
- Aluminium levels (0.06mg/L) slightly decreased during the current sampling event when compared to the February 2020 (0.3 mg/L) monitoring event. The results remained well below the background levels at upgradient well GW6, however, exceeded the adopted WQO;
- Iron (filtered) levels (9.99 mg/L) displayed a sharp increase when compared to the previous monitoring event (0.16 mg/L). This result remains consistent with previous results at this location and continues to be several orders of magnitude greater than upgradient locations. This result also exceeds the adopted WQOs;
- Phosphorus levels (0.17mg/L) have increased when compared to November 2019 levels (0.01 mg/L). The result exceeded background levels at upgradient well GW5 (0.0 mg/L) and exceeded the adopted WQOs.

#### 6.1.6.3 Downgradient well – GW3

The majority of monitored parameters at downgradient GW3 did not exceed the statistical assessment criteria, except for the following:

- Copper (0.012mg/L) exceeded the X+3s control line criteria.

Concentrations of parameters, including where WQOs were exceeded, were consistent with background concentration ranges and/or with recent concentration trends with the exception of:

- pH levels (5.4 pH units) slightly decreased since the previous event in February 2020 (5.9 pH units), however, exceeded the adopted WQOs.

- Aluminium levels (0.21 mg/L) slightly decreased during the current sampling event when compared to the February 2020 (0.37 mg/L) monitoring event. The results remained well below the background levels at upgradient well GW6, however, exceeded the adopted WQO;
- Copper levels (0.012 mg/L) sharply increased when compared to the November 2019 (0.0018 mg/L) monitoring event. This result is a new maximum concentration and far exceeds background levels at GW5 (0.00 mg/L) and GW6 (0.00 mg/L);
- Iron (filtered) levels (0.11 mg/L) decreased when compared to the previous monitoring event (0.13 mg/L). The result remains below the background levels at upgradient well GW6 (1.49 mg/L), however, exceeds the adopted WQOs;
- Phosphorus levels (1.35 mg/L) have increased when compared to November 2019 levels (0.01 mg/L). The result exceeded background levels at upgradient wells GW5 (0.00 mg/L) and GW6 (0.16 mg/L), exceeding the adopted WQOs.
- Zinc levels (0.012 mg/L) have slightly increased when compared to February 2020 levels (0.00 mg/L) and exceeded background levels at upgradient well GW6 (0.014 mg/L).

### 6.1.7 Summary of potential landfill impact on Groundwater

All wells were sampled in May 2020. New maximums were reported at downgradient locations for:

- GW1 for EC;
- GW2 for EC and Ammonia; and
- GW3 for Copper.

Whilst concentrations exceeding the adopted WQOs were reported, results were consistent with background data with the exception of:

- GW2 for Ammonia; and
- GW3 for Copper.

Ammonia as N displayed a sharp increase in downgradient well GW2 when compared to upgradient wells, reaching a new maximum concentration. Ammonia levels at this location have displayed variation in concentrations when looking at historical levels, indicating that this sharp increase may be related to natural variation, rather than landfill impacts.

Iron (filtered) displayed a sharp increase at downgradient well GW2 when compared to other downgradient wells and upgradient wells GW5 and GW6. The variability of results at GW2 continues, as Iron concentrations have fluctuated here in the past. Iron is considered another key leachate indicator, and these results, in conjunction with the Ammonia results at GW2, might indicate potential leachate impacts.

pH, an important consideration for acid frog habitat downstream of the former landfill, was noted to be higher at downgradient wells (5.4-6.33) than upgradient wells (3.72-4.73). Historical pH levels appear to fluctuate and be influenced by rainfall events at GW2 and GW3, and to a lesser extent at GW1, suggesting the soil profile at these locations may be more permeable to surface water inputs and/or impacted by historical landfilling on the site.

## 6.2 SURFACE WATER RESULTS

### 6.2.1 Monitoring location descriptions

The details of the surface water locations and field observation have been summarised in **Table 9**.

**Table 9. Surface water locations and sample descriptions**

| Location ID | Location Description | Sample description |
|---|---|---|
| **Background surface water monitoring locations** | | |
| CISW2 | Background, potential Wallum frog habitat | Tannin-stained colour. Large particle present, with no odour. |
| CISW3 | Background, potential Wallum frog habitat | Tannin-stained colour. Large particle present, with no odour. |
| CISW4 | Background | Low water level, with an oily film. Light brown in colour, with no odour. |
| **Downstream surface water monitoring locations** | | |
| CISW1 | Downstream of former landfill | Light brown in colour, with small-medium particles. |
| CISW5 | Downstream of former landfill | Light brown in colour, with small particles. |

### 6.2.2 Background Surface Water Results

#### 6.2.2.1 Surface Water Sites – CISW2, CISW3, CISW4

WQO exceedances for background sites CISW2, CISW3 and CISW4 are summarised in **Table 10** below. WQO exceedances at CISW2, CISW3 and CISW4 are considered to represent background conditions and are not considered to represent impact from the former landfill but are included for comparative purposes.

**Table 10. Exceedances of WQOs Upstream Surface Water Sites**

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | CISW2 | CISW3 | CISW4 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 6.25 | 5.59 | 6.70 |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5 – 8 | | | |
| DO | %Sat | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 85-110 | 49.4 | 37.3 | 38.3 |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 331 | 304 | 340 |
| Ammonia | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.02 | N/A | 0.08 | N/A |
| Aluminium | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.027 | 0.19 | 0.34 | N/A |
| | | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.055 | | | |
| Arsenic | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.0008 | 0.001 | 0.001 | N/A |
| Nitrogen (total) | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.5 | 2.4 | 4.0 | 1.4 |
| Chromium (III+VI) | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.00001 | 0.002 | 0.002 | 0.003 |
| | | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.001 | | | |

| Parameter | Units | EVs | WQOs | Current Result | | |
|---|---|---|---|---|---|---|
| | | | | CISW2 | CISW3 | CISW4 |
| Iron | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | 2.98 | 7.36 | 14.5 |
| Phosphorus | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.05 | 0.17 | 0.26 | 0.10 |
| Zinc | mg/L | ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only | 0.0024 | 0.007 | N/A | 0.025 |
| | | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.008 | | | |

Note: * N/A Indicates that the result from that sampling location did not exceed any guidelines and thus not included in the exceedance table.

Comparison of the current surface water results at CISW2, CISW3 and CISW4 against recent data indicates all parameters were consistent, and were within ranges reported historically with the exception of:

- Ammonia increased above historical data at CISW3 (0.08mg/L) and represent new maximums at these locations, thereby exceeded the adopted WQOs;
- EC increased above historical data for CISW4 (340 µ/S) reaching a new maximum at this location and exceeding the adopted WQOs;
- Iron increased above historical data for CISW4 (14.5 mg/L) and represent new maximums at this location. The adopted WQOs for Iron were again exceeded at this location;
- pH increased above historical data for CISW3 (5.59 pH units) and represent new maximums at these locations. The adopted WQOs for pH were again exceeded this location;
- Phosphorus increased above historical data for CISW3 (0.26 mg/L) and represent new maximums at these locations. The result exceeded the adopted WQOs for Phosphorus; and
- Nitrogen increased above historical data for CISW3 (4 mg/L) and represent new maximums at these locations. The result exceeded the adopted WQOs.

New maximum concentrations were also recorded at CISW3 for COD (452 mg/L) and TSS (129 mg/L) and CISW4 for Magnesium (8 mg/L), Manganese (0.046 mg/L), Nickel (0.002 mg/L) and TSS (42 mg/L). Despite these parameters reaching new maximum concentrations, their levels were below the adopted WQOs and therefore are not considered a risk at this stage.

### 6.2.3 Downstream Surface Water Sampling Results

WQO exceedances for downstream surface sites CISW1 and CISW5 are summarised in **Table 11** below.

**Table 11. Exceedances of WQOs Downstream Surface Water Sites**

| Parameter | Units | EVs | WQOs | Current Result | |
|---|---|---|---|---|---|
| | | | | CISW1 | CISW5 |
| pH | pH Units | GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 6.66 | 5.85 |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5 – 8 | | |
| DO | %Sat | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 85-110 | 34.9 | 34.9 |
| EC | µS/cm | GHD 2018 Coochiemudlo Island wetland | 90 | 916 | 180.5 |
| | | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 626 | | |
| Ammonia | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.02 | 0.04 | N/A |
| Aluminium | mg/L | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.055 | N/A | 0.87 |
| Nitrogen (total) | mg/L | Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 0.5 | 0.6 | 0.6 |
| Copper | mg/L | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.0014 | 0.002 | 0.002 |
| Iron | mg/L | Schedule 1 EPP (water) - Drinking Water | 0.05 | 0.88 | 0.53 |
| Zinc | mg/L | ANZECC 2000 Fresh water Slightly-moderate disturbed system | 0.008 | N/A | 0.022 |

#### 6.2.3.1 Surface Water Sites – CISW1 and CISW5

An assessment of the above results for surface water sites CISW1 and CISW5 reveal the following:

- Aluminium levels (0.87mg/L CISW5) decreased when compared to the previous monitoring period (1.83 mg/L CISW5), however, is higher than background locations CISW2, CISW3 and CISW4. The concentration at CISW1 remains within historical levels;
- Ammonia levels (0.04 mg/L CISW1) have increased since the previous monitoring period, however remained below levels at upstream location CISW3;

- Copper levels (0.002 mg/L) displayed an increase when compared the previous monitoring period, however, this parameter has not been sampled since July 2019.This result exceeded the levels at all upstream locations and the adopted WQOs;
- DO (34.9% CISW1 and CISW5) decreased when compared to the February 2020 (50.3% CISW1 and 47.6% CWIS5) monitoring event. These results still fall short of the adopted WQO criteria.
- EC levels (916 µS/cm CISW1 and 180.5 µS/cm CISW5) displayed a slight increase when compared to the previous monitoring period. The EC level at CWIS5 (180.5 µS/cm) reached a new maximum during the current sampling event. EC levels at CISW1 exceeded levels at all upstream locations. Both locations exceeded the adopted WQOs this monitoring period;
- Iron (filtered) levels, remained consistent with historical limits, however, exceeded the adopted WQOs;
- pH increased above historical data for CISW1 (6.66 pH units) and represents a new maximum at this location. The adopted WQOs for pH were exceeded for both downstream locations; and
- Zinc levels slightly increased when compared to the previous monitoring period, exceeding the adopted WQOs.

### 6.2.4 Summary of potential landfill impact on surface water

Ammonia (a key leachate indicator) was detected during the current sampling at one downstream location CISW1. The elevated levels could possibly be related to the to external factors that may be affecting upstream location CISW3, which also recorded elevated levels of Ammonia. Another leachate indicator, Iron, was detected at very low levels across all locations, with concentrations increasing slightly when compared to the previous monitoring period. Most parameters displayed a slight increase since previous monitoring events, indicative of decreased rainfall, which may increase the concentrations of metals and inorganics due to the low flow/stagnant conditions.

A soluble sulfate ratio ($Cl^-:SO_4^{2-}$) of less than 2 was detected during the current sampling round (0.3), with 36mg/L chloride and 124mg/L sulfate detected at GW1. All other sites monitored were greater than 2. The *State Planning Policy 2/02 Guideline Acid Sulfate Soils (ASS)* (Queensland Government 2002) outlines that where there is an elevated level of sulfate ions relative to chloride ions, these results may indicate the presence of ASS. However, the soluble sulfate ratio becomes less predictive as the water becomes less brackish. Water at GW1 had an EC of 751 µS/cm, which indicates freshwater is present. pH at GW1 was also not less than 6 and aluminium was below the limit of reporting. Therefore, contrary to previous reports (GHD, 2019b), there appears no impact of acid sulphate soils in the current monitoring results.

# 7.0 CONCLUSIONS

## 7.1 GROUNDWATER

All groundwater monitoring wells were sampled in May 2020, and results have been assessed for their potential for landfill leachate to impact groundwater by comparing results with the WQOs (as per the EVs in the *EPP (Water) 2009*), statistical assessment of the dataset and by comparing the (inferred) up gradient and down gradient groundwater quality results.

Statistically significant results were reported in the downgradient groundwater locations[2] for the following parameters:

- GW3 for Copper;
- GW5 for TOC; and
- GW6 for Iron.

Adopted WQOs were exceeded at both up and down gradient locations for pH, EC, Aluminium, Iron, Nitrogen, Phosphorus and Zinc . Ammonia and Copper were the only parameters that exceeded the adopted WQOs only at down-gradient wells. These parameters will require continued monitoring in future events to determine if further investigations are required.

New maximums were reported for several parameters at the following wells:

- GW1 for EC;
- GW2 for EC and Ammonia; and
- GW3 for Copper;

Ammonia as N displayed a sharp increase in downgradient well GW2 when compared to upgradient wells; reaching a new maximum concentration. Due to Ammonia being considered a key leachate indicator it is recommended that this parameter is closely monitored during the next sampling event. Iron (filtered) displayed sharp increase at downgradient well GW2 when compared to other downgradient wells and upgradient wells GW5 and GW6. Fluctuations in Iron concentration continue at this well, as is observed from historical results and the peak detected in this sampling event could be related to natural variation within the site. However, as Iron is considered another key leachate indictor, these results, in conjunction with the Ammonia results at GW2, might indicate potential leachate impacts. Further monitoring of these parameters is needed to determine if increased concentration of these parameters is related to landfill impacts or other external factors upstream of the site.

[2] Where Control Line statistical data is available. GW2 require data from eight sample events before Control Line data can be determined.

pH, an important consideration for acid frog habitat downstream of the former landfill, was noted to be higher at downgradient wells (5.4-6.33) than upgradient wells (3.72-4.73). Historical pH levels appear to fluctuate and be influenced by rainfall events at GW2 and GW3, and to a lesser extent at GW1, suggesting the soil profile at these locations may be more permeable to surface water inputs and/or impacted by historical landfilling on the site.

### 7.2 SURFACE WATER

All surface water locations were sampled in May 2020, and results have been assessed for their potential for landfill leachate by comparing results with the WQOs (as per the EVs in the *EPP (Water) 2009*) and by comparing the upstream and downstream surface water quality results.

Ammonia (a key leachate indicator) was detected during the current sampling at one downstream surface water location CISW1. The elevated levels could possibly be related to external factors that appear to be effecting upstream location CISW3, which also recorded elevated levels of Ammonia. Another leachate indicator, Iron, was detected at very low levels across all locations; with concentrations increasing slightly when compared to the previous monitoring period. Most parameters displayed a slight increase since previous monitoring events, indicative of decreased rainfall, which may increase the concentrations of metals and inorganics due to the low flow/stagnant conditions.

There was no indication of ASS impact on downstream surface water during the current monitoring round.

In conclusion, EA conditions WA3 and WA4 have been met as quarterly surface water monitoring of the required parameters (pH, Electrical Conductivity (EC), Dissolved Oxygen (DO), COD, BOD, Total Suspended Solids (TSS), Calcium, Sodium, Sulphate, Iron, Copper, Lead, Nickel, Magnesium, Manganese, Zinc, Ammonia (As N), Aluminium, Arsenic, Nitrate (As N), Total Organic Carbon (TOC), Chromium and Total Phosphorus) was completed in May 2020.

## 8.0 RECOMMENDATIONS

Further statistical analysis of the exceedances of key leachate parameters identified in terms of groundwater are recommended to determine if there are significant differences between upgradient and downgradient sampling results and if leachate from the site is potentially impacting on groundwater. Further investigations may be warranted if leachate is found to be impacting on downgradient monitoring locations.

## 9.0 REFERENCES

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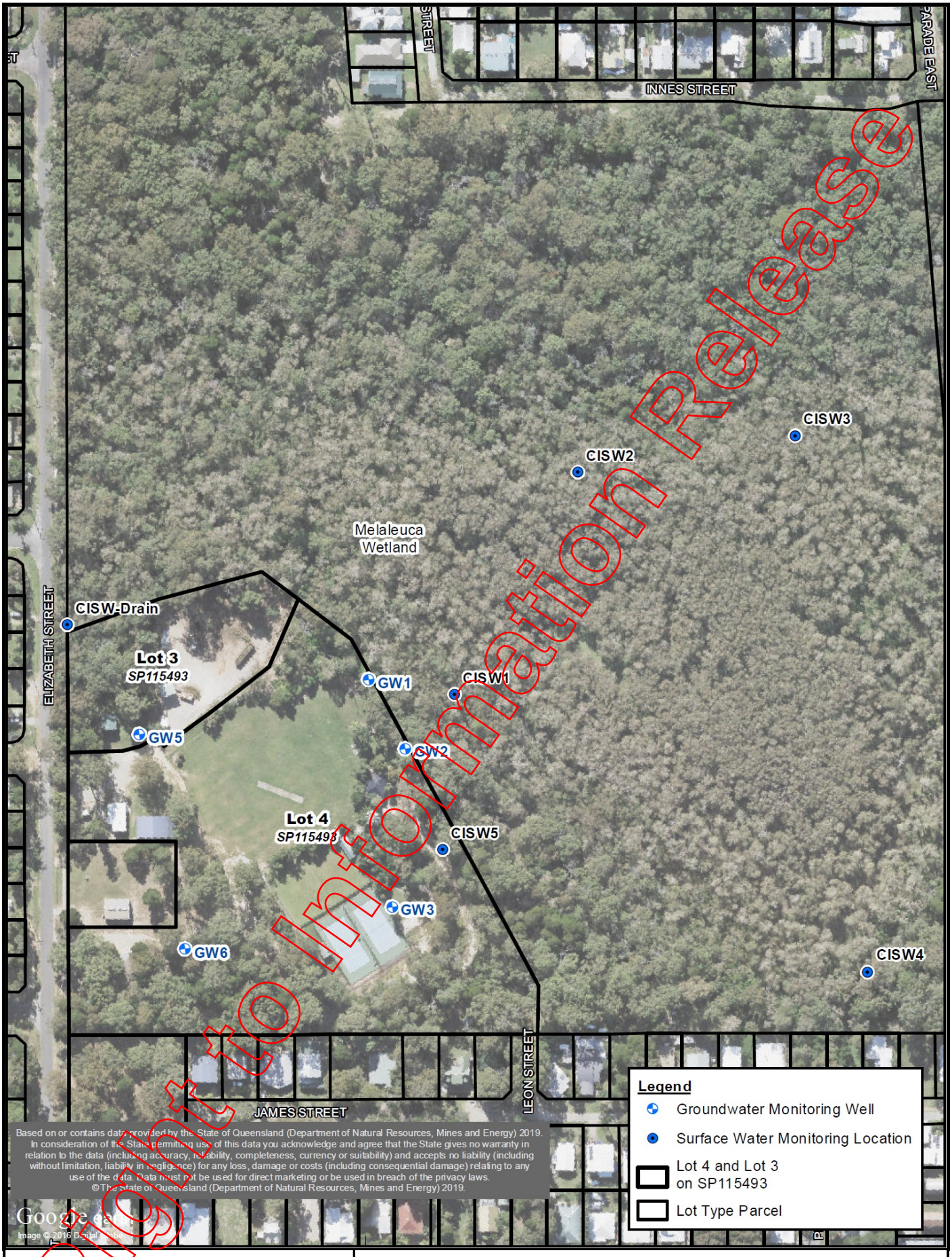
**Appendix A.**

**Monitoring Locations Plan**






future-plus ENVIRONMENTAL

# GROUNDWATER & SURFACE WATER MONITORING LOCATIONS

PROJECT: COOCHIEMUDLO ISLAND FORMER LANDFILL

CLIENT: REDLAND CITY COUNCIL

FPE REF: 5329-200331-0.1

1:2,500 (at A4)

0 15 30 45 60 75 90

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

IMAGERY SOURCED FROM REDLAND CITY COUNCIL

**Appendix B.**

**Results Summary**

| | Field | | Inorganics | | | | | | Metals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pH (Field) | EC (field) | Ammonia as N | Chloride | Nitrate (as N) | Sodium (filtered) | Sulfate as SO4 - Turbidimetric (filtered) | TOC | Aluminium (filtered) | Arsenic (filtered) | Cadmium (filtered) | Calcium (filtered) | Chromium (III+VI) (filtered) | Copper (filtered) | Iron (filtered) | Lead (filtered) | Magnesium (filtered) | Manganese (filtered) | Mercury (filtered) | Nickel (filtered) | Phosphorus | Potassium (filtered) | Zinc (filtered) |
| | - | µS/cm | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | 0.01 | 1 | 0.01 | 1 | 1 | 1 | 0.01 | 0.001 | 0.0001 | 1 | 0.001 | 0.001 | 0.05 | 0.001 | 1 | 0.001 | 0.0001 | 0.001 | 0.01 | 1 | 0.005 |
| *ANZECC 2000 Fresh water Slightly-moderate disturbed system* | | | *0.9* | | *0.158* | | | | *0.055* | *0.013* | *0.0002* | | *0.001* | *0.0014* | | *0.0034* | | *1.9* | | *0.011* | | | *0.008* |
| GHD 2018 Coochiemudlo Island wetland | 3.53-4.61 | 90 | | | | | | | | | 3.02 | | | | | | | | | | | | |
| Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 6.5-8 | 626 | 0.02 | | | | | | | | | | | | | | | | | | 0.05 | | |
| Schedule 1 EPP (water) - Drinking Water | | 1,000 | | | | | | | | | | | | | 0.05 | | | 0.05 | | | | | |

| Site ID | Monitoring Zone | Location Code | Date | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coochiemudlo Island | Downgradient | GW1 | 20/05/2020 | 6.88 | 751 | <0.01 | 36 | *0.36* | 26 | 124 | 5 | <0.01 | <0.001 | <0.0001 | 71 | <0.001 | <0.001 | <0.05 | <0.001 | 21 | 0.014 | <0.0001 | <0.001 | 0.01 | 13 | <0.005 |
| Coochiemudlo Island | Downgradient | GW2 | 6.07 | 1,403 | 0.1 | 332 | 0.02 | 136 | 15 | 7 | *0.06* | 0.002 | <0.0001 | 38 | <0.001 | <0.001 | 9.99 | <0.001 | 32 | 0.002 | <0.0001 | <0.001 | 0.17 | 8 | <0.005 |
| Coochiemudlo Island | Downgradient | GW3 | 5.4 | 51.3 | 0.02 | 12 | 0.02 | 9 | 4 | 8 | *0.21* | <0.001 | <0.0001 | 1 | <0.001 | *0.012* | 0.11 | <0.001 | 1 | 0.003 | <0.0001 | <0.001 | 1.35 | <1 | *0.012* |
| Coochiemudlo Island | Upgradient | GW5 | 20/05/2020 | 4.78 | 334 | <0.01 | 74 | *1.56* | 52 | 21 | 2 | 0.02 | <0.001 | <0.0001 | <1 | <0.001 | <0.001 | <0.05 | <0.001 | 4 | 0.001 | <0.0001 | <0.001 | <0.01 | <1 | <0.005 |
| Coochiemudlo Island | Upgradient | GW6 | 20/05/2020 | 3.72 | 2,724 | <0.01 | 770 | <0.01 | 336 | 15 | 2 | *6.05* | <0.001 | <0.0001 | 3 | <0.001 | <0.001 | 1.49 | <0.001 | 56 | 0.138 | <0.0001 | 0.002 | 0.16 | 2 | *0.014* |

**Statistics**

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of Results** | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| **Number of Detects** | 5 | 5 | 2 | 5 | 4 | 5 | 5 | 5 | 4 | 1 | 0 | 4 | 0 | 1 | 3 | 0 | 5 | 5 | 0 | 1 | 4 | 3 | 2 |
| **Minimum Concentration** | 3.7 | 51.3 | <0.01 | 12 | <0.01 | 9 | 4 | 2 | <0.01 | <0.001 | <0.0001 | 1 | <0.001 | <0.001 | <0.05 | <0.001 | 1 | 0.001 | <0.0001 | <0.001 | 0.01 | <1 | <0.005 |
| **Minimum Detect** | 3.7 | 51.3 | 0.02 | 12 | 0.02 | 9 | 4 | 2 | 0.02 | 0.002 | ND | 1 | ND | 0.012 | 0.11 | ND | 1 | 0.001 | ND | 0.002 | 0.01 | 2 | 0.012 |
| **Maximum Concentration** | 6.3 | 2,724 | 0.1 | 770 | 1.56 | 336 | 124 | 8 | 6.05 | 0.002 | <0.0001 | 71 | <0.001 | 0.012 | 9.99 | <0.001 | 56 | 0.138 | <0.0001 | 0.002 | 1.35 | 13 | 0.014 |
| **Maximum Detect** | 6.3 | 2,724 | 0.1 | 770 | 1.56 | 336 | 124 | 8 | 6.05 | 0.002 | ND | 71 | ND | 0.012 | 9.99 | ND | 56 | 0.138 | ND | 0.002 | 1.35 | 13 | 0.014 |
| **Average Concentration *** | 5 | 1,053 | 0.027 | 245 | 0.39 | 112 | 36 | 4.8 | 1.3 | 0.0008 | 0.00005 | 23 | 0.0005 | 0.0028 | 2.3 | 0.0005 | 23 | 0.032 | 0.00005 | 0.0008 | 0.34 | 4.8 | 0.0067 |
| **Median Concentration *** | 5.4 | 751 | 0.005 | 74 | 0.02 | 52 | 15 | 5 | 0.06 | 0.0005 | 0.00005 | 3 | 0.0005 | 0.0005 | 0.11 | 0.0005 | 21 | 0.003 | 0.00005 | 0.0005 | 0.16 | 2 | 0.0025 |
| **Standard Deviation *** | 1.1 | 1,064 | 0.041 | 320 | 0.67 | 134 | 50 | 2.8 | 2.7 | 0.00067 | 0 | 31 | 0 | 0.0051 | 4.3 | 0 | 22 | 0.06 | 0 | 0.00067 | 0.57 | 5.5 | 0.0058 |
| **95% UCL (Student's-t) *** | 6.26 | 2,067 | 0.0664 | 550.2 | 1.031 | 240 | 83 | 7.445 | 3.813 | 0.00144 | 0.00005 | 52.54 | 0.0005 | 0.0077 | 6.455 | 0.0005 | 44.22 | 0.0885 | 0.00005 | 0.00144 | 0.883 | 10.07 | 0.0122 |

* A Non Detect Multiplier of 0.5 has been applied.

| | Field | | | Inorganics | | | | | | | | | Metals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DO % Saturation (Field) | EC (field) | pH (Field) | Ammonia as N | BOD | Chloride | COD | Nitrate (as N) | Nitrogen (Total) | Sodium (filtered) | TOC | TSS | Aluminium (filtered) | Arsenic (filtered) | Cadmium (filtered) | Calcium (filtered) | Chromium (III+VI) (filtered) | Copper (filtered) | Iron (filtered) | Lead (filtered) | Magnesium (filtered) | Manganese (filtered) | Mercury (filtered) | Nickel (filtered) | Phosphorus | Potassium (filtered) | Zinc (filtered) |
| | %Sat | µS/cm | - | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | 0.01 | 2 | 1 | 10 | 0.01 | 0.1 | 1 | 1 | 5 | 0.01 | 0.001 | 0.0001 | 1 | 0.001 | 0.001 | 0.05 | 0.001 | 1 | 0.001 | 0.0001 | 0.001 | 0.01 | 1 | 0.005 |
| *ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only* | | | | *0.32* | | | | *4.9* | | | | | *0.027* | *0.0008* | *0.00006* | | *0.00001* | *0.001* | | *0.001* | | | *0.00006* | *0.008* | | | *0.0024* |
| *ANZECC 2000 Fresh water Slightly-moderate disturbed system* | | | | *0.9* | | | | *0.158* | | | | | *0.055* | *0.013* | *0.0002* | | *0.001* | *0.0014* | | *0.0034* | | *1.9* | | *0.011* | | | *0.008* |
| GHD 2018 Coochiemudlo Island wetland | | 90 | 3.53-4.61 | | | | | | | | | | | | 3.02 | | | | | | | | | | | | |
| Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater | 85-110 | 626 | 6.5-8 | 0.02 | | | | | 0.5 | | | | | | | | | | | | | | | | 0.05 | | |
| Schedule 1 EPP (water) - Drinking Water | | 1,000 | | | | | | | | | | | | | | | | | 0.05 | | | 0.05 | | | | | |
| **Site ID** | **Monitoring Zone** | **Location Code** | **Date** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Coochiemudlo Island** | **Downstream** | **CISW1** | **20/05/2020** | 34.9 | 458 | 6.66 | 0.04 | 3 | 151 | 44 | <0.01 | 0.6 | 67 | 17 | 6 | 0.03 | <0.001 | <0.0001 | 39 | <0.001 | 0.002 | 0.88 | <0.001 | 31 | 0.013 | <0.0001 | <0.001 | 0.01 | 18 | <0.005 |
| **Coochiemudlo Island** | **Downstream** | **CISW5** | **20/05/2020** | 34.9 | 180.5 | 5.88 | <0.01 | 7 | 29 | 30 | 0.02 | 0.6 | 22 | 11 | 7 | *0.87* | 0.002 | <0.0001 | 5 | 0.001 | *0.002* | 0.53 | <0.001 | 2 | 0.031 | <0.0001 | <0.001 | 0.04 | 3 | *0.022* |
| **Coochiemudlo Island** | **Upstream** | **CISW2** | **20/05/2020** | 49.4 | 331 | 6.78 | 0.01 | 3 | 81 | 307 | <0.01 | 2.4 | 40 | 43 | 74 | *0.19* | *0.001* | <0.0001 | 6 | *0.002* | 0.001 | 2.38 | <0.001 | 5 | 0.014 | <0.0001 | <0.001 | 0.17 | 10 | *0.007* |
| **Coochiemudlo Island** | **Upstream** | **CISW3** | **20/05/2020** | 37.3 | 304 | 5.59 | 0.08 | <2 | 75 | 452 | <0.05[#1] | 4.0 | 38 | 59 | 129 | *0.34* | *0.001* | <0.0001 | 6 | *0.002* | <0.001 | 7.36 | <0.001 | 5 | 0.029 | <0.0001 | <0.001 | 0.26 | 8 | <0.005 |
| **Coochiemudlo Island** | **Upstream** | **CISW4** | **20/05/2020** | 38.3 | 340 | 6.70 | <0.01 | <2 | 53 | 76 | <0.01 | 1.4 | 33 | 28 | 42 | *0.20* | 0.004 | <0.0001 | 8 | *0.003* | <0.001 | 14.5 | <0.001 | 8 | 0.046 | <0.0001 | 0.002 | 0.10 | 2 | *0.025* |
| **Statistics** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Number of Results** | | | | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** | **5** |
| **Number of Detects** | | | | **3** | **3** | **5** | **5** | **1** | **5** | **5** | **5** | **5** | **5** | **4** | **0** | **5** | **4** | **3** | **5** | **0** | **5** | **5** | **0** | **1** | **5** | **5** | **3** |
| **Minimum Concentration** | | | | **0.01** | **<2** | **29** | **30** | **<0.01** | **0.6** | **22** | **11** | **6** | **0.03** | **0.001** | **<0.0001** | **5** | **0.001** | **0.001** | **0.53** | **<0.001** | **2** | **0.013** | **<0.0001** | **<0.001** | **0.01** | **2** | **<0.005** |
| **Minimum Detect** | | | | **0.01** | **3** | **29** | **30** | **0.02** | **0.6** | **22** | **11** | **6** | **0.03** | **0.001** | **ND** | **5** | **0.001** | **0.001** | **0.53** | **ND** | **2** | **0.013** | **ND** | **0.002** | **0.01** | **2** | **0.007** |
| **Maximum Concentration** | | | | **0.08** | **7** | **151** | **452** | **<0.05** | **4** | **67** | **59** | **129** | **0.87** | **0.004** | **<0.0001** | **39** | **0.003** | **0.002** | **14.5** | **<0.001** | **31** | **0.046** | **<0.0001** | **0.002** | **0.26** | **18** | **0.025** |
| **Maximum Detect** | | | | **0.08** | **7** | **151** | **452** | **0.02** | **4** | **67** | **59** | **129** | **0.87** | **0.004** | **ND** | **39** | **0.003** | **0.002** | **14.5** | **ND** | **31** | **0.046** | **ND** | **0.002** | **0.26** | **18** | **0.025** |
| **Average Concentration *** | | | | **0.028** | **3** | **78** | **182** | **0.012** | **1.8** | **40** | **32** | **52** | **0.33** | **0.0017** | **0.00005** | **13** | **0.0017** | **0.0012** | **5.2** | **0.0005** | **10** | **0.027** | **0.00005** | **0.0008** | **0.12** | **8.2** | **0.012** |
| **Median Concentration *** | | | | **0.01** | **3** | **75** | **76** | **0.005** | **1.4** | **38** | **28** | **42** | **0.2** | **0.001** | **0.00005** | **6** | **0.002** | **0.001** | **2.98** | **0.0005** | **5** | **0.029** | **0.00005** | **0.0005** | **0.1** | **8** | **0.007** |
| **Standard Deviation *** | | | | **0.033** | **2.4** | **46** | **188** | **0.0097** | **1.4** | **17** | **20** | **62** | **0.32** | **0.0014** | **0** | **15** | **0.00097** | **0.00076** | **5.8** | **0** | **12** | **0.014** | **0** | **0.00067** | **0.1** | **6.4** | **0.011** |
| **95% UCL (Student's-t) *** | | | | **0.059** | **5.335** | **121.4** | **361.4** | **0.0213** | **3.168** | **55.85** | **50.25** | **100.8** | **0.634** | **0.00303** | **0.00005** | **26.8** | **0.00263** | **0.00192** | **10.82** | **0.0005** | **21.47** | **0.0396** | **0.00005** | **0.00144** | **0.212** | **14.32** | **0.0222** |

* A Non Detect Multiplier of 0.5 has been applied.

**Comments**

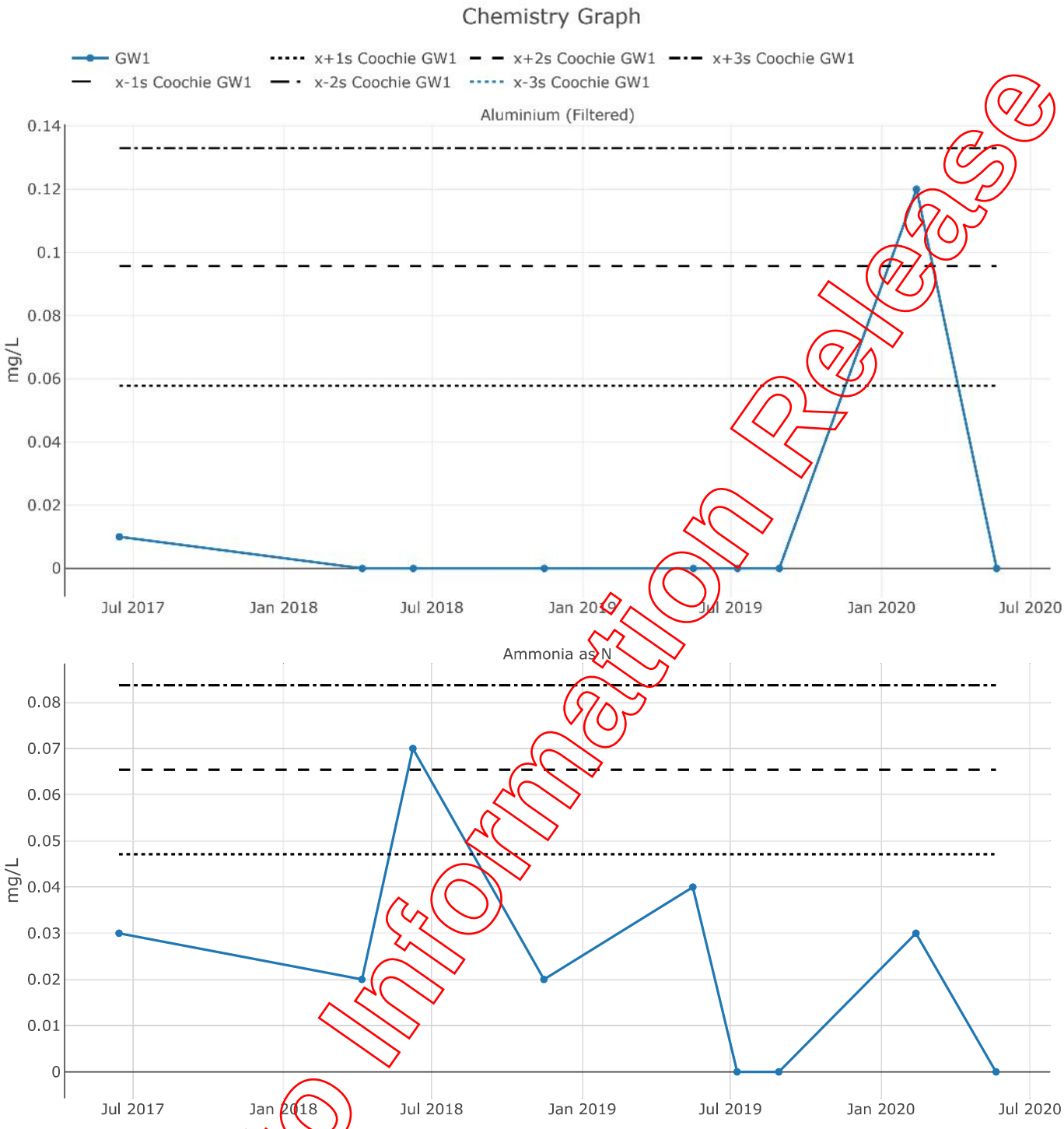
#1 Reported Analyte LOR is higher than Requested Analyte LOR

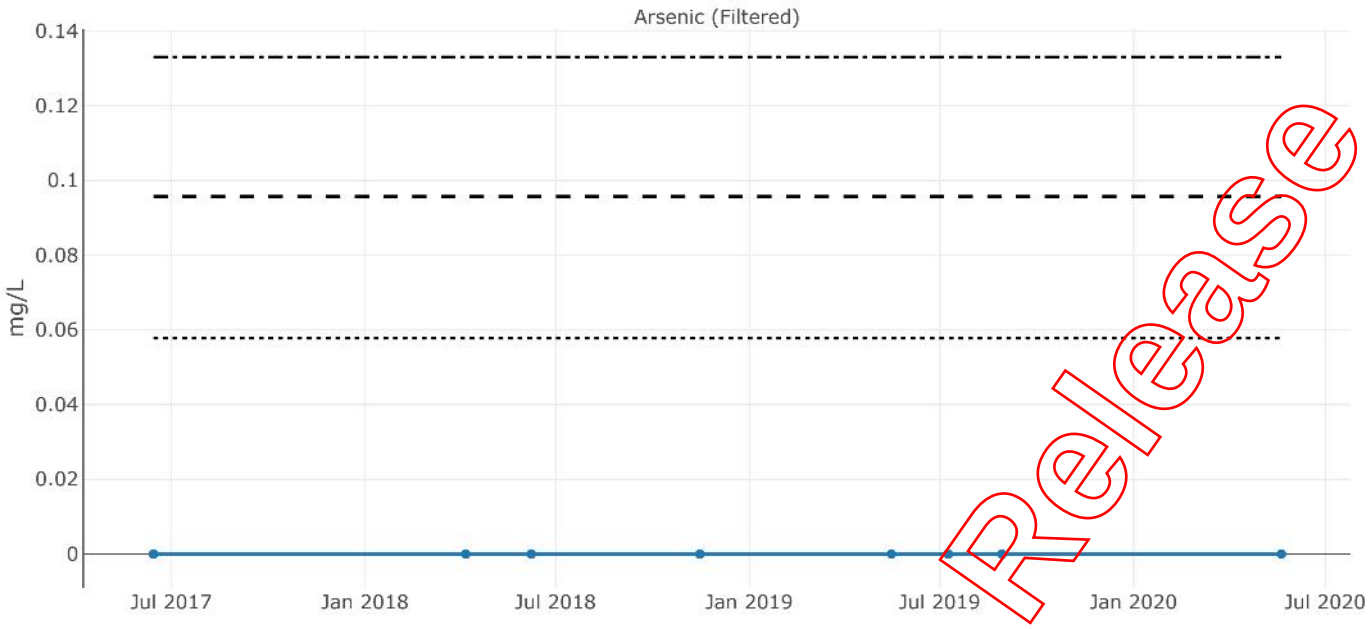
| | | | | Inorganics | | | | | | | | | | | | | Metals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sulfate as SO4 - Turbidimetric (filtered) | Nitrite + Nitrate as N | Ammonia as N | BOD | Chloride | COD | Kjeldahl Nitrogen Total | Nitrate (as N) | Nitrite (as N) | Nitrogen (Total) | Sodium (filtered) | TOC | TSS | Aluminium (filtered) | Arsenic (filtered) | Cadmium (filtered) | Calcium (filtered) | Chromium (III+VI) (filtered) | Copper (filtered) | Iron (filtered) | Lead (filtered) | Magnesium (filtered) | Manganese (filtered) | Mercury (filtered) | Nickel (filtered) | Phosphorous | Potassium (filtered) | Zinc (filtered) |
| | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | 1 | 0.01 | 0.01 | 2 | 1 | 10 | 0.1 | 0.01 | 0.01 | 0.1 | 1 | 1 | 5 | 0.01 | 0.001 | 0.0001 | 1 | 0.001 | 0.001 | 0.05 | 0.001 | 1 | 0.001 | 0.0001 | 0.001 | 0.01 | 1 | 0.005 |
| **Lab Report Number** | **Field ID** | **Date** | **Matrix Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **EB2013449** | **CISW4** | **20/05/2020** | **SW** | 8 | <0.01 | <0.01 | <2 | 53 | 76 | 1.4 | <0.01 | <0.01 | 1.4 | 33 | 28 | 42 | 0.20 | 0.004 | <0.0001 | 8 | 0.003 | <0.001 | 14.5 | <0.001 | 8 | 0.045 | <0.0001 | 0.002 | 0.10 | 2 | 0.025 |
| **EB2013449** | **SWQA** | **20/05/2020** | **SW** | 8 | <0.01 | <0.01 | 6 | 52 | 108 | 1.6 | <0.01 | <0.01 | 1.6 | 33 | 28 | 36 | 0.18 | 0.004 | <0.0001 | 8 | 0.003 | <0.001 | 14.2 | <0.001 | 8 | 0.045 | <0.0001 | 0.001 | 0.11 | 2 | 0.025 |
| **RPD** | | | | 0 | 0 | 0 | 100 | 2 | 35 | 13 | 0 | 0 | 13 | 0 | 0 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 67 | 10 | 0 | 0 |

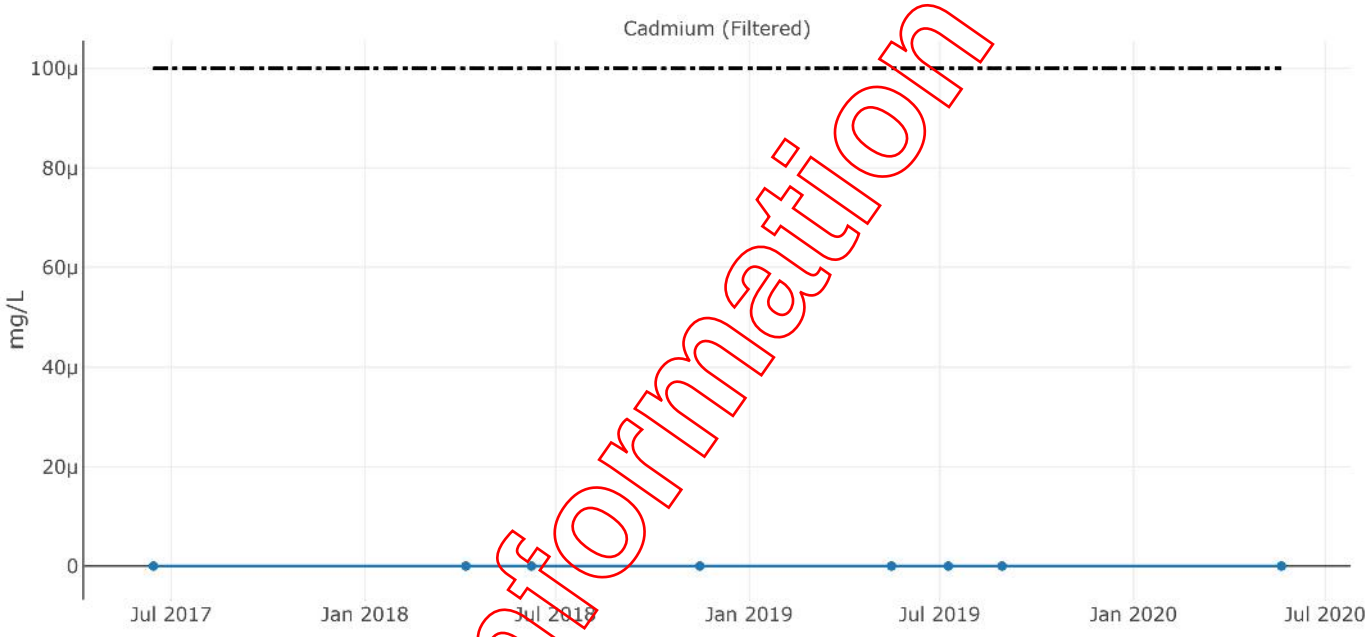
***RPDs have only been considered where a concentration is greater than 1 times the EQL.**
****Elevated RPDs are highlighted as per QAQC Profile settings (Acceptable RPDs for each EQL multiplier range are: 81 (1 - 10 x EQL); 50 (10 - 30 x EQL); 30 ( > 30 x EQL) )**
*****Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory**

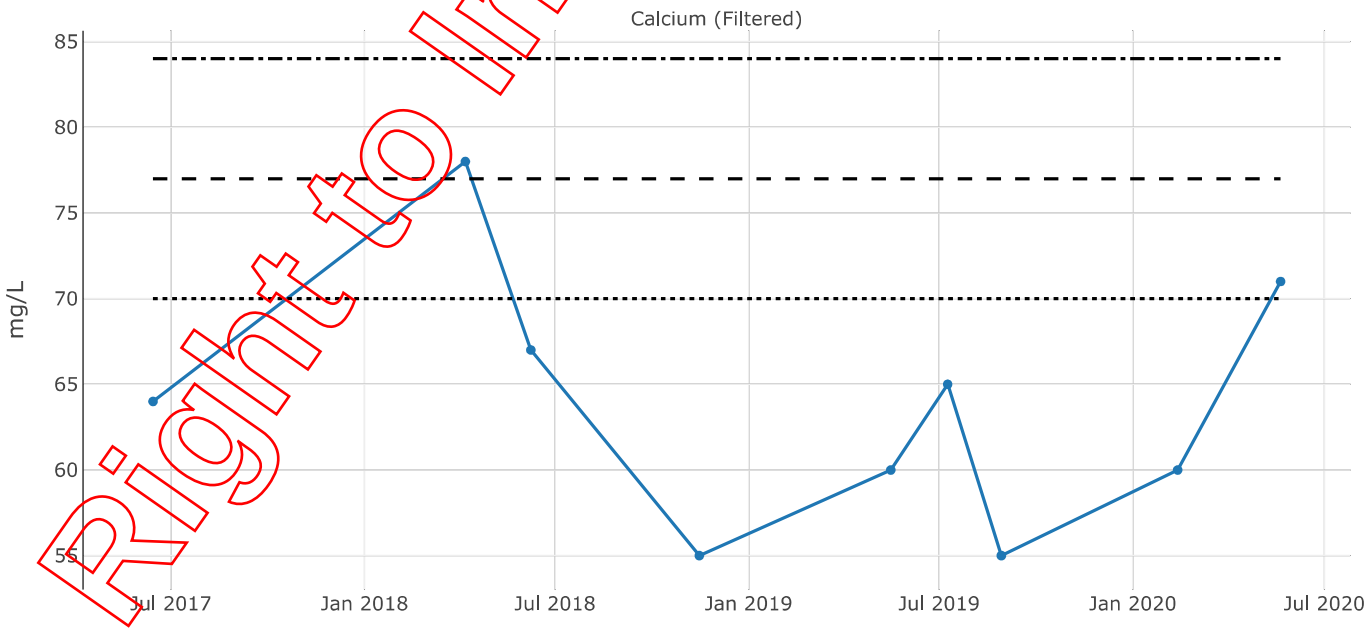
**Appendix C.**

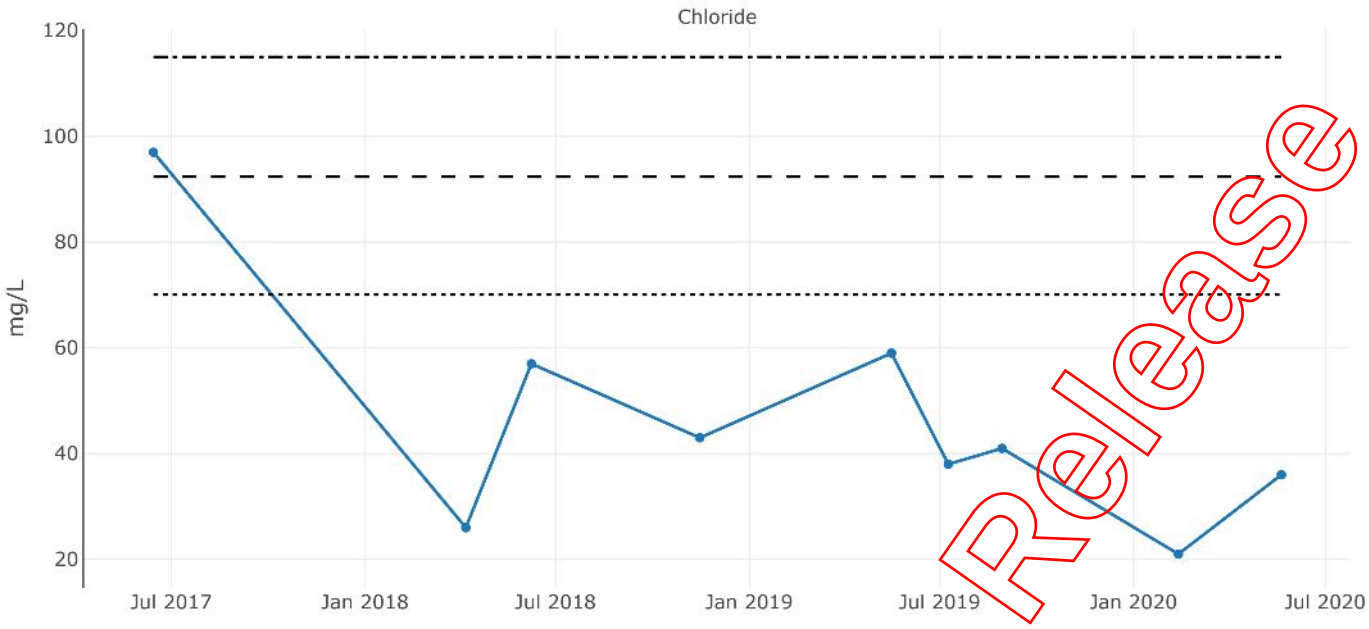
**Groundwater Statistical Charts**

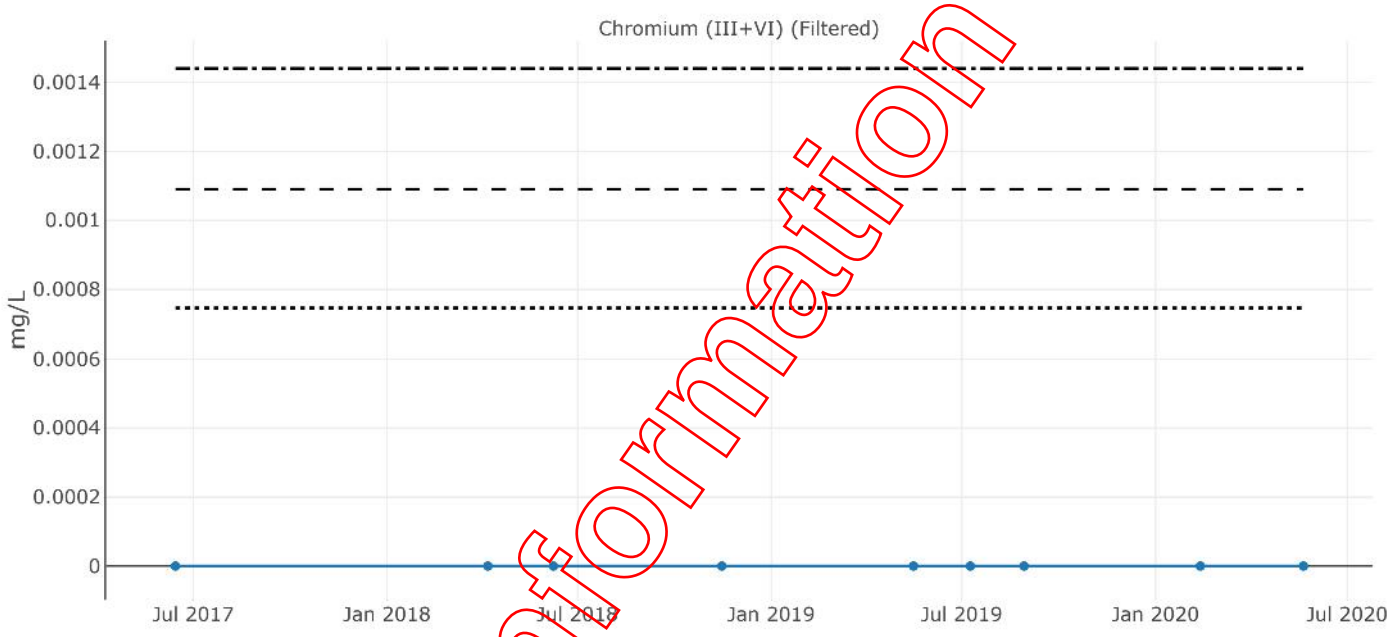


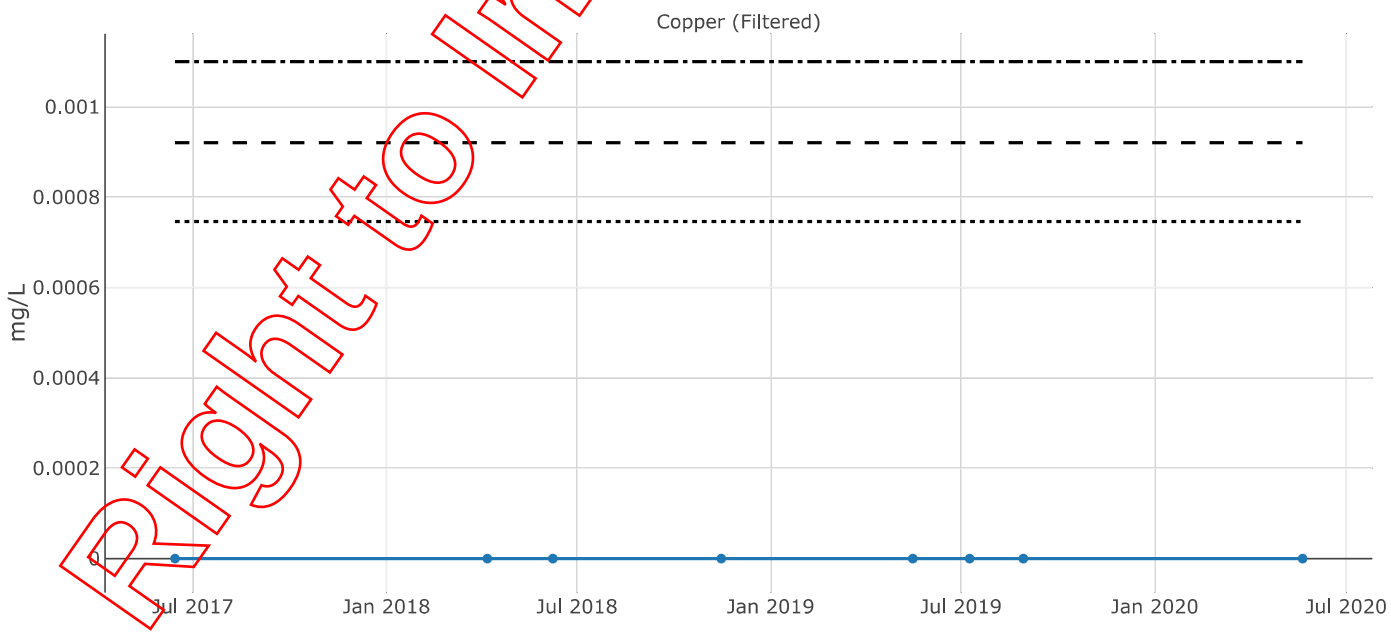


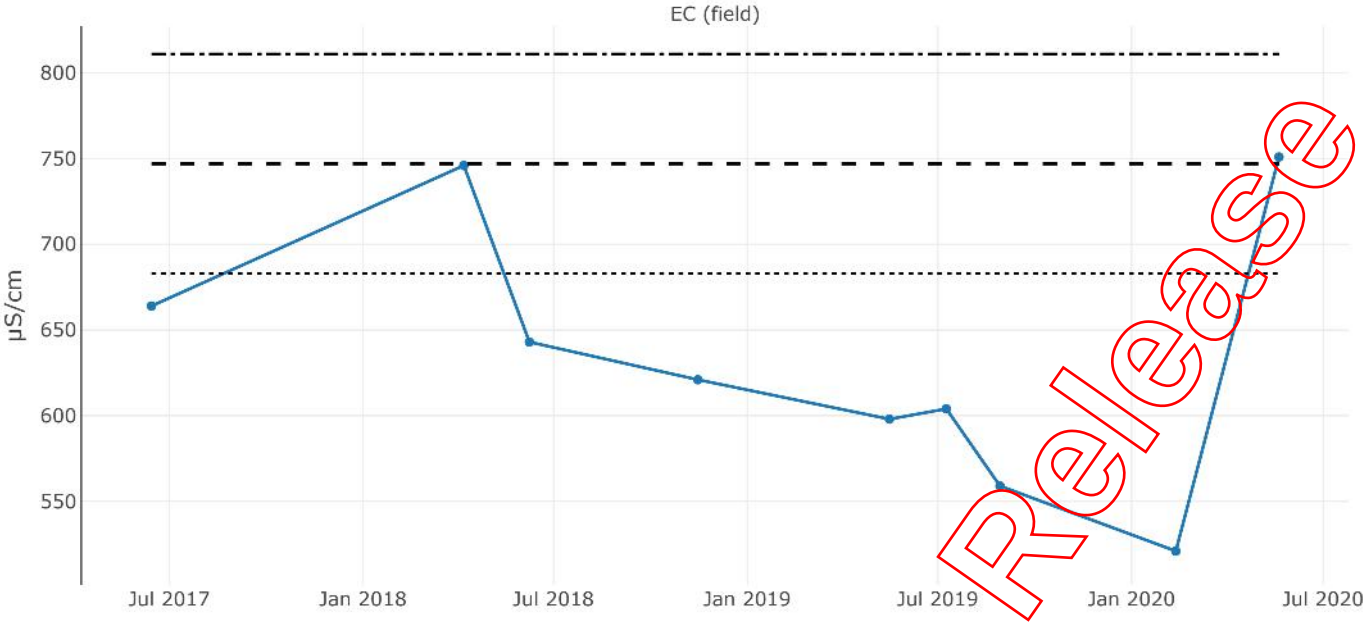



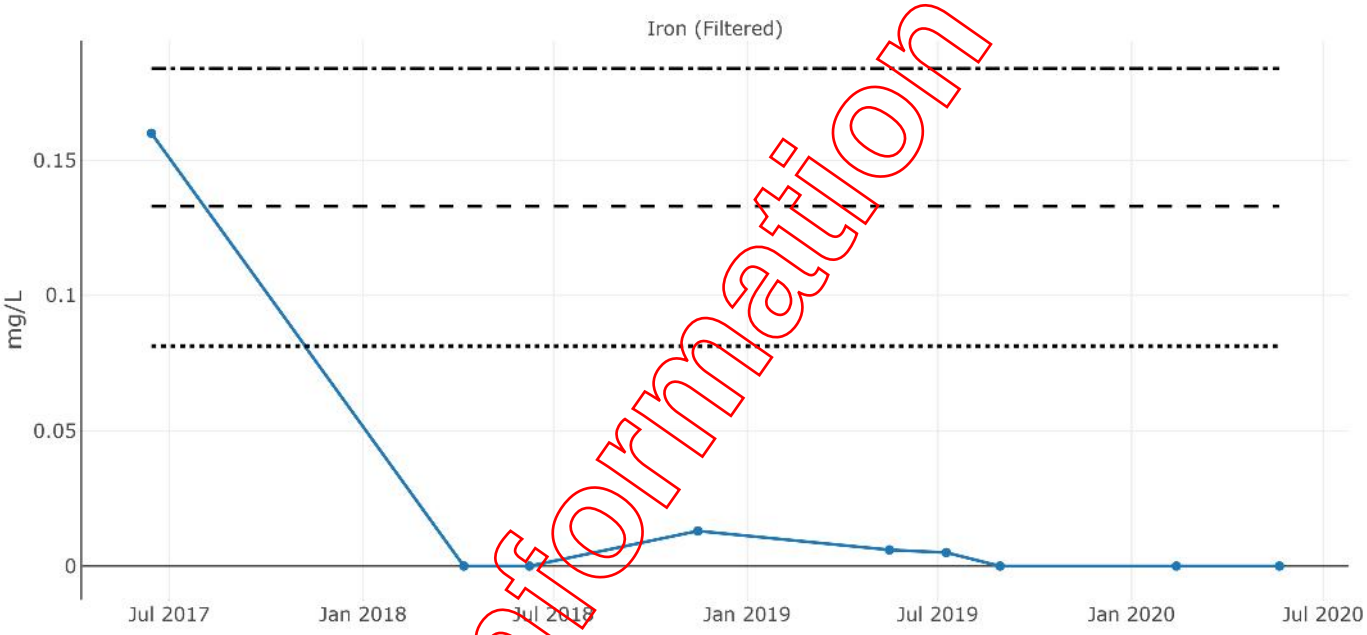



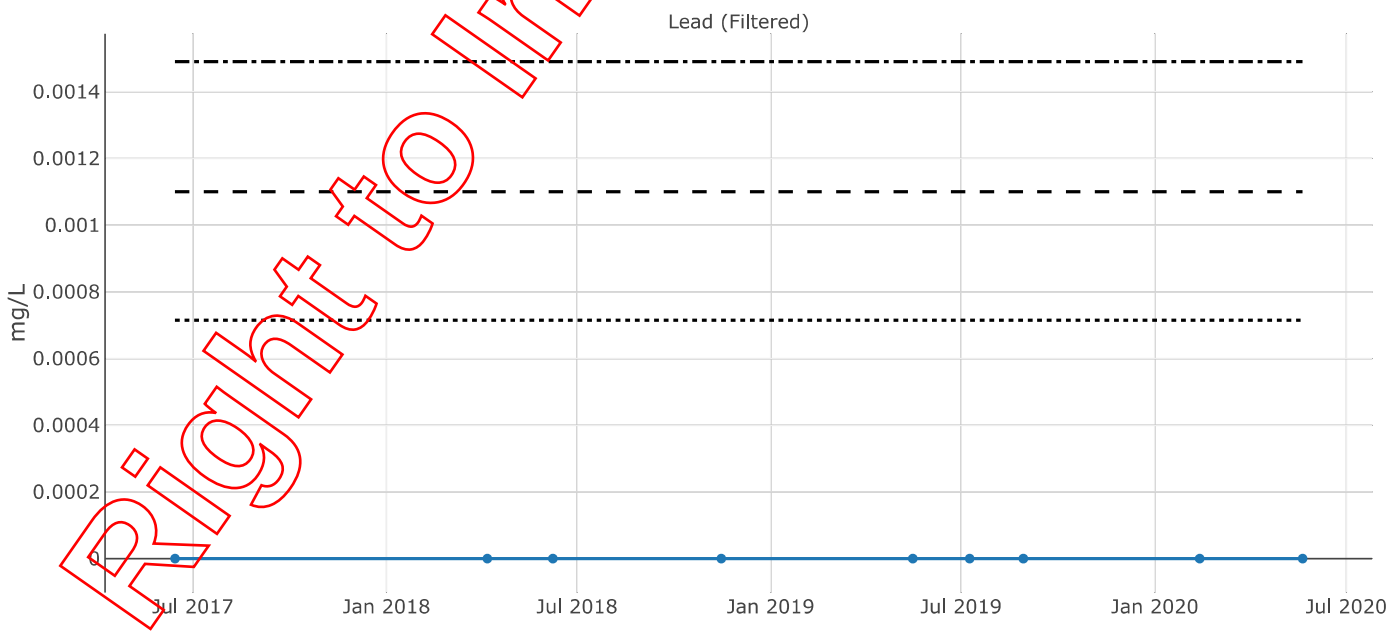


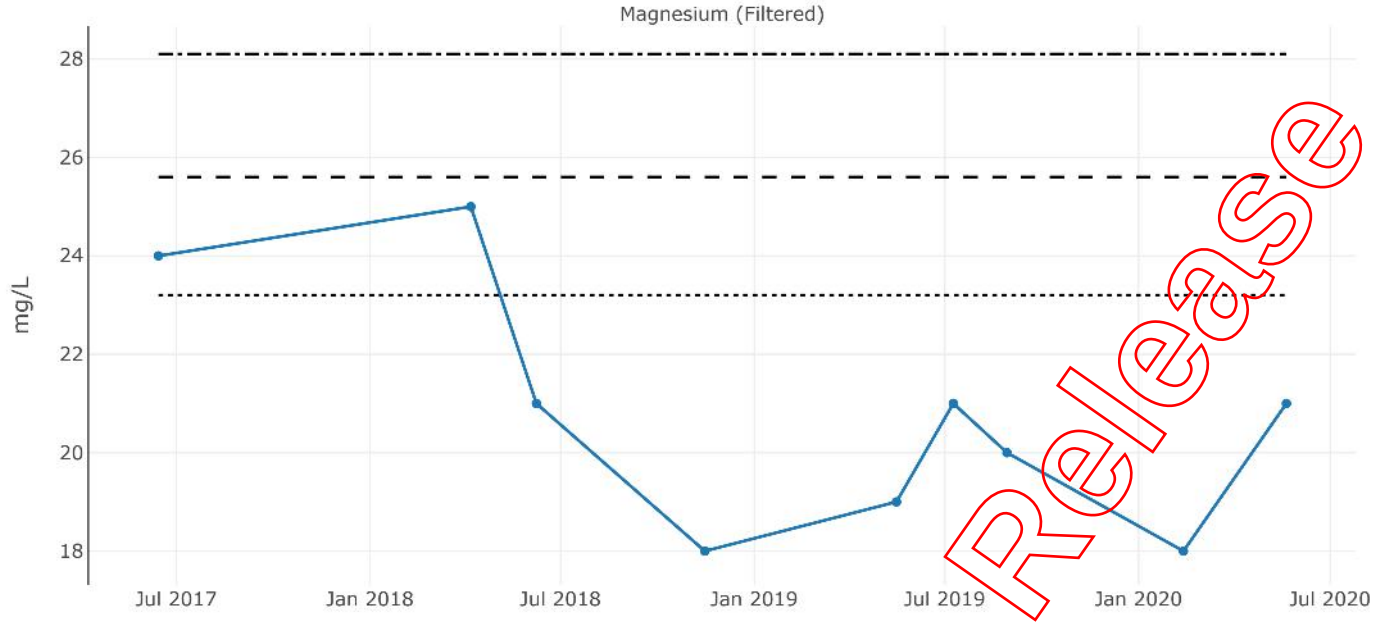



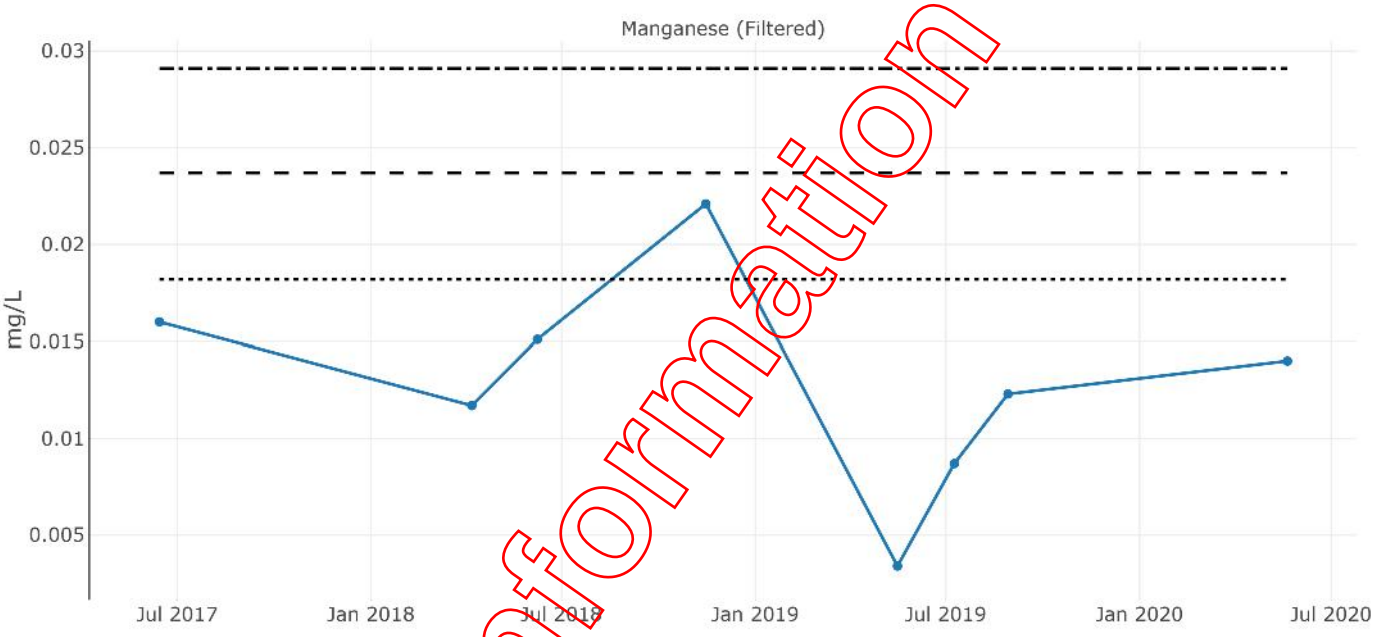



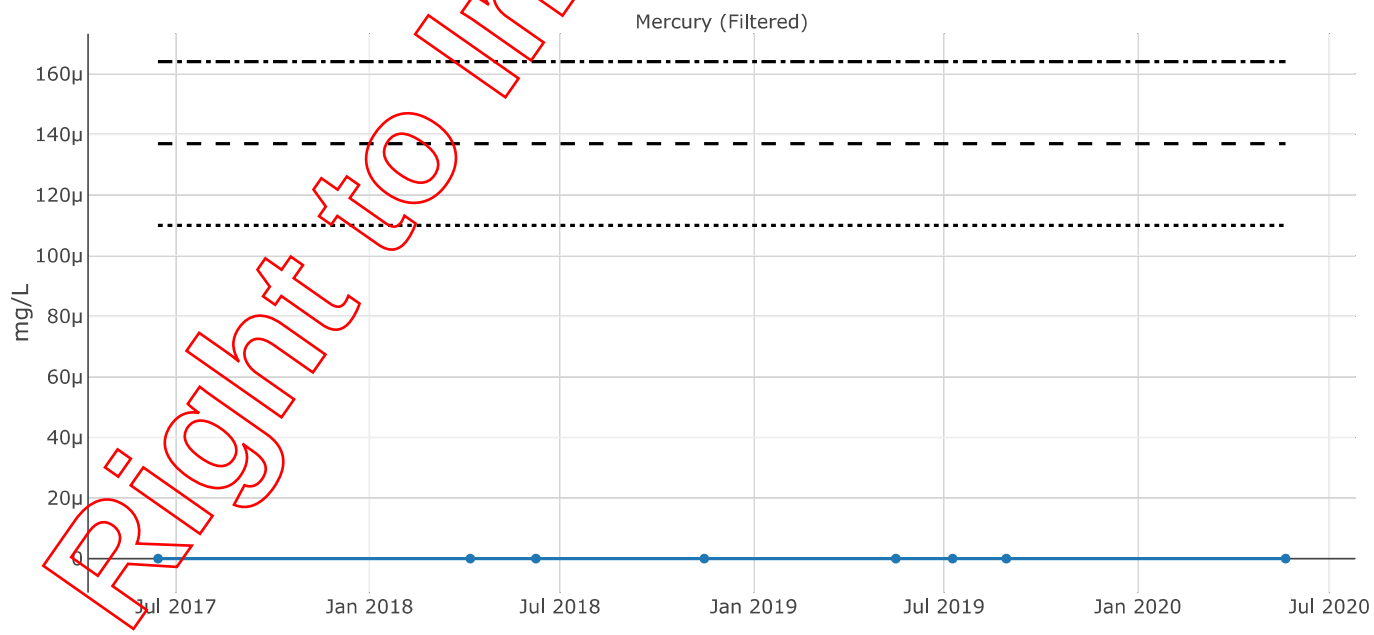


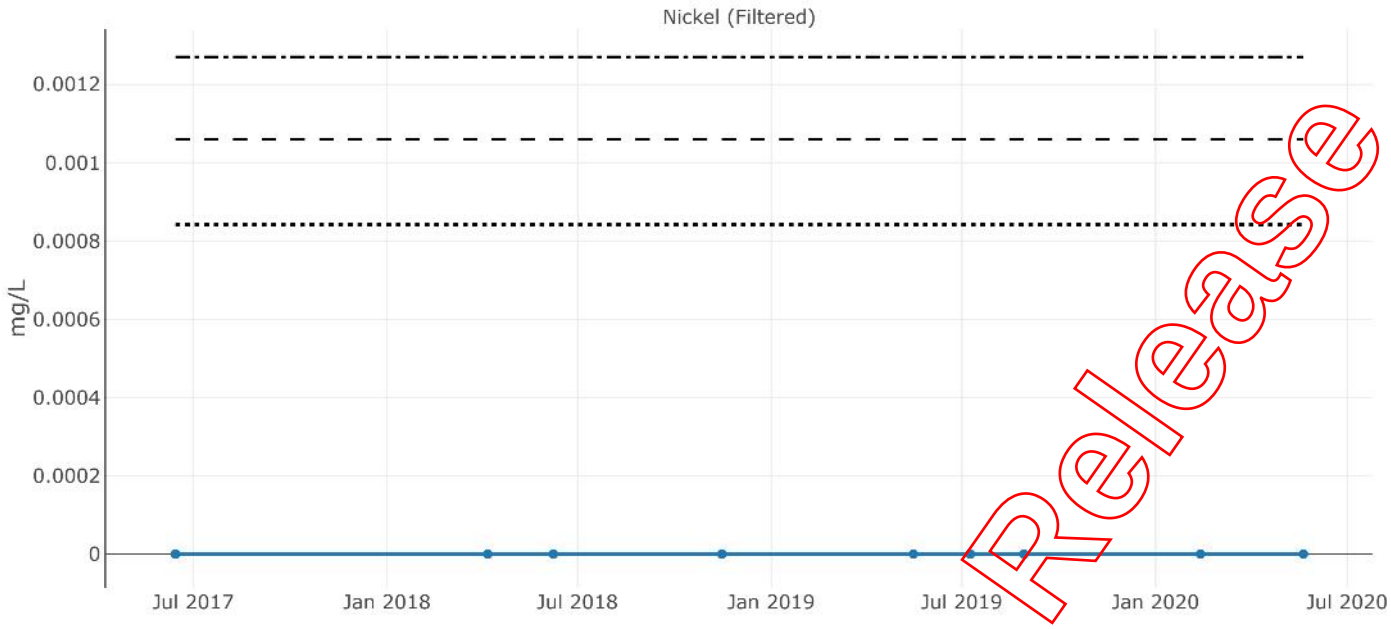



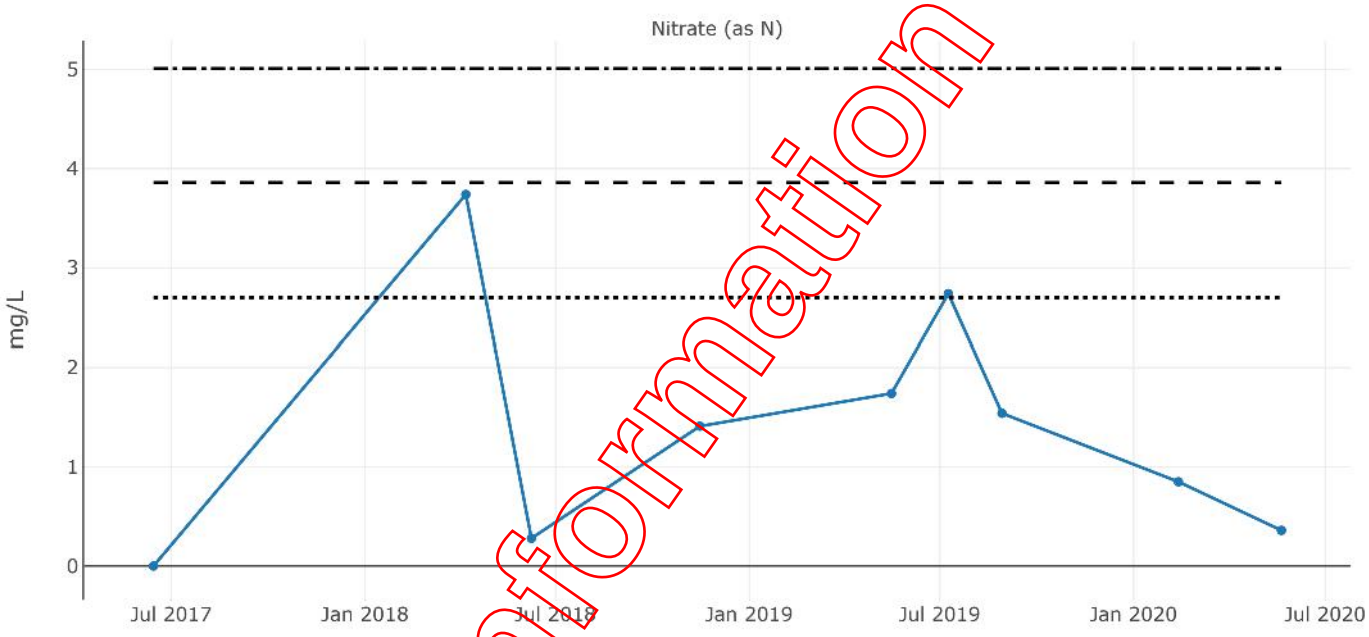



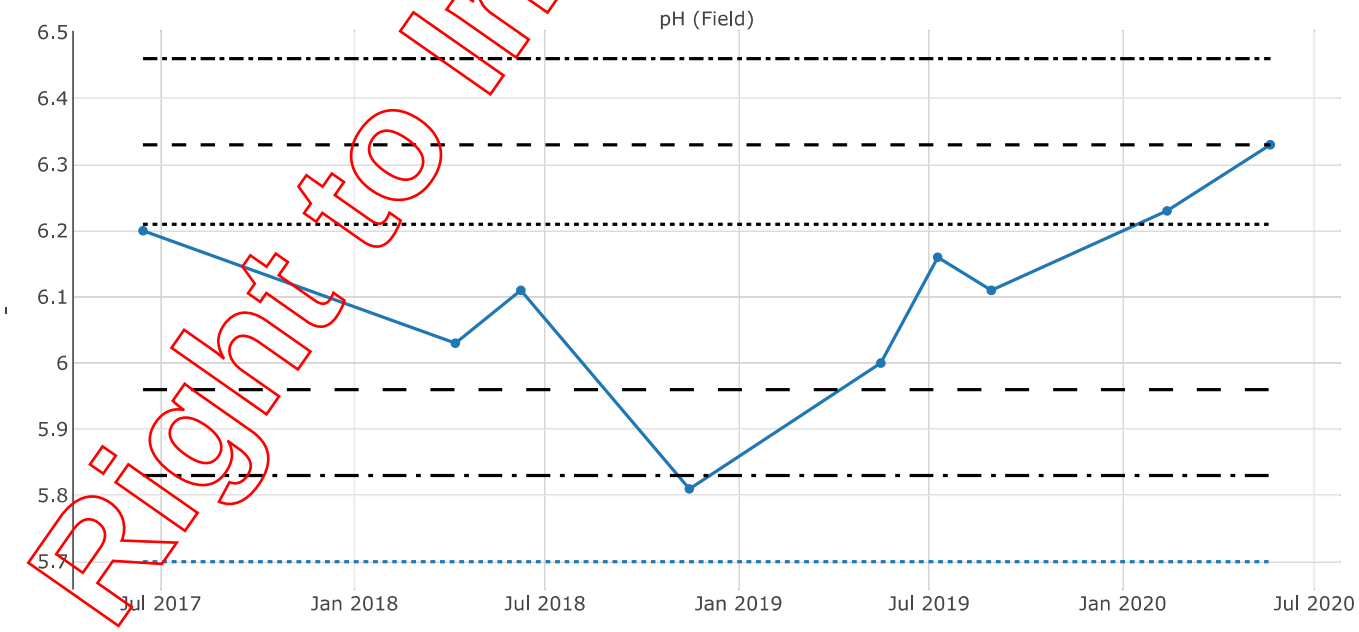


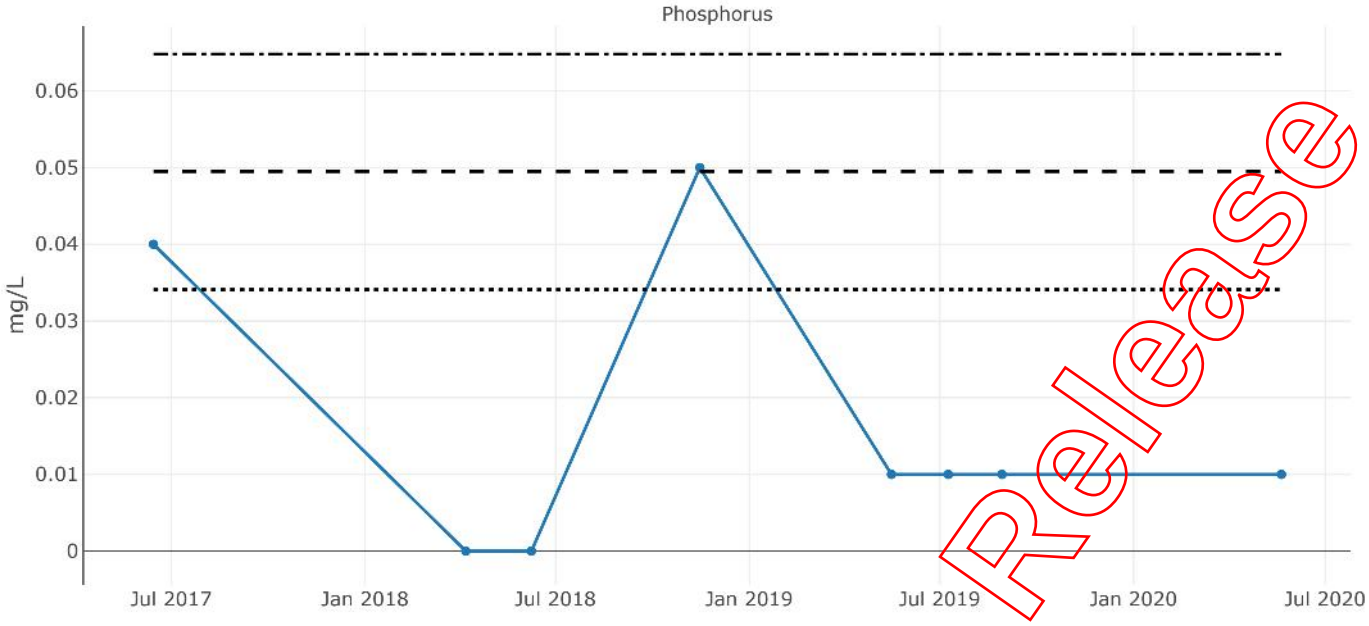



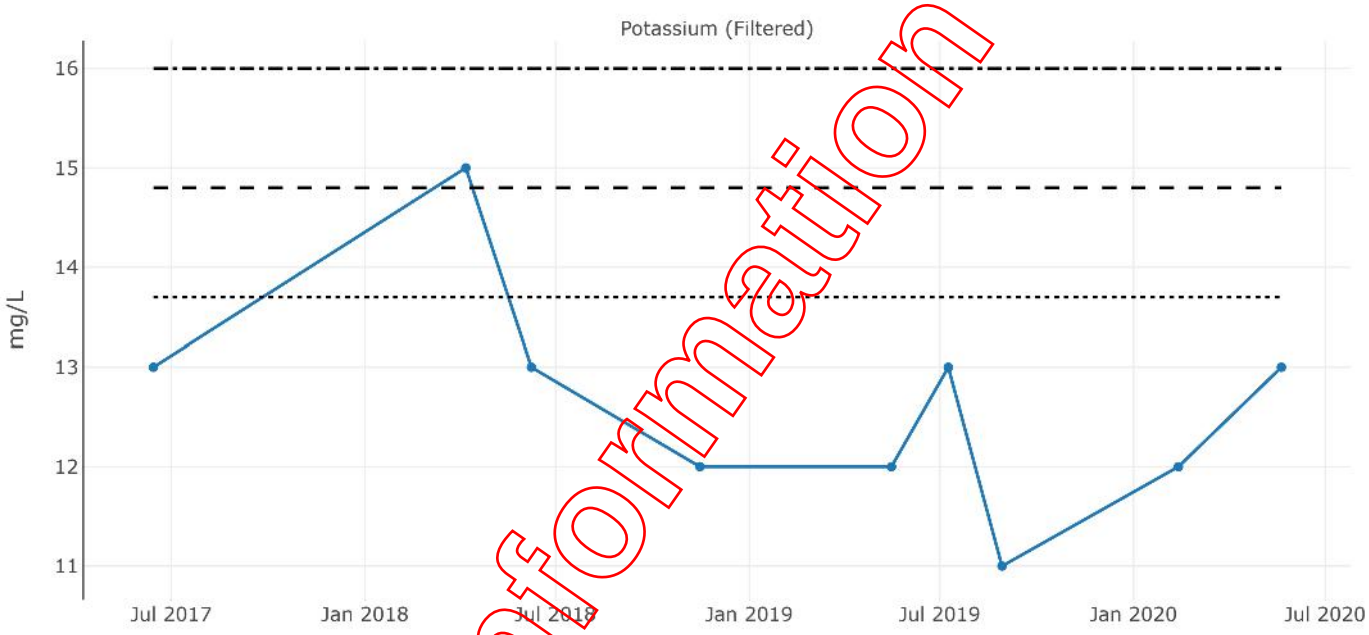



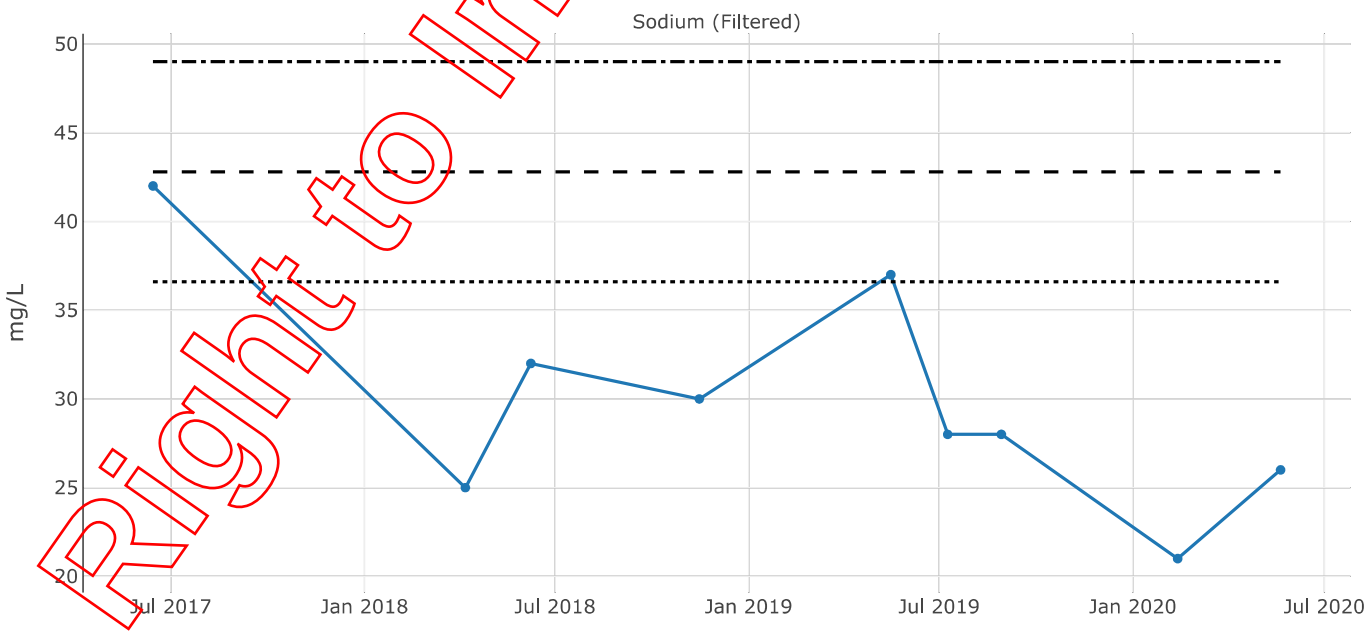


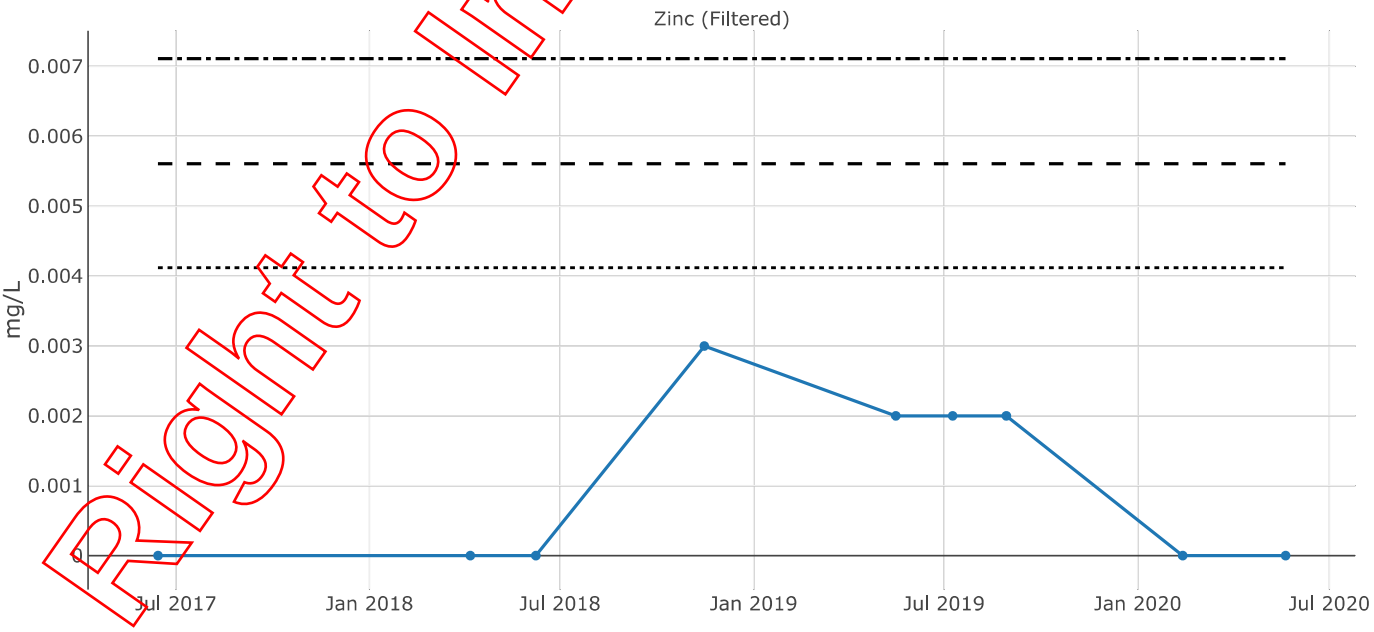





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Locations In "undefined",
Date between "01 Jan 2010" and "31 May 2020"

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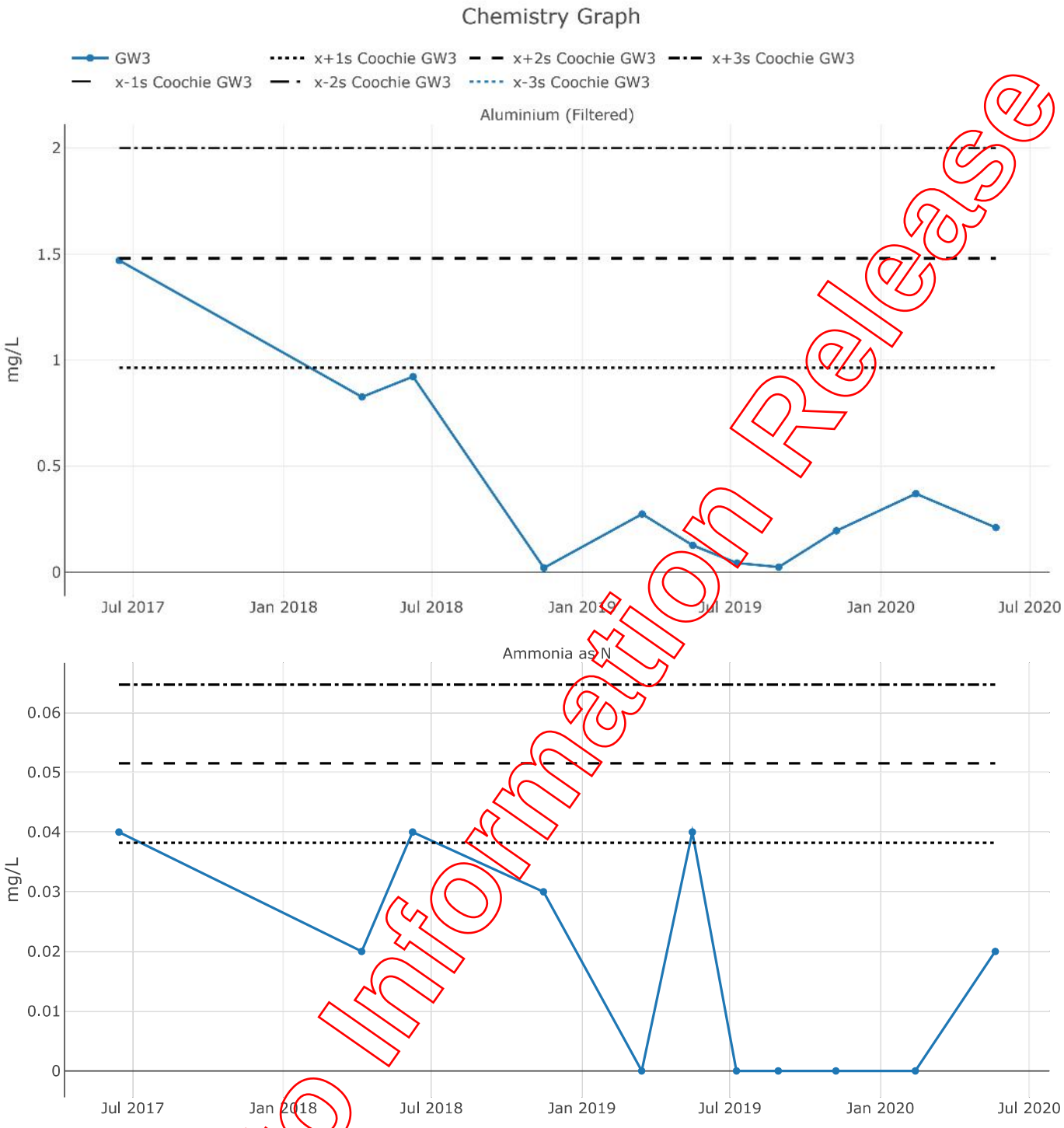

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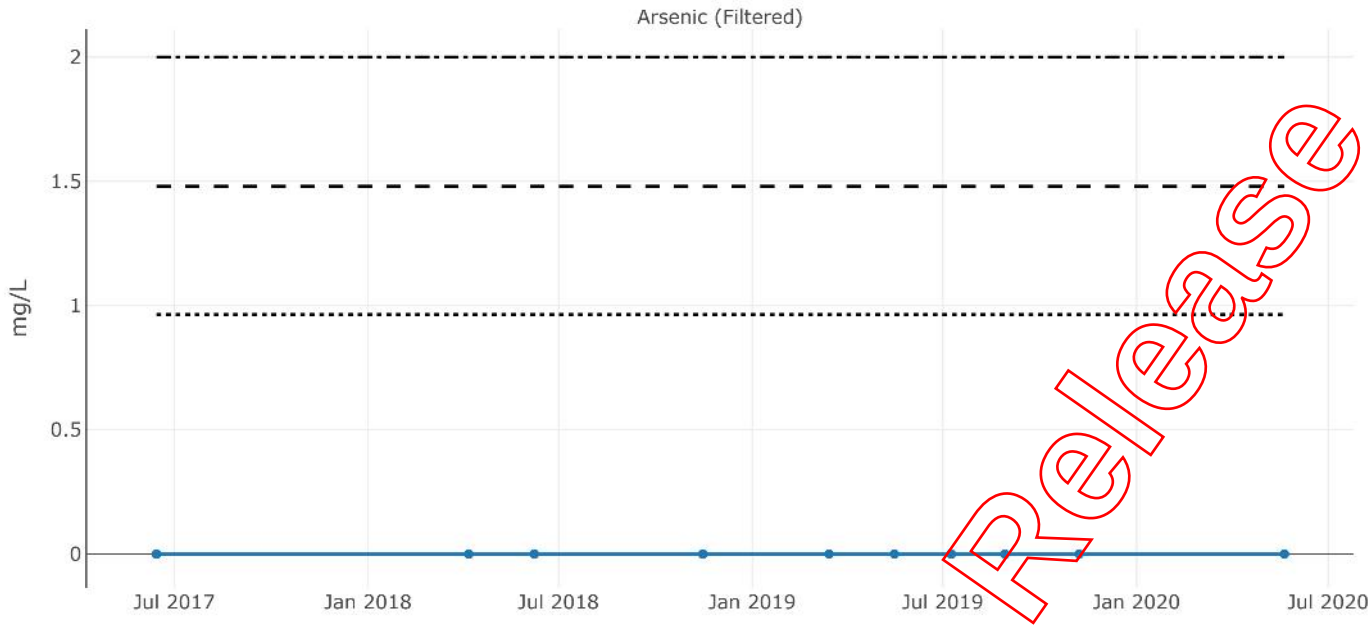


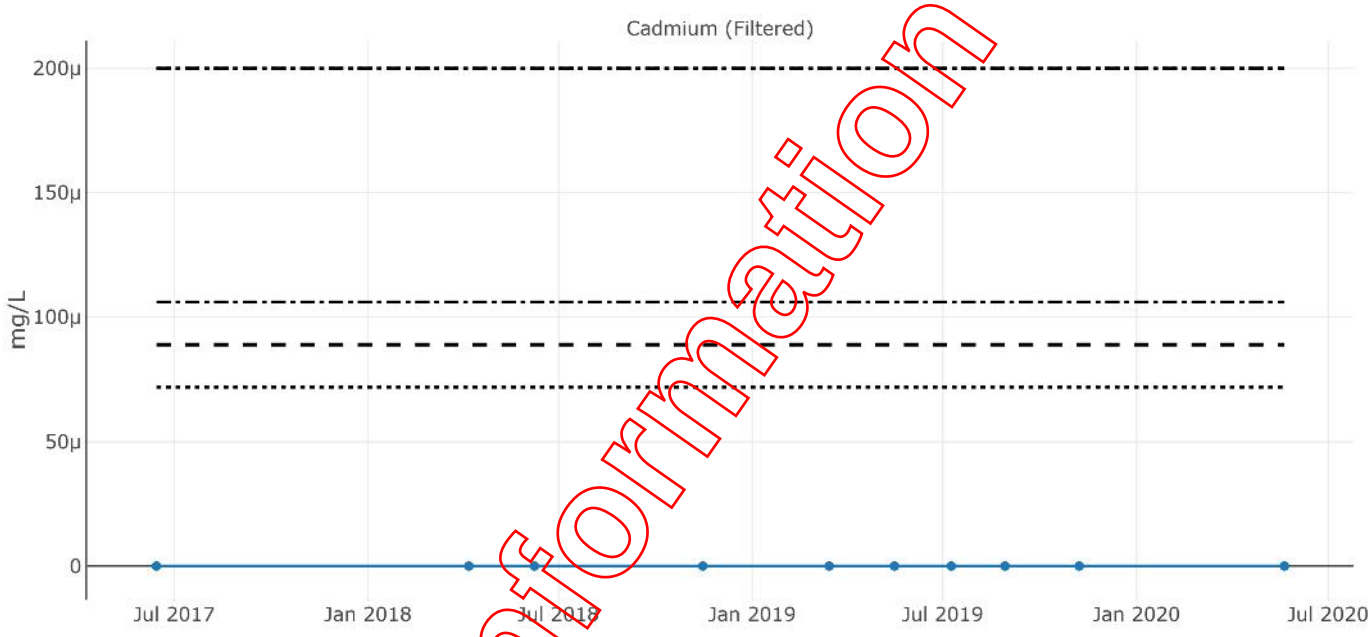


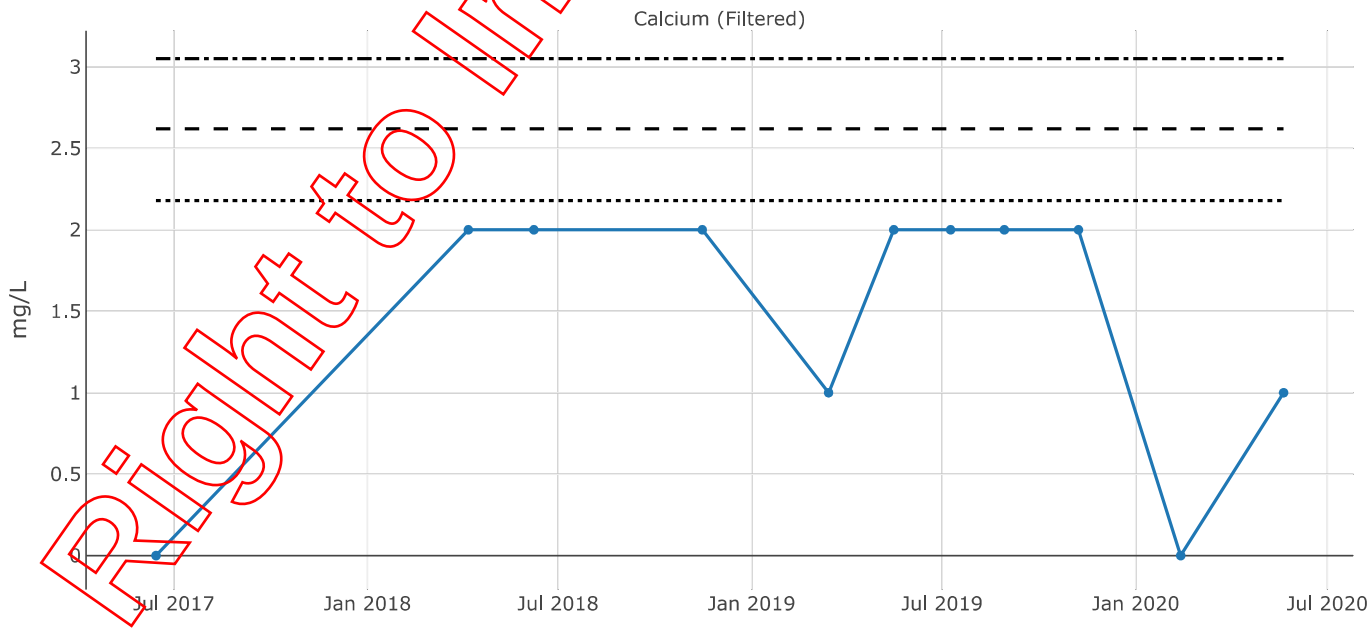


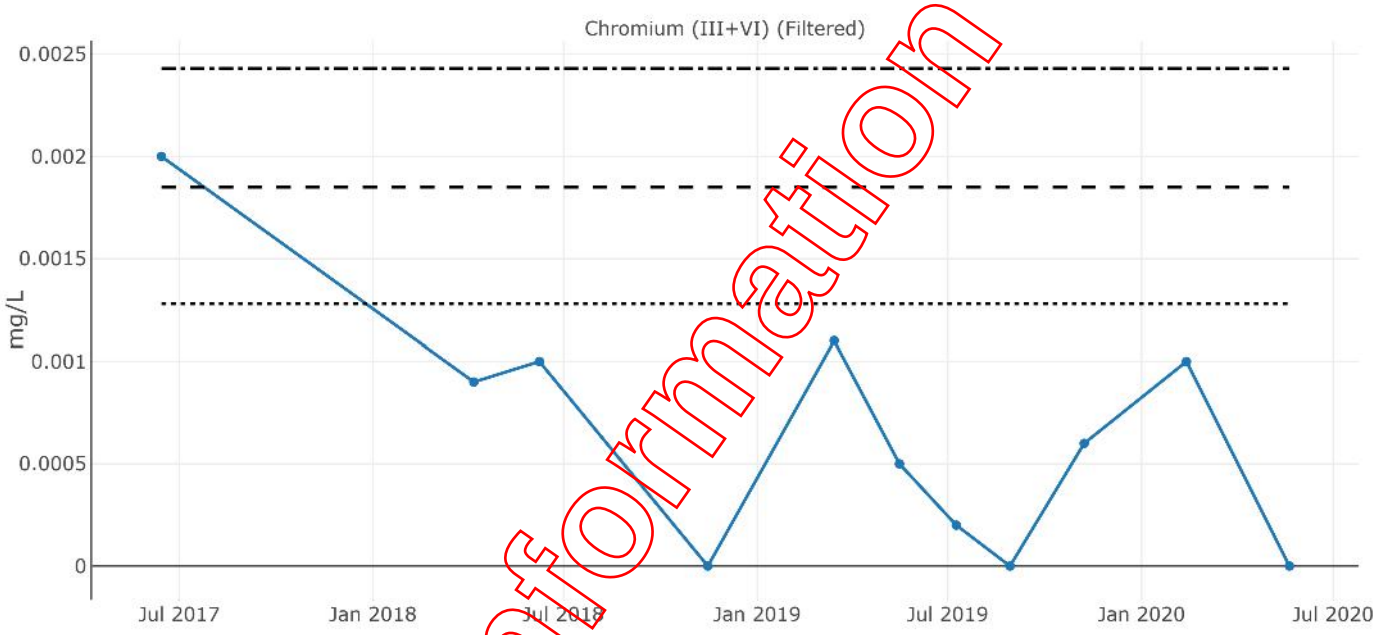


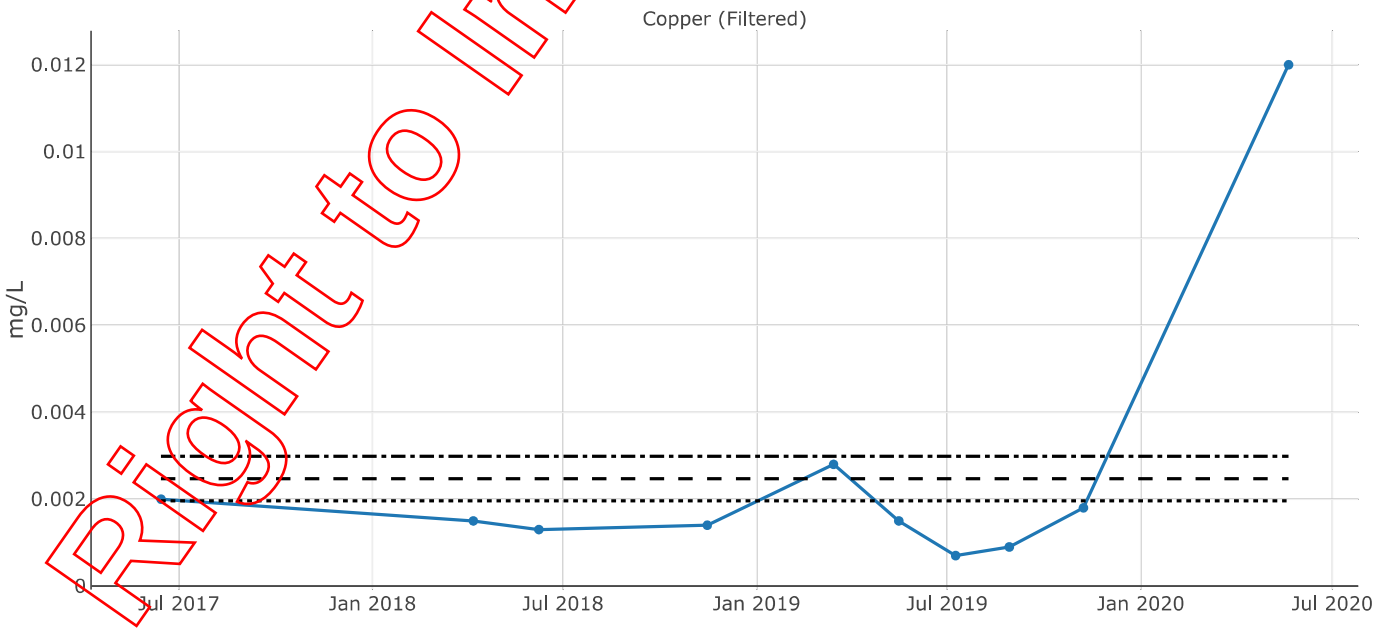

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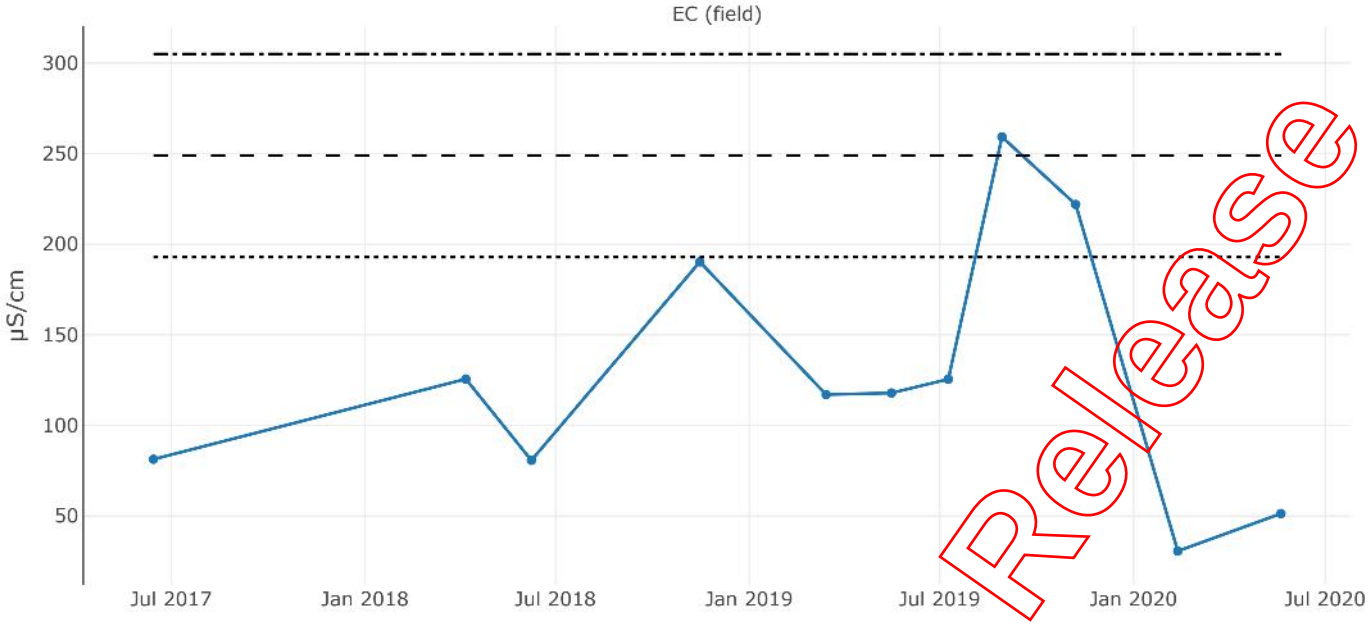



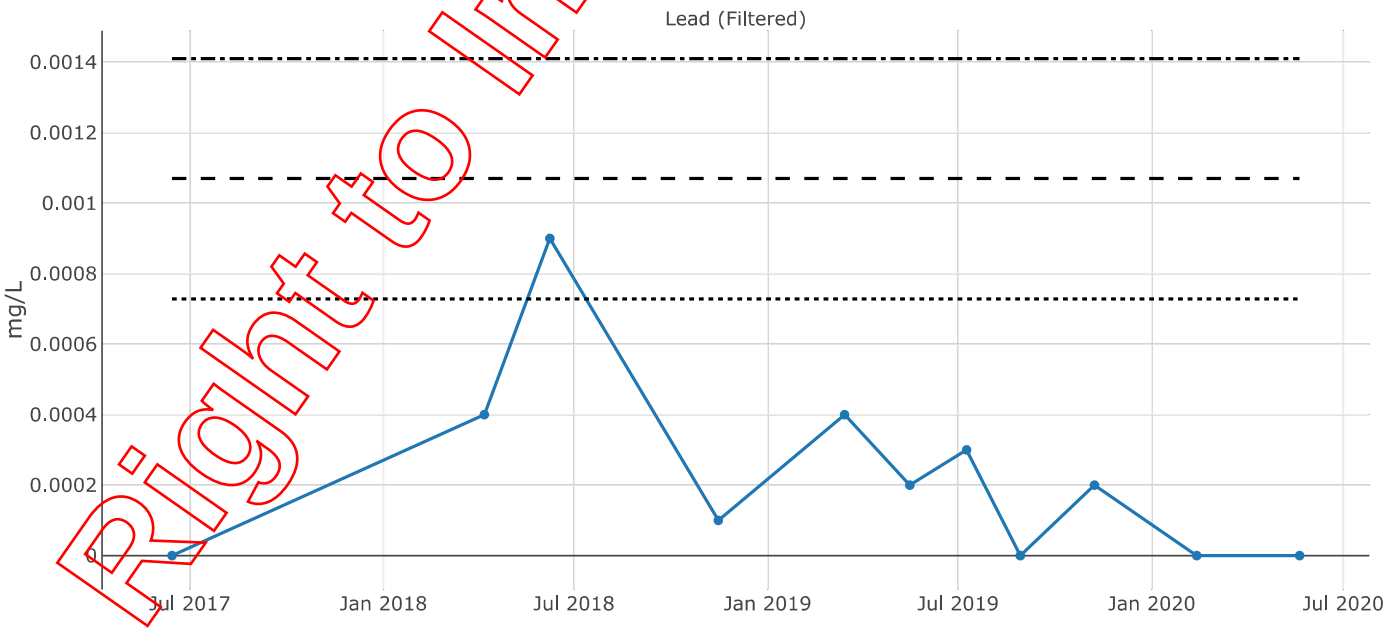

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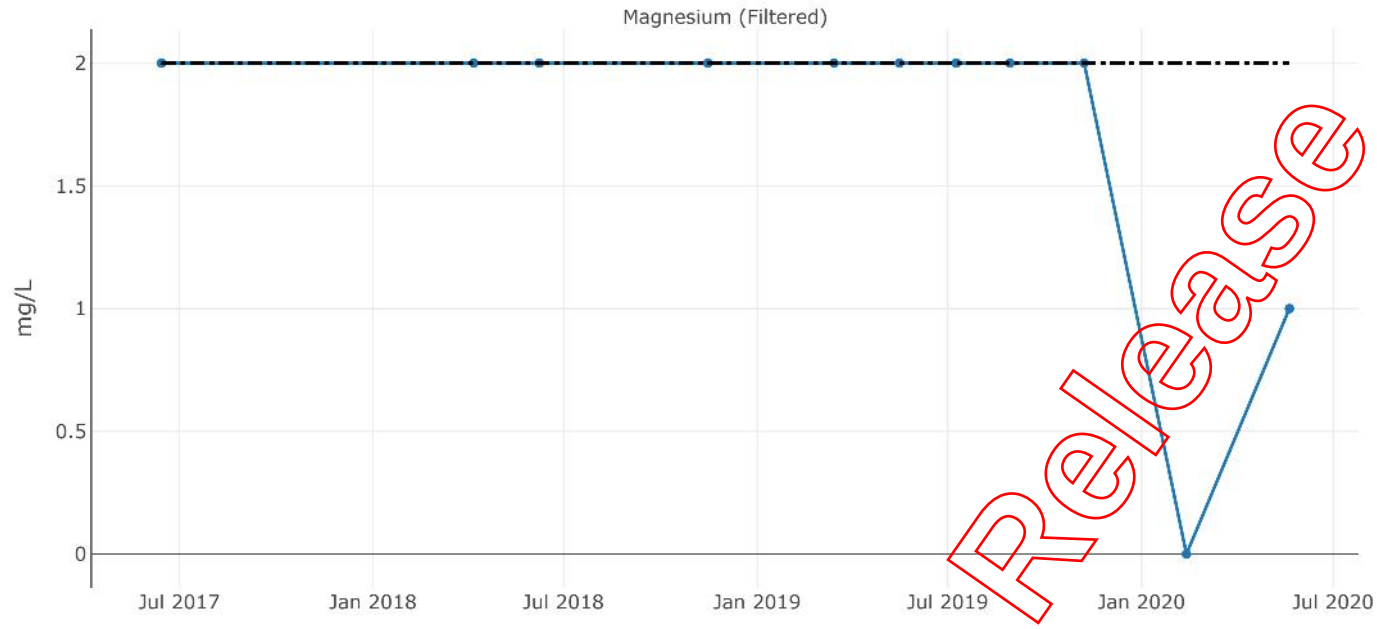


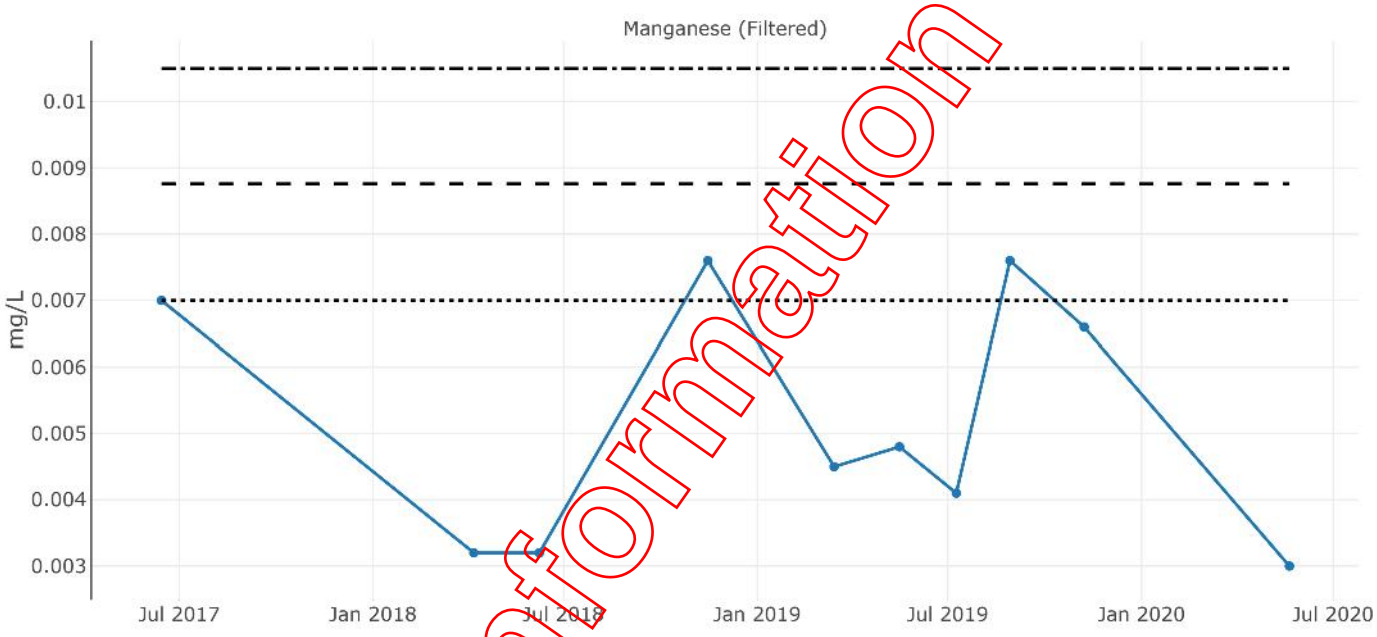


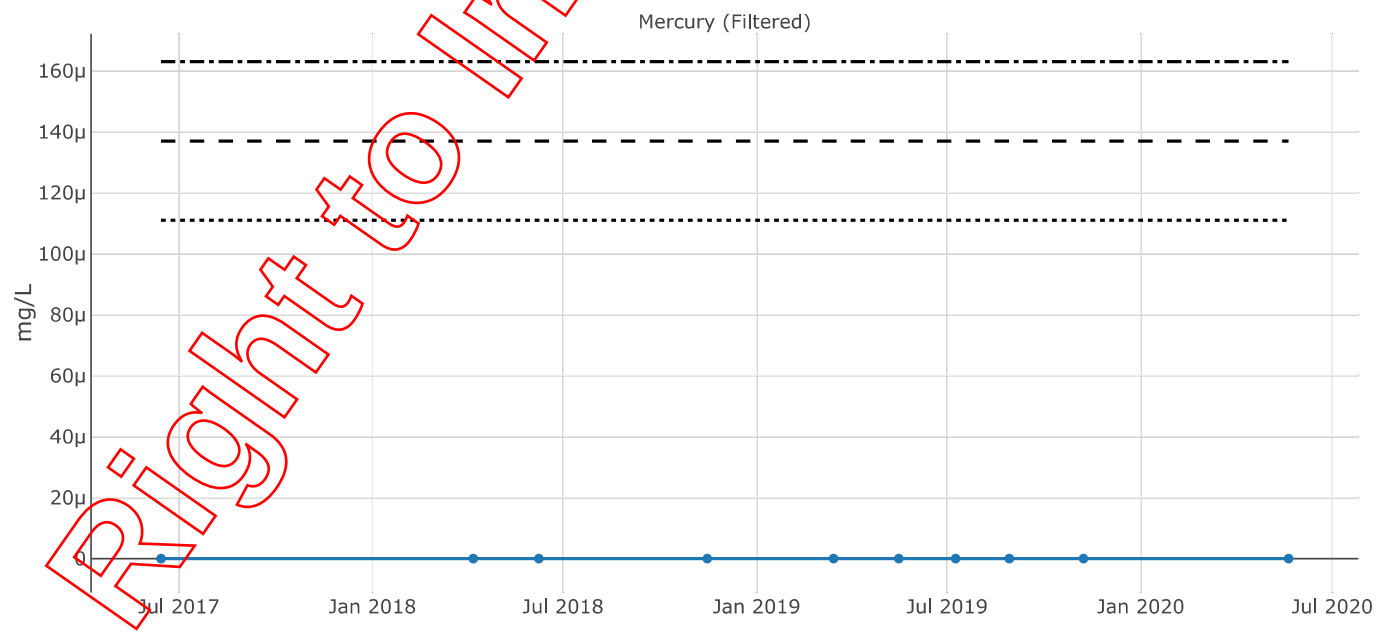

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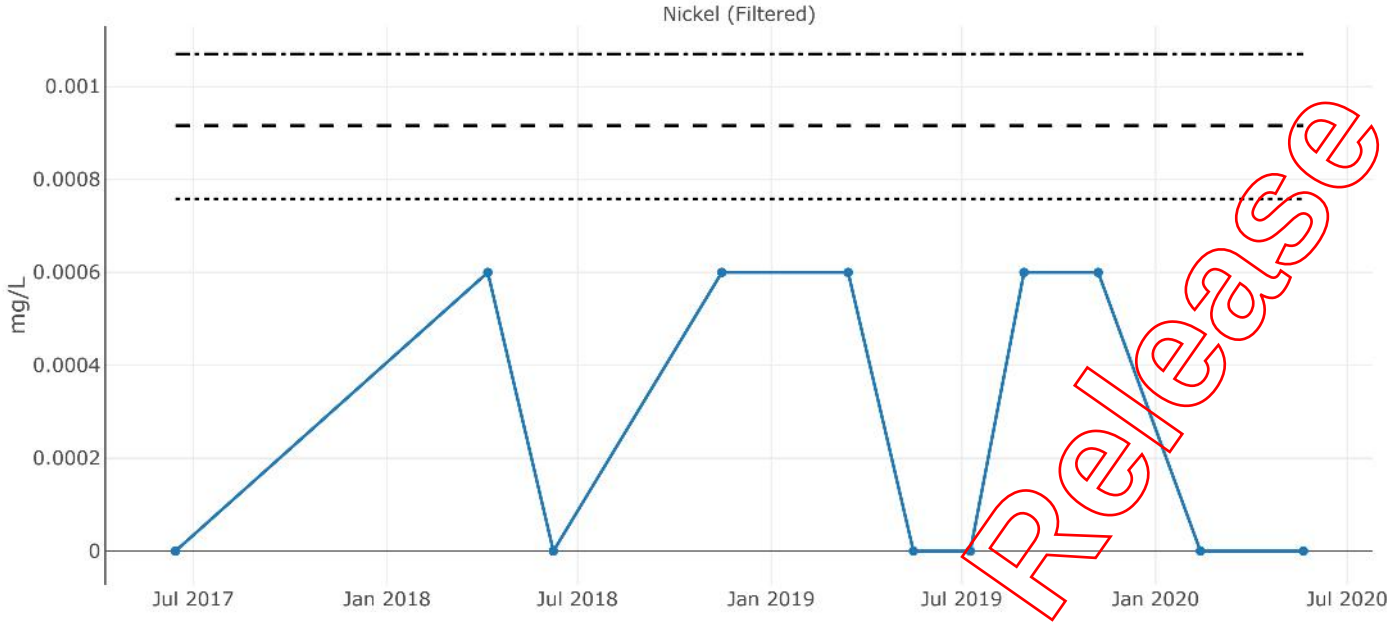


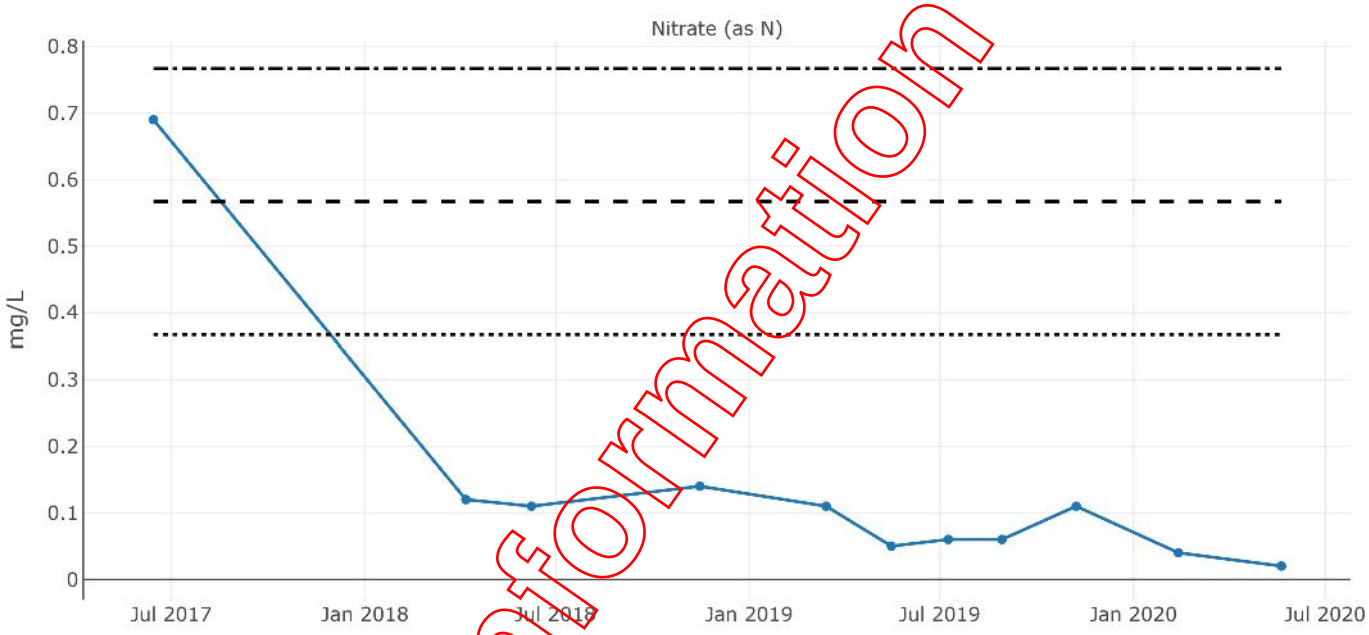


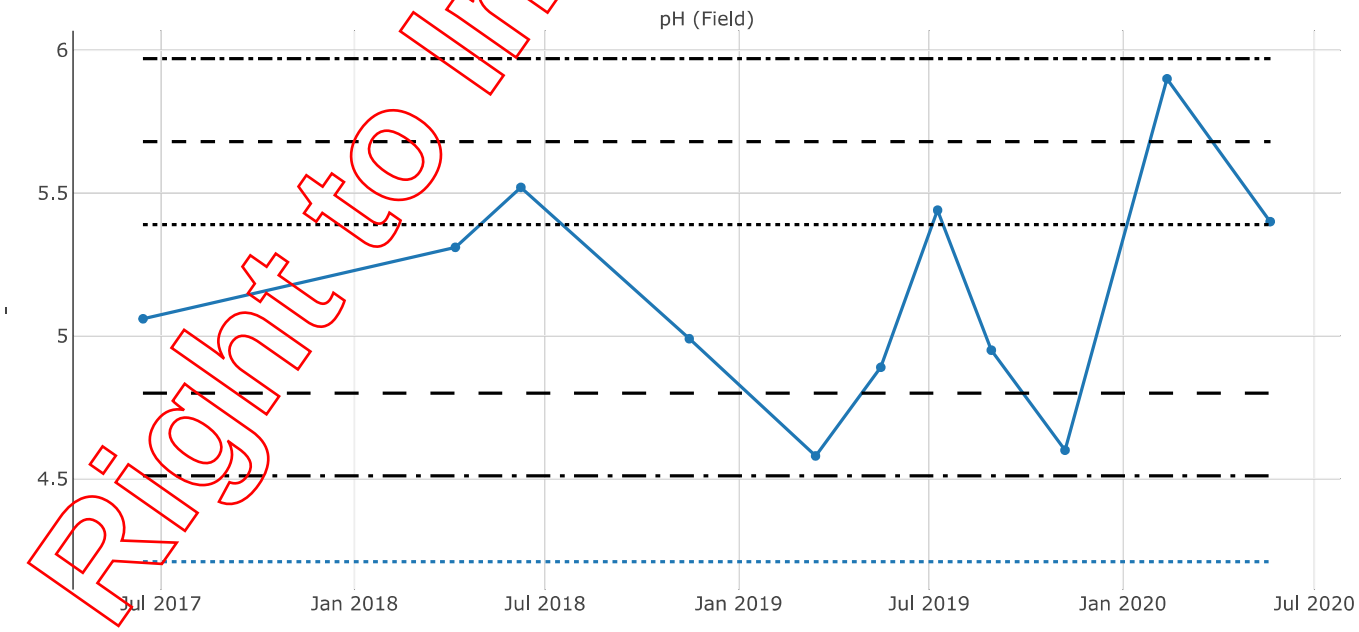

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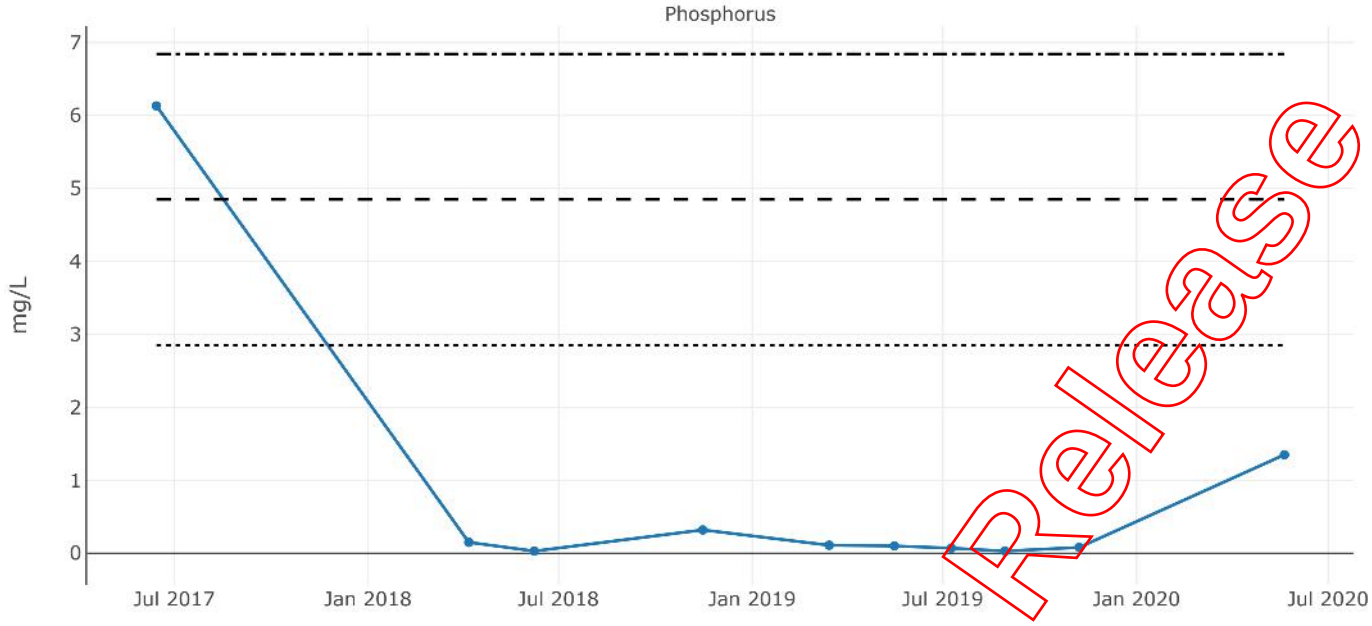


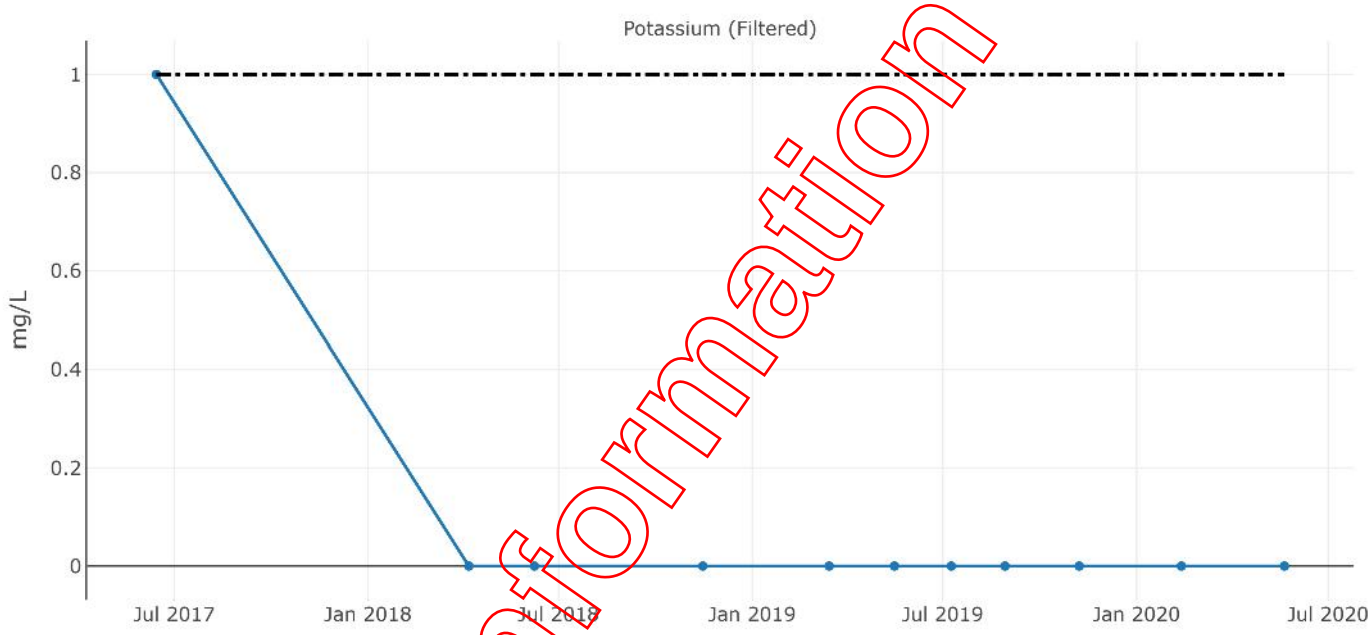


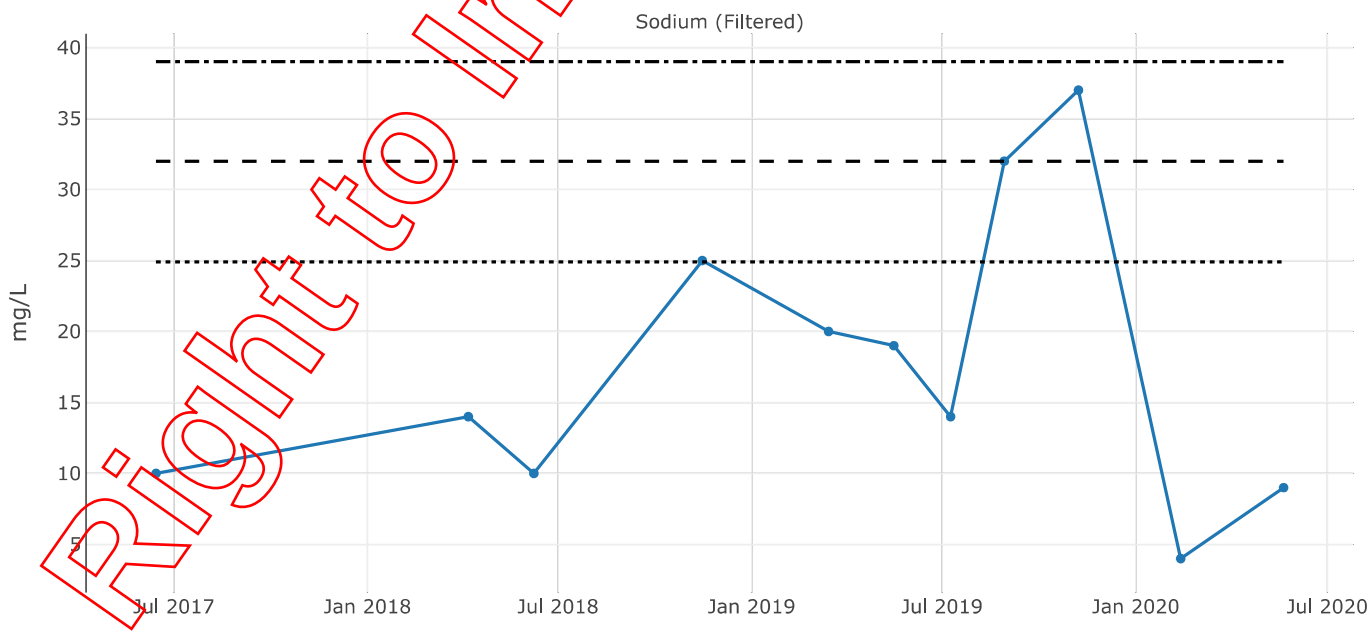


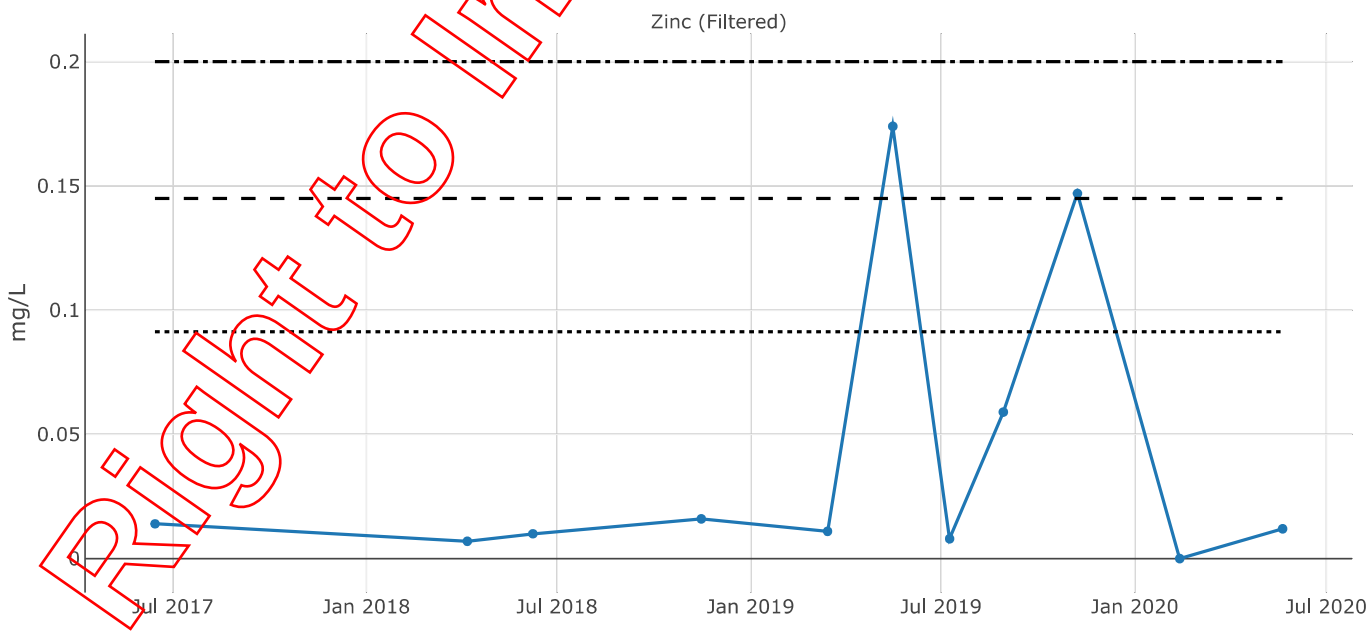

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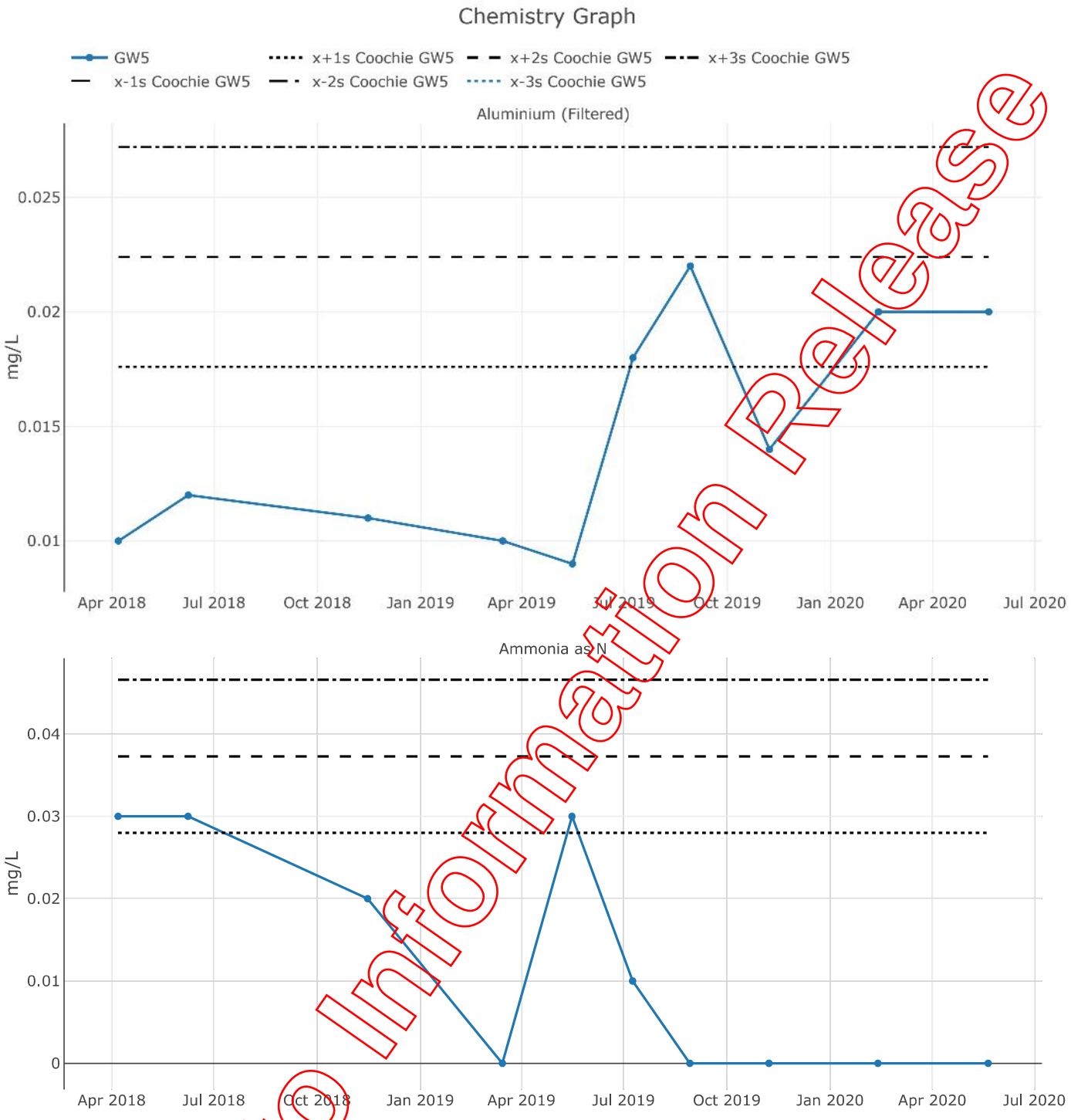

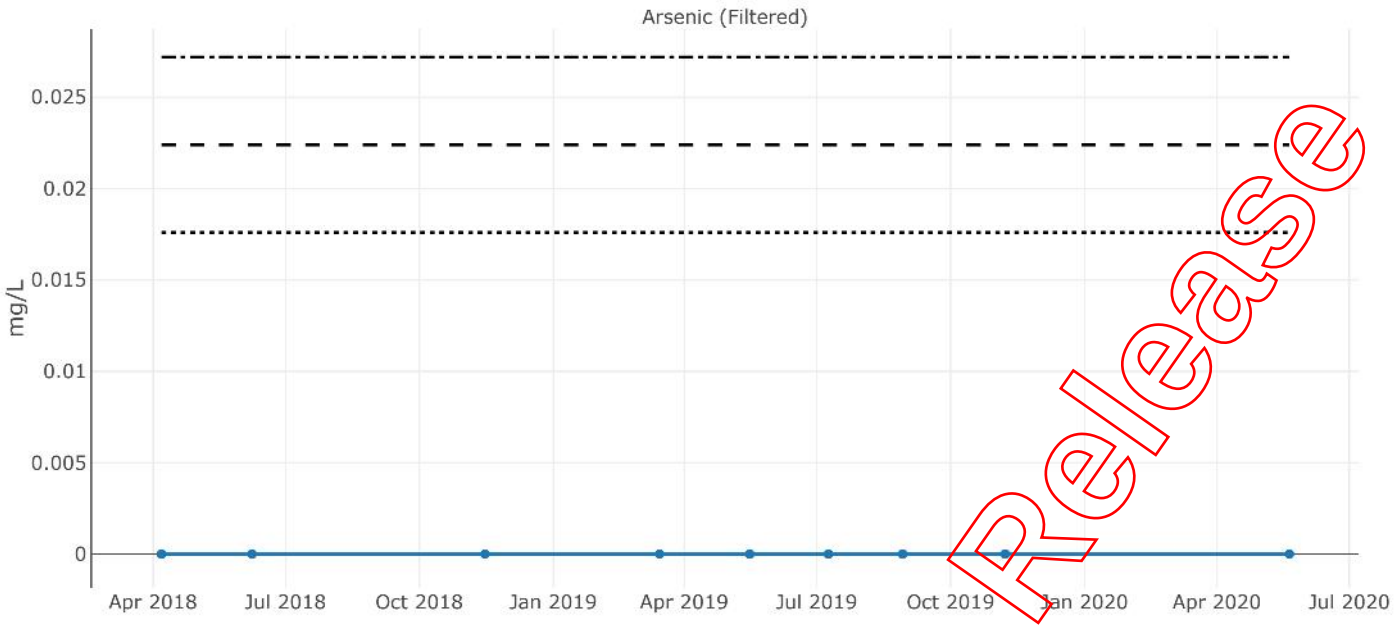


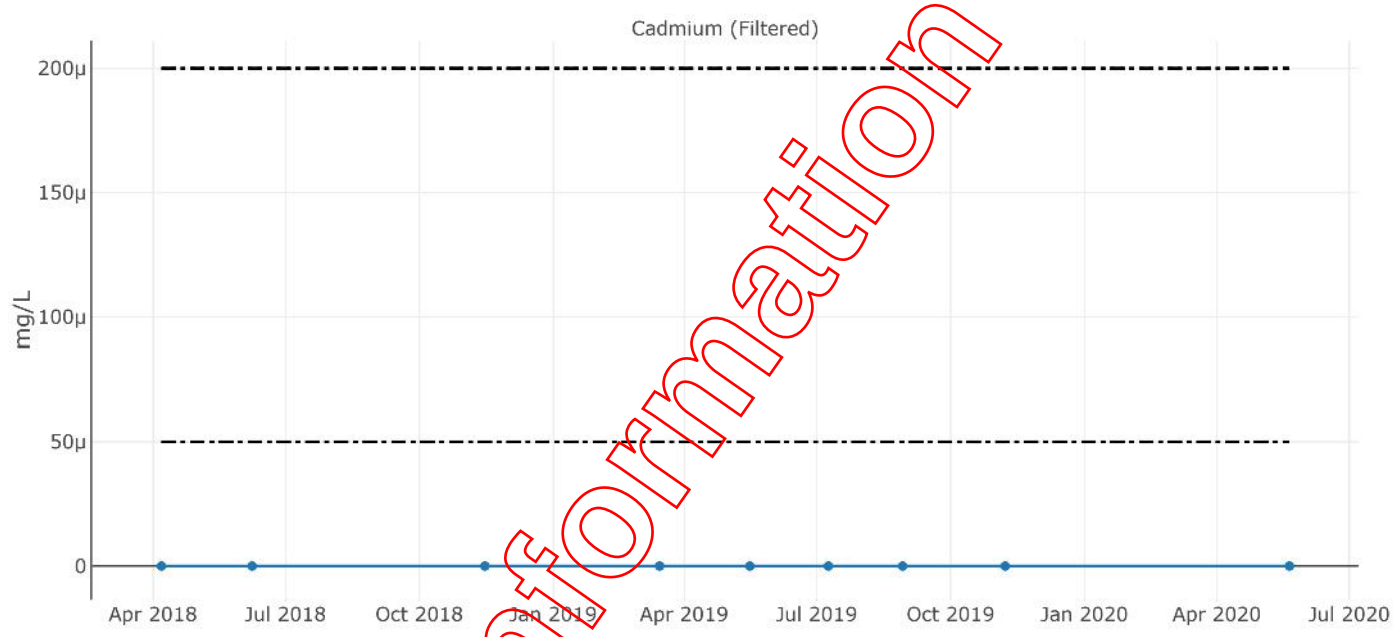


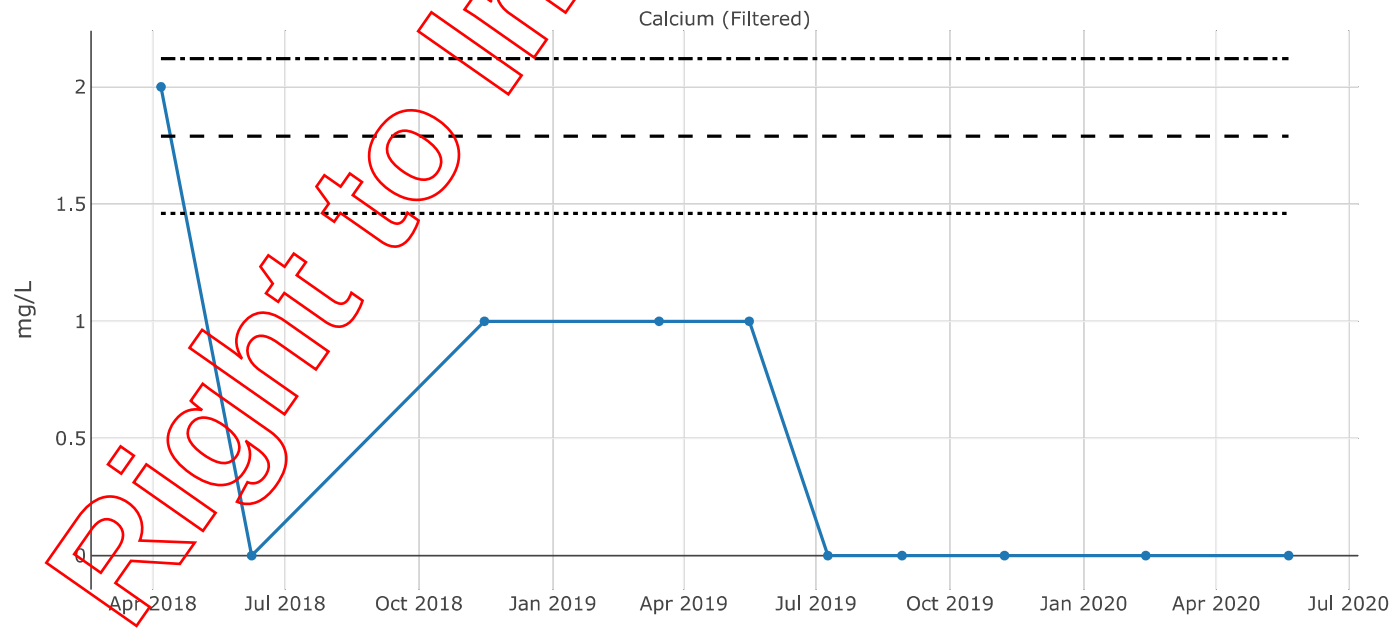

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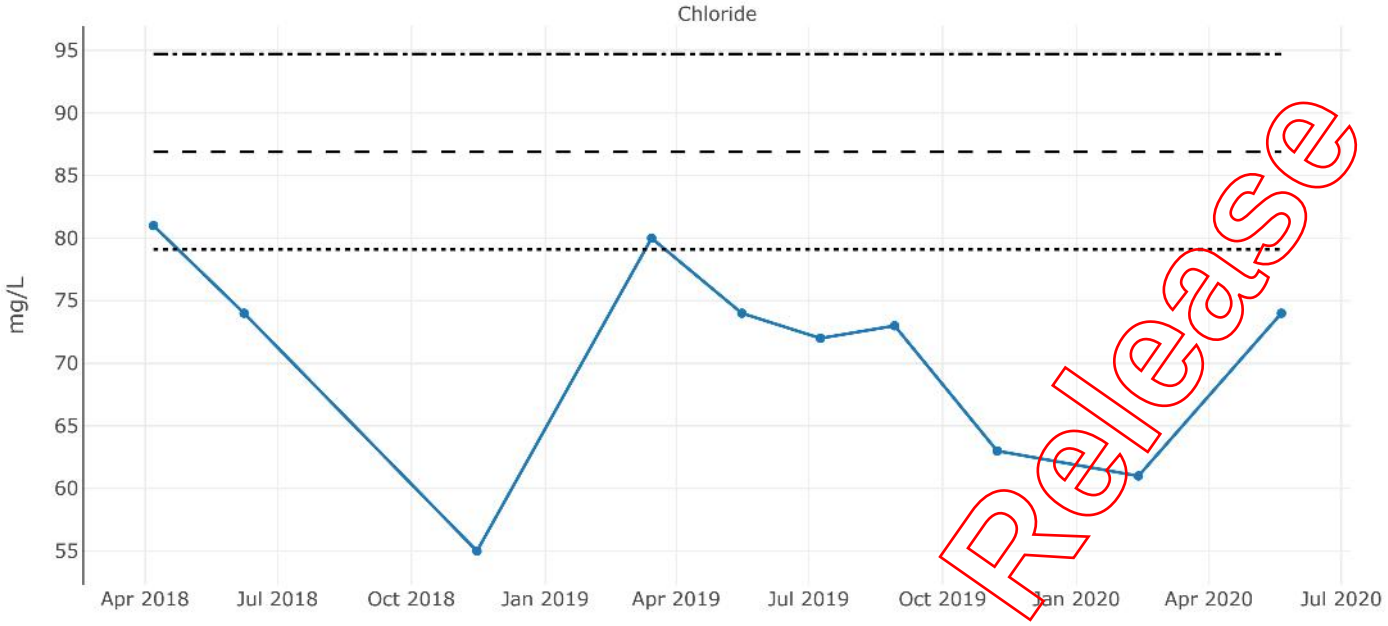


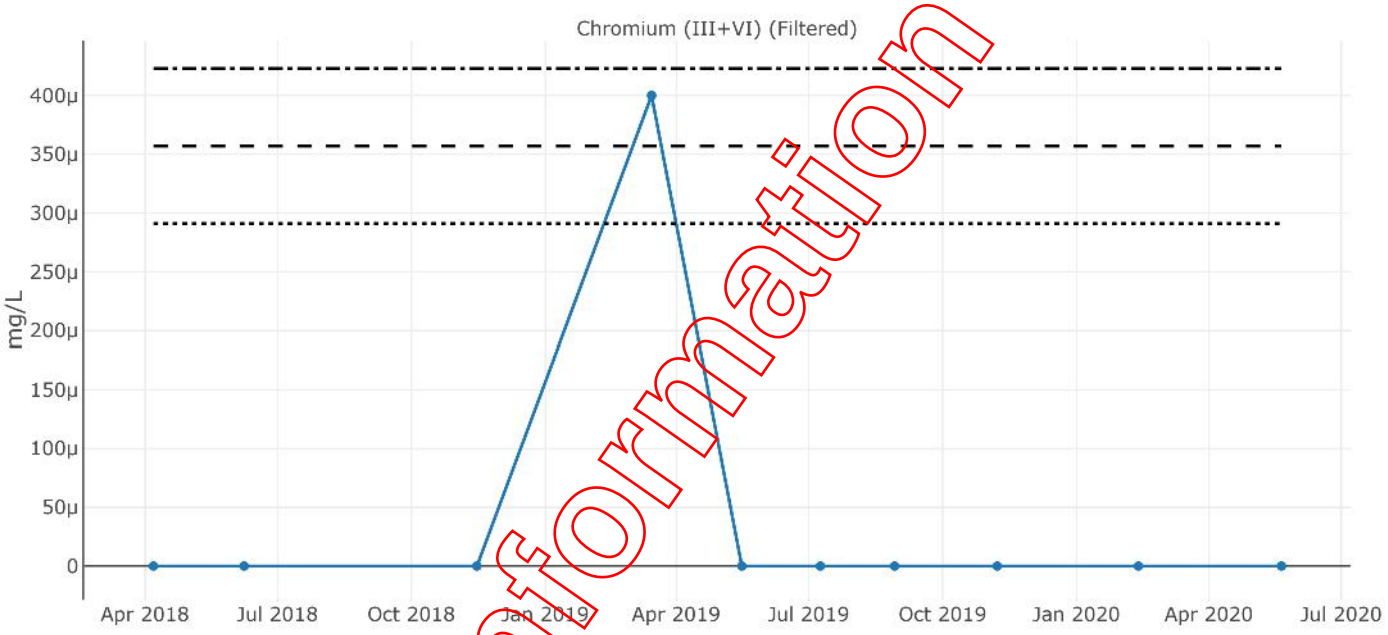


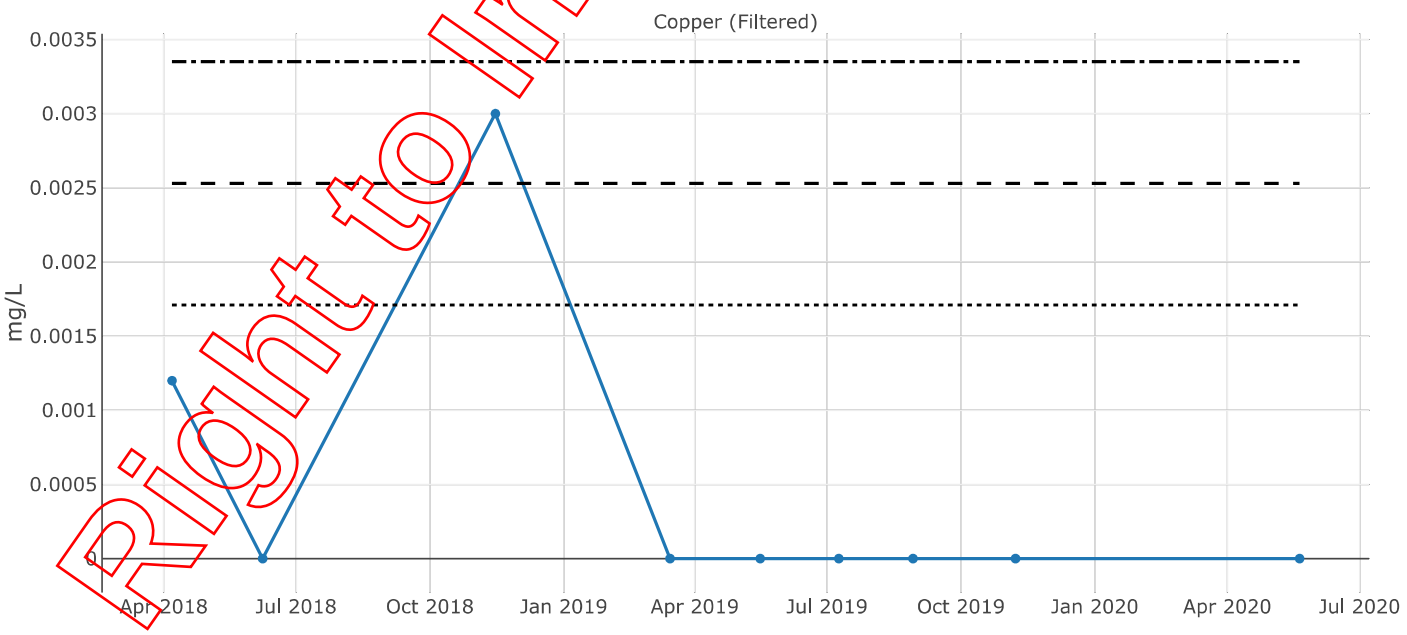

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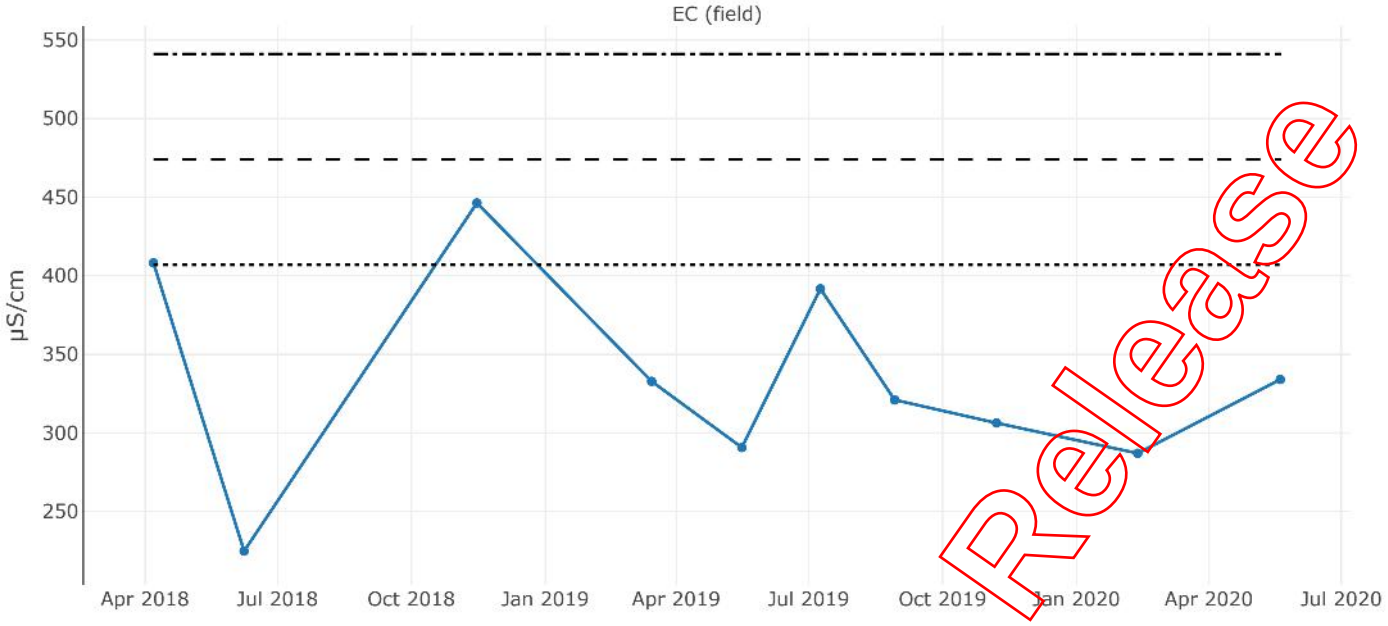



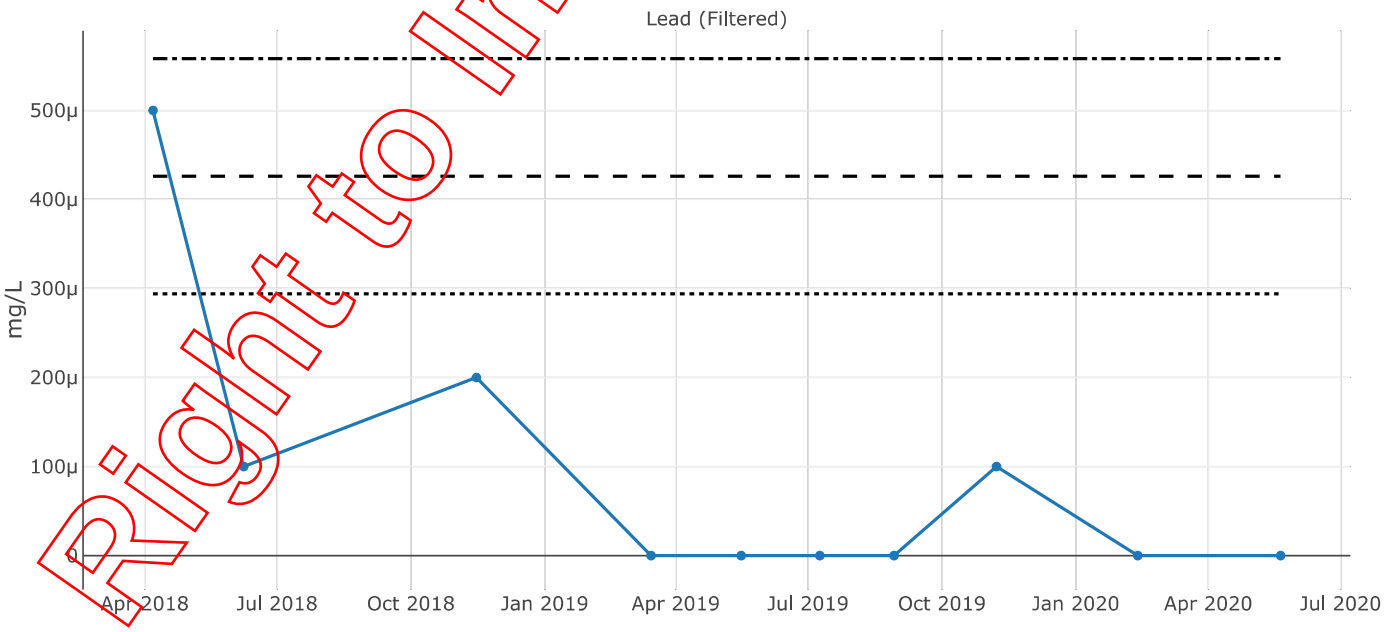

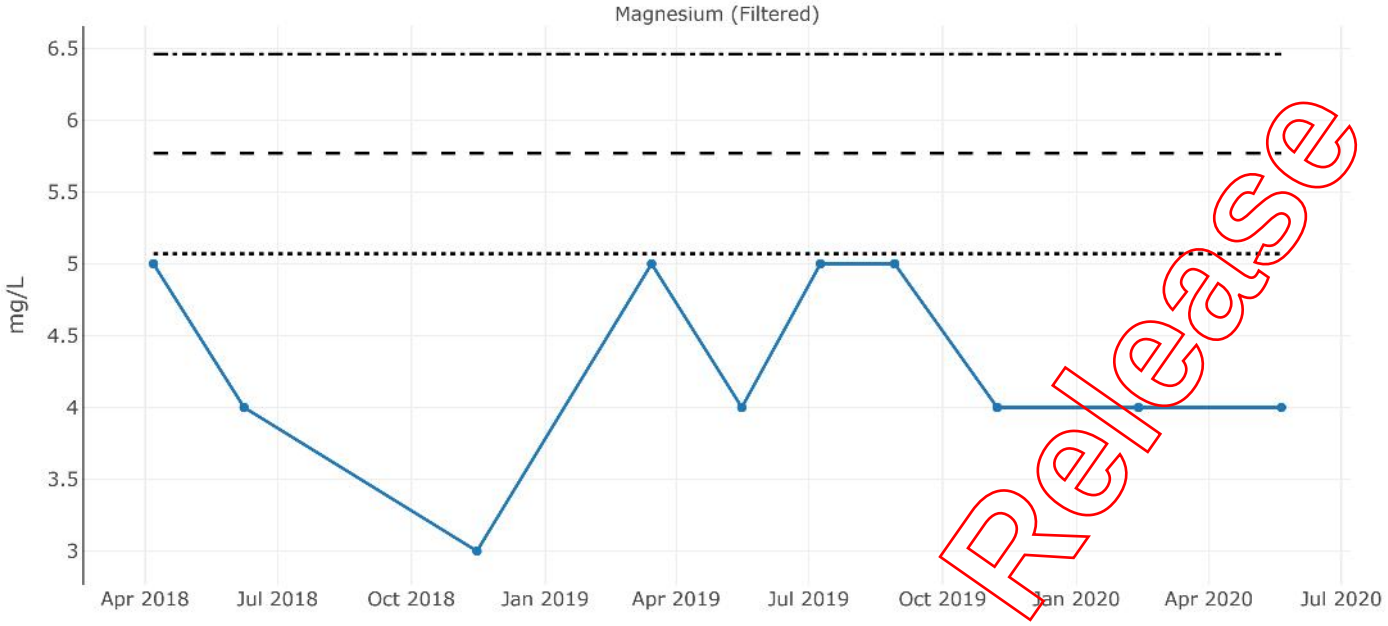


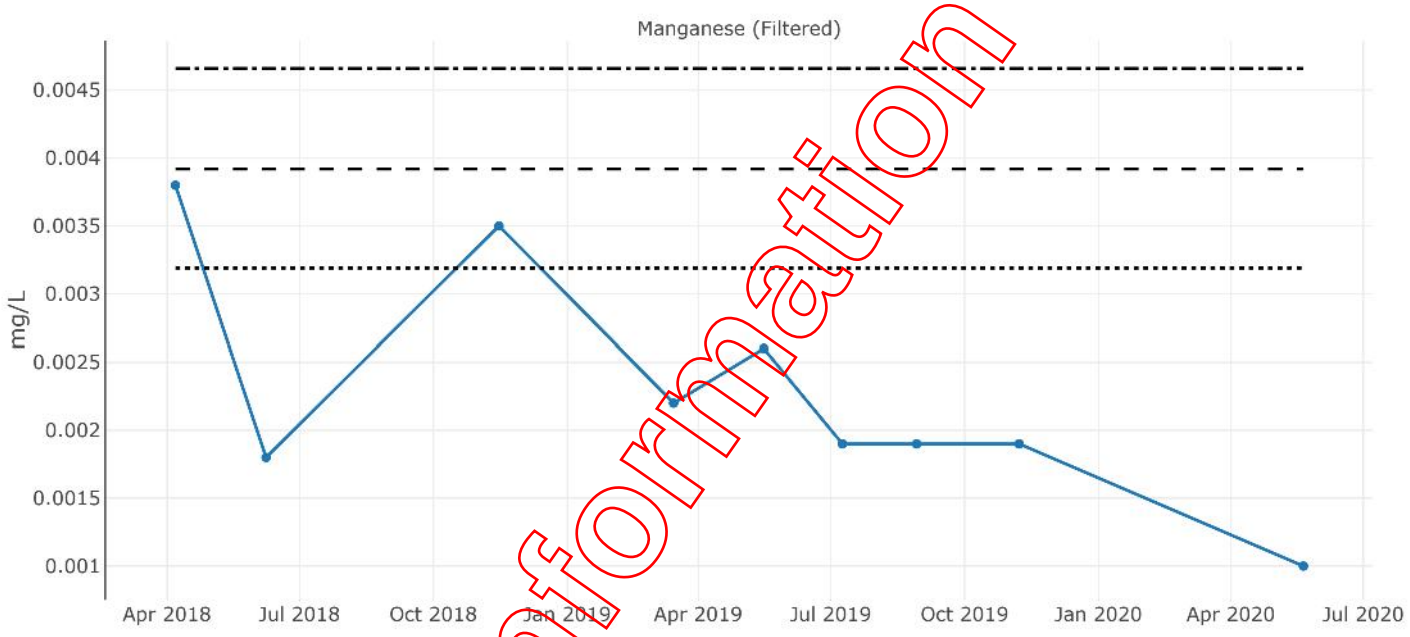


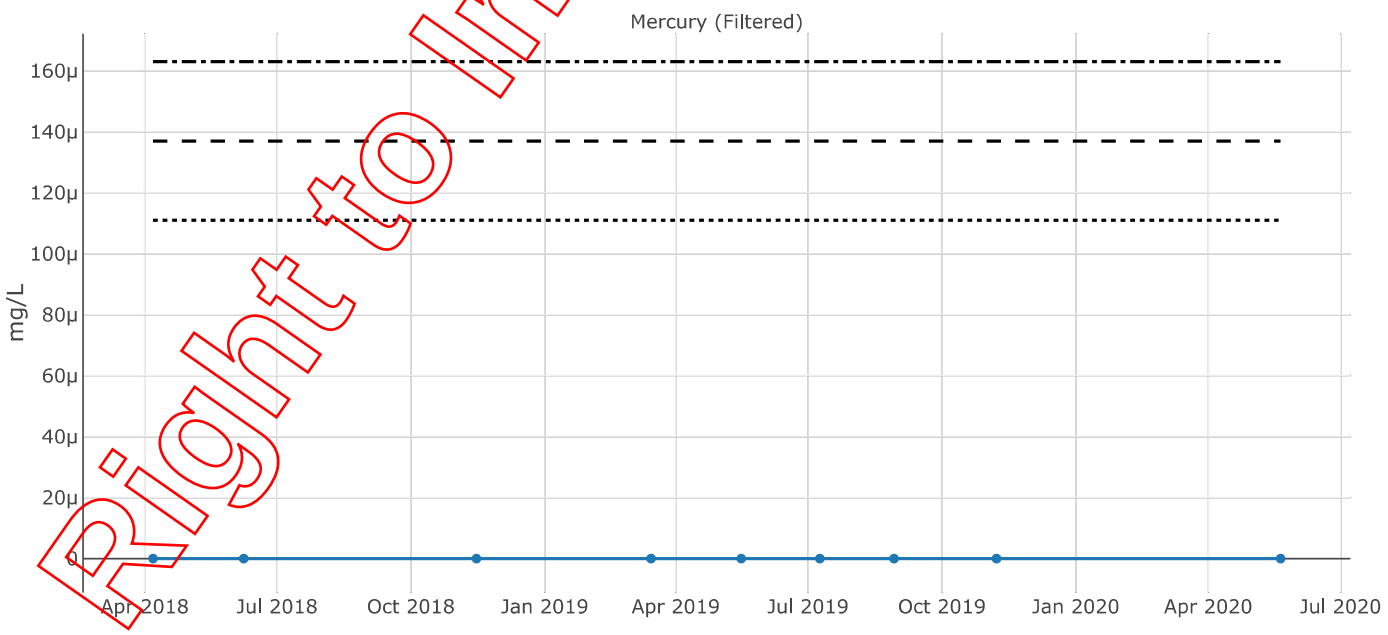

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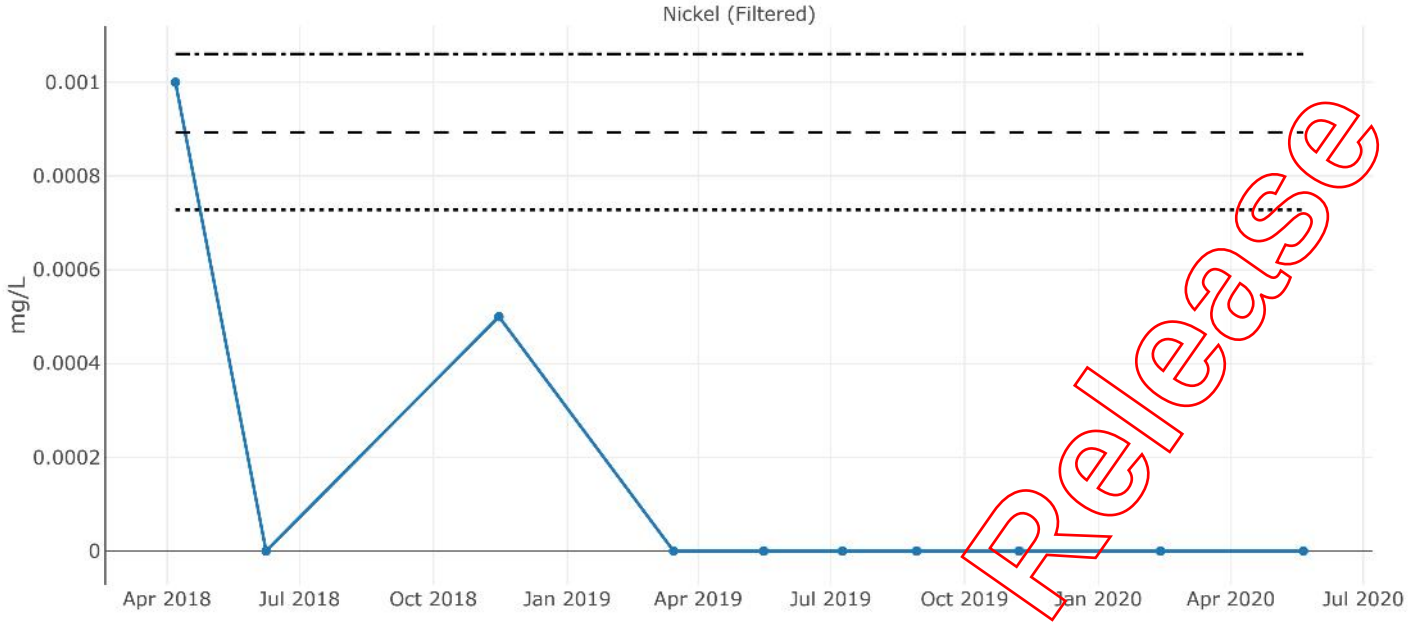


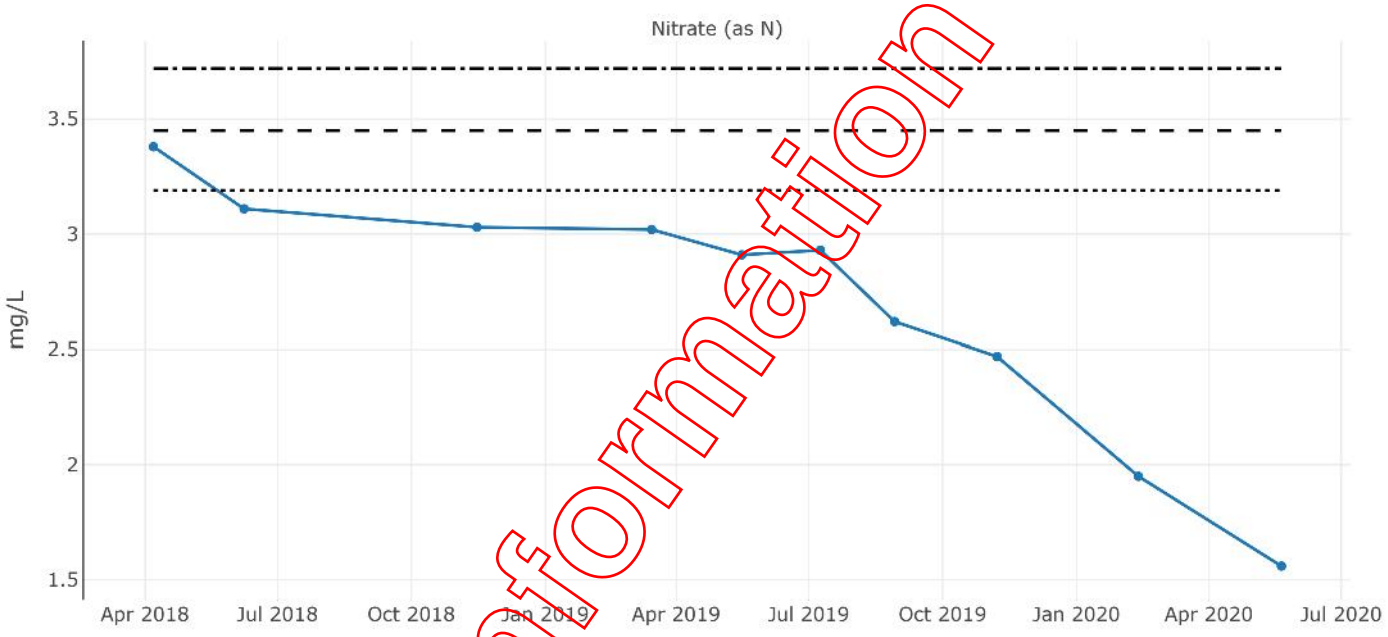


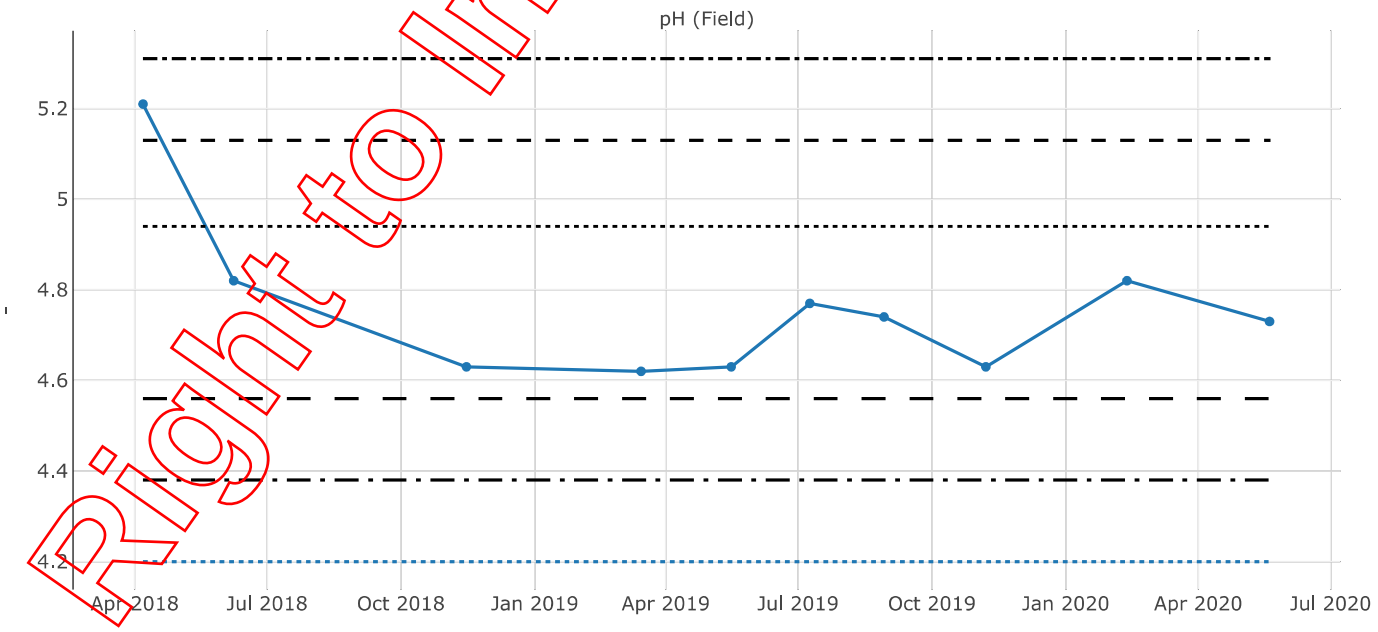

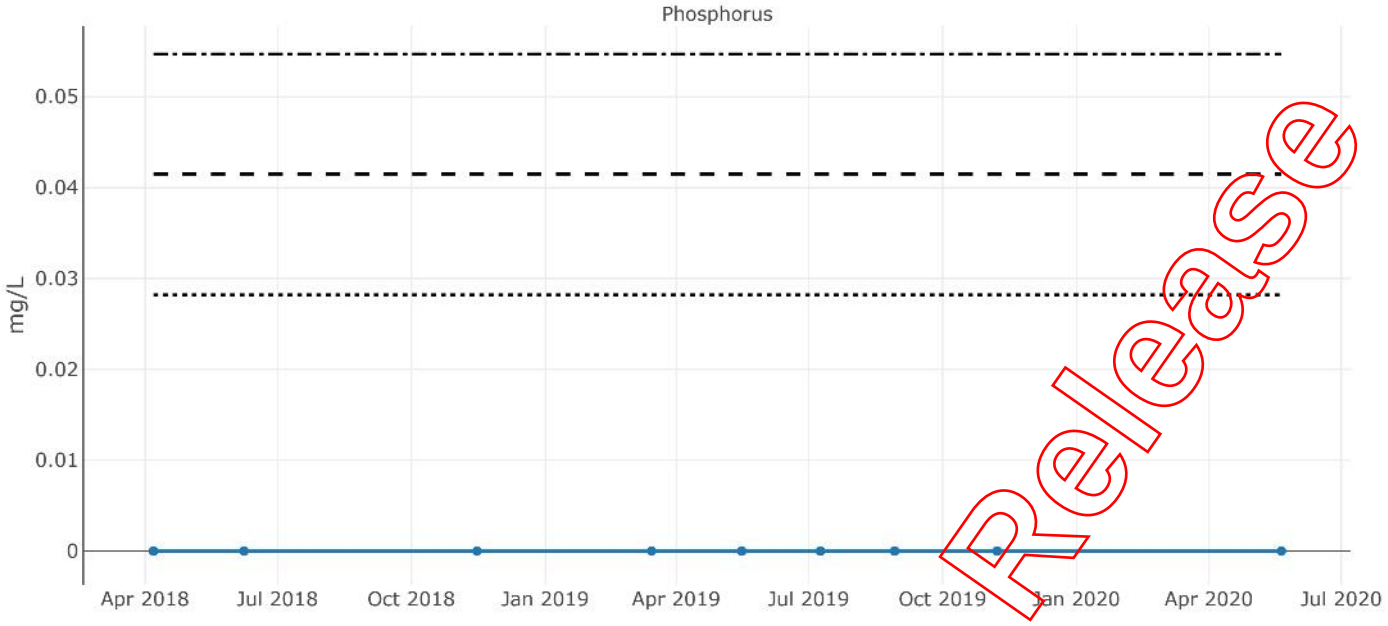


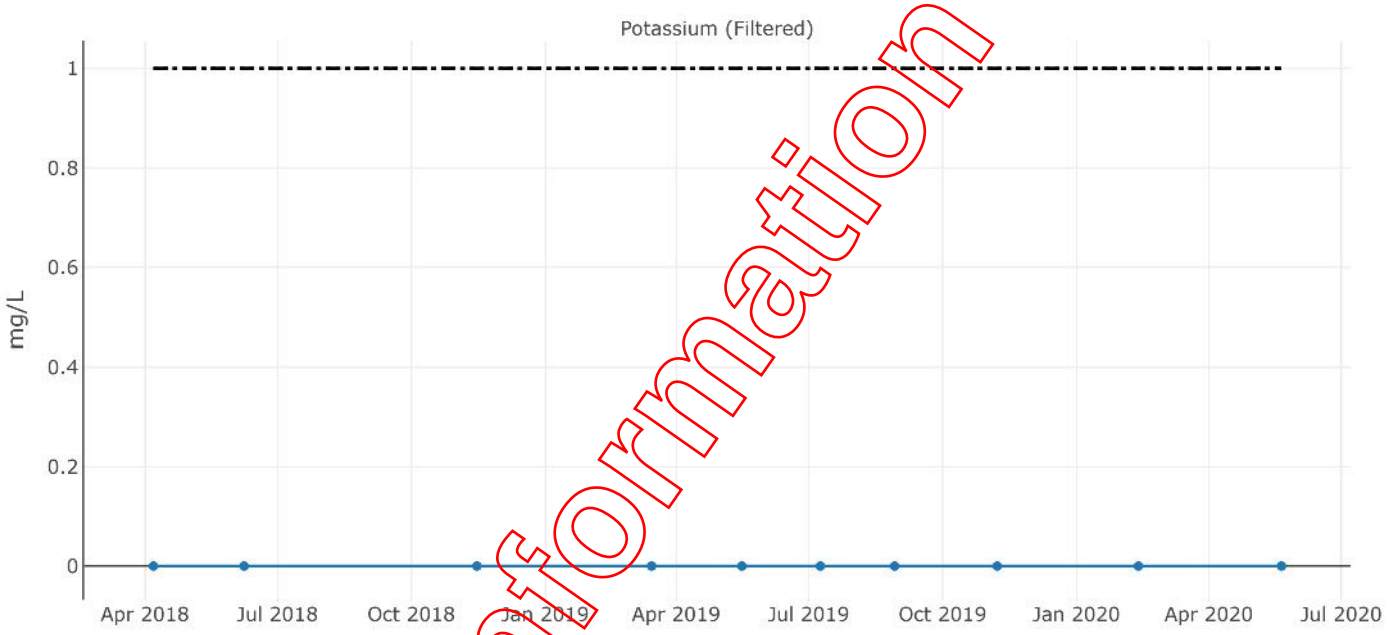


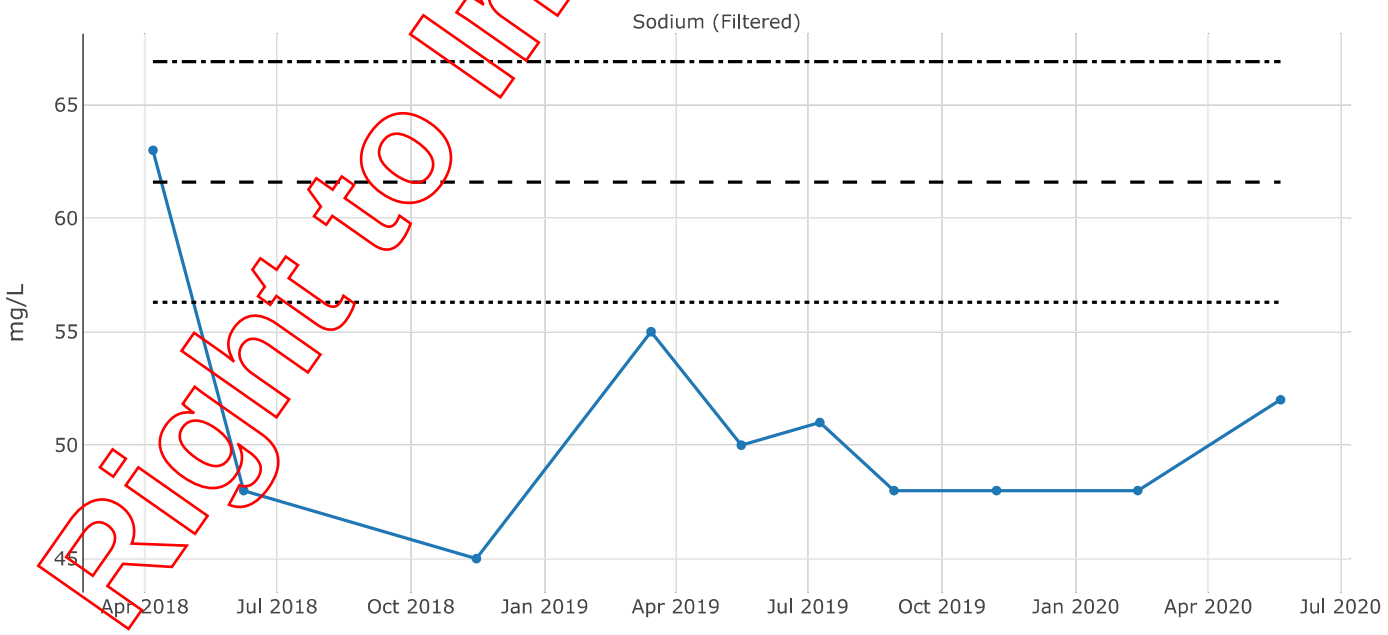


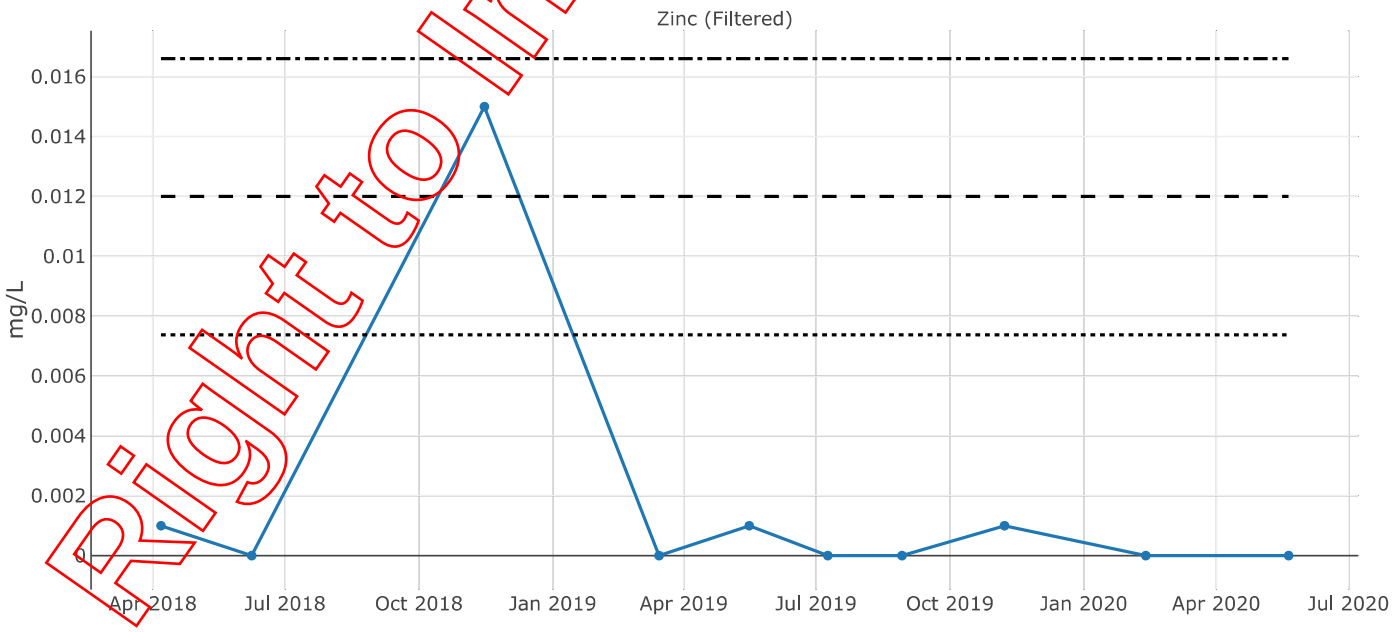

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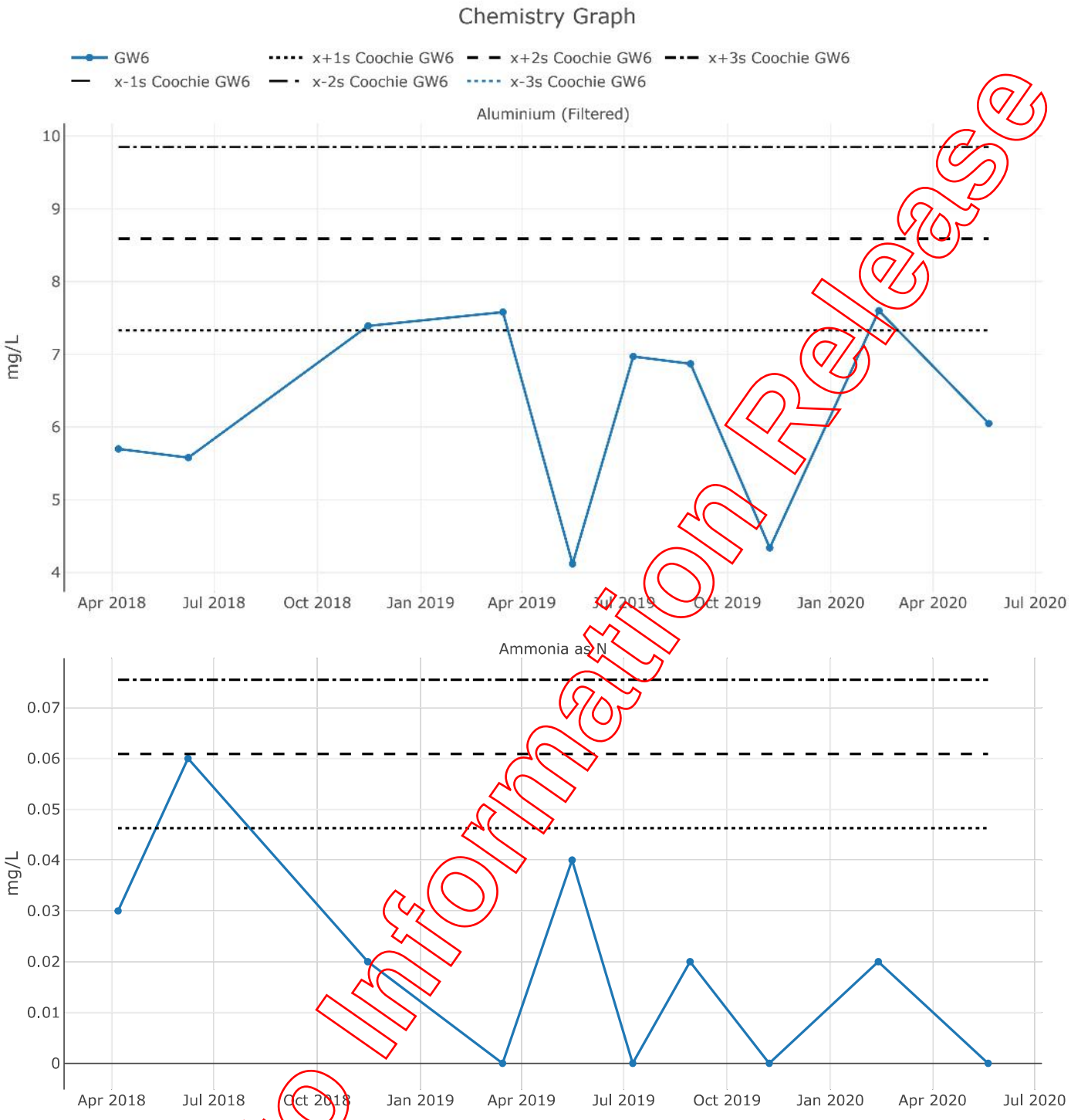
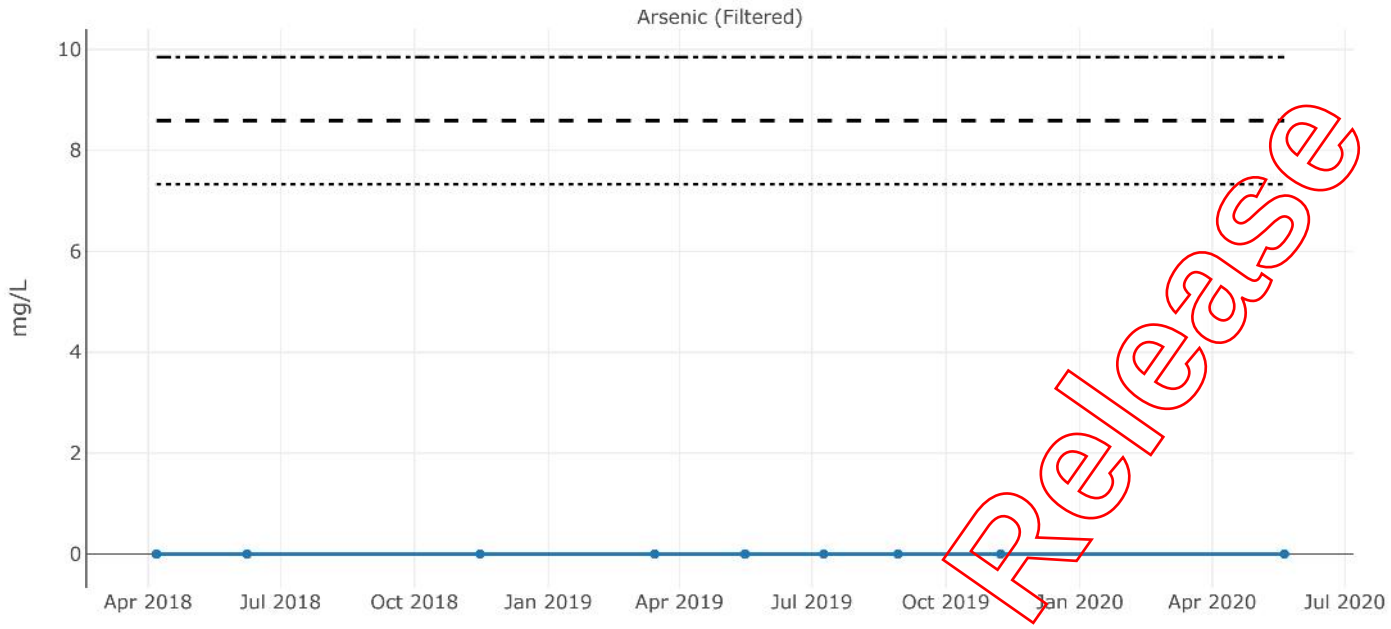
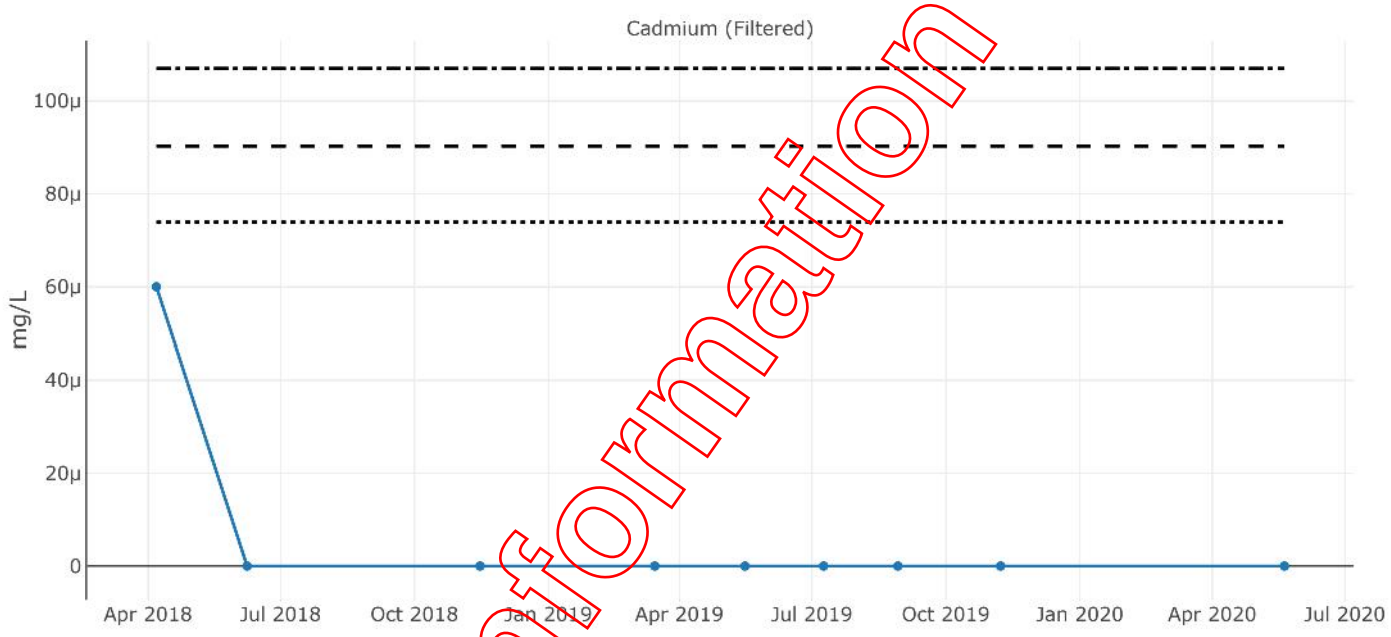
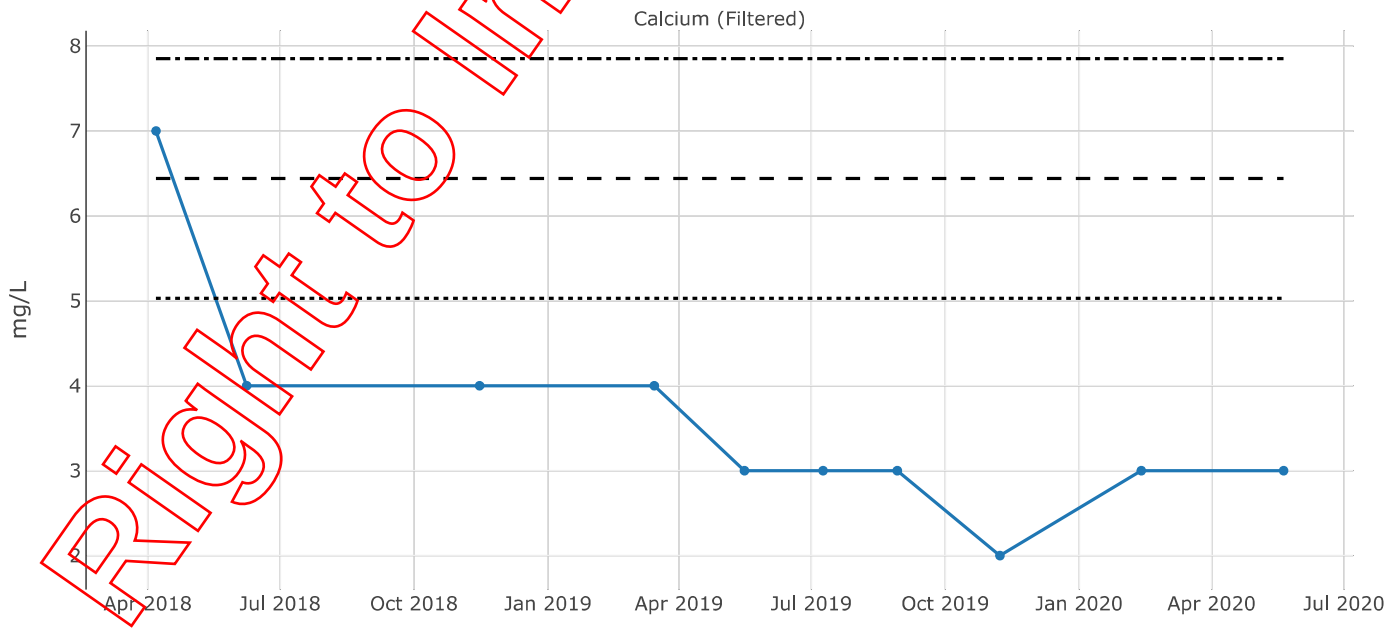
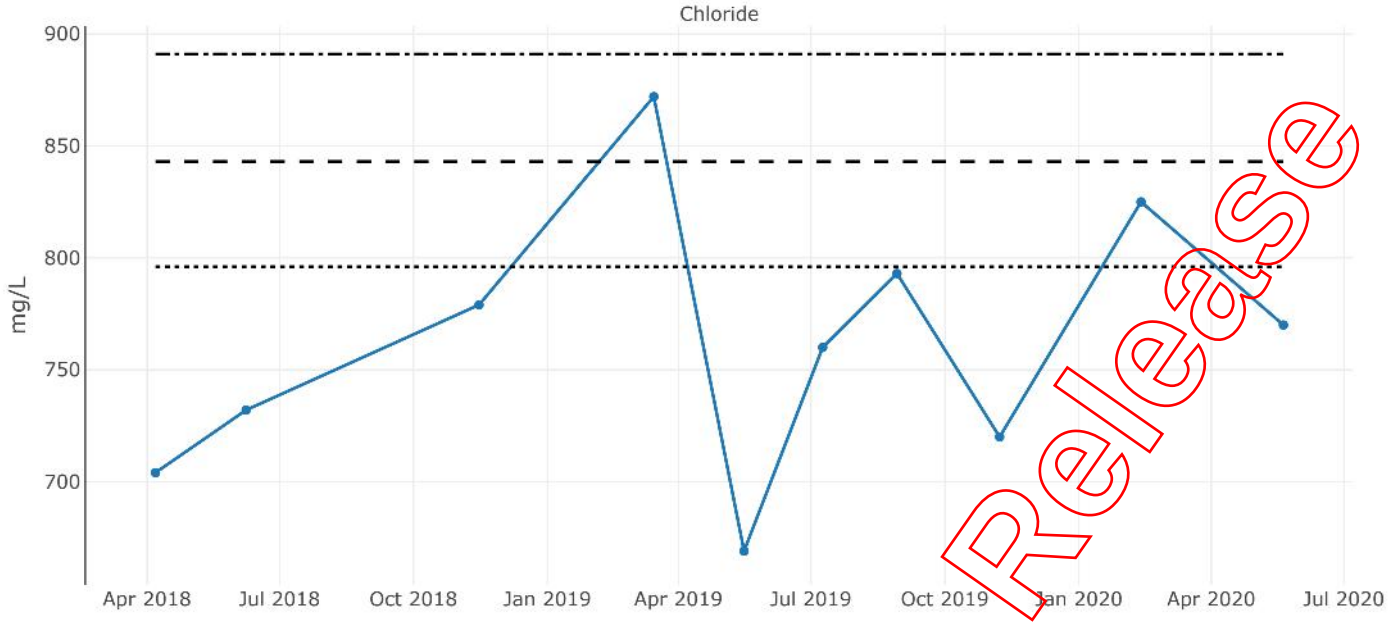
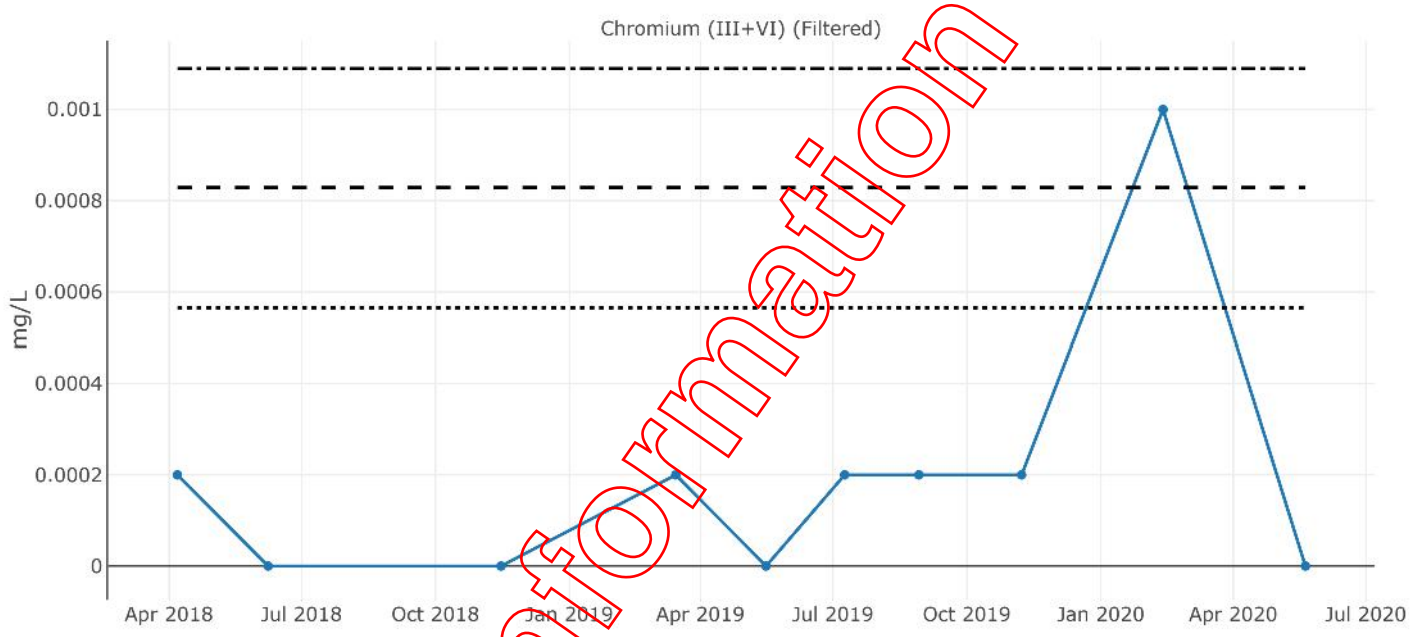


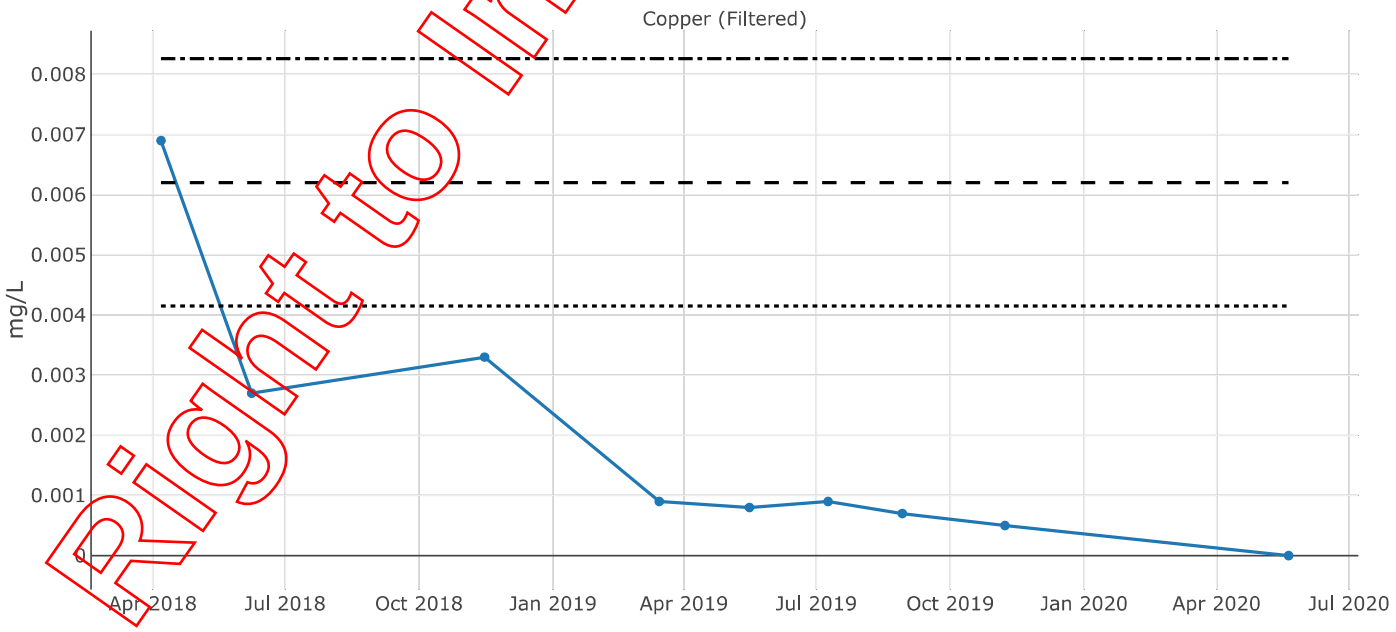


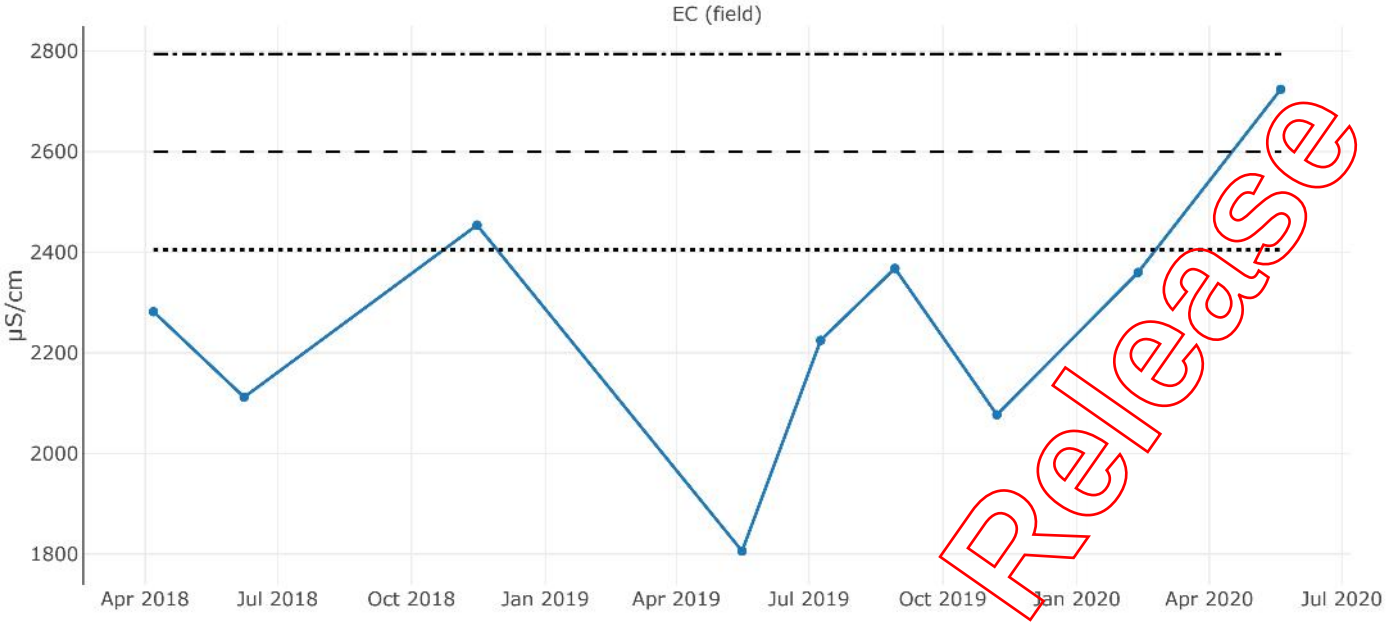



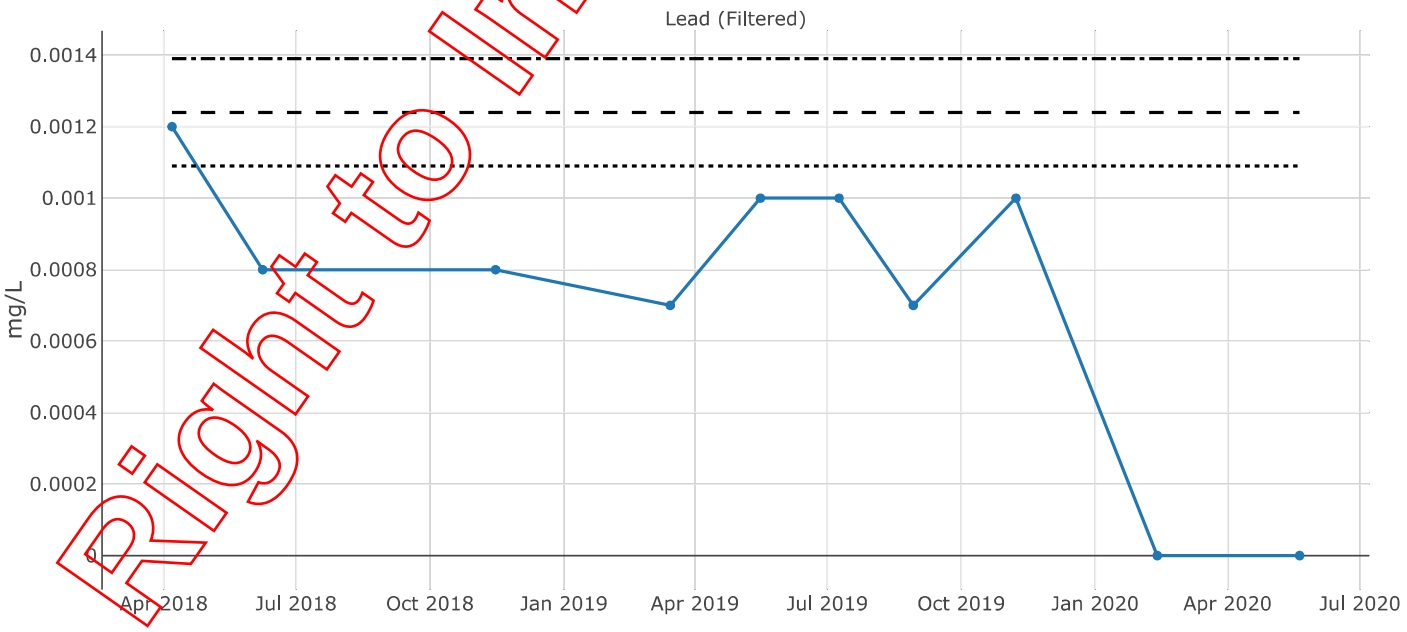


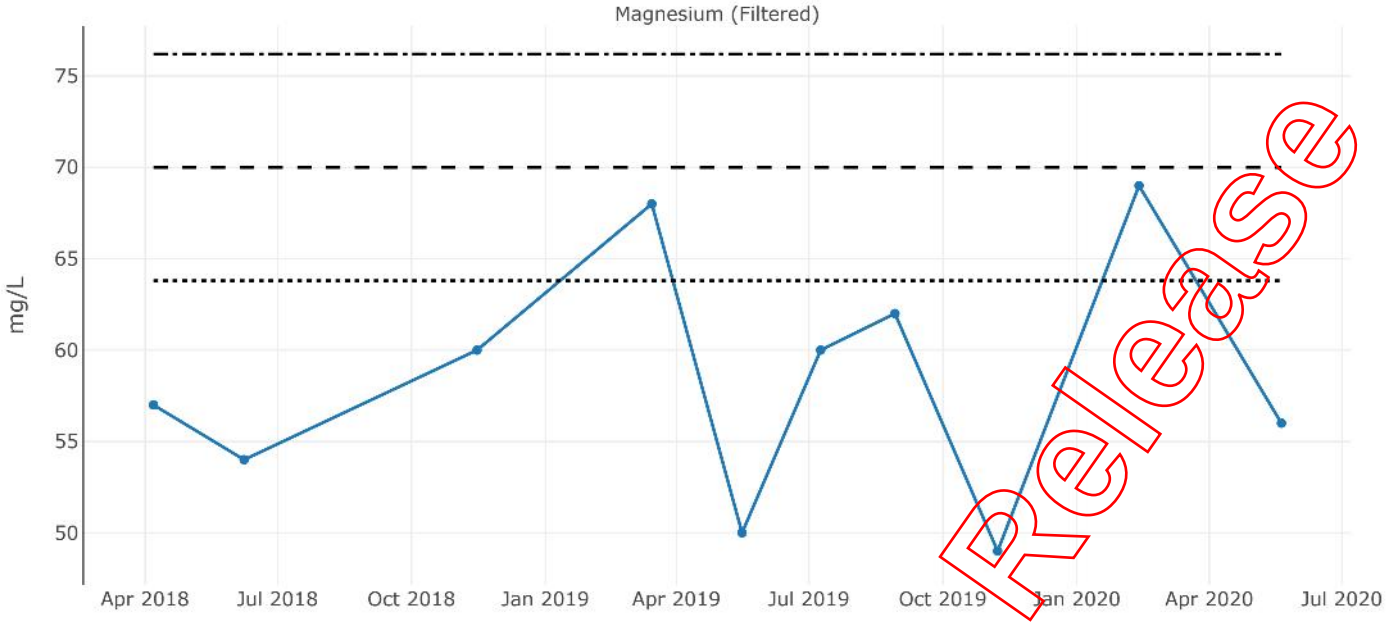



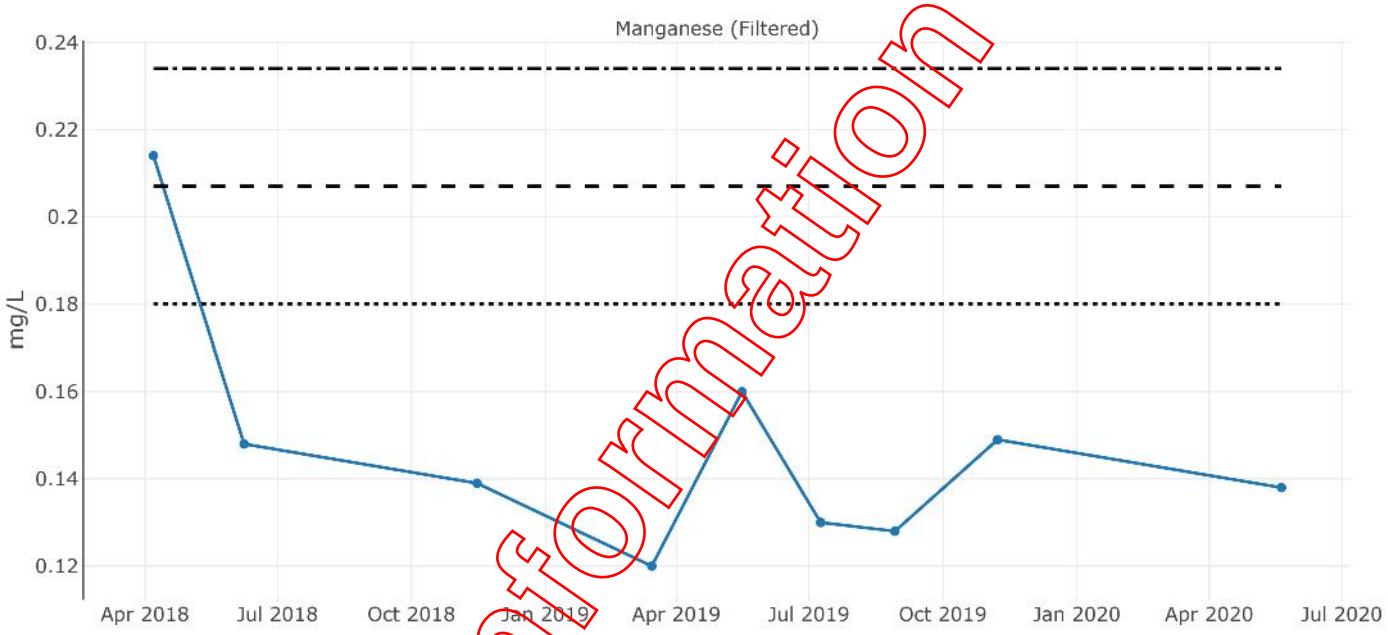



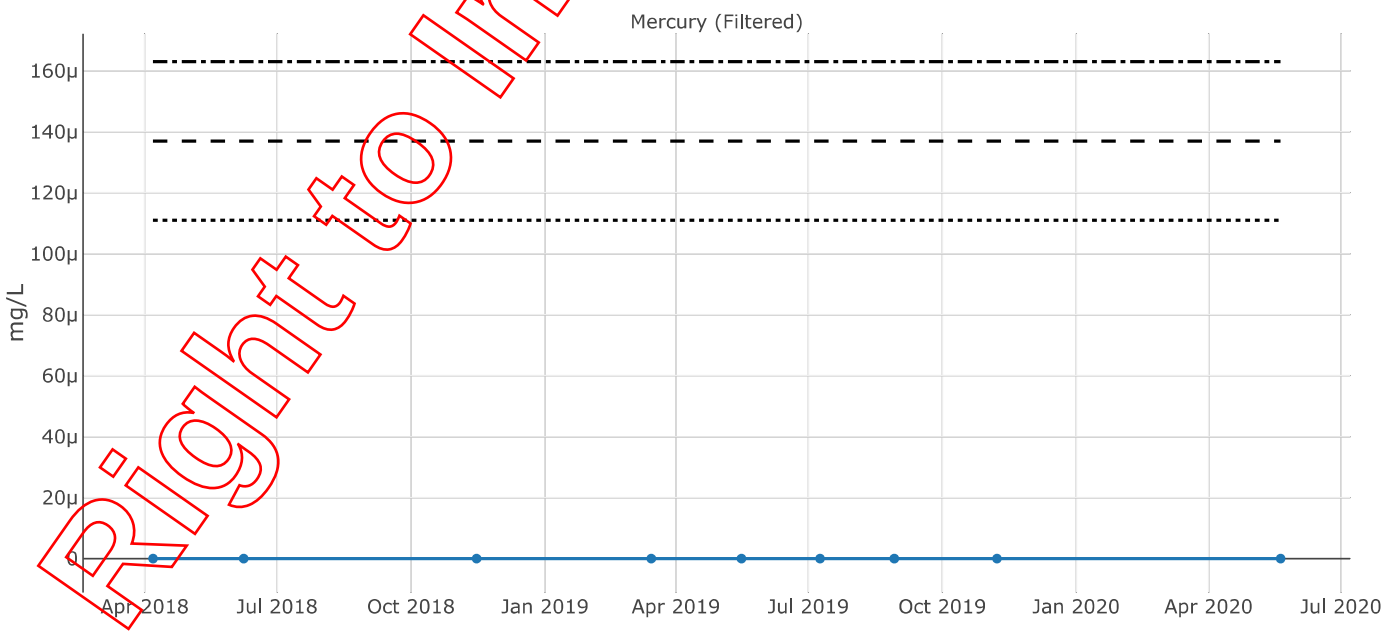


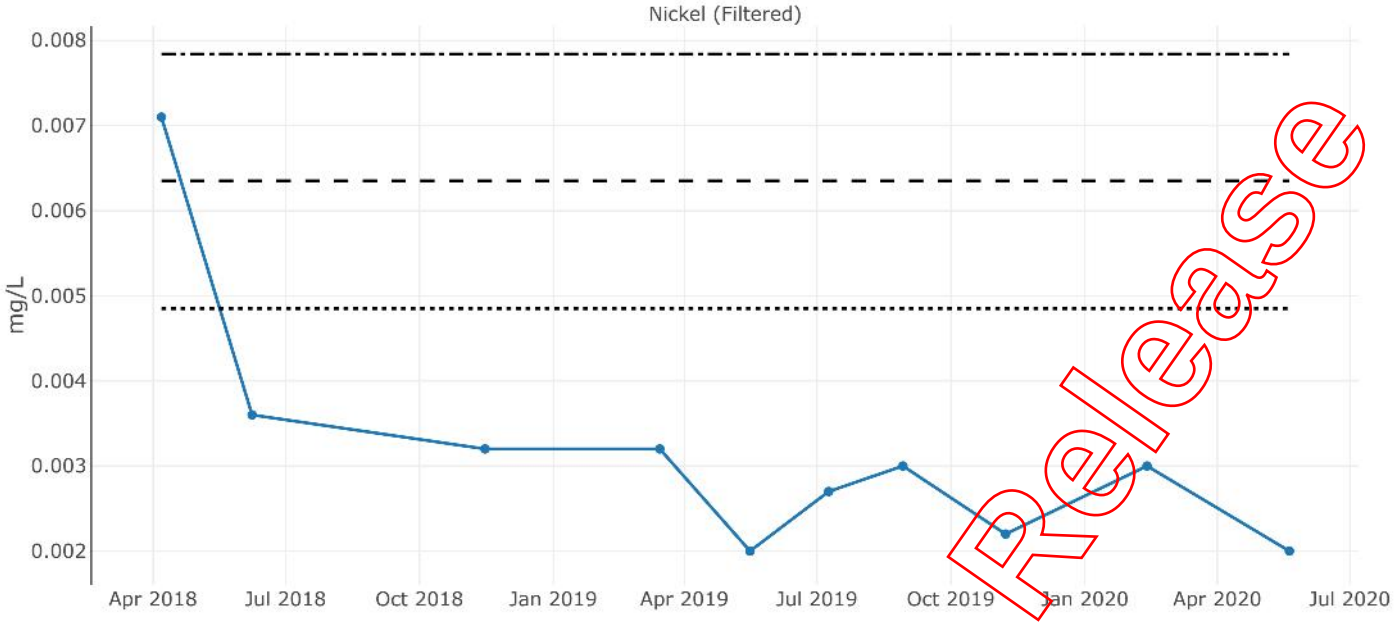


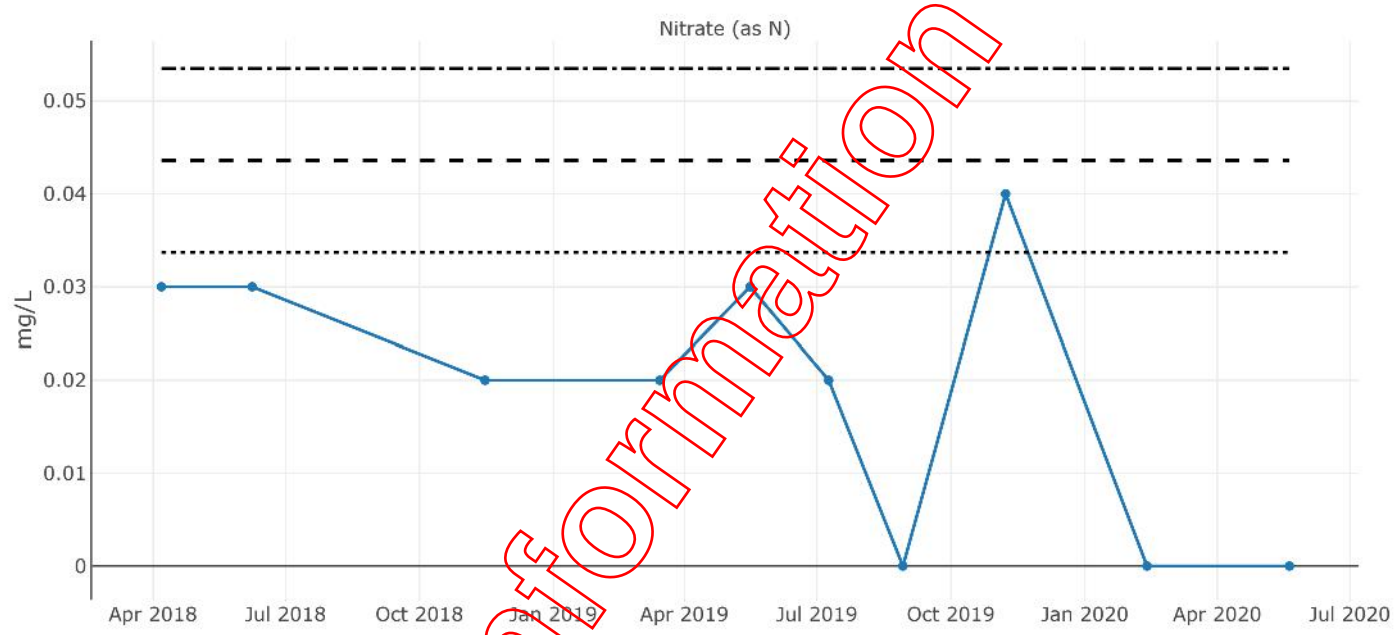


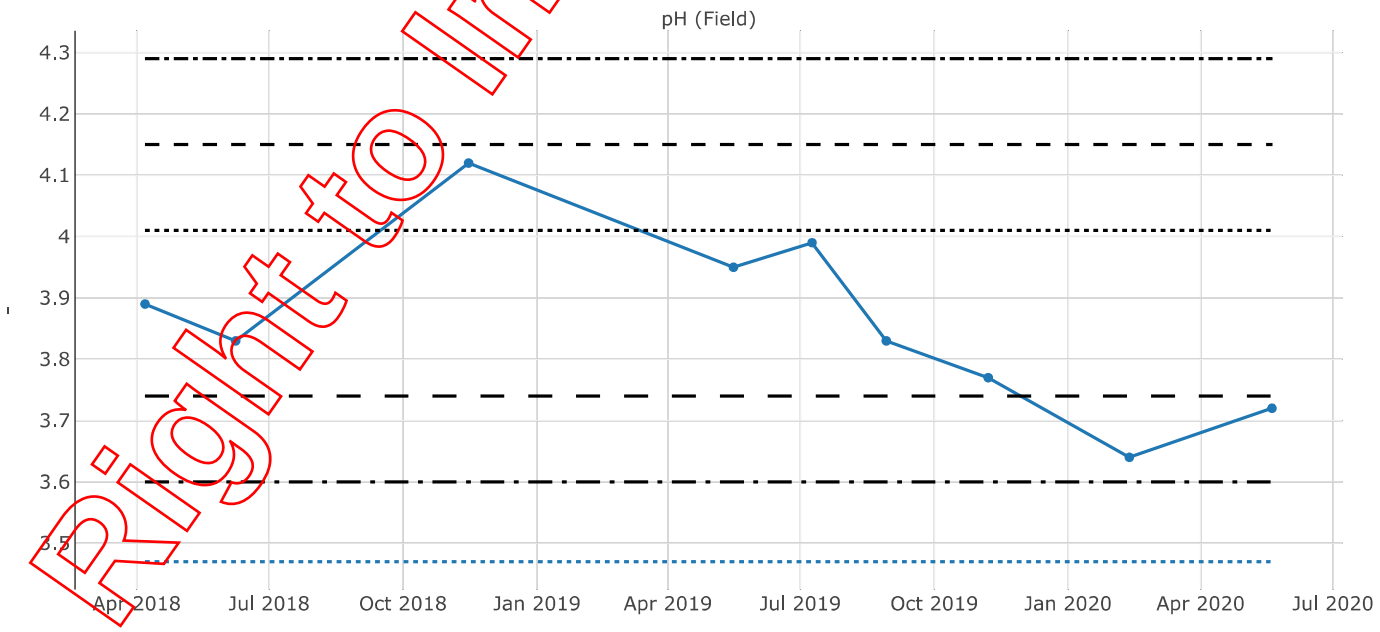


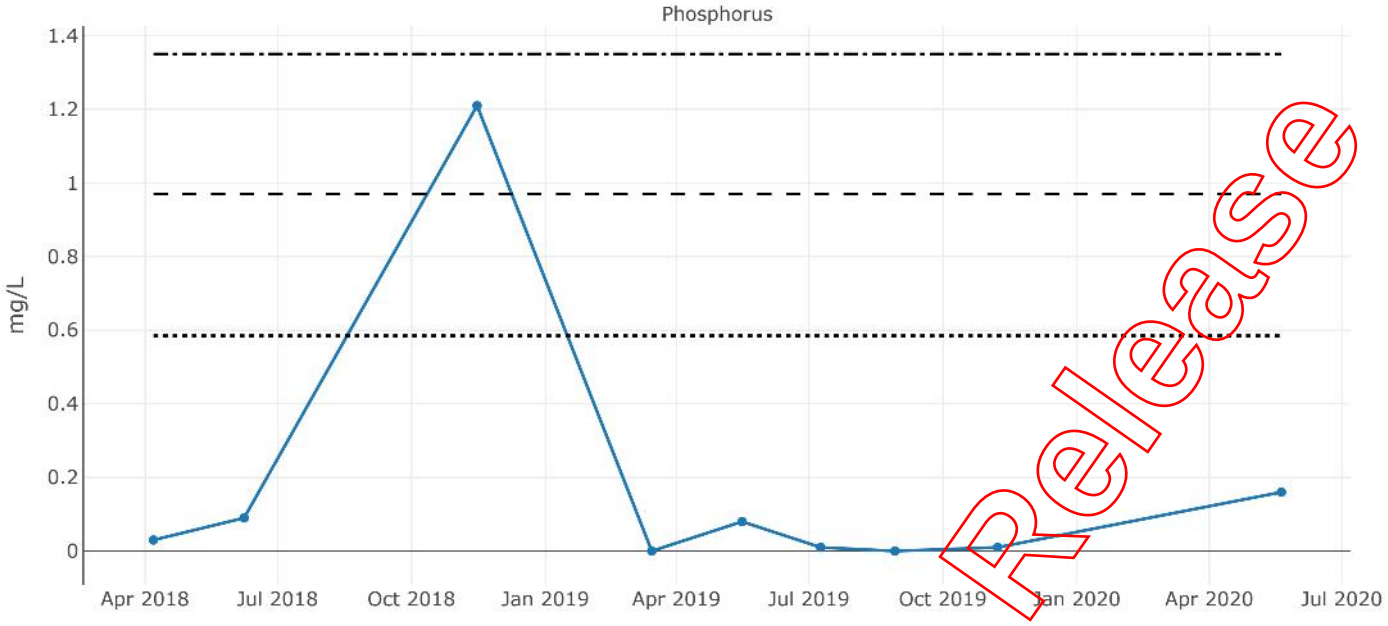



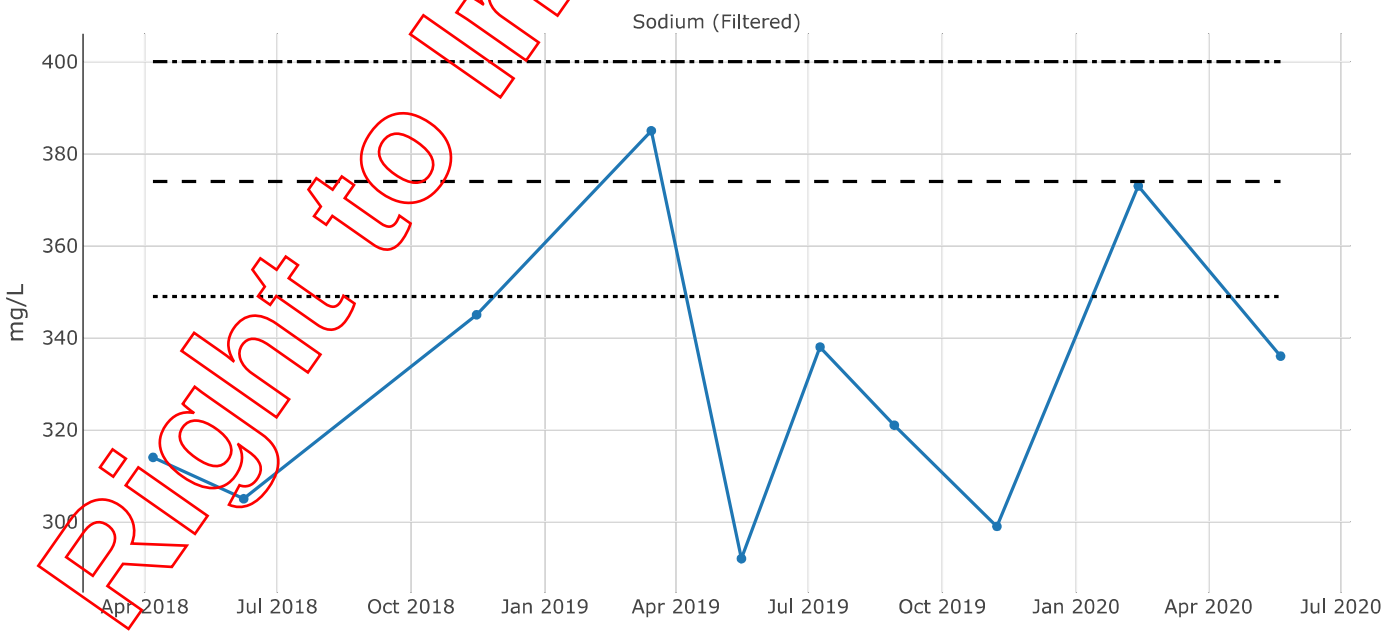


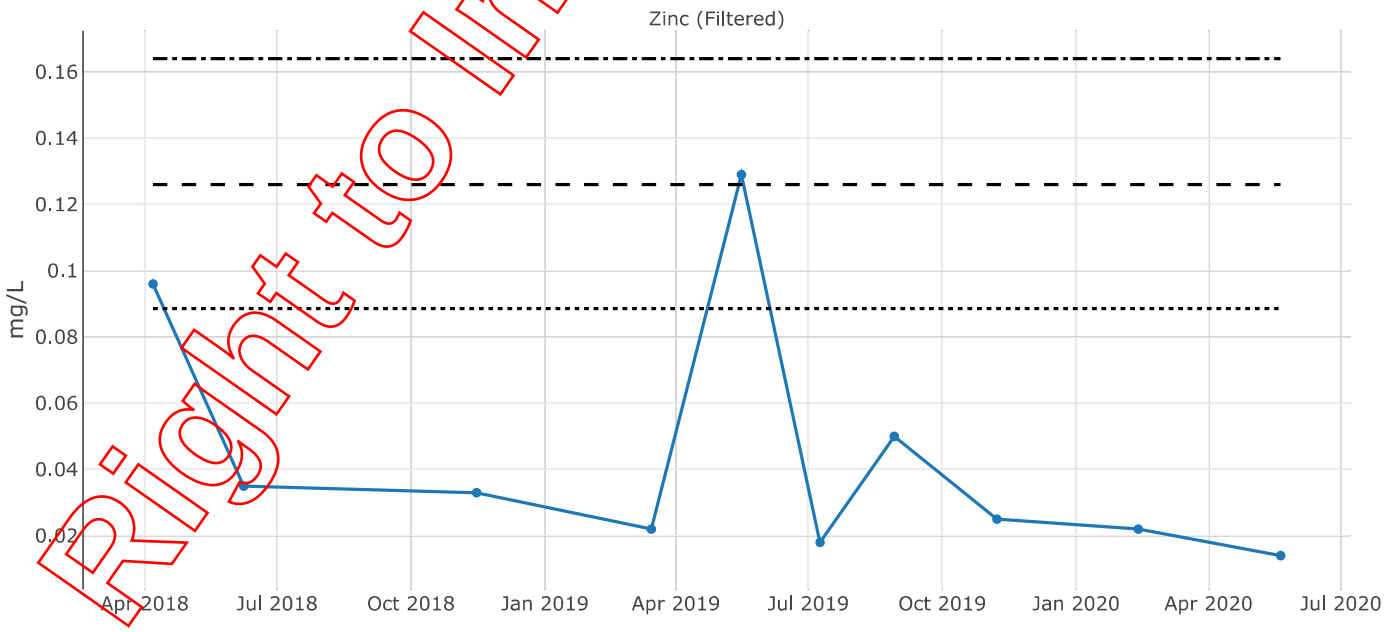









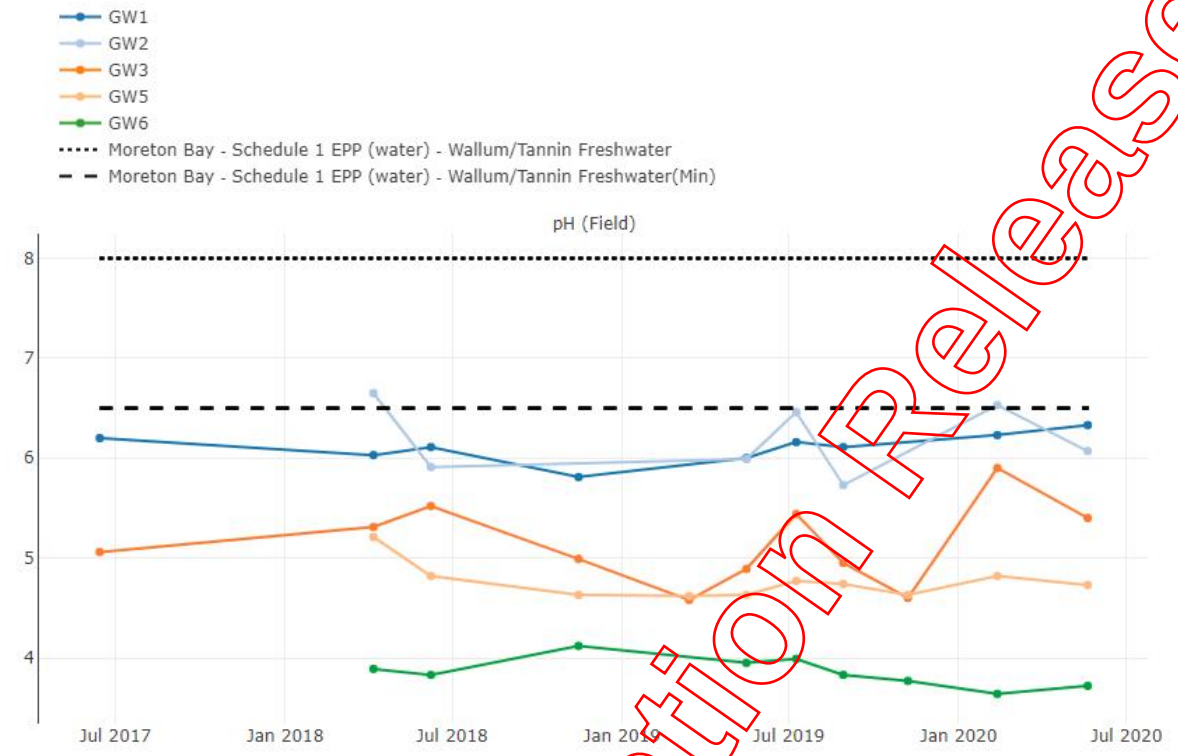
The report was generated based on the following filter:

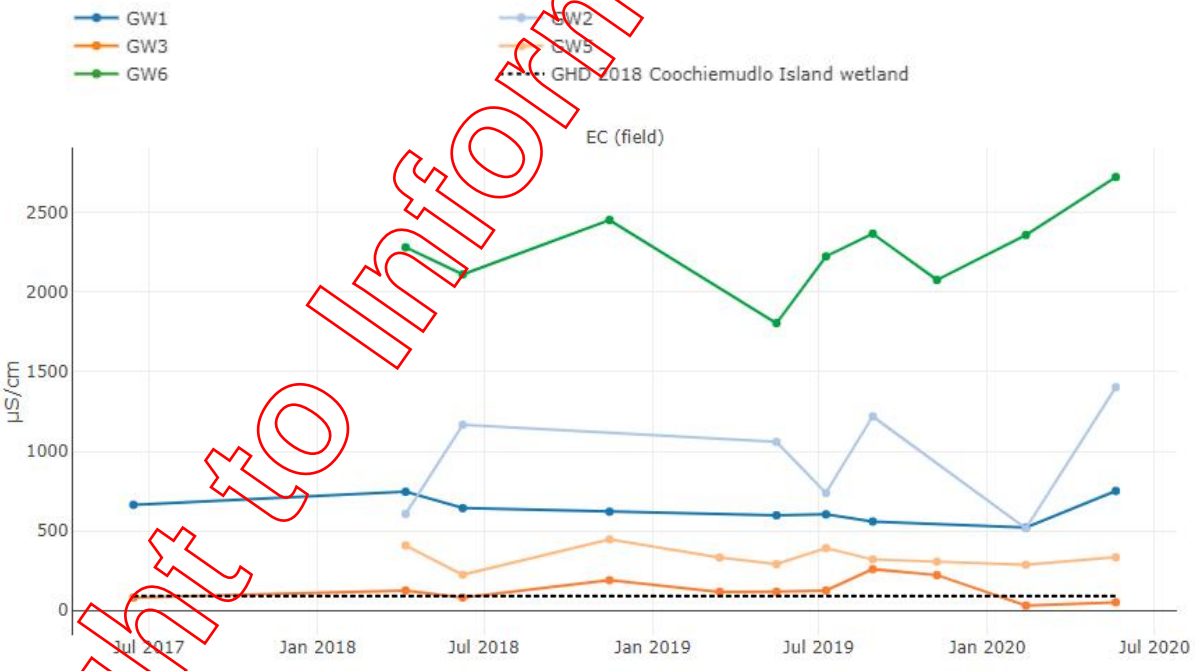
Publication Date: 17 Jun 2020

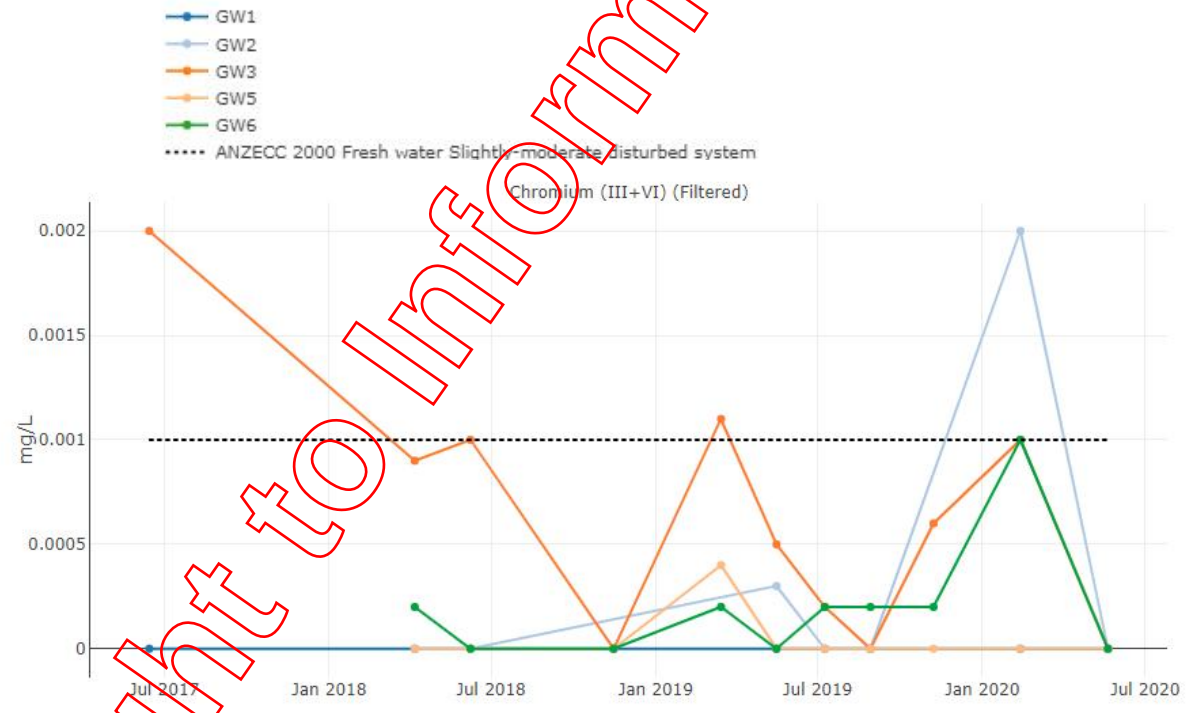
Chem Names In "EC (field),pH (Field),TOC,Ammonia as N,Nitrate (as N),Calcium,Chloride,Magnesium,Potassium,Sodium,Sulphate,Phosphorus,Manganese,Arsenic,Cadmium,Aluminium,Chromium (III+VI),Copper,Lead,Zinc,Mercury,Nickel,Iron",
Locations In "undefined",
Date between "01 Jan 2010" and "31 May 2020"

**Appendix D.**

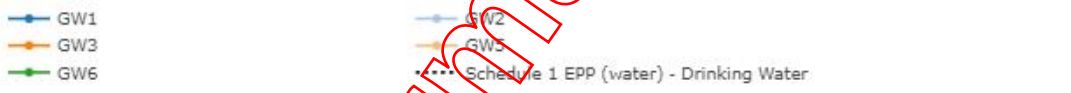
**Groundwater Graphs**

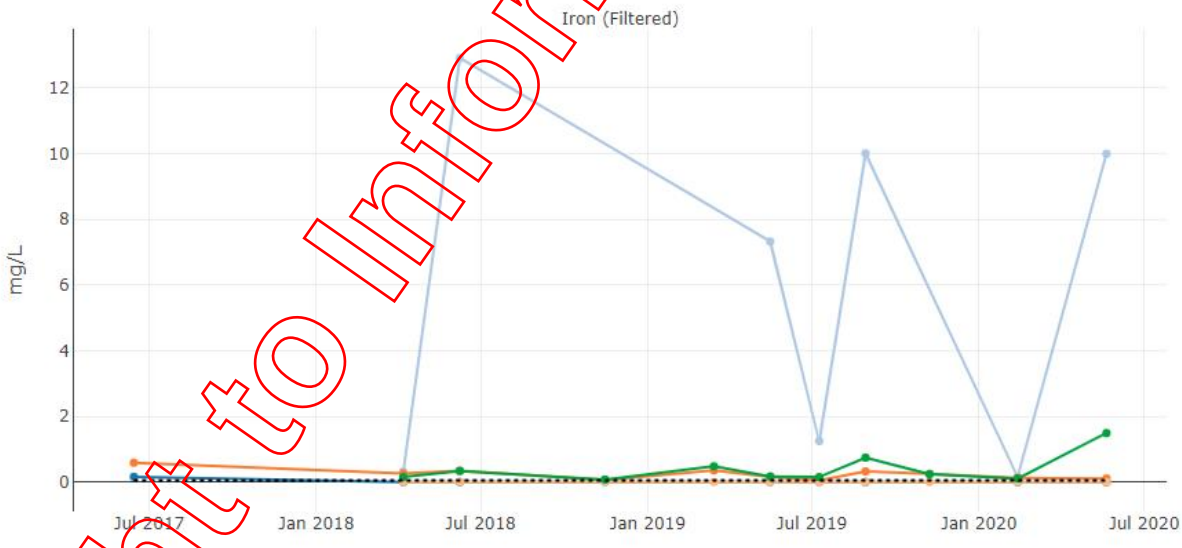


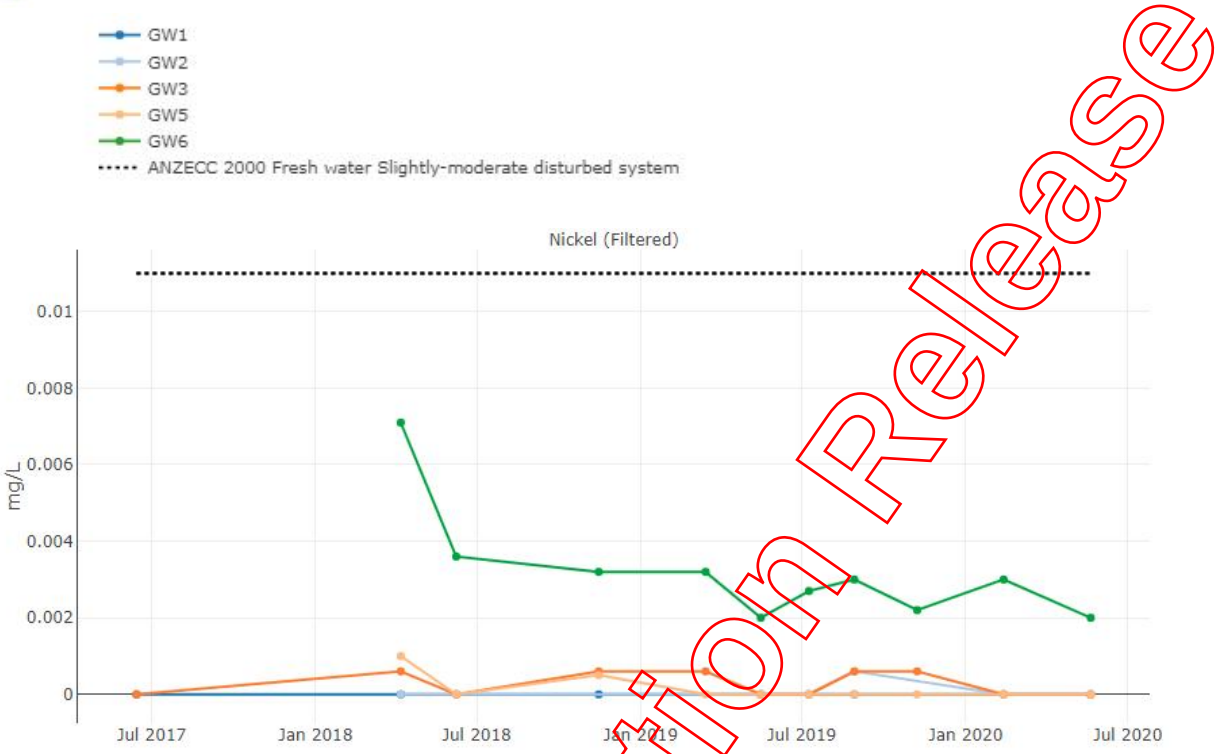



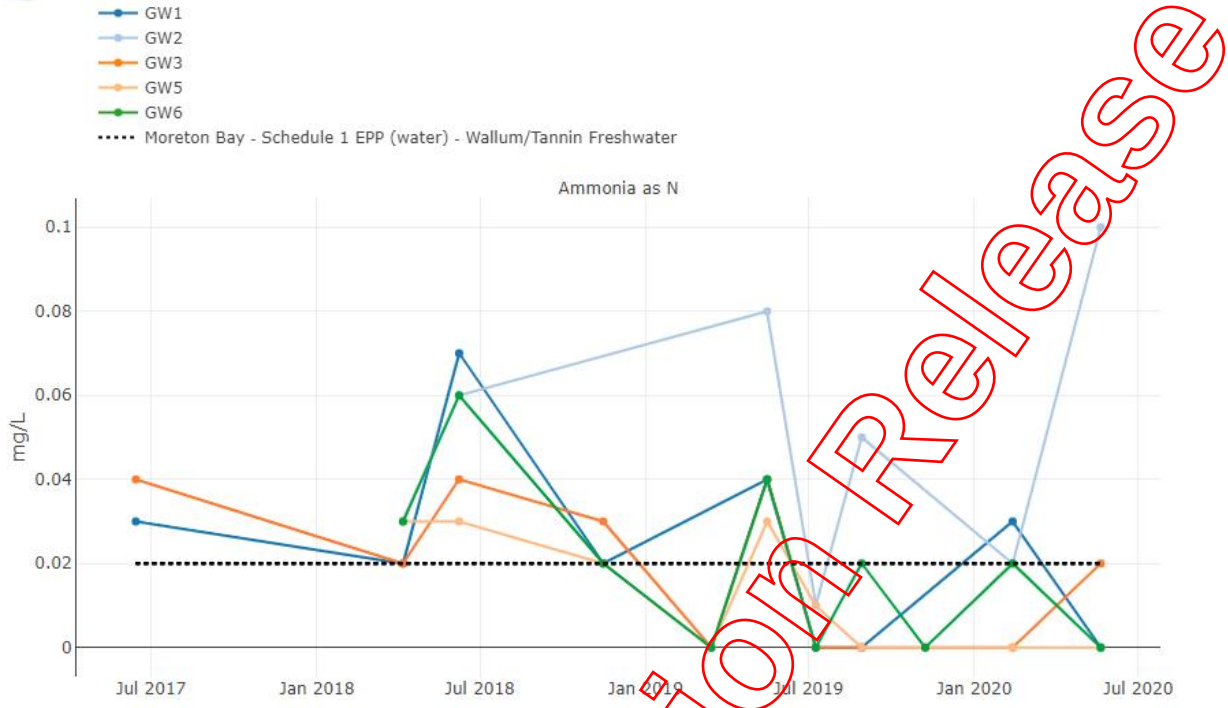



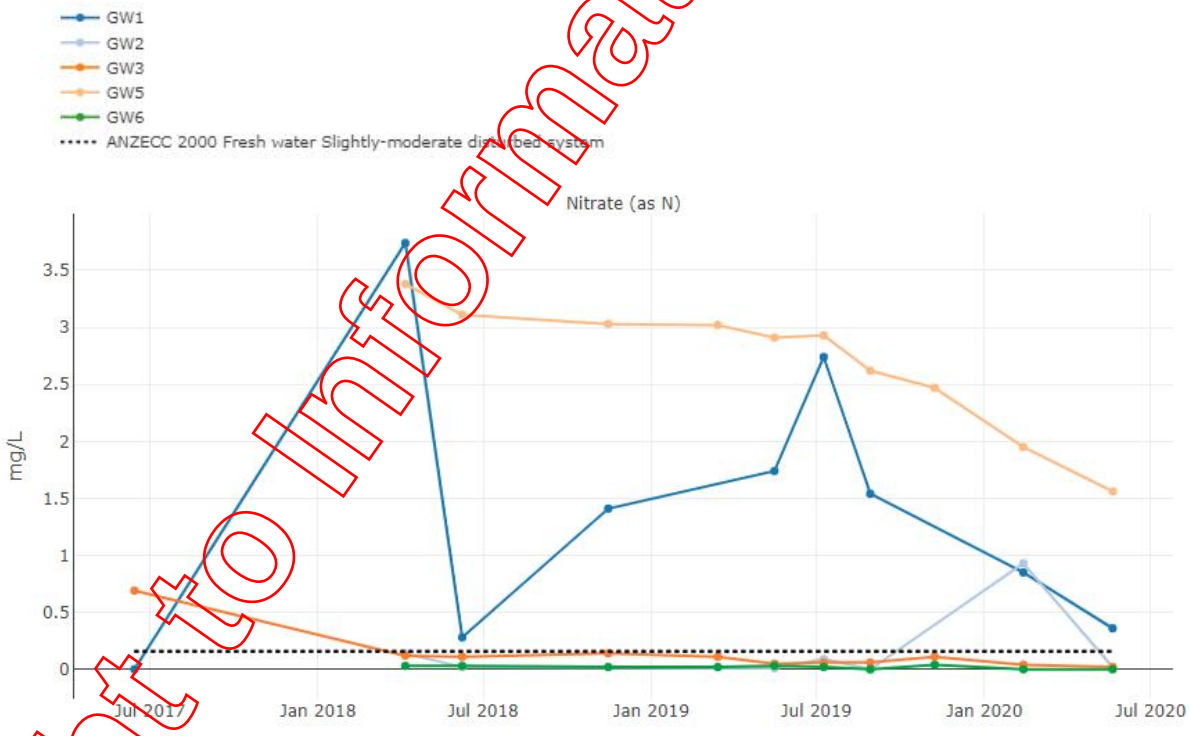


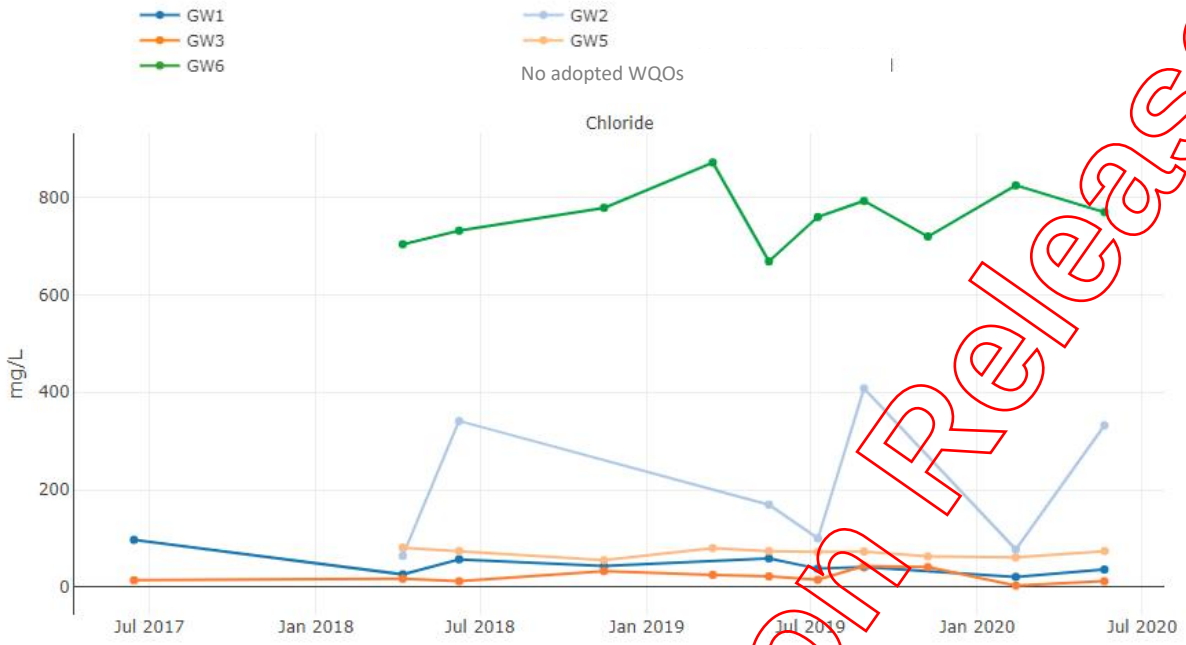


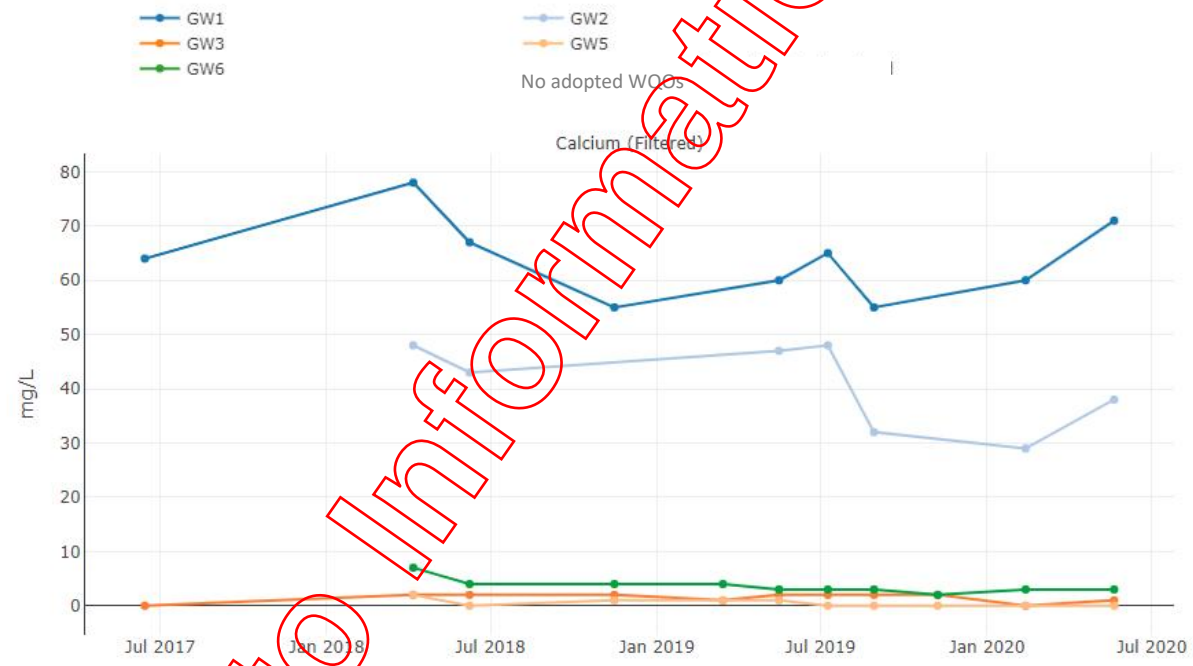



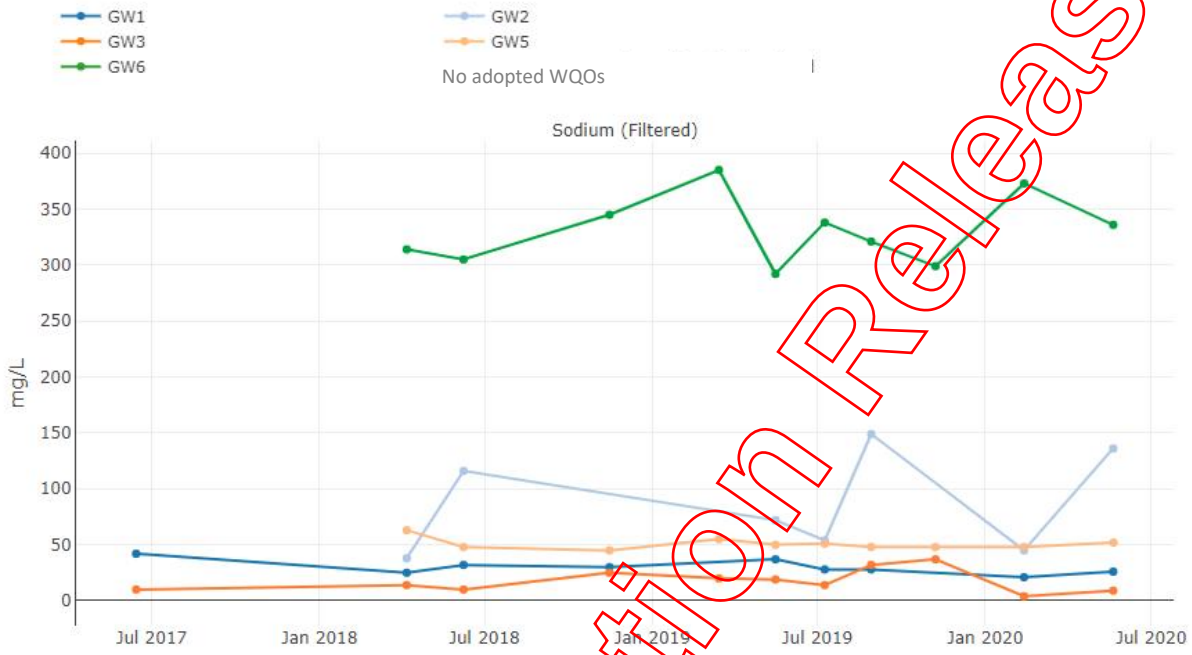


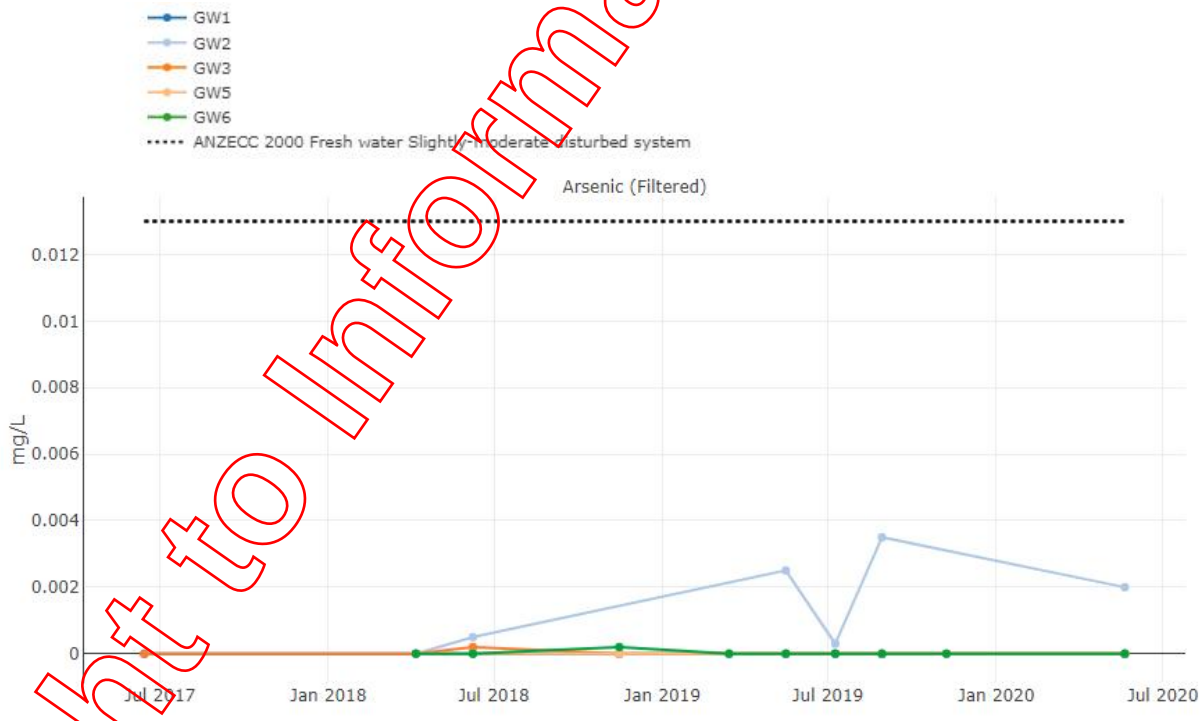



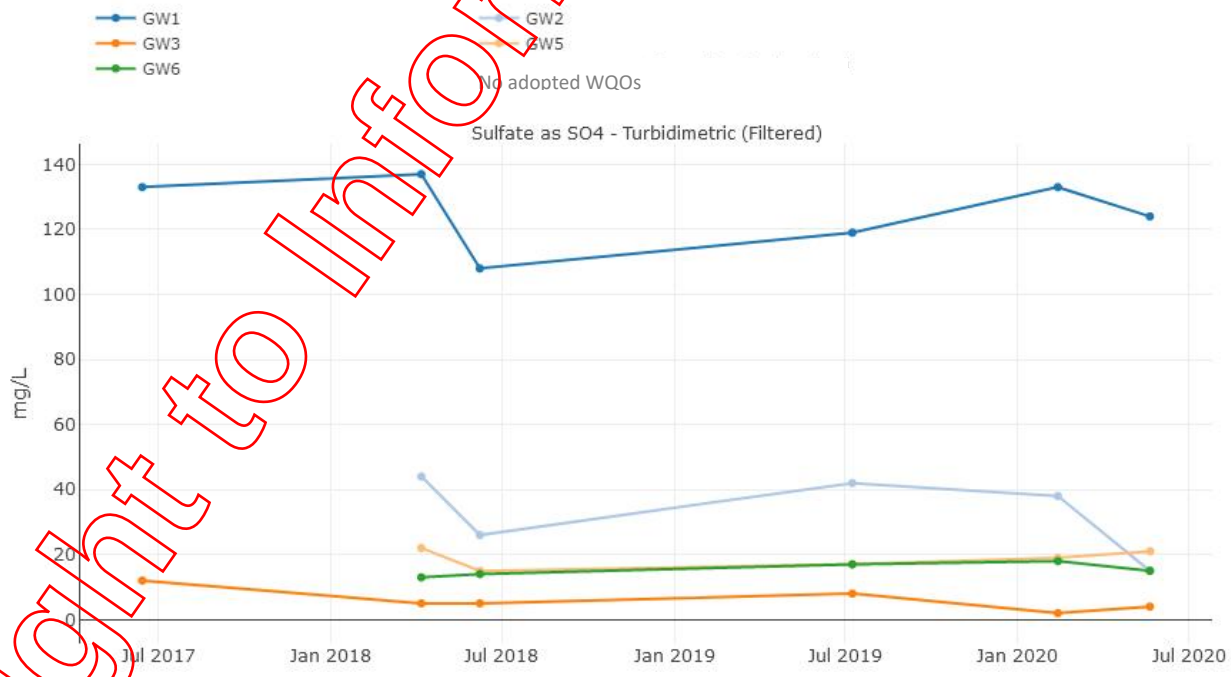



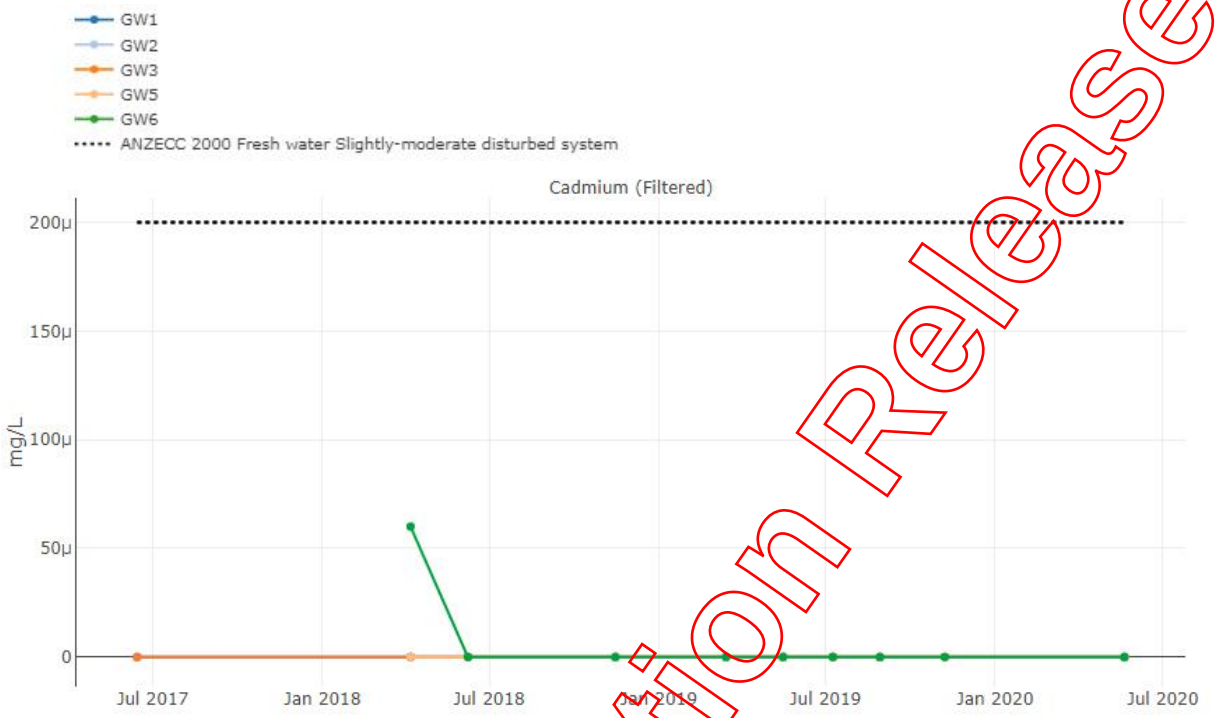


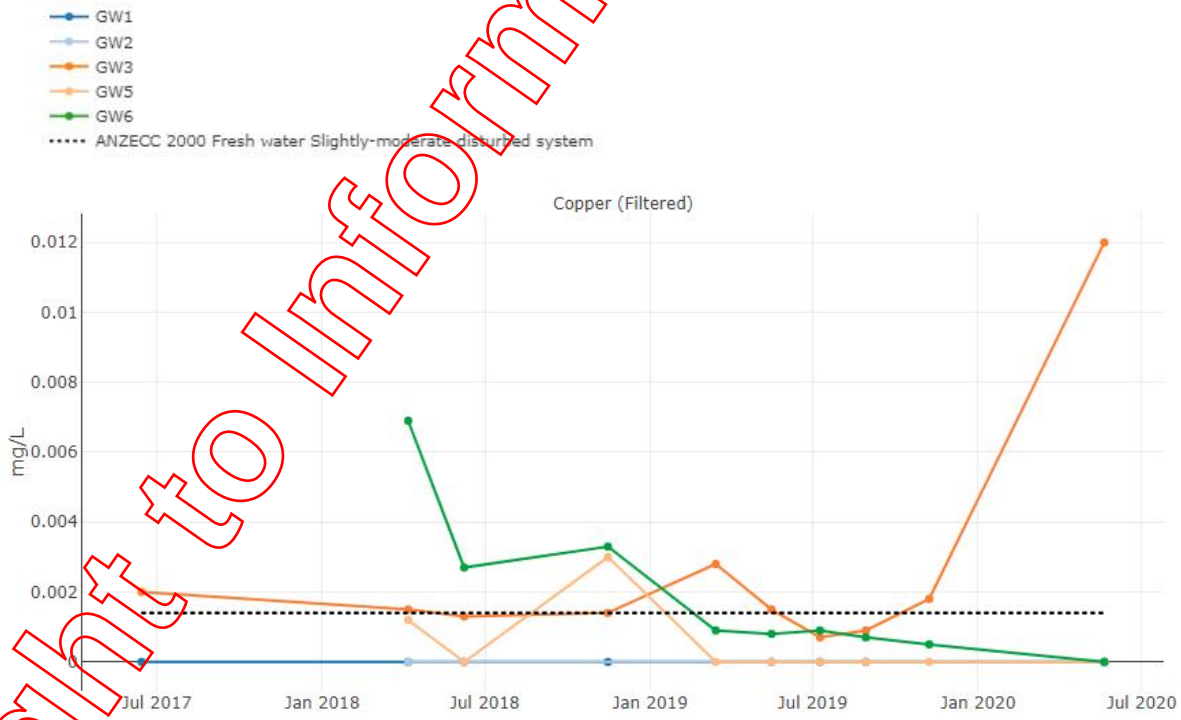



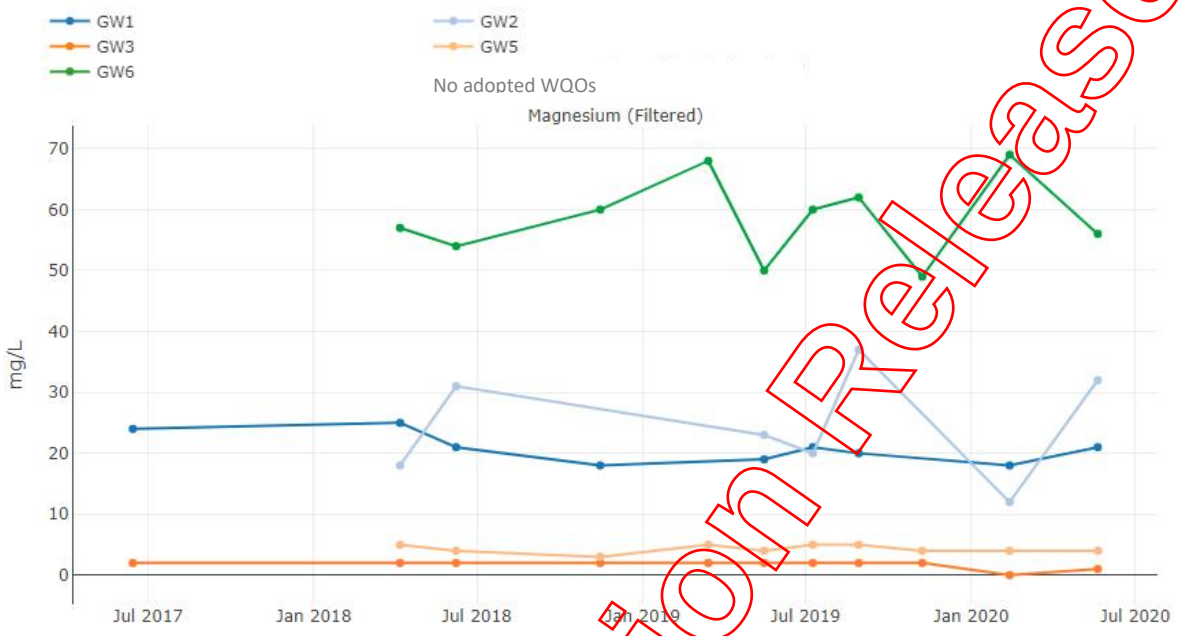


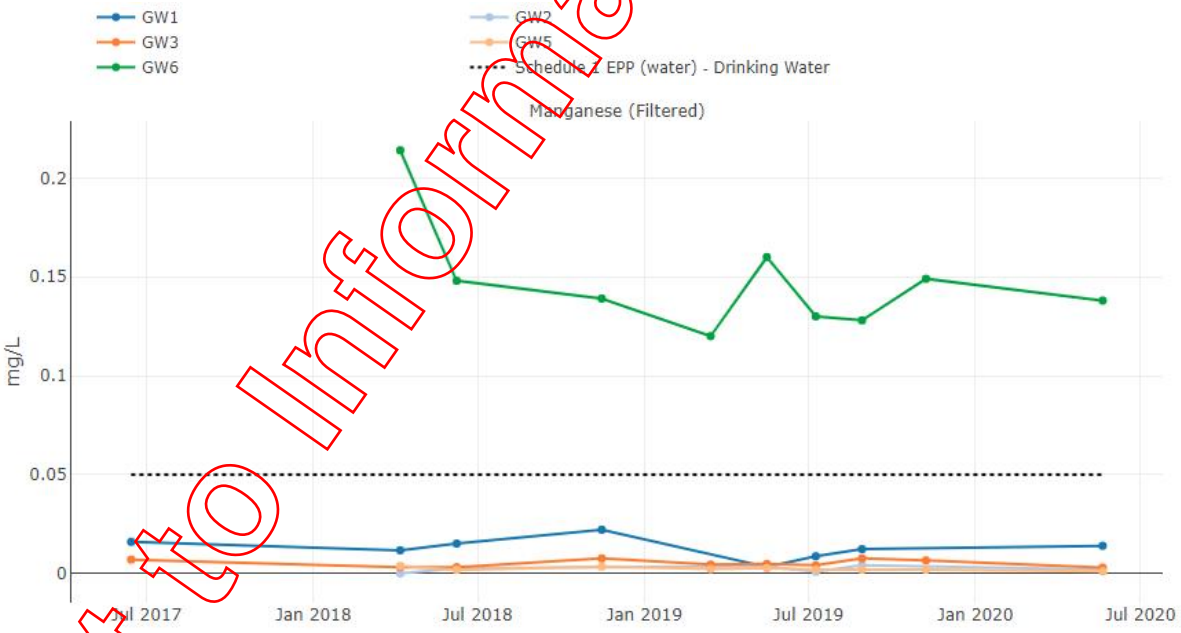



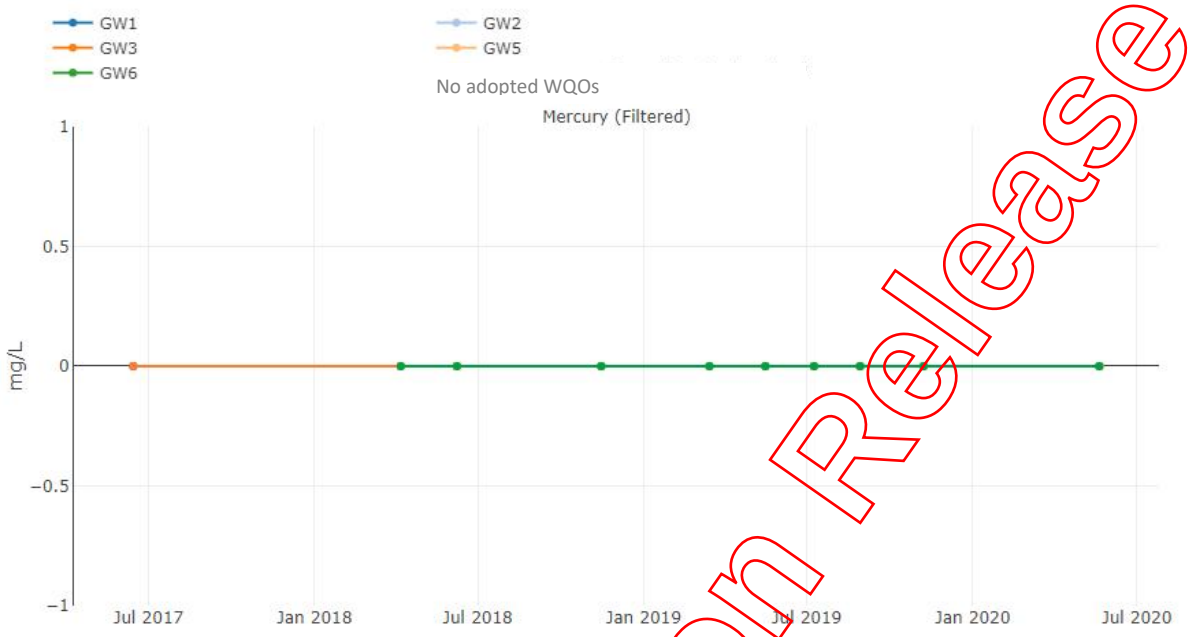



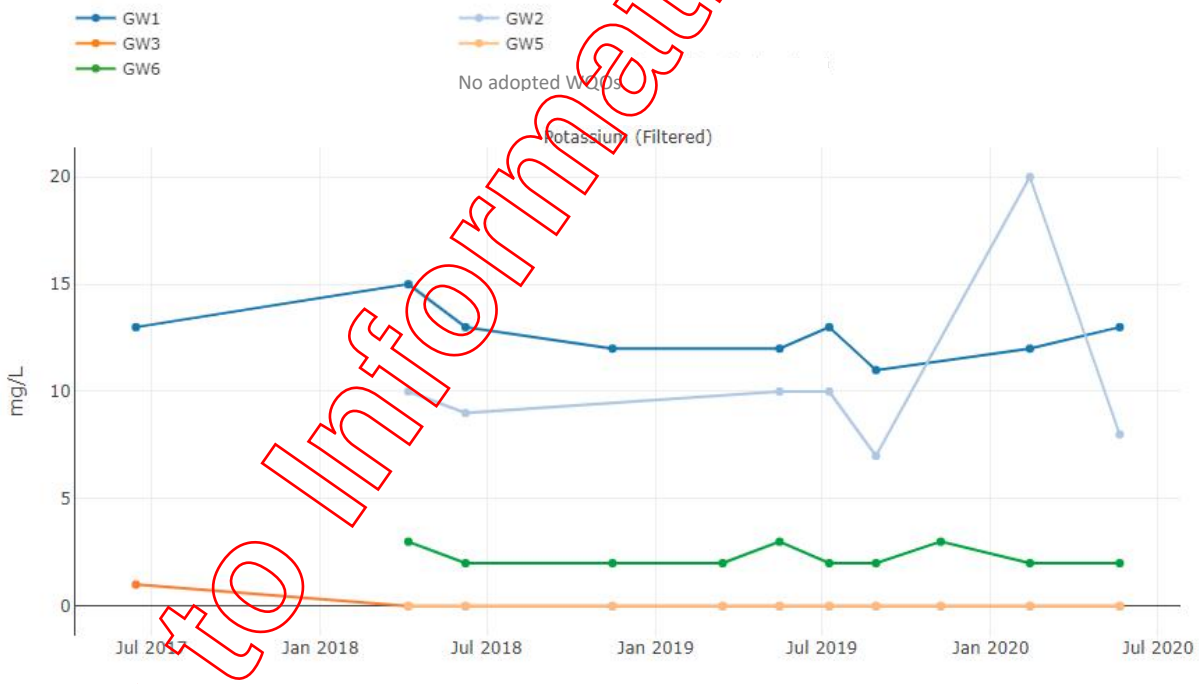


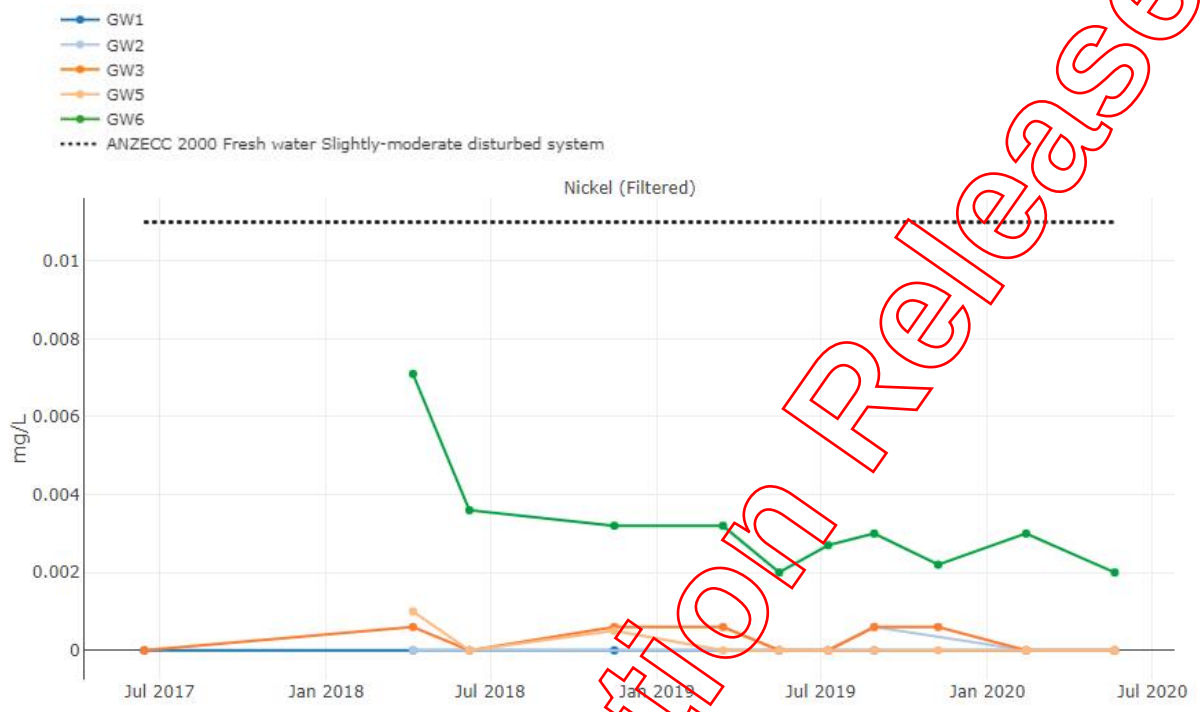





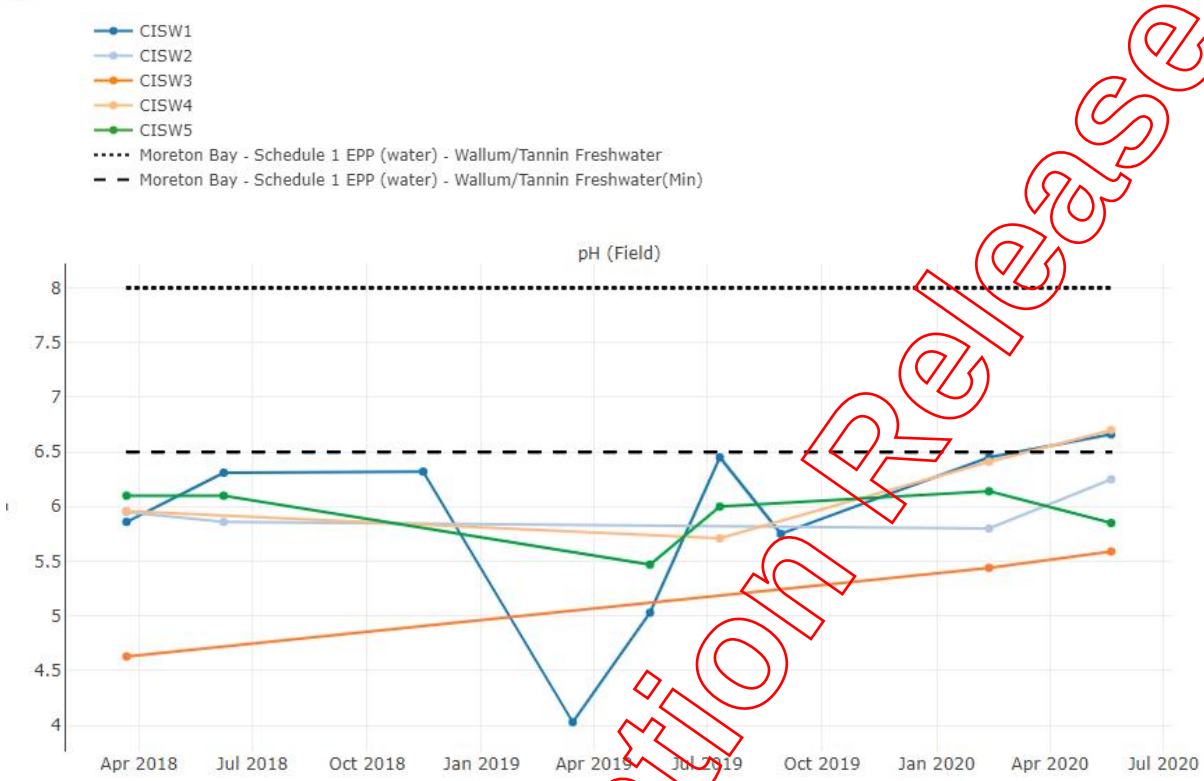


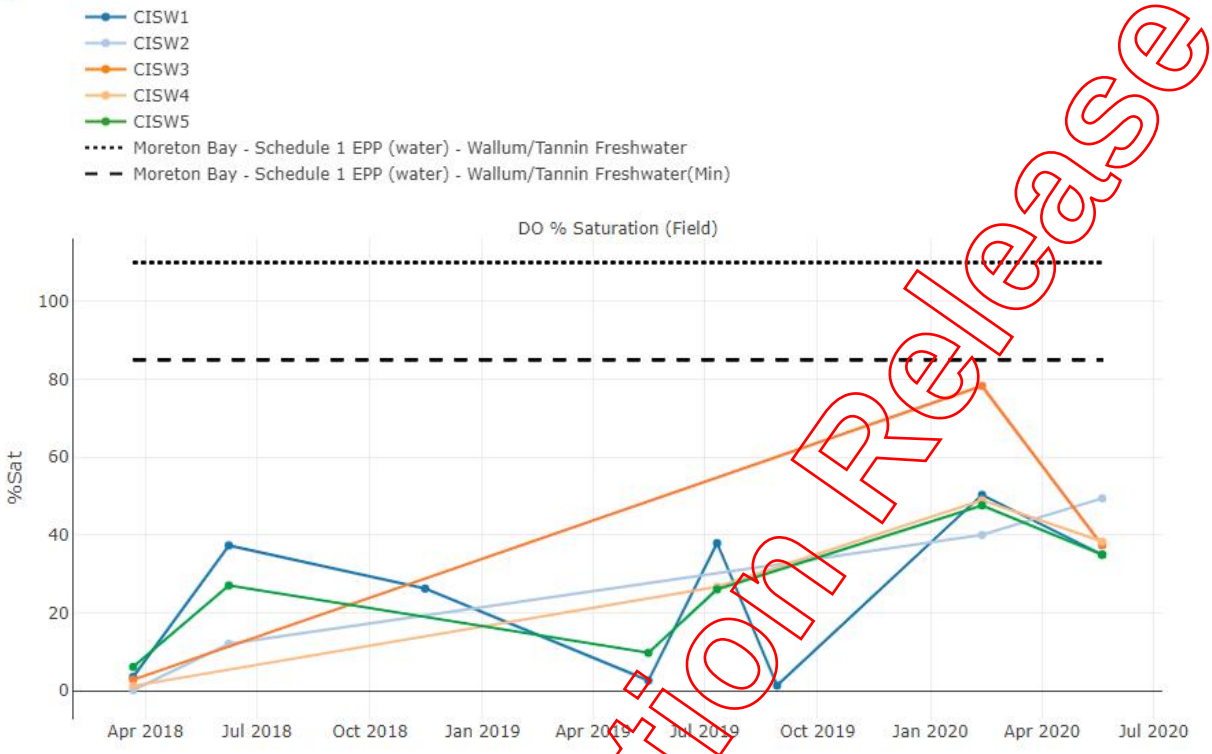



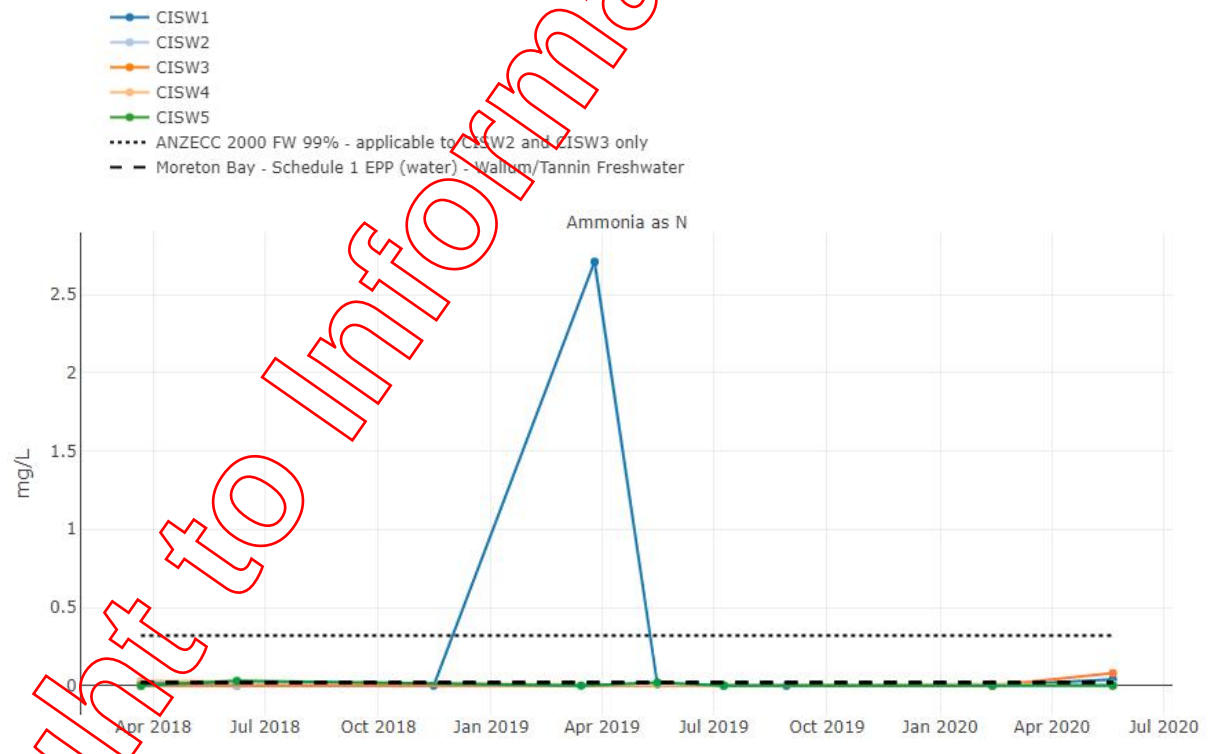


**Appendix E.**

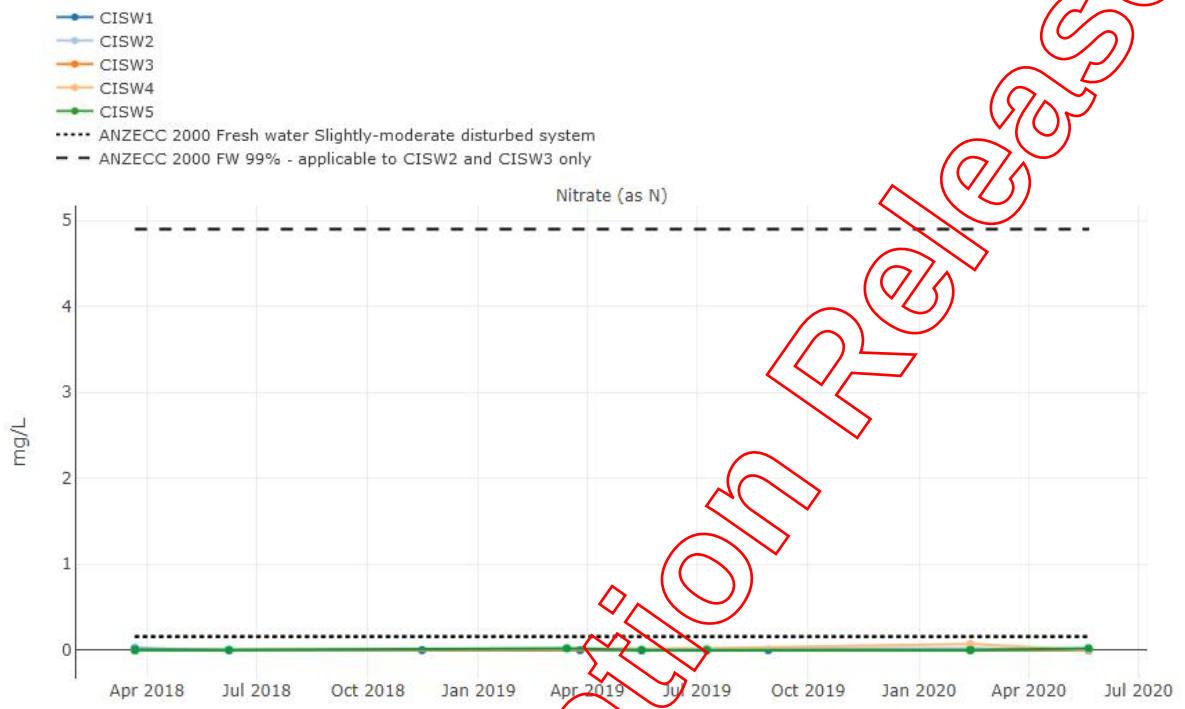
**Surface Water Graphs**

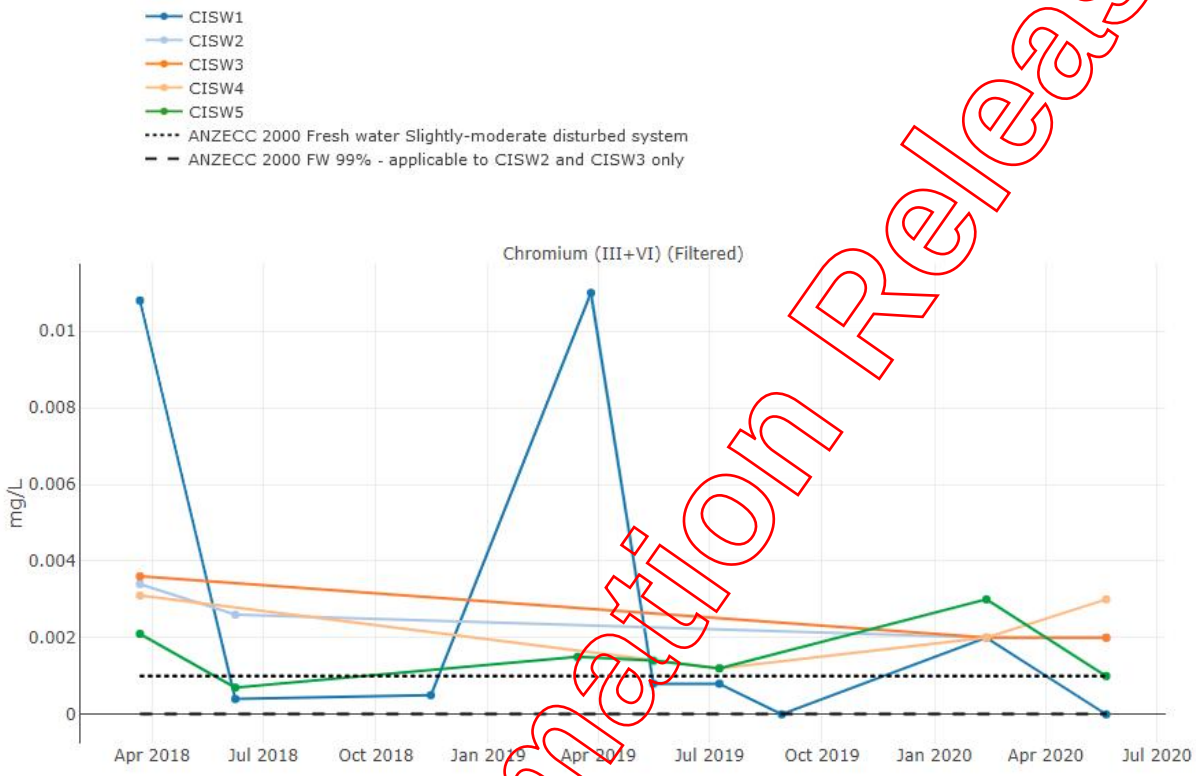


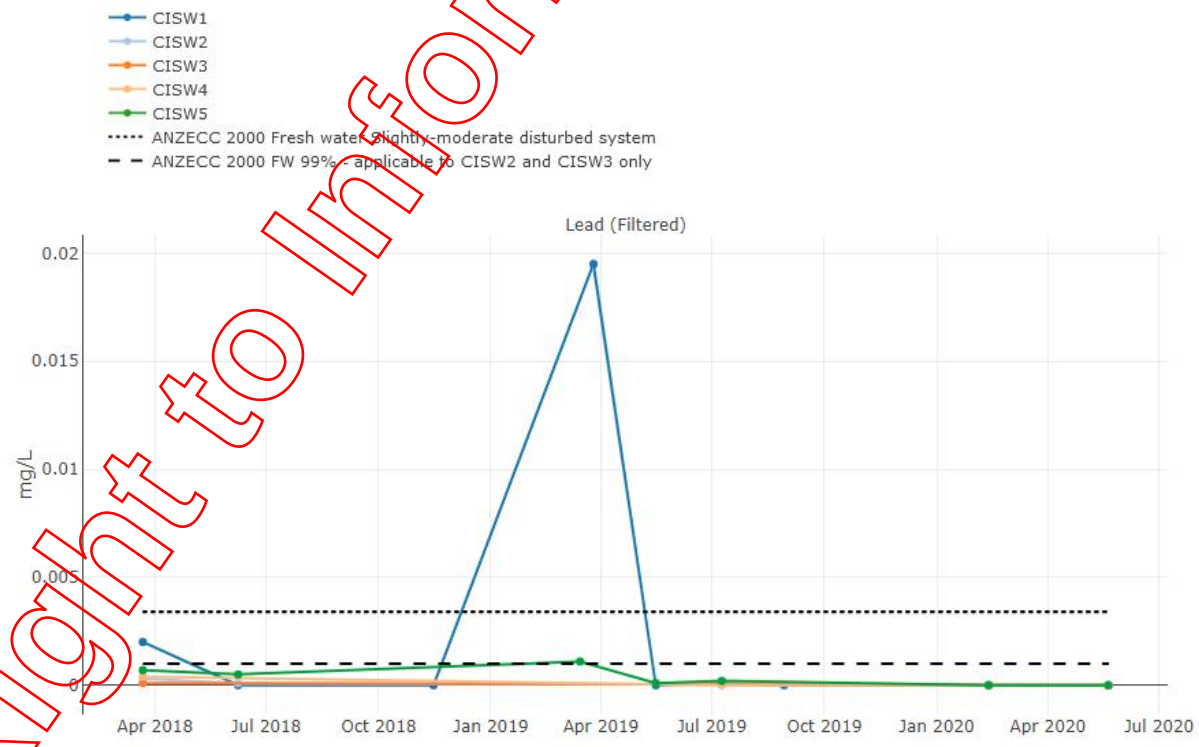



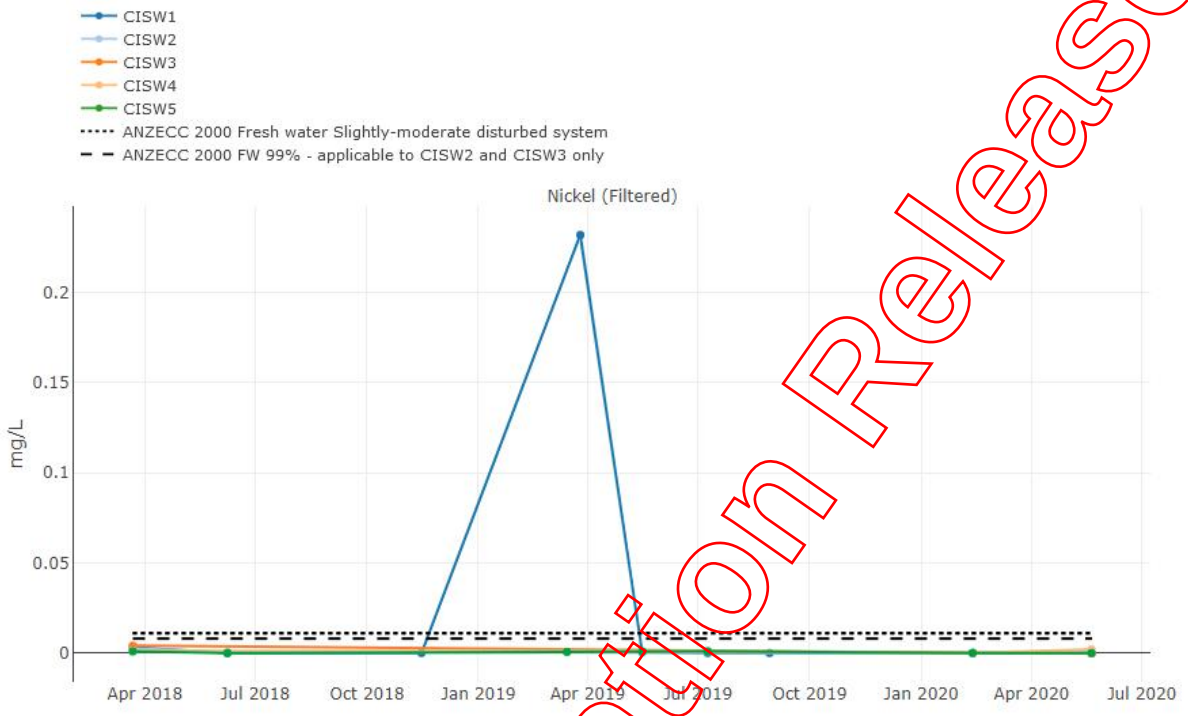





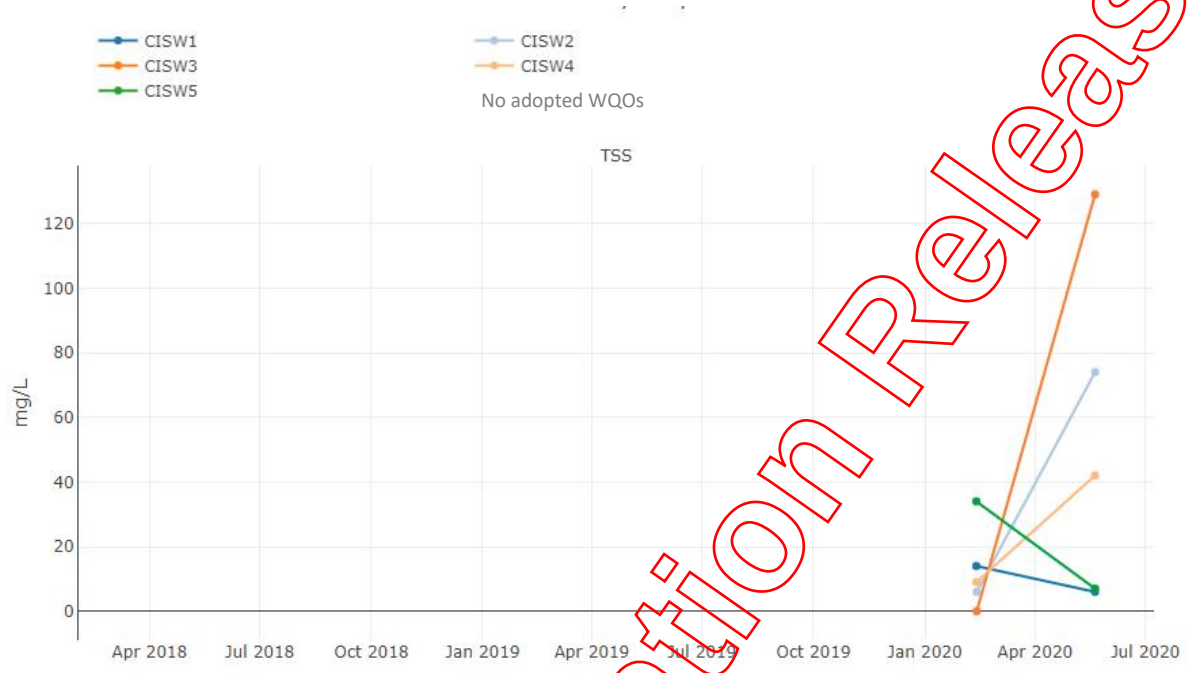


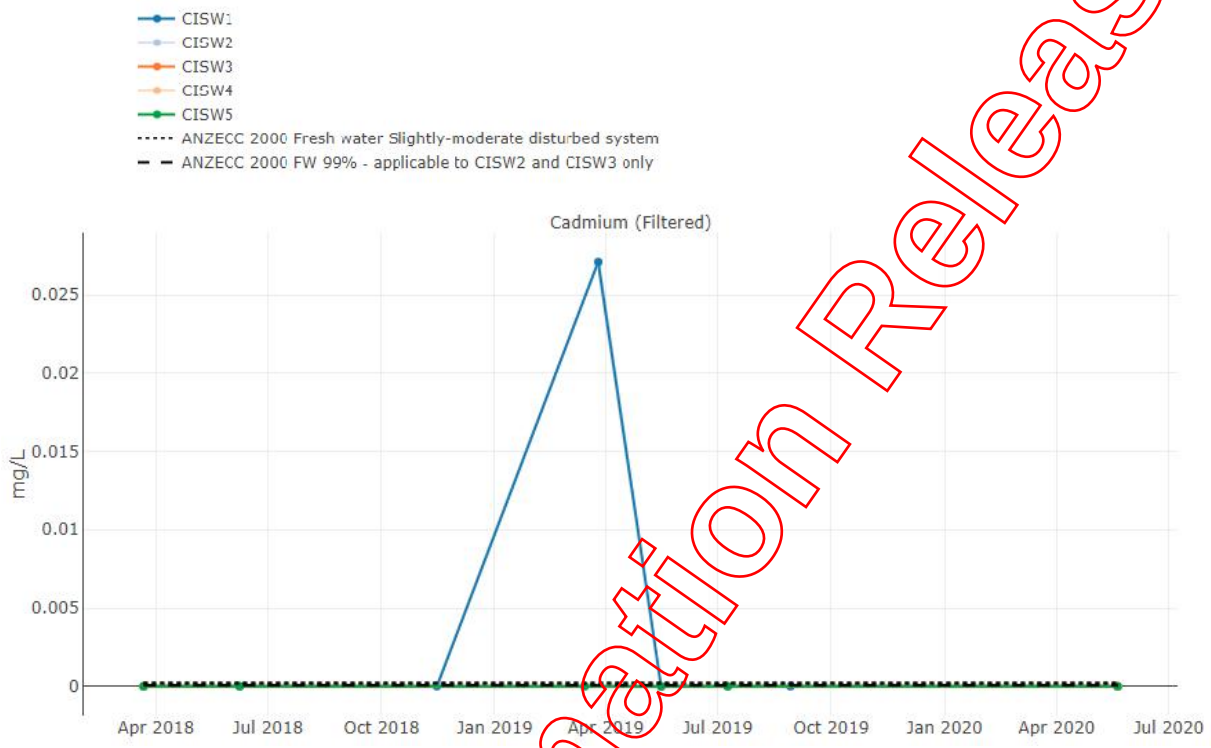



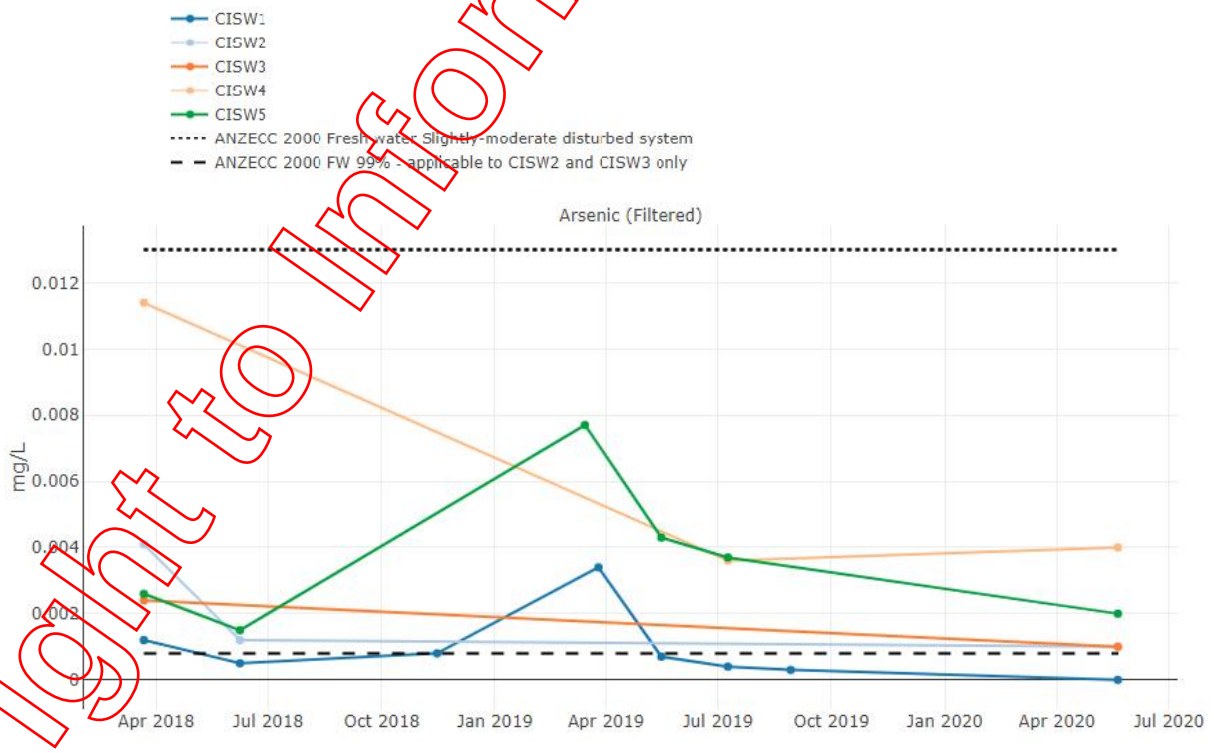



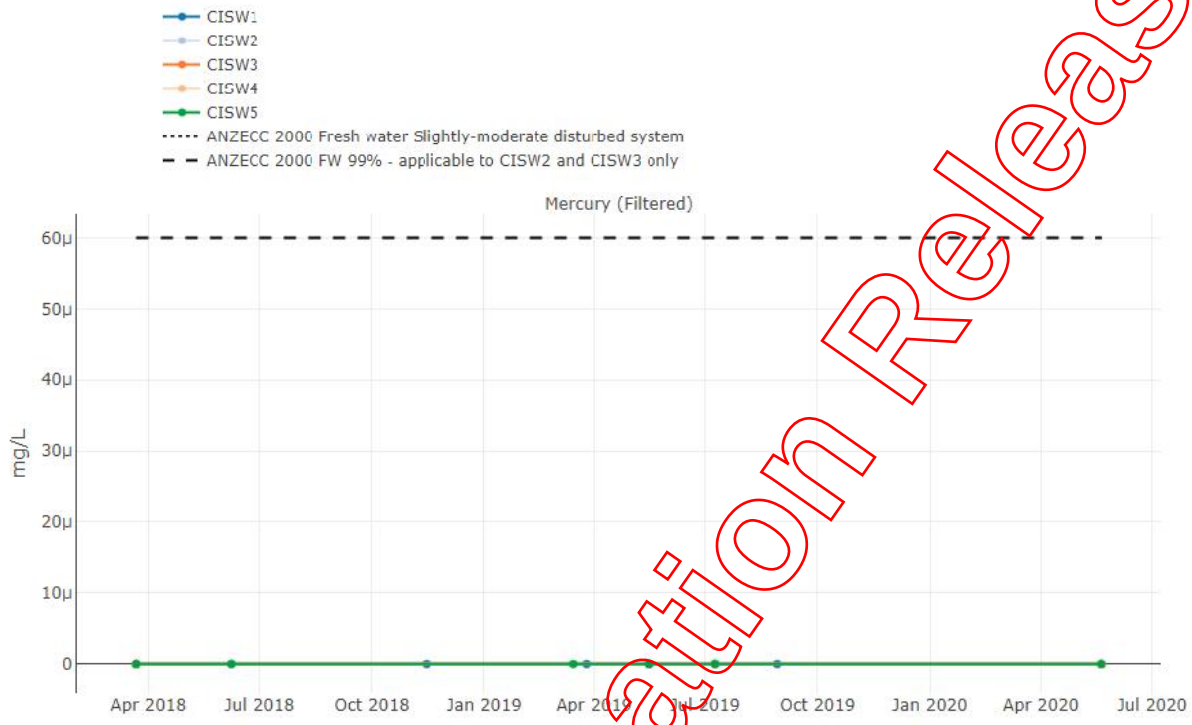


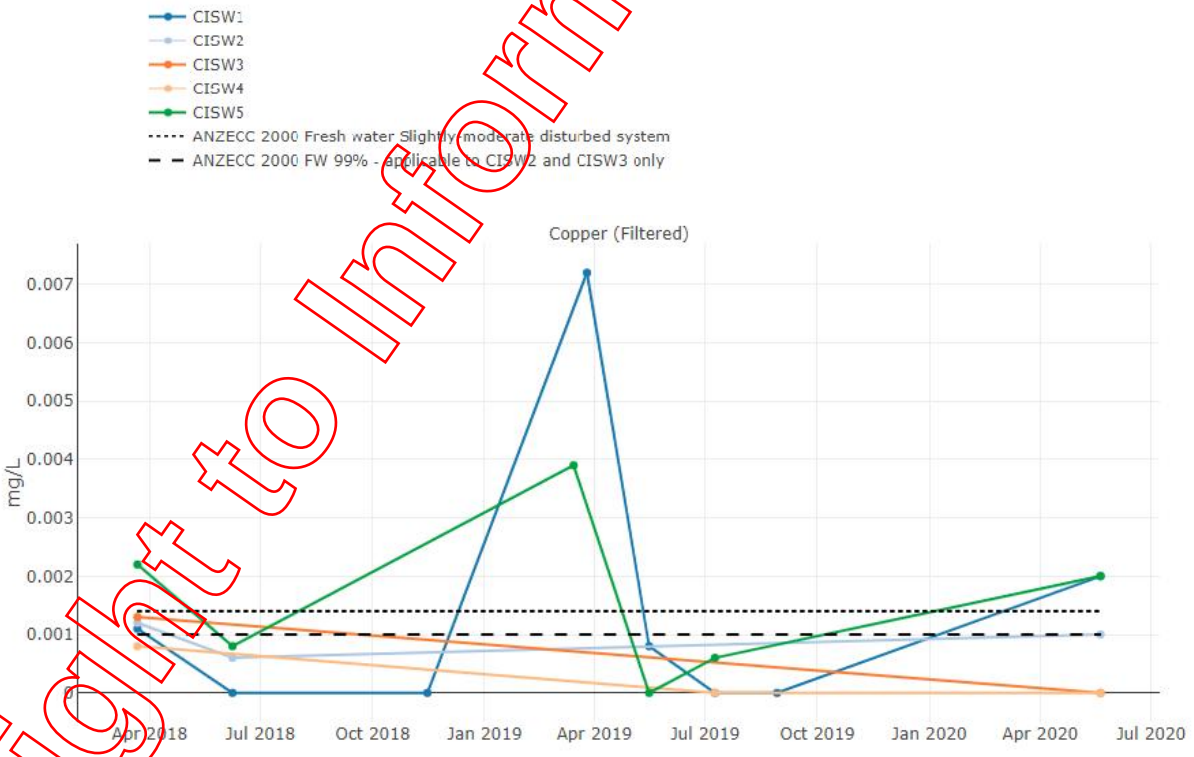


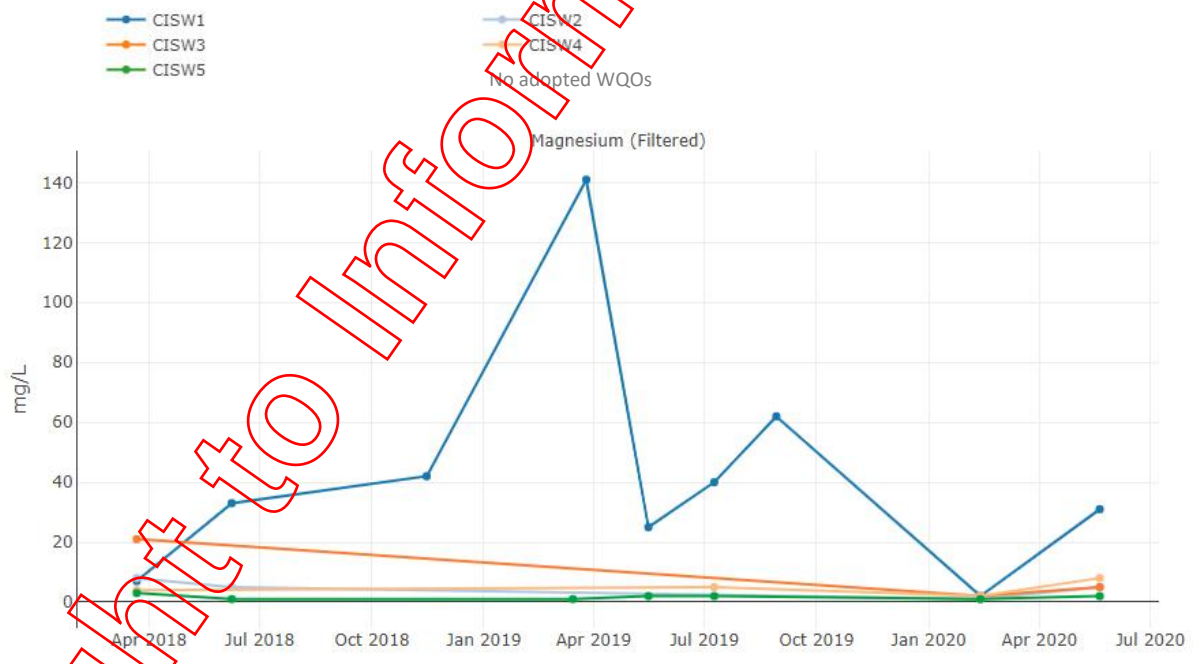


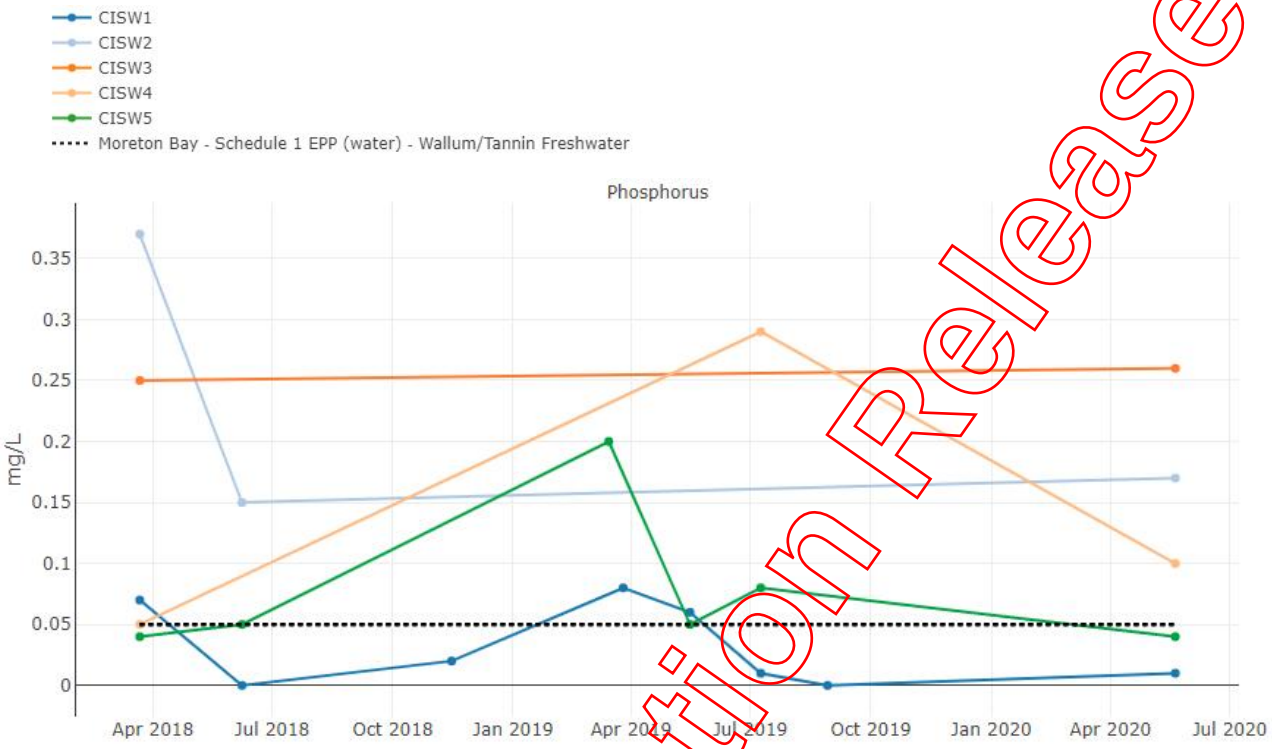





**Appendix F.**

**Laboratory Analysis Results and QA/QC Reports**

ALSCompass
SAMPLING *Intelligence*

265

ALS

Environmental Division
Brisbane
Work Order Reference
EB2013449

Telephone : + 61-7-3243 7222

# Custody Document

| ALS USE ONLY (Circle) | | | |
|---|---|---|---|
| Custody Seal Intact? | YES | NO | N/A |
| Free ice / frozen ice bricks present upon receipt? | YES | NO | N/A |
| Random Sample Temperature on receipt | | °C | |

**Project:** Redlands Landfills **Client:** RCC **Project Manager:** Kaine Pritchard

ALS Compass Job Ref: [redacted] **# Samples:** 13 **Sampler:** Sophie Blond

**Phone:** ( [redacted] **Phone:** ( [redacted]

**Turnaround Requirement:** Standard 5 day TAT Urgent

**Special Instructions:**

HT

**Custody:**

| Relinquished by: | Received by: | Relinquished by: | Received by: |
|---|---|---|---|
| Sophie Blond | Kirsten | | |
| **Date / Time:** | **Date / Time:** | **Date / Time:** | **Date / Time:** |
| 21/05/20 | 21/05/2020 10:30 | | |

# CHAIN OF CUSTODY

ALS COC#: 10929 ALS Laboratory: EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: May2020 Coochiemudlo Is Closed LF

ORDER NO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V12 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

| SAMPLE DETAILS | | | | | | | ANALYSIS REQUIRED | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE | NAME | DESCRIPTION | DATE / TIME | MATRIX | TOTAL BOTTLES | ON HOLD | Table 18: Surface Water - Coochiemudlo Is - Quarterly WATER | Table 19: Groundwater - Coochiemudlo Is - Quarterly WATER | ALTERNATIVE ANALYSIS | ADDITIONAL INFORMATION |
| 001 | GW1 | | 20/05/2020 09:23 AM | Water | ALS: 4 Non ALS: 0 | No | | X | | |
| 002 | GW2 | | 20/05/2020 09:36 AM | Water | ALS: 4 Non ALS: 0 | No | | X | | |
| 003 | GW3 | | 20/05/2020 10:02 AM | Water | ALS: 4 Non ALS: 0 | No | | X | | |
| 004 | GW5 | | 20/05/2020 05:55 PM | Water | ALS: 4 Non ALS: 0 | No | | X | | |
| 005 | GW6 | | 20/05/2020 10:34 AM | Water | ALS: 4 Non ALS: 0 | No | | X | | |
| 006 | CISW1 | | 20/05/2020 11:28 AM | Water | ALS: 5 Non ALS: 0 | No | X | | | |
| 007 | CISW2 | | 20/05/2020 12:10 PM | Water | ALS: 5 Non ALS: 0 | No | X | | | |
| 008 | CISW3 | | 20/05/2020 12:10 PM | Water | ALS: 5 Non ALS: 0 | No | X | | | |
| 009 | CISW4 | | 20/05/2020 11:01 AM | Water | ALS: 5 Non ALS: 0 | No | X | | | |

# CHAIN OF CUSTODY

ALS COC#: **10929** *ALS Laboratory:* EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: May2020 Coochiemudlo Is Closed LF

ORDER NO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V12 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

| SAMPLE DETAILS | | | | | | | ANALYSIS REQUIRED | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE | NAME | DESCRIPTION | DATE / TIME | MATRIX | TOTAL BOTTLES | ON HOLD | Table 18: Surface Water - Coochiemudlo Is - Quarterly WATER | Table 19: Groundwater - Coochiemudlo Is - Quarterly WATER | ALTERNATIVE ANALYSIS | ADDITIONAL INFORMATION |
| 010 | CISW5 | | 20/05/2020 11:29 AM | Water | ALS: 5 Non ALS: 0 | No | X | | | |
| 011 | Rinstate | | 20/05/2020 06:04 PM | Water | ALS: 5 Non ALS: 0 | No | X | | | |
| 012 | Blank | | 20/05/2020 05:58 PM | Water | ALS: 5 Non ALS: 0 | No | X | | | |
| 013 | SWQA | | 20/05/2020 11:02 AM | Water | ALS: 5 Non ALS: 0 | No | X | | | |

# CHAIN OF CUSTODY

(ALS) COC#: **10929** *ALS Laboratory:* EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: May2020 Coochiemudlo Is Closed LF

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V12 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| SAMPLE | SAMPLE NAME | BOTTLE NAME | VOLUME | BARCODE | TYPE | FILTERED | REASON |
|---|---|---|---|---|---|---|---|
| 001 | GW1 | Clear Plastic Bottle - Natural | 250 mL | 00071119137052 | Green | No | |
| 001 | GW1 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062733 | Purple | No | |
| 001 | GW1 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005542 | Red | Yes | |
| 001 | GW1 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019040349 | Purple | No | |
| 002 | GW2 | Clear Plastic Bottle - Natural | 250 mL | 00071119137065 | Green | No | |
| 002 | GW2 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062807 | Purple | No | |
| 002 | GW2 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055653 | Purple | No | |
| 002 | GW2 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005562 | Red | Yes | |
| 003 | GW3 | Clear Plastic Bottle - Natural | 250 mL | 00071119137064 | Green | No | |
| 003 | GW3 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062719 | Purple | No | |
| 003 | GW3 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005539 | Red | Yes | |
| 003 | GW3 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055543 | Purple | No | |
| 004 | GW5 | Clear Plastic Bottle - Natural | 250 mL | 00071119137062 | Green | No | |
| 004 | GW5 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005533 | Red | Yes | |
| 004 | GW5 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062740 | Purple | No | |
| 004 | GW5 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055661 | Purple | No | |
| 005 | GW6 | Clear Plastic Bottle - Natural | 250 mL | 00071119137058 | Green | No | |
| 005 | GW6 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055638 | Purple | No | |
| 005 | GW6 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062760 | Purple | No | |
| 005 | GW6 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005519 | Red | Yes | |
| 006 | CISW1 | BOD Bottle Unpreserved | 250 mL | 00071119137051 | Green | No | |
| 006 | CISW1 | Clear Plastic Bottle - Natural | 250 mL | 00071119136937 | Green | No | |
| 006 | CISW1 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055667 | Purple | No | |
| 006 | CISW1 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062923 | Purple | No | |
| 006 | CISW1 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005536 | Red | Yes | |
| 007 | CISW2 | Clear Plastic Bottle - Natural | 250 mL | 00071119137046 | Green | No | |

# CHAIN OF CUSTODY

ALS COC#: 10929 ALS Laboratory: EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: May2020 Coochiemudlo Is Closed LF

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V12 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comments:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 007 | CISW2 | BOD Bottle Unpreserved | 250 mL | 00071119137037 | Green | No | |
| 007 | CISW2 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062988 | Purple | No | |
| 007 | CISW2 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002095535 | Red | Yes | |
| 007 | CISW2 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055564 | Purple | No | |
| 008 | CISW3 | BOD Bottle Unpreserved | 250 mL | 00071119137039 | Green | No | |
| 008 | CISW3 | Clear Plastic Bottle - Natural | 250 mL | 00071119137061 | Green | No | |
| 008 | CISW3 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002097078 | Red | Yes | |
| 008 | CISW3 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062768 | Purple | No | |
| 008 | CISW3 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055628 | Purple | No | |
| 009 | CISW4 | Clear Plastic Bottle - Natural | 250 mL | 00071119019052 | Green | No | |
| 009 | CISW4 | BOD Bottle Unpreserved | 250 mL | 00071119137066 | Green | No | |
| 009 | CISW4 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062840 | Purple | No | |
| 009 | CISW4 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002097116 | Red | Yes | |
| 009 | CISW4 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055612 | Purple | No | |
| 010 | CISW5 | BOD Bottle Unpreserved | 250 mL | 00071119018987 | Green | No | |
| 010 | CISW5 | Clear Plastic Bottle - Natural | 250 mL | 00071119019036 | Green | No | |
| 010 | CISW5 | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062799 | Purple | No | |
| 010 | CISW5 | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002097120 | Red | Yes | |
| 010 | CISW5 | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055644 | Purple | No | |
| 011 | Rinstate | BOD Bottle Unpreserved | 250 mL | 00071119019089 | Green | No | |
| 011 | Rinstate | Clear Plastic Bottle - Natural | 250 mL | 00071119019018 | Green | No | |
| 011 | Rinstate | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519063002 | Purple | No | |
| 011 | Rinstate | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002097118 | Red | Yes | |
| 011 | Rinstate | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019040250 | Purple | No | |
| 012 | Blank | BOD Bottle Unpreserved | 250 mL | 00071119137036 | Green | No | |
| 012 | Blank | Clear Plastic Bottle - Natural | 250 mL | 00071119137053 | Green | No | |
| 012 | Blank | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062902 | Purple | No | |

# CHAIN OF CUSTODY

ALS COC#: 10929 ALS Laboratory: EB Brisbane

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE TIME: | DATE TIME: | DATE TIME: | DATE TIME: |

CLIENT: FUPE - FUTURE-PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: May2020 Coochiemudlo Is Closed LF

ORDER NO:

PROJECT MANAGER: Nicholas Evans CONTACT PH: 07 5357 9463 SAMPLER MOBILE: 07 5357

PRIMARY SAMPLER: Nicholas Evans QUOTE NO: BN/235/18 B V12 / EB2019FUPE0003

EMAIL REPORTS TO:

EMAIL INVOICES TO:

TURNAROUND REQUIREMENTS : 5 Days

Biohazard info:

**LABORATORY USE ONLY (Circle)**

Custody Seal intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: C

Other comments:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 012 | Blank | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005546 | Red | Yes | |
| 012 | Blank | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055650 | Purple | No | |
| 013 | SWQA | BOD Bottle Unpreserved | 250 mL | 00071119137063 | Green | No | |
| 013 | SWQA | Clear Plastic Bottle - Natural | 250 mL | 00071119019003 | Green | No | |
| 013 | SWQA | Clear Plastic Bottle - Nitric Acid; Filtered | 60 mL | 00122002005548 | Red | Yes | |
| 013 | SWQA | Amber TOC Vial - Sulfuric Acid | 40 mL | 00181019055613 | Purple | No | |
| 013 | SWQA | Clear Plastic Bottle - Sulfuric Acid | 60 mL | 00100519062686 | Purple | No | |

**Total Bottle Count: ALS: 60, Non ALS: 0**

# SAMPLE RECEIPT NOTIFICATION (SRN)

**Work Order** : **EB2013449**

| | | | |
|---|---|---|---|
| Client | : **FUTURE-PLUS ENVIRONMENTAL** | Laboratory | : Environmental Division Brisbane |
| Contact | : NICHOLAS EVANS | Contact | : John Pickering |
| Address | : 4/40 TECHNOLOGY DRIVE WARANA QUEENSLAND 4575 | Address | : 2 Byth Street Stafford QLD Australia 4053 |
| E-mail | : | E-mail | : |
| Telephone | : +61 07 54502688 | Telephone | : +61 7 3552 8634 |
| Facsimile | : +61 07 54502686 | Facsimile | : +61-7-3243 7218 |
| Project | : Redlands Landfill | Page | : 1 of 3 |
| Order number | : - | Quote number | : EB2019FUPE0003 (BN/235/18 B V12) |
| C-O-C number | : 10929 | QC Level | : NEPM 2013 B3 & ALS QC Standard |
| Site | : May2020 Coochiemudlo Is Closed LF | | |
| Sampler | : KAINE PRITCHARD, NICHOLAS EVANS, SOPHIE BLOND | | |

## Dates

| | | | |
|---|---|---|---|
| Date Samples Received | : 21-May-2020 10:30 | Issue Date | : 21-May-2020 |
| Client Requested Due Date | : 28-May-2020 | Scheduled Reporting Date | : **28-May-2020** |

## Delivery Details

| | | | |
|---|---|---|---|
| Mode of Delivery | : Carrier | Security Seal | : Intact. |
| No. of coolers/boxes | : 4 | Temperature | : 3.1°C, 0.1°C, 7.3°C, 0°C - Ice present |
| Receipt Detail | : SMALL & MEDIUM HARD ESKY | No. of samples received / analysed | : 13 / 13 |

## General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- ***SRN Reissued 21/05/2020: Correction made to the invoice recipients***
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

## Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

## Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - ED045G Chloride by Discrete Analyser | WATER - EG020F Dissolved Metals by ICP/MS | WATER - EK055G Ammonia as N By Discrete Analyser | WATER - EK058G Nitrite as N by Discrete Analyser | WATER - EK067G Total Phosphorus as P by Discrete Analyser | WATER - EP005 Total Organic Carbon (TOC) | WATER - W-02 8 Metals |
|---|---|---|---|---|---|---|---|---|---|
| EB2013449-001 | 20-May-2020 09:23 | GW1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-002 | 20-May-2020 09:36 | GW2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-003 | 20-May-2020 10:02 | GW3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-004 | 20-May-2020 17:55 | GW5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-005 | 20-May-2020 10:34 | GW6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-006 | 20-May-2020 11:28 | CISW1 | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-007 | 20-May-2020 12:10 | CISW2 | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-008 | 20-May-2020 12:10 | CISW3 | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-009 | 20-May-2020 11:01 | CISW4 | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-010 | 20-May-2020 11:29 | CISW5 | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-011 | 20-May-2020 18:04 | Rinstate | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-012 | 20-May-2020 17:58 | Blank | ✓ | ✓ | | | | ✓ | ✓ |
| EB2013449-013 | 20-May-2020 11:02 | SWQA | ✓ | ✓ | | | | ✓ | ✓ |

Matrix: **WATER**

| Laboratory sample ID | Client sampling date / time | Client sample ID | WATER - EA025H Suspended Solids - Standard Level | WATER - ED041G Sulfate (Turbidimetric) as SO4 2 by Discrete | WATER - EP026SP Chemical Oxygen Demand (COD) | WATER - EP030 BOD | WATER - NT-01 Major Cations (Ca, Mg, Na, K) | WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P |
|---|---|---|---|---|---|---|---|---|
| EB2013449-001 | 20-May-2020 09:23 | GW1 | | ✓ | | | ✓ | |
| EB2013449-002 | 20-May-2020 09:36 | GW2 | | ✓ | | | ✓ | |
| EB2013449-003 | 20-May-2020 10:02 | GW3 | | ✓ | | | ✓ | |
| EB2013449-004 | 20-May-2020 17:55 | GW5 | | ✓ | | | ✓ | |
| EB2013449-005 | 20-May-2020 10:34 | GW6 | | ✓ | | | ✓ | |
| EB2013449-006 | 20-May-2020 11:28 | CISW1 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-007 | 20-May-2020 12:10 | CISW2 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-008 | 20-May-2020 12:10 | CISW3 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-009 | 20-May-2020 11:01 | CISW4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-010 | 20-May-2020 11:29 | CISW5 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-011 | 20-May-2020 18:04 | Rinstate | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| | | | WATER - EA025H Suspended Solids - Standard Level | WATER - ED041G Sulfate (Turbidimetric) as SO4 2 by Discrete | WATER - EP026SP Chemical Oxygen Demand (COD) | WATER - EP030 BOD | WATER - NT-01 Major Cations (Ca, Mg, Na, K) | WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P |
|---|---|---|---|---|---|---|---|---|
| EB2013449-012 | 20-May-2020 17:58 | Blank | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EB2013449-013 | 20-May-2020 11:02 | SWQA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

## Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

## Requested Deliverables

| | | |
|---|---|---|
| **ESDAT RESULTS** | | |
| - EDI Format - ESDAT (ESDAT) | Email | future-plus@esdat.com.au |
| **INVOICES** | | |
| - A4 - AU Tax Invoice (INV) | Email | accounts@future-plus.com.au |
| **JONO HOOPER** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | jonoh@future-plus.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | jonoh@future-plus.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | jonoh@future-plus.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | jonoh@future-plus.com.au |
| - A4 - AU Tax Invoice (INV) | Email | jonoh@future-plus.com.au |
| - Chain of Custody (CoC) (COC) | Email | jonoh@future-plus.com.au |
| - EDI Format - ENMRG (ENMRG) | Email | jonoh@future-plus.com.au |
| - EDI Format - XTab (XTAB) | Email | jonoh@future-plus.com.au |
| **KAINE PRITCHARD** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | kainep@future-plus.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | kainep@future-plus.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | kainep@future-plus.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | kainep@future-plus.com.au |
| - A4 - AU Tax Invoice (INV) | Email | kainep@future-plus.com.au |
| - Chain of Custody (CoC) (COC) | Email | kainep@future-plus.com.au |
| - EDI Format - ENMRG (ENMRG) | Email | kainep@future-plus.com.au |
| - EDI Format - XTab (XTAB) | Email | kainep@future-plus.com.au |
| **NICHOLAS EVANS** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | nicholase@future-plus.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | nicholase@future-plus.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | nicholase@future-plus.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | nicholase@future-plus.com.au |
| - A4 - AU Tax Invoice (INV) | Email | nicholase@future-plus.com.au |
| - Chain of Custody (CoC) (COC) | Email | nicholase@future-plus.com.au |
| - EDI Format - ENMRG (ENMRG) | Email | nicholase@future-plus.com.au |
| - EDI Format - XTab (XTAB) | Email | nicholase@future-plus.com.au |
| **SOPHIE BLOND** | | |
| - *AU Certificate of Analysis - NATA (COA) | Email | sophie.blond@future-plus.com.au |
| - *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI) | Email | sophie.blond@future-plus.com.au |
| - *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC) | Email | sophie.blond@future-plus.com.au |
| - A4 - AU Sample Receipt Notification - Environmental HT (SRN) | Email | sophie.blond@future-plus.com.au |
| - Chain of Custody (CoC) (COC) | Email | sophie.blond@future-plus.com.au |
| - EDI Format - ENMRG (ENMRG) | Email | sophie.blond@future-plus.com.au |
| - EDI Format - XTab (XTAB) | Email | sophie.blond@future-plus.com.au |

ALS Environmental

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **EB2013449** | Page | : 1 of 7 |
| Client | : **FUTURE-PLUS ENVIRONMENTAL** | Laboratory | : Environmental Division Brisbane |
| Contact | : NICHOLAS EVANS | Contact | : John Pickering |
| Address | : 4/40 TECHNOLOGY DRIVE<br>WARANA QUEENSLAND 4575 | Address | : 2 Byth Street Stafford QLD Australia 4053 |
| Telephone | : +61 07 54502688 | Telephone | : +61 7 3552 8634 |
| Project | : Redlands Landfill | Date Samples Received | : 21-May-2020 10:30 |
| Order number | : - | Date Analysis Commenced | : 21-May-2020 |
| C-O-C number | : 10929 | Issue Date | : 28-May-2020 12:22 |
| Sampler | : KAINE PRITCHARD, NICHOLAS EVANS, SOPHIE BLOND | | |
| Site | : May2020 Coochiemudlo Is Closed LF | | |
| Quote number | : BN/235/18 B V12 | | |
| No. of samples received | : 13 | | |
| No. of samples analysed | : 13 | | |

ilac-MRA NATA

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

## *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Dave Gitsham | Metals Instrument Chemist | Brisbane Inorganics, Stafford, QLD |
| Kim McCabe | Senior Inorganic Chemist | Brisbane Inorganics, Stafford, QLD |
| Kim McCabe | Senior Inorganic Chemist | Brisbane Organics, Stafford, QLD |
| Morgan Lennox | | Brisbane Organics, Stafford, QLD |
| Santusha Pandra | Senior Chemist | Brisbane Inorganics, Stafford, QLD |

## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED041G (Sulfate as SO4 2-) / EK057G (Nitrite as N): Sample EB2013449_008 (CISW3) was diluted due to matrix interference. LOR adjusted accordingly.
- EP030 (BOD): The analytical BOD run containing samples from this work order recovered all certified reference standards within the acceptable criteria except for the dilution water blank which was elevated above 0.20 mg/L.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

## Analytical Results

Sub-Matrix: **GROUNDWATER** (Matrix: **WATER**)

| Compound | CAS Number | LOR | Unit | Client sample ID | GW1 | GW2 | GW3 | GW5 | GW6 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-May-2020 09:23 | 20-May-2020 09:36 | 20-May-2020 10:02 | 20-May-2020 17:55 | 20-May-2020 10:34 |
| | | | | | EB2013449-001 | EB2013449-002 | EB2013449-003 | EB2013449-004 | EB2013449-005 |
| | | | | | Result | Result | Result | Result | Result |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | **124** | **15** | **4** | **21** | **15** |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | **36** | **332** | **12** | **74** | **770** |
| **ED093F: Dissolved Major Cations** | | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | | **71** | **38** | **1** | <1 | **3** |
| Magnesium | 7439-95-4 | 1 | mg/L | | **21** | **32** | **1** | **4** | **56** |
| Sodium | 7440-23-5 | 1 | mg/L | | **26** | **136** | **9** | **52** | **336** |
| Potassium | 7440-09-7 | 1 | mg/L | | **13** | **8** | <1 | <1 | **2** |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | <0.01 | **0.06** | **0.21** | **0.02** | **6.05** |
| Arsenic | 7440-38-2 | 0.001 | mg/L | | <0.001 | **0.002** | <0.001 | <0.001 | <0.001 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | | <0.001 | <0.001 | **0.012** | <0.001 | <0.001 |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | **0.002** |
| Lead | 7439-92-1 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | | <0.005 | <0.005 | **0.012** | <0.005 | **0.014** |
| Manganese | 7439-96-5 | 0.001 | mg/L | | **0.014** | **0.002** | **0.003** | **0.001** | **0.138** |
| Iron | 7439-89-6 | 0.05 | mg/L | | <0.05 | **9.99** | **0.11** | <0.05 | **1.49** |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | <0.01 | **0.10** | **0.02** | <0.01 | <0.01 |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | **0.36** | **0.02** | **0.02** | **1.56** | <0.01 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | **0.36** | **0.02** | **0.02** | **1.56** | <0.01 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | | **0.01** | **0.17** | **1.35** | <0.01 | **0.16** |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | | **5** | **7** | **8** | **2** | **2** |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | CISW1 | CISW2 | CISW3 | CISW4 | CISW5 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-May-2020 11:28 | 20-May-2020 12:10 | 20-May-2020 12:10 | 20-May-2020 11:01 | 20-May-2020 11:29 |
| Compound | CAS Number | LOR | Unit | | EB2013449-006 | EB2013449-007 | EB2013449-008 | EB2013449-009 | EB2013449-010 |
| | | | | | Result | Result | Result | Result | Result |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | | 6 | 74 | 129 | 42 | 7 |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | 110 | 3 | <5 | 8 | 24 |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | 151 | 81 | 75 | 53 | 29 |
| **ED093F: Dissolved Major Cations** | | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | | 39 | 6 | 6 | 8 | 5 |
| Magnesium | 7439-95-4 | 1 | mg/L | | 31 | 5 | 5 | 8 | 2 |
| Sodium | 7440-23-5 | 1 | mg/L | | 67 | 40 | 38 | 33 | 22 |
| Potassium | 7440-09-7 | 1 | mg/L | | 18 | 10 | 8 | 2 | 3 |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | 0.03 | 0.19 | 0.34 | 0.20 | 0.87 |
| Arsenic | 7440-38-2 | 0.001 | mg/L | | <0.001 | 0.001 | 0.001 | 0.004 | 0.002 |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| Chromium | 7440-47-3 | 0.001 | mg/L | | <0.001 | 0.002 | 0.002 | 0.003 | 0.001 |
| Copper | 7440-50-8 | 0.001 | mg/L | | 0.002 | 0.001 | <0.001 | <0.001 | 0.002 |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | 0.002 | <0.001 |
| Lead | 7439-92-1 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Zinc | 7440-66-6 | 0.005 | mg/L | | <0.005 | 0.007 | <0.005 | 0.025 | 0.022 |
| Manganese | 7439-96-5 | 0.001 | mg/L | | 0.013 | 0.014 | 0.029 | 0.046 | 0.031 |
| Iron | 7439-89-6 | 0.05 | mg/L | | 0.88 | 2.98 | 7.36 | 14.5 | 0.53 |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | 0.04 | 0.01 | 0.08 | <0.01 | <0.01 |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | <0.01 | <0.01 | <0.05 | <0.01 | 0.02 |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | <0.01 | 0.02 |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | 0.6 | 2.4 | 4.0 | 1.4 | 0.6 |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | CISW1 | CISW2 | CISW3 | CISW4 | CISW5 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-May-2020 11:28 | 20-May-2020 12:10 | 20-May-2020 12:10 | 20-May-2020 11:01 | 20-May-2020 11:29 |
| Compound | CAS Number | LOR | Unit | | EB2013449-006 | EB2013449-007 | EB2013449-008 | EB2013449-009 | EB2013449-010 |
| | | | | | Result | Result | Result | Result | Result |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ Total Nitrogen as N | ---- | 0.1 | mg/L | | 0.6 | 2.4 | 4.0 | 1.4 | 0.6 |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| Total Phosphorus as P | ---- | 0.01 | mg/L | | 0.01 | 0.17 | 0.26 | 0.10 | 0.04 |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | | |
| Total Organic Carbon | ---- | 1 | mg/L | | 17 | 43 | 59 | 28 | 11 |
| **EP026SP: Chemical Oxygen Demand (Spectrophotometric)** | | | | | | | | | |
| Chemical Oxygen Demand | ---- | 10 | mg/L | | 44 | 307 | 452 | 76 | 30 |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| Biochemical Oxygen Demand | ---- | 2 | mg/L | | 3 | 3 | <2 | <2 | 7 |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | Rinstate | Blank | SWQA | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-May-2020 18:04 | 20-May-2020 17:58 | 20-May-2020 11:02 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EB2013449-011 | EB2013449-012 | EB2013449-013 | -------- | -------- |
| | | | | | Result | Result | Result | ---- | ---- |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | | |
| Suspended Solids (SS) | ---- | 5 | mg/L | | <5 | <5 | **36** | ---- | ---- |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | | |
| Sulfate as SO4 - Turbidimetric | 14808-79-8 | 1 | mg/L | | <1 | <1 | **8** | ---- | ---- |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | | |
| Chloride | 16887-00-6 | 1 | mg/L | | <1 | <1 | **52** | ---- | ---- |
| **ED093F: Dissolved Major Cations** | | | | | | | | | |
| Calcium | 7440-70-2 | 1 | mg/L | | <1 | <1 | **8** | ---- | ---- |
| Magnesium | 7439-95-4 | 1 | mg/L | | <1 | <1 | **8** | ---- | ---- |
| Sodium | 7440-23-5 | 1 | mg/L | | <1 | <1 | **33** | ---- | ---- |
| Potassium | 7440-09-7 | 1 | mg/L | | <1 | <1 | **2** | ---- | ---- |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | | | |
| Aluminium | 7429-90-5 | 0.01 | mg/L | | <0.01 | <0.01 | **0.18** | ---- | ---- |
| Arsenic | 7440-38-2 | 0.001 | mg/L | | <0.001 | <0.001 | **0.004** | ---- | ---- |
| Cadmium | 7440-43-9 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | ---- | ---- |
| Chromium | 7440-47-3 | 0.001 | mg/L | | <0.001 | <0.001 | **0.003** | ---- | ---- |
| Copper | 7440-50-8 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Nickel | 7440-02-0 | 0.001 | mg/L | | <0.001 | <0.001 | **0.001** | ---- | ---- |
| Lead | 7439-92-1 | 0.001 | mg/L | | <0.001 | <0.001 | <0.001 | ---- | ---- |
| Zinc | 7440-66-6 | 0.005 | mg/L | | <0.005 | <0.005 | **0.025** | ---- | ---- |
| Manganese | 7439-96-5 | 0.001 | mg/L | | <0.001 | <0.001 | **0.045** | ---- | ---- |
| Iron | 7439-89-6 | 0.05 | mg/L | | <0.05 | <0.05 | **14.2** | ---- | ---- |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.0001 | mg/L | | <0.0001 | <0.0001 | <0.0001 | ---- | ---- |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | | | |
| Ammonia as N | 7664-41-7 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | | | |
| Nitrite as N | 14797-65-0 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK058G: Nitrate as N by Discrete Analyser** | | | | | | | | | |
| Nitrate as N | 14797-55-8 | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | | | |
| Nitrite + Nitrate as N | ---- | 0.01 | mg/L | | <0.01 | <0.01 | <0.01 | ---- | ---- |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | ---- | 0.1 | mg/L | | <0.1 | <0.1 | **1.6** | ---- | ---- |

## Analytical Results

| Sub-Matrix: SURFACE WATER (Matrix: WATER) | | | | Client sample ID | Rinstate | Blank | SWQA | ---- | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 20-May-2020 18:04 | 20-May-2020 17:58 | 20-May-2020 11:02 | ---- | ---- |
| Compound | CAS Number | LOR | Unit | | EB2013449-011 | EB2013449-012 | EB2013449-013 | -------- | -------- |
| | | | | | Result | Result | Result | ---- | ---- |
| **EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser** | | | | | | | | | |
| ^ **Total Nitrogen as N** | ---- | 0.1 | mg/L | | <0.1 | <0.1 | **1.6** | ---- | ---- |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | | | |
| **Total Phosphorus as P** | ---- | 0.01 | mg/L | | <0.01 | <0.01 | **0.11** | ---- | ---- |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | | |
| **Total Organic Carbon** | ---- | 1 | mg/L | | <1 | **6** | **28** | ---- | ---- |
| **EP026SP: Chemical Oxygen Demand (Spectrophotometric)** | | | | | | | | | |
| **Chemical Oxygen Demand** | ---- | 10 | mg/L | | <10 | **15** | **108** | ---- | ---- |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | | |
| **Biochemical Oxygen Demand** | ---- | 2 | mg/L | | **18** | **10** | **6** | ---- | ---- |

ALS Environmental

# QA/QC Compliance Assessment to assist with Quality Review

| | | | |
|---|---|---|---|
| **Work Order** | : **EB2013449** | Page | : 1 of 9 |
| Client | : **FUTURE-PLUS ENVIRONMENTAL** | Laboratory | : Environmental Division Brisbane |
| Contact | : NICHOLAS EVANS | Telephone | : +61 7 3552 8634 |
| Project | : Redlands Landfill | Date Samples Received | : 21-May-2020 |
| Site | : May2020 Coochiemudlo Is Closed LF | Issue Date | : 28-May-2020 |
| Sampler | : KAINE PRITCHARD, NICHOLAS EVANS, SOPHIE BLOND | No. of samples received | : 13 |
| Order number | : - | No. of samples analysed | : 13 |

**This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.**

Brief method summaries and references are also provided to assist in traceability.

## Summary of Outliers

### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

### Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

### Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

## Outliers : Quality Control Samples

*Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes*

Matrix: **WATER**

| Compound Group Name | Laboratory Sample ID | Client Sample ID | Analyte | CAS Number | Data | Limits | Comment |
|---|---|---|---|---|---|---|---|
| **Matrix Spike (MS) Recoveries** | | | | | | | |
| EK067G: Total Phosphorus as P by Discrete Analyser | EB2012877--002 | Anonymous | **Total Phosphorus as P** | ---- | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |

## Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|---|
| | | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EA025: Total Suspended Solids dried at 104 ± 2°C** | | | | | | | | |
| **Clear Plastic Bottle - Natural (EA025H)** | | | | | | | | |
| CISW1, CISW3, CISW5, Blank, | CISW2, CISW4, Rinstate, SWQA | **20-May-2020** | **----** | ---- | ---- | **21-May-2020** | 27-May-2020 | ✓ |
| **ED041G: Sulfate (Turbidimetric) as SO4 2- by DA** | | | | | | | | |
| **Clear Plastic Bottle - Natural (ED041G)** | | | | | | | | |
| GW1, GW3, GW6, CISW2, CISW4, Rinstate, SWQA | GW2, GW5, CISW1, CISW3, CISW5, Blank, | **20-May-2020** | **----** | ---- | ---- | **22-May-2020** | 17-Jun-2020 | ✓ |
| **ED045G: Chloride by Discrete Analyser** | | | | | | | | |
| **Clear Plastic Bottle - Natural (ED045G)** | | | | | | | | |
| GW1, GW3, GW6, CISW2, CISW4, Rinstate, SWQA | GW2, GW5, CISW1, CISW3, CISW5, Blank, | **20-May-2020** | **----** | ---- | ---- | **22-May-2020** | 17-Jun-2020 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **ED093F: Dissolved Major Cations** | | | | | | | |
| **Clear Plastic Bottle - Nitric Acid; Filtered (ED093F)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **----** | ---- | ---- | **25-May-2020** | 17-Jun-2020 | ✓ |
| **EG020F: Dissolved Metals by ICP-MS** | | | | | | | |
| **Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **----** | ---- | ---- | **25-May-2020** | 16-Nov-2020 | ✓ |
| **EG035F: Dissolved Mercury by FIMS** | | | | | | | |
| **Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **----** | ---- | ---- | **25-May-2020** | 17-Jun-2020 | ✓ |
| **EK055G: Ammonia as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK055G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **----** | ---- | ---- | **26-May-2020** | 17-Jun-2020 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EK057G: Nitrite as N by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Natural (EK057G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **----** | ---- | ---- | **22-May-2020** | 22-May-2020 | ✓ |
| **EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK059G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **----** | ---- | ---- | **26-May-2020** | 17-Jun-2020 | ✓ |
| **EK061G: Total Kjeldahl Nitrogen By Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK061G)** | | | | | | | |
| CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **25-May-2020** | 17-Jun-2020 | ✓ | **25-May-2020** | 17-Jun-2020 | ✓ |
| **EK067G: Total Phosphorus as P by Discrete Analyser** | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EK067G)** | | | | | | | |
| CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA | **20-May-2020** | **25-May-2020** | 17-Jun-2020 | ✓ | **25-May-2020** | 17-Jun-2020 | ✓ |
| **Clear Plastic Bottle - Sulfuric Acid (EK067G)** | | | | | | | |
| GW1, GW2, GW3, GW5, GW6 | **20-May-2020** | **27-May-2020** | 17-Jun-2020 | ✓ | **27-May-2020** | 17-Jun-2020 | ✓ |

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

| Method / Container / Client Sample ID(s) | | Sample Date | Extraction / Preparation | | | Analysis | | |
|---|---|---|---|---|---|---|---|---|
| | | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EP005: Total Organic Carbon (TOC)** | | | | | | | | |
| **Amber TOC Vial - Sulfuric Acid (EP005)** | | | | | | | | |
| GW1, | GW2, | **20-May-2020** | **----** | ---- | ---- | **25-May-2020** | 17-Jun-2020 | ✓ |
| GW3, | GW5, | | | | | | | |
| GW6, | CISW1, | | | | | | | |
| CISW2, | CISW3, | | | | | | | |
| CISW4, | CISW5, | | | | | | | |
| Rinstate, | Blank, | | | | | | | |
| SWQA | | | | | | | | |
| **EP026SP: Chemical Oxygen Demand (Spectrophotometric)** | | | | | | | | |
| **Clear Plastic Bottle - Sulfuric Acid (EP026SP)** | | | | | | | | |
| CISW1, | CISW2, | **20-May-2020** | **----** | ---- | ---- | **26-May-2020** | 17-Jun-2020 | ✓ |
| CISW3, | CISW4, | | | | | | | |
| CISW5, | Rinstate, | | | | | | | |
| Blank, | SWQA | | | | | | | |
| **EP030: Biochemical Oxygen Demand (BOD)** | | | | | | | | |
| **BOD Bottle Unpreserved (EP030)** | | | | | | | | |
| CISW1, | CISW2, | **20-May-2020** | **----** | ---- | ---- | **22-May-2020** | 22-May-2020 | ✓ |
| CISW3, | CISW4, | | | | | | | |
| CISW5, | Rinstate, | | | | | | | |
| Blank, | SWQA | | | | | | | |

# Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Laboratory Duplicates (DUP)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 2 | 13 | **15.38** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Biochemical Oxygen Demand (BOD) | EP030 | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 2 | 19 | **10.53** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS | EG035F | 2 | 15 | **13.33** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 4 | 36 | **11.11** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved | ED093F | 4 | 34 | **11.76** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Suspended Solids (High Level) | EA025H | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 2 | 19 | **10.53** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser | EK067G | 4 | 36 | **11.11** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| **Laboratory Control Samples (LCS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 13 | **7.69** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 2 | 19 | **10.53** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS | EG035F | 1 | 15 | **6.67** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 36 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Major Cations - Dissolved | ED093F | 2 | 34 | **5.88** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 2 | 20 | **10.00** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Suspended Solids (High Level) | EA025H | 3 | 20 | **15.00** | **15.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 2 | 19 | **10.53** | **10.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 36 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| **Method Blanks (MB)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 13 | **7.69** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Biochemical Oxygen Demand (BOD) | EP030 | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 1 | 19 | **5.26** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS | EG035F | 1 | 15 | **6.67** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 36 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

| Quality Control Sample Type | | Count | | Rate (%) | | | Quality Control Specification |
|---|---|---|---|---|---|---|---|
| *Analytical Methods* | *Method* | *QC* | *Regular* | ***Actual*** | ***Expected*** | *Evaluation* | |
| **Method Blanks (MB) - Continued** | | | | | | | |
| Major Cations - Dissolved | ED093F | 2 | 34 | **5.88** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Suspended Solids (High Level) | EA025H | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 1 | 19 | **5.26** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 36 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| **Matrix Spikes (MS)** | | | | | | | |
| Ammonia as N by Discrete analyser | EK055G | 1 | 13 | **7.69** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | 1 | 19 | **5.26** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Chloride by Discrete Analyser | ED045G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Mercury by FIMS | EG035F | 1 | 15 | **6.67** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | 2 | 36 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Nitrite as N by Discrete Analyser | EK057G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | 1 | 20 | **5.00** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Organic Carbon | EP005 | 1 | 19 | **5.26** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |
| Total Phosphorus as P By Discrete Analyser | EK067G | 2 | 36 | **5.56** | **5.00** | ✓ | NEPM 2013 B3 & ALS QC Standard |

## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Suspended Solids (High Level) | EA025H | WATER | In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3) |
| Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser | ED041G | WATER | In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3) |
| Chloride by Discrete Analyser | ED045G | WATER | In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003 |
| Major Cations - Dissolved | ED093F | WATER | In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3)<br><br>Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3)<br><br>Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3) |
| Dissolved Metals by ICP-MS - Suite A | EG020A-F | WATER | In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. |
| Dissolved Mercury by FIMS | EG035F | WATER | In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3) |
| Ammonia as N by Discrete analyser | EK055G | WATER | In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Nitrite as N by Discrete Analyser | EK057G | WATER | In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Nitrate as N by Discrete Analyser | EK058G | WATER | In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3) |

| Analytical Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Nitrite and Nitrate as N (NOx) by Discrete Analyser | EK059G | WATER | In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Kjeldahl Nitrogen as N By Discrete Analyser | EK061G | WATER | In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Nitrogen as N (TKN + Nox) By Discrete Analyser | EK062G | WATER | In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Phosphorus as P By Discrete Analyser | EK067G | WATER | In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3) |
| Total Organic Carbon | EP005 | WATER | In house: Referenced to APHA 5310 B. The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM (2013) Schedule B(3) |
| Chemical Oxygen Demand (COD) (Spectrophotometric) | EP026SP | WATER | In house: Referenced to APHA 5220 D. Samples are digested with a known excess of an acidic potassium dichromate solution using silver sulfate as a catalyst. The chromium is reduced from the Cr (VI) oxidation state to the Cr (III) state by the oxygen present in the organic material. Both of these chromium species are coloued and absorb in the visible region of (400nm & 600nm) the spectrum. The oxidisable organic matter can be calculated in terms of oxygen equivalents. |
| Biochemical Oxygen Demand (BOD) | EP030 | WATER | In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3) |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| TKN/TP Digestion | EK061/EK067 | WATER | In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3) |

**Appendix G.**

**Fieldnotes & Calibration Form**

Client: RCC

Job No.: 5329

$v=\prod r^2 \times L \times 1000$

Date: 20/05/20

Project: Redlands Landfills - Coochiemudlo

| Time | Site | SWL | Depth | Well Volume | Volume Purged | Temp. (°C) | Turbidity (NTU) | Conductivity (uS/cm) | TDS (ppm) | Dissolved Oxygen (ppm) | pH | Redox (mV) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GW5 | 3.84 | 12.06 | 48.33 | 1 | 13.1 | 11.4 | 402 | 200 | 3.31/41.4 | 5.62 | 105 | Clear, no |
| | | | | | 10 | 13.2 | 17.7 | 282 | 130 | 3.42/24.5 | 4.92 | 163 | suspended |
| | | | | | 20 | 14.0 | 12.7 | 324 | 153 | 2.91/35.8 | 4.77 | 179 | solids or |
| | | | | | 30 | 13.9 | 11.1 | 336 | 162 | 3.31/28.7 | 4.69 | 206 | odour |
| | | | | | 40 | 15.1 | 9.9 | 361 | 167 | 2.58/29.4 | 4.63 | 224 | |
| | | | | | 48 | 15.4 | 12.1 | 334 | 157 | 3.51/29.4 | 4.73 | 230 | |
| | | | | | (sample) | | | | | | | | |
| | GW1 | 1.57 | 3 | 8.4 | ~~3.4~~ 1 | 13.4 | 2.6 | 747 | 360 | 2.98/45.3 | 6.06 | 165 | Clear, small |
| | | | | | ~~10~~ 8 | 15.0 | 7.7 | 752 | 371 | 3.75/32.6 | 6.33 | 132 | particles, no |
| | | | | | (sample) | | | | | | | | odour |
| | GW2 | 2.39 | 3.34 | 5.58 | 1 | 14.4 | 107 | 1413 | 712 | 2.70/46.3 | 6.05 | -22 | Odour (Strong) |
| | | | | | 5.5 | 15.4 | 1888 | 1403 | 712 | 3.19/26.2 | 6.07 | -51 | (sulpher, |
| | | | | | (sample) | | | | | | | | hydrocarbon |
| | GW3 | 4.27 | 11.42 | 42.02 | 1 | 14.3 | 1345 | 93.5 | 41.1 | 6.85/75.4 | 6.69 | 8 | Orange/brown |
| | | | | | 10 | 15.5 | 285 | 62.2 | 27.0 | 6.76/58.7 | 5.99 | 46 | turbid, no |
| | | | | | 20 | 17.1 | 694 | 61.7 | 27.3 | 5.56/65.2 | 5.85 | 59 | odour, turbid |
| | | | | | 30 | 17.4 | 1236 | 51.8 | 22.5 | 5.26/47.8 | 5.56 | 79 | |
| | | | | | 42 | 16.3 | OVR | 51.3 | 22.8 | 4.83/51.4 | 5.40 | 120 | |
| | | | | | (sample) | | | | | | | | |
| | GW6 | 8.34 | 16.53 | 48.15 | 1 | 15.0 | 33.8 | 2628 | 1375 | 2.07/17.4 | 3.85 | 139 | Organic/Sulphur |
| | | | | | 10 | 15.3 | 29.0 | 2773 | 1450 | 1.04/14.2 | 3.71 | 132 | odour |
| | | | | | 20 | 15.6 | 34.3 | 2.8ms | 1.47ppk | 2.19/12.6 | 3.72 | 108 | Cloudy/small |
| | | | | | 30 | 15.5 | 35.6 | 2759 | 1443 | 0.90/15.6 | 3.69 | 181 | particles |
| | | | | | 40 | 14.6 | 295 | 2724 | 1425 | 3.54/31.1 | 3.72 | 158 | Dry @ 40 |
| | | | | | (sample | | | | | | | | |
| | CISW4 | - | - | - | - | 14.2 | 48.7 | 340 | 162 | 2.66/38.3 | 6.70 | 76 | QA/R/B |
| | | | | | | | | Low water level. Oily film. Light brown colour | | | | | |
| | | | | | | | | No odour | | | | | |

Client: RCC

Date: 20/05/20

Job No.: 5329

Project: Redlands Landfills - Coochiemudlo

$v=\pi r^2 \times L \times 1000$

| Time | Site | SWL | Depth | Well Volume | Volume Purged | Temp. (°C) | Turbidity (NTU) | Conductivity (uS/cm) | TDS (ppm) | Dissolved Oxygen (ppm) | pH | Redox (mV) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CISW5 | - | - | - | - | 13.6 | 18.6 | 180.5 | 83.3 | 4.46/34.9 | 5.85 | -4 | No odour |
| | | | | | | Light brown | | Tannin colour. | | | Small particles. | | |
| | CISW1 | - | - | - | - | 13.4 | 34.2 | 916 | 455 | 3.55/34.9 | 6.66 | -32 | |
| | | | | | | Light brown colour, small-medium particles | | | | | | | |
| | CIS2 | - | - | - | - | 13.5 | 20.4 | 331 | 154 | 3.00/49.4 | 6.25 | -26 | |
| | | | | | | Dark tannins/large particles, no odour | | | | | | | |
| | CIS3 | - | - | - | - | 14.0 | 28.1 | 304 | 147 | 3.20/37.3 | 5.59 | -73 | |
| | | | | | | Dark tannins/large particles/no odour | | | | | | | |

**Calibration Record**

**Instrument:** TPS 90 FLT

| | Calibration Record | | |
|---|---|---|---|
| | **Date Calibrated:** | 8/05/2020 | |
| **Analyte** | **Standard** | **Completed (Y/N)** | **Shift** |
| Temp | - | Y | 11.1°C |
| pH | pH 4 | Y | 96.60% |
| | pH 6.88 | Y | 97.00% |
| TDS | 0ppk | Y | 2.77ppm |
| | 36ppk | Y | 13.1k |
| EC | 0uS | Y | 0uS |
| | 2760uS | Y | 12.4k |
| DO | 100% (Air) | Y | 89.50% |
| | 0% | Y | 5.80% |
| Turbidity | 0 NTU | Y | -42.7 |
| | 90 NTU | Y | 103.40% |

Calibrated by: JB