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Coochiemudlo Island Closed Landfill

Groundwater & Surface Water Quarterly LEMP Report

August 2020

Version 0.1

Client: Redland City Council

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Signed on behalf of
Future-Plus Environmental

Date: 26 August 2020

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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

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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 Environmental Monitoring Program* (EMP) (FPE, 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 in August 2020 for Quarter 3, 2020.

In summary, the Quarter 3 monitoring event identified the following:

Groundwater:

- Statistically significant results (where available) were reported at one downgradient groundwater monitoring location:
  - GW3 for Chloride
- New maximums were reported for the following downgradient locations and parameters:
  - GW2 for Calcium (56mg/L), pH (6.69 pH) and Sulphate (45mg/L); and
  - GW3 for Chloride (175mg/L).
- Ammonia as N has decreased at downgradient wells GW2 since the previous monitoring event and does not exceed any WQOs at any downgradient or upgradient groundwater wells;
- Iron (filtered) exceeded the WQO at downgradient wells GW2 and GW3 and upgradient well GW6, however was within historic ranges;
- Latest groundwater results do not indicate leachate impact on groundwater and are considered to pose a low risk to groundwater and sensitive receptors downgradient of the former landfill;
- 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 site (CISW5). Ammonia levels slightly exceeded the WQO at CISW5;
- Low Ammonia levels were also recorded at upstream locations, indicating that traces of Ammonia at both upstream and downstream locations could be related to external factors rather than landfill impacts;

- Iron was detected across all locations with concentrations similar between upstream and downstream locations.
- 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.

The current quarterly monitoring program should continue in order to detect any future impact of leachate on groundwater and surface waters downgradient and downstream of the former landfill.

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 Environmental Monitoring Plan (EMP) (FPE, December 2019).

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 3 2020 report summarises the groundwater and surface water environmental monitoring findings for sampling conducted by FPE in August 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 EMP, including quarterly monitoring of groundwater and surface water.

Works undertaken during the Quarter 3 (August 2020) monitoring events, as per the EMP requirements, were comprised of quarterly groundwater and surface water monitoring undertaken on 5 August 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 Downgradient: GW1, GW2, GW3	pH (pH units) Electrical Conductivity (µS/cm) Standing water level (SWL)	Sulphate - (Turbidimetric) as SO_4 Major Cations (Na, Mg, K, Ca) Ammonia as N Nitrate Total Phosphorus as P Dissolved metals (Mn, As, Al, Cr, Cu, Cd, Pb, Zn, Fe, Hg, Ni) Dissolved Mercury Total Organic Carbon (TOC)
Surface Water (Quarterly)	Upstream (Background): CISW2, CISW3, CISW4 Downstream: CISW1, CISW5	pH (pH units) Electrical Conductivity (µS/cm) Dissolved Oxygen (ppm and % saturation)	Total Suspended Soils (TSS) Sulphate - (Turbidimetric) as SO_4 Major Cations (Na, Mg, K, Ca) Ammonia as N Nitrate Total Nitrogen Total Phosphorus as P Dissolved metals (Mn, As, Al, Cr, Cu, Cd, Pb, Zn, Fe, Hg, Ni) Total Organic Carbon (TOC) Chemical Oxygen Demand (COD) 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), 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, 2019) 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, 2018), 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:
  - Physio-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°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 4Error! Reference source not found..

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 Hg: 0.0001 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

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 5 August 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 9.1 to 22.6 ºC during sampling.

Annual rainfall statistics were also utilised from the Capalaba Water Treat Bureau Station No.040458 (Bureau of Meteorology [BOM] 2020), 15.1km from the site. There was no rainfall recorded in the week preceding the sampling event or during the sampling event.

Annual rainfall statistics from the Capalaba Water Treat Station No. 040458 are displayed in Figure 1 below.

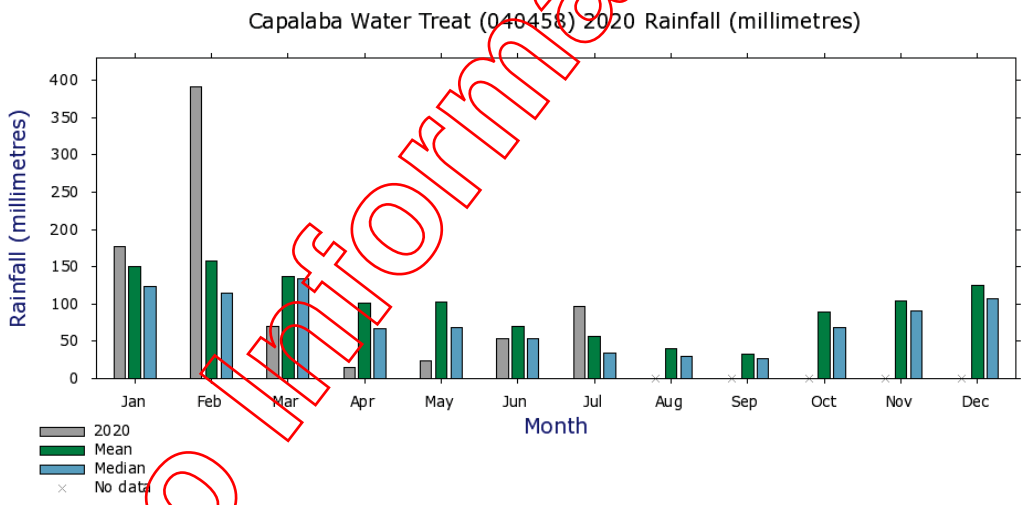

Figure 1. Annual Rainfall Statistics (BOM, 2020).

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 any parameters were identified from within the Rinsate or Field Blank sample.

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 3 monitoring event. All tabulated groundwater and surface water results from the Quarter 3 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.

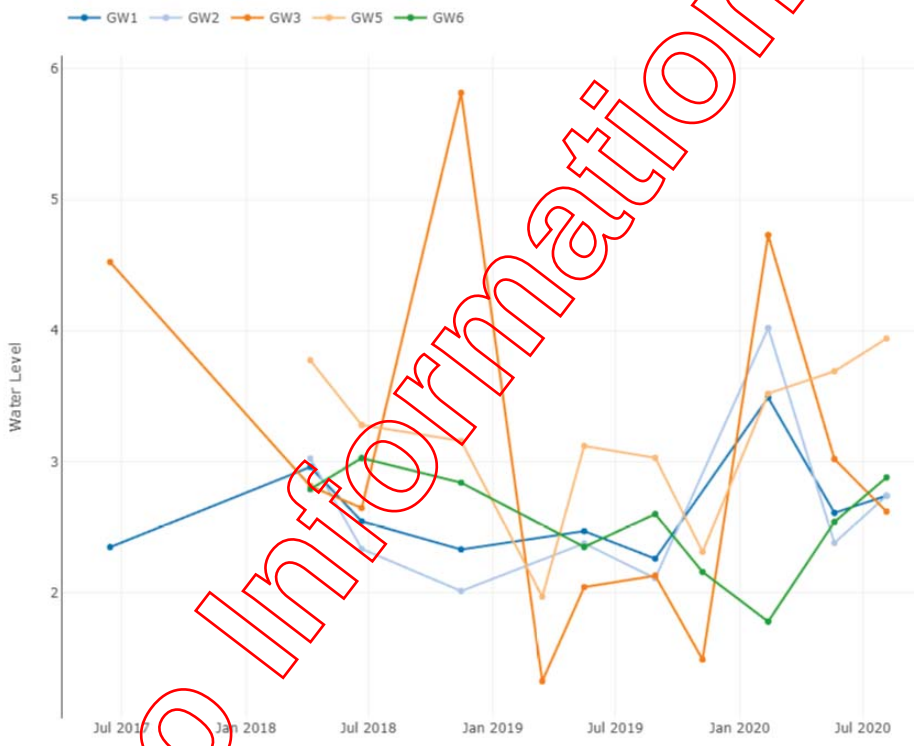

Figure 2. Groundwater levels (mAHD) of monitoring wells at Coochiemudlo Island Closed Landfill from 2017 to 2020

Groundwater levels have increased at all downgradient locations except for GW3 during the current monitoring event when compared to the previous monitoring event. Groundwater levels increased at upgradient locations GW5 and GW6 during the August 2020 sampling event. Groundwater levels varied from 2.62mAHD (GW3) to 3.949mAHD (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 August 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 odour with suspended solids present.
GW6	Located 60 m south of the waste transfer station.	Organic/Sulphur odour, cloudy with small particles and sand present.
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, suspended solids present
GW3	Located 50 m south-west of the former landfill, adjacent to the tennis court.	Orange/brown in color, highly turbid and no odour.

6.1.4 Groundwater Statistical Analysis

Monitoring Well	Parameter	Units	Sampling Date					X+ 1s	X+2s	X+3s
			20/08/19	13/11/19	17/02/20	19/05/20	5/08/20			
GW3	Chloride	mg/L	N/A	N/A	N/A	12	175	31.95	41.78	51.61

Monitoring Well	Parameter	Units	Sampling Date					X+ 1s	X+2s	X+3s
			20/08/19	13/11/19	17/02/20	19/05/20	5/08/20			
GW5	TOC	mg/L	<1	1	<1	2	2	1	1	1
GW6	Iron	mg/L	0.745	0.241	0.11	1.49	2.23	0.45126	0.65353	0.85579

A review of the statistically significant results and WQO exceedances reported during the August 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. It is noted that whilst Ammonia was not detected at either upgradient well, Iron was detected at GW6 and exceeds the adopted WQO.

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	4.59	3.8
		Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	6.5-8		
EC	µS/cm	GHD 2018 Coochiemudlo Island wetland	90	279	2074
		Moreton 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	1.48	N/A
Aluminium	mg/L	ANZECC FW Slight-mod disturbed system	0.055	N/A	5.71
Iron (Filtered)	mg/L	Schedule 1 EPP (water) - Drinking Water	0.05	N/A	2.23

Parameter	Units	EVs	WQOs	Current Result	
				GW5	GW6
Manganese	mg/L	Schedule 1 EPP (water) - Drinking Water	0.05	N/A	0.135
Phosphorus	mg/L	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	0.05	N/A	0.08
Zinc	mg/L	ANZECC FW Slight-mod disturbed system	0.008	N/A	0.015

*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+2s and 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	6.69	4.93
		Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	6.5 – 8			
EC	µS/cm	GHD 2018 Coochiemudlo Island wetland	90	501	749	N/A
		Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	626			
		Schedule 1 EPP (water) - Drinking Water	1000			
Nitrate (as N)	mg/L	ANZECC FW Slight-mod disturbed system	0.158	1.48	N/A	N/A

Parameter	Units	EVs	WQOs	Current Result		
				GW1	GW2	GW3
Aluminium	mg/L	ANZECC FW Slight-mod disturbed system	0.055	N/A	N/A	0.12
Iron (Filtered)	mg/L	Schedule 1 EPP (water) - Drinking Water	0.05	N/A	1.20	0.08
Phosphorus	mg/L	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	0.05	N/A	0.08	0.46

*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:

- Calcium levels (60mg/L) remain above all downgradient and upgradient wells;
- Nitrate levels (1.48mg/L) were at the same level as upgradient well GW5, and whilst the current results exceed the adopted WQO, it is within the historical range of data;
- pH (6.33 pH) remains above both upgradient well results and a potential increasing trend is noted;
- Potassium (13mg/L) remains above both upgradient wells and a potential recent increasing trend is noted, however results are within historical data;
- Sulphate (115mg/L) remains several orders of magnitude above both upgradient wells however a potential decreasing trend is noted. Results remain within historical levels; and
- TOC (5mg/L) remains above both upgradient wells but is within historical 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:

- Arsenic (0mg/L) has decreased considerably and like at the upgradient wells, was not detected during the current monitoring event.

- Calcium levels (56mg/L) remain above the upgradient wells and a potentially increasing trend is noted. A new maximum concentration has also been reported during this event;
- Iron (1.2mg/L) levels are now below the concertation at upgradient well GW6, decreasing considerably since the previous monitoring event;
- pH levels (6.69 pH units) are considerably above upgradient wells and represent a new maximum during current event. pH also exceeded the adopted WQO;
- Potassium (10mg/L) remains above both upgradient wells however has not increased above historical data;
- Sulphate (45mg/L) remains above both upgradient wells and represents a new maximum concentration during the monitoring event; and
- Whilst TOC (4mg/L) remains above both upgradient wells, there is only 1-2mg/L difference from the upgradient wells.

6.1.6.3 Downgradient well – GW3

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

- Chloride (175 mg/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:

- Ammonia (0.02mg/L) remains above both upgradient wells however only a small concentration was detected.
- Whilst Copper (0.001mg/L) was detected and remains above upgradient wells, the concentrations has decreased considerably since the peak of the increasing trend in May 2020;
- pH (4.93 pH) remains above upgradient wells however a potentially decreasing trend is noted;
- Chloride levels (175mg/L) increased above historical data during the current monitoring round and reported a new historic maximum for this site. Whilst remains above upgradient well GW5, the concentration remains well below GW6;
- Phosphorus levels (0.46mg/L) remain higher than all upgradient and downgradient wells, however have decreased since the recent peak in May 2020; and
- Whilst TOC (4mg/L) remains above both upgradient wells, there is only 1-2mg/L difference from the upgradient wells.

6.1.7 Summary of potential landfill impact on groundwater

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

- GW2 for Calcium (56mg/L), pH (6.69 pH) and Sulphate (45mg/L); and
- GW3 for Chloride (175mg/L).

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

- GW1 for Nitrate, pH, Potassium and Sulphate;
- GW2 for Arsenic, Calcium, Iron, pH and Sulphate
- GW3 for Copper and Chloride .

Ammonia levels have decreased at all upgradient and downgradient wells (with the exception of GW1 (0.01mg/L) during the current monitoring round and do not exceed any WQOs. Ammonia levels have fluctuated historically, indicating that these results may be related to natural variation, rather than landfill impacts.

In addition to low Ammonia levels, Iron (filtered) decreased at all groundwater wells with the exception of GW6 (upgradient well). Iron has gradually increased at this groundwater well since February 2020 monitoring event, indicating a possible increasing trend. Given this well is upgradient of the former landfill cell, it is not expected to be impacted by landfill leachate.

pH, an important consideration for acid frog habitat downstream of the former landfill, was noted to be higher at downgradient wells (4.93 - 6.69) than upgradient wells (3.8 - 4.59). 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 particles present, no odour.
CISW3	Background, potential Wallum frog habitat	Tannin-stained colour. Large particles present, no odour.
CISW4	Background	Low water level, with an oily film. Light brown in colour, no odour.
Downstream surface water monitoring locations		
CISW1	Downstream of former landfill	Light brown in colour, small-medium particles.

Location ID	Location Description	Sample description
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	4.91	4.91	5.47
		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	64.4	52.4	37.8
EC	µS/cm	GHD 2018 Coochiemudlo Island wetland	90	418	284	362
Aluminium	mg/L	ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only	0.027	0.40	0.22	0.26
		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	N/A	0.002

Parameter	Units	EVs	WQOs	Current Result		
				CISW2	CISW3	CISW4
Nitrogen (total)	mg/L	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	0.5	1.5	1.6	0.7
Chromium	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			
Iron	mg/L	Schedule 1 EPP (water) - Drinking Water	0.05	4.33	4.73	2.09
Phosphorus	mg/L	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	0.05	0.08	0.08	N/A
Zinc	mg/L	ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only	0.0024	0.010	0.007	0.013
		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:

- COD decreased considerably at CISW2, CISW3 and CISW4 but remain with historical data;
- EC increased above historical data for CISW2 (418 µ/S), reaching a new maximum at this location and exceeding the adopted WQOs;
- Chloride increased above historical data for CISW4 (95mg/L) and reported a new historic maximum;
- pH increased above historical data for CISW5 (6.18 pH units) and represents a new maximum at this location. The adopted WQOs for pH were again exceeded at this location;

- Sodium increased above historical data and reported new historic maximums for CISW4 (57mg/l) and CISW2 (51mg/l);
- Magnesium increased above historical data and reported a new historical maximum at CISW2 (10mg/L) and CISW4 (9mg/L);
- Sulphate increased above historical maximums at CISW2 (58mg/L) and CISW4 (38mg/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	6.46	6.18
		Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	6.5 – 8		
Chromium	mg/L	ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only	0.00001	0.001	0.002
		ANZECC 2000 Fresh water Slightly-moderate disturbed system	0.001		
DO	%Sat	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	85-110	42.1	36
EC	µS/cm	GHD 2018 Coochiemudlo Island wetland	90	681	96.9
		Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	626		
Ammonia	mg/L	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	0.02	N/A	0.03
Aluminium	mg/L	ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only	0.027	0.32	0.42
		ANZECC 2000 Fresh water Slightly-moderate disturbed system	0.055		

Parameter	Units	EVs	WQOs	Current Result	
				CISW1	CISW5
Arsenic	mg/L	ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only	0.0008	N/A	0.004
Chromium	mg/L	ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only	0.00001	0.001	0.002
		ANZECC 2000 Fresh water Slightly-moderate disturbed system	0.001		
Nitrogen (total)	mg/L	Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater	0.5	N/A	0.6
Iron	mg/L	Schedule 1 EPP (water) - Drinking Water	0.05	0.56	3.13
Zinc	mg/L	ANZECC 2000 Fresh water Slightly-moderate disturbed system	0.008	0.009	0.006

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:

- Arsenic (0.004mg/L) at CISW5 was at the highest level of all upgradient and downgradient wells and exceeded the WQOs;
- Ammonia (0.03mg/L) at CISW5 increased above the upstream locations during the current monitoring event;
- Calcium (32mg/L) at CISW1 remained above upstream locations during the current monitoring event;
- Chloride (161mg/L) at CISW1 remained above upstream locations during the current monitoring event and a potentially increasing trend may be evident, however is noted to have occurred historically;
- EC (681 µS/cm) at CISW1 remains above all upstream and the downstream locations, exceeding the adopted WQO (as do all other locations);
- Magnesium (30mg/L) at CISW1 remains above all upstream and the downstream locations but below the historical maximum;
- pH (6.18 – 6.46 pH) at both downstream locations remains above the upstream locations, and represent new maximum concentrations at both locations and exceed the adopted WQOs;
- Potassium (15mg/L) at CISW1 remains above the upstream locations and continues to vary during each event;

- Sodium (68mg/L) at CISW1 remains above the upstream locations and continues to vary during each event; and
- Sulphate (101mg/L) at CISW1 remains above the upstream locations and continues to vary during each event.

6.2.4 Summary of potential landfill impact on surface water

Ammonia (a key leachate indicator) was detected at low levels during the current sampling event at one downstream location (CISW5 – which also slightly exceeded the WQO) and two upstream sites (CISW2 and CISW4), however these results were all ≤0.03mg/L. Another leachate indicator, Iron, was detected at low levels across all locations, with concentrations at the downstream locations within the range of results from the upstream locations. It is therefore considered unlikely that surface water is impacted by leachate, rather, that these results are due to natural variation in surface water from these locations. Leachate indicator parameters should continue to be monitored to identify any increasing trends.

7.0 CONCLUSIONS

7.1 GROUNDWATER

All groundwater monitoring wells were sampled in August 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 for the following parameters:

- GW3 for Chloride

Adopted WQOs were exceeded at most up and down gradient locations for pH, EC, Nitrate, Iron and Phosphorus. GW6 was the only groundwater monitoring well to report an exceedance of WQOs for Manganese.

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

- GW2 for Calcium (56mg/L), pH (6.69 pH) and Sulphate (45mg/L); and
- GW3 for Chloride (175mg/L).

Ammonia as N had decreased at all up gradient and downgradient wells (with the exception of GW1 (0.01mg/L) since the previous monitoring round and no longer exceed the WQOs. Iron levels (filtered) have decreased since the previous monitoring round with the exception of GW6 (upgradient well), however exceedances of WQOs were reported at GW2, GW3 and GW6. Historically, Iron levels have fluctuated at GW2 which could be related to natural variation within the site.

Levels of leachate indicator parameters varied during the current monitoring round. Ongoing 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. However, given the continued low levels of Ammonia and generally low levels of Iron, the former landfill is considered to pose a low risk to groundwater and identified receptors downstream.

pH, an important consideration for acid frog habitat downstream of the former landfill, was noted to be higher at downgradient wells (4.93 - 6.69) than upgradient wells (3.8 - 4.59). 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 August 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 event at one downstream surface water location, CISW5, and exceeded the WQOs. Another leachate indicator, Iron, was detected at most locations; with concentrations at the downstream locations within the range of results from the upstream locations. It is therefore considered unlikely that surface water is impacted by leachate, rather, that these results are due to natural variation in surface water from these locations. Whilst it is considered there is a low risk of landfill leachate impact to surface water, leachate indicator parameters should continue to be monitored to identify any increasing trends.

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.

The current quarterly monitoring program should continue in order to detect any future impact of leachate on groundwater and surface waters downgradient and downstream of the former landfill.

9.0 REFERENCES

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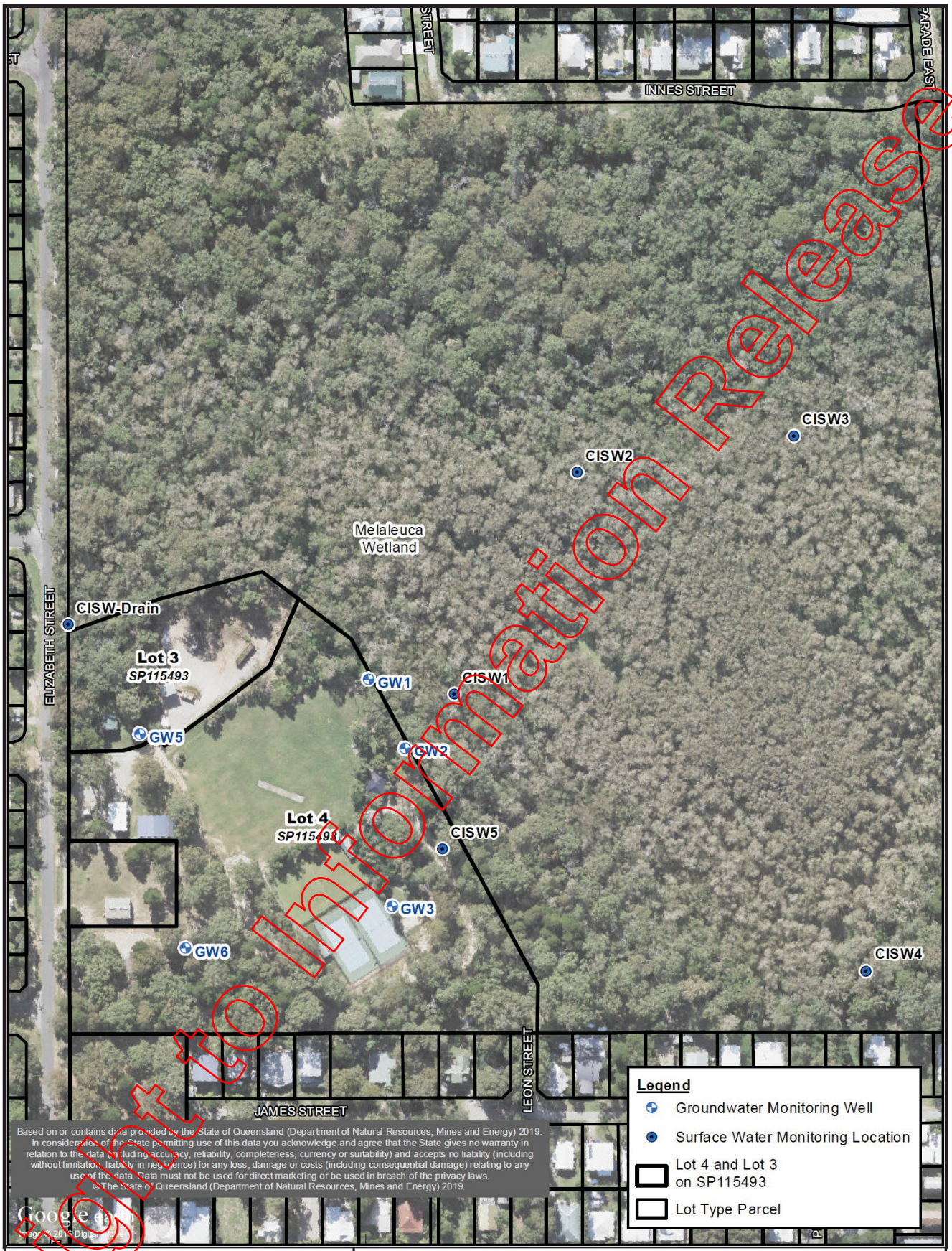
Appendix A.

Monitoring Locations Plan



GROUNDWATER & SURFACE WATER MONITORING LOCATIONS

future-plus ENVIRONMENTAL

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)	Sulfate as SO4 - Turbidimetric (filtered)	Ammonia as N	Chloride	Nitrate (as N)	Phosphorus	Sodium (filtered)	TOC	Aluminium (filtered)	Arsenic (filtered)	Cadmium (filtered)	Calcium (filtered)	Chromium (filtered)	Copper (filtered)	Iron (filtered)	Lead (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
EQL						1	0.01	1	0.01	0.01	1	1	0.01	0.001	0.0001	1	0.001	0.001	0.05	0.001
ANZECC 2000 Fresh water Slightly-moderate disturbed system							*0.9*		*0.158*				*0.055*	*0.013*	*0.0002*		*0.001*	*0.0014*		*0.0034*
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	
Site ID	**Monitoring Zone**	**Location Code**	**Date**																	
Coochiemudlo Island	**Downgradient**	**GW1**	**5/08/2020**	6.37	501	115	0.01	30	*1.48*	<0.01	23	5	0.01	<0.001	<0.0001	60	<0.001	<0.001	<0.05	<0.001
Coochiemudlo Island	**Downgradient**	**GW2**	**5/08/2020**	6.69	749	45	<0.01	132	0.05	0.08	57	4	0.04	<0.001	<0.0001	56	<0.001	<0.001	1.20	<0.001
Coochiemudlo Island	**Downgradient**	**GW3**	**5/08/2020**	4.8	89.8	12	0.02	175	0.02	0.46	16	4	*0.12*	<0.001	<0.0001	1	<0.001	0.001	0.08	<0.001
Coochiemudlo Island	**Upgradient**	**GW5**	**5/08/2020**	4.59	279	25	<0.01	69	*1.48*	<0.01	49	2	0.02	<0.001	<0.0001	<1	<0.001	<0.001	<0.05	<0.001
Coochiemudlo Island	**Upgradient**	**GW6**	**5/08/2020**	3.8	2,074	15	<0.01	763	<0.01	0.08	335	3	*5.71*	<0.001	<0.0001	2	<0.001	<0.001	2.23	<0.001
Statistics																				
Minimum Concentration				**3.8**	**89.8**	**12**	**0.01**	**30**	**<0.01**	**<0.01**	**16**	**2**	**0.01**	**<0.001**	**<0.0001**	**1**	**<0.001**	**0.001**	**<0.05**	**<0.001**
Maximum Concentration				**6.69**	**2,074**	**715**	**0.02**	**763**	**1.48**	**0.46**	**335**	**5**	**5.71**	**<0.001**	**<0.0001**	**60**	**<0.001**	**0.001**	**2.23**	**<0.001**
Average Concentration *				**5.3**	**739**	**42**	**0.009**	**234**	**0.61**	**0.13**	**96**	**3.6**	**1.2**	**0.0005**	**0.00005**	**24**	**0.0005**	**0.0006**	**0.71**	**0.0005**

* A Non Detect Multiplier of 0.5 has been applied.

				Magnesium (filtered)	Manganese (filtered)	Mercury (filtered)	Nickel (filtered)	Potassium (filtered)	Zinc (filtered)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL				1	0.001	0.0001	0.001	1	0.005
ANZECC 2000 Fresh water Slightly-moderate disturbed system					*1.9*		*0.011*		*0.008*
GHD 2018 Coochiemudlo Island wetland									
Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater									
Schedule 1 EPP (water) - Drinking Water					0.05				
Site ID	**Monitoring Zone**	**Location Code**	**Date**						
Coochiemudlo Island	**Downgradient**	**GW1**	**5/08/2020**	20	0.011	<0.0001	<0.001	13	<0.005
Coochiemudlo Island	**Downgradient**	**GW2**	**5/08/2020**	25	0.001	<0.0001	<0.001	10	0.006
Coochiemudlo Island	**Downgradient**	**GW3**	**5/08/2020**	2	0.004	<0.0001	<0.001	<1	0.007
Coochiemudlo Island	**Upgradient**	**GW5**	**5/08/2020**	4	0.001	<0.0001	<0.001	<1	<0.005
Coochiemudlo Island	**Upgradient**	**GW6**	**5/08/2020**	57	0.135	<0.0001	0.003	2	*0.015*
Statistics									
Minimum Concentration				**2**	**0.001**	**<0.0001**	**<0.001**	**<1**	**<0.005**
Maximum Concentration				**57**	**0.135**	**<0.0001**	**0.003**	**13**	**0.015**
Average Concentration *				**22**	**0.03**	**0.00005**	**0.001**	**5.2**	**0.0066**

* A Non Detect Multiplier of 0.5 has been applied.

				Field			Inorganics															
				pH (Field)	EC (field)	DO % Saturation (Field)	Sulfate as SO4 - Turbidimetric (filtered)	Ammonia as N	BOD	Chloride	COD	Nitrate (as N)	Nitrogen (Total)	Phosphorus	Sodium (filtered)	TOC	TSS	Aluminium (filtered)	Arsenic (filtered)	Cadmium (filtered)	Calcium (filtered)	Chromium (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
EQL							1	0.01	2	1	10	0.01	0.1	0.01	1	1	5	0.01	0.001	0.0001	1	0.001
ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only								*0.32*				*4.9*						*0.027*	*0.0008*	*0.00006*		*0.00001*
ANZECC 2000 Fresh water Slightly-moderate disturbed system								*0.9*				*0.158*						*0.055*	*0.013*	*0.0002*		*0.001*
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	85-110		0.02					0.5	0.05								
Schedule 1 EPP (water) - Drinking Water					1,000																	
Site ID	**Monitoring Zone**	**Location Code**	**Date**																			
Coochiemudlo Island	**Downstream**	**CISW1**	**5/08/2020**	6.46	681	42.1	101	<0.01	<2	161	34	<0.01	0.4	0.01	68	14	<5	*0.32*	<0.001	<0.0001	32	*0.001*
Coochiemudlo Island	**Upstream**	**CISW2**	**5/08/2020**	4.91	418	64.4	58	0.01	3	86	143	<0.05[#1]	1.5	0.08	51	39	21	*0.40*	*0.001*	<0.0001	10	*0.002*
Coochiemudlo Island	**Upstream**	**CISW3**	**5/08/2020**	4.91	284	52.4	25	<0.01	4	64	185	<0.05[#1]	1.6	0.08	37	44	15	*0.22*	<0.001	<0.0001	8	*0.002*
Coochiemudlo Island	**Upstream**	**CISW4**	**5/08/2020**	5.47	362	47.5	38	0.01	2	95	46	<0.01	0.7	0.02	57	19	10	*0.26*	*0.002*	<0.0001	7	*0.003*
Coochiemudlo Island	**Downstream**	**CISW5**	**5/08/2020**	6.18	96.9	36.0	<1	0.03	<2	22	45	<0.01	0.6	0.05	14	15	<5	*0.42*	*0.004*	<0.0001	4	*0.002*
Statistics																						
Minimum Concentration				**4.91**	**96.9**	**36.0**	**<1**	**0.01**	**2**	**22**	**34**	**<0.01**	**0.4**	**0.01**	**14**	**14**	**<5**	**0.22**	**0.001**	**<0.0001**	**4**	**0.001**
Maximum Concentration				**6.46**	**681**	**64**	**101**	**0.03**	**4**	**161**	**185**	**<0.05**	**1.6**	**0.08**	**68**	**44**	**21**	**0.42**	**0.004**	**<0.0001**	**32**	**0.003**
Average Concentration *				**5.6**	**368**	**47**	**44**	**0.012**	**2.2**	**86**	**91**	**0.013**	**0.96**	**0.048**	**45**	**26**	**10**	**0.32**	**0.0016**	**0.00005**	**12**	**0.002**

* A Non Detect Multiplier of 0.5 has been applied.

Comments

#1 Reported Analyte LOR is higher than Requested Analyte LOR

				Metals									
				Copper (filtered)	Iron (filtered)	Lead (filtered)	Magnesium (filtered)	Manganese (filtered)	Mercury (filtered)	Nickel (filtered)	Potassium (filtered)	Zinc (filtered)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL				0.001	0.05	0.001	1	0.001	0.0001	0.001	1	0.005
ANZECC 2000 FW 99% - applicable to CISW2 and CISW3 only				*0.001*		*0.001*		*1.2*	*0.00006*	*0.008*		*0.0024*
ANZECC 2000 Fresh water Slightly-moderate disturbed system				*0.0014*		*0.0034*		*1.9*		*0.011*		*0.008*
GHD 2018 Coochiemudlo Island wetland												
Moreton Bay - Schedule 1 EPP (water) - Wallum/Tannin Freshwater												
Schedule 1 EPP (water) - Drinking Water					0.05			0.05				
Site ID	**Monitoring Zone**	**Location Code**	**Date**									
Coochiemudlo Island	**Downstream**	**CISW1**	**5/08/2020**	<0.001	0.56	<0.001	30	0.008	<0.0001	<0.001	15	*0.009*
Coochiemudlo Island	**Upstream**	**CISW2**	**5/08/2020**	0.001	4.33	<0.001	10	0.036	<0.0001	0.001	6	*0.010*
Coochiemudlo Island	**Upstream**	**CISW3**	**5/08/2020**	0.001	4.73	<0.001	6	0.043	<0.0001	0.001	8	*0.007*
Coochiemudlo Island	**Upstream**	**CISW4**	**5/08/2020**	0.001	2.09	<0.001	9	0.019	<0.0001	<0.001	<1	*0.013*
Coochiemudlo Island	**Downstream**	**CISW5**	**5/08/2020**	<0.001	3.13	<0.001	2	0.019	<0.0001	<0.001	2	*0.006*
Statistics												
Minimum Concentration				**0.001**	**0.56**	**<0.001**	**2**	**0.008**	**<0.0001**	**0.001**	**<1**	**0.006**
Maximum Concentration				**0.001**	**4.73**	**<0.001**	**30**	**0.043**	**<0.0001**	**0.001**	**15**	**0.013**
Average Concentration *				**0.0008**	**3**	**0.0005**	**11**	**0.025**	**0.00005**	**0.0007**	**6.3**	**0.009**

* 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)	Ammonia as N	BOD	Chloride	COD	Nitrate (as N)	Nitrogen (Total)	Phosphorus	Sodium (filtered)	TOC	TSS	Aluminium (filtered)	Cadmium (filtered)	Calcium (filtered)	Copper (filtered)	Iron (filtered)	Lead (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
EQL				1	0.01	2	1	10	0.01	0.1	0.01	1	1	5	0.01	0.0001	1	0.001	0.05	0.001
Lab Report Number	Field ID	Date	Matrix Type																	
EB2020621	CISW4	5/08/2020	SW	38	0.01	2	95	46	<0.01	0.7	0.02	57	19	10	0.26	<0.0001	7	0.001	2.09	<0.001
EB2020621	SWQA	5/08/2020	SW	37	<0.01	2	96	47	<0.01	0.8	0.03	57	17	8	0.26	<0.0001	7	0.001	2.06	<0.001
RPD				3	0	0	1	2	0	13	40	0	11	22	0	0	0	0	1	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 - 20 x EQL); 20 (> 20 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

				Manganese (filtered)	Nickel (filtered)	Zinc (filtered)
				mg/L	mg/L	mg/L
EQL				0.001	0.001	0.005
Lab Report Number	**Field ID**	**Date**	**Matrix Type**			
EB2020621	**CISW4**	**5/08/2020**	**SW**	0.019	<0.001	0.013
EB2020621	**SWQA**	**5/08/2020**	**SW**	0.020	<0.001	0.013
RPD				5	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 a
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any me

Appendix C.

Groundwater Statistical Charts

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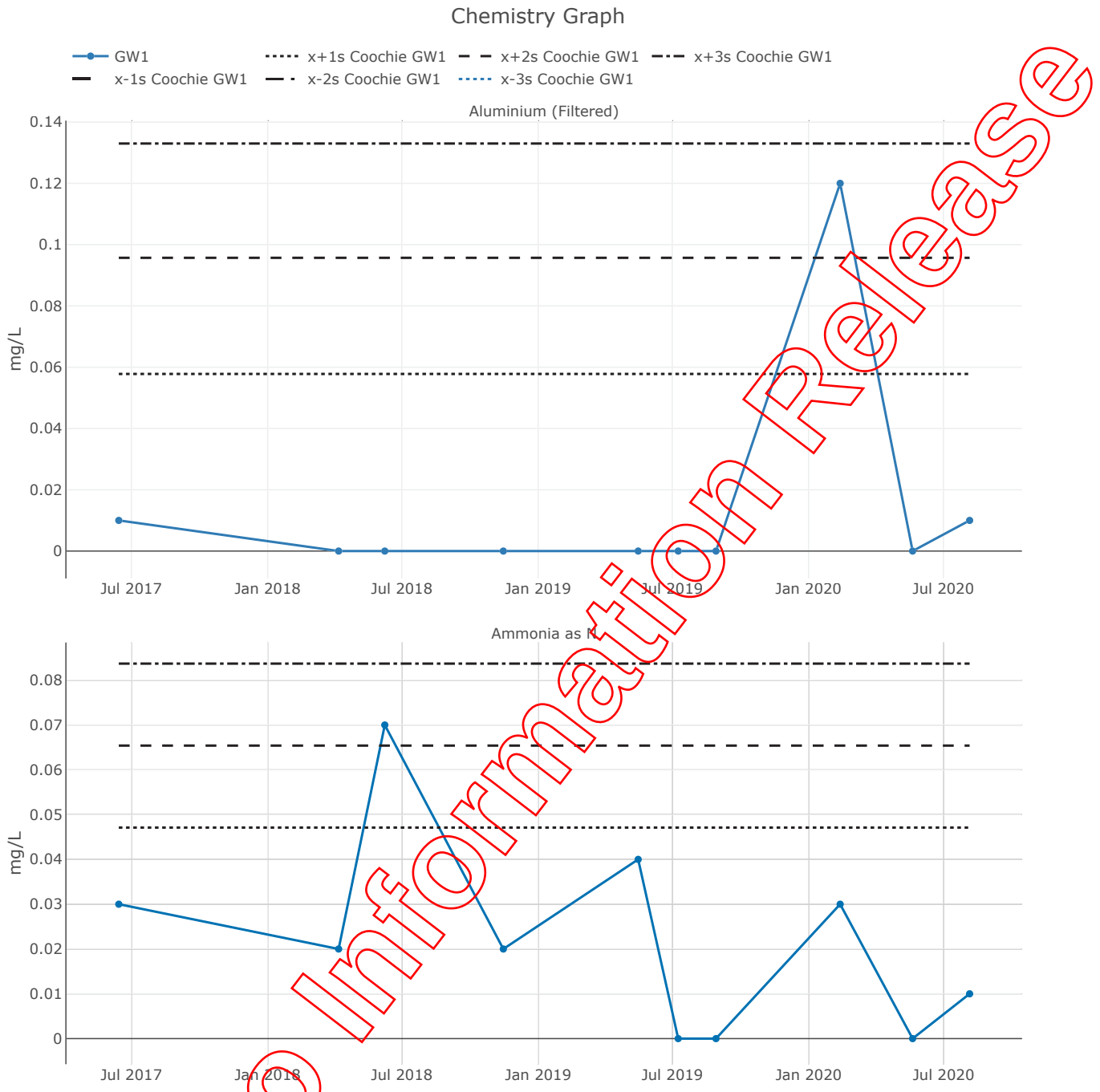

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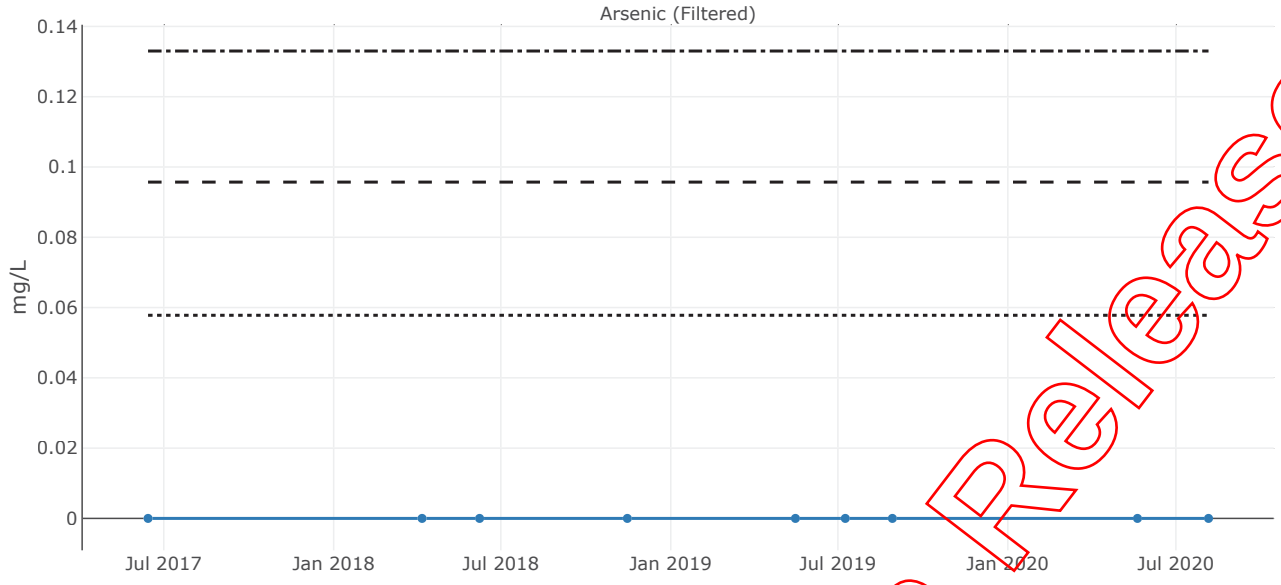

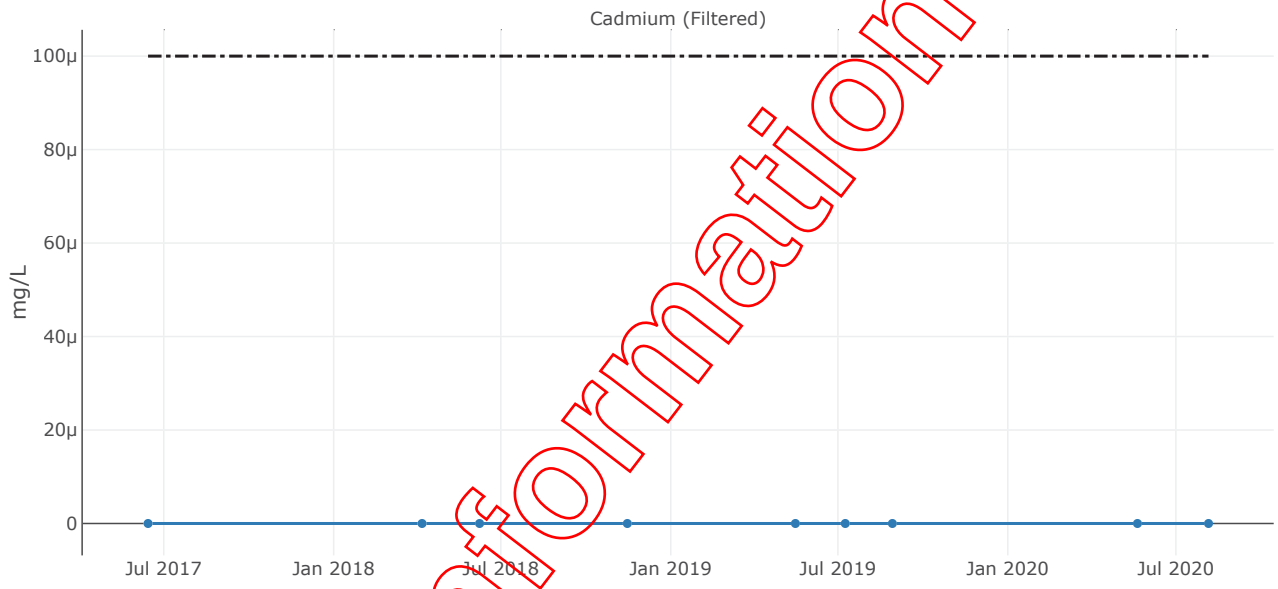

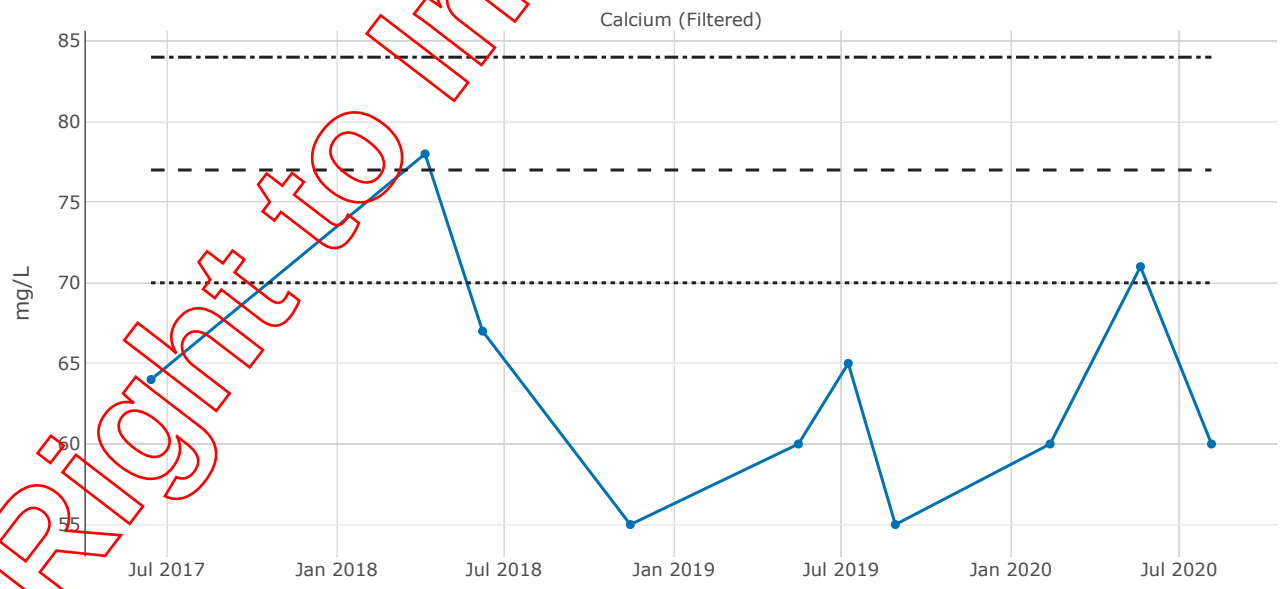

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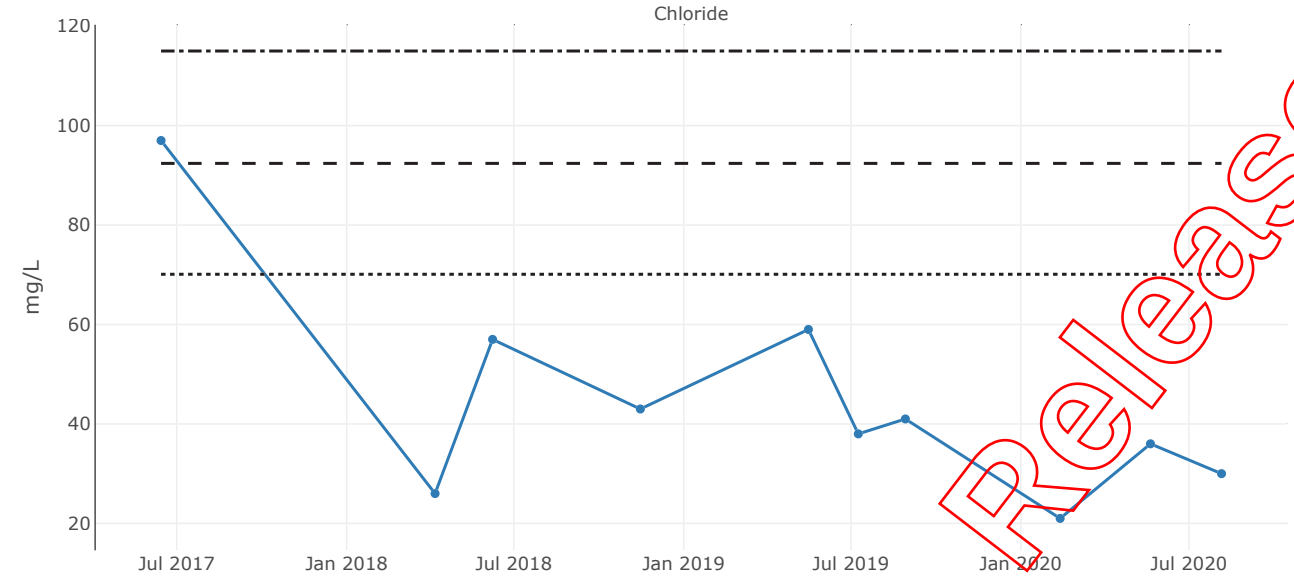

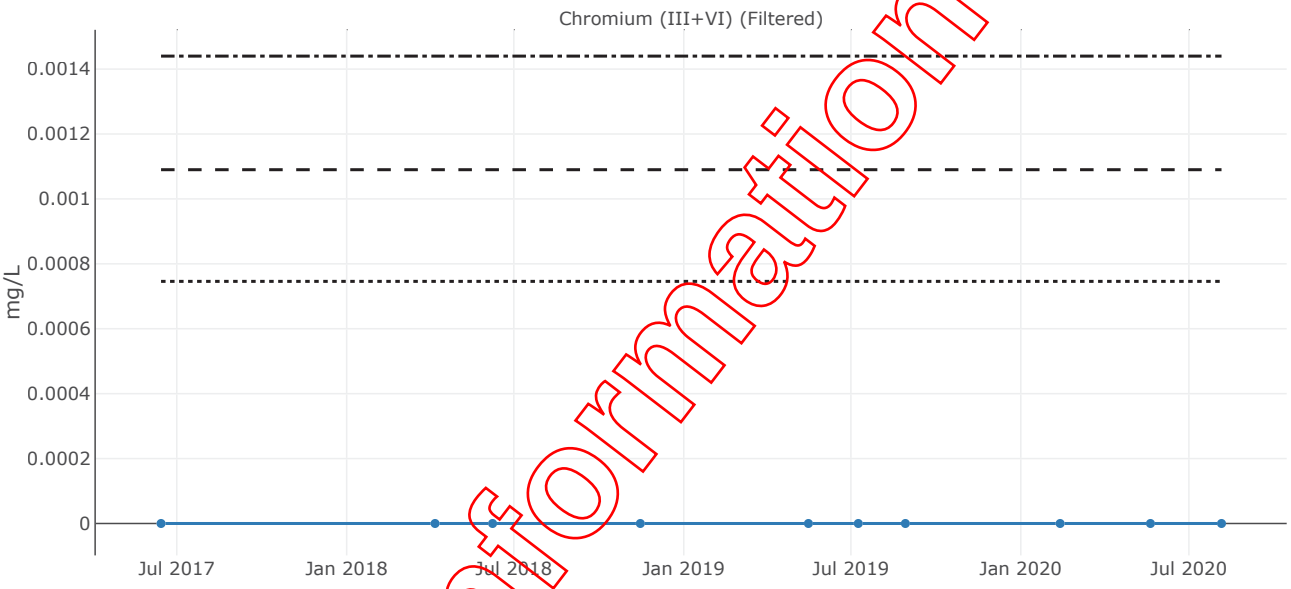

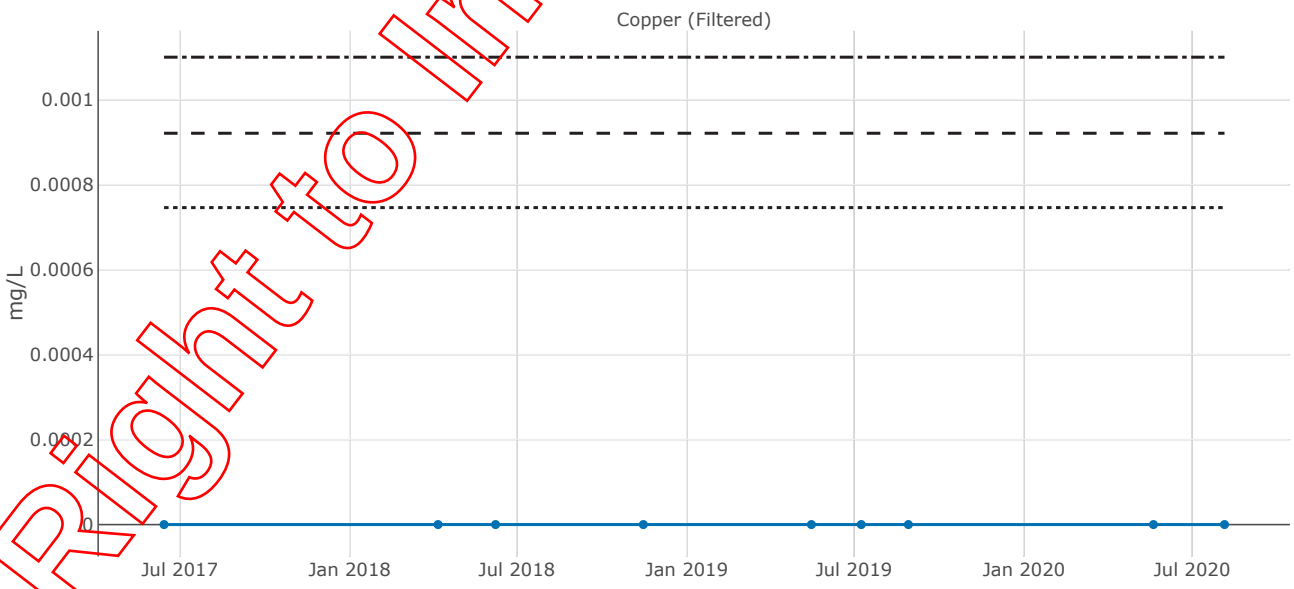

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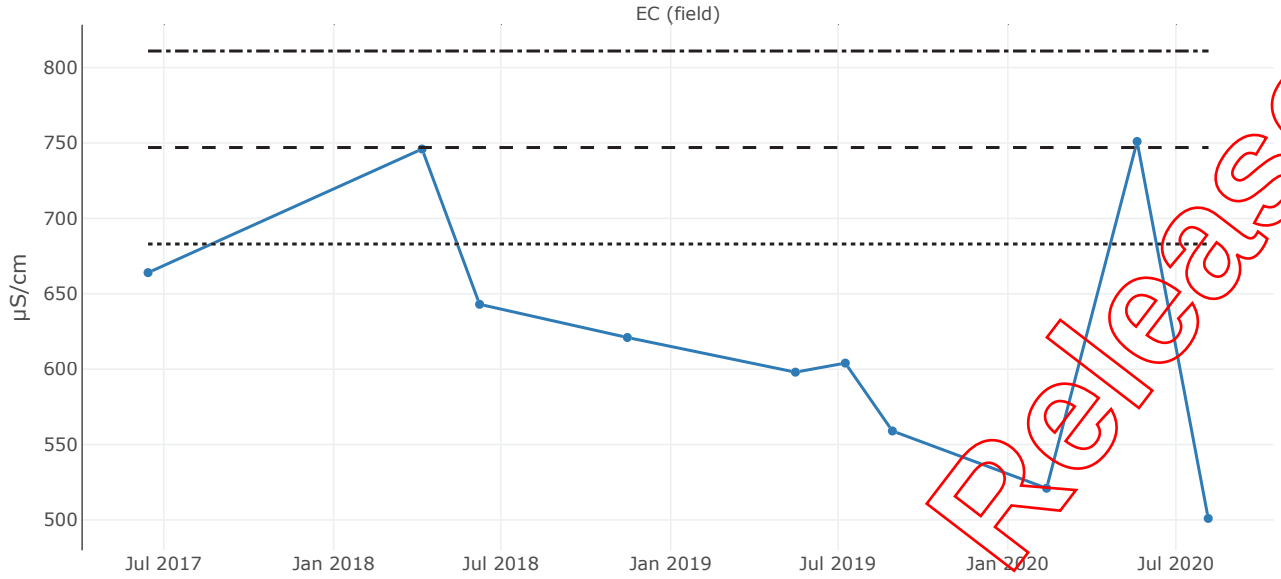

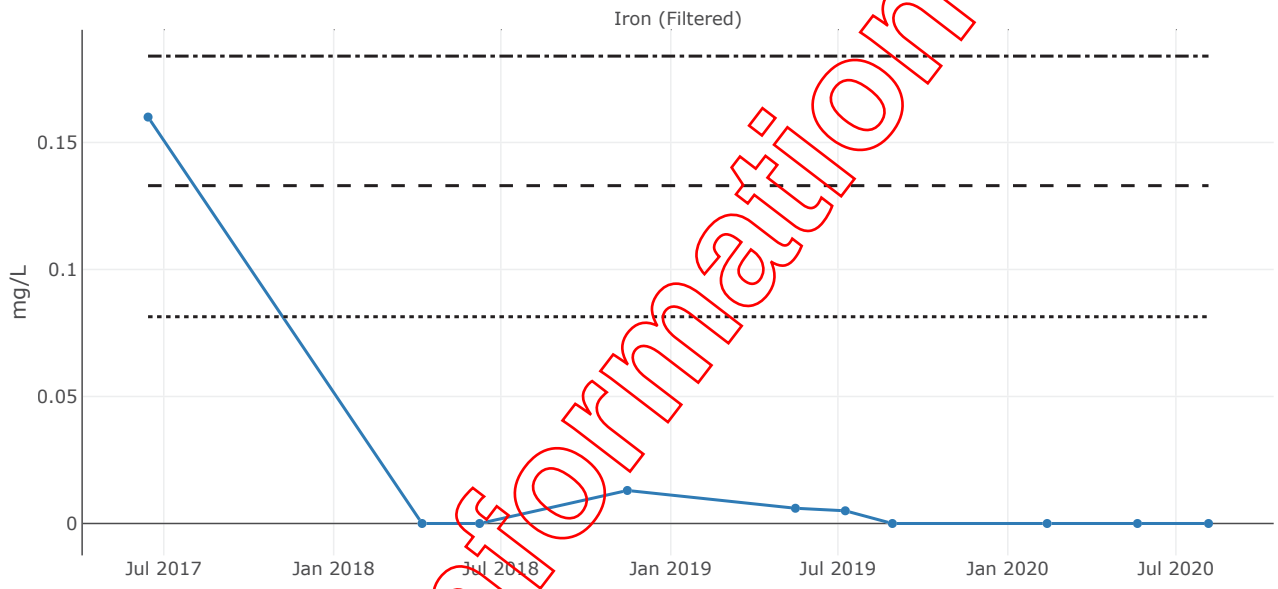

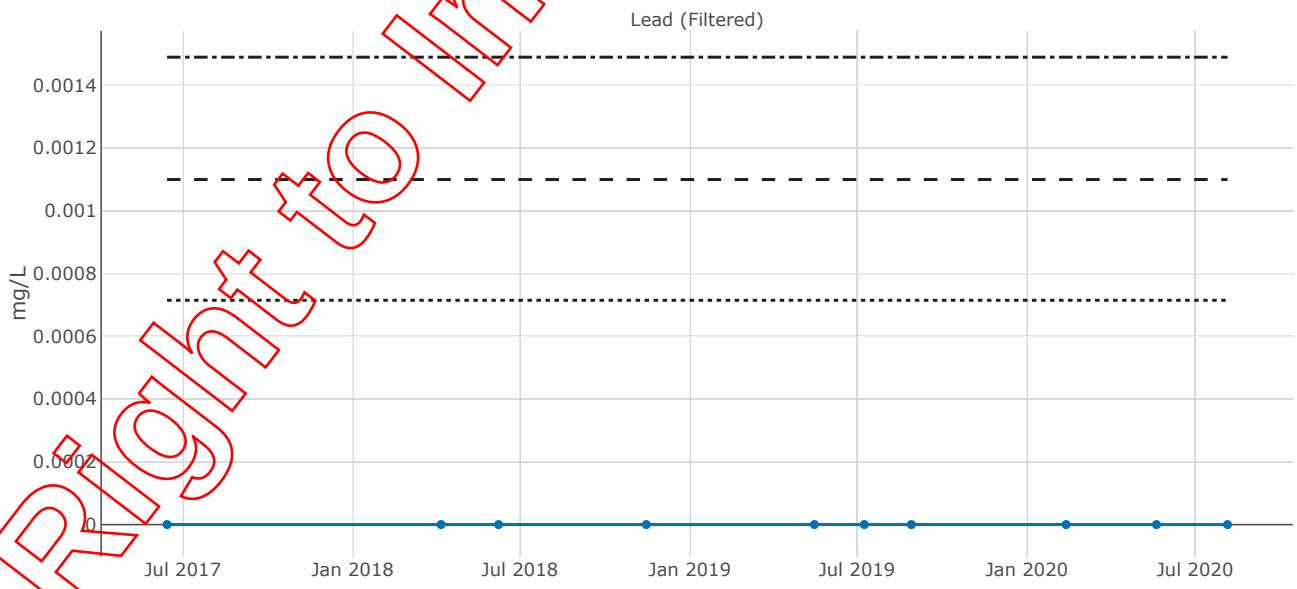

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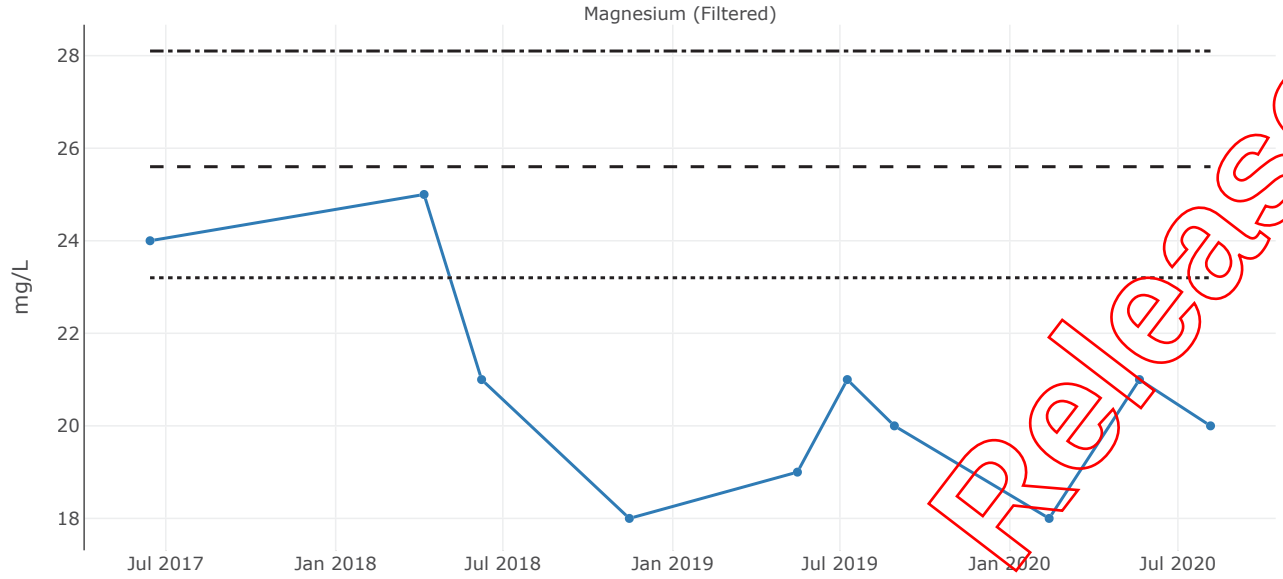

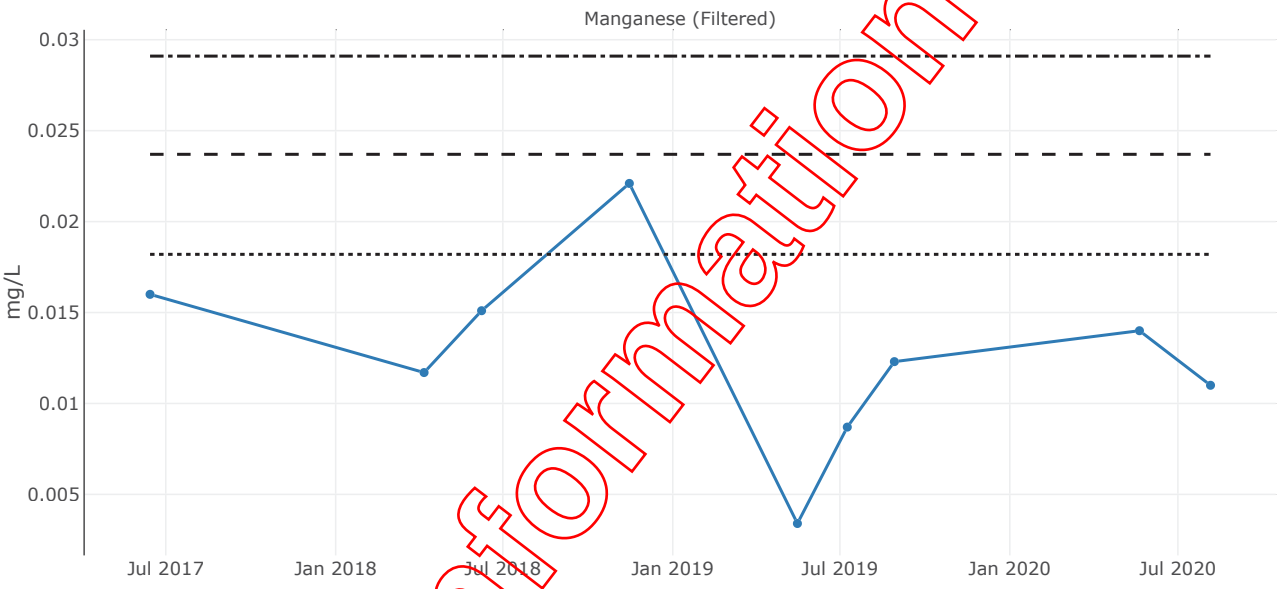

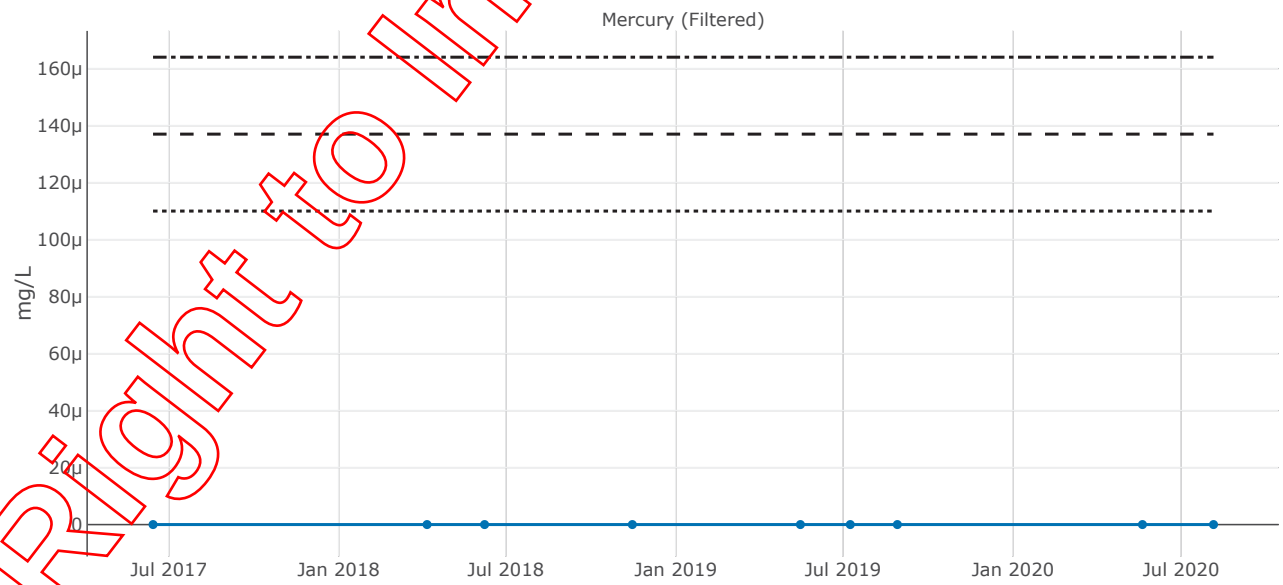

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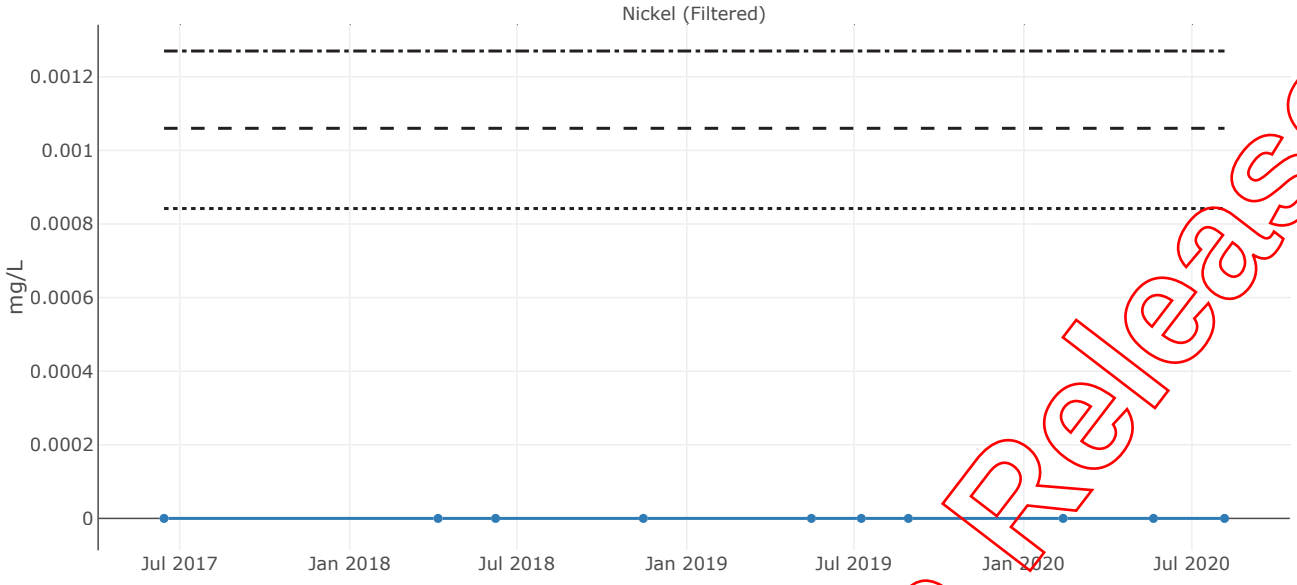

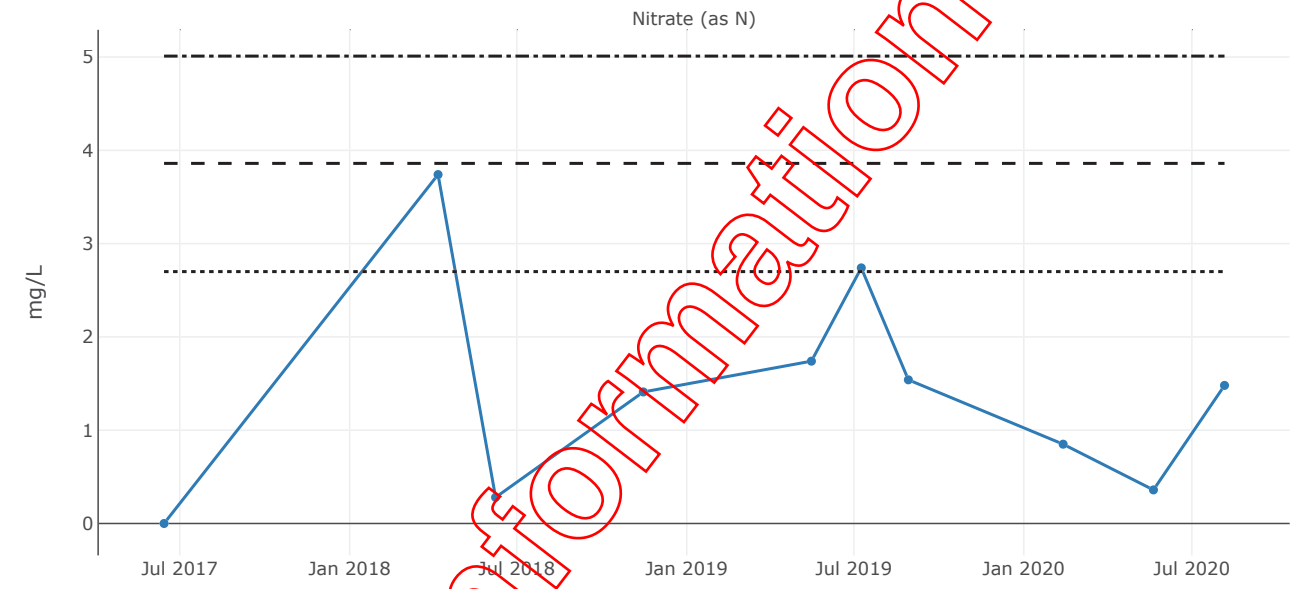

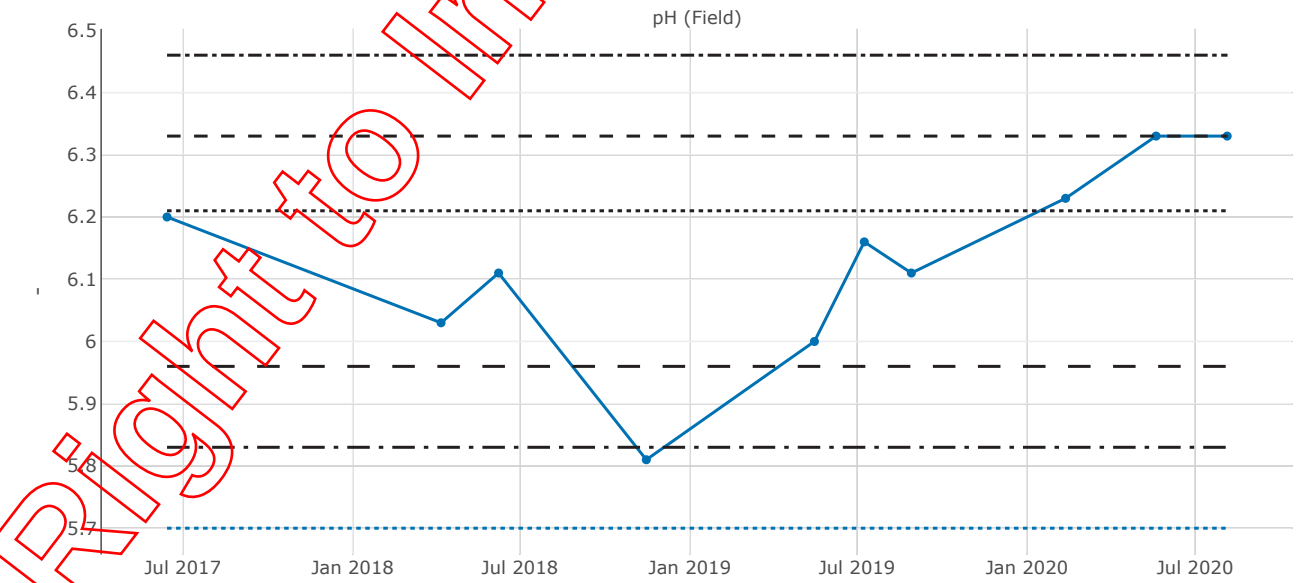

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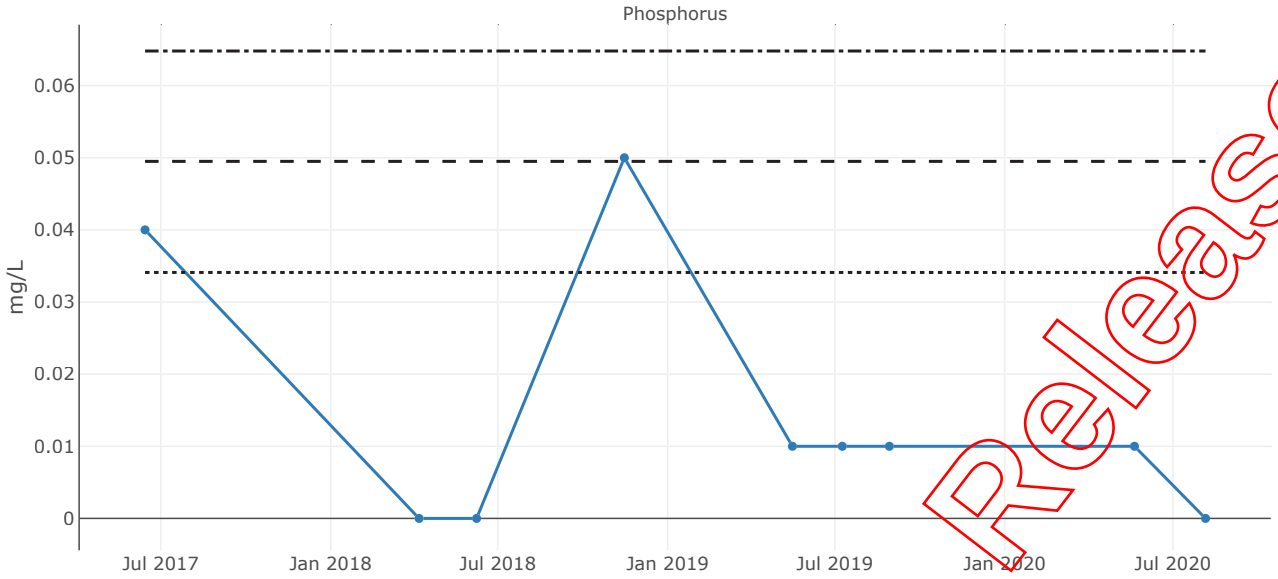

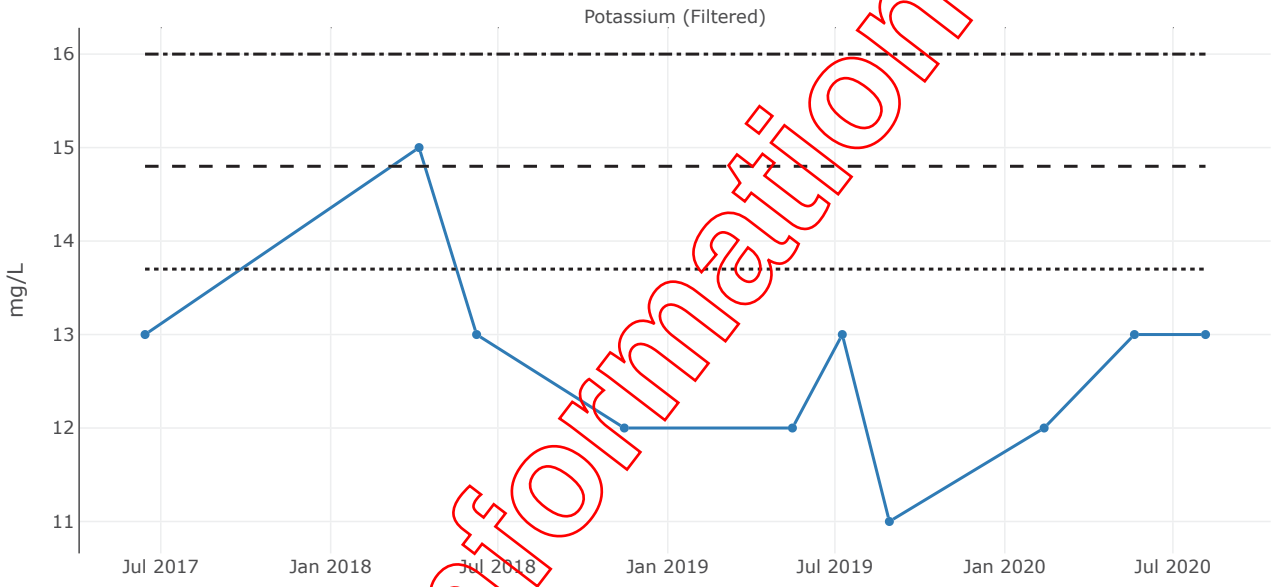

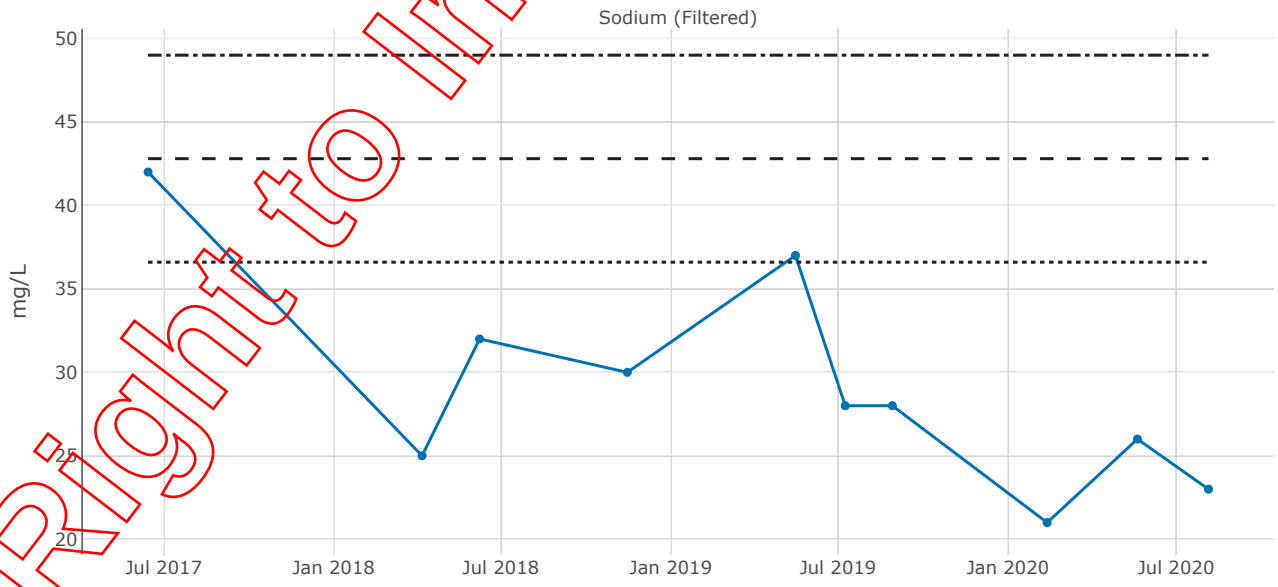

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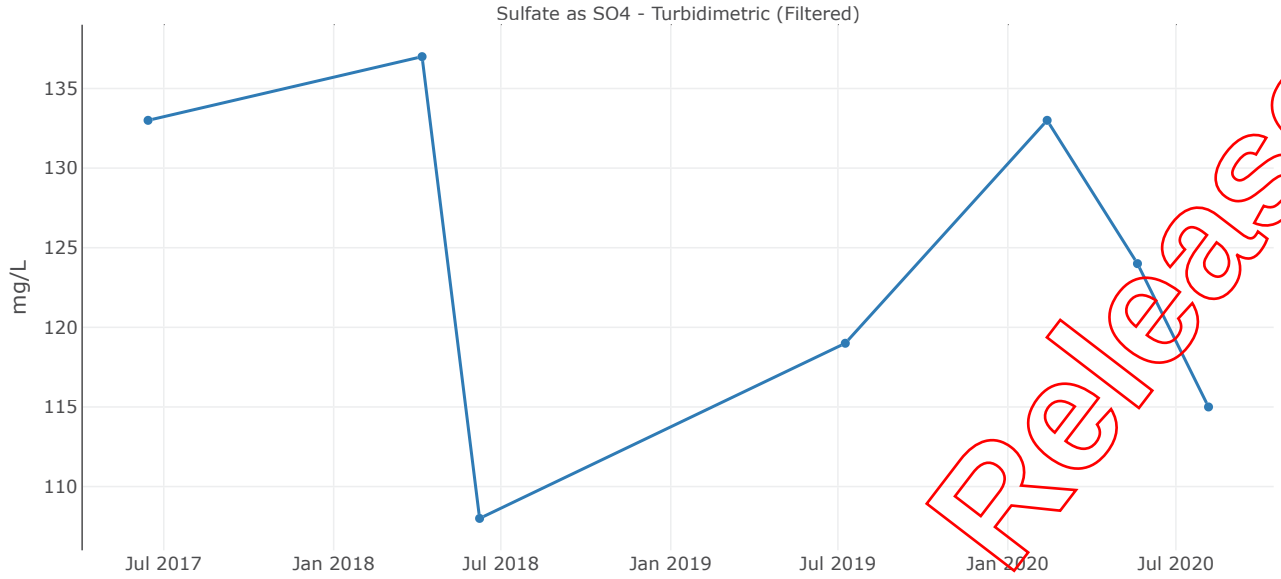

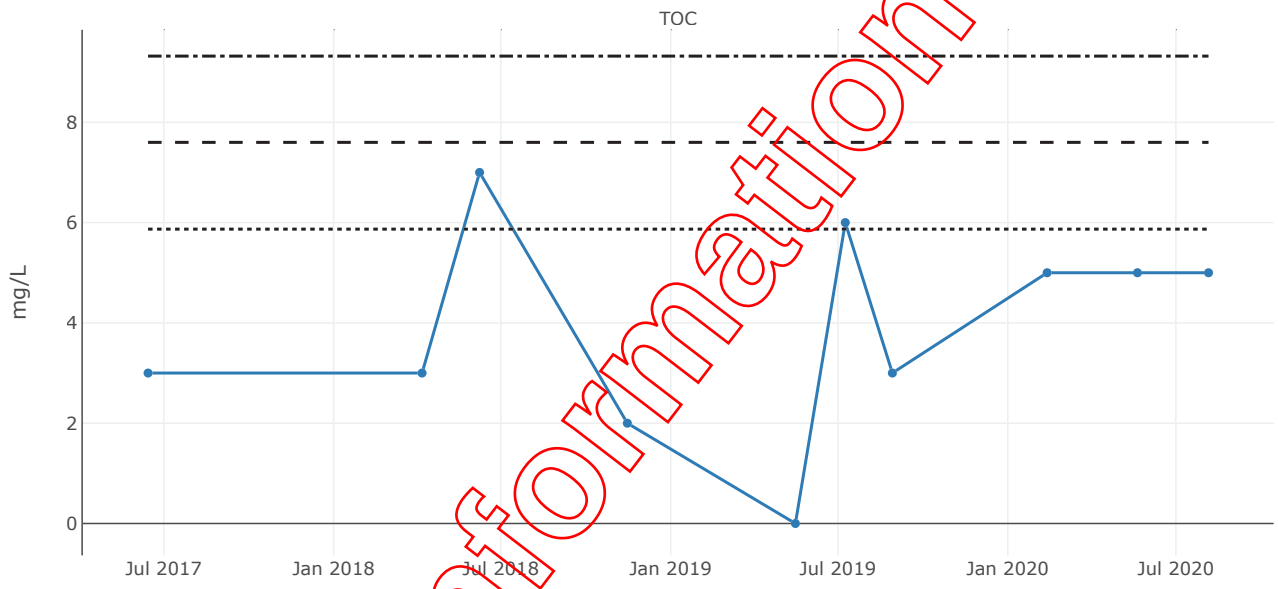

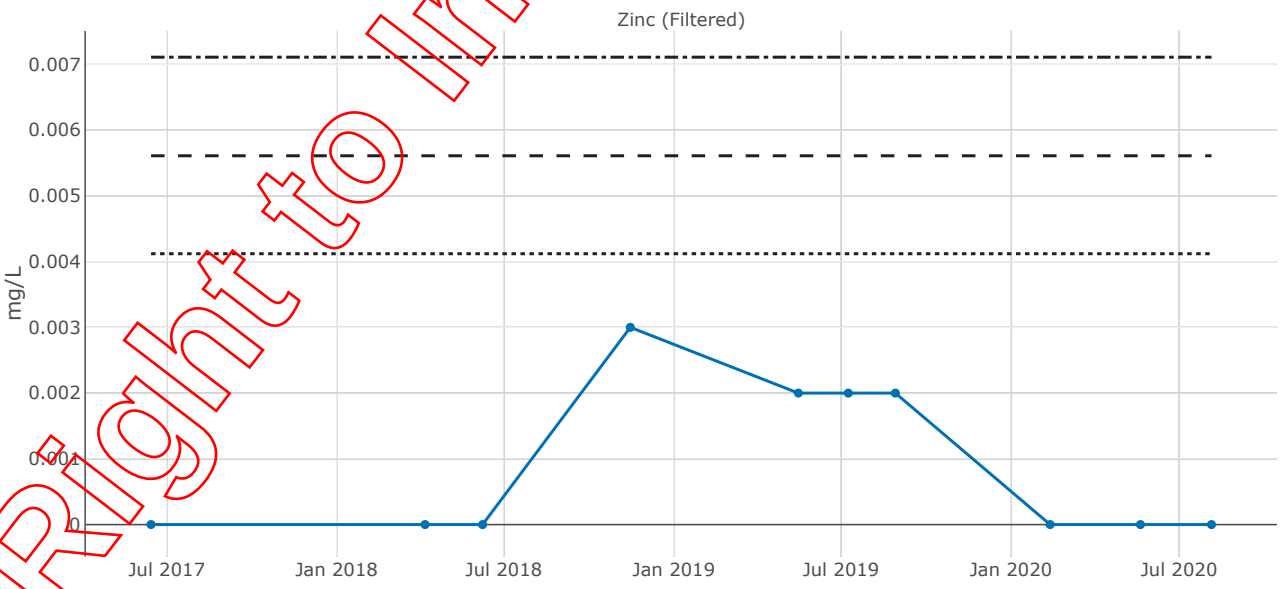

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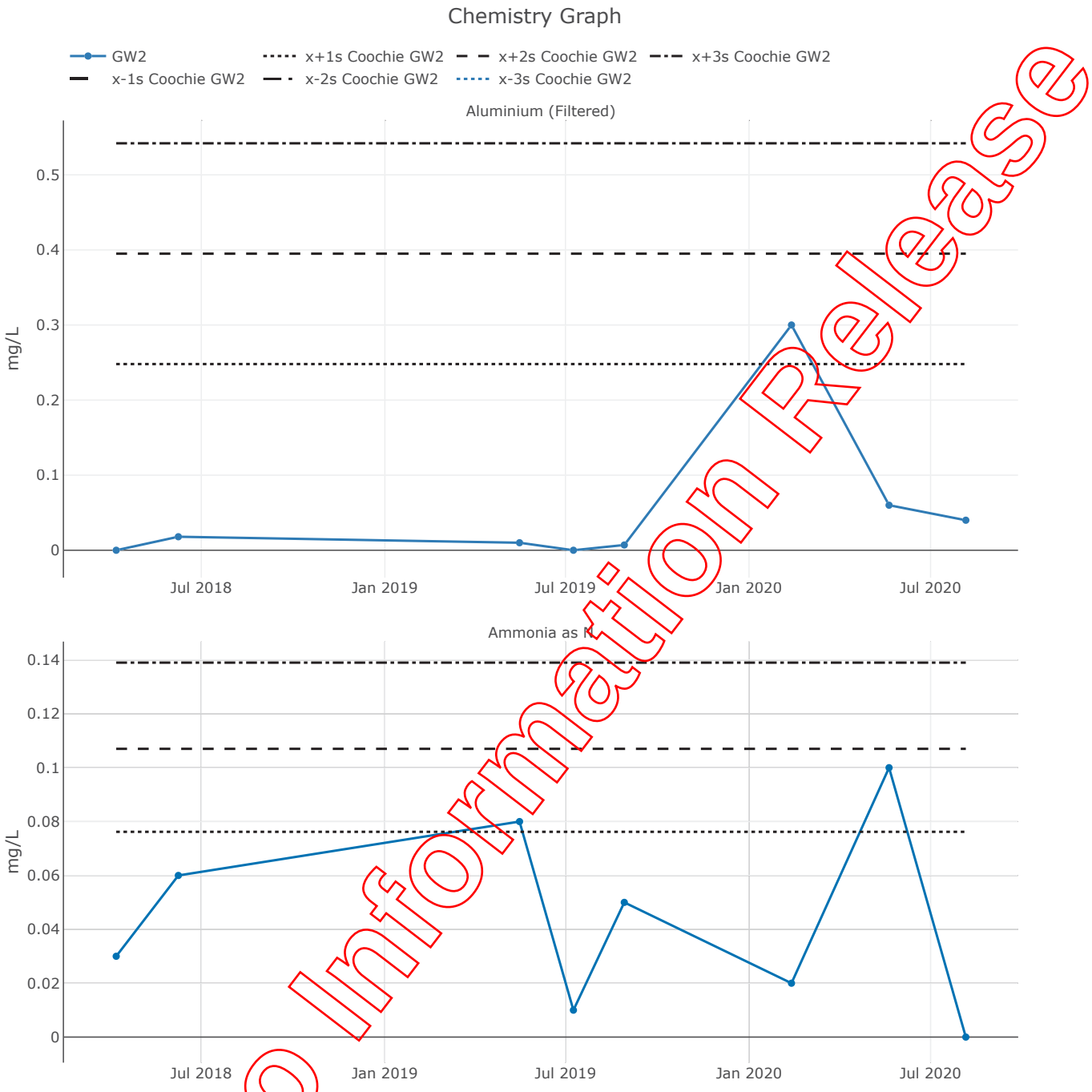
The report was generated based on the following filter:

Chem Names In "Zinc,Ammonia as N,Arsenic,Cadmium,Calcium,Chromium (III+VI),Copper,EC (field),Iron,Lead,Magnesium,Manganese,Nitrate (as N),pH (Field),Potassium,Sodium,Sulfate as SO4 - Turbidimetric,TOC,Phosphorus,Nickel,Mercury,Chloride,Aluminium",
Date between "01 Jan 2010" and "19 Aug 2020",
Field or Lab Data "Both",
Projects In "Redland Landfills",
Sites In "Coochiemudlo Island",
Locations In "undefined"

Publication Date: 20 Aug 2020

Well ID: GW2



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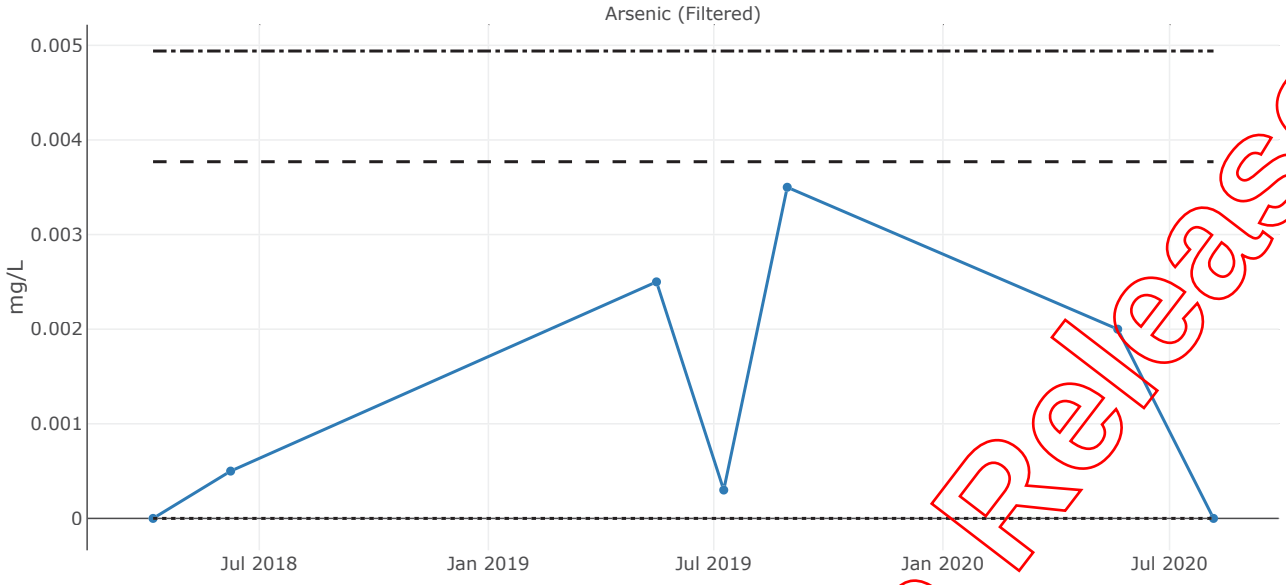

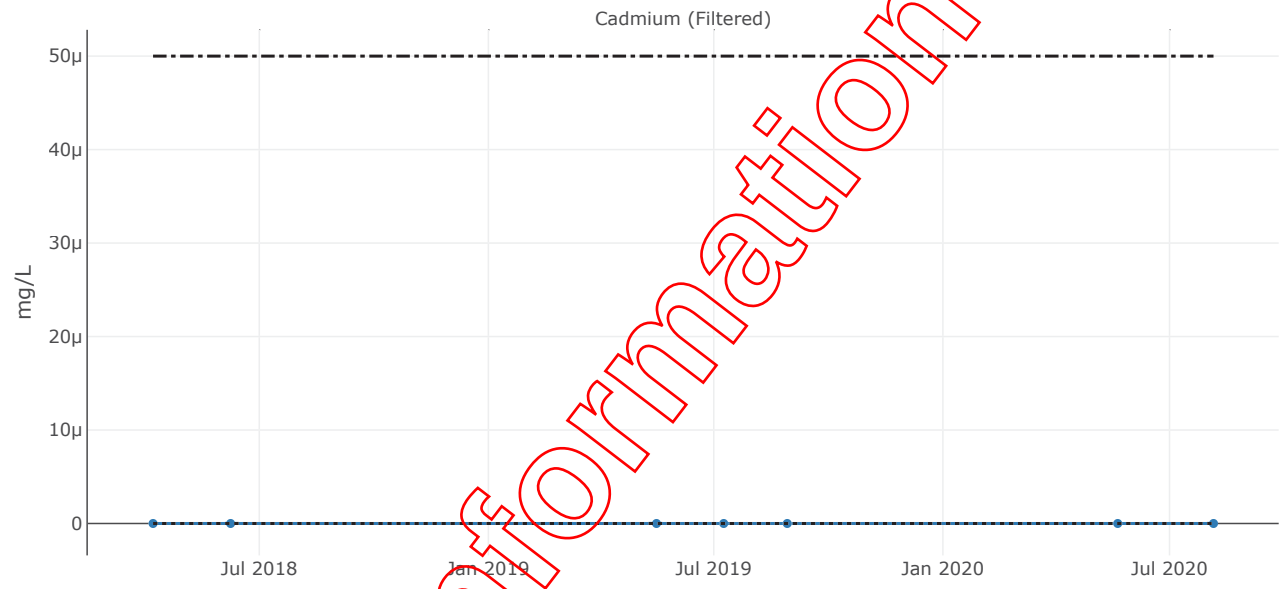

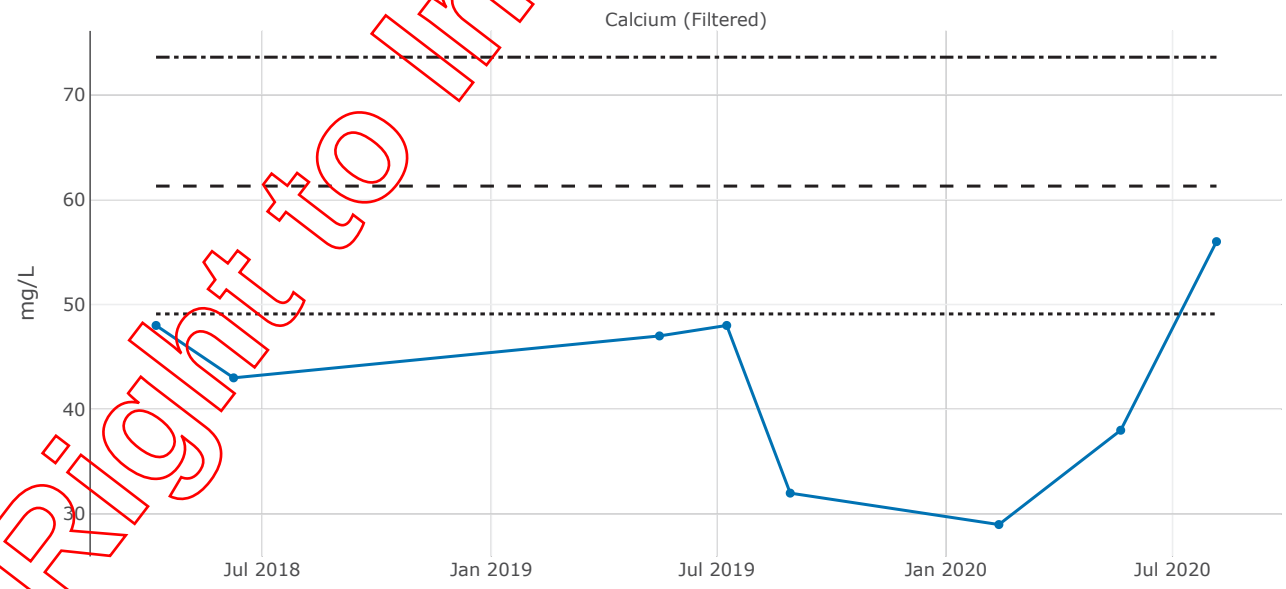

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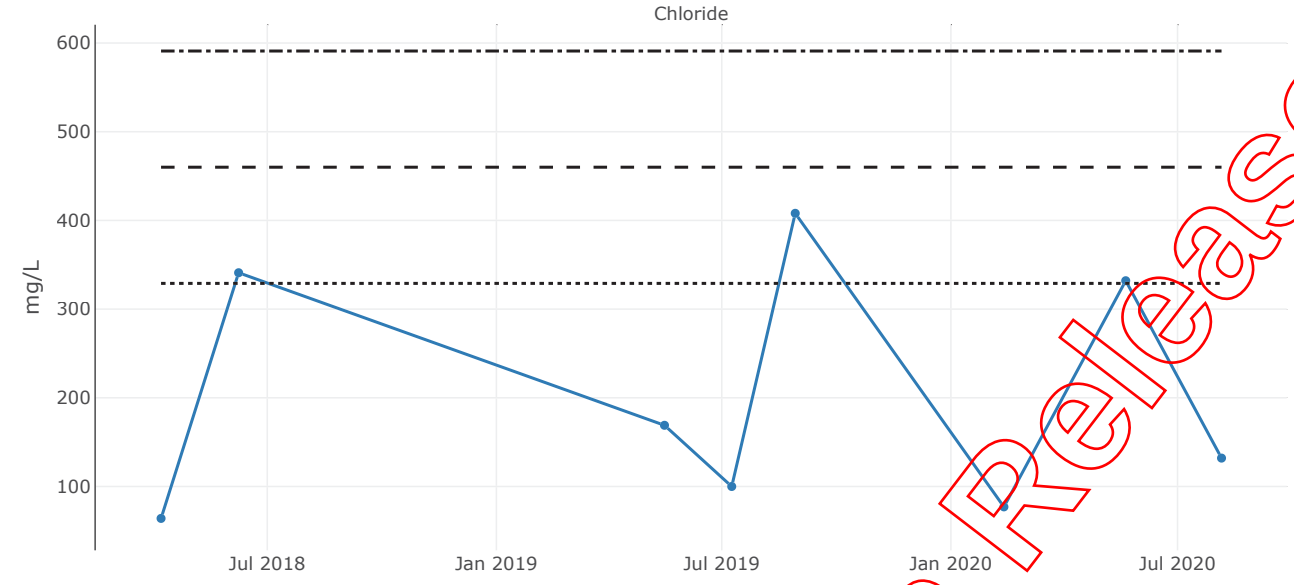

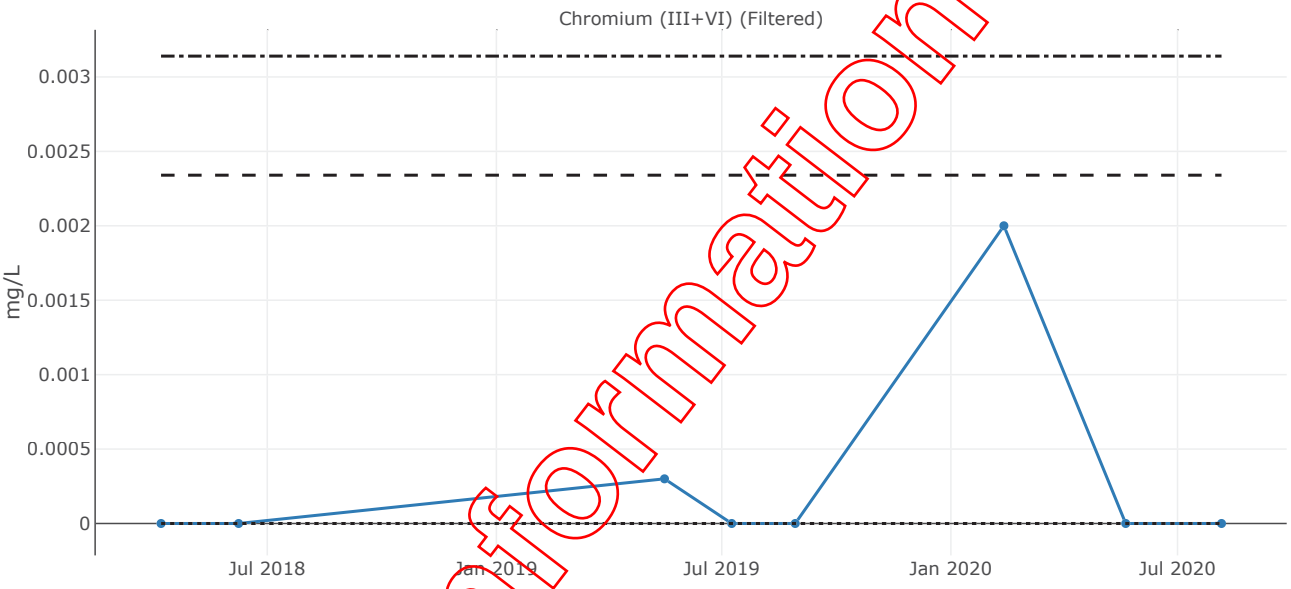

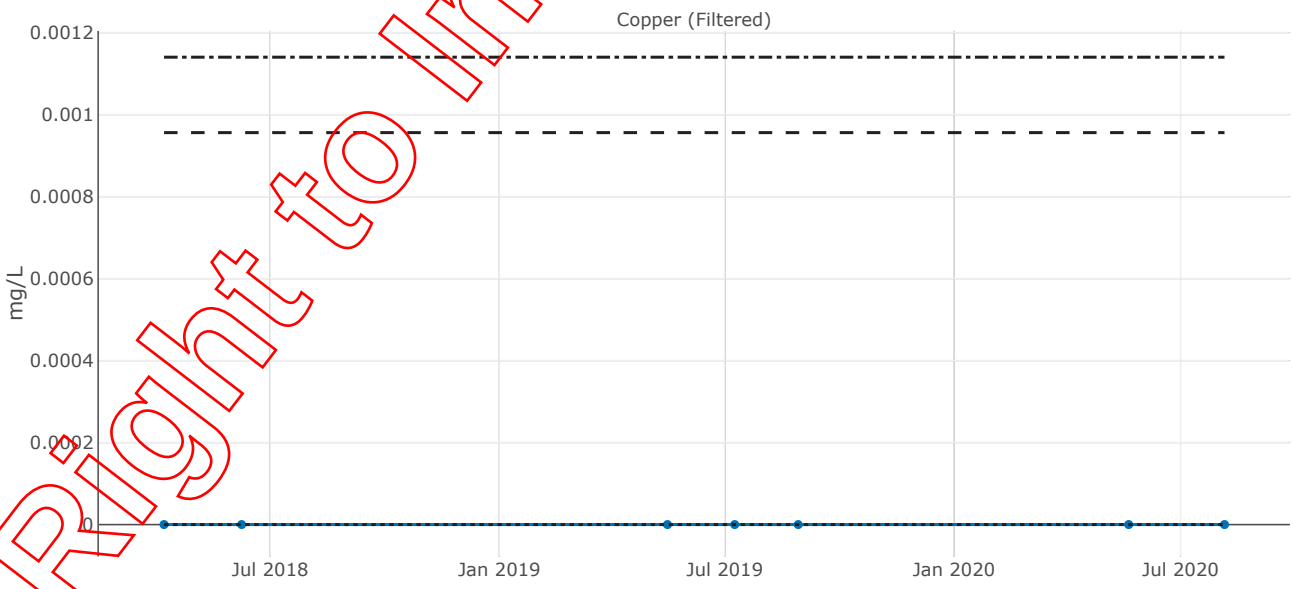

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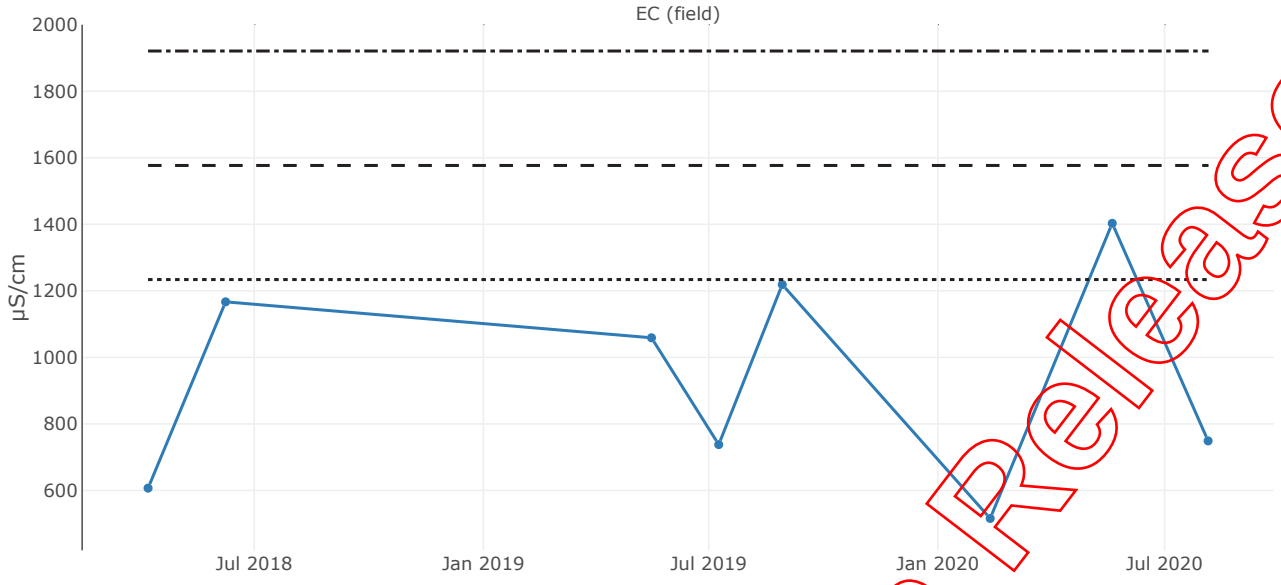

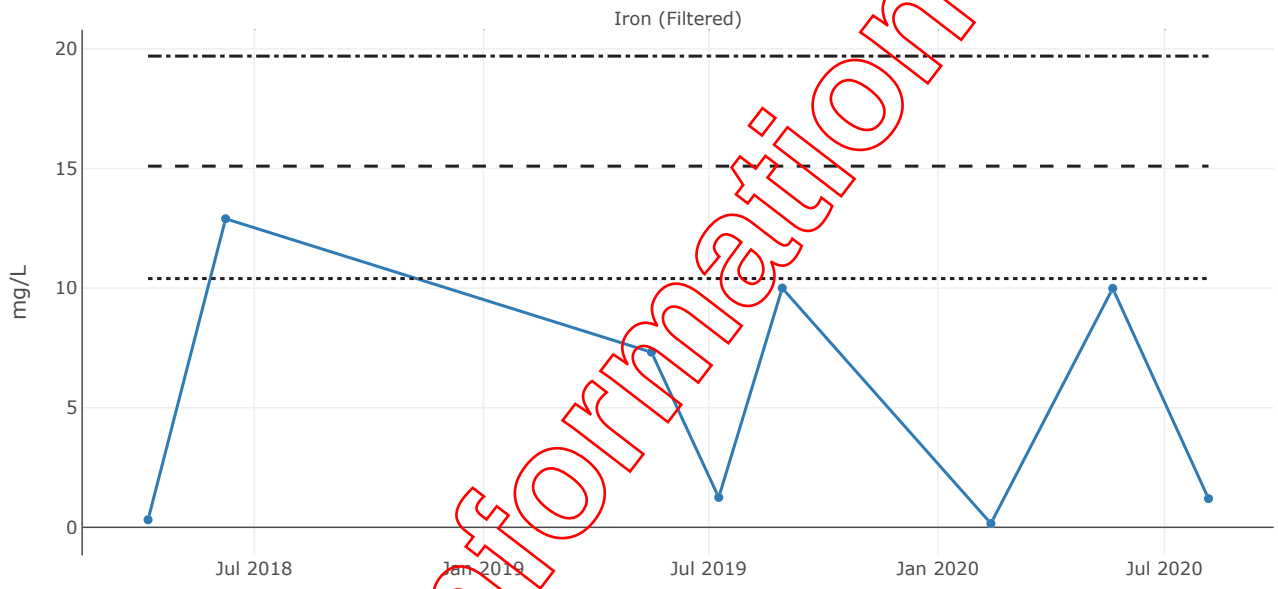

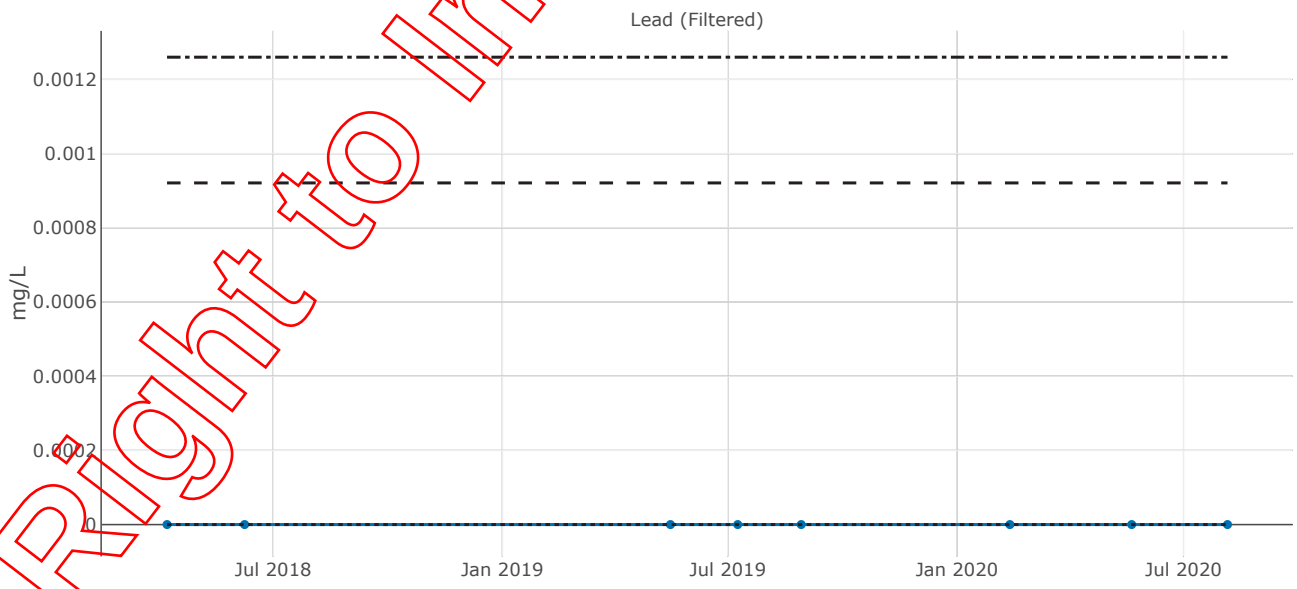

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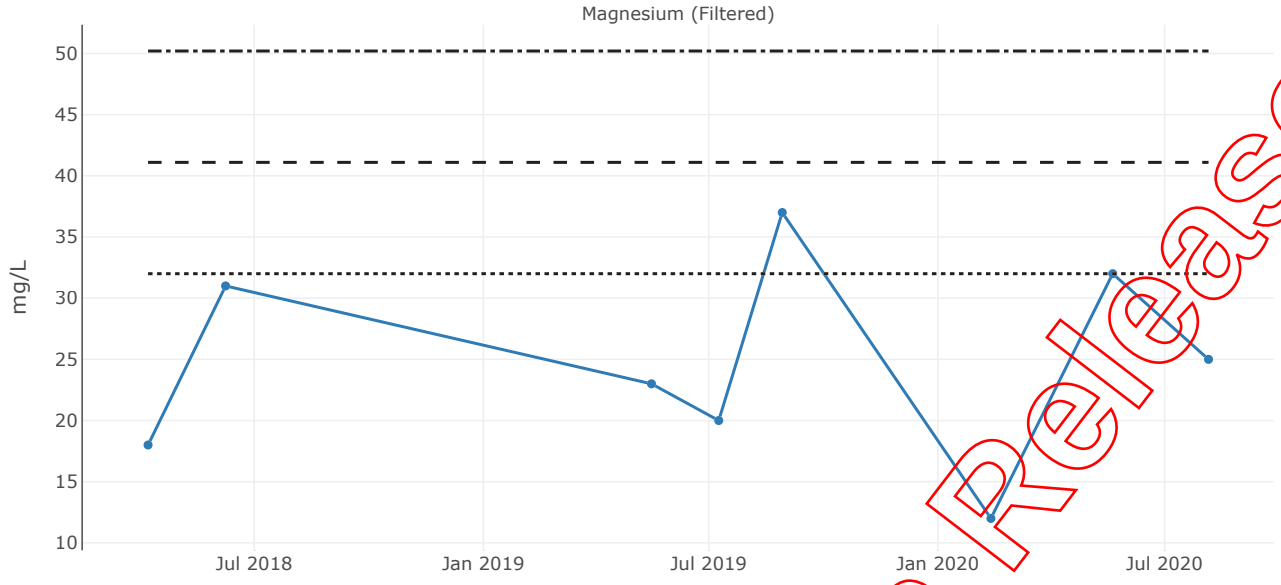

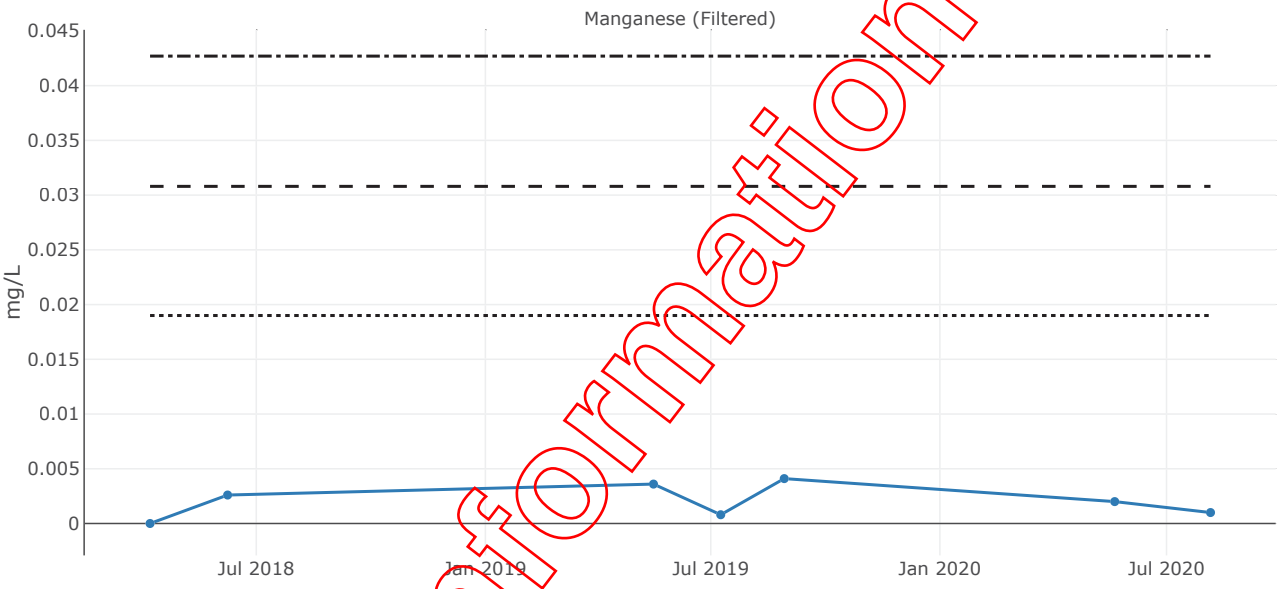

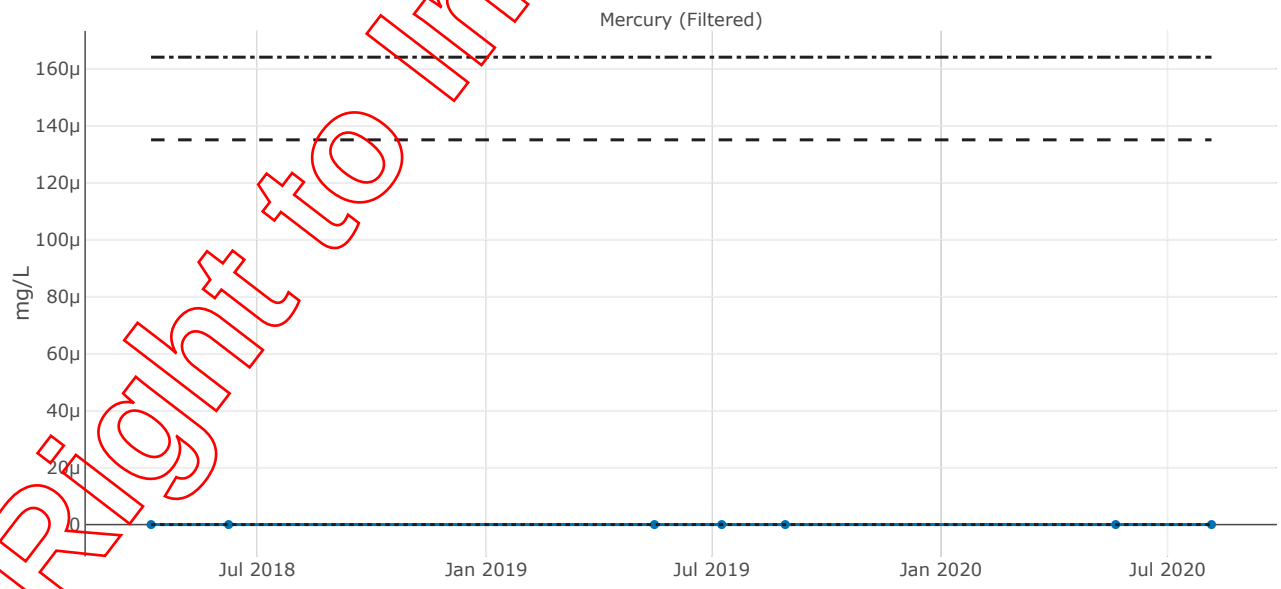

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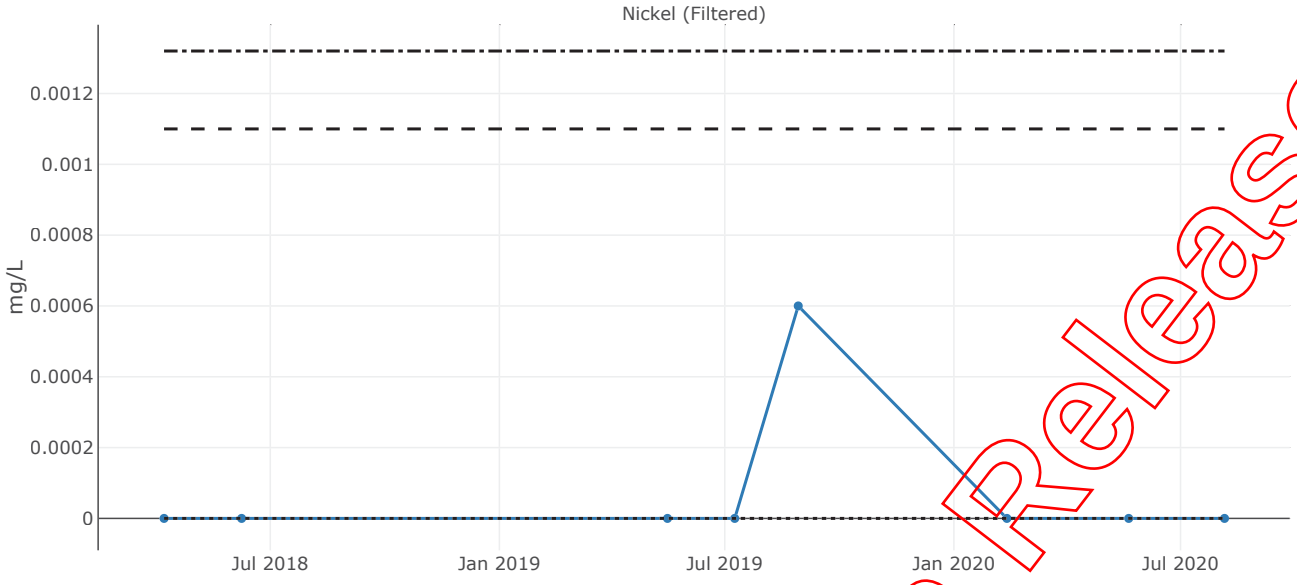

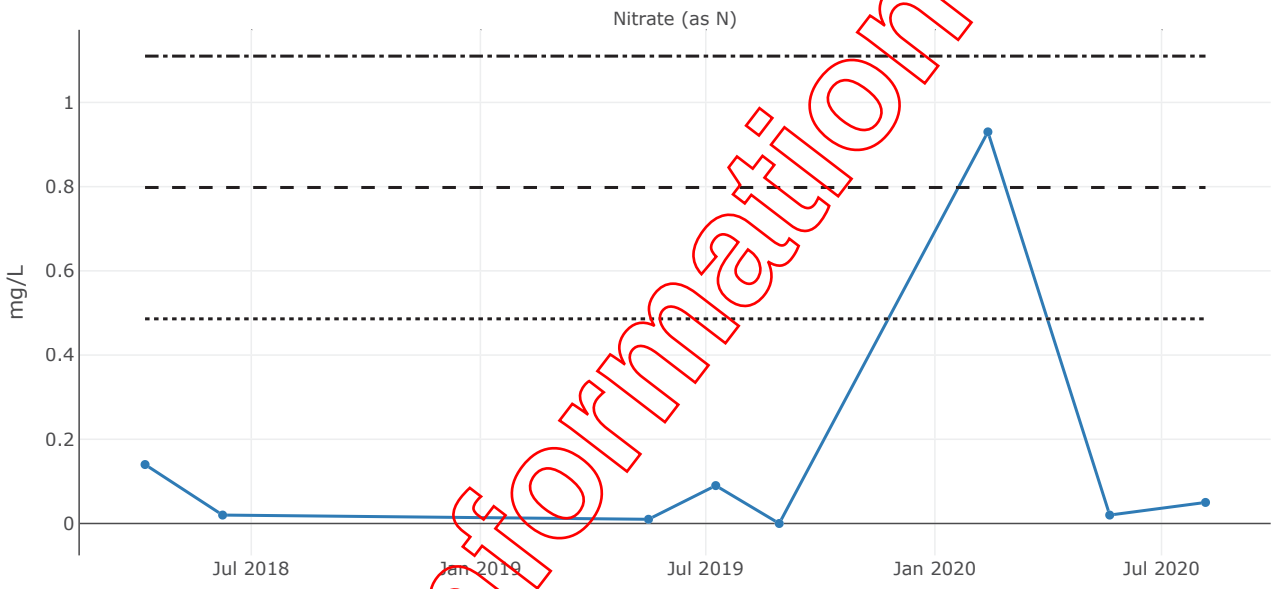

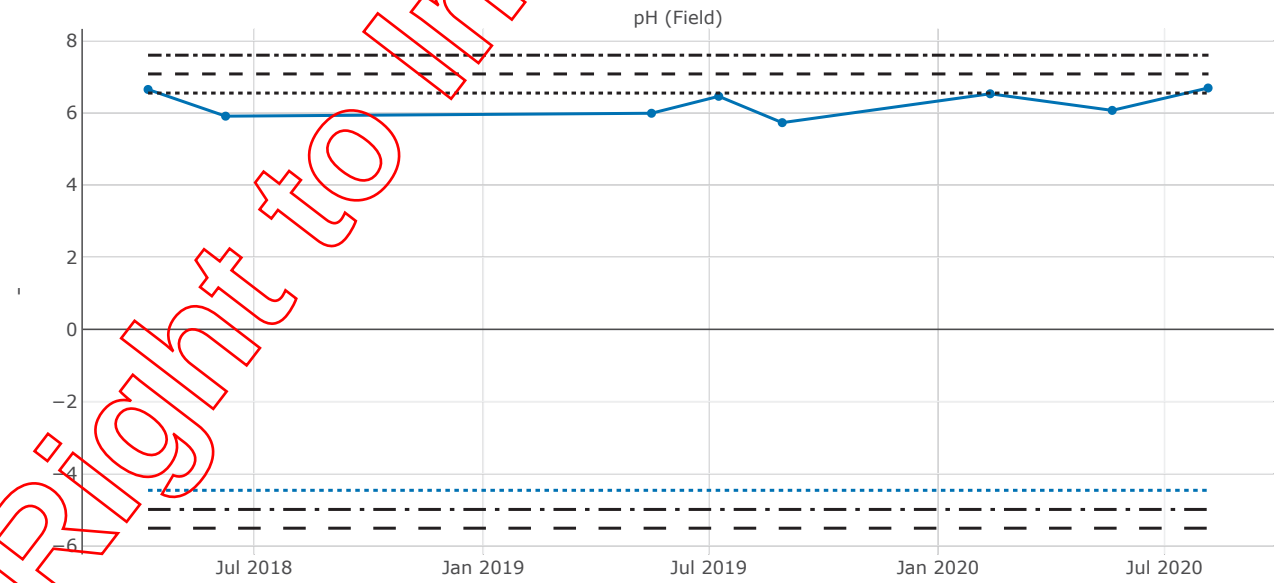

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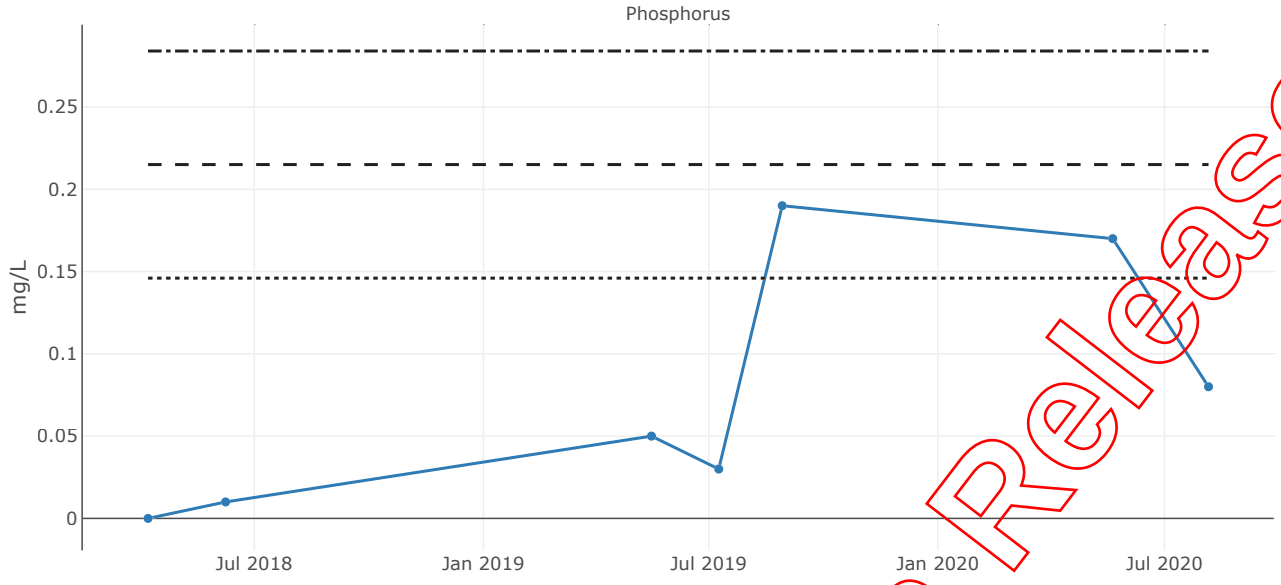

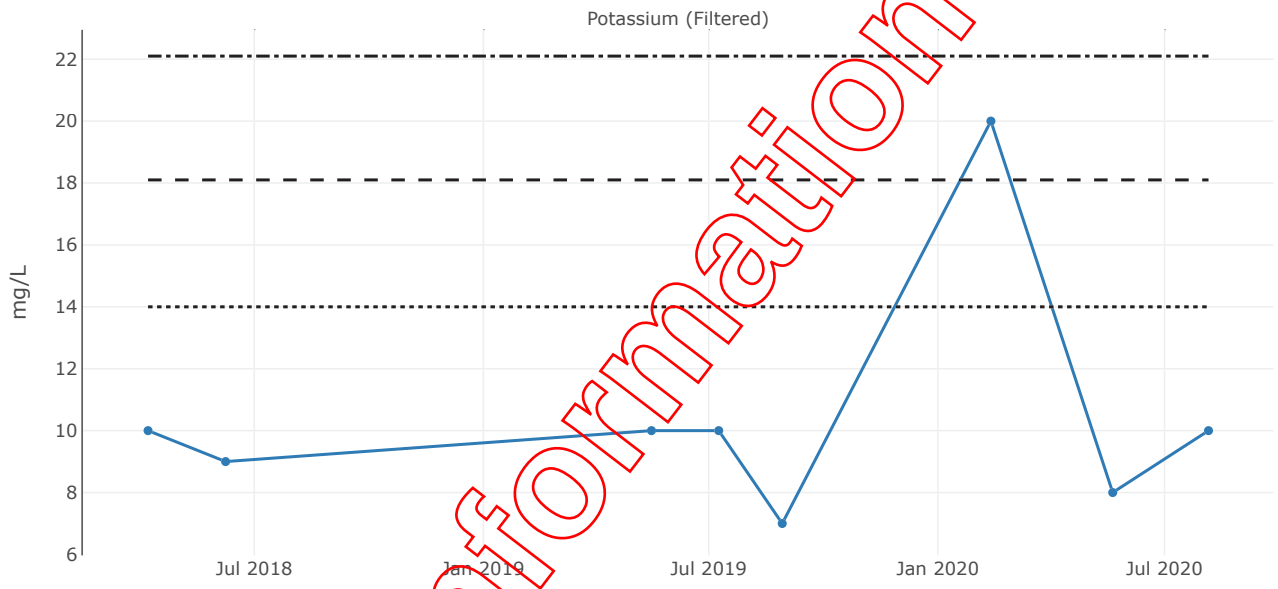

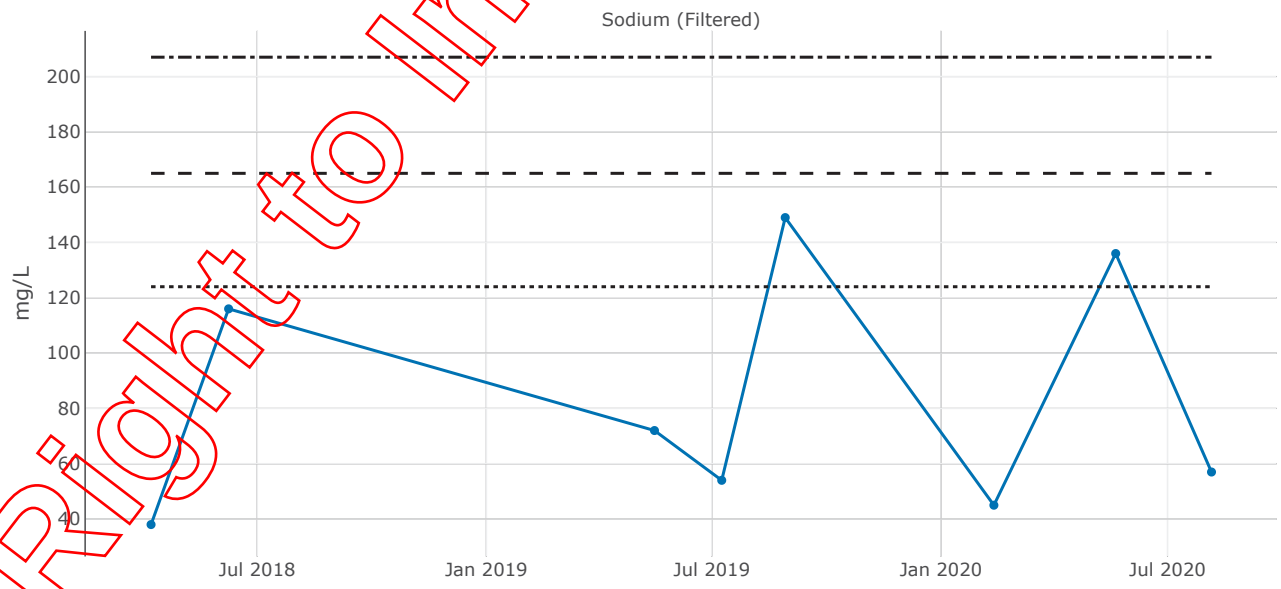

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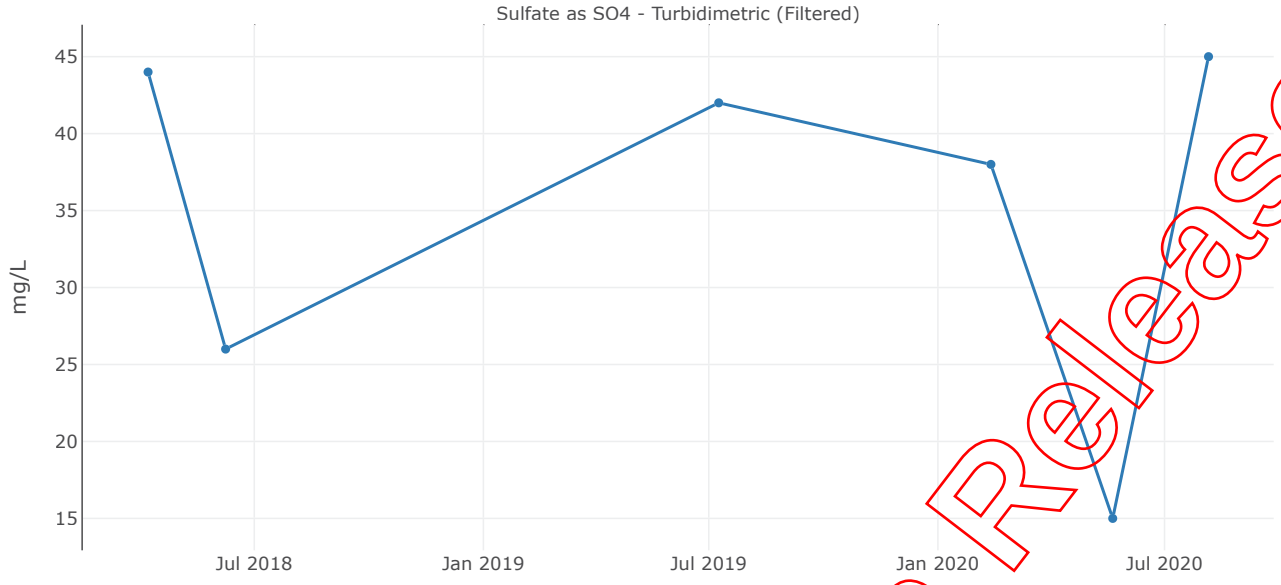
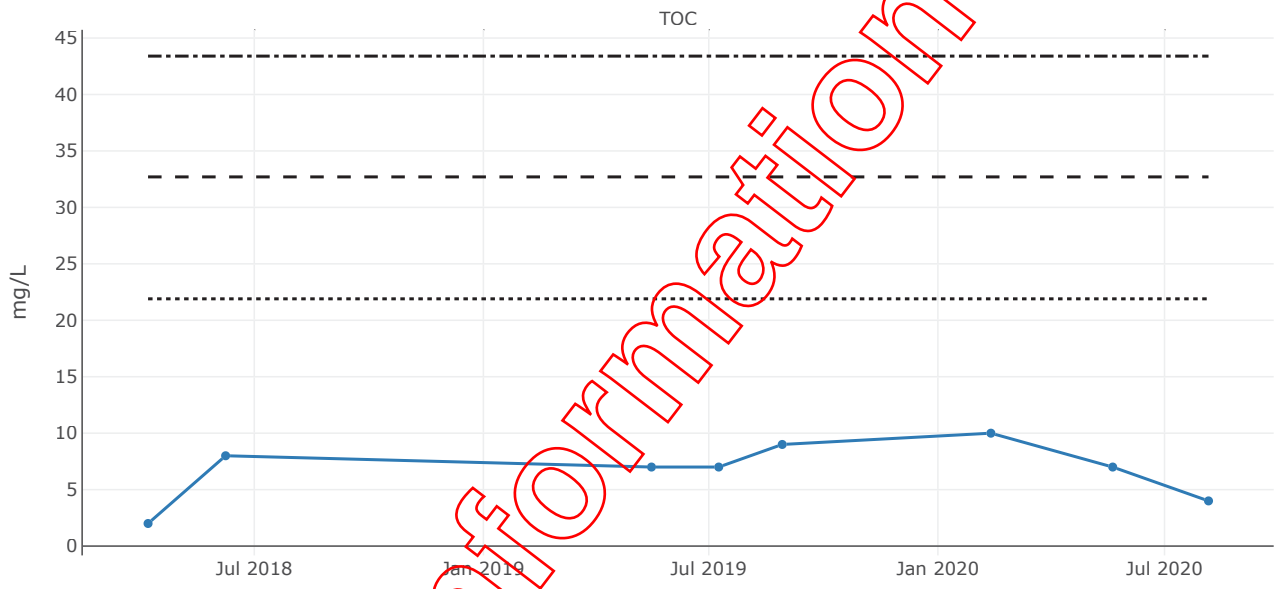
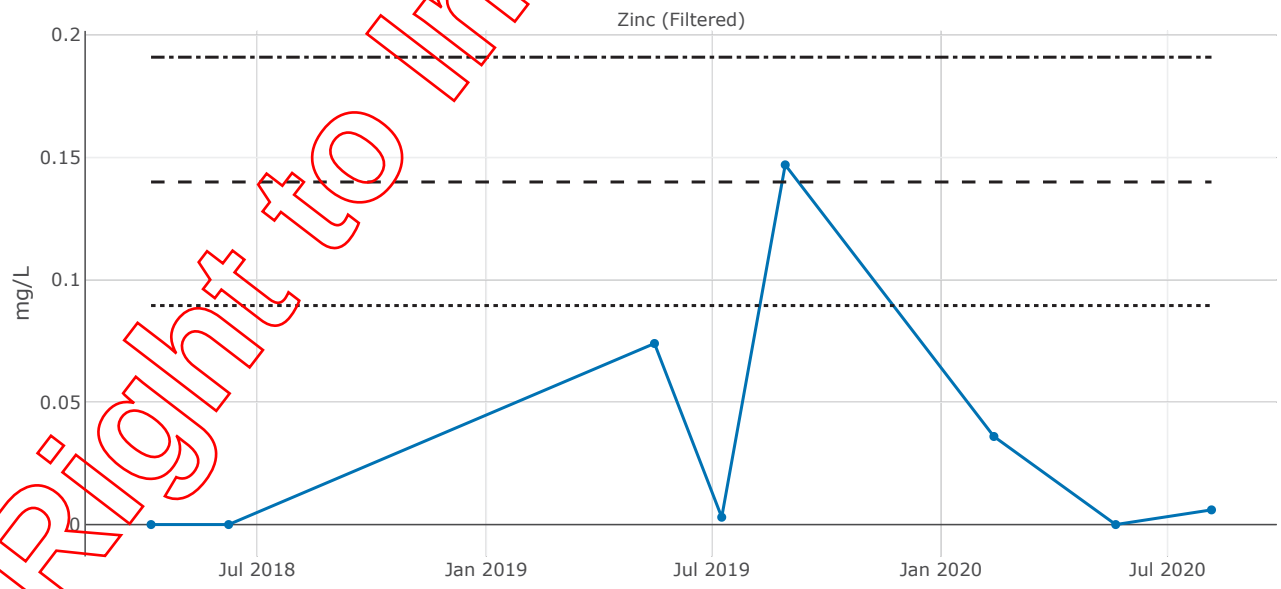






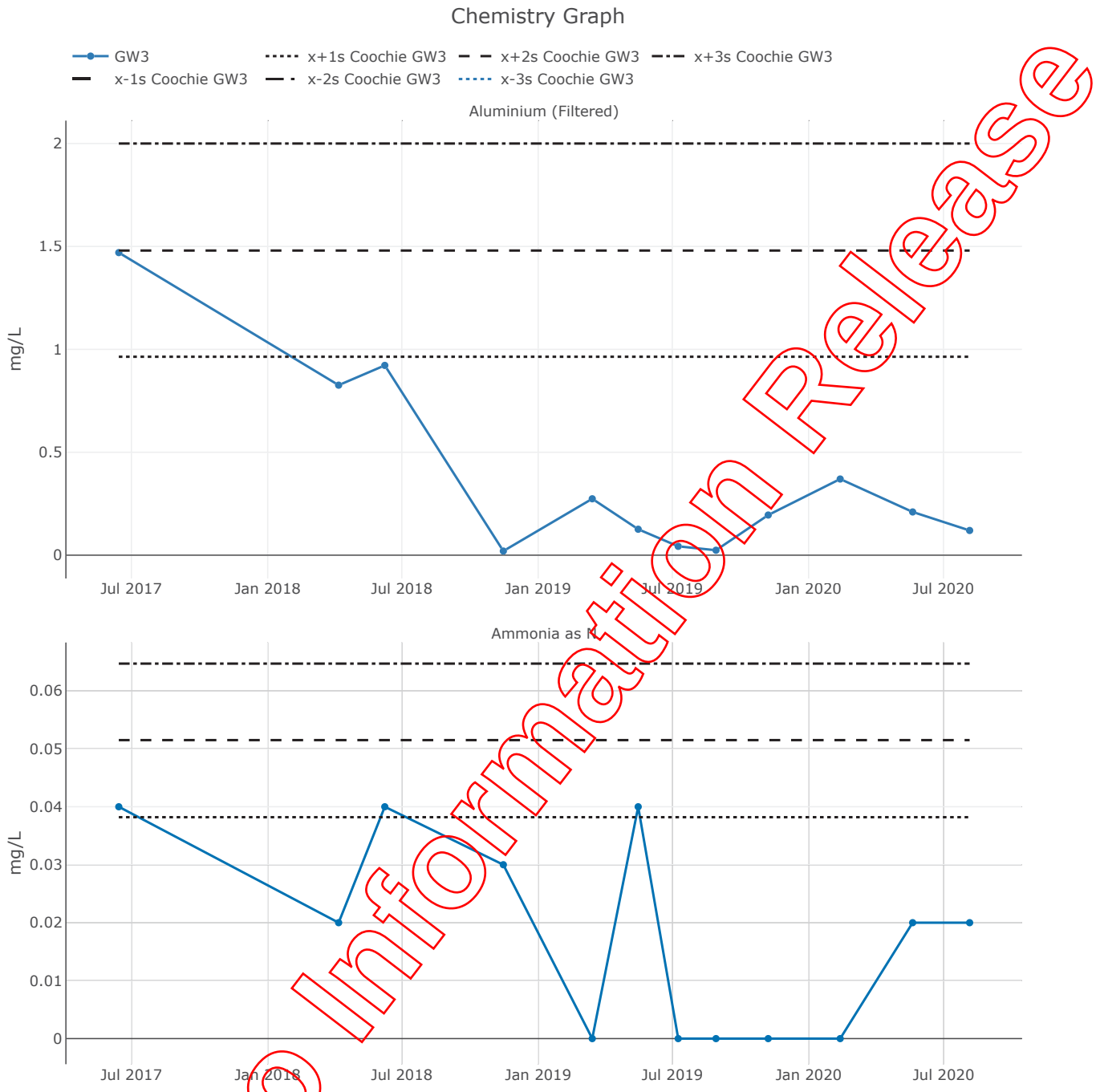
Well ID: GW2

The report was generated based on the following filter:

Chem Names In "Zinc,Ammonia as N,Arsenic,Cadmium,Calcium,Chromium (III+VI),Copper,EC (field),Iron,Lead,Magnesium,Manganese,Nitrate (as N),pH (Field),Potassium,Sodium,Sulfate as SO4 - Turbidimetric,TOC,Phosphorus,Nickel,Mercury,Chloride,Aluminium",
Date between "01 Jan 2010" and "19 Aug 2020",
Field or Lab Data "Both",
Projects In "Redland Landfills",
Sites In "Coochiemudlo Island",
Locations In "undefined"

Publication Date: 20 Aug 2020

Well ID: GW3



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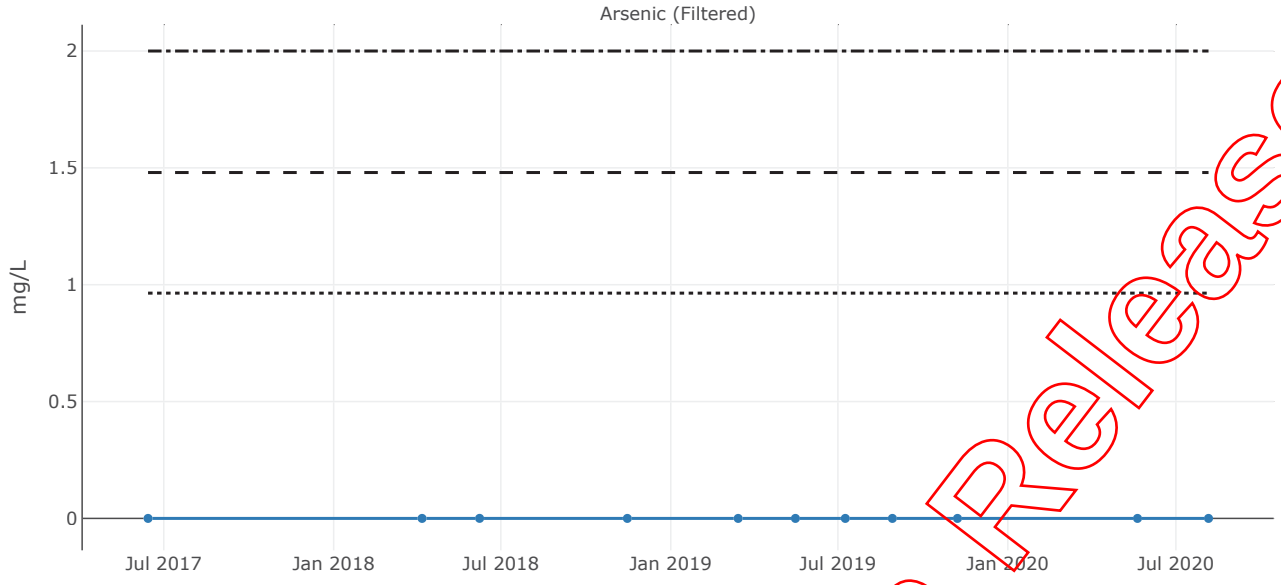

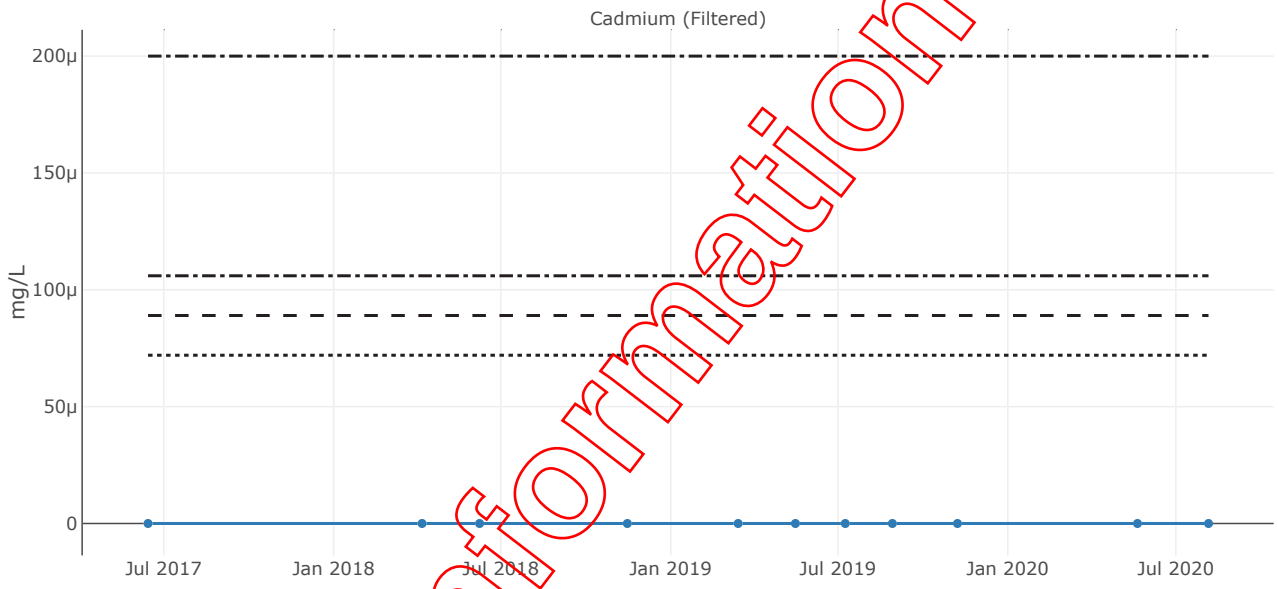

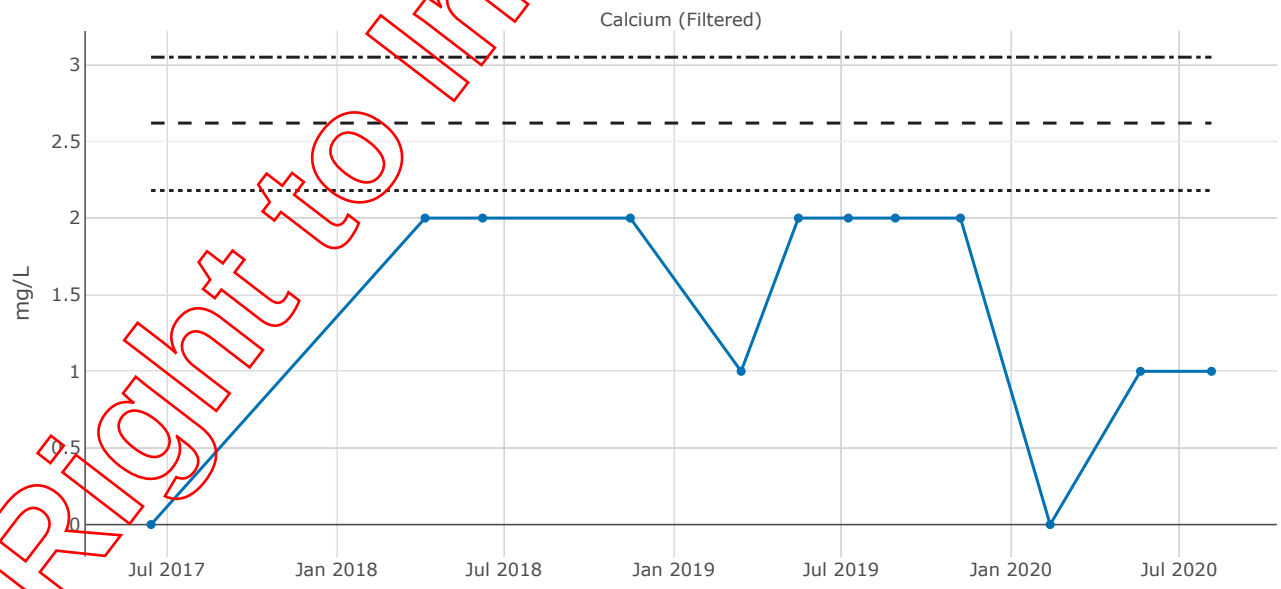

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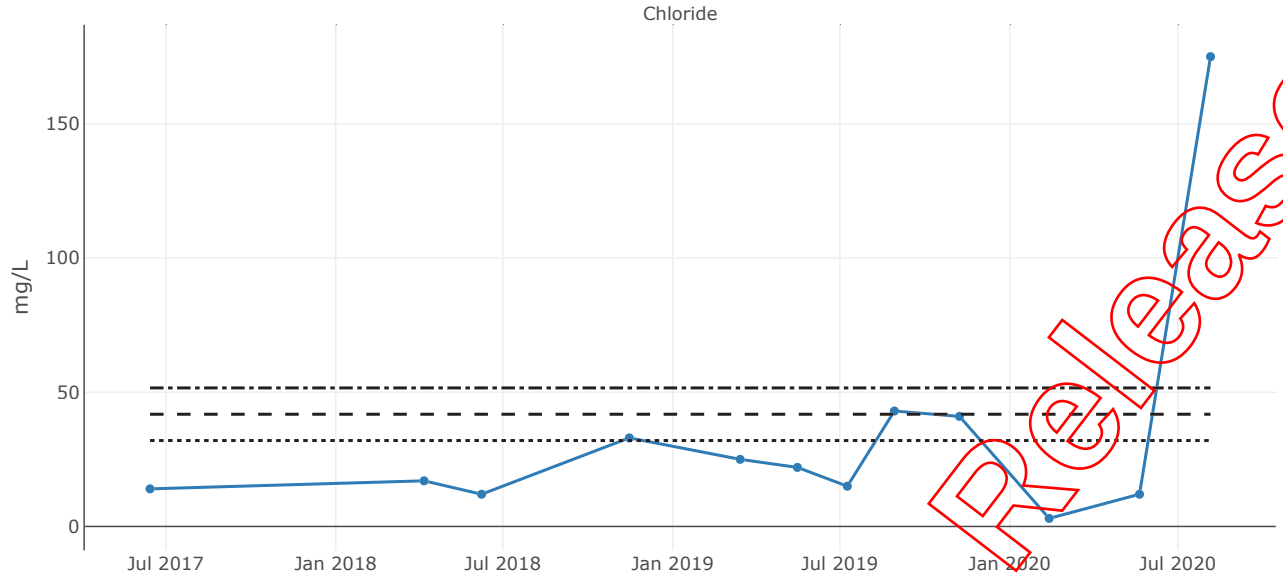

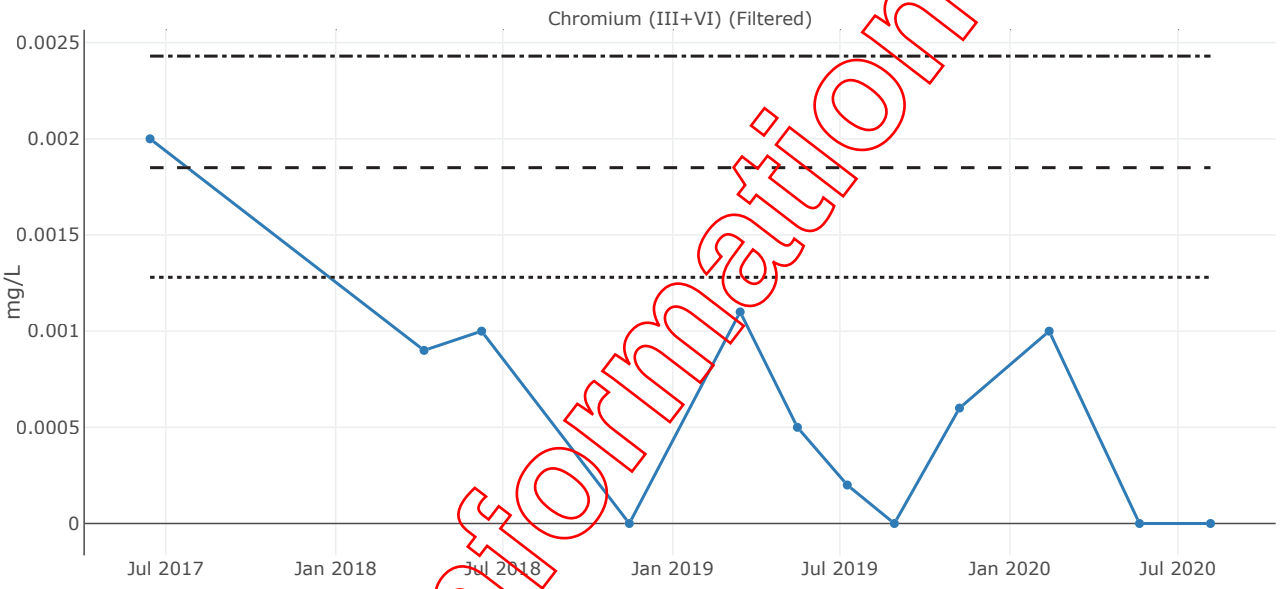

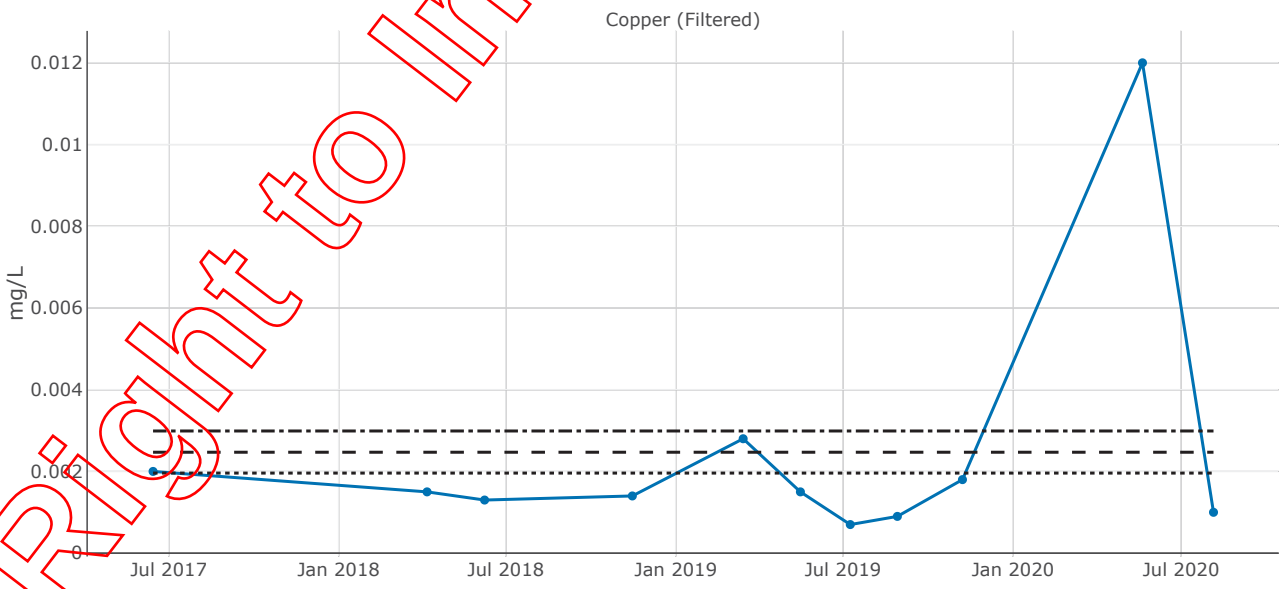

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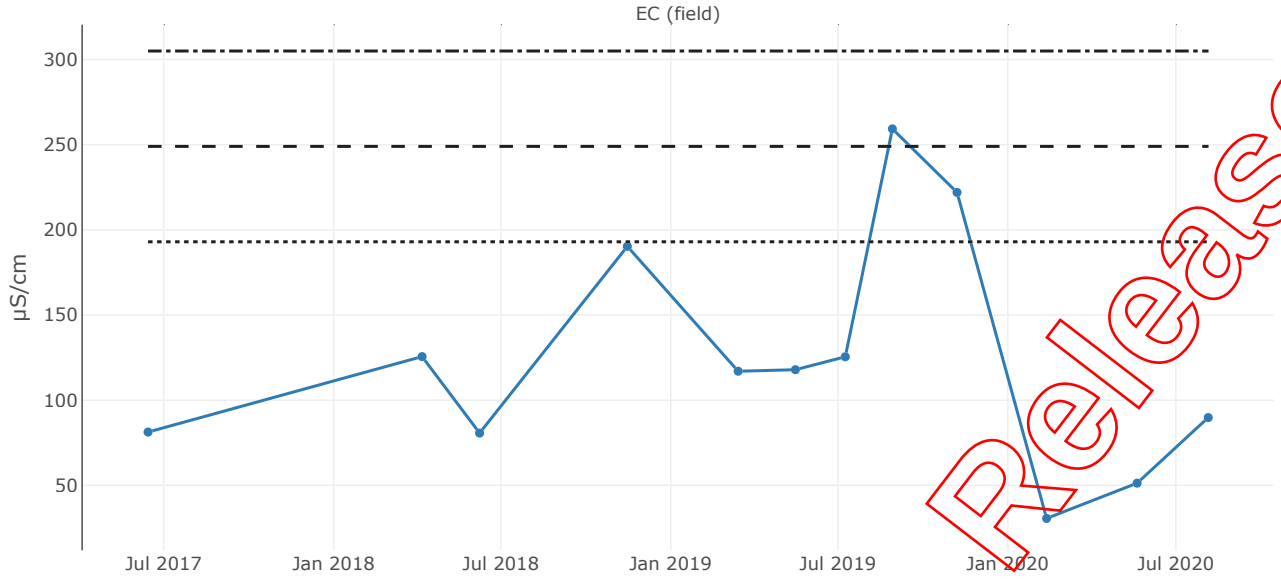

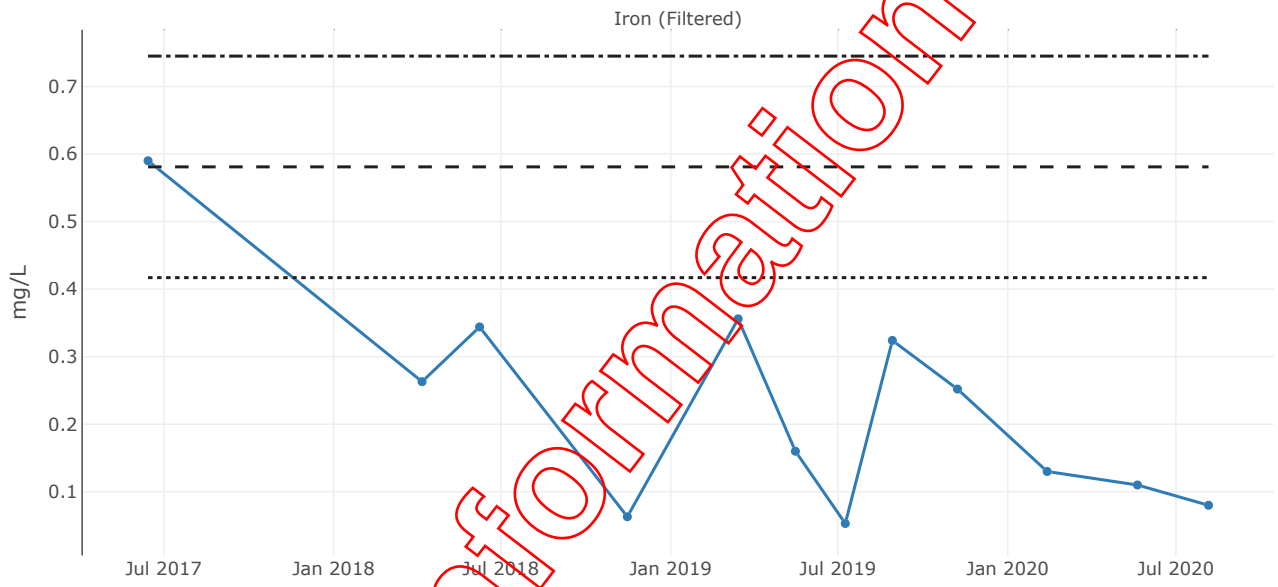

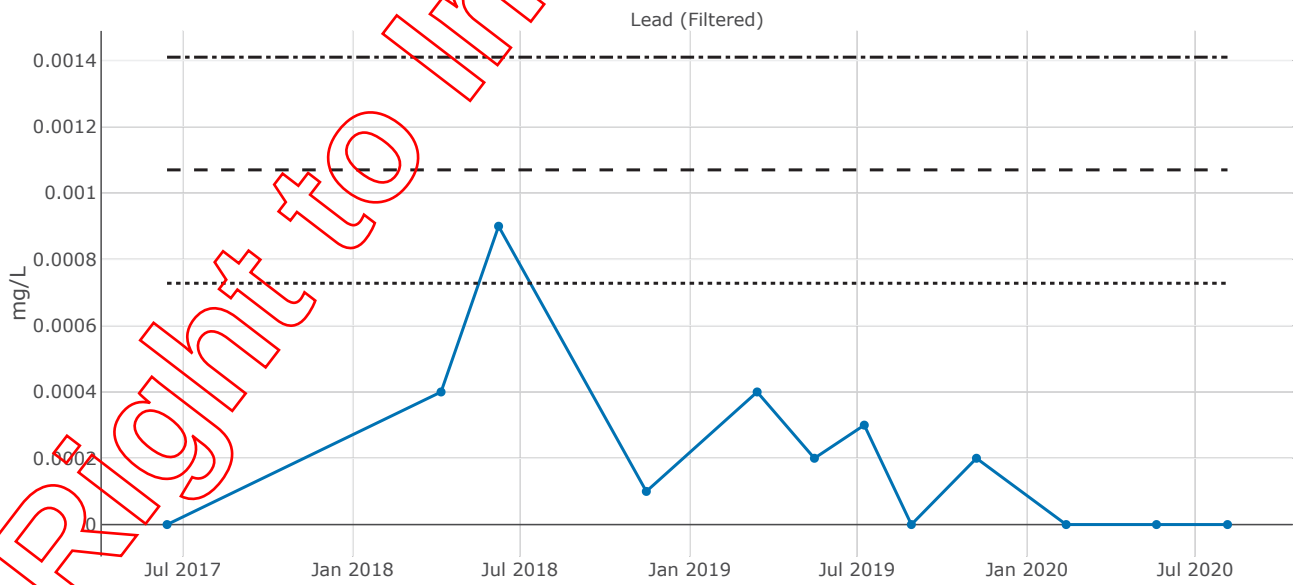

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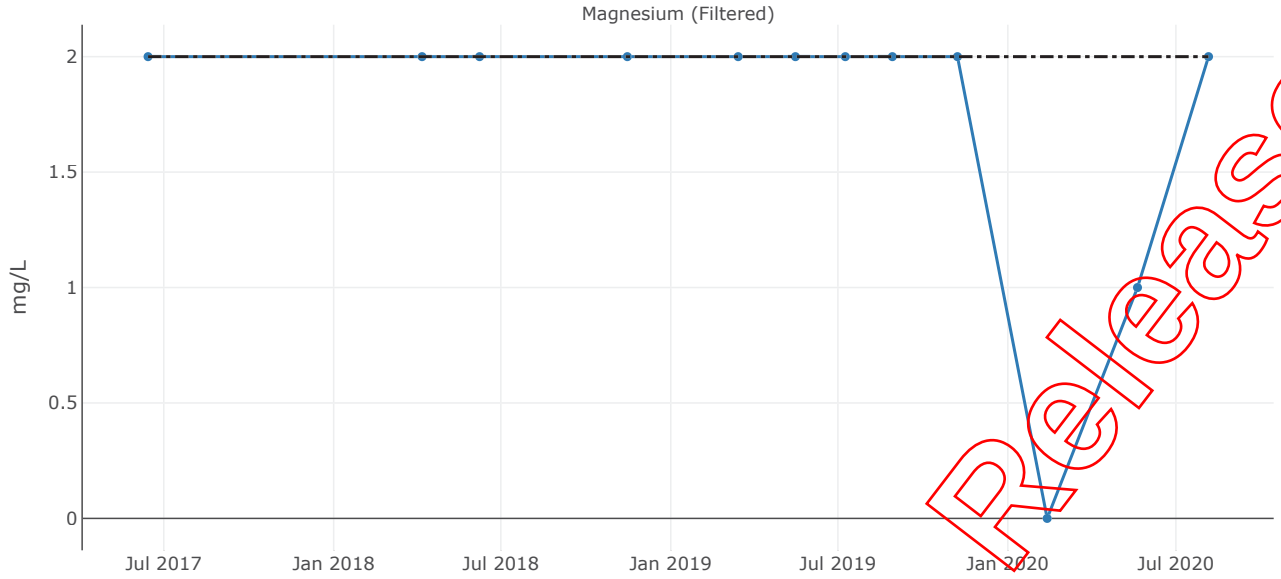

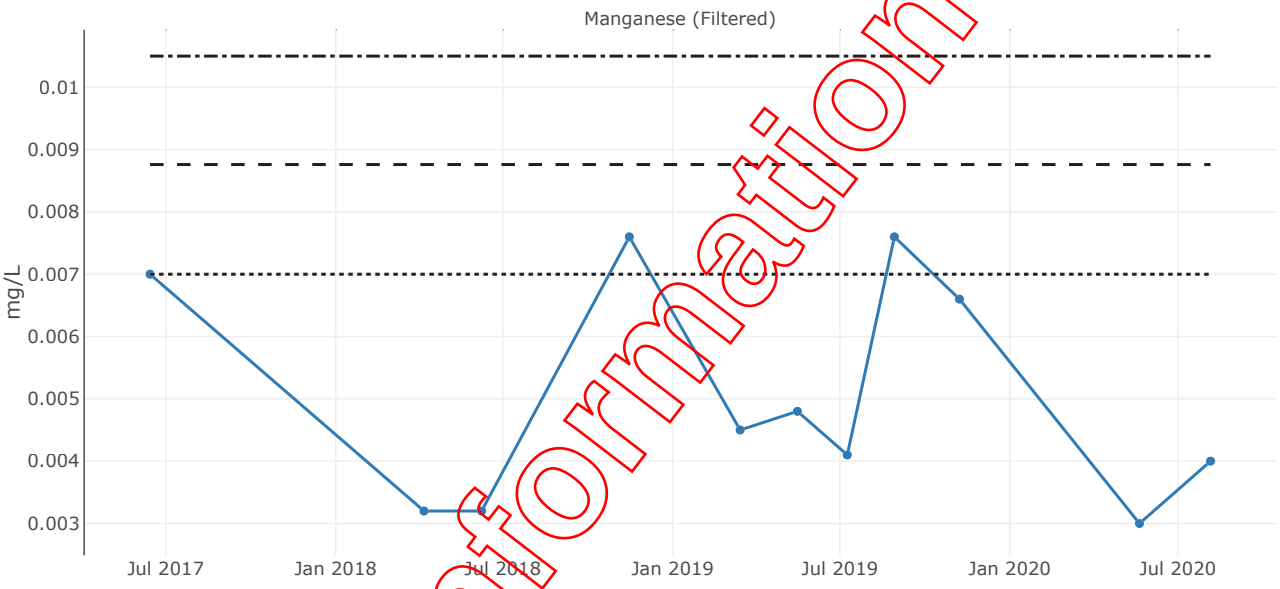

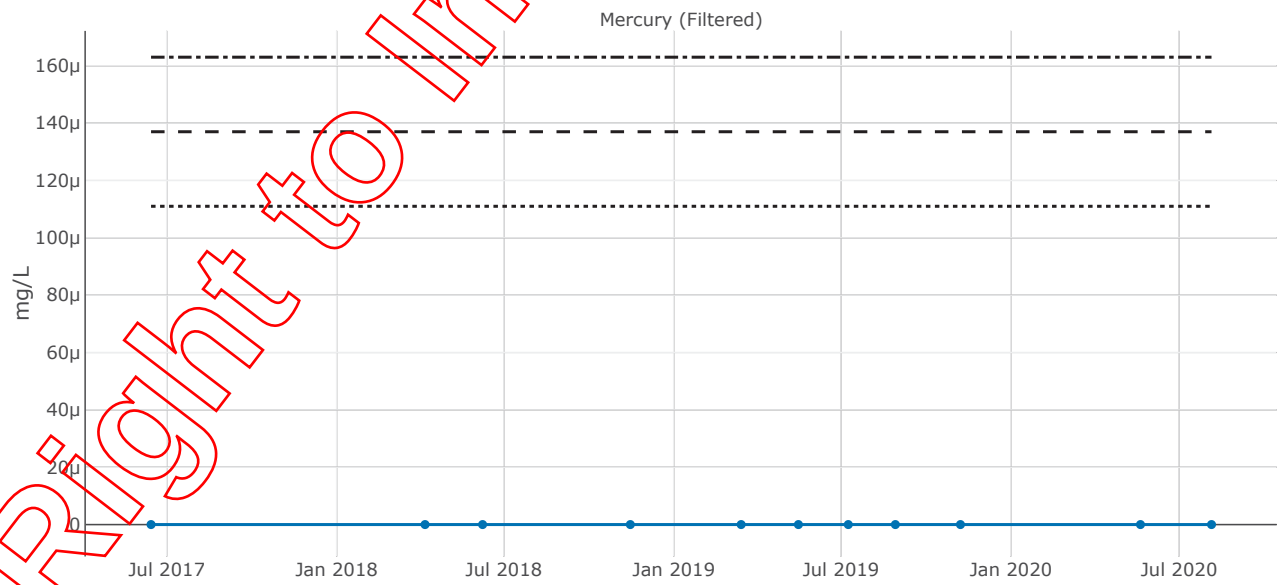

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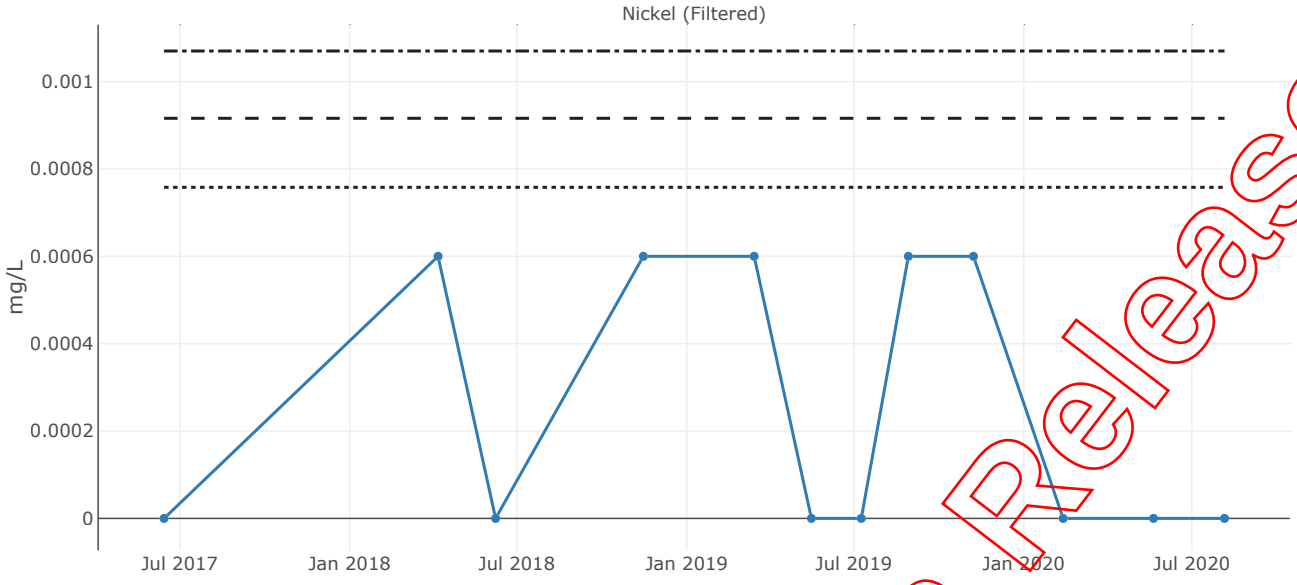

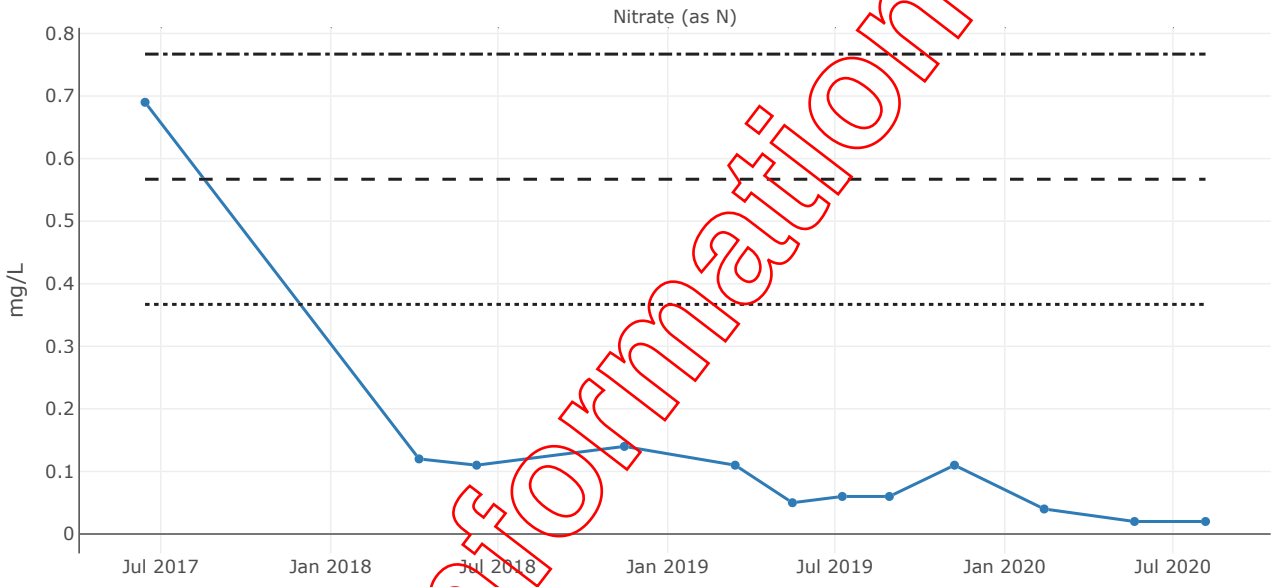

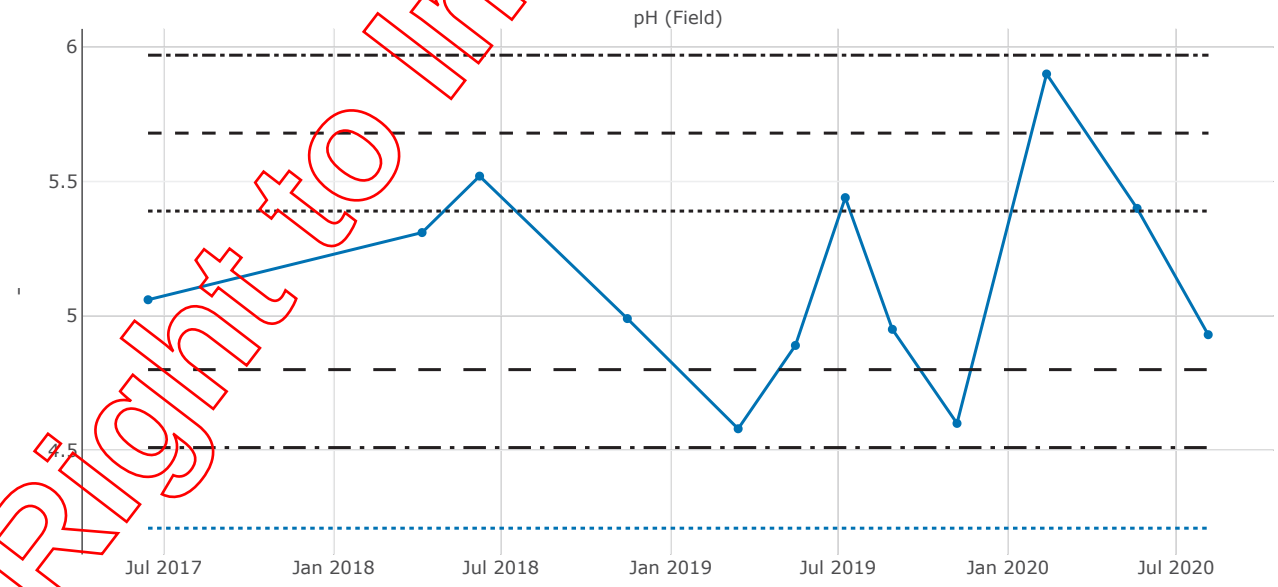

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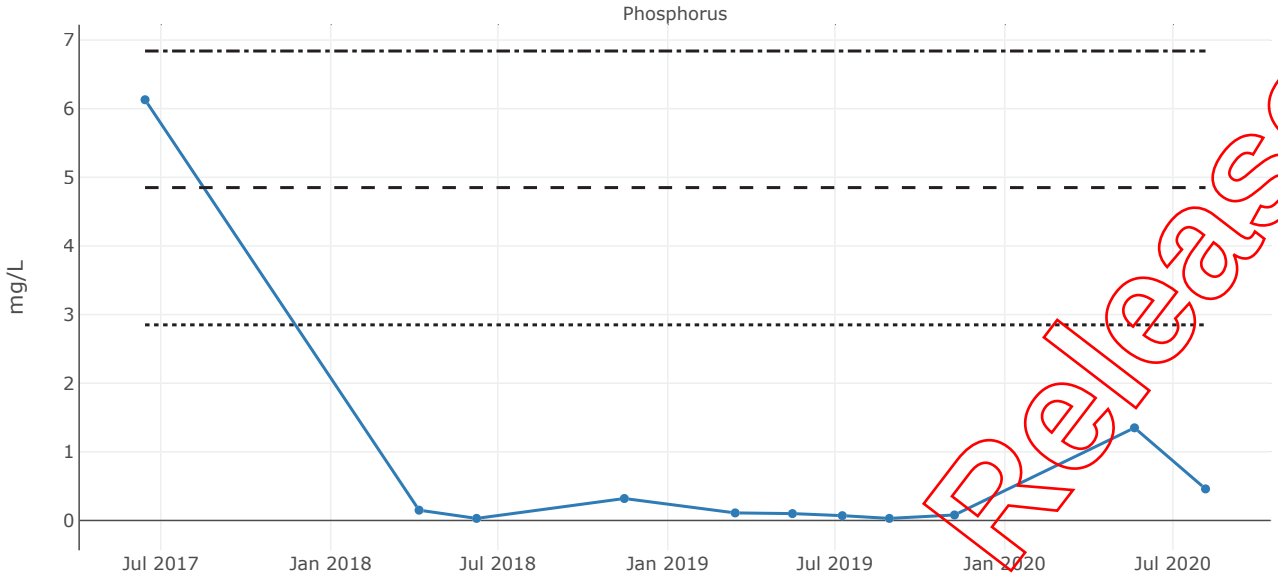

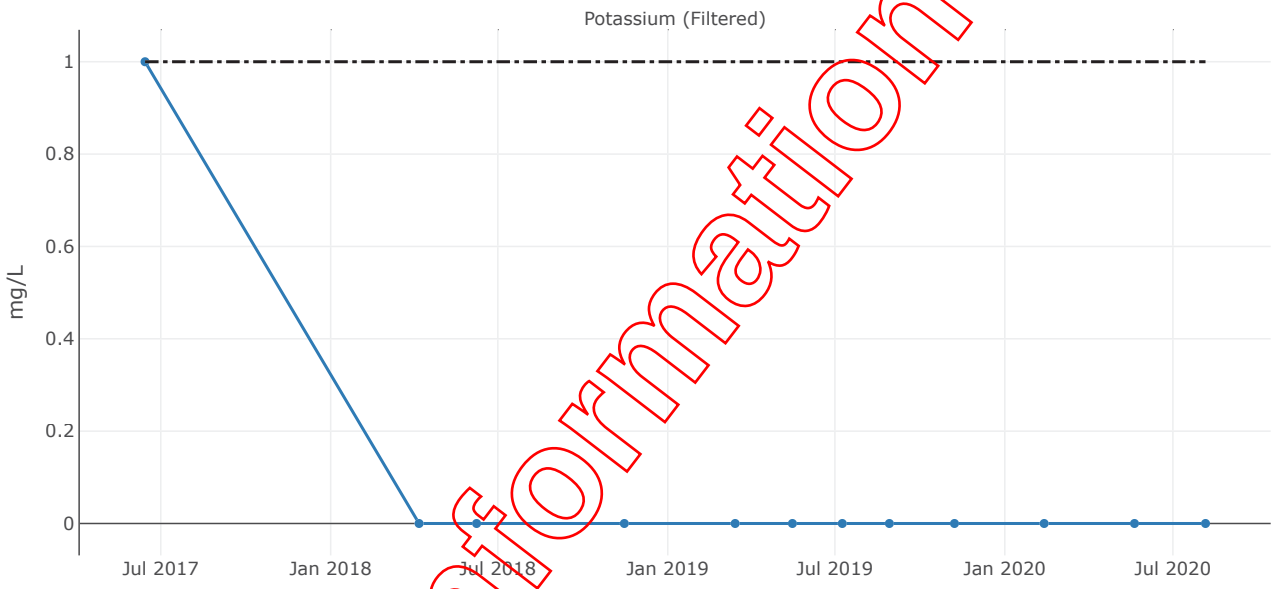

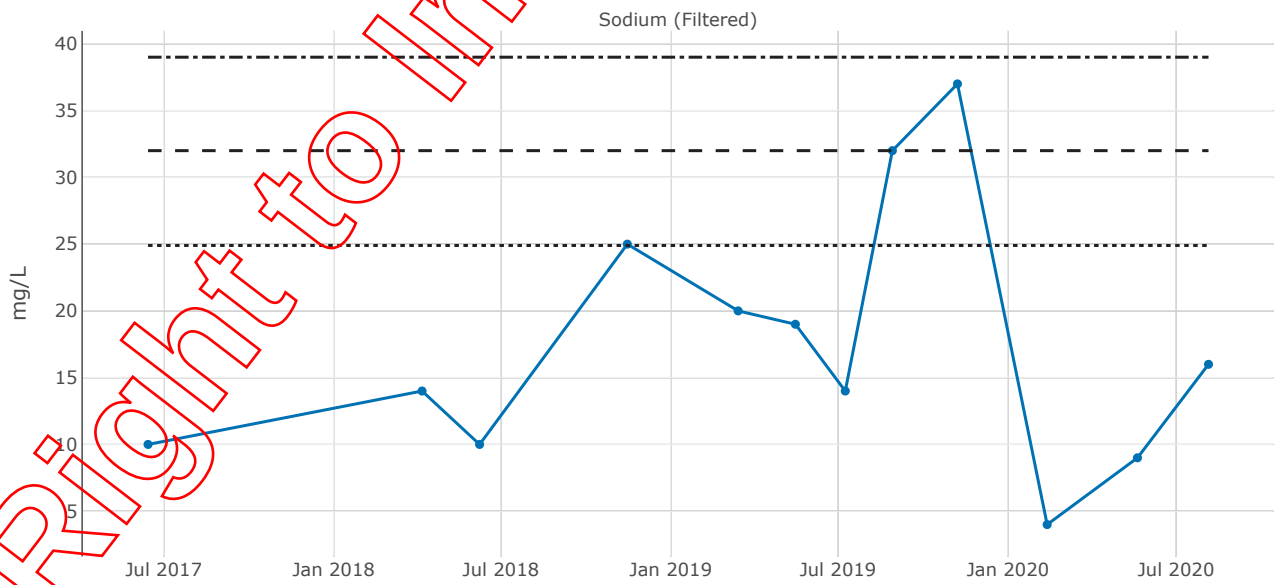

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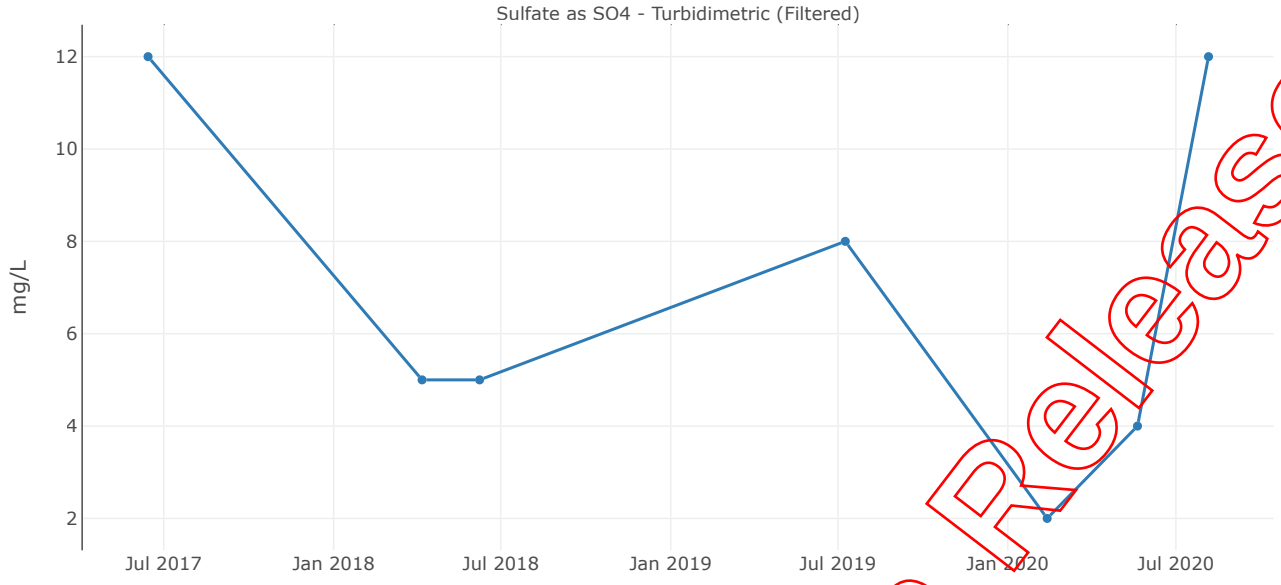
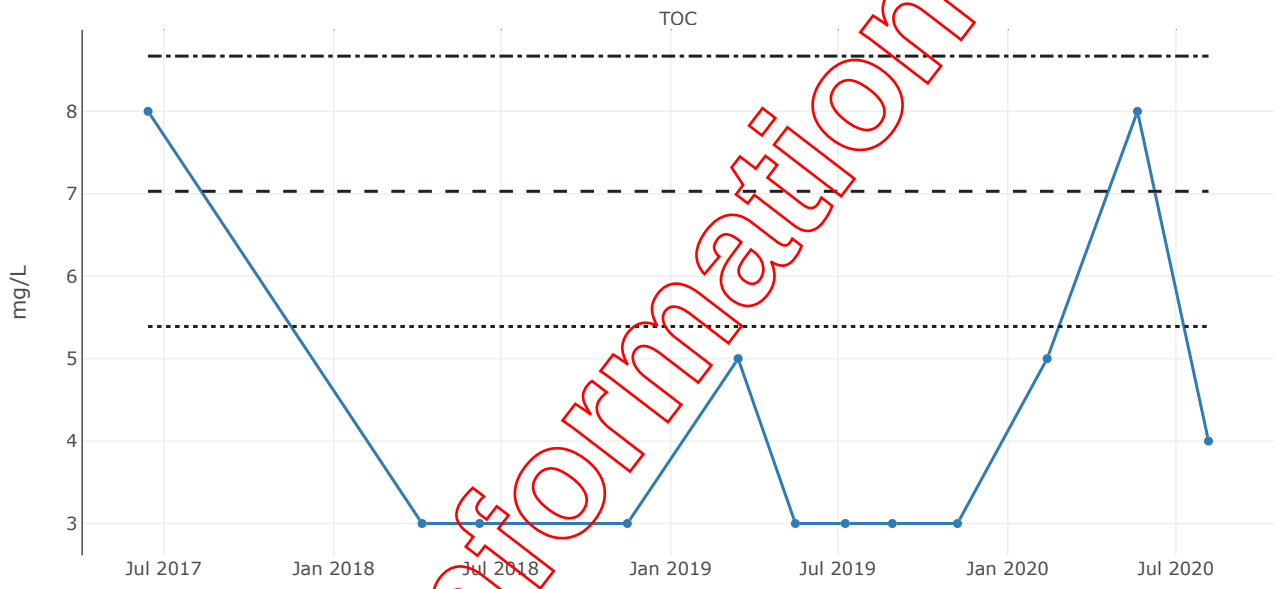
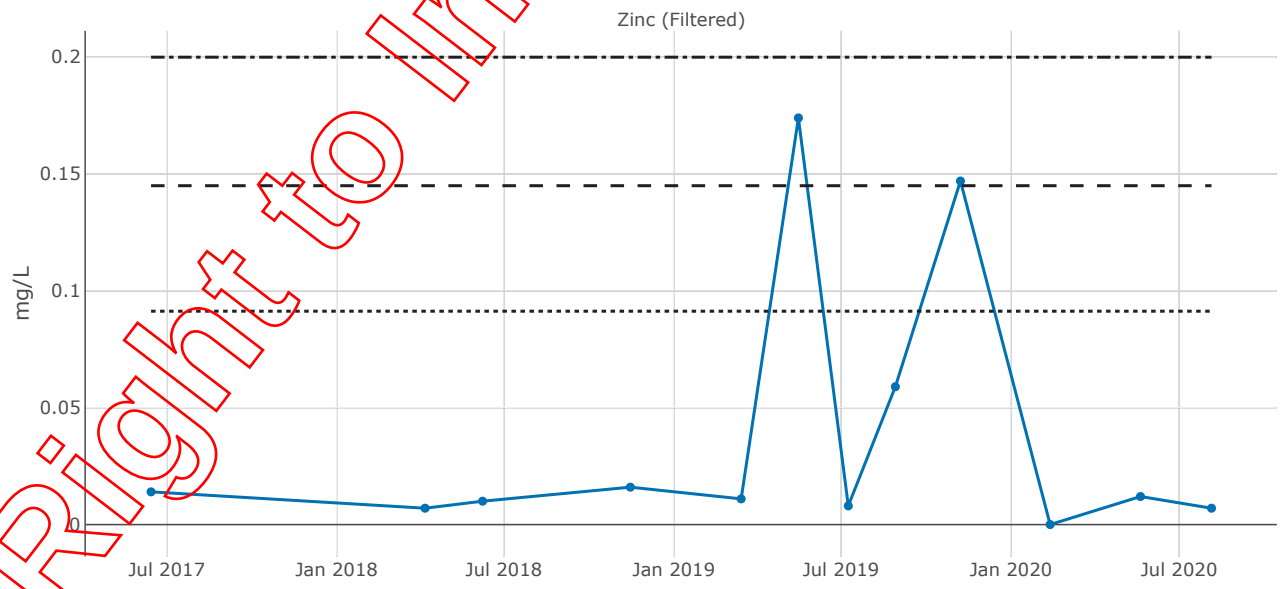






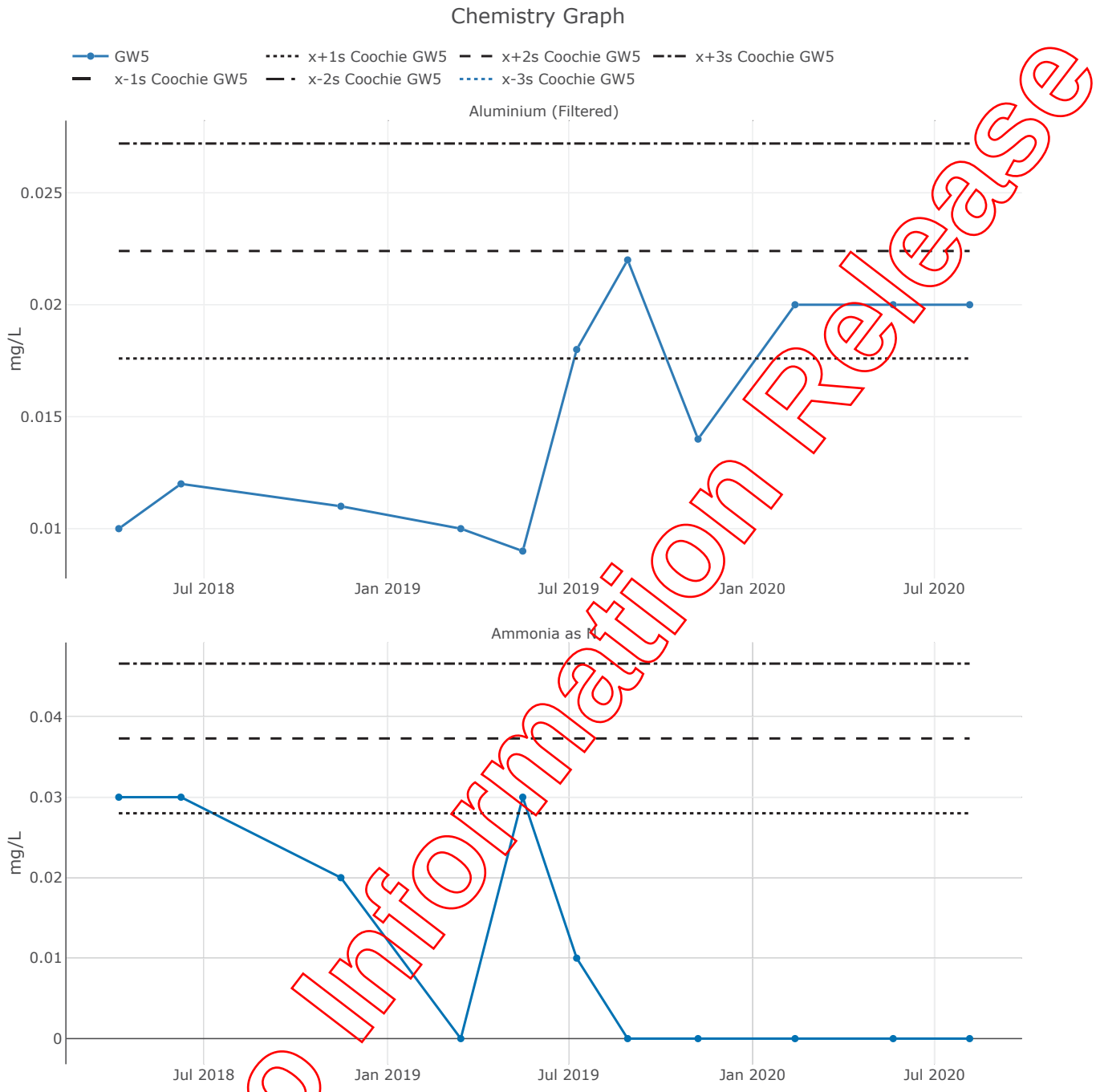
Well ID: GW3

The report was generated based on the following filter:

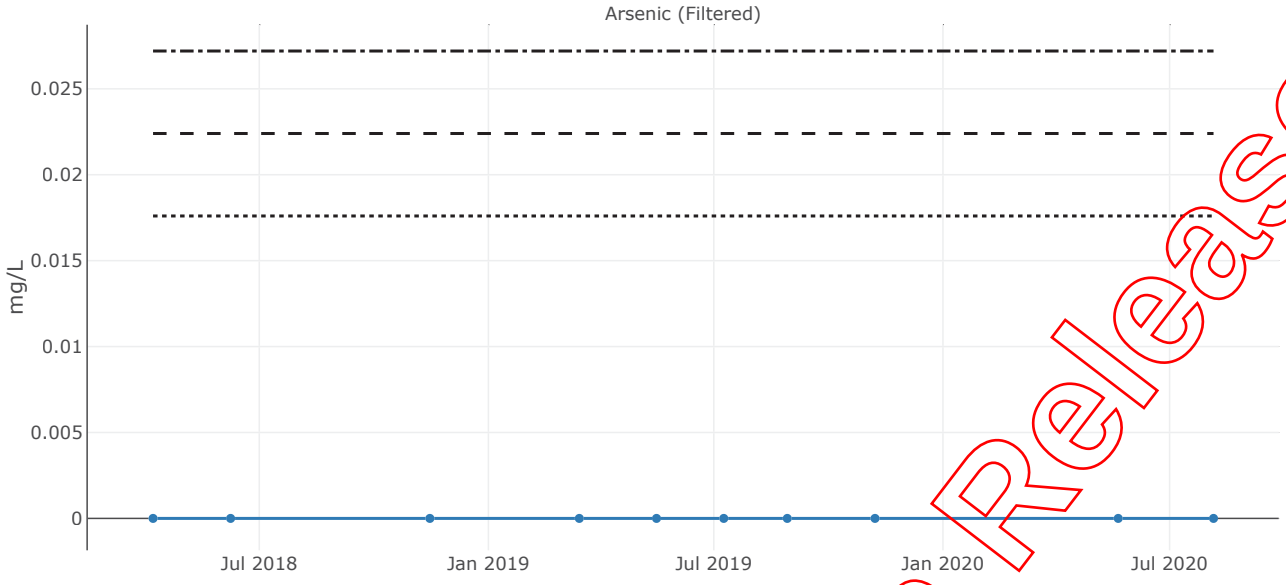
Chem Names In "Zinc,Ammonia as N,Arsenic,Cadmium,Calcium,Chromium (III+VI),Copper,EC (field),Iron,Lead,Magnesium,Manganese,Nitrate (as N),pH (Field),Potassium,Sodium,Sulfate as SO4 - Turbidimetric,TOC,Phosphorus,Nickel,Mercury,Chloride,Aluminium",
Date between "01 Jan 2010" and "19 Aug 2020",
Field or Lab Data "Both",
Projects In "Redland Landfills",
Sites In "Coochiemudlo Island",
Locations In "undefined"

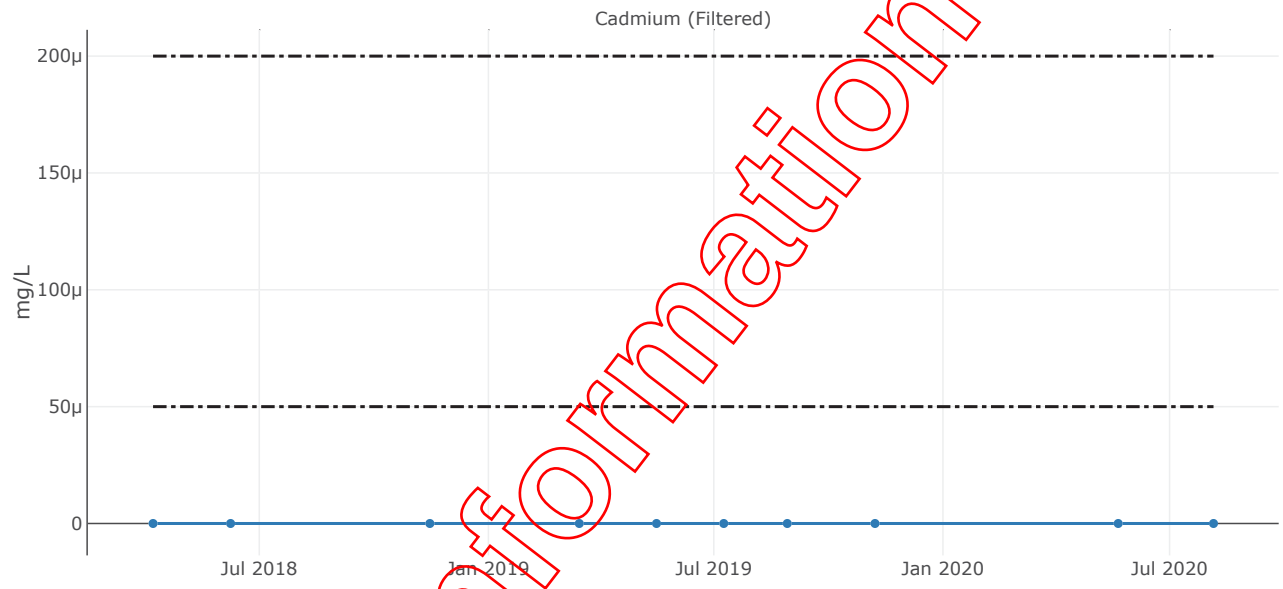
Publication Date: 20 Aug 2020

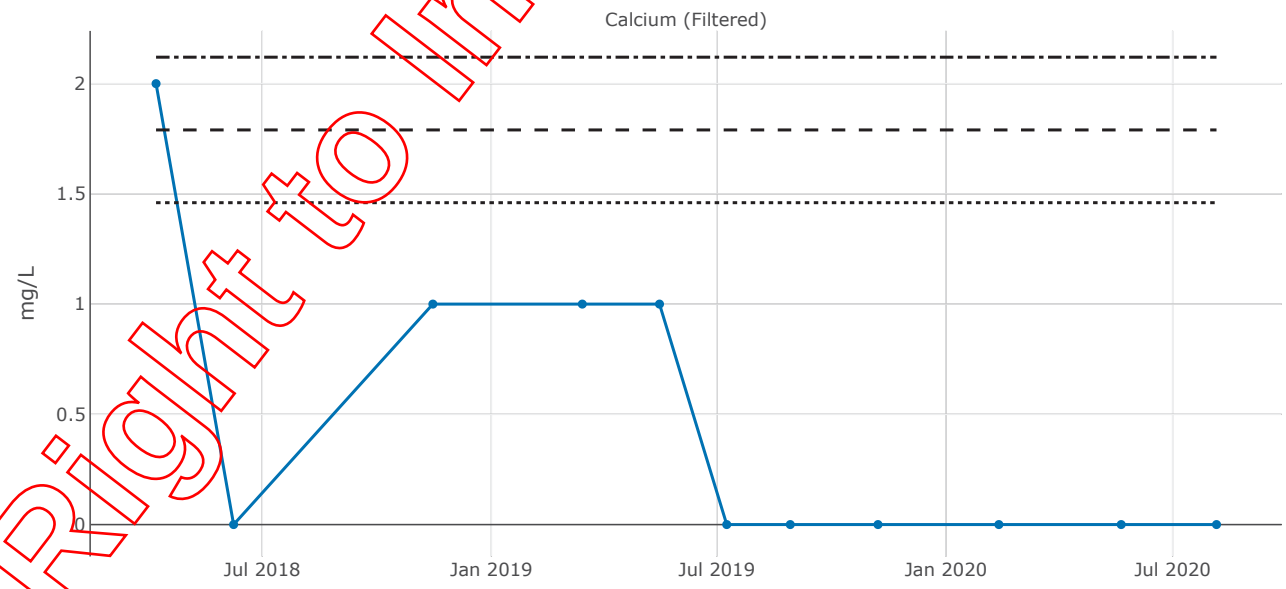
Well ID: GW5



Well ID: GW5







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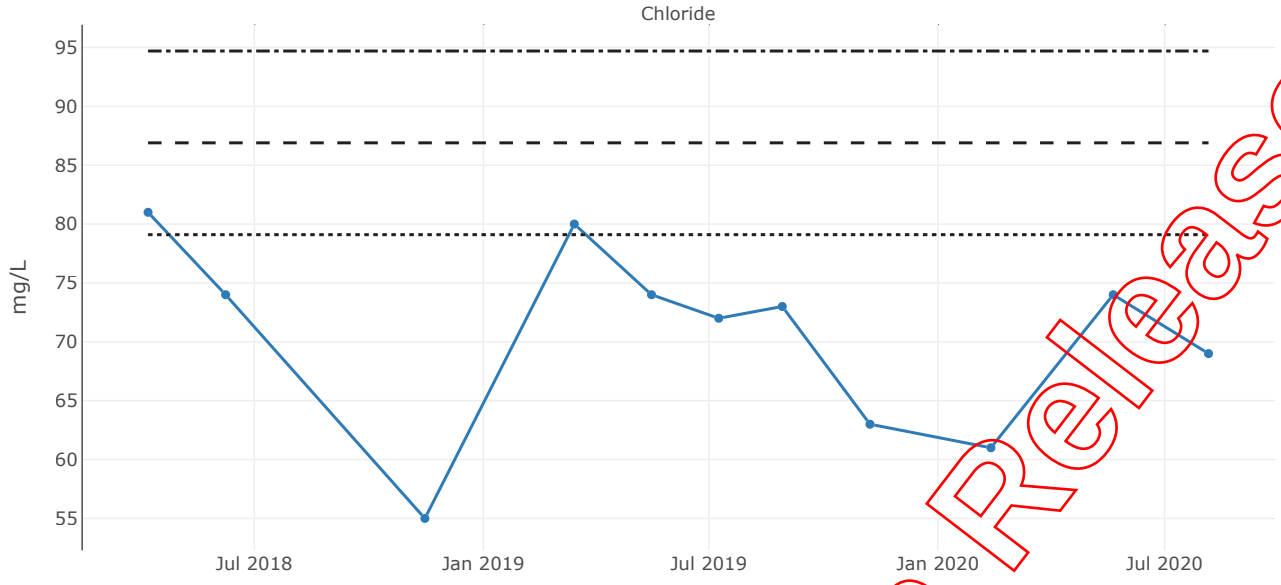

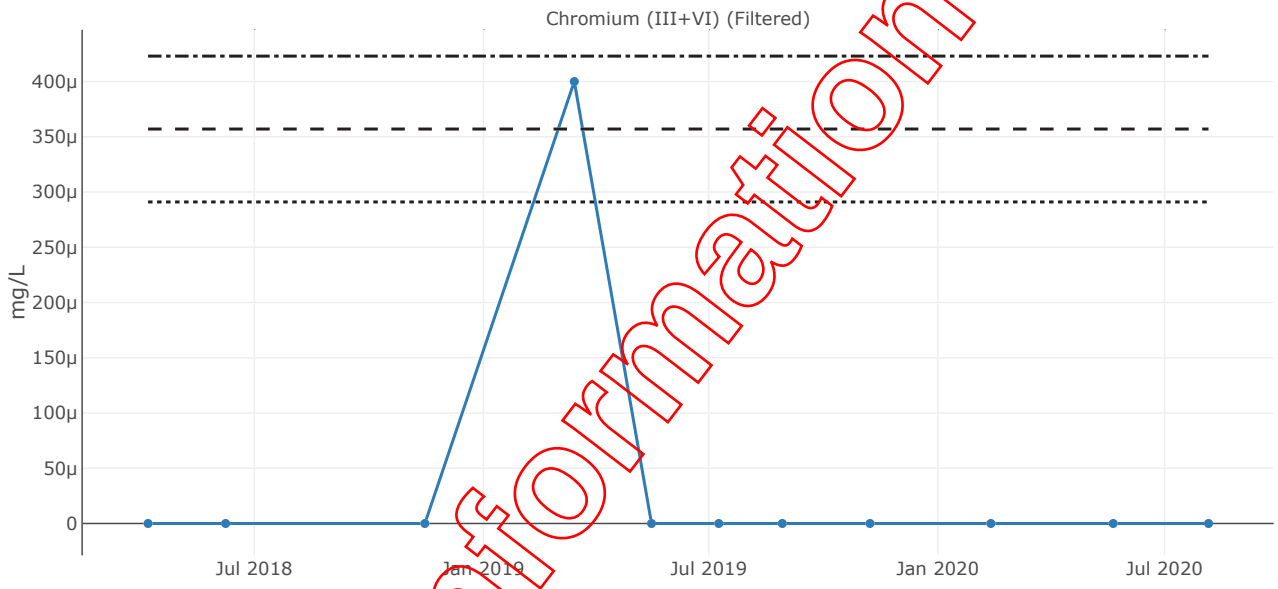

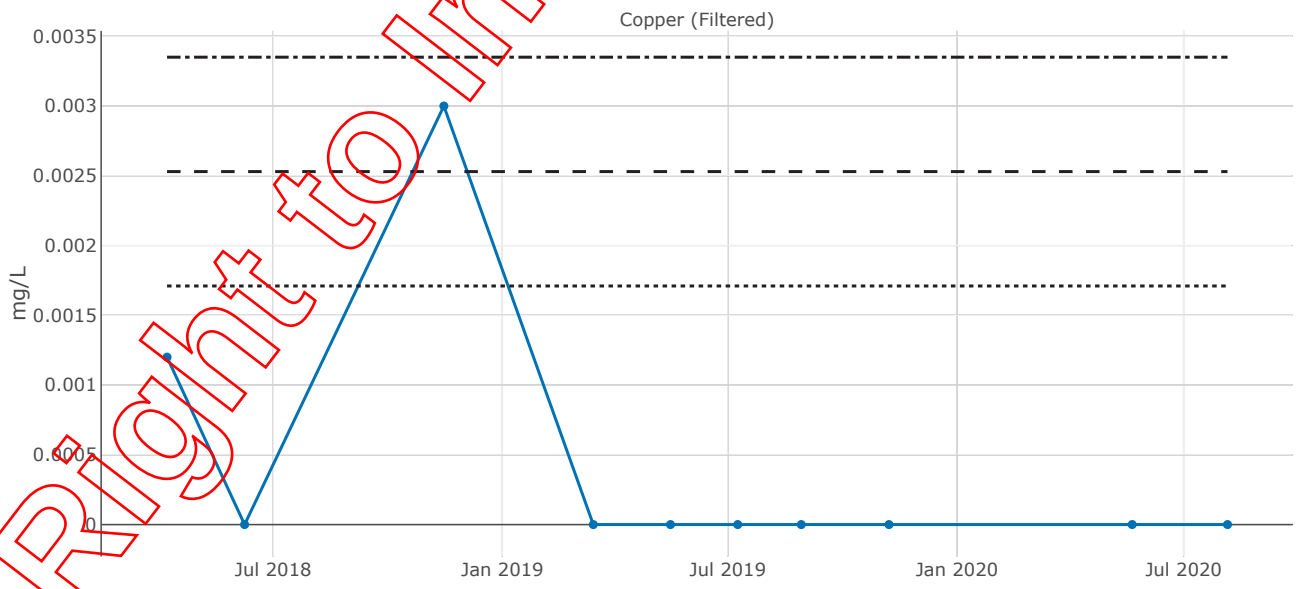

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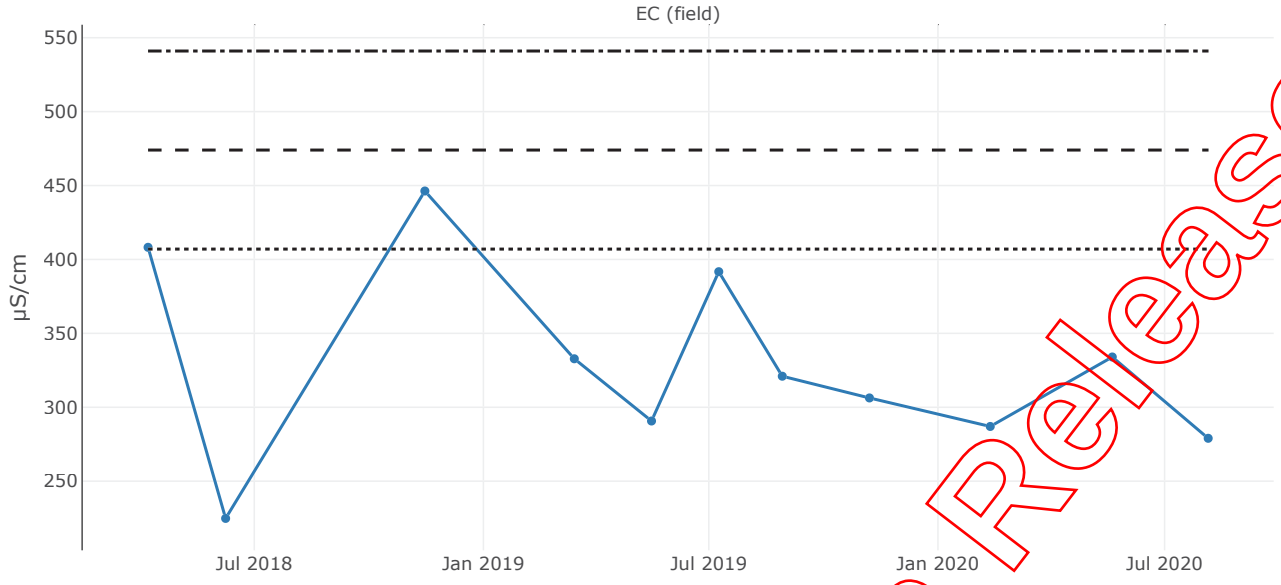

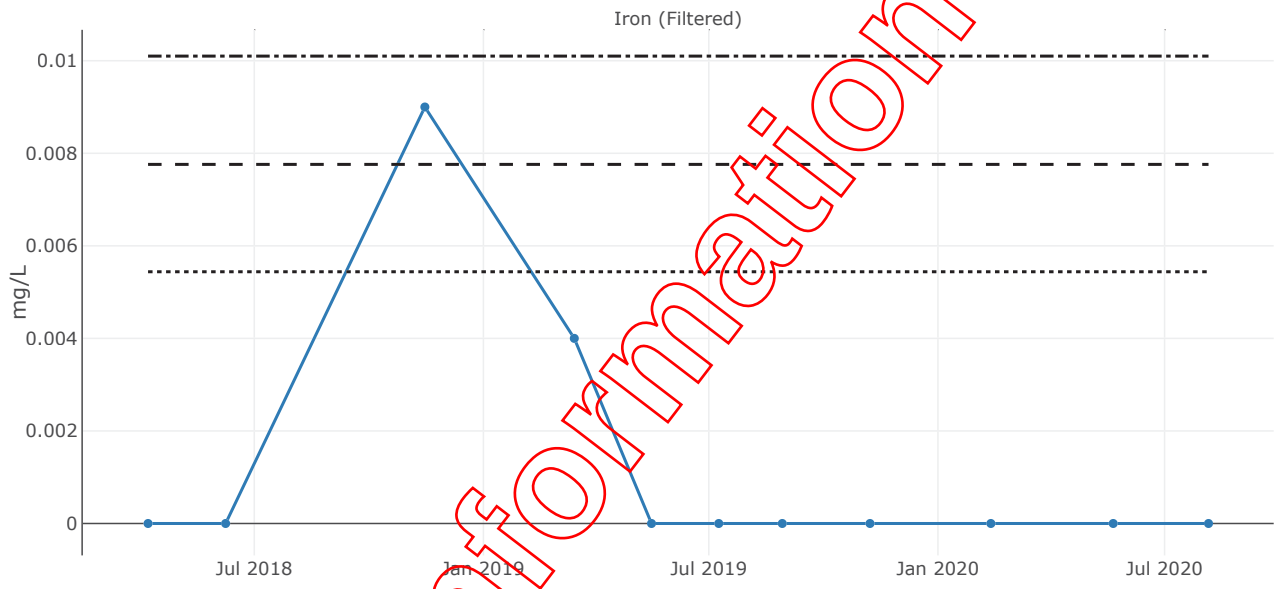

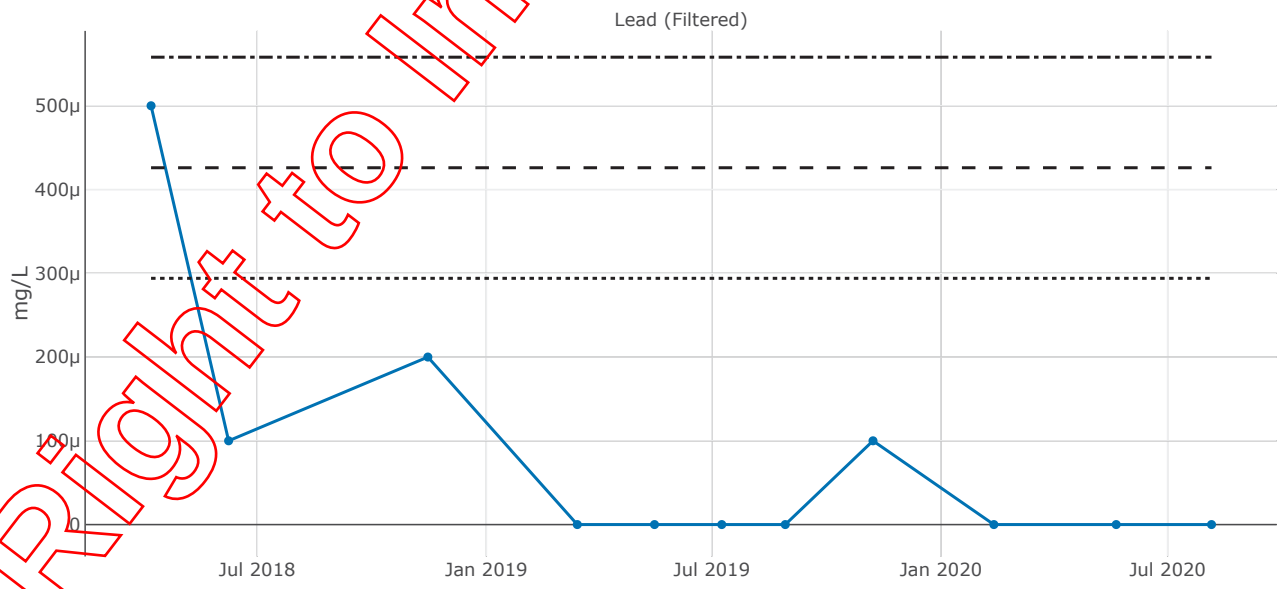

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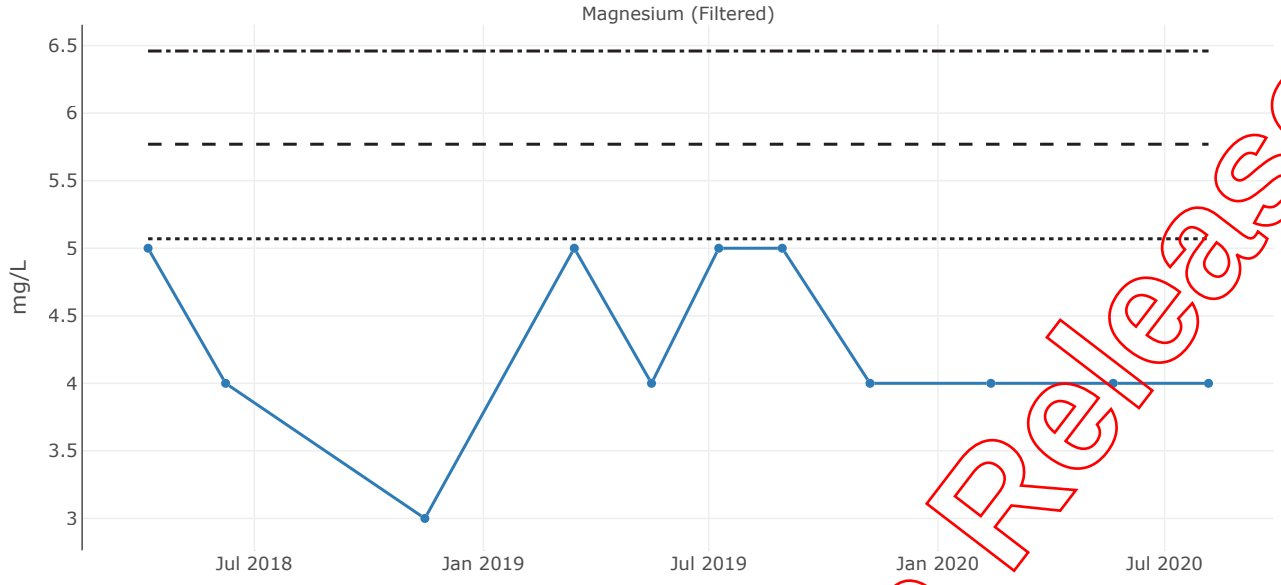

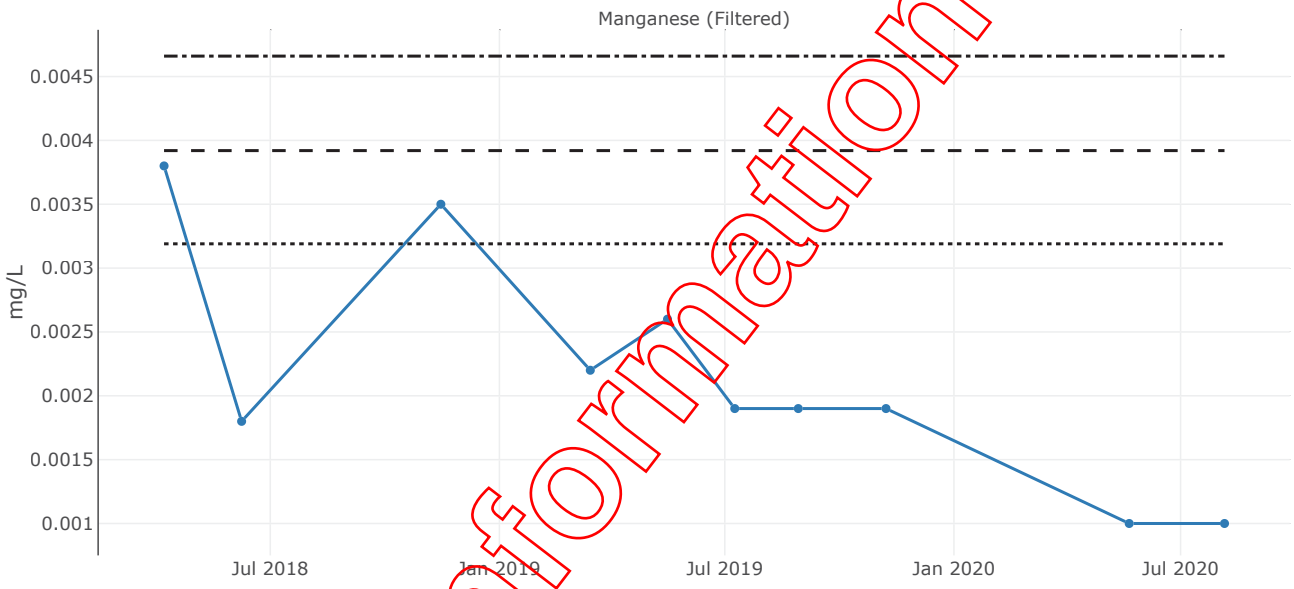

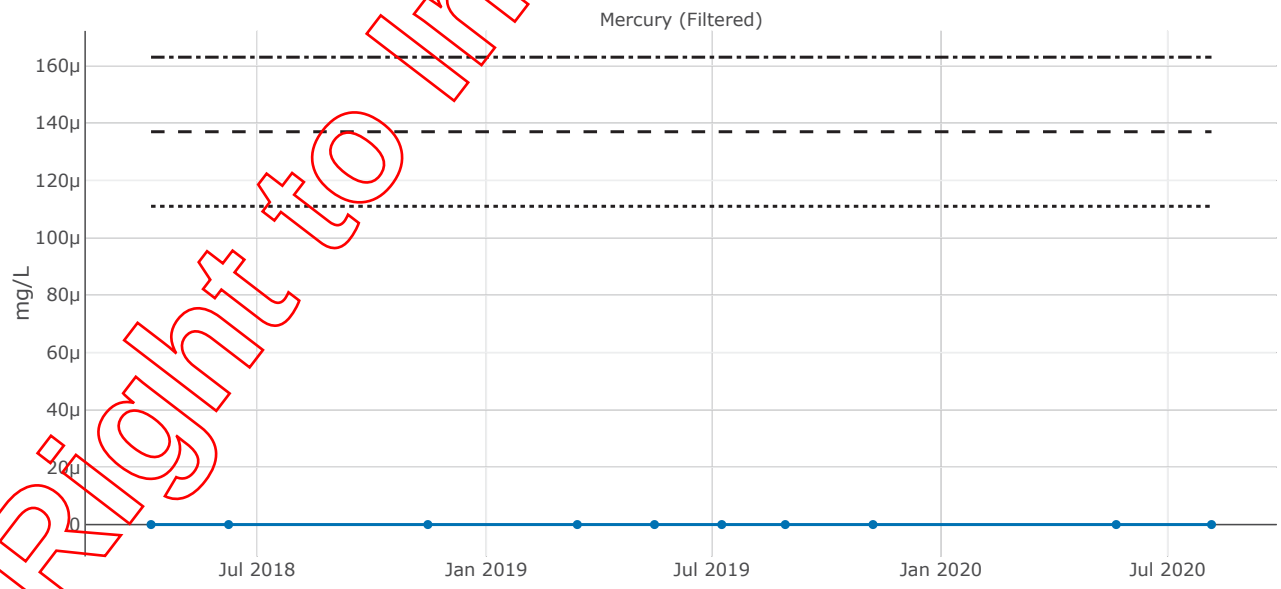

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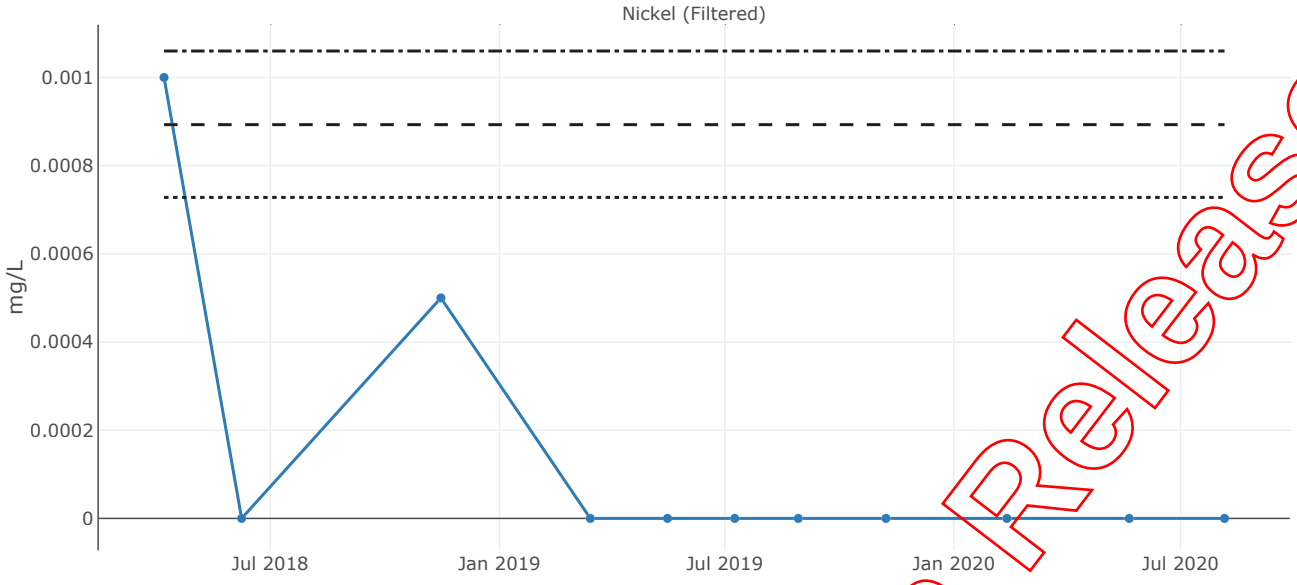

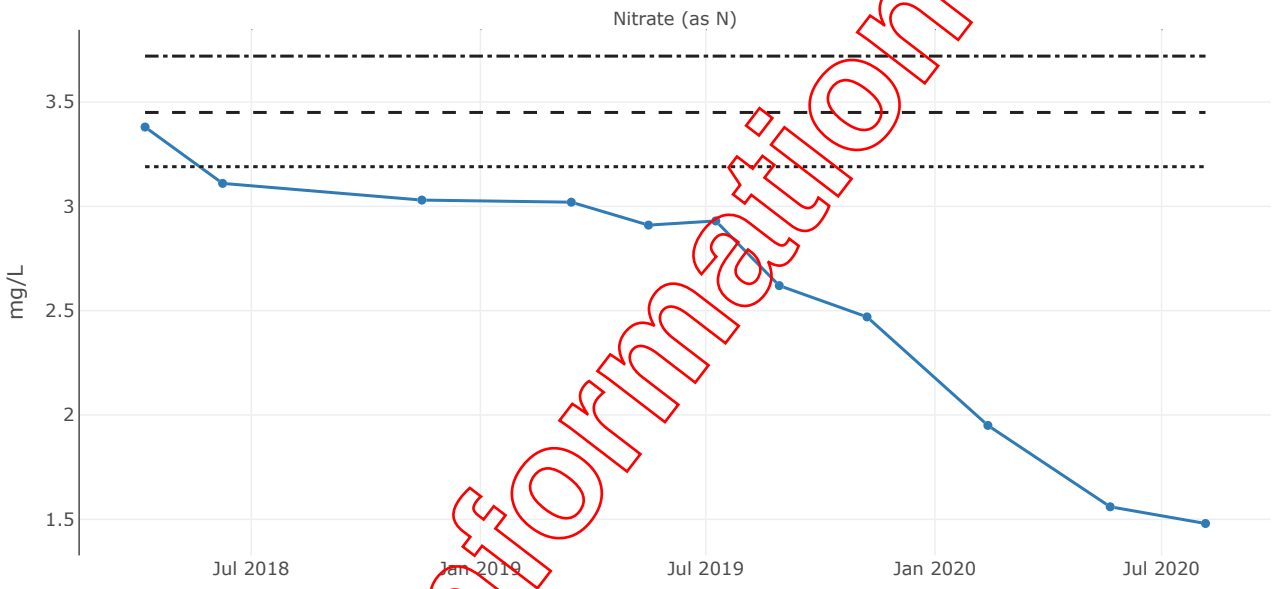

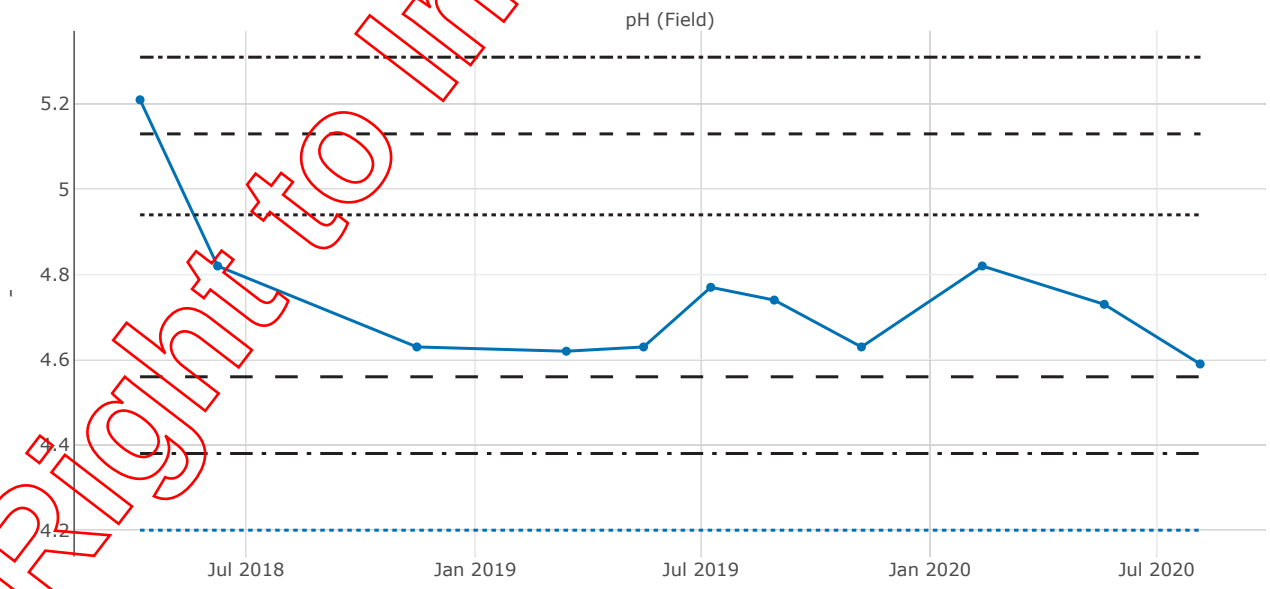

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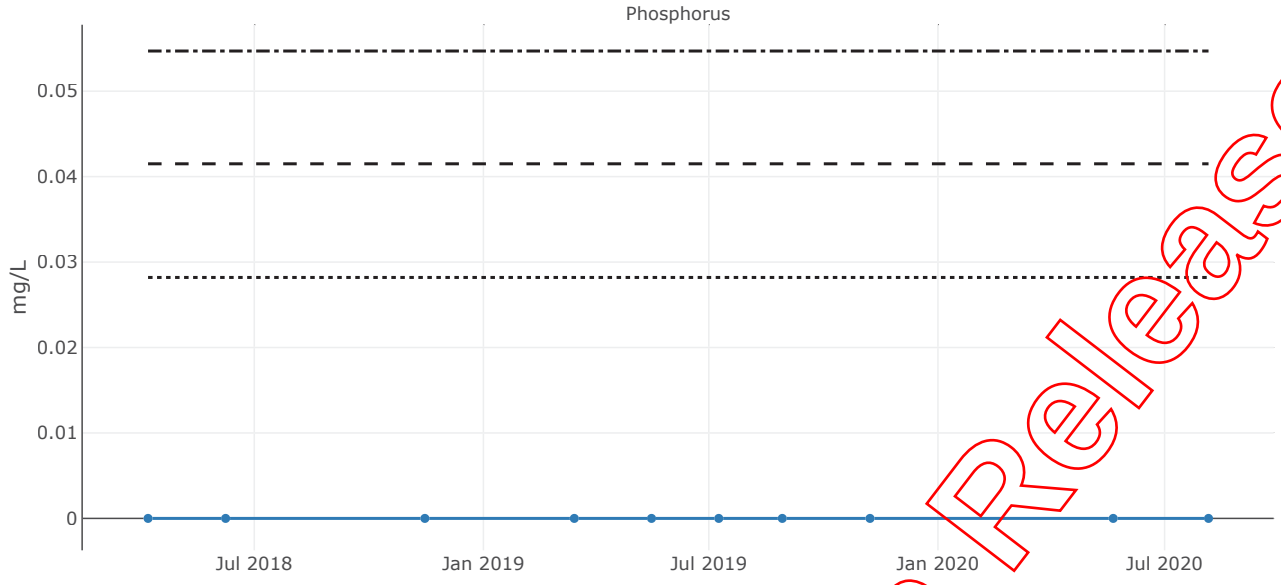

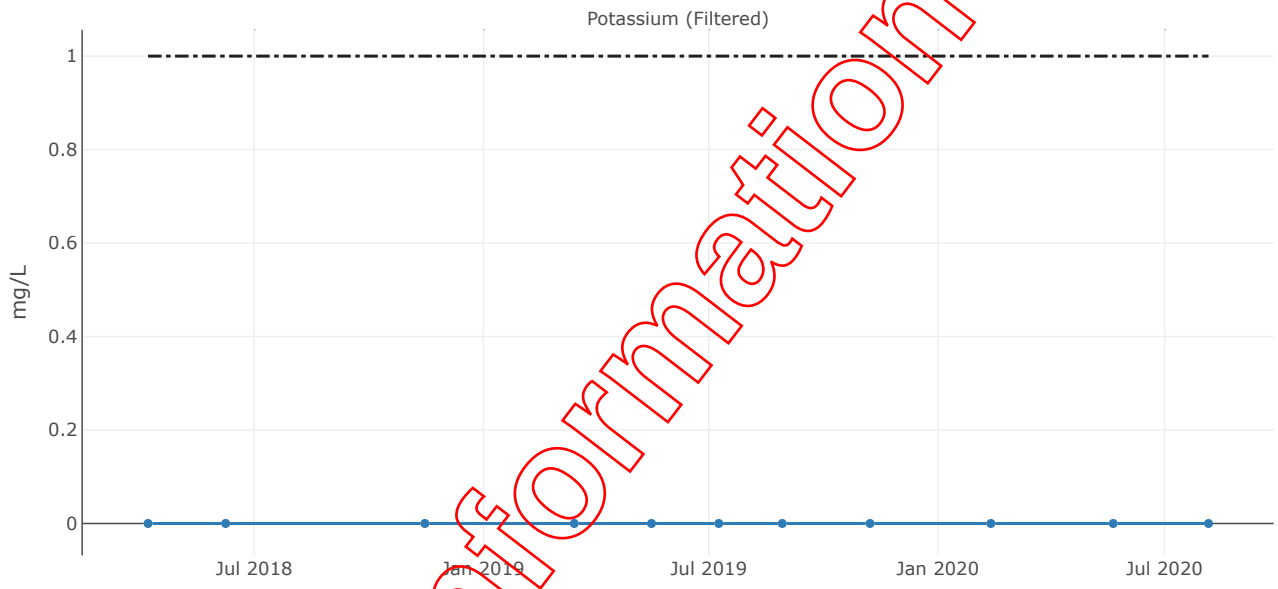

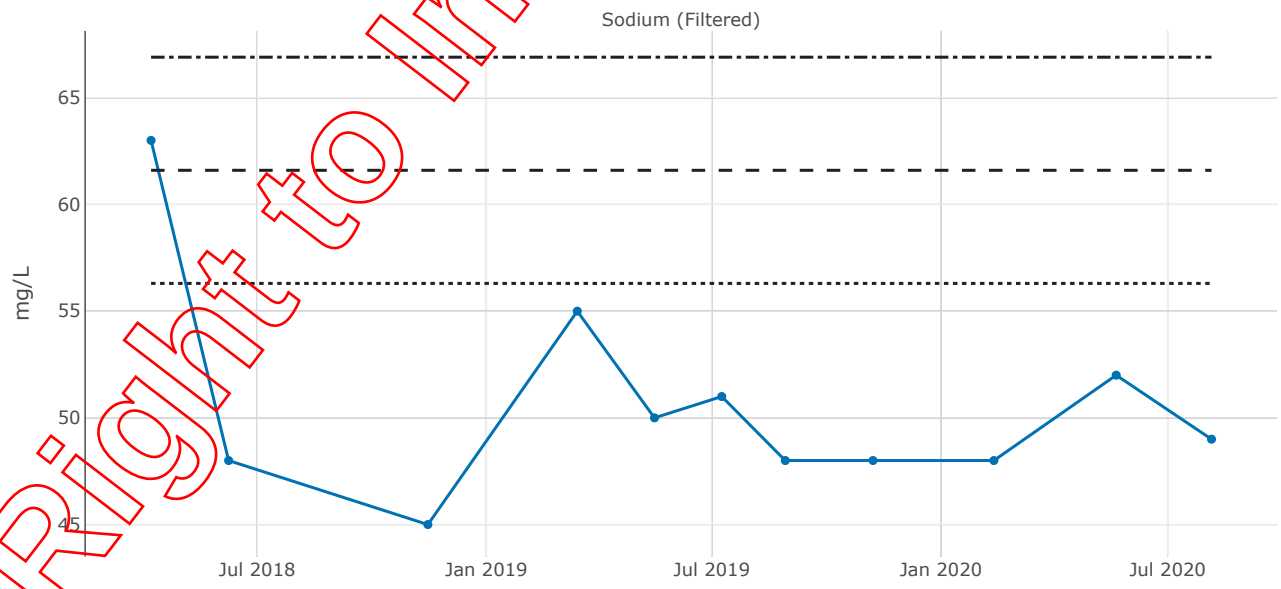

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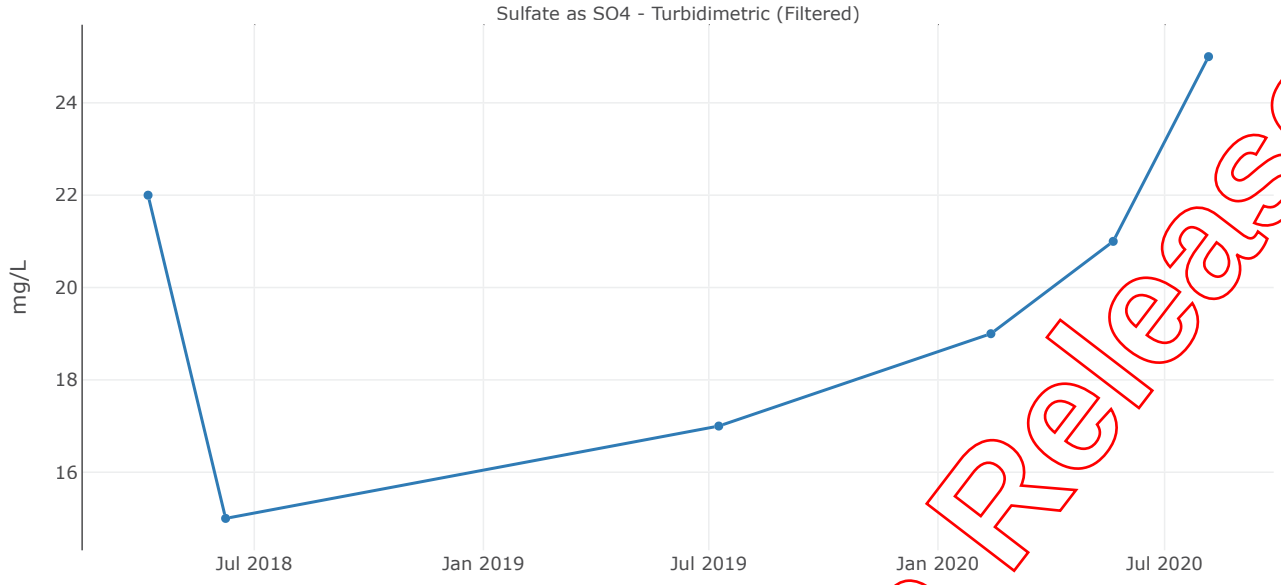
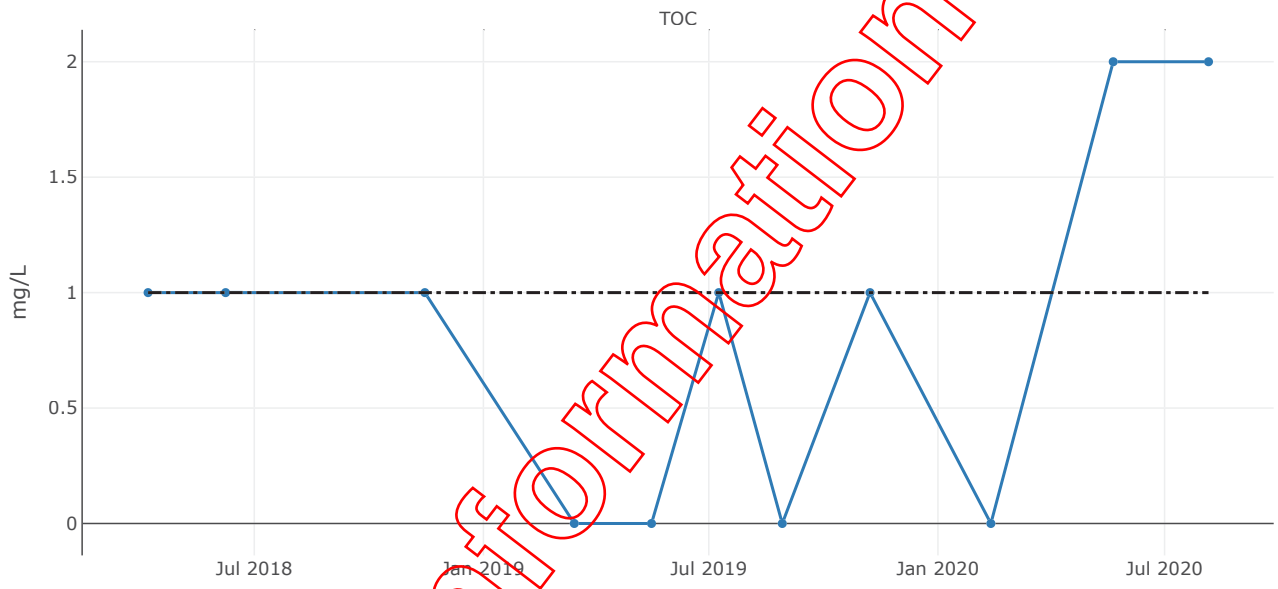
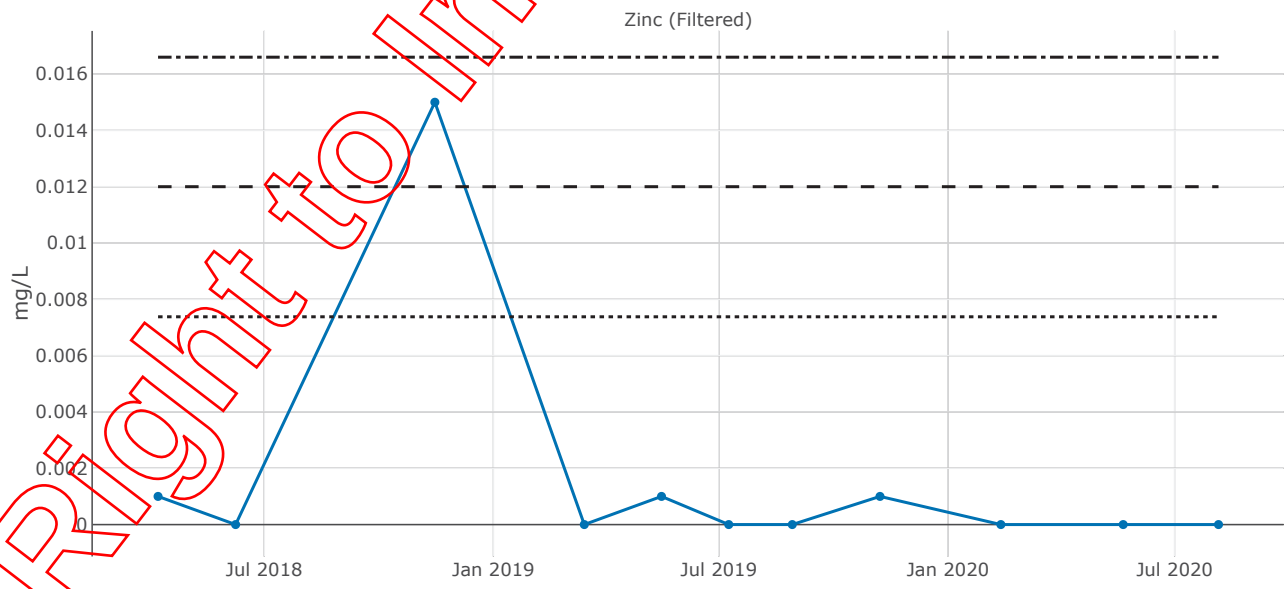






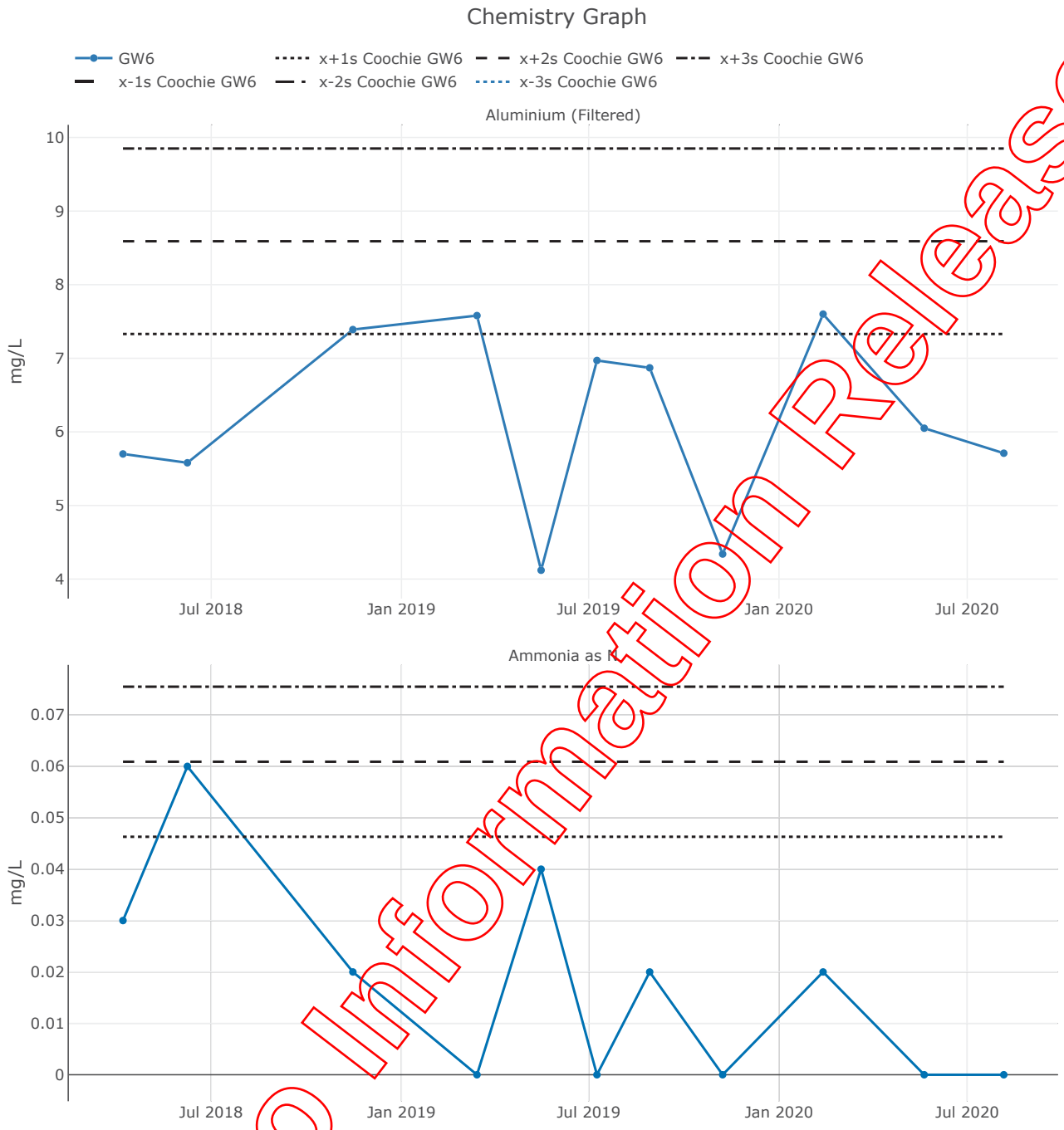
Well ID: GW5

The report was generated based on the following filter:

Chem Names In "Zinc,Ammonia as N,Arsenic,Cadmium,Calcium,Chromium (III+VI),Copper,EC (field),Iron,Lead,Magnesium,Manganese,Nitrate (as N),pH (Field),Potassium,Sodium,Sulfate as SO4 - Turbidimetric,TOC,Phosphorus,Nickel,Mercury,Chloride,Aluminium",
Date between "01 Jan 2010" and "19 Aug 2020",
Field or Lab Data "Both",
Projects In "Redland Landfills",
Sites In "Coochiemudlo Island",
Locations In "undefined"

Publication Date: 20 Aug 2020

Well ID: GW6



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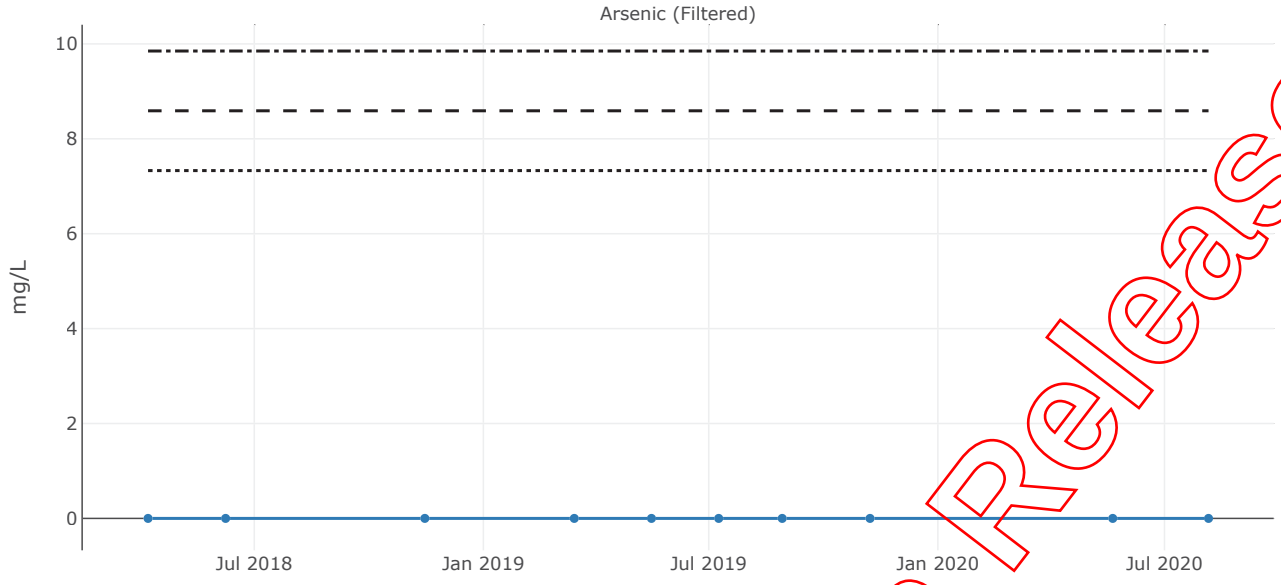

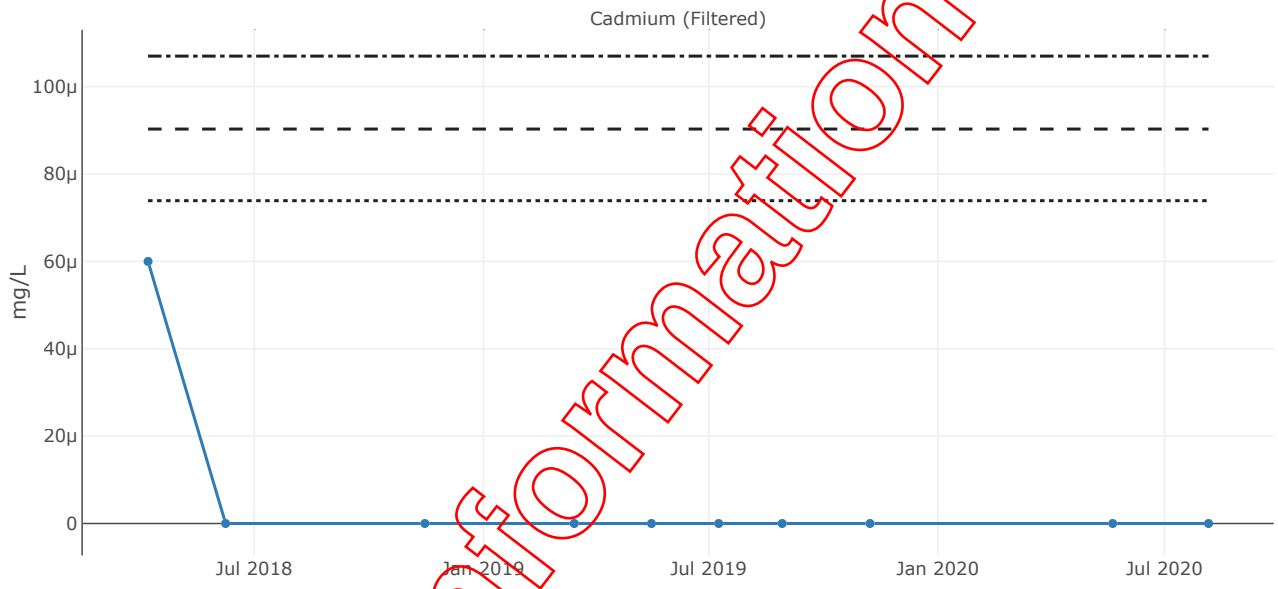

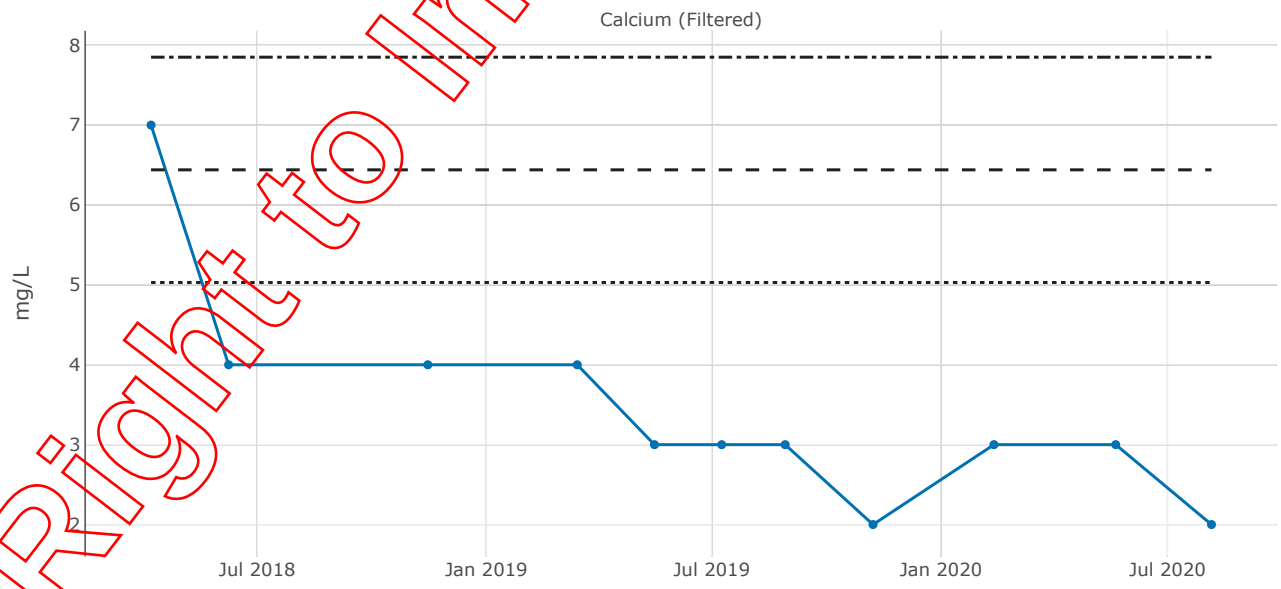

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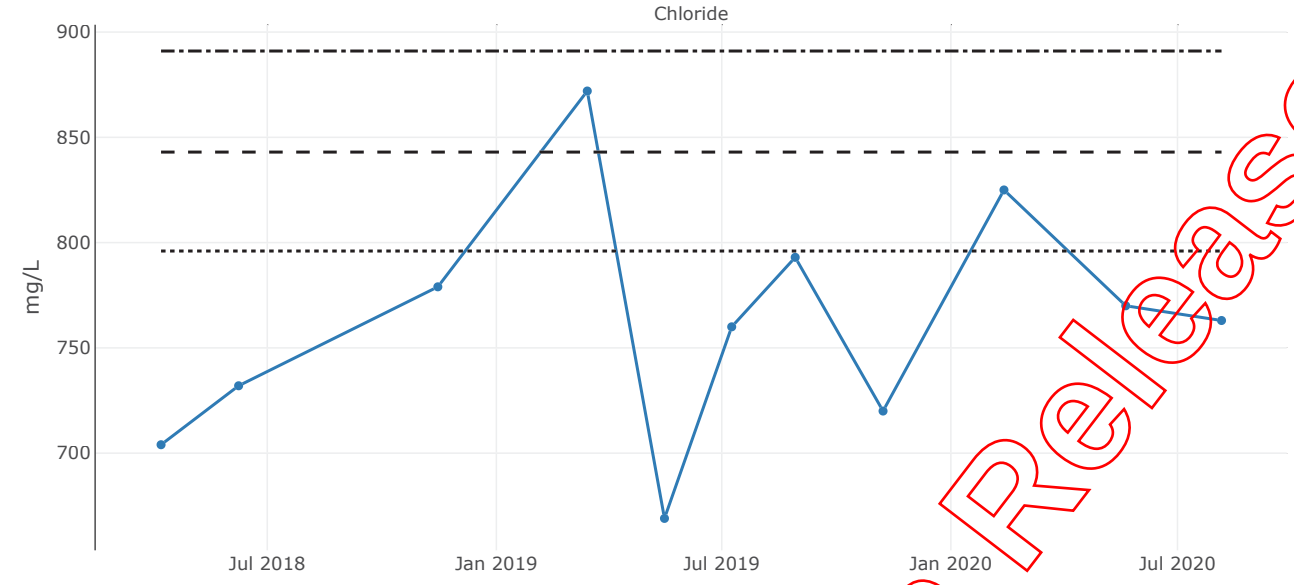

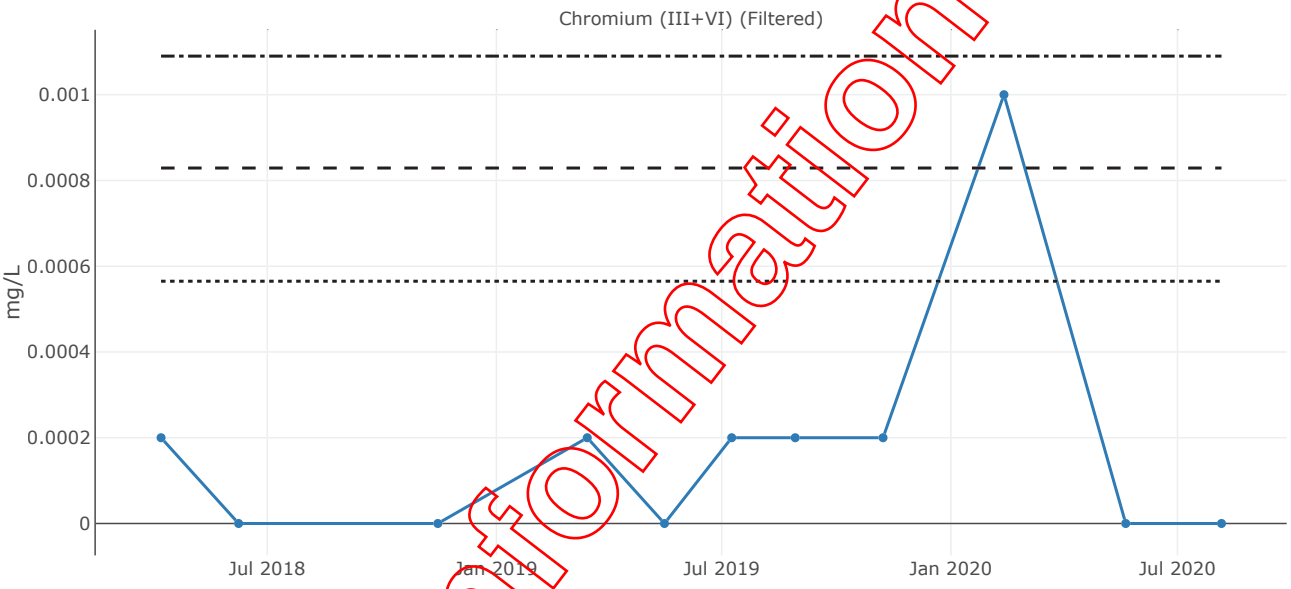

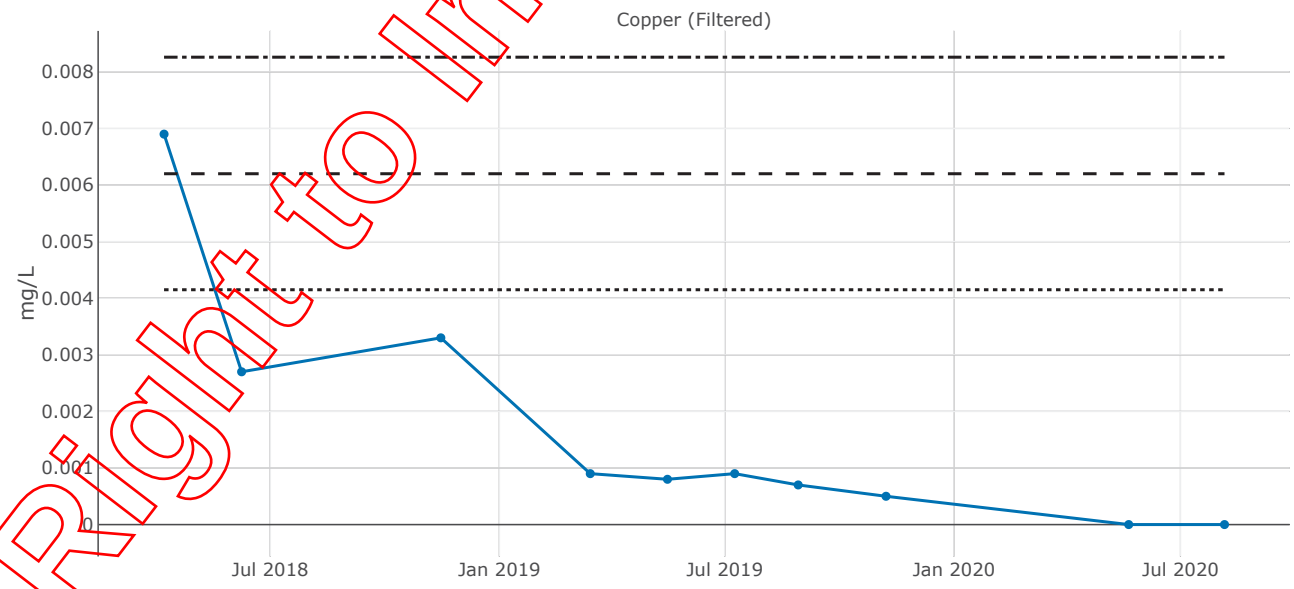

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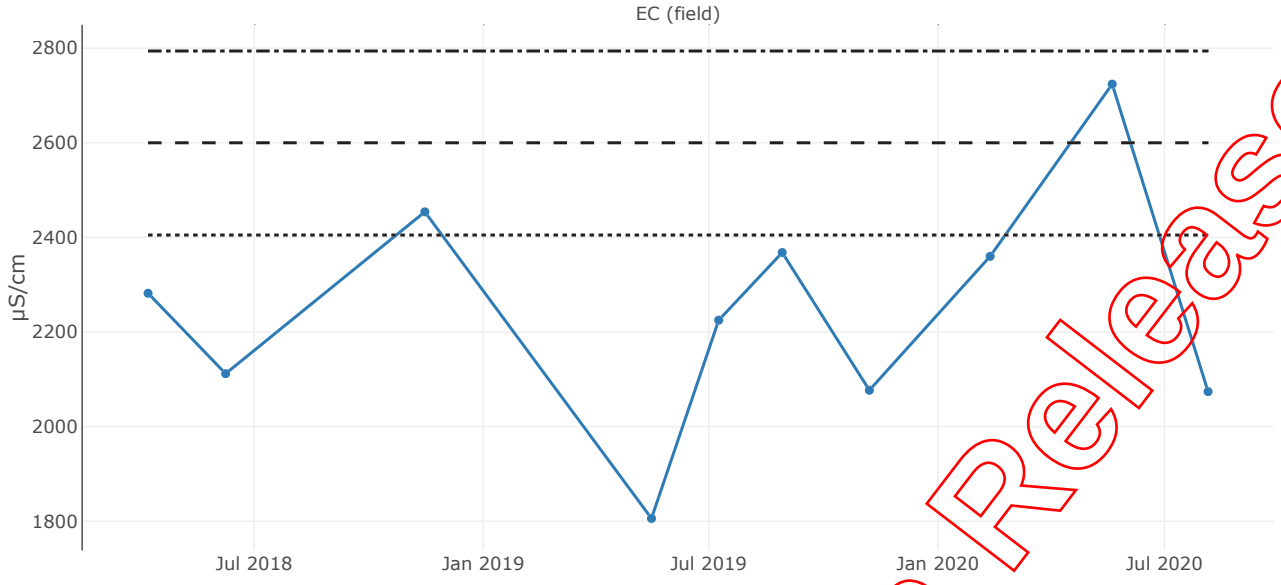

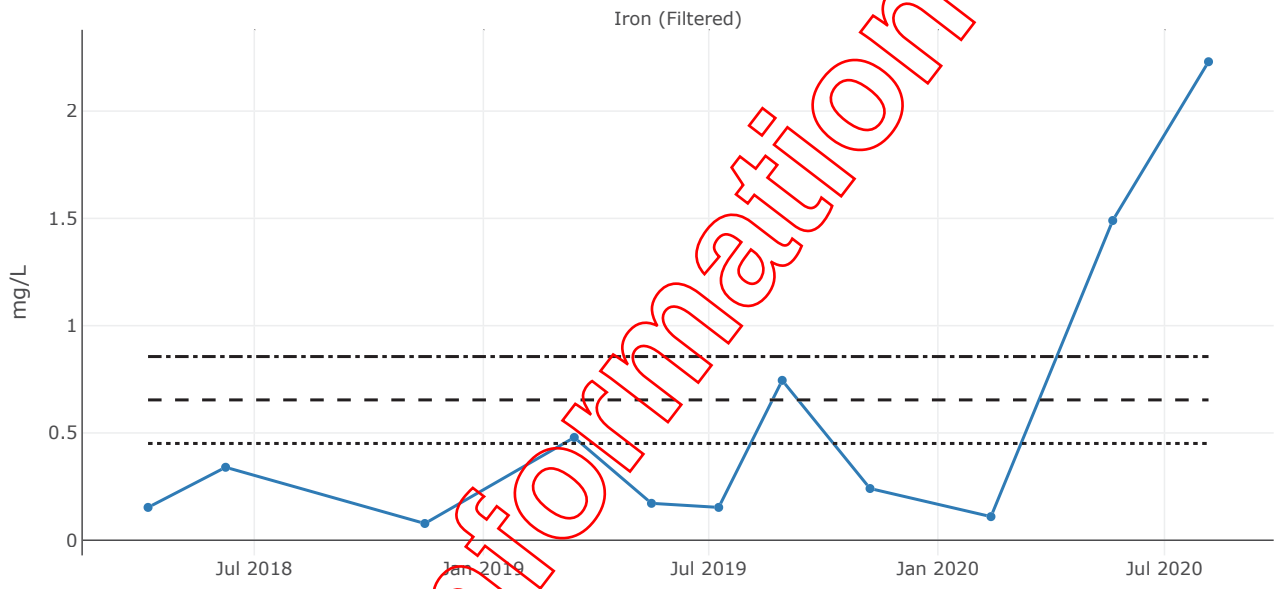

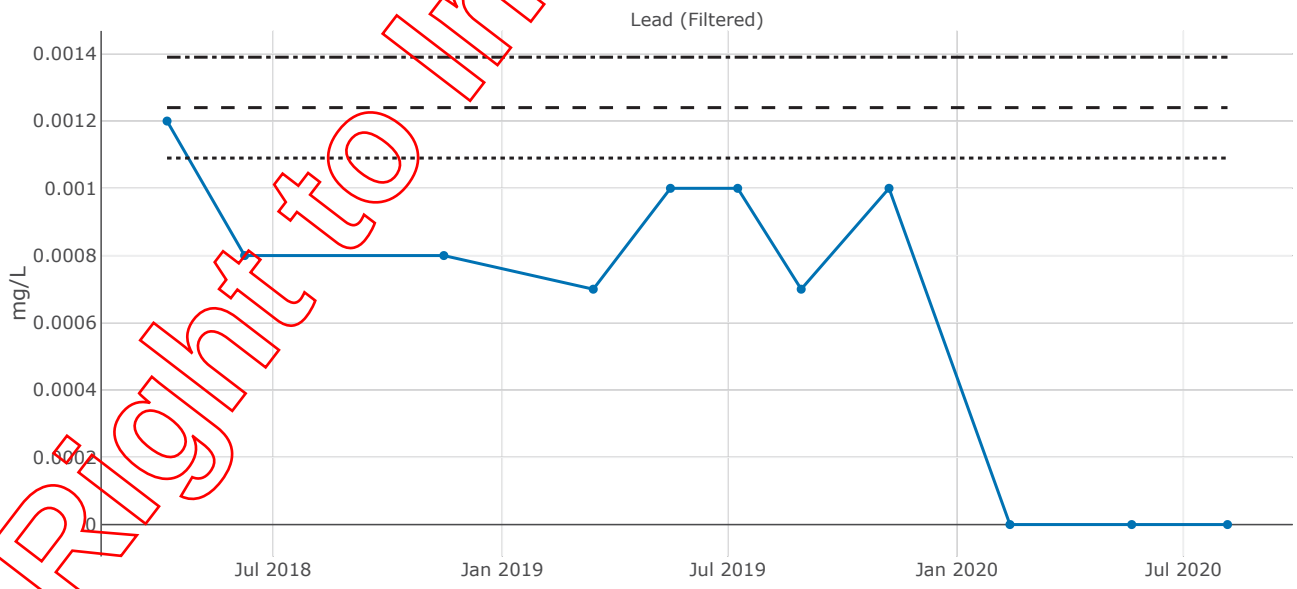

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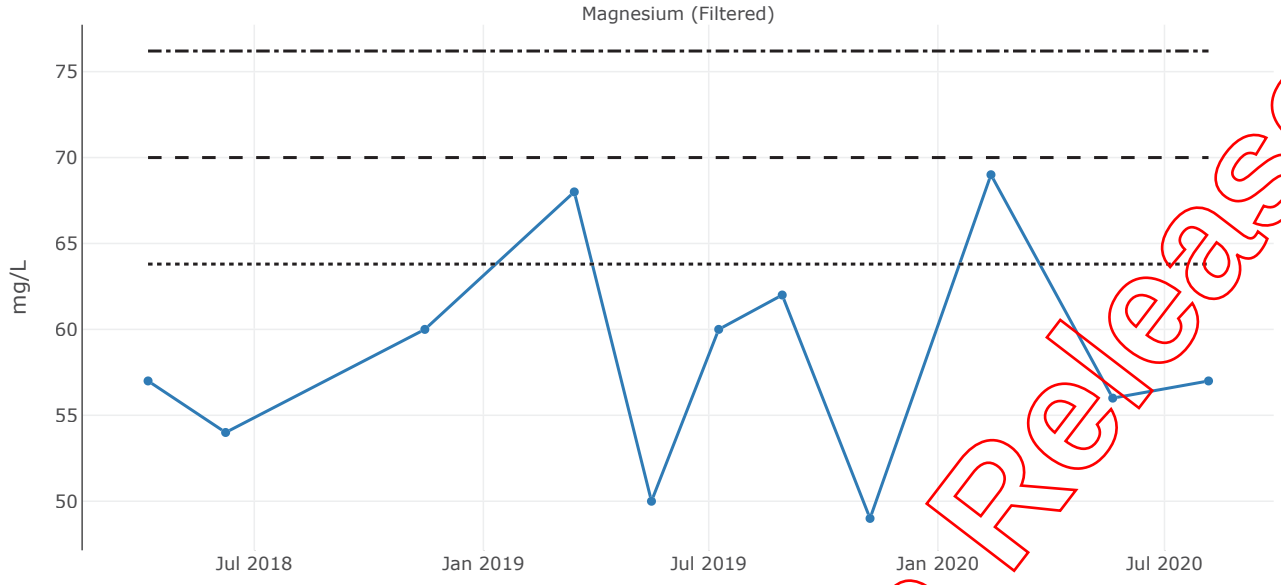

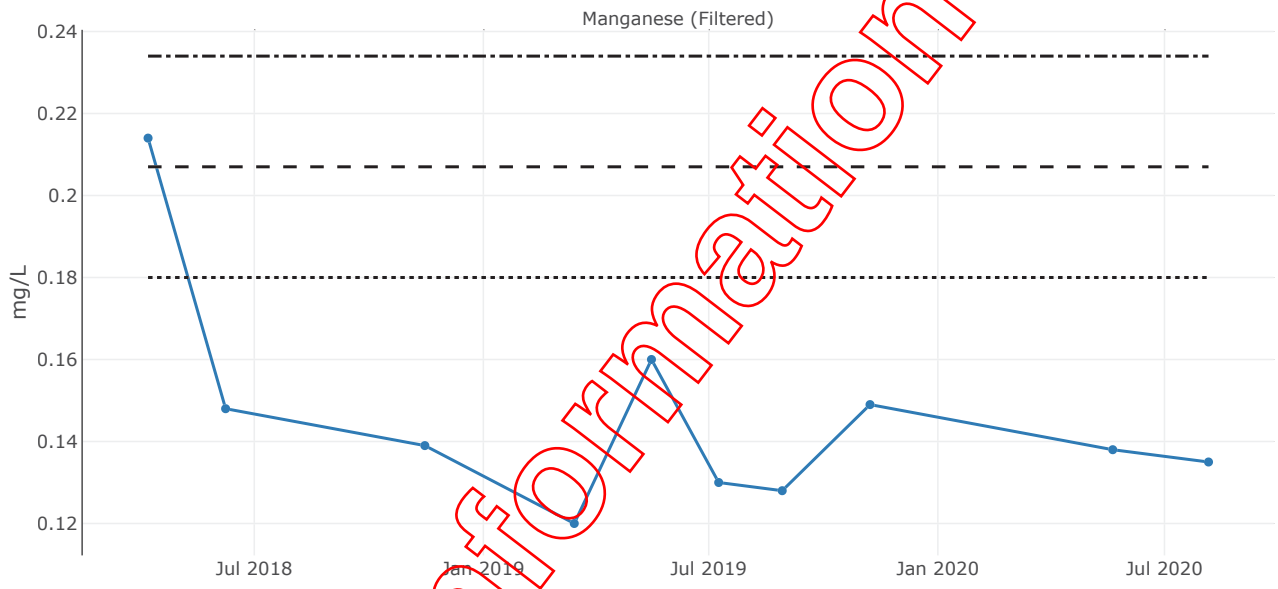

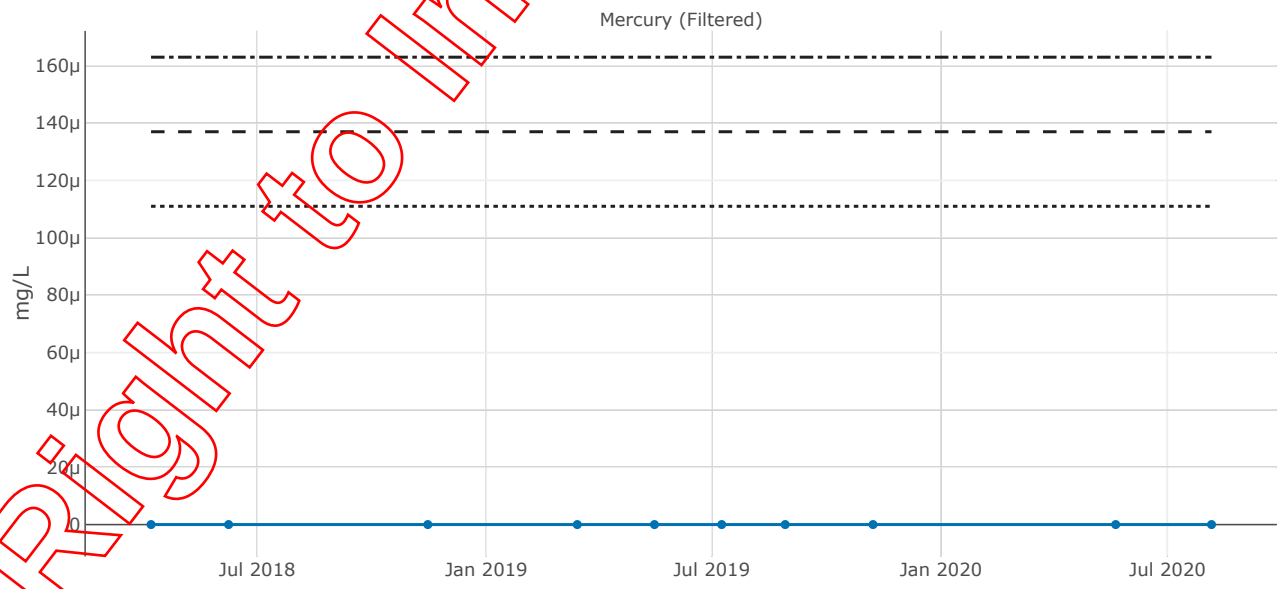

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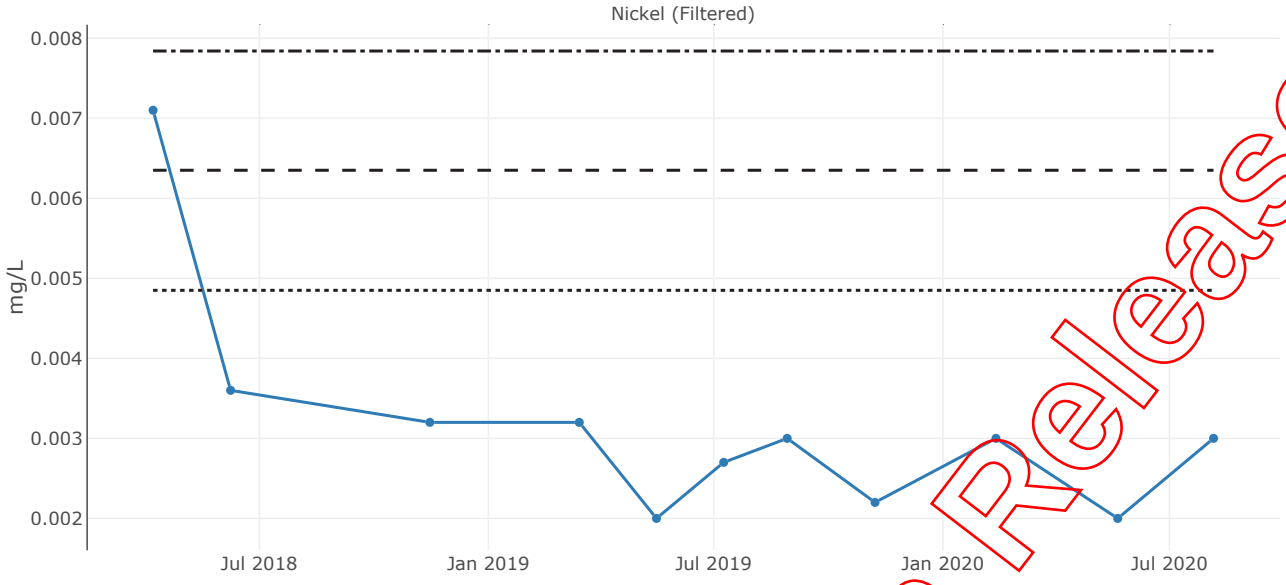

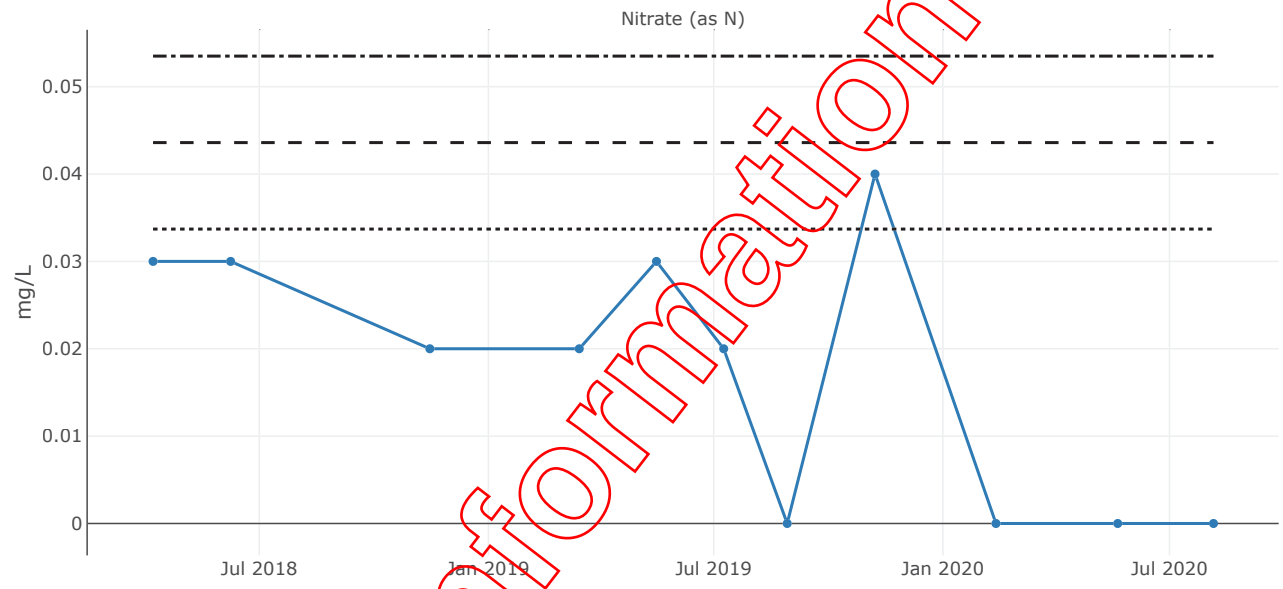

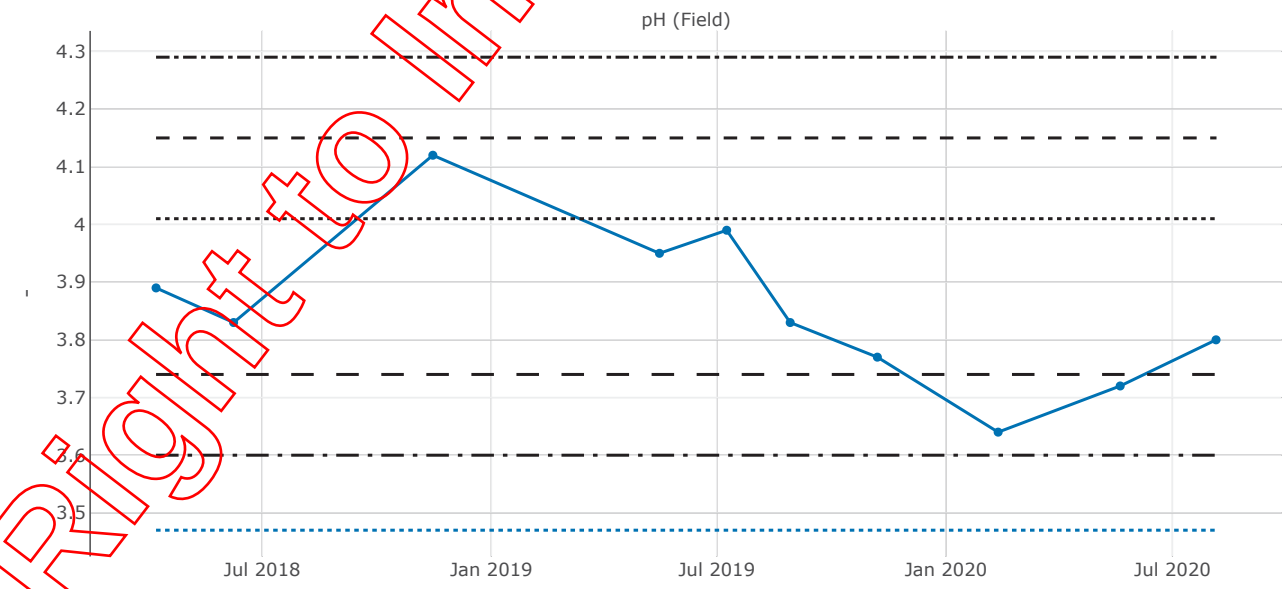

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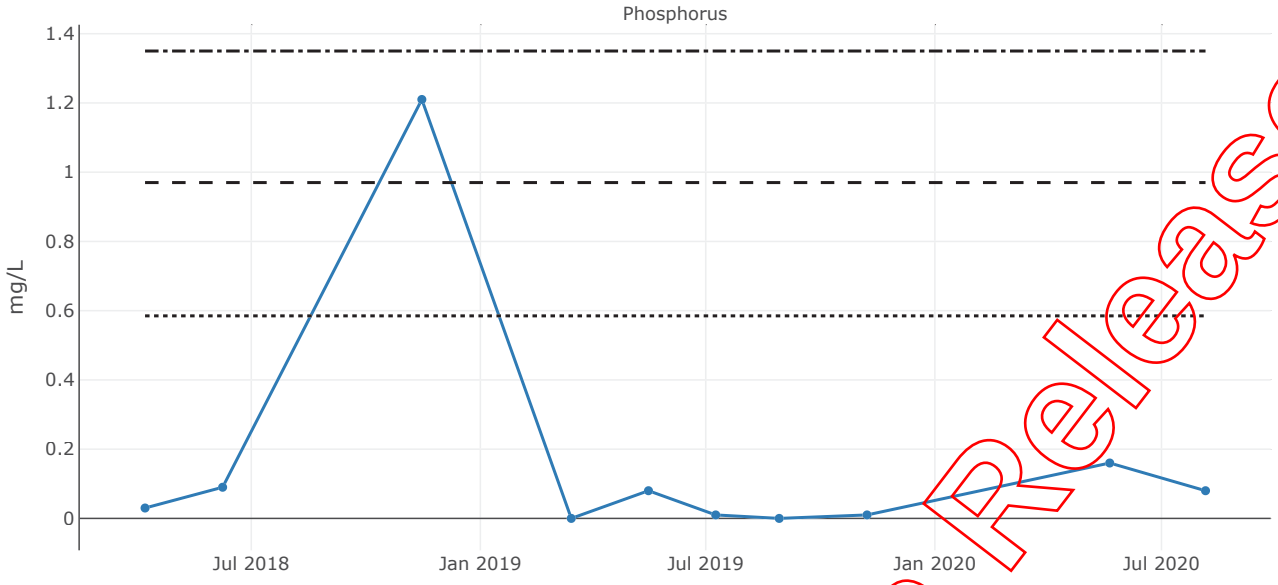

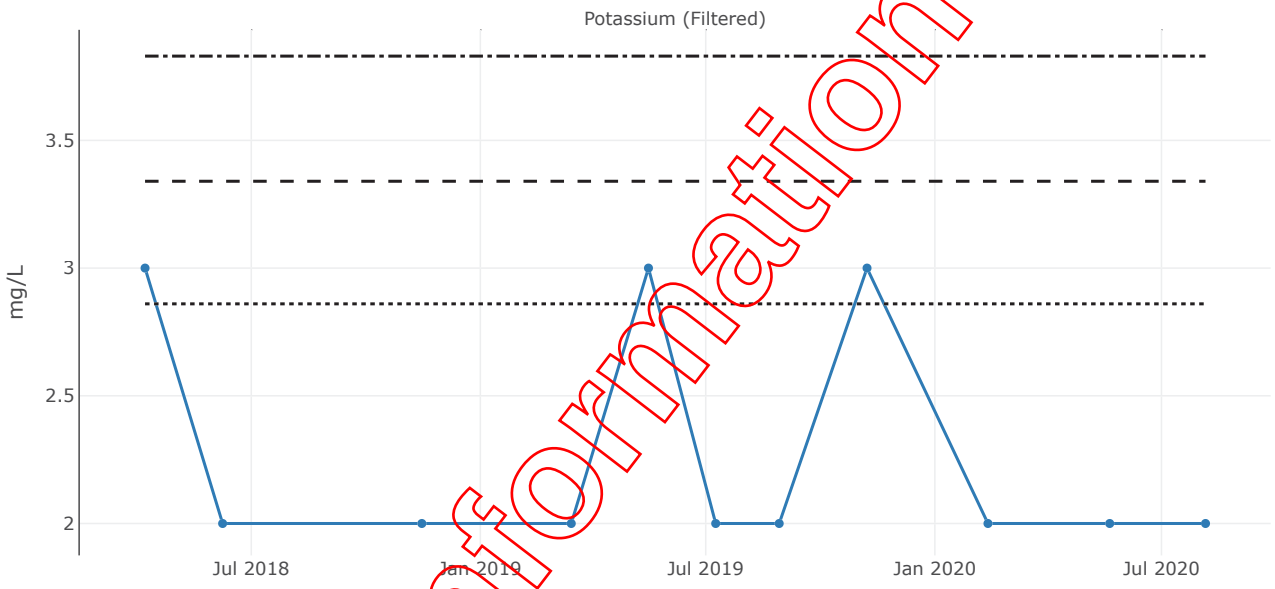

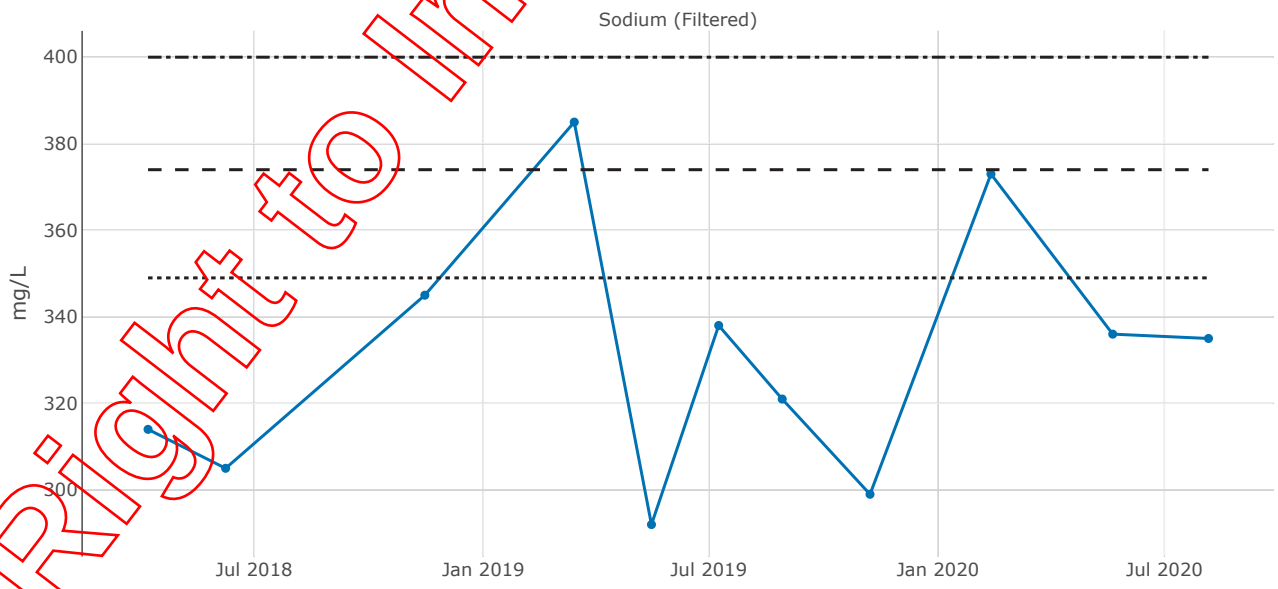

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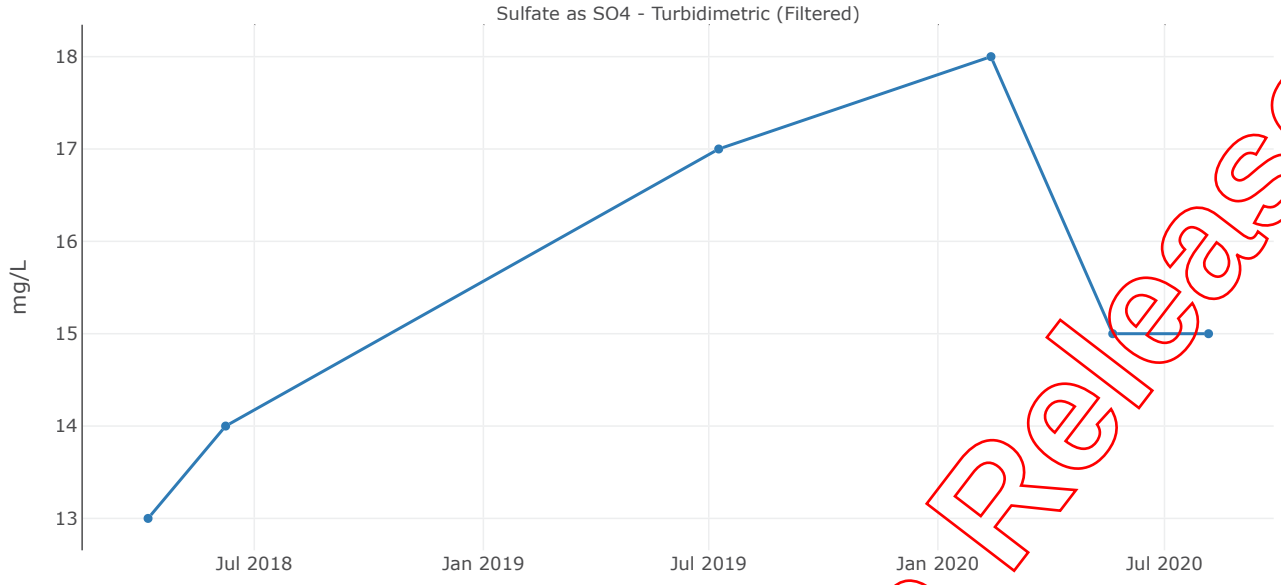
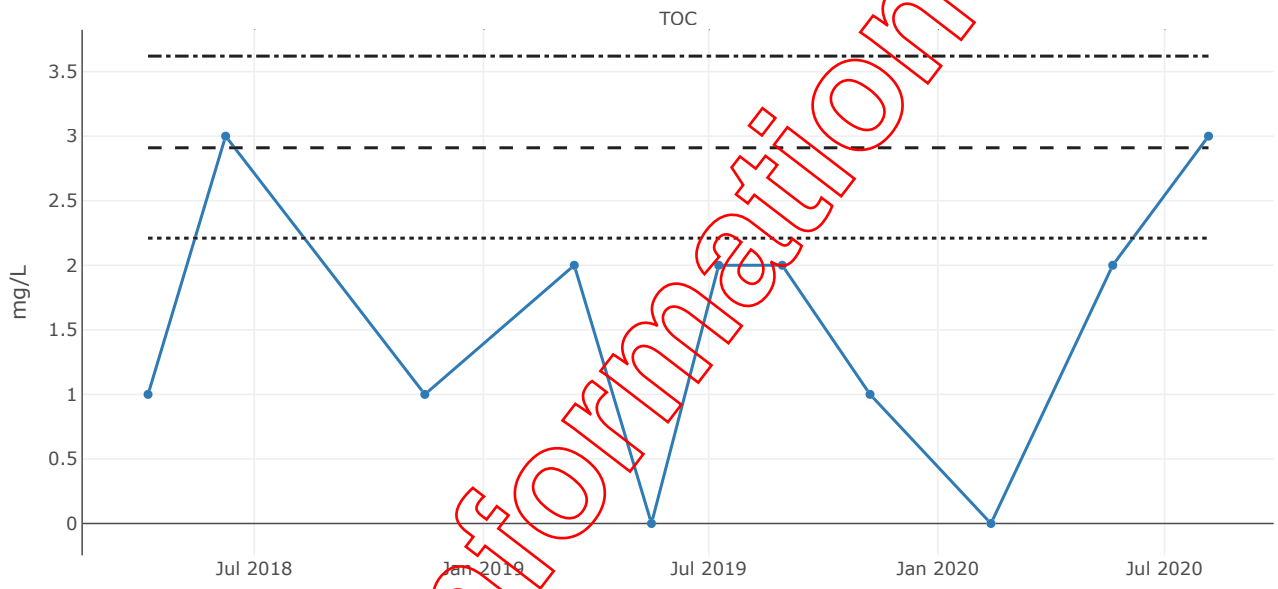
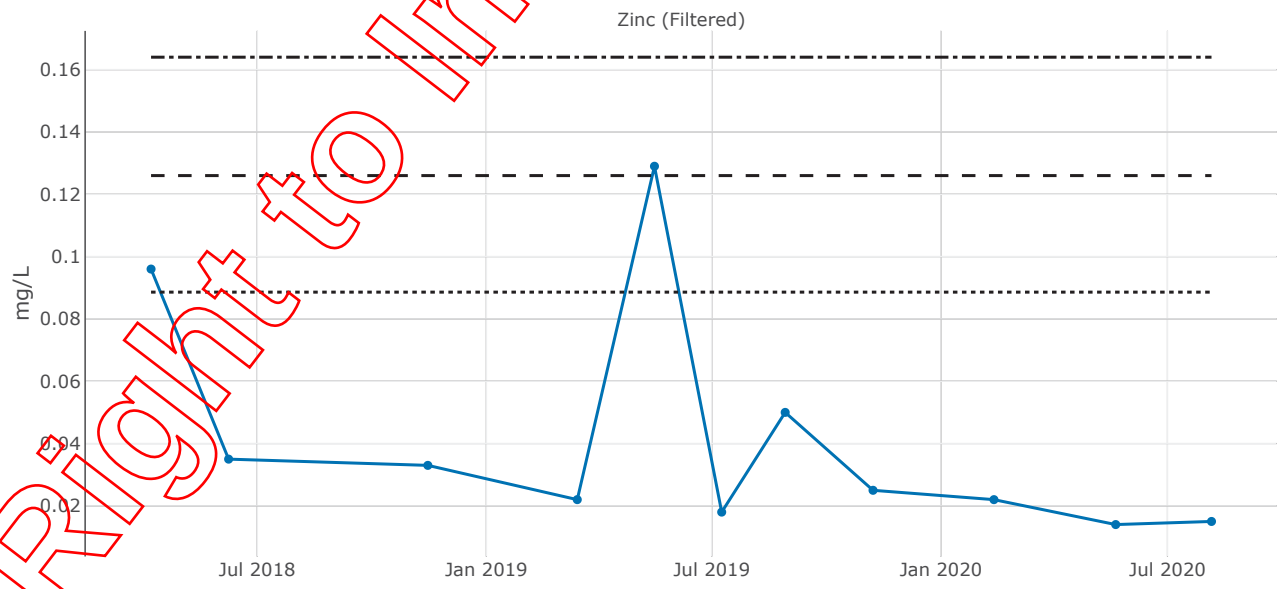






Well ID: GW6

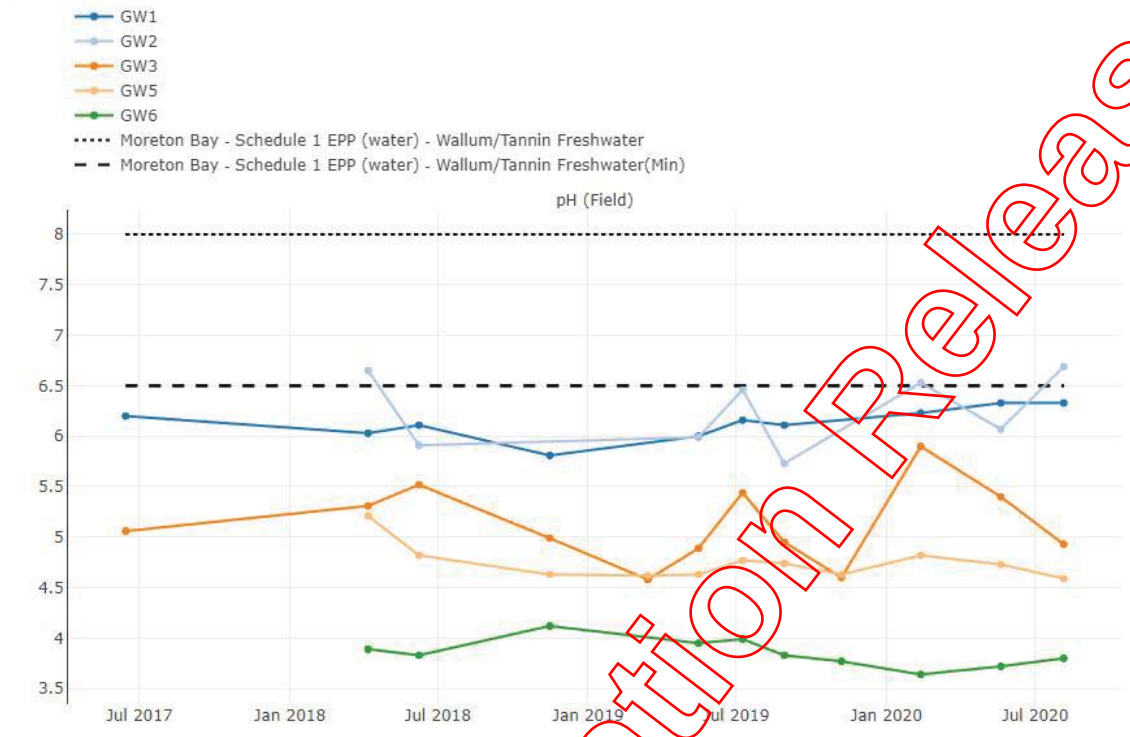
The report was generated based on the following filter:

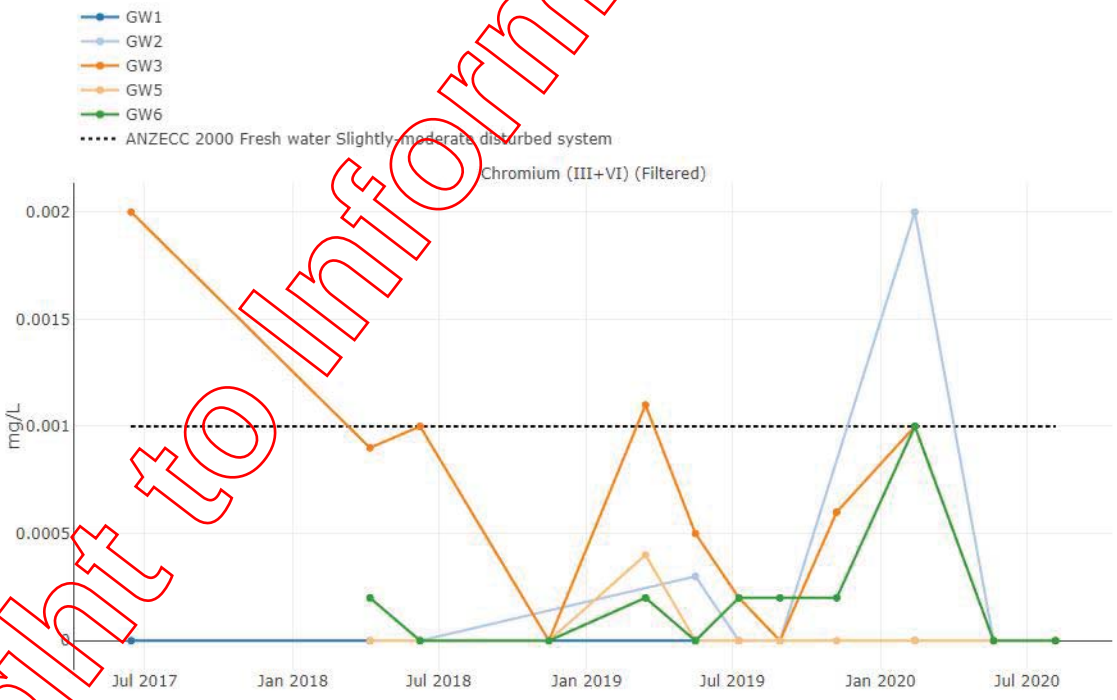
Chem Names In "Zinc,Ammonia as N,Arsenic,Cadmium,Calcium,Chromium (III+VI),Copper,EC (field),Iron,Lead,Magnesium,Manganese,Nitrate (as N),pH (Field),Potassium,Sodium,Sulfate as SO4 - Turbidimetric,TOC,Phosphorus,Nickel,Mercury,Chloride,Aluminium",
Date between "01 Jan 2010" and "19 Aug 2020",
Field or Lab Data "Both",
Projects In "Redland Landfills",
Sites In "Coochiemudlo Island",
Locations In "undefined"

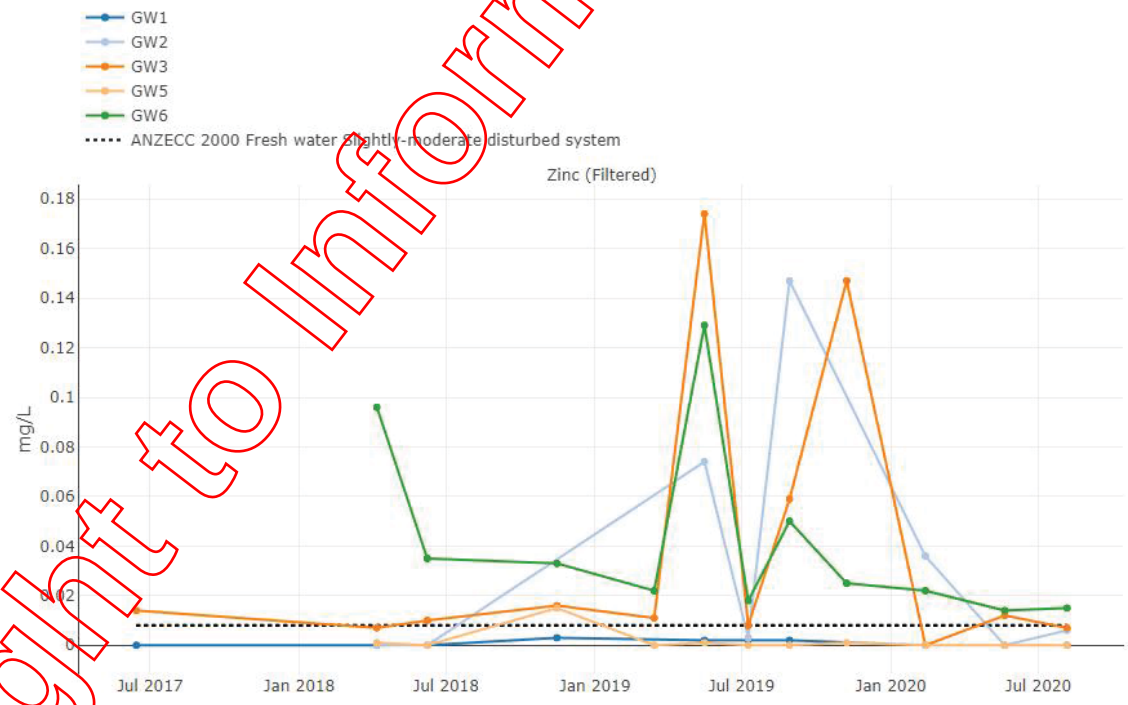
Publication Date: 20 Aug 2020

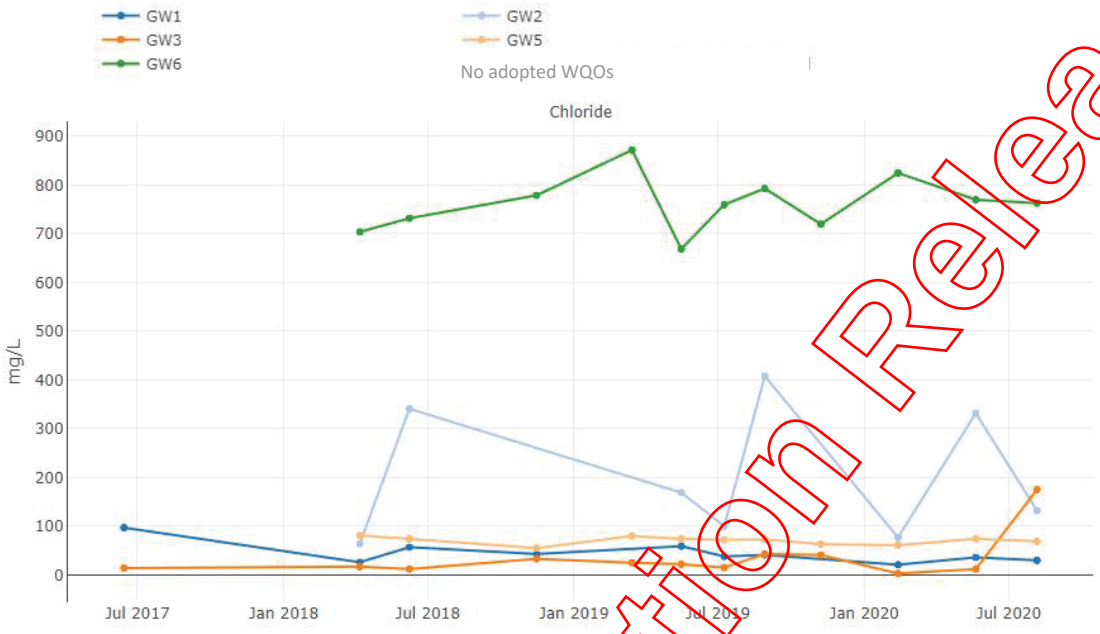
Appendix D.

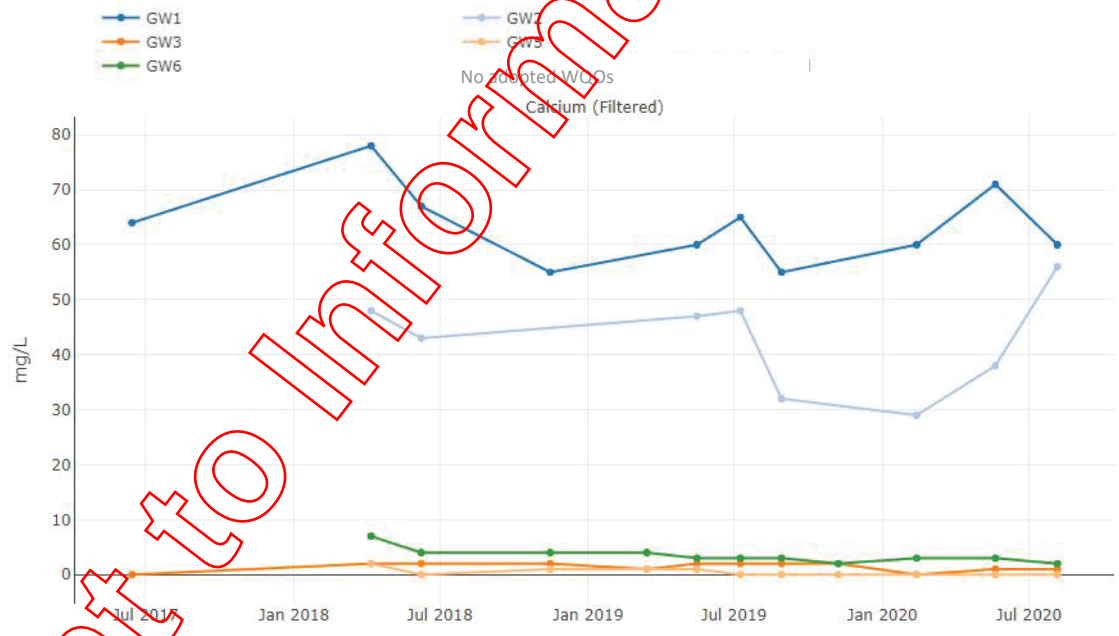
Groundwater Graphs

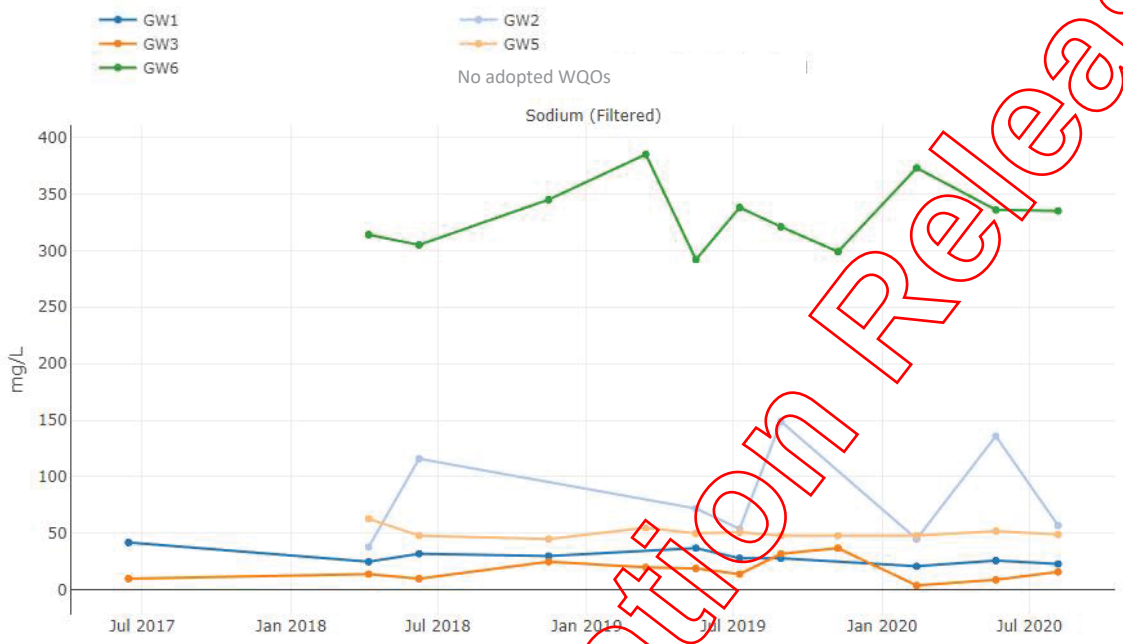


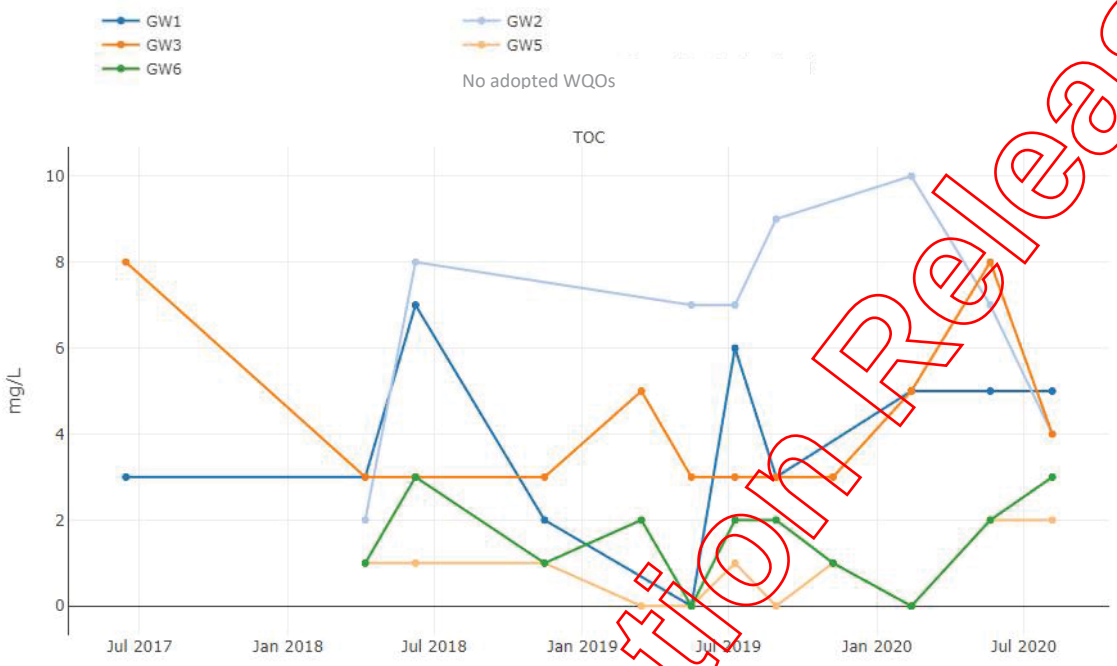


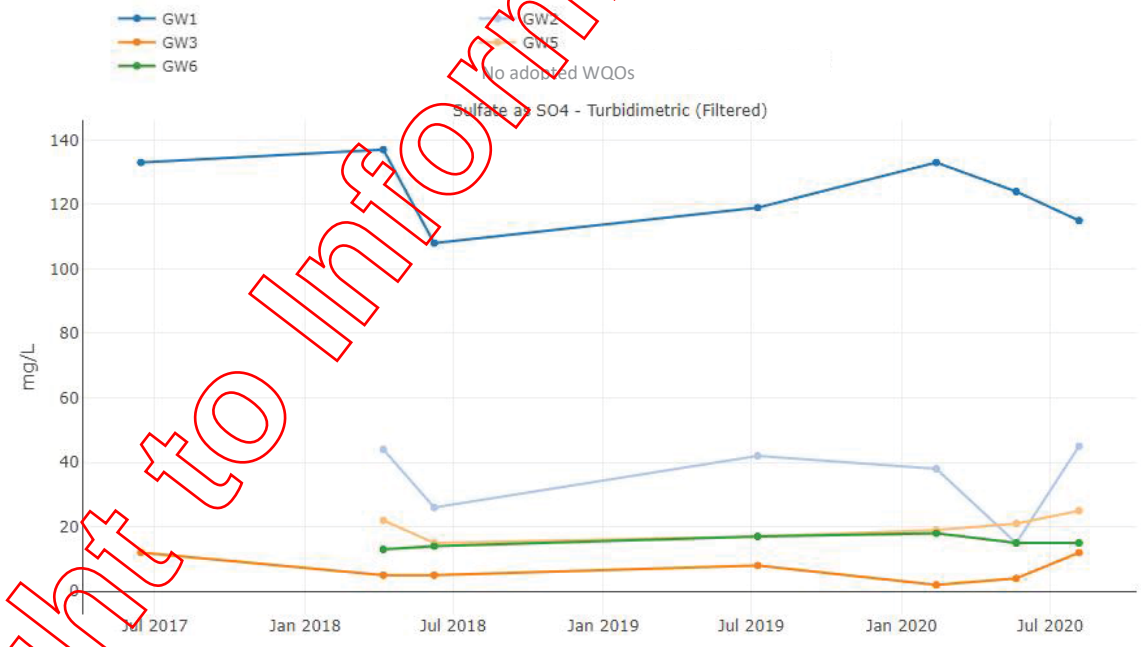


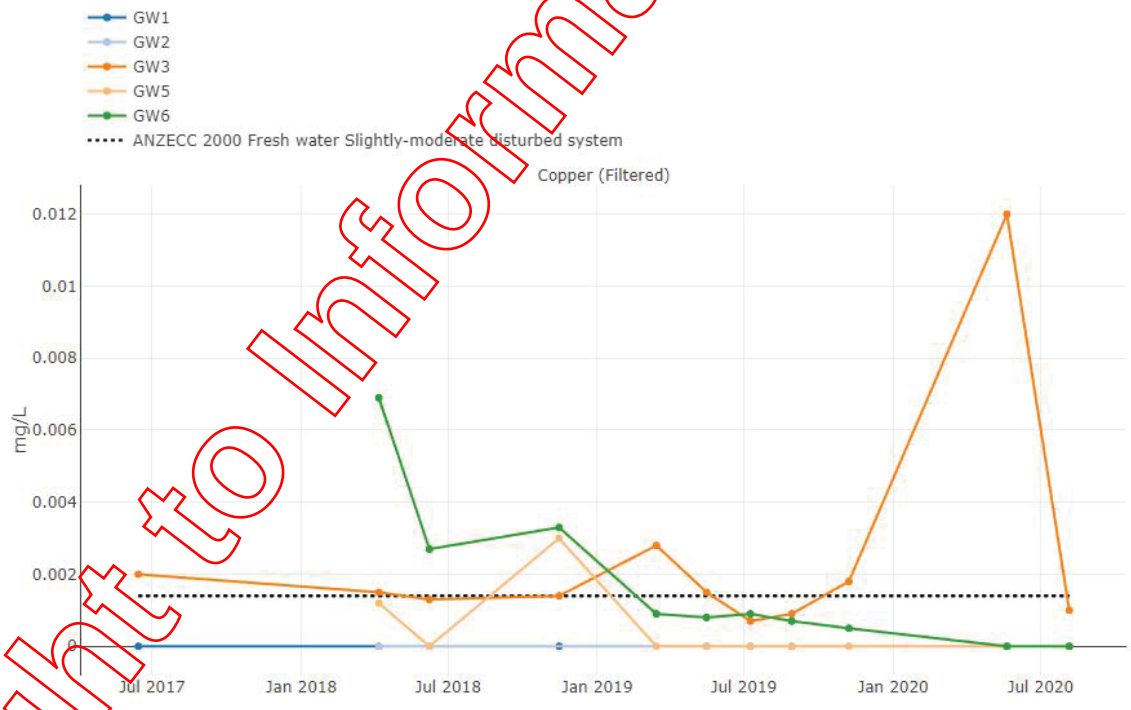


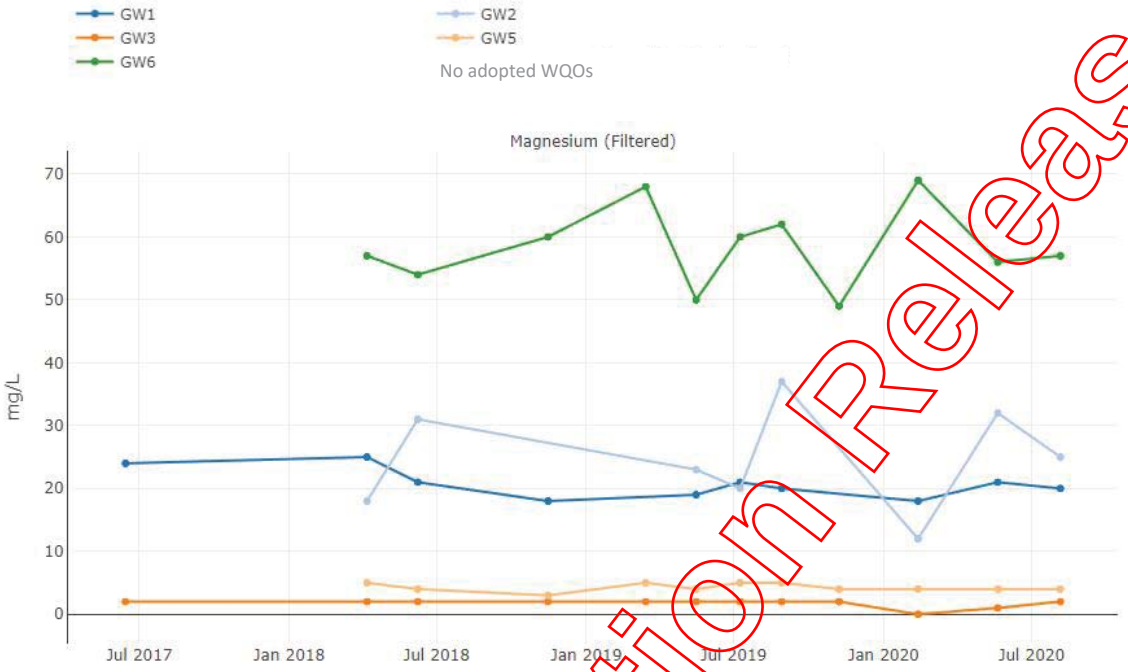


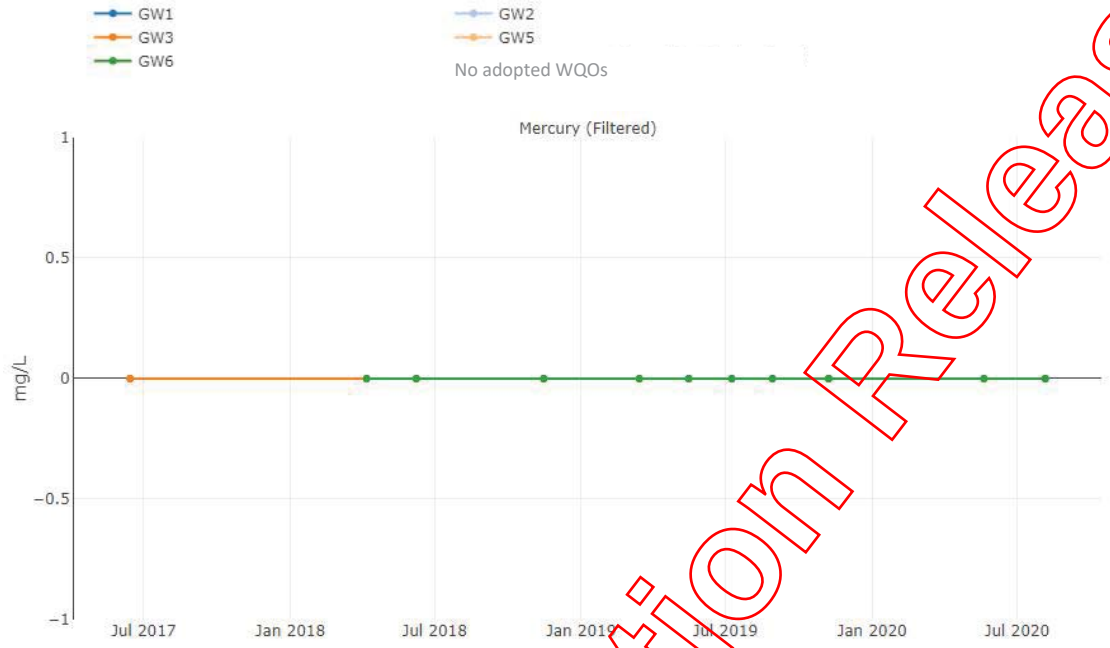


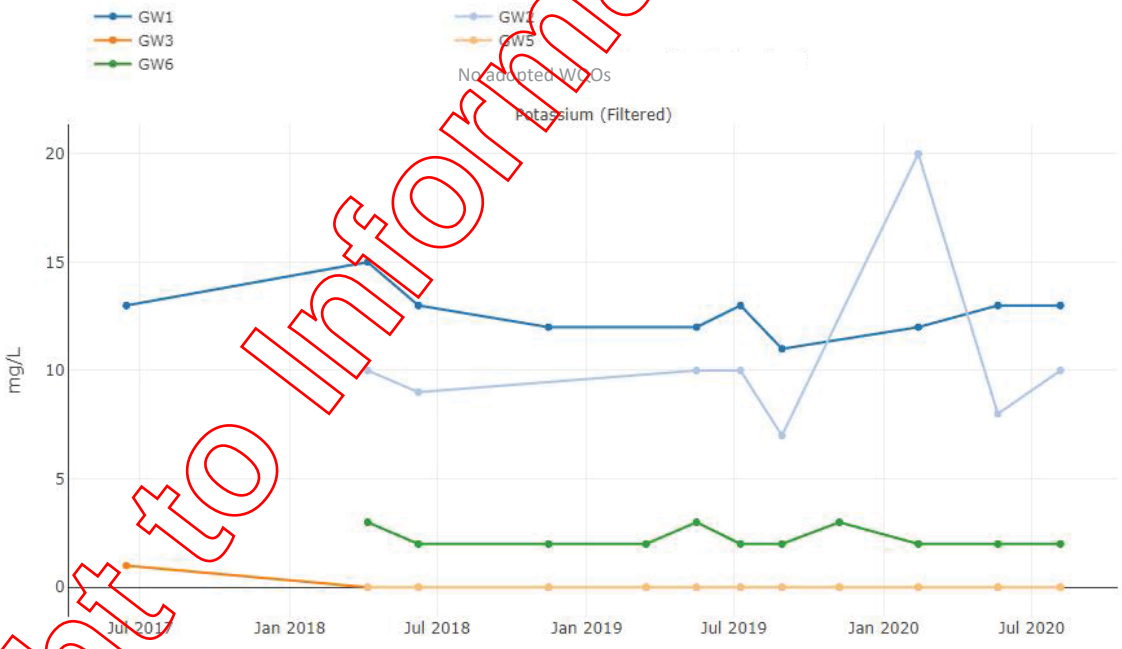


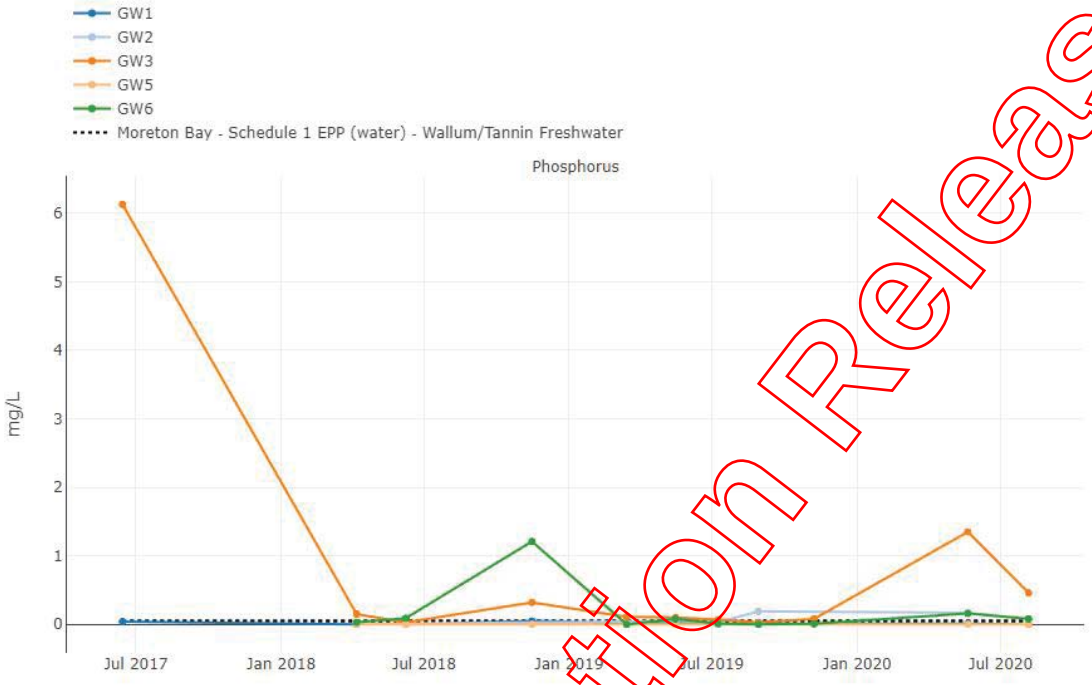






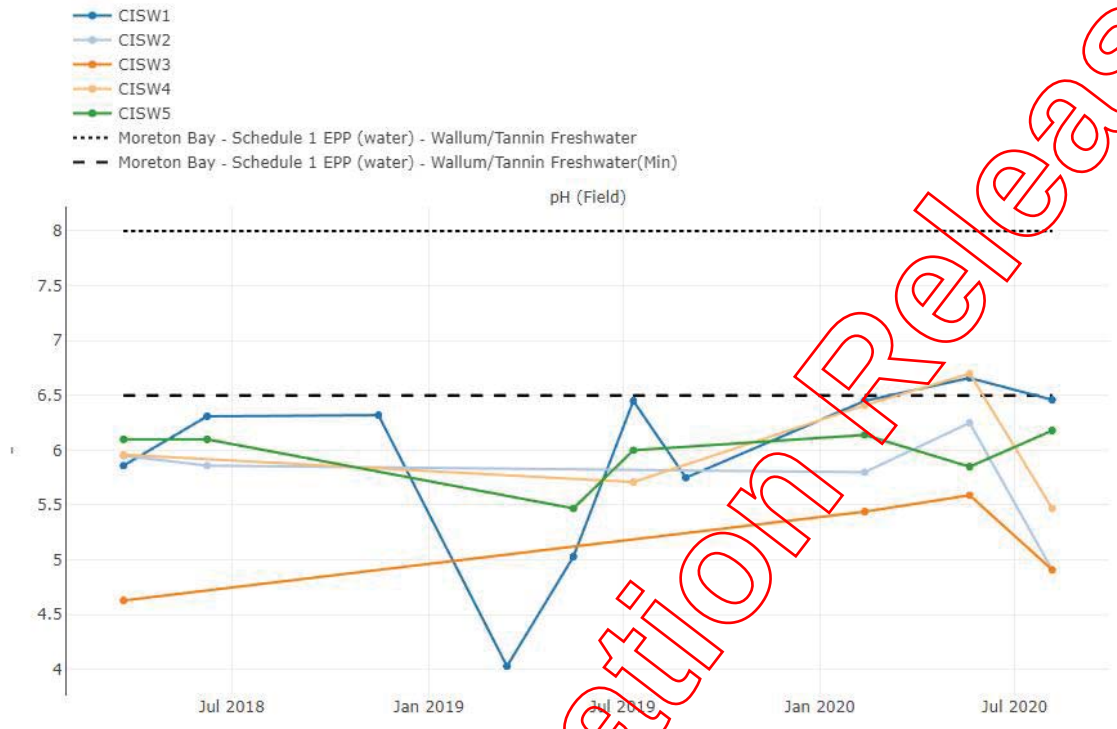


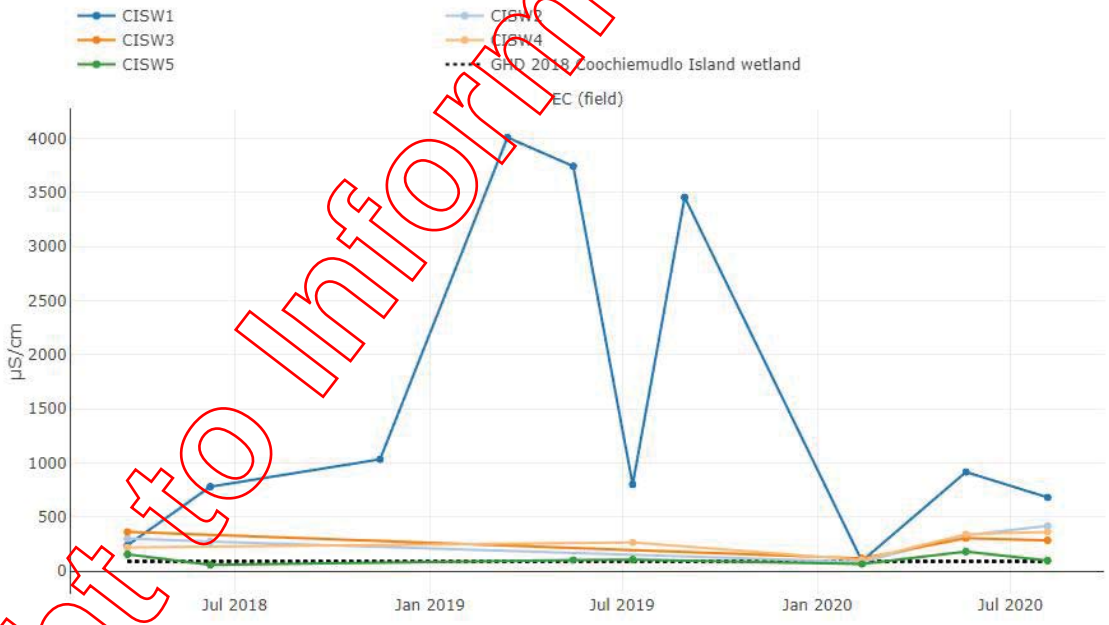


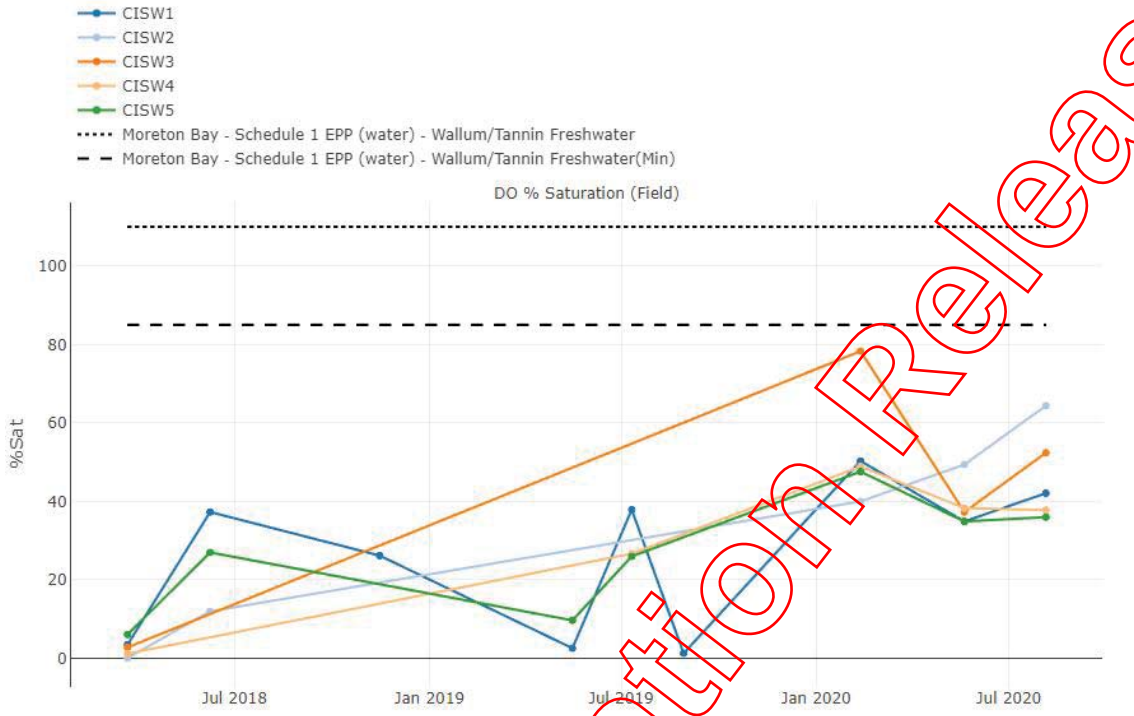


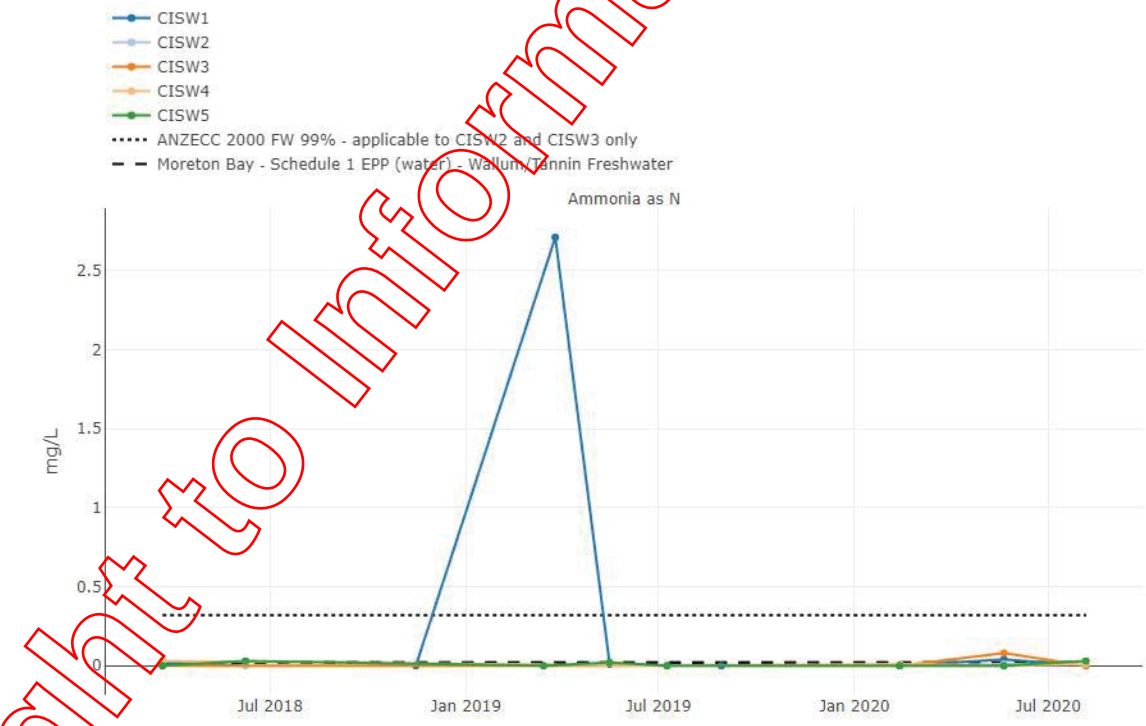
Appendix E.

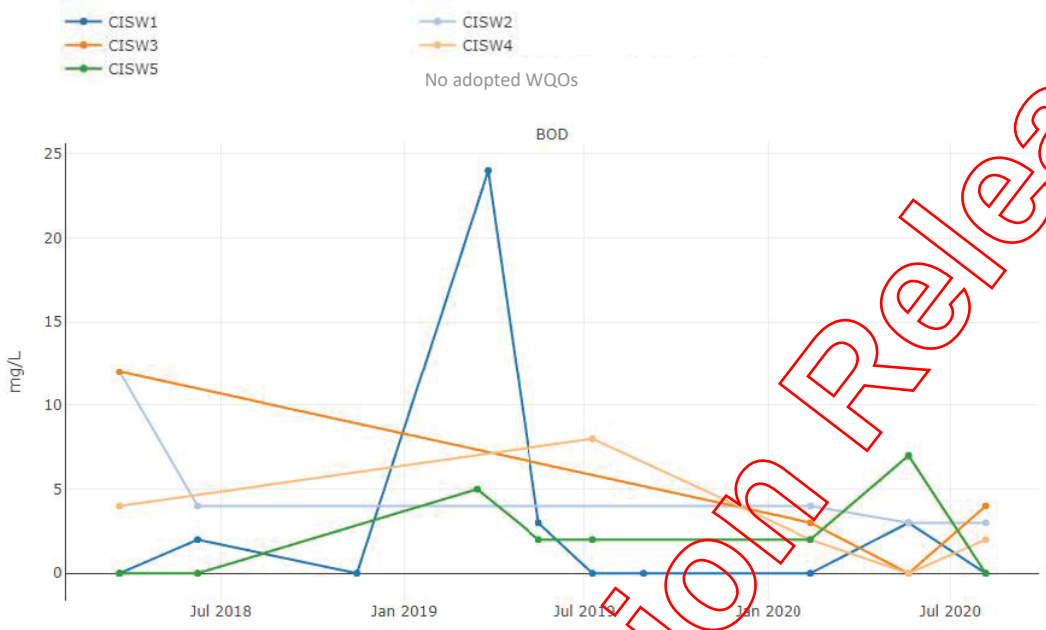
Surface Water Graphs

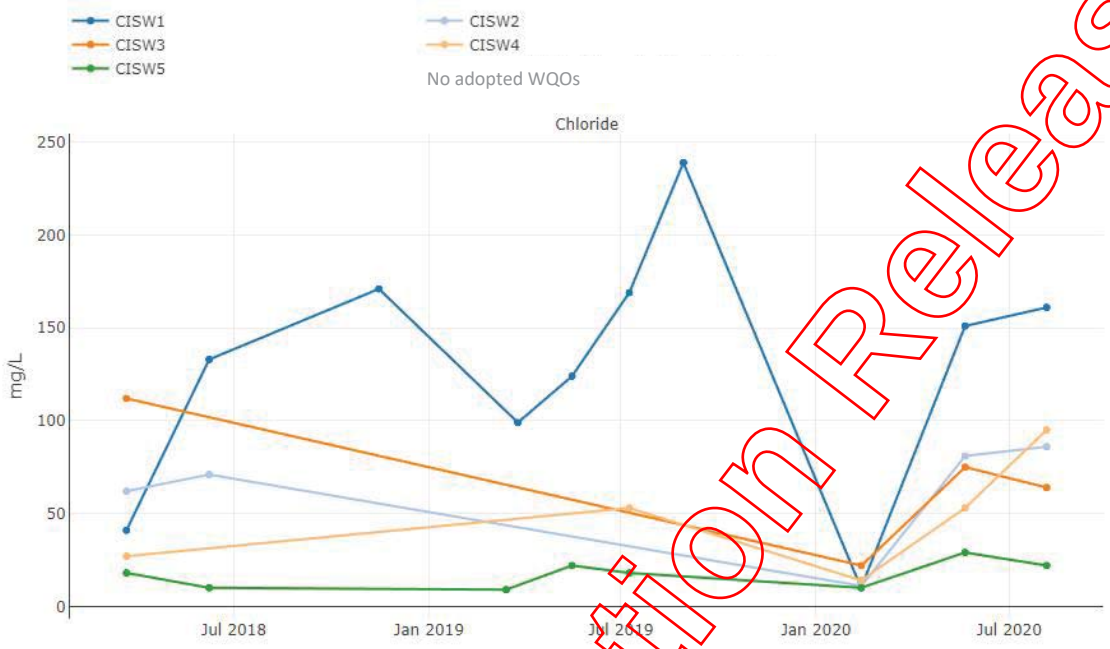


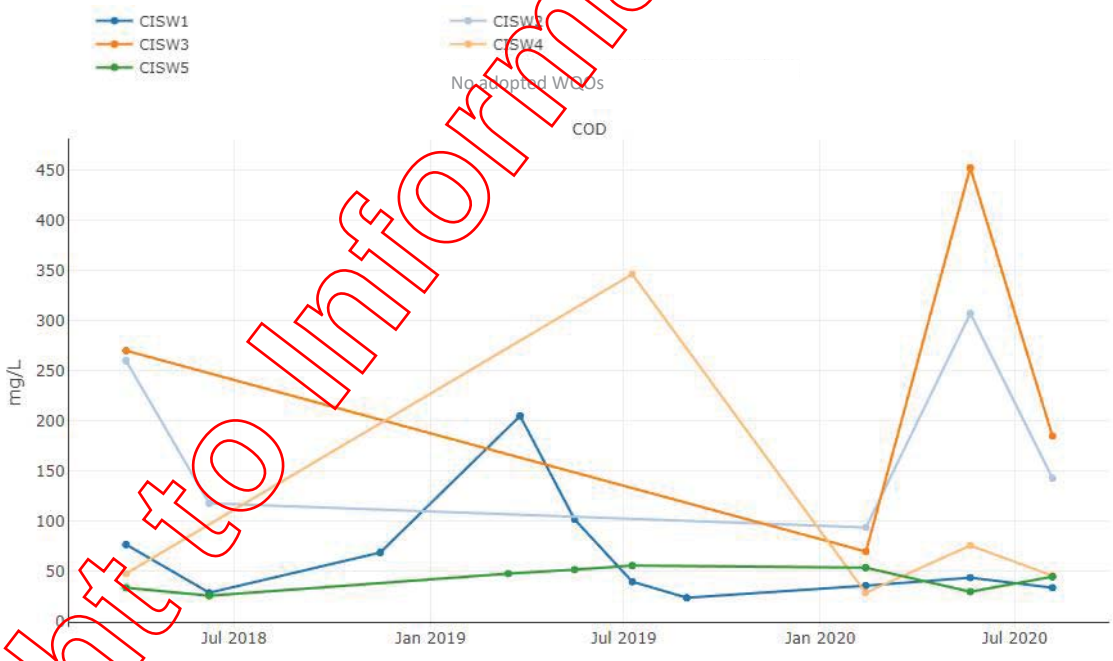


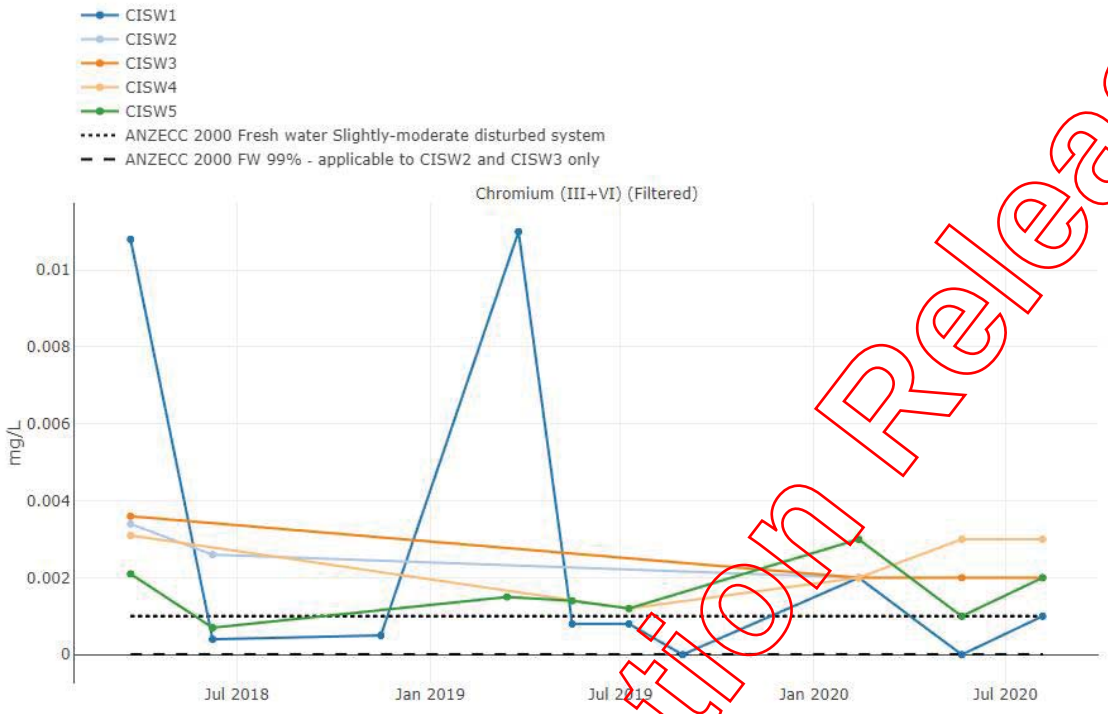


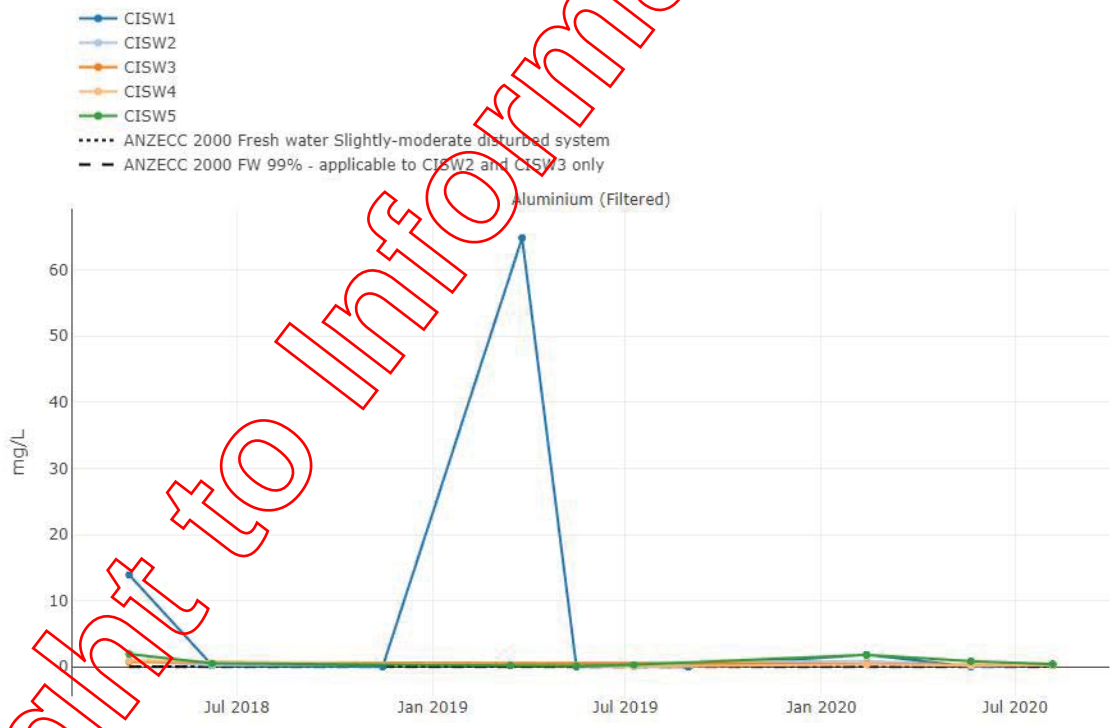


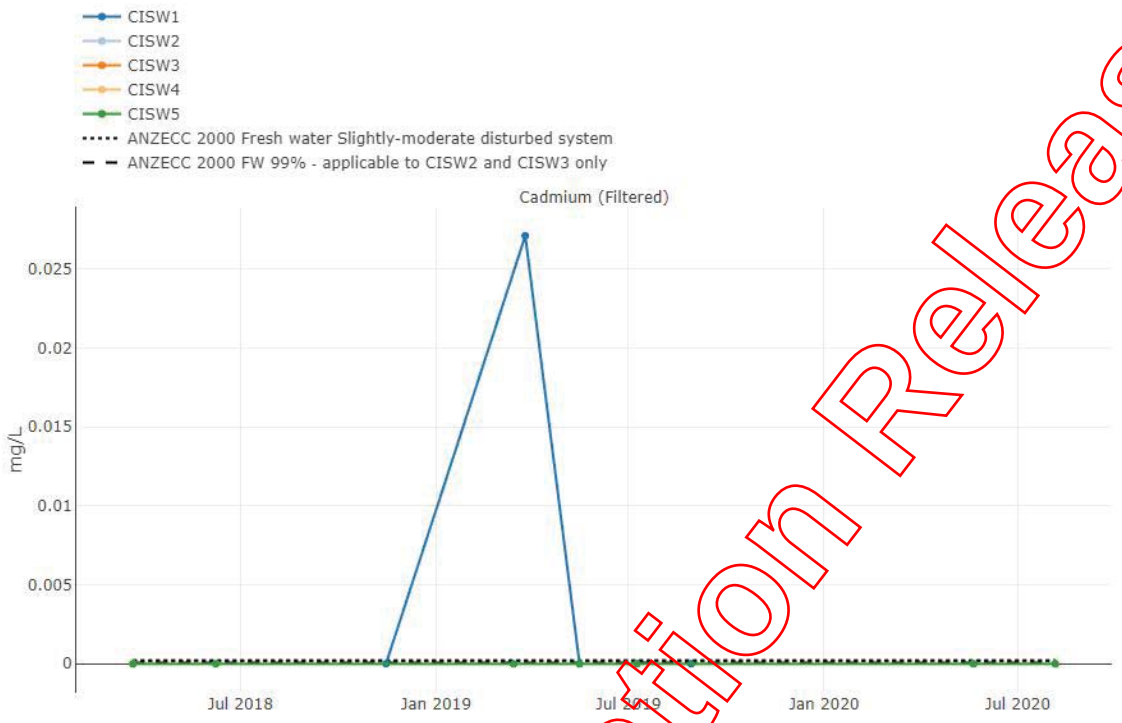


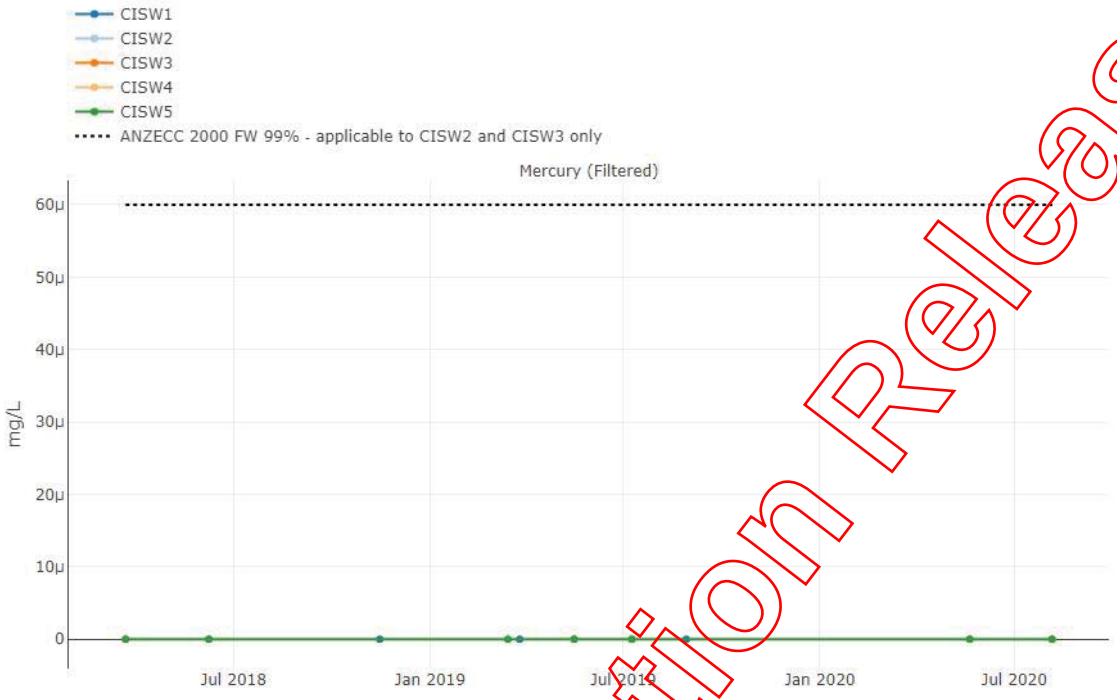


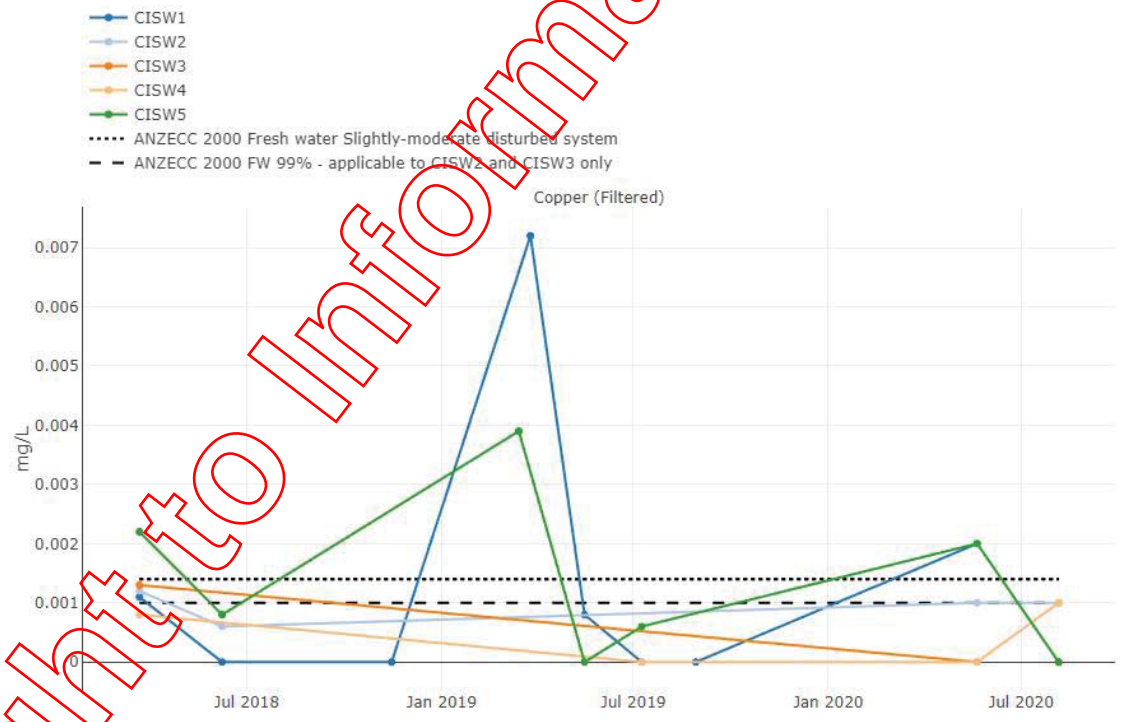


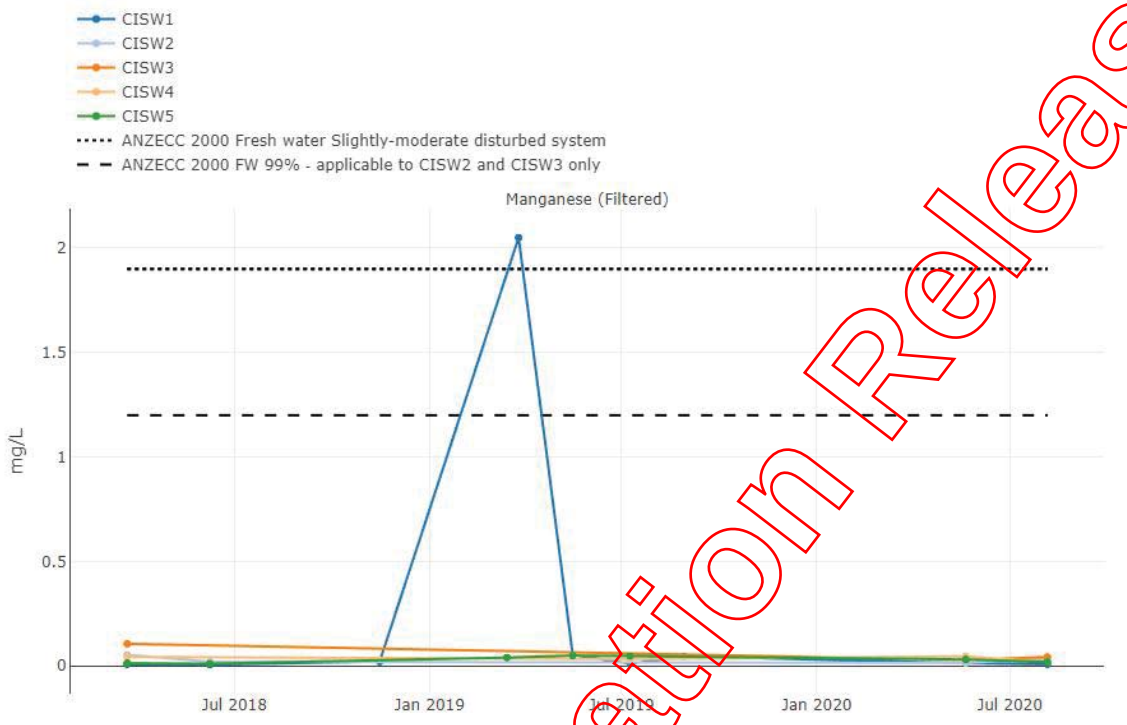


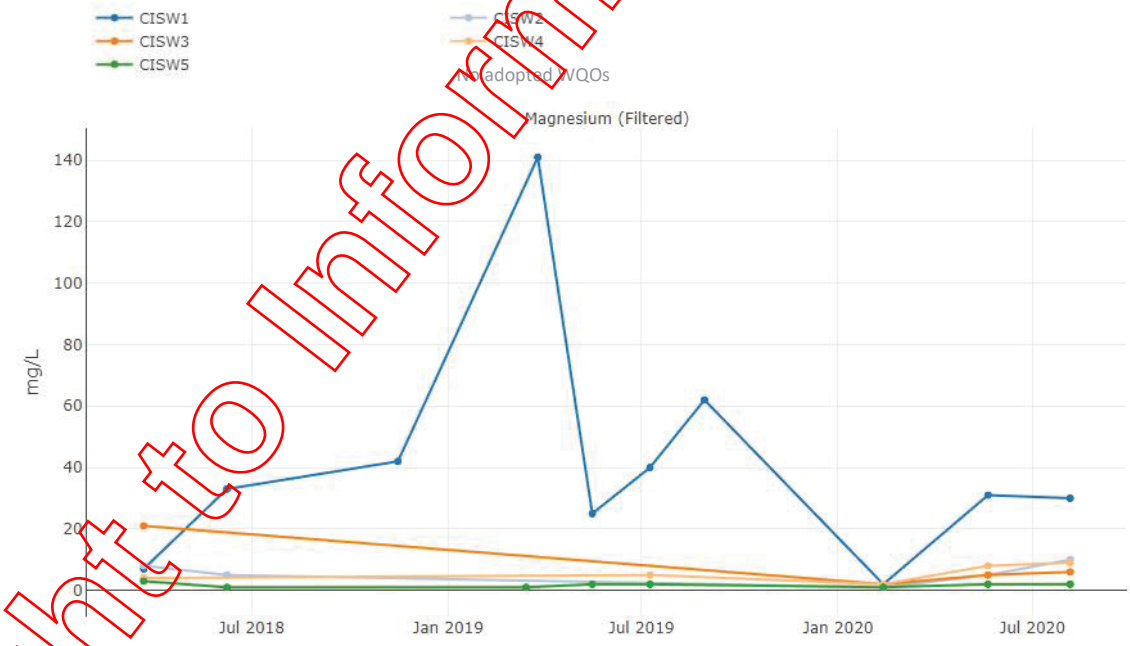


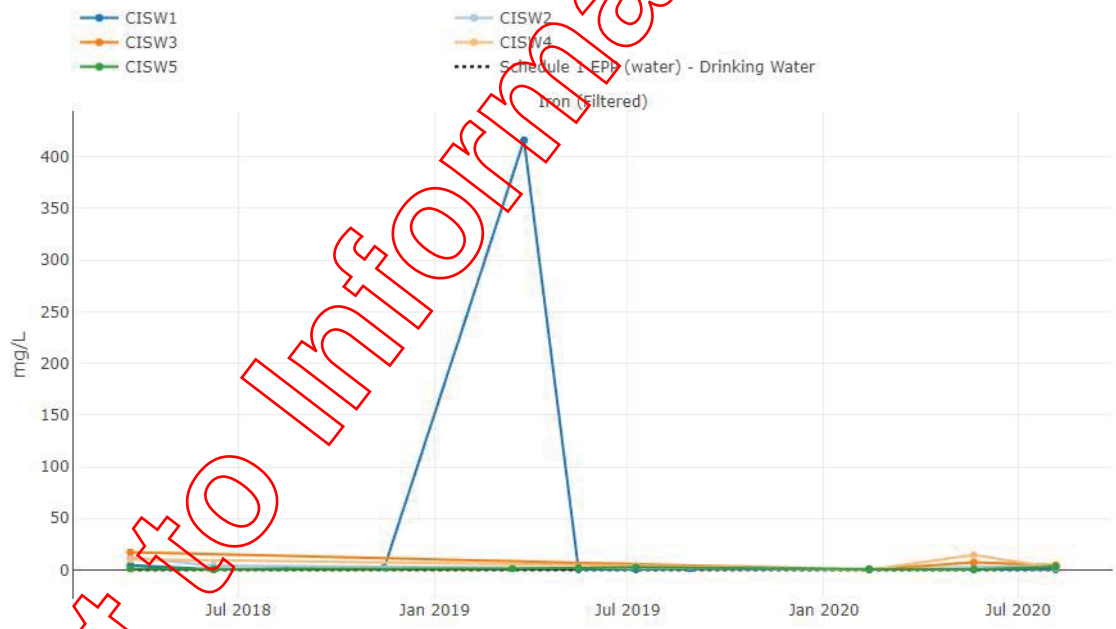


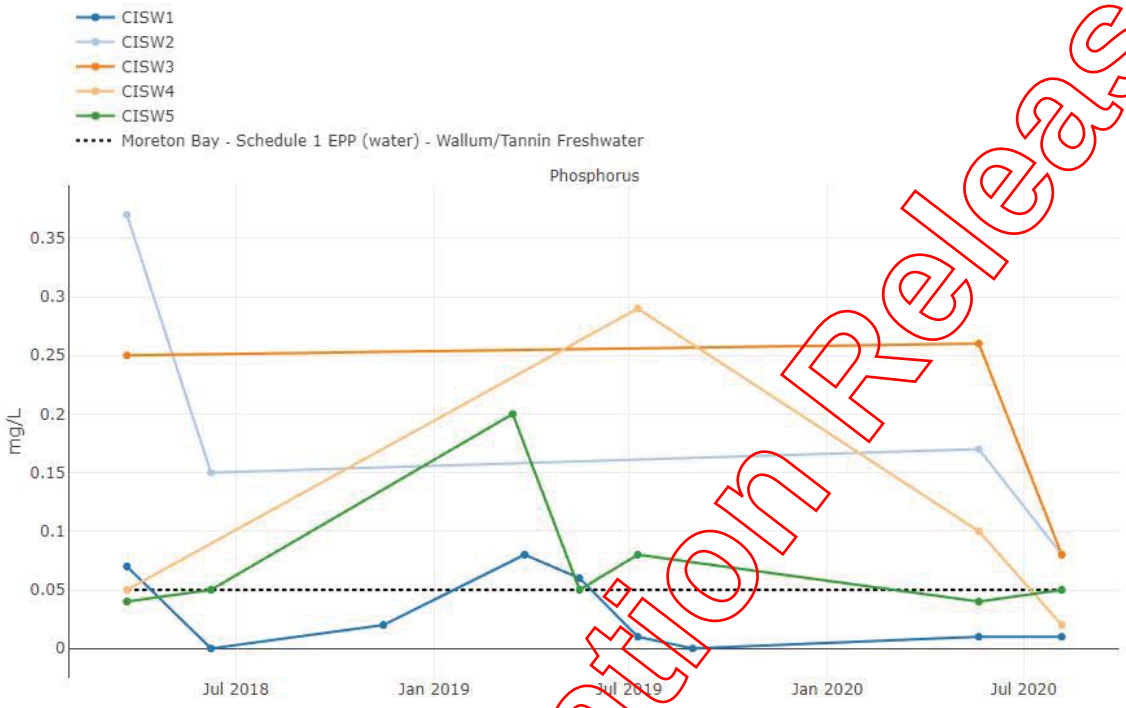












Appendix F.

Laboratory Analysis Results and QA/QC Reports

13/8

ALSCompass
SAMPLING Intelligence

ALS

Environmental Division
Brisbane
Work Order Reference
EB2020621

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 5329 13085 **Client:** RCC

Project Manager: Kaine Pritchard

Phone: (

[redacted] **# Samples:** 13

Sampler: Sophie Blond

Phone: [redacted]

Turnaround Requirement: Standard 5 day TAT Urgent

Special Instructions:

Custody:

Relinquished by:	Received by:	Relinquished by:	Received by:
Sophie Blond	Ccs		
Date / Time: 6/08/20	**Date / Time:** 6/08/2020 13:20	**Date / Time:**	**Date / Time:**

CHAIN OF CUSTODY

ALS COC#: 13096 *ALS Laboratory:* EB Brisbane

CLIENT: FUPE - FUTURE PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -200805

ORDER NO:

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

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

EMAIL REPORTS TO: [redacted]

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:

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		05/08/2020 08:02 AM	Water	ALS: 4 Non ALS: 0	No		X		
002	GW2		05/08/2020 08:03 AM	Water	ALS: 4 Non ALS: 0	No		X		
003	GW3		05/08/2020 08:00 AM	Water	ALS: 4 Non ALS: 0	No		X		
004	GW5		05/08/2020 06:43 AM	Water	ALS: 4 Non ALS: 0	No		X		
005	GW6		05/08/2020 08:50 AM	Water	ALS: 4 Non ALS: 0	No		X		
006	CISW1		05/08/2020 09:43 AM	Water	ALS: 5 Non ALS: 0	No	X			
007	CISW2		05/08/2020 10:28 AM	Water	ALS: 5 Non ALS: 0	No	X			
008	CISW3		05/08/2020 10:32 AM	Water	ALS: 5 Non ALS: 0	No	X			
009	CISW4		05/08/2020 09:18 AM	Water	ALS: 5 Non ALS: 0	No	X			

CHAIN OF CUSTODY

ALS COC#: 13096 *ALS Laboratory:* EB Brisbane

CLIENT: FUPE - FUTURE PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -200805

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: [redacted]

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:

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		05/08/2020 09:44 AM	Water	ALS: 5 Non ALS: 0	No	X			
011	Rinstate		05/08/2020 05:12 PM	Water	ALS: 5 Non ALS: 0	No	X			
012	Blank		05/08/2020 05:22 PM	Water	ALS: 5 Non ALS: 0	No	X			
013	SWQA		05/08/2020 09:19 AM	Water	ALS: 5 Non ALS: 0	No	X			

CHAIN OF CUSTODY

ALS COC#: 13096 ALS Laboratory: EB Brisbane

CLIENT: FUPE - FUTURE PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -200805

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: [redacted]

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:

SAMPLE	SAMPLE NAME	BOTTLE NAME	VOLUME	BARCODE	TYPE	FILTERED	REASON
001	GW1	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002073359	Red	Yes	
001	GW1	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219018625	Purple	No	
001	GW1	Clear Plastic Bottle - Natural	250 mL	00071119206961	Green	No	
001	GW1	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036593	Purple	No	
002	GW2	Clear Plastic Bottle - Natural	250 mL	00071119206971	Green	No	
002	GW2	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019245	Purple	No	
002	GW2	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090382	Red	Yes	
002	GW2	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036651	Purple	No	
003	GW3	Clear Plastic Bottle - Natural	250 mL	00071119207005	Green	No	
003	GW3	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219018660	Purple	No	
003	GW3	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036672	Purple	No	
003	GW3	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002073373	Red	Yes	
004	GW5	Clear Plastic Bottle - Natural	250 mL	00071119206979	Green	No	
004	GW5	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219018665	Purple	No	
004	GW5	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002073377	Red	Yes	
004	GW5	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036631	Purple	No	
005	GW6	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002073393	Red	Yes	
005	GW6	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036569	Purple	No	
005	GW6	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019258	Purple	No	
005	GW6	Clear Plastic Bottle - Natural	250 mL	00071119206946	Green	No	
006	CISW1	BOD Bottle Unpreserved	250 mL	00071119207009	Green	No	
006	CISW1	Clear Plastic Bottle - Natural	250 mL	00070519138793	Green	No	
006	CISW1	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036469	Purple	No	
006	CISW1	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090475	Red	Yes	
006	CISW1	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019261	Purple	No	
007	CISW2	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090478	Red	Yes	

CHAIN OF CUSTODY

ALS COC#: 13096 *ALS Laboratory:* EB Brisbane

CLIENT: FUPE - FUTURE PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -200805

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

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:

007	CISW2	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019287	Purple	No	
007	CISW2	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036714	Purple	No	
007	CISW2	BOD Bottle Unpreserved	250 mL	00071119206985	Green	No	
007	CISW2	Clear Plastic Bottle - Natural	250 mL	00071119207015	Green	No	
008	CISW3	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090485	Red	Yes	
008	CISW3	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036701	Purple	No	
008	CISW3	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019273	Purple	No	
008	CISW3	BOD Bottle Unpreserved	250 mL	00071119206999	Green	No	
008	CISW3	Clear Plastic Bottle - Natural	250 mL	00071119206984	Green	No	
009	CISW4	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019254	Purple	No	
009	CISW4	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036715	Purple	No	
009	CISW4	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002073348	Red	Yes	
009	CISW4	BOD Bottle Unpreserved	250 mL	00071119206996	Green	No	
009	CISW4	Clear Plastic Bottle - Natural	250 mL	00071119207001	Green	No	
010	CISW5	BOD Bottle Unpreserved	250 mL	00071119206965	Green	No	
010	CISW5	Clear Plastic Bottle - Natural	250 mL	00071119206989	Green	No	
010	CISW5	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002073326	Red	Yes	
010	CISW5	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019331	Purple	No	
010	CISW5	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036647	Purple	No	
011	Rinstate	BOD Bottle Unpreserved	250 mL	00071119207014	Green	No	
011	Rinstate	Clear Plastic Bottle - Natural	250 mL	00071119207012	Green	No	
011	Rinstate	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090465	Red	Yes	
011	Rinstate	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036492	Purple	No	
011	Rinstate	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019281	Purple	No	
012	Blank	BOD Bottle Unpreserved	250 mL	00071119206978	Green	No	
012	Blank	Clear Plastic Bottle - Natural	250 mL	00071119207006	Green	No	
012	Blank	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019286	Purple	No	

CHAIN OF CUSTODY

COC#: 13096 *ALS Laboratory:* EB Brisbane

CLIENT: FUPE - FUTURE PLUS ENVIRONMENTAL

PROJECT: Redlands Landfill

SITE: Coochiemudlo Is Closed LF -200805

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: [redacted]

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:

012	Blank	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090483	Red	Yes	
012	Blank	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036692	Purple	No	
013	SWQA	Clear Plastic Bottle - Nitric Acid; Filtered	60 mL	00122002090453	Red	Yes	
013	SWQA	Amber TOC Vial - Sulfuric Acid	40 mL	00180220036467	Purple	No	
013	SWQA	Clear Plastic Bottle - Sulfuric Acid	60 mL	00101219019277	Purple	No	
013	SWQA	BOD Bottle Unpreserved	250 mL	00071119206972	Green	No	
013	SWQA	Clear Plastic Bottle - Natural	250 mL	00071119206974	Green	No	

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

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2020621**

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	: 5329 Redlands	Page	: 1 of 3
Order number	:	Quote number	: EB2019FUPE0003 (BN/235/18 B V12)
C-O-C number	: 13096	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: Coochiemudlo Is Closed LF -200805		
Sampler	: KAINE PRITCHARD, NICHOLAS EVANS		

Dates

Date Samples Received	: 06-Aug-2020 13:20	Issue Date	: 06-Aug-2020
Client Requested Due Date	: 13-Aug-2020	Scheduled Reporting Date	: **13-Aug-2020**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 3	Temperature	: 1.4°C, 1.2°C, 0.6°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
- 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 Nitrate 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
EB2020621-001	05-Aug-2020 08:02	GW1	✓	✓	✓	✓	✓	✓	✓
EB2020621-002	05-Aug-2020 08:03	GW2	✓	✓	✓	✓	✓	✓	✓
EB2020621-003	05-Aug-2020 08:00	GW3	✓	✓	✓	✓	✓	✓	✓
EB2020621-004	05-Aug-2020 06:43	GW5	✓	✓	✓	✓	✓	✓	✓
EB2020621-005	05-Aug-2020 08:50	GW6	✓	✓	✓	✓	✓	✓	✓
EB2020621-006	05-Aug-2020 09:43	CISW1	✓	✓				✓	✓
EB2020621-007	05-Aug-2020 10:28	CISW2	✓	✓				✓	✓
EB2020621-008	05-Aug-2020 10:32	CISW3	✓	✓				✓	✓
EB2020621-009	05-Aug-2020 09:18	CISW4	✓	✓				✓	✓
EB2020621-010	05-Aug-2020 09:44	CISW5	✓	✓				✓	✓
EB2020621-011	05-Aug-2020 17:12	Rinstate	✓	✓				✓	✓
EB2020621-012	05-Aug-2020 17:22	Blank	✓	✓				✓	✓
EB2020621-013	05-Aug-2020 09:19	SW0A	✓	✓				✓	✓

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
EB2020621-001	05-Aug-2020 08:02	GW1		✓			✓	
EB2020621-002	05-Aug-2020 08:03	GW2		✓			✓	
EB2020621-003	05-Aug-2020 08:00	GW3		✓			✓	
EB2020621-004	05-Aug-2020 06:43	GW5		✓			✓	
EB2020621-005	05-Aug-2020 08:50	GW6		✓			✓	
EB2020621-006	05-Aug-2020 09:43	CISW1	✓	✓	✓	✓	✓	✓
EB2020621-007	05-Aug-2020 10:28	CISW2	✓	✓	✓	✓	✓	✓
EB2020621-008	05-Aug-2020 10:32	CISW3	✓	✓	✓	✓	✓	✓
EB2020621-009	05-Aug-2020 09:18	CISW4	✓	✓	✓	✓	✓	✓
EB2020621-010	05-Aug-2020 09:44	CISW5	✓	✓	✓	✓	✓	✓
EB2020621-011	05-Aug-2020 17:12	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
EB2020621-012	05-Aug-2020 17:22	Blank	✓	✓	✓	✓	✓	✓
EB2020621-013	05-Aug-2020 09:19	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
- *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

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2020621**	Page	: 1 of 7
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
Telephone	: +61 07 54502688	Telephone	: +61 7 3552 8634
Project	: 5329 Redlands	Date Samples Received	: 06-Aug-2020 13:20
Order number	:	Date Analysis Commenced	: 06-Aug-2020
C-O-C number	: 13096	Issue Date	: 13-Aug-2020 12:01
Sampler	: KAINE PRITCHARD, NICHOLAS EVANS		
Site	: Coochiemudlo Is Closed LF -200805		
Quote number	: BN/235/18 B V12		
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

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
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Morgan Lennox		Brisbane Organics, 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.

- EK057G (Nitrite as N) / EK059G (Nitrite and Nitrate as N): Some samples were 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)				Client sample ID	GW1	GW2	GW3	GW5	GW6
				Client sampling date / time	05-Aug-2020 08:02	05-Aug-2020 08:03	05-Aug-2020 08:00	05-Aug-2020 06:43	05-Aug-2020 08:50
Compound	CAS Number	LOR	Unit		EB2020621-001	EB2020621-002	EB2020621-003	EB2020621-004	EB2020621-005
					Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		115	45	12	25	15
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		30	132	175	69	763
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		60	56	1	<1	2
Magnesium	7439-95-4	1	mg/L		20	25	2	4	57
Sodium	7440-23-5	1	mg/L		23	57	16	49	335
Potassium	7440-09-7	1	mg/L		13	10	<1	<1	2
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.01	0.04	0.12	0.02	5.71
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	<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	0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.003
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	0.006	0.007	<0.005	0.015
Manganese	7439-96-5	0.001	mg/L		0.011	0.001	0.004	0.001	0.135
Iron	7439-89-6	0.05	mg/L		<0.05	1.20	0.08	<0.05	2.23
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	<0.01	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		1.48	0.05	0.02	1.48	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		1.48	0.05	0.02	1.48	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	0.08	0.46	<0.01	0.08
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		5	4	4	2	3

Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)				Client sample ID	CISW1	CISW2	CISW3	CISW4	CISW5
				Client sampling date / time	05-Aug-2020 09:43	05-Aug-2020 10:28	05-Aug-2020 10:32	05-Aug-2020 09:18	05-Aug-2020 09:44
Compound	CAS Number	LOR	Unit		EB2020621-006	EB2020621-007	EB2020621-008	EB2020621-009	EB2020621-010
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		<5	21	15	10	<5
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		101	58	25	38	<1
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		161	86	64	95	22
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		32	10	8	7	4
Magnesium	7439-95-4	1	mg/L		30	10	6	9	2
Sodium	7440-23-5	1	mg/L		68	51	37	57	14
Potassium	7440-09-7	1	mg/L		15	6	8	<1	2
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.32	0.40	0.22	0.26	0.42
Arsenic	7440-38-2	0.001	mg/L		<0.001	0.001	<0.001	0.002	0.004
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	0.002
Copper	7440-50-8	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
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		0.009	0.010	0.007	0.013	0.006
Manganese	7439-96-5	0.001	mg/L		0.008	0.036	0.043	0.019	0.019
Iron	7439-89-6	0.05	mg/L		0.56	4.33	4.73	2.09	3.13
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	0.01	<0.01	0.01	0.03
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.05	<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	<0.05	<0.05	<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	<0.05	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.4	1.5	1.6	0.7	0.6

Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)				Client sample ID	CISW1	CISW2	CISW3	CISW4	CISW5
				Client sampling date / time	05-Aug-2020 09:43	05-Aug-2020 10:28	05-Aug-2020 10:32	05-Aug-2020 09:18	05-Aug-2020 09:44
Compound	CAS Number	LOR	Unit		EB2020621-006	EB2020621-007	EB2020621-008	EB2020621-009	EB2020621-010
					Result	Result	Result	Result	Result
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.4	1.5	1.6	0.7	0.6
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.01	0.08	0.08	0.02	0.05
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		14	39	44	19	15
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		34	143	185	46	45
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	3	4	2	<2

Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)				Client sample ID	Rinstate	Blank	SWQA	----	----
				Client sampling date / time	05-Aug-2020 17:12	05-Aug-2020 17:22	05-Aug-2020 09:19	----	----
Compound	CAS Number	LOR	Unit		EB2020621-011	EB2020621-012	EB2020621-013	--------	--------
					Result	Result	Result	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		<5	<5	**8**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	**37**	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		<1	<1	**96**	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		<1	<1	**7**	----	----
Magnesium	7439-95-4	1	mg/L		<1	<1	**9**	----	----
Sodium	7440-23-5	1	mg/L		<1	<1	**57**	----	----
Potassium	7440-09-7	1	mg/L		<1	<1	<1	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	**0.26**	----	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	**0.002**	----	----
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	**0.002**	----	----
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	**0.013**	----	----
Manganese	7439-96-5	0.001	mg/L		<0.001	<0.001	**0.020**	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	**2.06**	----	----
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	**0.8**	----	----

Analytical Results

Sub-Matrix: SURFACE WATER (Matrix: WATER)				Client sample ID	Rinstate	Blank	SWQA	----	----
				Client sampling date / time	05-Aug-2020 17:12	05-Aug-2020 17:22	05-Aug-2020 09:19	----	----
Compound	CAS Number	LOR	Unit		EB2020621-011	EB2020621-012	EB2020621-013	--------	--------
					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	**0.8**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	**0.03**	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	<1	**17**	----	----
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		<10	<10	**47**	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	**2**	----	----

Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2020621**	Page	: 1 of 9
Client	: **FUTURE PLUS ENVIRONMENTAL**	Laboratory	: Environmental Division Brisbane
Contact	: NICHOLAS EVANS	Telephone	: +61 7 3552 8634
Project	: 5329 Redlands	Date Samples Received	: 06-Aug-2020
Site	: Coochiemudlo Is Closed LF -200805	Issue Date	: 13-Aug-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

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

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, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**----**	----	----	**12-Aug-2020**	12-Aug-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	**05-Aug-2020**	**----**	----	----	**06-Aug-2020**	02-Sep-2020	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
GW1, GW2, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**----**	----	----	**06-Aug-2020**	02-Sep-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	**05-Aug-2020**	**----**	----	----	**07-Aug-2020**	02-Sep-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	**05-Aug-2020**	**----**	----	----	**07-Aug-2020**	01-Feb-2021	✓
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	**05-Aug-2020**	**----**	----	----	**10-Aug-2020**	02-Sep-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	**05-Aug-2020**	**----**	----	----	**11-Aug-2020**	02-Sep-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	**05-Aug-2020**	**----**	----	----	**06-Aug-2020**	07-Aug-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	**05-Aug-2020**	**----**	----	----	**11-Aug-2020**	02-Sep-2020	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**11-Aug-2020**	02-Sep-2020	✓	**11-Aug-2020**	02-Sep-2020	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**11-Aug-2020**	02-Sep-2020	✓	**11-Aug-2020**	02-Sep-2020	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
GW1, GW2, GW3, GW5, GW6	**05-Aug-2020**	**12-Aug-2020**	02-Sep-2020	✓	**12-Aug-2020**	02-Sep-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, GW3, GW5, GW6, CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**----**	----	----	**07-Aug-2020**	02-Sep-2020	✓
EP026SP: Chemical Oxygen Demand (Spectrophotometric)							
Clear Plastic Bottle - Sulfuric Acid (EP026SP)							
CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**----**	----	----	**11-Aug-2020**	02-Sep-2020	✓
EP030: Biochemical Oxygen Demand (BOD)							
BOD Bottle Unpreserved (EP030)							
CISW1, CISW2, CISW3, CISW4, CISW5, Rinstate, Blank, SWQA	**05-Aug-2020**	**----**	----	----	**07-Aug-2020**	07-Aug-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	3	28	10.71	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	19	10.53	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	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	17	11.76	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	3	22	13.64	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	5	39	12.82	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	28	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	5.26	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	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	17	11.76	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	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	39	7.69	5.00	✓	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	28	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chemical Oxygen Demand (COD) (Spectrophotometric)	EP026SP	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	5.26	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	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	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	17	5.88	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	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	39	7.69	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	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	5.26	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	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	22	9.09	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	39	7.69	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 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 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 seal method 2 017-1-L
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 Schedule B(3) 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 Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM 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 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 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 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 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 Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
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 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 Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. 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 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 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 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 Schedule B(3)

Appendix G.

Fieldnotes & Calibration Certificate

Future Plus Environmental - Groundwater Quality Monitoring Form

Client: RCC

Job No.: 5329

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

Date: 5/8/20

Site: Redlands Landfills - ~~Judy Holt~~ 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
	CISW5	-	-	-	-	17.9	49.0	96.9	55.3	36.0/2.52	6.18	56	Tannin, large particles, no odour
	CISW1	-	-	-	-	17.7	9.7	681	422	42.1/5.35	6.46	89	Clear, no odour, large particles
	CISW2	-	-	-	-	18.8	37.2	418	255	64.4/4.35	4.91	28	Tannin, organic particles
	CISW3	-	-	-	-	18.2	6.1	284	169	52.4/5.62	4.91	66	Tannin organic particles

Future Plus Environmental - Groundwater Quality Monitoring Form

Client: RCC

Job No.: 5329

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

Date: 5/08/23

Site: Redlands Landfills - ~~Judy Holt~~ 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	3.59	12.06	49.8	1	18.1	6.9	206	123.8	40.5/7.34	6.55	27	Clear, small particles, no odour
					10	19.3	23.7	240	138	42.5/3.01	4.61	130	
					20	22.0	26.1	259	154	32.4/3.37	4.59	134	
					30	22.3	19.4	257	151	34.4/2.72	4.54	130	
					40	22.5	7.7	270	161	28.8/2.66	4.50	133	
					50 (sample)	23.4	8.3	279	159	37.7/2.54	4.59	132	
	GW1	1.44	3	9.17	1	19.3	1.9	476	285	38.2/6.69	5.84	94	Clear, small suspended solids, no odour
					9 (sample)	21.5	9.5	501	309	33.6/2.87	6.33	79	
	GW2	2.03	3.34	8.03	1	18.8	821	822	514	24.2/2.45	6.46	37	Sulphuric odour, suspended solids.
					8 (sample)	19.6	206	749	470	36.0/2.88	6.69	-58	
	GW3	4.67	11.42	39.69	1	16.7	1658	135.3	78.6	28.6/3.58	6.02	10	Orange, turbid, no odour
					10	17.1	946	150.1	75.4	28.5/2.07	4.87	44	
					20	20.4	876	94.9	56.8	19.1/2.15	5.04	28	
					30	19.6	2019	84.6	48.9	19.8/1.26	5.12	19	
					40 (sample)	20.2	1558	89.8	50.7	17.0/1.85	4.93	37	
	GW6	8	16.53	50.15	1	15.7	38.8	2209	1465	33.4/2.91	3.69	-76	Clear, no odour
					10	18.1	36.1	2.31mS	1.47ppK	30.9/2.50	3.78	-96	Sandy, sulphuric odour
					20	21.1	62.2	2149	1435	16.2/1.18	3.81	-118	
					30	20.4	33.6	2.23mS	1.43ppK	19.3/2.49	3.76	-110	
					40	20.2	52.1	2096	1374	5.6/6.9	3.91	-22	Dry @ 48
					48 (sample)	22.7	208	2074	1351	25.9/2.13	3.80	-46	
	CISW4	-	-	-	18.2	18.2	10.1	362	219	37.8/4.43	5.47	-16	QA Tannin, large organic particles

CERTIFICATE OF CALIBRATION

Customer Name : FUTURE PLUS ENVIRONMENTAL
Product Code : 90FLT
Part Number : 126105
Serial No : U9332
Certificate N0: 14826

Battery : Battery = 7.58 V
Battery = 7.67 V at 210mA charge current
Battery is ok.

pH : Sensor tested with meter in buffers at...

Standard Value	Calibration Result
Ph6.88 at 20.7oC	0.34 pH Asymmetry
pH4.00 at 20.7oC	94.6% Slope

Sensor Asymmetry and Slope calibration values are within allowable tolerances.

Conductivity : Sensor tested with meter in standard solutions...

Standard Value	Calibration Result
Zero (in Air)	Zero = 0.0 uS/cm
36 ppK	k = 12.5

Sensor Zero and Span calibration values are within allowable tolerances.

Temperature : Calibrated Temperature section of Conductivity sensor...

Calibration Value	Calibration Result	
Low: Ambient	20.7 oC	Offset = 1.8 oC
High: 38.0 oC	38.2 oC	SPAN =101.1%

Sensor Offset value IS within allowable tolerances.

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Email sales@tps.com.au

Dissolved Oxygen : Sensor tested with meter...

Standard Value	Calibration Result
0.0 % Sat (Na2SO3)	Zero = 4.8%
100.0 % Sat (Air)	Span = 83.1%

Sensor Zero and Span calibration values are within allowable tolerances.

Redox : Sensor tested with meter in standard solutions...

Standard Value	Calibration Result
Zobell (20.8 oC)	223 mV

Sensor values are within allowable tolerances.

Turbidity : Sensor tested with meter in standard solutions...

Standard Value	Calibration Result
Zero (Pure Water)	0 NTU
90 NTU	90 NTU
90 NTU	Span = 106.3%
900 NTU	900 NTU
900 NTU	Span = 100.2 %

Sensor Zero and Span calibration values are within allowable tolerances.

Keypad : All keypad functions tested. All keys OK.

Tested by : J.W

Issue Date : 27, JULY , 2020

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