
METSERVE
Mining & Energy Technical Services Pty Ltd

# Groundwater Quality and Level Trigger Assessment

## for Vulcan South

**September 2022**

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**TABLES**



**FIGURES**



**APPENDICES**

# 1 INTRODUCTION

Mining & Energy Technical Services Pty Ltd (METServe) has been engaged by Vitrinite Pty Ltd to prepare a groundwater quality and level trigger assessment to support an Environmental Authority (EA) application for Vulcan South (the Project). The Project is proposed to be developed by Vitrinite Pty Ltd., owner of Queensland Coking Coal Pty Ltd and QLD Coal Aust No.1 Pty Ltd, the proponents of the Project and subsequent EA applicants.

## 1.1 BACKGROUND

The Project is located immediately south of Vitrinite's Vulcan Coal Mine (VCM), located on ML700060, 40 km south of Moranbah in Queensland. The proposed MLA boundary (the Project area) abuts ML700060; however, proposed activities for Vulcan South and VCM will be implemented separately. The Vulcan hard coking coal target has been defined and selected for open cut development via three separate open cut pits that form the primary mining focus of the Project (i.e. Vulcan North pit, Vulcan Main pit, and Vulcan South pit). The Project will operate for approximately nine years, including primary rehabilitation works, following a two-year construction period. The Project will extract approximately 13.5 million tonnes (Mt) of Run of Mine (ROM) coal consisting predominantly of hard coking coal with an incidental thermal secondary product at a rate of up to 1.95 million tonnes per annum (Mtpa). The Project will target the Alex and multiple Dysart Lower coal seams. Truck and shovel mining operations will be employed to develop the pits.

Ex-pit waste rock dumps will be established prior to commencing in-pit dumping activities that will continue for the life of the operation. Ancillary infrastructure, including a ROM pad, modular coal handling and preparation plant (CHPP), rail loop and train load-out facility (TLO), Mine Infrastructure Area (MIA), offices, roads and surface water management infrastructure will be established to support the operation. In-pit dumping will fill the majority of the pit volumes during operations with the remaining final voids to be backfilled upon cessation of mining, resulting in the establishment of low waste rock dump landforms over the former pit areas. The initial Ex-pit waste rock dump will be rehabilitated in-situ.

The Project includes a small-scale highwall mining trial program in the north of the Project area. The trial will involve the establishment of four highwall mining benches across several hillsides to facilitate extraction of coal utilising a highwall miner. The highwall mining trial will target up to 750 kilotonnes (kt) of coal which will be transported by truck to the CHPP via a dedicated haul road. The highwall mining trial is scheduled to be completed within the first year of mining operations.

A groundwater monitoring network was established across the Project area in June 2019 to support the collection of baseline data for Vulcan South. Vulcan South's groundwater monitoring network consists of eight monitoring bores, whereby water level and quality are periodically monitored (see section 2 for further details).

## 2 GROUNDWATER MONITORING NETWORK

The Project's groundwater monitoring network consists of eight monitoring bores across the Project area. Bore details are outlined in **Table 1** and locations shown in **Figure 1.**

**Table 1 Vulcan South's Groundwater Monitoring Bore Construction Details**

| Monitoring location | Easting | Northing | Target formation | Casing height (m) | Casing elevation (mAHD) | Depth (mbgl) | Monitoring interval (mbgl) | Airlift yield (L/min) |
|---|---|---|---|---|---|---|---|---|
| MB01 | 625606 | 7529691 | DLL coal seam | 0.70 | 222.91 | 24.9 | 21.9 – 24.9 | Dry |
| MB06 | 628119 | 7526476 | Weathered Permian | 0.70 | 214.61 | 24.6 | 21.6 – 24.6 | Dry |
| MB07 | 628691 | 7526258 | Weathered Permian | 0.67 | 215.99 | 43.0 | 40.0 – 43.0 | 0.1 |
| MB08 | 628092 | 7527015 | Weathered Permian | 0.70 | 212.24 | 24.0 | 21.0 – 24.0 | Dry |
| MB09 | 629511 | 7525222 | DLL coal seam | 0.65 | 208.98 | 34.4 | 31.4 – 34.4 | 0.1 |
| MB10 | 628123 | 7526469 | DLL coal seam | 0.70 | 214.60 | 40.3 | 37.3 – 40.3 | < 0.1 |
| MB11 | 627403 | 7527854 | DLL coal seam | 0.70 | 225.66 | 29.9 | 26.9 – 29.9 | Dry |
| MB12 | 625251 | 7526409 | Back Creek Group | 0.66 | 241.43 | 38.2 | 32.2 – 38.2 | 1 |

*Notes:* *mAHD – meters Australian Height Datum*
*mbgl – metres below ground level*
*L/min – litres per minute*

Groundwater monitoring bores MB01, MB06, MB08, and MB11 have been consistently dry since installation in 2019. Owing to this, no groundwater quality or level trigger limits have been developed for these dry bores.

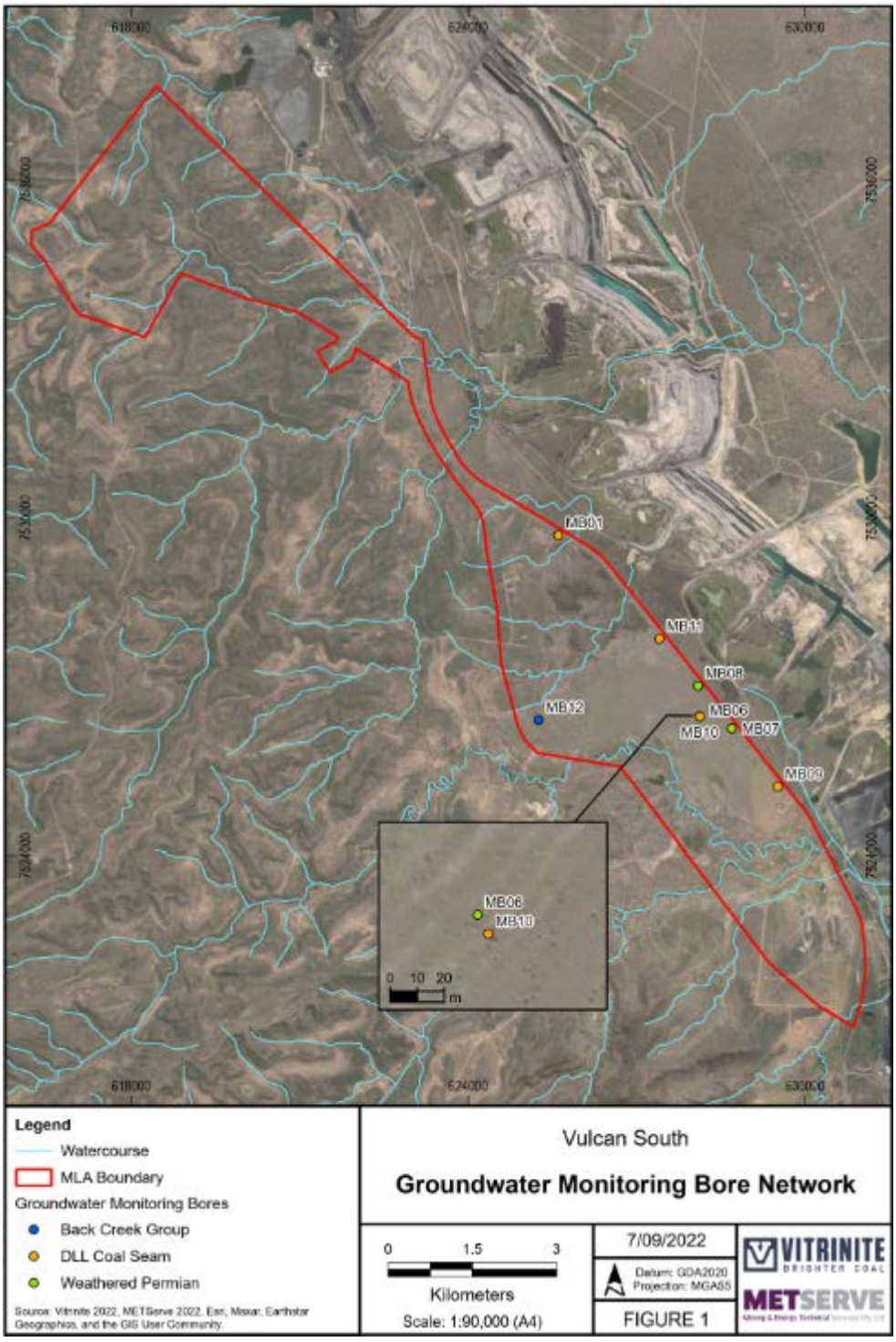


**Figure 1 Vulcan South Groundwater Monitoring Network**

# 3 GROUNDWATER LEVELS

## 3.1 METHODOLOGY

The methodology used to develop the proposed groundwater level trigger thresholds for Vulcan South included:

- determining the pre-mining baseline groundwater level for each monitoring bore;
- calculating the seasonal variation in groundwater levels for each monitoring bore; and
- extracting the predicted groundwater drawdown at the monitoring bore location for the bore's monitored formation from the numerical flow model (developed by hydrogeologist.com.au).

The pre-mining baseline for each monitoring bore was determined as the groundwater level seen in the latest groundwater level measurements collected in June 2022. The seasonal variation in groundwater levels recorded at each bore were also calculated using the variation between minimum and maximum measurements recorded over the pre-mining data collection period (June 2019 to June 2022).

Using the numerical model developed for the Project, predicted drawdowns within the bore's monitored geologic formation were extracted at each bore location (hydrogeologist.com.au, 2022). If a formation's predicted drawdown was to be limited / negligible at the monitoring bore's location, a conservative drawdown value of 0.2 m was applied (hydrogeologist.com.au, 2021). The numerical model indicates the largest maximum drawdown within the shallowest layer is the weathered Permian formation at MB07, followed by the DLL coal seam at both MB09 and MB10. The groundwater level trigger values were then calculated as the pre-mining baseline level minus the seasonal variation and predicted drawdown (see **Table 2** for values used in calculation).

## 3.2 PROPOSED GROUNDWATER LEVEL TRIGGER VALUES

The proposed groundwater level trigger thresholds are listed in **Table 2** below.

**Table 2 Proposed Groundwater Level Trigger Values**

| Monitoring location | Target formation | Pre-mining baseline level (mAHD) | Predicted formation drawdown (m) | Seasonal variation (m) | Groundwater level trigger threshold (mAHD) |
|---|---|---|---|---|---|
| MB07 | Weathered Permian | 180.01 | 10.96 | 0.91 | 168.14 |
| MB09 | DLL coal seam | 181.38 | 5.23 | 0.53 | 175.63 |
| MB10 | DLL coal seam | 182.66 | 6.47 | 0.52 | 175.67 |
| MB12 | Back Creek Group | 215.83 | 0.2[1] | 2.49 | 213.14 |

*Notes: mAHD – meters Australian Height Datum*

*[1] No drawdown predicted by the numerical model, hence 0.2 m drawdown value used.*

# 4 GROUNDWATER QUALITY

## 4.1 METHODOLOGY

The methodology to determine the proposed groundwater quality trigger levels included:

- collating the available groundwater quality data from the groundwater monitoring bores;
- analysing the available groundwater data and developing summary statistics for each individual monitoring bore, and each geological formation monitored by the groundwater monitoring bores;
- comparing the summary statistics to ANZG (2018) guidelines and any published groundwater quality objectives associated with the local groundwater regime; and
- developing groundwater quality triggers that address the environmental protection requirements of an EA condition.

The following sections provide additional information on the methodology used to develop the proposed groundwater quality trigger values.

### 4.1.1 Data collation and statistical analysis

Vulcan South's groundwater monitoring network consists of eight monitoring bores; four of which have remained dry since installation in 2019 and have not been addressed in this assessment. In-line with the groundwater monitoring regime at the VCM, monthly water quality sampling was completed for the first four months post-install, decreasing to quarterly sampling thereafter. A total of 17 – 18 monitoring events have occurred at the Project's monitoring bores since June 2019.

Each groundwater sample collected was measured for field parameters in-situ (e.g pH, EC), as well as laboratory analysis which included major ion and metals (dissolved and totals) analysis. Total Recoverable Hydrocarbons (TRH) was added to the sample suite in December 2020.

Although duplicate samples were collected during each monitoring event, such samples have been removed from the dataset prior to statistical analysis. Where groundwater quality concentrations were measured to be below the laboratories limit of reporting (LOR), a value of half the LOR was substituted to enable statistical analysis. LOR results detailed in **Appendix A** – Groundwater Quality and Level Data are coloured red and are in italics.

Summary statistics for each analyte per monitoring bore are shown in **Appendix B** – Groundwater Quality Statistics Summary aligning with DES' guideline *Using monitoring data to assess groundwater quality and potential environmental impacts'* (2021).

**Appendix C** illustrates box and whisker plots as well as long-term trends of each analyte (per bore) which are considered a contaminant of concern. Box and whisker plots represent the 25$^{th}$ to 75$^{th}$ percentile (edges of boxes) and medians of the data, while the whiskers represent the minimum or maximum value that falls within 1.5 times the interquartile range (75$^{th}$ percentile minus the 25$^{th}$ percentile).

### 4.1.2 Review of applicable water quality objectives

The *Environmental Protection Act* (EP Act) establishes an Environmental Protection Policy (EPP) for water. The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (Qld) (EPP Water) provides a framework for the protection of environmental values (e.g surface water uses) associated with Queensland rivers, streams, wetlands, lakes, aquifer, estuaries and coastal areas. Under this framework, environmental values for specific catchments and drainage basins have been formalised through a process of statutory declaration. Environmental values formalised in this way are listed in Schedule 1 of the EPP Water.

The published groundwater environmental values for the Isaac River sub-basin include aquatic ecosystems, recreational use, agriculture (irrigation, farm supply, stock water), drinking water supply and cultural values.

The EPP Water provides groundwater quality objectives for the protection of high ecological value groundwater ecosystems and drinking water. However, it should be noted that there are no high ecological value groundwater ecosystems present within the vicinity of the project.

While the Project is located outside the extent of the Fitzroy Basin groundwater zones and any subsequent sub-basin plans, box and whisker plots developed from the site-specific dataset includes water quality objectives (WQOs) for the nearest local government groundwater zone, zone 34 within the Dawson River sub-basin plan. 20$^{th}$, 50$^{th}$ and 80$^{th}$ percentile values for Zone 34 are illustrated on the box and whisker plot as a comparison to the regional groundwater chemistry (see **Appendix C** for plots). Zone 34 'deep' values were considered the most relevant to the Project's groundwater monitoring bores, as majority of the bores are greater than 30 m in depth.

Overall, groundwater within the Project area measured at the Project's monitoring bores are consistently more acidic than that of the relevant regional values. Hence, the application of Zone 34's regional groundwater quality objectives to the Project's groundwater monitoring network is not considered appropriate.

### 4.1.3 Development of groundwater quality triggers

Reference bores were not considered when determining the compliance approach for groundwater quality triggers, as pre-mining baseline data is not available for multiple bores within every aquifer across the Project area. Additionally, the ionic composition between bores, both within the same aquifer and between different aquifers, varies. For these reasons, comparison between compliance and reference bores is not considered appropriate. Instead, the recommended compliance approach outlined in the DES (2021) guideline *Using monitoring data to assess groundwater quality and potential environmental impacts* was followed, developing a single compliance limit from the 95$^{th}$ percentile of site-specific data.

Groundwater quality trigger values were not developed for MB01, MB06, MB08 or MB11 due to these monitoring bores being consistently dry since installation. Proposed groundwater quality trigger values for MB07, MB09, MB10 and MB12 were developed for the following analytes: field pH, field EC, sulphate, aluminium, arsenic, iron, lead, mercury, molybdenum, selenium, and TRH (both TRH C6-C10 and TPH C10-C40). Dissolved fractions were used when developing trigger values for metalloid analytes. Analytes such as major cations (sodium, potassium, calcium, magnesium) and major anions (chloride, bicarbonate, carbonate) did not have triggers developed as they are not considered a contaminant of concern. Such analytes are monitored for interpretive purposes only.

## 4.2. Groundwater Quality Characteristics and Proposed Groundwater Quality Trigger Values

The groundwater quality characteristics measured at the Project's monitoring bores is illustrated in Figure 2. The Piper plot indicates that groundwater is generally of a sodium-chloride type. No distinct relationship between the aquifer and groundwater quality is apparent, with each bore plotting in different locations on the Piper plot, **Figure 2.**

Monitoring bores MB09 and MB10, which both monitor the DLL coal seam, show differing groundwater characteristics. This indicates a low degree of connectivity between bores screened within the same aquifer, and the spatial differences in water chemistry across the Project area.

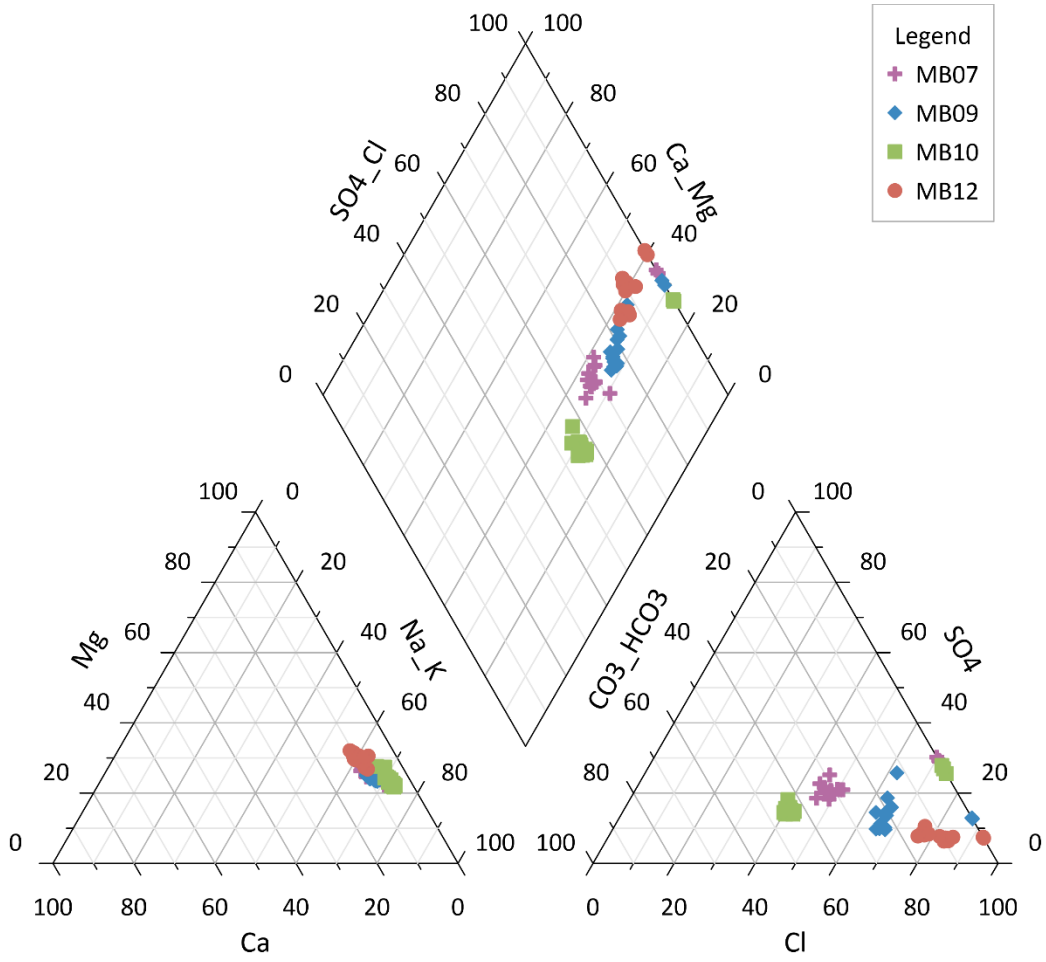


**Figure 2** **Piper Plot for Vulcan South Groundwater Monitoring Bores**

The proposed groundwater quality triggers were developed from site-specific data collected between June 2019 and June 2022, consisting of 18 monitoring events. The 95$^{th}$ percentile for each analyte per monitoring bore were calculated and compared to the corresponding ANZG (2018) default guideline.

Since monitoring began in June 2019, several metalloid analytes have consistently recorded concentrations below the limit of reporting (LOR). In this case, the ANZG (2018) guideline values for the 95% level of species protection have been applied rather than a 95$^{th}$ percentile derived trigger owing to the numerous records below LOR. For TRH (both C6-C10 and C10-C40), the LOR has also been applied as the proposed trigger value, due to the ANZG (2018) guideline value for TRH being significantly lower than LOR. It is recommended that if several results are recorded above the LOR for aluminium, arsenic, lead, mercury, molybdenum, selenium and TRH, site specific trigger values should then be calculated. Proposed groundwater quality trigger values for Vulcan South are presented in **Table 3** below.

**Table 3 Proposed Groundwater Quality Trigger Values**

| Parameter | Unit | Bores | Limit | Comment |
|---|---|---|---|---|
| **pH (field)** | **pH unit** | **All bores** | **5.5 - 8.0** | **ANZG (2018)** |
| Electrical Conductivity (field) | µS/cm | MB07 | 5,834 | Site-specific 95th percentile |
| | | MB09 | 15,095 | Site-specific 95th percentile |
| | | MB10 | 4,836 | Site-specific 95th percentile |
| | | MB12 | 23,160 | Site-specific 95th percentile |
| Sulphate | mg/L | MB07 | 786 | Site-specific 95th percentile |
| | | MB09 | 1,917 | Site-specific 95th percentile |
| | | MB10 | 518 | Site-specific 95th percentile |
| | | MB12 | 938 | Site-specific 95th percentile |
| **Metals and Metalloids** | | | | |
| Aluminium | mg/L | All bores | 0.050 | ANZG (2018) |
| Arsenic | mg/L | All bores | 0.013 | ANZG (2018) |
| Iron | mg/L | MB07 | 0.600 | Site-specific 95th percentile |
| | | MB09 | 0.7 | Site-specific 95th percentile |
| | | MB10 | 0.2 | Site-specific 95th percentile |
| | | MB12 | 4.6 | Site-specific 95th percentile |
| Lead | mg/L | All bores | 0.004 | ANZG (2018) |
| Mercury | mg/L | All bores | 0.0006 | ANZG (2018) |
| Molybdenum | mg/L | All bores | 0.034 | ANZG (2018) |
| Selenium | mg/L | All bores | 0.005 | ANZG (2018) |
| TRH (C6-C10) | ug/L | All bores | < 20 | LOR |
| TRH (C10-40) | ug/L | All bores | < 50 | LOR |
| **Major Ions** | | | | |
| Bicarbonate | mg/L | All bores | For interpretation purposes only | |
| Carbonate | | | | |
| Calcium | | | | |
| Chloride | | | | |
| Magnesium | | | | |
| Potassium | | | | |
| Sodium | | | | |

# 5 GROUNDWATER TRIGGERS SUITABILITY FOR MINE CLOSURE

The proposed groundwater quality triggers are designed to detect changes in groundwater quality that has the potential to impact the environmental values associated with surrounding groundwater in the region. As the proposed triggers are based on data collected prior to mining activity commencing, the proposed triggers are representative of baseline groundwater quality within the Project area. Assuming there are no impacts to groundwater quality during the life of the Project, the proposed groundwater triggers for quality and level are considered suitable to apply in mine closure.

However, groundwater triggers should be routinely reviewed, as future sampling may indicate changes in groundwater quality that require the proposed trigger values to be amended as required. The installation or addition of new bores to the groundwater monitoring network at Vulcan South would also prompt a review of the proposed groundwater trigger values.

# 6 CONCLUSION

The proposed groundwater quality and level trigger values for Vulcan South are based upon a long-term dataset collected across the existing groundwater monitoring network. The proposed trigger values are robust, technically justifiable and have been derived in consideration of government guidelines (DES, 2021).

Adoption of the proposed groundwater trigger values for quality and level will:

- allow for the detection of changes in groundwater quality which are not consistent with long-term trends;
- identify abnormal groundwater levels or unexpected drawdowns which are inconsistent with the numerical flow model predictions;
- assessed and investigated groundwater quality or level changes in accordance with the Project's EA conditions; and
- prevent and reduce the frequency of groundwater quality or levels which are consistent with long-term trends from exceeding default trigger values (false positives) which are unrepresentative of the Project's groundwater system.

## 7 REFERENCES

ANZG (2018). Australian and New Zealand guidelines for fresh and marine water quality. Accessed from www.waterquality.gov.au/anz-guidelines. Australian and New Zealand Governments and Australia state and territory governments, Canberra.

DES (2021). Using monitoring data to assess groundwater quality and potential environmental impacts. Version 2. Department of Environment and Science (DES), Queensland Government, Brisbane.

hydrogeologist.com.au (2021). Vulcan Complex Project – Groundwater Quality Trigger Assessment. Prepared for Vitrinite Pty Ltd. April 2021.

hydrogeologist.com.au (2022). Vulcan South – Groundwater Impact Assessment. Prepared for Vitrinite Pty Ltd. March 2022.

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# Appendix A – Groundwater Quality & Level Data

**Appendix A - Groundwater Quality and Level Data**

| MB07 | LOR | Units | 6/06/2019 | 14/07/2019 | 11/08/2019 | 23/09/2019 | 24/10/2019 | 2/12/2019 | | 4/06/2020 | 6/08/2020 | 4/10/2020 | 3/12/2020 | 26/02/2021 | 10/05/2021 | 12/07/2021 | 12/09/2021 | 16/12/2021 | 22/03/2022 | 18/06/2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | 0.01 | pH units | 8.31 | 7.73 | 7.48 | 7.43 | 7.57 | 7.48 | | 7.48 | 7.79 | 7.32 | 7.98 | 7.75 | 7.95 | 7.9 | 8.11 | 7.62 | 7.63 | 8.16 |
| EC | 1 | µS/cm | 5430 | 5430 | 5630 | 5620 | 5890 | 5820 | | 5420 | 5260 | 5420 | 5530 | 5320 | 5150 | 5430 | 5440 | 5200 | 5590 | 5290 |
| $SO_4$ | 1 | mg/L | 819 | 778 | 665 | 754 | 733 | 722 | | 722 | 592 | 682 | 666 | 684 | 671 | 675 | 691 | 653 | 687 | 657 |
| Aluminium (dissolved) | 0.01 | mg/L | 0.02 | *0.005* | *0.005* | *0.005* | 0.02 | *0.005* | | *0.005* | *0.005* | *0.005* | *0.005* | 0.02 | *0.005* | *0.005* | *0.005* | *0.005* | 0.01 | *0.0025* |
| Arsenic (dissolved) | 0.001 | mg/L | 0.001 | 0.002 | *0.0005* | *0.0005* | *0.0005* | *0.0005* | | 0.003 | 0.001 | 0.003 | 0.002 | 0.003 | 0.003 | 0.002 | 0.003 | 0.002 | *0.0029* | 0.0015 |
| Lead (dissolved) | 0.001 | mg/L | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* |
| Iron (dissolved) | 0.05 | mg/L | *0.025* | *0.025* | *0.025* | *0.025* | 0.07 | *0.025* | No sample | 0.98 | 0.33 | 0.34 | 0.37 | *0.025* | 0.53 | 0.38 | 0.37 | 0.4 | 0.283 | 0.13 |
| Mercury (dissolved) | 0.0001 | mg/L | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | | |
| Molybdenum (dissolved) | 0.001 | mg/L | 0.007 | 0.006 | *0.00005* | *0.00005* | 0.001 | 0.001 | | *0.00005* | 0.001 | 0.001 | *0.00005* | 0.001 | 0.004 | *0.00005* | *0.00005* | 0.002 | 0.0016 | 0.001 |
| Selenium (dissolved) | 0.0002 | mg/L | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* |
| TRH (C6-C9) | 20 | µg/L | *10* | *10* | *10* | *10* | *10* | *10* | | *10* | *10* | *10* | *10* | 40 | *10* | *10* | *10* | *10* | *10* | *10* |
| TRH (C10-C36) | 50 | µg/L | *25* | *25* | *25* | *25* | *25* | *25* | | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | 60 | 200 | *25* |
| Standing Water Level | - | mAHD | - | 207 | 207.06 | 207.08 | 206.93 | 207.23 | | 206.41 | 207.21 | 207.16 | 207.2 | 207.28 | 207.2 | 207.25 | 207.32 | 207.31 | 207.3 | 207.3 |

| MB09 | LOR | Units | 6/06/2019 | 14/07/2019 | 12/08/2019 | 24/09/2019 | 26/10/2019 | 3/12/2019 | 22/03/2020 | 4/06/2020 | 6/08/2020 | 4/10/2020 | 3/12/2020 | 26/02/2021 | 10/05/2021 | 12/07/2021 | 12/09/2021 | 16/12/2021 | 23/03/2022 | 18/06/2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | 0.01 | pH units | 7.59 | 7.65 | 7.64 | 7.47 | 7.53 | 7.58 | 7.99 | 7.51 | 7.81 | 7.28 | 7.93 | 7.53 | 7.76 | 7.56 | 7.97 | 8.09 | 8.13 | 7.95 |
| EC | 1 | µS/cm | 16200 | 12500 | 14900 | 13500 | 13300 | 11500 | 11400 | 12000 | 12100 | 12100 | 12000 | 11600 | 11500 | 12100 | 12200 | 12000 | 11600 | 11200 |
| $SO_4$ | 1 | mg/L | 2580 | 1020 | 1800 | 1400 | 1210 | 934 | 708 | 808 | 700 | 748 | 716 | 745 | 746 | 729 | 751 | 718 | 744 | 703 |
| Aluminium (dissolved) | 0.01 | mg/L | 0.01 | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* |
| Arsenic (dissolved) | 0.001 | mg/L | 0.001 | *0.0005* | 0.001 | *0.0005* | 0.002 | 0.001 | 0.001 | 0.001 | *0.0005* | 0.001 | *0.0005* | 0.001 | 0.001 | *0.0005* | 0.001 | *0.0005* | 0.0008 | *0.0005* |
| Lead (dissolved) | 0.001 | mg/L | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* |
| Iron (dissolved) | 0.05 | mg/L | *0.025* | *0.025* | *0.025* | *0.025* | 0.89 | 0.63 | 0.66 | 0.65 | 0.29 | 0.29 | 0.08 | 0.09 | 0.42 | 0.24 | 0.3 | 0.13 | 0.137 | 0.083 |
| Mercury (dissolved) | 0.0001 | mg/L | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | | |
| Molybdenum (dissolved) | 0.001 | mg/L | 0.003 | 0.002 | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | 0.002 | *0.0005* | *0.00005* |
| Selenium (dissolved) | 0.0002 | mg/L | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* |
| TRH (C6-C10) | 20 | µg/L | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | 20 | *10* | *10* | *10* | *10* | *10* | *10* |
| TRH (C10-C40) | 50 | µg/L | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | 70 | *25* | *25* |
| Standing Water Level | - | mAHD | - | 215.64 | 215.66 | 215.69 | 215.46 | 215.81 | 215.73 | 215.53 | 215.54 | 215.28 | 215.59 | 215.65 | 215.63 | 215.62 | 215.73 | 215.76 | 215.76 | 215.68 |

| MB10 | LOR | Units | | 14/07/2019 | 12/08/2019 | 24/09/2019 | 24/10/2019 | 2/12/2019 | 22/03/2020 | 4/06/2020 | 8/08/2020 | 4/10/2020 | 3/12/2020 | 1/03/2021 | 11/05/2021 | 12/07/2021 | 13/09/2021 | 16/12/2021 | 22/03/2022 | 18/06/2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | 0.01 | pH units | | 7.62 | 7.54 | 7.67 | 7.64 | 7.51 | 7.42 | 7.57 | 7.97 | 7.37 | 8.08 | 7.59 | 8.02 | 8.01 | 8.2 | 7.55 | 7.94 | 8.14 |
| EC | 1 | µS/cm | | 5060 | 4780 | 4140 | 4280 | 4000 | 4000 | 4080 | 4110 | 3960 | 3970 | 3790 | 3720 | 3800 | 3830 | 3810 | 3760 | 3660 |
| $SO_4$ | 1 | mg/L | | 628 | 491 | 458 | 445 | 420 | 414 | 435 | 396 | 395 | 381 | 386 | 378 | 367 | 375 | 372 | 383 | 388 |
| Aluminium (dissolved) | 0.01 | mg/L | | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | 0.01 | 0.007 | *0.005* |
| Arsenic (dissolved) | 0.001 | mg/L | | *0.0005* | *0.0005* | *0.0005* | *0.0005* | *0.0005* | 0.001 | 0.001 | 0.001 | 0.001 | *0.0005* | *0.0005* | 0.001 | *0.0005* | *0.0005* | *0.0005* | 0.001 | 0.0007 |
| Lead (dissolved) | 0.001 | mg/L | | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* |
| Iron (dissolved) | 0.05 | mg/L | No sample | *0.025* | 0.07 | *0.025* | *0.025* | *0.025* | 0.29 | 0.18 | 0.12 | 0.11 | 0.08 | *0.025* | *0.025* | *0.025* | *0.025* | *0.025* | *0.025* | 0.03 |
| Mercury (dissolved) | 0.0001 | mg/L | | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | - | - |
| Molybdenum (dissolved) | 0.001 | mg/L | | 0.003 | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.004 | 0.003 | 0.002 | 0.002 | 0.007 | 0.003 | 0.0024 |
| Selenium (dissolved) | 0.0002 | mg/L | | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* |
| TRH (C6-C10) | 20 | µg/L | | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* |
| TRH (C10-C40) | 50 | µg/L | | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* |
| Standing Water Level | - | mAHD | | 210.83 | 210.88 | 210.97 | 211.02 | 211.06 | 210.98 | 216.08 | 211.17 | 211.18 | 211.23 | 211.28 | 211.24 | 211.29 | 211.33 | 211.35 | 211.34 | 211.32 |

**Appendix A - Groundwater Quality and Level Data**

| MB12 | LOR | Units | 6/06/2019 | 14/07/2019 | 11/08/2019 | 23/09/2019 | 26/10/2019 | 2/12/2019 | 22/03/2020 | 4/06/2020 | 6/08/2020 | 3/10/2020 | 3/12/2020 | 26/02/2021 | 10/05/2021 | 12/07/2021 | 13/09/2021 | 16/12/2021 | 22/03/2022 | 18/06/2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | 0.01 | pH units | 7.81 | 7.61 | 7.36 | 7.33 | 7.19 | 7.28 | 7.18 | 7.08 | 7.65 | 7.07 | 7.64 | 7.5 | 7.75 | 7.77 | 7.89 | 7.36 | 7.52 | 7.9 |
| EC | 1 | µS/cm | 21600 | 17300 | 17400 | 16900 | 20900 | 17000 | 14800 | 22200 | 23100 | 21900 | 23500 | 21900 | 22000 | 22500 | 22400 | 21800 | 21800 | 20000 |
| $SO_4$ | 1 | mg/L | 908 | 804 | 852 | 1090 | 808 | 785 | 682 | 911 | 781 | 842 | 830 | 861 | 847 | 842 | 822 | 817 | 861 | 824 |
| Aluminium (dissolved) | 0.01 | mg/L | 0.04 | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | 0.08 | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* | *0.005* |
| Arsenic (dissolved) | 0.001 | mg/L | 0.002 | 0.002 | 0.004 | 0.009 | *0.0005* | *0.0005* | *0.0005* | 0.001 | 0.001 | 0.002 | *0.0005* | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.0018 | *0.0005* |
| Lead (dissolved) | 0.001 | mg/L | 0.001 | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* |
| Iron (dissolved) | 0.05 | mg/L | 0.025 | 0.47 | 0.77 | 1.2 | 0.43 | 1.04 | 2.41 | 4.85 | 4.5 | 3.53 | 2.7 | 2.41 | 3.2 | 3.58 | 3.08 | 3.03 | 3.84 | 1.37 |
| Mercury (dissolved) | 0.0001 | mg/L | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | *0.00005* | - | - |
| Molybdenum (dissolved) | 0.001 | mg/L | 0.003 | 0.004 | 0.004 | 0.002 | 0.002 | 0.004 | 0.001 | *0.00005* | *0.00005* | 0.001 | *0.00005* | 0.004 | 0.002 | 0.001 | 0.001 | 0.001 | 0.0011 | 0.0003 |
| Selenium (dissolved) | 0.0002 | mg/L | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* | *0.0001* |
| TRH (C6-C10) | 20 | µg/L | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* | *10* |
| TRH (C10-C40) | 50 | µg/L | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | *25* | 180 | 220 | *25* |
| Standing Water Level | - | mAHD | - | 218.07 | 218.26 | 218.51 | 219.19 | 218.15 | 218.03 | 216.9 | 218.4 | 218.41 | 218.38 | 217.7 | 217.45 | 217.46 | 216.7 | 217.29 | 217.68 | 216.86 |

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# Appendix B – Groundwater Quality Statistics Summary

**Appendix B - Groundwater Quality Statistics Summary**

| MB07 | Unit | LOR | n | Min | 5th percentile | 20th percentile | 50th percentile | Mean | 80th percentile | 95th percentile | Max | Std Dev |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH - Field | | 0.01 | 17 | 6.53 | 6.682 | 6.754 | 6.91 | 7.00 | 7.072 | 7.598 | 8.31 | 0.40 |
| EC - Field | µS/cm | 1 | | 4040 | 4235.2 | 5186.4 | 5383 | 5365.76 | 5803 | 6099.2 | 6132 | 545.04 |
| Ca | mg/L | 1 | | 84 | 86.4 | 95.6 | 102 | 105.12 | 114.2 | 129 | 129 | 13.56 |
| Mg | mg/L | 1 | | 161 | 165.8 | 173.2 | 182 | 181.71 | 190 | 202.8 | 210 | 12.43 |
| Na | mg/L | 1 | | 759 | 781.4 | 800 | 845 | 844.24 | 866.4 | 914.6 | 997 | 53.06 |
| K | mg/L | 1 | | 6 | 6 | 6 | 7 | 7.82 | 7 | 11.4 | 25 | 4.48 |
| HCO3 | mg/L | 1 | | 752.74 | 609.695 | 638.792 | 671 | 671.09 | 699.792 | 731.329 | 752.74 | 41.80 |
| SO4 | mg/L | 1 | | 592 | 640.8 | 665.2 | 684 | 697.12 | 730.8 | 786.2 | 819 | 53.31 |
| Cl | mg/L | 1 | | 1080 | 1096 | 1132 | 1190 | 1198.82 | 1272 | 1320 | 1320 | 77.37 |
| Al (dissolved) | mg/L | 0.01 | | 0.0025 | 0.0045 | 0.005 | 0.005 | 0.008 | 0.009 | 0.02 | 0.02 | 0.01 |
| As (dissolved) | mg/L | 0.001 | | 0.0005 | 0.0005 | 0.0006 | 0.002 | 0.002 | 0.003 | 0.003 | 0.003 | 0.00 |
| Fe (dissolved) | mg/L | 0.05 | | 0.025 | 0.025 | 0.025 | 0.283 | 0.255 | 0.378 | 0.62 | 0.98 | 0.26 |
| Pb (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00 |
| Hg (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00 |
| Mo (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.001 | 0.002 | 0.00192 | 0.0062 | 0.007 | 0.00 |
| Se (dissolved) | mg/L | 0.0002 | | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.00 |
| TRH (C6-C10) | µg/L | 20 | | 10 | 10 | 10 | 10 | 13.75 | 10 | 29.5 | 40 | 10.61 |
| TRH (C10-C40) | µg/L | 50 | | 25 | 25 | 25 | 25 | 51.25 | 46 | 151 | 200 | 61.34 |

**Appendix B - Groundwater Quality Statistics Summary**

| MB09 | Unit | LOR | n | Min | 5th percentile | 20th percentile | 50th percentile | Mean | 80th percentile | 95th percentile | Max | Std Dev |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH - Field | | 0.01 | 18 | 6.64 | 6.6995 | 6.816 | 6.92 | 7.01 | 7.158 | 7.576 | 7.95 | 0.32 |
| EC - Field | µS/cm | 1 | | 6332 | 10642.35 | 11643.2 | 11961 | 12267.17 | 13543.6 | 15290.5 | 16200 | 1995.11 |
| Ca | mg/L | 1 | | 184 | 194.2 | 206.4 | 220 | 232.50 | 251.2 | 305.25 | 369 | 43.18 |
| Mg | mg/L | 1 | | 312 | 324.75 | 350.4 | 364.5 | 398.50 | 422.6 | 570.75 | 694 | 90.71 |
| Na | mg/L | 1 | | 1600 | 1736 | 1864 | 1930 | 1977.78 | 2050 | 2318.5 | 2820 | 250.10 |
| K | mg/L | 1 | | 44 | 44.85 | 47.4 | 49.5 | 50.72 | 52 | 58.55 | 73 | 6.29 |
| HCO3 | mg/L | 1 | | 771.04 | 861.564 | 1017.724 | 1065.06 | 1039.28 | 1106.052 | 1131.184 | 1151.68 | 95.84 |
| SO4 | mg/L | 1 | | 700 | 702.55 | 716.8 | 747 | 986.67 | 1134 | 1917 | 2580 | 496.85 |
| Cl | mg/L | 1 | | 3250 | 3301 | 3470 | 3610 | 3706.11 | 3814 | 4530.5 | 4590 | 379.23 |
| Al (dissolved) | mg/L | 0.01 | | 0.0025 | 0.0025 | 0.005 | 0.005 | 0.005 | 0.005 | 0.00575 | 0.01 | 0.00 |
| As (dissolved) | mg/L | 0.001 | | 0.0001 | 0.00044 | 0.0005 | 0.001 | 0.001 | 0.001 | 0.00115 | 0.002 | 0.00 |
| Fe (dissolved) | mg/L | 0.05 | | 0.025 | 0.025 | 0.047 | 0.1885 | 0.277 | 0.546 | 0.6945 | 0.89 | 0.27 |
| Pb (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00 |
| Hg (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00 |
| Mo (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.000 | 0.00032 | 0.00215 | 0.003 | 0.00 |
| Se (dissolved) | mg/L | 0.0002 | | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.00 |
| TRH (C6-C10) | µg/L | 20 | | 10 | 10 | 10 | 10 | 11.25 | 10 | 16.5 | 20 | 3.54 |
| TRH (C10-C40) | µg/L | 50 | | 25 | 25 | 25 | 25 | 30.625 | 25 | 54.25 | 70 | 15.91 |

**Appendix B - Groundwater Quality Statistics Summary**

| MB10 | Unit | LOR | n | Min | 5th percentile | 20th percentile | 50th percentile | Mean | 80th percentile | 95th percentile | Max | Std Dev |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH - Field | | 0.01 | 17 | 6.7 | 6.748 | 6.82 | 6.91 | 6.96 | 7.062 | 7.318 | 7.43 | 0.19 |
| EC - Field | µS/cm | 1 | | 3742 | 3758 | 3808.4 | 3980 | 4121.82 | 4291.6 | 5024.8 | 5668 | 489.80 |
| Ca | mg/L | 1 | | 33 | 33.8 | 37.4 | 42 | 42.82 | 46.8 | 55 | 67 | 8.05 |
| Mg | mg/L | 1 | | 96 | 100.8 | 104.2 | 116 | 120.53 | 128.6 | 163.4 | 177 | 20.96 |
| Na | mg/L | 1 | | 605 | 629.8 | 648 | 673 | 685.65 | 729.6 | 762.4 | 177 | 51.06 |
| K | mg/L | 1 | | 2 | 2.8 | 3 | 3 | 3.00 | 3 | 3.2 | 4 | 0.35 |
| HCO3 | mg/L | 1 | | 690.52 | 696.071 | 719.068 | 751.52 | 778.80 | 801.54 | 968.619 | 1013.82 | 92.63 |
| SO4 | mg/L | 1 | | 367 | 371 | 378.6 | 395 | 418.35 | 443 | 518.4 | 628 | 64.11 |
| Cl | mg/L | 1 | | 742 | 763.6 | 786 | 813 | 831.24 | 833.6 | 1008.4 | 1050 | 79.43 |
| Al (dissolved) | mg/L | 0.01 | | 0.0025 | 0.0045 | 0.005 | 0.005 | 0.005 | 0.005 | 0.0076 | 0.01 | 0.00 |
| As (dissolved) | mg/L | 0.001 | | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.001 | 0.001 | 0.001 | 0.001 | 0.00 |
| Fe (dissolved) | mg/L | 0.05 | | 0.015 | 0.023 | 0.025 | 0.025 | 0.001 | 0.104 | 0.202 | 0.29 | 0.07 |
| Pb (dissolved) | mg/L | 0.0001 | | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.00 |
| Hg (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00 |
| Mo (dissolved) | mg/L | 0.0001 | | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.003 | 0.0046 | 0.007 | 0.00 |
| Se (dissolved) | mg/L | 0.0002 | | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.00 |
| TRH (C6-C10) | µg/L | 20 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0.00 |
| TRH (C10-C40) | µg/L | 50 | | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 0.00 |

**Appendix B - Groundwater Quality Statistics Summary**

| MB12 | Unit | LOR | n | Min | 5th percentile | 20th percentile | 50th percentile | Mean | 80th percentile | 95th percentile | Max | Std Dev |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH - Field | | 0.01 | 18 | 6.22 | 6.3475 | 6.57 | 6.69 | 6.76 | 6.99 | 7.1895 | 7.81 | 0.36 |
| EC - Field | µS/cm | 1 | | 14000 | 14340 | 16927.4 | 21625 | 19907.89 | 22337.6 | 22841.65 | 22851 | 3078.20 |
| Ca | mg/L | 1 | | 230 | 290.35 | 350.6 | 483 | 436.06 | 502.4 | 523.55 | 538 | 88.89 |
| Mg | mg/L | 1 | | 555 | 573.7 | 633.6 | 857.5 | 808.00 | 925.6 | 947.5 | 956 | 139.71 |
| Na | mg/L | 1 | | 2330 | 2372.5 | 2694 | 3195 | 3038.89 | 3276 | 3464.5 | 3490 | 362.83 |
| K | mg/L | 1 | | 13 | 13 | 14 | 18 | 16.89 | 19 | 20 | 20 | 2.49 |
| HCO3 | mg/L | 1 | | 570.96 | 668.316 | 742.248 | 762.5 | 777.95 | 841.068 | 904.02 | 946.72 | 84.92 |
| SO4 | mg/L | 1 | | 682 | 766.15 | 805.6 | 836 | 842.61 | 861 | 937.85 | 1090 | 79.75 |
| Cl | mg/L | 1 | | 4940 | 5203.5 | 5920 | 7665 | 7099.44 | 7936 | 8098 | 8200 | 1101.17 |
| Al (dissolved) | mg/L | 0.01 | | 0.0025 | 0.0025 | 0.005 | 0.005 | 0.011 | 0.005 | 0.046 | 0.08 | 0.02 |
| As (dissolved) | mg/L | 0.001 | | 0.0005 | 0.0005 | 0.001 | 0.0019 | 0.002 | 0.0032 | 0.0056 | 0.009 | 0.00 |
| Fe (dissolved) | mg/L | 0.05 | | 0.025 | 0.36925 | 0.878 | 2.555 | 2.358 | 3.56 | 4.5525 | 4.85 | 1.47 |
| Pb (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.0001 | 0.00005 | 0.0001925 | 0.001 | 0.00 |
| Hg (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00005 | 0.00 |
| Mo (dissolved) | mg/L | 0.0001 | | 0.00005 | 0.00005 | 0.00058 | 0.00105 | 0.002 | 0.0036 | 0.004 | 0.004 | 0.00 |
| Se (dissolved) | mg/L | 0.0002 | | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.00 |
| TRH (C6-C10) | µg/L | 20 | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 0.00 |
| TRH (C10-C40) | µg/L | 50 | | 25 | 25 | 25 | 25 | 68.75 | 118 | 206 | 220 | 81.71 |

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# Appendix C – Groundwater Quality Trends

# Appendix C – Groundwater Quality Trends

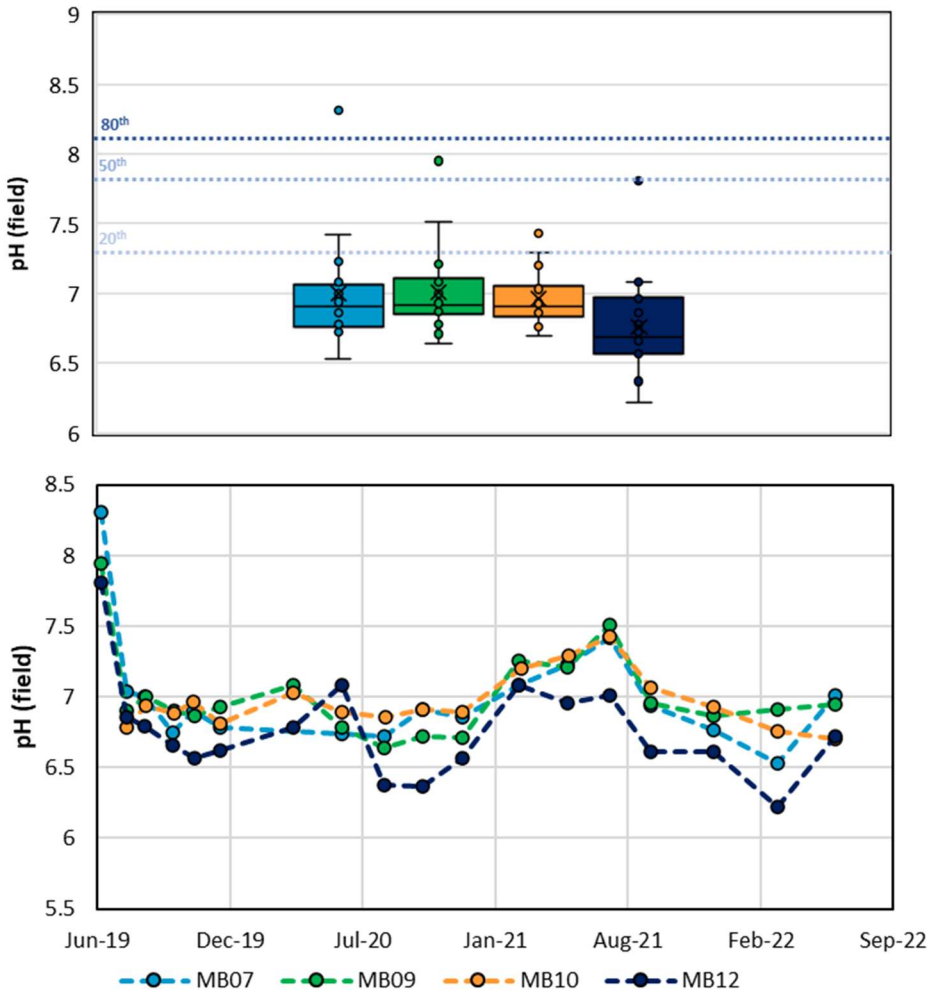


**Plate 1** – Field pH

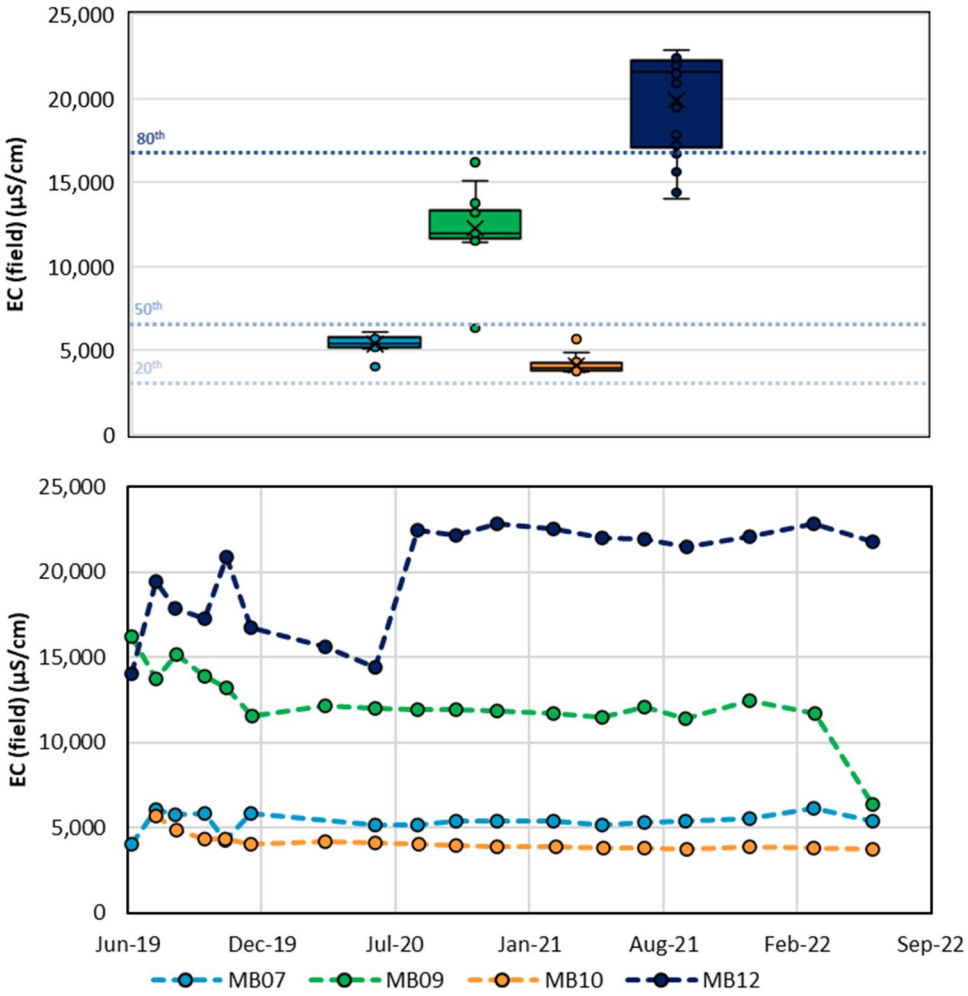


**Plate 2** – Field Electrical Conductivity

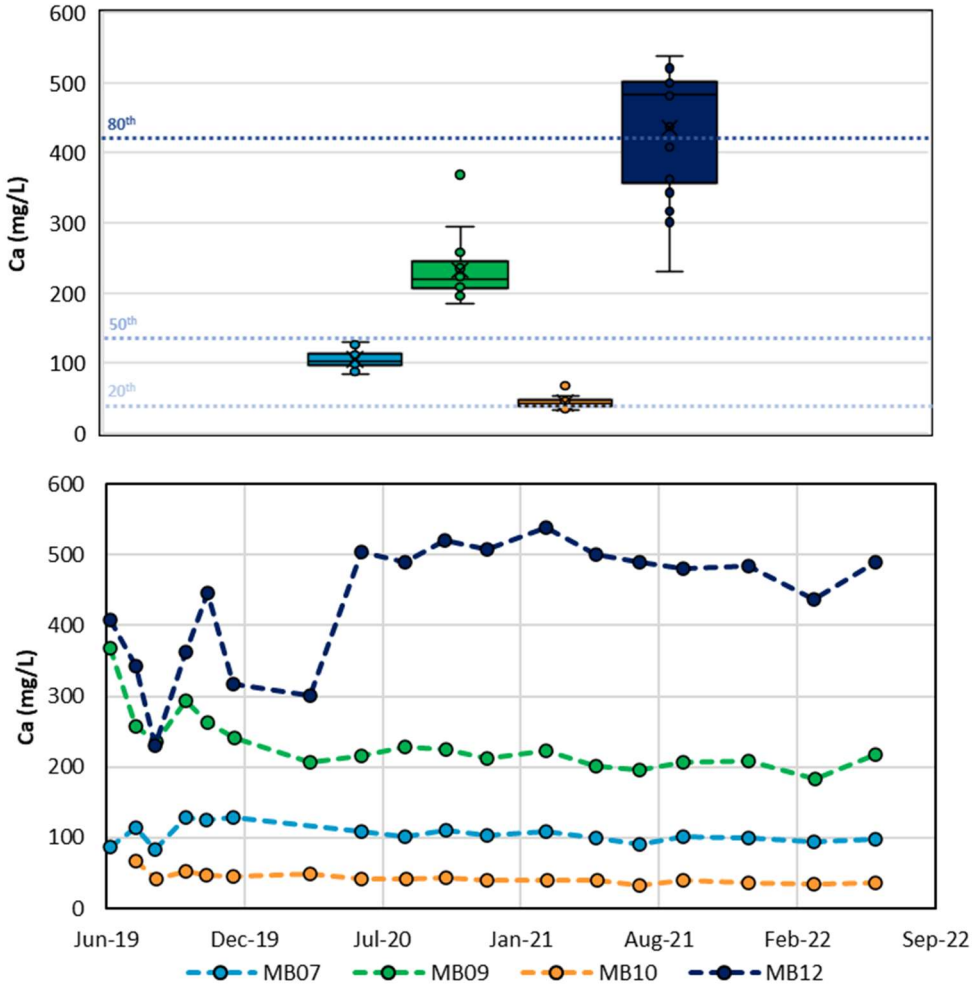


**Plate 3 –** Calcium ($Ca^{2+}$)

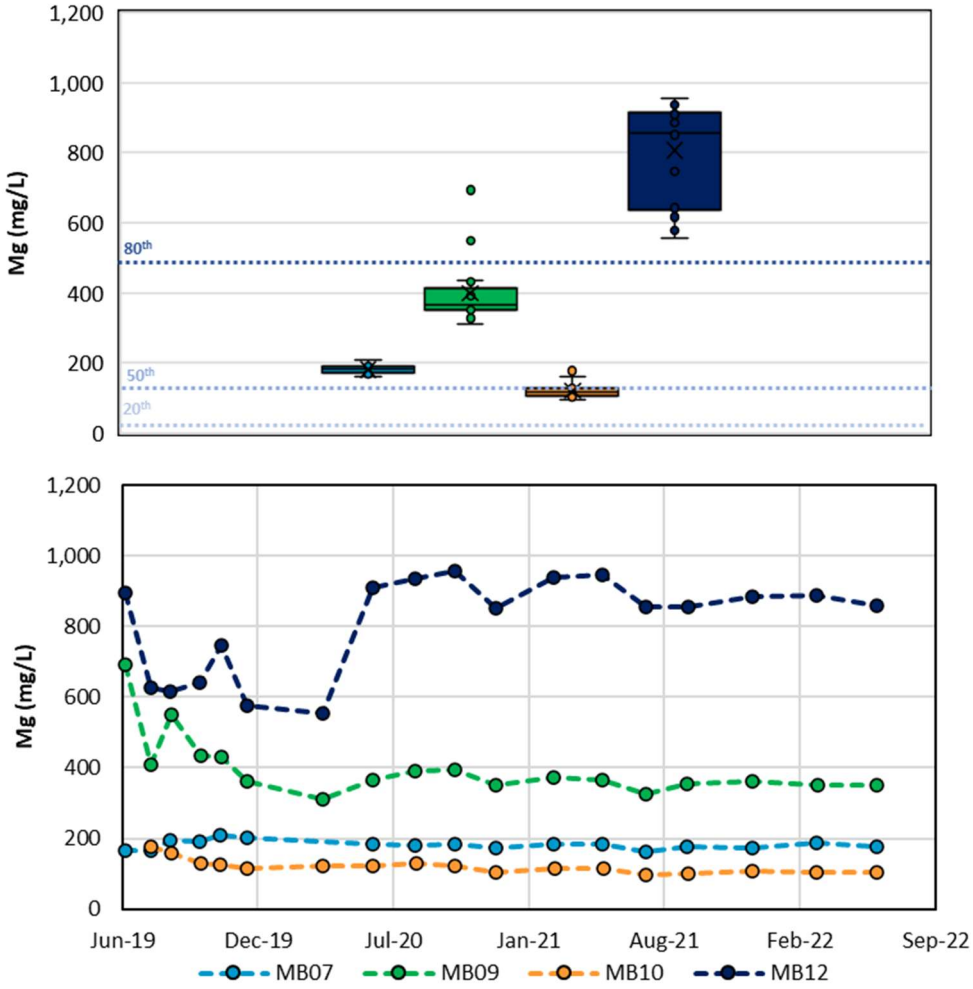


**Plate 4** – Magnesium ($Mg^{2+}$)

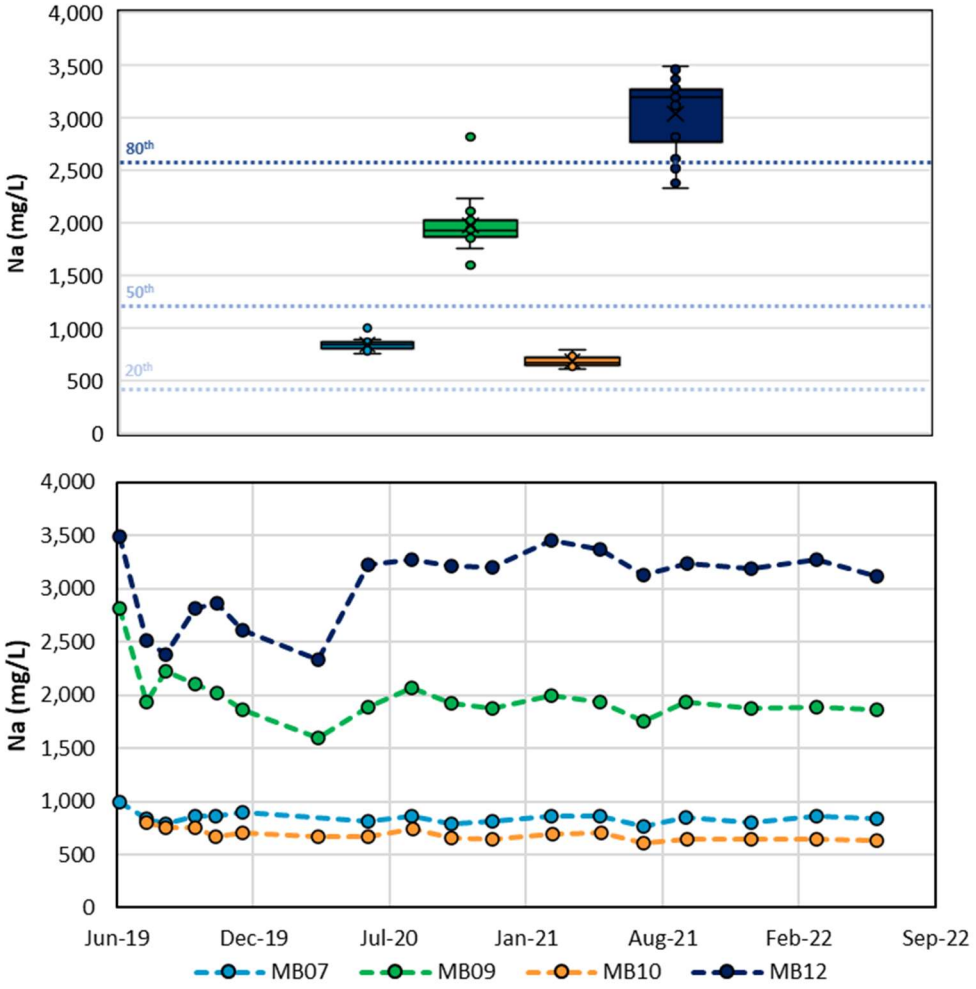


**Plate 5** – Sodium ($Na^+$)

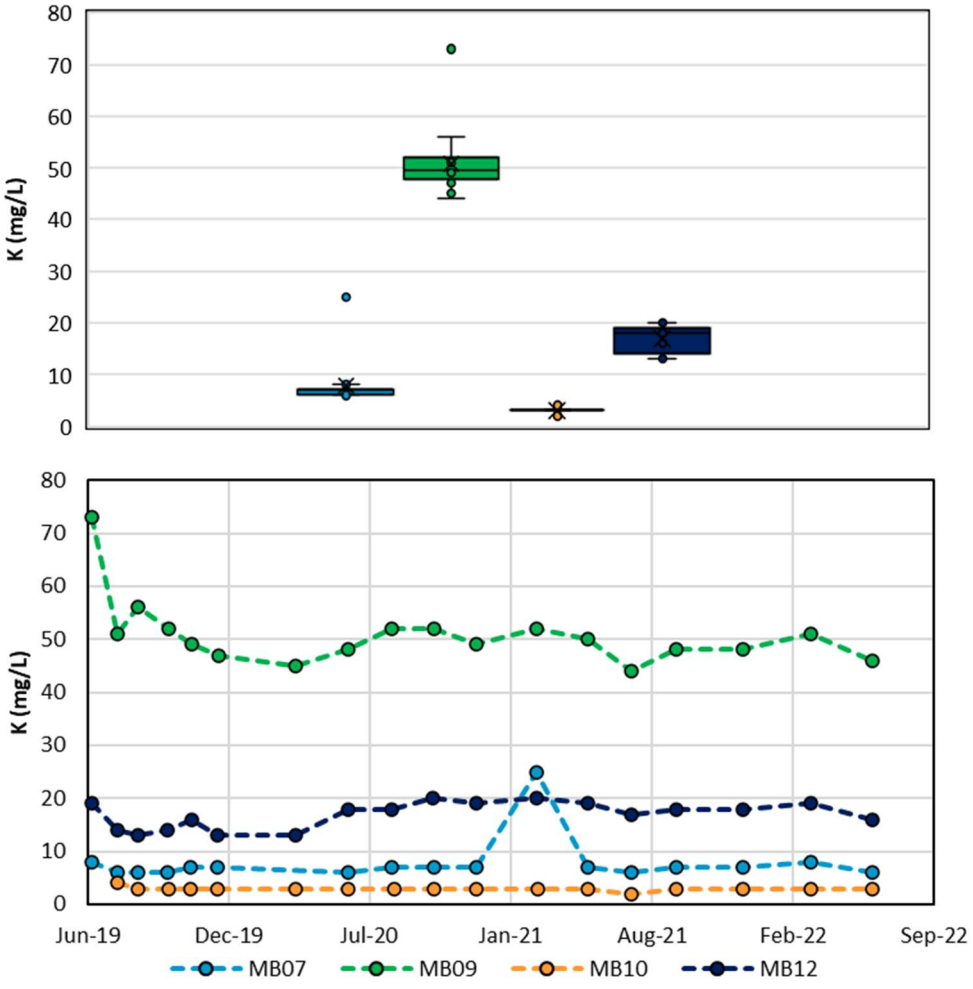


**Plate 6** – Potassium ($K^+$)

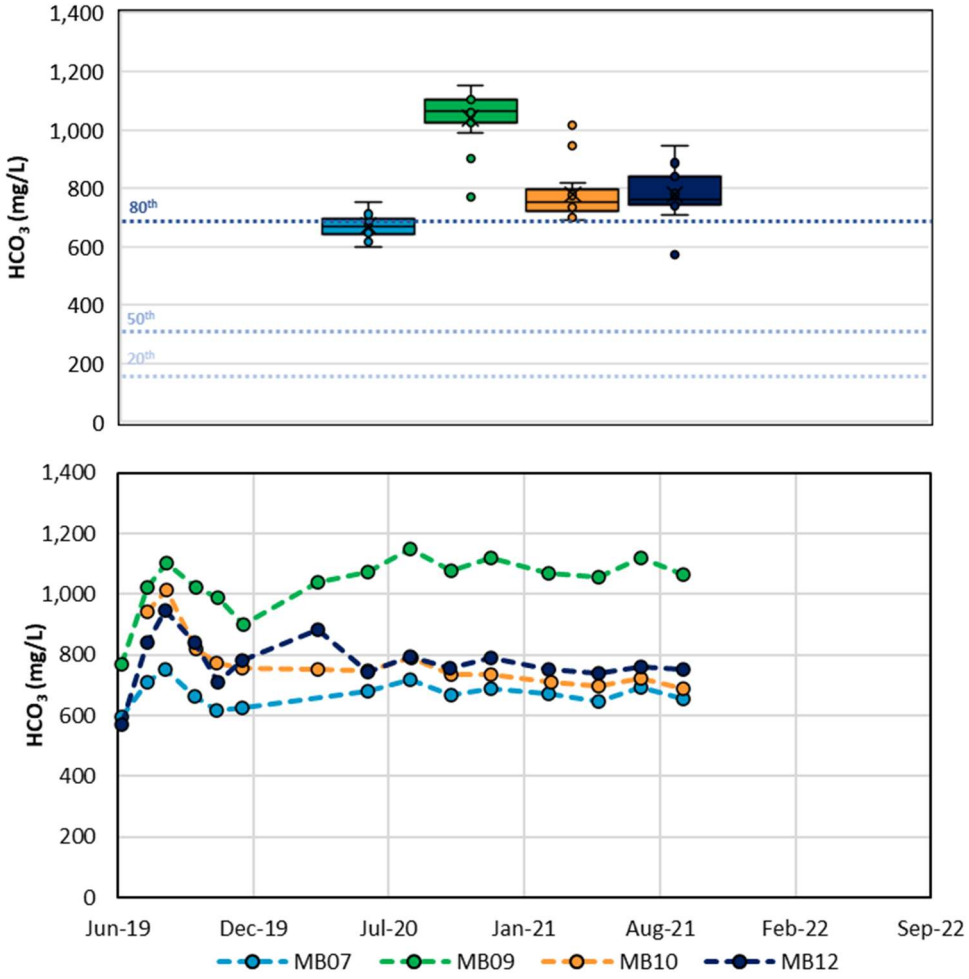


**Plate 7** – Bicarbonate ($HCO_3^-$)

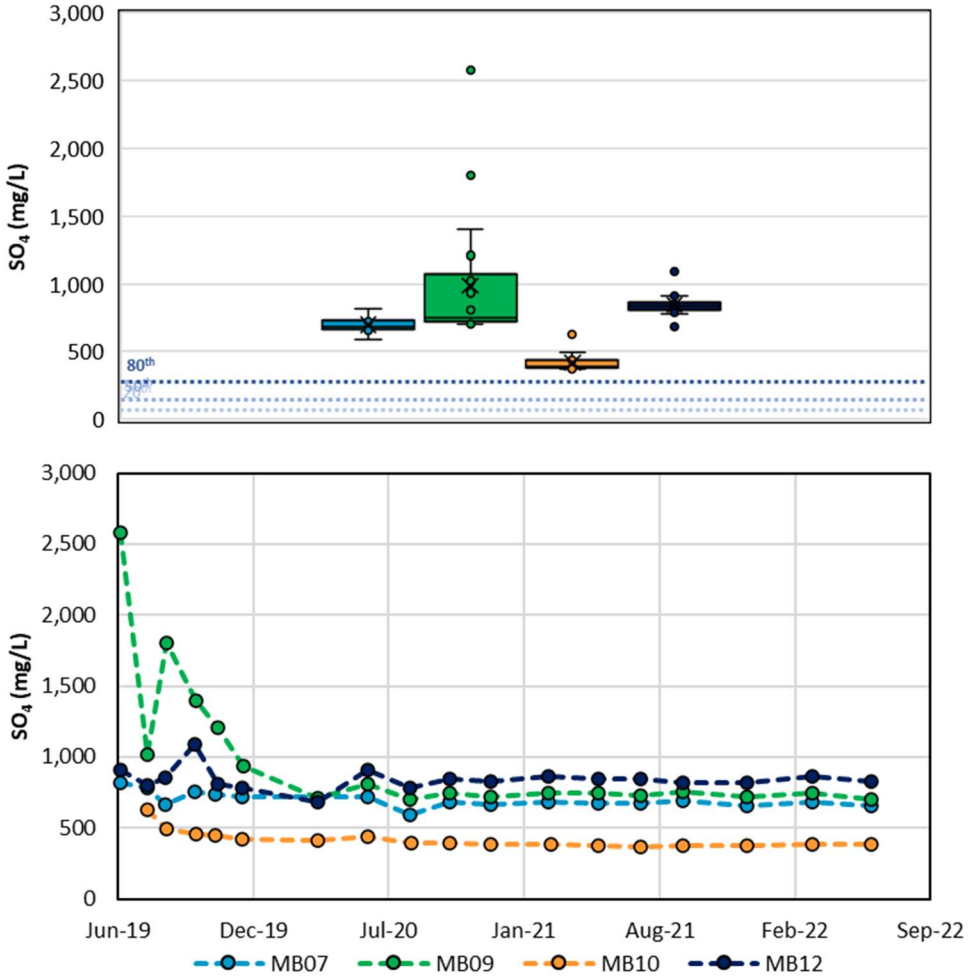


**Plate 8** – Sulphate ($SO_4^{2-}$)

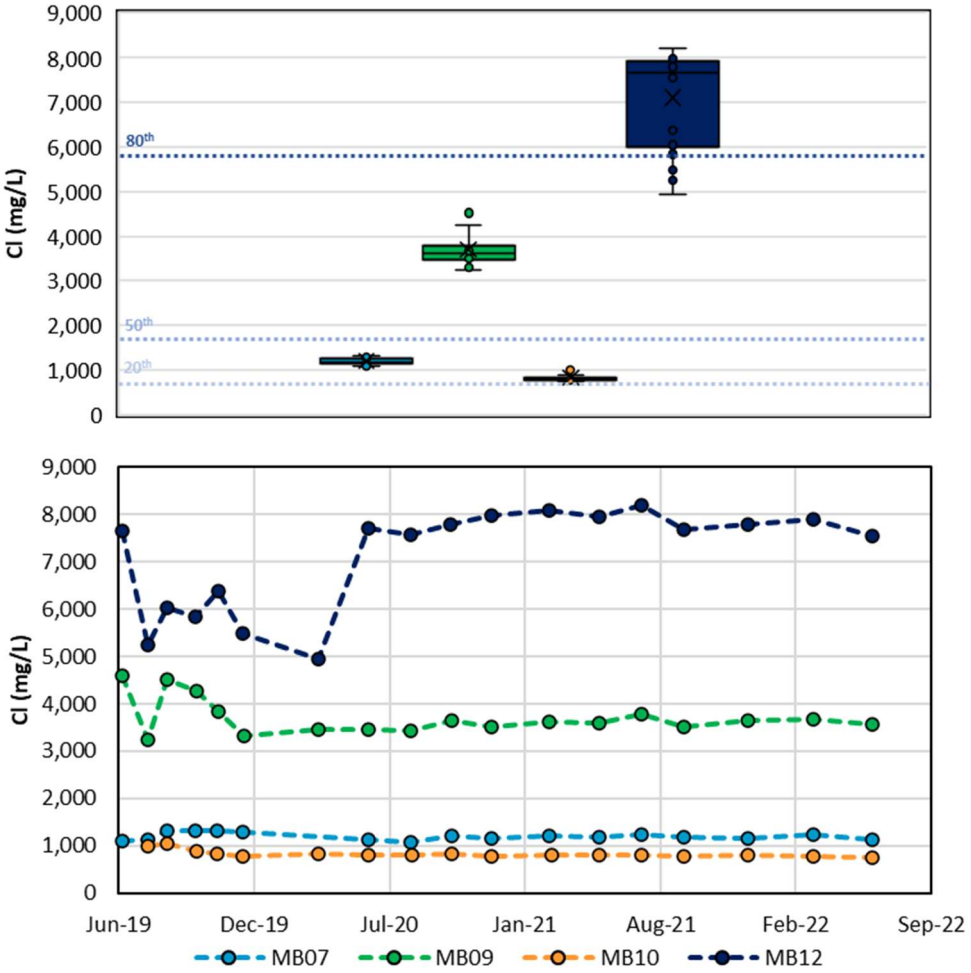


**Plate 9** – Chloride ($Cl^-$)

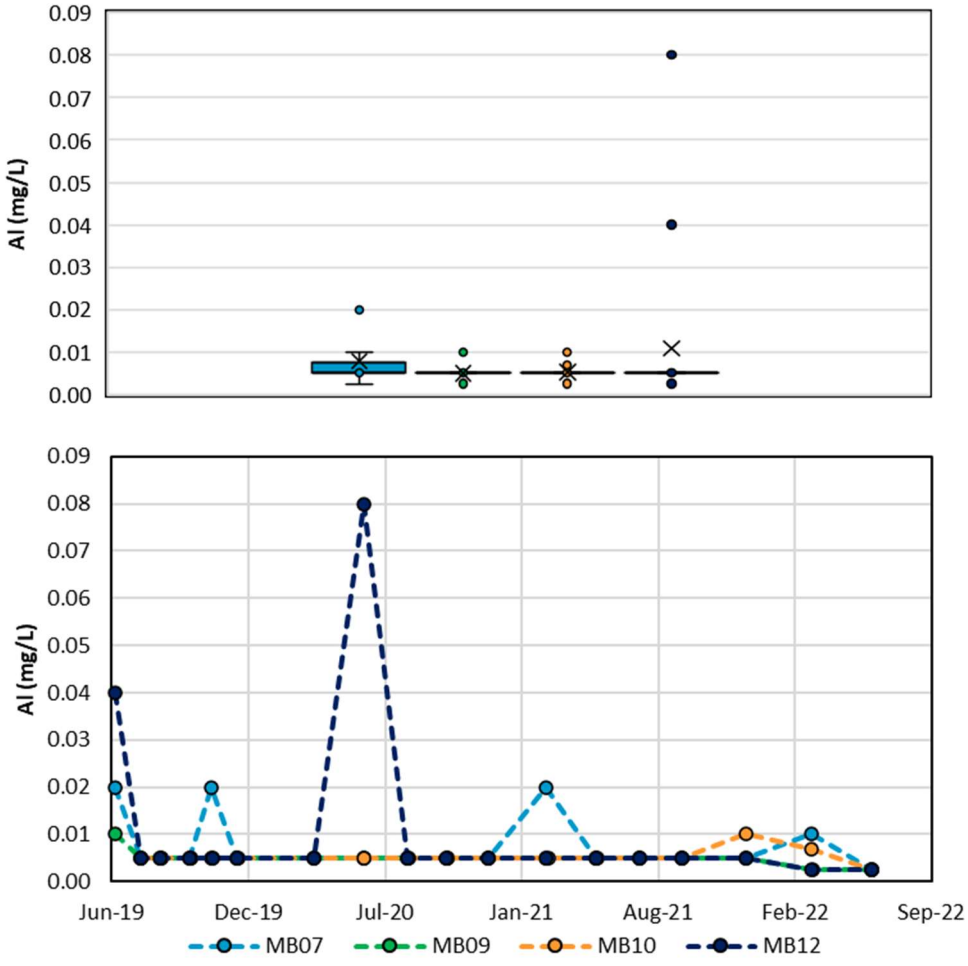


**Plate 10** – Dissolved Aluminium (Al)

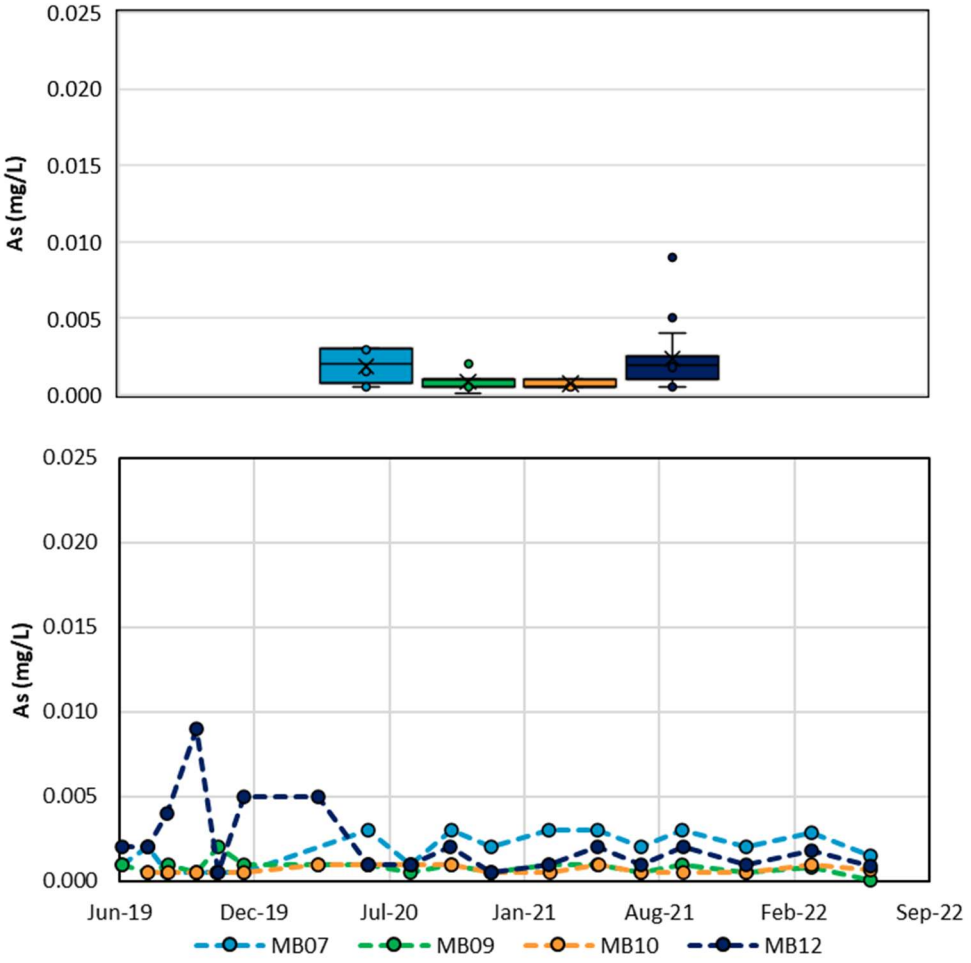


**Plate 10** – Dissolved Arsenic (As)

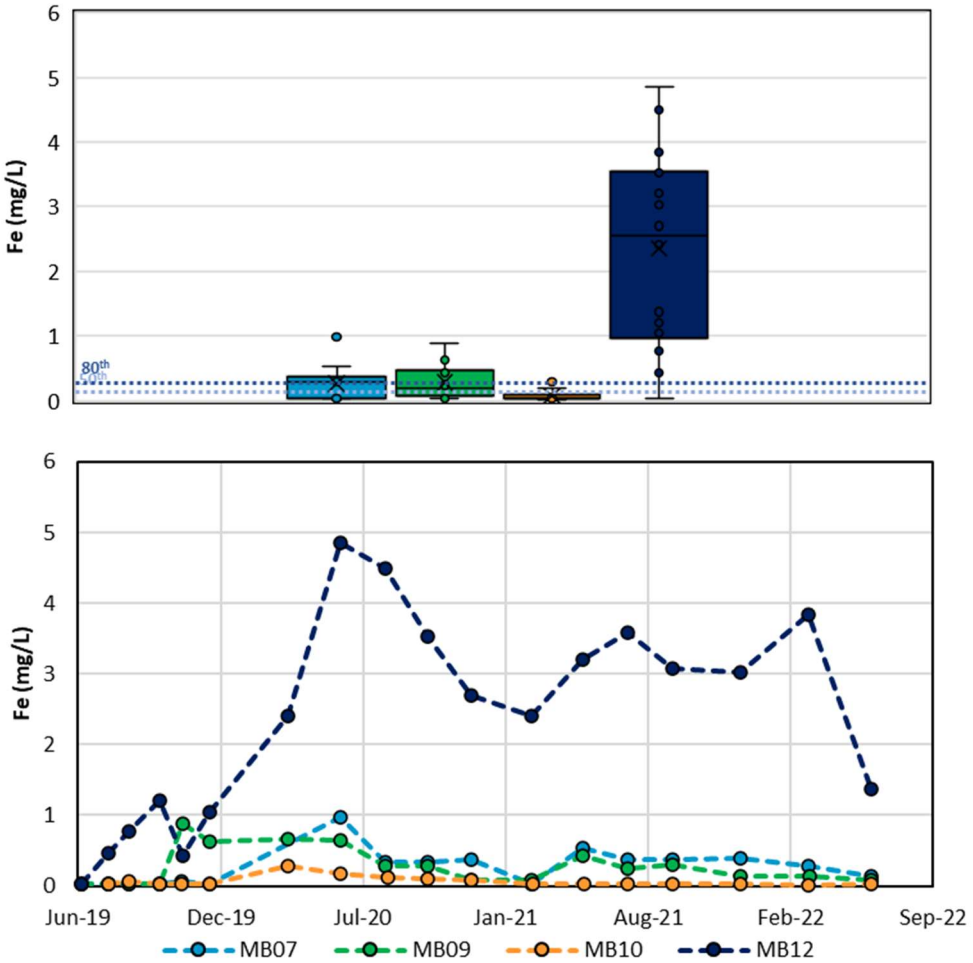


**Plate 11** – Dissolved Iron (Fe)

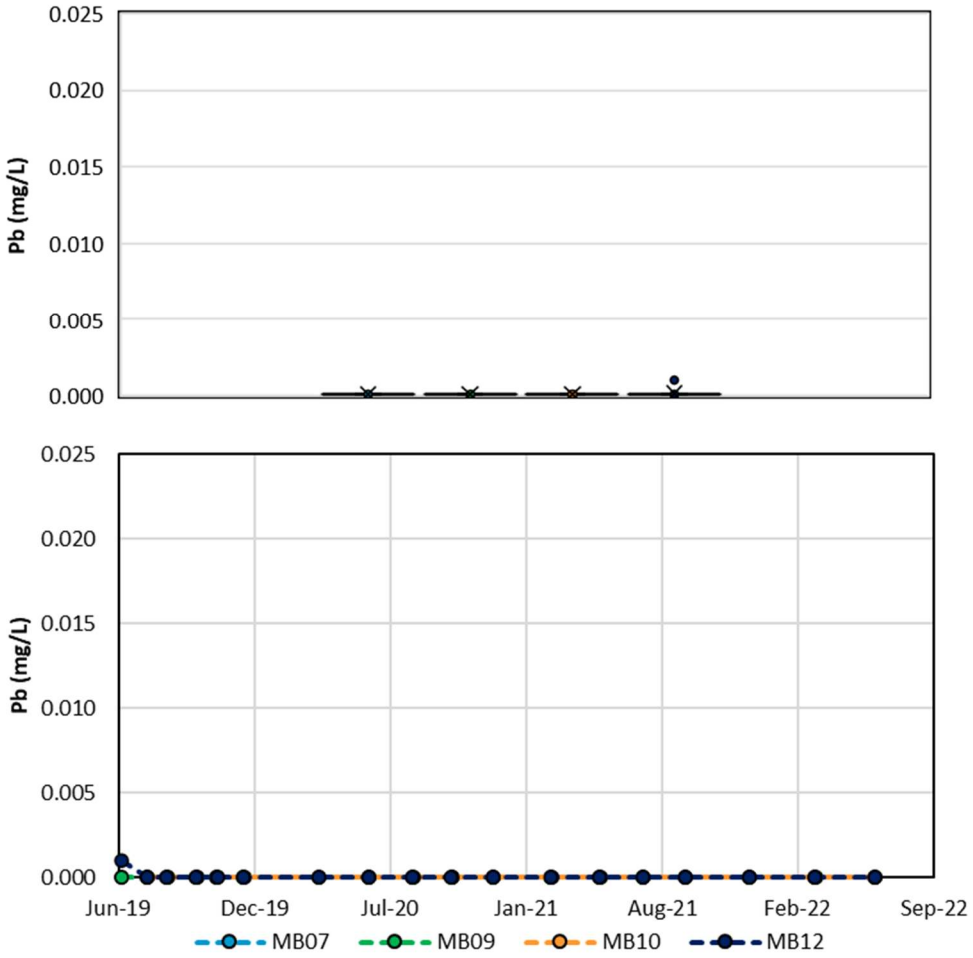


**Plate 12** – Dissolved Lead (Pb)

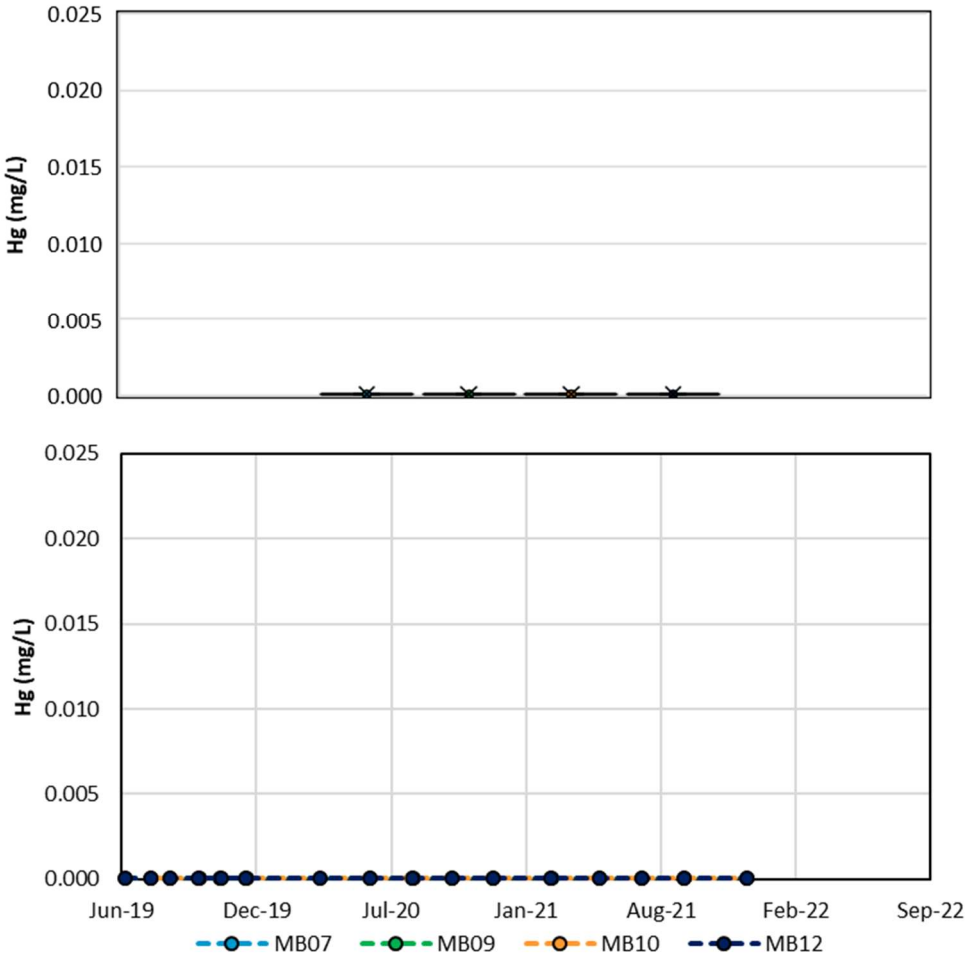


**Plate 13** – Dissolved Mercury (Hg)

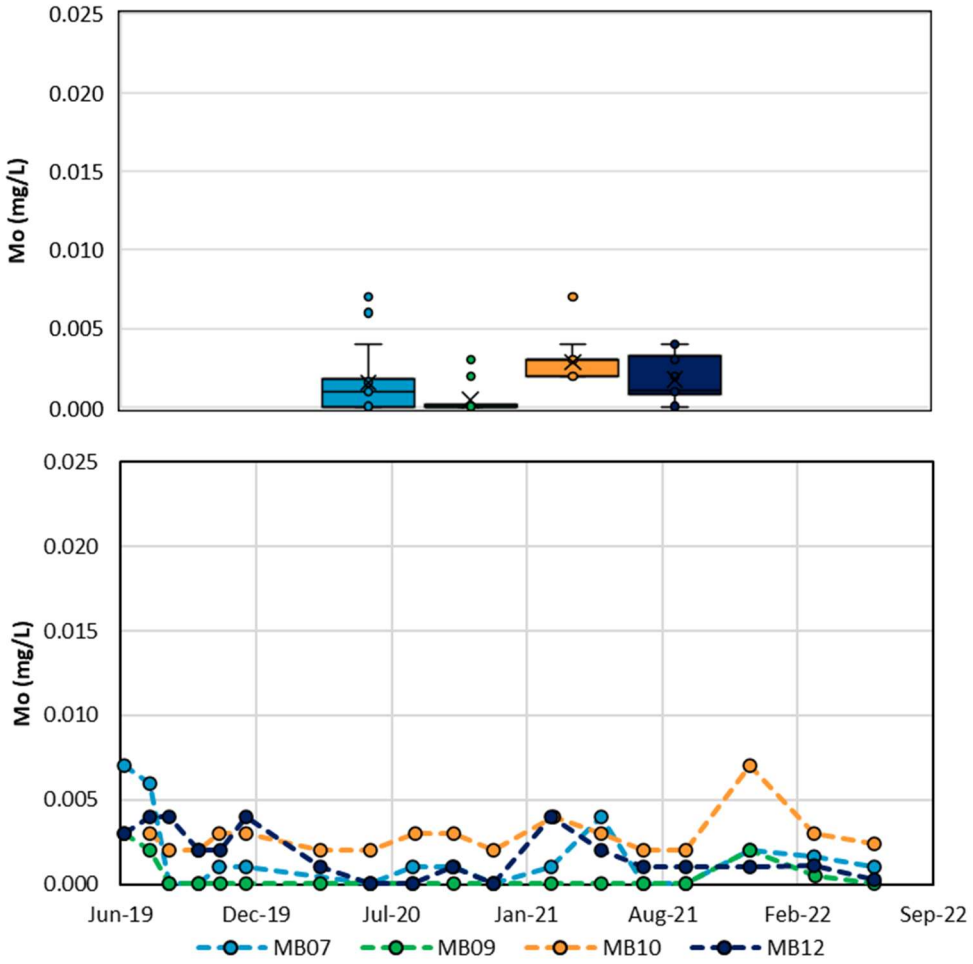


**Plate 14 –** Dissolved Molybdenum (Mo)

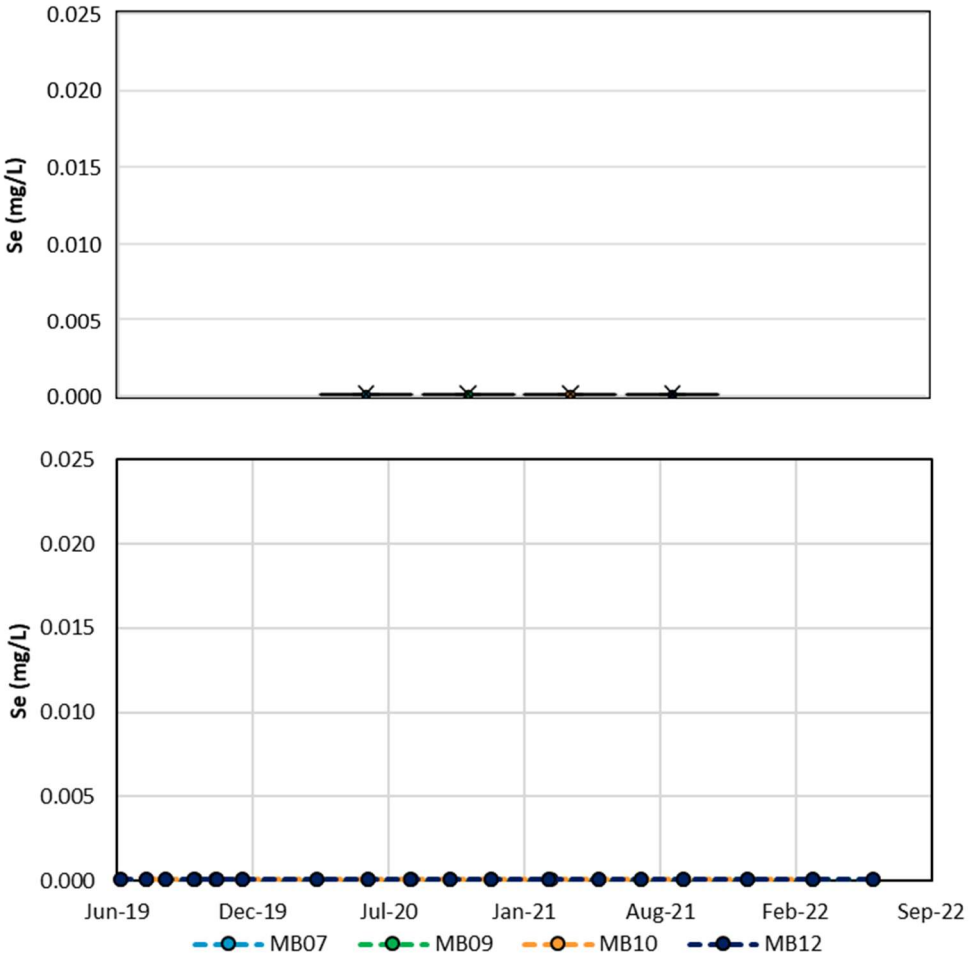


**Plate 15** – Dissolved Selenium (Se)

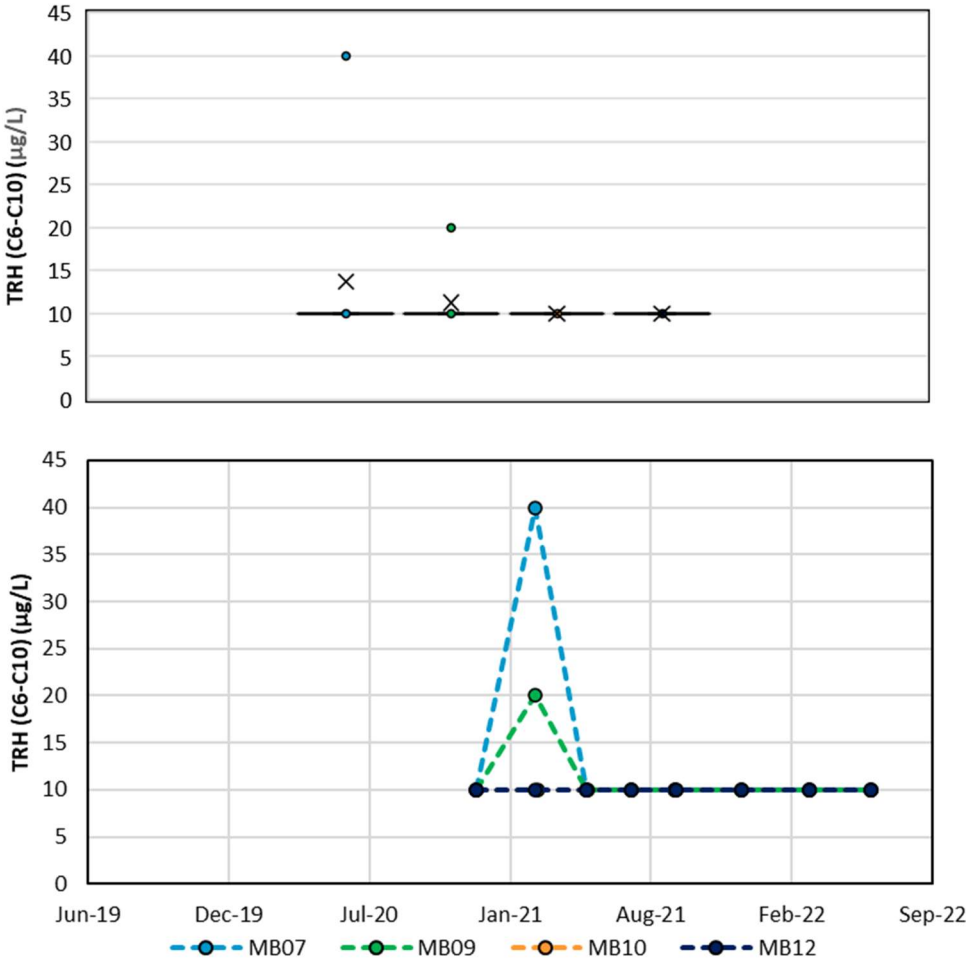


**Plate 16 –** Total Recoverable Hydrocarbons (TRH) C6 – C10 fraction

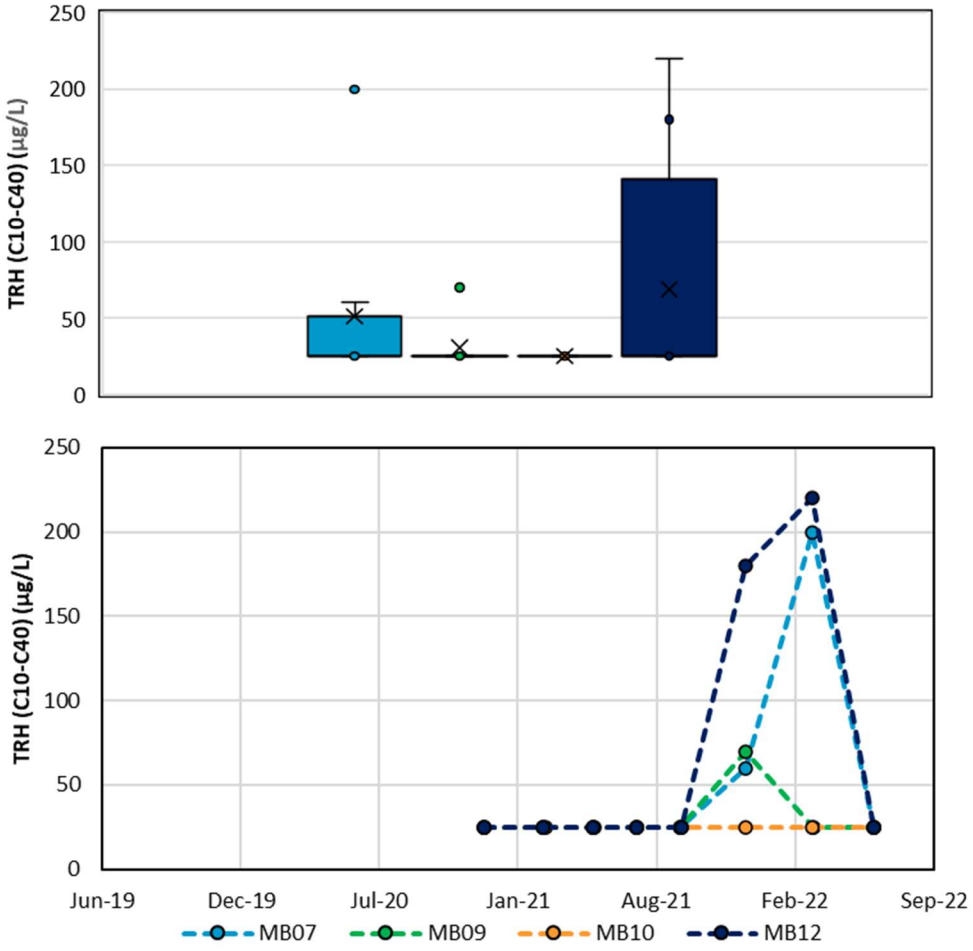


**Plate 17 –** Total Recoverable Hydrocarbons (TRH) C10 – C40 fraction