Santos QNT Pty Ltd

EP161 – HFS EMP Annual Groundwater Monitoring Data Review

21 December 2022 - Final

1. Introduction

Santos is the operator of Exploration Permit 161 (EP161) in the Northern Territory, Australia. EP161 is the subject of shale gas exploration targeting formations of the Beetaloo Sub-basin and is located approximately 120 km east of Daly Waters on the Carpentaria Highway and 600 km south-east of Darwin.

The Santos *Environment Management Plan: McArthur Basin Hydraulic Fracturing Program NT Exploration Permit (EP) 161 (revision) STO3-8* (Santos, 2021) (the HFS EMP) was approved on 6 October 2021. The scope of the HFS EMP was for hydraulic fracture stimulation and production testing of wells at the Tanumbirini and Inacumba sites (the regulated activities) (Figure 1).

This report satisfies Condition 5 of the approval which requires:

An interpretative report of groundwater quality based on the groundwater monitoring required to be conducted at the well site(s) in accordance with Table 6 of the Code. The interpretative report must be provided annually within three months of the anniversary of the approval date of the EMP and include:

- *Identification of any change to groundwater quality or level attributable to conduct of the regulated activity at the well site(s) and discussion of the significance and cause of any such observed change;*
- *Interpretation of any statistical outliers observed from baseline measured values for each of the analytes;*
- *Discussion of any trends observed;*
- *A summary of the results inclusive of descriptive statistics; and*
- *A description of the layout of groundwater monitoring bores and wells, indicative groundwater flow directions and levels in accordance with the* Preliminary Guideline Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin.

The Code is in reference to the *Code of Practice: Onshore petroleum activities in the Northern Territory* (DENR, 2019). It is referred to as the "Code" throughout this report. The *Preliminary Guideline Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin* (DENR, 2018) is referred to as the "Guideline" throughout this report.

In summary, the interpretation and discussion of the observed outliers and trends identifies:

- Water levels in the control monitoring bore (CMB) and impact monitoring bore (IMB) remained within the range of background variability following execution of the regulated activities.
- There has been no impact to the beneficial use of the Gum Ridge Formation aquifer with respect to Livestock drinking water following execution of the regulated activities.
- There was a statistically significant increase in the dissolved methane concentration in the IMB during execution of the authorised activities, but the concentration has subsequently decreased. The dissolved methane concentration increased in the CMB from a starting concentration of less than the laboratory limit of reporting, but has subsequently decreased and is less than the limit of reporting. The maximum reported dissolved methane concentration (48 µg/L in the IMB) is an order of magnitude less than maximum concentration observed in pastoral bores elsewhere on Tanumbirini Station. The absence of propane and ethane is indicative that the methane is most likely not thermogenic in origin and therefore

unlikely to come from the reservoir via the exploration wells. CSIRO has previously identified that dissolved methane in the Gum Ridge Formation – the same aquifer as the CMB and IMB – is biogenic methane.
- Changes in major ion and trace element chemistry and the temperature response in the IMB are indicative of a subtle influence of the drilling process on the groundwater quality. Similar changes were observed following the drilling of the CMB and IMB. No influence of the hydraulic fracture stimulation was observed.
- No drilling or hydraulic fracture stimulation activities have been performed at the Inacumba site.
- Rising trends have been observed in pH and other analyte concentrations at the Inacumba site however no regulated activities have been commenced by Santos at this site.
- There is a small but consistent correlation between analysed batches of samples and trace parameter concentrations across all results. This is expected where all analyte concentrations are extremely low. The correlation represents the variability in measurement accuracy which is consistent between batches of samples analysed by the laboratory.

2. Exploration activities

The locations of Santos activities on EP161 are shown on Figure 1.

Santos drilled the Tanumbirini 2H and Tanumbirini 3H exploration wells between May and November 2021, after which they were hydraulically fracture stimulated (HFS) and production testing (including flowback) commenced. Key dates associated with the drilling activities are summarised in Table 1, and are shown on Figure 2 and on the graphs in Attachment C. 'Tanumbirini 2' and 'Tanumbirini 3' are used throughout this report to refer to the vertical wells and their associated horizontals.

Drilling of Tanumbirini 2 and Tanumbirini 3 was approved under *Environment Management Plan: McArthur Basin Drilling Program STO2-7*. The wells were drilled using mud rotary methods. The wells were initially drilled using water-based drilling fluids (mud) until lost circulation was encountered in the Cambrian Limestone Aquifer. At this point the drilling fluid was swapped to bore water with no drilling additives until the aquifer had been sealed off from the well. Water for drilling was sourced from RN040930, the CMB at the Tanumbirini site.

The wells were hydraulically fracture stimulated (HFS) in December 2021. Water for the HFS was sourced from the Gum Ridge Formation, inclusive of RN040930, the CMB at the Tanumbirini site. Flowback commenced immediately thereafter and continue to the time of this report preparation. Stimulation of Tanumbirini 2 and Tanumbirini 3 was approved under *Environment Management Plan: McArthur Basin Hydraulic Fracturing Program STO3-8*.

No drilling or hydraulic fracturing activities have been performed at the Inacumba site to date. Monitoring bores were installed at the Inacumba site in 2018 and 2019.

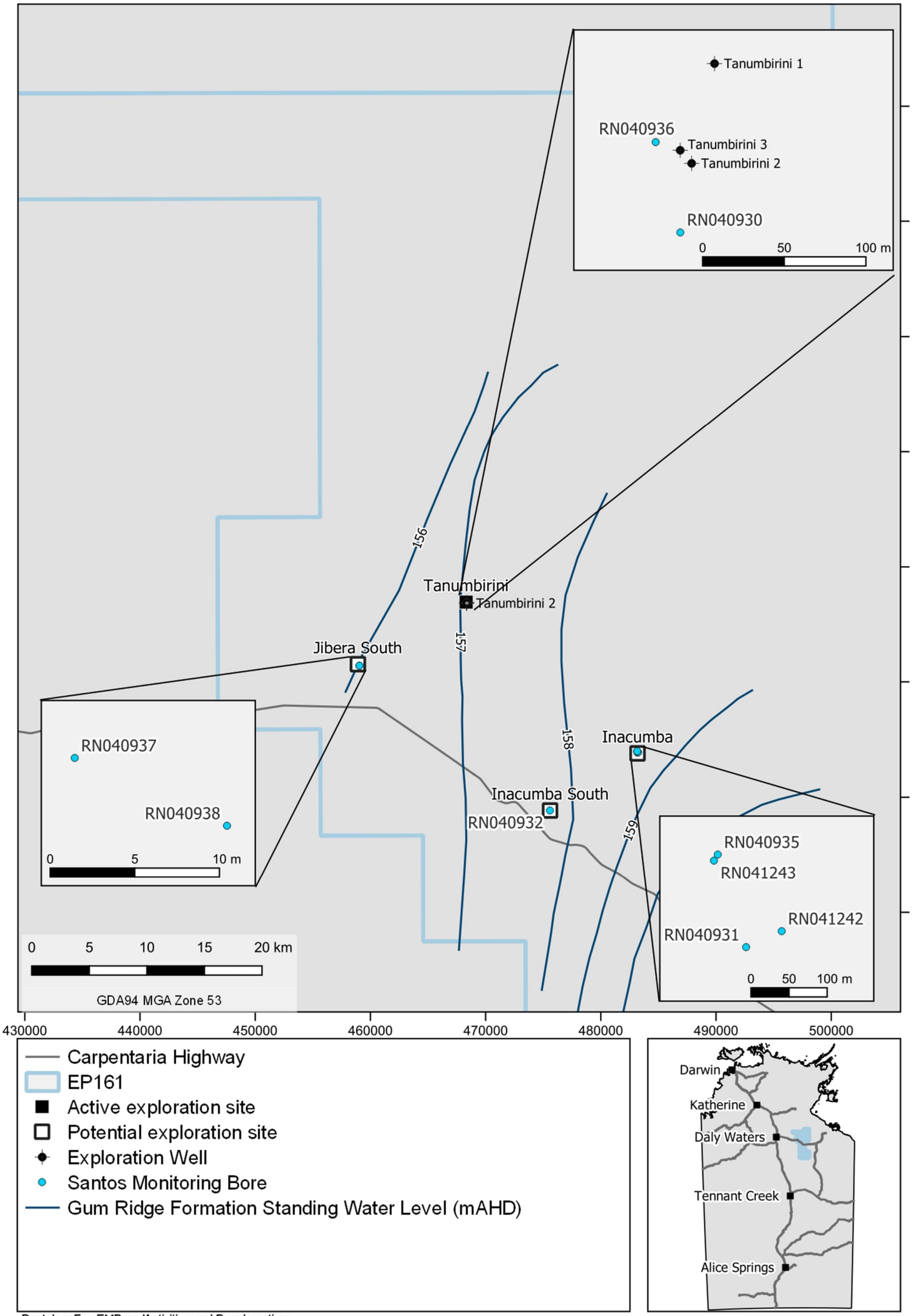
Santos has installed groundwater monitoring bores at the Jibera South and Inacumba South locations. No exploration activities have been approved or performed at these locations.

Table 1 Key dates of the exploration activities at Tanumbirini during the reporting period

Date	Event
11-May-2021	Tanumbirini 2 start drilling
17-Aug-2021	Tanumbirini 2 complete drilling (rig release)*
23-Aug-2021	Tanumbirini 3 start drilling
19-Nov-2021	Tanumbirini 3 complete drilling (rig release)*
1-Dec-2021	Hydraulic fracture stimulation (frac) start[1]
19-Dec-2021	Hydraulic fracture stimulation end
19-Dec-2021	Flowback start

* drilling and well construction would have been completed several days prior to rig release

Figure 1 Activity and monitoring bore locations



Beetaloo_FracEMP.qgz|Activities and Bore Locations

3. Tanumbirini

This review focusses on the groundwater monitoring data acquired during and after the drilling and HFS of the Tanumbirini 2 and Tanumbirini 3 exploration wells. Data from prior to May 2021, when drilling commenced, was used to establish baseline groundwater conditions.

Monitoring Activities

In December 2018 and in accordance with the Guideline a control monitoring bore (RN040930 – 43 m from Tanumbirini 2) was installed at the Tanumbirini site, and the impact monitoring bore (RN040936 – 16 m from Tanumbirini 3) was installed in July 2019. Water level contours for the GRF were prepared using data collected by Santos (RDM Hydro, 2021) and indicate groundwater flow directions in the vicinity of Tanumbirini are from east-southeast to west-northwest (Figure 1). Both bores are installed to enable monitoring of the full thickness of the Gum Ridge Formation (GRF). The Anthony Lagoon Formation aquifer is not present at the Tanumbirini well pad.

Water level, temperature and conductivity (LTC) sensors were installed in the monitoring bores in September 2020 (prior to the approval of the HFS EMP), replacing the previously installed sensors. A barometric pressure sensor was also installed at the site at this time. During background monitoring the sensors record every four hours. Condition 6 of the HFS EMP approval required *groundwater level/pressure monitoring at each impact monitoring bore established, using a logger to record water level for 2 weeks prior to, during, and 4 weeks after completion of hydraulic fracturing operations at each well pad. Data logging should record at a minimum of every 4 minutes for the duration of the recording period.* Accordingly, the datalogger recording interval in RN040930 and RN040936 was increased to four minutes from 29 September 2021 (62 days prior to the start of the HFS) to 2 February 2022 (45 days after the end of the HFS activity). It was then returned to a four-hourly recording interval.

RN040930 is equipped with a dedicated electric submersible pump which is used for purging and sampling, at a pumping rate of 17 L/s. This bore was used for water supply throughout the 2021 exploration activities.

RN040936 was constructed with sealed sub-surface headworks in a “gatic” in accordance with the Bore Work Permit. Prior to the commencement of the 2021 drilling program, an electric submersible pump was installed in the bore to allow baseline water quality monitoring. Because of its close proximity to the exploration wells (16 m from Tanumbirini 3, in accordance with the Guideline) and to allow the drill rig to operate, the pump was removed from the bore and the headworks sealed, therefore water quality monitoring could not be undertaken during drilling activities. The LTC sensor remained in the bore for the duration of the drilling campaign. The sampling pump was reinstalled during rig-down (at the end of drilling) and prior to the commencement of HFS activities.

Routine water quality monitoring of the bores commenced in July 2019. The suite of analysis is compliant with Table 6 of the Code and exceeds the requirements of the Guideline. RN040930 had been monitored 27 times and RN040936 had been monitored 10 times prior to the commencement of drilling in 2021. RN040930 has continued to be monitored for water quality at a quarterly interval. RN040936 was monitored on 16 March 2021, approximately 1 month before the drilling rig mobilised to site, and quarterly monitoring recommenced on 17 November 2021, after the completion of drilling of Tanumbirini 3, but prior to the HFS. Quarterly monitoring has continued through 2022. Seven samples have been collected from RN040930 and six samples have been collected from RN040936 (two on the same day) since the start of activities.

Water level, temperature and electrical conductivity monitoring

The timing of sampling relative to exploration activities can be seen on Figure 2. The downhole sensor responses are described and interpreted as follows.

RN040930 (CMB)

- Groundwater extraction for water supply from RN040930 started on 6 April 2021. Extraction was initially during daytime hours only until the commencement of Tanumbirini 2 drilling. The frequency then reduced and become more intermittent. Extraction increased to fill storages prior to the HFS. During the HFS, extraction was effectively continuous. There has been infrequent, short-duration extraction only since the completion of the HFS in late December 2021.
- There are diurnal water level fluctuations of 2 mm to 12 mm in RN040930 due to barometric pressures changes.
- A water level drawdown of approximately 0.05 m (5 cm) was recorded within the bore during pumping of RN040930
- There was a long-term *rising* trend of 0.2 m over the period of extraction, which appeared to cease approximately a month after extraction ceased and then stabilised. The change is too small to determine the potential cause with any confidence, but may be related to:
    - Seasonal barometric pressure changes.
    - Regional water level trends as observed in NTG monitoring bores (accessed via the Water Monitoring Portal) screened in the Cambrian Limestone Aquifer around the Beetaloo Basin. These trends are shown on Figure 3 and mostly show similar longer term rising and seasonal trends.
- There was a rise in temperature of 0.2 °C during extraction, followed by a longer-term rise in the overall water temperature. Following extraction the temperature stabilised and then declined. The increased temperature indicates that the extracted groundwater is coming from deeper in the bore than the sensor and pump intake (roughly 130m below ground).
- The EC showed a correlation to the amount of pumping, with EC increasing in proportion to the amount of extraction. This may relate to differential depressurisation of discrete fractures within the limestone, and a change in the relative proportion of water provided by each fracture to the bore.

RN040936 (IMB)

- The overall water level response was similar to RN040930, but the overall rising trend was smaller, with a maximum increase of less than 0.05 m (5 cm).
- The influence of ongoing extraction over approximately 2 months can be seen as a small (~1 cm) decline in water level.
- Shortly after the start of drilling of Tanumbirini 2, there was a drop in water level, much like if the bore were being pumped (which lasted about a day), and then a flat signal.
- A small decrease in temperature (<0.05 °C) after the start of drilling of Tanumbirini 2 and a declining temperature after the start of drilling of Tanumbirini 3. These changes in temperature may be related to the influence of drilling fluids which were cooler than the aquifer water due to the former being stored on the surface.
- Step changes in the temperature response is due to changes in the logger depth. These changes are only 0.3 °C in total.
- The temperature and electrical conductivity in RN040936 are subtly affected by pumping in RN040930.
- There is a small (~1 cm) seasonal influence of barometric pressure on the water level trend.

Water quality monitoring

For each of RN040930 and RN040936, Attachment A includes a summary table that contains:

- A statistical summary of all groundwater quality results,
- The results of samples collected immediately prior to the start of drilling and following drilling, and
- The P-value of the T-Test comparing the analyte results from pre the start of drilling and post the start of activities.

A Before After/Control Impact (BACI) approach has been used to assess the potential effects of drilling and HFS activities on groundwater quality.

Gross alpha is the only parameter that exceeded its ANZECC (2000) livestock drinking water guideline value. It was exceeded in both the RN040930 and RN040936 including baseline water quality. Therefore, this exceedance is not related to the exploration activities. Gross beta activity also exceeded the ANZECC (2000) livestock drinking water guideline value in one baseline water quality result from RN040930.

The groundwater quality results have been graphically presented as box-and-whisker plots (Attachment B). The statistics were calculated on all data up to and including 16 March 2021 (baseline data – prior to the start of drilling), with those results from samples collected post 16 March 2021 shown as individual symbols. The box-and-whisker plots were used to identify those parameters which exceeded the range of background variability. Where a parameter was identified to exceed the range of background variability in at least one sample, a timeseries chart was prepared (Attachment C), with results from other sites where Santos has installed monitoring bores provided for comparison (control sites). The timeseries charts for a parameter are scaled based on the maximum concentration across all of the sites. The trends identified in these charts are described in Table 2.

The timeseries charts mostly show no consistent trend in parameter concentrations. In some cases the baseline maximum is exceeded in the first sample collected after the drilling commenced, others the middle or the last. Sometimes the concentrations have decreased to less than the baseline maximum by the end of drilling. There appears to be correlations in the many of the parameter concentrations across all of the monitoring sites. This is most likely related to laboratory measurement uncertainties rather than changes in the aquifer as the monitoring bores are separated by distances of 10-20 km and show the same variations in concentrations. Laboratory measurement uncertainties are greatest when the concentrations are less than ten times the limit of reporting (i.e. the values are very low concentrations).

Since there is bias in the selection of the pre-activity maximum concentration, a statistical assessment was made using a Student T-Test to test whether there was a significant difference in the results before and after the start of exploration activities on Tanumbirini 2 and Tanumbirini 3. An F-Test was used to determine whether the homoscedastic (statistically similar variance) or heteroscedastic (statistically different variance) formula for the T-Test was used. Where a concentration was reported as less than the limit of reporting, the limit of reporting was assumed to be the sample concentration. The statistical significance was assessed to a 95% confidence. The results of the analysis are included in the statistical summaries in Attachment A. The bores and parameters where the P-value was less 0.05 (95% confidence that there is a significant different between the pre- and post-drilling data) are identified in Table 3. The parameters identified are generally consistent with those in which the maximum baseline concentration was exceeded. For some of the trace elements (metals/metalloids), there was a statistically significant *decrease* in the reported concentration, i.e. water quality improved following exploration activities.

The observed variability in major ion and trace element concentrations suggest a possible, but subtle, influence of the exploration activities on the groundwater quality in the vicinity of the wells. This influence is likely to be related to the drilling of the wells through the following mechanisms:

- **Drilling mud**: there were increases in potential indicators of the presence of drilling mud such as potassium, chloride, pH, alkalinity and barium.
- **Drill cuttings**: Mobilisation of ions and elements associated with the increased surface area of the cuttings relative to in-tact formation, and through the oxidation of the minerals from the oxygen rich drilling mud that had been stored in open tanks on surface. Wallis and Pichler (2018) and Poulsen et al. (2020) refer to these mechanisms in the literature. A similar influence on water chemistry could be seen in the evolution of the baseline water chemistry observed in most of the monitoring bores where declining trends in parameters were observed following drilling of the water bore itself, until a relatively stable baseline had been reached (RDM Hydro, 2022).

There were no significant changes to the groundwater chemistry that can be attributed to the HFS.

Figure 2 Tanumbirini - LTC timeseries monitoring data

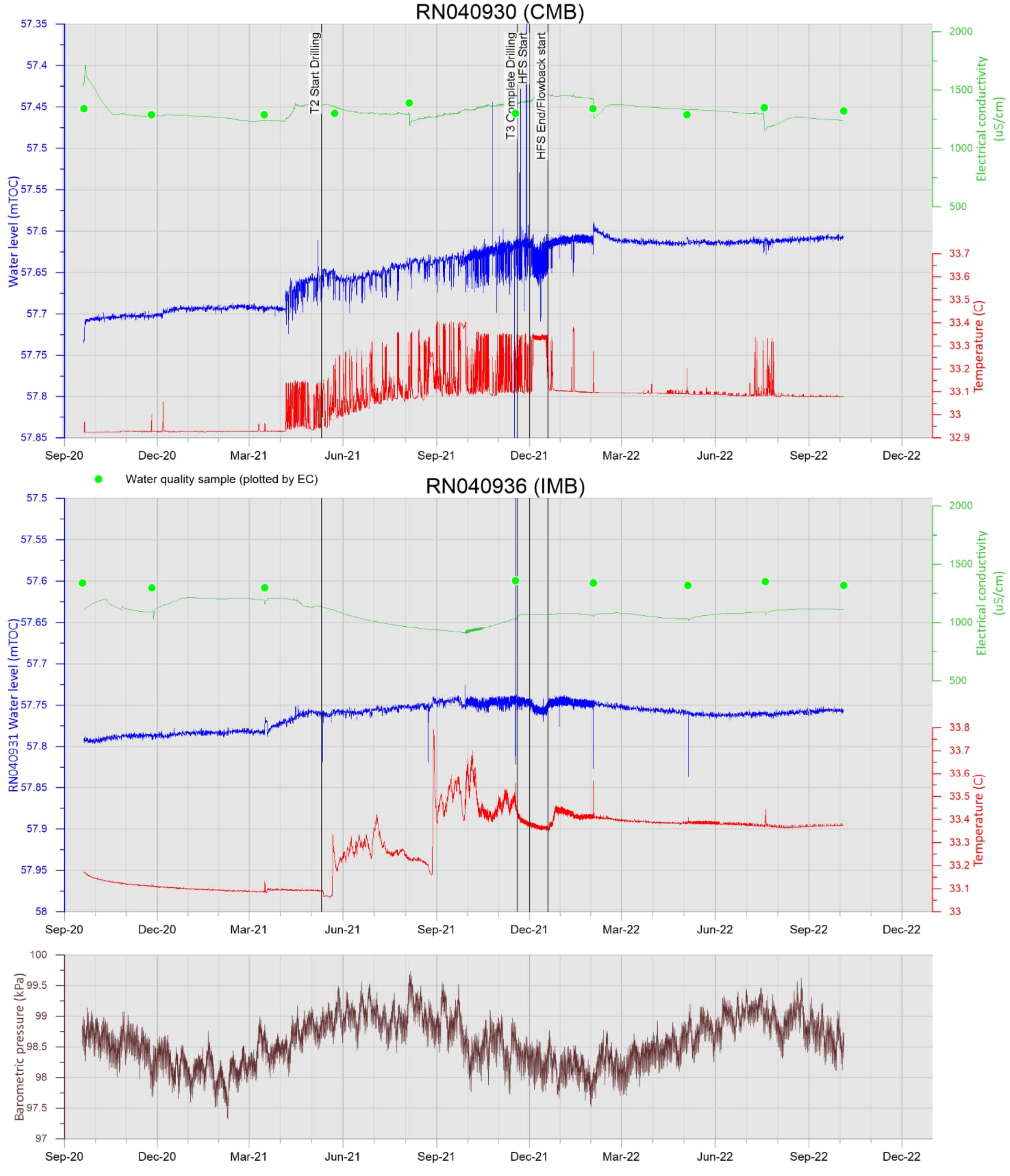


Figure 3 Regional groundwater level monitoring of the Cambrian Limestone Aquifer

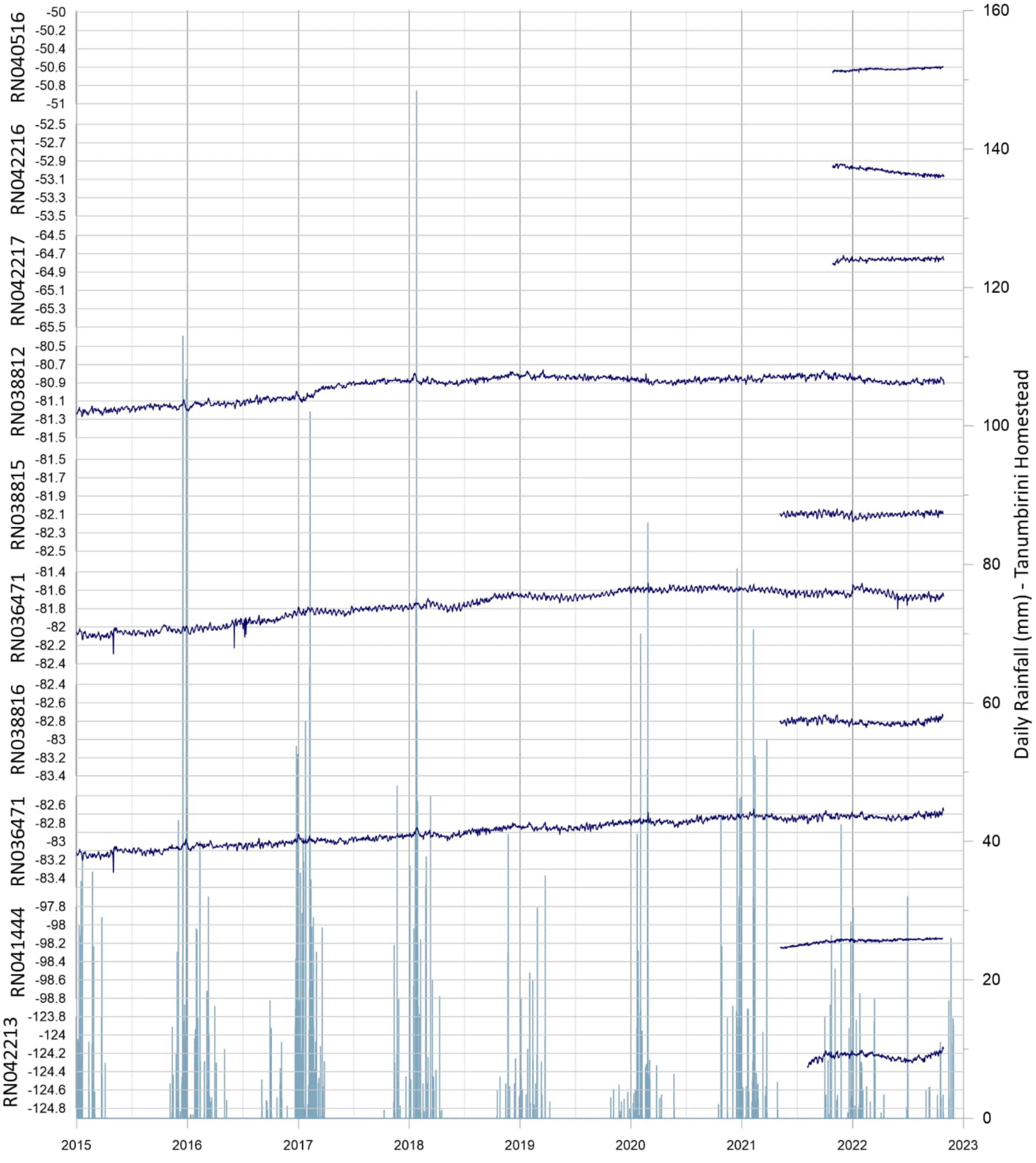


Table 2 Tanumbirini - Description of trends in parameters exceeding the baseline maximum concentration

Parameter (and fraction) exceeding baseline range in natural variability	Bore(s) in which exceedances were reported	Description
Methane (dissolved)	RN040930 (CMB), RN040936 (IMB)	Dissolved methane concentrations have shown steadily declining trends from their peaks in February 2022. The most recent (October 2022) IMB concentration was 16 mg/L as compared with a pre-activity maximum of 9 mg/L. The most recent (October 2022) CMB dissolved methane concentration was <LOR. The IMB and RN038580 reported dissolved low methane concentrations prior to the commencement activities. The CMB had previously only reported concentration <LOR. The maximum reported concentration was 48 µg/L in the IMB. In February 2022, two samples were collected from the IMB, the first after 3 well volumes of purging, the second after 6 well volumes. The second sample showed a ~20% decrease in methane concentration to 37 µg/L. RN038580 concentrations showed a declining trend from November 2019 through to August 2021 (during drilling activities) to a local minimum concentration of 2 mg/L. Thereafter the concentration slowly increased to 6 mg/L in May 2022, prior to declining again in July 2022 to 4 mg/L. Results from other Santos monitoring sites, where there have been no exploration activities, show variable methane concentrations. RN040938 showed an increase trend from <LOR to a peak of 37 µg/L, followed by a decrease over 6 months to 10 µg/L.
Chloride		Both the CMB and IMB chloride concentrations increased marginally during activities and exceeded their pre-activity maxima. In the first sample collected post HFS, the concentrations decreased to less than their pre-activity averages, but then increased again to their maximum reported concentrations prior to showing a declining trend in the most recent samples. The chloride concentration in RN038580 rose very slightly after the start of drilling but has declined to less than the pre-activity concentrations in the most recent sample Chloride results from Jibera South, Inacumba and Inacumba show similar trends across all aquifers.
Sodium		There was effectively no trend to any sodium concentration prior to the two most recent samples, which shows very small rising trends in all Santos monitoring bores. This suggests that the rising concentrations are most likely related to variations in laboratory methods rather than variations in the water quality in the aquifers.
Potassium		Potassium concentrations in the CMB increased to its maximum reported value in the first sample after the start of drilling, but then deceased to within the background range, although on a slight rising trend to the end of the HFS. The IMB showed a similar rising trend through the drilling and HFS activities. The potassium concentration in both bore decreased in the first two samples following the HFS but show an upward trend in the two subsequent (and most recent samples). Samples form the other sites and all aquifers show similar rising trends.
Calcium		Calcium concentrations in the CMB and IMB displayed declining concentrations during the drilling and HFS, changing to a rising trend since July 2022. The observed trends are consistent with the calcium concentrations at the other monitoring sites and in the different aquifers
Boron (dissolved)		The CMB reported a maximum concentration (0.21 mg/L) in the first sample following the start of drilling, as compared with its pre-activity maximum of 0.19 mg/L. The concentration decreased to 0.19 mg/L (May 2021) and 0.18 mg/L (November 2021) before increasing again to 0.2 mg/L in February 2022. In the IMB, the pre-activity maximum reported boron concentration was 0.19 mg/L. The reported concentration prior to the HFS (November 2021) was 0.19 mg/L and was 0.2 mg/L in February 2022. In RN038580, the dissolved boron concentration decreased from a pre-activity maximum of 0.19 mg/L to 0.13 mg/L in February 2022. Since February 2022, the dissolved boron concentration has shown a decreasing concentration in all Santos monitoring bores.
Copper (dissolved)		Following stabilisation of background concentrations (after December 2019) the dissolved copper concentration were <LOR in the CMB and IMB. The pre-HFS samples in both the CMB (0.004 mg/L) and IMB (0.001 mg/L) were =LOR or >LOR respectively but reduced to <LOR in the most recent sample. The IMB reported a maximum concentration in May 2022 of 0.014 mg/L. The two most recent samples from the CMB and IMB were <LOR RN038580 had previously reported a dissolved copper concentration <= LOR.
Boron (total)		The CMB reported a total boron concentration (0.27 mg/L) during the drilling of Tanumbirini 2 exceeding its pre-activity maximum (0.22 mg/L) in August 2021. The concentration decreased to 0.16 mg/L in November 2021 (prior to HFS) but increased again to 0.2 mg/L in February 2022. The reported total boron concentration in the IMB did not exceed its pre-activity maximum and shows a declining trend through the activities. Both the CMB and IMB boron concentrations increased following the end of the HFS, but are currently showing declining trends, with most recent concentrations within the rang of background variability. RN038580 reported total boron concentration in February 2022 (0.21 mg/L) that exceeded its pre-activity maximum (0.19 mg/L)
Copper (total)	RN040930 (CMB)	The total copper concentration in the CMB peaked at 0.031 mg/L in the last sample prior to drilling and exhibited a declining trend during the drilling and HFS program. The concentration was <LOR in May 2022, but then spiked up to 0.16 mg/L in July 2022, and reduced to 0.043mg/L in October 2022. Total copper concentrations in other monitoring bores have been <=LOR.
Electrical conductivity at 25°C	RN040936 (IMB)	The electrical conductivity (EC) of the groundwater in the Gum Ridge Formation at the Tanumbirini site is approximately 1,300 µS/cm, with the three bores showing slight variations over time, generally in concert with each other. The maximum reported EC in the IMB was 1360 µS/cm, as compared with its maximum prior to the start of activities of 1,340 µS/cm and minimum of 1280 µS/cm. The maximum reported EC in the CMB was 1,410 µS/cm prior to activities starting, and 1,390 µS/cm during activities. Both the CMB and RN038580 displayed some variability in their reported ECs. EC's are currently trending downward (very slightly) Bores at other sites also reported slight variations in EC over time and in concert with each other.
Total Dissolved Solids @180°C		The TDS concentrations reported from the IMB have varied in concert with the CMB. The maximum reported pre-activity TDS from the IMB was 878 mg/L, with a maximum concentration of 920 mg/L reported from the pre-HFS sample collected in November 2021. The reported TDS from the IMB decreased to 826 mg/L after the completion of the HFS (July 2022), but increase in the most recent sample (October 2022) The October 2022 concentration in the CMB was 910 mg/L TDS and shows a similar trend to the IMB. The most recent concentration (July. 2022) in RN038580 was 827 mg/L TDS and shows a similar trend to the CMB and IMB.
pH - Lab		The laboratory pH measured in all three bores was reported to increase during both drilling and HFS activities, but has then varied down and up in subsequent samples by approximately 0.5 pH units. Similar trends are reported from Jibera South, Inacumba and Inacumba South.
Bicarbonate Alkalinity as $CaCO_3$		The dominant major anion in the groundwater in the Gum Ridge Formation is bicarbonate. The maximum bicarbonate concentration in the IMB (435 mg/L) was reported from the November 2021 sample, compared with a pre-activity maximum of 420 mg/L. The bicarbonate concentration decreased to 423/421 mg/L in the two samples collected in February 2022 and continued to decline, with a the most recent sample (October 2022) reporting 377 mg/L. All other bores reported increased bicarbonate concentrations in November 2021 compared with the prior sample and have show declining trends and minimum concentrations in their recent samples.
Magnesium		The magnesium concentrations in the IMB, CBMA and RN038580 reported effectively flat trends following the establishment of baseline conditions in Q1 2019 and very slightly declining trends from the start of drilling through to the July 2022 samples. The most recent sample (October 2022) samples reported relatively higher concentrations, with he IMB exceeding its pre-activity maximum (60 mg/L compared with 59 mg/L). Magnesium concentrations in bores at Jibera South, Inacumba and Inacumba South also increased in their October 2022 samples.
Reactive Silica		The reactive silica concentration in the IMB has exhibited a very slight rising trend from 22.9 mg/L in March 2021 to 25.1 mg/L October 2022. The maximum pre-activity concentration was 24.9 mg/L. Reactive silica concentrations show more variability between the Santos monitoring bores than most other parameters.
Gross alpha		The pre-activity maximum reported Gross alpha concentration in the IMB was 0.82 Bq/L with the maximum concentration (0.83 Bq/L) post the start of activities reported from February 2022. Gross alpha shows some variability in reported concentration magnitude in all monitored bores. The CMB reported an increased concentration during drilling to a maximum of 0.91 Bq/L in August 2021, but a decreased concentration in the November 2021 sample (0.6 Bq/L). This is compared with a "stabilised" baseline maximum concentration of 0.86 Bq/L in September 2021. The IMB and CMB gross alpha concentrations have moved in concert since February 2022. They decreased to 0.63 Bq/L in May 2022 and rose to ~0.9 Bq/L in July where they effectively remained in the October 2022 sample.
Gross beta		The gross beta concentration in the IMB reported a declining trend from a 0.39 Bq/L peak in July 2020 (prior to the start of drilling) to 0.24 Bq/L in November 2021, immediately prior to the HFS. In the first sample following the HFS (February 2022) the concentration increased to 0.36 Bq/L, decreased to 0.31 Bq/L in May 2022 and then increased to its reported maximum of 0.44 Bq/L in July 2022 prior to declining to 0.34 mg/L in October 2022. Gross beta concentrations show some consistencies in concentration trends between the monitoring bores, but are less correlated than many of the other parameters where this occurs.
Barium (dissolved)		The pre-activity maximum reported concentration of dissolved barium (0.05 mg/L) was only exceeded in the IMB (0.051 mg/L) in November 2021 declining to 0.48/0.47 mg/L in the samples collected in February 2022. A similar trend was reported from the CMB, reaching a maximum of 0.048 mg/L during activities compared with a pre-activity maximum of 0.05 mg/L. The concentration declined to 0.046 mg/L in February 2022. There is some discrepancy in trends between the IMB, CMB and RN038580. Barium is ubiquitously present in the groundwater samples collected across the Santos monitoring bores. The maximum reported dissolved barium concentration (0.137 mg/L) reported from RN040938 at Jibera South is approximately 4 times greater than the concentrations reported from the Tanumbirini site.
Aluminium (total)		Total aluminium was reported <LOR in the IMB in all samples prior to activities starting. One of the samples collected in February 2022 reported 0.02 mg/L whereas the other reported <LOR (0.01 mg/L).

Parameter (and fraction) exceeding baseline range in natural variability	Bore(s) in which exceedances were reported	Description
		The CMB reported total aluminium in the August 2021 sample (0.02 mg/L), but had previously had a reported concentration of 0.03 mg/L. Both he IMB and CMB have reported <LOR since February 2022. Significantly higher dissolved aluminium concentrations have been reported from the other Santos monitoring bores, generally from the first sample collected, where the concentration may be influenced by the presence of solids resulting from the drilling of the bore. Concentrations are generally =LOR or <LOR.
Barium (total)		In the IMB, the total barium concentration exceeded the pre-activity maximum (0.049 mg/L) in the November 2021 (0.05 mg/L) and the two samples collected in February 2022 (0.086 mg/L and 0.055 mg/L). The total barium concentration has remained greater than the pre-activity maximum and the current total barium concentration in the IMB is 0.054 mg/L. The CMB reported some variability in total barium concentration through the activities (0.044-0.04 mg/L), but the concentration did not exceed the pre-activity maximum (0.049 mg/L), and has shown only a marginally increasing trend since the end of activities, rising from 0.047 mg/L to 0.049 mg/L between February and October 2022. Total barium concentrations are routinely greater at Jibera South and Inacumba South as compared with Tanumbirini.
Chromium (total)		Prior to activities commencing, the IMB reported total chromium <LOR. The November 2021 sample reported 0.002 mg/L total chromium. The concentration reduced to <LOR in February 2022 and has remained <LOR throughout 2022. The CMB total chromium concentration was also <LOR throughout 2022. Most other Santos monitoring bores report total chromium that fluctuate between <LOR and =LOR.
Molybdenum (total)		Prior to activities commencing, the IMB reported total molybdenum <LOR. The November 2021 sample reported 0.003 mg/L total molybdenum. The concentration reduced to <LOR in February 2022 and has remained <LOR throughout 2022. The CMB total molybdenum concentration has remained <LOR since March 2020 when it stabilised post the drilling of the bore. Most other Santos monitoring bores report total molybdenum <LOR. RN040931 at Inacumba consistent reports total molybdenum in the range 0.002-0.004 mg/L. RN040938 at Jibera South reported a maximum dissolved molybdenum concentration of 0.02 mg/L prior to declining to <LOR.
Strontium (total)		The total strontium concentration in the IMB has moved in concert with the concentration in the CMB. Pre-activity maximum concentrations were report in September 2020 (IMB 0.876 mg/L and CMB 0.859 mg/L). Minimum concentrations were then reported in the next sample, collected in November 2020. The concentrations in both bores increased to 0.769 mg/L in the IMB and 0.792 mg/L in the CMB in March 2021 prior to the start of drilling. Concentrations remained relatively stable during drilling and then increased to 0.87 mg/L / 0.861 mg/L in the IMB/CMB respectively in February 2022. Concentrations then declined in May 2022 prior to showing an increasing trend from May through October 2022 when maximum concentrations of 0.879/0.878 mg/L were reported in the IMB/CMB respectively. Similar concentrations and trends in total strontium are observed across all monitoring bores.

LOR - limit of reporting; <LOR – less than the LOR; =LOR – equal to the LOR; >LOR – greater than the LOR
CMB = RN040930; IMB=RN040936

Table 3 Parameters with a significant difference between pre- and post-activity concentrations

Bore	Parameter	Comment
	Electrical Conductivity – Field	
RN040930 (CMB)	Total Dissolved Solids @180°C	
	Potassium	
	Reactive Silica (dissolved)	
	Boron (dissolved)	
	Cobalt (dissolved)	Post-activity mean concentration less than pre-activity mean
	Nickel (dissolved)	Post-activity mean concentration less than pre-activity mean
	Cobalt (total)	Post-activity mean concentration less than pre-activity mean
	Iron (total)	
	Uranium (total)	Post-activity mean concentration less than pre-activity mean
RN040936 (IMB)	Electrical Conductivity – Field	
	Electrical Conductivity @ 25°C	
	Total Dissolved Solids @180°C	
	Potassium	
	Reactive Silica	
	Methane	
	Barium (dissolved)	
	Nickel (dissolved)	Post-activity mean concentration less than pre-activity mean
	Strontium (dissolved)	
	Uranium (dissolved)	Post-activity mean concentration less than pre-activity mean
	Arsenic (total)	Post-activity mean concentration less than pre-activity mean
	Barium (total)	
	Manganese (total)	
	Uranium (total)	Post-activity mean concentration less than pre-activity mean

4. Inacumba

There have been no drilling or HFS activities at Inacumba. The Inacumba site is approximately 20 km to the east of Tanumbirini.

Monitoring Activities

Monitoring activities target two formations at the Inacumba site.

Gum Ridge Formation (GRF)

A control monitoring bore (RN040931 – up hydraulic gradient of the proposed well locations) was installed in the Gum Ridge Formation (GRF) at the Inacumba site in December 2018 and a future impact monitoring bore (RN040935 – down hydraulic gradient of the proposed well locations) was installed in July 2019. Both bores are installed across the full thickness of the Gum Ridge Formation (GRF) in accordance with the Guideline.

Water level, temperature and conductivity (LTC) sensors were installed in the monitoring bores in September 2020, replacing previously installed sensors that were found to provide unreliable data. The sensors record at four hourly intervals.

RN040931 is equipped with a dedicated electric submersible pump which is used for purging and sampling, at a pumping rate of ~0.5 L/s, however the bore cannot sustain this pumping rate. Routine water quality monitoring of RN040931 commenced in late July 2019. The suite of analysis exceeds the requirements of the Guideline and is compliant with Table 6 of the Code. RN040931 has been sampled 27 times. A sample could not be collected in February 2022 as the site was not accessible due to wet weather.

RN040935 was constructed as a future IMB with sealed sub-surface headworks in a “gatic” in accordance with the Bore Work Permit. There is no pump installed in this bore and no water quality samples have been collected.

Inacumba Aquifer (IA)

Santos, working with the NTG (Tickell, 2020), identified a previously unrecognised stratigraphic interval, informally called the Inacumba Unit. The Inacumba Unit comprises a red-brown siltstone overlying a clean limestone. The Inacumba Unit has been encountered at the Tanumbirini and Inacumba exploration sites, where it is up to ~200 m thick, but is not known further west. A control monitoring bore (RN041242) and a future impact monitoring bore (RN041243) were installed in the Inacumba Unit aquifer in September 2019.

Water level, temperature and conductivity (LTC) sensors were installed in the monitoring bores in September 2020. The sensors record at four hourly intervals.

RN041242 is equipped with a dedicated electric submersible pump which is used for purging and sampling, at a pumping rate of 17 L/s. Routine of water quality monitoring of RN041242 commenced in October 2019. The suite of analysis exceeds the requirements of the Guideline and is compliant with Table 6 of the Code. RN041242 had been sampled eleven times. A sample could not be collected in February 2022 as the site was not accessible due to wet weather.

RN041243 was constructed as a future IMB with sealed sub-surface headworks in a “gatic” in accordance with the Bore Work Permit. There is no pump installed in this bore and no water quality samples have been collected.

Water level, temperature and electrical conductivity monitoring

The downhole sensor responses are presented on Figure 4 and Figure 5 and are described and interpreted as follows.

- There is a slight seasonal fluctuation in water level that lags behind but follows barometric pressure
- The following diurnal variations in water level (approximate) can be observed:
    - RN040931 (GRF) – 0.05 m (5 cm)
    - RN040935 (GRF) – 0.025 m (2.5 cm)
    - RN042142 (IA) – 0.07 m (7 cm)
    - RN042143 (IA) – 0.07 m (7 cm)
- There is an approximately 0.05 m decline in overall water levels in both the GRF and IA
- An earthtide response can be seen in the data from RN040935, RN042142 and RN042143
- The temperature and conductivity response in RN042142 indicate that pumped water is coming up the bore from deeper in the formation, and that the deeper water may be more saline than shallower water within the same geological formation. This is indicative of fracture dominated flow.
- The electrical conductivity measured by the sensor in RN040931 is roughly 250 µS/cm greater than the field measured electrical conductivity. Both sets of data show similar effectively flat trends. The offset is likely to relate to a different calibration on the downhole sensor. The field measured electrical conductivity is considered the more reliable measurement as the portable meter is routinely calibrated each field visit.
- The noisy water level data in the later time of the RN041243 record is most likely related to a nearby lightening strike affecting the water level sensor (pers. Comm. In-Situ Inc, 2022). While the apparent diurnal and earth tide fluctuations appear to have increased, the magnitude of variation remains less than approximately 15 cm. The data continues to show a similar longer-term trend as prior to the damage.

Figure 4 Inacumba Gum Ridge Formation (GRF) - LTC timeseries monitoring data

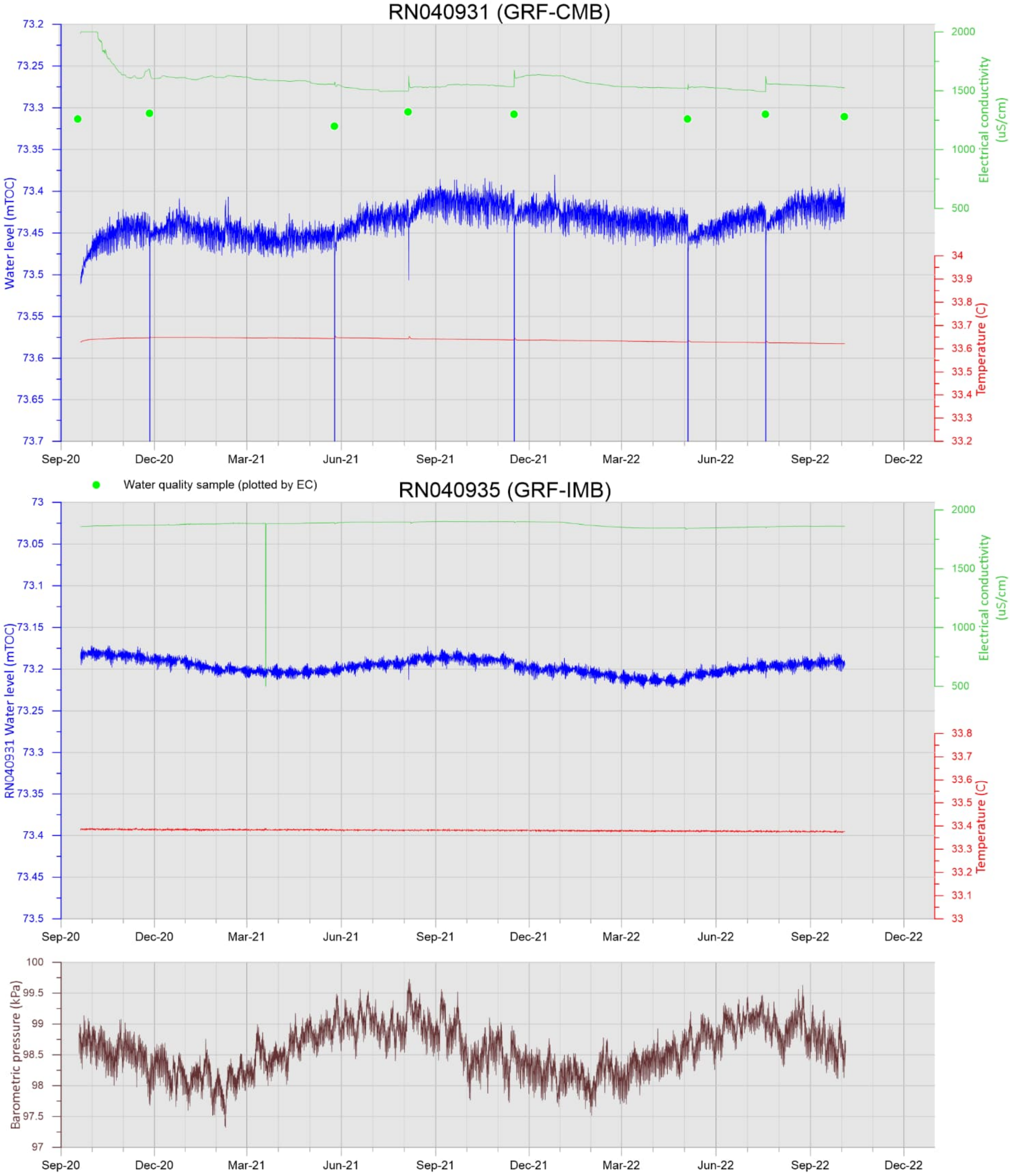
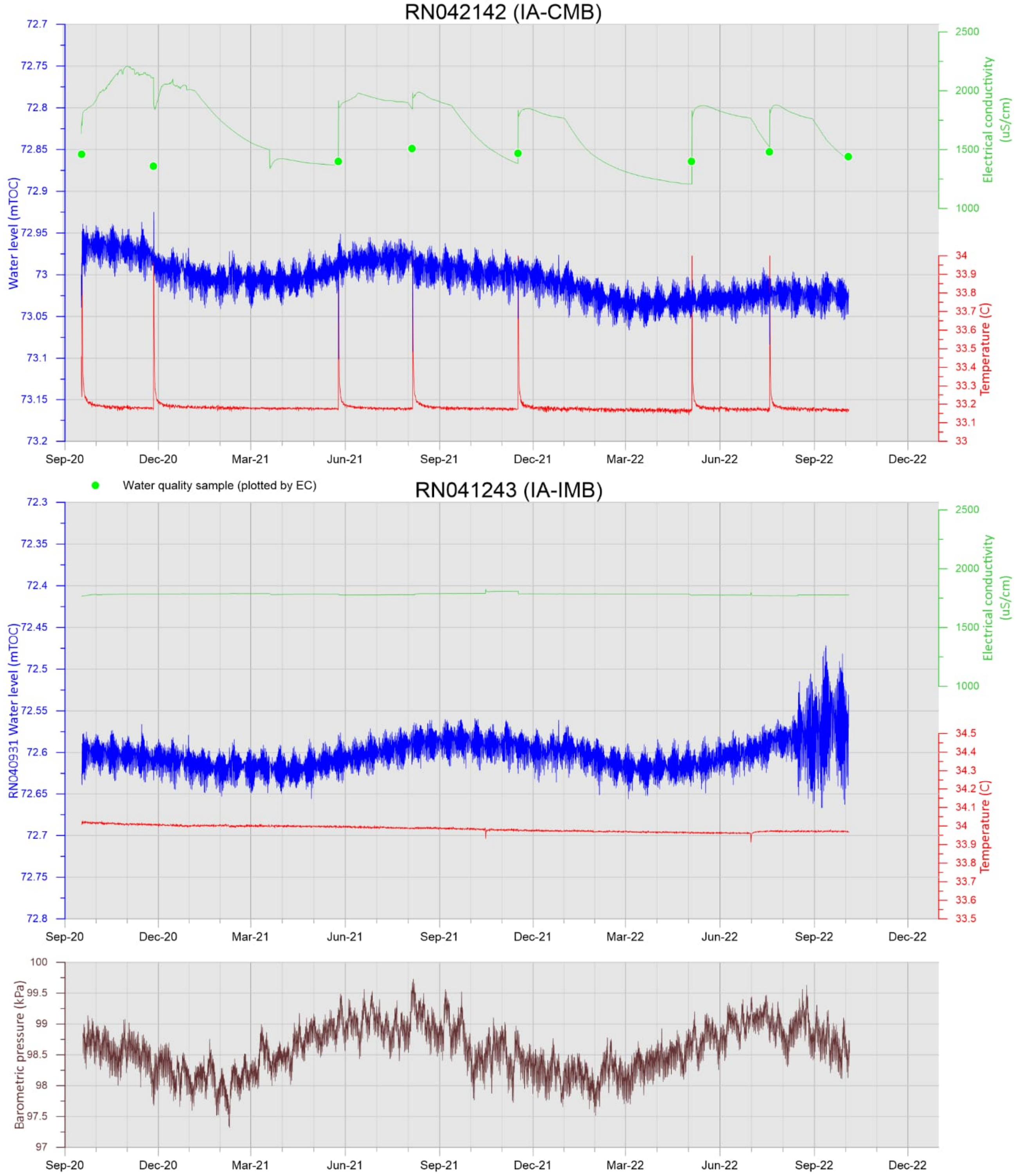


Figure 5 Inacumba Aquifer (IA) - LTC timeseries monitoring data



Water quality monitoring

There have been no drilling or HFS activities at Inacumba.

Statistical summaries of the water quality results are provided in Attachment A. In lieu of assessing potential changes to water quality associated with drilling or HFS activities, the Mann-Kendall test for trend has been performed for all analytes for each of RN040931 and RN041242. Where the Mann-Kendall test has identified a rising trend (i.e. there appears to be a deterioration in the reported water quality), a time-series chart has been prepared and the data qualitatively described in Table 4

Table 4 Inacumba - Description of timeseries data for those analytes with a rising trend

Bore in which exceedances were reported	Parameter with rising trend	Description of trend
RN040931 (Gum Ridge Formation)	pH – field	The field pH was quite variable when routine sampling commenced in Jul 2019, showing an overall steeply declining trend to a minimum of 6.4. The field pH then rose to ~pH 8, where it was relatively stable, except for an anomalously low reading in September 2020. The field pH has shown a slight declining trend through 2022.
	pH - laboratory	The laboratory measured pH exhibits similar trends to the field pH. The value of the laboratory measured pH is generally approximately 0.5 pH units greater than the field measured pH. This is likely due to volatilisation of dissolved carbon dioxide, a weak acid, that is commonly observed effervescing in the groundwaters collected from the Gum Ridge Formation
	Carbonate alkalinity	Carbonate alkalinity has mostly been reported at <LOR except for one sample in January 2022 and for 3 samples from August 2021, October and 2021 and February 2022 where concentrations peaked at 20 mg/L. The two most recent samples (July and October 2022) were both <LOR.
	Potassium	The potassium sample collected immediately after drilling contained 22 mg/L potassium. The concentration rose from 25 mg/L to 33 mg/L as the bore continued to be sampled, and then gradually declined to 26 mg/L between January 2020 and July 2022. Most recent sample report a concentration of 28 mg/L.
	Methane (dissolved)	Dissolved methane was report <LOR in all samples prior to October 2021. The concentration rose to a maximum of 5 mg/L in May 2022, declining to 20 mg/L in July 2022 and <LOR in October 2022.
	Lithium (dissolved)	The dissolved lithium concentration has fluctuated between 0.4 mg/L and 0.5 mg/L except for a few lower concentration outliers. The most recent sample (0.48 mg/L) contained lower than the maximum reported concentration (0.51 mg/L).
	Molybdenum (total)	The maximum total molybdenum concentration (0.05 mg/L) was reported from the sample immediately after drilling. When routine sampling commenced, concentrations were generally 0.002 mg/L, but reduced to <LOR in January 2020. Concentrations rose to a maximum of 0.004 mg/L in May 2021 and remained less than this concentration but >LOR since.
RN041242 (Inacumba Aquifer)	Gross alpha	The gross alpha concentration has fluctuated between roughly 0.8 Bq/L and 1.2 Bq/L. The two most recent samples reported 1.17 Bq/L and 1.26 Bq/L in Jul and October 2022 respectively.
	Iron (dissolved)	The dissolved iron concentration exhibited a gradually increasing concentration from 0.14 mg/L in October 2019 to 0.38 mg/L November 2021. The May 2022 sample report <LOR followed by 0.5 mg/L in July 2022, reducing to 0.35 mg/L in October 2022.
	Manganese (dissolved)	The dissolved manganese concentration has risen from 0.004 mg/L in the first sample collected to a maximum of 0.019 mg/L in May 2022. The concentration has since declined to 0.01 mg/L.
	Iron (total)	The total iron concentration reports a generally gradually increasing trend from the first sample (0.17 mg/L) collected in October 2019, through to 0.4 mg/L in May 2022. In July 2022m a maximum concentration of 0.7 mg/L was reported, reducing to 0.56 mg/L in October 2022.
	Manganese (total)	The total manganese concentrations and trends are very similar to the dissolved manganese concentrations and trends.

5. Dissolved methane

Santos has analysed 279 individual samples for dissolved methane across its monitoring bores and from pastoral bores baselined and routinely monitored on Tanumbirini Station and the adjacent O.T. Downs (Beetaloo) station. Methane was detected in 87 of those samples (31%). Dissolved methane has been detected in all monitored formations (Anthony Lagoon Formation, Gum Ridge Formation, Inacumba Unit aquifer and Proterozoic Bedrock) before and after drilling, and before and after HFS activities. The maximum reported dissolved methane concentration was 777 µg/L, from RN037666 (a station bore) that is more than 50 km to the northeast of the Tanumbirini site, compared with a maximum reported concentration of less than 50 µg/L at the Tanumbirini site. Methane saturation in water at atmospheric pressure is 20,700 µg/L at 30 °C (Walker and Mallants, 2014), which is the concentration required for free gas to be present.

Timeseries data shows a rise trend in the reported dissolved methane concentrations in the Tanumbirini IMB (RN040936) and CMB (RN040930) over the period of the exploration activities, followed by a decline in concentration from February 2022 to October 2022. The IMB reported a maximum concentration of 48 µg/L and the CMB a maximum of 16 µg/L. The CMB dissolved methane concentration declined to less than the limit of reporting in October 2022 and the reported concentration was 16 µg/L in the IMB at that time. RN038580 is also at the Tanumbirini site and exhibited a rising and then falling trend in reported methane concentrations with a maximum reported concentration of 6 µg/L over 2021/2022. The peak concentration lagged behind the IMB and CMB. A maximum concentration of 20 µg/L (CSIRO, 2019) was reported from this bore prior to the commencement of drilling. Low concentrations of dissolved methane were detected in the IMB and RN038580 prior to the commencement of drilling, however dissolved methane had not previously been detected in the CMB.

While the dissolved methane concentrations have increased at the Tanumbirini exploration site, the detected dissolved methane concentrations remain less than concentrations observed elsewhere across EP161. A timeseries comparison of the methane concentrations from Santos's regular monitoring of pastoral bores and those at the Tanumbirini exploration site is shown on Figure 6 and the spatial distribution of methane concentrations from all Santos monitoring activities (including bore baselines) are shown on Figure 7. From these graphs, it can be seen:

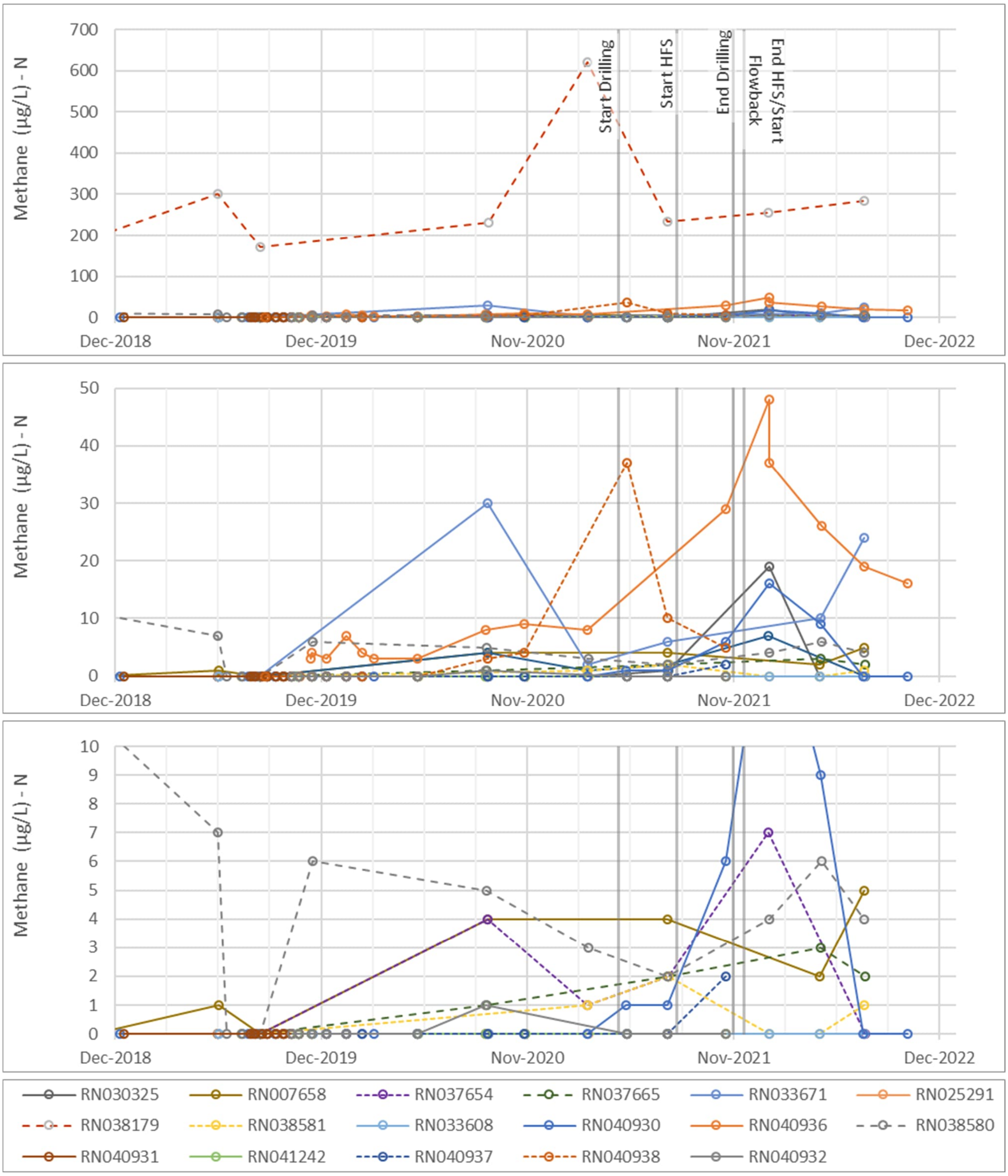
- Dissolved methane has been detected in all monitored formations (Anthony Lagoon Formation, Gum Ridge Formation, Inacumba Aquifer and Proterozoic Bedrock) before and after drilling, and before and after HFS activities.
- There is no apparent spatial pattern to the distribution of dissolved methane concentrations
- The maximum reported dissolved methane concentration was 777 µg/L, from RN037666 (a station bore) that is more than 50 km to the northeast of the Tanumbirini exploration site.
- RN038179 (11 km southwest of the Tanumbirini site) routinely reports dissolved methane concentrations greater than 200 µg/L, with a maximum concentration of 620 µg/L reported in March 2021. CSIRO (2019) reported a concentration of 379 µg/L from RN038179 (sampled in October 2018).
- RN030325 (3.6 km from Tanumbirini), RN040937 (10.8 km from Tanumbirini) and RN037654 (24.3 km from Tanumbirini) also report rising dissolved methane concentrations over the equivalent period to the drilling and HFS activities (May 2021 to February 2022), albeit at lower concentrations compared with the Tanumbirini site. The dissolved methane concentration in RN040937 was <LOR in October 2022 and RN030325 was reported <LOR in May 2022 (its most recent sample).
- RN040938 reported an increasing trend from <LOR to a peak of 37 µg/L in May 2021, followed by a gradual decrease to 1 µg/L in October 2022.
- RN033761 reported an increasing trend from <LOR to a peak of 30 µg/L, followed by a decrease to less than 10 µg/L in the following two samples. From March 2021 the reported concentration increased to 10 µg/L in May 2022, and was reported to be 24 µg/L in July 2022.
- Of the bores that are routinely sampled by Santos, only six bores have never reported dissolved methane greater than the limit of reporting (RN040939, RN041242, RN025291, RN033608, RN035502).

- Dissolved methane concentrations may reduce to less than the limit of reporting, and then increase again. These changes may occur between consecutive samples (every three or six months depending on the bore) or over a longer period.

CSIRO (2019) collected 25 samples for dissolved methane in October to November 2018. The CSIRO (2019) limit of reporting was 0.2 µg/L as compared with the 1 µg/L at which Santos's results are usually reported. CSIRO reported the presence of methane in all the samples it collected. It found that concentrations were generally less than 10 µg/L, but concentrations up to 1129.5 µg/L were present. Stable isotope composition of the methane in the two samples analysed (RN031397 and RN038179) indicated that the presence of methane was due to microbial activity. RN038179 is on Tanumbirini Station and is included in the Santos regional monitoring program. CSIRO (2020) identified that methanogenic organisms (i.e. methane producing organisms) are naturally occurring within the groundwater of the Cambrian Limestone Aquifer. Dissolved methane concentrations are generally too low to enable isotopic characterisation. CSIRO has advised Santos that analysis to determine the stable isotope composition of the methane, which would confirm whether the methane is sourced from microbial activity, cannot be performed with confidence if the dissolved methane concentration is less than 500 µg/L (pers. Comm. Santos, 2022).

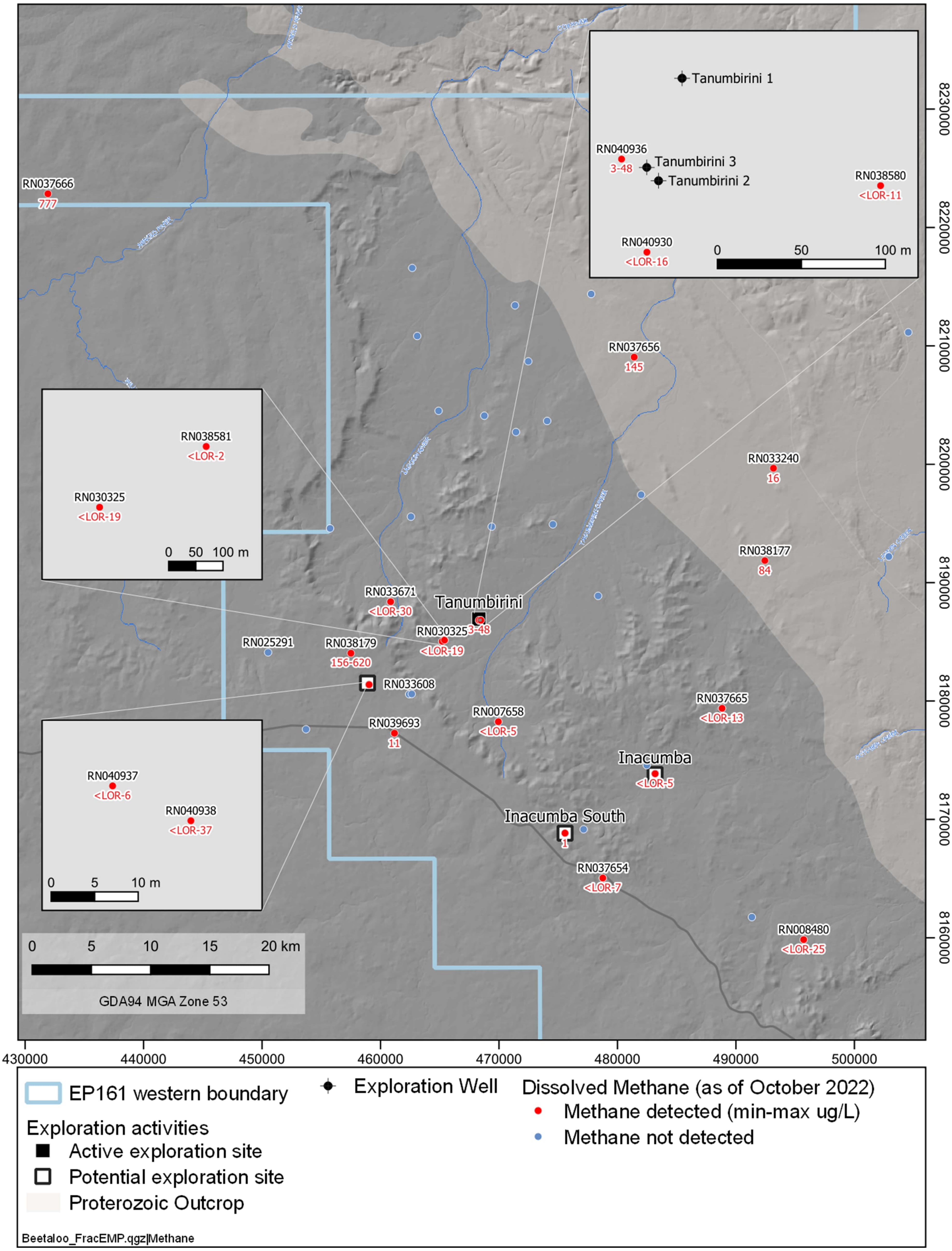
No propane or ethane has been detected in any of the groundwater samples collected by Santos. While the absence of propane and ethane does not preclude a thermogenic origin for the methane, it does indicate that a biogenic source to the methane detected is more likely.

Figure 6 Dissolved methane time series comparison*



* the graphs report the same data at different scales, except for the lower graphs where some bores with higher concentrations have been removed for clarity

Figure 7 Spatial distribution of methane concentrations



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7. Disclaimer

RDM Hydro Pty Ltd (RDM Hydro) has prepared this report with all reasonable skill, care and diligence, and taking account of the timescale and resources allowed to it by agreement with Santos (the Client). Information reported herein is based on the interpretation of data collected and collated, which has been accepted in good faith as being accurate and valid.

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Attachment A – Groundwater chemistry statistical summaries

RN040930				Statistical Summary - All Data									Pre-Activity Data				Post Activity Data							Statistics	
Group	Parameter	Units	Fraction	Count	Min	Max	Average	P10	P50	P90	First	Last	19-May-20	20-Sep-20	25-Nov-20	16-Mar-21	24-May-21	5-Aug-21	17-Nov-21	1-Feb-22	4-May-22	19-Jul-22	5-Oct-22	F.Test Statistic	T.Test - P-value
Field Measurements	pH - Field	pH Unit	N	30	6.28	7.61	6.94	6.559	6.91	7.281	7.1	7.02	7.29	6.67	7.61	7.28	6.92	6.81	6.97	6.89	6.86	6.9	7.02	0.00	0.11
	Electrical Conductivity - Field	µS/cm	N	30	1183	1643	1389	1304	1382	1447	1470	1183	1388	1375	1643	1428	1445	1342	1429	1304	1281	1304	1183	0.45	0.04
	CH4 - Field	% LEL	N	27	<LOR	0.2	0.01	<LOR	<LOR	<LOR	0	0	0	0	0	0.2	0	0	0	0	0	0	0	-	0.10
	Electrical Conductivity @ 25°C	µS/cm	N	34	878	1410	1309.4	1290	1310	1381	1330	1320	1270	1340	1290	1290	1300	1390	1300	1340	1290	1350	1320	0.84	0.10
Physiochemical	Total Dissolved Solids @180°C	mg/L	T	34	616	929	842.2	793.8	846.5	900.2	824	910	827	848	759	815	859	896	894	872	902	834	910	0.45	0.003
	pH - Lab	pH Unit	N	34	7.27	8.04	7.765	7.443	7.77	8.01	7.97	7.95	7.76	7.67	7.9	7.7	7.84	8.03	8.04	7.55	8.01	7.52	7.95	0.22	0.24
	Suspended Solids	mg/L	N	34	5	46	6.4	5	5	5	<LOR	<LOR	11	5	5	5	5	5	5	5	5	5	5	-	0.10
Major Ions	Bicarbonate Alkalinity as CaCO3	mg/L	N	34	269	467	404.3	380.6	409.5	424	417	382	415	384	409	411	401	400	444	422	377	392	382	0.43	0.44
	Carbonate Alkalinity as CaCO3	mg/L	N	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	1	1	-	-
	Chloride	mg/L	N	34	60	121	109.6	105.3	110.5	116	106	111	108	110	113	112	121	116	116	105	121	118	111	0.15	0.08
	Sulfate as SO4 2-	mg/L	D	34	125	208	172	161.6	173.5	183.7	208	184	159	161	180	183	174	182	178	171	174	179	184	0.04	0.18
	Sodium	mg/L	D	34	45	83	75.7	74	76	79	78	83	79	77	73	79	79	76	78	77	76	76	83	0.75	0.31
	Potassium	mg/L	D	34	7	17	11.9	11	12	13	12	14	11	12	11	12	17	13	14	13	12	13	14	0.12	0.01
	Calcium	mg/L	D	34	86	156	135.8	126.3	137	149.7	137	156	134	132	122	141	134	140	137	133	127	86	156	0.13	0.44
	Magnesium	mg/L	D	34	35	63	56	53.3	56	60.7	57	61	57	57	51	58	56	56	56	55	55	53	61	0.53	0.44
	Fluoride	mg/L	N	34	0.5	1	0.65	0.6	0.6	0.7	1	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.87	0.46
Nutrients & Radiological	Nitrite as N	mg/L	N	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Nitrate as N	mg/L	N	34	0.04	0.04	0.012	0.01	0.01	0.01	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Reactive Silica	mg/L	N	33	14.8	25.7	23.4	22.62	23.5	24.94	25.7	24.5	23.4	23.2	24	22.9	25.5	24.6	23.4	24.4	23.8	24.1	24.5	0.59	0.02
	Gross alpha	Bq/L	N	34	0.43	1.46	0.765	0.606	0.75	0.897	1.46	0.9	0.66	0.86	0.62	0.59	0.79	0.91	0.6	0.79	0.63	0.89	0.9	0.98	0.11
	Gross beta activity - 40K	Bq/L	N	34	0.21	0.82	0.378	0.25	0.35	0.481	0.82	0.43	0.3	0.38	0.25	0.35	0.37	0.46	0.22	0.26	0.25	0.37	0.43	0.44	0.38
Dissolved Gases	Methane	µg/L	N	34	1	16	2.1	1	1	4.5	<LOR	<LOR	0.99	1.01	0.99	1.01	0.99	1.01	6	16	9	1	1	0.00	0.06
	Ethane	µg/L	N	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	1	1	-	-
	Propane	µg/L	N	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	1	1	-	-
Dissolved Metals/ Metalloids	Aluminium	mg/L	D	34	0.02	0.02	0.01	0.01	0.01	0.01	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Arsenic	mg/L	D	34	0.001	0.008	0.0044	0.001	0.005	0.007	0.002	<LOR	0.003	0.003	0.002	0.002	0.005	0.002	0.001	0.001	0.001	0.001	0.001	0.15	0.17
	Barium	mg/L	D	34	0.032	0.05	0.0438	0.0413	0.044	0.046	0.039	0.044	0.045	0.043	0.042	0.043	0.044	0.046	0.048	0.046	0.045	0.032	0.044	0.04	0.44
	Beryllium	mg/L	D	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Boron	mg/L	D	34	0.1	0.21	0.172	0.146	0.175	0.19	0.18	0.16	0.14	0.16	0.17	0.17	0.21	0.19	0.18	0.2	0.18	0.17	0.16	0.81	0.02
	Cadmium	mg/L	D	34	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0002	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	0.05
	Chromium	mg/L	D	34	0.009	0.009	0.0012	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Cobalt	mg/L	D	34	0.001	0.057	0.0054	0.001	0.004	0.0077	0.057	<LOR	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	0.001
	Copper	mg/L	D	34	0.001	0.014	0.0015	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.014	0.001	0.001	-	0.18
	Iron	mg/L	D	34	0.06	1.11	0.385	0.053	0.39	0.674	<LOR	0.49	0.41	0.8	1.11	0.39	0.54	0.39	0.56	0.47	0.66	0.05	0.49	0.22	0.10
	Lead	mg/L	D	34	0.001	0.003	0.0011	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	0.10
	Lithium	mg/L	D	34	0.057	0.076	0.0666	0.0623	0.066	0.0727	0.069	0.071	0.065	0.064	0.065	0.068	0.059	0.068	0.066	0.07	0.068	0.064	0.071	0.19	0.32
	Manganese	mg/L	D	34	0.001	0.046	0.0185	0.015	0.018	0.0242	0.026	0.018	0.02	0.014	0.016	0.02	0.017	0.019	0.018	0.018	0.019	0.001	0.018	0.23	0.31
	Mercury	mg/L	D	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	0.05
	Molybdenum	mg/L	D	34	0.001	0.009	0.0013	0.001	0.001	0.001	0.003	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Nickel	mg/L	D	34	0.001	0.22	0.0197	0.002	0.012	0.0254	0.22	0.001	0.007	0.006	0.007	0.004	0.003	0.005	0.002	0.001	0.002	0.001	0.001	0.96	0.001
	Selenium	mg/L	D	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Silver	mg/L	D	33	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Strontium	mg/L	D	33	0.692	0.864	0.7876	0.7476	0.786	0.84	0.719	0.788	0.84	0.772	0.734	0.75	0.753	0.747	0.804	0.858	0.764	0.692	0.788	0.93	0.48
	Uranium	mg/L	D	34	0.001	0.037	0.0056	0.002	0.005	0.008	0.037	0.001	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.79	0.01
	Vanadium	mg/L	D	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Zinc	mg/L	D	34	0.005	0.099	0.0248	0.0063	0.02	0.0446	0.099	0.016	0.005	0.025	0.015	0.007	0.035	0.033	0.012	0.006	0.018	0.005	0.016	0.69	0.25
Total Metals/ Metalloids	Aluminium	mg/L	T	34	0.02	0.03	0.011	0.01	0.01	0.01	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	-	0.24
	Arsenic	mg/L	T	34	0.001	0.014	0.0049	0.001	0.005	0.0077	0.002	<LOR	0.004	0.003	0.002	0.003	0.005	0.004	0.001	0.001	0.001	0.002	0.001	0.27	0.18
	Barium	mg/L	T	34	0.038	0.053	0.0467	0.0433	0.047	0.05	0.04	0.049	0.047	0.045	0.038	0.05	0.044	0.051	0.046	0.047	0.048	0.048	0.049	0.08	0.13
	Beryllium	mg/L	T	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Boron	mg/L	T	34	0.08	0.27	0.177	0.14	0.175	0.21	0.16	0.14	0.22	0.16	0.17	0.18	0.17	0.27	0.16	0.2	0.24	0.18	0.14	0.38	0.33
	Cadmium	mg/L	T	34	0.0001	0.0002	0.00011	0.0001	0.0001	0.0001	0.0002	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	0.05
	Chromium	mg/L	T	34	0.001	0.003	0.0012	0.001	0.001	0.0017	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Cobalt	mg/L	T	34	0.002	0.06	0.006	0.001	0.004	0.0087	0.06	<LOR	0.004	0.002	0.002	0.003	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.57	0.01
	Copper	mg/L	T	34	0.002	0.158	0.0124	0.001	0.006	0.0177	<LOR	0.043	0.007	0.004	0.001	0.031	0.017	0.018	0.005	0.014	0.001	0.158	0.043	0.04	0.14
	Iron	mg/L	T	34	0.21	3.62	1.071	0.292	0.715	2.367	0.23	0.83	3.3	1.69	1.06	1.9	0.75	2.29	0.55	0.61	0.6	1.07	0.83	0.34	0.03
	Lead	mg/L	T	34	0.001	0.028	0.0053	0.001	0.004	0.009	0.001	0.002	0.005	0.002	0.002	0.004	0.002	0.005	0.001	0.001	0.001	0.004	0.002	0.99	0.18
	Lithium	mg/L	T	34	0.057	0.082	0.0689	0.0613	0.0685	0.0767	0.062	0.064	0.077	0.069	0.06	0.071	0.067	0.072	0.061	0.071	0.075	0.068	0.064	0.39	0.40
	Manganese	mg/L	T	34	0.008	0.057	0.0207	0.016	0.018	0.0284	0.029	0.017	0.023	0.016	0.015	0.022	0.017	0.027	0.016	0.018	0.018	0.021	0.017	0.80	0.48
	Mercury	mg/L	T	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	0.05
	Molybdenum	mg/L	T	34	0.001	0.004	0.0011	0.001	0.001	0.001	0.003	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Nickel	mg/L	T	34	0.001	0.234	0.0212	0.003	0.014	0.028	0.234	0.002	0.012	0.008	0.006	0.005	0.004	0.014	0.001	0.003	0.001	0.003	0.002	0.56	0.09
	Selenium	mg/L	T	34	0.05	0.05	0.011	0.01	0.01	0.01	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Silver	mg/L	T	33	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Strontium	mg/L	T	33	0.668	0.944	0.8162	0.7488	0.826	0.8706	0.7	0.878	0.86	0.859	0.668	0.792	0.776	0.819	0.765	0.861	0.797	0.802	0.878	0.11	0.32
	Uranium	mg/L	T	34	0.001	0.038	0.0061	0.002	0.005	0.009	0.038	0.001	0.004	0.003	0.003	0.003	0.002	0.003	0.002	0.002	0.001	0.002	0.001	0.64	0.003
	Vanadium	mg/L	T	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Zinc	mg/L	T	34	0.006	0.101	0.0438	0.0146	0.0395	0.0692	0.101	0.046	0.034	0.038	0.014	0.045	0.054	0.062	0.01	0.016	0.006	0.063	0.046	0.32	0.39
Complex Hydrocarbons	C6 - C36 Fraction (Sum)	µg/L	N	29	1360	1360	66.2	20	20	20	<LOR	<LOR	20	20	1360	20	20	20	20	20	20	20	20	-	0.10
	Sum of BTEX	µg/L	N	34	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	1	1	-	-
	Sum of polycyclic aromatic hydrocarbons (PAHs)	µg/L	N	32	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	0.05

RN040936				Statistical Summary - All Data									Pre-Activity Data			Post Activity Data						Statistics	
Group	Parameter	Units	Fraction	Count	Min	Max	Average	P10	P50	P90	First	Last	18-Sep-20	25-Nov-20	16-Mar-21	17-Nov-21	1-Feb-22	1-Feb-22	5-May-22	20-Jul-22	5-Oct-22	F-Test Statistic	T-Test - P-value
Field Measurements	pH - Field	pH Unit	N	15	6.44	7.13	6.751	6.578	6.73	6.946	6.55	6.69	6.66	7.01	6.81	6.72	6.82	6.82	6.85	6.62	6.69	0.20	0.21
	Electrical Conductivity - Field	µS/cm	N	15	1201	1691	1378.1	1268.4	1393	1437	1395	1201	1412	1691	1342	1393	1312	1312	1250	1296	1201	0.05	0.03
	CH4 - Field	% LEL	N	15	<LOR	0.2	0.02	<LOR	<LOR	0.06	0	0	0	0	0.2	0	0	0	0	0	0	-	0.09
Physiochemical	Electrical Conductivity @ 25°C	µS/cm	N	16	1280	1360	1324.4	1300	1320	1350	1320	1320	1340	1300	1300	1360	1350	1340	1320	1350	1320	0.49	0.04
	Total Dissolved Solids @180°C	mg/L	T	16	783	920	860.7	827.5	865.5	887.5	853	892	853	783	829	920	848	880	883	826	892	0.78	0.03
	pH - Lab	pH Unit	N	16	7.28	8.05	7.514	7.3	7.445	7.94	7.46	7.56	7.37	7.43	7.39	8.05	7.34	7.28	7.89	7.33	7.56	0.02	0.12
	Suspended Solids	mg/L	N	16	6	18	7.9	5	7.5	9.5	6	<LOR	6	9	8	5	8	10	7	8	5	0.85	0.36
Major Ions	Bicarbonate Alkalinity as CaCO3	mg/L	N	16	377	435	401.6	380	402.5	422	416	377	384	409	408	435	423	421	381	389	377	0.53	0.40
	Carbonate Alkalinity as CaCO3	mg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	-	-
	Chloride	mg/L	N	16	103	125	111.4	105.5	110.5	119.5	111	109	112	114	113	118	107	108	125	121	109	0.03	0.31
	Sulfate as SO4 2-	mg/L	D	16	156	187	174.9	164	176.5	185.5	187	180	166	179	182	174	170	168	179	178	180	0.29	0.43
	Sodium	mg/L	D	16	76	83	78.7	76	79	80.5	80	83	77	76	77	78	77	76	76	80	83	0.09	0.17
	Potassium	mg/L	D	16	11	15	13	12	12.5	15	12	15	12	11	12	15	14	15	14	14	15	0.80	0.0001
	Calcium	mg/L	D	16	124	155	138.6	128.5	137.5	153	151	154	130	128	138	138	130	129	124	132	154	0.42	0.36
	Magnesium	mg/L	D	16	54	60	56.5	54	57	58.5	57	60	57	54	56	55	55	54	54	56	60	0.69	0.50
	Fluoride	mg/L	N	16	0.6	0.7	0.61	0.6	0.6	0.65	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-	-
Nutrients & Radiological	Nitrite as N	mg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Nitrate as N	mg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Reactive Silica	mg/L	N	16	21.8	25.1	23.65	22.15	23.9	24.8	22.2	25.1	22.1	23.3	22.9	24.2	24.4	24.7	24.3	24.7	25.1	0.24	0.0003
	Gross alpha	Bq/L	N	16	0.54	0.93	0.724	0.56	0.74	0.855	0.79	0.88	0.82	0.76	0.58	0.66	0.73	0.83	0.63	0.93	0.88	0.83	0.27
	Gross beta activity - 40K	Bq/L	N	16	0.2	0.44	0.326	0.25	0.33	0.385	0.36	0.34	0.39	0.31	0.37	0.24	0.38	0.36	0.31	0.44	0.34	0.60	0.40
Dissolved Gases	Methane	µg/L	N	16	3	48	14.2	3	8	33	3	16	8	9	8	29	48	37	26	19	16	0.00	0.004
	Ethane	µg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	-	-
	Propane	µg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	-	-
Dissolved Metals/ Metalloids	Aluminium	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Arsenic	mg/L	D	16	0.001	0.004	0.0021	0.001	0.002	0.0035	0.004	<LOR	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Barium	mg/L	D	16	0.039	0.051	0.0452	0.0415	0.045	0.0495	0.045	0.046	0.043	0.043	0.044	0.051	0.048	0.047	0.04	0.049	0.046	0.05	0.04
	Beryllium	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Boron	mg/L	D	16	0.12	0.2	0.168	0.135	0.175	0.19	0.19	0.16	0.16	0.18	0.17	0.18	0.19	0.2	0.18	0.18	0.16	0.80	0.11
	Cadmium	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	-
	Chromium	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Cobalt	mg/L	D	16	0.001	0.002	0.0013	0.001	0.001	0.002	0.002	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Copper	mg/L	D	16	0.001	0.001	0.001	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Iron	mg/L	D	16	1.95	4.73	2.519	1	2.47	3.85	3.68	1.95	2.16	3.1	2.37	2.51	2.43	2.17	0.05	1.97	1.95	0.49	0.13
	Lead	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Lithium	mg/L	D	16	0.055	0.074	0.0678	0.063	0.0695	0.071	0.07	0.07	0.068	0.071	0.067	0.067	0.07	0.07	0.069	0.071	0.07	0.40	0.24
	Manganese	mg/L	D	16	0.023	0.062	0.038	0.0295	0.0365	0.047	0.05	0.035	0.023	0.036	0.031	0.038	0.039	0.034	0.032	0.034	0.035	0.09	0.06
	Mercury	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	-
	Molybdenum	mg/L	D	16	0.001	0.001	0.001	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Nickel	mg/L	D	16	0.001	0.009	0.0038	0.001	0.003	0.0075	0.009	<LOR	0.003	0.004	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.09	0.00
	Selenium	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Silver	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Strontium	mg/L	D	16	0.722	0.86	0.7975	0.754	0.7965	0.847	0.794	0.775	0.752	0.758	0.722	0.804	0.817	0.833	0.756	0.84	0.775	0.55	0.01
	Uranium	mg/L	D	16	0.001	0.005	0.003	0.001	0.003	0.0045	0.005	0.001	0.003	0.004	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.80	0.001
	Vanadium	mg/L	D	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Zinc	mg/L	D	16	0.006	0.024	0.0134	0.008	0.012	0.0195	0.006	0.012	0.024	0.021	0.015	0.018	0.018	0.012	0.007	0.016	0.012	0.79	0.04
Total Metals/ Metalloids	Aluminium	mg/L	T	16	0.01	0.02	0.011	0.01	0.01	0.01	<LOR	<LOR	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	-	0.26
	Arsenic	mg/L	T	16	0.001	0.004	0.0022	0.001	0.002	0.0035	0.004	<LOR	0.002	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.001	-	0.00
	Barium	mg/L	T	16	0.039	0.086	0.0504	0.0425	0.048	0.0575	0.043	0.054	0.044	0.039	0.049	0.05	0.086	0.055	0.059	0.056	0.054	0.27	0.04
	Beryllium	mg/L	T	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Boron	mg/L	T	16	0.08	0.28	0.165	0.125	0.165	0.21	0.17	0.17	0.14	0.16	0.2	0.17	0.14	0.16	0.22	0.28	0.17	0.56	0.25
	Cadmium	mg/L	T	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	-
	Chromium	mg/L	T	16	0.002	0.002	0.0011	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	-	0.26
	Cobalt	mg/L	T	16	0.002	0.002	0.0016	0.001	0.002	0.002	0.002	<LOR	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Copper	mg/L	T	16	0.001	0.01	0.0028	0.001	0.002	0.0045	0.004	0.002	0.001	0.001	0.001	0.004	0.001	0.003	0.001	0.003	0.002	-	0.05
	Iron	mg/L	T	16	2.27	6.19	3.763	2.345	3.8	5.445	4.12	2.33	2.27	4.69	3.58	2.5	2.97	2.36	2.37	2.89	2.33	0.01	0.15
	Lead	mg/L	T	16	0.001	0.005	0.0017	0.001	0.001	0.003	0.004	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Lithium	mg/L	T	16	0.058	0.076	0.0676	0.0615	0.0675	0.0745	0.069	0.07	0.065	0.058	0.074	0.066	0.071	0.061	0.071	0.07	0.07	0.18	0.27
	Manganese	mg/L	T	16	0.025	0.062	0.0381	0.0315	0.036	0.0485	0.052	0.032	0.025	0.033	0.032	0.035	0.037	0.035	0.037	0.034	0.032	0.12	0.02
	Mercury	mg/L	T	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-	-
	Molybdenum	mg/L	T	16	0.001	0.003	0.0011	0.001	0.001	0.001	<LOR	<LOR	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	-	0.26
	Nickel	mg/L	T	16	0.001	0.011	0.0051	0.001	0.0055	0.0095	0.009	<LOR	0.006	0.007	0.002	0.01	0.002	0.001	0.001	0.001	0.001	0.77	0.18
	Selenium	mg/L	T	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Silver	mg/L	T	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-	-
	Strontium	mg/L	T	16	0.702	0.879	0.8081	0.7635	0.7985	0.873	0.763	0.879	0.876	0.702	0.769	0.77	0.791	0.87	0.794	0.837	0.879	0.20	0.18
	Uranium	mg/L	T	16	0.001	0.005	0.0032	0.001	0.004	0.005	0.005	0.001	0.003	0.004	0.004	0.002	0.002	0.002	0.001	0.001	0.001	0.80	0.0004
	Vanadium	mg/L	T	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-
	Zinc	mg/L	T	16	0.013	0.041	0.021	0.015	0.0205	0.026	0.015	0.016	0.02	0.02	0.021	0.02	0.022	0.015	0.015	0.026	0.016	0.03	0.25
Complex Hydrocarbons	C6 - C36 Fraction (Sum)	µg/L	N	15	80	140	50	20	20	120	<LOR	<LOR	20	20	20	20	20	20	20	20	20	-	-
	Sum of BTEX	µg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	1	1	1	1	1	1	1	1	-	-
	Sum of polycyclic aromatic hydrocarbons (PAHs)	µg/L	N	16	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-

RN040931

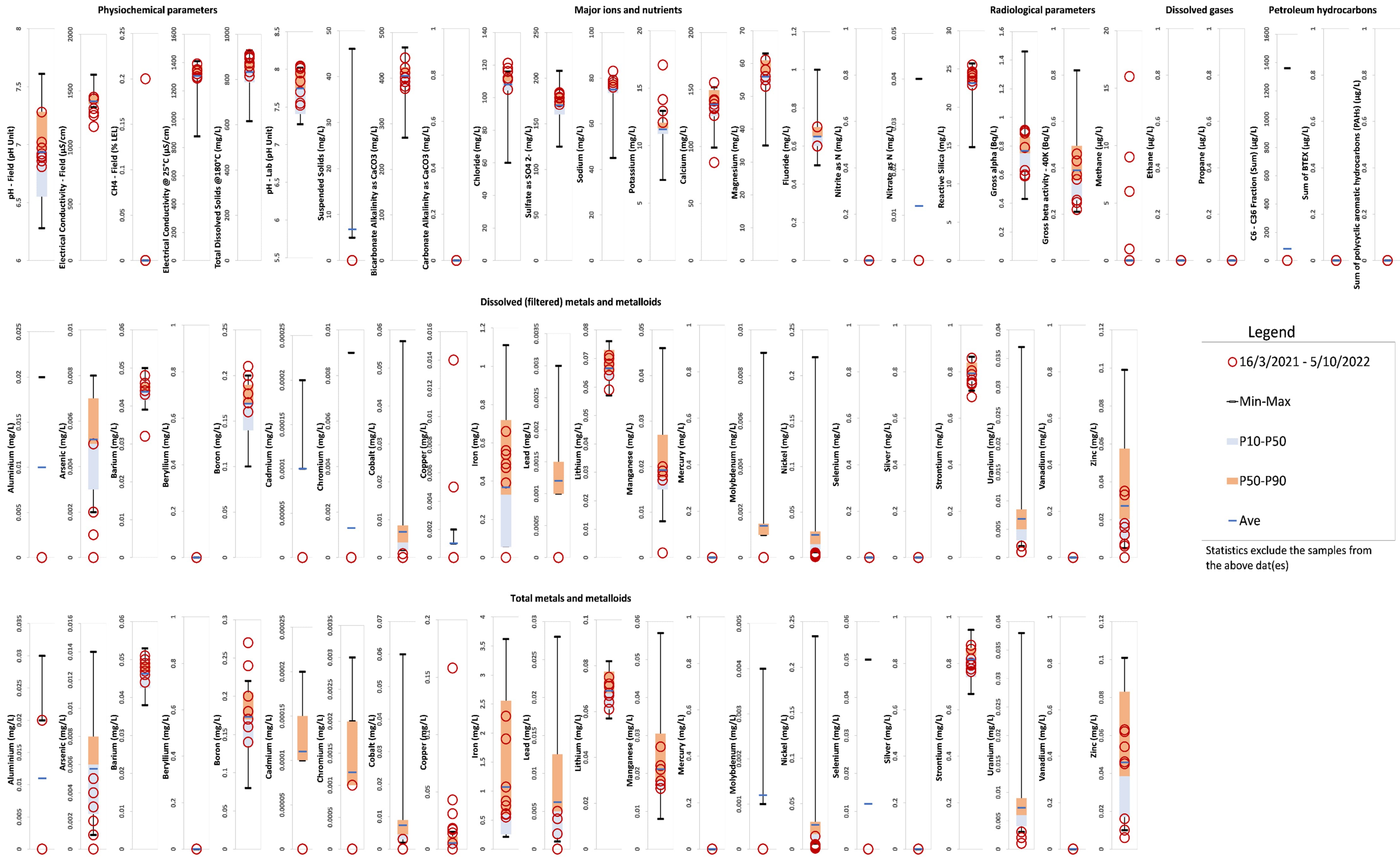
Group	Parameter	Units	Fraction	Count	Min	Max	Average	P10	P50	P90	First	Last	MK-trend
Field Measurements	pH - Field	pH Unit	N	25	6.39	8.11	7.356	6.77	7.3	8.008	7.8	7.78	Rising
	Electrical Conductivity - Field	µS/cm	N	25	1241	2018	1662.5	1319	1794	1925.4	1845	1290	Falling
	CH4 - Field	% LEL	N	23	<LOR	0.2	0.01	<LOR	<LOR	<LOR	0	0	No Trend
	Electrical Conductivity @ 25°C	µS/cm	N	27	1200	1940	1583.3	1260	1590	1894	1560	1280	Falling
	Total Dissolved Solids @180°C	mg/L	T	27	697	1330	1016.4	732.2	1130	1258	976	783	Falling
Physiochemical parameters	pH - Lab	pH Unit	N	27	7.36	8.49	7.947	7.454	8	8.354	8.06	8.29	Rising
	Suspended Solids	mg/L	N	27	8	36	14.6	5	13	30.4	35	<LOR	Falling
Major ions, nutrients and radiological parameters	Bicarbonate Alkalinity as CaCO3	mg/L	N	27	225	470	362.2	244.4	366	461.8	363	271	Falling
	Carbonate Alkalinity as CaCO3	mg/L	N	27	7	22	3.3	1	1	10.6	<LOR	<LOR	Rising
	Chloride	mg/L	N	27	142	161	153.1	147.2	154	159	148	142	No Trend
	Sulfate as SO4 2-	mg/L	D	27	192	451	313.1	195	343	423	328	203	Falling
	Sodium	mg/L	D	27	100	127	110.1	105.4	109	117.4	103	117	No Trend
	Potassium	mg/L	D	27	22	33	27.6	26	28	30	22	28	No Trend
	Calcium	mg/L	D	27	20	163	92	21.6	114	156.6	134	28	Falling
	Magnesium	mg/L	D	27	80	122	98.6	83.6	102	114.4	88	95	Falling
	Fluoride	mg/L	N	27	1.3	3	2.15	1.5	2.3	2.8	1.8	1.5	Falling
	Nitrite as N	mg/L	N	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Nitrate as N	mg/L	N	27	0.02	2.12	0.091	0.01	0.01	0.014	0.02	<LOR	No Trend
	Reactive Silica	mg/L	N	26	7.42	24.8	16.492	7.88	17.75	24.55	23.9	9.37	Falling
	Gross alpha	Bq/L	N	27	0.05	1.7	0.28	0.114	0.24	0.354	1.7	0.09	Falling
	Gross beta activity - 40K	Bq/L	N	27	0.1	0.84	0.223	0.106	0.21	0.28	0.84	<LOR	Falling
Dissolved Gases	Methane	µg/L	N	27	2	5	1.5	1	1	1.4	<LOR	<LOR	Rising
	Ethane	µg/L	N	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Propane	µg/L	N	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
Dissolved Metals/Metalloids	Aluminium	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Arsenic	mg/L	D	27	0.001	0.003	0.0012	0.001	0.001	0.002	0.003	<LOR	Falling
	Barium	mg/L	D	27	0.019	0.047	0.0293	0.0206	0.029	0.036	0.028	0.021	Falling
	Beryllium	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Boron	mg/L	D	27	0.1	0.31	0.244	0.208	0.25	0.28	0.31	0.25	No Trend
	Cadmium	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Chromium	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Cobalt	mg/L	D	27	0.033	0.033	0.0022	0.001	0.001	0.001	0.033	<LOR	No Trend
	Copper	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Iron	mg/L	D	27	0.07	9.58	1.878	0.05	0.29	5.77	<LOR	<LOR	Falling
	Lead	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Lithium	mg/L	D	27	0.19	0.51	0.4224	0.3796	0.434	0.482	0.416	0.48	Rising
	Manganese	mg/L	D	27	0.068	0.249	0.1407	0.0696	0.125	0.2284	0.142	<LOR	Falling
	Mercury	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Molybdenum	mg/L	D	27	0.001	0.046	0.0037	0.001	0.002	0.0034	0.046	0.002	No Trend
	Nickel	mg/L	D	27	0.001	0.032	0.0021	0.001	0.001	0.001	0.032	<LOR	No Trend
	Selenium	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Silver	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Strontium	mg/L	D	27	0.096	1.02	0.5809	0.117	0.671	0.9864	0.868	0.145	Falling
	Uranium	mg/L	D	27	0.01	0.01	0.0013	0.001	0.001	0.001	0.01	<LOR	No Trend
	Vanadium	mg/L	D	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Zinc	mg/L	D	27	0.012	0.098	0.0212	0.005	0.012	0.0482	0.014	0.023	Falling
Total Metals/Metalloids	Aluminium	mg/L	T	27	0.01	0.3	0.023	0.01	0.01	0.02	0.3	<LOR	Falling
	Arsenic	mg/L	T	27	0.001	0.01	0.0019	0.001	0.002	0.002	0.01	<LOR	Falling
	Barium	mg/L	T	27	0.025	0.048	0.034	0.026	0.034	0.0416	0.036	0.026	Falling
	Beryllium	mg/L	T	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Boron	mg/L	T	27	0.06	0.36	0.261	0.224	0.26	0.316	0.27	0.26	No Trend
	Cadmium	mg/L	T	27	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<LOR	0.0001	No Trend
	Chromium	mg/L	T	27	0.003	0.003	0.0011	0.001	0.001	0.001	<LOR	<LOR	No Trend
	Cobalt	mg/L	T	27	0.036	0.036	0.0023	0.001	0.001	0.001	0.036	<LOR	No Trend
	Copper	mg/L	T	27	0.001	0.002	0.001	0.001	0.001	0.001	0.002	<LOR	No Trend
	Iron	mg/L	T	27	0.05	19.1	6.776	0.872	5.03	14.96	7.33	0.12	Falling
	Lead	mg/L	T	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Lithium	mg/L	T	27	0.199	0.606	0.4475	0.4016	0.45	0.5038	0.365	0.49	No Trend
	Manganese	mg/L	T	27	0.002	0.269	0.159	0.0778	0.163	0.2418	0.163	0.002	Falling
	Mercury	mg/L	T	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Molybdenum	mg/L	T	27	0.002	0.05	0.0041	0.002	0.002	0.003	0.05	0.003	Rising
	Nickel	mg/L	T	27	0.001	0.034	0.0024	0.001	0.001	0.0014	0.034	<LOR	No Trend
	Selenium	mg/L	T	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Silver	mg/L	T	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Strontium	mg/L	T	27	0.082	1.16	0.6234	0.1222	0.835	1.03	0.835	0.164	Falling
	Uranium	mg/L	T	27	0.011	0.011	0.0014	0.001	0.001	0.001	0.011	<LOR	No Trend
	Vanadium	mg/L	T	27	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Zinc	mg/L	T	27	0.021	0.473	0.078	0.0298	0.048	0.1042	0.041	0.045	No Trend
Complex Hydrocarbons	C6 - C36 Fraction (Sum)	µg/L	N	23	50	120	30	20	20	44	<LOR	120	No Trend
	Sum of BTEX	µg/L	N	27	2	2	1	1	1	1	<LOR	<LOR	No Trend
	Sum of polycyclic aromatic hydrocarbons (PAHs)	µg/L	N	26	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA

RN041242

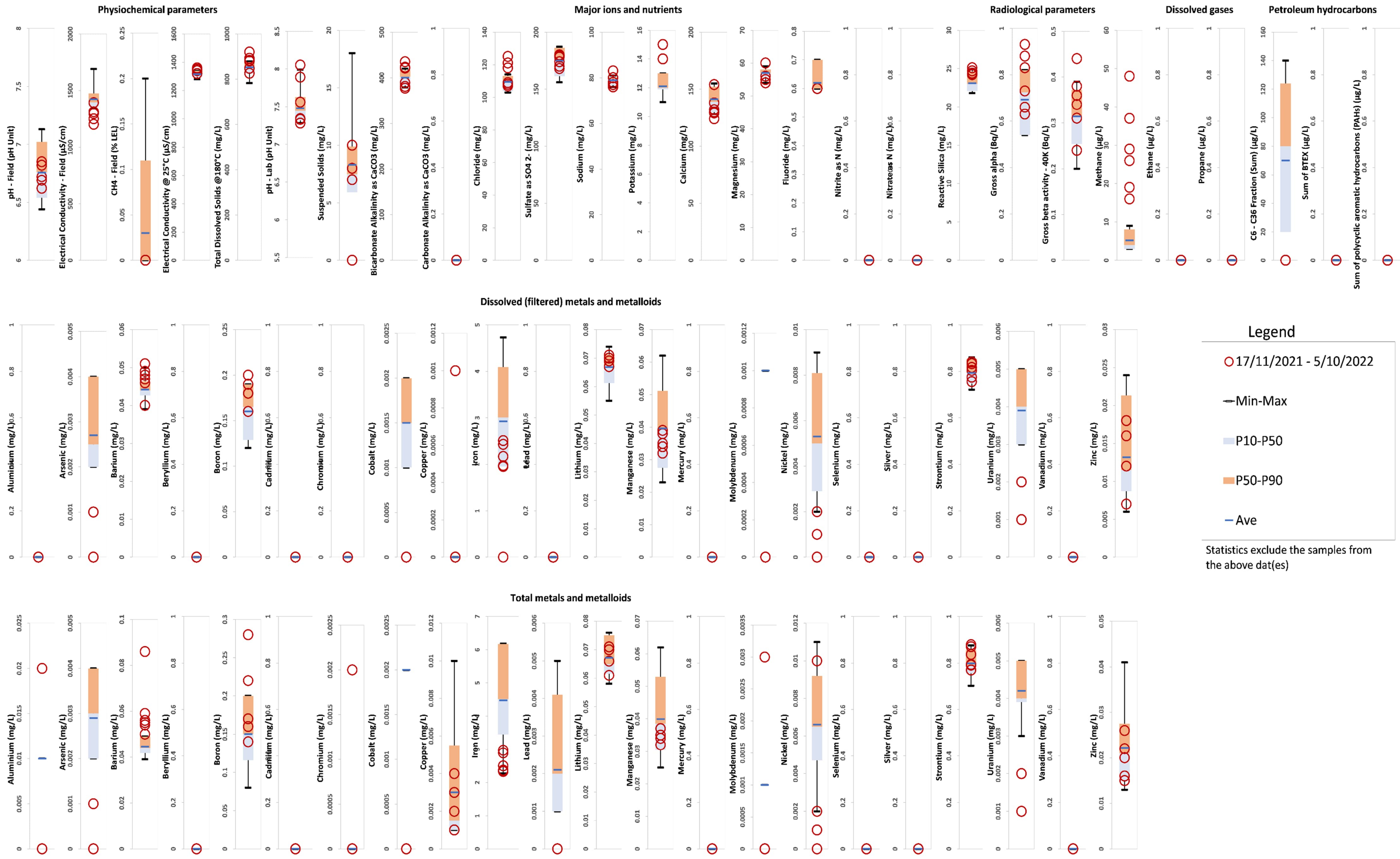
Group	Parameter	Units	Fraction	Count	Min	Max	Average	P10	P50	P90	First	Last	MK-trend
Field Measurements	pH - Field	pH Unit	N	11	6.69	7.25	6.907	6.7	6.89	7.13	7.13	7.25	No Trend
	Electrical Conductivity - Field	µS/cm	N	11	733	1841	1442.9	1340	1480	1579	1579	1340	Falling
	CH4 - Field	% LEL	N	9	<LOR	0.2	0.02	<LOR	<LOR	0.04	0.2	0	No Trend
	Electrical Conductivity @ 25°C	µS/cm	N	11	1360	1510	1431.8	1390	1430	1480	1410	1440	No Trend
	Total Dissolved Solids @180°C	mg/L	T	11	854	1030	980.6	966	990	1030	991	1030	No Trend
Physiochemical parameters	pH - Lab	pH Unit	N	11	7.41	8	7.682	7.48	7.61	7.9	7.57	7.84	No Trend
	Suspended Solids	mg/L	N	11	6	32	7.5	5	5	6	<LOR	<LOR	No Trend
Major ions, nutrients and radiological parameters	Bicarbonate Alkalinity as CaCO3	mg/L	N	11	355	438	389.9	372	386	406	355	375	No Trend
	Carbonate Alkalinity as CaCO3	mg/L	N	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Chloride	mg/L	N	11	103	114	106.2	103	106	108	103	103	No Trend
	Sulfate as SO4 2-	mg/L	D	11	242	287	268.5	258	265	284	258	278	No Trend
	Sodium	mg/L	D	11	67	74	71.1	69	72	72	67	74	No Trend
	Potassium	mg/L	D	11	12	14	12.5	12	12	13	13	14	No Trend
	Calcium	mg/L	D	11	143	179	158.9	147	157	174	147	179	No Trend
	Magnesium	mg/L	D	11	60	69	64.4	62	64	66	60	69	No Trend
	Fluoride	mg/L	N	10	0.6	0.8	0.68	0.6	0.7	0.8	0.8	0.6	Falling
	Nitrite as N	mg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Nitrate as N	mg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Reactive Silica	mg/L	N	10	21.7	23.6	22.54	22.06	22.6	22.88	22.3	23.6	No Trend
	Gross alpha	Bq/L	N	11	0.71	1.26	0.959	0.78	0.87	1.21	0.71	1.26	Rising
	Gross beta activity - 40K	Bq/L	N	11	0.27	1	0.452	0.28	0.37	0.61	0.37	0.61	No Trend
Dissolved Gases	Methane	µg/L	N	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Ethane	µg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Propane	µg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
Dissolved Metals/Metalloids	Aluminium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Arsenic	mg/L	D	11	0.001	0.002	0.0011	0.001	0.001	0.001	0.001	<LOR	No Trend
	Barium	mg/L	D	11	0.03	0.038	0.0355	0.034	0.036	0.037	0.035	0.035	No Trend
	Beryllium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Boron	mg/L	D	11	0.12	0.18	0.159	0.13	0.17	0.18	0.17	0.12	No Trend
	Cadmium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Chromium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Cobalt	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Copper	mg/L	D	11	0.013	0.013	0.0021	0.001	0.001	0.001	<LOR	<LOR	No Trend
	Iron	mg/L	D	11	0.14	0.5	0.292	0.14	0.32	0.38	0.14	0.35	Rising
	Lead	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Lithium	mg/L	D	11	0.08	0.116	0.0906	0.082	0.09	0.095	0.116	0.082	Falling
	Manganese	mg/L	D	11	0.004	0.019	0.0089	0.004	0.008	0.013	0.004	0.01	Rising
	Mercury	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Molybdenum	mg/L	D	10	0.001	0.006	0.0016	0.001	0.001	0.0024	0.006	<LOR	No Trend
	Nickel	mg/L	D	11	0.001	0.006	0.0016	0.001	0.001	0.003	0.001	<LOR	No Trend
	Selenium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Silver	mg/L	D	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Strontium	mg/L	D	10	0.727	0.87	0.7843	0.7432	0.778	0.8358	0.87	0.782	No Trend
	Uranium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Vanadium	mg/L	D	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Zinc	mg/L	D	11	0.01	0.099	0.0317	0.01	0.028	0.05	0.028	0.028	No Trend
Total Metals/Metalloids	Aluminium	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Arsenic	mg/L	T	11	0.001	0.002	0.0011	0.001	0.001	0.001	0.001	<LOR	No Trend
	Barium	mg/L	T	11	0.02	0.044	0.0361	0.032	0.038	0.039	0.038	0.044	No Trend
	Beryllium	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Boron	mg/L	T	11	0.08	0.3	0.175	0.13	0.17	0.23	0.17	0.13	No Trend
	Cadmium	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Chromium	mg/L	T	11	0.001	0.002	0.0012	0.001	0.001	0.002	<LOR	<LOR	No Trend
	Cobalt	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Copper	mg/L	T	11	0.001	0.01	0.0035	0.001	0.002	0.007	0.004	0.002	No Trend
	Iron	mg/L	T	11	0.17	0.7	0.391	0.25	0.4	0.56	0.17	0.56	Rising
	Lead	mg/L	T	11	0.001	0.002	0.0011	0.001	0.001	0.001	0.002	<LOR	No Trend
	Lithium	mg/L	T	11	0.034	0.121	0.0884	0.078	0.092	0.102	0.121	0.079	Falling
	Manganese	mg/L	T	11	0.003	0.02	0.0091	0.004	0.008	0.014	0.004	0.011	Rising
	Mercury	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Molybdenum	mg/L	T	11	0.005	0.005	0.0017	0.001	0.001	0.005	0.005	<LOR	Falling
	Nickel	mg/L	T	11	0.001	0.01	0.0018	0.001	0.001	0.001	<LOR	0.001	No Trend
	Selenium	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Silver	mg/L	T	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Strontium	mg/L	T	10	0.394	0.896	0.7704	0.646	0.825	0.8636	0.843	0.896	No Trend
	Uranium	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Vanadium	mg/L	T	11	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Zinc	mg/L	T	11	0.009	0.078	0.0288	0.018	0.022	0.053	0.021	0.02	No Trend
Complex Hydrocarbons	C6 - C36 Fraction (Sum)	µg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Sum of BTEX	µg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA
	Sum of polycyclic aromatic hydrocarbons (PAHs)	µg/L	N	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	NA

Attachment B – Box-and-whisker plots

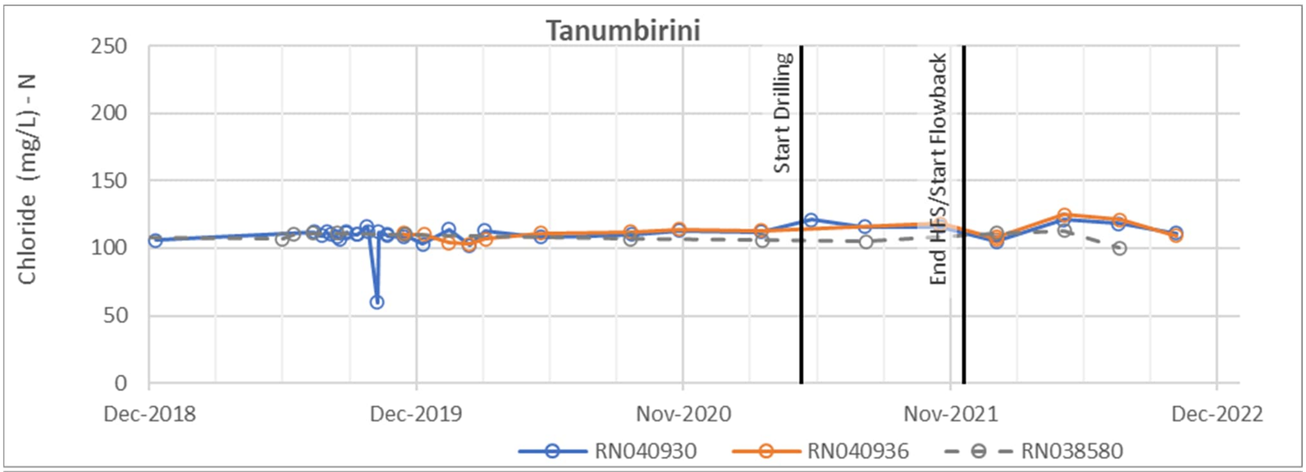
RN040930

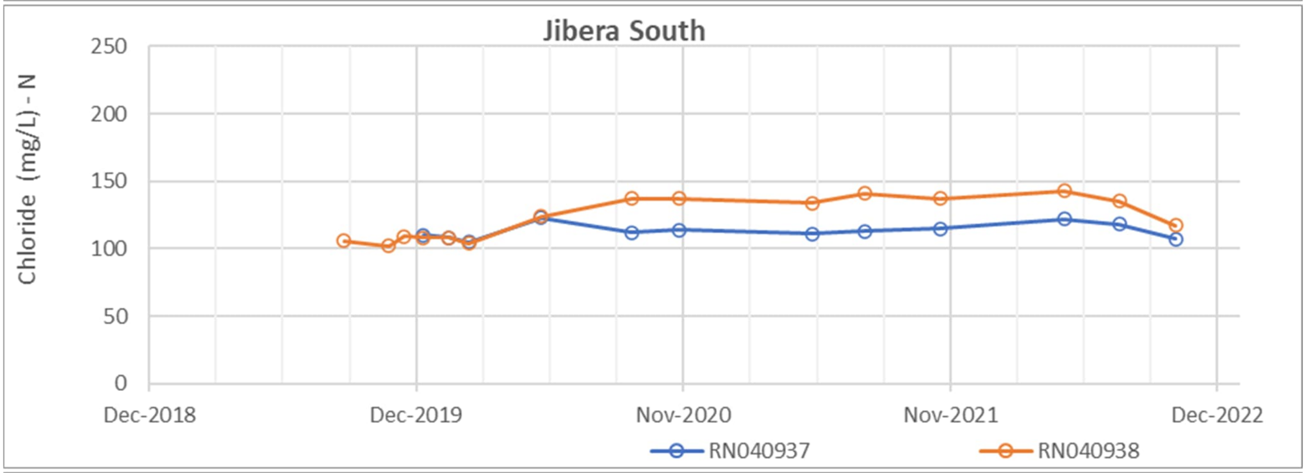

Physiochemical parameters
pH - Field (pH Unit)
Electrical Conductivity - Field (µS/cm)
CH4 - Field (% LEL)
Electrical Conductivity @ 25°C (µS/cm)
Total Dissolved Solids @180°C (mg/L)
pH - Lab (pH Unit)
Suspended Solids (mg/L)
Major ions and nutrients
Bicarbonate Alkalinity as CaCO3 (mg/L)
Carbonate Alkalinity as CaCO3 (mg/L)
Chloride (mg/L)
Sulfate as SO4 2- (mg/L)
Sodium (mg/L)
Potassium (mg/L)
Calcium (mg/L)
Magnesium (mg/L)
Fluoride (mg/L)
Nitrite as N (mg/L)
Nitrate as N (mg/L)
Reactive Silica (mg/L)
Radiological parameters
Gross alpha (Bq/L)
Gross beta activity - 40K (Bq/L)
Dissolved gases
Methane (µg/L)
Ethane (µg/L)
Propane (µg/L)
Petroleum hydrocarbons
C6 - C36 Fraction (Sum) (µg/L)
Sum of BTEX (µg/L)
Sum of polycyclic aromatic hydrocarbons (PAHs) (µg/L)
Dissolved (filtered) metals and metalloids
Total metals and metalloids
Aluminium (mg/L)
Arsenic (mg/L)
Barium (mg/L)
Beryllium (mg/L)
Boron (mg/L)
Cadmium (mg/L)
Chromium (mg/L)
Cobalt (mg/L)
Copper (mg/L)
Iron (mg/L)
Lead (mg/L)
Lithium (mg/L)
Manganese (mg/L)
Mercury (mg/L)
Molybdenum (mg/L)
Nickel (mg/L)
Selenium (mg/L)
Silver (mg/L)
Strontium (mg/L)
Uranium (mg/L)
Vanadium (mg/L)
Zinc (mg/L)
Legend
16/3/2021 - 5/10/2022
Min-Max
P10-P50
P50-P90
Ave
Statistics exclude the samples from the above dat(es)

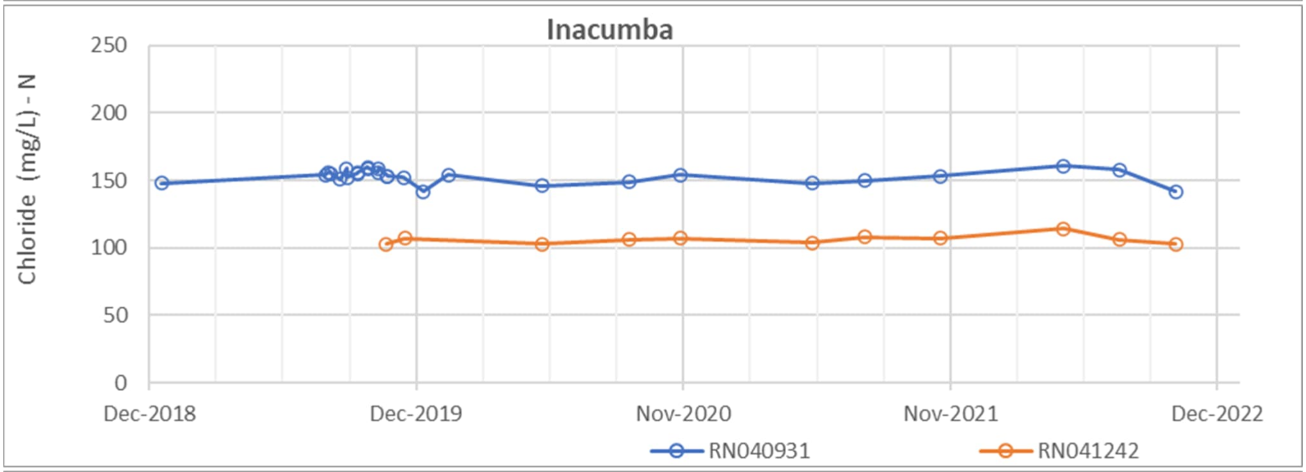
RN040936

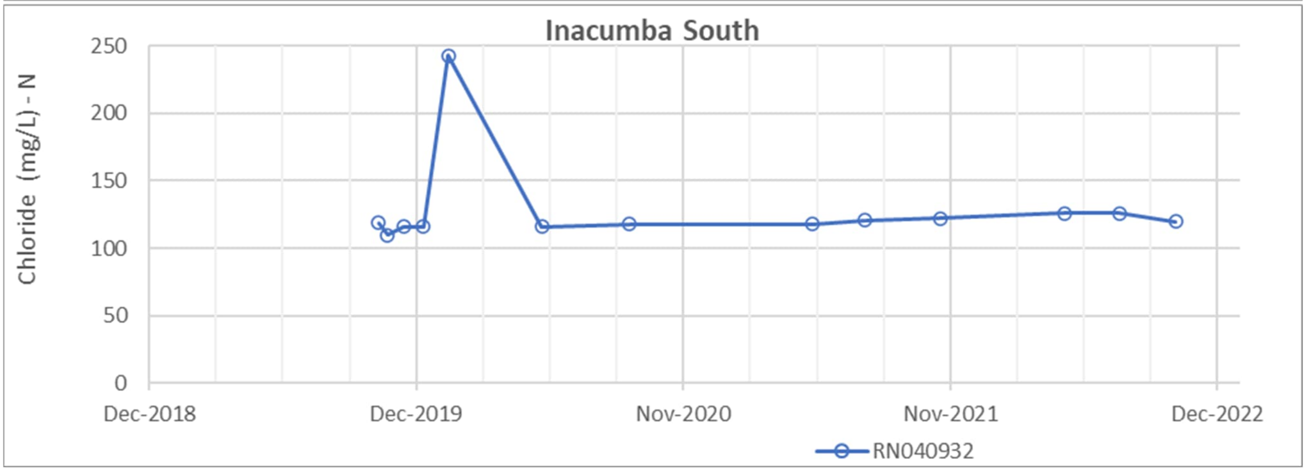

Physiochemical parameters
Major ions and nutrients
Radiological parameters
Dissolved gases
Petroleum hydrocarbons
Dissolved (filtered) metals and metalloids
Total metals and metalloids
Legend
17/11/2021 - 5/10/2022
Min-Max
P10-P50
P50-P90
Ave
Statistics exclude the samples from the above dat(es)

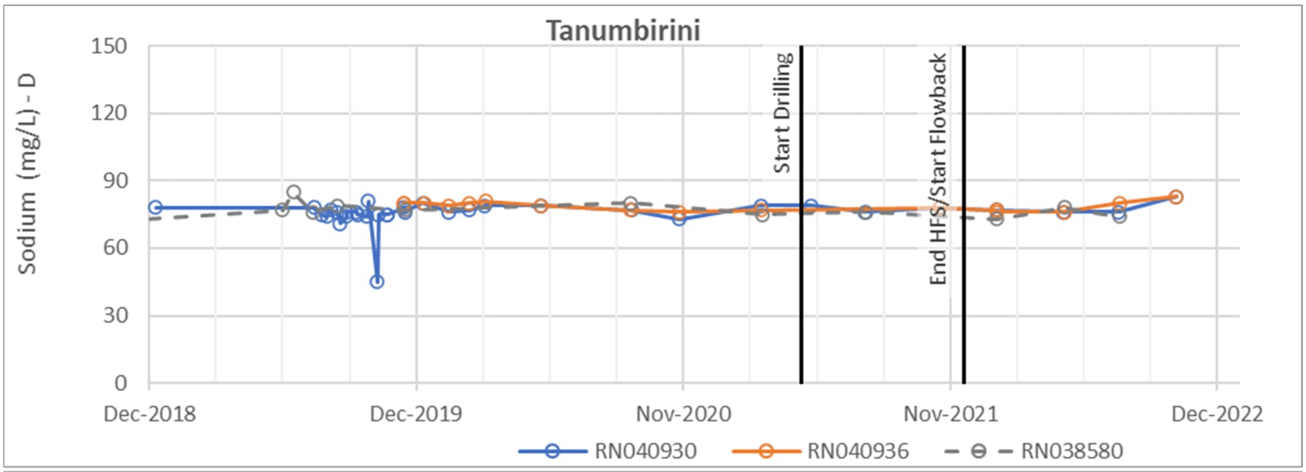
Attachment C –Tanumbirini Timeseries Chemistry Charts

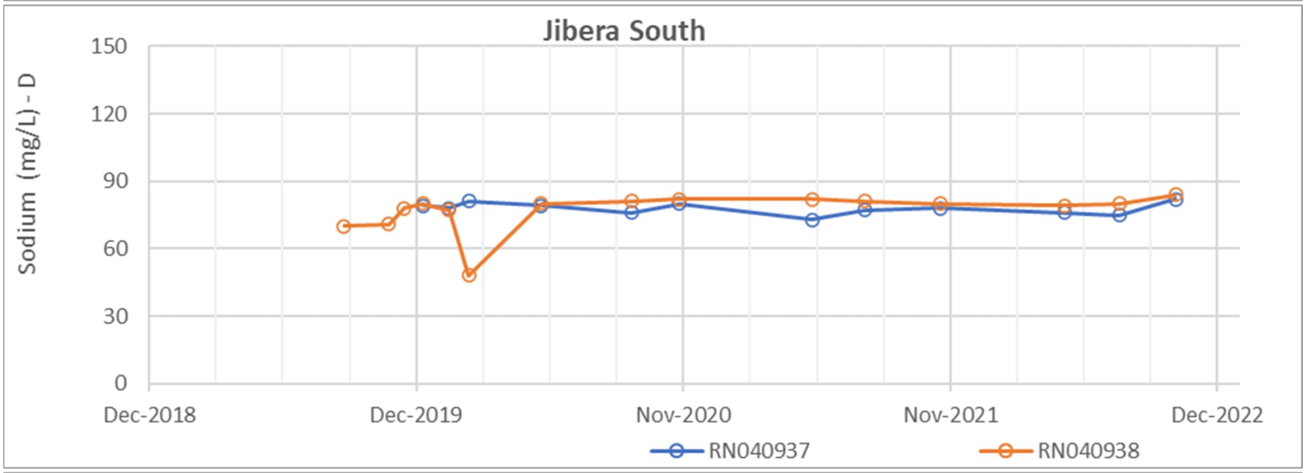

Tanumbirini
Chloride (mg/L) - N
250
200
150
100
50
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580

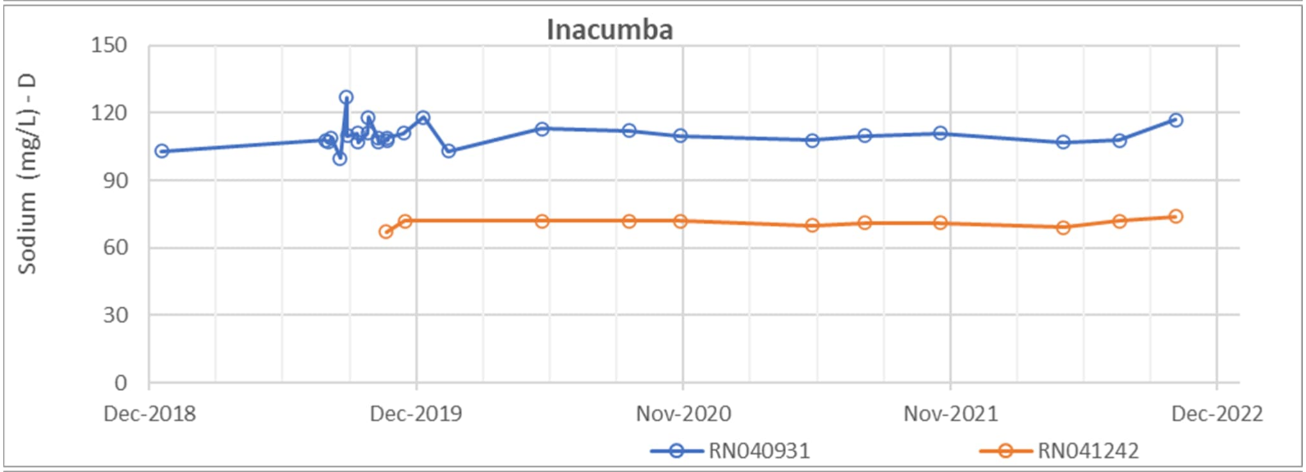

Jibera South
Chloride (mg/L) - N
250
200
150
100
50
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

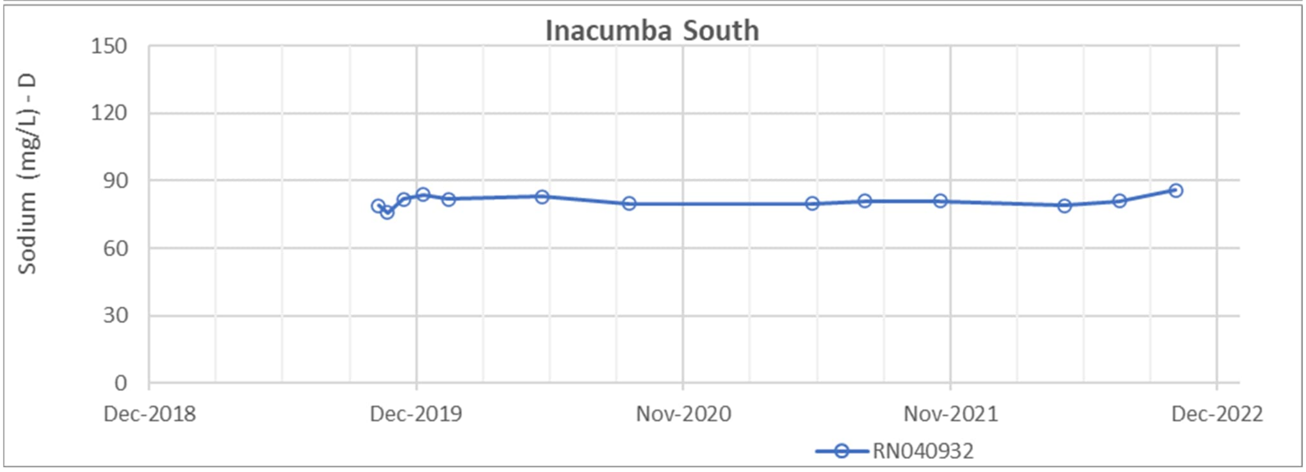

Inacumba
Chloride (mg/L) - N
250
200
150
100
50
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

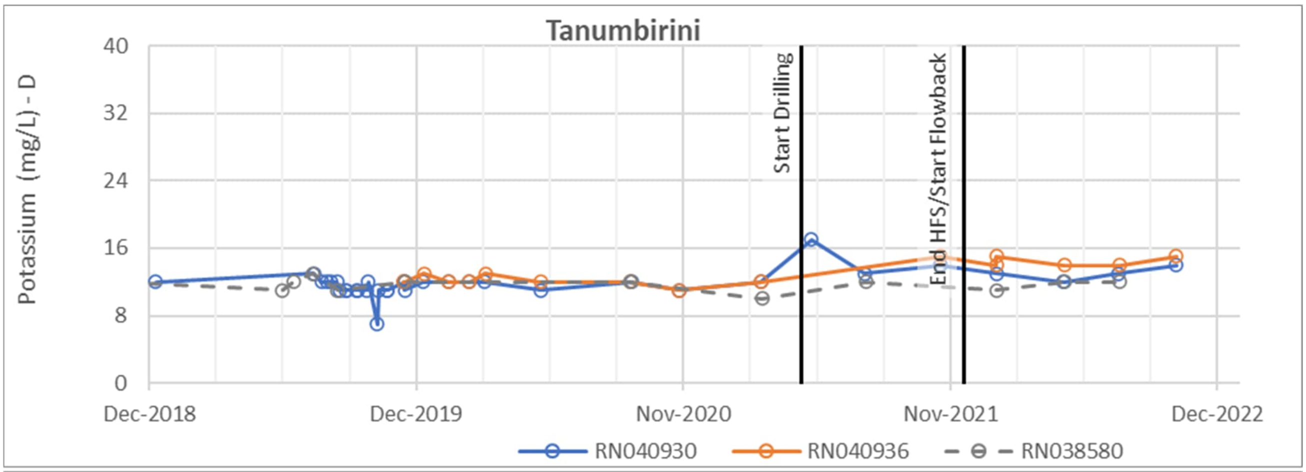

Inacumba South
Chloride (mg/L) - N
250
200
150
100
50
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

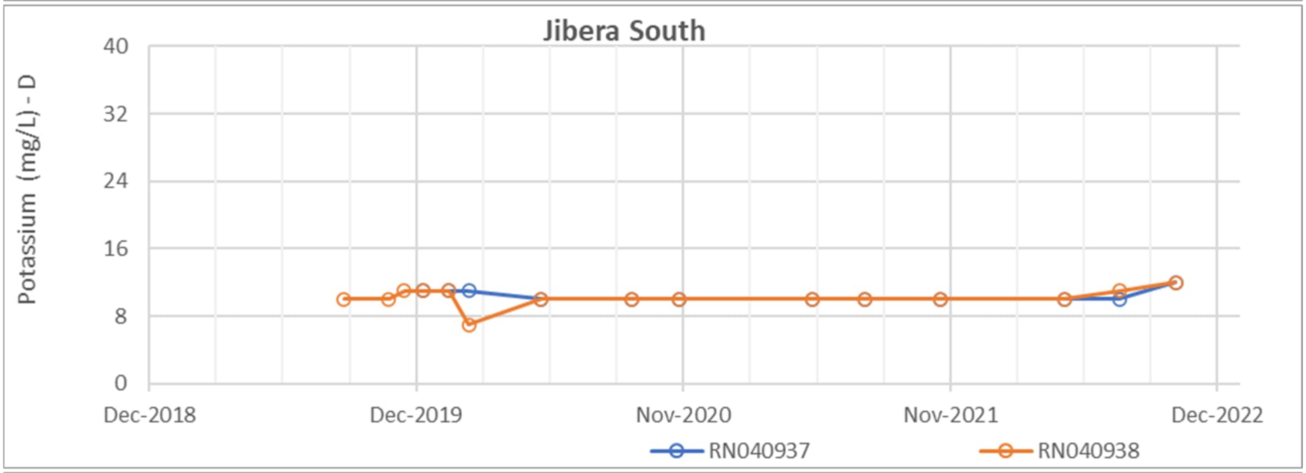

Tanumbirini
Sodium (mg/L) - D
150
120
90
60
30
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

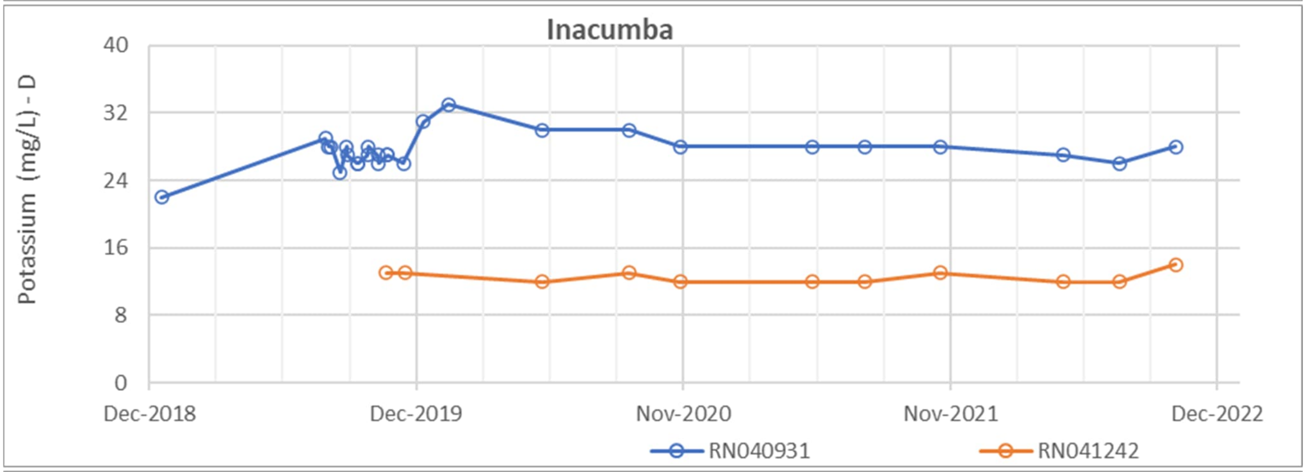

Jibera South
Sodium (mg/L) - D
150
120
90
60
30
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

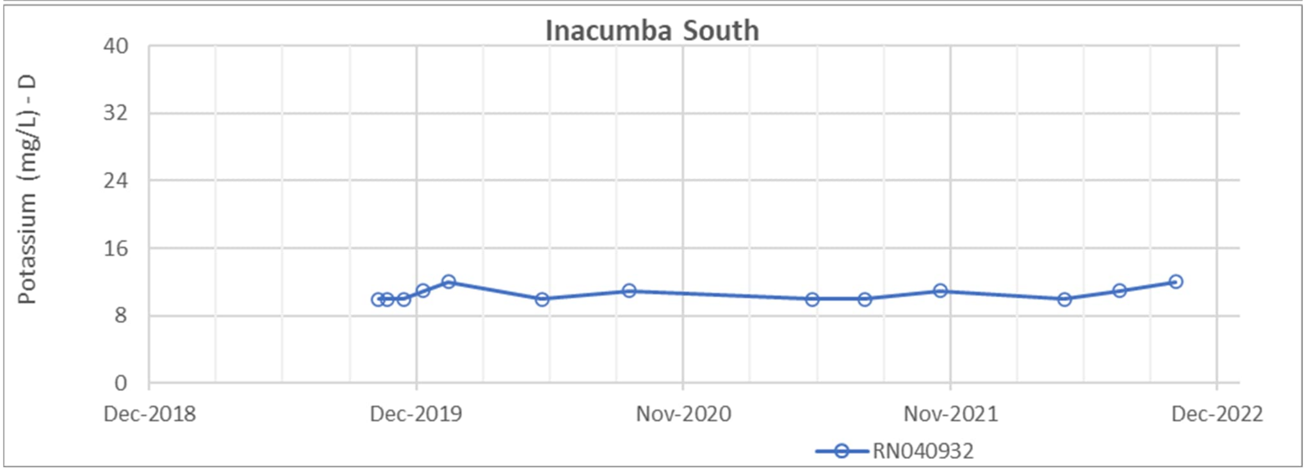

Inacumba
Sodium (mg/L) - D
150
120
90
60
30
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

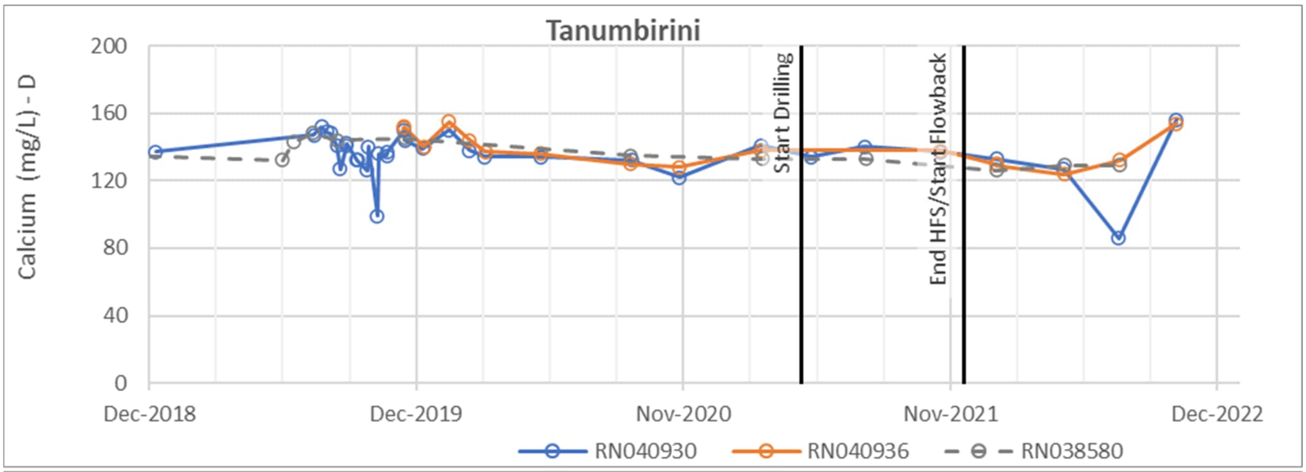

Inacumba South
Sodium (mg/L) - D
150
120
90
60
30
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

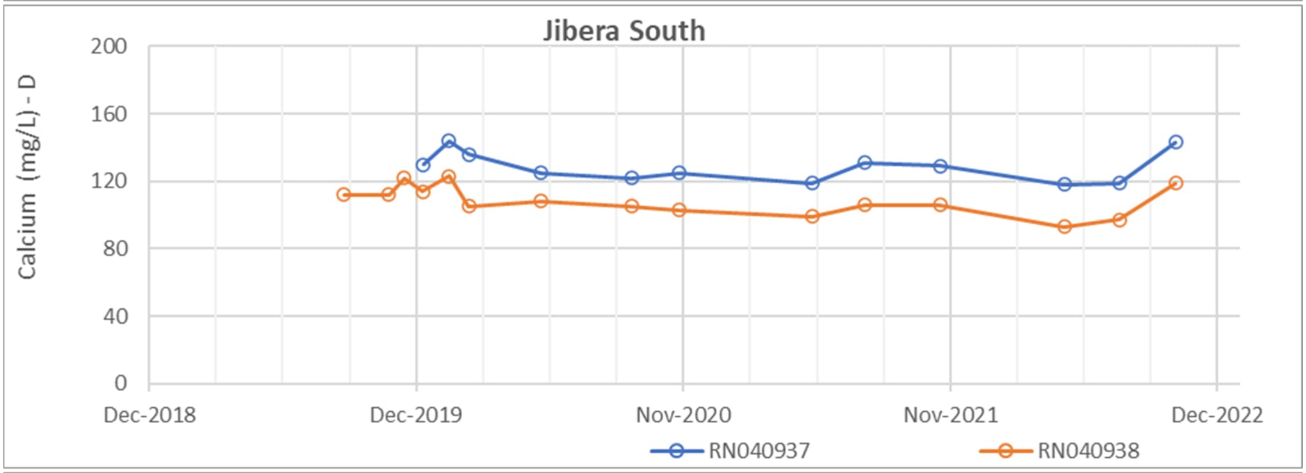

Tanumbirini
Potassium (mg/L) - D
40
32
24
16
8
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

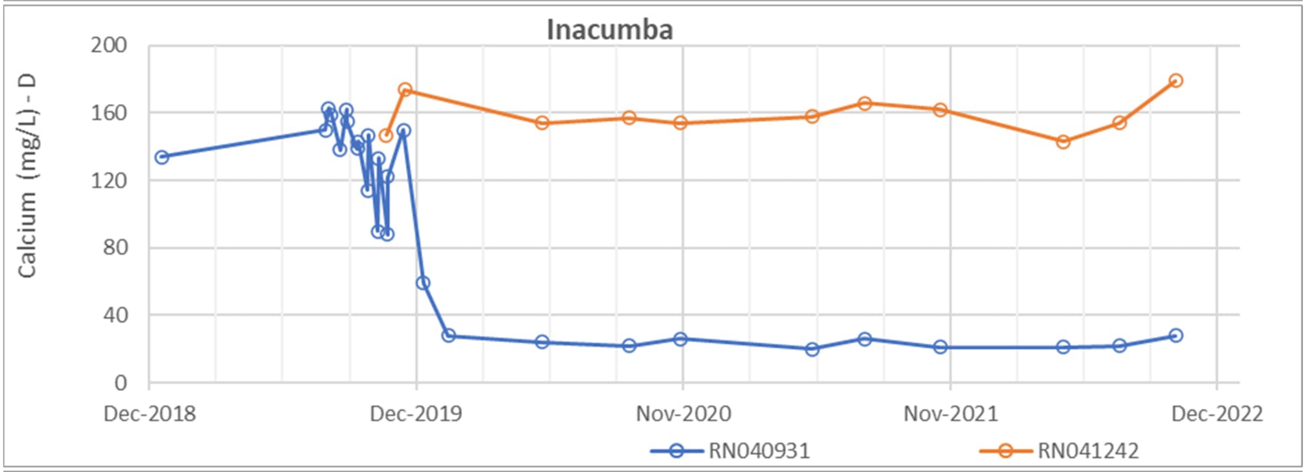

Jibera South
Potassium (mg/L) - D
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

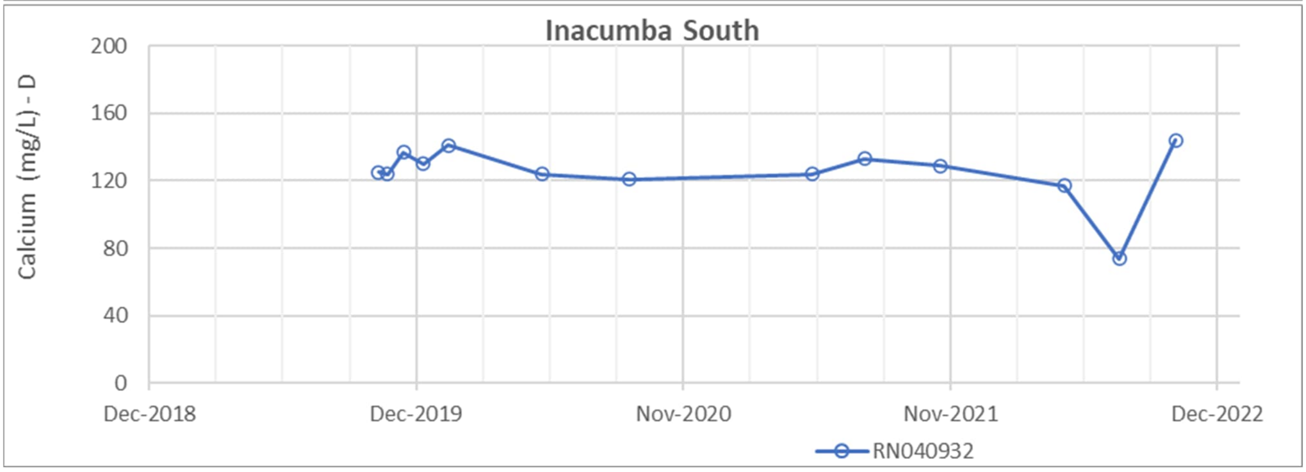

Inacumba
Potassium (mg/L) - D
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

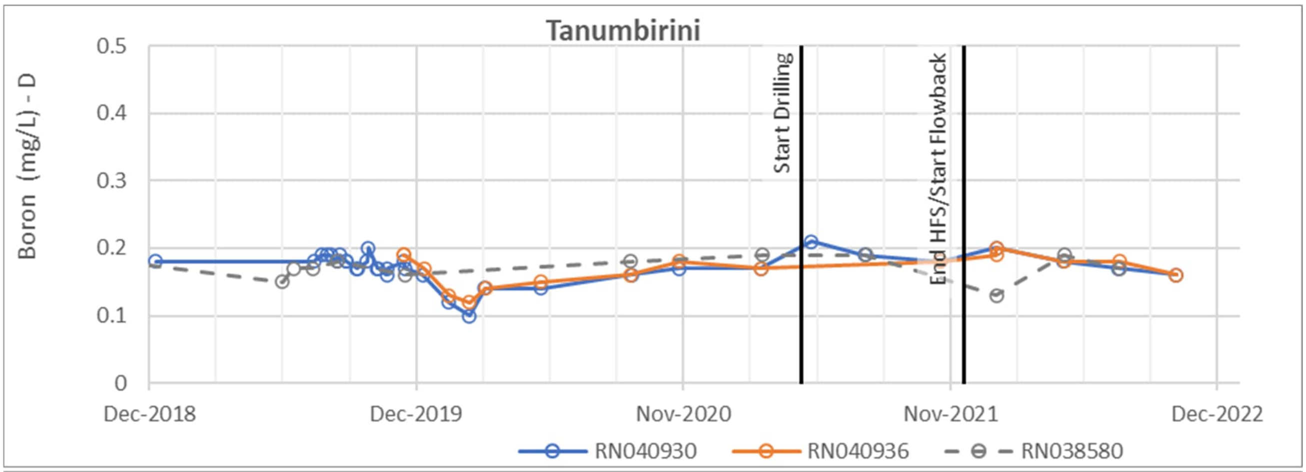

Inacumba South
Potassium (mg/L) - D
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

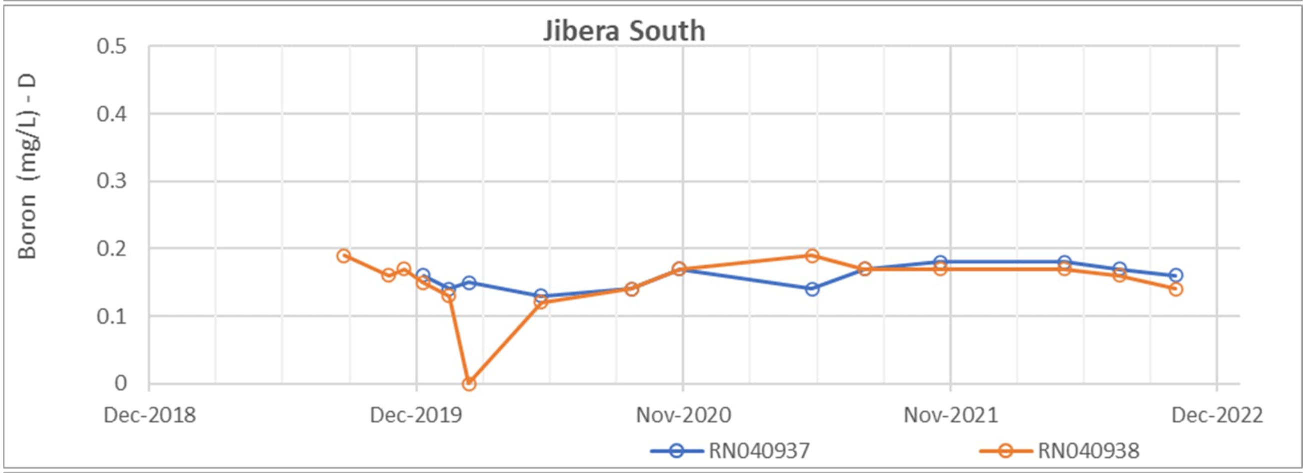

Tanumbirini
Calcium (mg/L) - D
200
160
120
80
40
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

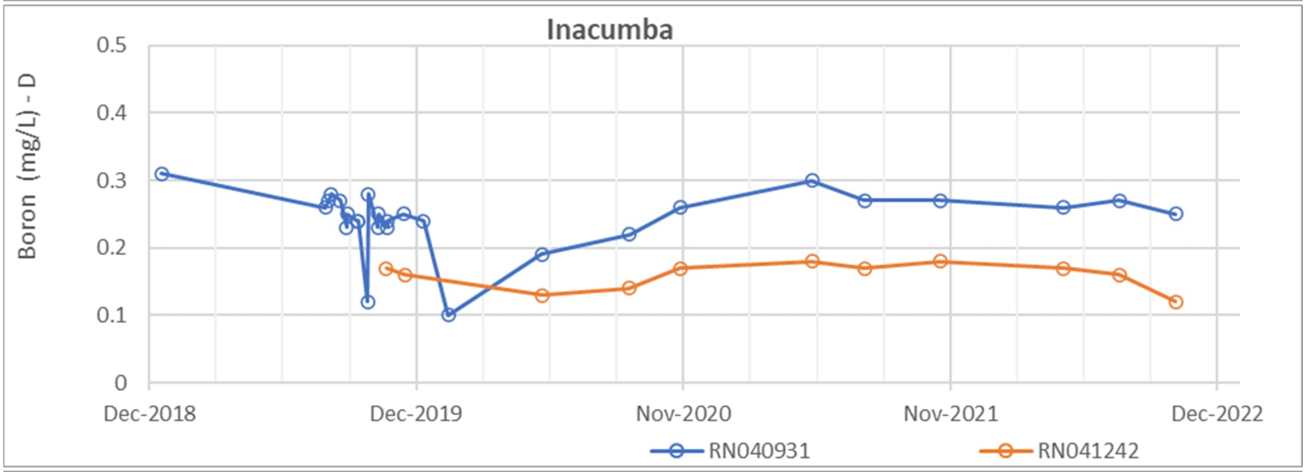

Jibera South
Calcium (mg/L) - D
200
160
120
80
40
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

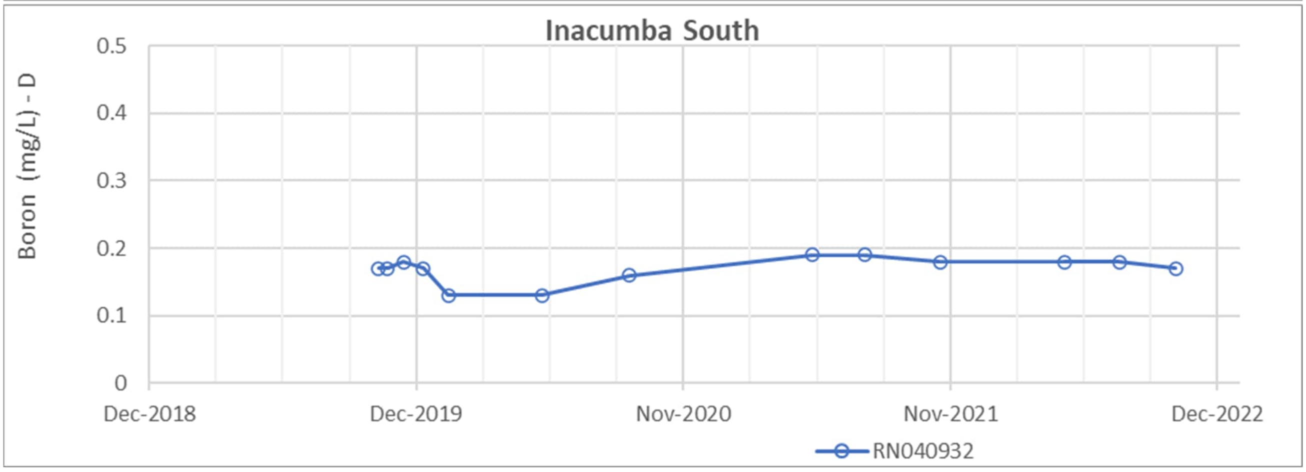

Inacumba
Calcium (mg/L) - D
200
160
120
80
40
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

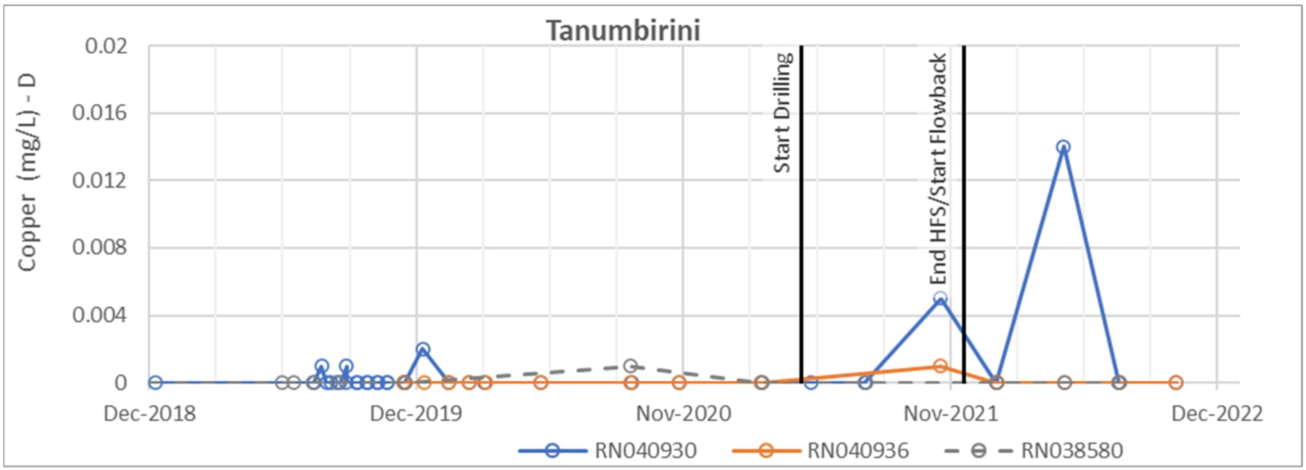

Inacumba South
Calcium (mg/L) - D
200
160
120
80
40
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

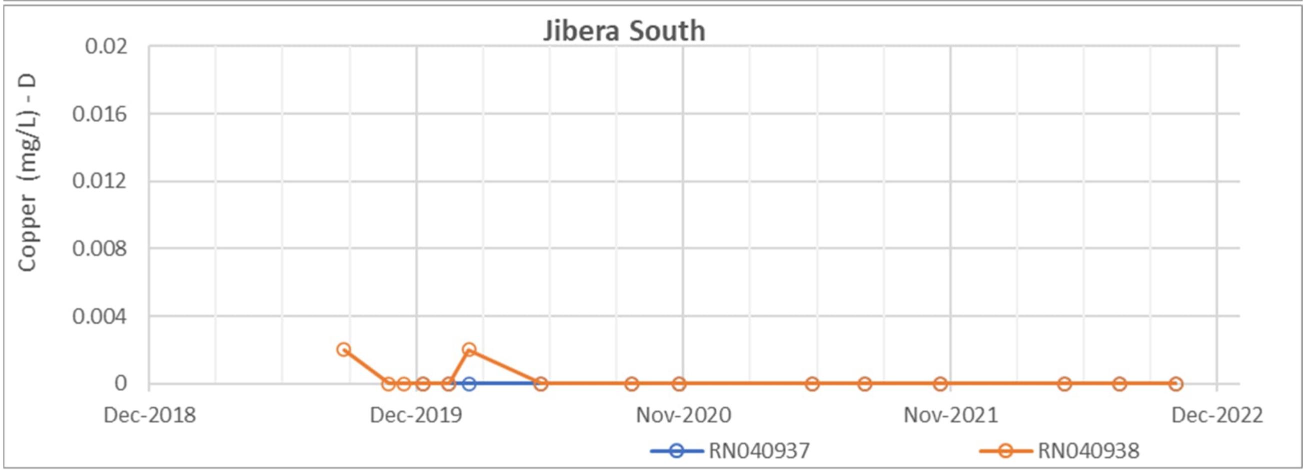

Tanumbirini
Boron (mg/L) - D
0.5
0.4
0.3
0.2
0.1
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

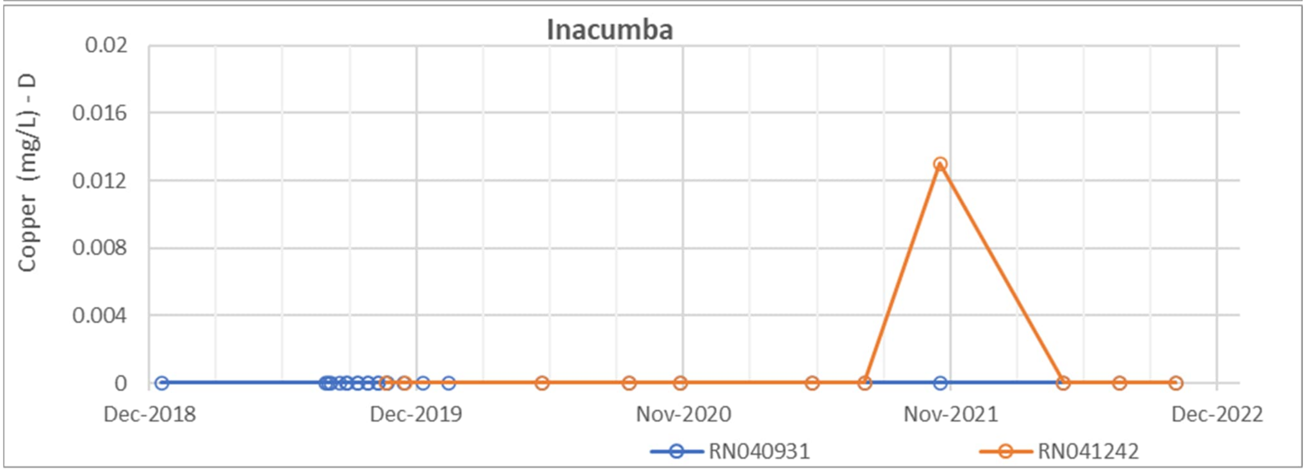

Jibera South
Boron (mg/L) - D
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

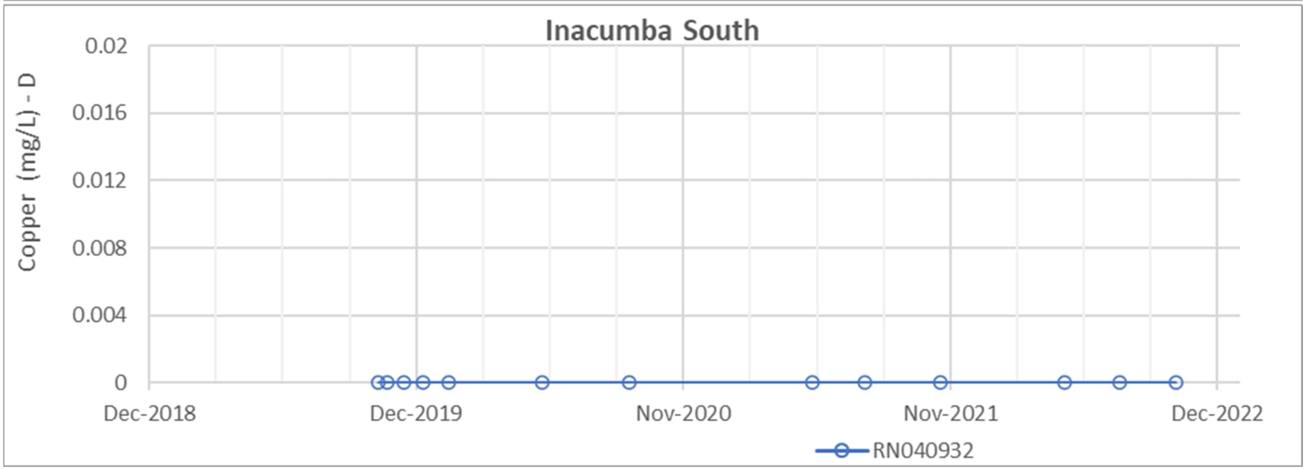

Inacumba
Boron (mg/L) - D
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

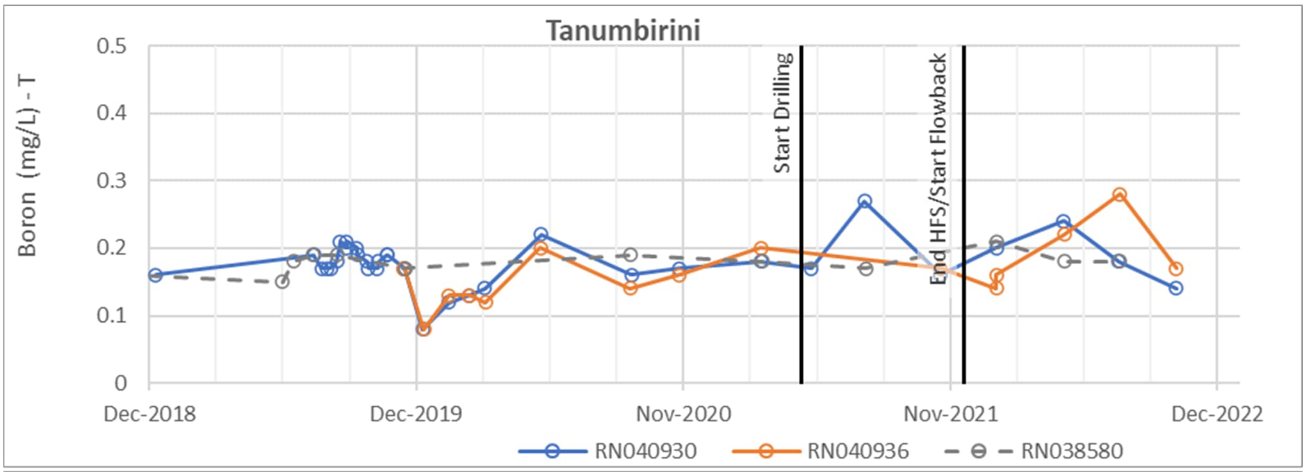

Inacumba South
Boron (mg/L) - D
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

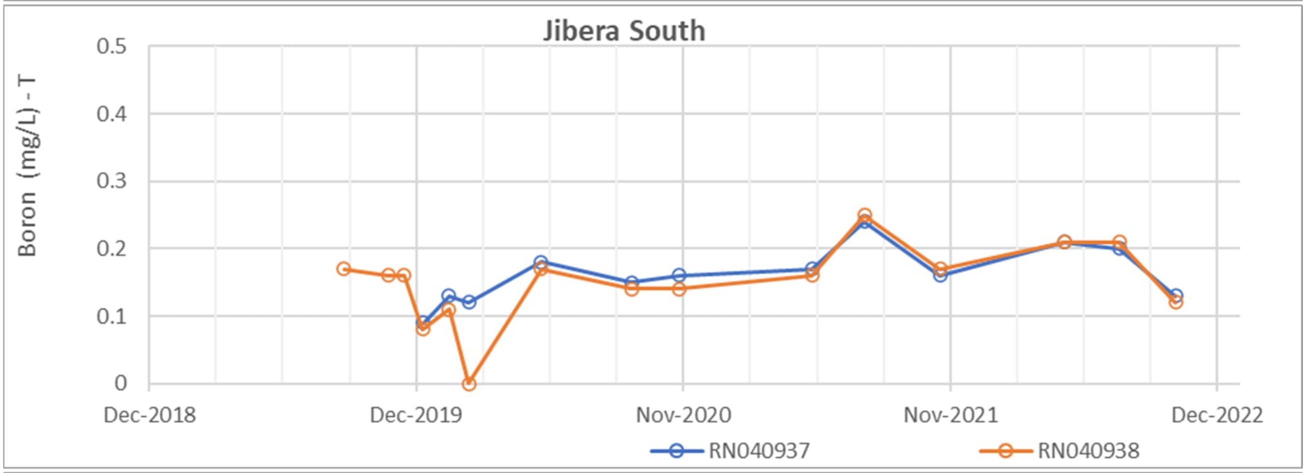

Tanumbirini
Copper (mg/L) - D
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580

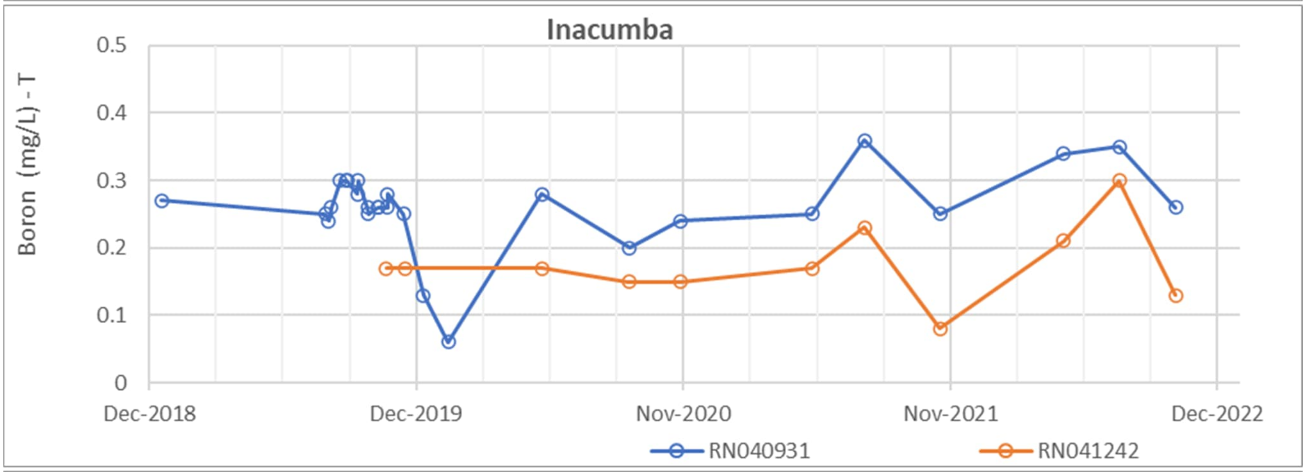

Jibera South
Copper (mg/L) - D
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

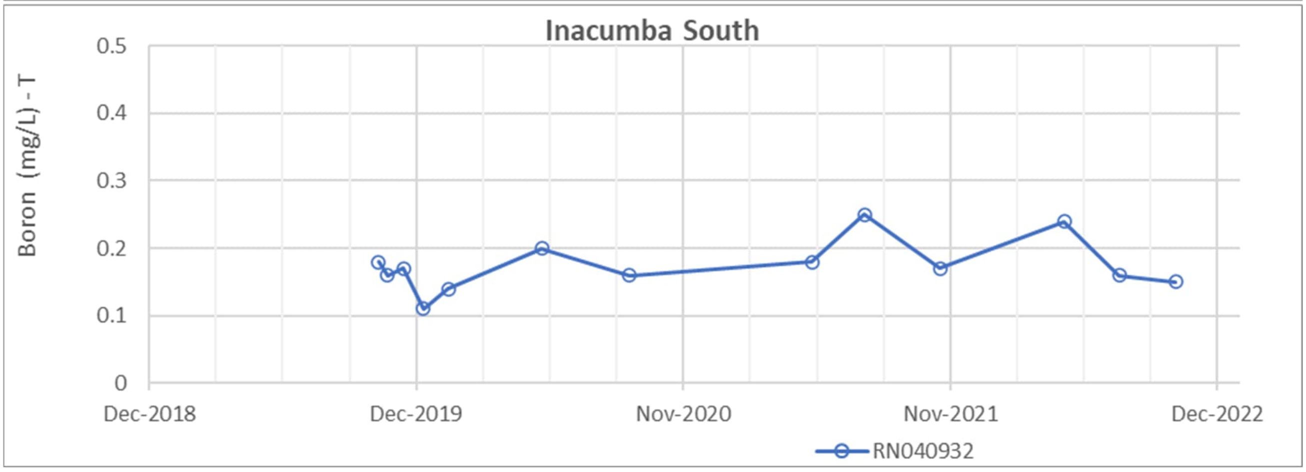

Inacumba
Copper (mg/L) - D
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

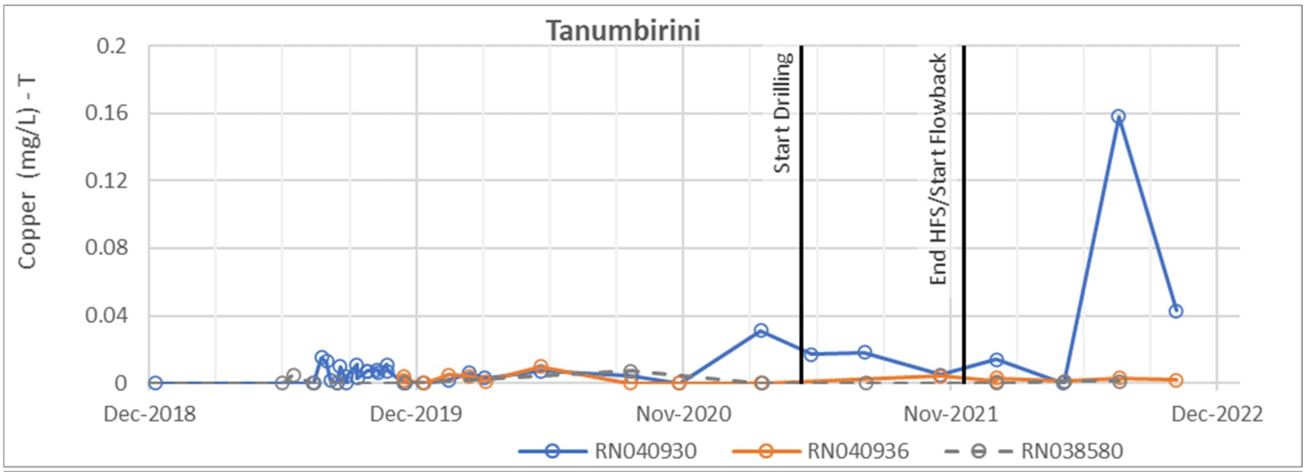

Inacumba South
Copper (mg/L) - D
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

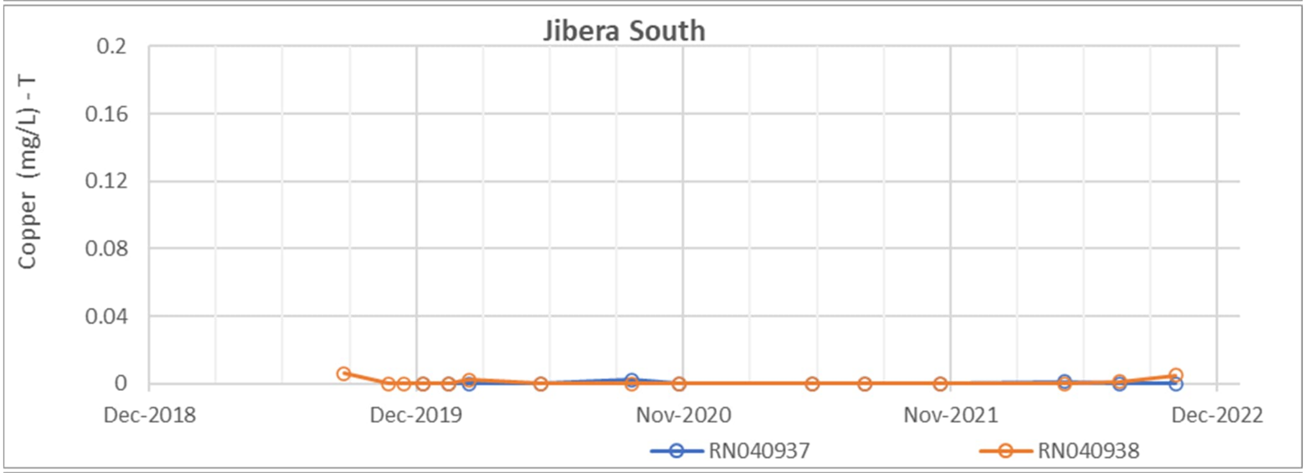

Tanumbirini
Boron (mg/L) - T
0.5
0.4
0.3
0.2
0.1
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

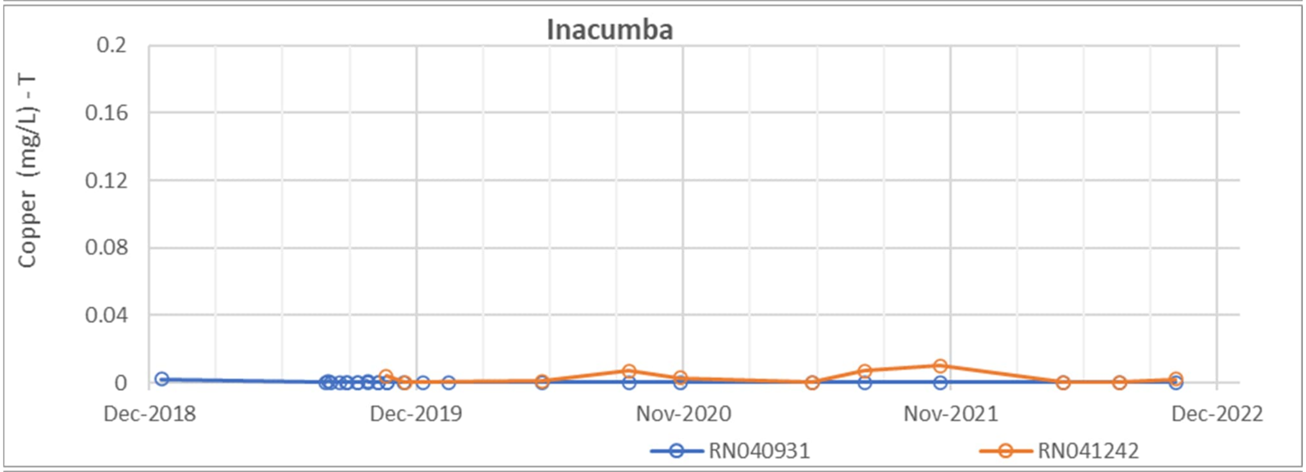

Jibera South
Boron (mg/L) - T
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

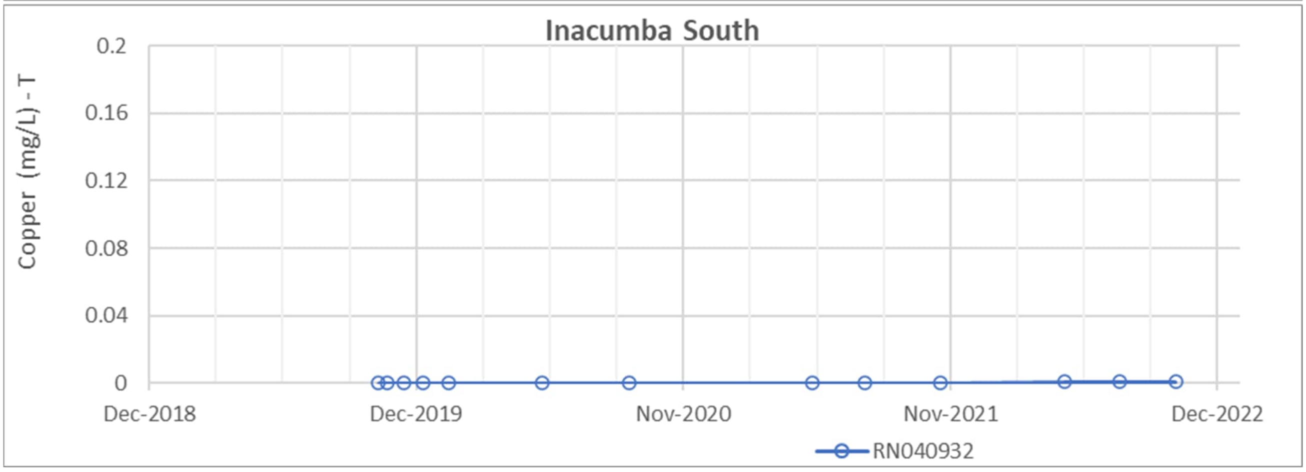

Inacumba
Boron (mg/L) - T
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

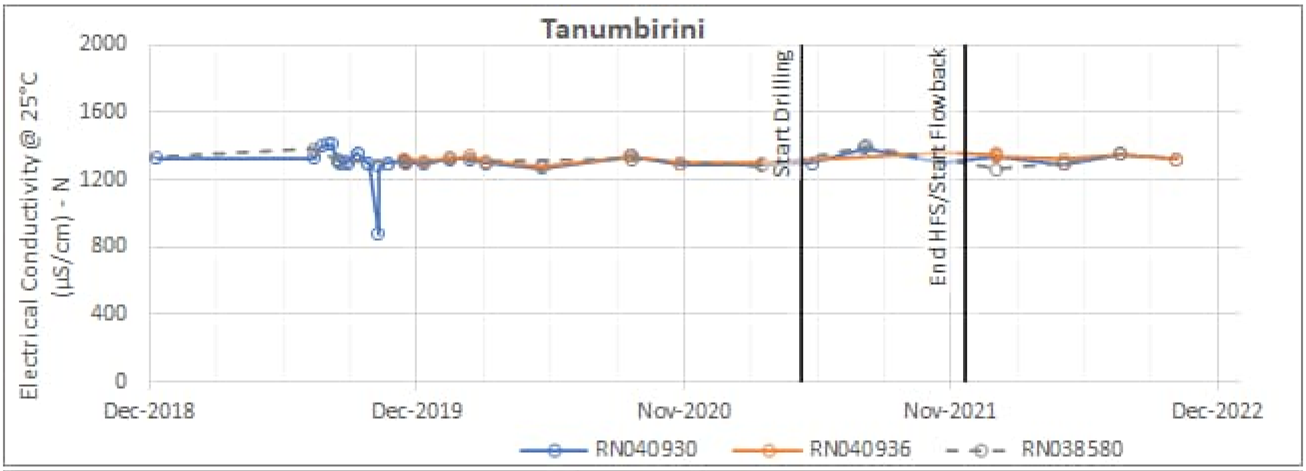

Inacumba South
Boron (mg/L) - T
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

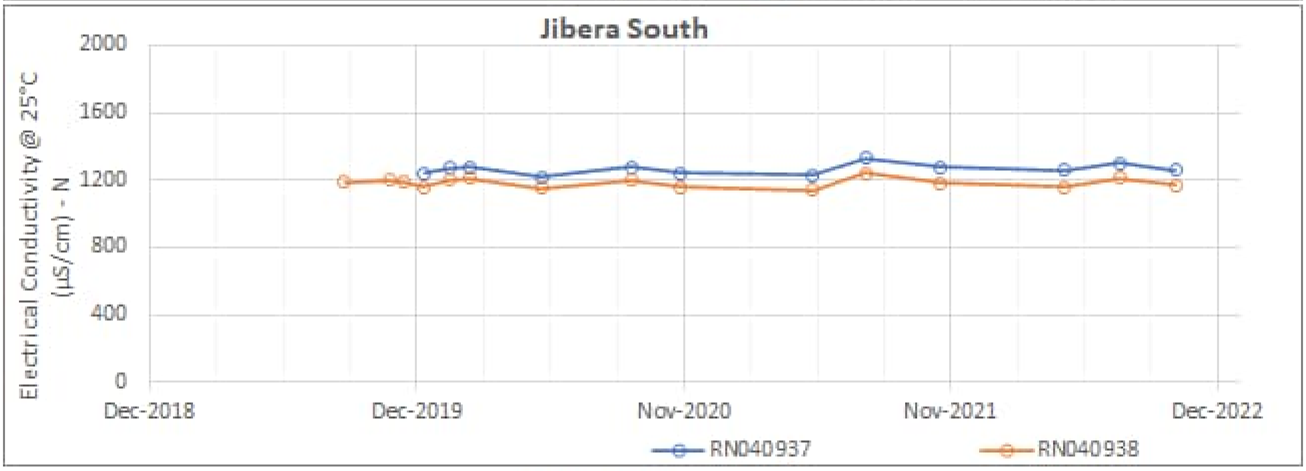

Tanumbirini
Copper (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

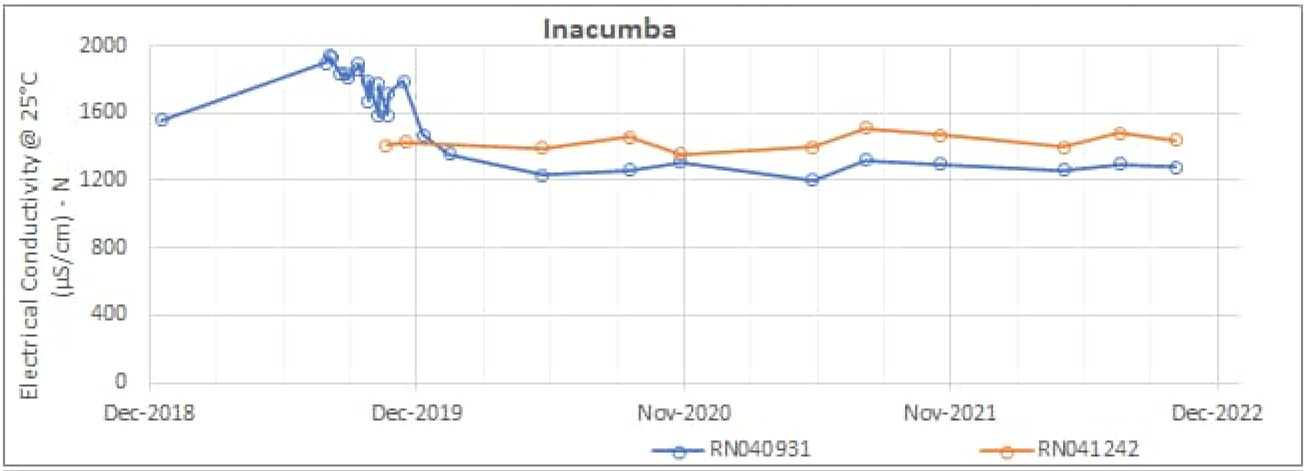

Jibera South
Copper (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

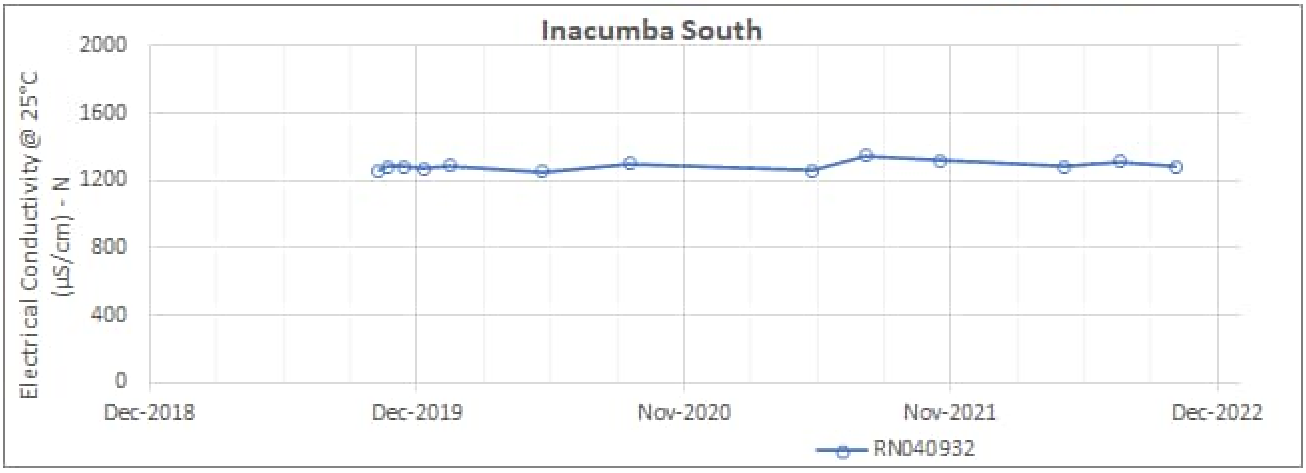

Inacumba
Copper (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

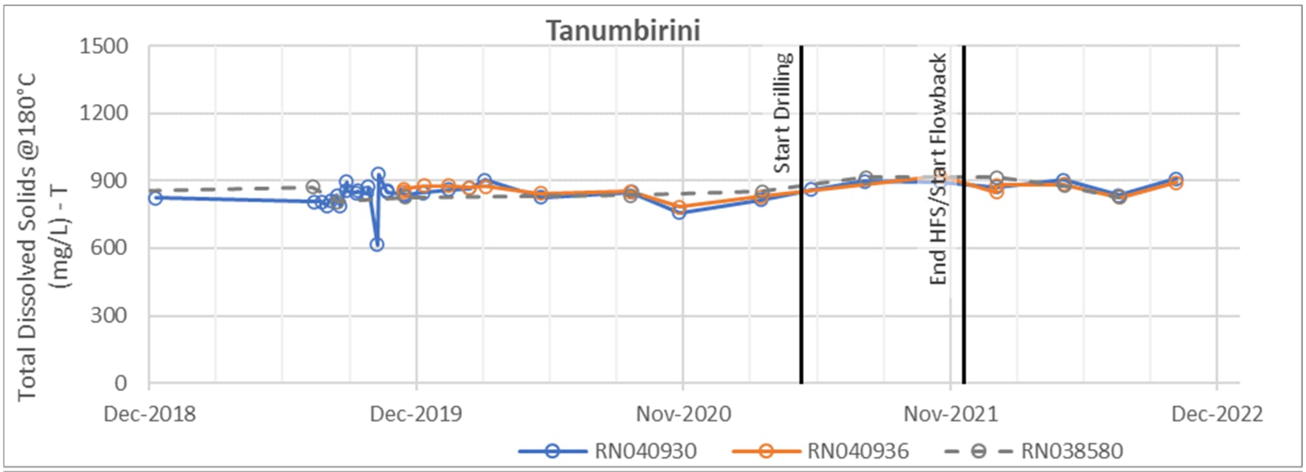

Inacumba South
Copper (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

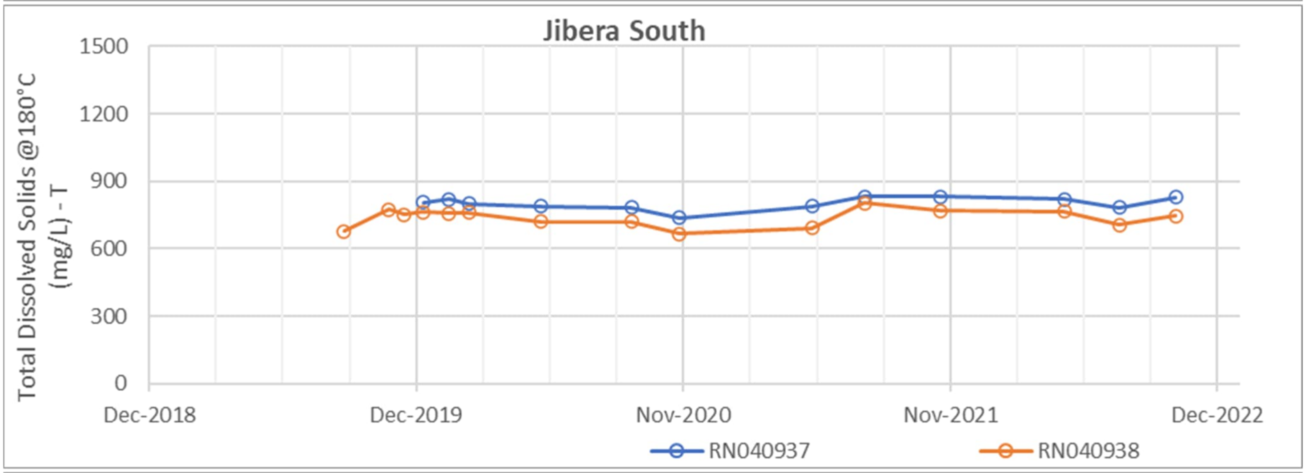

Tanumbirini
Electrical Conductivity @ 25°C (µS/cm) - N
2000
1600
1200
800
400
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580

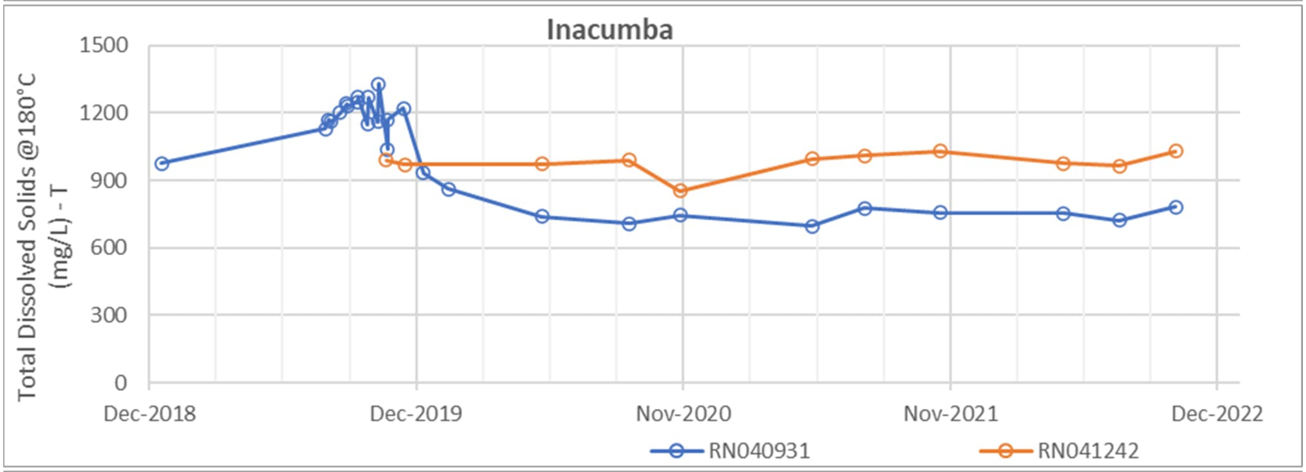

Jibera South
Electrical Conductivity @ 25°C (µS/cm) - N
2000
1600
1200
800
400
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

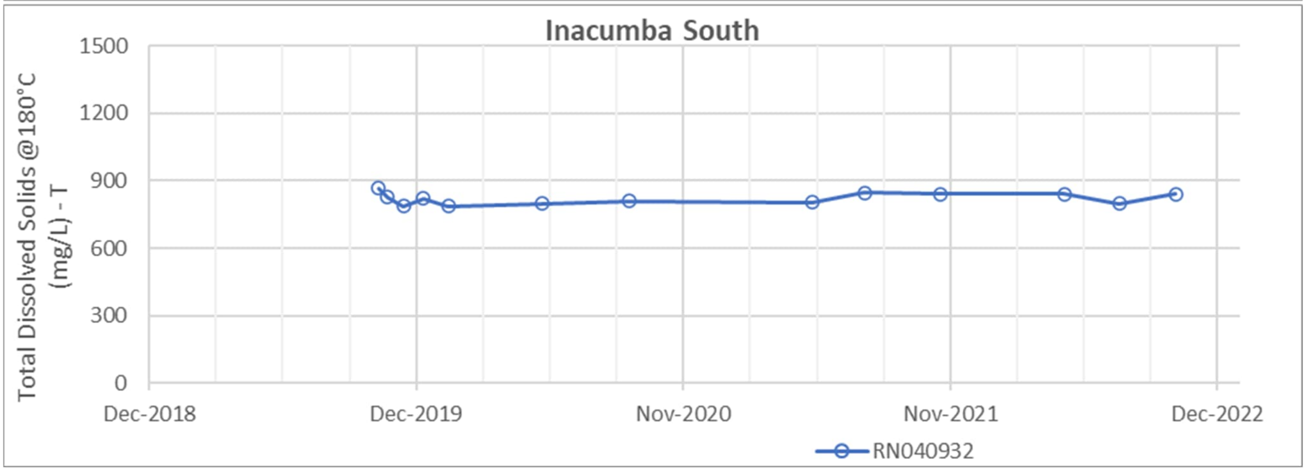

Inacumba
Electrical Conductivity @ 25°C (µS/cm) - N
2000
1600
1200
800
400
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

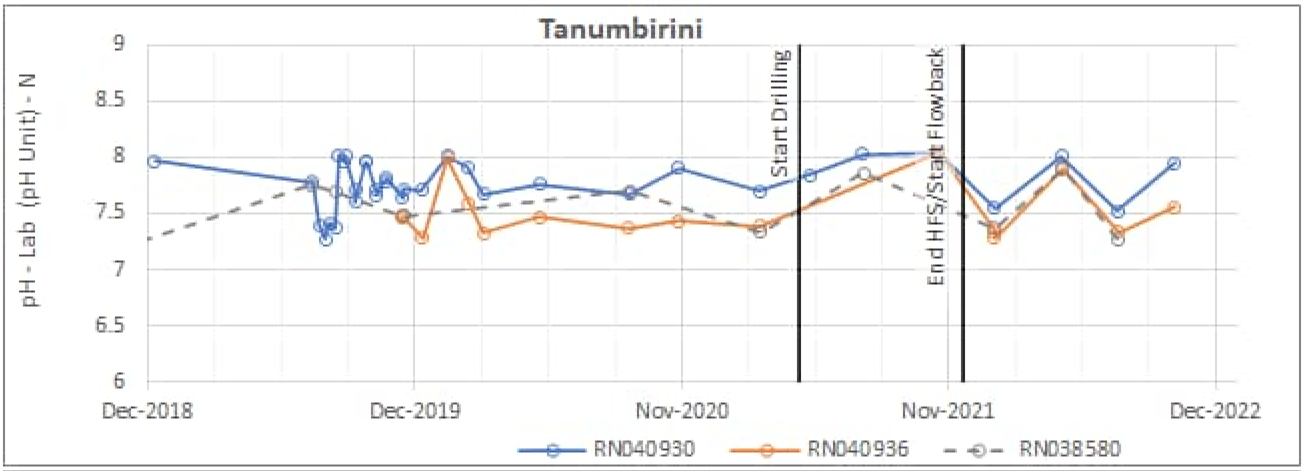

Inacumba South
Electrical Conductivity @ 25°C (µS/cm) - N
2000
1600
1200
800
400
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

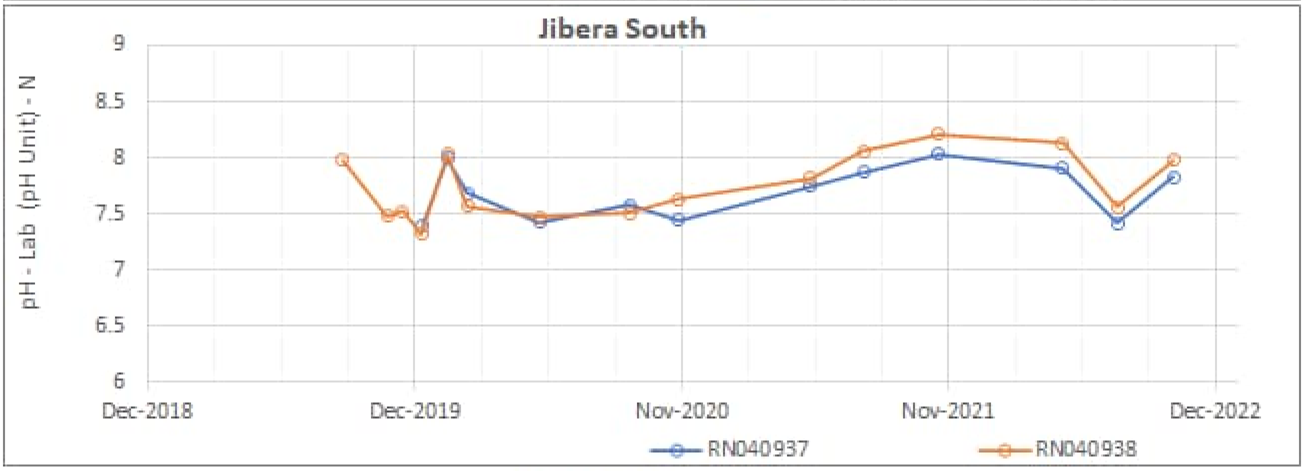

Tanumbirini
Total Dissolved Solids @180°C (mg/L) - T
1500
1200
900
600
300
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580

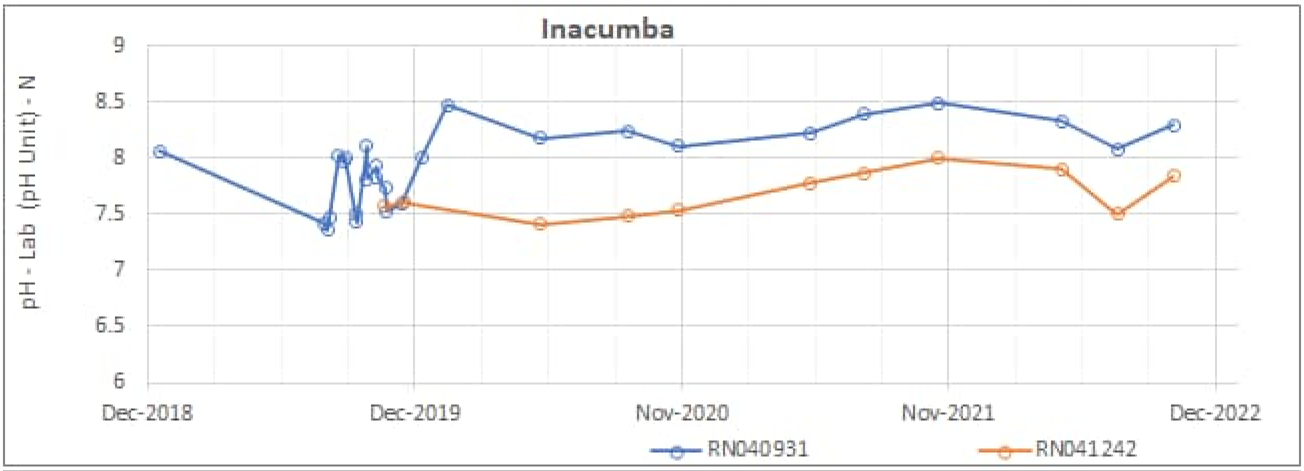

Jibera South
Total Dissolved Solids @180°C (mg/L) - T
1500
1200
900
600
300
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

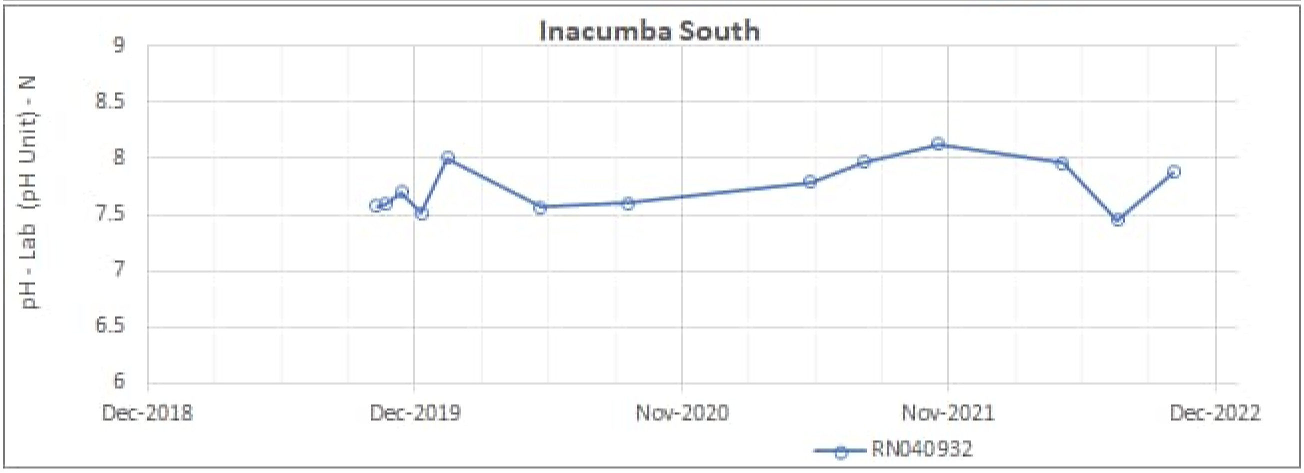

Inacumba
Total Dissolved Solids @180°C (mg/L) - T
1500
1200
900
600
300
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

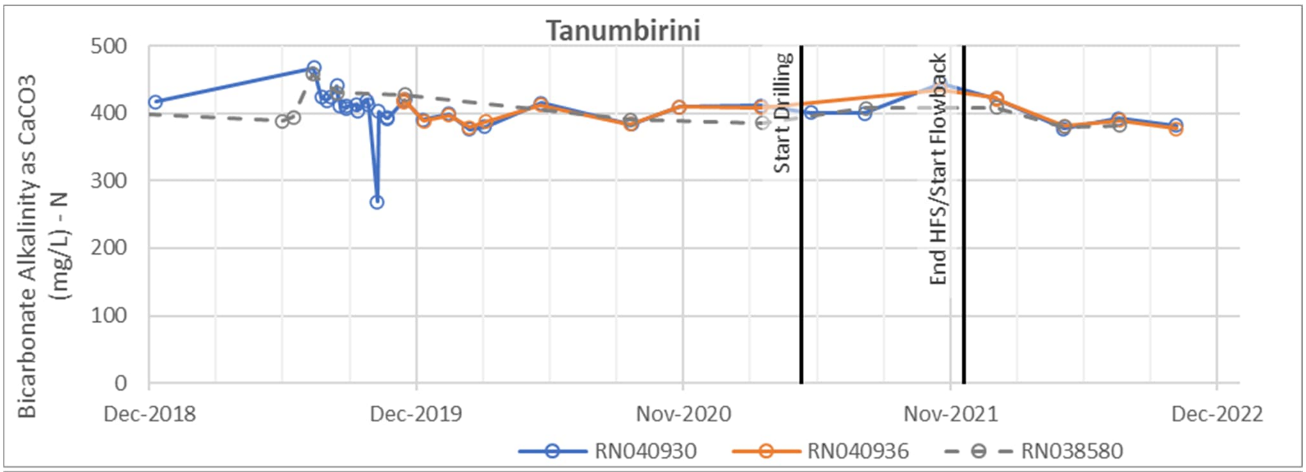

Inacumba South
Total Dissolved Solids @180°C (mg/L) - T
1500
1200
900
600
300
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

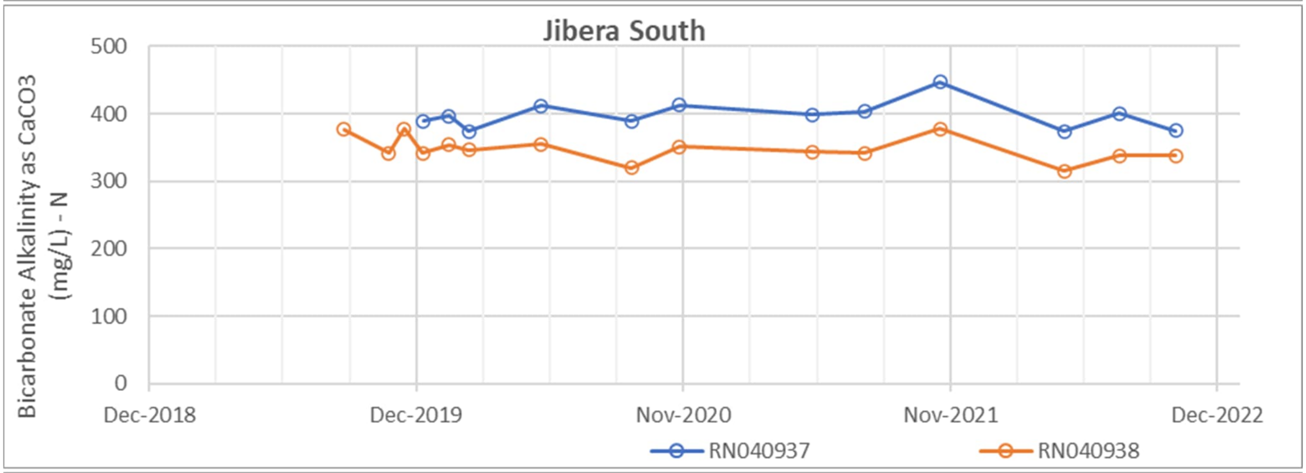

Tanumbirini
pH - Lab (pH Unit) - N
9
8.5
8
7.5
7
6.5
6
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

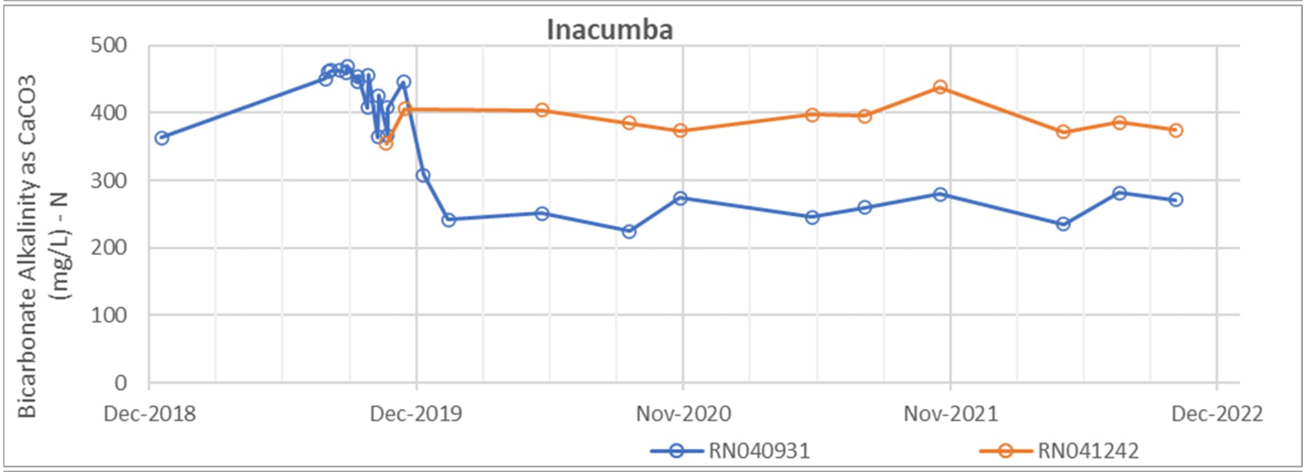

Jibera South
pH - Lab (pH Unit) - N
9
8.5
8
7.5
7
6.5
6
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

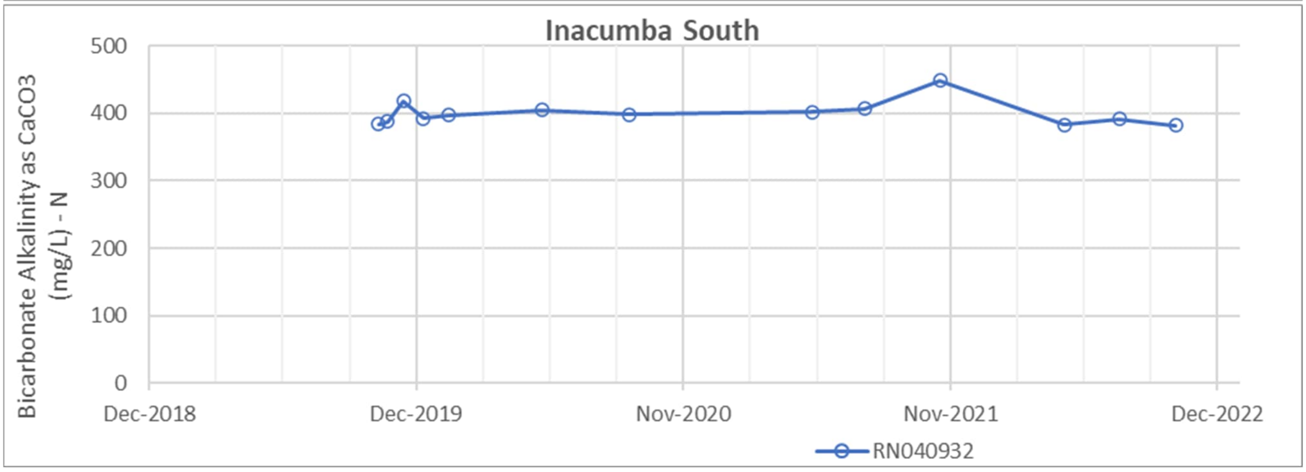

Inacumba
pH - Lab (pH Unit) - N
9
8.5
8
7.5
7
6.5
6
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

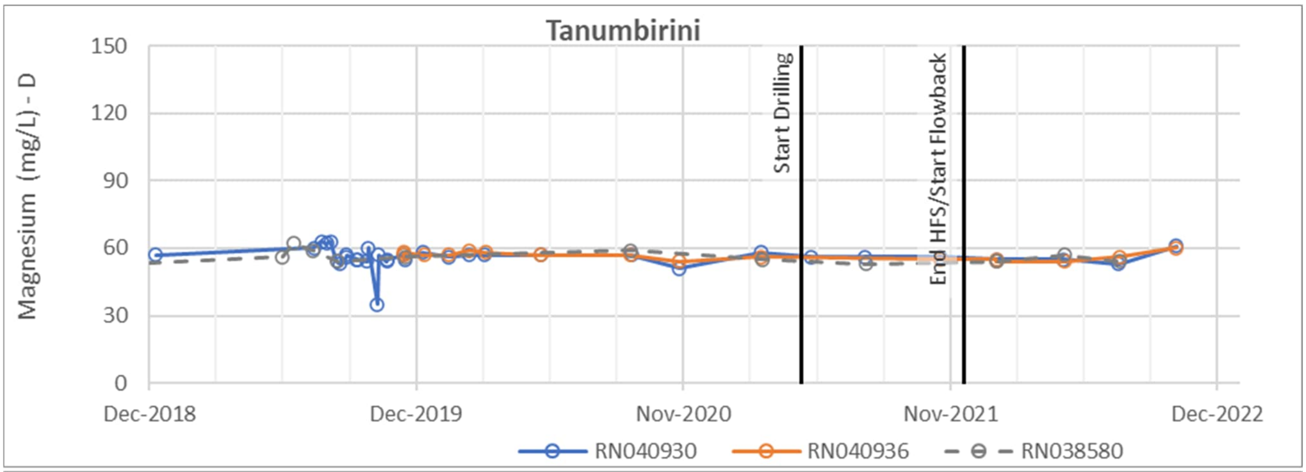

Inacumba South
pH - Lab (pH Unit) - N
9
8.5
8
7.5
7
6.5
6
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

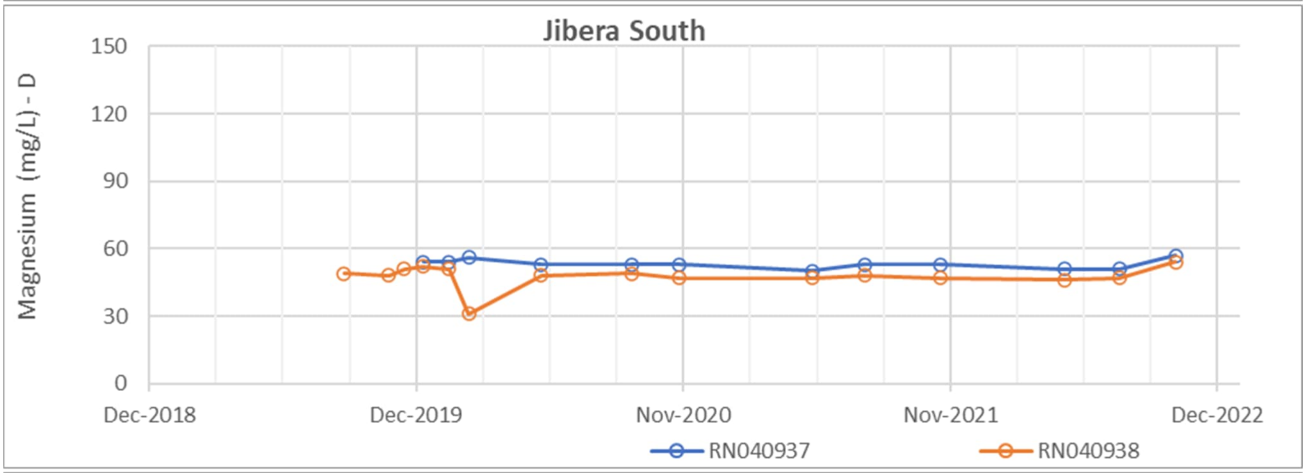

Tanumbirini
Bicarbonate Alkalinity as CaCO3 (mg/L) - N
500
400
300
200
100
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580

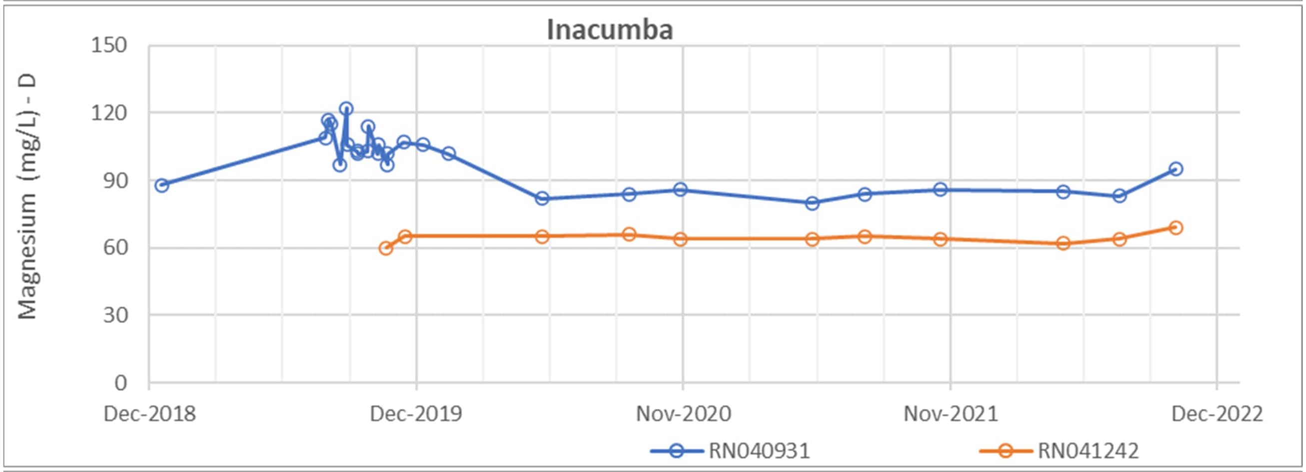

Jibera South
Bicarbonate Alkalinity as CaCO3 (mg/L) - N
500
400
300
200
100
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938


Inacumba
Bicarbonate Alkalinity as CaCO3 (mg/L) - N
500
400
300
200
100
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242


Inacumba South
Bicarbonate Alkalinity as CaCO3 (mg/L) - N
500
400
300
200
100
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932


Tanumbirini
Magnesium (mg/L) - D
150
120
90
60
30
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580


Jibera South
Magnesium (mg/L) - D
150
120
90
60
30
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938


Inacumba
Magnesium (mg/L) - D
150
120
90
60
30
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
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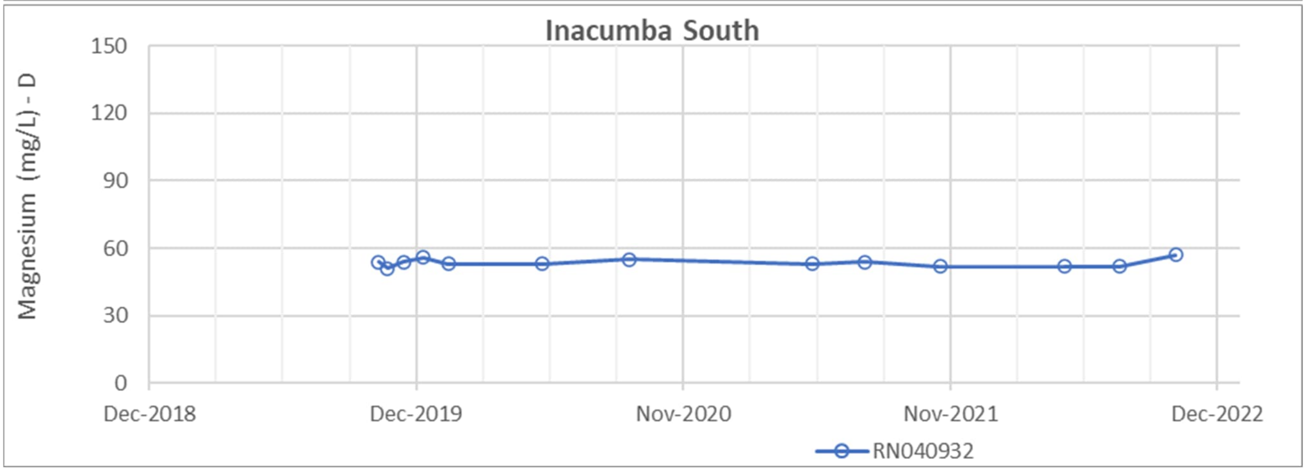
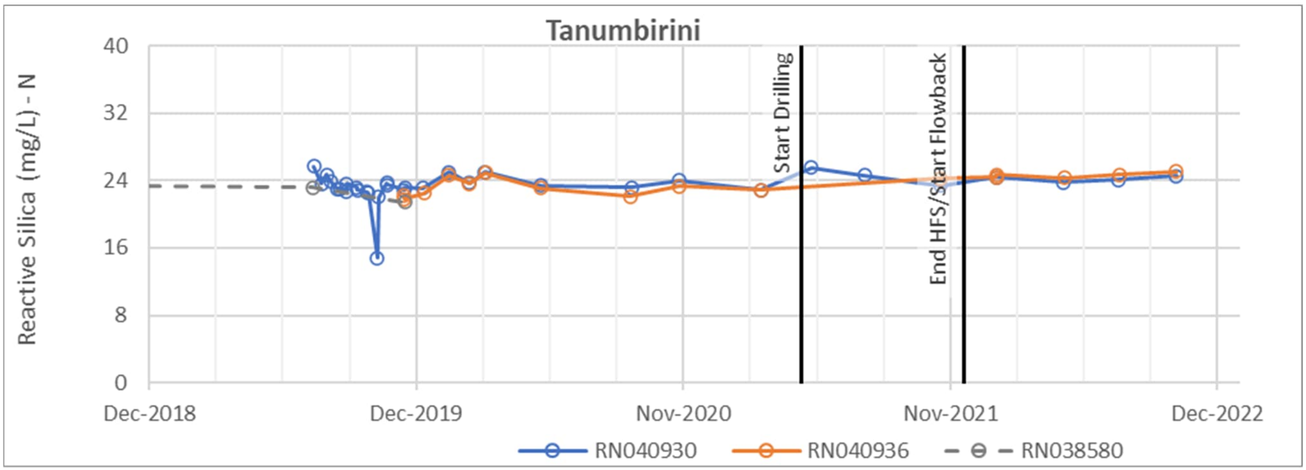
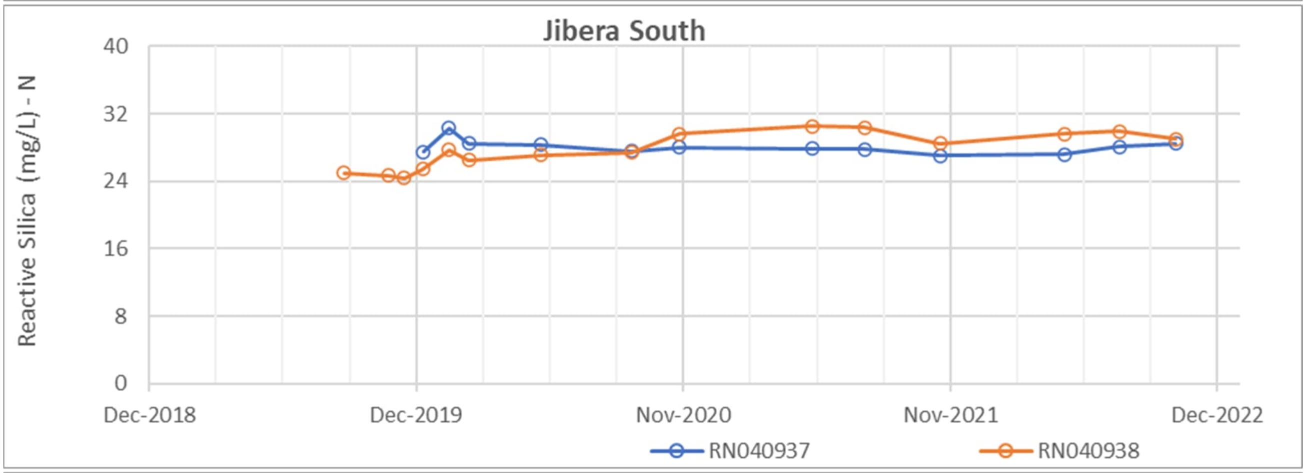
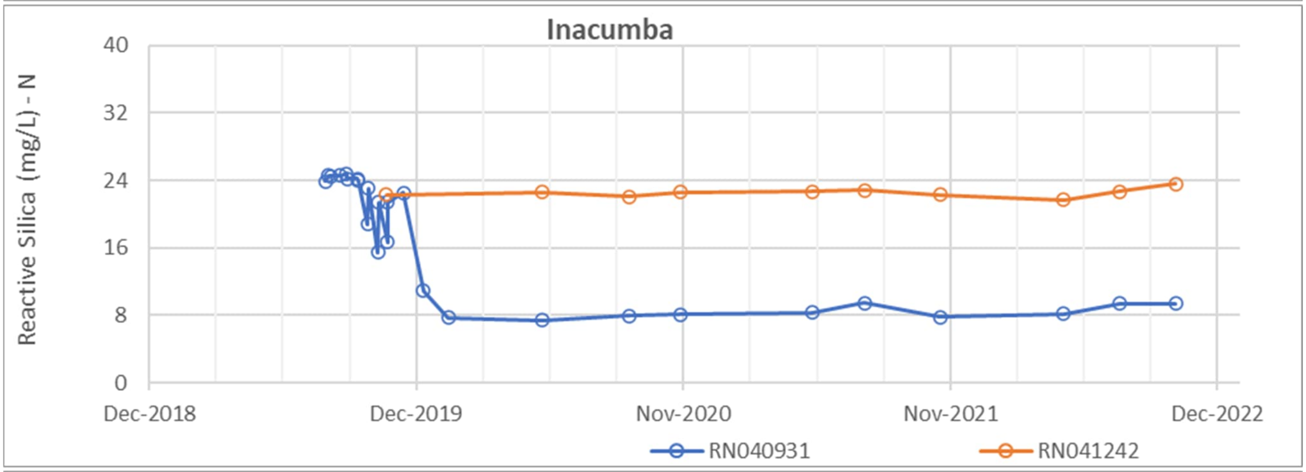
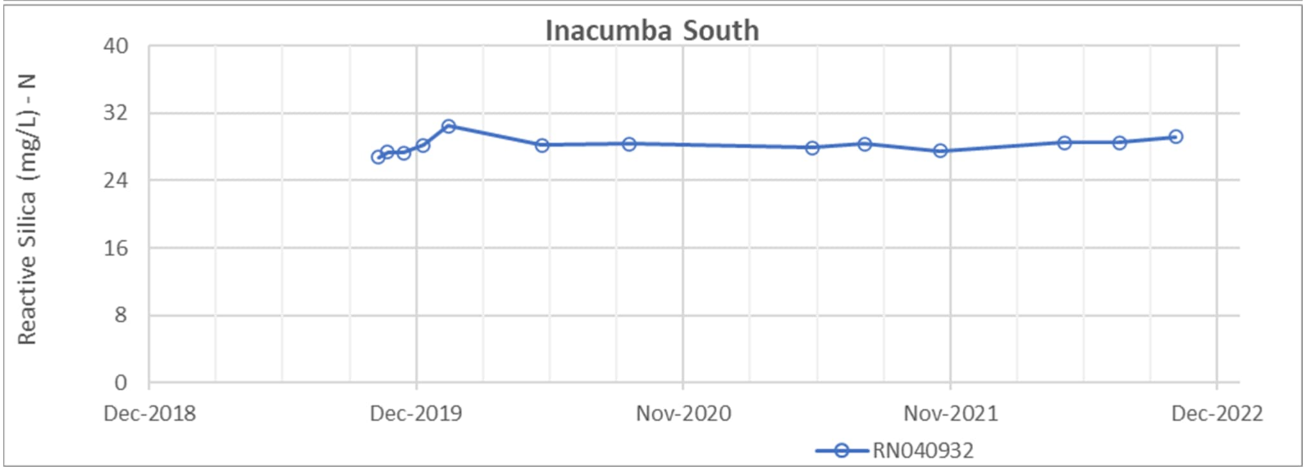
RN040931
RN041242

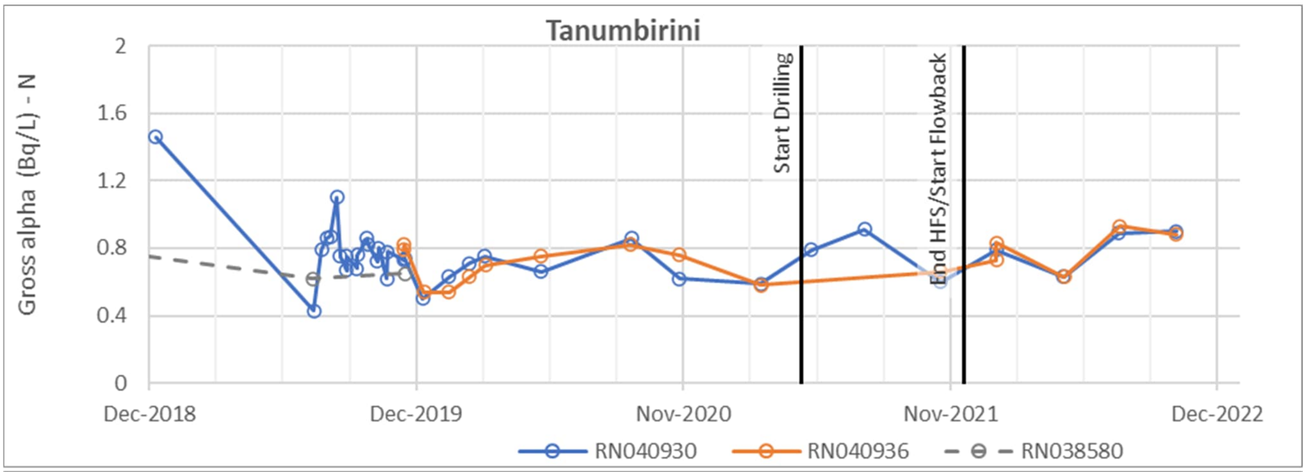

Inacumba South
Magnesium (mg/L) - D
150
120
90
60
30
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

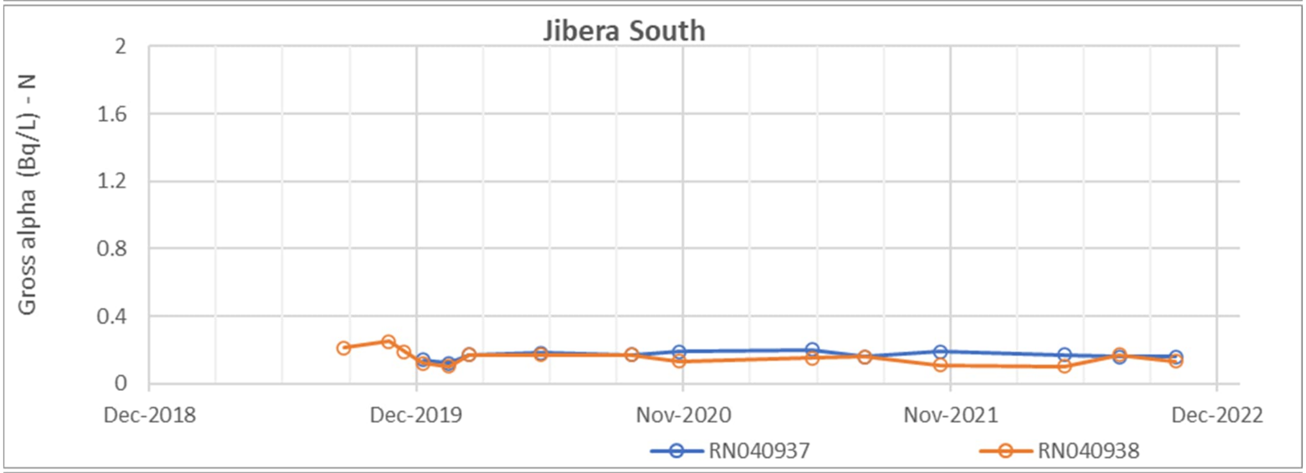

Tanumbirini
Reactive Silica (mg/L) - N
40
32
24
16
8
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
RN040936
RN038580

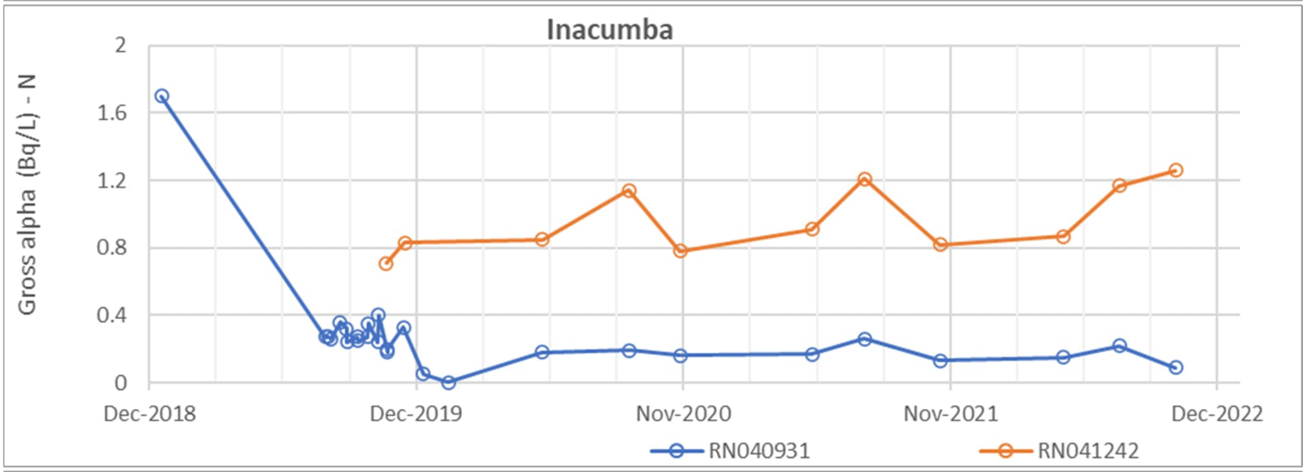

Jibera South
Reactive Silica (mg/L) - N
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

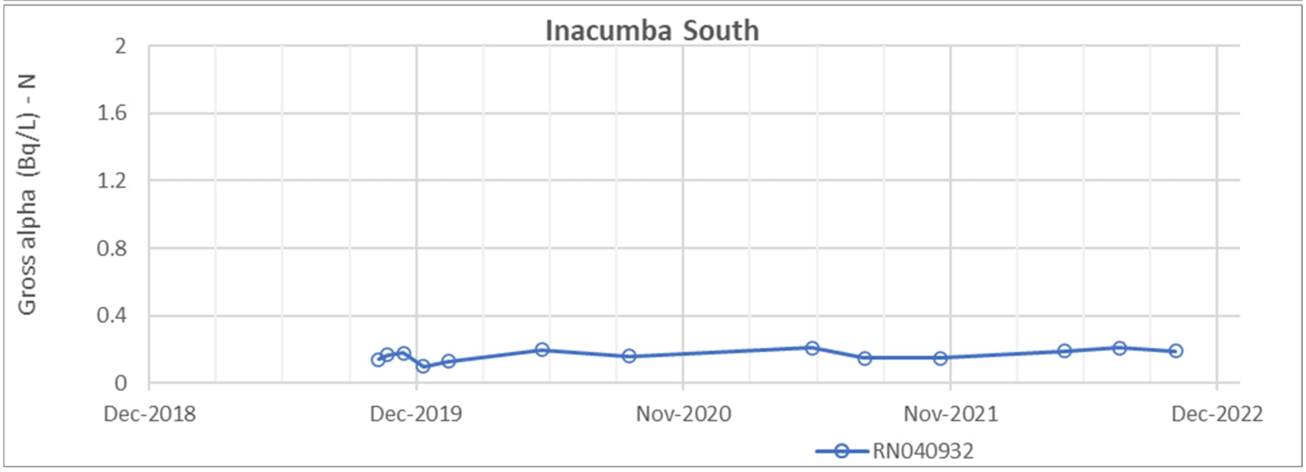

Inacumba
Reactive Silica (mg/L) - N
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

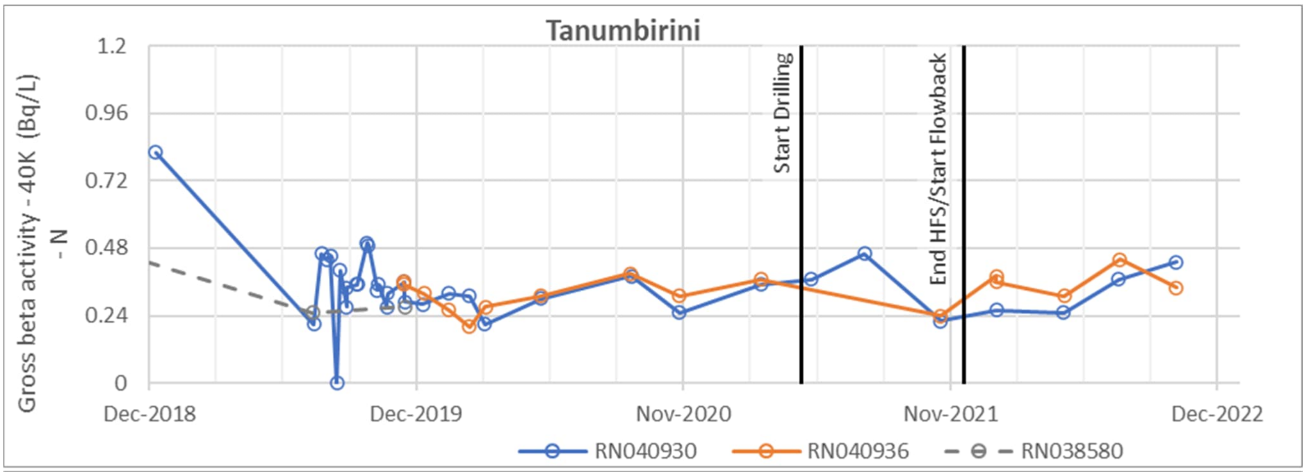

Inacumba South
Reactive Silica (mg/L) - N
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932


Tanumbirini
Gross alpha (Bq/L) - N
2
1.6
1.2
0.8
0.4
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580


Jibera South
Gross alpha (Bq/L) - N
2
1.6
1.2
0.8
0.4
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938


Inacumba
Gross alpha (Bq/L) - N
2
1.6
1.2
0.8
0.4
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242


Inacumba South
Gross alpha (Bq/L) - N
2
1.6
1.2
0.8
0.4
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932


Tanumbirini
Gross beta activity - 40K (Bq/L) - N
1.2
0.96
0.72
0.48
0.24
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
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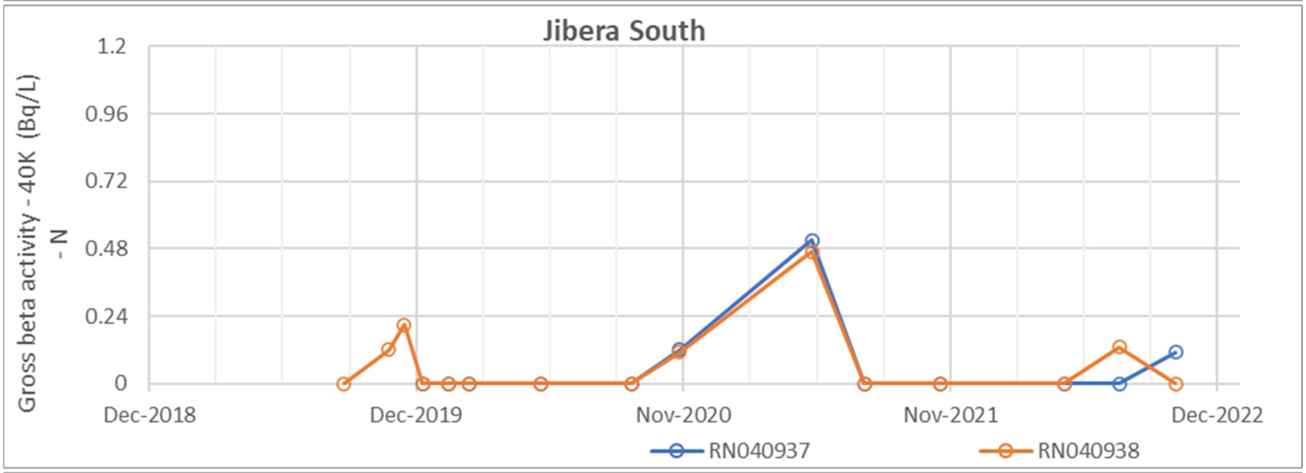
Jibera South
Gross beta activity - 40K (Bq/L) - N
1.2
0.96
0.72
0.48
0.24
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
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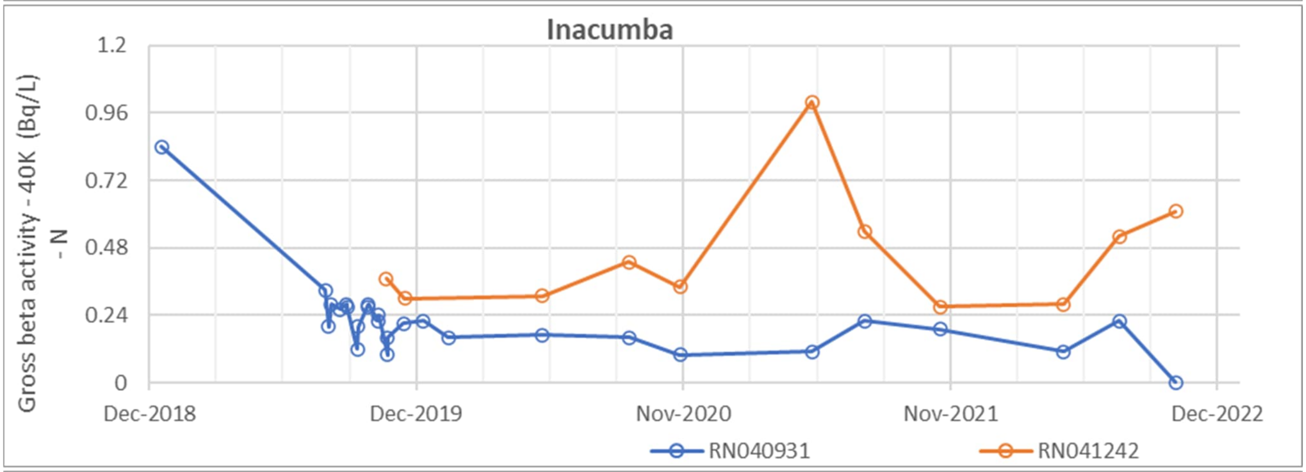
Inacumba
Gross beta activity - 40K (Bq/L) - N
1.2
0.96
0.72
0.48
0.24
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
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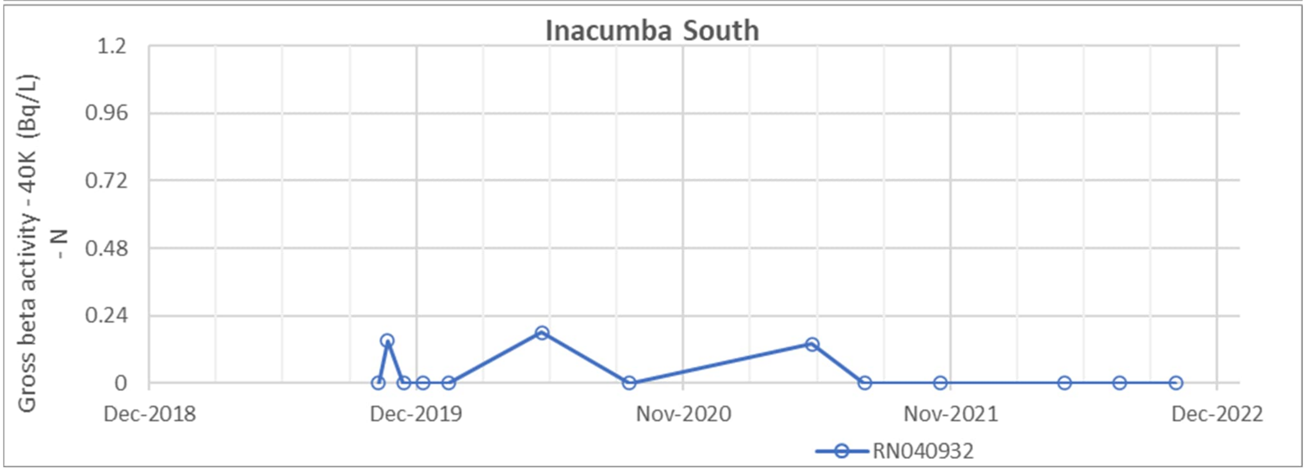
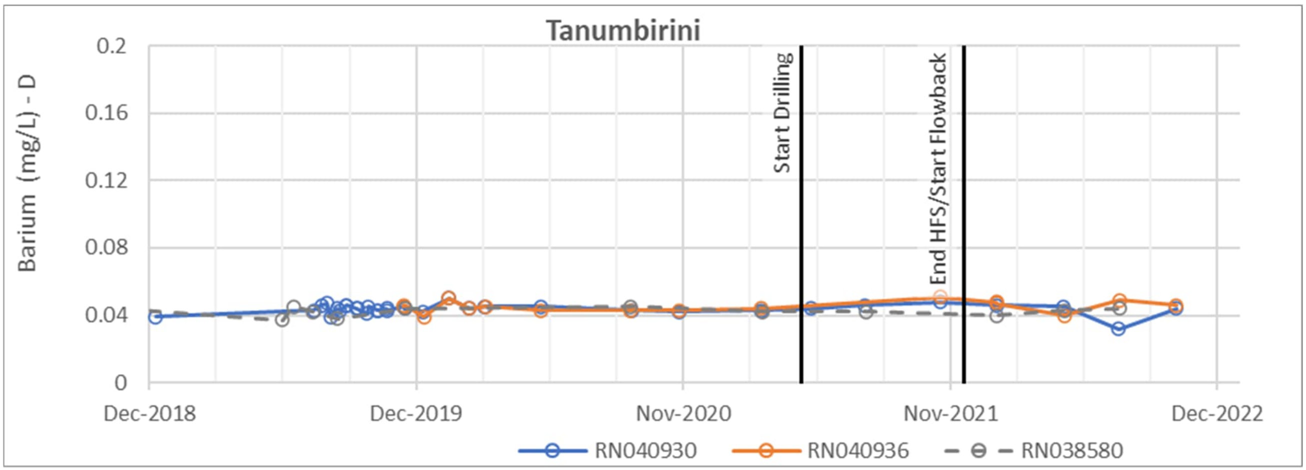

Inacumba South
Gross beta activity - 40K (Bq/L) - N
1.2
0.96
0.72
0.48
0.24
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932


Tanumbirini
Barium (mg/L) - D
0.2
0.16
0.12
0.08
0.04
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
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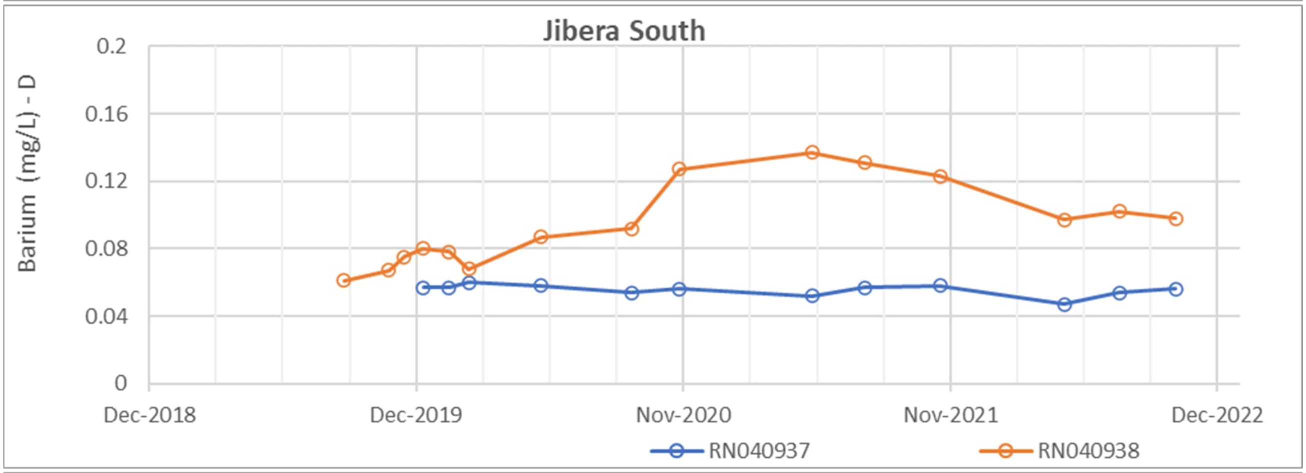
Jibera South
Barium (mg/L) - D
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
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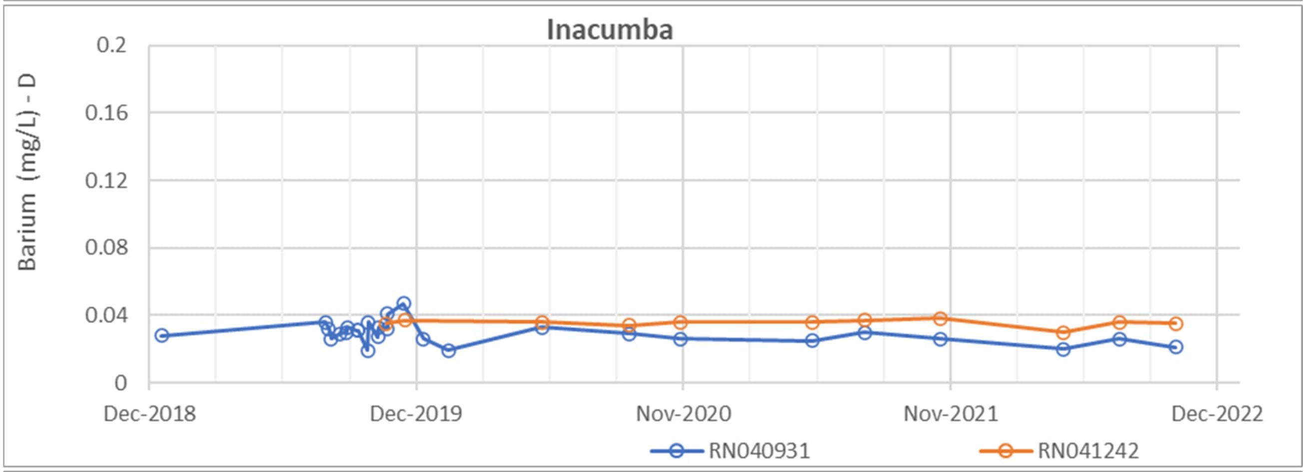
Inacumba
Barium (mg/L) - D
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
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Nov-2021
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RN040931
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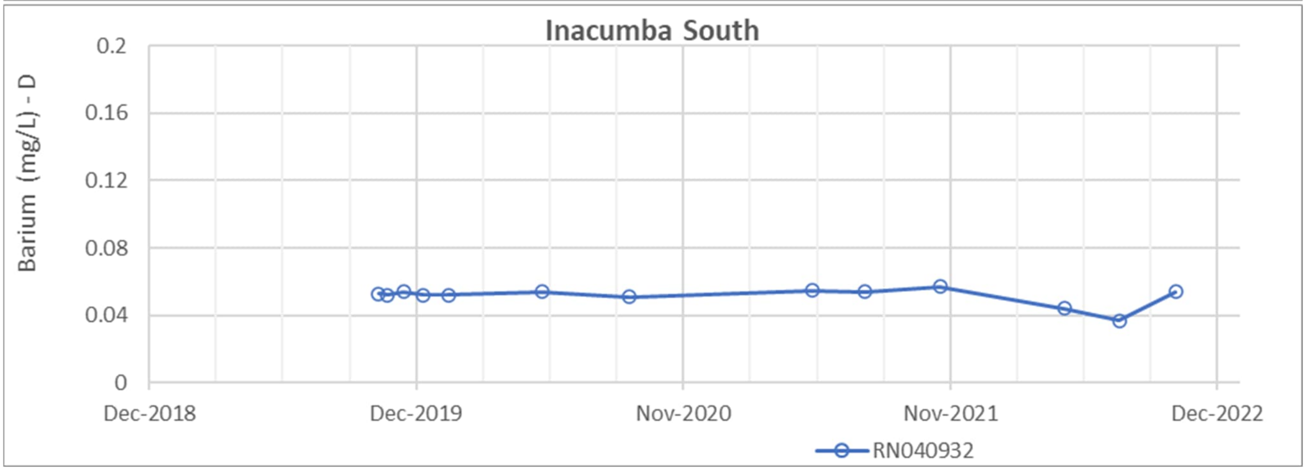
Inacumba South
Barium (mg/L) - D
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
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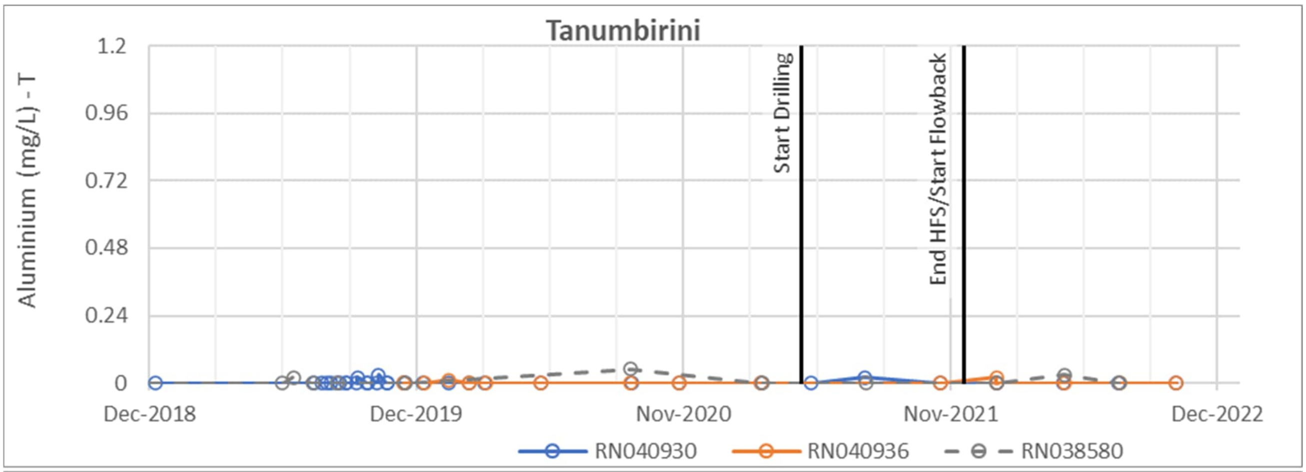
Dec-2022
RN040932


Tanumbirini
Aluminium (mg/L) - T
1.2
0.96
0.72
0.48
0.24
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040930
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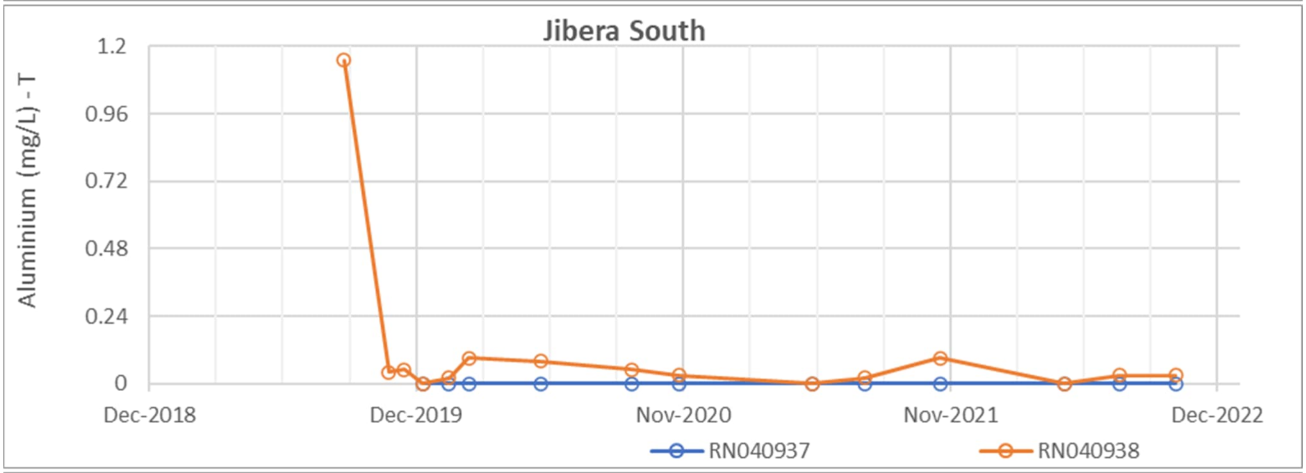
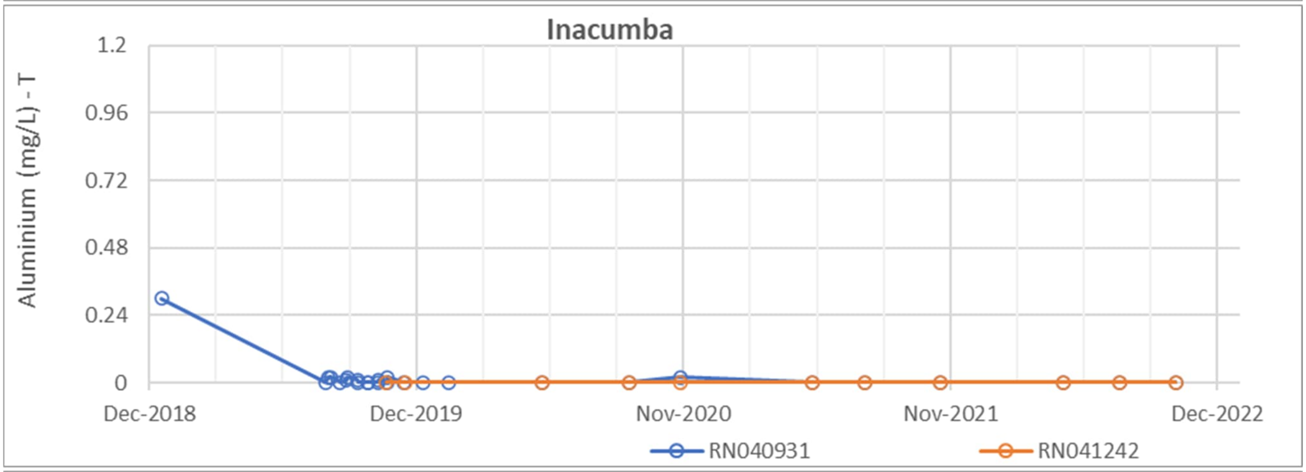

Jibera South
Aluminium (mg/L) - T
1.2
0.96
0.72
0.48
0.24
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938


Inacumba
Aluminium (mg/L) - T
1.2
0.96
0.72
0.48
0.24
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
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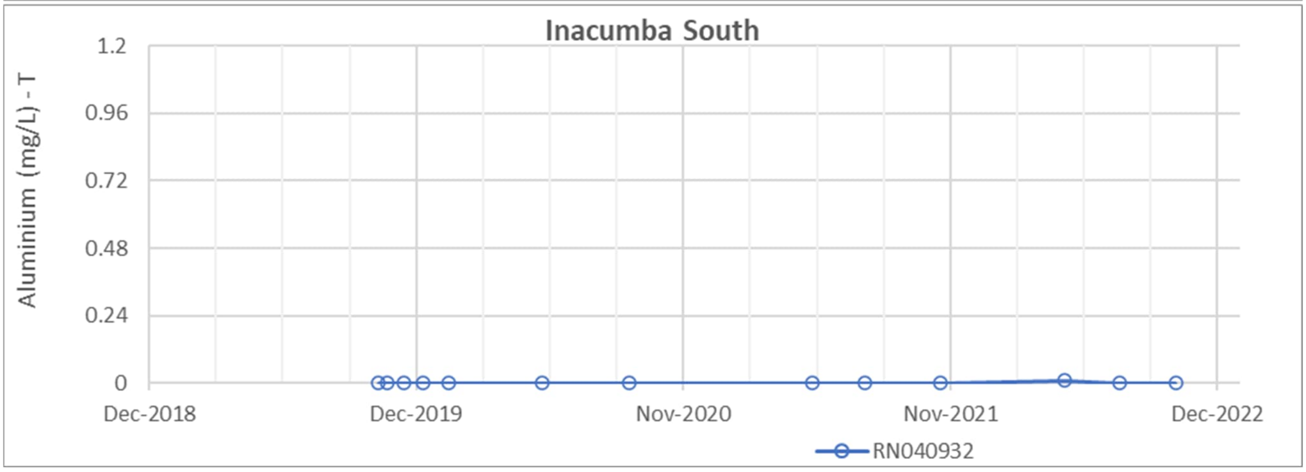
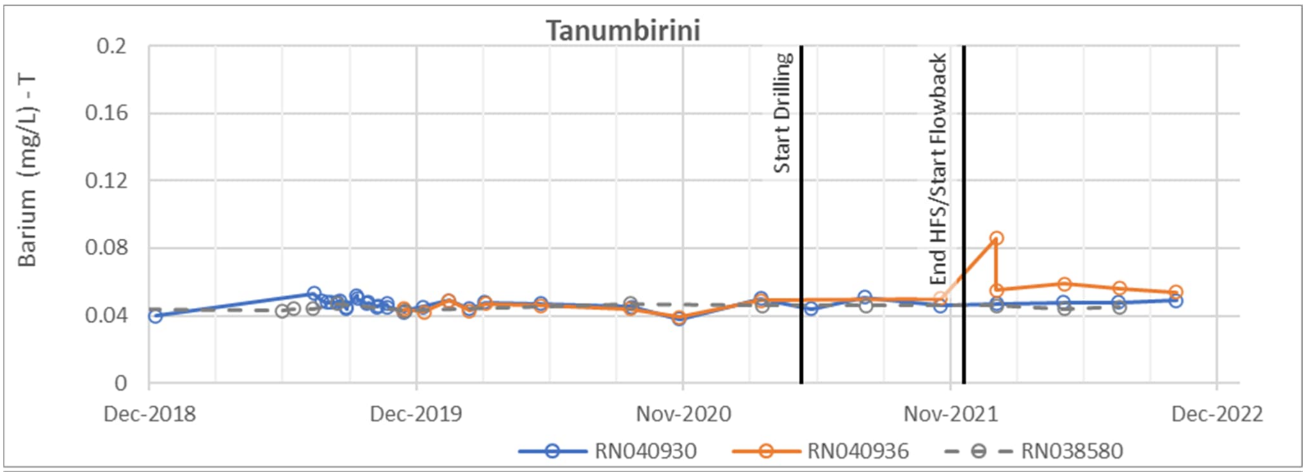
RN040931
RN041242


Inacumba South
Aluminium (mg/L) - T
1.2
0.96
0.72
0.48
0.24
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932


Tanumbirini
Barium (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Start Drilling
End HFS/Start Flowback
Dec-2018
Dec-2019
Nov-2020
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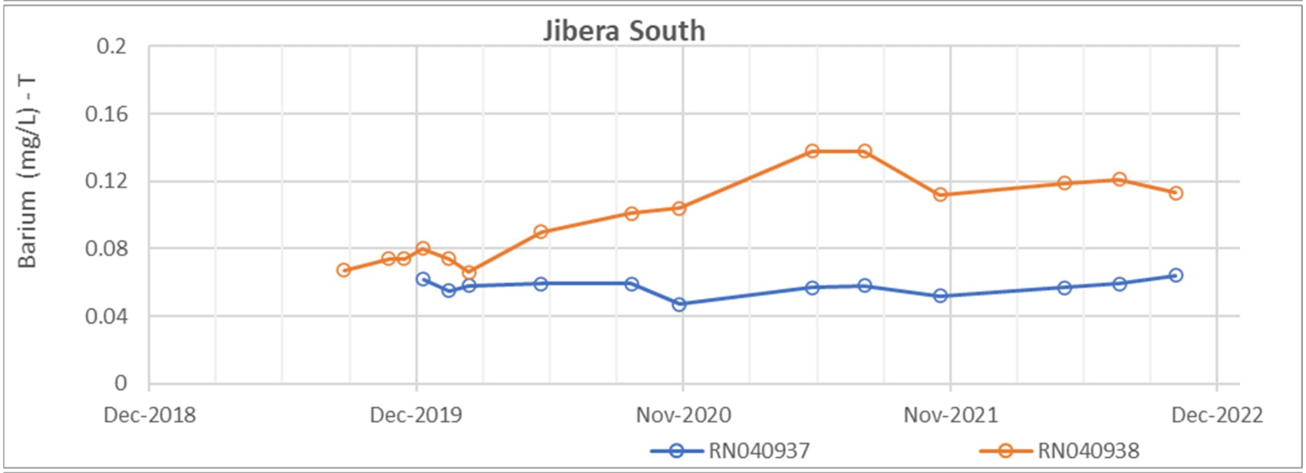
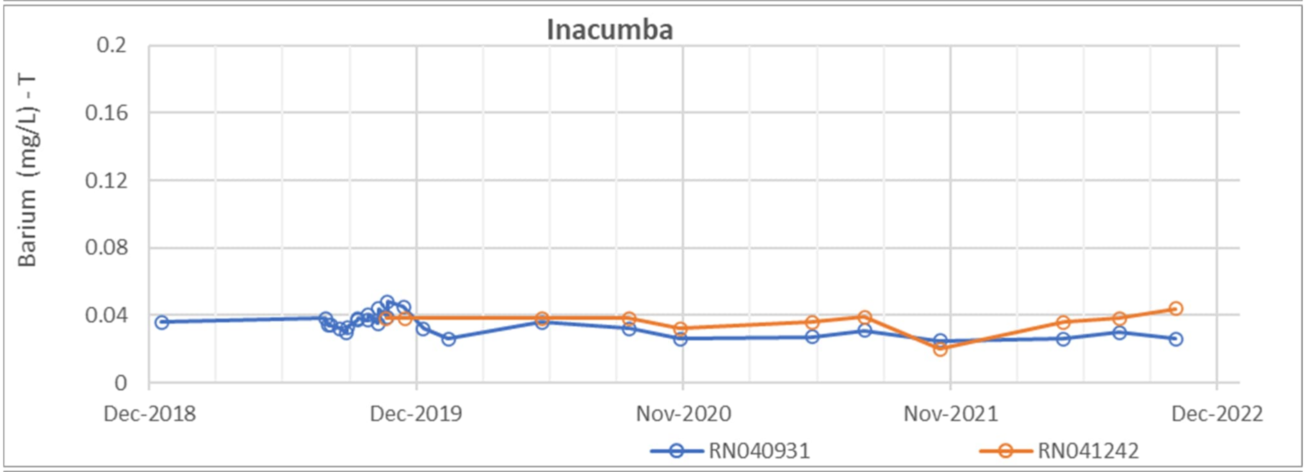
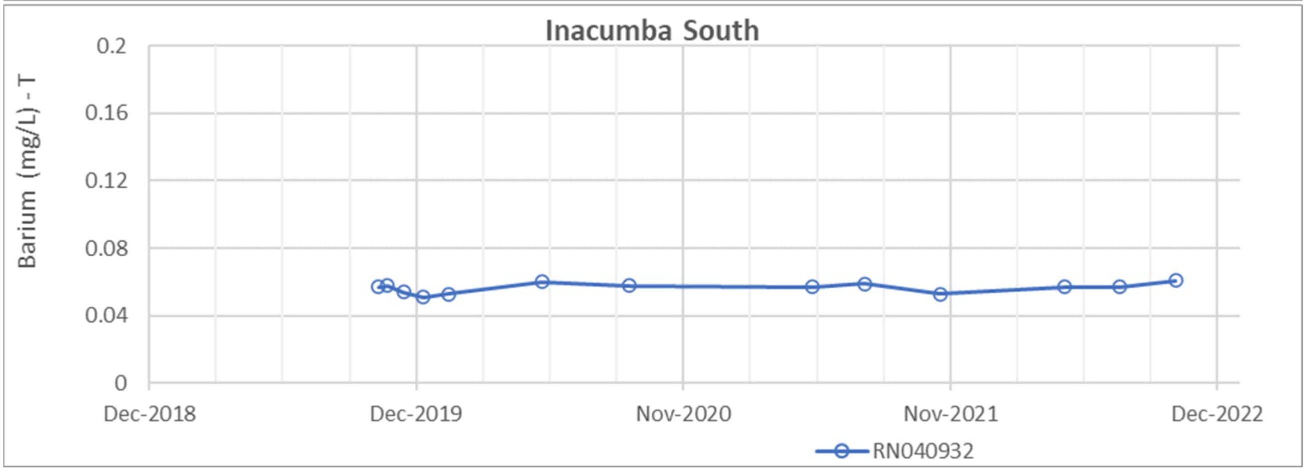
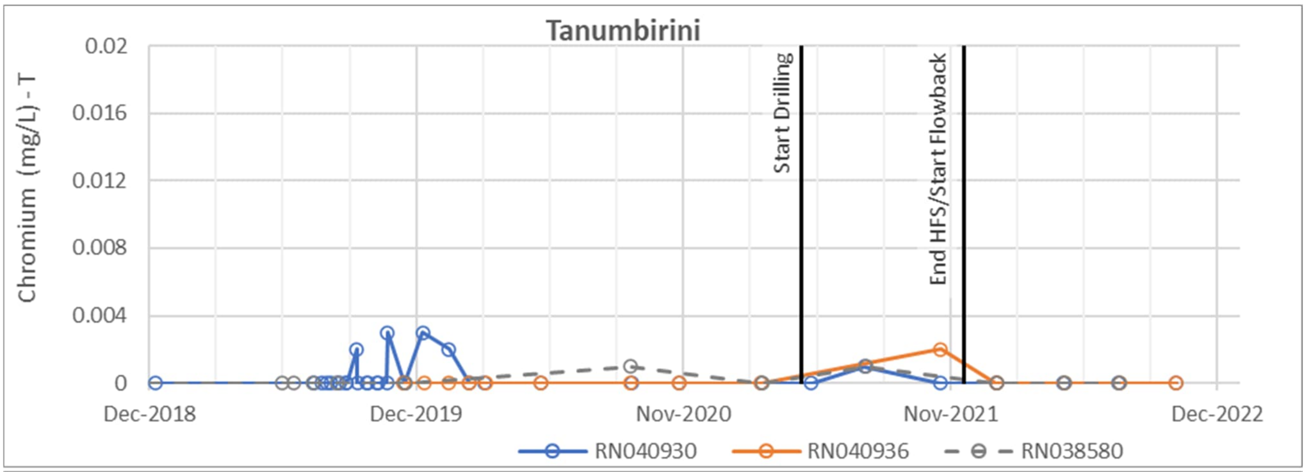

Jibera South
Barium (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938


Inacumba
Barium (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242


Inacumba South
Barium (mg/L) - T
0.2
0.16
0.12
0.08
0.04
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932


Tanumbirini
Chromium (mg/L) - T
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
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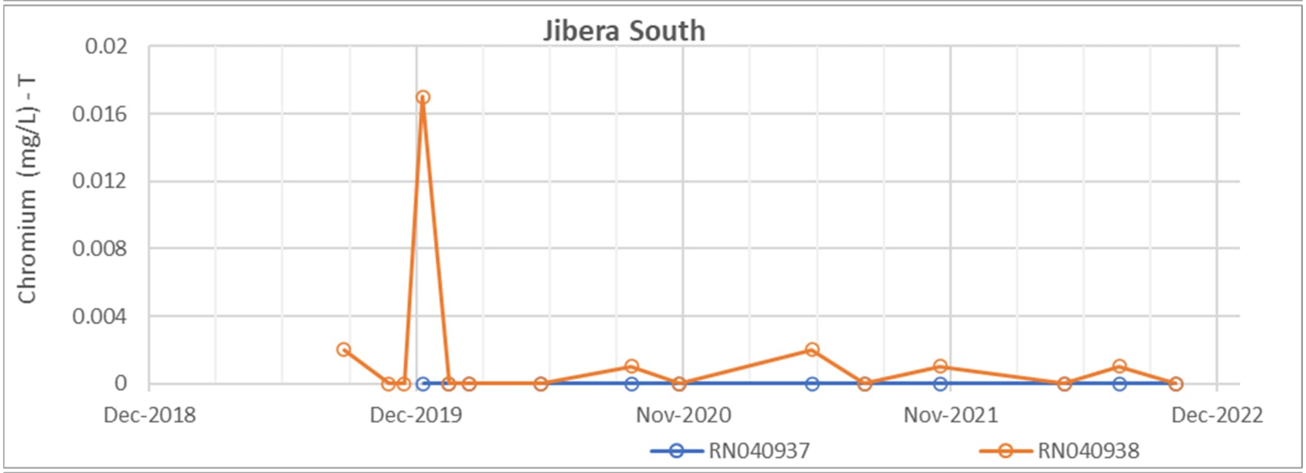
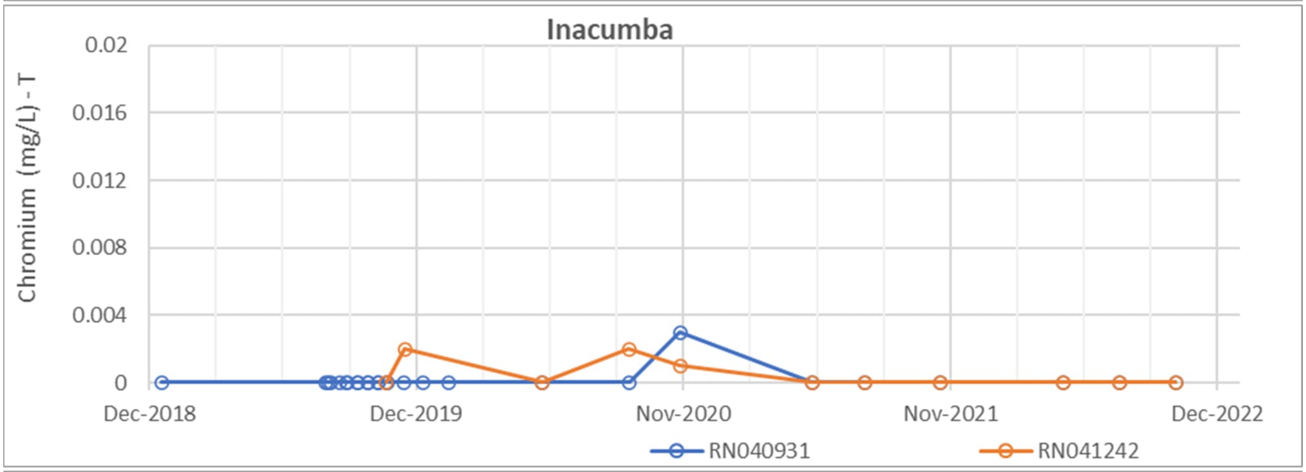
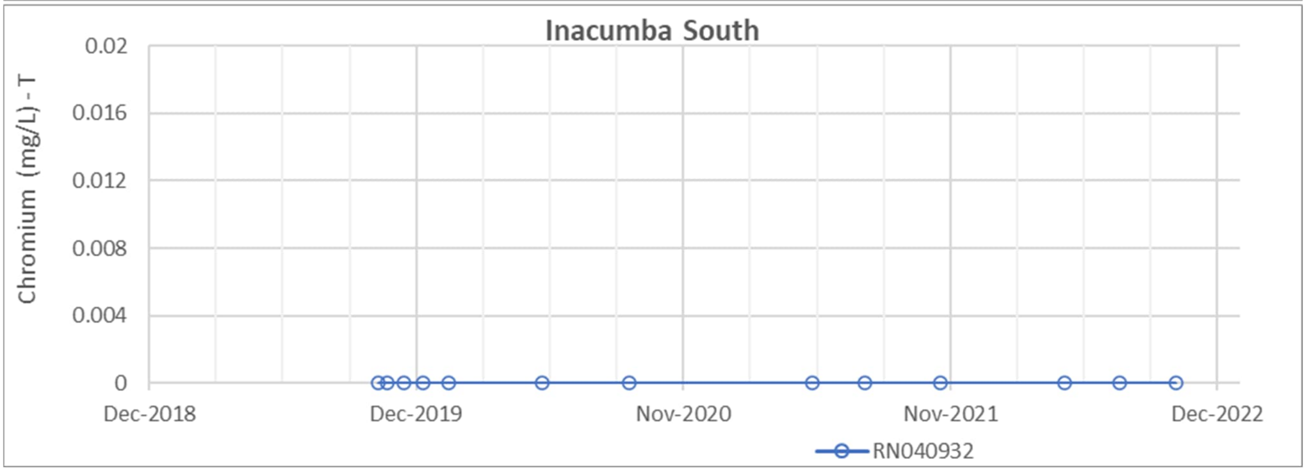
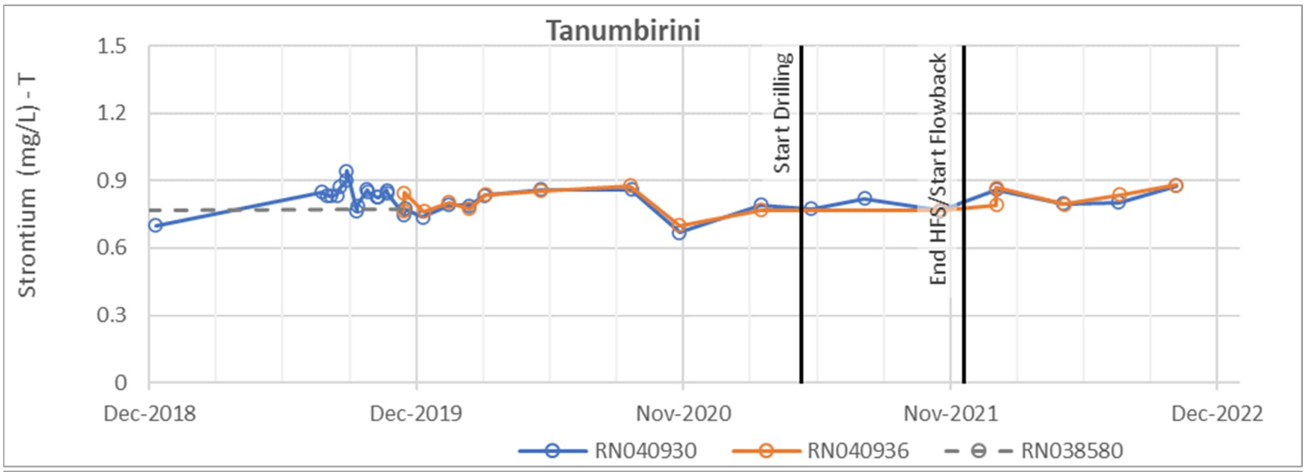
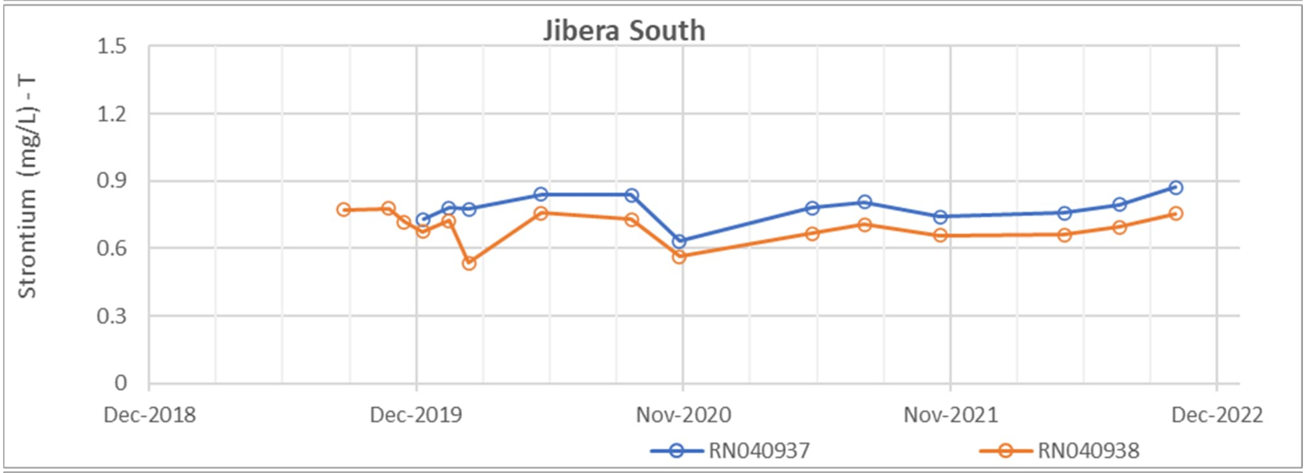
RN038580

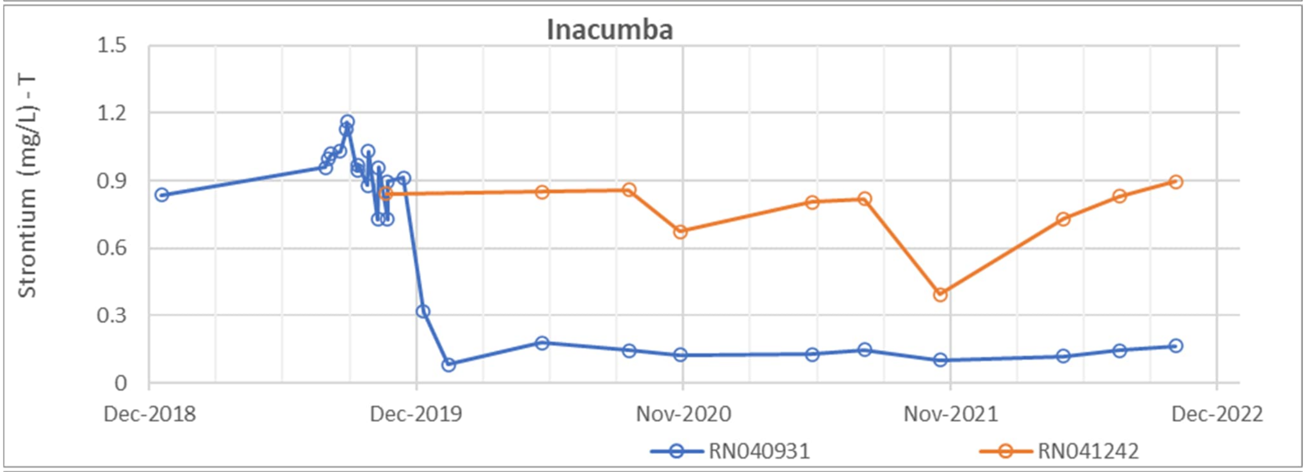

Jibera South
Chromium (mg/L) - T
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

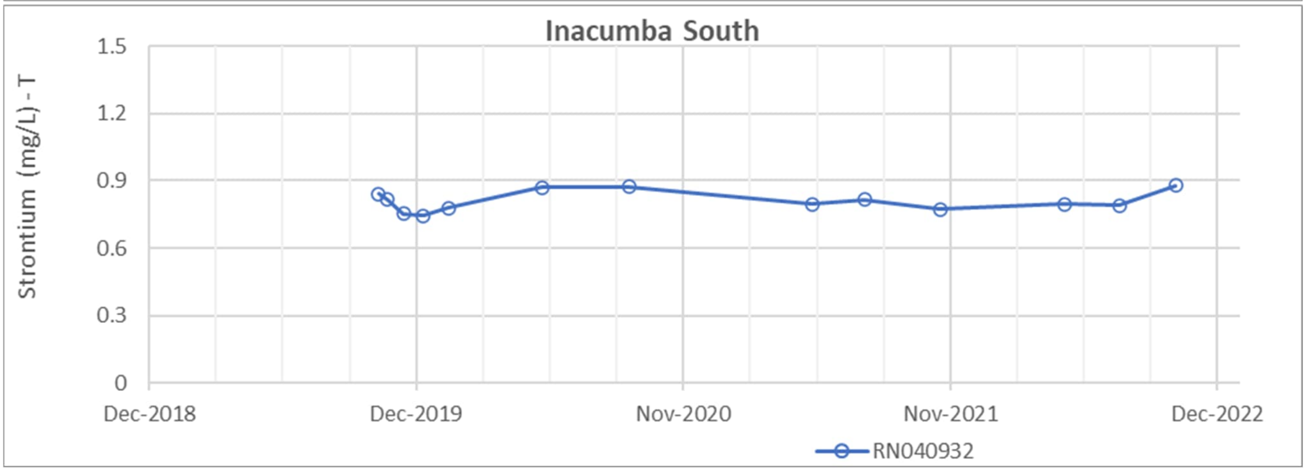

Inacumba
Chromium (mg/L) - T
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242


Inacumba South
Chromium (mg/L) - T
0.02
0.016
0.012
0.008
0.004
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

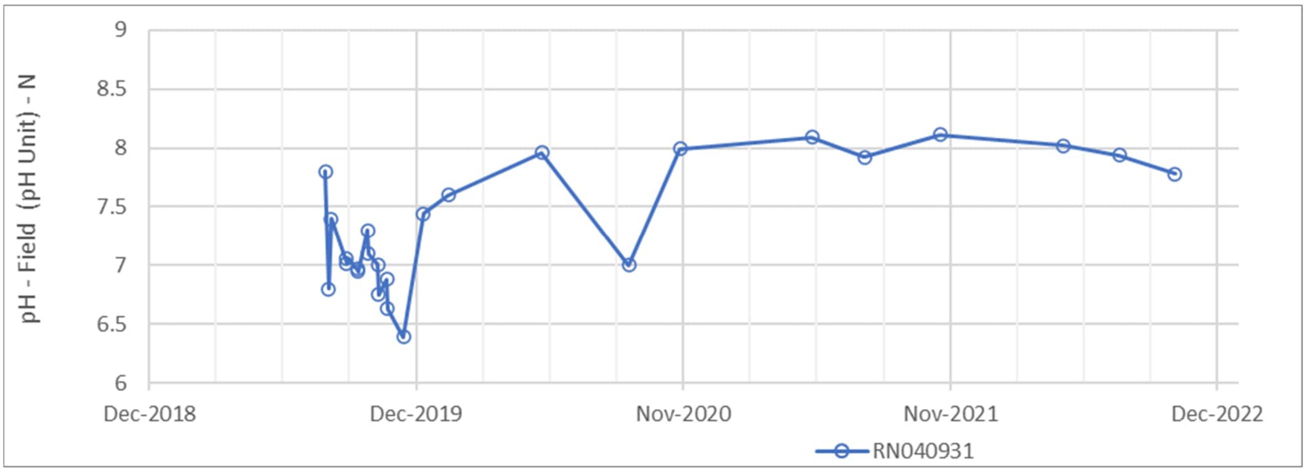

Tanumbirini
Strontium (mg/L) - T
1.5
1.2
0.9
0.6
0.3
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
Start Drilling
End HFS/Start Flowback
RN040930
RN040936
RN038580

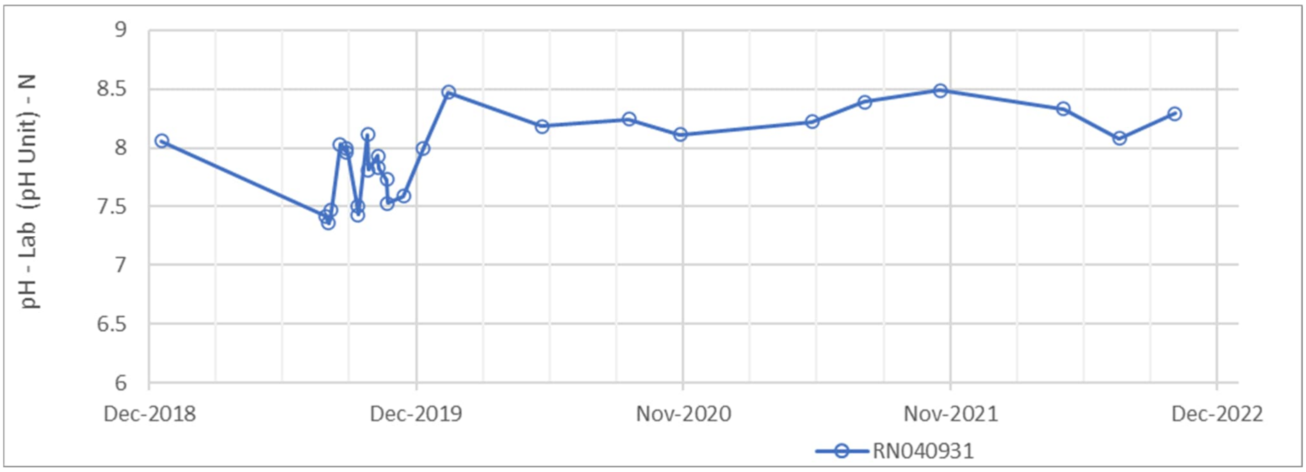

Jibera South
Strontium (mg/L) - T
1.5
1.2
0.9
0.6
0.3
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040937
RN040938

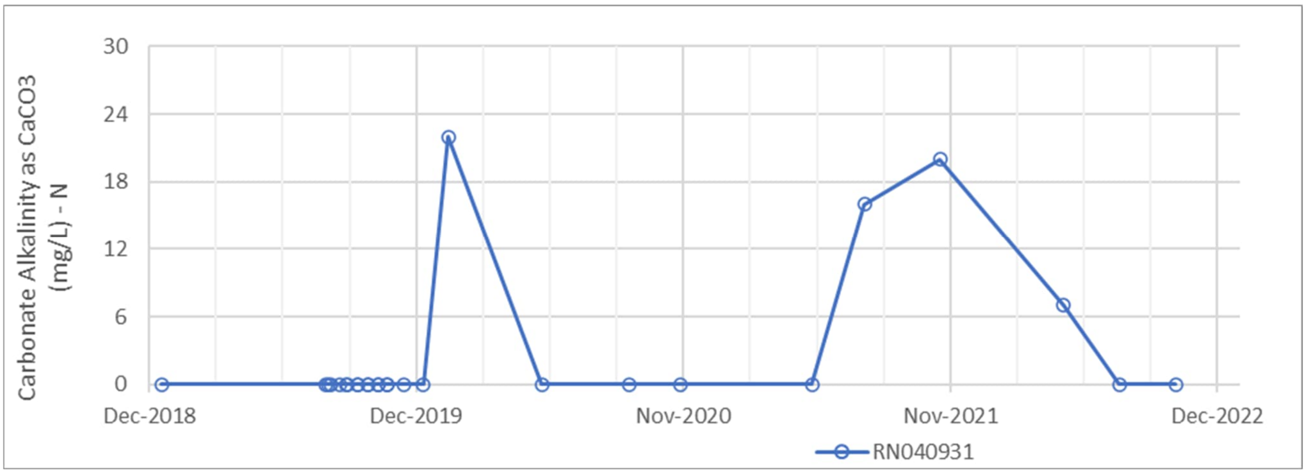

Inacumba
Strontium (mg/L) - T
1.5
1.2
0.9
0.6
0.3
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931
RN041242

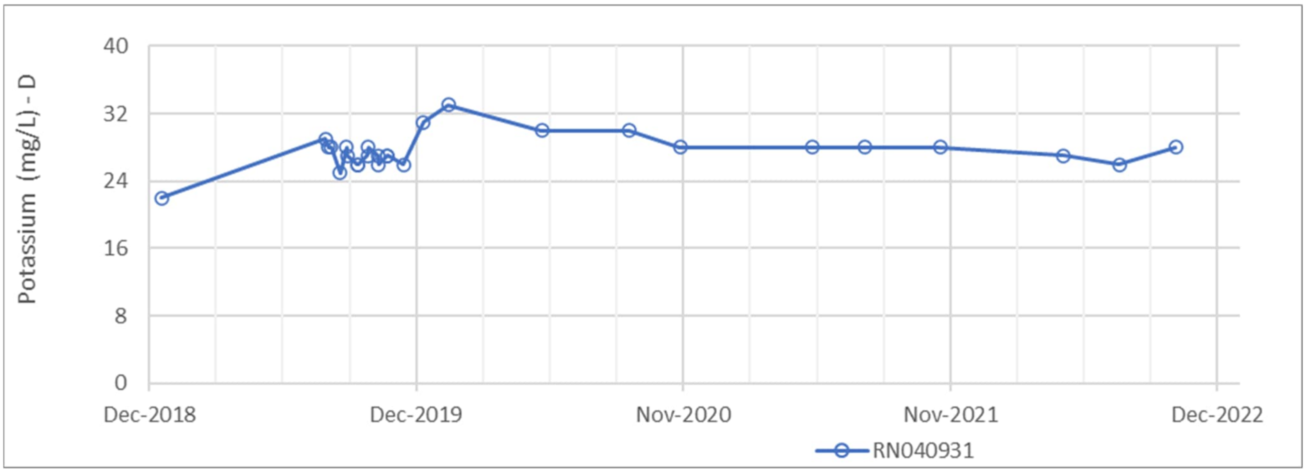

Inacumba South
Strontium (mg/L) - T
1.5
1.2
0.9
0.6
0.3
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040932

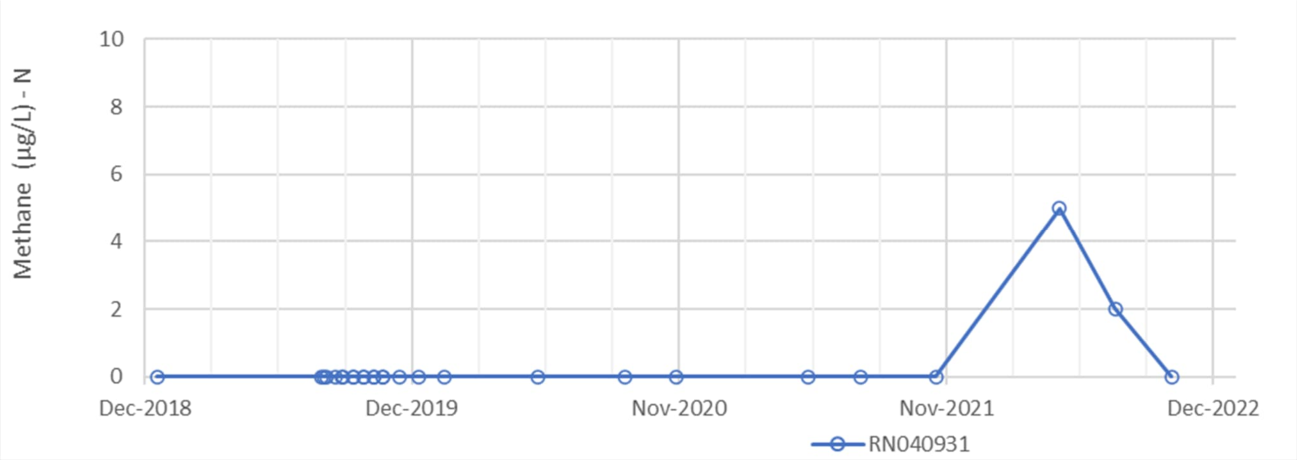
Attachment C – Inacumba Timeseries Chemistry Charts

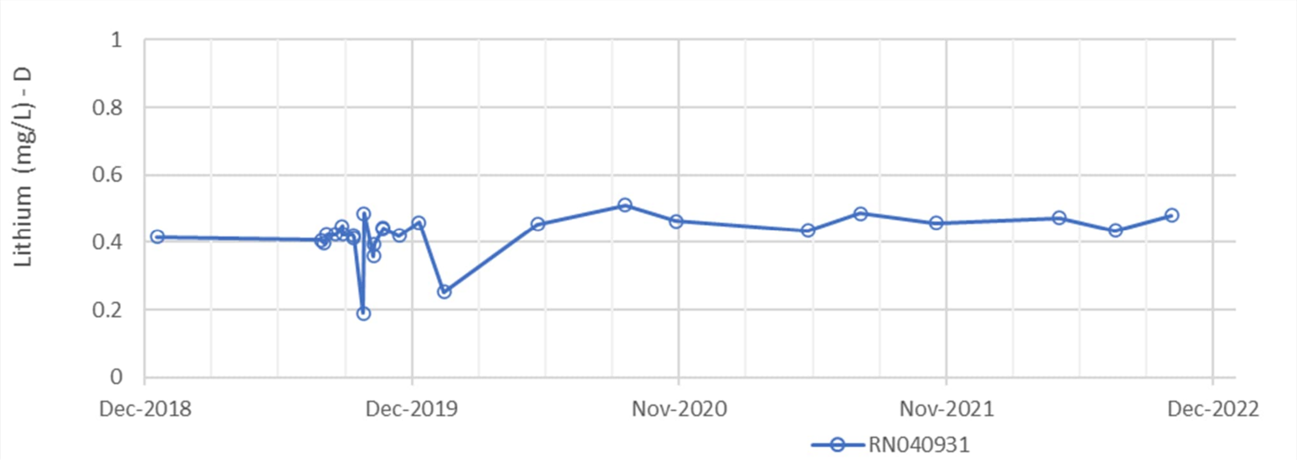

pH - Field (pH Unit) - N
9
8.5
8
7.5
7
6.5
6
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931

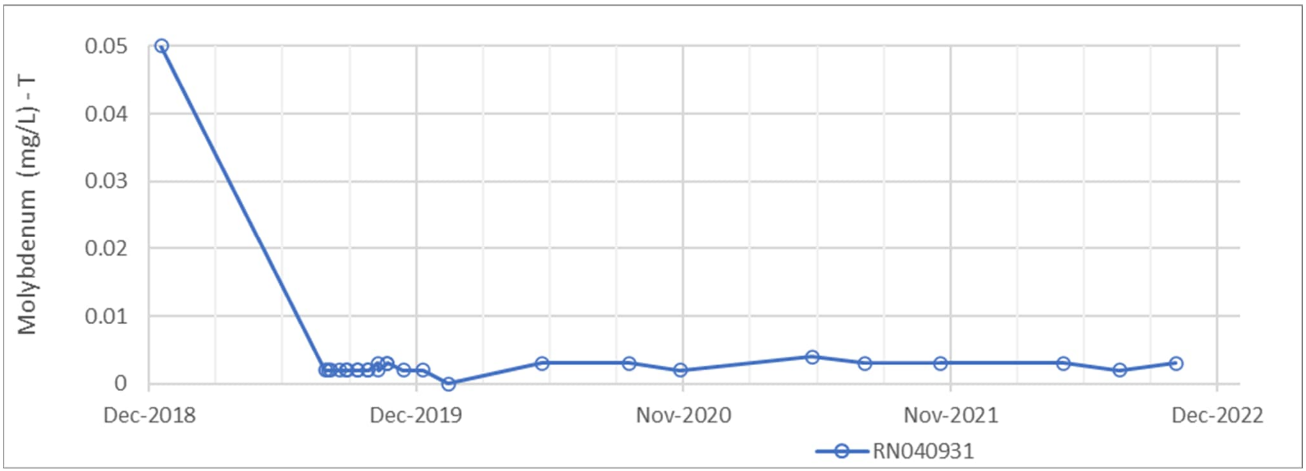

pH - Lab (pH Unit) - N
9
8.5
8
7.5
7
6.5
6
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931

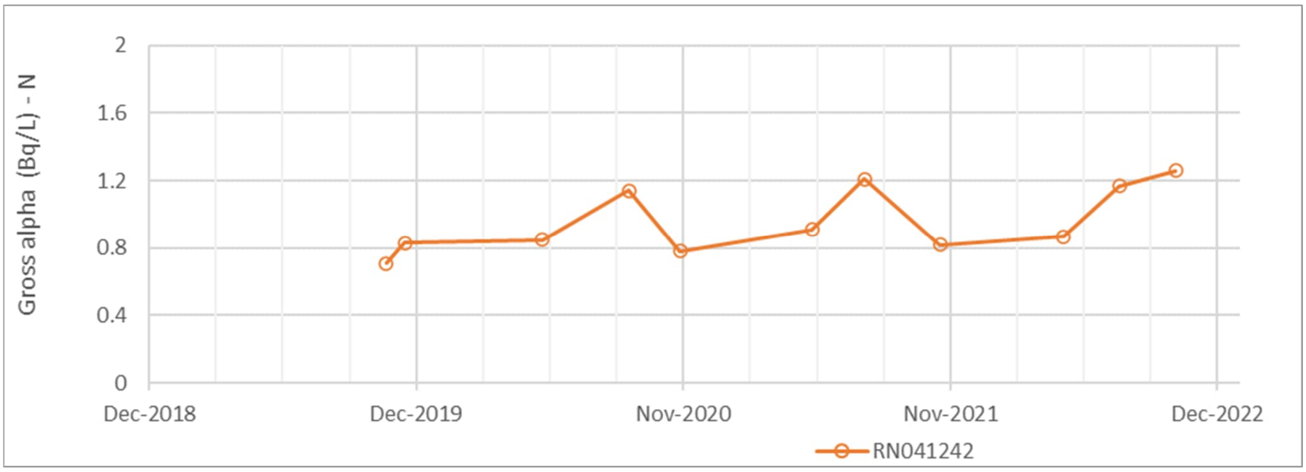

Carbonate Alkalinity as CaCO3 (mg/L) - N
30
24
18
12
6
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931

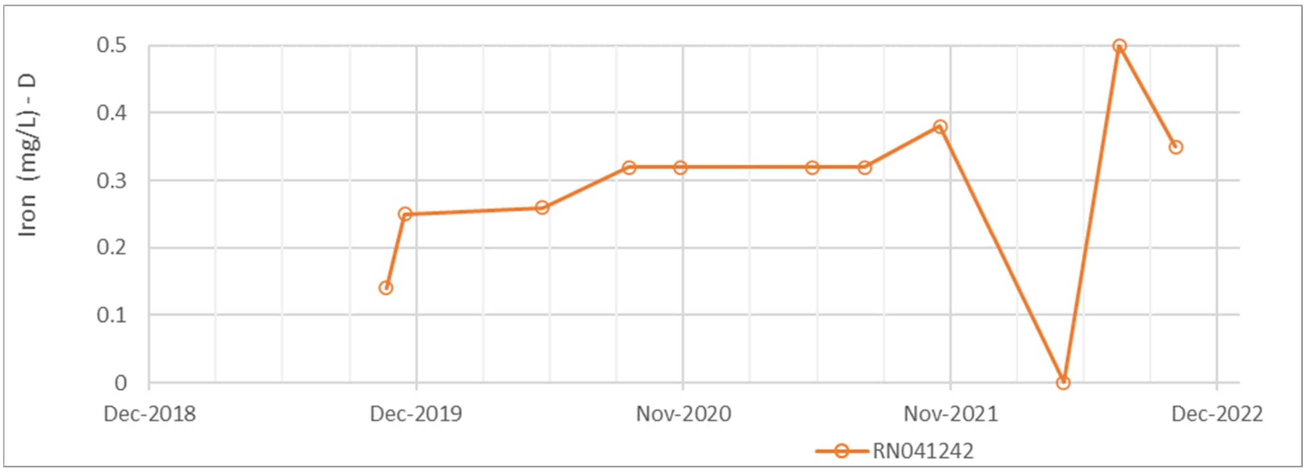

Potassium (mg/L) - D
40
32
24
16
8
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931

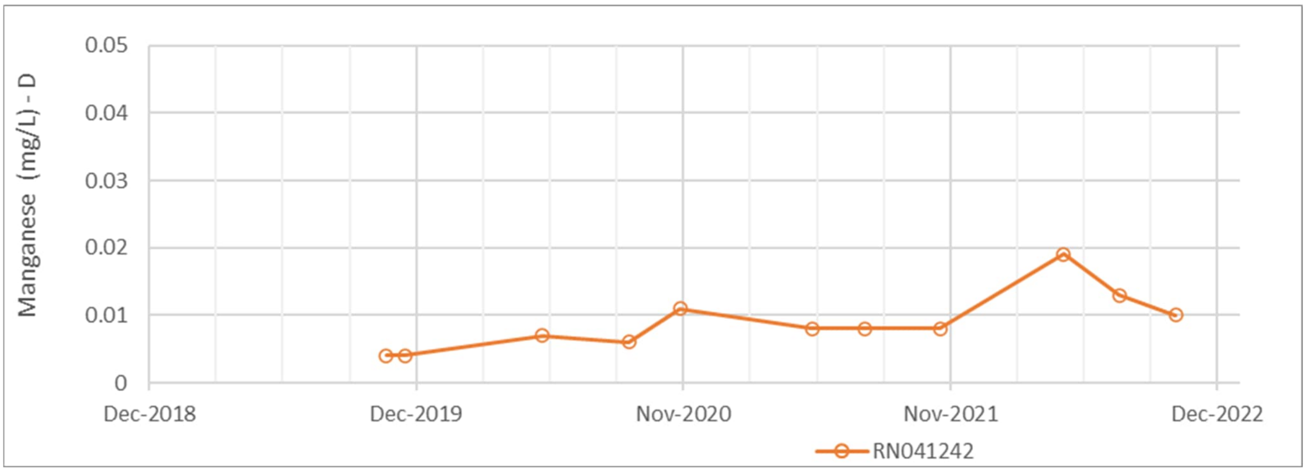

Methane (µg/L) - N
10
8
6
4
2
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931

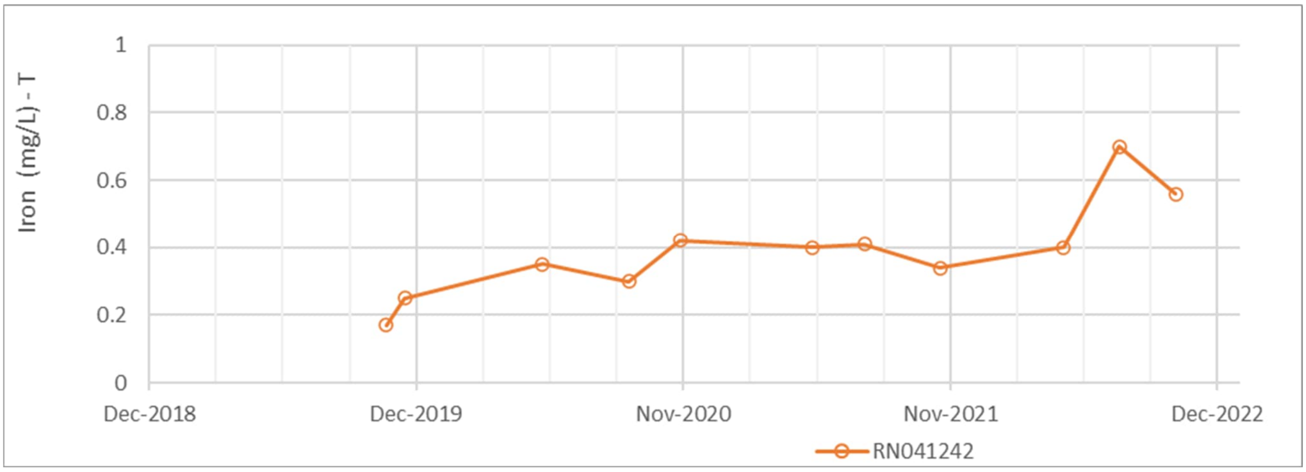

Lithium (mg/L) - D
1
0.8
0.6
0.4
0.2
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931

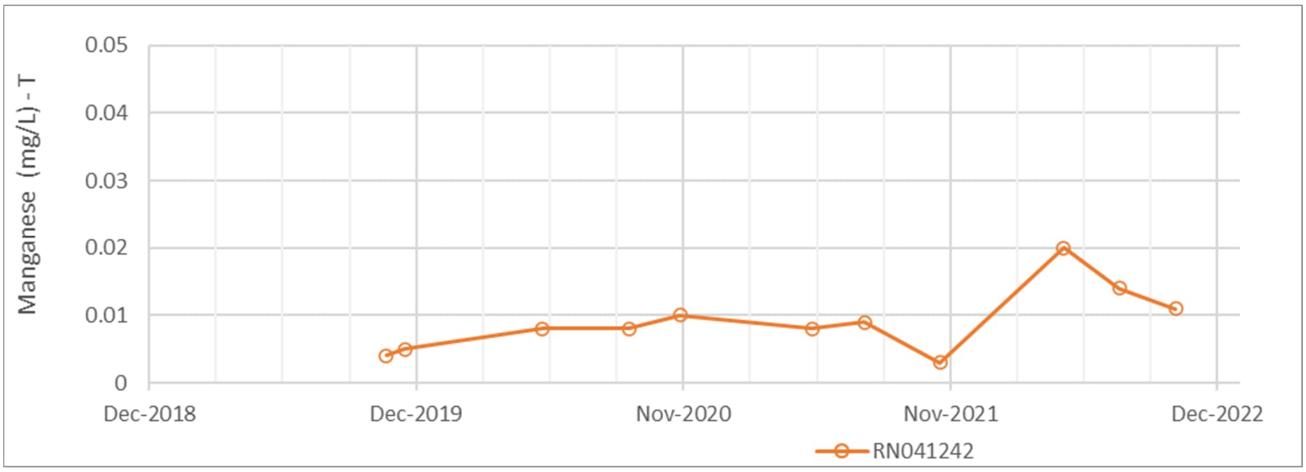

Molybdenum (mg/L) - T
0.05
0.04
0.03
0.02
0.01
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN040931


Gross alpha (Bq/L) - N
2
1.6
1.2
0.8
0.4
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN041242


Iron (mg/L) - D
0.5
0.4
0.3
0.2
0.1
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN041242


Manganese (mg/L) - D
0.05
0.04
0.03
0.02
0.01
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN041242


Iron (mg/L) - T
1
0.8
0.6
0.4
0.2
0
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN041242


0.05
0.04
0.03
0.02
0.01
0
Manganese (mg/L) - T
Dec-2018
Dec-2019
Nov-2020
Nov-2021
Dec-2022
RN041242