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SIX MONTHLY SUBSIDENCE IMPACT REPORT

Tahmoor South Domain Longwalls South 1A – South 6A

18 October 2022 – 31 December 2022

Report 1 – March 2023

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Document Control

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Executive Summary

This report is the first six-monthly report to be submitted since the commencement of extraction in the Tahmoor South Domain, in accordance with the requirements of the Longwall South 1A to South 6A (LW S1A-S6A) Extraction Plan.

Extraction of coal from Longwall South 1A (LW S1A) commenced on 18 October 2022 and 536.5 m of LW S1A had been extracted by 31 December 2022. The reporting period of this report is from 18 October 2022 (commencement of extraction in Tahmoor South Domain) to 31 December 2022.

During the reporting period, the maximum observed vertical subsidence relating to the extraction of LW S1A was 200 mm recorded at the GNSS unit Site S01.

During the reporting period, there was five (5) environmental aspects that were associated with a TARP triggers. These TARP triggers are summarised below:

- Surface Water Level TARP (WMP3) – Level 1 triggered at monitoring site TT9 due to decline in recorded water level by greater than 10 cm below the recorded baseline minimum level for the period 27 to 30 December 2022. This trigger was considered to be related to the prevailing climatic conditions and likely unrelated to mining influences. Water level monitoring will continue in accordance with the LW S1A-S6A Water Management Plan; and
- Multiple triggers of groundwater TARPs WMP9, WMP10, WMP11 and WMP13 during the reporting period. Upon review of these TARP triggers, it was apparent that a revision of the TARPs in question was required as some parameters were too sensitive, resulting in triggers from typical short term fluctuations in parameters rather than trends indicating potential environmental consequences from longwall extraction. Following the revision of the TARPs, a re-assessment of the groundwater data against the TARPs noted that there were no residual TARP triggers for this reporting period. The LW S1A-S6A Water Management Plan and associated documents will be updated to reflect the revised groundwater TARPs, and submitted to DPE via the Planning Portal.

During the reporting period, there were no exceedances of environmental performance measures or indicators, as adopted from Condition C1 and Condition C5 of SSD 8445.

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1 Introduction

1.1 Background

Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates the Tahmoor Mine, an existing underground coal mine located approximately 80 kilometres (km) south-west of Sydney in the Southern Coalfields of New South Wales (NSW) (refer to **Figure 1-1**). The mine has previously extracted longwalls to the north and west of the surface facilities and has been operating continuously since 1979 when coal was first mined using bord and pillar mining methods, followed by longwall mining methods since 1987.

Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Extracted coal is processed on site at the coal handling and preparation plant (CHPP) and coal clearance facilities prior to transportation via rail to Port Kembla and Newcastle for Australian domestic and export customers.

In April 2021, Tahmoor Coal received Development Application Approval (SSD 8445) from NSW Department of Planning and Environment (DPE, formerly NSW Department of Planning, Industry and Environment (DPIE)) for the Tahmoor South Domain using existing surface infrastructure and extension of underground longwall mining to the south of existing workings. The approval allows the extraction of up to 4 Mtpa of ROM coal, with a total of up to around 33 Mt of ROM coal proposed to be extracted over a 10-year period.

In addition to the SSD 8445 approval Tahmoor Coal also received conditions of approval (EPBC 2017/8084) under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) in October 2021.

The Tahmoor South Domain is located south of the Bargo River and east of Remembrance Driveway and the township of Bargo. Longwall mining would be used to extract coal from the Bulli coal seam within the bounds of Consolidated Coal Lease (CCL) 716 and CCL 747. Twelve longwalls are proposed in this domain which are divided into a series of six northern (A series) and six southern (B series) longwalls. The A series, Longwalls South 1A to South 6A (LW S1A-S6A), were the focus of the LW S1A-S6A Extraction Plan, for which approval was granted on 20 September 2022. The Study Area for this extraction plan is provided in **Figure 1-2**.

Extraction of coal from Longwall South 1A (LW S1A) commenced on 18 October 2022 and 536.5 m of LW S1A had been extracted by 31 December 2022.

1.2 Purpose

1.2.1 Six-Monthly Subsidence Impact Report Requirements

The purpose of this report is to address the requirements for six-monthly reporting on impacts and environmental monitoring results associated with the extraction of LW S1A-S6A. These requirements are outlined in Section 7.1.1 of the LW S1A-S6A Extraction Plan, which are derived from the Section 6 of the DPE *Draft Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015). It is noted that an updated version of the Guidelines was published in October 2022.

This report provides a summary of subsidence and environment monitoring results, subsidence impacts and management actions undertaken during the reporting period. The reporting period for this report is defined in **Section 1.3**.

Reporting requirements are listed in **Table 1-1** below, together with the cross-reference where the requirements are addressed in this report.

Table 1-1 Six Monthly Subsidence Impact Report Requirements

Requirement No.	Requirement Description	Section Addressed
Reporting Requirements as per Section 7.1.1 of the LW S1A-S6A Extraction Plan		
1	A comprehensive summary of all impacts, including a revised characterisation according to the relevant TARP(s);	Section 3.1
2	Any proposed actions resulting from triggers being met in the TARP, or other actions;	Section 3.2
3	An assessment of compliance with all relevant performance measures and indicators; and	Section 4
4	A comprehensive summary of all quantitative and qualitative environmental monitoring results, including landscape monitoring, water quality data, water flow and level data, piezometer readings.	Section 2

This report will be distributed to the stakeholders listed in **Section 5.4**.

1.2.2 Annual Review Requirements

An Annual Review for Tahmoor Mine operations during the previous calendar year is required in accordance with Condition E13 (SSD 8445) and is submitted by 31 March annually to Department of Planning and Environment and other stakeholders, as well as upload to the Tahmoor Coal Website. This Six-Monthly Subsidence Impact Report assists with the completion of the 2022 Annual Review and will be included as an appendix to the Annual Review.

The Annual Review will address compliance with Condition 22 of the EPBC Act (EPBC 2017/8084) approval, which requires the submission of an Annual Compliance Report to the Department by 31 March of each year (in accordance with email confirmation received on 16 June 2022).

1.3 Scope

1.3.1 Reporting Period

This report is the first six-monthly report to be submitted since the commencement of extraction of LW S1A, in accordance with the requirements of the LW S1A-S6A Extraction Plan. The reporting period of this report is from 18 October 2022 to 31 December 2022, and covers subsidence impacts observed during the extraction of LW S1A.

Table 1-2 summarises the monitoring and reporting completed during the reporting period, as well as the timeframe of data reviewed for each monitoring component.

1.3.2 LW S1A-S6A Study Area

The Extraction Plan Study Area for LW S1A-S6A is defined as the surface area that is likely to be affected by the extraction of LW S1A-S6A from the Bulli Coal Seam. This Study Area has been calculated by combining the areas bound by the following limits:

- The predicted limit of vertical subsidence, taken as the 20 millimetre (mm) subsidence contour resulting from the extraction of LW S1A-S6A; and
- A 35^{o} angle of draw line from the limit of proposed extraction for LW S1A-S6A.

The Study Area is illustrated in **Figure 1-2**.

1.3.3 LW S1A-S6A Extraction Plan Context

The LW S1A-S6A Extraction Plan is part of the Tahmoor Coal Environmental Management Structure, as illustrated in **Figure 1-3**.

As part of the LW S1A-S6A Extraction Plan, a set of management plans was prepared to manage particular environment or built features with the LW S1A-S6A Study Area, which consisted of the following:

- Water Management Plan;
- Land Management Plan;
- Biodiversity Management Plan;
- Heritage Management Plan;
- Built Features Management Plan, with a number of sub-plans to manage potential environmental consequences to infrastructure and specific building structures as a result of secondary extraction; and
- Public Safety Management Plan.

The overall framework for subsidence monitoring and management of impacts of the LW S1A-S6A Extraction Plan is provided in the relevant Subsidence Monitoring Programs. Monitoring of environmental and built features has been completed by Tahmoor Coal in accordance with management plans listed above.

It is noted that the management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan.

Table 1-2 Monitoring and Reports Reviewed for this Reporting Period

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Subsidence Monitoring Program	Subsidence	General subsidence	• SMEC • Building Inspection Service	• Mine Subsidence Engineering Consultants (MSEC)	• Weekly reports during mining	Appendix A (referenced reports only)
Water Management Plan	Surface Water	Streamflow	• ALS • SMEC	• ATC Williams	• Quarterly report for 18 October 2022 to 31 December 2022.	Appendix B
		Pool water level				
		Stream water quality				
		Physical features and natural behaviour of pools and reaches	• Brienan Environment and Safety	• Brienan Environment and Safety	• Monthly reports during mining	Available on request
		Morphology and channel stability				
	Groundwater	Groundwater quality	• CES	• SLR	• Quarterly report for 18 October 2022 to 31 December 2022.	Appendix C
		Groundwater bore level at open standpipes and private bores				
		Shallow groundwater pressures				
		Deep groundwater pressures				
		Groundwater level and quality at Thirlmere Lakes	• NSW Government			
		Groundwater Inflow	• Tahmoor Coal			

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Land Management Plan	Landscape	Cliffs Natural Steep Slopes Farm Dams	• Douglas Partners	• Douglas Partners	• Monthly reports for all geotechnical features during mining.	Available on request
		Farm Dams	• Building Inspection Service (BIS)	• BIS	• Weekly dam inspection and reports for dams with active subsidence.	Available on request
	Agricultural Land	Agricultural Land	• SMEC • BIS	• MSEC	• Weekly inspections along local roads – completed as part of roads survey.	Appendix A (referenced reports only)
			• SLR	• SLR	• Visual inspections at the completion of each longwall – not required during this reporting period.	Not applicable
Biodiversity Management Plan	Aquatic Ecology	Macroinvertebrates	• Niche	• Niche	• Aquatic Ecology Monitoring Report for Spring 2022 (November 2022)	Available on request
	Terrestrial Ecology	Amphibians, riparian vegetation, threatened flora and fauna, Threatened Ecological Communities	• Niche	• Niche	• Terrestrial Ecology Monitoring Report for Spring 2022 (October and November 2022)	Available on request
Heritage Management Plan	Aboriginal heritage	Teatree Hollow 2013.1	• SMEC	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
			• BIS	• BIS	• Monthly inspection and reporting (alternate to Douglas Partners) during period of active subsidence for LW S1A, S2A, S3A and S4A.	Available on request
			• Douglas Partners	• Douglas Partners	• Monthly inspection and reporting (alternate to Douglas Partners) during period of active subsidence for LW S1A, S2A, S3A and S4A.	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S1A, S2A, S3A and S4A – not required during this reporting period.	Not Required.

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Heritage Management Plan	Historical heritage	Picton Weir Great Southern Road (partial)	• SMEC • BIS	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
		Bargo Cemetery	• SMEC • BIS	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
			• EMM	• EMM	• Visual inspections at the completion of LW S6A – not required during this reporting period.	Not Required.
		Wirrimbirra Sanctuary (Australian Wildlife Sanctuary)	• SMEC	• MSEC	• AWS Subsidence Status Reports (weekly).	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S5A – not required during this reporting period.	Not Required.
		Tahmoor Colliery (Tahmoor Mine Site)	• SMEC • BIS	• MSEC	• Tahmoor Mine Site Status Reports (weekly) – none required during this monitoring period.	Not Required.
		Bargo Railway Bridge North (Wellers Road Overbridge)	• SMEC • Southern rail Services • Bloor Rail • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction (one prepared covering the reporting period).	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S6A – not required during this reporting period.	Not Required.
		Bargo Railway Viaduct	• SMEC • Southern rail Services • Bloor Rail • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction (one prepared covering the reporting period).	Available on request
			• EMM	• EMM	• Visual inspections at the completion of LW S6A – not required during this reporting period.	Not Required.

Management Plan	Aspect	Feature	Monitoring Completed By	Monitoring Reported by	Monitoring Reports Completed during this Reporting Period	Reference
Built Features Management Plan	Built Features	Local roads, bridges and culverts	• SMEC • BIS • Comms Network Solutions	• MSEC	• Weekly reports during mining.	Appendix A (referenced reports only)
		Potable Water Infrastructure				
		Sewerage Infrastructure				
		Gas Infrastructure				
		Electricity Infrastructure				
		Telecommunications Infrastructure				
		Residential structures				
		Structures for public amenity, commercial, industrial and agricultural purposes				
		Picton Weir				
		Main Southern Railway (MSR)	• SMEC • Southern rail Services • Bloor Rail • Newcastle Geotech	• MSEC	• MSR Weekly Status Reports during extraction (one prepared covering the reporting period)	Available on request
		Tahmoor Mine Site	• SMEC • BIS	• MSEC	• Tahmoor Mine Site Status Reports (weekly) – none required during this monitoring period.	Not Required.
		Australian Wildlife Sanctuary (AWS)	• SMEC	• MSEC	• AWS Subsidence Status Reports (weekly)	Available on request

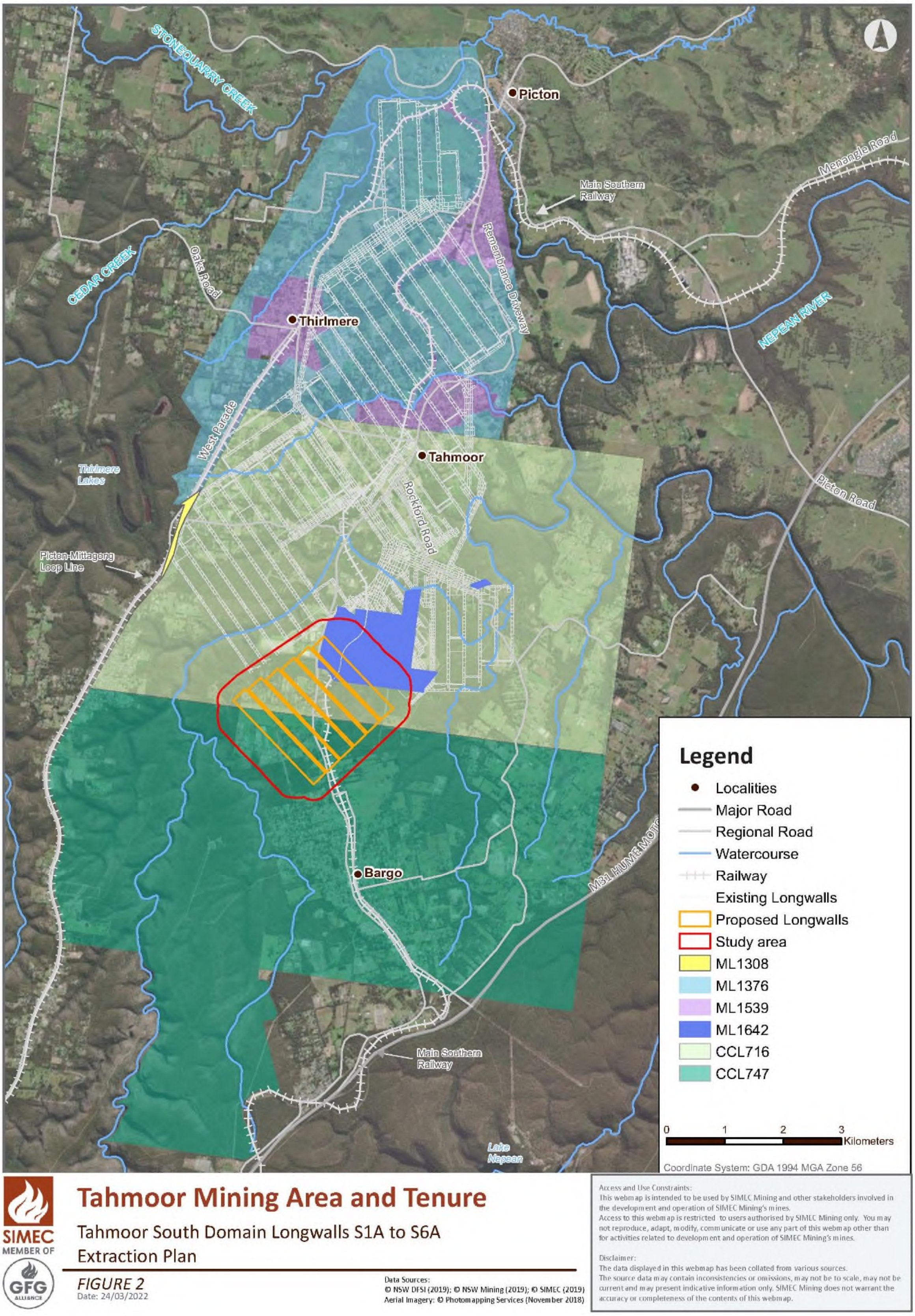

Figure 1-1 Tahmoor Mine Area and Tenure (source: LW S1A-S6A Extraction Plan)

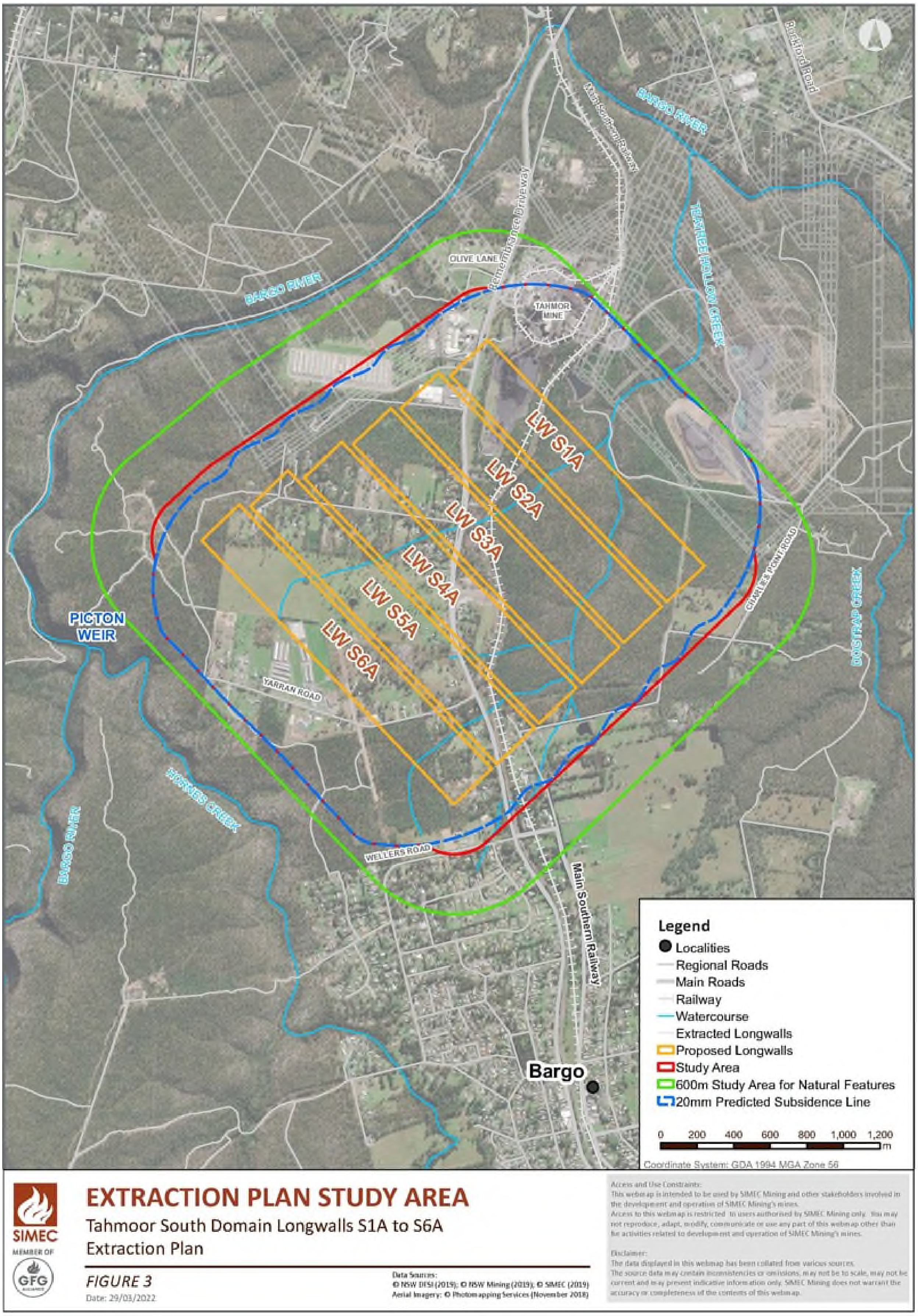

Figure 1-2 LW S1A-S6A Extraction Plan Study Area (source: LW S1A-S6A Extraction Plan)

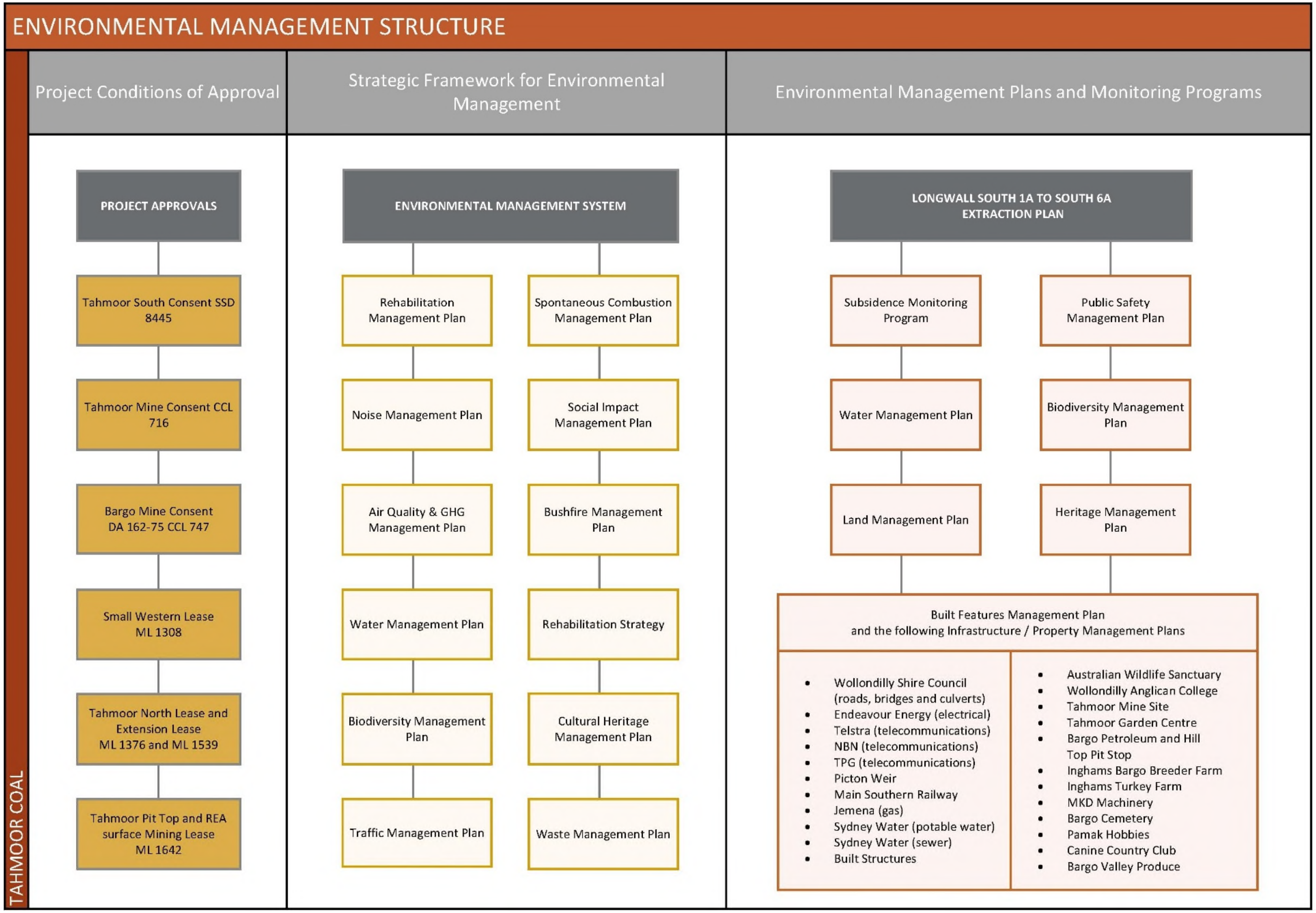

Figure 1-3 Overview of Environmental Management Structure for Tahmoor Coal (source: LW S1A-S6A Extraction Plan)

2 Summary of Environmental Monitoring Results

2.1 Subsidence Monitoring

During the reporting period, the LW S1A-S6A Subsidence Monitoring Program have been implemented to monitor subsidence impacts within the Study Area. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-1**. The Subsidence Monitoring Program includes twenty (20) Global Navigation Satellite System (GNSS) units measuring absolute horizontal and vertical positions in real time installed directly above and adjacent to LW S1A-S6A.

A summary of all surveys and inspections completed during the reporting period is provided in MSEC1304 LW S1A Subsidence Monitoring Report 7 (refer **Appendix A**). A weekly review of the subsidence survey results was completed by Tahmoor Coal and MSEC during the extraction period.

Extraction of LW S1A commenced on 18 October 2022 and 536.5 m of LW S1A had been extracted by 31 December 2022.

Table 2-1 summarises the maximum observed ground movements within the active subsidence zone at the start and end of this reporting period. During the reporting period, a maximum of 200 mm of vertical subsidence relating to the extraction of LW S1A was recorded at the GNSS unit Site S01.

Table 2-1 Subsidence Monitoring Observations for the start and end of this Reporting Period (source: MSEC report, Appendix A)

	MSEC1304 LW S1A Subsidence Monitoring Report 7	
Monitoring Period	26 December 2022 to 1 January 2023	
Progress of extraction	LW S1A extraction - 545 metres on 1 January 2023	
Observed Ground Movement Parameters	**Maximum Observed Total**	**Location**
Subsidence (mm)	200	GNSS unit Site S01
Tilt (mm/m)	0.1	V-Line & Charlies Point Road
Hogging Curvature (km^{-1})	0.01	Charlies Point Road
Sagging Curvature (km^{-1})	-0.01	V-Line & Charlies Point Road
Tensile Strain (mm/m)	0.3	Charlies Point Road
Compressive Strain (mm/m)	0.3	Charlies Point Road

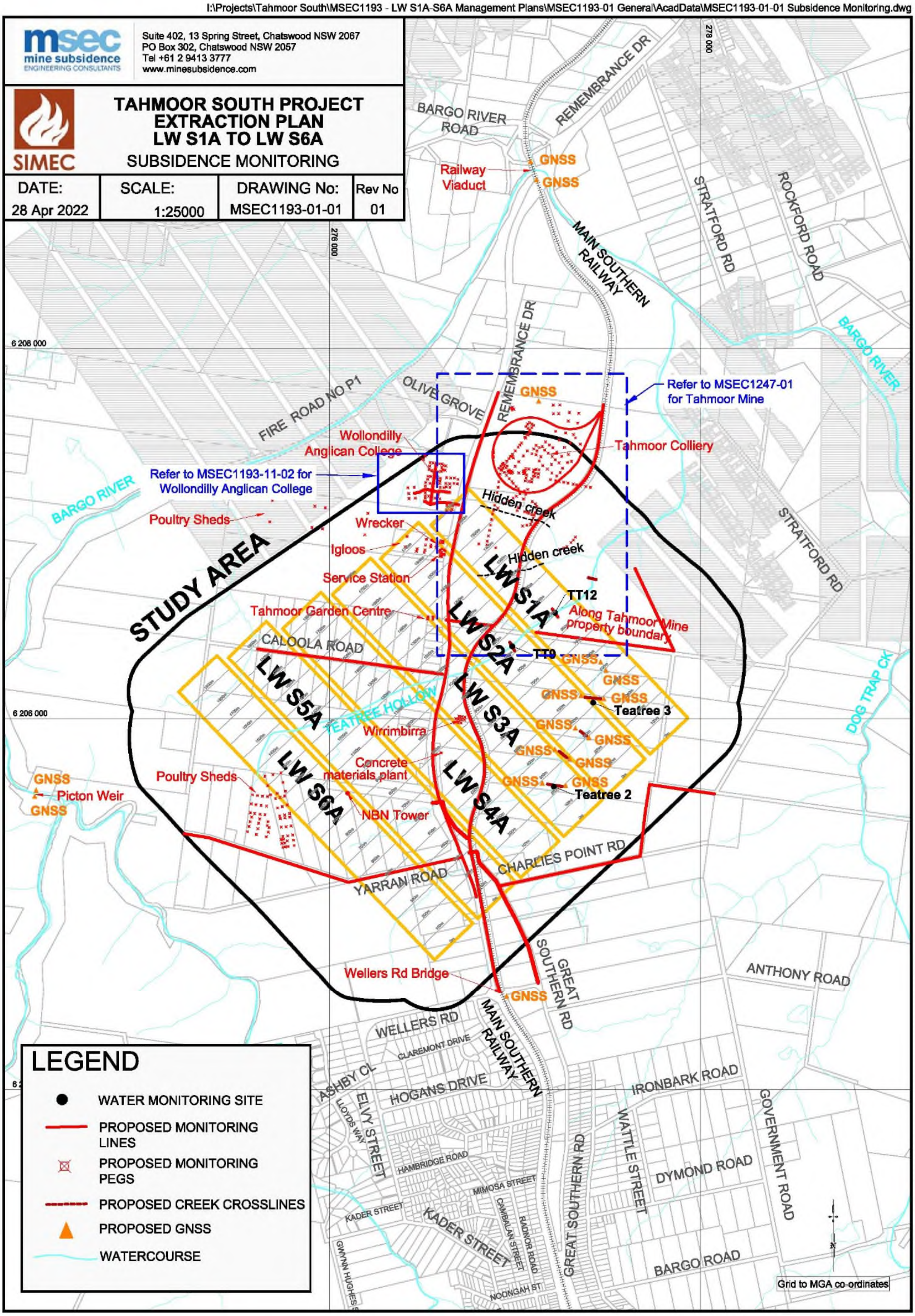

Figure 2-1 LW S1A-S6A Subsidence Monitoring Program (source: LW S1A-S6A Subsidence Monitoring Program)

2.1.1 Ground Survey Results

Monthly survey of pegs along the Tahmoor Mine Boundary Survey Line (V Line) has commenced, with very minor changes observed from the survey completed on 12 December 2022.

2.1.2 GNSS Unit Results

The development of subsidence at the two GNSS units (Sites S01 and S02) above the commencing end and along the centreline of LW S1A are illustrated in **Figure 2-2**. This figure shows that mining-induced movements are developing at the GNSS units, with maximum measured subsidence of approximately 200 mm. Subsidence is currently developing within the predictions, with magnitude of subsidence similar to observed above previously extracted Longwall 22. In comparison, observed subsidence above previously extracted first panel LW West 1 was substantially less than prediction.

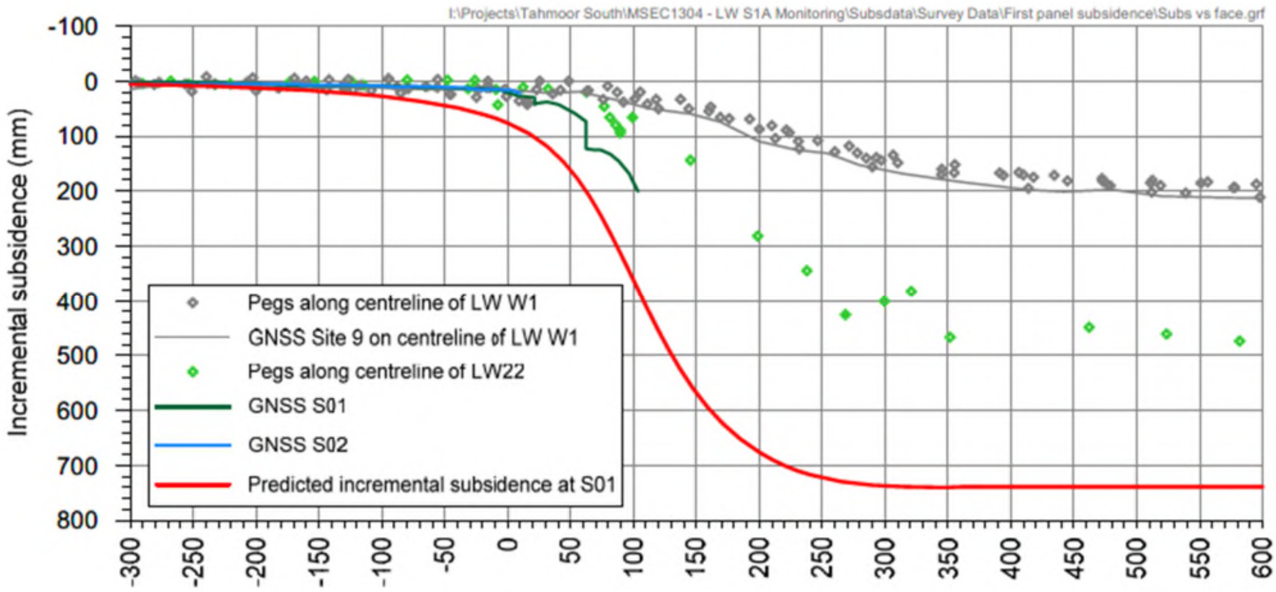

Figure 2-2 Development of observed subsidence along LW S1A (source: MSEC, Subsidence Monitoring Report 7, Appendix A)

Changes in horizontal distances between paired GNSS units that are stationed close together on opposite sides of Teatree Hollow and Teatree Hollow Tributary (also known as 'Wirrimbirra Creek') are illustrated in **Figure 2-3**. This figure shows that small changes are developing between Sites 01 and 02, and Sites 03 and 04 across Wirrimbirra Creek. Minor changes are also currently observed between other pairs of GNSS units.

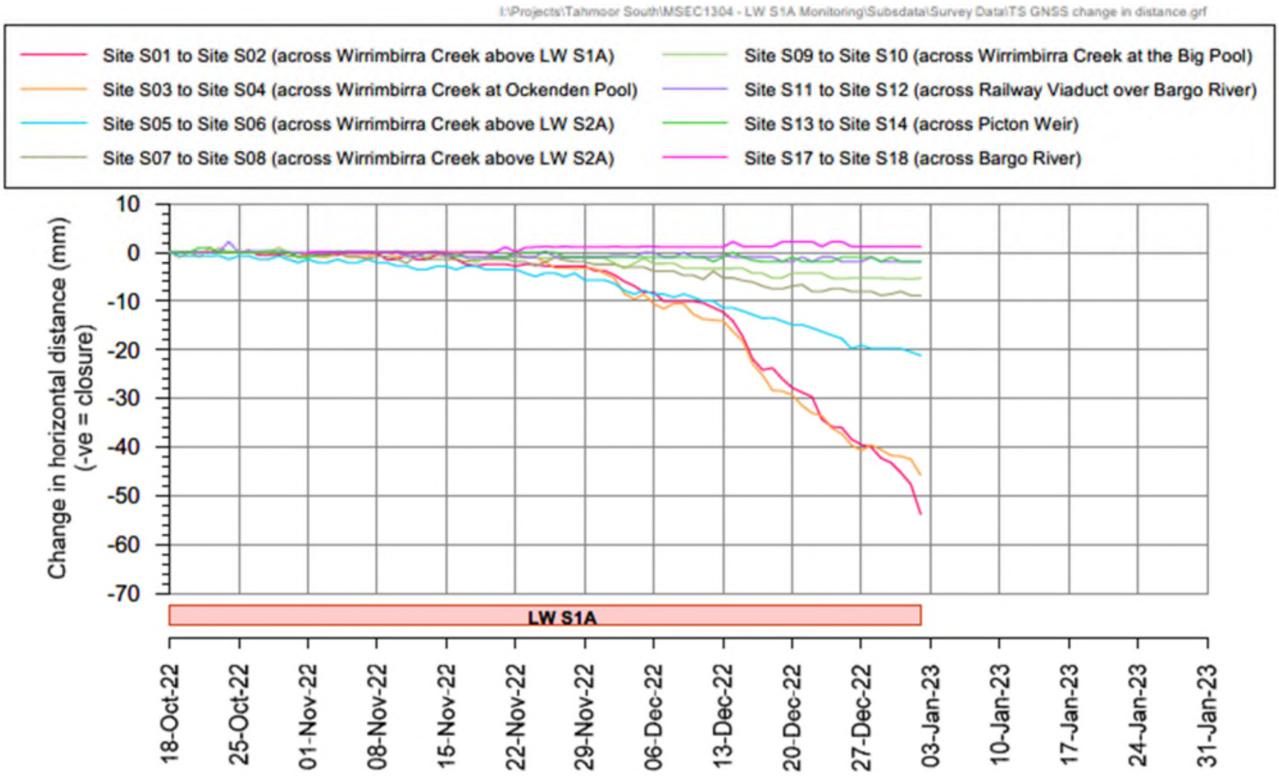

Figure 2-3 Observed changes in horizontal distances between GNSS units during LW S1A extraction (source: MSEC, Subsidence Monitoring Report 7, Appendix A).

2.2 Surface Water Monitoring

The LW S1A-S6A Water Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on surface water in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Water Management Plan has been implemented to monitor surface water:

- Flow, pool water level and surface water quality monitored for Teatree Hollow, Teatree Hollow tributary (‘Wirrimbirra Creek’), Bargo River, and Bargo River Tributary – monthly monitoring data reviewed and reported by ATC Williams on a monthly basis (refer to **Appendix B**); and
- Creek monitoring for physical features and natural behaviour of pools, as well as channel stability, sedimentation and erosion – visual inspections and reporting by Brienan Environment and Safety completed on a monthly basis (reports available on request).

The following sections summarise the observations made during the reporting period for each surface water category. Performance against all Surface Water Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2**.

2.2.1 Pool Water Level

Surface water level data has been recorded at the pool monitoring sites on Teatree Hollow, Teatree Hollow Tributary (also known as Wirrimbirra Creek), Bargo River, and Bargo River Tributary as shown in **Figure 2-5**. Continuous surface water level data and manual monthly water level measurements have been recorded at seven monitoring sites on Teatree Hollow (and tributary) and six monitoring sites on Bargo River (and tributary). Sites on Teatree Hollow and Bargo River are shown in **Figure 2-5**.

During the reporting period, water levels at monitoring sites on Teatree Hollow and Bargo River (and their tributaries) remained above baseline minimum levels, with the exception of:

- Monitoring site TT7 – the water level declined below the baseline minimum level from 23 December 2022, however remained above the trigger level;
- Monitoring site TT9 – the water level declined below the baseline minimum level from 23 November 2022 and below the trigger level from 27 to 30 December 2022 – refer to **Section 3.2.1** for further discussion;
- Monitoring site TT13 – the water level declined below the baseline minimum level from 22 December 2022, however remained above the trigger level;
- Monitoring site BR16 – the water level declined below the baseline minimum level from 10 to 30 December 2022;
- Monitoring site BR17 – the water level declined below the baseline minimum level from 6 to 30 December 2022, however remained above the trigger level; and
- Monitoring site BR18 – the water level declined below the baseline minimum level from 10 to 30 December 2022, however remained above the trigger level.

Charts illustrating monitored pool water level hydrographs for pools on Teatree Hollow and Bargo River (and their tributaries) are presented in the Surface Water Monitoring Report (refer to **Appendix B**).

2.2.2 Physical Features and Natural Behaviour

Visual and photographic surveys for subsidence impacts on creeks have been completed monthly for monitoring pools and reaches in Teatree Hollow and Teatree Hollow tributary within the active subsidence zone of LW S1A. The purpose of these surveys is to note whether change has occurred to pool level, drainage or overland flow, and to assist in determining if any change can be attributed to mining impacts. Surveys are carried out to identify rock bar and/or stream base cracking, changes in overland connected flow, gas release, turbidity or increased iron precipitation. Creek monitoring locations for physical features and natural behaviour are illustrated on **Figure 2-6**.

During this reporting period, there were no observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity, as compared with baseline conditions.

2.2.3 Channel Stability, Sedimentation and Erosion

Visual and photographic surveys for subsidence impacts on creeks have been completed monthly for morphology and channel stability monitoring site in Teatree Hollow and Teatree Hollow tributary within the active subsidence zone of LW S1A, with the exception of headwater sites which are completed on an annual basis. The purpose of these surveys is to note whether change has occurred to channel stability, erosion and sedimentation, and to assist in determining if any change can be attributed to mining impacts. Surveys are carried out to identify any visual changes in knickpoint development and channel morphology. Creek monitoring locations for channel stability, sedimentation and erosion are illustrated on **Figure 2-7**.

During this reporting period, only one channel morphology site, CM7, was located within the active subsidence zone of LW S1A. There was no observed increase in cracking or shearing, no reduction in overland connective flow and no additional iron seeps beyond what was identified during the baseline survey of CM7.

2.2.4 Surface Water Quality

Surface water quality data has been recorded at the following sites (refer to **Figure 2-5**):

- Teatree Hollow:
  - Reference site: TT1-QRLa;
  - Potential impact sites: TT2--QLa, TT3-QLa, TT7-QRLa, TT9-QLa, TT12-QLa, TT13-QLa, and TT14-QLa;
- Bargo River:
  - Reference site: BR16-QLa; and
  - Potential impact sites: BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR16-QLa, BR17-QLa and BR18-QLa.

Water quality data consisted of constituents which are considered to be primary indicators of mining includes. These constituents include pH, electrical conductivity (EC), and specific dissolved metals (aluminium, copper, iron, manganese, nickel and zinc).

A summary of observations for the reporting period is provided in **Table 2-2**. Charts illustrating water quality results for monitored pools in Teatree Hollow and Bargo River are presented in Appendix C of the Surface Water Review report (refer to **Appendix B**).

The water quality characteristics of monitoring sites following commencement of mining LW S1A have been largely consistent with baseline conditions and / or consistent with reference site conditions. During the reporting period, the following sites recorded an exceedance of the Site Specific Guideline Values (SSGVs) for specific constituents:

- TT7, TT12 and TT14 – exceedance for electrical conductivity in December 2022;
- TT7 – exceedance for dissolved aluminium in November and December 2022;
- TT14 – exceedance for dissolved aluminium in December 2022;
- BR12 – exceedance for dissolved iron in November and December 2022;
- BR13 – exceedance for dissolved iron in December 2022; and
- TT12 and TT14 – exceedance for dissolved iron in November 2022.

However, as the exceedances of SSGVs has not persisted for greater than three months, there is negligible evidence of an influence of mining LW S1A on surface water quality in Teatree Hollow or Bargo River (and their tributaries).

Table 2-2 Summary of Notable Results for Key Water Quality Parameters for the Reporting Period

Parameter	Bargo River	Teatree Hollow
pH	• Near neutral pH recorded at the majority of the sites. • Slightly acidic pH conditions recorded at BR6-QLa in November and December 2022 and at BR3-QLa in December 2022. • pH recorded at all sites generally consistent baseline conditions.	• Near neutral pH conditions for the majority of the sites. • Slightly acidic pH conditions recorded at TT1-QRLa, TT3-QRLa and TT9-QRLa in December 2022.
Electrical Conductivity	• Field EC values consistent with baseline values at all sites (less than 350 µS/cm at all sites).	• Field EC values consistent with baseline values at all sites for the duration of the review period. • Slight exceedance of SSGV recorded at TT7-QRLa, TT12-QLa and TT14-QLa in December 2022.

Parameter	Bargo River	Teatree Hollow
Dissolved Aluminium	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline concentrations. • Dissolved aluminium concentrations remained below the SSGV for BR12-QRLa and BR13-QRLa.	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline concentrations. • Slight exceedance of SSGV recorded at TT7-QRLa in November and December 2022. • Slight exceedance of SSGV recorded at TT14-QLa in December 2022.
Dissolved Copper	• Recorded dissolved copper concentrations were equal to or less than the limit of reporting at all sites for the duration of the review period.	• Recorded dissolved copper concentrations were equal to or less than the limit of reporting at all sites for the duration of the review period.
Dissolved Iron	• Dissolved iron concentrations recorded at all sites for the duration of the review period were within the range of baseline concentrations. • Dissolved iron concentrations recorded at BR12-QRLa exceeded the SSGV in November and December 2022. • Dissolved iron concentration recorded at BR13-QRLa exceeded the SSGV in December 2022.	• Dissolved iron concentrations recorded at all sites for the duration of the review period were within the range of baseline concentrations. • Dissolved iron concentration recorded at TT12-QLa slightly exceeded the SSGV in November 2022. • Dissolved iron concentration recorded at TT14-QLa slightly exceeded the SSGV in November 2022.
Dissolved Manganese	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline values.	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline values.
Dissolved Nickel	• Dissolved nickel concentrations recorded at all sites were consistent with baseline values.	• Dissolved nickel concentrations recorded at all sites were consistent with baseline values.
Dissolved Zinc	• Dissolved zinc concentrations recorded at all sites were consistent with baseline values.	• Dissolved zinc concentrations recorded at all sites were consistent with baseline values.

2.2.5 Recommendations and Actions

2.2.5.1 Current Surface Water Monitoring Recommendations

As discussed in the Surface Water Review for October to December 2022 (**Appendix B**), it is recommended that ongoing review of surface monitoring data is continued to be undertaken in accordance with the LW S1A-S6A Water Management Plan.

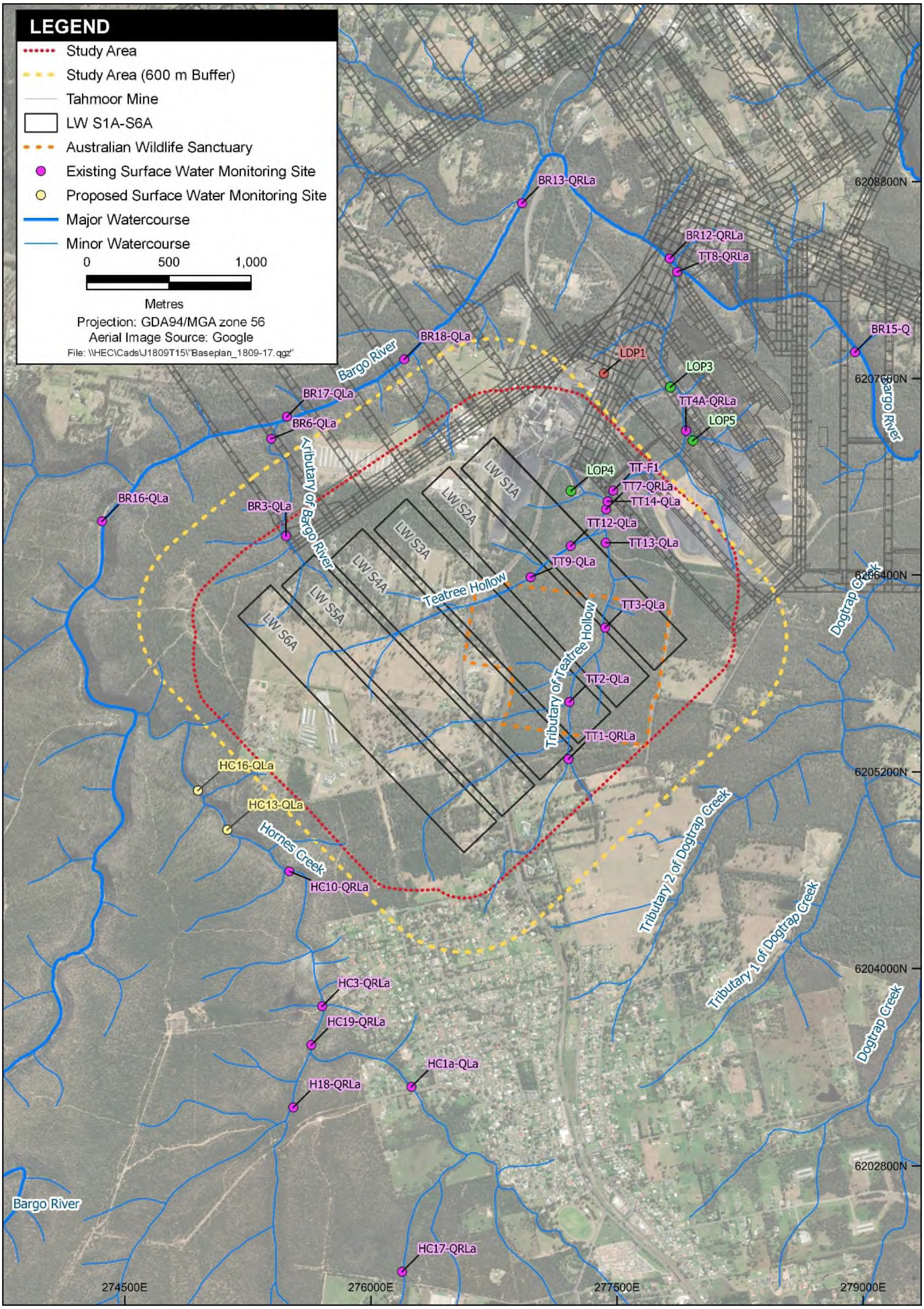

Figure 2-4 LW S1A-S6A Surface Water Monitoring Sites Specific to LW S1A-S6A (source: LW S1A-S6A Water Management Plan)

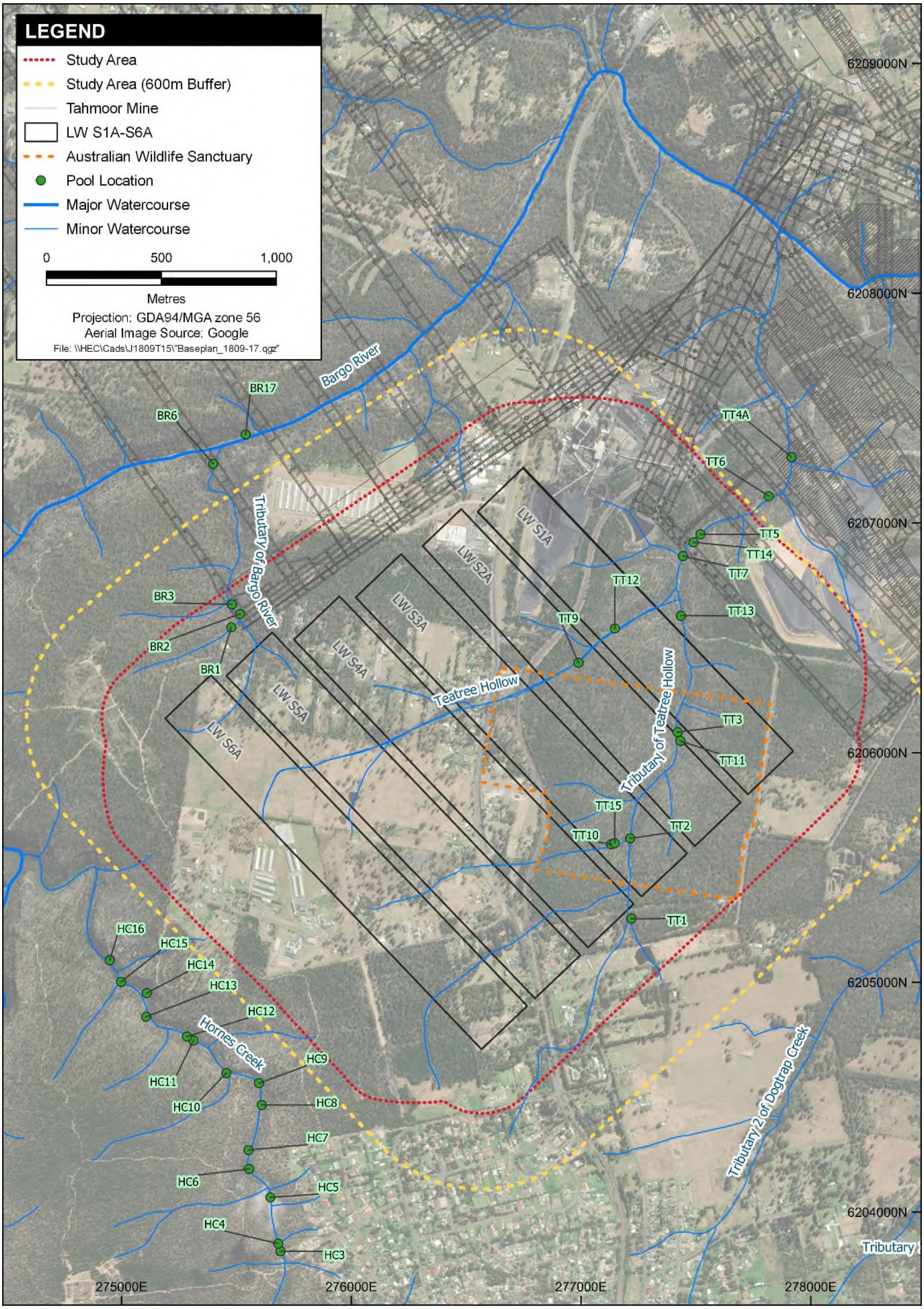

Figure 2-5 LW S1A-S6A Pool Visual Inspection Sites (source: LW S1A-S6A Water Management Plan)

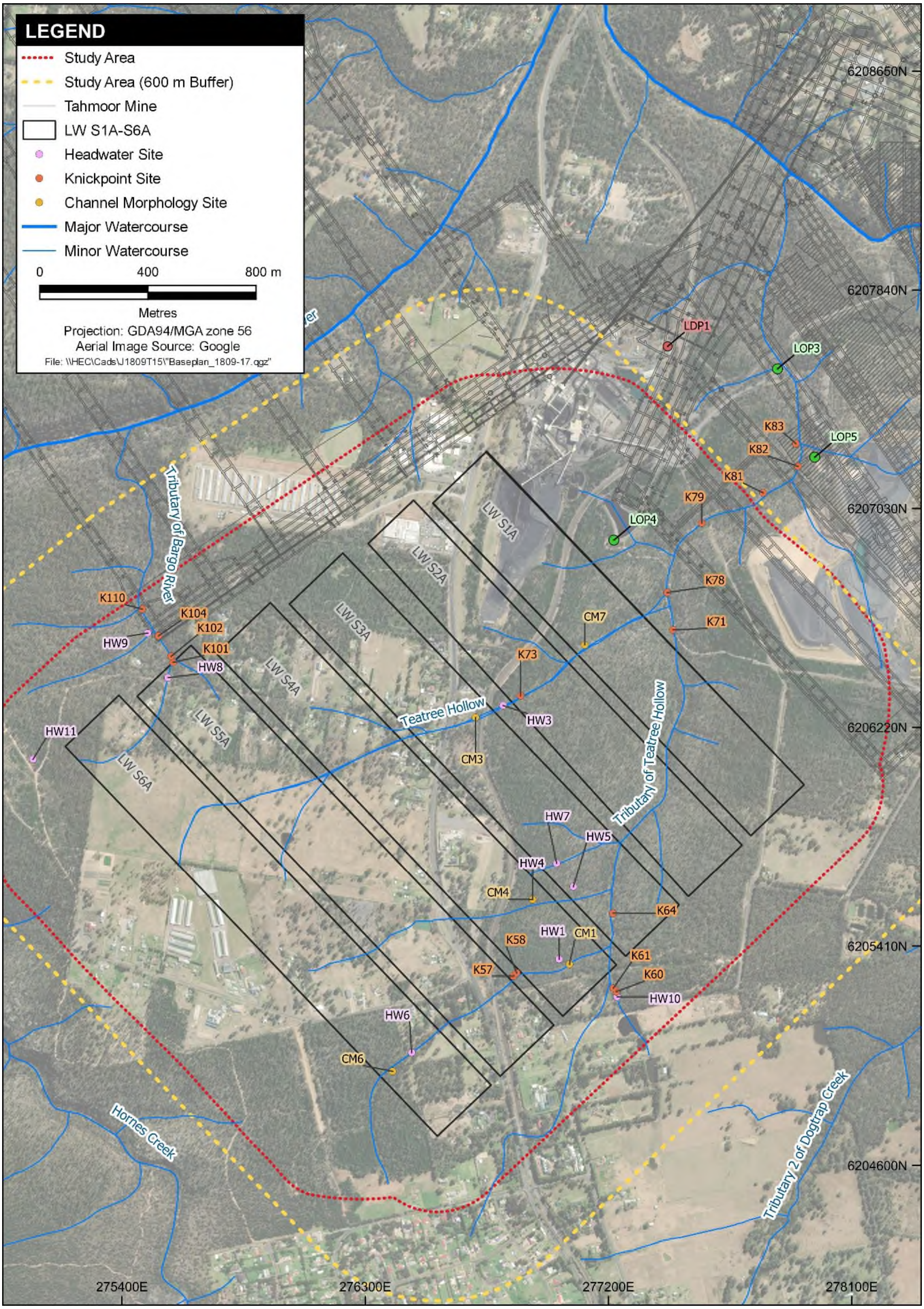

Figure 2-6 LW S1A-S6A Morphology and Channel Stability Monitoring Sites (source: LW S1A-S6A Water Management Plan)

2.3 Groundwater Monitoring

The LW S1A-S6A Water Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on groundwater in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Water Management Plan has been implemented to monitor groundwater:

- Shallow groundwater levels, quality and pressures, and deep groundwater levels / pressures – monthly monitoring data reviewed and reported by SLR on a monthly basis (reported in **Appendix C**); and
- Mine water intake – data for this reporting period reviewed and reported by SLR (refer to **Appendix C**).

The following sections summarise the observations made during the reporting period for each groundwater category. Performance against all Groundwater Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.3.1 Groundwater Bore Levels

The Tahmoor South Monitoring Network comprises both open standpipes (OSP) and Vibrating Wire Piezometers (VWPs). The standpipe piezometers can be used for monitoring water levels manually or with an automated datalogger (installed in 10 sites to date), as well as for collection of water samples for groundwater quality monitoring purposes. The VWPs are grouted and therefore can only be used for monitoring groundwater pressures, but do allow for multiple instruments to be installed at different depths within a single borehole.

Table 3 in the SLR Groundwater Report (**Appendix C**) summarises the Tahmoor South Groundwater Monitoring Network, and the locations of groundwater monitoring bores is provided in **Figure 2-7**.

Given it is only three months since commencement of extraction, it is difficult to characterise 'trends' in water levels, and as such a general discussion is provided without conclusions drawn to 'trends' in groundwater levels yet. Further, the climatic conditions experienced in 2022 were quite disparate from long-term average conditions which is likely to have impacted shallow groundwater levels. Further data is required to establish trends and attribute to extraction operations.

Further detail on groundwater level results, including graphs showing progressive groundwater levels, are provided in the SLR Groundwater Report (refer to **Appendix C**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.2**.

2.3.1.1 Shallow OSPs bores

Plots showing the groundwater levels in the Shallow OSPs are provided in the SLR Groundwater Report (**Appendix C**). P54a and P54b have been dry since commencement of groundwater monitoring.

There was some decline in groundwater levels observed in P55a, P55c and P56c in December 2022. However, given the below average rainfall experienced in November and December, and significantly higher than long-term average rainfall prior to this, the decline may be a response to these varying climatic conditions. Further data is required to establish a trend.

2.3.1.2 Private bores

Plots showing the groundwater levels in the private bores are provided in the SLR Groundwater Report (**Appendix C**). There was some decline in groundwater levels observed in GW104659 in December 2022. However, given the below average rainfall experienced in November and December, and significantly higher than long-term average rainfall prior to this, the decline may be a response to these varying climatic conditions. Further data is required to establish a trend.

2.3.1.3 Shallow VWPs (sensors <200 metres)

Groundwater pressures at TBC032 HBSS 131m declined by approximately 6 metres through November and December 2022 (refer to hydrographs provided in the SLR Groundwater Report in **Appendix C**). A depressurisation of 4 metres was observed over the same period in TBC 032 HBSS 95m. The two deepest sensors in TBC032 (BHCS 181m and BGSS 200m) also presented depressurisations of 5.8 and 5.5 metres respectively. Interestingly, the mid-point sensor, HBSS 168m recorded a depressurisation of approximately 2 metres over the same period.

Shallow sensors at site TBC027 recorded a groundwater depressurisation ranging from 1.3m to 2.6m during the reporting period, being greatest in HBSS-132m (2.6m) and lowest in BGSS-198m (0.3m). The groundwater depressurisation started in mid-late November 2022.

The shallow sensors at TBC09 and TBC018 recorded no significant changes in groundwater pressure.

2.3.1.4 Deep VWPs (sensors >200 metres)

The deep VWPs predominantly indicated minimal depressurisation over the reporting period (refer to hydrographs provided in the SLR Groundwater Report in **Appendix C**). Given the short period of depressurisation, conclusions regarding trends are not suitable at this time. The majority of sensors are aligning with the predicted depressurisation predicted via the groundwater modelling.

2.3.2 Mine Water Intake

Tahmoor Coal has a Groundwater Licence (WAL 36442) to extract 1642 ML/year of groundwater make from underground.

The inferred water make (groundwater that has seeped into the mine from the strata) is calculated from the difference between total mine inflows and total mine outflows. This calculation is assisted by input from flow meters installed on fresh water supply lines that pump water into the mine (mine inflow from Sydney Water supply to underground workings), and flow meters on three pipelines that extract water from underground (mine outflow). In addition, mine inflow and outflow also includes a measurement of water that enters and exits the mine through other means such as moisture in air vented in and out of the mine (water in vented air), and moisture in coal extracted from the mine.

Water make calculations provide an indication of the groundwater pumped out of the total Tahmoor Mine underground workings, which include water make from the Western Domain.

SLR completed an analysis of water make for Tahmoor Mine recorded between 1 January 2009 to 31 December 2022 (**Appendix D**). During this period, observed inflows to Tahmoor Mine have been ranging between 2 to 6 ML/d.

The reporting period October to December 2022 falls within the water year calendar 2022-23. The observed cumulative groundwater make for the water 2022-23 is 546 ML and remains below the groundwater entitlement of 1,642 ML per annum (i.e. water year) as of December 2022. This is below the water licence on a pro-rata basis.

2.3.3 Groundwater Quality

Groundwater quality has been monitored monthly in the OSPs (monitoring network and private bores) since the commencement of extraction.

Table 3 in the SLR Groundwater Report (**Appendix C**) summarises the Tahmoor South Groundwater Monitoring Network, and the locations of groundwater monitoring bores is provided in **Figure 2-7**.

As per the groundwater level data, the limited record during extraction coupled with the highly variable climatic conditions make it illogical to define trends in the quality and ascertain their relationship to extraction or not.

Further detail on groundwater quality results, including graphs showing progressive groundwater quality results, are provided in the SLR Groundwater Report (refer to **Appendix C**). Further detail and discussion of TARP triggers for groundwater level are also discussed in **Section 3.2.2**.

2.3.3.1 Electrical conductivity and pH

The pH and EC across all bores show some level of fluctuation with no apparent trends across the full record.

A very high pH (greater than 12) was recorded at the following bores in October 2022, which suggest either an issue with the bore construction (e.g. grout contamination) or an error in pH measurements. These results were:

- P51B (pH = 14.22)
- P56B (pH = 12.22)
- P56C (pH = 15.12)
- GW104659 (pH = 13.15)

Further monitoring in November and December 2022 showed that the pH returned within baseline levels.

2.3.3.2 Metal concentrations

Metals across all bores showed some variations, most likely attributable to climatic conditions and not extraction. As of December 2022, it is quite difficult to assess short-term increases in metal concentrations as seen during the reporting period is mining related. Further monitoring data is required to assess and confirm trends.

2.3.4 Recommendations and Actions

2.3.4.1 Current Groundwater Monitoring Recommendations

As discussed in the Groundwater Review for October to December 2022 (**Appendix C**), the following groundwater recommendations were made for this reporting period by SLR:

- Update of the LW S1A-S6A Water Management Plan to incorporate revision of the TARPs;
- In the next Six Monthly Subsidence Impact Report, review the baseline data in conjunction with the additional data collected to that point. If no impact from mining has been identified, consider incorporating the additional data points into the ‘baseline’ period and recalculate the triggers to capture natural variability of the system; and
- Install and commence monitoring at P50, and consequently replace P51 with this new bore as an early warning bore in TARP WMP13.

Progress of these recommendations will be provided in the next Six Monthly Subsidence Impact Assessment for the Tahmoor South Domain.

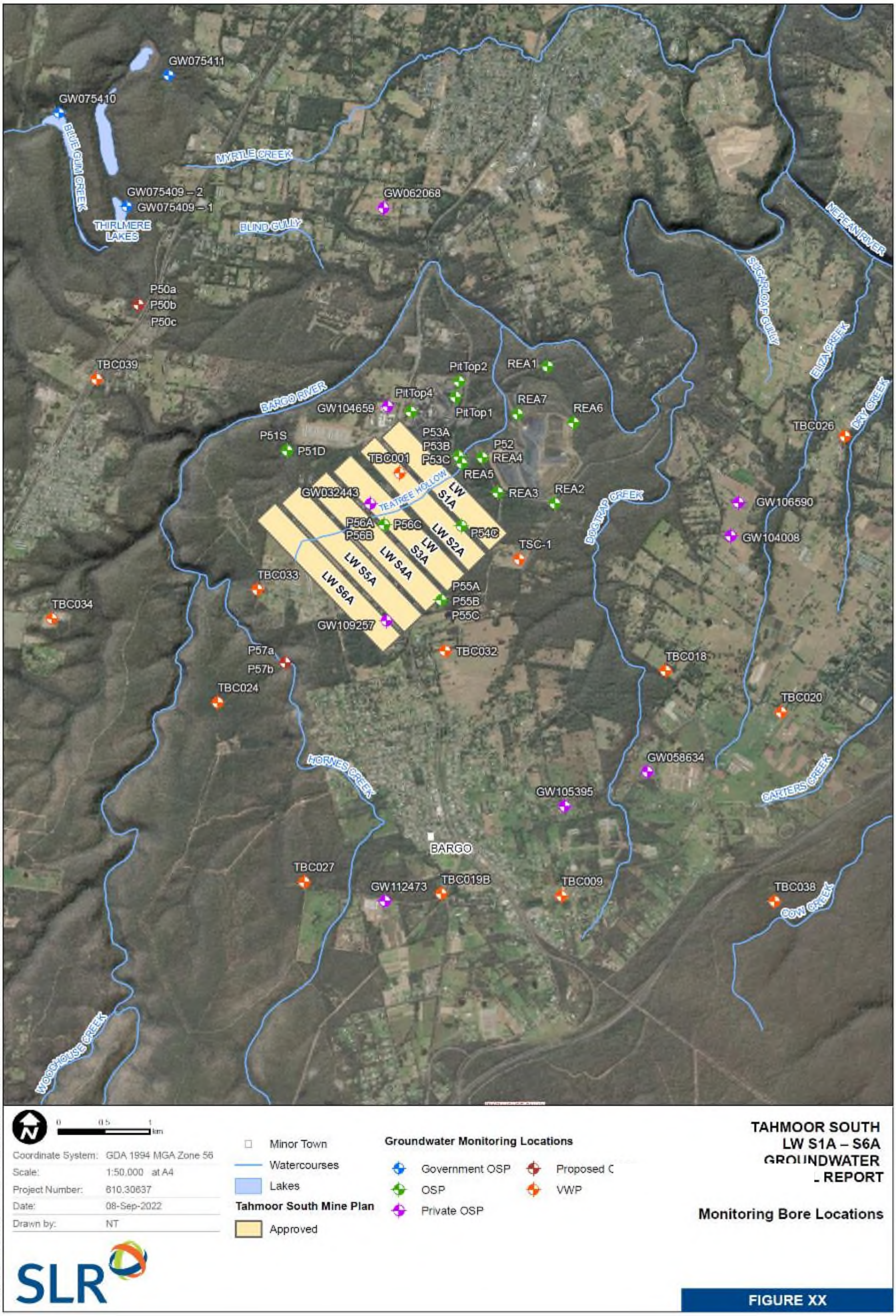

Figure 2-7 LW S1A-S6A Groundwater Monitoring Site (source: LW S1A-S6A Water Management Plan)

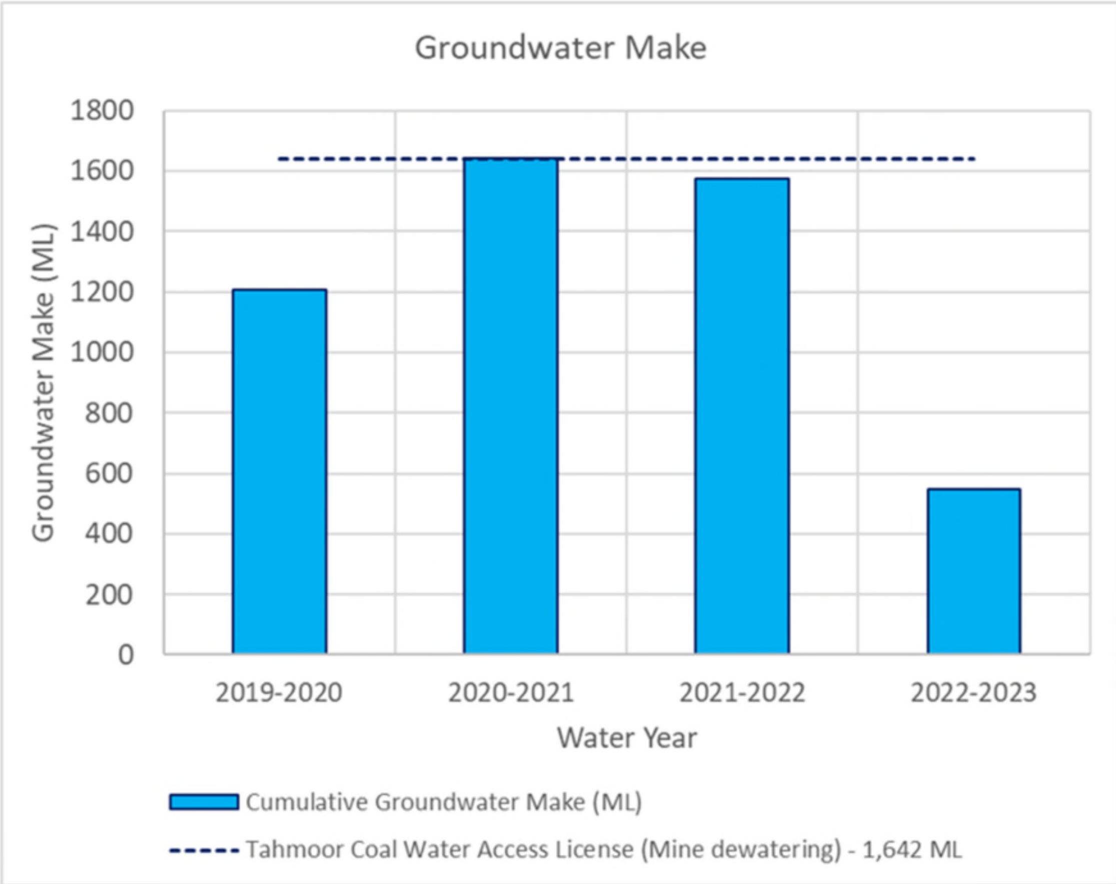

Figure 2-8 Groundwater Make per Water Year (financial year) from 2019/20 to 2022/23 (source SLR, Groundwater Monitoring Report, Appendix C). Note: 2022-2023 data is for 6 months, and not the full water year.

2.4 Land Monitoring

The LW S1A-S6A Land Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on cliffs, natural steep slopes, farm dams, agricultural land in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Land Management Plan has been implemented to monitor the following landscape features:

- Cliffs – visual inspection at the completion of mining by a geotechnical engineer (Cliff BC1 after LW S6A, Cliff BC2 after LW S3A, S4A, S5A and S6A). No visual inspections have been required during this reporting period;
- Natural steep slopes – monthly visual inspection during active subsidence period by a geotechnical engineer. This monitoring and reporting is completed by Douglas Partners (available on request);
- Farm dams – dam embankment integrity and water level observation every week during active subsidence, and every month the active subsidence period by a geotechnical consultant. This monitoring is completed by Building Inspection Services on a weekly basis, and Douglas Partners on a monthly basis, and reported in their reports (available on request); and
- Agricultural land – weekly inspections along local roads and farm dams, and visual inspection at the completion of each longwall for land within the predicted limit of subsidence for each longwall. This monitoring is covered by the farm dams inspections discussed above and built features monitoring discussed in **Section 2.7.2**. No post-longwall visual inspections have been required during this reporting period.

The following sections summarise the observations made during the reporting period for each land category. Performance against all Land Management Plan TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.4.1 Cliffs

The locations of cliffs (BC1 and BC2) within the LW S1A-S6A Study Area are illustrated in **Figure 2-9**.

During the reporting period, no visual inspections of cliffs has been required according to the LW S1A-S6A Land Management Plan.

2.4.2 Natural Steep Slopes

The locations of natural steep slopes within the LW S1A-S6A Study Area are illustrated in **Figure 2-9**.

During the reporting period, visual and photographic surveys of natural steep slopes were completed monthly for features within the LW S1A active subsidence zone. No visual observations or cracks, localised ground bulging, buckling or shearing was observed at natural steep slopes.

2.4.3 Farm Dams

The location of dams within the LW S1A-S6A Study Area are illustrated in **Figure 2-10**.

During the reporting period, visual and photographic surveys for subsidence impacts on dams were completed on a weekly and monthly basis of dams within the LW S1A active subsidence zone.

A visual inspection of FD-1 on 9 December 2022 found no issues, however the water level has dropped since the previous inspection due to drier weather conditions. No significant changes were observed on 30 December 2022. The small dam is holding a small volume of water following recent rainfall.

2.4.4 Agricultural Land

Agricultural land identified within the LW S1A-S6A Study Area are illustrated on **Figure 2-11**.

Inspections points were set up prior to the commencement of LW S1A mining to provide vantage of agricultural land within the LW S1A-S6A Study Area. The purpose of the surveys is to note whether change has occurred to agricultural land, and to assist in determining if any change can be attributed to mining impacts. Surveys noted the presence of erosion, condition of boundary and internal fencing components, paddock gate condition, out-building condition, paddock dam condition, presence of any surface slumping or cracking, and the presence of vegetation dieback.

During the reporting period, visual and photographic surveys of agricultural land have been completed as part of inspections for local roads, which are discussed in **Section 2.7.2**. No post-longwall visual inspections were required during this reporting period.

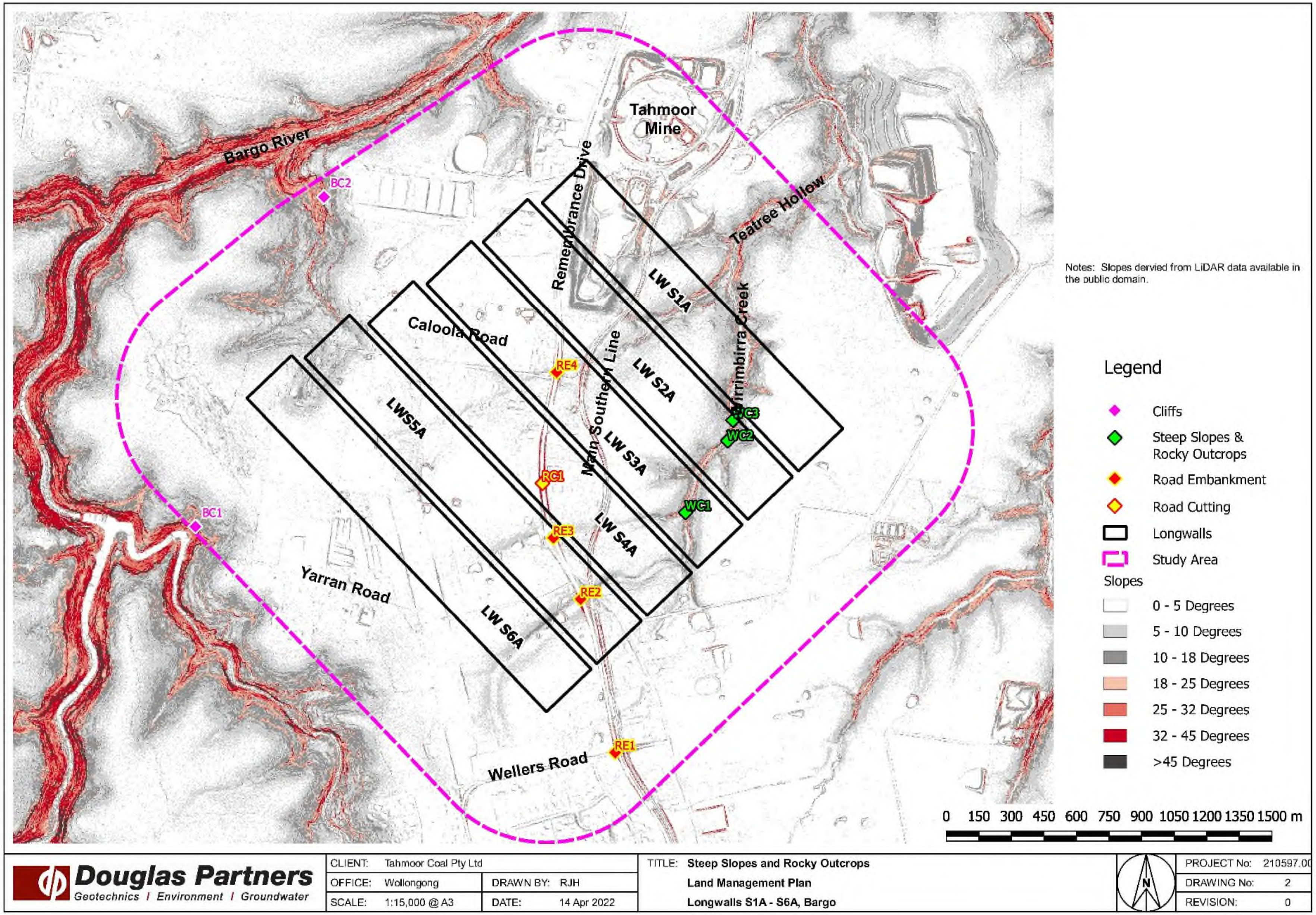

Figure 2-9 Cliffs and natural steep slopes within the LW S1A-S6A Study Area (source: LW S1A-S6A Land Management Plan)

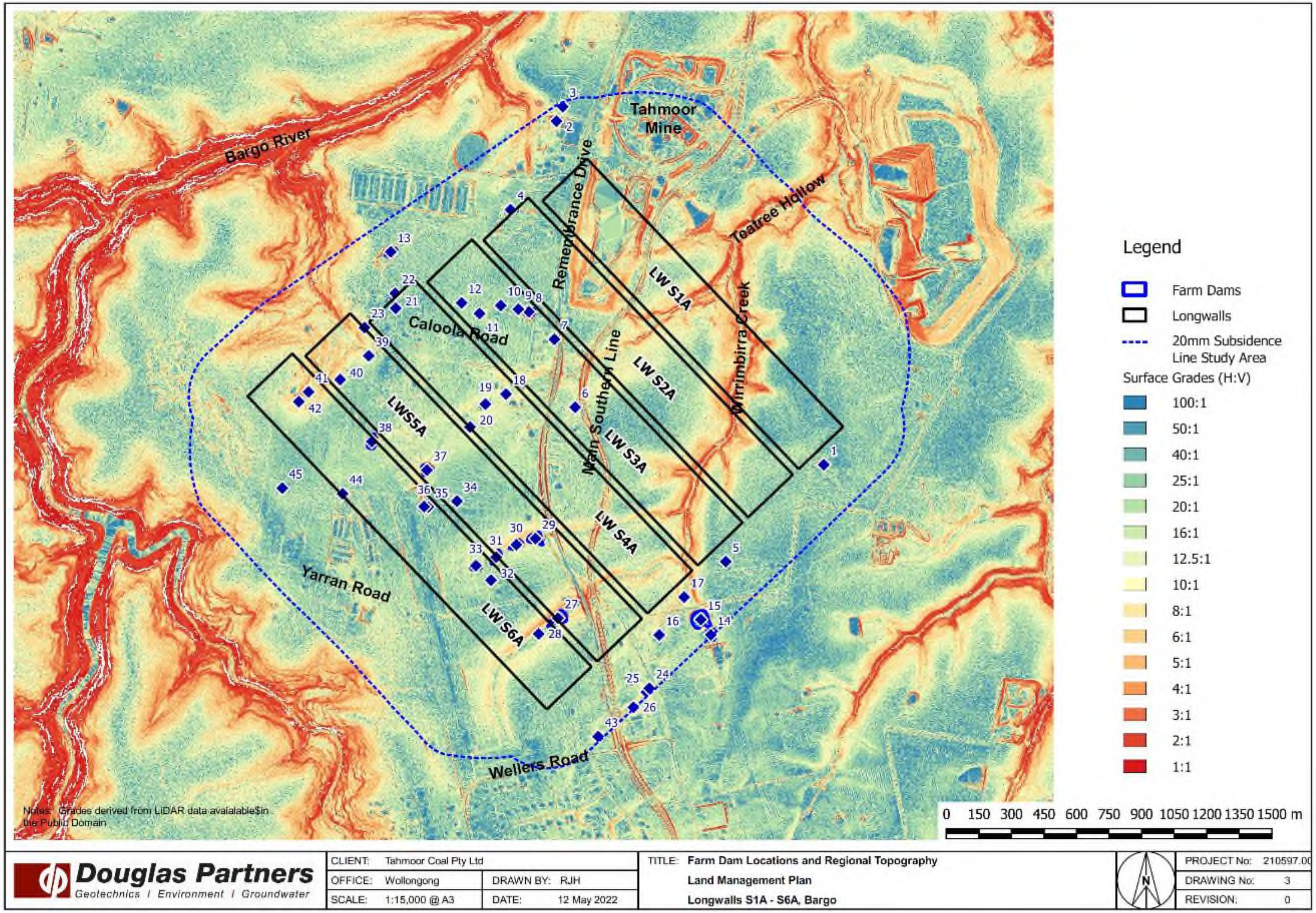

Figure 2-10 Dams within the LW S1A-S6A Study Area (source: LW S1A-S6A Land Management Plan)

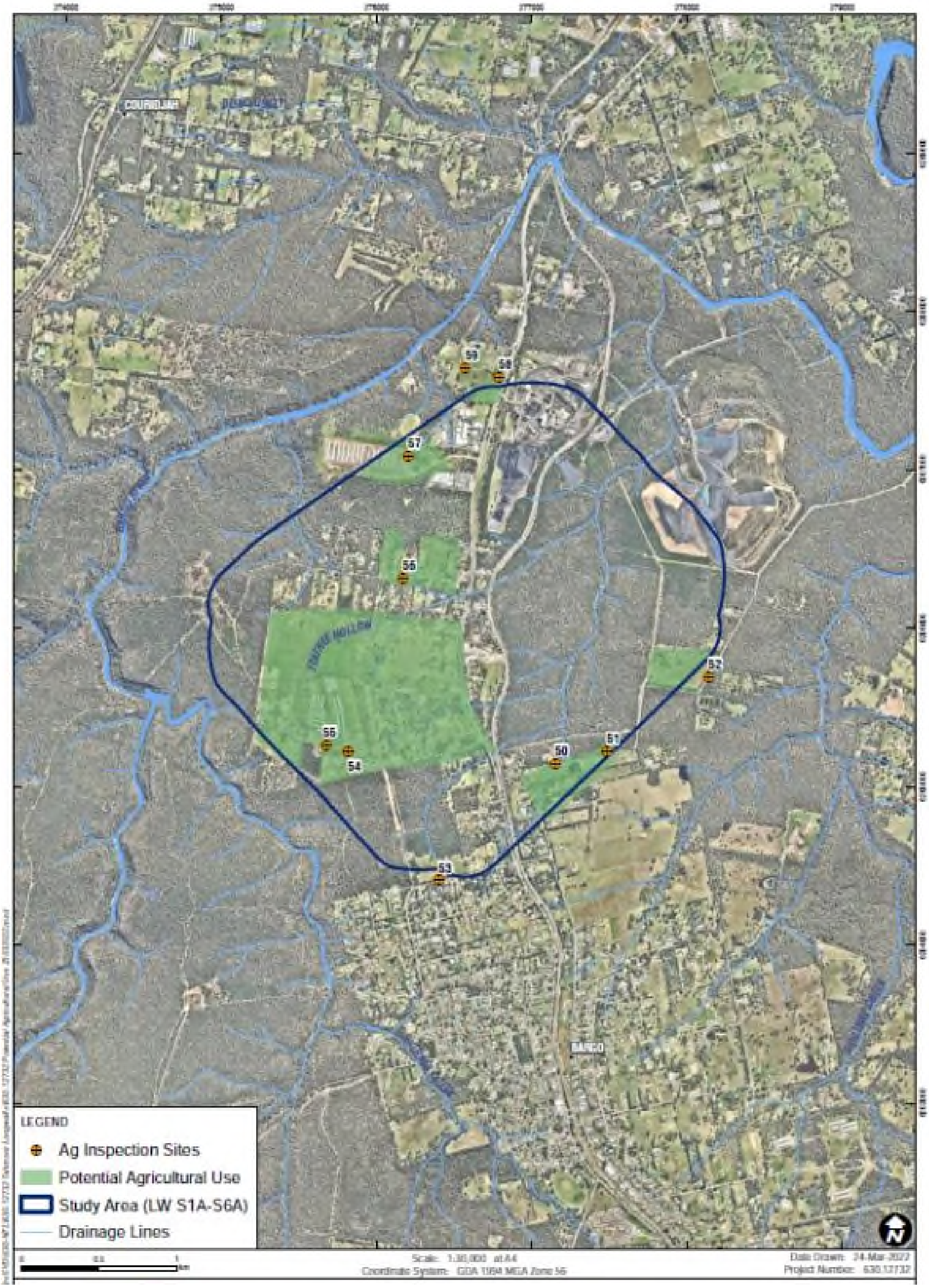

Figure 2-11 Agricultural land and inspection sites within the LW S1A-S6A Study Area (source: LW S1A-S6A Land Management Plan)

2.5 Biodiversity Monitoring

The LW S1A-S6A Biodiversity Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on aquatic and terrestrial flora and fauna in accordance with Condition C8 of SSD 8445.

During the reporting period, the LW S1A-S6A Biodiversity Management Plan has been implemented to monitor ecology in the Study Area, as outlined below:

- Aquatic ecology – Bi-annual (Spring and Autumn) monitoring. During this reporting period, this monitoring was completed monitoring during Spring 2022 by Niche Environment and Heritage (Niche, 2023a); and
- Terrestrial ecology – Bi-annual (Spring and Autumn) monitoring. During this reporting period, this monitoring was completed monitoring during Spring 2022 by Niche Environment and Heritage (Niche, 2023b).

The following sections summarise the observations made during the reporting period for aquatic and terrestrial ecology. Performance against all Biodiversity Management Plan TARPs (BMP1-4) for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.5.1 Aquatic Ecology

The aquatic ecology monitoring program for LW S1A-S6A has been designed to monitor subsidence-induced impacts on aquatic ecology. The following survey methods have been completed during baseline and during mining monitoring sampling:

- Aquatic habitat assessment of geomorphology, channel diversity, bank stability, riparian vegetation and adjacent land use, water quality, macrophytes and local impacts and land use practices in accordance with the Australian River Assessment System (AUSRIVAS);
- Macroinvertebrate survey:
    - AUSRIVAS macroinvertebrate sampling; and
    - Quantitative benthic macroinvertebrate monitoring program.

The aquatic ecology monitoring program is primarily focused on macroinvertebrate monitoring regimes including AUSRIVAS and quantitative using Before After Control Impact (BACI) design.

2.5.1.1 Spring 2022 Monitoring Results

Aquatic monitoring for spring 2022 was conducted by Niche Environment and Heritage from 17 – 22 November 2022. A total of eight locations were sampled within Teatree Hollow, Hornes Creek and Moore Creek comprising four impact sites (TTH12, TTH13, TTH16, TTH17) and four control sites (HC7, HC8, MC14, MC15). The locations of monitoring sites are illustrated in **Figure 2-12**.

The following results were observed for this monitoring period (Niche, 2023a):

- Elevated water levels were observed across the monitoring sites in spring 2022;
- Increased riparian vegetation growth has occurred since the 2019 bushfires;
- Water quality readings were generally consistent across the monitoring sites with low turbidity and electrical conductivity levels, and high dissolved oxygen levels recorded. Results were indicative of the elevated flow levels and continuous rainfall inputs;
- No indicators of any acute or chronic water quality issues were identified in the spring 2022 water quality data;
- A continued slight increase in AUSRIVAS stream health scores have been observed since spring 2021;

- AUSRIVAS scores, SIGNAL2 and EPT were low at both potential impact and control streams but comparable between the site treatments, suggesting that background conditions are under natural environmental stress;
- Quantitative macroinvertebrate assemblage data showed some significant spatial differences across the impact sites in spring 2022. The variation was found to be influenced by Leptophlebiidae, Baetidae and Chironomidae macroinvertebrate families. It is considered likely that these spatial differences have been driven by the significant environmental conditions (elevated rainfall) in spring 2022; and
- The quantitative data will be considered in detail in autumn 2023 to confirm whether fine scale differences observed in spring 2022 are part of natural variability or indicative of long-term changes.

There was slight improvement in water quality and stream health scores in spring 2022. These changes are likely attributed to increase flows over the period, leading to increased habitat availability. A continuation of trends observed in autumn 2022. The variation in water quality, and stream health is expected in response to changing environment conditions, particularly intermittent waterways that experience extreme fluctuations in aquatic habitat availability and quality.

2.5.2 Terrestrial Ecology

The terrestrial ecology monitoring program for LW S1A-S6A has been designed to monitor subsidence-induced impacts on terrestrial ecology including riparian vegetation and amphibian monitoring.

The terrestrial ecology monitoring program uses a Before After Control Impact (BACI) design to identify ecological change within the Study Area as a result of mine subsidence by permitting comparisons of population trends between control and impact areas, before and after the impact. The following survey methods have been completed during baseline and during mining monitoring sampling:

- Floristic surveys within established vegetation monitoring plots for riparian vegetation, Threatened Ecological Communities (TEC), and threatened flora species;
- Amphibian monitoring along established transects:
  - Spotlighting;
  - Call provocation;
  - Listening for diagnostic frog calls; and
  - Tadpole identification.

2.5.2.1 Spring 2022 Monitoring Results for Riparian Vegetation

Riparian vegetation monitoring for Spring 2022 was conducted by Niche Environment and Heritage on 28 October, 8 and 21 November 2022. A total of six locations were sampled for riparian vegetation, including three impact sites (i01, i02, and i03) and three control sites (c04, c05 and c06).

The following results were observed for this monitoring period for riparian vegetation (Niche, 2023b):

- According to the Fire Extent Severity Mapping (FESM) mapping, all riparian Sites were burnt in the 2019/2020 bushfires and were within a ‘Moderate’ to ‘Extreme’ severity burnt class, where all stratum layers were severely burnt to canopy height. Many species and communities will take years to recover, particularly those not adapted to fire or impacted by prolonged drought or other threatening processes;
- Dominant species in terms of percent cover for Spring 2022 riparian plots include *Pteridium esculentum*, *Acacia decurrens*, *A. mearnsii* (particularly dominant in Spring at impact Site 3), *Desmodium rhytidophyllum*, *Banksia spinulosa* and *B. serrata*. Most dominant exotic species included *Desmodium intortum*, *Lonicera japonica*, and *Cyperus eragrostis*;

- Across all sampling seasons, native species richness appears to be decreasing at riparian control Sites, while native cover at future impact Sites is relatively stable (only fluctuating slightly across seasons);
- During the Spring 2020, 2021 and 2022 riparian monitoring, the average floristic cover at the impact Sites was much higher compared with the control Sites in both native and exotic species, whereas native vegetation cover across impact and control Sites during Autumn monitoring appears to be similar. This suggests that seasonality is currently very influential on the degree of vegetation cover across impact sites;
- The six riparian plots, across sampling seasons (Spring 2020 to Spring 2022) had a Vegetation Integrity (VI) score between 23.6 (impact Site 3, Spring 2020) to 59.1 (impact Site 1, Spring 2021) (low to moderate condition). VI scores between Autumn 2022 and Spring 2022 have decreased slightly at impact Sites 1, 2, 3 and control Sites 4 and 5. The reduction in VI score is attributed to reduced structural condition, and increased exotic species, which is likely due to the significant flooding observed earlier in 2022;
- Catchment-scale drivers of change (flooding and prolonged rainfall events) were observed at Sites that had been previously impacted by bushfires (2019/2020 bushfires). Key influences observed in Spring 2022 including moderate to severe flooding (March and July 2022), human disturbance, particularly weeds and altered flow regimes as a result of elevated rainfall conditions; and
- The current dataset has indicated that the control and impact Sites are sufficiently similar (riparian vegetation and TEC [type and condition class]) to be suitable for long-term monitoring.

2.5.2.2 Spring 2022 Monitoring Results for Threatened Ecological Communities

Monitoring of TEC vegetation for Spring 2022 was conducted by Niche Environment and Heritage on 28 October, 8 and 21 November 2022. TEC monitoring was conducted at six sites including three impact sites (TEC4, TEC5 and TEC6) and three control sites (TEC1, TEC2 and TEC3). The locations of monitoring sites are illustrated in **Figure 2-14**.

TEC monitoring focused on Shale Sandstone Transition Forest in the Sydney Basin Bioregion (listed as Critically Endangered under the *Biodiversity Conservation Act 2016*) which is in moderate to high condition within the monitoring plots.

TEC monitoring for Spring 2022 indicated that TEC remnants within the Tahmoor South Study Area were in moderate to high condition across control and impact Sites. The current dataset has indicated that the TEC control and impact Sites are sufficiently similar to be suitable for long-term monitoring.

2.5.2.3 Spring 2022 Monitoring Results for Threatened Flora Species

Monitoring of threatened flora species for Spring 2022 was conducted by Niche Environment and Heritage on 28 October, 8 and 21 November 2022. Threatened flora species were monitored at six plot sites in areas with known threatened flora records, including three impact sites (TF4, TF5 and TF6) and three control sites (TF1, TF2 and TF3). The locations of monitoring sites are illustrated in **Figure 2-14**.

The threatened flora monitoring was established in September 2022, and the baseline number of threatened individuals at each site was recorded within a fixed 10 x 10 m plot (prior to the commencement of mining) at each monitoring site. A subsequent round of monitoring was undertaken in November 2022 (after the commencement of mining), and therefore the Spring 2022 round of threatened flora monitoring is represented by both baseline and post-mining monitoring surveys.

The six plots were designed to monitor a subset of individuals of the following species, Brown Pomaderris (*Pomaderris brunnea*), Bargo Geebung (*Persoonia bargoensis*), and small-flowered Grevillea (*Grevillea parviflora* subsp. *parviflora*).

During Spring 2022 monitoring, the highest number of individuals was identified at control Site TF3 (mean count of 211.5 of Small-flowered Grevillea), followed by control Site TF1 (mean count of 197.0 of Brown Pomaderris), and impact Site TF6 (mean count of 159.5 of Small-flowered Grevillea).

Monitoring to date has indicated that the control and impact Sites are sufficiently similar (species and abundance) to be suitable for long-term monitoring.

2.5.2.4 Spring 2022 Monitoring Results for Amphibian Monitoring

Amphibian monitoring for spring 2022 was conducted by Niche Environment and Heritage on 26 October, 1 and 2 November 2022. A total of six locations were sampled for riparian vegetation, including three impact sites (i01, i02, and i03) and three control sites (c04, c05 and c06). The locations of monitoring sites are illustrated in **Figure 2-13**.

Amphibian monitoring focused on the identification of two threatened frog species – the Giant Burrowing Frog (*Heleioporus australiacus*) and the Red-crowned Toadlet (*Pseudophryne australis*).

The following results were observed for this monitoring period (Niche, 2023b):

- Frog detection rates were variable across Spring monitoring events. The two species driving this variation were Common Eastern Froglet (*Crinia signifera*) and Stony Creek Frog (*Litoria lesueurii*). At the time of Spring 2022 monitoring, there were consecutive months of substantially above average monthly rainfall totals, including a notable flooding event in March and July 2022;
- A total of three frog species were detected across the Spring 2022 monitoring event, which represents a reduced level of species detection that is observed across both control and impact monitoring sites in comparison to previous baseline surveys. This may be attributable to the recent flooding event in March and July 2022, which altered microhabitats within the streams. Amphibian species diversity (e.g., tree frogs) are likely to increase with time after flooding and as flow conditions return to more nominal levels and habitats are restored and reworked;
- The targeted threatened frog species appears not to be present in the Study Area. While the study area contains superficially suitable habitat, it is possible that these species would no longer be able to survive in the area due to number of factors such as:
  - Absence of suitable non-breeding habitat for Giant Burrowing Frog at most monitoring Sites (due to removal of groundcover from fire, heavy weed encroachment and erosion);
  - Increased urban encroachment resulting in habitat removal, altered hydrological flows, water quality and nutrient loads; and
  - Potential predation pressures from two introduced predators: Eastern Gambusia (*Gambusia holbrooki*) and the Yabby (*Cherax destructor*), both of which were detected at all Sites.

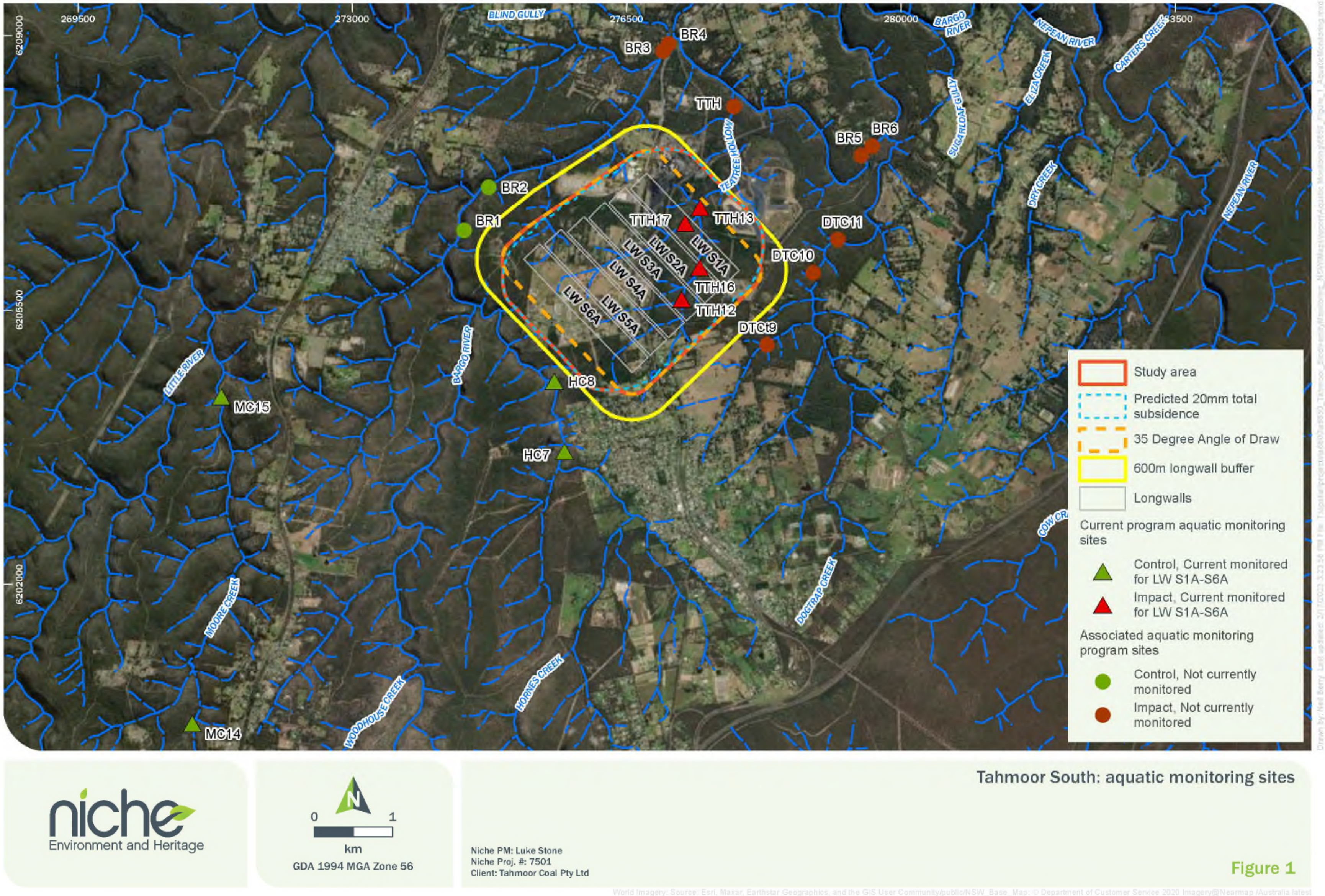

Figure 2-12 LW S1A-S6A Aquatic Ecology Monitoring Locations (source: Niche, 2023a)

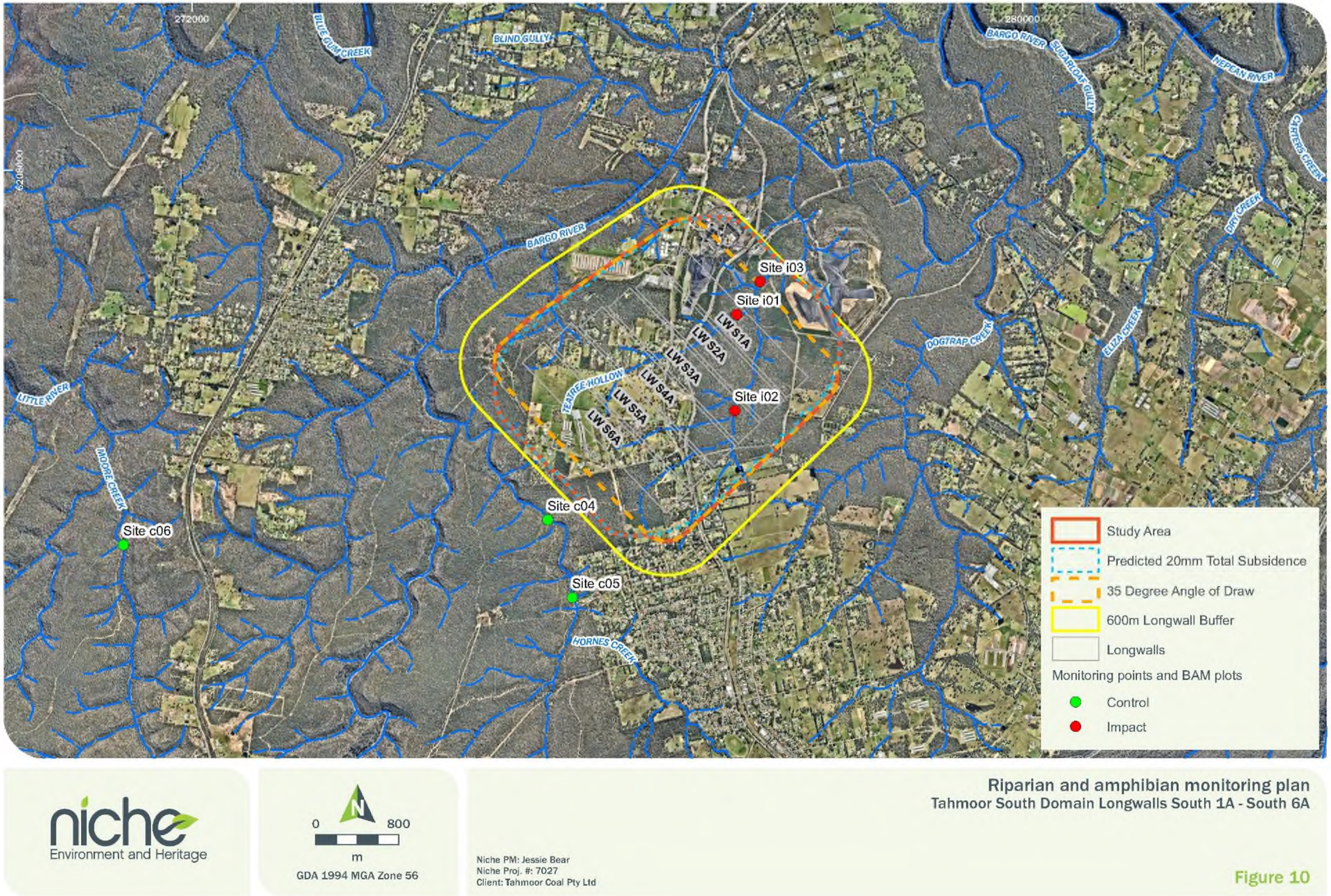

Figure 2-13 LW S1A-S6A Riparian Vegetation and Amphibian Monitoring Locations (source: LW S1A-S6A Biodiversity Management Plan)

This information has been retracted

- For more information contact Tahmoor Coal

2.6 Heritage Monitoring

The LW S1A-S6A Heritage Management Plan was prepared to manage the potential environmental consequences of LW S1A-S6A extraction on Aboriginal heritage and historical heritage sites and values in accordance with Condition C8 of SSD 8445.

The following sections summarise the observations made during the reporting period for Aboriginal and historical heritage items. Performance against all Heritage Management Plan TARPs (HMP1 and HMP2) for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.6.1 Aboriginal Heritage

During this reporting period, the LW S1A-S6A Heritage Management Plan has been implemented to monitor subsidence impacts on the rockshelter Teatree Hollow 2013.1 (AHIMS 52-2-4471). The Aboriginal heritage monitoring of this rockshelter requires the following monitoring during and post-mining:

- Fortnightly visual inspection of the rockshelter (monitoring overall rockshelter stability) during periods of active subsidence for LW S1A, S2A, S3A and S4A, to be completed from a safe distance. This monitoring is completed by Building Inspection Services and Douglas Partners on an alternative monthly schedule, and reported in their monthly reports (available on request);
- Monitoring of GNSS units / survey lines in proximity to the rockshelter, reviewed on a monthly basis during periods of active subsidence for LW S1A, S2A, S3A and S4A. This monitoring is summarised in the weekly MSEC Subsidence Reports (refer to **Appendix A** for referenced reports); and
- Visual inspection by archaeologist with RAPs at the completion of LW S1A, S2A, S3A and S4A. No visual inspections have been required during this reporting period.

It is noted that the artefact scatter Remebrance Drive 2013.1 (AHIMS 52-2-3968) and isolated find TC14-2-19 (AHIMS 48-2-0275) were also assessed in the LW S1A-S6A Heritage Management Plan, however no pre-mining, during mining or post-mining monitoring is required for these sites.

During the reporting period, very minor ground movements have been measured by GNSS units S03 and S04 located on either side of Wirrimbirra Creek (in vicinity of the rockshelter site) (**Appendix A**). In addition, no visual impacts have been observed at the rockshelter site during the reporting period.

2.6.2 Historical Heritage

During this reporting period, the LW S1A-S6A Heritage Management Plan was implemented to monitor subsidence impacts for the following historical heritage items:

- Wirrimbirra Sanctuary (Australian Wildlife Sanctuary):
  - Various monitoring as per the Australian Wildlife Sanctuary Management Plan - This monitoring is summarised into a Weekly Subsidence Status Report by MSEC (available on request); and
  - Visual inspection by a heritage consultant at the completion of LW S5A - No visual inspections have been required during this reporting period.
- Bargo Railway Bridge North (Wellers Road Overbridge) and Bargo Railway Viaduct:
  - Various monitoring as per the Main Southern Railway Management Plan - This monitoring is summarised into a Weekly Subsidence Status Report by MSEC (available on request); and
  - Visual inspection by a heritage consultant at the completion of LW S6A - No visual inspections have been required during this reporting period.

- Bargo Cemetery:
    - Various monitoring as per the Bargo Cemetery Management Plan - This monitoring will be summarised into a Weekly Subsidence Status Report by MSEC and is not yet required; and
    - Visual inspection by a heritage consultant at the completion of LW S6A - No visual inspections have been required during this reporting period.
- Picton Weir
    - Various monitoring as per the Picton Weir Management Plan - This monitoring will be summarised into a Weekly Subsidence Status Report by MSEC and is not yet required.
- Tahmoor Colliery (Tahmoor Mine Site):
    - Various monitoring as per the Tahmoor Mine Site Management Plan - This monitoring will be summarised into a Weekly Subsidence Status Report by MSEC and is not yet required.
- Great Southern Road (partial):
    - Various monitoring as per the Main Southern Railway Management Plan - This monitoring is summarised in the weekly MSEC Subsidence Reports (refer to **Appendix A** for referenced reports).

During the reporting period, no impacts to historical heritage items were reported in relation to LW S1A mining.

Main Southern Railway features (including the Wellers Road Overbridge and Bargo Railway Viaduct) are discussed further in **Section 2.7.1**, local roads in **Section 2.7.2**, Tahmoor Mine Site in **Section 2.7.8**, Australian Wildlife Sanctuary in **Section 2.7.9**, Bargo Cemetery in **Section 2.7.12**, and Picton Weir in **Section 2.7.13**.

This information has been retracted

- For more information contact Tahmoor Coal

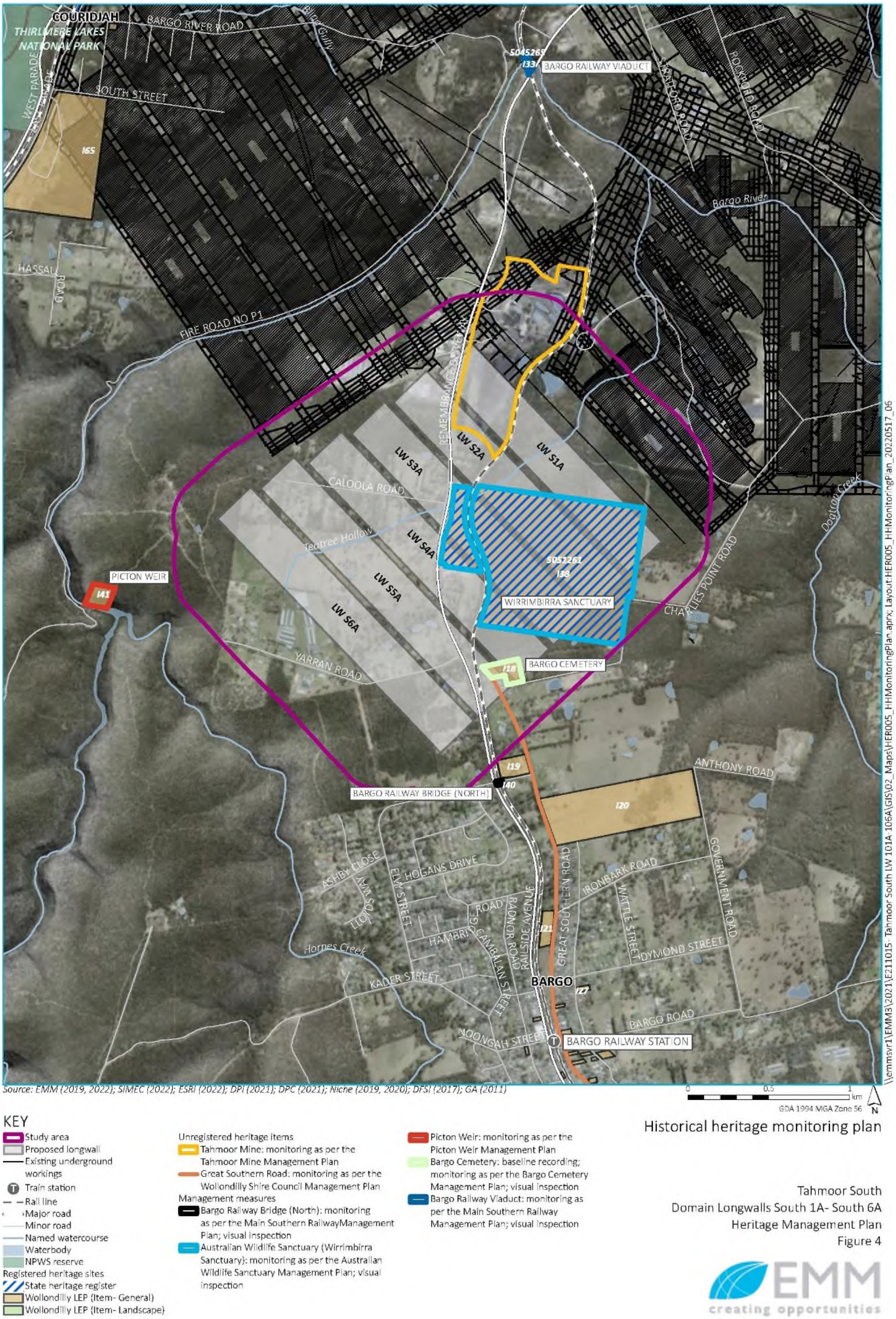

Figure 2-16 Historical Heritage Sites in the LW S1A-S6A Study Area and Surrounds (Source LW S1A-S6A Heritage Management Plan)

2.7 Built Features Monitoring

The LW S1A-S6A Built Features Management Plan and associated sub-plans were prepared to manage the potential environmental consequences of LW S1A-S6A extraction on built features in accordance with Condition C8 of SSD 8445.

During this reporting period, the LW S1A-S6A Subsidence Monitoring Program was implemented to monitor subsidence impacts on infrastructure owned by Wollondilly Shire Council (roads, bridges and culverts), ARTC (rail infrastructure), Sydney Water (potable water infrastructure and sewer infrastructure), Endeavour Energy (electrical infrastructure), Jemena (gas infrastructure), Telstra (telecommunications infrastructure), NBN (telecommunications infrastructure), TPG (telecommunications infrastructure) and private property owners. The details of the Subsidence Monitoring Program are illustrated in **Figure 2-1**.

A weekly review of the subsidence survey results during the reporting period has been completed by MSEC during mining of LW S1A (referred documents provided in **Appendix A**). In addition, weekly reports by MSEC are prepared for specific built features including the Main Southern Railway, Tahmoor Mine Site, and Australian Wildlife Sanctuary.

The following sections summarise the observations made during the reporting period for built features. Performance against all built features TARPs for the reporting period are summarised in **Table 3-3**, and actions and responses completed relating to any TARP triggers are discussed in **Section 3.2.**

2.7.1 Main Southern Railway

The first Subsidence Management Status Report for the Main Southern Railway has been prepared (covering the commencement of LW S1A mining to 24 January 2023).

During the reporting period, no safety incidents or delays to rail operations were reported. In addition, all survey measurements were very minor and no issues were reported.

2.7.2 Local Roads

There are no local roads located above the commencing end of LW S1A.

Monthly ground surveys have commenced along Charlies Point Road, with very minor changes observed on 12 December 2022.

Surveys of Rockford Road Bridge and Arina Road Bridge were conducted on 6 December 2022, with observed changes within survey tolerance.

A visual inspection along local roads, Arina Road Bridge and Rockford Road bridge on 23 December 2022 found no issues. Some potholes on Charlies Point Road were patched between 16 and 23 December 2022. Another visual inspection along local roads on 30 December 2022 found no issues.

2.7.3 Potable Water Infrastructure

No potable water infrastructure is located above the commencing end of LW S1A.

2.7.4 Sewer Infrastructure

No sewer infrastructure is located above the commencing end of LW S1A.

2.7.5 Gas Infrastructure

No gas infrastructure is located above the commencing end of LW S1A.

2.7.6 Electrical Infrastructure

An 11 kV powerline is located above the commencing end of LW S1A along Charlies Point Road. Ground surveys of critical power poles are being conducted when poles are within the active subsidence zone.

Monthly ground surveys have commenced along Charlies Point Road, with very minor changes observed on 12 December 2022.

A visual inspection on 30 December 2022 found no issues.

2.7.7 Telecommunications Infrastructure

No telecommunications infrastructure is located above the commencing end of LW S1A.

2.7.8 Tahmoor Mine Site

The Tahmoor Mine Site is not located above the commencing end of LW S1A.

2.7.9 Australian Wildlife Sanctuary

Weekly Subsidence Status Reports have been prepared for the Australian Wildlife Sanctuary, which summarises monitoring and inspections results from relevant GNSS units, ground survey (Tahmoor Mine Boundary line (V line)), survey and visual inspections of Main Southern Railway, local streets, structures; and natural features observations.

During the reporting period, there were no triggers under the Australian Wildlife Sanctuary Management Plan.

2.7.10 Built Structures

There are no built structures located above the commencing end of LW S1A.

2.7.11 Farm Dams

A summary of observations of farm dams is provided in **Section 2.4.3**.

2.7.12 Bargo Cemetery

This location is not located above the commencing end of LW S1A.

2.7.13 Picton Weir

This built feature is not located above the commencing end of LW S1A.

2.8 Public Safety Monitoring

The LW S1A-S6A Public Safety Management Plan was prepared to manage the potential consequences as a result of LW S1A-S6A extraction on public safety within the Study Area in accordance with Condition C8 of SSD 8445.

As noted in **Section 1.3.3** of this report, management requirements for public safety are covered in the Built Features Management Plan and the Land Management Plan. Monitoring of cliffs, natural steep slopes and other landscape features has been conducted for the reporting period in accordance with the LW S1A-S6A Land Management Plan (refer to **Section 2.4** for a summary of monitoring results). In addition, monitoring of built features has been conducted for the reporting period in accordance with the LW S1A-S6A Built Features Management Plan (refer to **Section 2.7** for a summary of monitoring results).

No subsidence impacts were identified during the reporting period that were considered to pose a risk to public safety.

3 Overview of Impacts and Actions

3.1 Summary of Impacts

This section provides a comprehensive summary of all impacts during the reporting period, including a revised characterisation according to the relevant TARPs (if required).

A full list of TARPs for environmental features that are applicable is provided in Appendix B of the LW S1A-S6A Extraction Plan.

A summary of monitoring results for relevant TARPs is provided in **Table 2-3**.

Table 3-1 Summary of TARP Triggers for October to December 2022

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
Water Management Plan	WMP1	Stream Water Quality for all Watercourses within the Subsidence Area	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.
	WMP2	Stream Water Quality for other Watercourses (Bargo River and Hornes Creek)	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.	Exceedance of an SSGV did not occur or occurred for less than three consecutive months.
	WMP3	Pool Water Level for all Watercourses within the Subsidence Area	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	LEVEL 1 TRIGGERED[1] The recorded water level declined by greater than 10 centimetres (cm) below the recorded baseline minimum level at TT9 (and the same did not occur at the reference site(s)).
	WMP4	Pool Water Level for other Watercourses (Bargo River and Hornes Creek)	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	The recorded water level did not decline below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).
	WMP5	Physical Features and Natural Behaviour of Watercourses within the Subsidence Area	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.
	WMP6	Physical Features and Natural Behaviour of Pools for other Watercourses (Bargo River and Hornes Creek)	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	No observed impacts to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.
	WMP7	Channel Stability, Sedimentation and Erosion	No further development of soft knickpoints or increased erosion of headwater streams.	No further development of soft knickpoints or increased erosion of headwater streams.	No further development of soft knickpoints or increased erosion of headwater streams.
	WMP8	Shallow Groundwater Level (Open Standpipes and Private Bores)	Groundwater level remained consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two metres.	Groundwater level remained consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two metres.	Groundwater level remained consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two metres.
	WMP9	Shallow Groundwater Pressure (VWP Sensors < 200 m Depth) – original TARP	ORIGINAL TARP* Normal Condition[2] for all monitoring bores. REVISED TARP* Normal Condition[4] for all monitoring bores.	ORIGINAL TARP* Normal Condition[2] for all monitoring bores. REVISED TARP* Normal Condition[4] for all monitoring bores.	ORIGINAL TARP* Level 2 TARP Trigger[3] for TBC032 – HBSS-131m intake. REVISED TARP* Normal Condition[4] for all monitoring bores.
	WMP10	Groundwater Level / Pressure Deep VWPs (> 200 m Depth excluding Monitoring the Bulli Coal Seam)	ORIGINAL TARP* Level 1 TARP trigger[5] for TBC09 (BGSS–322m), TBC09 (BGSS-343m), TBC018 (BGSS-282m), TBC018 (BGSS-366m), TBC18 (BUSM-404m), TBC20 (WBCS-397m), TBC20 (BGSS-375m), TBC26 (BUSM-432m), TBC32 (BGSS-237m), TBC32 (BGSS-294m). REVISED TARP* Normal condition[6] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[5] for TBC09 (WWCO-391m), TBC09 (WO-397m), TBC18 (W0-432m), TBC020 (211m), TBC32 (BGSS-200m), TBC39 (BGSS-299m); and all triggered in October 2022. REVISED TARP* Normal condition[6] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[5] for TBC020 (293m) and all triggered in October and November 2022. REVISED TARP* Normal condition[6] for all monitoring bores.

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
	WMP11	Groundwater Quality (Open Standpipes and Private Bores)	NA – Monitoring data for this month collected prior to commencement of mining.	ORIGINAL TARP* Level 1 TARP trigger[7] for P53B (pH upper), GW112473 (EC and pH lower), P52 (EC), P53A (EC), P55A (EC), numerous heavy metals P51B, P52, P53A, P53B, P53C, P55A, P55B, P55C, P56B, P56C, GW062068, GW104008, GW105395, GW109257 and GW112473. REVISED TARP* Normal condition[8] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[7] for P55A (EC) and numerous heavy metals at P51B, P52, P53A, P53B, P55A, P55B, P55C, P56B, P56C, GW062068, GW104008, GW104323, GW104659, GW105395, GW109257 and GW112473. REVISED TARP* Normal condition[8] for all monitoring bores.
	WMP12	Groundwater – Surface Water Interaction	Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.	Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.	Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.
	WMP13	Groundwater Bores Monitoring for Thirlmere Lakes	ORIGINAL TARP* Normal condition[9] for all "early warning" bores listed in TARP. REVISED TARP* Normal condition[11] for all "early warning" bores listed in the TARP.	ORIGINAL TARP* Level 1 TARP trigger[10] for P51B (groundwater quality) and GW062068 (groundwater quality). REVISED TARP* Normal condition[11] for all monitoring bores.	ORIGINAL TARP* Level 1 TARP trigger[10] for P51B (groundwater quality), GW062068 (groundwater quality), and GW104659 (groundwater quality). REVISED TARP* Normal condition[11] for all monitoring bores.
Land Management Plan	LMP1	Cliffs	NA – No monitoring is required.	NA – No monitoring is required.	NA – No monitoring is required.
	LMP2	Natural Steep Slope (excluding Constructed Steep Slopes associated with Roads, Railway and the Tahmoor Mine Site)	NA – No monitoring is required as features are no within the active subsidence zone.	No observations of surface cracking, or localised ground bulging, buckling or shearing.	No observations of surface cracking, or localised ground bulging, buckling or shearing.
	LMP3	Farm Dams	NA – No monitoring is required as features are no within the active subsidence zone.	No observations of cracks developing within dam embankments.	No observations of cracks developing within dam embankments.
	LMP4	Agricultural Land	No changes to agricultural land observed.	No changes to agricultural land observed.	No changes to agricultural land observed.
Biodiversity Management Plan	BMP1	Aquatic Habitat and Macroinvertebrate Indicators (Stream Health)	Visual monitoring indicates aquatic pool habitat parameters are similar to baseline observations at aquatic ecology monitoring sites, and AUSRIVAS score equal to or greater than Band C.	Visual monitoring indicates aquatic pool habitat parameters are similar to baseline observations at aquatic ecology monitoring sites, and AUSRIVAS score equal to or greater than Band C.	NA – Monitoring next required in Autumn 2023.
	BMP2	Amphibian Populations	Amphibian populations are stable and habitat parameters are predominantly within a reasonable range of baseline data.	Amphibian populations are stable and habitat parameters are predominantly within a reasonable range of baseline data.	NA – Monitoring next required in Autumn 2023.
	BMP3	Riparian Vegetation	Riparian vegetation parameters are predominantly within a reasonable range of baselines data, and monitoring indicates native vegetation cover is within a reasonable range of baseline data.	Riparian vegetation parameters are predominantly within a reasonable range of baselines data, and monitoring indicates native vegetation cover is within a reasonable range of baseline data.	NA – Monitoring next required in Autumn 2023.
	BMP4	Threatened Species, Threatened Populations and Endangered Ecological Communities	TEC parameters are within a reasonable range of average baseline data and targeted threatened flora species numbers are stable.	TEC parameters are within a reasonable range of average baseline data and targeted threatened flora species numbers are stable.	NA – Monitoring next required in Autumn 2023.

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
Heritage Management Plan	HMP1	Aboriginal Cultural Heritage Sites – Teatree Hollow 2013.1	No detectable environmental consequences observed.	No detectable environmental consequences observed.	No detectable environmental consequences observed.
	HMP2	Historical Heritage Items - Wirrimbirra Sanctuary (Australian Wildlife Sanctuary) - Bargo Cemetery - Bargo Railway Bridge North (Wellers Road Overbridge) - Picton Wier - Tahmoor Colliery (Tahmoor Mine Site) - Bargo Railway Viaduct - Great Southern Road (partial)	No detectable environmental consequences observed.	No detectable environmental consequences observed.	No detectable environmental consequences observed.
Built Features Management Plan	1. Main Southern Railway Management Plan	Main Southern Railway Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	2. Wellers Road Overbridge Management Plan	Wellers Road Overbridge	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.
	3. Wollondilly Shire Council Management Plan	Public roads, bridges and culverts	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.
	4. Sydney Water Potable Water Management Plan	Potable Water Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	5. Sydney Water Sewer Management Plan	Sewerage Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	6. Jemena Management Plan	Gas Infrastructure	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	7. Endeavour Energy Management Plan	Electricity Infrastructure	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.
	8. Telstra Management Plan	Telecommunications	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	9. NBN Management Plan	Telecommunications	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	10. TPG Management Plan	Telecommunications	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.	NA – No infrastructure located above the commencing end of LW S1A.
	11. Built Structures Management Plan	Public amenities, private structures and farm dams	NA – No structures located above the commencing end of LW S1A.	NA – No structures located above the commencing end of LW S1A.	NA – No structures located above the commencing end of LW S1A.
	12. Bargo Cemetery Management Plan	Bargo Cemetery (Heritage Site)	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	13. Wollondilly Anglican College Management Plan	Wollondilly Anglican College	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	14. Tahmoor Mine Site Management Plan	Tahmoor Mine Site	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	15. Australian Wildlife Sanctuary Management Plan	Australian Wildlife Sanctuary	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.	No mining impacts or environmental consequences observed.
	16. Picton Weir Management Plan	Picton Weir	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.	NA – This structure is not located above the commencing end of LW S1A.

Management Plan	TARP Reference / Sub-Management Plan	TARP Description	October 2022	November 2022	December 2022
	17. 3030 Remembrance Drive Management Plan	**Bargo Petroleum and Hill Top Pit Stop**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	18. Inghams Bargo Chicken Breeder Production Complex Management Plan	**Inghams Bargo Breeder Farm**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	19. Inghams Bargo Turkey Farm Management Plan	**Inghams Bargo Turkey Farm**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	20. Tahmoor Garden Centre Management Plan	**Tahmoor Garden Centre**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	21. MKD Machinery Management Plan	**MKD Machinery**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	22. Bargo Valley Produce Management Plan	**Bargo Valley Produce**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	23. Canine Country Club Management Plan	**Canine Country Club**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.
	24. Pamak Hobbies Management Plan	**Pamak Hobbies**	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.	NA – This property is not located above the commencing end of LW S1A.

Notes:

NR – Monitoring not required this month.

NA – Monitoring data not available as monitoring not completed this month or reporting not yet available.

* As discussed further in **Section 3.2.2**, a review of TARPs WMP9, WMP10, WMP11 and WMP13 was required due to multiple triggers in October to December 2022 from short term fluctuations in parameters demonstrated that the TARP triggers were too sensitive. Re-assessment of groundwater data against the revised TARPs was completed following this review process. This table presents the TARP triggers in accordance with the original TARPs and the revised TARPs. Further discussion of these TARP triggers and the TARP review process is provided in **Section 3.2.2** and the Groundwater Report (**Appendix C)**.

[1] TARP WMP3 Level 1 Trigger (LW S1A-S6A Water Management Plan): The recorded water level has declined by greater than 10 centimetres (cm) below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) and the same has not occurred at the at the reference site(s).

[2] Original TARP WMP9 Normal Condition (LW S1A-S6A Water Management Plan): No recorded mining induced change at VWP depth, or greater than 5 m water level reduction in VWP intakes following the commencement of extraction for a period less than six months.

[3] Original TARP WMP9 Level 2 Trigger (LW S1A-S6A Water Management Plan): Water level declines below the calculated Level 2 trigger – being the average of Level 1 (the '5 m drawdown'1) and Level 3 (the 'maximum modelled drawdown') – following the commencement of extraction for a period of greater than six consecutive months AND The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.

[4] Revised TARP WMP9 Normal Condition (refer to Appendix C): No observable mining induced change at VWP intakes OR Greater than 5 m water level reduction in VWP intakes following the commencement of extraction for a period of less than six months.

[5] Original TARP WMP10 Level 1 Trigger (LW S1A-S6A Water Management Plan): Recorded drawdown is within 30 m of modelled predicted drawdown, for a period less than 6 months.

[6] Revised TARP WMP10 Normal Condition (refer to Appendix C): Observed data does not exceed modelled predicted drawdown by greater than 30 metres OR observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for less than three consecutive months.

[7] Original TARP WMP11 Level 1 Trigger (LW S1A-S6A Water Management Plan): Recorded salinity and/or metals or pH outside of defined trigger levels for 3 consecutive months or less. The effect does not persist after a significant rainfall recharge event AND a similar trend or response is noted at other monitored bores or private groundwater bores.

[8] Revised TARP WMP11 Normal Condition (refer to Appendix C): No observable changes in salinity, pH or metals outside of the baseline variability AND Observed salinity and/or metals or pH outside of defined trigger levels for less than 3 consecutive months.

[9] Original TARP WMP13 Normal Condition (LW S1A-S6A Water Management Plan): Groundwater level and water quality remain consistent with baseline variability and/or pre-mining trends, and changes in groundwater levels/quality not persisting after significant rainfall recharge events.

[10] Original TARP WMP13 Level 1 Trigger (LW S1A-S6A Water Management Plan): Level 1 trigger of TARP WMP8 for a minimum of two "early warning" bores OR Level 1 trigger of TARP WMP11 for a minimum of two "early warning" bores.

[11] Revised TARP WMP13 Normal Condition (refer to Appendix C): Groundwater level and water quality remain consistent with baseline variability and/or pre-mining trends, and changes in groundwater levels/quality not persisting after significant rainfall recharge events.

3.2 Summary of Actions and Responses

During the reporting period, there was five (5) environmental aspects that were associated with a TARP triggers. This section provides a summary of actions resulting from triggers being met in the TARPs, as well as the progress and success of any remediation actions.

3.2.1 Pool Water Level TARP – Level 1 Trigger for Pool Water Level Reduction

3.2.1.1 Background

The following TARP trigger for TARP WMP3 occurred during the current reporting period for water level (refer **Appendix B**):

- Monitoring Site TT9-QLa – Level 1 TARP trigger occurred from 27 to 30 December 2022.

As illustrated in **Figure 3-1**, the recorded water level at monitoring site TT9 declined by greater than 10 cm below the recorded baseline minimum level for the period 27 to 30 December 2022. During and following a rainfall event in late December 2022, the water level rose and was recorded above the baseline minimum as of 10 January 2022 (extent of available water level data for this assessment).

It is noted that only 2 months of baseline water level data are available for monitoring site TT9-Qla.

A suitable reference site location for Teatree Hollow, upstream of potential mining related influences, is not available. An alternative reference site, TT1-QRLa, is located upstream of LW S4A on the Teatree Hollow tributary (known as Wirrimbirra Creek). At this reference site, the water level did not decline below the baseline minimum during the period 27 to 30 December 2022.

Therefore, in accordance with the LW S1A-S6A Water Management Plan, a level 1 trigger in relation to pool water level decline at monitoring site TT9 has been derived during this reporting period.

Further discussion of this trigger is provided in the Surface Water Review report (refer **Appendix B**).

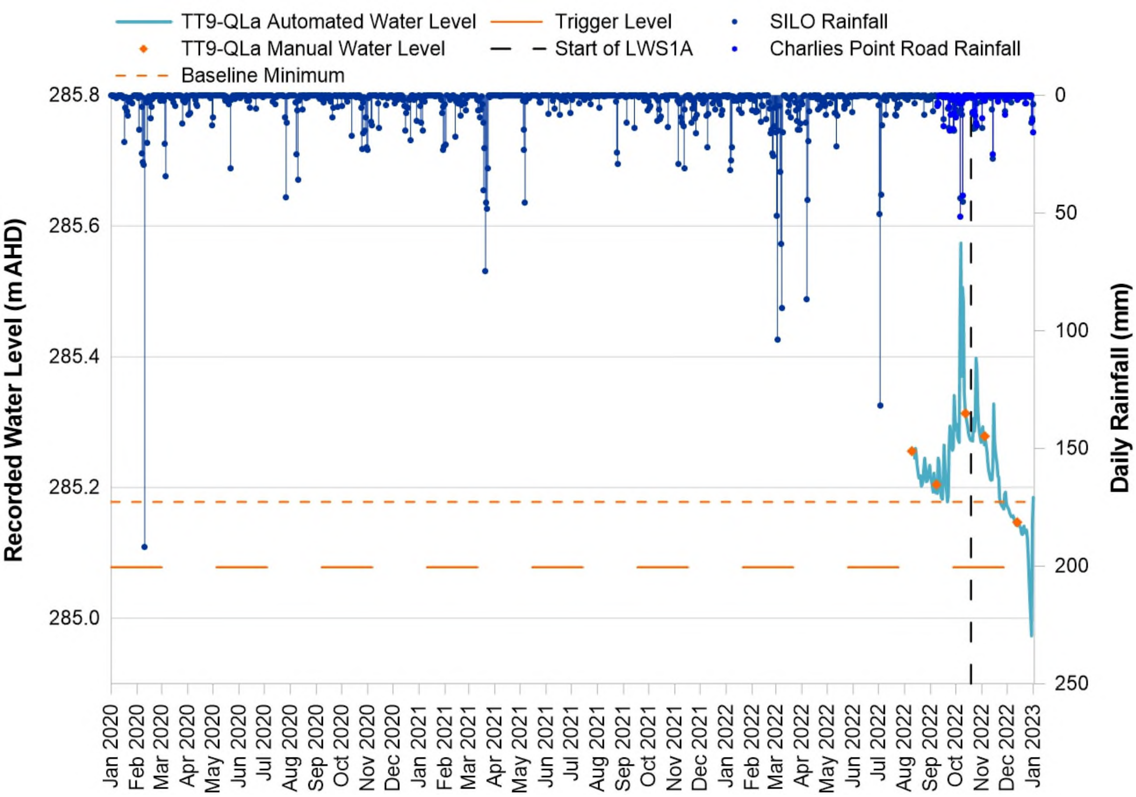

Figure 3-1 TT9-QLa Water Level Data

3.2.1.2 *Actions and Responses Completed*

Table 3-2 outlines the actions and responses that are required to be completed in accordance with a Level 1 TARP trigger for pool water level (TARP WMP3), as well as how these actions and responses have been addressed.

Table 3-2 Actions and Responses for Level 1 TARP Trigger for Pool Water Level Reduction

Action / Response	Tahmoor Coal response
Actions	
Continue monitoring and review of data as per monitoring program	Monthly monitoring and review of data is ongoing according to the monitoring program.
Review water level trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions	Completed in the Surface Water Review report (**Appendix B**). This assessment noted that similar very slight declines were recorded at monitoring sites TT3-QLa, TT2-QLa, TT7-QLa, and TT12-QLa. However, the decline in water level at these monitoring sites did not exceed 10 cm below the associated recorded baseline minimum level. It was noted that the baseline monitoring period for TT7-QLa and TT3-QLa commenced in early 2020, whereas the baseline monitoring period for TT9-QLa commenced in August 2022. Based on the available monitoring data, it is considered that the hydrological characteristics of TT9-QLa are similar to that of TT&-QLa. As such, there is potential that the water level at monitoring site TT9-Qla declined to a similar level historically to that which was recorded in late December 2022.
Review streamflow data recorded at TT-F1 and conduct streamflow reduction assessment;	Completed in the Surface Water Review report (**Appendix B**). Challenges in the construction of the v-notch weir on Teatree Hollow (TT-F1) were encountered such that further construction works were required in late 2022 to early 2023. Therefore, as the streamflow monitoring data for TT-F1 was influenced by the weir construction works for the duration of the review period and was not reflective of natural conditions, a streamflow reduction assessment has not been undertaken.
Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater level monitoring results) necessary to inform assessment.	Completed in the Surface Water Review report (**Appendix B**). A review of subsidence monitoring results indicated that, as mining of LW S1A had only progressed 630 metres (approximately 400 m to the east of TT9-QLa), it was considered unlikely that pool TT9 had been impacted by mining of LW S1A. A visual inspection of pool TT9 conducted on 17 January 2023 did not identify any environmental consequences from mining, such as evidence of fractures, impacts to pool water level, overland connected flows, iron staining or gas release. A review of groundwater monitoring data from the closes groundwater monitoring site P56 indicated that a notable decline in groundwater level was recorded in the Hawkesbury Sandstone (equating to approximately 3.4 m decline since the start of LW S1A mining). This indicates that there is potential that a decline in baseline contribution to Teatree Hollow occurred from October to December 2022, which may have had a minor contribution to the overall recorded decline in water level at TT9-QLa.

Action / Response	Tahmoor Coal response
Responses	
Report trigger exceedance to DPE and key stakeholders	Trigger exceedance notification provided to DPE on 28 February 2023, and the Tahmoor Colliery Community Consultative Committee on 2 March 2023.
Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review	Completed as part of this report.

3.2.1.3 Proposed Actions and Responses

From the completion of actions and responses (as discussed in Table 3-2), it is concluded that the water level decline at monitoring site TT9-QLa for the period 27 to 30 December 2022 is considered to be related to the prevailing climatic conditions and likely unrelated to mining influences. Therefore, this TARP trigger is not considered to be an environmental consequence of mining, and the results remain within predictions in accordance with the LW S1A-S6A Water Management Plan. Proposed Actions and Responses

Water level data recorded at monitoring site TT9-QLa will continue to be recorded and reviewed in accordance with the LW S1A-S6A Water Management Plan. If additional monitoring data indicates continued decline in water level at monitoring site TT9-QLa, further assessment and actions will be taken in accordance with the LW S1A-S6A Water Management Plan.

The current monitoring program will continue in accordance with the LW S1A-S6A Water Management Plan. The next update will be provided as part of the next Six Monthly Subsidence Impact Assessment report, to be provided to DPE by 30 September 2023.

3.2.2 Groundwater TARP triggers

3.2.2.1 Background

During the reporting period, a number of TARP triggers occurred in accordance with the following groundwater TARPs:

- TARP WMP9 Shallow Groundwater Pressure (VWP Sensors < 200 m Depth): Potential Level 2 for TBC032 HBSS recorded at 131m in December 2022;
- TARP WMP10 Groundwater Level / Pressure Deep VWPs (> 200 m Depth excluding Bulli Coal Seam): Level 1 triggered since October 2022 for TBC09 (BGSS – 322m), TBC09 (BGSS-343m), TBC018 (BGSS-282m), TBC018 (BGSS-366m), TBC18 (BUSM-404m), TBC20 (WBCS-397m), TBC20 (BGSS-375m), TBC26 (BUSM-432m), TBC32 (BGSS-237m), TBC32 (BGSS-294m); since November 2022 for TBC09 (WWCO-391m), TBC09 (WO-397m), TBC18 (W0-432m), TBC020 (211m), TBC32 (BGSS-200m), TBC39 (BGSS-299m); December 2022 for TBC020 (293m);
- TARP WMP11 Groundwater Quality (Open Standpipes and Private Bores): Level 1 triggered for P53B (pH upper), GW112473 (EC and pH lower), P52 (EC), P53A (EC) for November; P55A (EC) for November and December; numerous exceedances of heavy metals (Fe, MN, Cu, Pb, Zn, Ni, Al, As, Li, Ba, Sr) at P51B, P52, P53A-C, P55A-C, P56B-C, GW062068, GW104008, GW104323, GW104659, GW105395, GW109257 and GW112473 in November and December 2022; and
- TARP WMP13 Groundwater Bores Monitoring for Thirlmere Lakes: Level 1 triggered due to Level 1 triggers of TARP WMP11 for "early warning" bores P51B (Al, As), GW062068 (Fe, Cu, Zn, Ni), and GW104659 (Mn, Al, Li, Ba) recorded in November and December 2022.

Regarding the TARP WMP9 trigger, the decline in observed groundwater levels below the TARP Level 2 at TBC032-HBSS 131m could be related to climate or mining of LW S1A. However the wording in the current TARP has no timeframe associated with the change in groundwater levels.

Regarding the TARP WMP11 triggers (and consequently the WMP13 triggers), the TARP Level 1 triggers for groundwater quality were not likely to be mining related but rather due to climate related events. All triggers for pH, EC and metal concentrations were short term exceedances (less than three months) that were likely due to natural fluctuation in groundwater conditions following above average rainfall in October and November 2022. The trigger level was calculated using a short baseline period which could have resulted in a conservative trigger level.

Regarding the TARP WMP10 triggers, it was noted that secondary extraction of the new mining domain commenced on 18 October 2022 and the Level 1 TARP trigger triggered shortly thereafter. Therefore Level 1 triggers in October 2022 appear to be very conservative. In addition, the TARPs did not allow for any level of variation below the modelled drawdown.

3.2.2.2 Actions and Responses Completed

Groundwater TARP triggers for October to December 2022 were notified to DPE via the Planning Portal on 28 February 2022.

Upon review of the TARP triggers, it was identified that these TARP were not representative of incurred variations to the system that required further analysis as per the objectives of the TARPs. This was primarily due to the temporal scales in many of the TARP trigger descriptions being either incorrect, insufficient or lacking. Without an appropriate temporal scale, isolated fluctuations and seasonal variations were resulting in triggers to the TARPs, which was unrepresentative of trends that would indicate potential environmental consequences from longwall extraction.

Further, where modelled drawdown was relied upon to define trigger levels, insufficient allowance was given for the known and accepted level of accuracy with modelled drawdowns (i.e. an exceedance of 20 cm beyond modelled drawdown would trigger a Level 1, although this can be considered within the bounds of the model results and not representative of trends of exceedance of model outputs).

The TARPs in question were therefore revised. A marked-up version of the original TARPs showing changes is provided in Appendix F of the Groundwater Report (**Appendix C**), and the reasoning behind each TARP change is provided in **Table 3-3.**

Following the revision of the TARPs, a re-assessment of the data against the TARPs was completed and there were no residual TARP triggers for this reporting period.

Table 3-3 Reasoning for Revision of Groundwater TARPs

TARP	Proposed Changes	Reasoning
WMP9	Normal Conditions – additions of second dot point 'greater than 5 metre water level reduction in VWP intakes following the commencement of extraction for a period of less than 6 months' Level 1 – addition of wording 'for a period of greater than 6 months' Level 2 – addition of wording 'for a period of greater than 6 months' Level 3 – addition of wording 'for a period of greater than 6 months'	The current wording has no timeframe associated with the change in groundwater levels. Addition of a temporal scale provides greater clarity around trends in the water level (i.e. if only one month exceeds trigger but then we see a recovery it is unlikely due to mining impacts). A minimum of six months allows for trend analysis prior to enacting the TARP. Section 6.1.2.2 of the GTR* states: "Regionally, climatic variations have been observed to cause reductions in water levels of up to 5 m in shallow (< 200 m depth) VWPs. Therefore, a water level reduction of greater than 5 m for shallow VWP loggers for a period beyond 6 months is considered to be a possible indicator of greater than predicted impacts to groundwater (even if greater drawdown was predicted, the concept is to use this magnitude of drawdown as an early warning)." This approach was successfully adopted in the Western Domain Water Management Plan and TARPs. This informs the temporal scale of 6 months for inclusion into the TARP.

TARP	Proposed Changes	Reasoning
WMP10	Normal Conditions – update wording to reflect that within 30 metres of modelled drawdown is considered 'normal conditions', or if drawdown exceeds modelled impacts by greater than 30 metres for a period of less than three months. Level 1 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than three consecutive months. Level 2 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than six consecutive months. Level 3 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than twelve consecutive months.	The current trigger levels has NO level of variation below modelled drawdown which is too sensitive. The revision also adds a temporal scale in order to determine trends rather than triggers from isolated fluctuations. For example: Level 1: initially stated '*within 30 metres of predicted drawdown for a period of less than six months*'. If exceedance beyond model drawdown is by 2 cm for one month this would trigger Level 1. However, this is considered to be within the bounds of the model accuracy and not representative of a trend and therefore does not warrant a trigger. IAPUM feedback stated: *"For the trigger level wording:* *- the normal condition should be more clearly stated as 'observed levels are within (some measurable value – 10m?) of predicted impacts',* *- for each of the levels 1,. 2 and 3 start with the words observed drawdown exceeds….' "* The 'normal' condition should allow for some reasonable variation from predicted impacts (not 'does not exceed' as is current). It is believed, in consideration of the overall level of predicted depressurisation, 30 metres beyond model predictions may be cause for review. Historically, the 30 metres has proven to be a successful and reasonable measure when utilised in the Western Domain WMP and TARPs. Within 30 metres of the modelled predicted drawdown should be considered 'normal conditions'. Given the point accuracy of the groundwater model at each point, using a value of less than 30 metres here is considered unreasonable, with review undertaken at the model review every three years. Additionally, if predicted impacts are exceeded by greater than 30 metres but for a period of less than 3 months, this is not considered representative of a trend and is still within 'normal conditions'. To enact various TARP Levels, the temporal scale over which we observe this variation from modelled drawdown will be instated. This is a logical and realistic approach to identify potential exceedances in impact via extraction to the groundwater system. Wording edited from 'for a period of' to 'consecutive months' for consistency and clarity across the TARPs.
WMP11	Level 1 – amend wording to state 'Observed salinity and/or metals or pH outside of defined trigger levels1 for *3 consecutive months or more'* Level 2 – amend wording to state 'Observed salinity and/or metals or pH outside of defined trigger levels1 for *3 consecutive months or more'* Level 3 – edit temporal scale from 3 to 6 months of consecutive breach of trigger.	The current wording does not include a timeframe associated with changes in water quality. Propose inclusion of a temporal scale to the TARP levels in order to determine trends rather than typical fluctuations in water quality. Without a temporal scale, isolated fluctuations are triggering TARPs which are unrepresentative of any trends associated with potential response to longwall extraction.

TARP	Proposed Changes	Reasoning
WMP13	Instate P50 as an early warning bore (as soon as commissioned), to replace P51. Rewording associated with GW075409–1, GW075409–2, GW075410, GW075411 to clarify that these are part of the broader monitoring network, however are not trigger bores.	Due to land access issues the location of P51 required alteration and is now located above LWS5A and is not considered a suitable early warning bore. As the TARP currently reads, the Thirlmere Lakes Bores (GW075409–1, GW075409–2, GW075410, GW075411) would require specific trigger levels as part of GWMP8 and WMP11. However, given their distal proximity to the mine development and the purpose of WMP8 and WMP11, inclusion of these bores is considered inappropriate. It is proposed that the most suitable approach to identifying potential impacts to the Lakes is to use the 'early warning bores' to enact the trigger, which will then subsequently review the Thirlmere Lakes bores for potential impacts. The wording in the TARP has been amended to reflect this approach.

3.2.2.3 Proposed Actions and Responses

The LW S1A-S6A Water Management Plan and associated documents will be updated and submitted to DPE via the Planning Portal to reflect the changes made to the groundwater TARPs (following the submission of the Annual Review and this Six Monthly Subsidence Impact Report).

4 Assessment of Environmental Performance

4.1 Environmental Performance Measures and Indicators

The following development consents include subsidence impact performance measures as conditions for the extraction of LW S1A-S6A:

- SSD 8445:
  - Performance Measures – Natural and heritage features: Condition C1 (Table 7); and
  - Performance Measures – Built Features: Condition C5 (Table 8).

The subsidence impact performance measures were adopted as part of the LW S1A-S6A Extraction Plan and associated management plans. To assist in defining the performance measures, each measure has been assigned subsidence performance indicator(s) and addressed in relevant TARPs.

These performance measures and indicators are provided in **Table 4-1**, as well as an assessment of performance in accordance with the TARPs (as discussed previously in **Table 3-3** and **Section 3.2**.

Table 4-1 Assessment of Environmental Performance

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Water Resources				
All watercourses within the Subsidence Area	• No greater subsidence impact or environmental consequences to water quality, water flows (including baseflow) or stream health (including riparian vegetation), than predicted in the EIS.	Exceedance of the impact assessment criteria, as defined in the relevant Level 1 to Level 3 trigger, where a Level 3 trigger denotes progression towards a potential exceedance of the performance measure.	TARP WMP1, WMP3 and WMP5.	**No**
Other watercourses	• Negligible environmental consequences including beyond those predicted in the EIS, including: - Negligible diversion of flows or changes in the natural drainage behaviour of pools; - Negligible decline in baseline channel stability; - Negligible gas releases and iron staining; and - Negligible increase in water turbidity.	The performance measure will be considered to be exceeded if a Level 3 TARP is triggered in relation to water level decline and/or water quality changes and the investigation outcomes indicate a mining related impact based on monitoring data for sites in Hornes Creek and the Bargo River. Performance indicators in relation to channel stability are not proposed as soft knickpoints have not been mapped in Hornes Creek or the Bargo River.	TARP WMP2, WMP4 and WMP6.	**No**
GDEs including Thirlmere Lakes	• Negligible impacts including: - Negligible change in groundwater levels; and - Negligible change in groundwater quality.	The performance measure will be considered to be exceeded if a Level 3 TARP is triggered and the investigation outcomes indicate a mining related impact based on monitoring data for the Thirlmere Lakes.	TARP WMP13.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Land				
Any cliff located directly above longwalls	• Minor environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 5% of the total face area of the cliff within any longwall mining domain)	This performance measure is not relevant to this Extraction Plan, as there are no cliffs located directly above LW S1A-S6A.	None, not applicable to LW S1A-S6A.	Not applicable.
Any cliff within Subsidence Area beyond the extent of longwalls	• Negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs within Subsidence Area)	This performance measure will be considered to be triggered if more than 0.5% of the total face area of the cliffs within the 600 m Environmental Features Study Area is impacted by mining (i.e. by occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing).	TARP LMP1.	**No**
All land within the Subsidence Area	• No greater subsidence impacts or environmental consequences than predicted in the EIS	This performance measure will be considered to be triggered if mining results in mine subsidence-induced slope instability, which would be a greater subsidence impact or consequence than predicted in the EIS.	TARP LMP2.	**No**
All land outside the Subsidence Area	• Negligible subsidence impacts or environmental consequences	This performance measure is not relevant to this Extraction Plan, as there are no steep slopes identified within the 600 m Environmental Features Study Area, other than the three steep slopes located within the Subsidence Area and already assessment in accordance with the 'All land within the Subsidence Area' performance measure.	None, not applicable to LW S1A-S6A.	Not applicable.

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Biodiversity				
Threatened species, threatened populations, or endangered ecological communities	• No greater subsidence impacts or environmental consequences than predicted in the EIS. • Negligible impacts on threatened species, populations or communities due to remediation of subsidence cracking.	This performance measure will be triggered if subsidence impacts cannot be remediated in a manner that restores habitat of threatened species, threatened populations, or endangered ecological communities.	TARP BMP4.	**No**
GDEs including Thirlmere Lakes	• Negligible impacts including: - Negligible change in groundwater levels; and - Negligible change in groundwater quality	The performance measure will be considered to be exceeded if the groundwater levels or groundwater quality decline below Level 3 (in the relevant groundwater TARP triggers for water level and water quality – TARP WMP8 or WMP11) following the commencement of extraction, and the investigation outcomes indicate a mining related impact based on monitoring data for riparian vegetation.	TARP BMP3.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Heritage sites				
Aboriginal cultural heritage sites listed in Appendix 4	• No greater subsidence impacts or loss of heritage values than predicted in the EIS.	**TC14-2-19** (Isolated find): No performance indicators are currently established as impacts are predicted to be negligible.	None, not applicable to LW S1A-S6A.	Not applicable.
		Remembrance Drive 2013.1 (open camp site): No performance indicators are currently established as impacts are predicted to be negligible.	None, not applicable to LW S1A-S6A.	Not applicable.
		Teatree Hollow 2013.1 (rockshelter with art and deposit): This performance indicator will be considered to be triggered if more than 10% of rockshelters (i.e. more than two) in the Tahmoor South Domain (including A and B series longwalls) are impacted by: • Subsidence monitoring identifies obvious perceptible change, e.g. rockfall, cracking, or toppling within rockshelters; and • These subsidence impacts result in impacts to the heritage values of the site, e.g. cracking or spalling of the art work panels or, elsewhere in the shelter, cracking or spalling greater than naturally caused examples in the rockshelter. This performance measure cannot be exceeded during the extraction of the A series longwalls, even if the above-mentioned performance indicators are fully triggered for Teatree Hollow 2013.1. Such impacts would not exceed the 10% threshold of impacts to the 19 total rockshelters in the longwalls A and B Study Area.	TARP HMP1.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Heritage sites				
Historical heritage sites listed in Appendix 4	• No greater subsidence impacts or loss of heritage values than predicted in the EIS.	This performance indicator will be considered to be triggered if subsidence impacts cannot be repaired in a manner that preserves the heritage value of the historical heritage items. This performance indicator is applicable to the following historical heritage items: • Wirrimbirra Sanctuary (Australian Wildlife Sanctuary); • Bargo Cemetery; • Bargo Railway Bridge North (Wellers Road Overbridge); • Picton Weir; • Tahmoor Colliery (Tahmoor Mine Site); • Great Southern Road (partial); and • Bargo Railway Viaduct.	TARP HMP2.	**No**
Mine workings				
First workings	• To remain long term stable and non-subsiding.	None allocated.	None – ongoing assessment in accordance with mine design.	**No**
Second workings	• To be carried out only within the approved mine plan, in accordance with an approved Extraction Plan.	None allocated.	None – ongoing assessment in accordance with LW S1A-S6A Extraction Plan mine plan.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Public Infrastructure				
Key public infrastructure: • Main Southern Railway • Remembrance Drive • M31 Motorway • Moomba to Sydney Gas Pipeline • Gorodok Ethane Pipeline • Bargo Waste Management Centre	• Always safe and serviceable • Damage that does not affect safety or serviceability must be fully repairable, and must be fully investigated and repaired at the cost of the Applicant	None allocated.	Addessed in TARPs contained in the Main Southern Railway Management Plan and Wollondilly Shire Council Management Plan. It is noted that the Bargo Waste Management Centre, M31 Motorway, Moomba to Sydney Gas Pipeline, and the Gorodok Ethane Pipelines are not located within the Study Area of this Extraction Plan.	**No**
• All other public infrastructure including roads, culverts, bridges, viaducts, water supply pipelines, sewerage mains, gas pipelines, electrical and telecommunication infrastructure and survey control marks.	• Always safe • Serviceability should be maintained wherever practicable • Loss of serviceability must be fully compensated • Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant	None allocated.	Addressed in TARPs contained in Subsidence Management Plans for various built features.	**No**

Feature	Subsidence Performance Measure	Subsidence Performance Indicator	Relevant TARP	Subsidence Performance Measure Exceeded?
Other Built Features				
• Public amenities including schools, churches and community centres • Industrial, commercial and business premises • Bargo Cemetery • Wirrimbirra Sanctuary • Privately-owned residences • Other privately-owned built features and improvements, including petrol stations, sheds, garages, farm dams, tanks, swimming pools, tennis courts, roads, tracks and fences	• Always safe • Serviceability should be maintained wherever practicable • Loss of serviceability must be fully compensated • Damage must be fully repairable, and must be fully investigated and repaired or else replaced or fully compensated at the cost of the Applicant.	**Farm dams**: This performance measure will be considered to be triggered if mining results in damage to a farm dam such that the dam is not safe and serviceable and/or any damages cannot be fully repairable and/or compensated.	TARP LMP3.	**No**
		All other features: None allocated.	Addressed in TARPs contained in Subsidence Management Plans for various built features.	**No**
Public Safety				
• Public safety	• Negligible additional risk	This performance measure will be considered to be triggered if subsidence monitoring identifies a mining induced hazard to the public that cannot be controlled or managed.	Assessed indirectly through TARP LMP1, LMP2, LMP3. Addressed in TARPs contained in Subsidence Management Plans for various built features.	**No**

5 Document Information

5.1 References

Department of Planning and Environment (DPE) (2015), Draft Guidelines for the Preparation of Extraction Plans V5.

Niche (2023a), Tahmoor South, Aquatic Monitoring Report Spring 2022, report to Tahmoor Coal, 28 February 2023.

Niche (2023b), Tahmoor Mine South, Terrestrial Ecology Monitoring Report: Spring 2022, report to Tahmoor Coal, 14 February 2023.

Tahmoor Coal Documents:

- Extraction Plan LW S1A-S6A Extraction Plan Main Document, TAH-HSEC-00360
- Extraction Plan LW S1A-S6A Water Management Plan, TAH-HSEC-00361
- Extraction Plan LW S1A-S6A Land Management Plan, TAH-HSEC-00362
- Extraction Plan LW S1A-S6A Biodiversity Management Plan, TAH-HSEC-00363
- Extraction Plan LW S1A-S6A Heritage Management Plan, TAH-HSEC-00364
- Extraction Plan LW S1A-S6A Built Features Management Plan, TAH-HSEC-00366
- Extraction Plan LW S1A-S6A Public Safety Management Plan, TAH-HSEC-00365
- Extraction Plan LW S1A-S6A Subsidence Monitoring Program, TAH-HSEC-00367

5.2 Glossary of Terms

Terms references to this document are provided below in **Table 5-1**.

Table 5-1 Glossary of Terms

Term	Definition
Active Subsidence Zone	The active subsidence zone for each longwall is defined by the area bounded by the predicted 20 mm subsidence contour for the active longwall and a distance of 150 m in front of the active longwall face and 450 m behind the active longwall face or following 500 m of longwall extraction.
Angle of draw	The angle of inclination from the vertical of the line connecting the goaf edge of the workings and the limit of subsidence (which is usually taken as 20 mm of subsidence).
Built features	Includes any building or work erected or constructed on land, including dwellings and infrastructure such as a formed road, street, path, walk, or driveway; any pipeline, water sewer, telephone, gas or other infrastructure service main.
Cliff	A continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 to 1 (>63.4°).
Closure	The reduction in the horizontal distance between the valley sides. The magnitude of closure, which is typically expressed in the units of mm, is the greatest reduction in distance between any two points on the opposing valley sides. It should be noted that the observed closure movement across a valley is the total movement resulting from various mechanisms, including conventional mining induced movements, valley closure movements, far-field effects, downhill movements and other possible strata mechanisms.

Term	Definition
Curvature	Second derivative of subsidence, or the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections. Curvature is usually expressed as the inverse of the Radius of Curvature with the units of 1/km (km-1), but the value of curvature can be inverted, if required, to obtain the radius of curvature, which is usually in km. Curvature can be either hogging (i.e. convex) or sagging (e.g. concave).
Longwall	A system of mining coal in which the seam is extracted on a broad front or long face using a coal shearer and the roof is supported by hydraulic roof supports.
Reporting period	18 October 2022 to 31 December 2022.
Run of mine (ROM)	Raw coal production. The unprocessed mined coal that is conveyed to the CPP. ROM may consist of coal and rock.
Steep slope	An area of land having a gradient between 1 in 3 (33% or 18.3°) and 2 in 1 (200% or 63.4°).
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points, i.e. strain is the relative differential displacement of the ground along or across a subsidence monitoring line. Strain is dimensionless and can be expressed as a decimal, a percentage or in parts per notation. Tensile Strains are measured where the distance between two points or survey pegs increases and Compressive Strains where the distance between two points decreases. Whilst mining induced strains are measured along monitoring lines, ground shearing can occur both vertically, and horizontally across the directions of the monitoring lines.
Study Area	Study Area as defined in the LW S1A-S6A Extraction Plan.
Subsidence	The vertical movement of a point on the surface of the ground as it settles above an extracted panel, but 'subsidence of the ground' in some references can include both a vertical and horizontal movement component. The vertical component of subsidence is measured by determining the change in surface level of a peg that is fixed in the ground before mining commenced and this vertical subsidence is usually expressed in units of mm. Sometimes the horizontal component of a peg's movement is not measured, but in these cases, the horizontal distances between a particular peg and the adjacent pegs are measured.
Subsidence impacts	The physical changes or damage to the fabric or structure of the ground, its surface and environmental features, or built structures that are caused by the subsidence effects. These impacts considerations can include tensile and shear cracking of the rock mass, localised buckling of strata, bed separation, rock falls, collapse of overhangs, failure of pillars, failure of pillar floors, dilation, slumping and also include subsidence depressions or troughs.
Subsidence consequences	The knock-on results of subsidence impacts, i.e. any change in the amenity or function of a natural feature or built structure that arises from subsidence impacts. Consequence considerations include public safety, loss of flows, reduction in water quality, damage to artwork, flooding, draining of aquifers, the environment, community, land use, loss of profits, surface improvements and infrastructure. Consequences related to environmental features are referred to as environmental consequences.
Tilt	The change in the slope of the ground as a result of differential subsidence, and is calculated as the change in subsidence between two points divided by the horizontal distance between those points. Tilt is, therefore, the first derivative of

Term	Definition
	the subsidence profile. Tilt is usually expressed in units of mm/m. A tilt of 1 mm/m is equivalent to a change in grade of 0.1 %, or 1 in 1000.

5.3 Abbreviations

Abbreviations used in this document are provided below in **Table 5-2**.

Table 5-2 Abbreviations

Abbreviation	Definition
AHIMS	Aboriginal Heritage Information System
ARTC	Australian Rail Track Corporation
AUSRIVAS	The Australian River Assessment System
BACI	Before After Control Impact design
BGSS	Bargo Sandstone
BIS	Building Inspection Service
CTF	Cease to flow
DPE	NSW Department of Planning and Environment (formerly DPIE)
DPIE	NSW Department of Planning, Industry and Environment (now DPE)
EC	Electrical conductivity
EPA	NSW Environment Protection Authority
EPT	Ephemeroptera Plecoptera Trichoptera scores
GFG	GFG Alliance
GNSS	Global Navigation Satellite System units
HBSS	Hawkesbury Sandstone
Km	Kilometres
LW S1A	Longwall South 1A
LW S2A	Longwall South 2A
LW S3A	Longwall South 3A
LW S4A	Longwall South 4A
LW S5A	Longwall South 5A
LW S6A	Longwall South 6A
LW S1A-S6A	Longwall South 1A to South 6A
m	metres
mbgl	Metres below ground level
mg/L	Milligrams per litre
ML	Mining Lease
mm	millimetre
MSEC	Mine Subsidence Engineering Consultants
MSR	Main Southern Railway
NRAR	NSW Industry – Land & Water – Natural Resources Access Regulator – East
NSW	New South Wales

Abbreviation	Definition
OE	Observed expected score
OSP	Open Standpipe Piezometers
pH	pH units
SSGVs	Site Specific Guideline Values
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
TfNSW	Transport for NSW
VMP	Vibrating Wire Piezometer

5.4 Document Distribution

This report and associated documents have been distributed according to **Table 5-3**.

Table 5-3 Distribution List for Six Monthly Subsidence Impact Report

Agency	Contact Person	Position	Electronic Copy
DPE	(Planning Portal)	(Planning Portal)	(https://www.planningportal.nsw.gov.au/major-projects)
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TCCCC Committee Members	Documents sent to TCCCC Committee Members at private email addresses.		

Appendix A – Subsidence Monitoring Report

Tahmoor South LW S1A

Subsidence Monitoring Report

Summary	
Monitoring period	26 December 2022 to 1 January 2023
Length of extraction of LW S1A	545 metres on 1 January 2023
Distance travelled by longwall since previous report	LW S1A travelled 34 metres in the last week
Distance to completion of LW S1A	1166 m

Summary of observed ground movements

Subsidence Parameter	Maximum observed within active subsidence zone	Location
Subsidence (mm)	200	GNSS unit Site S01 (as at 1 Jan)
Tilt (mm/m)	0.1	V-Line & Charlies Point Road
Hogging Curvature (km^{-1})	0.01	Charlies Point Road
Sagging Curvature (km^{-1})	-0.01	V-Line & Charlies Point Road
Tensile Strain (mm/m)	0.3	Charlies Point Road
Compressive Strain (mm/m)	-0.3	Charlies Point Road
Subsidence since previous survey (mm)	79 mm	GNSS unit Site S01 (since 26 Dec)

Actions

HAVE ANY DEFINED TRIGGERS BEEN REACHED SINCE PREVIOUS REPORT?	NO
IS ANY URGENT ACTION REQUIRED?	NO

This monitoring report provides the results of the latest ground surveys during the mining of LW S1A, in accordance with the requirements of subsidence management plans.

Longwall face position

LW S1A commenced on 18 October 2022, and at the time of this report had progressed a distance of 545 metres from its start position. The mine layout and the monitoring peg positions are shown in Drawing No. MSEC1304-01.

Monitoring results

Ground monitoring is being undertaken within the active subsidence zone of LW S1A. Maximum incremental subsidence parameters within the current extent of monitoring are summarised in Table 1. No surveys were conducted this week.

Table 1 Summary of maximum observed subsidence parameters

Monitoring Line	Maximum observed subs (mm)	Maximum observed tilt (mm/m)	Maximum observed hogging curvature (km^{-1})	Maximum observed sagging curvature (km^{-1})	Maximum observed tensile strain (mm/m)	Maximum observed comp. strain (mm/m)
V-Line	13	0.1	0.00	-0.01	0.2	-0.2
Charlies Point Road	19	0.1	0.01	-0.01	0.3	-0.3

Ground survey results

Ground monitoring is being undertaken within the active subsidence zone of LW S1A. Monitoring results are shown graphically at the back of this report.

The spatial distribution of incremental subsidence is shown in Drawing No. MSEC1304-02. Changes in subsidence since the previous survey are shown in Drawing No. MSEC1304-03.

Tahmoor Mine Boundary Survey Line (V Line)

Monthly surveys along the V Line have commenced. Very minor changes observed from survey on 12 December.

GNSS monitoring

Global Navigation Satellite System (GNSS) units are fixed survey stations that continuously measure their absolute horizontal and vertical positions in real time. There are 20 units located directly above and adjacent to LW S1A to S6A. These include two units above the commencing end, and along the centreline of, LW S1A, being Sites S01 and S02.

The measured position of each GNSS unit varies depending on atmospheric conditions and the array of satellites that are present in the sky at each time, and the vegetation cover surrounding each unit. Measured variations in height are typically greater than the variations for eastings and northings.

The results from the GNSS units are shown in Fig. S01 to Fig. S10. The 7-day running average readings are the most appropriate reflection of measured changes to date. Mining-induced movements are developing at the GNSS units, with maximum measured subsidence of approximately 200 mm.

Observed development of subsidence above LW S1A is shown in Figure A. Subsidence is currently developing within predictions, with magnitudes of subsidence similar to observations above previously extracted LW 22. In comparison, observed subsidence above previously extracted first panel LW W1 was substantially less than prediction.

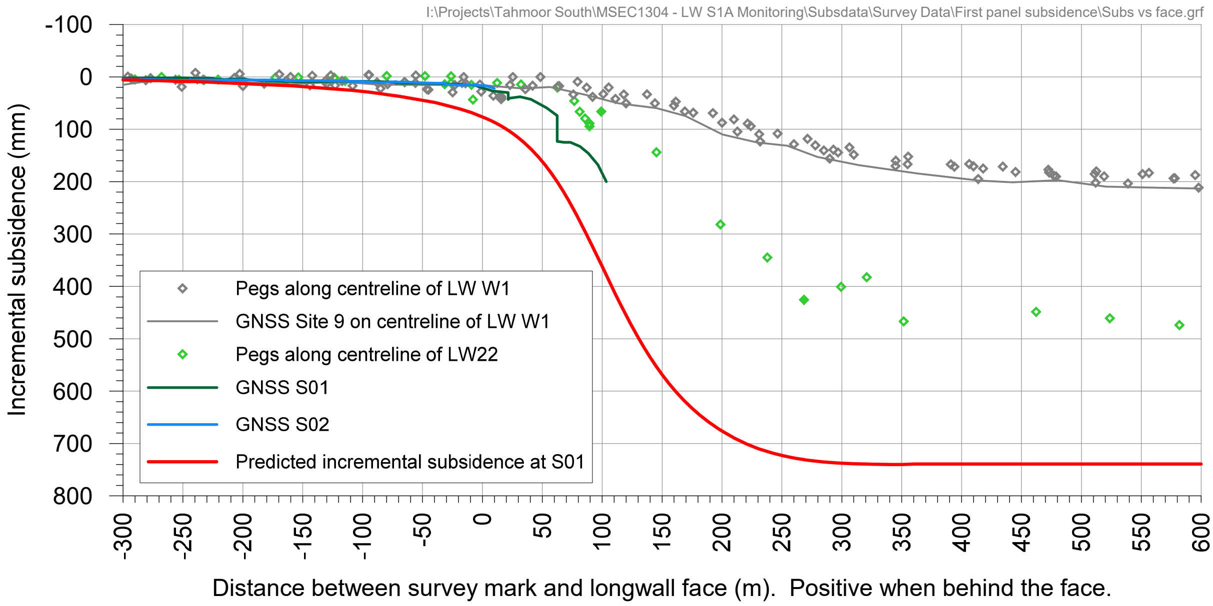

Figure A Observed development of subsidence above LW S1A

Changes in horizontal distances can be calculated between GNSS units that are stationed close together and results are shown in Figure B. Small changes are developing between Sites 01 and 02, and Sites 03 and 04 across Wirrimbirra Creek. Minor changes currently observed between other pairs of GNSS units.

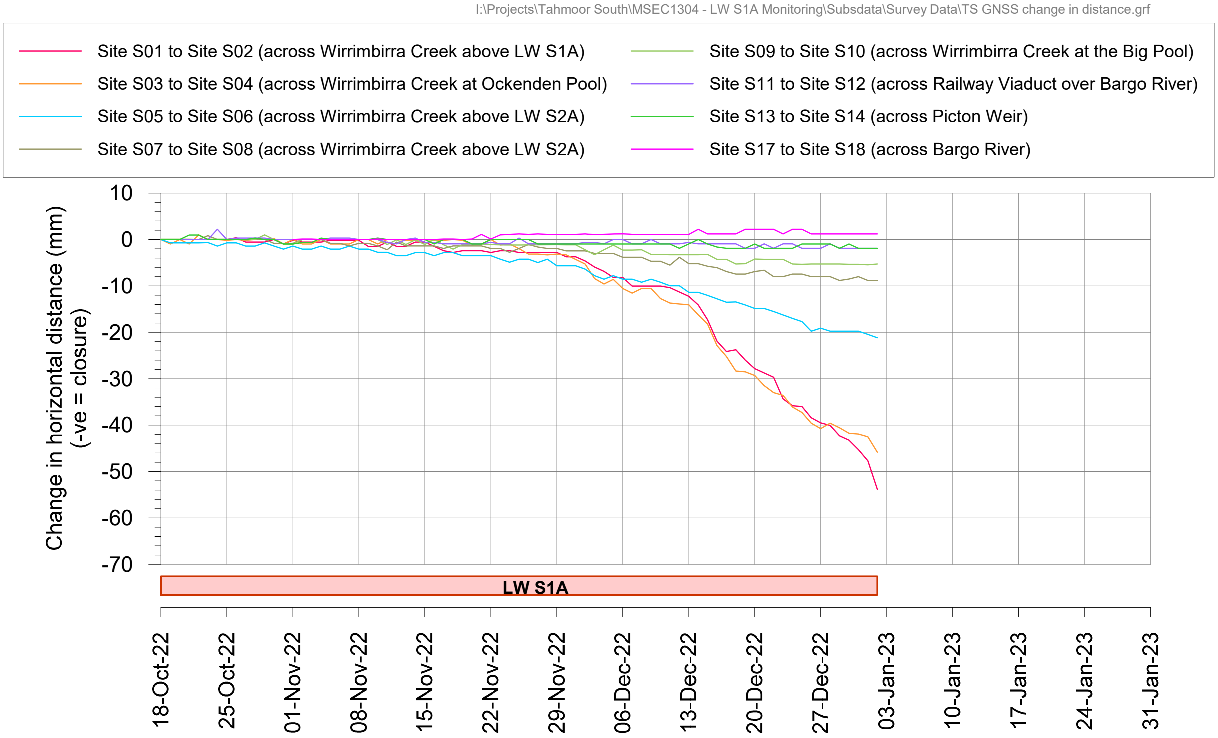

Figure B Observed changes in horizontal distances between GNSS units

Natural Features

Survey marks have been installed at six locations across the Tributary to Teatree Hollow (Wirrimbirra Creek) and at two locations across Teatree Hollow prior to the commencement of LW S1A. The locations are shown in Drawing No. MSEC1304-01.

Visual inspections have been conducted in September, October and November, all three of which could be considered to be baseline inspections.

Structures

There are no structures located above the commencing end of LW S1A.

Local Roads

There are no roads located above the commencing end of LW S1A.

Monthly ground surveys have commenced along Charlies Point Road, with very minor changes observed on 12 December.

Surveys of Rockford Road Bridge and Arina Road Bridge were conducted on 6 December, with observed changes within survey tolerance.

A visual inspection along local roads, Arina Road Bridge and Rockford Road Bridge on 23 December found no issues. Some potholes on Charlies Point Road were patched between 16 and 23 December.

A visual inspection along local roads on 30 December found no issues.

Gas Infrastructure

No gas infrastructure is located above the commencing end of LW S1A.

Electrical Infrastructure

An 11 kV powerline is located above the commencing end of LW S1A. An 11 kV powerline is located along Charlies Point Road. Ground surveys of critical power poles are being conducted when poles are within the active subsidence zone.

Monthly ground surveys have commenced along Charlies Point Road, with very minor changes observed on 12 December.

A visual inspection on 30 December found no issues.

Telecommunications Infrastructure

No telecommunications infrastructure is located above the commencing end of LW S1A.

Potable Water Infrastructure

No potable water infrastructure is located above the commencing end of LW S1A.

Sewer Infrastructure

No sewer infrastructure is located above the commencing end of LW S1A.

Dams

Weekly visual inspections, and monthly geotechnical inspections will be undertaken when dams are within the active subsidence zone.

A visual inspection of FD-1 on 9 December found no issues, however, the water level has dropped since the previous inspection due to drier weather conditions. No significant changes were observed on 30 December. The small dam is holding a small volume of water following recent rainfall.

Archaeological Sites

Very minor ground movements have been measured by GNSS units S03 and S04 located on either side of Wirrimbirra Creek, with no impacts observed at rock shelter site 52-2-4471.

Summary

LW S1A commenced extraction on 18 October 2022. Minor subsidence is developing above the commencing end of the longwall panel.

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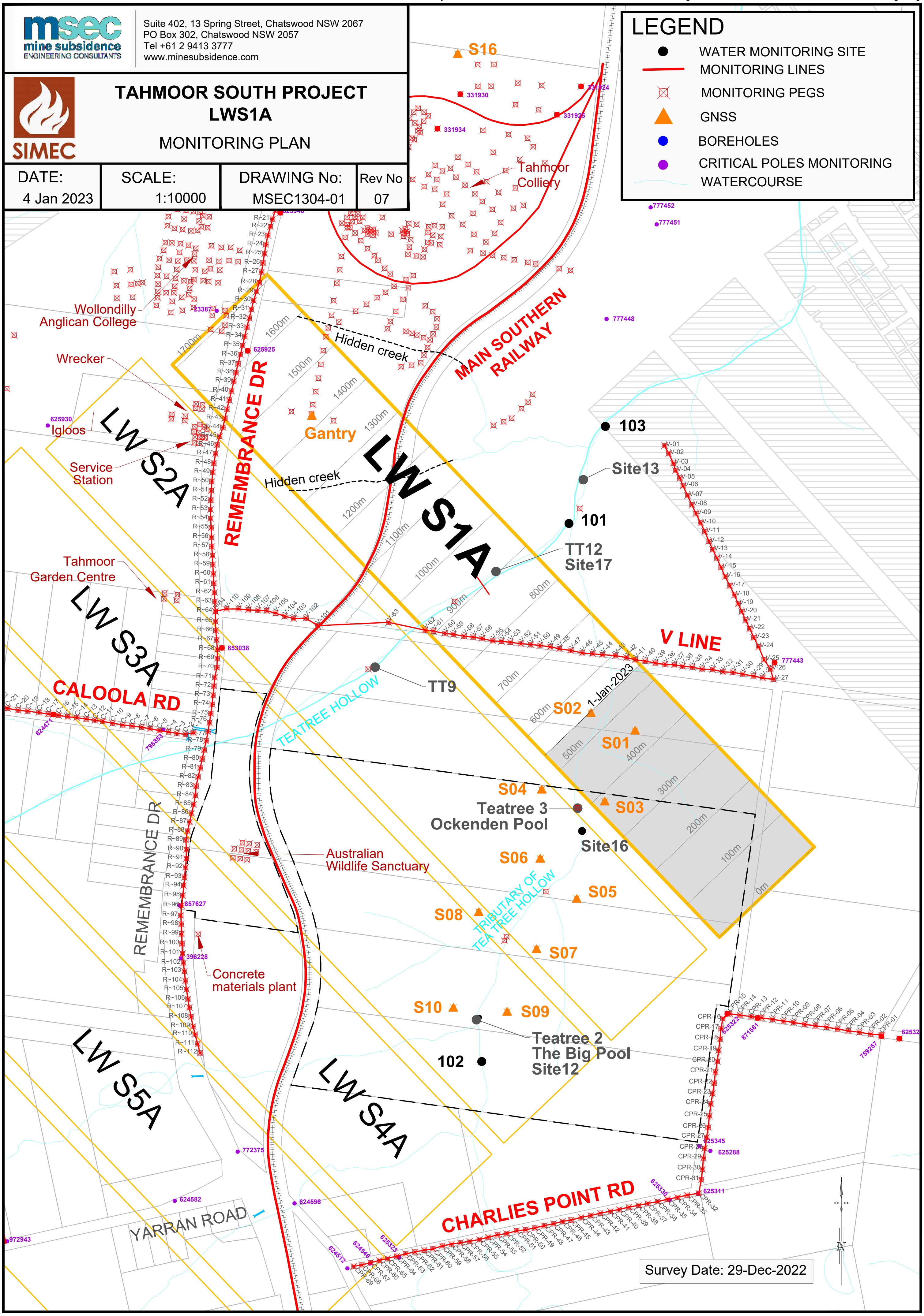
TAHMOOR SOUTH PROJECT LWS1A

MONITORING PLAN

DATE:	SCALE:	DRAWING No:	Rev No
4 Jan 2023	1:10000	MSEC1304-01	07



Tahmoor South LW S1A - GNSS Monitoring

Site S01 above LW S1A

I:\Projects\Tahmoor South\MSEC1304 - LW S1A Monitoring\Subsdata\Survey Data\Fig. S01 GNSS.grf

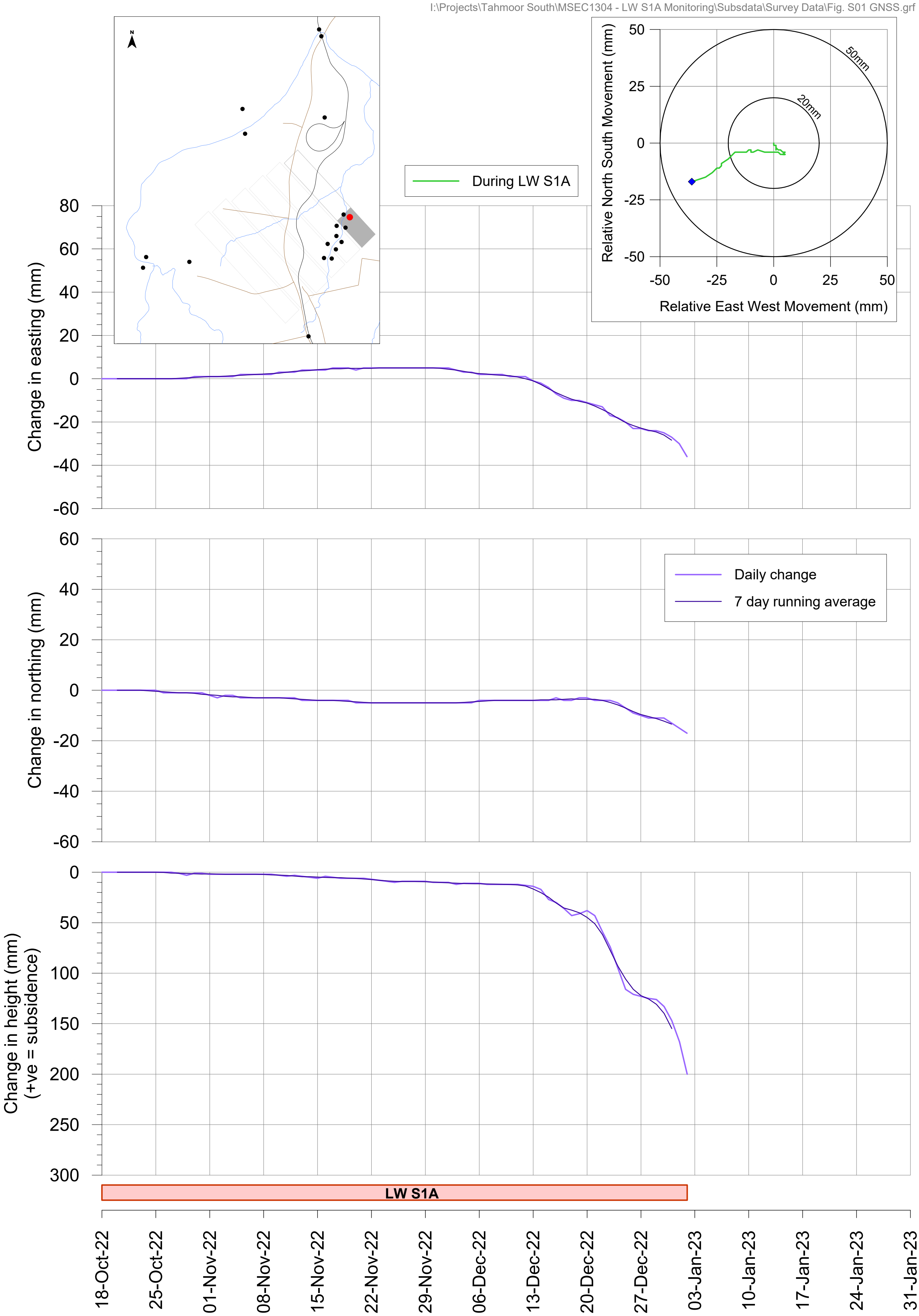


Fig. S01-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S02 above LW S1A

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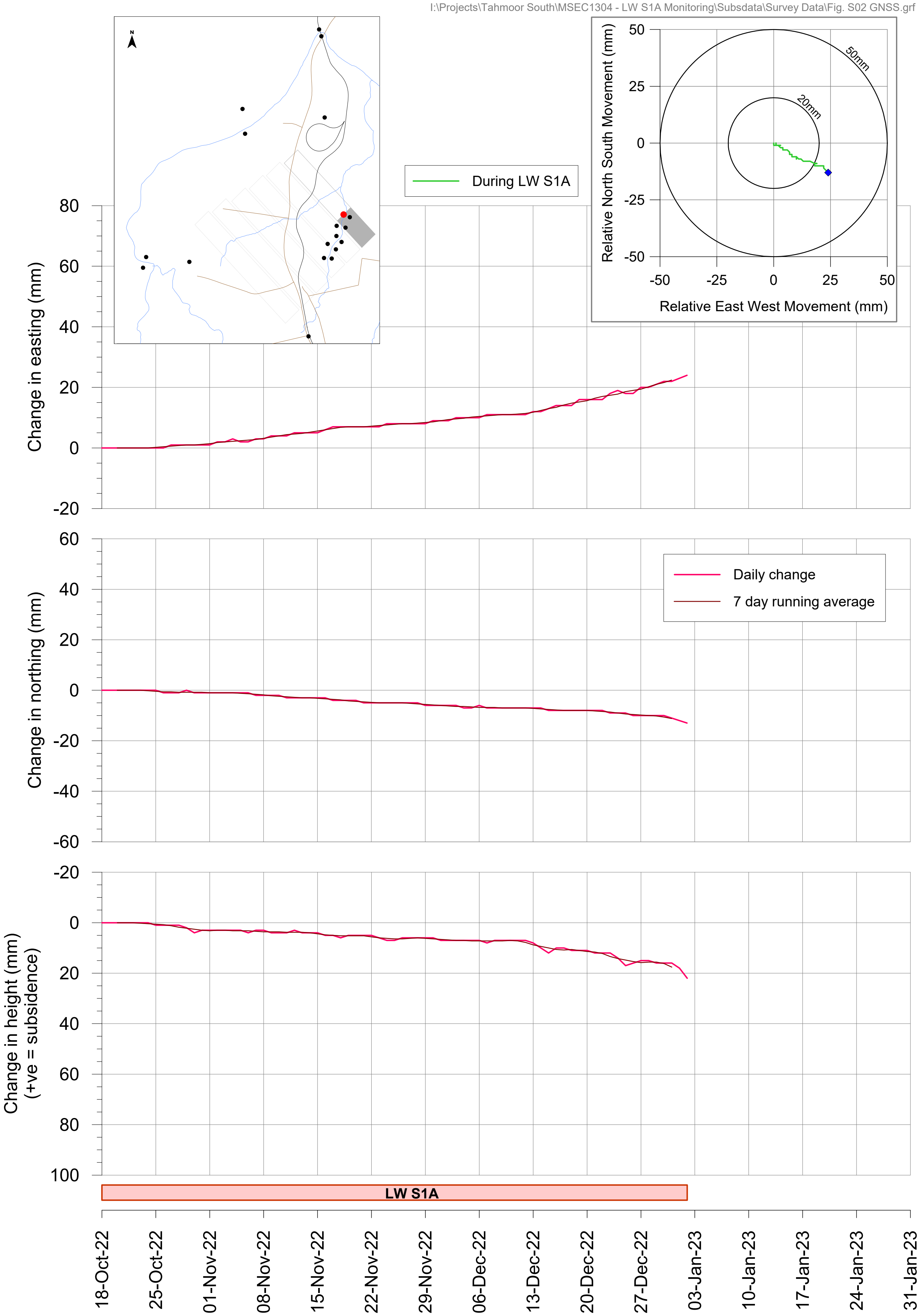

Fig. S02-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S03 above LW S1A at Teatree 3

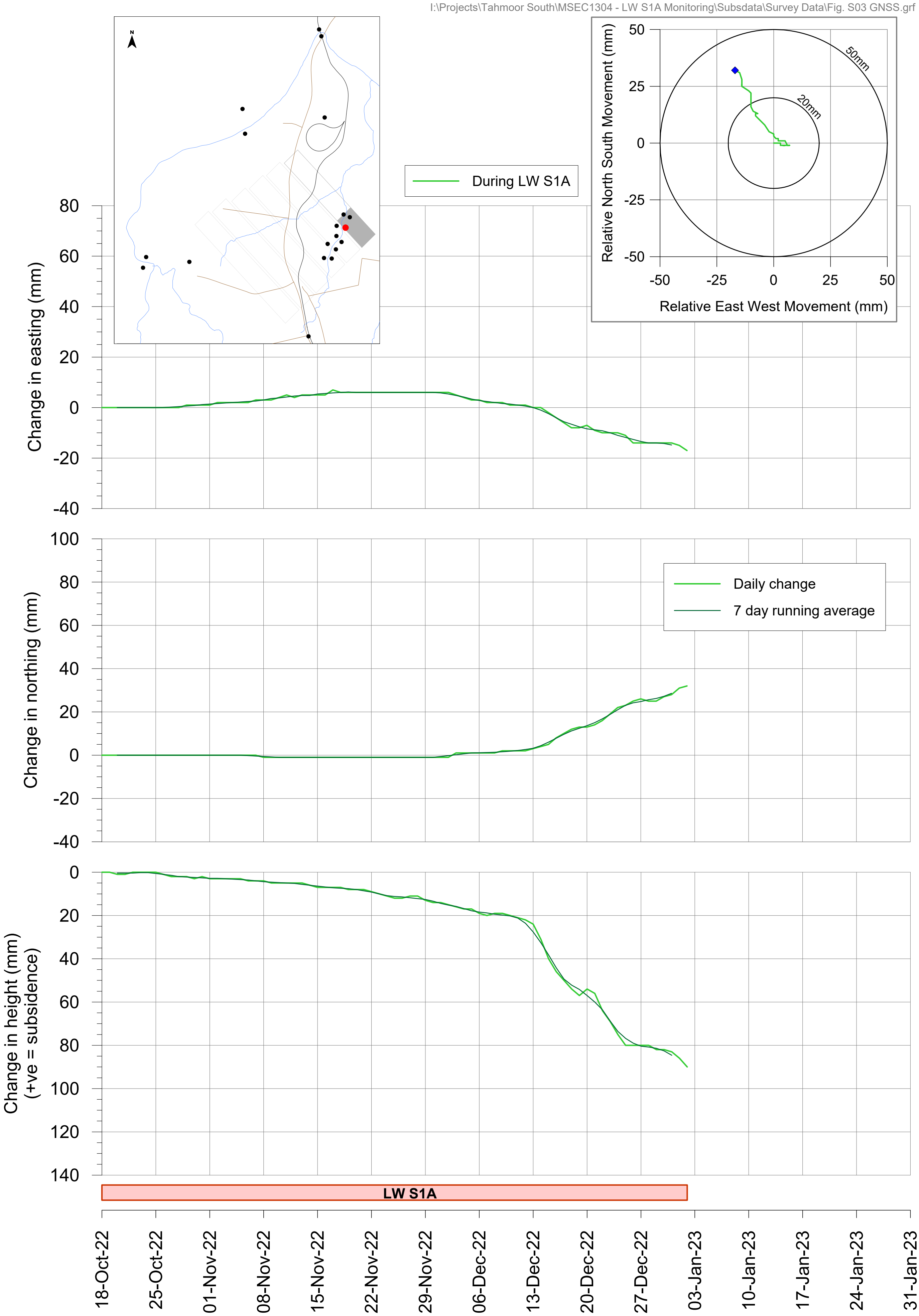

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Fig. S03-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S04 above LW S2A at Teatree 3

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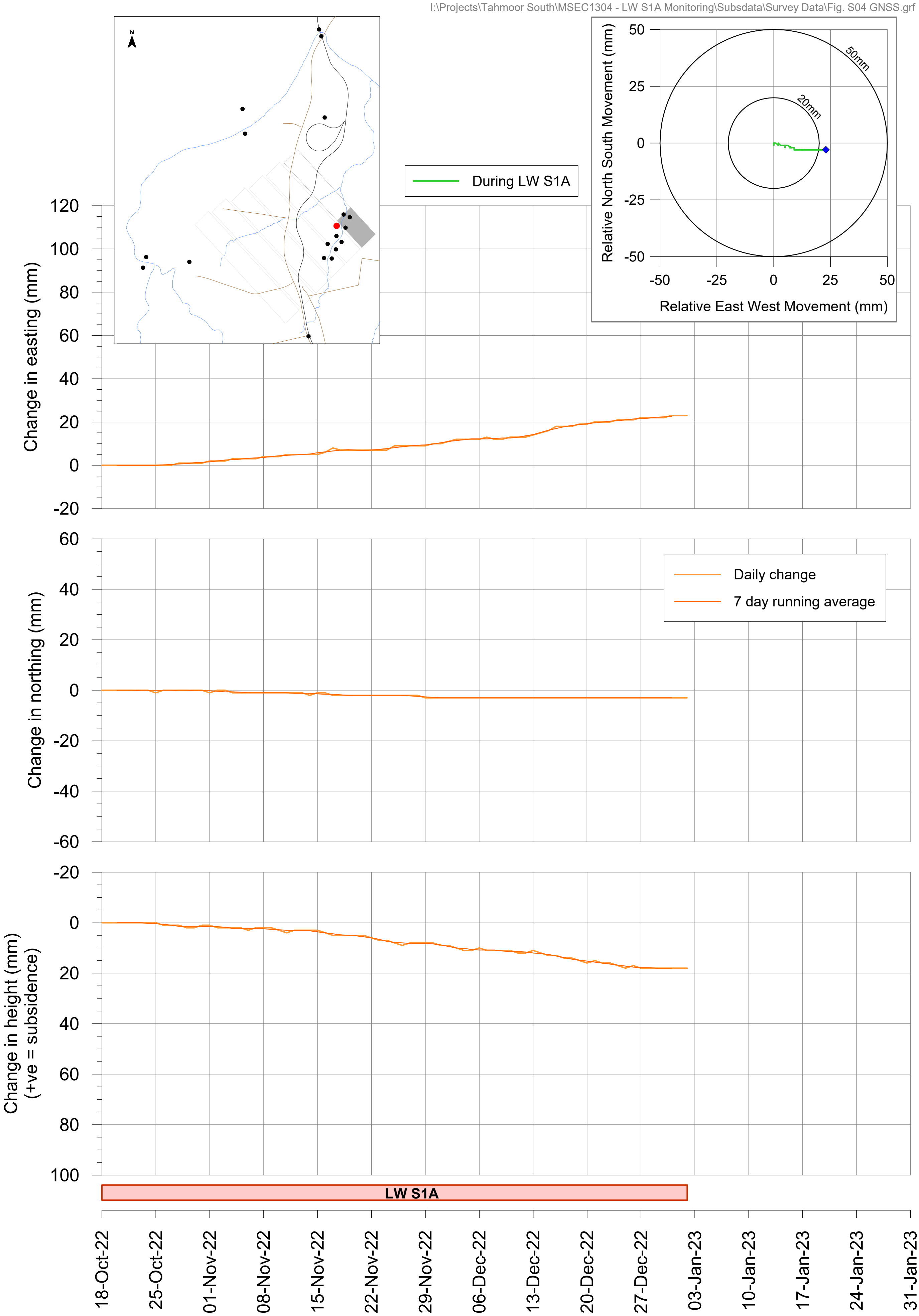

Fig. S04-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S05 above LW S2A

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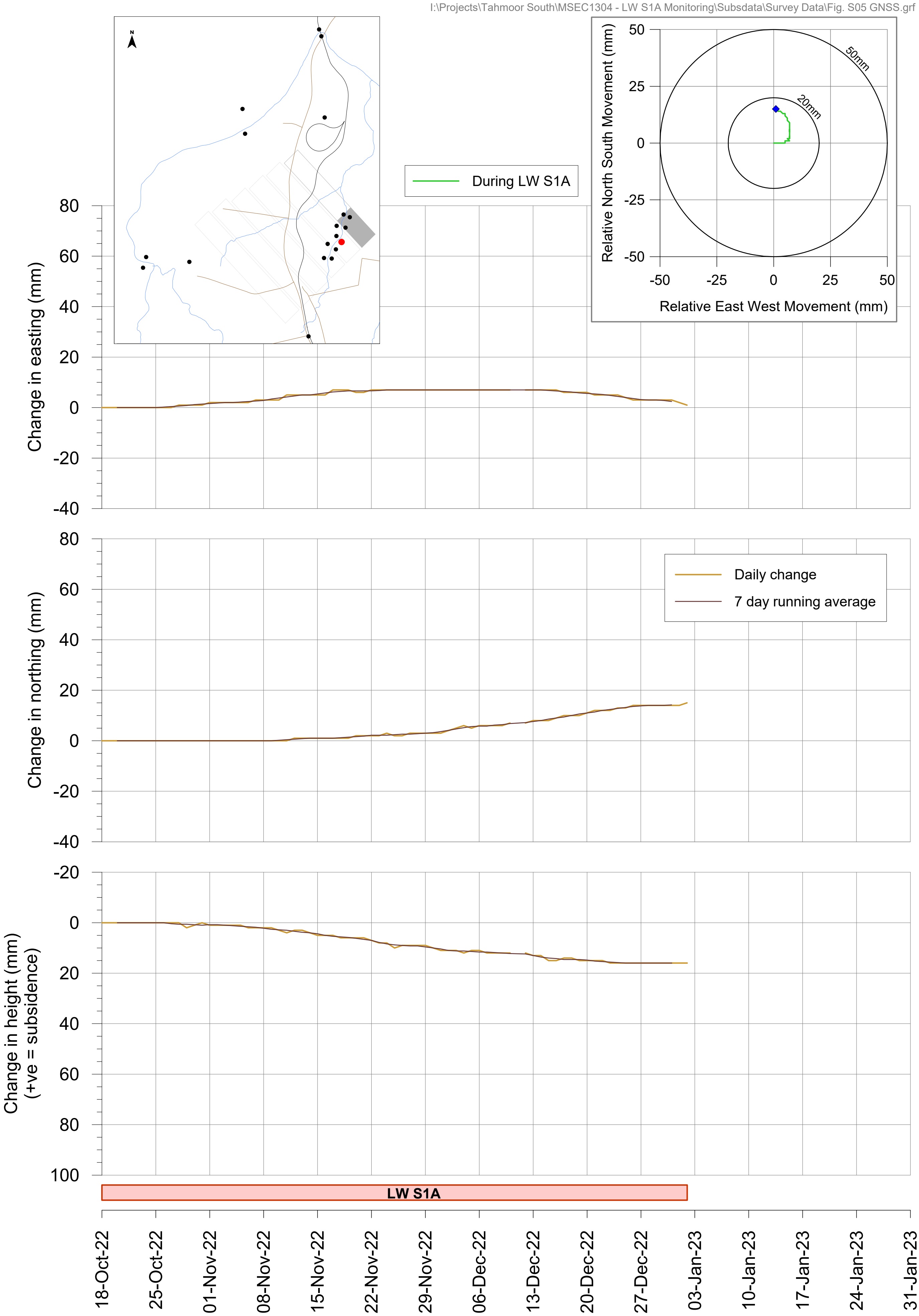

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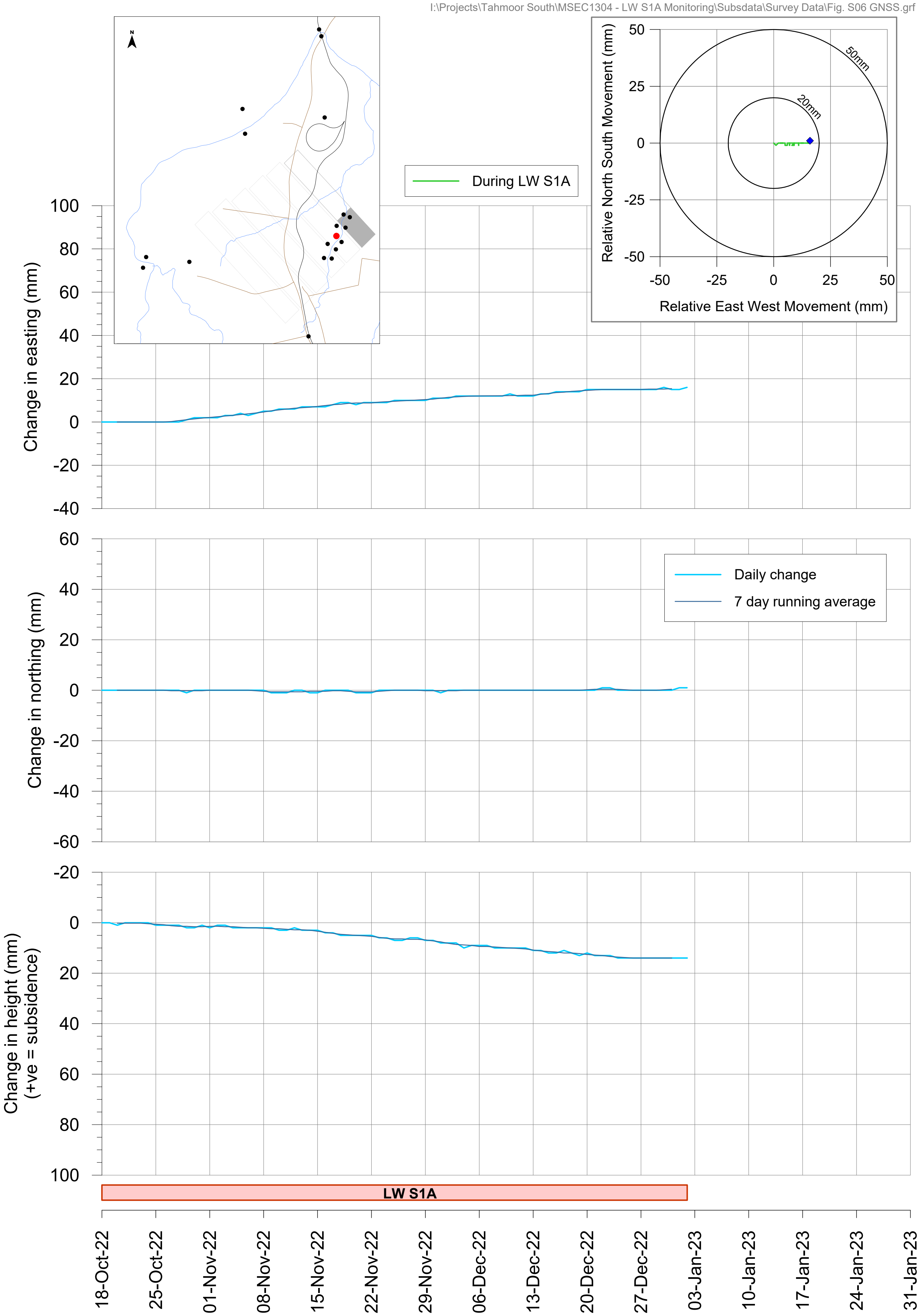
Fig. S05-R07

Tahmoor South LW S1A - GNSS Monitoring

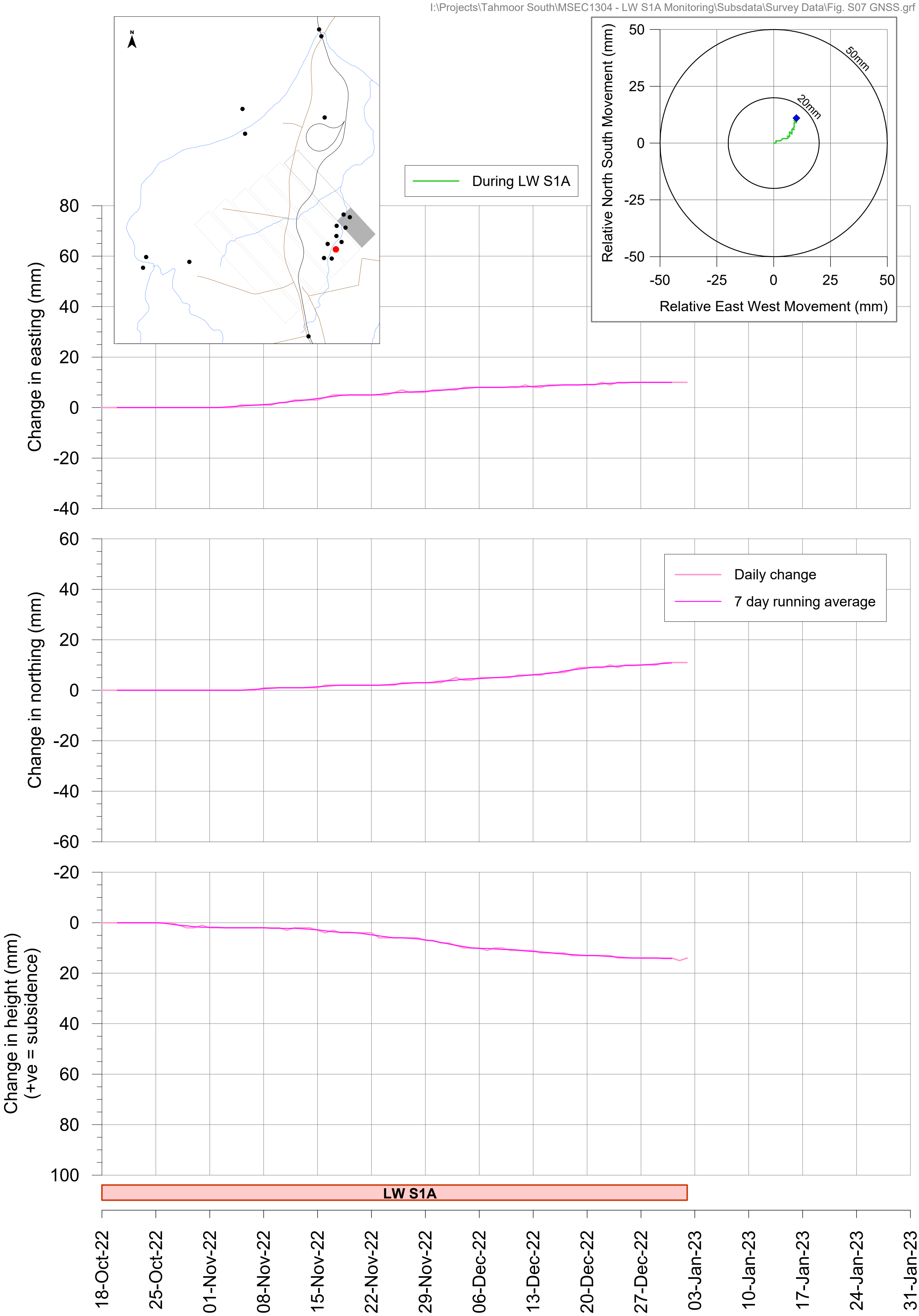
Site S06 above LW S2A



msec

Fig. S06-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S07 above LW S2A



msec

Fig. S07-R07

Tahmoor South LW S1A - GNSS Monitoring

Site S08 between LW S2A and LW S3A

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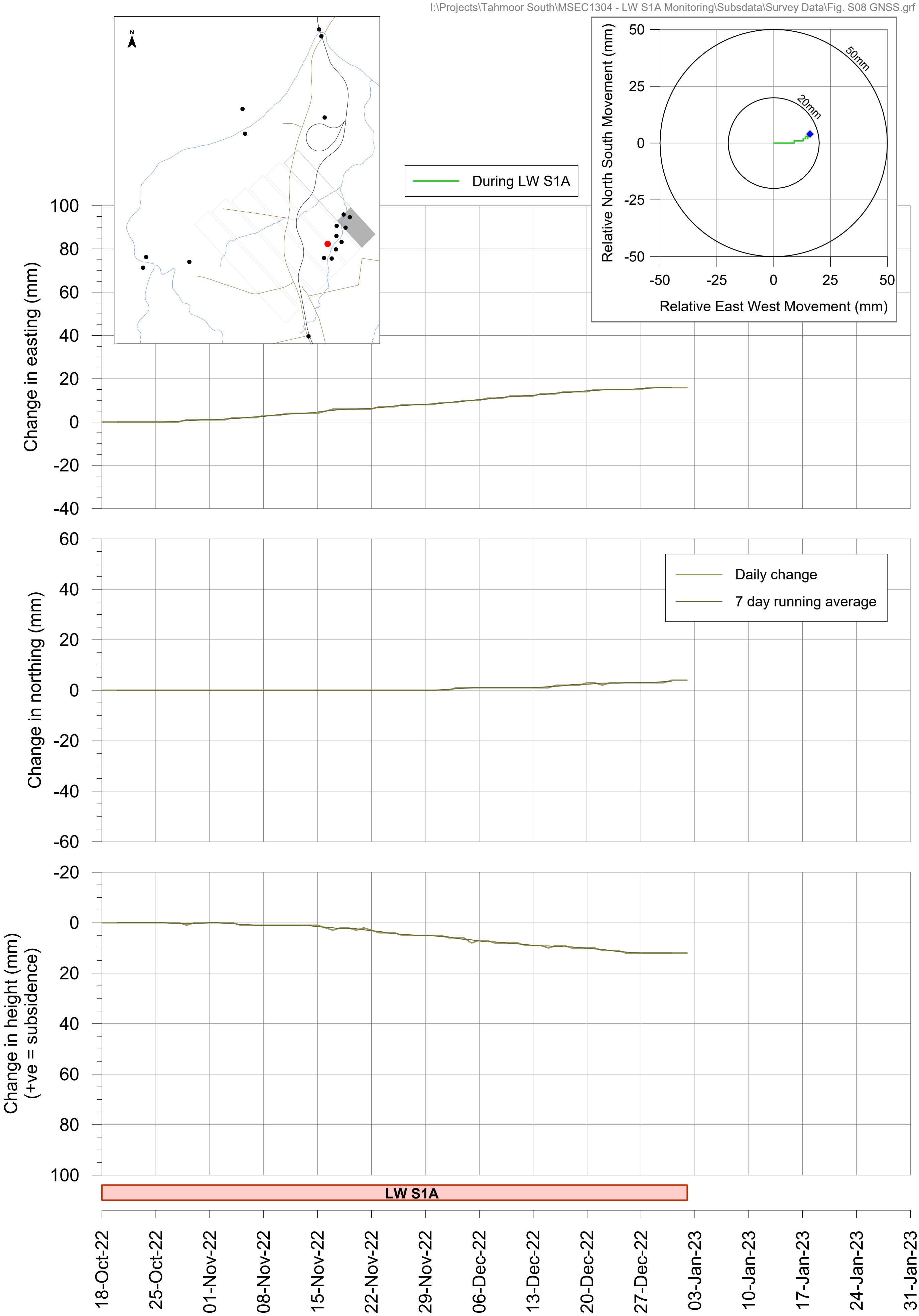

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Fig. S08-R07

Tahmoor South LW S1A - GNSS Monitoring

Site S09 above LW S3A at Teatree 2

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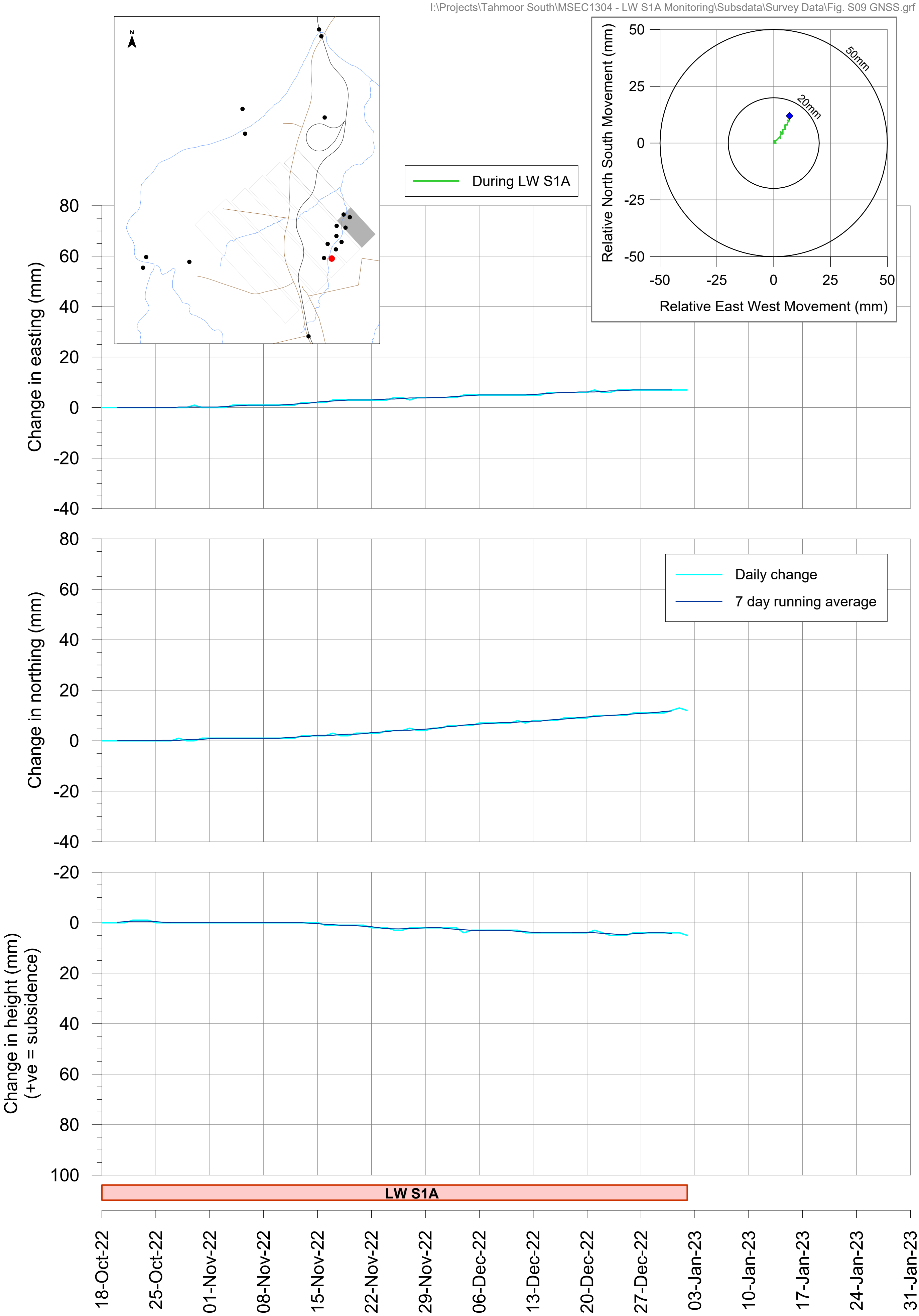

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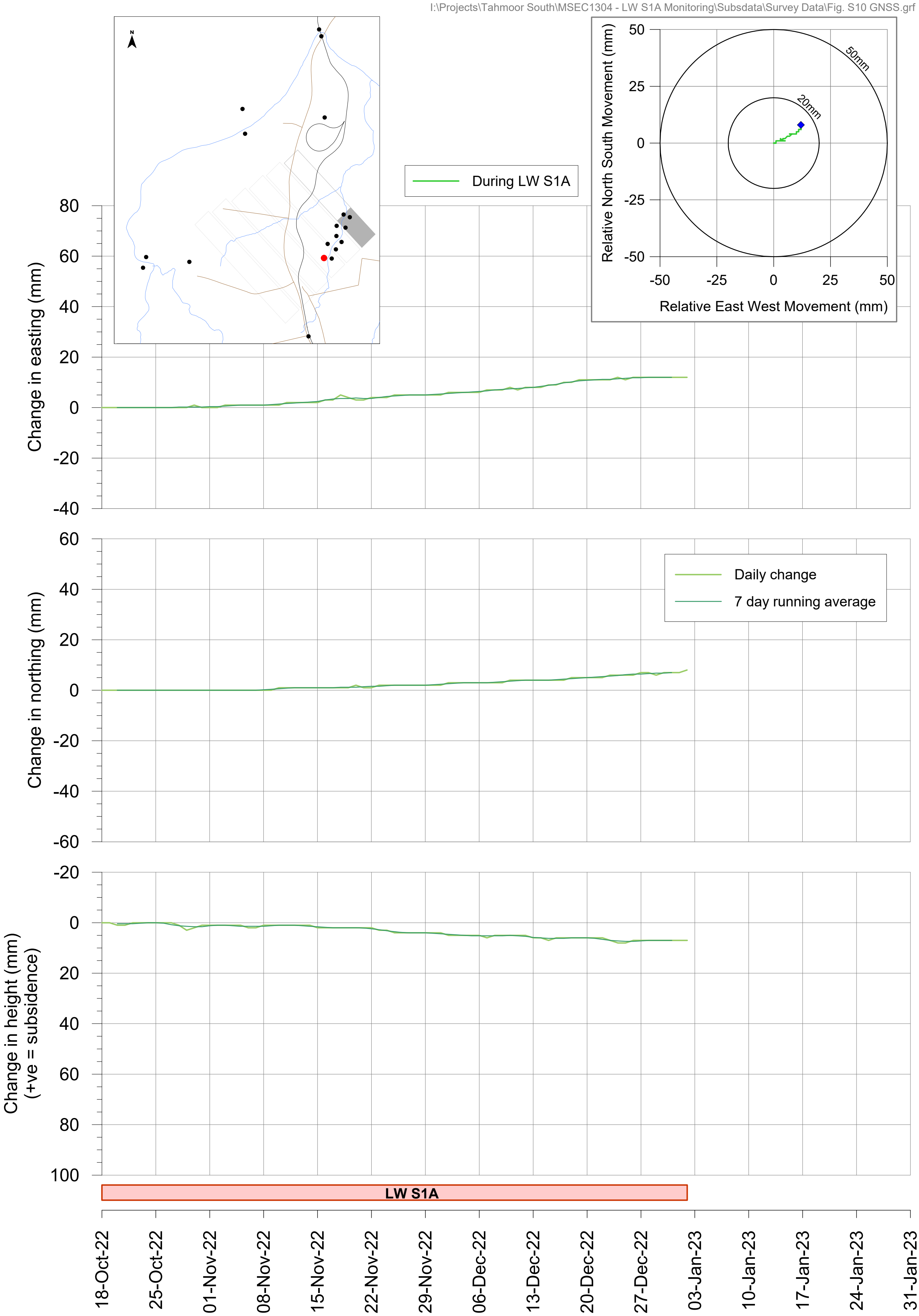
Fig. S09-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S10 above LW S3A at Teatree 2



msec

Fig. S10-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S11 at northern end of railway viaduct over Bargo River

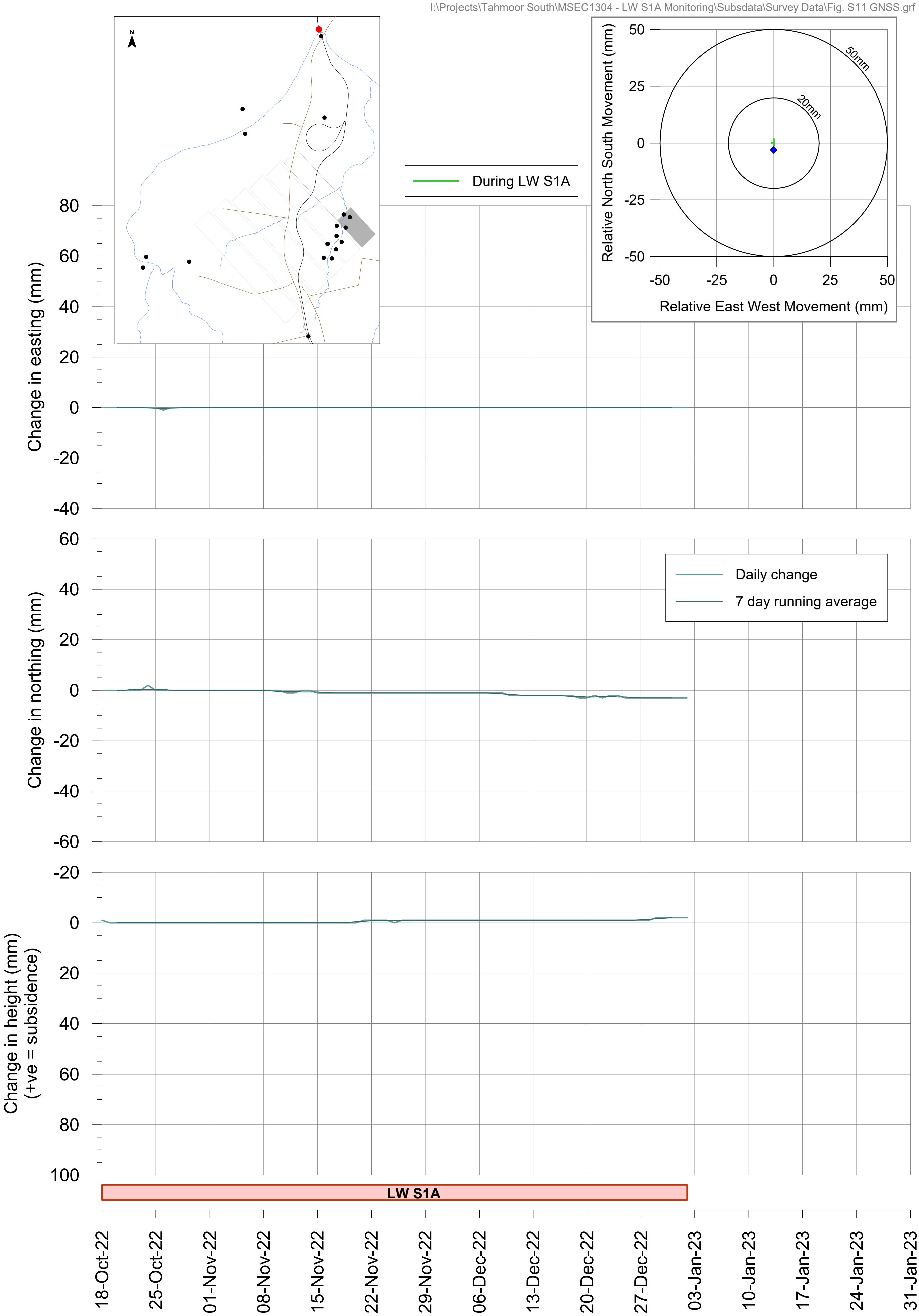


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Fig. S11-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S12 at southern end of railway viaduct over Bargo River

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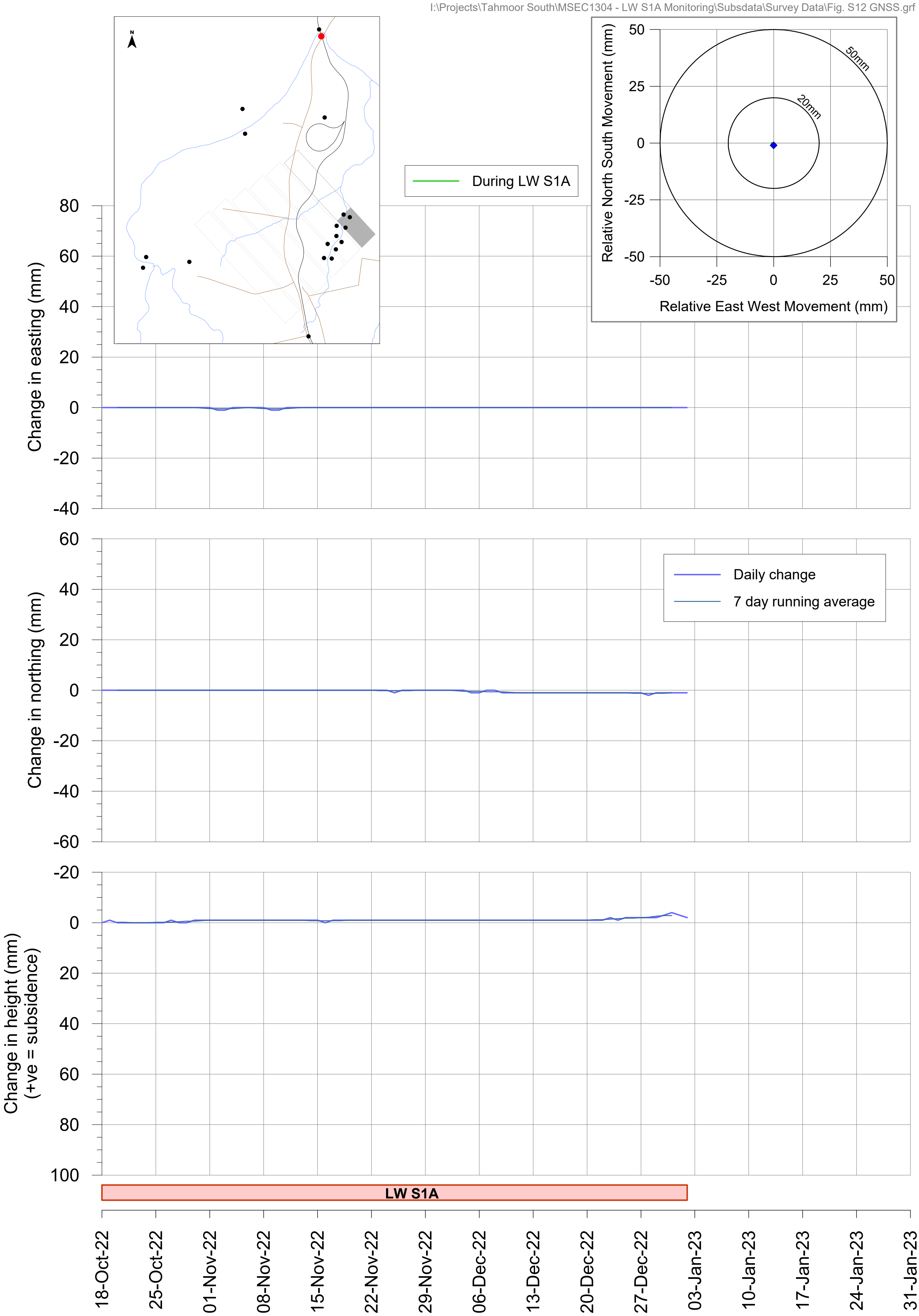

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Fig. S12-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S13 on northern side of Picton Weir

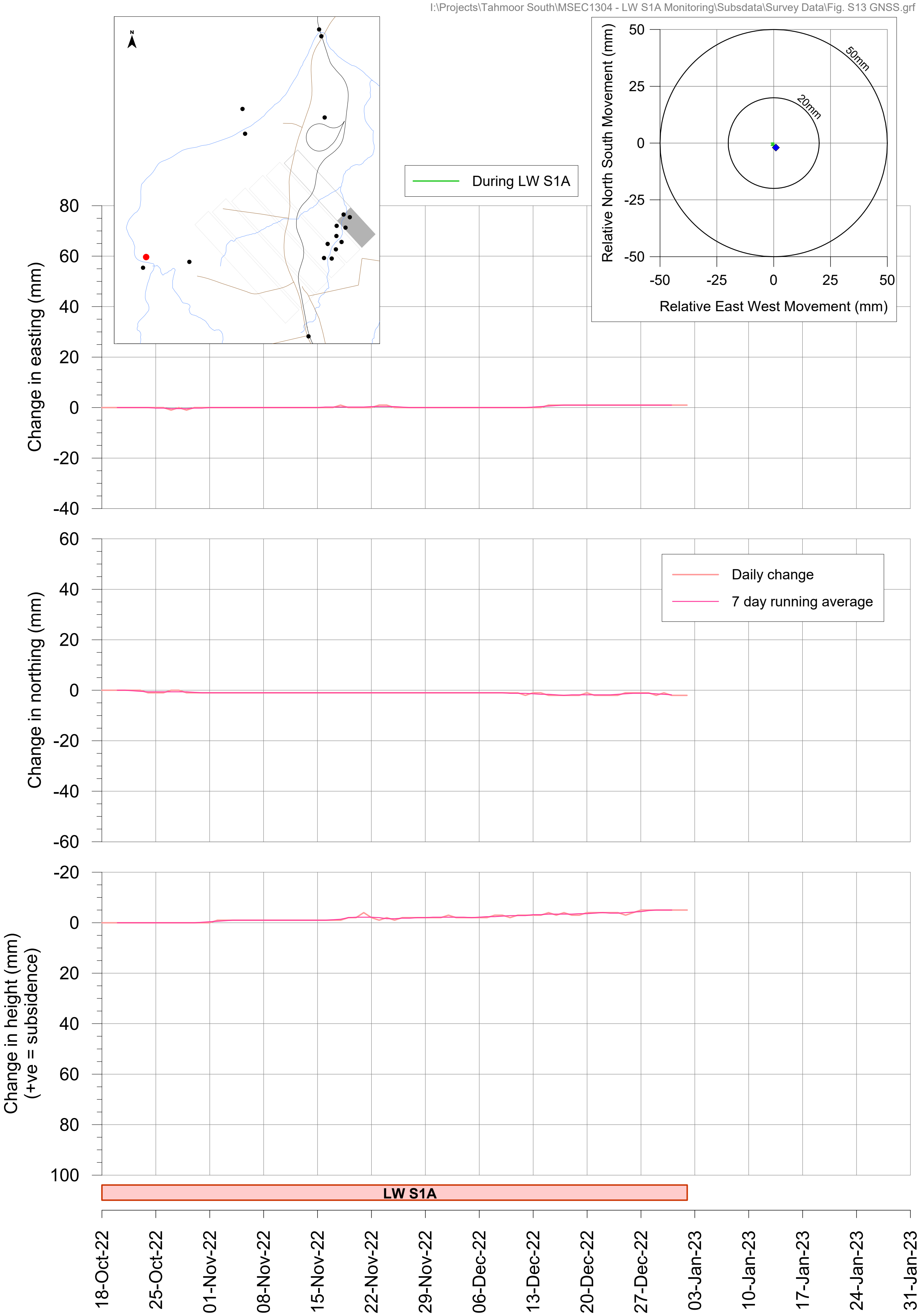

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Fig. S13-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S14 on southern side of Picton Weir

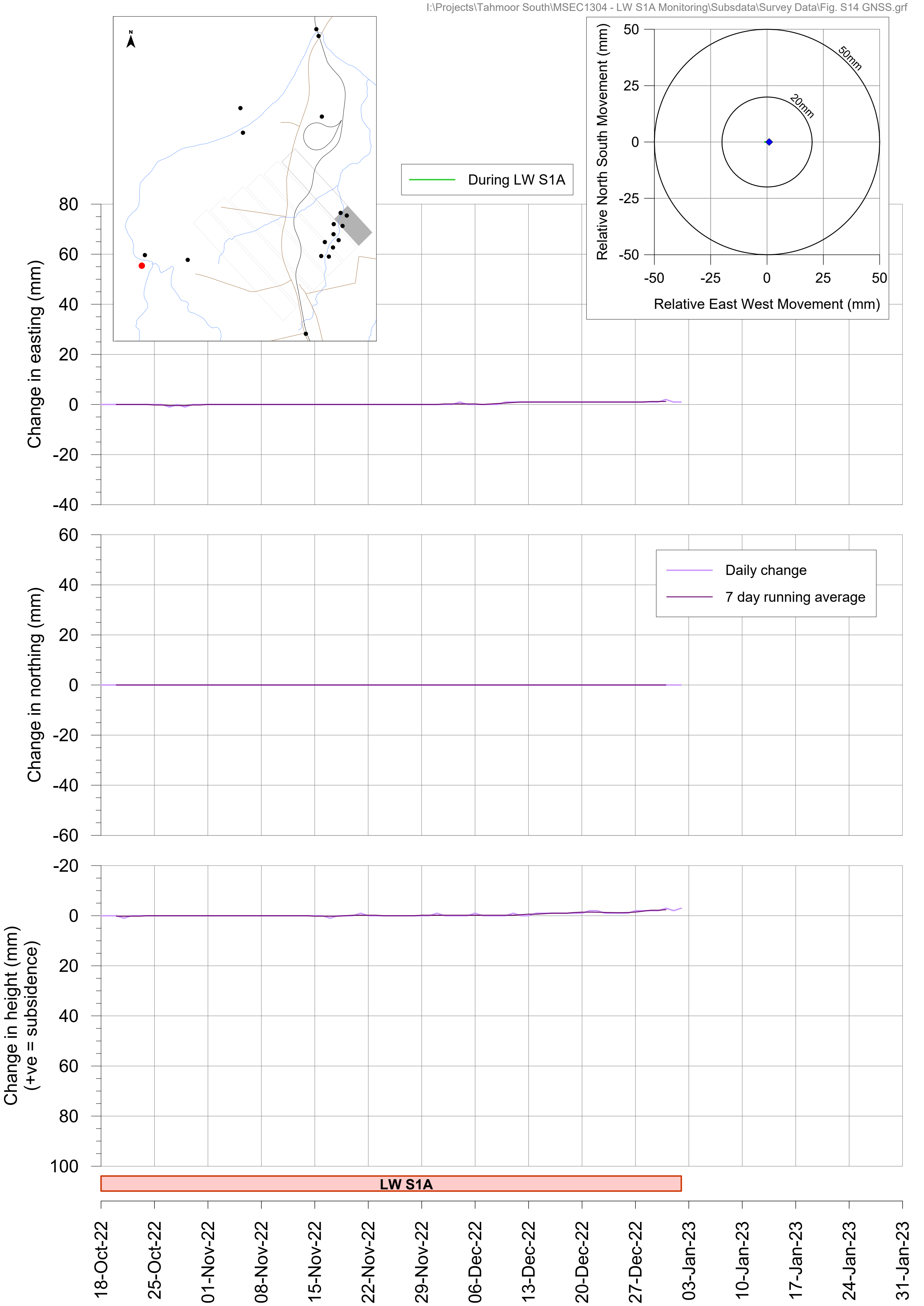

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Fig. S14-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S15 at Wellers Road Overbridge

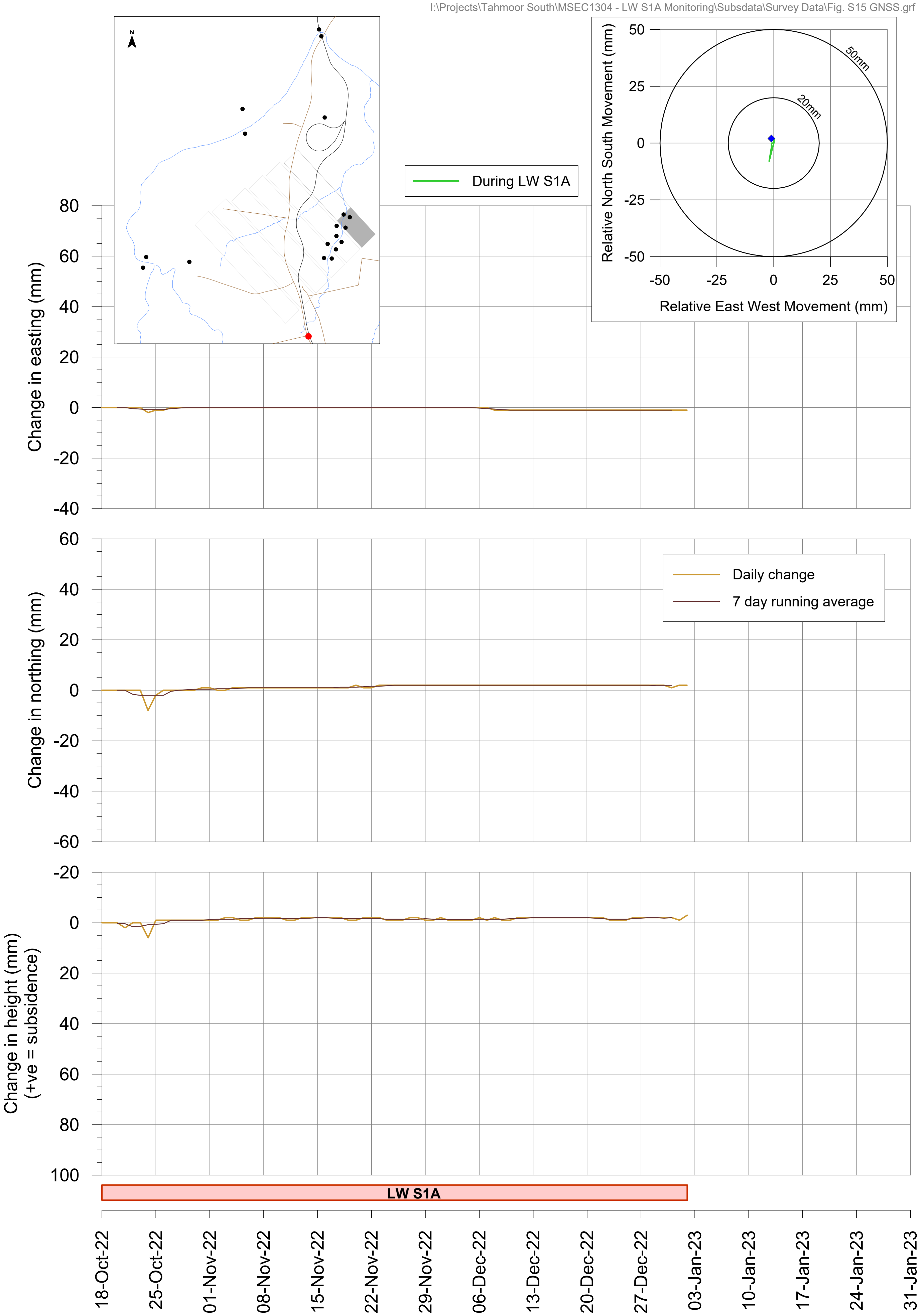

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Fig. S15-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S16 at Tahmoor Mine site

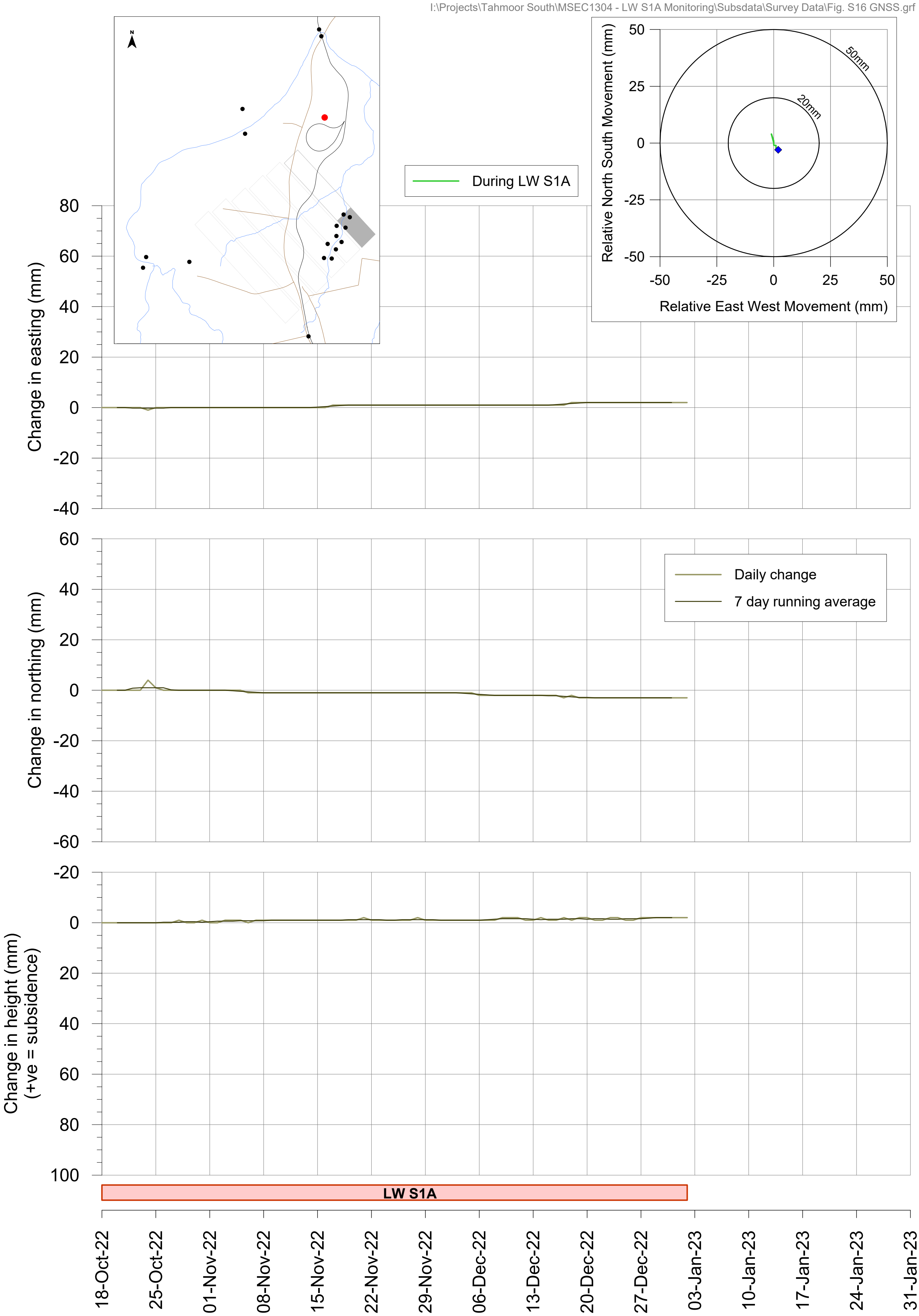

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Fig. S16-R07

Tahmoor South LW S1A - GNSS Monitoring

Site S17 on east bank of Bargo River

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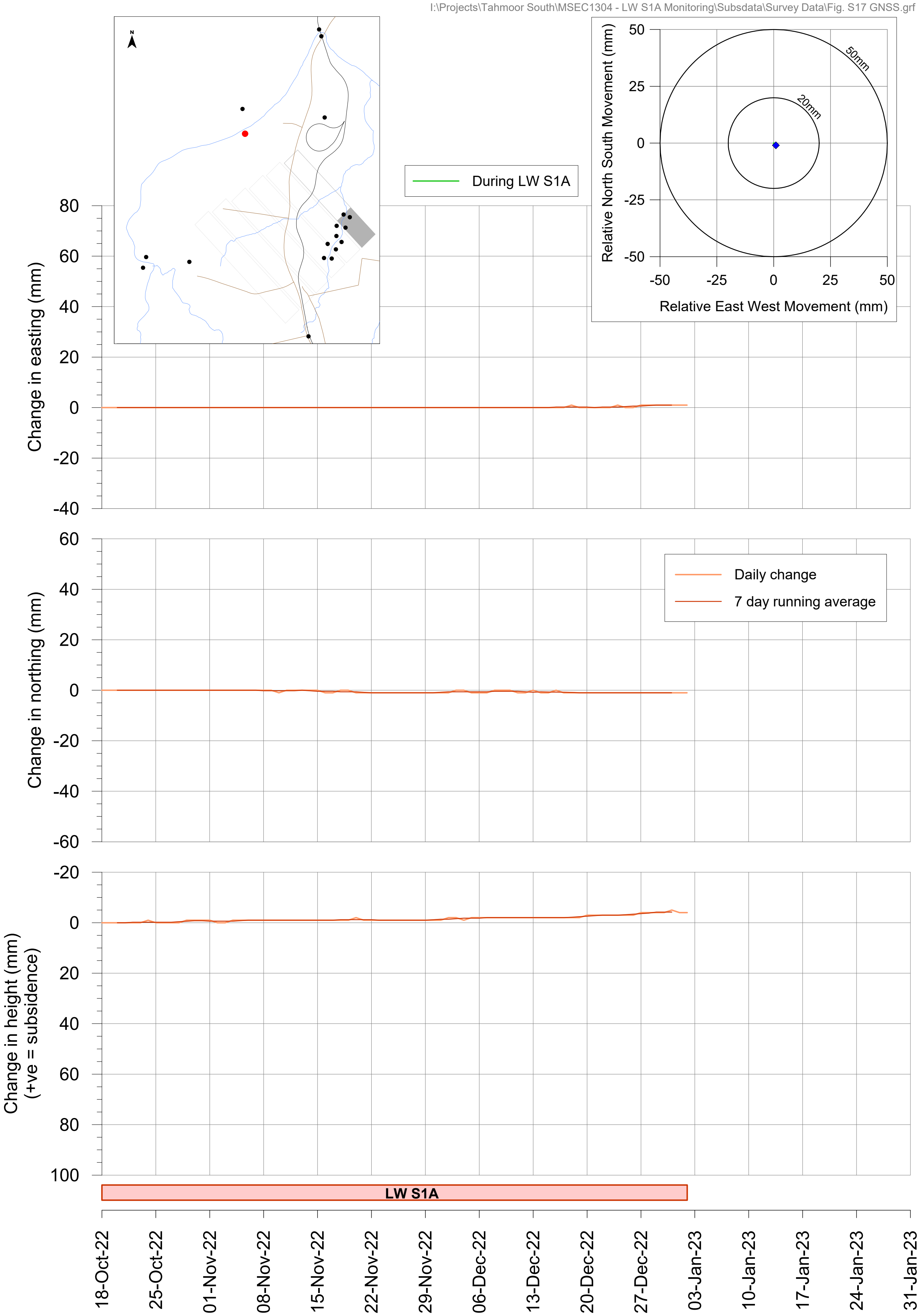

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Fig. S17-R07

Tahmoor South LW S1A - GNSS Monitoring
Site S18 on west bank of Bargo River

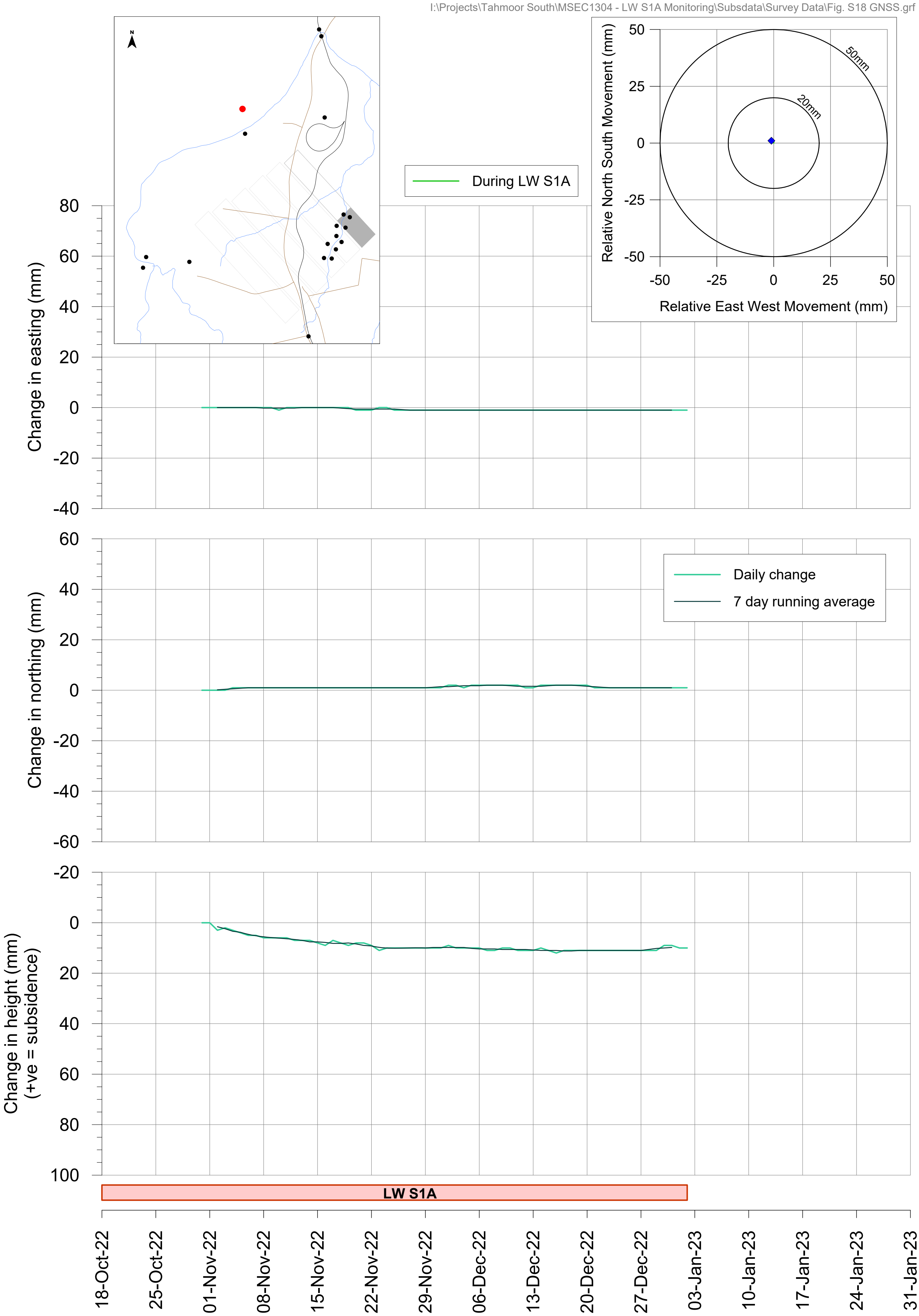

Fig. S18-R07

Tahmoor South LW S1A - GNSS Monitoring

Site S19 near Hornes Creek

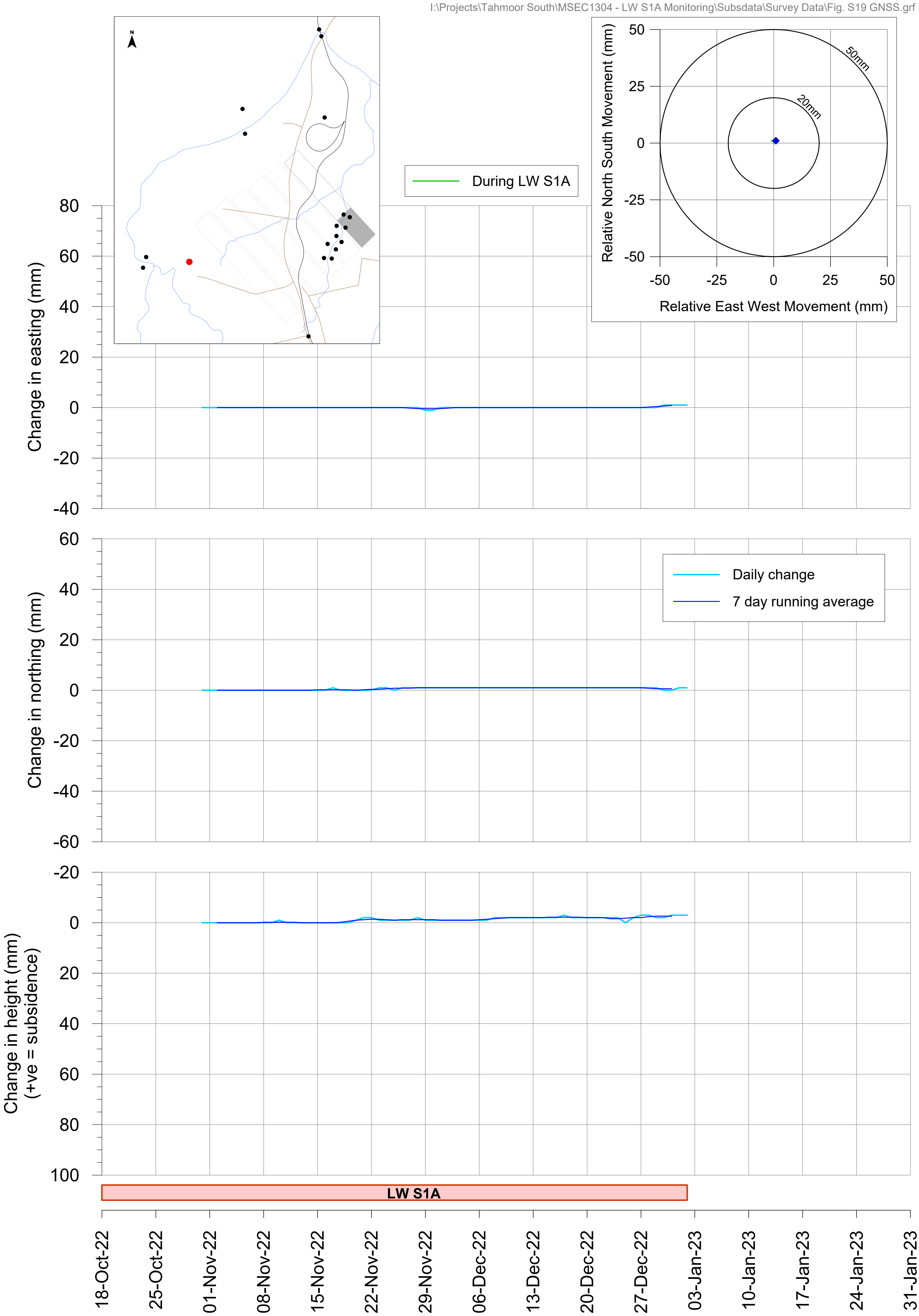

Fig. S19-R07

Tahmoor South LW S1A - GNSS Monitoring

Gantry at Tahmoor Mine site

I:\Projects\Tahmoor South\MSEC1304 - LW S1A Monitoring\Subsdata\Survey Data\Fig. G01 GNSS gantry.grf

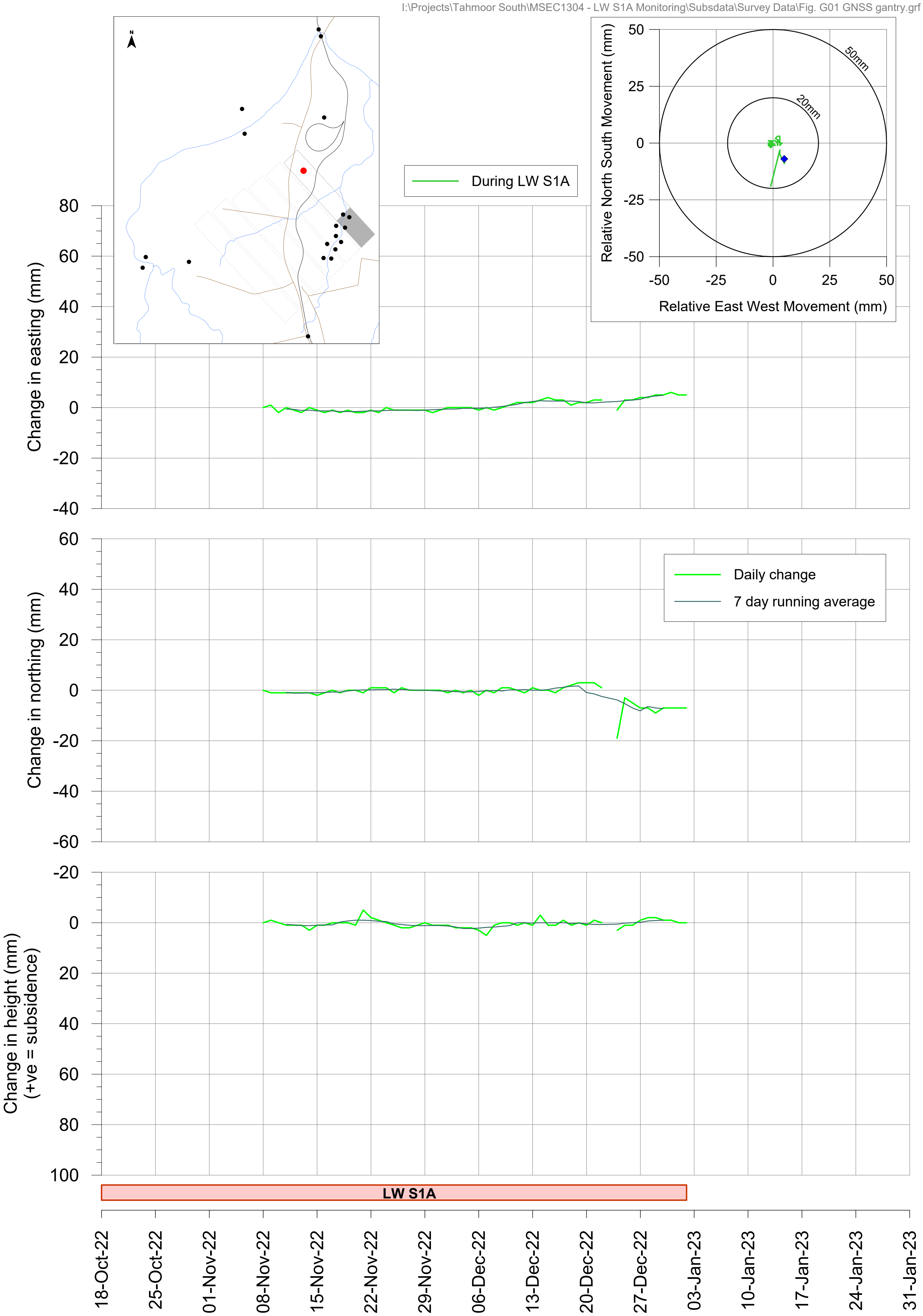

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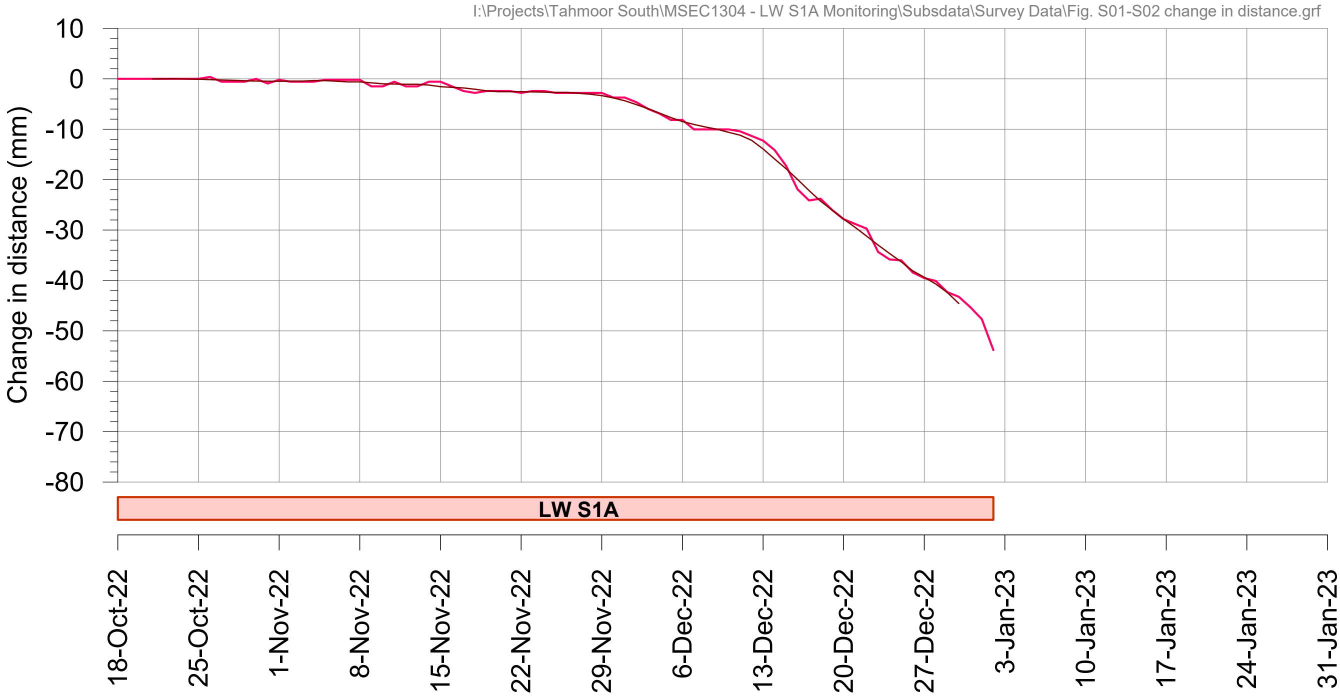
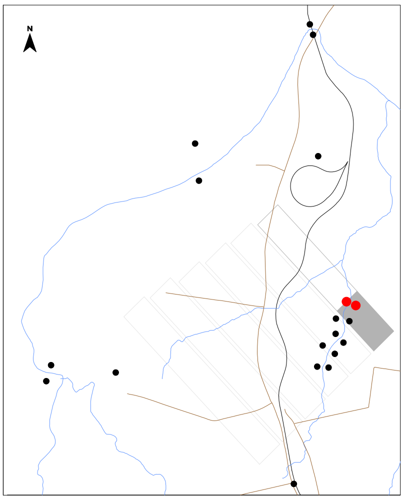
Fig. S20-R07

Tahmoor South LW S1A - GNSS Monitoring
Change in distance across Wirrimbirra Creek
Sites S01 and S02 above LW S1A



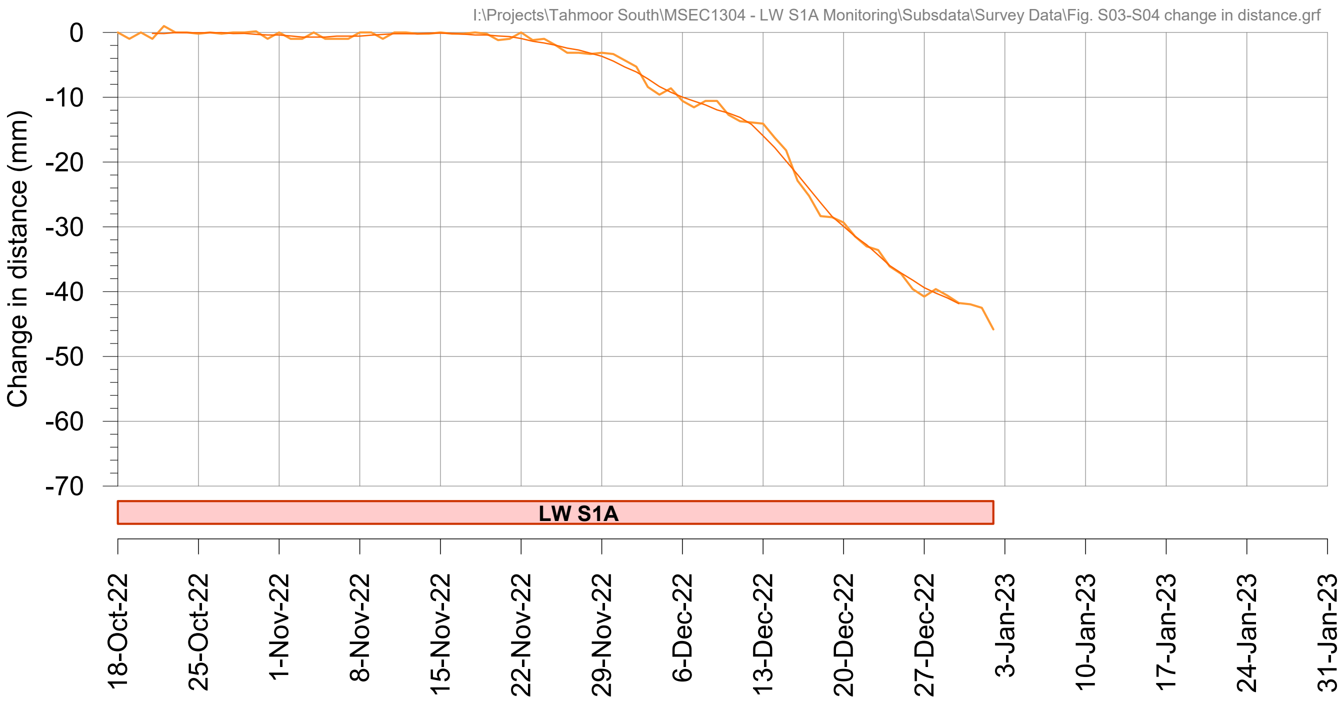


msec

Fig. S01-S02-R07

Tahmoor South LW S1A - GNSS Monitoring

Change in distance across Wirrimbirra Creek at Teatree 3
Site S03 above LW S1A and Site S04 above LW S2A



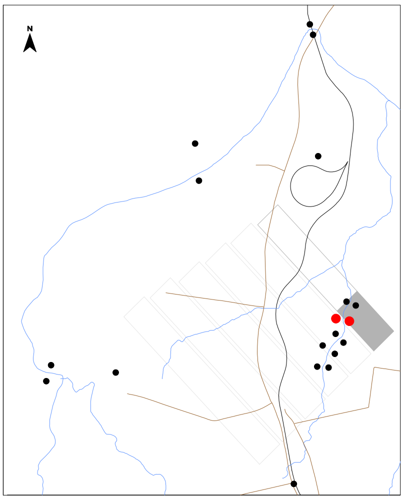


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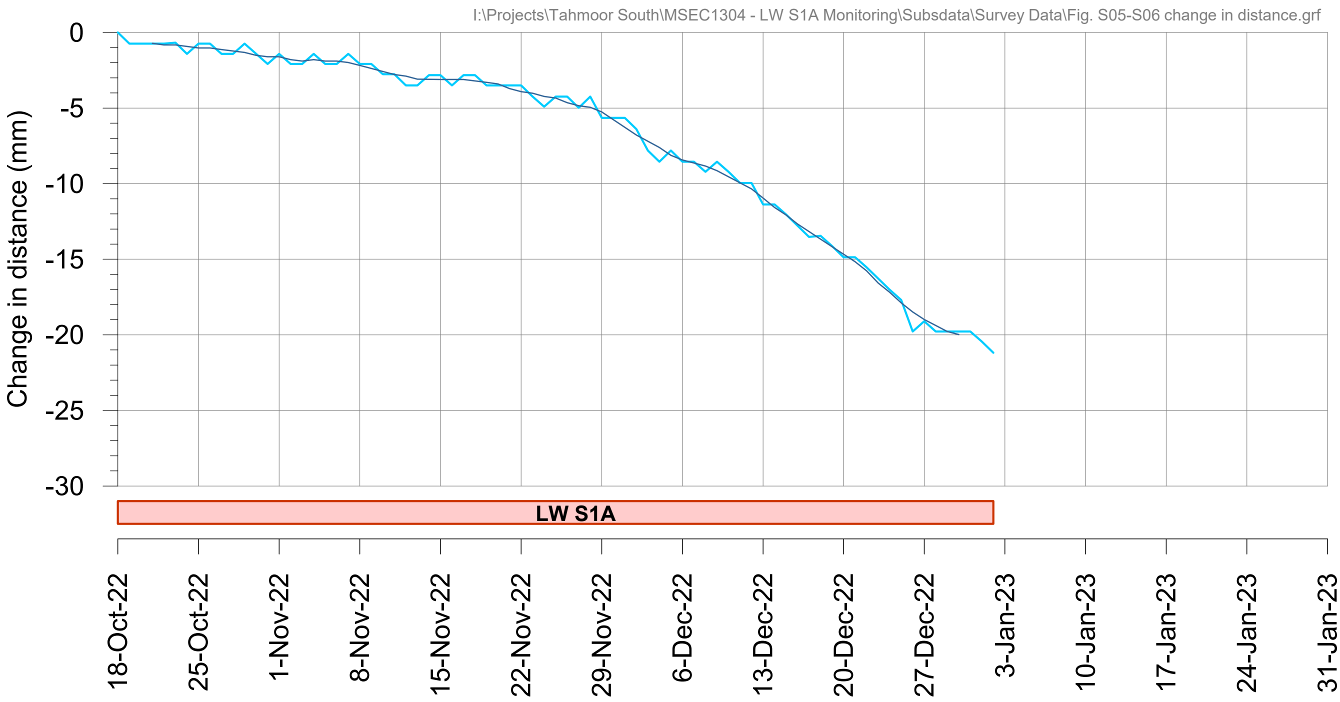
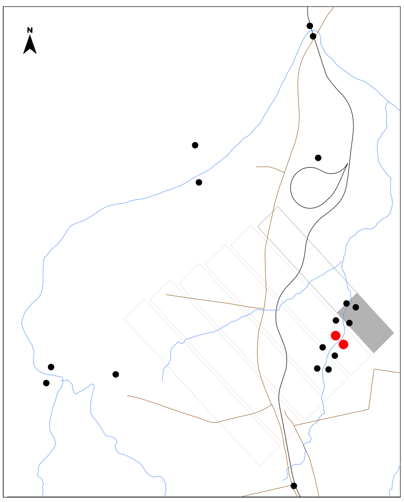
Fig. S03-S04-R07

Tahmoor South LW S1A - GNSS Monitoring
Change in distance across Wirrimbirra Creek
Sites S05 and S06 above LW S2A

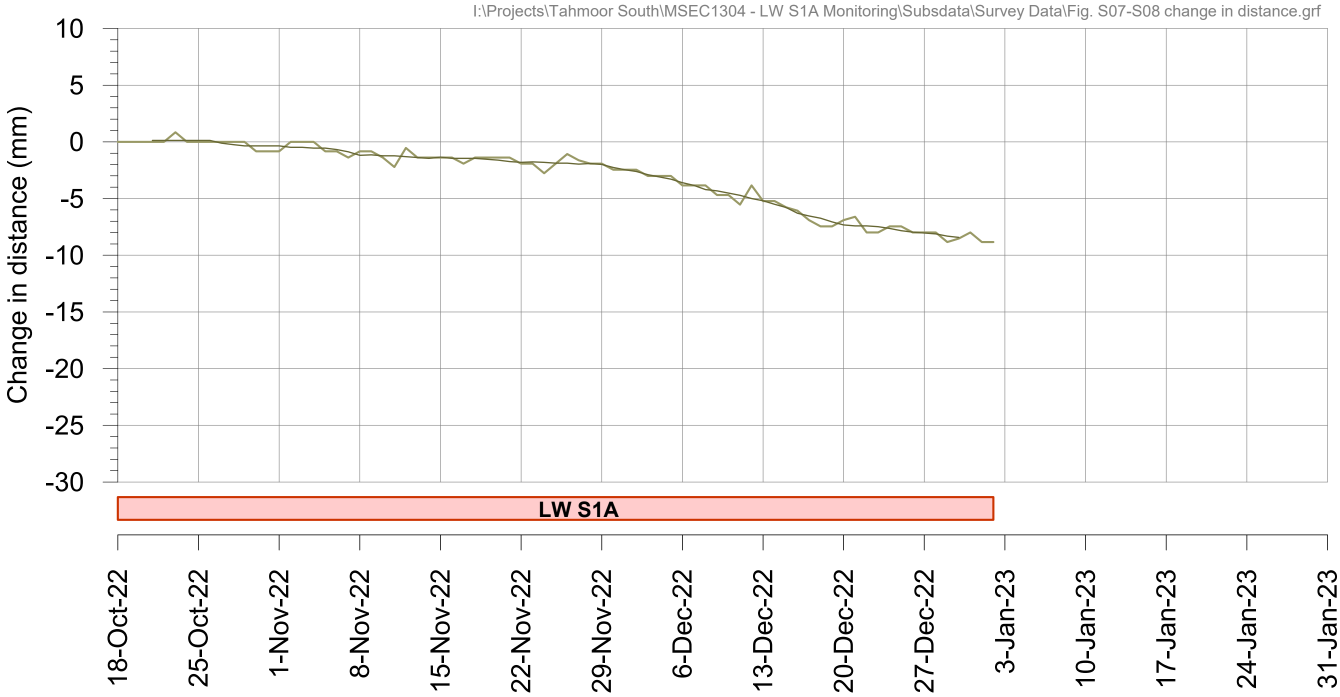




msec

Fig. S05-S06-R07

Tahmoor South LW S1A - GNSS Monitoring
Change in distance across Wirrimbirra Creek
Site S07 above LW S2A and Site S08 between LW S2A and LW S3A



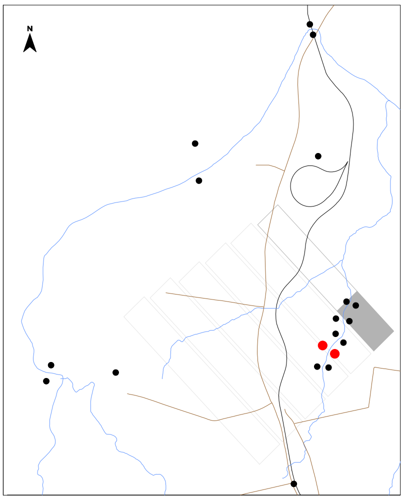


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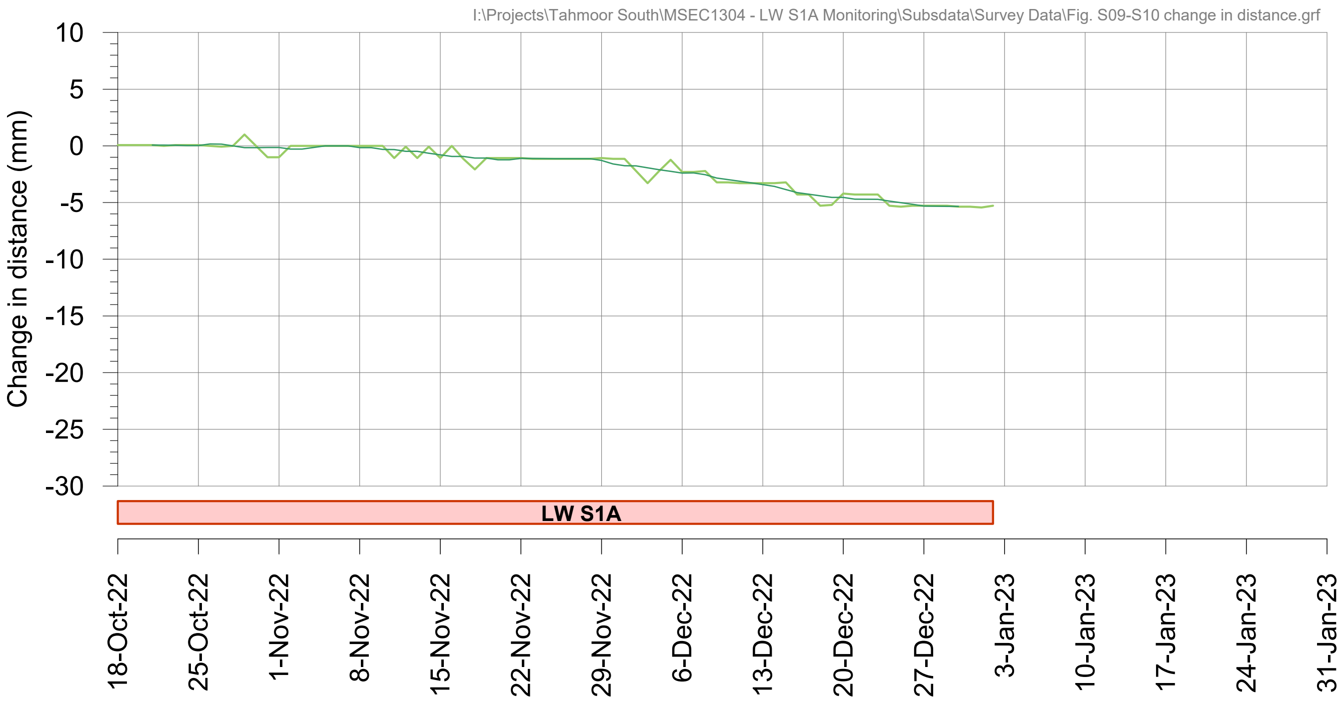
Fig. S07-S08-R07

Tahmoor South LW S1A - GNSS Monitoring

Change in distance across Wirrimbirra Creek at Teatree 2
Sites S09 and S10 above LW S3A



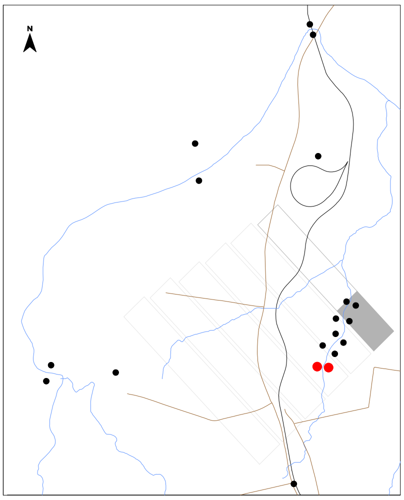


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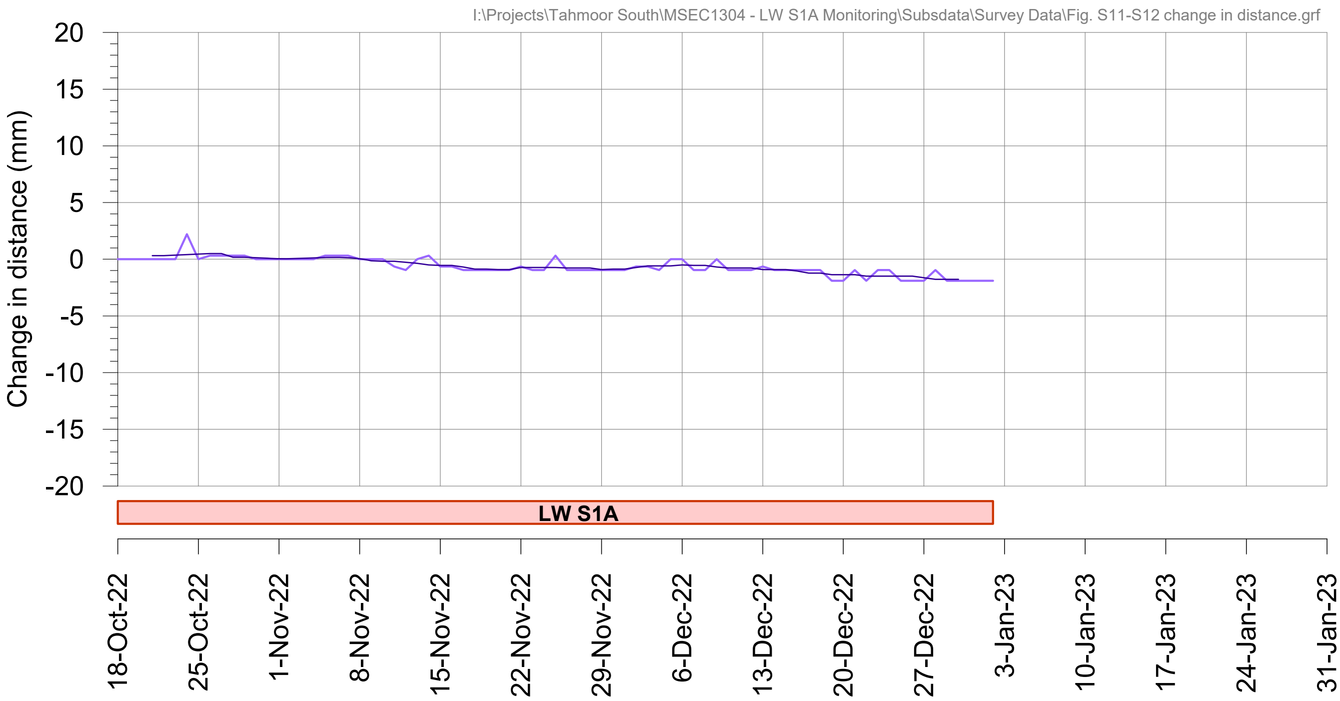
Fig. S09-S10-R07

Tahmoor South LW S1A - GNSS Monitoring

Change in distance across Railway Viaduct over Bargo River
Sites S11 and S12



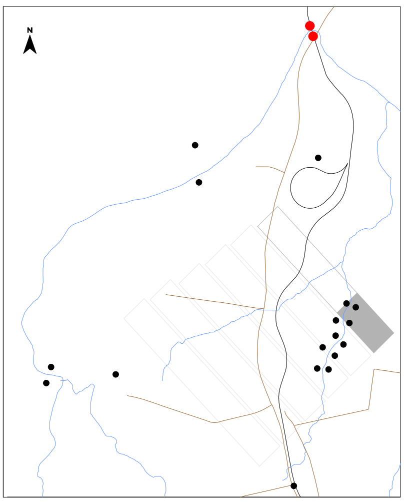


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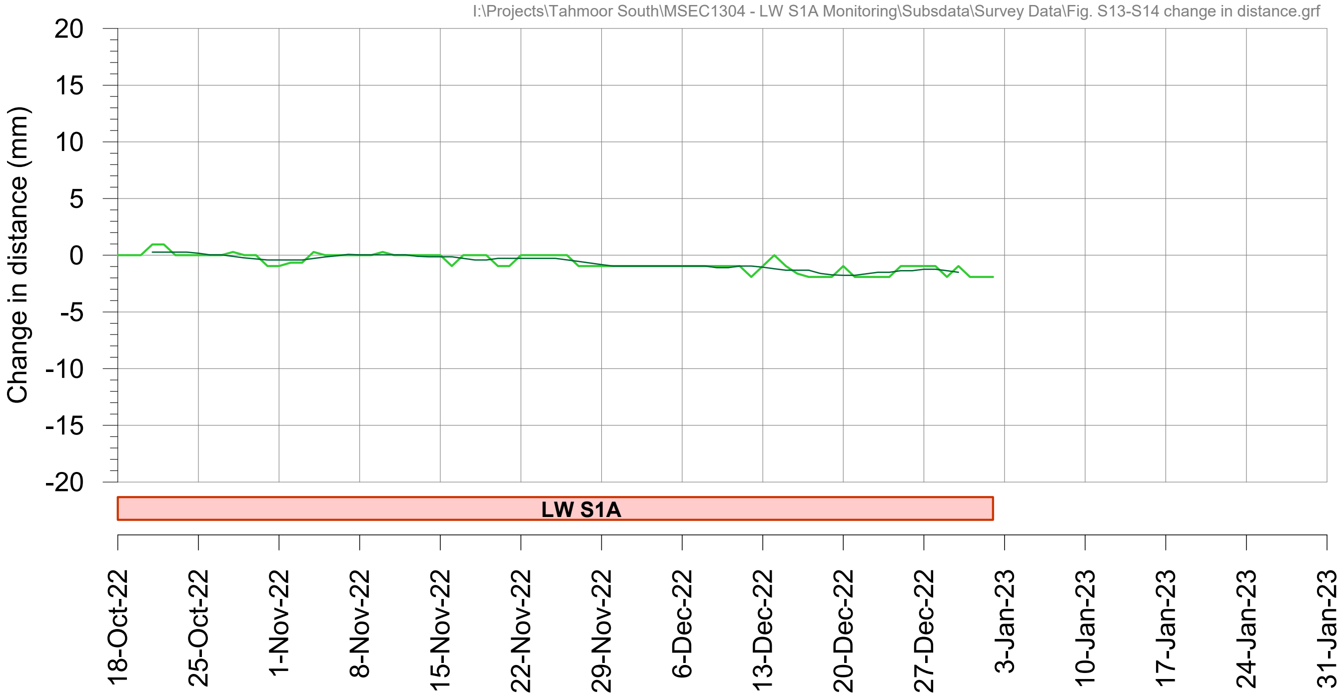
Fig. S11-S12-R07

Tahmoor South LW S1A - GNSS Monitoring
Change in distance across Picton Weir
Sites S13 and S14



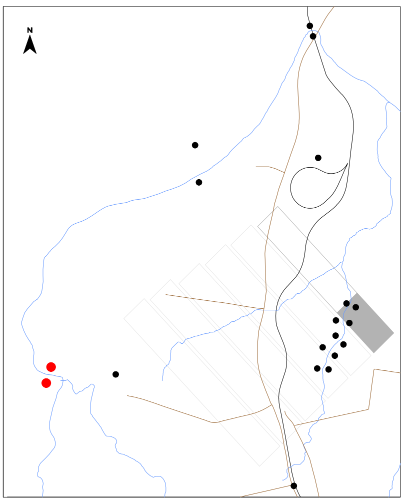


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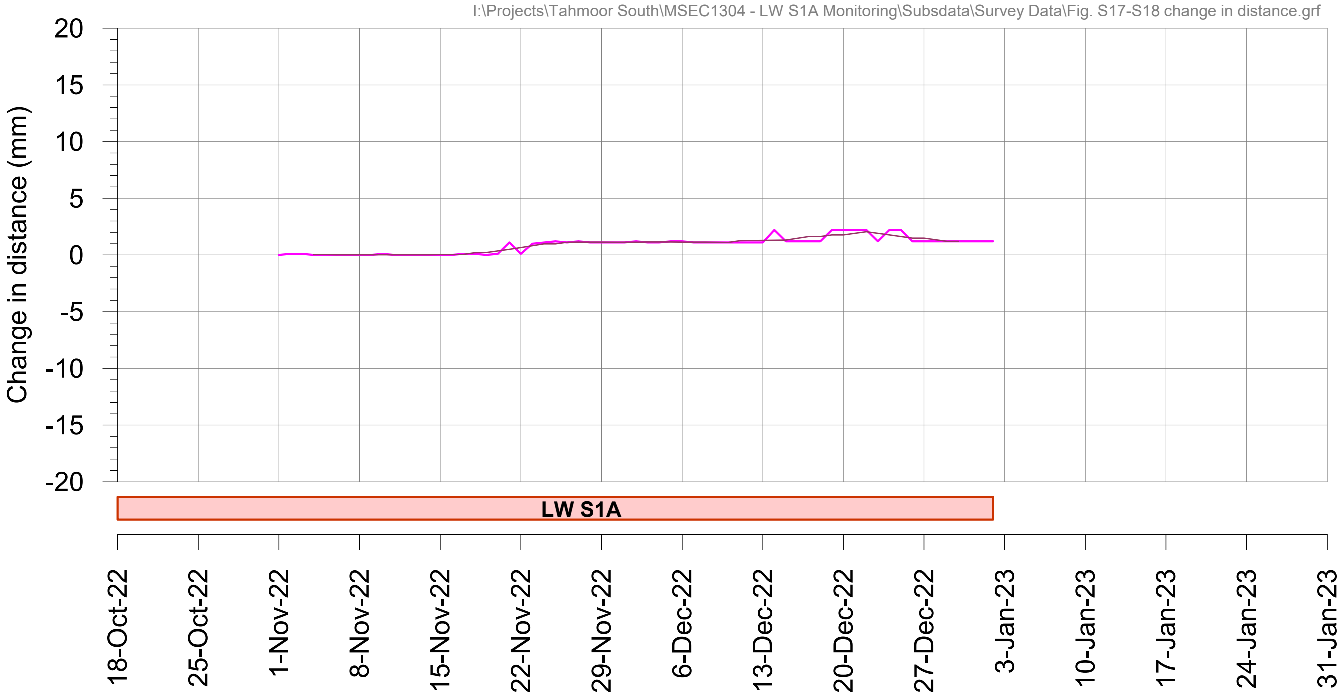
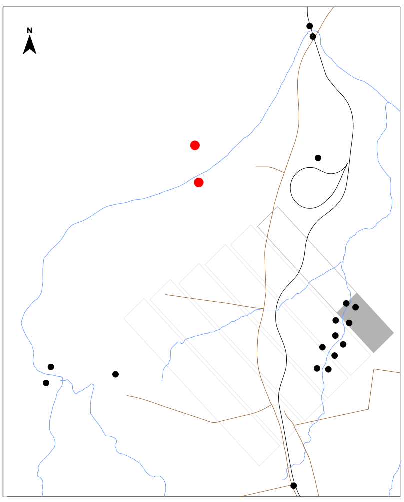
Fig. S13-S14-R07

Tahmoor South LW S1A - GNSS Monitoring
Change in distance across Bargo River
Sites S17 and S18





msec

Fig. S17-S18-R07

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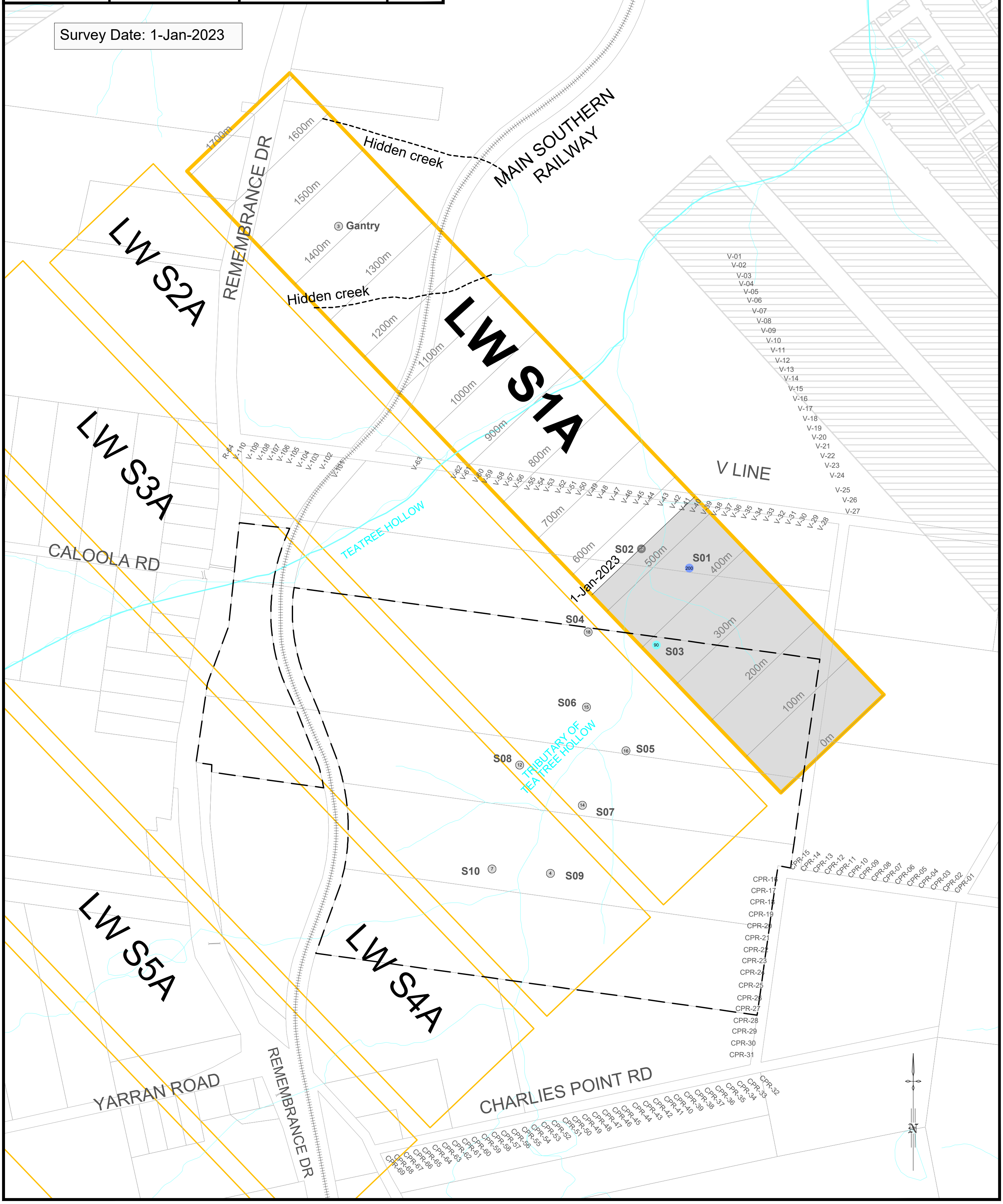
SIMEC

TAHMOOR SOUTH PROJECT LWS1A

OBSERVED INCREMENTAL SUBSIDENCE DUE TO LW S1A

DATE:	SCALE:	DRAWING No:	Rev No
4 Jan 2023	1:10000	MSEC1304-02	07



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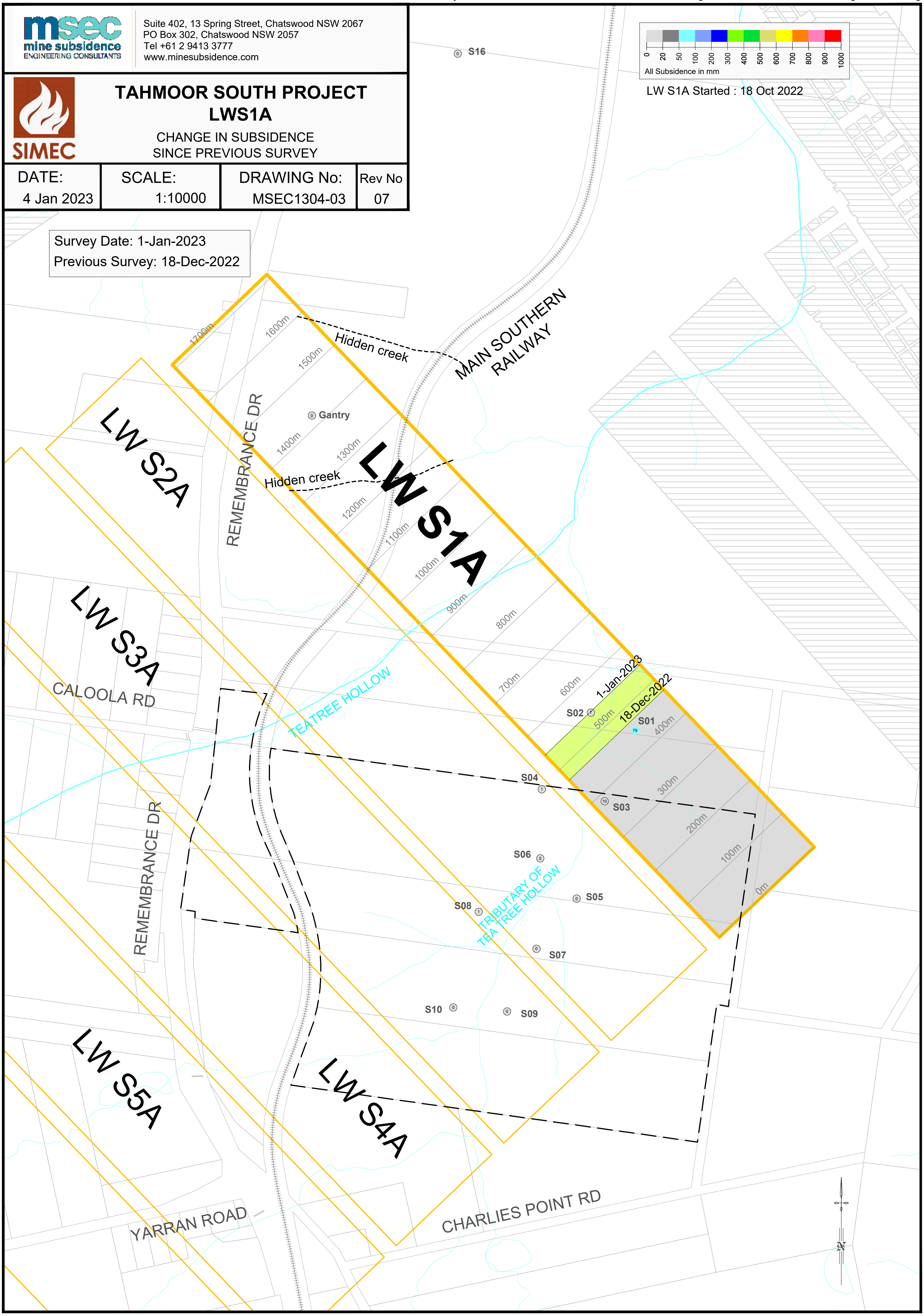
TAHMOOR SOUTH PROJECT LWS1A

CHANGE IN SUBSIDENCE SINCE PREVIOUS SURVEY

DATE:	SCALE:	DRAWING No:	Rev No
4 Jan 2023	1:10000	MSEC1304-03	07

Survey Date: 1-Jan-2023
Previous Survey: 18-Dec-2022



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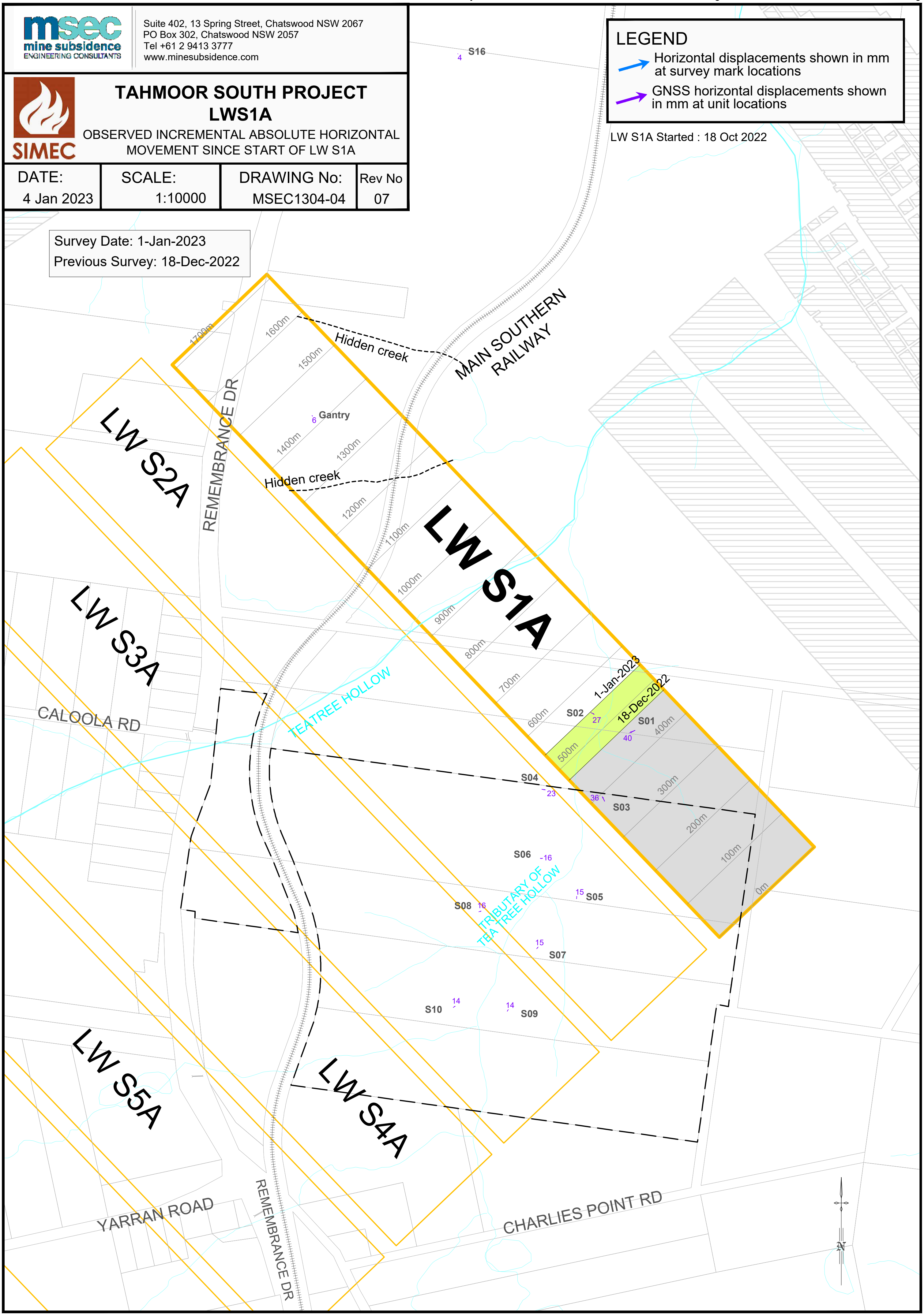
TAHMOOR SOUTH PROJECT LWS1A

OBSERVED INCREMENTAL ABSOLUTE HORIZONTAL MOVEMENT SINCE START OF LW S1A

DATE:	SCALE:	DRAWING No:	Rev No
4 Jan 2023	1:10000	MSEC1304-04	07



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TAHMOOR SOUTH PROJECT LWS1A

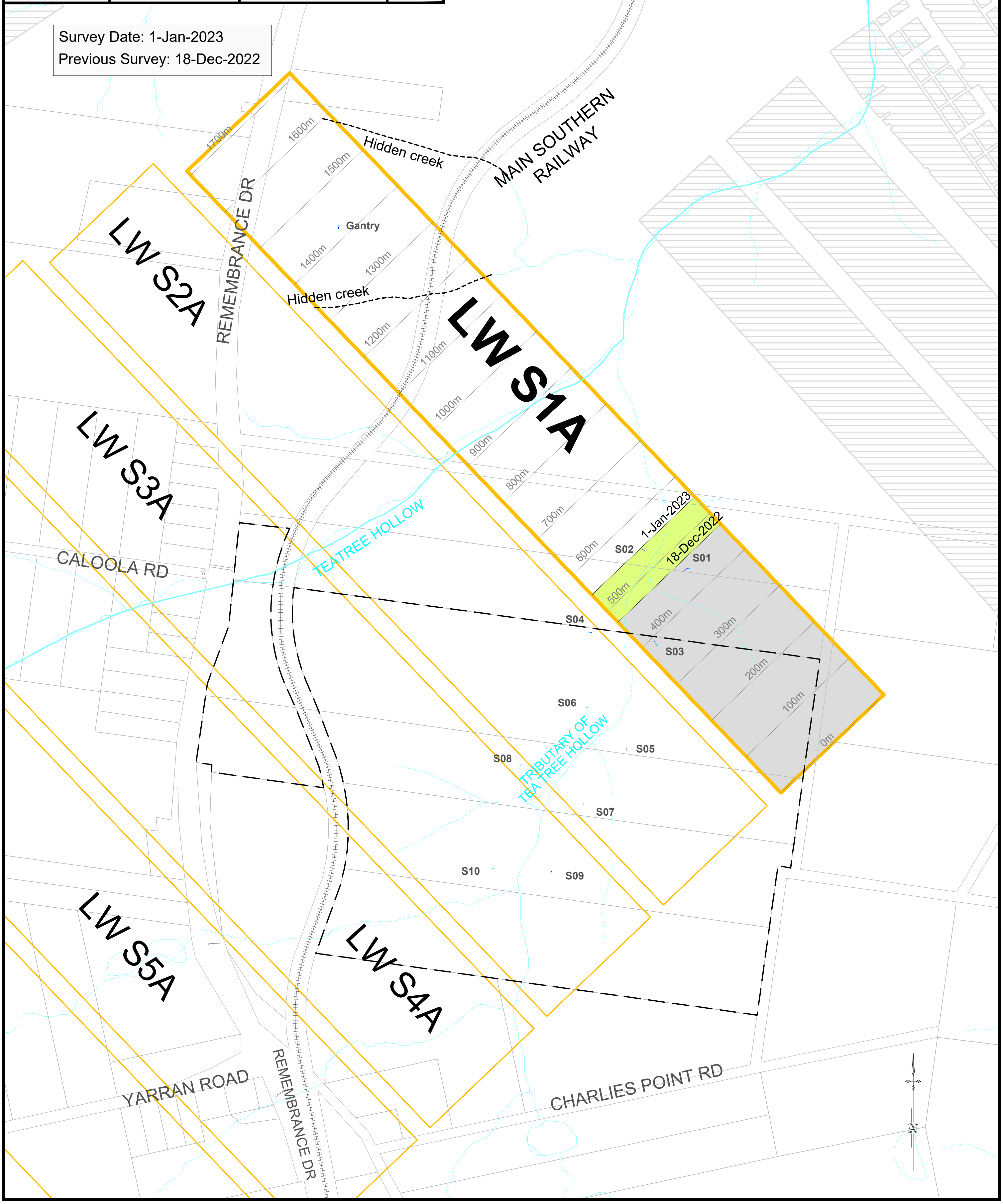
OBSERVED PATH OF INCREMENTAL ABSOLUTE HORIZONTAL MOVEMENT SINCE START OF LW S1A

DATE:	SCALE:	DRAWING No:	Rev No
4 Jan 2023	1:10000	MSEC1304-05	07

LEGEND
- Path of horizontal movement
- Path of horizontal movement since last survey
- Path of GNSS horizontal movement
- Path of GNSS horizontal movement since last survey

LW S1A Started : 18 Oct 2022

Survey Date: 1-Jan-2023
Previous Survey: 18-Dec-2022



Appendix B – Surface Water Monitoring Report

REPORT

TAHMOOR COAL PTY LTD
ABN: 97076663968

Tahmoor South Domain

Surface Water Review
18 October to 31 December 2022

121171-16R004-rev0
March 2022

TAILINGS.WATER.WASTE.

Document Control

Project Name:	Tahmoor South Domain - Surface Water and Groundwater Review
Document Title:	Quarterly Review 18 October to 31 December 2022
File Location:	N:\Synergy\Projects\121\121171 1809 Tahmoor (SIMEC) Surface Water Assistance\16 Quarterly SW and GW Investigation\Documents\R004 (SD)\Text\121171-16R004-rev0.docx
Document Number:	121171-16R004-rev0.docx

Revision History

Revision	Issue	Issue Date	Prepared by	Reviewed by
A	Draft	2 March 2023	Makaela McGrath	Camilla West
0	Final	30 March 2023	Makaela McGrath	Tahmoor Coal

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1 INTRODUCTION

1.1 Background

Tahmoor Coal Pty Ltd (Tahmoor Coal) owns and operates Tahmoor Mine, an underground coking coal mine. The mine surface operations are located south of Tahmoor NSW (within the Greater Sydney Basin) approximately 80 km southwest of Sydney. Tahmoor Mine is within the Wollondilly Shire Council (WSC) Local Government Area (LGA). Underground workings extend north under the town of Tahmoor and Picton with two ventilation shafts being located on the outskirts of Tahmoor.

The Tahmoor South Domain is located south of the Bargo River and east of Remembrance Driveway and the township of Bargo. Mining of Longwall (LW) S1A-S6A was approved on 23 April 2021 in accordance with SSD 8445. Mining of Longwall (LW) S1A commenced on the 18 October 2022. The location of LW S1A-S6A and associated Study Area are illustrated in **MAP 1**.

In accordance with the *Tahmoor Water Management Plan - Tahmoor South Domain – Longwalls South S1A-S6A* (WMP), Tahmoor Coal are required to implement a monitoring program that includes groundwater, surface water and subsidence.

To support the monitoring program, Tahmoor Coal have developed a comprehensive rainfall, surface water and groundwater monitoring network within and adjacent to the Southern Domain. The surface water monitoring network comprises water level monitoring sites, water quality monitoring sites and visual inspection sites. The locations of the relevant rainfall stations, surface water and groundwater monitoring sites and visual inspection sites are shown in **MAP 2**.

Tahmoor Coal have engaged ATC Williams Pty Ltd (ATCW) to undertake a review and analysis of surface water monitoring data recorded at sites within and adjacent to the Tahmoor South Domain (Tahmoor South) for the period 18 October 2022 to 31 December 2022. The groundwater and subsidence review and analysis are undertaken by independent specialists.

The review period of 18 October to 31 December 2022 comprises the period since commencement of mining LW S1A to the end of 2022.

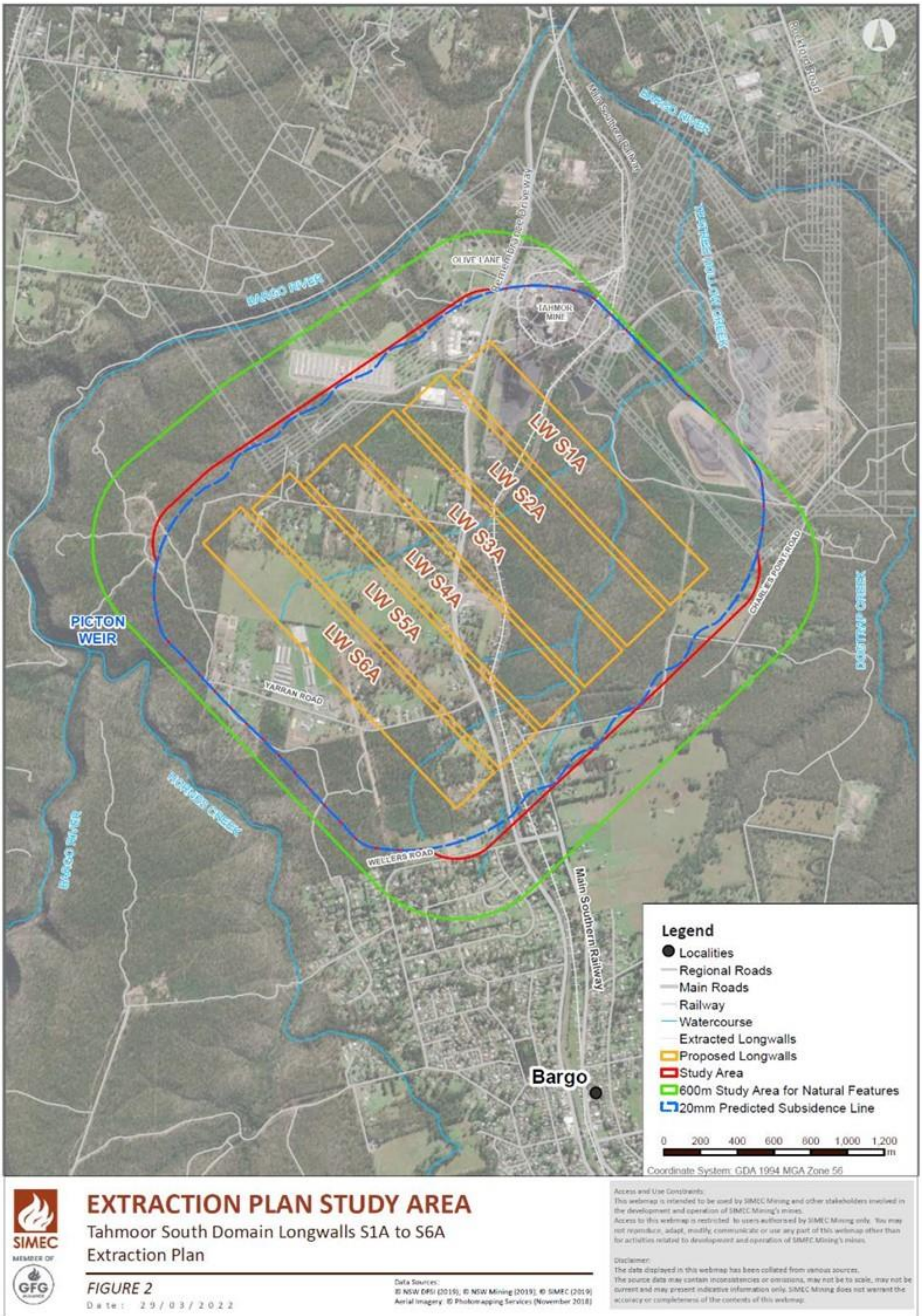
1.2 Scope and Report Purpose

In accordance with the WMP, a Trigger Action Response Plan (TARPs) is required to be implemented including assessment of surface water monitoring data. The purpose of this report is to present:

- review and interpretation of monitoring data for the period 18 October to 31 December 2022 where available data permits - referred to as the review period herein;
- assessment against the performance measures and performance indicators (as described in the WMP) for surface water; and
- recommendations in relation to ongoing monitoring and/or corrective actions.

This report predominantly presents and interprets surface water monitoring data recorded in the vicinity of the LW S1A-S6A.

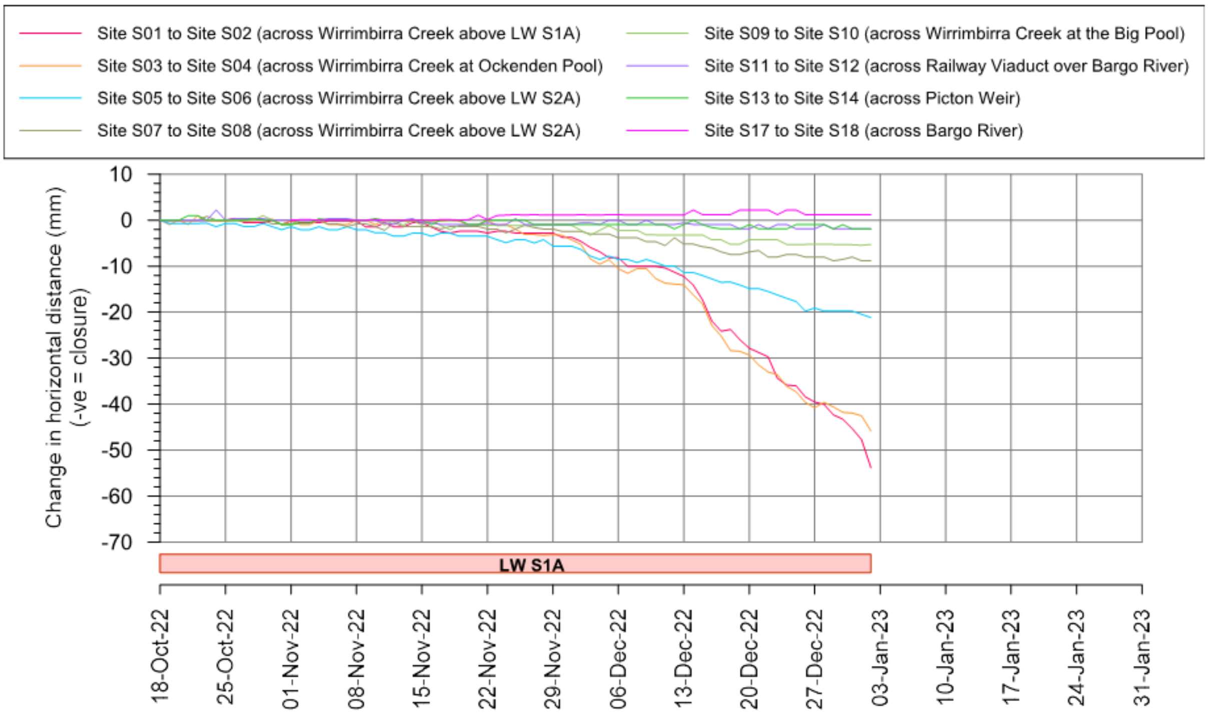
MAP 1: TAHMOOR SOUTH MINING AREA



2 SUMMARY OF MONITORED SUBSIDENCE MOVEMENTS

Tahmoor Coal has installed ground survey marks above and adjacent to LW S1A – S6A with monitoring of subsidence movements undertaken at key locations across the Tahmoor South Domain. The subsidence monitoring is detailed in monthly subsidence monitoring reports prepared by Mine Subsidence Engineering Consultants (MSEC) and summarised below. Changes in horizontal distances calculated between GNSS[1] units located at key locations associated with the Tahmoor South Domain are presented in **DIAGRAM 1**.

DIAGRAM 1: OBSERVED CHANGES IN HORIZONTAL DISTANCES BETWEEN GNSS UNITS (SOURCE: MSEC, 2022)



Since the commencement of LW S1A to 1 January 2023, the following was recorded (MSEC, 2022):

- Closure has developed at Site 01 to Site 02 and Site 03 to Site 04 across Teatree Hollow tributary (known as Wirrimbirra Creek).
- Approximately 45 millimetres (mm) closure was recorded at pool TT3 in Teatree Hollow tributary as of 1 January 2023 (Site S03 to Site S04).
- Approximately 20 mm closure was recorded at pool TT5 in Teatree Hollow tributary (Site S05 to Site S06).
- Less than 10 mm closure has been recorded at upstream sites across Teatree Hollow tributary including at pool TT2 (Site S09 to Site S10).

[1] Global Navigation Satellite System (GNSS) units are fixed survey stations that continuously measure absolute horizontal and vertical positions at a location in real time.

3 SURFACE WATER MONITORING PROGRAM

3.1 Overview

Tahmoor Coal has implemented an extensive surface water monitoring program within and adjacent to the Study Area, as detailed in the WMP. The LW S1A-S6A surface water monitoring program includes water level monitoring sites, water quality monitoring sites and visual inspection sites. The purpose of the surface water monitoring program is to ensure compliance with regulatory requirements and to enable identification of potential mining related impacts to:

- physical features and natural behaviour, assessed by independent specialists and summarised herein;
- surface water level; and
- surface water quality.

The monitoring program aimed to develop a baseline (before) dataset for a range of surface water features and to assess operational and post-mining (after) impacts through the monitoring of reference (control) and potential impact sites (impact).

The monitoring sites are characterised as follows:

Baseline Site:	Surface water monitoring site that has been monitored for water level and quality prior to the commencement of mining in the Western Domain. Baseline surface water monitoring data was used to derive water quality Site Specific Guideline Values (SSGVs) and water level trigger values.
Reference Site:	Surface water monitoring site that is located upstream of the subsidence impact zone and is considered unlikely to be affected by mining activity. These sites are utilised as benchmarks for observations from potential impact sites.
Potential Impact Site:	Surface water monitoring site located within the potential subsidence impact zone (as defined based on mining induced subsidence predictions), from which a potential effect on surface water level or quality from the site activity may be detected.

3.2 Monitoring Program Summary

Surface water monitoring sites are located on key watercourses within and adjacent to the Study Area including Teatree Hollow, Teatree Hollow tributary, Bargo River, Bargo River tributary and Hornes Creek. The locations of the monitoring sites relevant to the Study Area are shown in **MAP 2** to **MAP 4**.

The monitoring site nomenclature is associated with the watercourse and pool number (i.e. TT9 is pool 9 on Teatree Hollow) and the type of monitoring to be implemented: water quality (Q), automated (continuous) and manual water level monitoring (La), monthly manual water level measurements only (Lm) and rating relationship derived streamflow (R). The surface water monitoring program for LWS1A-S6A is summarised in **TABLE 1.**

TABLE 1: SUMMARY OF SURFACE WATER MONITORING

Feature	Locations	Monitoring		
		Prior to Mining	During Mining	Post Mining
Streamflow	Streamflow gauging stations: • TT-F1 (Existing) • DT-F1 (Proposed)	Continuous record. Data downloaded prior to the commencement of secondary extraction in relevant catchment.	Continuous record. Data downloaded and reviewed monthly.	Continuous record, data downloaded and reviewed quarterly for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group*.
Surface Water Quality	Existing sites: TT1-QRLa, TT2-QLa, TT3-QLa, TT7-QRLa, TT9-QLa, TT12-QLa, TT13-QLa, TT14-QLa, HC1a-QLa, HC3-QRLa, HC19-QRLa, BR3-QLa, BR6-QLa, BR13-QRLa, BR12-QRLa, BR16-QLa, BR17-QLa, BR18-QLa Proposed sites: HC13-QLa, HC16-QLa	Monthly sampling for a minimum of 12 months prior to secondary extraction.	Monthly sampling and analysis.	Monthly sampling and analysis for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group.
		Parameters: Field analysis: pH, EC and DO, temperature and ORP. Laboratory analysis for: pH, EC, total dissolved solids, total suspended solids, turbidity, major cations[†], sulphate, alkalinity, chloride, dissolved metals[‡], total metals[≠], total kjeldahl nitrogen, total nitrogen, total phosphorus, total cations and total anions.		
Automated pool water level	Existing sites: TT1-QRLa, TT2-QLa, TT3-QLa, TT7-QRLa, TT9-QLa, TT12-QLa, TT13-QLa, TT14-QLa, HC1a-QLa, HC3-QRLa, HC19-QRLa, BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR16-QLa, BR17-QLa, BR18-QLa Proposed sites: HC13-QLa, HC16-QLa	Continuous record and monthly manual measurements for a minimum of 12 months prior to secondary extraction. Data downloaded prior to the commencement of secondary extraction in relevant catchment.	Continuous record and monthly manual measurements. Data downloaded and reviewed monthly.	Continuous record and monthly manual measurements. Data downloaded and reviewed quarterly for 12 months following the completion of relevant mining activities. This period may be extended as per decision by the Environmental Response Group.

Feature	Locations	Monitoring		
		Prior to Mining	During Mining	Post Mining
Physical features and natural behaviour of pools and reaches	Teatree Hollow, Teatree Hollow tributary and the Bargo River tributary pools and reaches	One observation prior to mining using fixed location photo points.	Observations every month during the active subsidence period (after 200 m of secondary extraction of relevant longwall) for sites within the active subsidence zone^ using fixed location photo points.	Quarterly observations over 12 months for pools that are no longer within the active subsidence zone or as required in accordance with a Watercourse Corrective Action Management Plan.
Morphology and channel stability	Headwater and knickpoint sites in Teatree Hollow, Teatree Hollow tributary and the Bargo River tributary	One observation prior to mining using fixed location photo points. One catchment survey of 10 headwater sites	Observations of knickpoint formation every month during the active subsidence period for sites within the active subsidence zone using fixed location photo points. Annual catchment survey of 10 headwater sites.	One observation of knickpoint formation at sites that are no longer within the active subsidence zone using fixed location photo points. One catchment survey of 10 headwater sites. Post-mining geomorphology survey following completion of mining LW S6A.

* External technical specialists in subsidence, water resources, hydrogeology and aquatic ecology tasked with assessing the Project performance against the Trigger Action Response Plan defined in the Water Management Plan.

† Calcium, magnesium, sodium and potassium.

‡ Aluminium, arsenic, barium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc.

≠ Aluminium, arsenic, barium, cadmium, copper, iron, lead, lithium, manganese, nickel, selenium, strontium and zinc.

^ Survey area includes upstream, downstream and adjacent pools (to the extent of the potential impact) where a trigger exceedance has occurred at a potential impact site(s) in accordance with the TARPs (refer MSEC 2022)

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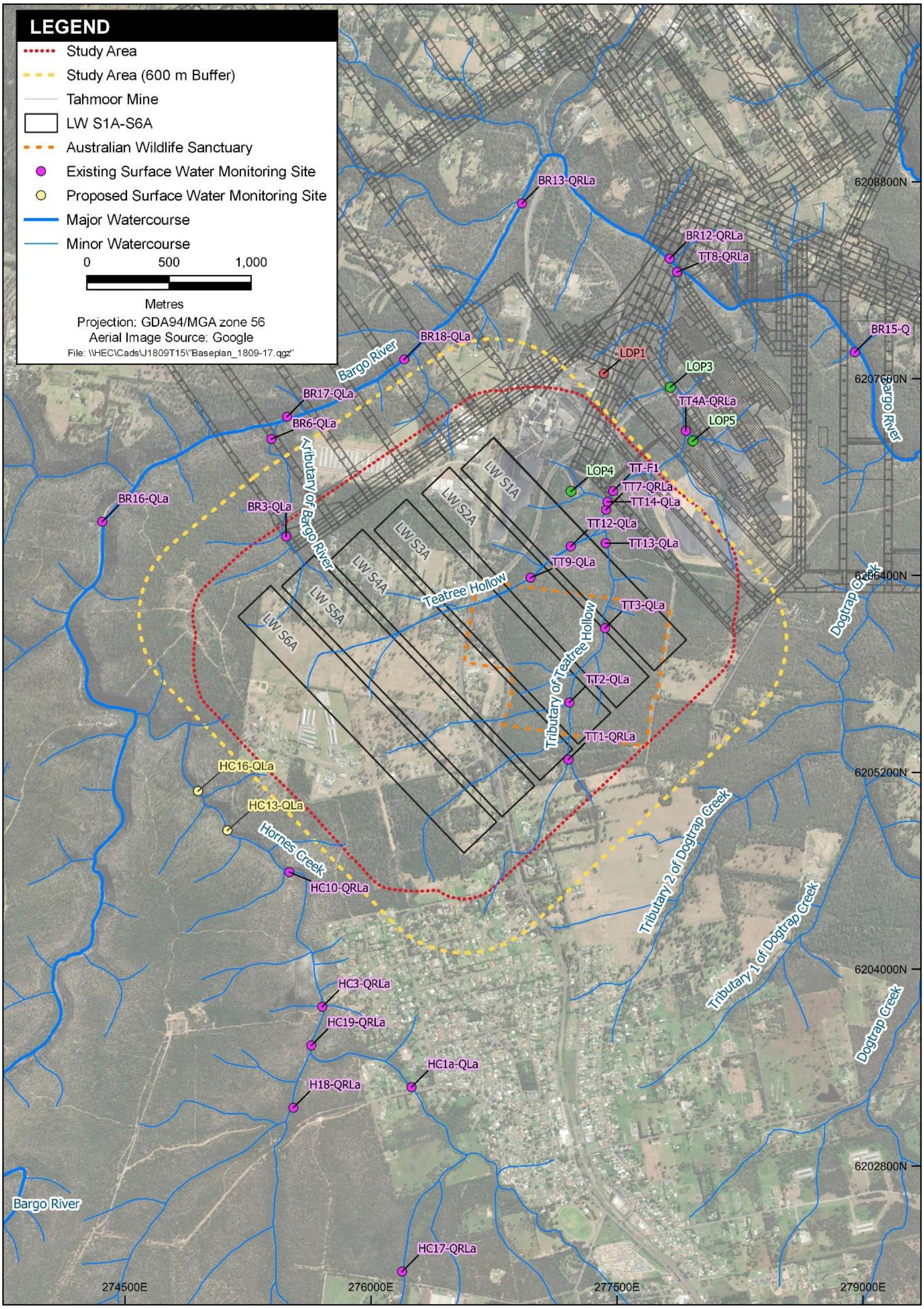
MAP 2: EXISTING AND PROPOSED SURFACE WATER QUALITY AND LEVEL MONITORING SITES SPECIFIC TO LWS1A-S6A



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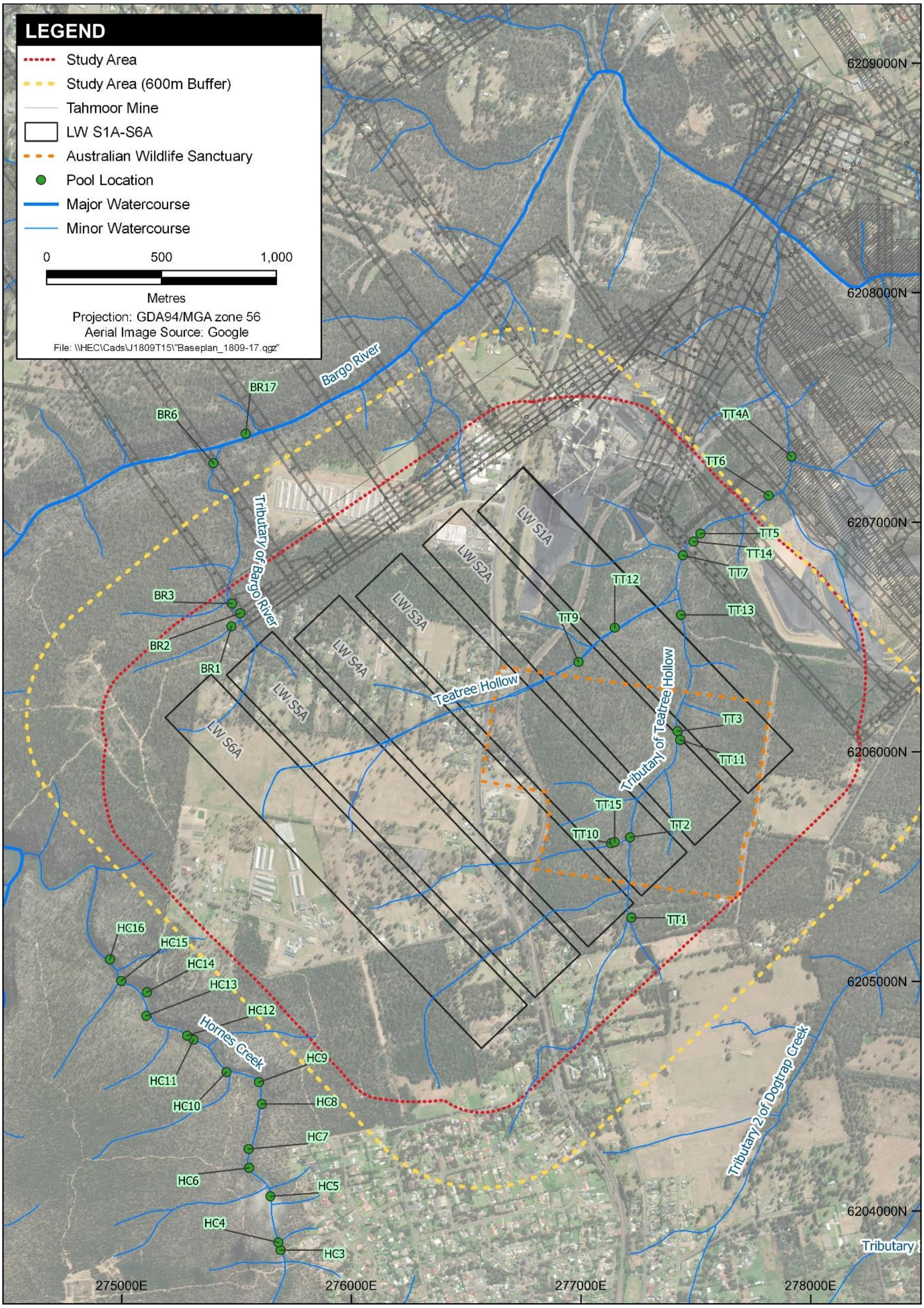
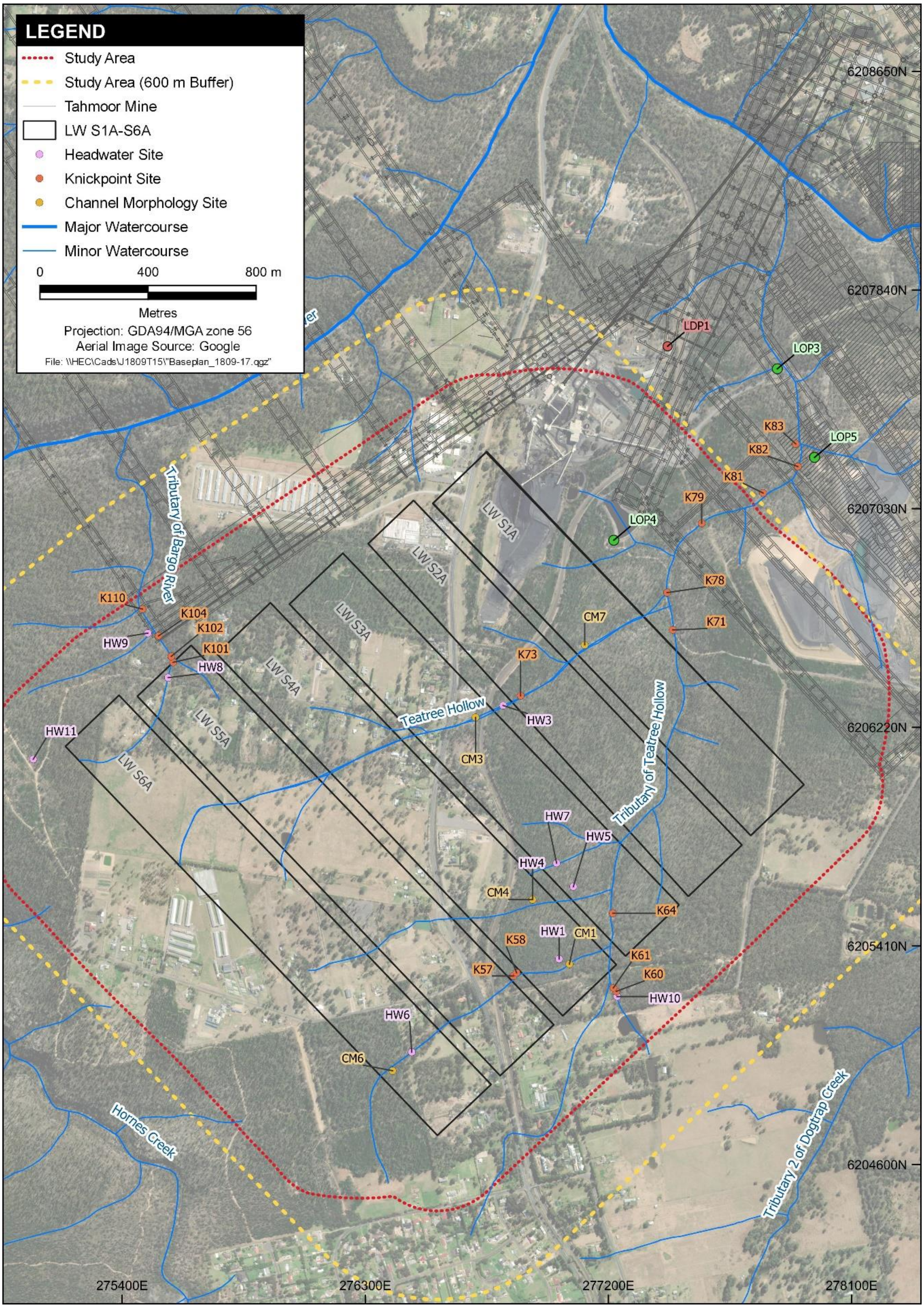
MAP 3: POOL VISUAL INSPECTION SITES SPECIFIC TO LWS1A-S6A



MAP 4: MORPHOLOGY AND CHANNEL STABILITY MONITORING SITES SPECIFIC TO LWS1A-S6A



4 SURFACE WATER MONITORING REVIEW

The following sections present a summary of the surface water level monitoring data, water quality monitoring data and visual inspection records. **Section 4.4** presents the assessment of monitoring data against the TARP significance levels defined in the WMP.

4.1 Surface Water Level Data

Continuous surface water level data has been collected by Tahmoor Coal at monitoring sites in Tahmoor South Domain as shown on **MAP 2**, **MAP 3** and **MAP 4**. The surface water level data has been recorded daily using water level sensors. Manual water level measurements have also been recorded monthly by at the sites shown in **MAP 1.**

Appendix C provides charts of the automated and manual water level data for the full period of record. Note that the cease to flow (CTF) level shown on the automated water level plots refers to the point at which surface water ceases to flow over the streamflow control (i.e., the lowest point on a controlling rockbar or boulder field). In the event that streamflow over the rockbar or boulder field ceases, there may still be streamflow around, through or under the rockbar / boulder field control which reports downstream of the control.

Construction activities relating to the streamflow gauging station weir on Teatree Hollow at TT-F1 are on-going. As such, assessment of the water level data for monitoring site TT14-QLa has been omitted for the current review period as the water level records are influenced by construction activities and therefore do not reflect natural conditions.

Water level monitoring of BR6-QLa commenced at the end of December 2022 and will be assessed in the following review period.

There is currently no potential for impacts to Hornes Creek associated with mining of LW S1A. As such, review of the Hornes Creek water level monitoring data has been excluded from the assessment for the current review period.

TABLE 2 presents a summary of the water level monitoring data for the review period.

TABLE 2: SUMMARY OF AUTOMATED WATER LEVEL MONITORING DATA FOR THE REVIEW PERIOD

Monitoring Site	Classification	Summary of Recorded Water Level During Review Period	Appendix C – Diagram Number
Teatree Hollow			
TT1-QRLa	Reference Site	• The water level remained above the baseline minimum for the duration of the review period.	B1.1
TT2-QLa	Potential Impact Site	• The water level remained above the baseline minimum for the duration of the review period.	B1.2
TT3-QLa	Potential Impact Site	• The water level remained above the baseline minimum for the duration of the review period.	B1.3
TT7-QRLa	Baseline / Potential Impact Site	• The water level was recorded above the baseline minimum level for the majority of the review period. From 23 December 2022, the water level declined below the baseline minimum level however remained above the trigger level.	B1.4
TT9-QLa	Potential Impact Site	• The water level was recorded above the baseline minimum level at the commencement of the review period. The water level declined below the baseline minimum level from 23 November 2022 and below the trigger level from 27 to 30 December 2022.	B1.5
TT12-QLa	Baseline / Potential Impact Site	• The water level remained above the baseline minimum for the duration of the review period.	B1.6
TT13-QLa	Baseline / Potential Impact Site	• The water level was recorded above the baseline minimum level for the majority of the review period. From 22 December 2022, the water level declined below the baseline minimum level however remained above the trigger level.	B1.7
Bargo River			
BR3-QLa	Potential Impact Site	• Limited pre-mining data exists for BR3-QLa and as such a baseline minimum has not been derived. Generally, the water level recorded at BR3-QLa declined over the review period which is likely associated with prevailing climatic conditions.	B2.1
BR12-QRLa	Baseline / Potential Impact Site	• The water level remained above the baseline minimum for the duration of the review period.	B2.2
BR13-QRLa	Baseline / Potential Impact Site	• The water level remained above the baseline minimum for the duration of the review period.	B2.3

Monitoring Site	Classification	Summary of Recorded Water Level During Review Period	Appendix C – Diagram Number
BR16-QLa	Reference Site	• The water level declined by a maximum of 12 cm below the baseline minimum level from 10 to 30 December 2022. Generally, the water level recorded at BR16-QLa declined over the review period which is likely associated with prevailing climatic conditions.	B2.4
BR17-QLa	Potential Impact Site	• The water level was recorded above the baseline minimum level for the majority of the review period. From 6 to 30 December 2022, the water level declined below the baseline minimum level however remained above the trigger level.	B2.5
BR18-QLa	Potential Impact Site	• The water level was recorded above the baseline minimum level for the majority of the review period. From 10 to 30 December 2022, the water level declined below the baseline minimum level however remained above the trigger level.	B2.6

4.2 Surface Water Quality

The water quality data for the following constituents, which are considered to be primary indicators of mining influence (as identified in the WMP), are summarised in **TABLE 3**:

- pH;
- Electrical conductivity (EC); and
- Specific dissolved metals: aluminium, copper, iron, manganese, nickel and zinc.

Monitoring results for key constituents are also shown on a series of plots in **Appendix D**.

There is currently no potential for impacts to Hornes Creek associated with mining of LW S1A. As such, review of the Hornes Creek water quality monitoring data has been excluded from the assessment for the current review period.

TABLE 3: SUMMARY OF KEY WATER QUALITY CONSTITUENTS – 18 OCTOBER TO 31 DECEMBER 2022

Constituent	**Bargo River** BR16-QLa (reference site) BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR16-QLa, BR17-QLa and BR18-QLa (potential impact sites)	**Teatree Hollow** TT1-QRLa (reference site) TT2-QLa, TT3-QLa, TT9-QLa, TT7-QRLa, TT12-QLa, TT13-QLa, TT14-QLa (potential impact sites)
pH (Diagram C1.1 and C2.1, Appendix C)	• Near neutral pH recorded at the majority of the sites • Slightly acidic pH conditions recorded at BR6-QLa in November and December 2022 and at BR3-QLa in December 2022 • pH recorded at all sites generally consistent baseline conditions	• Near neutral pH conditions for the majority of the sites • Slightly acidic pH conditions recorded at TT1-QRLa, TT3-QRLa and TT9-QRLa in December 2022
Electrical Conductivity (EC) (Diagram C1.2 and C2.2, Appendix C)	• Field EC values consistent with baseline values at all sites (less than 350 µS/cm at all sites)	• Field EC values consistent with baseline values at all sites for the duration of the review period • Slight exceedance of SSGV recorded at TT7-QRLa, TT12-QLa and TT14-QLa in December 2022
Dissolved Aluminium (Diagram C1.3 and C2.3, Appendix C)	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline concentrations • Dissolved aluminium concentrations remained below the SSGV for BR12-QRLa and BR13-QRLa	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline concentrations • Slight exceedance of SSGV recorded at TT7-QRLa in November and December 2022 • Slight exceedance of SSGV recorded at TT14-QLa in December 2022
Dissolved Copper (Diagram C1.4 and C2.4, Appendix C)	• Recorded dissolved copper concentrations were equal to or less than the limit of reporting at all sites for the duration of the review period	• Recorded dissolved copper concentrations were equal to or less than the limit of reporting at all sites for the duration of the review period

Constituent	Bargo River BR16-QLa (reference site) BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR16-QLa, BR17-QLa and BR18-QLa (potential impact sites)	Teatree Hollow TT1-QRLa (reference site) TT2-QLa, TT3-QLa, TT9-QLa, TT7-QRLa, TT12-QLa, TT13-QLa, TT14-QLa (potential impact sites)
Dissolved Iron (Diagram C1.5 and C2.5, Appendix C)	• Dissolved iron concentrations recorded at all sites for the duration of the review period were within the range of baseline concentrations • Dissolved iron concentrations recorded at BR12-QRLa exceeded the SSGV in November and December 2022 • Dissolved iron concentration recorded at BR13-QRLa exceeded the SSGV in December 2022	• Dissolved iron concentrations recorded at all sites for the duration of the review period were within the range of baseline concentrations • Dissolved iron concentration recorded at TT12-QLa slightly exceeded the SSGV in November 2022 • Dissolved iron concentration recorded at TT14-QLa slightly exceeded the SSGV in November 2022
Dissolved Manganese (Diagram C1.6 and C2.6, Appendix C)	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline values	• Dissolved aluminium concentrations recorded at all sites were consistent with baseline values
Dissolved Nickel (Diagram C1.7 and C2.7, Appendix C)	• Dissolved nickel concentrations recorded at all sites were consistent with baseline values	• Dissolved nickel concentrations recorded at all sites were consistent with baseline values
Dissolved Zinc (Diagram C1.8 and C2.8, Appendix C)	• Dissolved zinc concentrations recorded at all sites were consistent with baseline values	• Dissolved zinc concentrations recorded at all sites were consistent with baseline values

4.3 Pool Features and Natural Behaviours

Baseline geomorphological and visual inspections were undertaken for all sites shown on **MAP 2** and **MAP 3** between July and October 2022. The visual inspections conducted between 18 October to 31 December 2022 included the following sites:

- October and November 2022: TT3 and TT7; and
- December 2022: TT2, TT3, TT10, TT11, TT13 and TT15.

During this period, BES (2022a-c) identified that there was no observed impact to pool water level, overland connected flow, iron staining, gas release or turbidity, as compared with baseline conditions.

4.4 Geomorphology and Channel Stability

Baseline geomorphological and visual inspections were undertaken for all sites shown on **MAP 4** during August 2022. From 18 October to 31 December 2022 channel morphology site CM7 was visually inspected.

During this period, BES (2022a-c) identified that there was no observed increase in cracking or shearing, no reduction in overland connective flow and no additional iron seeps beyond what was identified during the baseline survey at CM7.

5 SURFACE WATER TARP ASSESSMENT

5.1 Subsidence Impact Performance Measures

The subsidence impact performance measures and performance indicators for natural features defined in the WMP are summarised in **TABLE 4**. The monitoring results, in conjunction with the TARPs, are used to assess the impacts of mining in Tahmoor South against the subsidence impact performance measures specified in **TABLE 4**.

TABLE 4: SUBSIDENCE PERFORMANCE MEASURES AND PERFORMANCE INDICATORS FOR SURFACE WATER

Feature	Subsidence Performance Measures	Subsidence Performance Indicators
All watercourses within the Subsidence Area	No greater subsidence impact or environmental consequences to water quality, water flows (including baseflow) or stream health (including riparian vegetation), than predicted in the EIS.	Exceedance of the impact assessment criteria, as defined in the relevant Level 1 to Level 3 trigger, where a Level 3 trigger denotes progression towards a potential exceedance of the performance measure.
Other watercourses	Negligible environmental consequences including beyond those predicted in the EIS, including: • negligible diversion of flows or changes in the natural drainage behaviour of pools; • negligible decline in baseline channel stability; • negligible gas releases and iron staining; and • negligible increase in water turbidity.	The performance measure will be considered to be exceeded if a Level 3 TARP is triggered in relation to water level decline and/or water quality changes and the investigation outcomes indicate a mining related impact based on monitoring data for sites in Hornes Creek and the Bargo River.

5.2 Surface Water TARP Significance Summary

The WMP TARPs are provided in **Appendix A**. The surface water TARP significance levels for the period of 18 October to 31 December 2022 (the review period), where available data permits, are summarised in **TABLE 5**.

TABLE 5: SURFACE WATER TARP SIGNIFICANCE LEVELS – 18 OCTOBER TO 31 DECEMBER 2022

Date	Location(s)	Comment	TARP Significance
Surface Water Level			
18 October to 31 December 2022	TT2-QLa, TT3-QLa, TT7-QRLa, TT9-QLa, TT12-QLa, TT13-QLa, BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR17-QLa, BR18-QLa	The recorded water level has not declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	Normal Condition
18 October to 26 December 2022 and 31 December 2022	TT9-QLa – Teatree Hollow	The recorded water level has not declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	Normal Condition
27 to 30 December 2022	TT9-QLa – Teatree Hollow	The recorded water level declined by greater than 10 centimetres (cm) below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) and the same did not occur at the reference site(s).	Level 1
Physical Features and Natural Pool Behaviour			
27 October 2022, 15 November 2022	TT3, TT7 and CM7	No observed impact to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	Normal Condition
13 December 2022	TT2, TT3, TT10, TT11, TT13, TT15 and CM7	No observed impact to pool water level, overland connected flow, iron staining, gas release or turbidity – as compared with baseline conditions.	Normal Condition
Surface Water Quality			
18 October to 31 December 2022	TT2-QLa, TT3-QLa, TT7-QRLa, TT9-QLa, TT12-QLa, TT13-QLa, BR3-QLa, BR6-QLa, BR12-QRLa, BR13-QRLa, BR17-QLa, BR18-QLa	Exceedance of an SSGV does not occur or occurs for less than three consecutive months.	Normal Condition

* Source: BES (2022a-c)

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6 ASSESSMENT OF POTENTIAL IMPACTS

The following describes the assessment outcomes for sites where a TARP significance in excess of 'Normal Condition' was reported during the review period.

6.1 Trigger Action and Response

As stated in **Section 5.2**, a Level 1 trigger in relation to water level decline was recorded at monitoring site TT9-QLa from 27 to 30 December 2022. **TABLE 6** summarises the actions and responses required to be undertaken in relation to a Level 1 trigger for pool water level, as defined in the WMP.

TABLE 6: TRIGGER ACTION AND RESPONSE

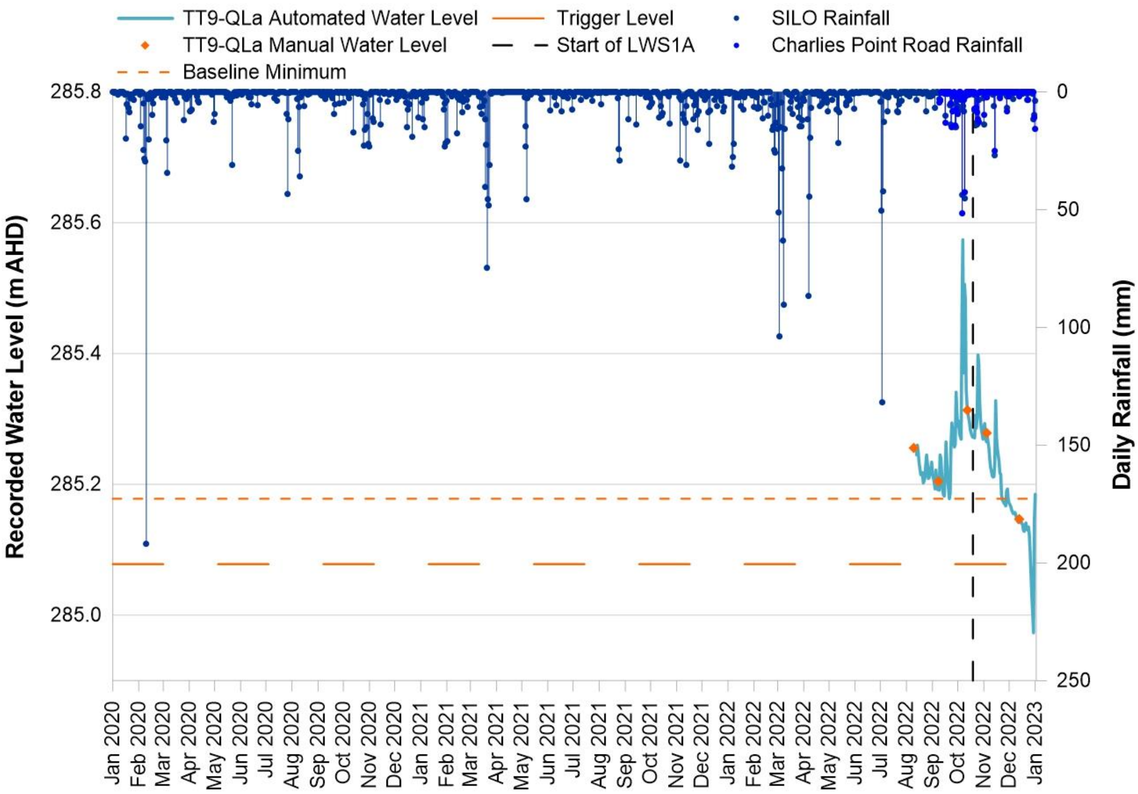
Level	Action	Response
Pool water level		
Level 1	• Continue monitoring and review of data as per monitoring program • Review water level trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Review streamflow data recorded at TT-F1 and conduct streamflow reduction assessment. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater level monitoring results) necessary to inform assessment.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Report and Annual Review.

6.2 Trigger Assessment

6.2.1 TT9-QLa and Reference Site Water Level Records

Monitoring site TT9-QLa is located in pool TT9 on Teatree Hollow, overlying future LW S2A (refer **MAP 1**). The recorded water level data for monitoring site TT9-QLa is presented in **GRAPH 1**.

GRAPH 1 – TT9-QLA WATER LEVEL DATA

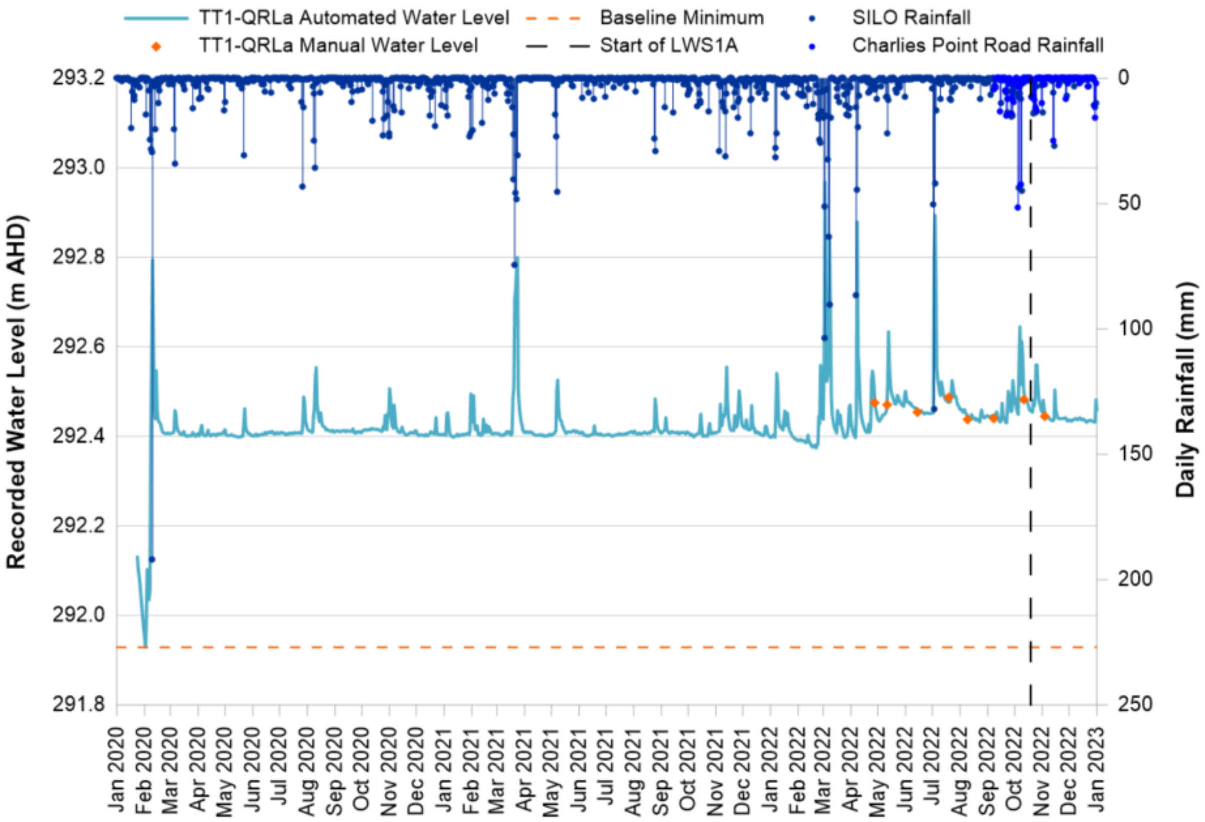


As shown in **GRAPH 1**, the recorded water level declined by greater than 10 cm below the recorded baseline minimum level for the period 27 to 30 December 2022. During and following a rainfall event in late December 2022, the water level rose and was recorded above the baseline minimum as of 10 January 2022 (extent of available water level data for this assessment).

It is noted that only 2 months of baseline water level data are available for monitoring site TT9-QLa.

A suitable reference site location for Teatree Hollow, upstream of potential mining related influences, is not available. An alternative reference site, TT1-QRLa, is located upstream of LW S4A on the Teatree Hollow tributary (known as Wirrimbirra Creek) – refer Attachment 1. The recorded water level data for reference site TT1-QRLa is presented in **GRAPH 2**.

GRAPH 2 – TT1-QRLA WATER LEVEL DATA



As shown in **GRAPH 2**, the water level recorded at TT1-QRLa did not decline below the baseline minimum during the period 27 to 30 December 2022. It is noted that a substantially longer period of baseline data is available for reference site TT1-QRLa than for TT9-QLa.

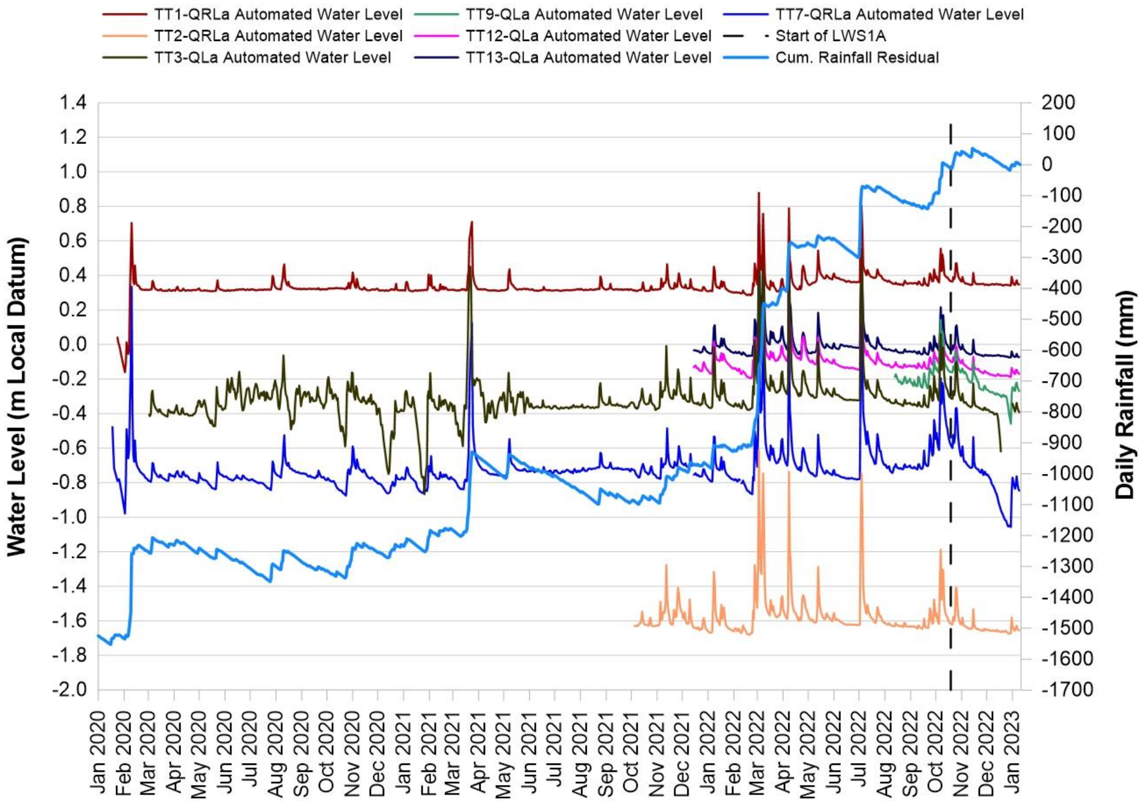
Because the water level declined by greater than 10 cm below the recorded baseline minimum level at monitoring site TT9-QLa for the period 27 to 30 December 2022, and the same was not recorded at reference site TT1-QLa, a level 1 trigger significance has been equated in accordance with the WMP.

6.2.2 Review of Watercourse Water Level Trends

In accordance with the actions for a level 1 water level trigger (refer **Appendix A**), water level trends of upstream and downstream monitoring sites on Teatree Hollow and Teatree Hollow tributary have been assessed. **GRAPH 3** presents a plot of the water level data, in local datum for comparative purposes, in comparison to the cumulative rainfall residual[2]. The water level monitoring data for TT14-QLa has not been presented due to the influence of weir construction works on the water level characteristics of this site.

[2] Calculated for the period January 2000 to January 2023 from the SILO Point Data dataset for a location in close proximity to the LW S1A-S6A Study Area.

GRAPH 3 – TEATREE HOLLOW CATCHMENT WATER LEVEL DATA



The data presented in **GRAPH 3** illustrates that the decline in water level recorded at TT9-QLa in late December 2022 occurred during a period of below average rainfall. A similar decline in water level was recorded at monitoring site TT3-QLa, and a very slight decline recorded at monitoring site TT2-QLa, on Teatree Hollow tributary. These two sites are uninfluenced by changes in water level and streamflow characteristics of Teatree Hollow. A similar decline in water level was also recorded at TT7-QLa, and a very slight decline recorded at monitoring site TT12-QLa, on Teatree Hollow. Both sites are located downstream of TT9-QLa and, as such, may be influenced by changes in water level and streamflow characteristics which occur in upstream reaches of Teatree Hollow. Consistent with the water level recorded at TT9-QLa, following a rainfall event in late December 2022, the recorded water levels rose at these monitoring sites and were recorded above baseline conditions as of 10 January 2022 (extent of available water level data for this assessment).

With the exception of monitoring site TT9-QLa, the decline in water level recorded at these monitoring sites did not exceed 10 cm below the associated recorded baseline minimum level. It is noted, however, that the baseline monitoring period for TT7-QRLa and TT3-QLa commenced in early 2020 whereas the baseline monitoring period for TT9-QLa commenced in August 2022. Based on the available monitoring data, it is considered that the hydrological characteristics of TT9-QLa are similar to that of TT7-QRLa. As such, there is potential that the water level at monitoring site TT9-QLa declined to a similar level historically to that which was recorded in late December 2022.

6.2.3 Streamflow Reduction Assessment

A concrete and steel v-notch weir has been constructed on Teatree Hollow (TT-F1 in **MAP 1**) to enable accurate and continuous low flow monitoring from commissioning. Challenges in the construction of the weir have been encountered and, as such, further construction works were required to be undertaken. The additional construction works were conducted from late 2022 to early 2023. Consequently, the streamflow monitoring data for TT-F1 was influenced by the weir construction works for the duration of the review period. As the streamflow monitoring data during this period was not reflective of natural conditions, a streamflow reduction assessment has not been undertaken.

6.2.4 Assessment of Relevant Information

As of 9 January 2023, mining of LW S1A had progressed 630 metres (m); approximately 400 m to the east of TT9-QLa. At this distance, it is considered unlikely that pool TT9 had been impacted by mining of LW S1A. A visual inspection of pool TT9, conducted on 17 January 2023, identified that there was no evidence of fractures, impact to pool water level, overland connected flow, iron staining or gas release (BES, 2023).

The closest groundwater monitoring site to TT9-QLa is P56, located approximately 400 m upstream (refer SLR [2023] for site location). Recorded data to 12 December 2022 indicated a notable decline in groundwater level at P56C (monitoring the deep Hawkesbury Sandstone), equating to approximately 3.4 m decline since the start of mining LW S1A. Recorded water levels at P56B (mid Hawkesbury Sandstone) indicated a decline of less than 1 m from the start of mining LW S1A while groundwater levels in the shallow Hawkesbury Sandstone (P56A) were generally stable from October to December 2022 (SLR, 2023).

Given the decline in groundwater level recorded within the vicinity of TT9-QLa, there is potential that a decline in baseflow contribution to Teatree Hollow occurred from October to December 2022 which may have had a minor contribution to the overall recorded decline in water level at TT9-QLa.

6.2.5 Summary of Assessment Findings

The decline in water level recorded at monitoring site TT9-QLa occurred during a period of below average rainfall conditions, as shown in **GRAPH 3**. Water level decline was also recorded at monitoring sites located on Teatree Hollow tributary i.e., at sites uninfluenced by changes in the water level and streamflow characteristics of Teatree Hollow. Following a rainfall event in late December 2022, the water level rose at all monitoring sites and was recorded above baseline conditions as of 10 January 2023 (extent of available water level data for this assessment).

Although a level 1 trigger is reported for monitoring site TT9-QLa for the period 27 to 30 December 2022, at this stage it is considered that the decline in water level was related to the prevailing climatic conditions and likely unrelated to mining influences.

Notwithstanding, the water level data recorded at monitoring site TT9-QLa will continue to be recorded and reviewed in accordance with the WMP. If additional monitoring data indicates continued decline in water level at monitoring site TT9-QLa, further assessment and actions will be taken in accordance with the WMP.

7 SUMMARY AND RECOMMENDATIONS

Review and assessment of surface water monitoring data recorded prior to and during the review period of 18 October to 31 December 2022 has indicated the following:

- Surface Water Level:
  - Normal water level conditions were recorded at all monitoring sites with the exception of TT9-QLa in Teatree Hollow.
  - A TARP level 1 exceedance was recorded for TT9-QLa. It is considered that the decline in water level was related to the prevailing climatic conditions and likely unrelated to mining influences. Notwithstanding, the water level data at monitoring site TT9-QLa will continue to be recorded and reviewed in accordance with the WMP. If additional monitoring data indicates continued decline in water level at monitoring site TT9-QLa, further assessment and actions will be taken in accordance with the WMP.
- Physical Features and Natural Behaviour of Pools:
  - No trigger level exceedances were recorded for the review period.
- Surface Water Quality:
  - No trigger level exceedances were recorded for the review period.

Based on the monitoring data for the period 18 October to 31 December 2022, following commencement of mining LW S1A, there is negligible indication of a mining related effect on surface water resources within and adjacent to the LW S1A-S6A Study Area.

As such, it is recommended that ongoing review of surface monitoring data is continued to be undertaken in accordance with the WMP.

REFERENCES

[1] BES (2022a). "October 2022 Tahmoor South Longwall S1A Monitoring". Prepared for Tahmoor Coking Coal by Brienen Environment & Safety (BES), October.

[2] BES (2022b). "November 2022 Tahmoor South Longwall S1A Monitoring". Prepared for Tahmoor Coking Coal by Brienen Environment & Safety (BES), November.

[3] BES (2022c). "December 2022 Tahmoor South Longwall S1A Monitoring". Prepared for Tahmoor Coking Coal by Brienen Environment & Safety (BES), December.

[4] BES (2023). "January 2023 Tahmoor South Longwall S1A Monitoring". Report by Brienen Environmental Services prepared for Tahmoor Coal Pty Ltd, January.

[5] SLR (2023). "Tahmoor South Groundwater Annual Reporting, Oct to Dec 2022". Prepared by SLR Consulting Australia Pty Ltd (SLR) on behalf of Tahmoor Coal, March.

[6] MSEC (2022). "Tahmoor LW S1A Subsidence Monitoring Report, Monitoring Period 26 December 2022 to 1 January 2023". Report Number: MSEC1304, January.

[7] Tahmoor Coal (2023). "Tahmoor South Domain – Longwalls South S1A-S6A Water Management Plan", January.

CONDITIONS OF REPORT

This report must be read in its entirety.

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APPENDICES

APPENDIX A – LWS1A-S6A WATER MANAGEMENT PLAN; TRIGGER ACTION RESPONSE PLAN

WATER MANAGEMENT PLAN TARP – WMP1 STREAM WATER QUALITY FOR ALL WATERCOURSES WITHIN THE SUBSIDENCE AREA[1]

Performance Measure and Indicator, TARP Objective and Assessment Criteria

Performance Measure Feature
All watercourses within the Subsidence Area[1].

Performance Measure
No greater subsidence impact or environmental consequences to water quality, water flows (including baseflow) or stream health (including riparian vegetation), than predicted in the EIS.

The EIS concludes that where the longwalls directly mine beneath the streams, it is considered likely that fracturing would result in surface water flow diversion and that localised and transient increases in water quality constituents would occur[2]. The performance measure will be considered to be exceeded if subsidence impacts cannot be repaired in a manner that restores pool water holding capacity and stream health. Remediation measures will be developed as required and detailed in the Watercourse Corrective Action Management Plan (C12 of the SSD 8445). These plans will contain relevant performance indicators specific to remediation performance measures.

Performance Indicator
Exceedance of the site specific guideline values (SSGVs), as defined in the Level 1 to Level 3 trigger, where a Level 3 trigger denotes progression towards a potential exceedance of the performance measure.

TARP Objective
This TARP defines levels of variation in surface water quality from normal conditions[3] and the actions required to be implemented in response to each level of variation.

Assessment Criteria
SSGV as listed in table below.

Monitoring Program

Locations

Longwall	Potential Impact Sites	Reference Sites
LW S1A	TT7-QRLa TT12-QLa TT13-QLa TT14-QLa	TT1-QRLa
LW S2A	TT9-QLa[4] TT3-QLa[5] All sites above	
LW S3A	TT2-QLa All sites above	
LW S4A LW S5A LW S6A	BR3-QLa TT1-QRLa All sites above	DT73-QRLa DT64-QRLa

All monitoring locations are shown in Figure 20 of the Water Management Plan.

Monitoring Frequency

Pre-mining
Monthly sampling prior to secondary extraction of relevant longwall.

During Mining
Monthly sampling and analysis or as required by a specified action relevant to a trigger level.

Post-mining
Monthly sampling and analysis for a minimum of 12 months following the completion of LW S6A or as required in accordance with a Watercourse Corrective Action Management Plan.

Management

Level	Trigger	Action	Response
Normal Condition	• Exceedance of an SSGV does not occur or occurs for less than three consecutive months.	• Continue monitoring and review of data as per monitoring program.	• No response required.
Level 1	• Exceedance of an SSGV occurs at a given potential impact site in three consecutive months and the same has not occurred at the reference site(s).	• *Actions as required for Normal Condition.* • Assess if the trigger was exceeded during the baseline period prior to commencement of mining activities. • Review water quality trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Discuss findings with and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater quality monitoring results) necessary to inform assessment. • Consider and decide on reasonable and feasible options for remediation as relevant (e.g. limestone cobbles for increasing pH level).	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. limestone cobbles for increasing pH level). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
Level 2	• Exceedance of an SSGV occurs at a given potential impact site in four or five consecutive months and the same has not occurred at the reference site(s).	• *Actions as stated in Level 1.* • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 2 has been reached or at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. singular, anthropogenic, non-mining related change that resulted in a water quality change). • If increased monitoring is adopted, undertake further analysis of water quality trends along creek (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Review CMAs in light of findings from further investigations and consider additional remediation options. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access.
Level 3	• Exceedance of an SSGV occurs at a given potential impact site in six consecutive months and the same has not occurred at the reference site(s).	• *Actions as stated in Level 2.* • Increase monitoring and review of data frequency to fortnightly for sites where Level 3 has been reached and at corresponding reference sites, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing), other catchment changes, effects unrelated to mining or the prevailing climate.	• *Responses as stated in Level 2.* If it is concluded from the detailed investigation that watercourses have been damaged by subsidence impacts: • Offer site visit with DPE and other key stakeholders. • Develop Watercourse Corrective Action Management Plan (WCAMP) in consultation with the Resources Regulator, DPE and other key stakeholders (in accordance with C12 of SSD 8445). The stream remediation measures in the WCAMP could include grout curtain and grout pattern injection. • Implement approved WCAMP, subject to land access.

Site Specific Guideline Value (SSGV)						
Parameter	**TT1-QRLa**	**TT2-QLa**	**TT7-QRLa**	**TT12-QLa**	**TT13-QLa**	**TT14-QLa**
No. of Values[6]	30	10[7]	33	11[8]	11[8]	11[8]
pH (pH units)	6.5 – 8	5.9 – 8	6.5 – 8	6.5 – 8	6.5 – 8	6.5 – 8
EC (µS/cm)	531	350	361	350	350	350
Dissolved Aluminium (mg/L) pH > 6.5	0.06	0.13	0.06	0.08	0.055	0.1
Dissolved Copper (mg/L)	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014
Dissolved Iron (mg/L)	0.71	0.49	0.86	0.56	0.42	0.54
Dissolved Manganese (mg/L)	1.9	1.9	1.9	1.9	1.9	1.9
Dissolved Nickel (mg/L)	0.011	0.011	0.011	0.011	0.011	0.011
Dissolved Zinc (mg/L)	0.03	0.03	0.03	0.008	0.008	0.008

Notes:
[1] Subsidence Area is defined as the 'Subsidence Study Area' as illustrated in Figure 1 of Appendix 2 of SSD 8445.
[2] Due to the predicted surface fracturing of watercourses which directly overlie the longwall panels.
[3] As defined by the site specific guideline value (SSGV).
[4] Sites to be installed, subject to land access. The monitoring program relevant to this TARP has been designed to record at least 24 months of baseline data prior to commencement of mining of the relevant longwall (with the exception of TT12-Qla, TT13-Qla, TT14-Qla which will have 12 months of baseline data). Additional sites will be included prior to commencement of mining the relevant longwall. The derived SSGV for each relevant monitoring site would be included in the Water Management Plan and provided to the relevant government agencies for review and approval.
[5] SSGVs have not been derived for TT3-QLa as the pool was dry on five of eight sampling occasions.
[6] Minimum number of values used in SSGV derivation – for some constituents, a greater number of values were adopted.
[7] Number of values used to derive SSGV for TT2-QLa, prior to commencement of mining LWS3A, is expected to be greater than 24.
[8] TT12-QLa, TT13-QLa, TT14-QLa – a minimum of 12 samples (12 months) would be collected prior to secondary extraction.

WATER MANAGEMENT PLAN TARP – WMP2 STREAM WATER QUALITY FOR OTHER WATERCOURSES (BARGO RIVER AND HORNES CREEK)

Performance Measure and Indicator, TARP Objective and Assessment Criteria

Performance Measure Feature
Other watercourses.

Performance Measure
Negligible environmental consequences including beyond those predicted in the EIS.

Performance Indicator
The performance measure will be considered to be exceeded if a Level 3 TARP is triggered in relation to water quality changes and the investigation outcomes indicate a mining related impact based on monitoring data for sites in Hornes Creek and the Bargo River.

TARP Objective
This TARP defines levels of variation in surface water quality from normal conditions[1], indicators of exceedance of the performance measure and the actions required to be implemented in response to each level of variation or exceedance of the performance measure.

Assessment Criteria
SSGV as listed in table below.

Monitoring Program

Locations

Longwall	Potential Impact Sites	Reference Sites
LW S1A	BR12-QRLa BR13-QRLa	BR16-QLa[2,3]
LW S2A	BR18-QLa[2] All sites above	
LW S3A	BR17-QLa[2] All sites above	
LW S4A	BR6-QLa[2]	DT73-QRLa
LW S5A	All sites above	DT64-QRLa All sites above
LW S6A	HC13-QLa[2] HC16-QLa[2] HC10-QRLa HC3-QRLa HC19-QRLa All sites above	HC18-QRLa HC17-QRLa HC1a-QLa All sites above

All monitoring locations are shown in Figure 20 of the Water Management Plan.

Monitoring Frequency

Pre-mining
Monthly sampling prior to secondary extraction or other relevant mining activity.

During Mining
Monthly sampling and analysis or as required by a specified action relevant to a trigger level.

Post-mining
Monthly sampling and analysis for a minimum of 12 months following the completion of LW S6A or as required in accordance with a Watercourse Corrective Action Management Plan.

Management

Trigger	Action	Response
Normal Condition		
• Exceedance of an SSGV does not occur or occurs for less than three consecutive months.	• Continue monitoring and review of data as per monitoring program.	• No response required.
Level 1		
• Exceedance of an SSGV occurs at a given potential impact site in three consecutive months and the same has not occurred at the reference site(s).	• *Actions as required for Normal Condition.* • Assess if the trigger was exceeded during the baseline period prior to commencement of mining activities. • Review water quality trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater quality monitoring results) necessary to inform assessment. • Consider and decide on reasonable and feasible options for remediation as relevant (e.g. limestone cobbles for increasing pH level).	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. • Provide DPE and key stakeholders with proposed CMAs for consultation (e.g. limestone cobbles for increasing pH level). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
Level 2		
• Exceedance of an SSGV occurs at a given potential impact sites in four or five consecutive months and the same has not occurred at the reference site(s).	• *Actions as stated in Level 1.* • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 2 has been reached or at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. singular, anthropogenic, non-mining related change that resulted in a water quality change). • If increased monitoring is adopted, undertake further analysis of water quality trends along creek (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Review CMAs in light of findings from further investigations and consider additional remediation options. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access.
Level 3		
• Exceedance of an SSGV occurs at a given potential impact site in six consecutive months and the same has not occurred at the reference site(s).	• *Actions as stated in Level 2.* • Increase monitoring and review of data frequency to fortnightly for sites where Level 3 has been reached and at corresponding reference sites, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing), other catchment changes, effect unrelated to mining or the prevailing climate. • Undertake an investigation to determine if an exceedance of the performance measure is likely.	• *Responses as stated in Level 2.* • If relevant, notify DAWE of any predictions of an exceedance of a performance measure within two business days.
Exceeds Performance Measure		
• It is concluded from the Level 3 investigation that mining results in exceedance of an SSGV at a given potential impact site for six or more consecutive months.	• Investigate reasons for the performance measure exceedance. • Based on the outcomes of the investigation, review predictions of subsidence impacts and environmental consequences associated with future longwall extraction.	• Submit a report to DPE (in accordance with E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed by DPE). • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project). • Offer site visit with DPE and other key stakeholders. • Develop Watercourse Corrective Action Management Plan (WCAMP) in consultation with the Resources Regulator, DPE and other key stakeholders (in accordance with C12 of SSD 8445). The stream remediation measures in the WCAMP could include grout curtain and grout pattern injection.

				• Implement approved WCAMP, subject to land access.

Site Specific Guideline Value (SSGV)					
Parameter	BR12-QRLa	BR13-QRLa	HC3-QRLa	HC10-QRLa	HC19-QRLa
No. of Values[4]	35	35	34	28	30
pH (pH units)	6.5 - 8	6.5 - 8	5.7 - 8	6.5 - 8	6.5 - 8
EC (µS/cm)	350	350	365	350	350
Dissolved Aluminium (mg/L) pH > 6.5	0.062	0.055	0.09	0.07	0.1
Dissolved Copper (mg/L)	0.0014	0.0014	0.002	0.002	0.0014
Dissolved Iron (mg/L)	0.54	0.65	4.5	0.62	0.5
Dissolved Manganese (mg/L)	1.9	1.9	1.9	1.9	1.9
Dissolved Nickel (mg/L)	0.011	0.011	0.011	0.011	0.011
Dissolved Zinc (mg/L)	0.008	0.009	0.03	0.008	0.008

Notes:
[1] As defined by the SSGV.
[2] Sites to be installed, subject to land access. The monitoring program relevant to this TARP has been designed to record at least 24 months of baseline data prior to commencement of mining of the relevant longwall. Additional sites will be included prior to the commencement of mining the relevant longwall. The derived SSGV for each relevant monitoring site would be updated in the Water Management Plan and provided to the relevant government agencies for review and approval.
[3] Data collected from BR11-QRLa (water quality data collected between 2012-2021 and water level data collected between 2013-2021) will be used in combination with data from BR16-QLa (once established) to provide a long-term baseline dataset for the Bargo River upstream of mining activities. [4] Minimum number of values used in SSGV derivation - for some constituents, a greater number of values were adopted.

WATER MANAGEMENT PLAN TARP – WMP3 POOL WATER LEVEL FOR ALL WATERCOURSES WITHIN THE SUBSIDENCE AREA[1]

Performance Measure and Indicator, TARP Objective and Assessment Criteria

Performance Measure Feature
All watercourses within the Subsidence Area[1].

Performance Measure
No greater subsidence impact or environmental consequences to water quality, water flows (including baseflow) or stream health (including riparian vegetation), than predicted in the EIS.

The EIS concludes that where the longwalls directly mine beneath the streams, it is considered likely that fracturing would result in surface water flow diversion and that localised and transient increases in water quality constituents would occur[2]. The performance measure will be considered to be exceeded if subsidence impacts cannot be repaired in a manner that restores pool water holding capacity and stream health. Remediation measures will be developed as required and detailed in the Watercourse Corrective Action Management Plan (C12 of the SSD 8445). These plans will contain relevant performance indicators specific to remediation performance measures.

Performance Indicator
Water level decline as defined in the Level 1 to Level 3 trigger, where a Level 3 trigger denotes progression towards a potential exceedance of the performance measure.

TARP Objective
This TARP defines levels of variation in pool water level from normal conditions[3] and the actions required to be implemented in response to each level of variation.

Assessment Criteria
- Comparison of baseline and operational recorded water level data (all levels).
- Water level recession analysis for Level 2 and above.

Monitoring Program

Locations

Longwall	Potential Impact Sites	Reference Sites
LW S1A	TT7-QRLa TT12-QLa TT13-QLa TT14-QLa	TT1-QRLa
LW S2A	TT9-QLa[4] TT3-QLa All sites above	
LW S3A	TT2-QLa All sites above	
LW S4A	BR3-QLa[4] TT1-QRLa All sites above	DT73-QRLa DT64-QRLa

All monitoring locations are shown in Figure 20 of the Water Management Plan.

Monitoring Frequency

Pre-mining
Continuous record and monthly manual measurements. Data downloaded prior to the commencement of secondary extraction of the relevant longwall.

During Mining
Continuous record and monthly manual measurements. Data downloaded and reviewed monthly.

Post-mining
Continuous record and monthly manual measurements for a minimum of 12 months following the completion of LW S6A or as required in accordance with a Watercourse Corrective Action Management Plan.

Management

Trigger	Action	Response
Normal Condition		
• The recorded water level has not declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	• Continue monitoring and review of data as per monitoring program.	• No response required.
Level 1		
• The recorded water level has declined by greater than 10 centimetres (cm) below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) and the same has not occurred at the reference site(s).	• *Actions as required for Normal Condition.* • Review water level trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Review streamflow data recorded at TT-F1 and conduct streamflow reduction assessment. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater level monitoring results) necessary to inform assessment.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
Level 2		
• The recorded water level has declined atypically[5] below the recorded baseline minimum level for less than one month (as a consecutive period) and the same has not occurred at the reference site(s).	• *Actions as stated in Level 1.* • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 2 has been reached and at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. singular, anthropogenic, non-mining related change that resulted in a water level change). • If increased monitoring is undertaken, conduct further analysis of water level trends along creek (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan.
Level 3		
• The recorded water level has declined atypically[6] below the recorded baseline minimum level for greater than one month (as a consecutive period) and the same has not occurred at the reference site(s).	• *Actions as stated in Level 2.* • Increase monitoring and review of data frequency to fortnightly for sites where Level 3 has been reached and at corresponding reference sites, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing), other catchment changes, effect unrelated to mining or the prevailing climate.	• *Responses as stated in Level 2.* If it is concluded from the detailed investigation that watercourses have been damaged by subsidence impacts: • Offer site visit with DPE and other key stakeholders. • Develop Watercourse Corrective Action Management Plan (WCAMP) in consultation with the Resources Regulator, DPE and other key stakeholders (in accordance with C12 of SSD 8445). The stream remediation measures in the WCAMP could include grout curtain and grout pattern injection. • Implement approved WCAMP, subject to land access.

Notes:
[1] Subsidence Area is defined as the 'Subsidence Study Area' as illustrated in Figure 1 of Appendix 2 of SSD 8445.
[2] Due to the predicted surface fracturing of watercourses which directly overlie the longwall panels.
[3] As indicated by the baseline water level and recession rate.
[4] Sites to be installed, subject to land access. The monitoring program relevant to this TARP has been designed to record at least 24 months of baseline data prior to commencement of mining of the relevant longwall. Additional sites will be included prior to the commencement of mining the relevant longwall. The pool water levels for each relevant monitoring site would be updated in the Water Management Plan and provided to the relevant government agencies for review and approval.
[5] 'Atypical' surface water characteristics relate to a notable and/or rapid water level decline or change in the slope of the falling limb of the hydrograph or the water level recessionary behaviour below the cease to flow level which is inconsistent with baseline conditions and cannot be attributed to climatic conditions

WATER MANAGEMENT PLAN TARP – WMP4 POOL WATER LEVEL FOR OTHER WATERCOURSES (BARGO RIVER AND HORNES CREEK)

Performance Measure and Indicator, TARP Objective and Assessment Criteria

Performance Measure Feature
Other watercourses.

Performance Measure
Negligible environmental consequences including beyond those predicted in the EIS, including:

- Negligible diversion of flows or changes in the natural drainage behaviour of pools.

Performance Indicator
The performance measure will be considered to be exceeded if a Level 3 TARP is triggered in relation to water level changes and the investigation outcomes indicate a mining related impact based on monitoring data for sites in Hornes Creek and the Bargo River.

TARP Objective
This TARP defines levels of variation in pool water level from normal conditions[1] and the actions required to be implemented in response to each level of variation.

Assessment Criteria

- Comparison of baseline and operational recorded water level data (all levels).
- Water level recession analysis for Level 2 and above.

Monitoring Program

Locations

Longwall	Potential Impact Sites	Reference Sites
LW S1A	BR12-QRLa BR13-QRLa	BR16-QLa[2,3]
LW S2A	BR18-QLa[2] All sites above	
LW S3A	BR17-QLa[2] All sites above	
LW S4A LW S5A	BR6-QLa[2] All sites above	DT73-QRLa DT64-QRLa All sites above
LW S6A	HC13-QLa[2] HC16-QLa[2] HC10-QRLa HC3-QRLa HC19-QRLa All sites above	HC18-QRLa HC17-QRLa HC1a-QLa All sites above

All monitoring locations are shown in Figure 20 of the Water Management Plan.

Monitoring Frequency

Pre-mining
Continuous record and monthly manual measurements. Data downloaded prior to the commencement of secondary extraction of the relevant longwall.

During Mining
Continuous record and monthly manual measurements. Data downloaded and reviewed monthly.

Post-mining
Continuous record and monthly manual measurements for a minimum of 12 months following the completion of LW S6A or as required in accordance with a Watercourse Corrective Action Management Plan.

Management

Trigger	Action	Response
Normal Condition		
• The recorded water level has not declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level).	• Continue monitoring and review of data as per monitoring program.	• No response required.
Level 1		
• The recorded water level has declined by greater than 10 centimetres (cm) below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) and the same has not occurred at the reference site(s).	• *Actions as required for Normal Condition.* • Review water level trends along watercourse (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, groundwater level monitoring results) necessary to inform assessment.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
Level 2		
• The recorded water level has declined atypically[4] below the recorded baseline minimum level for less than one month (as a consecutive period) and the same has not occurred at the reference site(s).	• *Actions as stated in Level 1.* • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 2 has been reached or at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. singular, anthropogenic, non-mining related change that resulted in a water level change). • If increased monitoring is adopted, undertake further analysis of water level trends along creek (upstream to downstream) to identify spatial changes with consideration to climatic conditions. • Complete water level recession analysis for sites where Level 2 has been reached. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan.
Level 3		
• The recorded water level has declined atypically[4] below the recorded baseline minimum level for greater than one month (as a consecutive period) and the same has not occurred at the reference site(s).	• *Actions as stated in Level 2.* • Increase monitoring and review of data frequency to fortnightly for sites where Level 3 has been reached and at corresponding reference sites, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing), other catchment changes, effect unrelated to mining or the prevailing climate. • Undertake an investigation to determine if an exceedance of the performance measure is likely.	• *Responses as stated in Level 2.* • If relevant, notify DAWE of any predictions of an exceedance of a performance measure within two business days.
Exceeds Performance Measure		
• It is concluded from the detailed investigation that mining has resulted in an atypical[3] decline in water level for greater than one month (as a consecutive period).	• Investigate reasons for the performance measure exceedance. • Based on the outcomes of the investigation, review predictions of subsidence impacts and environmental consequences associated with further longwall extraction.	• Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed by DPE). • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project). • Offer site visit with DPE and other key stakeholders. • Develop Watercourse Corrective Action Management Plan (WCAMP) in consultation with the Resources Regulator, DPE and other key stakeholders (in accordance with C12 of SSD 8445). The stream remediation measures in the WCAMP could include grout curtain and grout pattern injection. • Implement approved WCAMP, subject to land access.

Notes:

[1] As indicated by the baseline water level and recession rate.

[2] Sites to be installed, subject to land access. The monitoring program relevant to this TARP has been designed to record at least 24 months of baseline data prior to commencement of mining of the relevant longwall. Additional sites will be included prior to the commencement of mining the relevant longwall. The derived SSGV for each relevant monitoring site would be updated in the Water Management Plan and provided to the relevant government agencies for review and approval.

[3] Data collected from BR11-QRLa (water quality data collected between 2012-2021 and water level data collected between 2013-2021) will be used in combination with data from BR16-QLa (once established) to provide a long-term baseline dataset for the Bargo River upstream of mining activities.

[4] 'Atypical' surface water characteristics relate to a notable and/or rapid water level decline or change in the slope of the falling limb of the hydrograph or the water level recessionary behaviour below the cease to flow level which is inconsistent with baseline conditions and cannot be attributed to climatic conditions.

WATER MANAGEMENT PLAN TARP – WMP5 PHYSICAL FEATURES AND NATURAL BEHAVIOUR OF WATERCOURSES WITHIN THE SUBSIDENCE AREA[1]

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="8"><u>Performance Measure Feature</u>
All watercourses within the Subsidence Area[1].

<u>Performance Measure</u>
No greater subsidence impact or environmental consequences to water quality, water flows (including baseflow) or stream health (including riparian vegetation), than predicted in the EIS.

The EIS concludes that where the longwalls directly mine beneath the streams, it is considered likely that fracturing would result in surface water flow diversion and that localised and transient increases in water quality constituents would occur[2]. The performance measure will be considered to be exceeded if subsidence impacts cannot be repaired in a manner that restores pool water holding capacity and stream health. Remediation measures will be developed as required and detailed in the Watercourse Corrective Action Management Plan (C12 of the SSD 8445). These plans will contain relevant performance indicators specific to remediation performance measures.

<u>Performance Indicator</u>
Variation in pool physical features and natural behaviour, as defined in the Level 1 to Level 3 trigger, where a Level 3 trigger denotes progression towards a potential exceedance of the performance measure.

<u>TARP Objective</u>
This TARP defines levels of variation in pool physical features and natural behaviour and the actions required to be implemented in response to each level of variation.

<u>Assessment Criteria</u>
Comparison of baseline and operational pool physical features and natural behaviour.</td><td rowspan="8"><u>Locations</u>
Accessible pools and reaches in Teatree Hollow, Teatree Hollow Tributary and Bargo River Tributary (subject to land access).

All monitoring locations are shown in Figure 21 of the Water Management Plan.

<u>Monitoring Frequency</u>
Pre-mining
One observation prior to mining using fixed location photo points.

During Mining
Observations every month during the active subsidence period (after 200 m of secondary extraction of relevant longwall) for sites within the active subsidence zone[3] using fixed location photo points.

Post-mining
Quarterly observations over 12 months for pools that are no longer within the active subsidence zone or as required in accordance with a Watercourse Corrective Action Management Plan.</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• No observed impact to pool water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions.</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Visually observed anomalous change in water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions - occurs in one month and the same has not occurred at the reference site(s)[3].
AND/OR
• Visual observation of fracturing.</td><td>• Actions as required for Normal Condition.
• Assess visual change along watercourse (upstream to downstream) to observe any spatial changes with consideration to climatic conditions.
• Discuss findings with and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water monitoring results, groundwater monitoring results) necessary to inform assessment.
• Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 1 has been reached and at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. surface fracturing of weathered bedrock that does not affect water holding capacity of rockbar control or pool base).</td><td>• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Visually observed anomalous change in water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions - occurs for two consecutive months and the same has not occurred at the reference site(s).</td><td>• Actions as stated in Level 1.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing other catchment changes, effect unrelated to mining or the prevailing climate).
• Review Water Management Plan and modify if necessary.
If the changes have been confirmed to be related to mining effects:
• Increase monitoring and review of data frequency to fortnightly for sites where Level 2 has been reached and at corresponding reference sites, subject to land access.</td><td>• Responses as stated in Level 1.
• Advise DPE and key stakeholders of any required amendments to Water Management Plan.</td></tr>
<tr><td colspan="3">Level 3</td></tr>
<tr><td>• Visually observed anomalous change in water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions - occurs for three consecutive months and the same has not occurred at the reference site(s).
AND
• The change in behaviour has been investigated and confirmed to be related to mining effects.</td><td>• Actions as stated in Level 2.</td><td>• Responses as stated in Level 2.
• Offer site visit with DPE and other key stakeholders.
• Develop Watercourse Corrective Action Management Plan (WCAMP) in consultation with the Resources Regulator, DPE and other key stakeholders (in accordance with C12 of SSD 8445). The stream remediation measures in the WCAMP could include grout curtain and grout pattern injection.
• Implement approved WCAMP, subject to land access.</td></tr>
<tr><td colspan="5">Notes:
[1] Subsidence Area is defined as the ‘Subsidence Study Area’ as illustrated in Figure 1 of Appendix 2 of SSD 8445.
[2] Due to the predicted surface fracturing of watercourses which directly overlie the longwall panels.
[3] Survey area to include upstream, downstream and adjacent pools (to the extent of the potential impact) where a trigger exceedance has occurred at a potential impact site(s) in accordance with the TARPs.</td></tr>
</table>

WATER MANAGEMENT PLAN TARP – WMP6 PHYSICAL FEATURES AND NATURAL BEHAVIOUR OF POOLS FOR OTHER WATERCOURSES (BARGO RIVER AND HORNES CREEK)

Performance Measure and Indicator, TARP Objective and Assessment Criteria

Performance Measure Feature
Other watercourses.

Performance Measure
Negligible environmental consequences including beyond those predicted in the EIS, including:
- Negligible diversion of flows or changes in the natural drainage behaviour of pools;
- Negligible gas releases and iron staining; and
- Negligible increase in water turbidity.

Performance Indicator
The performance measure will be considered to be exceeded if changes in physical features and natural behaviour of pools occur for three consecutive months and the investigation outcomes indicate a mining related impact based on visual observation records for sites in Hornes Creek and the Bargo River.

TARP Objective
This TARP defines levels of variation in pool physical features and natural behaviour and the actions required to be implemented in response to each level of variation.

Assessment Criteria
Comparison of baseline and operational pool physical features and natural behaviour.

Monitoring Program

Locations

Longwall	Potential Impact Sites	Reference Sites
LW S1A	BR12-QRLa BR13-QRLa	BR16-QLa[1,2]
LW S2A	BR18-QLa[1] All sites above	
LW S3A	BR17-QLa[1] All sites above	
LW S4A LW S5A	BR6-QLa[1] All sites above	DT73-QRLa DT64-QRLa All sites above
LW S6A	HC13-QLa[1] HC16-QLa[1] HC10-QRLa HC3-QRLa HC19-QRLa All sites above	HC18-QRLa HC17-QRLa HC1-QRLa All sites above

All monitoring locations are shown in Figure 20 of the Water Management Plan.

Pre-mining
One observation prior to mining using fixed location photo points.

During Mining
Observations every month during the active subsidence period (after 200 m of secondary extraction of relevant longwall) for sites within the active subsidence zone using fixed location photo points.

Post-mining
Quarterly observations over 12 months for pools that are no longer within the active subsidence zone or as required in accordance with a Watercourse Corrective Action Management Plan.

Management

Trigger	Action	Response
Normal Condition		
• No observed impact to pool water level, overland connected flow, iron staining, gas release, turbidity or channel stability - as compared with baseline conditions.	• Continue monitoring and review of data as per monitoring program.	• No response required.
Level 1		
• Visually observed anomalous change in water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions - occurs in one month and the same has not occurred at the reference site(s). AND/OR • Visual observation of fracturing.	• *Actions as required for Normal Condition.* • Assess visual change along watercourse (upstream to downstream) to observe any spatial changes with consideration to climatic conditions. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water monitoring results, groundwater monitoring results) necessary to inform assessment. • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 1 has been reached and at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. surface fracturing of weathered bedrock that does not affect water holding capacity of rockbar control or pool base).	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
Level 2		
• Visually observed anomalous change in water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions - occurs for two consecutive months and the same has not occurred at the reference site(s).	• *Actions as stated in Level 1.* • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing other catchment changes, effect unrelated to mining or the prevailing climate). • Review Water Management Plan and modify if necessary. If the changes have been confirmed to be related to mining effects: • Increase monitoring and review of data frequency to fortnightly for sites where Level 2 has been reached and at corresponding reference sites, subject to land access. • Undertake an investigation to determine if an exceedance of the performance measure is likely.	• *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. • If relevant, notify DAWE of any predictions of an exceedance of a performance measure within two business days.
Exceeds Performance Measure		
• Visually observed anomalous change in water level, overland connected flow, iron staining, gas release or turbidity - as compared with baseline conditions - occurs for three consecutive months and the same has not occurred at the reference site(s). AND • The change in behaviour has been investigated and confirmed to be related to mining effects.	• *Actions as stated in Level 2.* • Investigate reasons for the performance measure exceedance. • Based on the outcomes of the investigation, review predictions of subsidence impacts and environmental consequences associated with further longwall extraction.	• *Responses as stated in Level 2.* • Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed by DPE). • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project). • Offer site visit with DPE and other key stakeholders. • Develop Watercourse Corrective Action Management Plan (WCAMP) in consultation with the Resources Regulator, DPE and other key stakeholders (in accordance with C12 of SSD 8445). The stream remediation measures in the WCAMP could include grout curtain and grout pattern injection. • Implement approved WCAMP, subject to land access.

[1] Sites to be installed, subject to land access. The monitoring program relevant to this TARP has been designed to record at least 24 months of baseline data prior to commencement of mining of the relevant longwall. Additional sites will be included prior to the commencement of mining the relevant longwall. The derived SSGV for each relevant monitoring site would be updated in the Water Management Plan and provided to the relevant government agencies for review and approval.
[2] Data collected from BR11-QRLa (water quality data collected between 2012-2021 and water level data collected between 2013-2021) will be used in combination with data from BR16-QLa (once established) to provide a long-term baseline dataset for the Bargo River upstream of mining activities.

WATER MANAGEMENT PLAN TARP – WMP7 CHANNEL STABILITY, SEDIMENTATION AND EROSION

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	**Action**	**Response**
__Performance Measure Feature__ No performance measure relevant[1,2,3]. __TARP Objective__ This TARP defines levels of variation in channel stability, erosion and sedimentation and the actions required to be implemented in response to each level of variation. __Assessment Criteria__ Comparison of baseline and operational condition of headwater streams and soft knickpoints.	__Locations__ 10 headwater sites and soft knickpoints, as shown in Figure 22 of the Water Management Plan. __Monitoring Frequency__ **Pre-mining** • One observation prior to mining using fixed location photo points. • One inspection of 10 headwater sites. **During Mining** • Observations of knickpoint formation every month during the active subsidence period for sites within the active subsidence zone using fixed location photo points. • Annual inspection of 10 headwater sites. **Post-mining** • One observation of knickpoint formation at sites that are no longer within the active subsidence zone using fixed location photo points. • One inspection of 10 headwater sites. • Post-mining geomorphology survey following completion of mining.	**Normal Condition**		
		• No further development of soft knickpoints or increased erosion of headwater streams.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Visually observed minor increase in knickpoint development and/or minor erosion and sedimentation of headwater streams.	• *Actions as required for Normal Condition.* • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, biodiversity monitoring results) necessary to inform assessment. • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 2 has been reached or at other relevant sites, subject to land access. Reasons for not increasing monitoring frequency could include confident identification of causation (e.g. singular, anthropogenic, non-mining related change that resulted in increased erosion). • Consider and decide on reasonable and feasible options for remediation as relevant (e.g. enhanced vegetation establishment, rock armouring).	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for approval (e.g. enhanced vegetation establishment, rock armouring). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Visually observed moderate increase in knickpoint development and/or moderate or greater increase in erosion and sedimentation of headwater streams.	• *Actions as stated in Level 1.* • Increase monitoring and review of data frequency to fortnightly for sites where Level 3 has been reached and at corresponding reference sites, subject to land access. • Undertake an investigation to assess if the change in behaviour is related to mining effects (e.g. subsidence induced, other catchment changes, effect unrelated to mining or the prevailing climate). • Obtain specialist advice on further CMAs. • Review CMAs in light of findings from further investigations and consider additional remediation options. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. If it is concluded from the detailed investigation that watercourses have been damaged by subsidence impacts: • Offer site visit with DPE and other key stakeholders. • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access.

Notes:
[1] Subsidence Area is defined as the 'Subsidence Study Area' as illustrated in Figure 1 of Appendix 2 of SSD 8445.
[2] It is noted that SSD 8445 does not specify a performance measure in relation to channel stability, sedimentation and erosion for all watercourses within the Subsidence Area[1].
[3] It is noted that no soft knickpoints have been mapped in Hornes Creek or Bargo River. Therefore, assessment of 'decline in baseline channel stability' for these watercourses is not applicable.

APPENDIX B – WATER LEVEL PLOTS

APPENDIX B.1 – TEATREE HOLLOW WATER LEVEL PLOTS

DIAGRAM 1.1: MONITORING SITE TT1-QRLA WATER LEVEL RECORDS

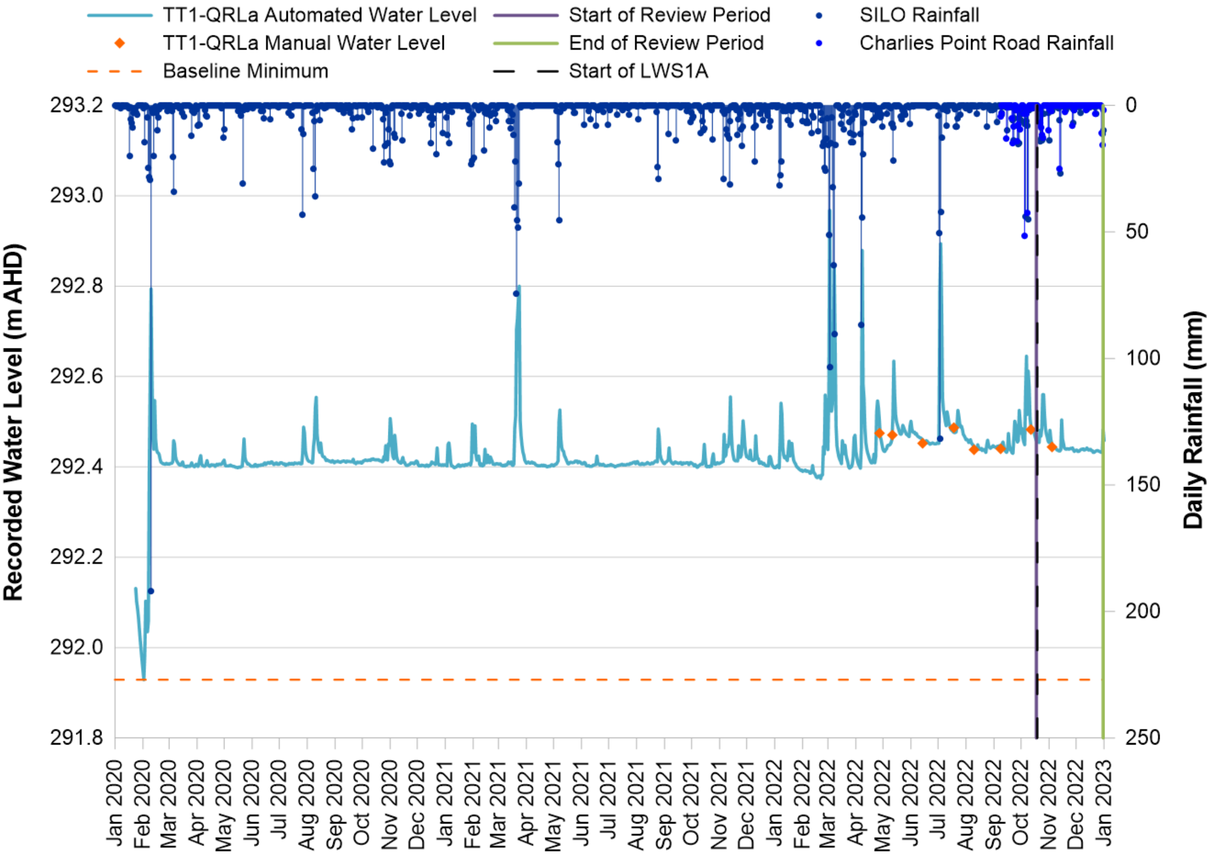


DIAGRAM 1.2: MONITORING SITE TT2-QLA WATER LEVEL RECORDS

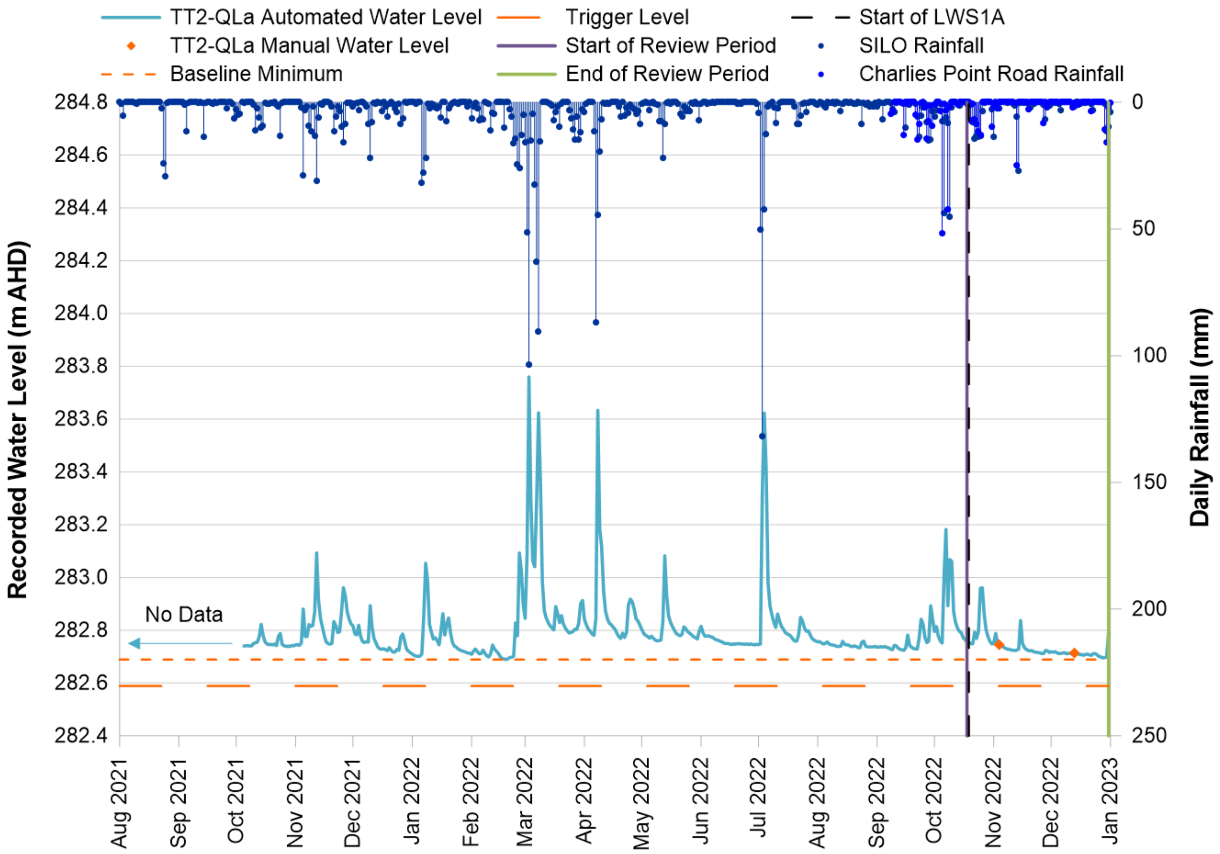


DIAGRAM 1.3: MONITORING SITE TT3-QLA WATER LEVEL RECORDS

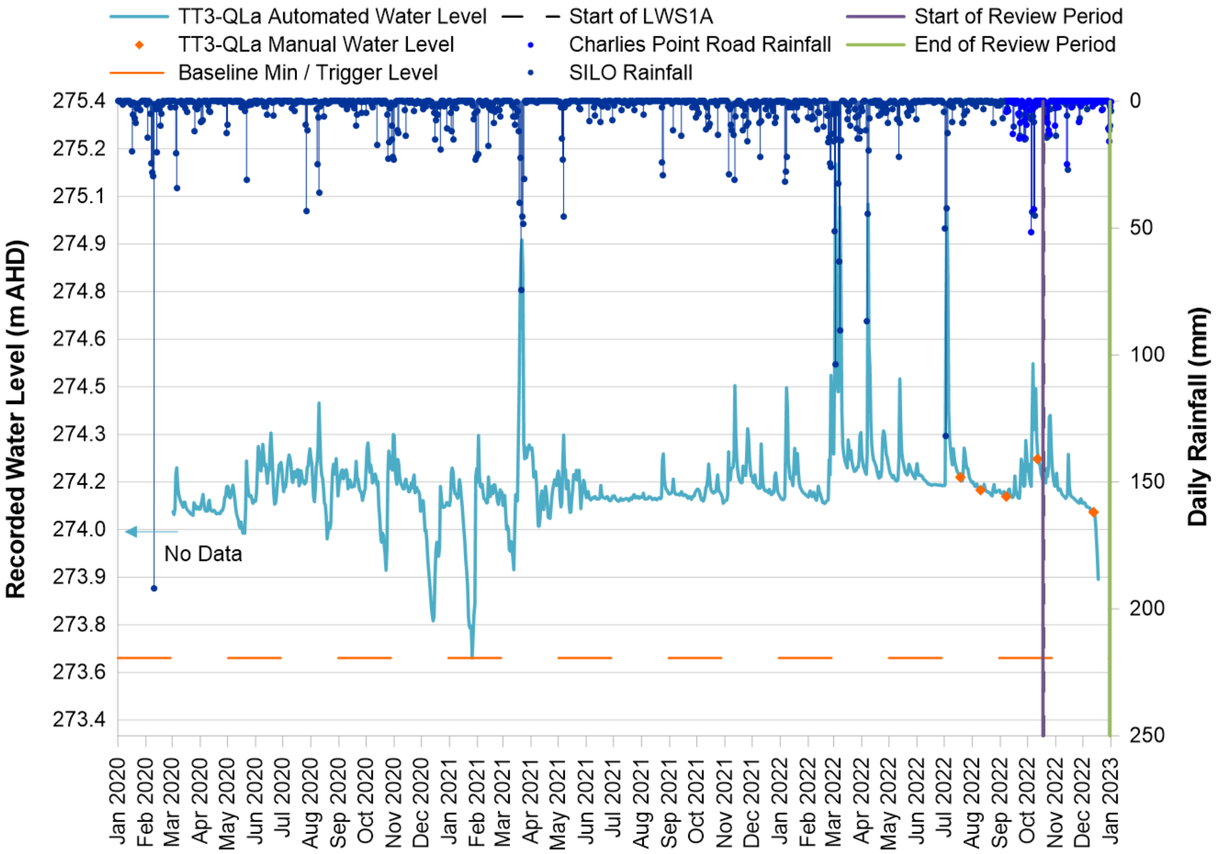


DIAGRAM 1.4: MONITORING SITE TT7-QRLA WATER LEVEL RECORDS

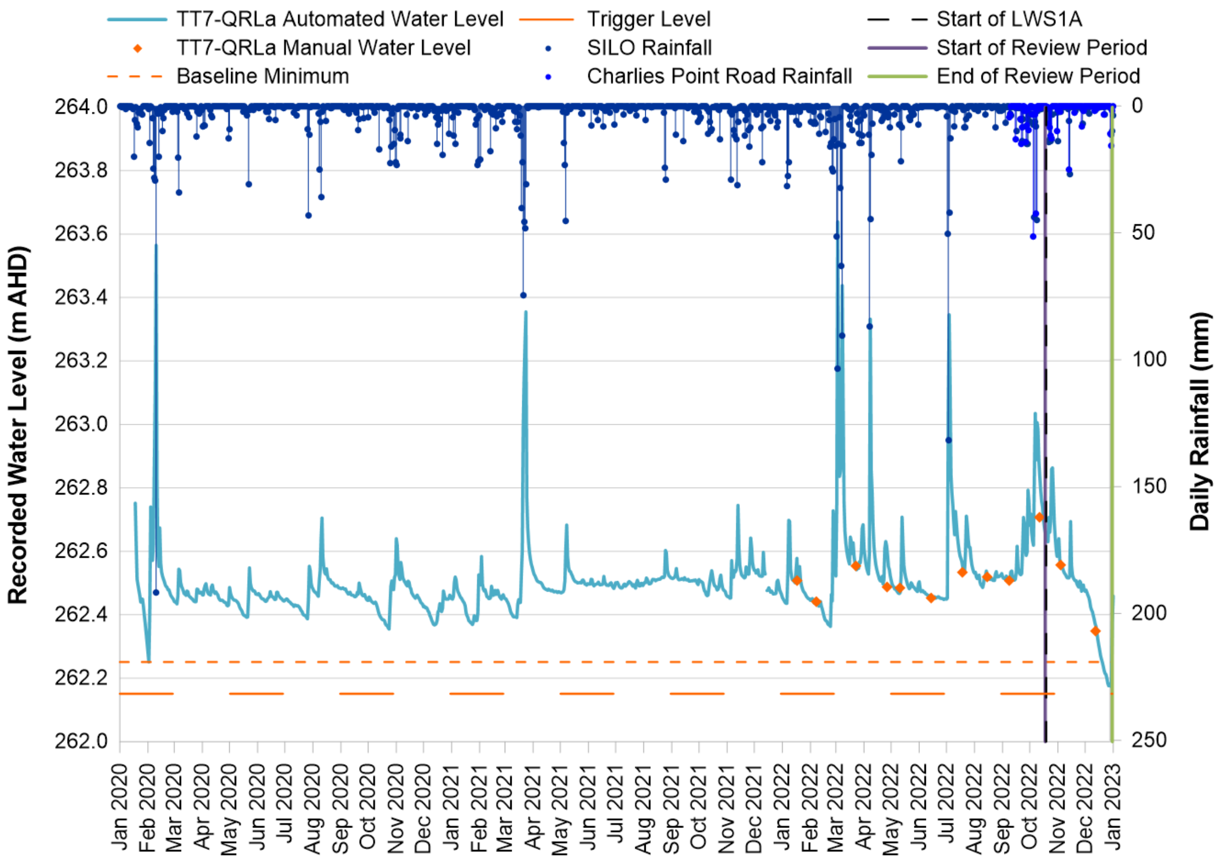


DIAGRAM 1.5: MONITORING SITE TT9-QLA WATER LEVEL RECORDS

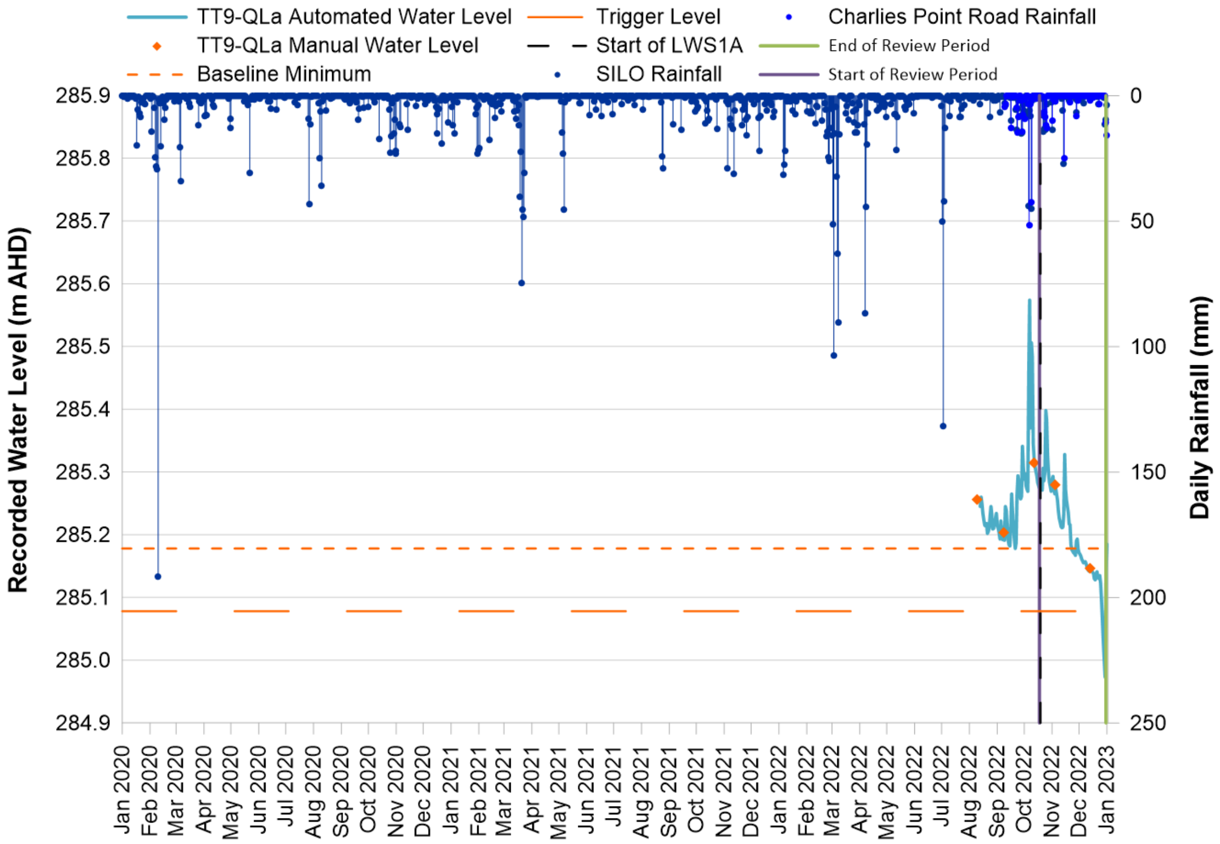


DIAGRAM 1.6: MONITORING SITE TT12-QLA WATER LEVEL RECORDS

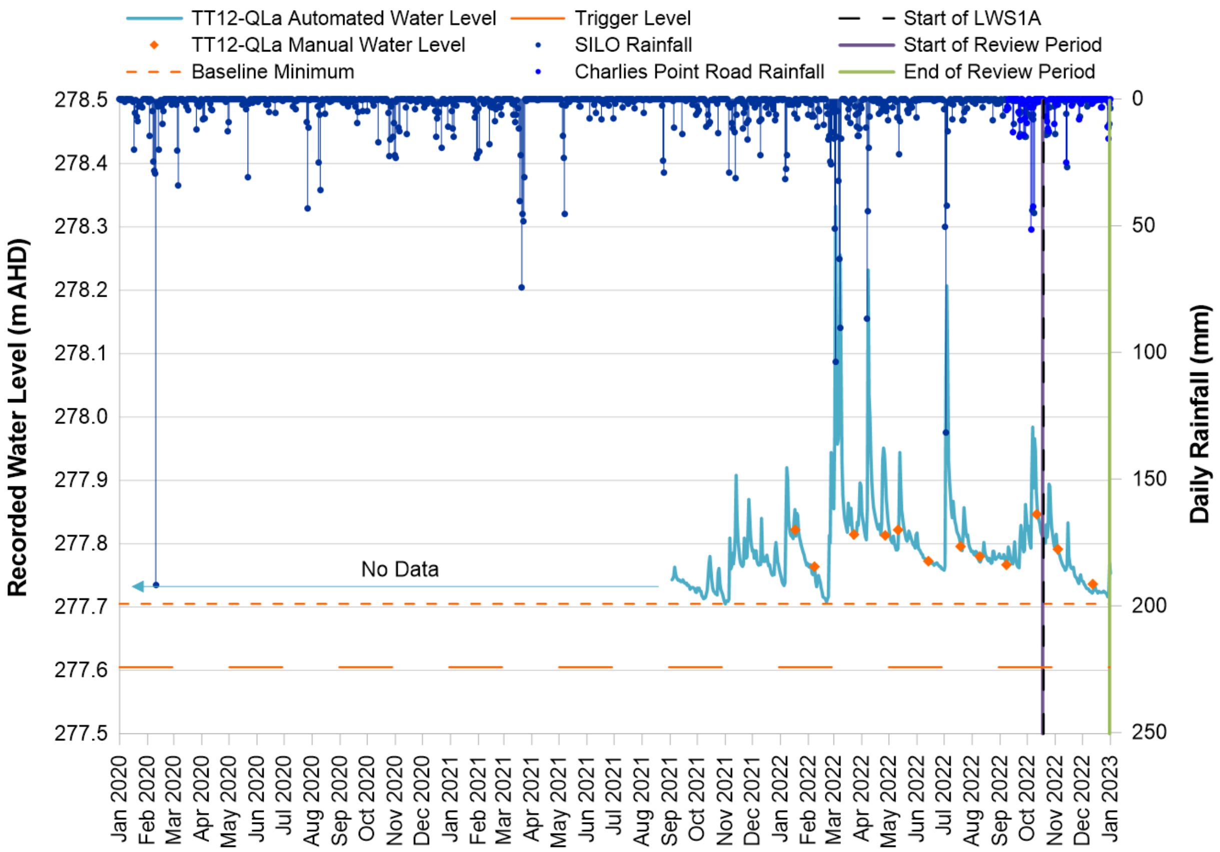
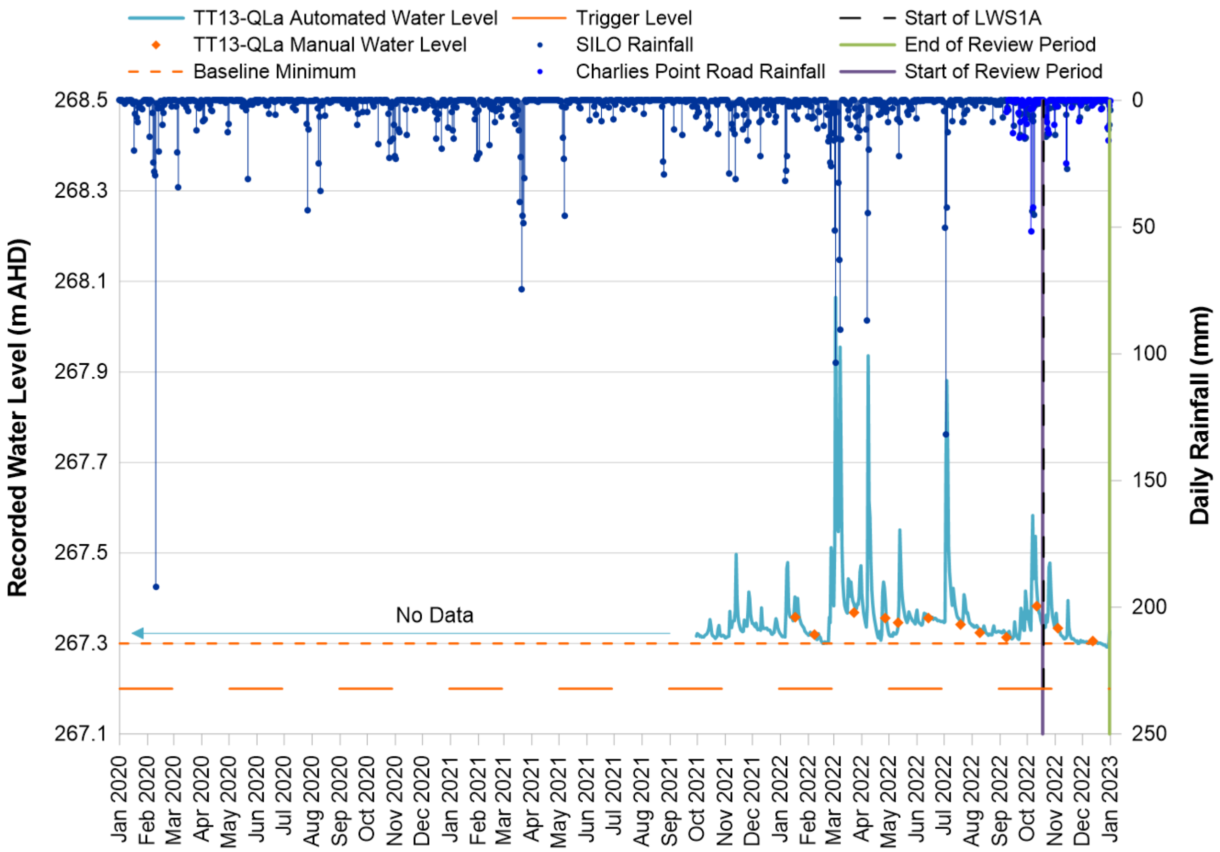


DIAGRAM 1.7: MONITORING SITE TT13-QLA WATER LEVEL RECORDS



APPENDIX B.2 – BARGO RIVER WATER LEVEL PLOTS

DIAGRAM 2.1: MONITORING SITE BR3-QLA WATER LEVEL RECORDS

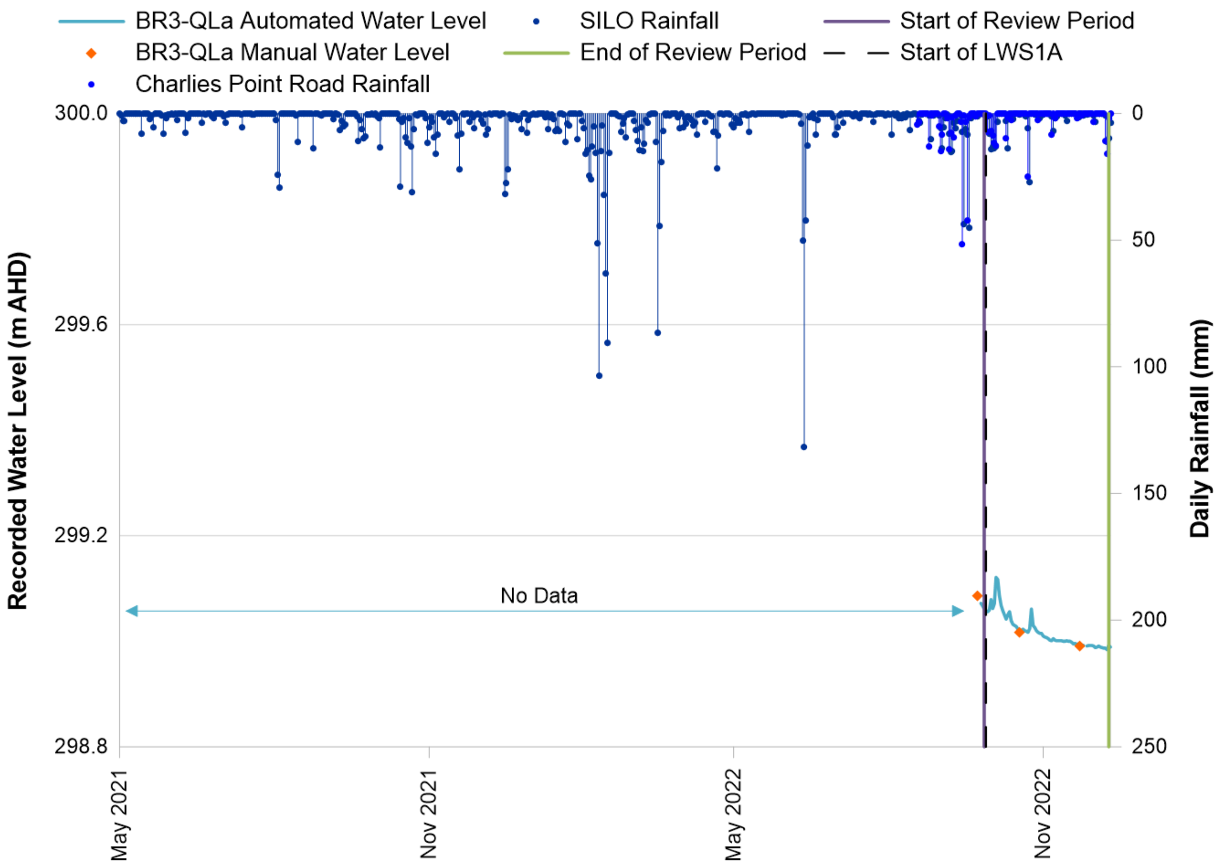


DIAGRAM 2.2: MONITORING SITE BR12-QRLA WATER LEVEL RECORDS

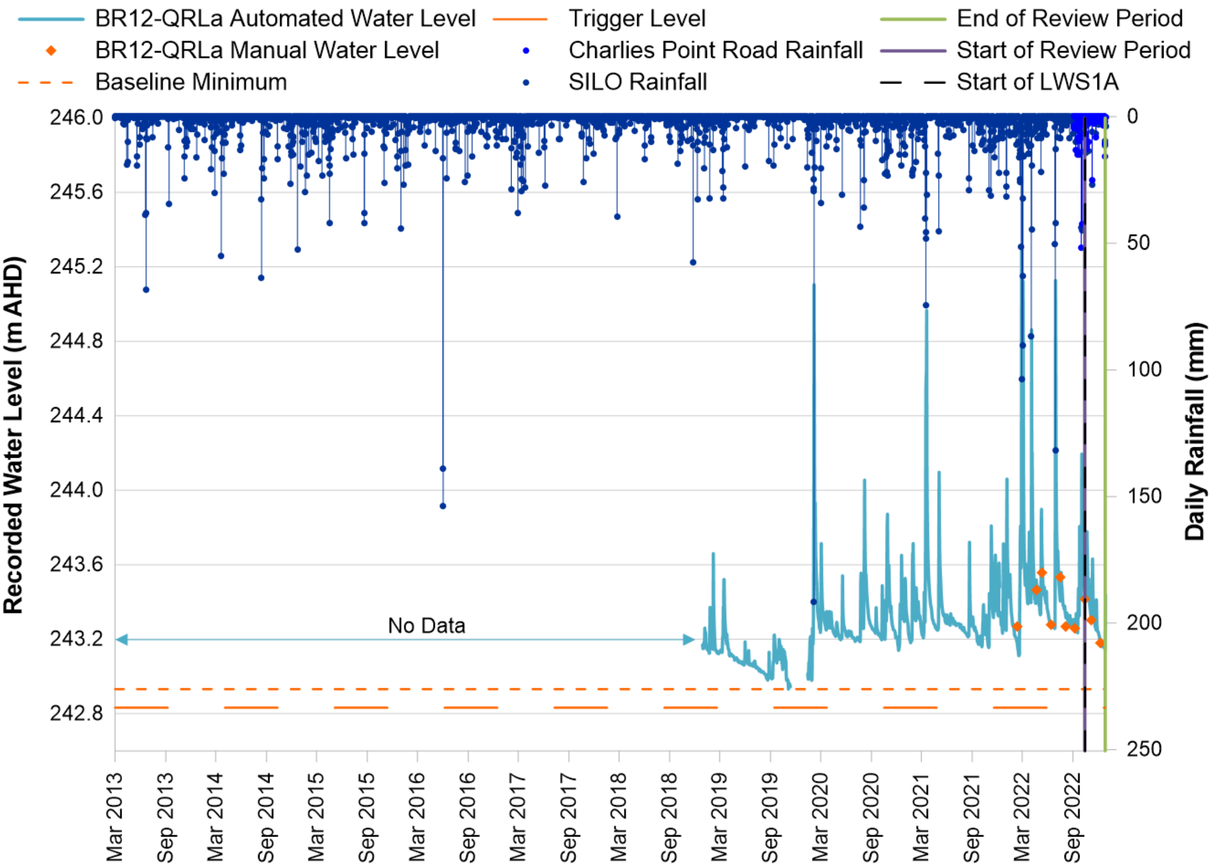


DIAGRAM 2.3: MONITORING SITE BR13-QRLA WATER LEVEL RECORDS

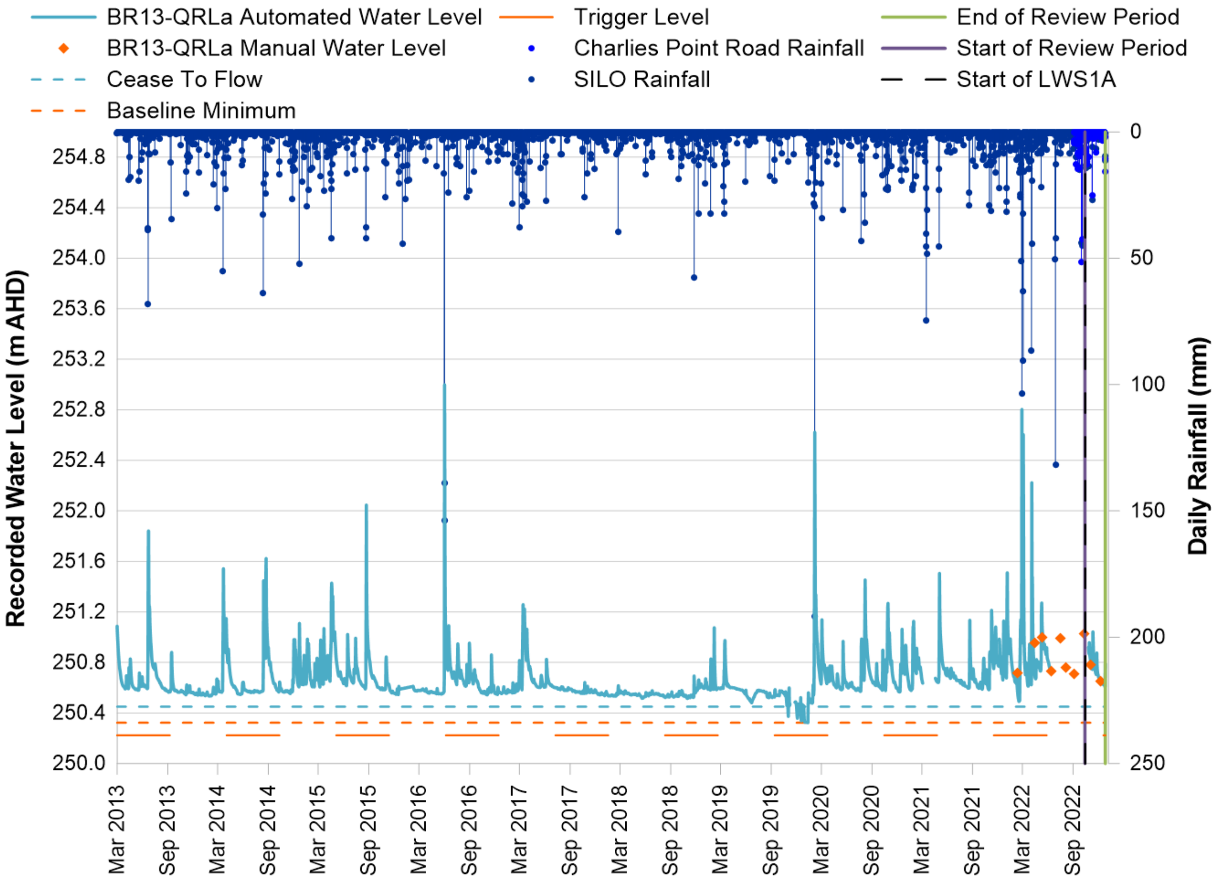


DIAGRAM 2.4: MONITORING SITE BR16-QLA WATER LEVEL RECORDS

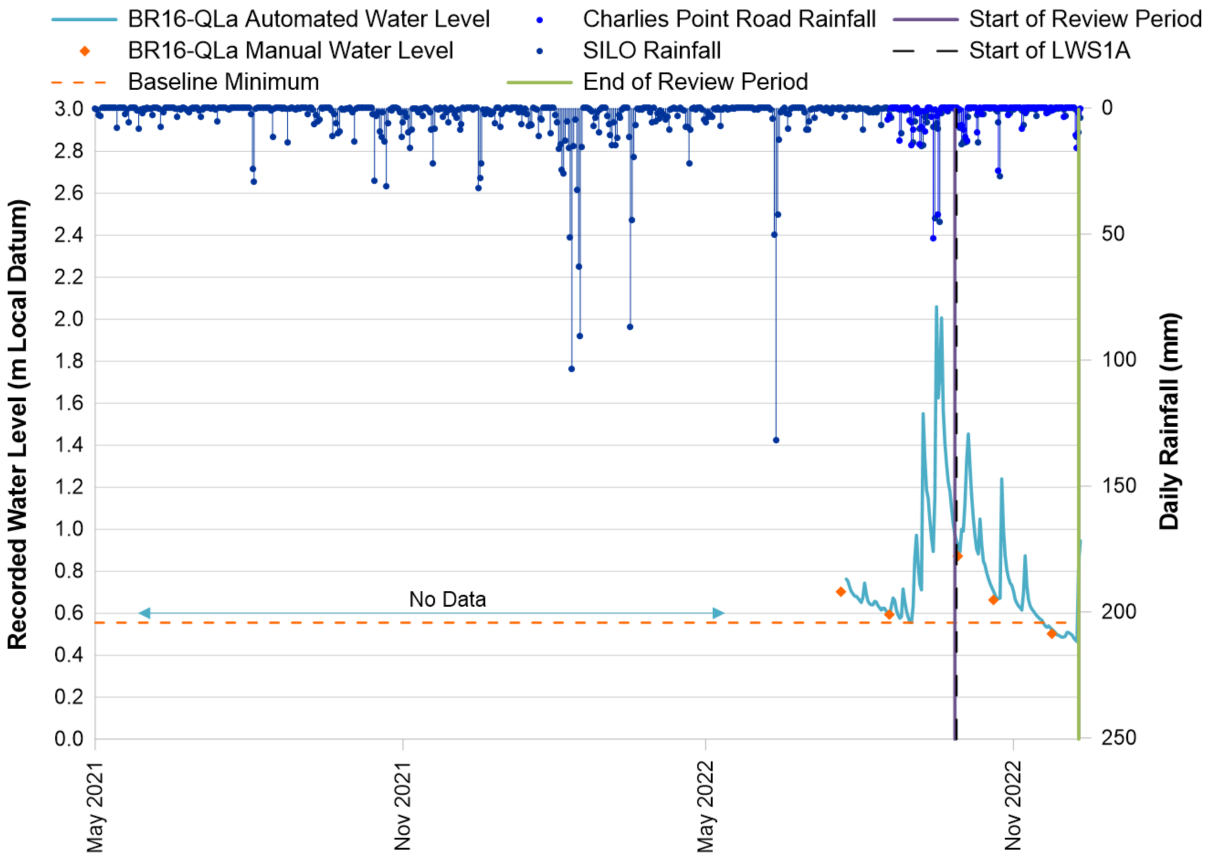


DIAGRAM 2.5: MONITORING SITE BR17-QLA WATER LEVEL RECORDS

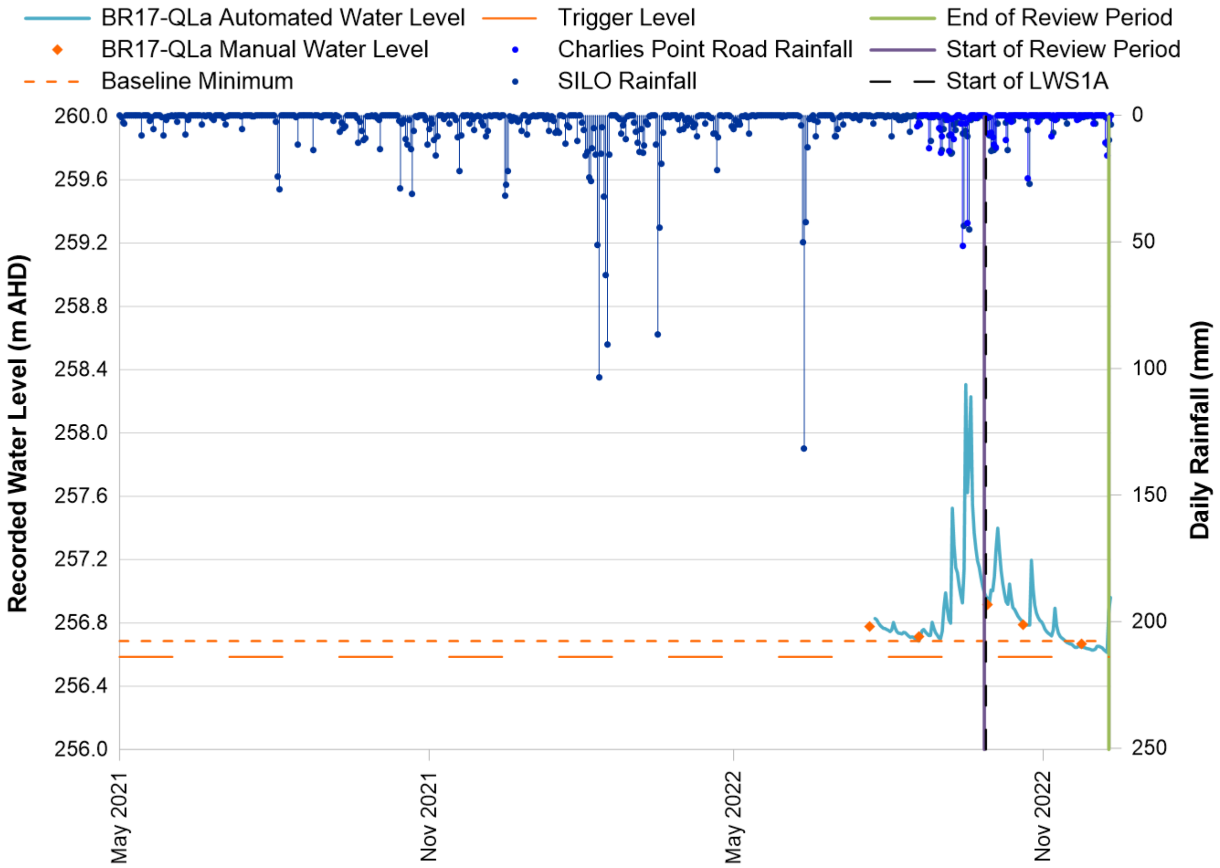
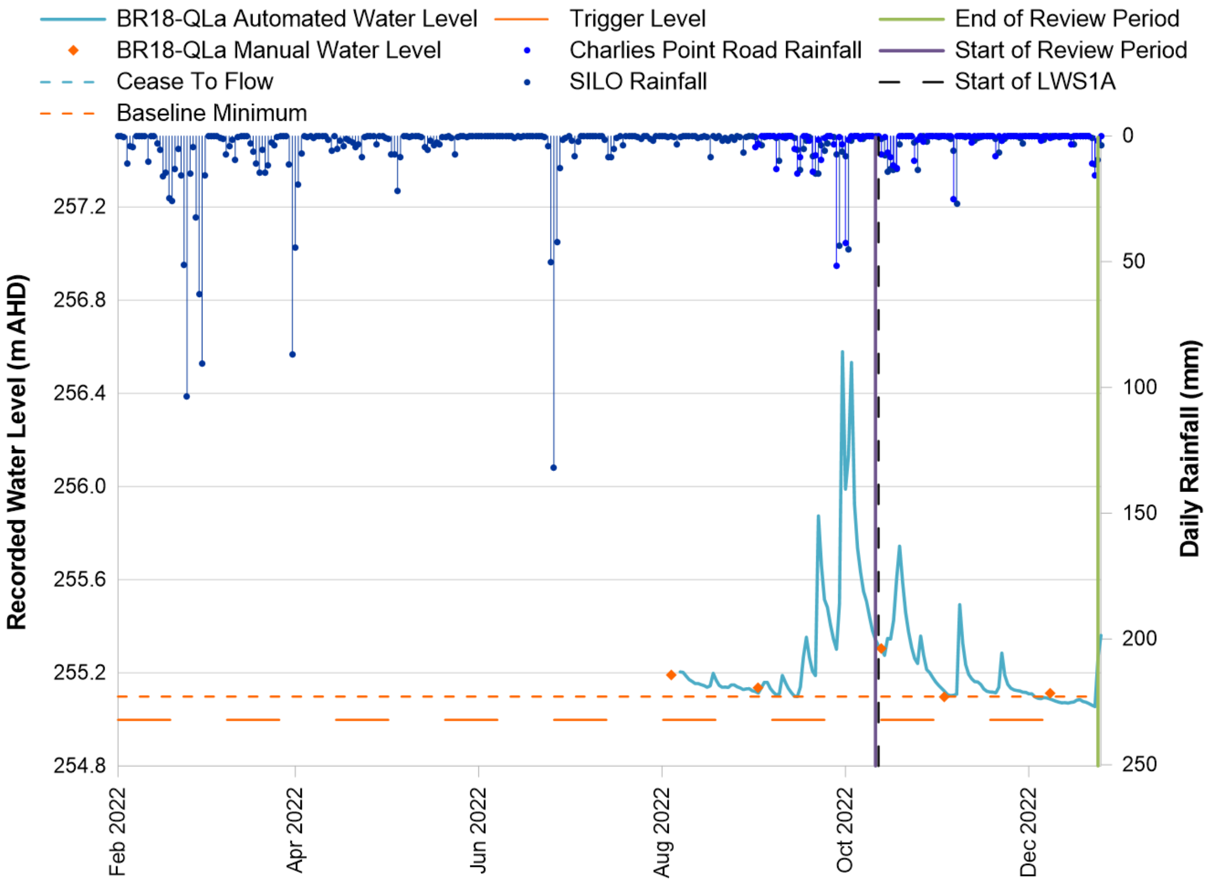


DIAGRAM 2.6: MONITORING SITE BR18-QLA WATER LEVEL RECORDS

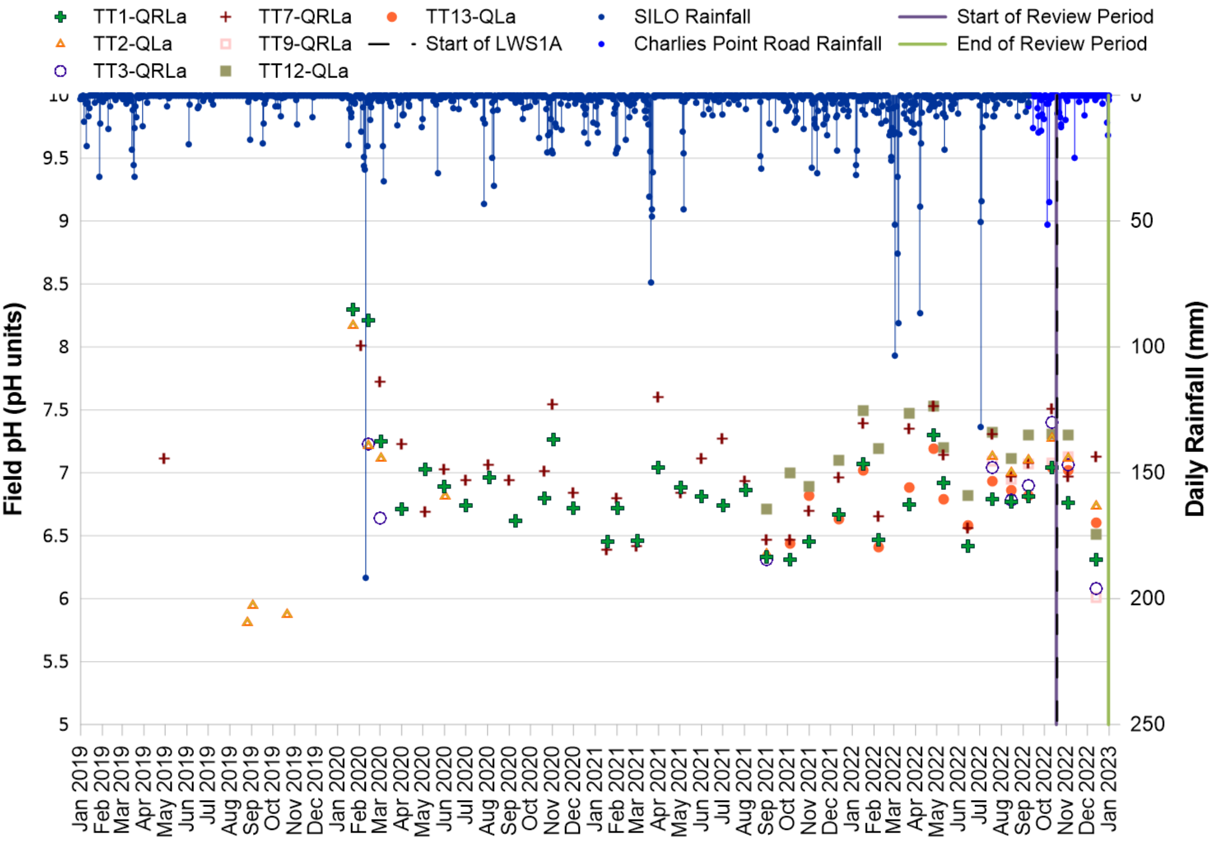


APPENDIX C – WATER QUALITY PLOTS[3]

[3] When the recorded value was below the limit of reporting, the value has been plotted at the limit of reporting in the following plots.

APPENDIX C.1 – TEATREE HOLLOW WATER QUALITY PLOTS

DIAGRAM 1.1: FIELD AND LABORATORY PH RECORDS



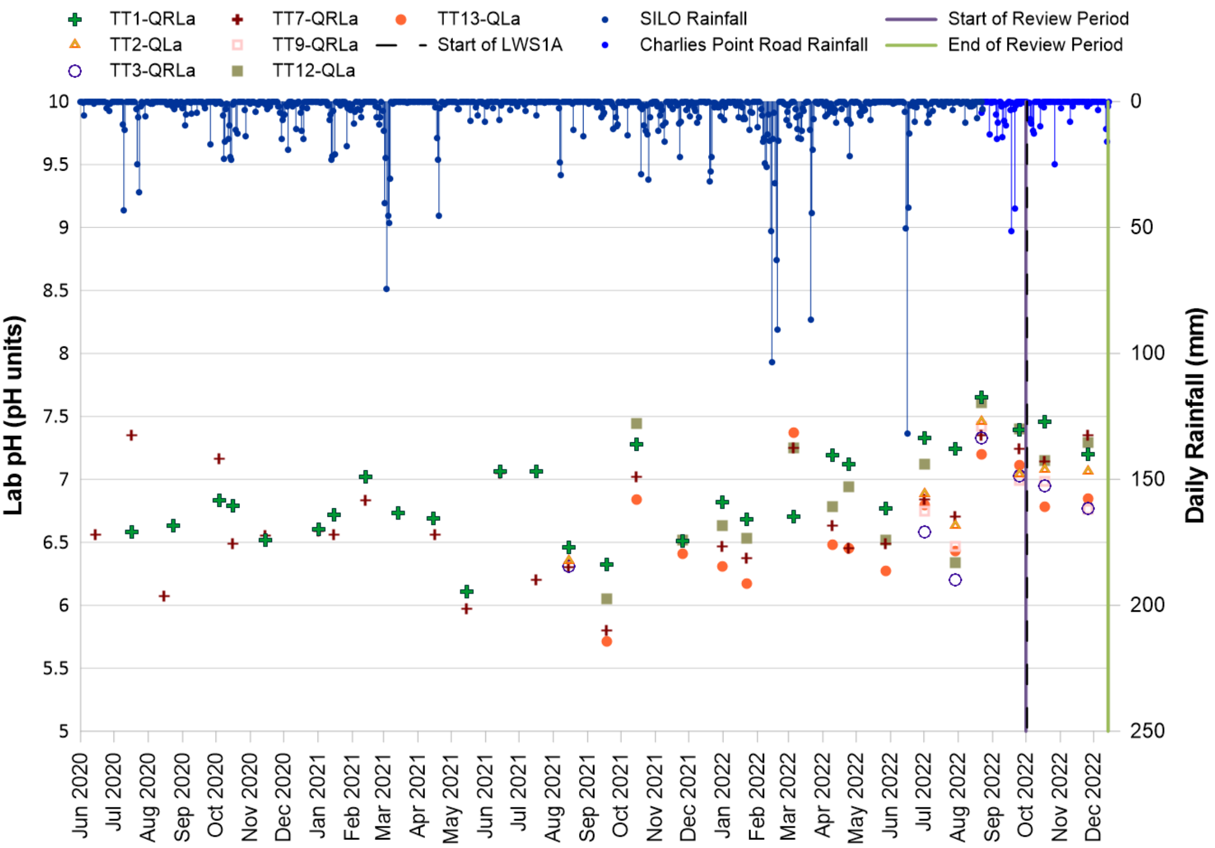
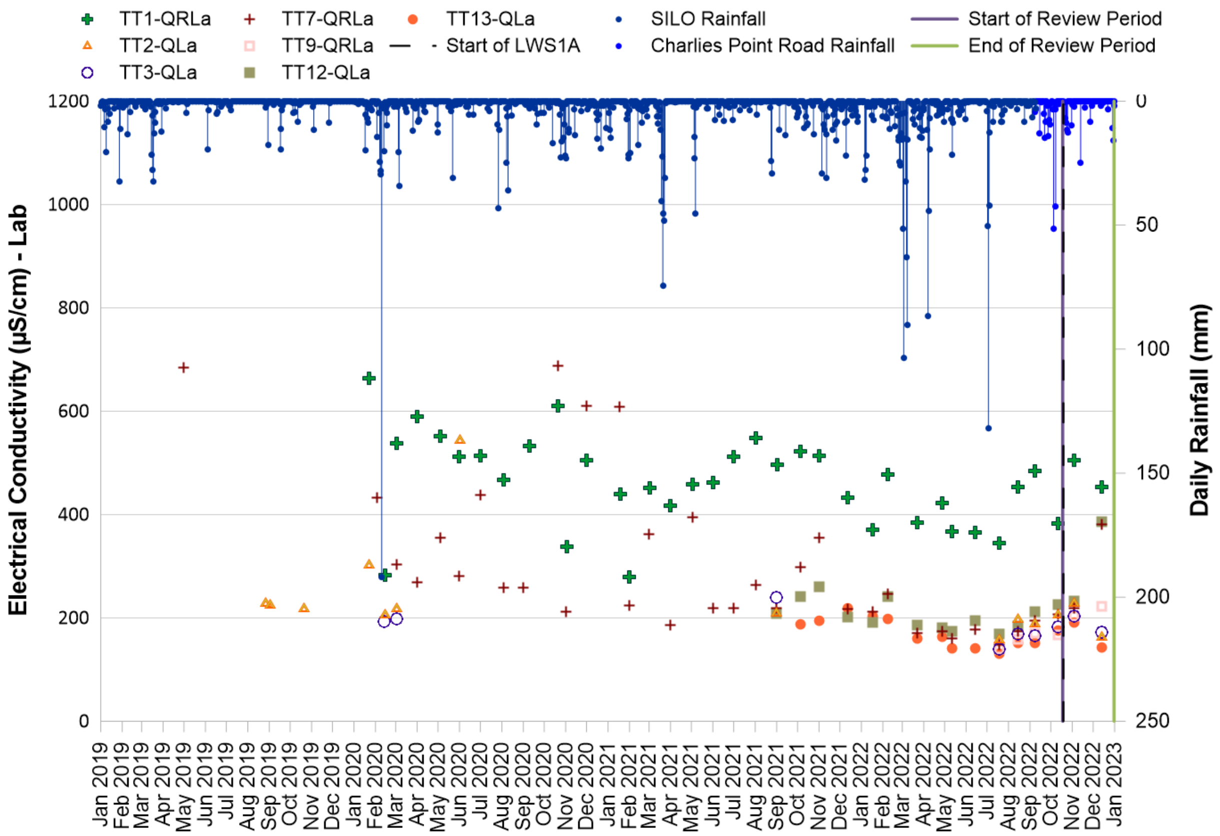


DIAGRAM 1.2: FIELD AND LABORATORY ELECTRICAL CONDUCTIVITY RECORDS



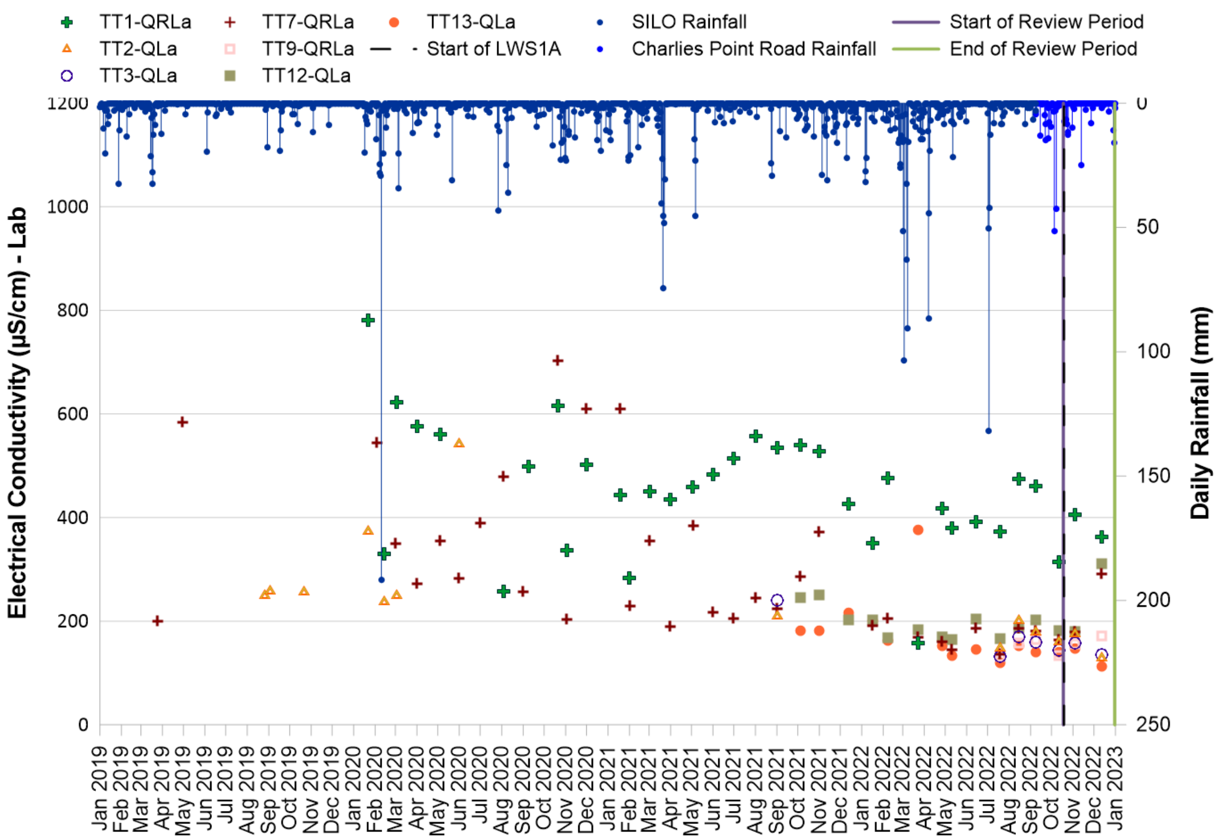


DIAGRAM 1.3: DISSOLVED ALUMINIUM RECORDS

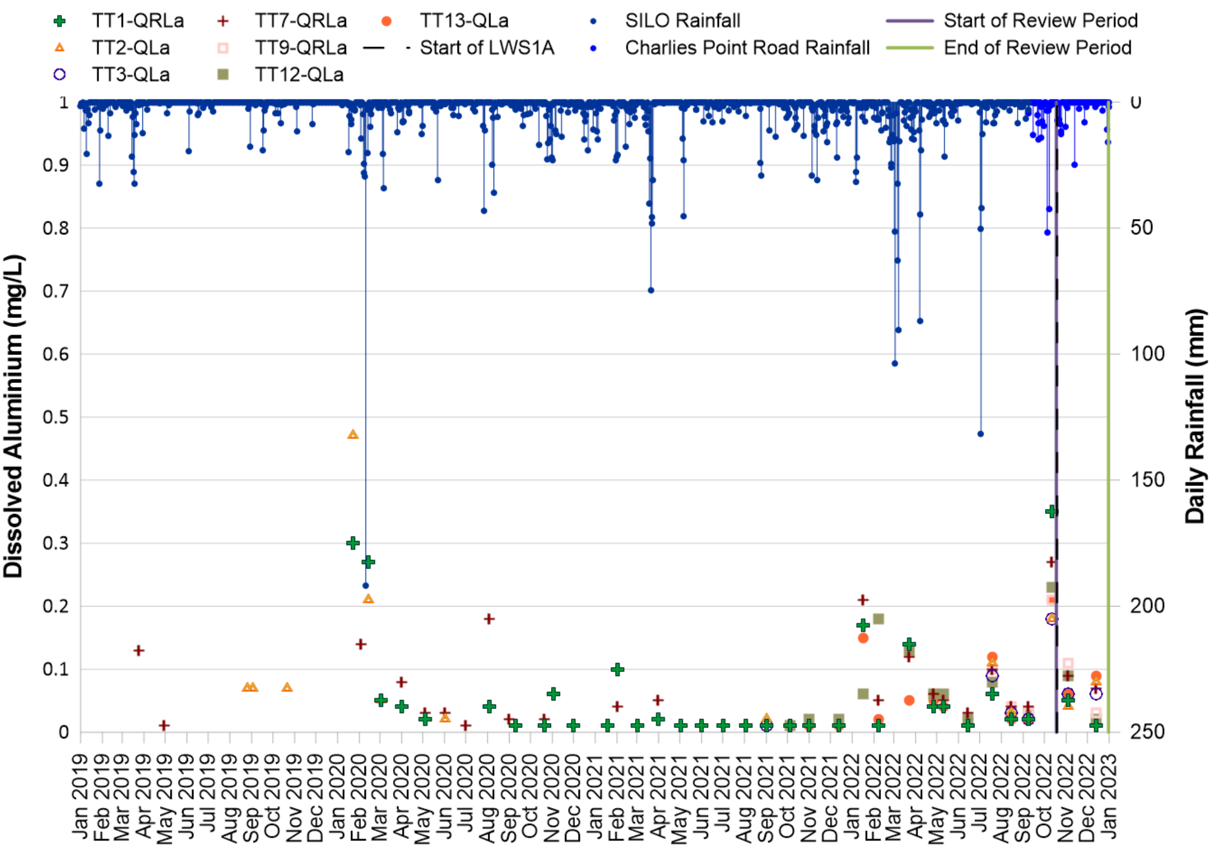


DIAGRAM 1.4: DISSOLVED COPPER RECORDS

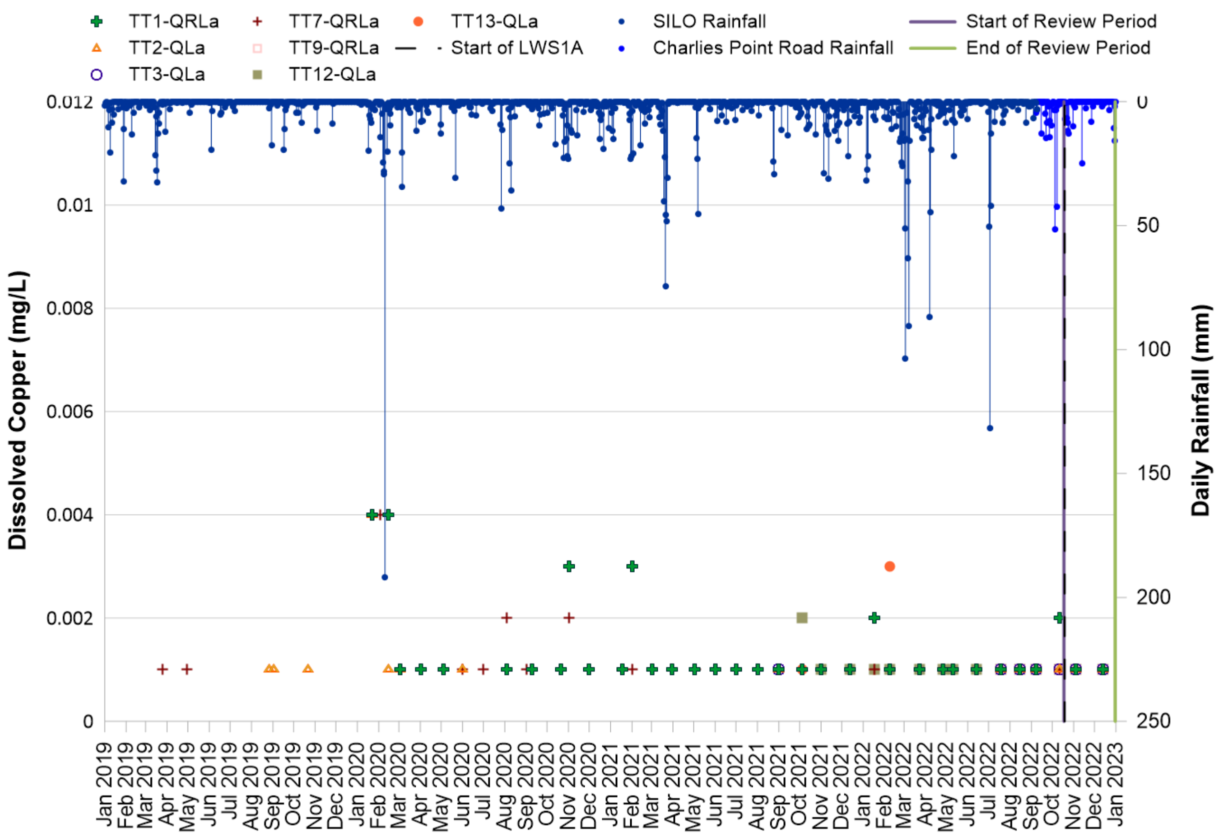


DIAGRAM 1.5: DISSOLVED IRON RECORDS

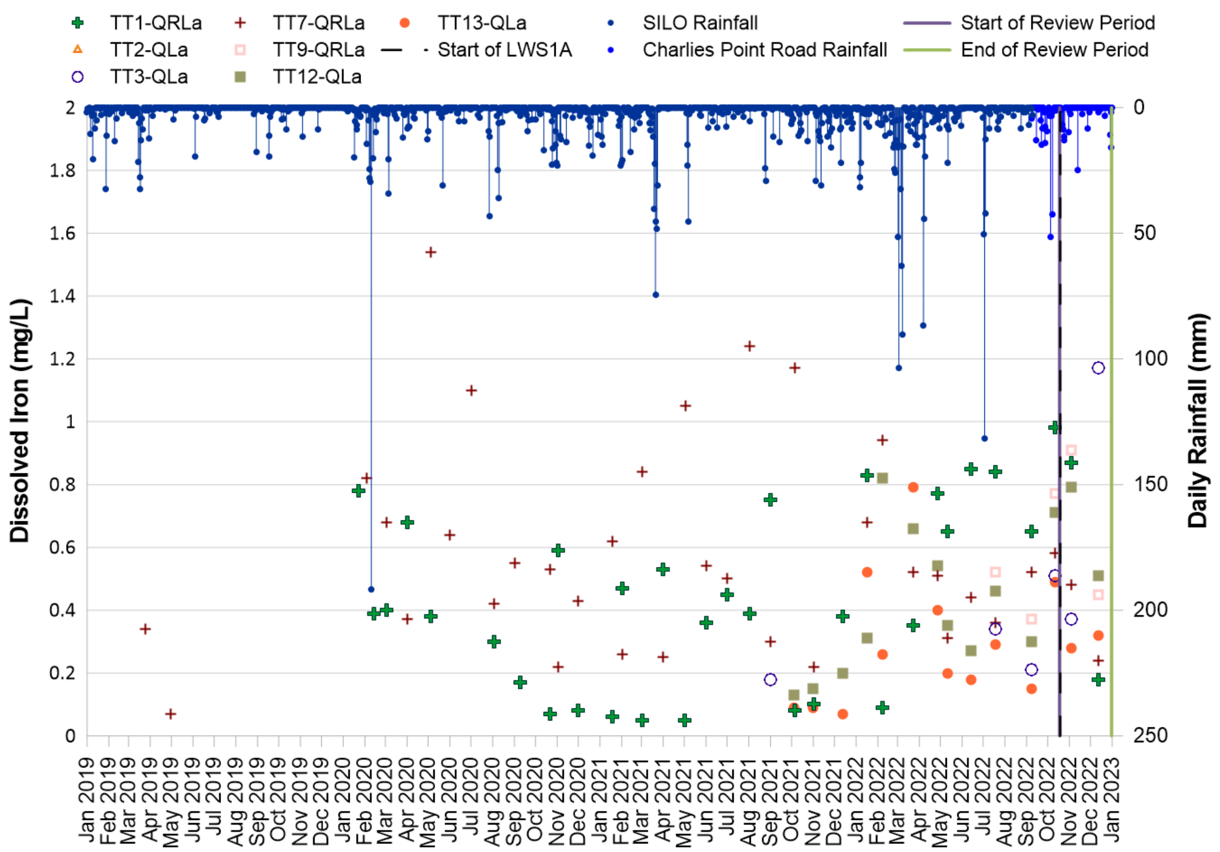


DIAGRAM 1.6: DISSOLVED MANGANESE RECORDS

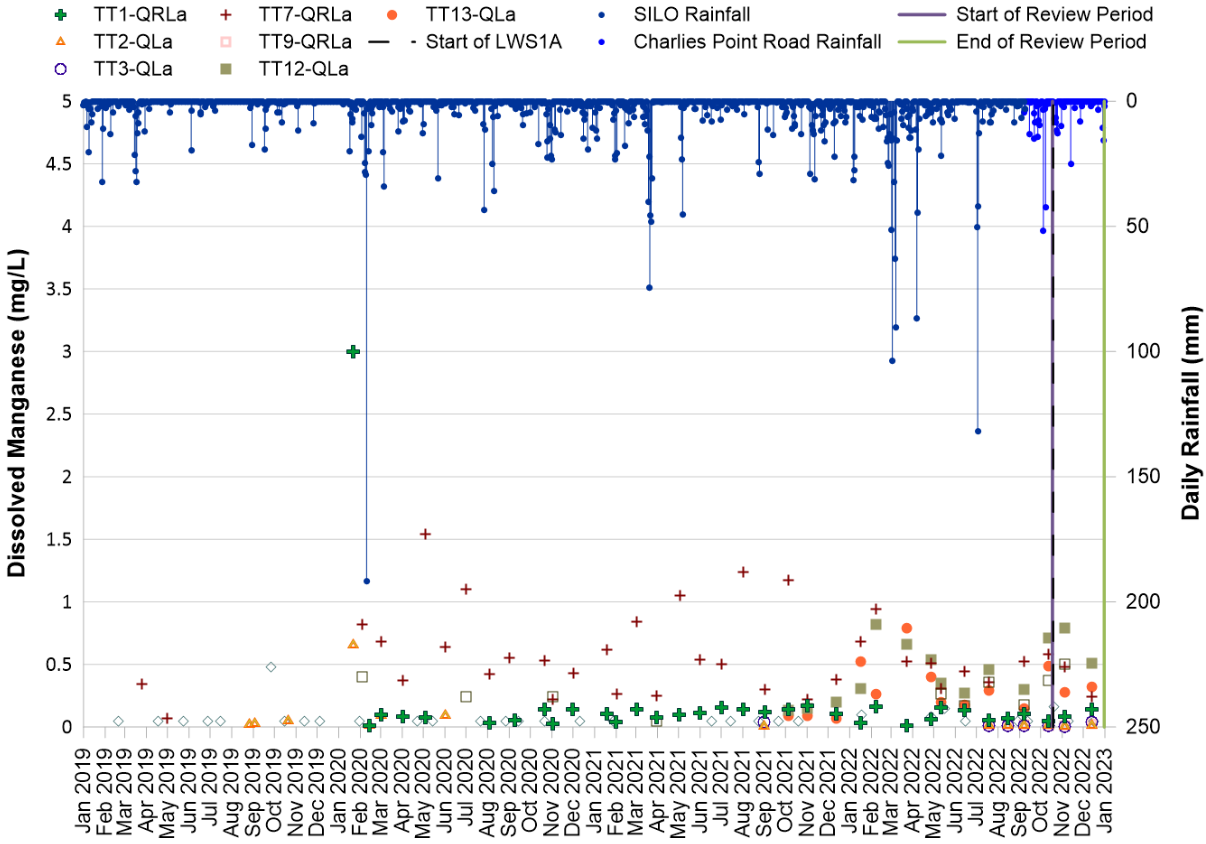


DIAGRAM 1.7: DISSOLVED NICKEL RECORDS

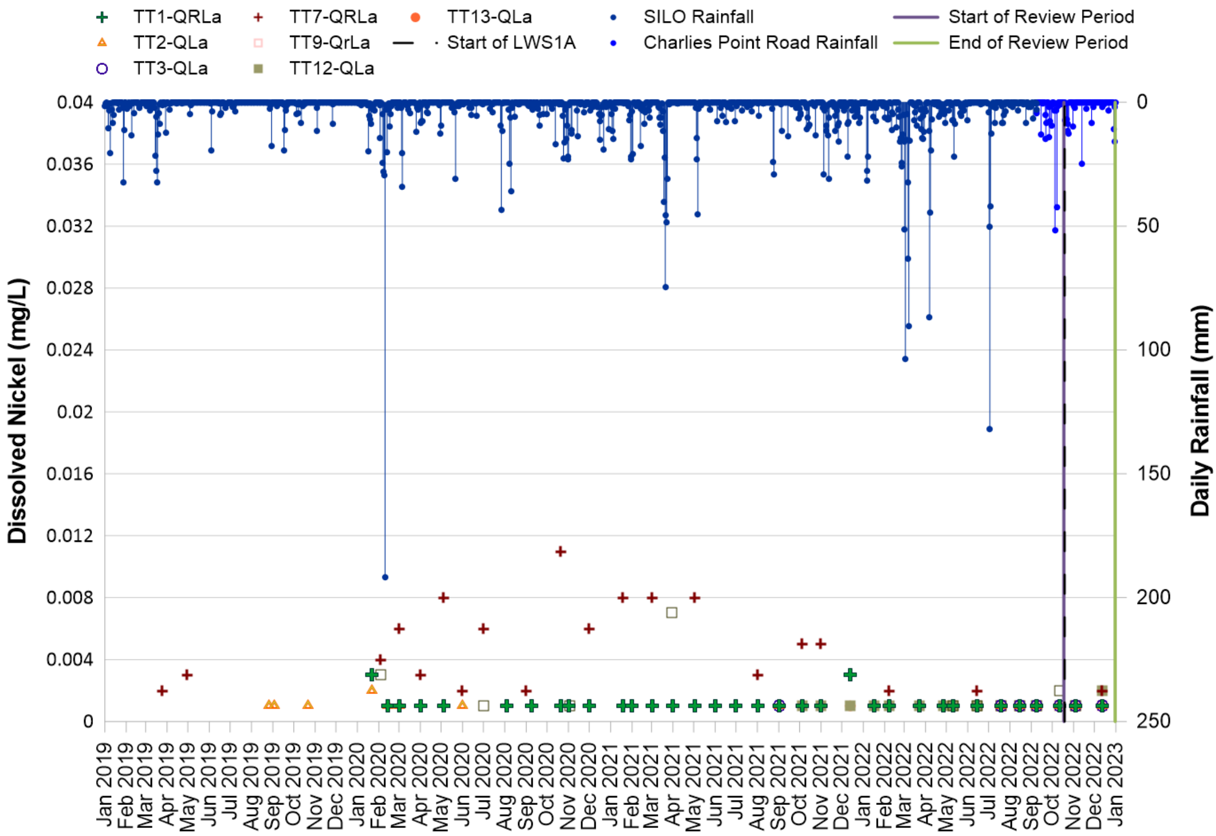
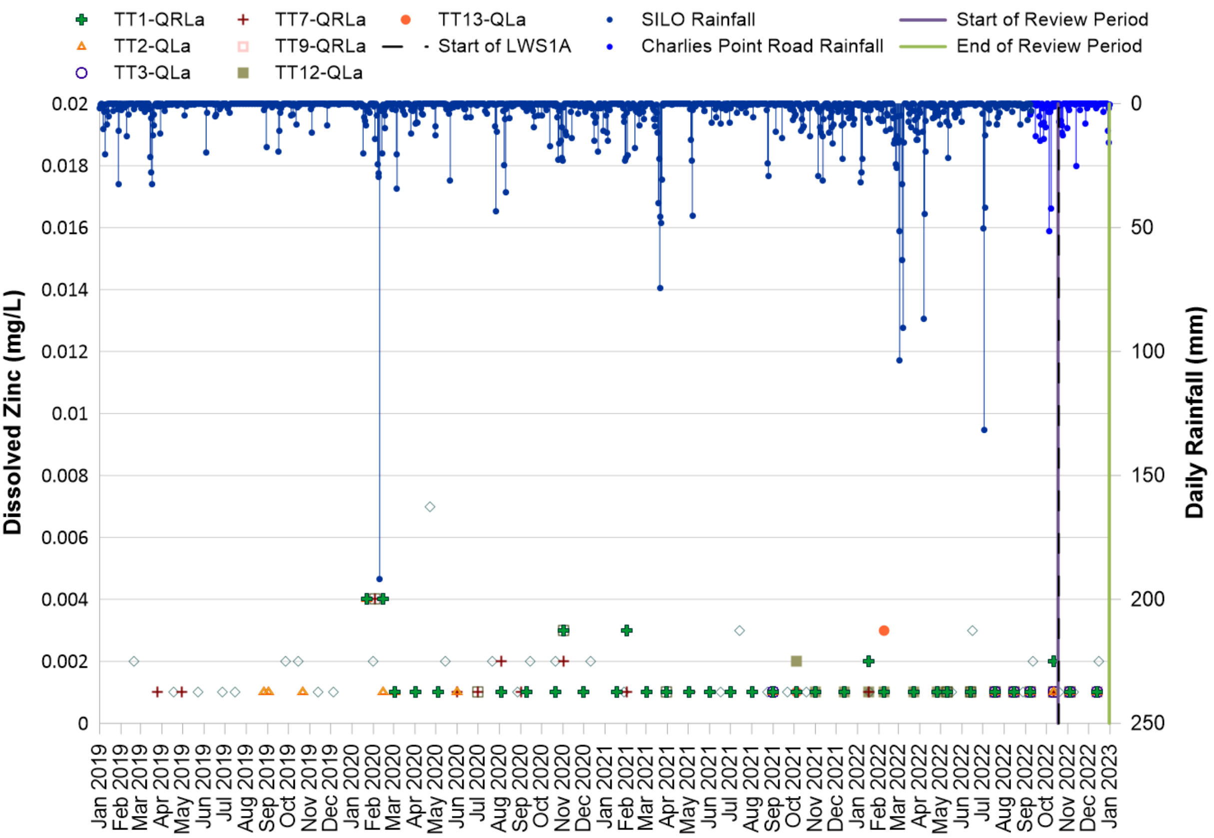
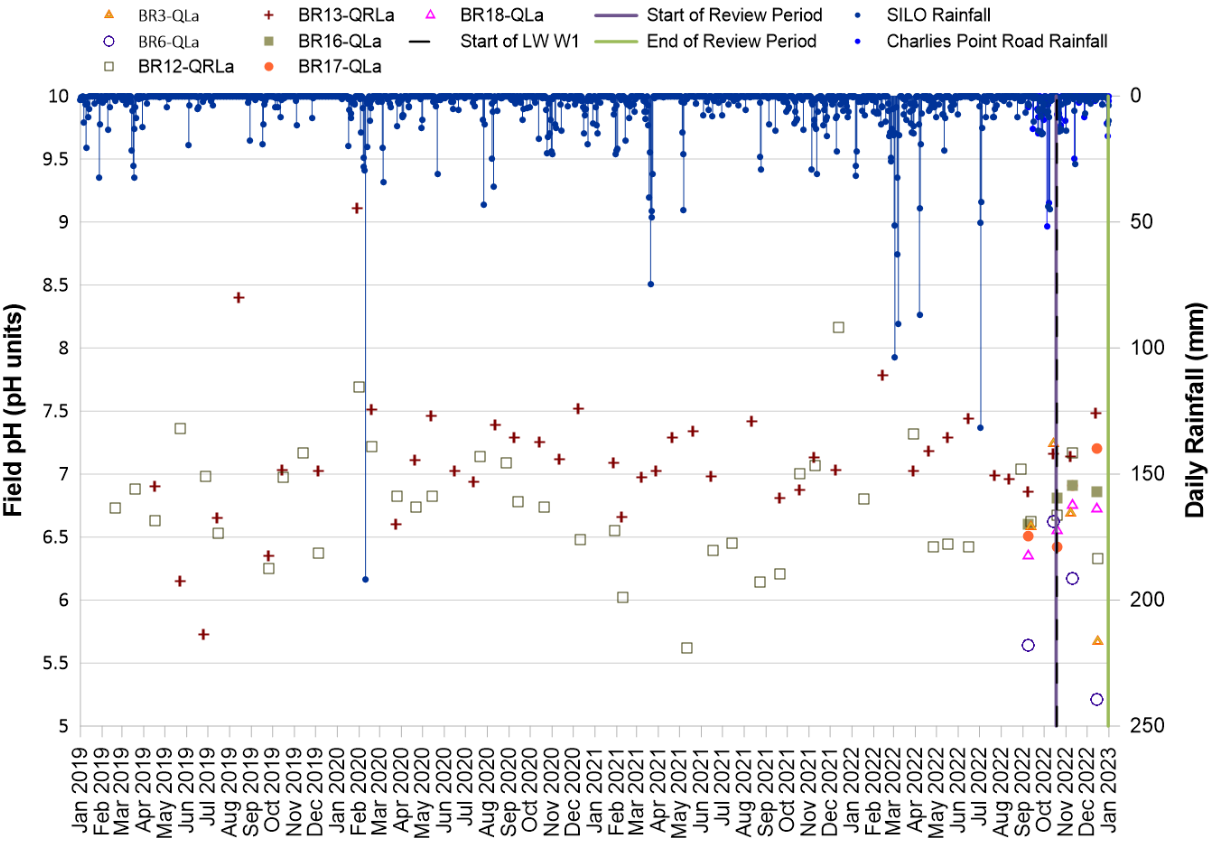


DIAGRAM 1.8: DISSOLVED ZINC RECORDS



APPENDIX C.2 – BARGO RIVER WATER QUALITY PLOTS

DIAGRAM 2.1: FIELD AND LABORATORY PH RECORDS



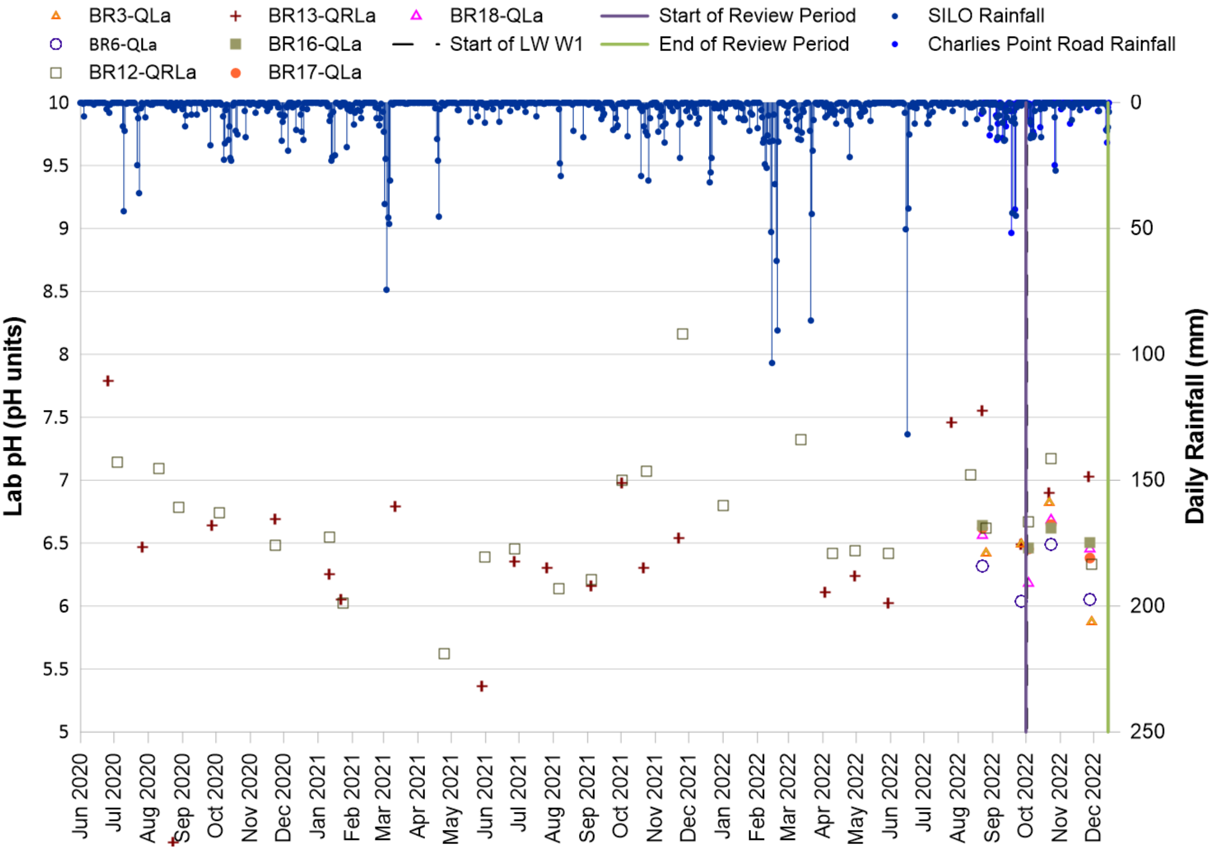
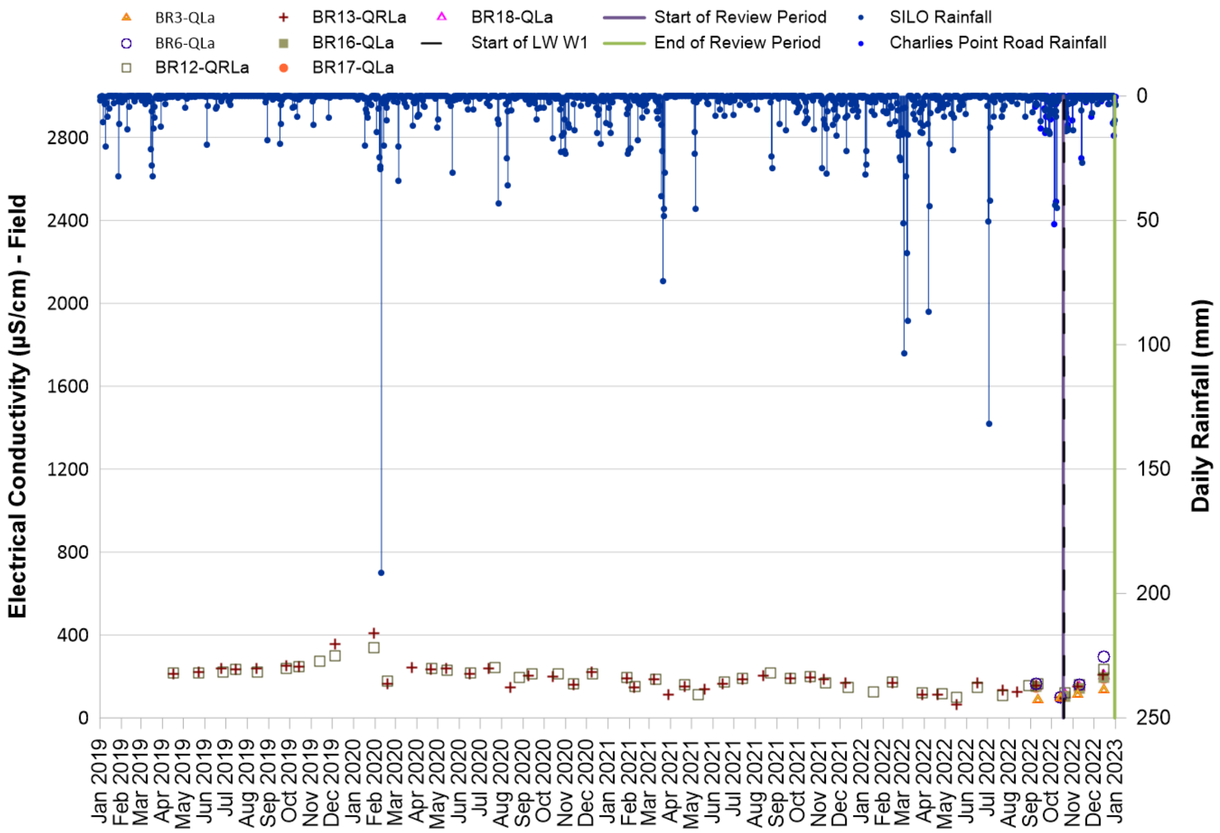


DIAGRAM 2.2: FIELD AND LABORATORY ELECTRICAL CONDUCTIVITY RECORDS



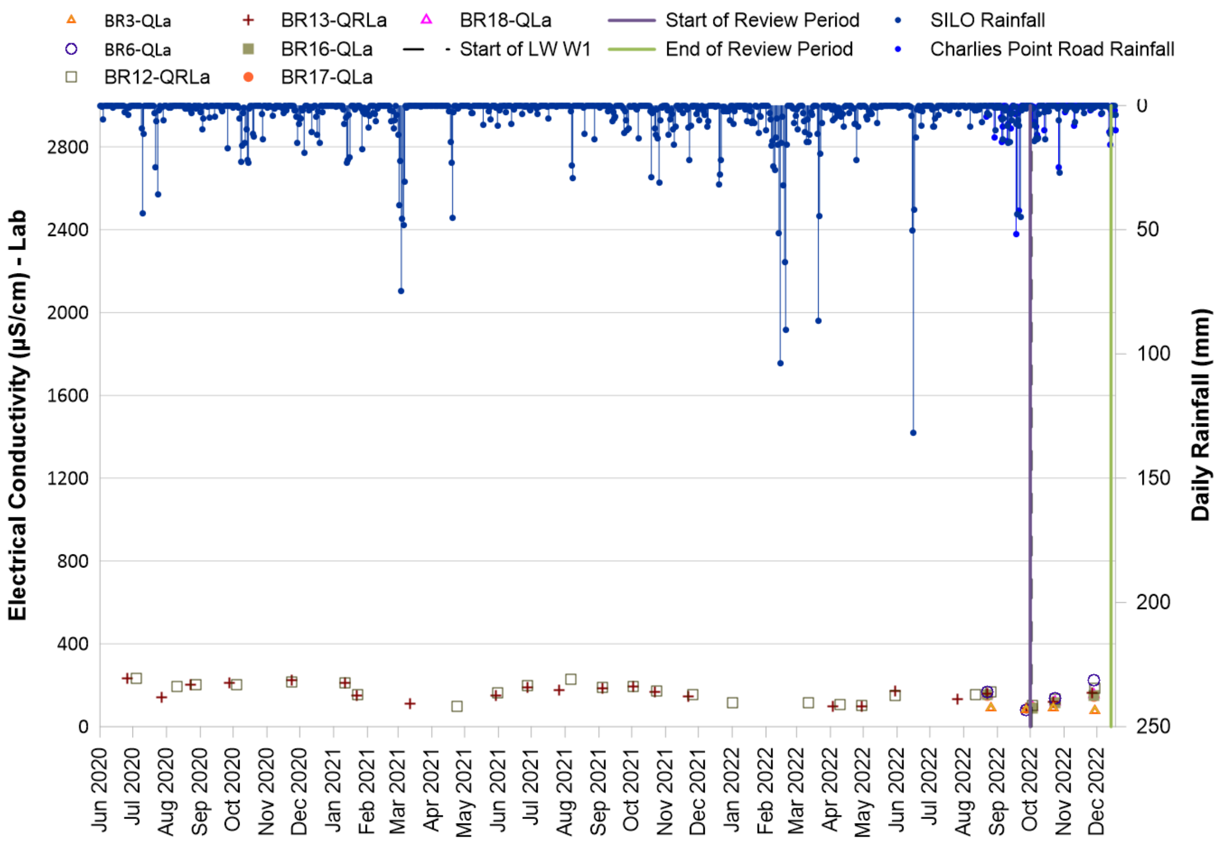


DIAGRAM 2.3: DISSOLVED ALUMINIUM RECORDS

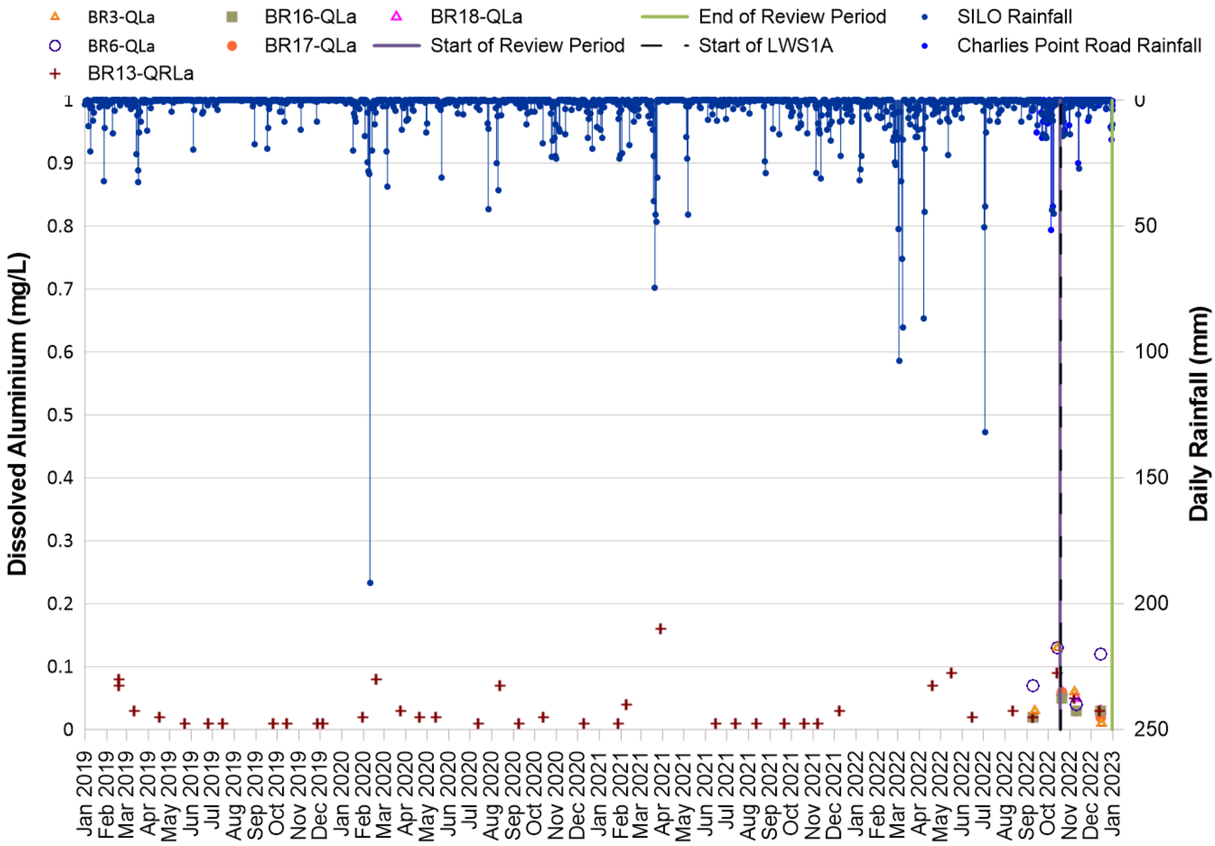


DIAGRAM 2.4: DISSOLVED COPPER RECORDS

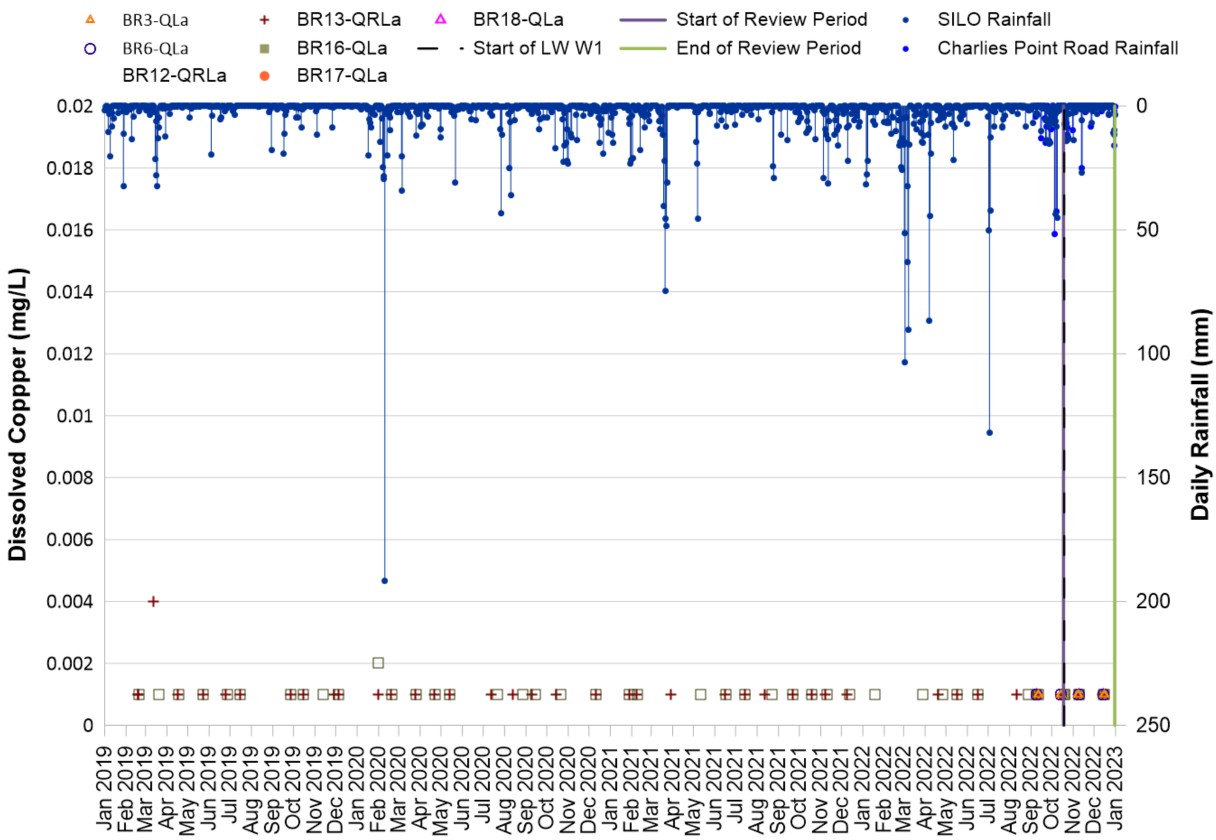


DIAGRAM 2.5: DISSOLVED IRON RECORDS

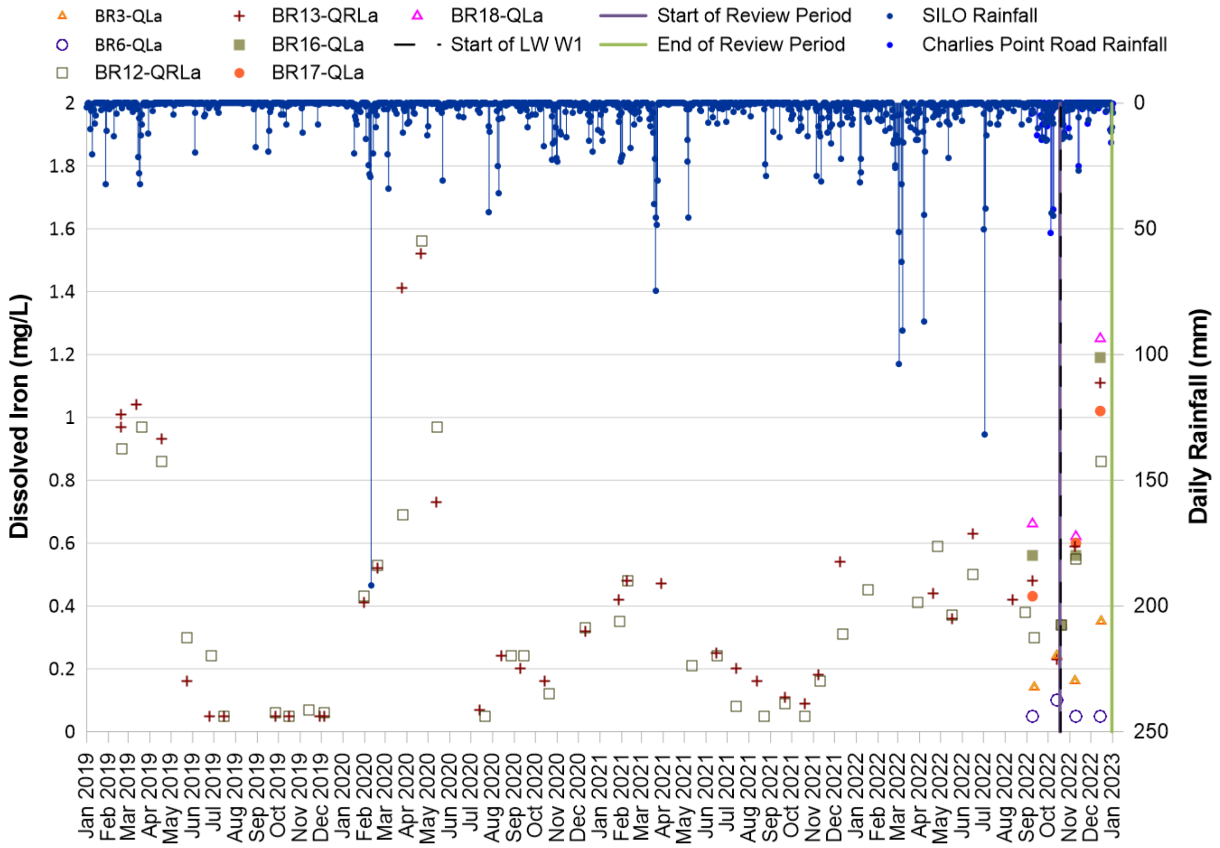


DIAGRAM 2.6: DISSOLVED MANGANESE RECORDS

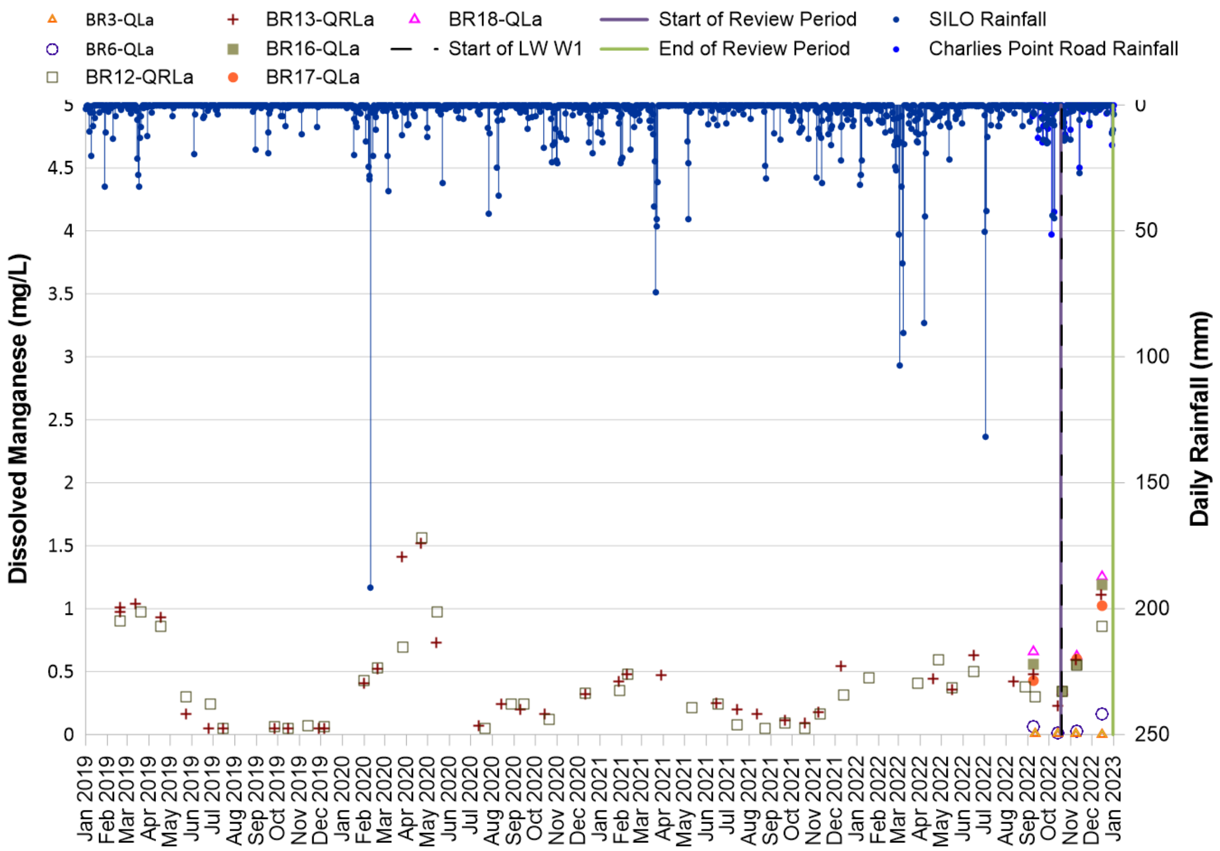


DIAGRAM 2.7: DISSOLVED NICKEL RECORDS

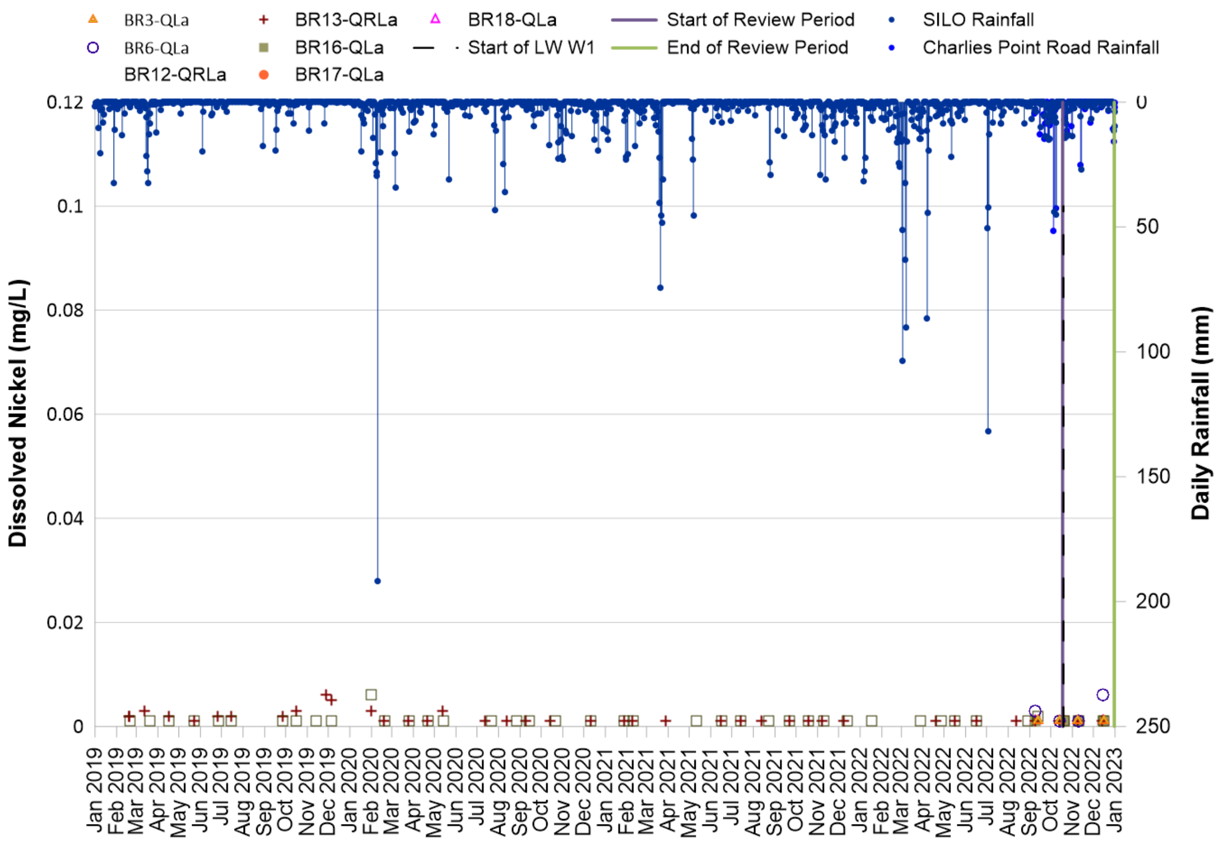
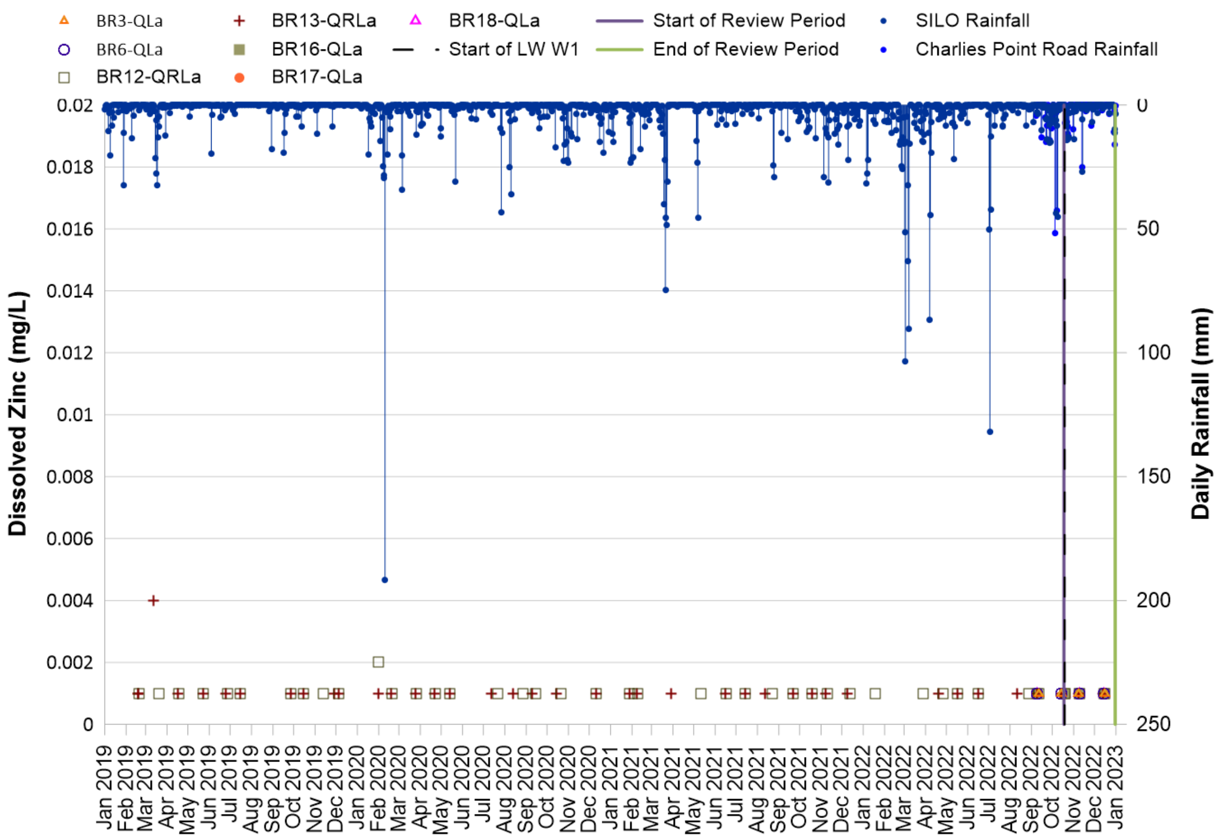


DIAGRAM 2.8: DISSOLVED ZINC RECORDS



TAILINGS.WATER.WASTE.

Appendix C – Groundwater Monitoring Report

TAHMOOR SOUTH GROUNDWATER REPORTING

Oct - Dec 2022

Prepared for:

Tahmoor Coal
2975 Remembrance Driveway
Tahmoor NSW 2574

SLR Ref: 640.30614.00000-R01
Version No: -v2.0
March 2023

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Tahmoor Coal (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
640.30614.00000-R01-v2.0	30 March 2023	Sharon Hulbert	Ines Epari	Ines Epari
640.30614.00000-R01-v1.1	30 March 2023	Sharon Hulbert	Ines Epari	Ines Epari
640.30614.00000-R01-v1.0	22 February 2023	Sharon Hulbert	Ines Epari	Ines Epari

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APPENDICES

1 Introduction

Tahmoor Coal Mine is an underground coal mine located approximately 80 kilometres (80km) south-west of Sydney, in New South Wales (NSW). Tahmoor Coal commenced extraction operations at Tahmoor South on the 18th October 2022, primarily producing hard coking coal and a secondary higher ash coking coal product predominantly used for coke manufacture for steel production.

Historical operations at Tahmoor Mine commenced in 1979 using board and pillar mining method, which converted to longwall mining methods in 1987, which is currently still utilised.

The Tahmoor South operation targets the Bulli Coal seam within consolidated Coal Leases (CCL) 716 and 747. On the 23rd April 2021, Tahmoor Coal received Development Consent SSD 8445 (the Consent) for the Tahmoor South Project. On the 20th September 2022 Tahmoor Coal received approval for the Longwall South 1A to South 6A (LW S1A-S6A) Extraction Plan.

1.1 Objective

SLR has been commissioned by Tahmoor Coal to produce a groundwater report to assist in satisfying the requirements for the 2022 Annual Reporting.

From the information contained within your email dated Wednesday 25th January 2023, it is understood that you require a groundwater report developed to satisfy the requirements of the Project Instrument of Consent SSD 8445. Specifically, the following conditions:

> *Condition B24: The Applicant must report on water captured, intercepted or extracted from the site each year in the Annual Review*

> *Condition E13: Annual Review - By the end of March in each year after the commencement of the development, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary.*

Extraction at Tahmoor South commenced on the 18th October 2022. Consequently, the reporting period covered by this report is 18th October 2022 through until 31st December 2022.

This report will provide:

- An overview of the groundwater data collected at the monitored locations (see Figure 1) over the reporting period.
- An assessment of collected groundwater data against the Trigger Action Response Plans (TARPs) in the *Water Management Plan – Tahmoor South Domain – Longwalls South 1A – South 6A* (Tahmoor Coal, 2022).
- A review of the TARPs in consideration primarily of their function for use, also considering the additional data collected and suitability for intended purpose.
- A summary of the groundwater level and groundwater quality TARP level exceedances and a brief analysis of the potential influencing factors for these exceedances. Exceedances will be noted according to the 'original' TARPs, however will be presented against the updated TARPs as discussed prior.

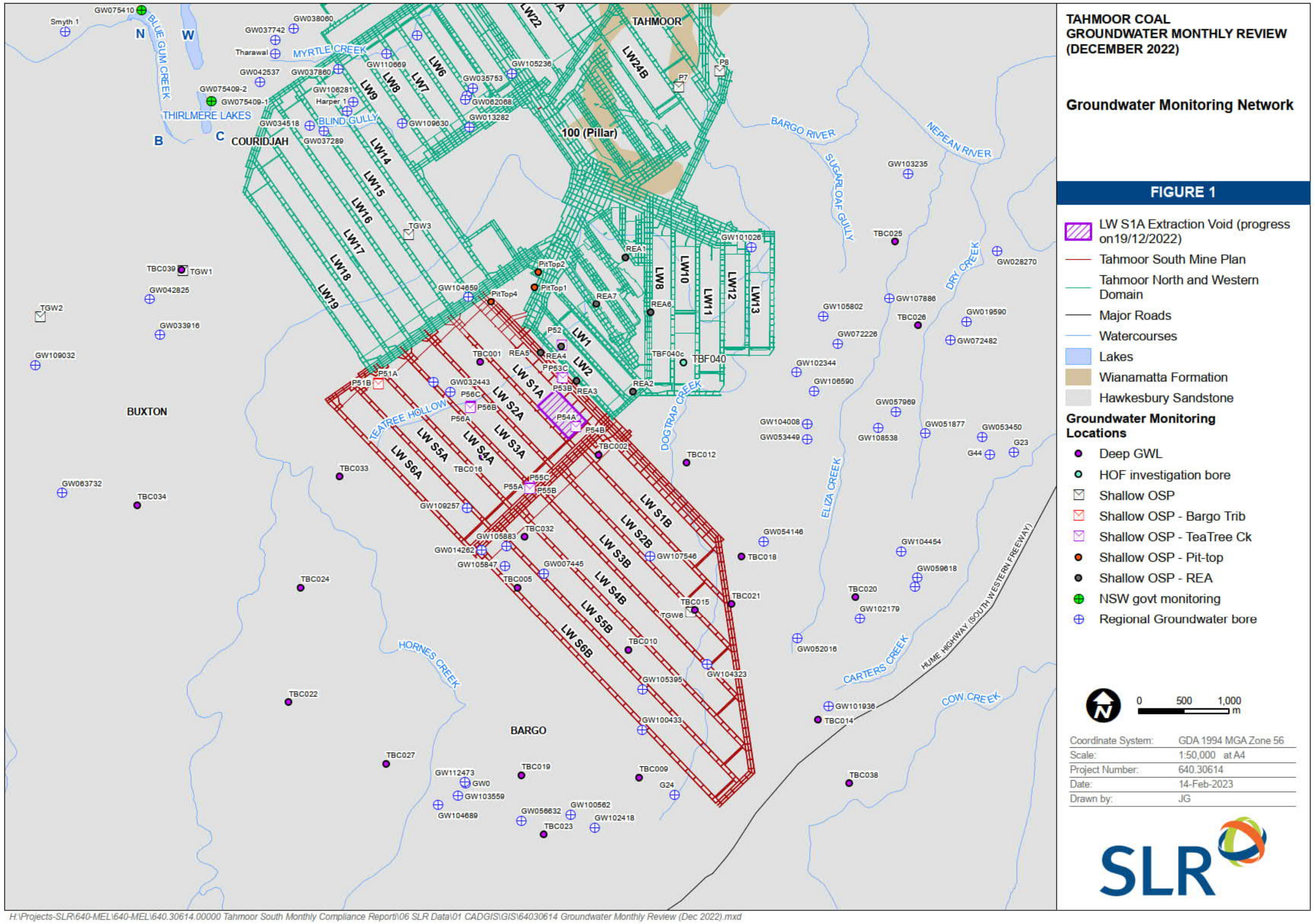


Figure 1 Groundwater Monitoring Network

2 Monitoring Period Summary

2.1 Mining Activities

Over the reporting period, extraction commenced within the Tahmoor South domain at LW S1A on the 18th October 2022, reaching 536.5 metres by the 31st December 2022. Table 1 presents a summary of the extraction chainage over time.

Table 1 Extraction chainage

Date	Extraction Chainage (m)	% Longwall S1A Complete
18-10-2022	0	0%
23-10-2022	40.5	2%
31-10-2022	117.5	7%
07-11-2022	176.5	10%
14-11-2022	223.5	13%
28-11-2022	308.5	18%
04-12-2022	376.5	22%
11-12-2022	396.5	23%
19-12-2022	469.5	28%
31-12-2022	536.5	32%

Tahmoor Coal enacted the annual 5-day maintenance shut down from Sunday 4th December to Thursday 8th December 2022.

2.2 Climatic Conditions

The SILO record for the 0.05° x 0.05° tile centred on Bargo (SILO point latitude -34.3 and longitude 150.60) has been adopted for this assessment to understand long-term rainfall trends. Table 2 shows the 2022 rainfall in comparison to the long-term average (January 1900 to present). Eight of the twelve months through 2022 exceeded the long-term average monthly rainfall, with March and July being particularly higher than average rainfall months. June 2022 saw the greatest deficit below the long-term average monthly rainfall.

Table 2 Long-term and 2022 Monthly Rainfall (mm)

SILO Station	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Long-term monthly average rainfall (mm)	92.3	101.1	90.5	77.2	69.5	78.7	58.8	52.2	47.2	66.1	74.3	77.7
2022 monthly average rainfall (mm)	118.8	179.6	494.8	227.2	89	3.4	289.1	26.1	108.2	207.5	63.9	39.3
Surplus (+) /Deficit (-) (mm)	26.5	78.5	404.3	150.0	19.5	-75.3	230.3	-26.1	61.0	141.4	-10.4	-38.4

Monthly average rainfall is presented on Figure 2, alongside potential evaporation and estimated actual evapotranspiration. Figure 3 shows the historical record of monthly rainfall calculated trend in rainfall (using cumulative residual departure from mean method), where a positive gradient indicates above average rainfall, whilst a declining trend represents below average.

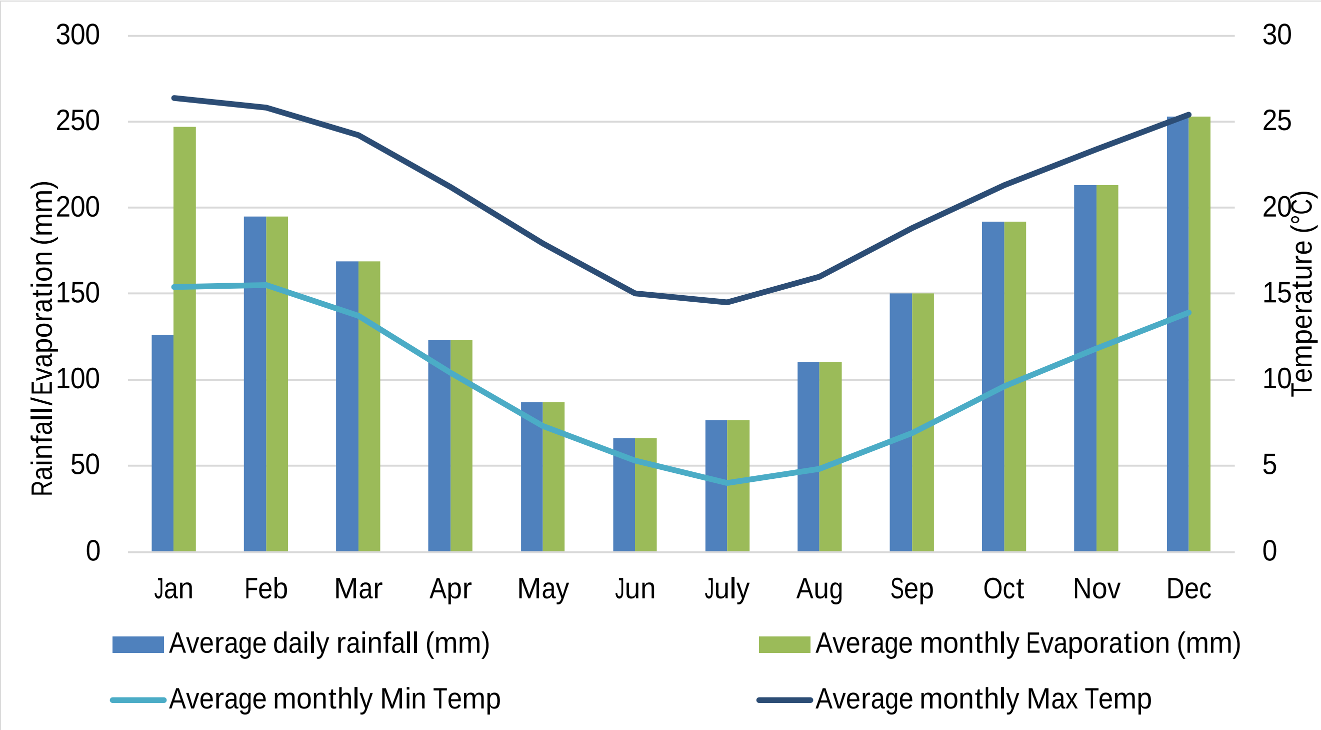


Figure 2 Average Monthly Rainfall, Evaporation and Evapotranspiration

Figure 3 Long term monthly rainfall cumulative residual deviation (1970-2023)

2.3 Groundwater Monitoring Network Status

The Tahmoor South Monitoring Network comprises both open standpipes (OSP) and Vibrating Wire Piezometers (VWPs). The standpipe piezometers can be used for monitoring water levels manually or with an automated datalogger (installed in 10 sites to date), as well as for collection of water samples for groundwater quality monitoring purposes. The VWPs are grouted and therefore can only be used for monitoring groundwater pressures, but do allow for multiple instruments to be installed at different depths within a single borehole.

The network was designed to allow for monitoring of potential impacts to groundwater resources as a result of extraction activities. The monitoring program provides opportunity to record the groundwater conditions at each monitoring site during the following three phases:

- Prior to mining – to establish baseline conditions;
- During mining – identification of potential changes to groundwater resources as a result of extraction activities; and
- Post mining – allows for review of conditions post-extraction to assess is conditions have stabilised/recovered/etc.

The spatial coverage of the network was devised to align with specific features/receptors identified. Table 3 summarises the Tahmoor South Groundwater Monitoring Network and how it aligns with key receptors.

Table 3 Key Receptors and Associated Groundwater Monitoring

Receptor / Aspect	Parameter	Data Collection Frequency	Bore IDs
Teatree Hollow	Water Quality (field parameters)	Monthly	TBC032. P52A, REA4, P53a, P53b, P53c, P54a, P54b, P55a, P55b, P55c, P56a, P56b, P56c
	Water Quality (speciation)	Quarterly	
	Water levels	Monthly (for manual dips and data downloads where loggers installed)	
	Water Quality (speciation)	Quarterly	
	Water levels	Monthly (for manual dips and data downloads where loggers installed)	
Other watercourses	Water Quality (field parameters)	Monthly	TBC026, TBC027, TBC033, TBC038, P51a, P51b Proposed: P57
	Water Quality (speciation)	Quarterly	
	Water levels	Monthly (for manual dips and data downloads where loggers installed)	
Existing Users (bores)	Water levels / pressures	Monthly (for manual dips and data downloads where loggers installed)	TBC009, TBC018, TBC019B, TBC020, TBC027, TBC032, TBC039, P56a, P56b, P56c, GW58634, GW109257, GW032443, GW104008, GW112473, GW106590, GW104659, GW062068, GW105395
	Water Quality (field parameters)	Quarterly	
	Water Quality (speciation)	Monthly/quarterly (dependent on land access agreements).	
Wirrimbirra Sanctuary (on Teatree Hollow)	Water Quality (field parameters)	Monthly	P55a, P55b, P55c, P56a, P56b, P56c
	Water Quality (speciation)	Quarterly	

Receptor / Aspect	Parameter	Data Collection Frequency	Bore IDs
	Water levels	Monthly (for manual dips and data downloads where loggers installed)	
Thirlmere Lakes	Water levels / pressures	Monthly (for manual dips and data downloads where loggers installed)	NSW govt: GW075409-1 & -2, GW075410, GW075411.
	Water levels / pressures	Monthly (for manual dips and data downloads where loggers installed)	TBC039.
	Water levels / pressures Water Quality (field parameters)	Monthly	P51a, P51b Proposed: P50
Cumulative effects (re: Bulli Seam Operations mine)	Water levels / pressures	Monthly (for manual dips and data downloads where loggers installed)	TBC026

2.3.1 Planned Monitoring Installations

Further monitoring installations are planned as extraction progresses, and in preparation for the B-series extraction. Sites for piezometers P50 and P57 are currently undergoing land access negotiations.

3 Groundwater Level Conditions

A brief summary of the groundwater level conditions is provided here for the shallow OSPs, shallow VWPs and deep VWPs. Given it is only three months since commencement of extraction, it is difficult to characterise 'trends' in water levels, and as such a general discussion is provided without conclusions drawn to 'trends' in groundwater levels yet. Further, as discussed in Section 2.2, the climatic conditions experienced in 2022 were quite disparate from long-term average conditions which is likely to have impacted shallow groundwater levels. Further data is required to establish trends and attribute to extraction operations.

The groundwater level data for the shallow OSPs and private bores is described in Section 3.1 with hydrographs provided in Appendix A. Groundwater pressures for the shallow VWPs are discussed in Section 3.2 with hydrographs provided in Appendix B. Section 3.3 discusses the deep groundwater pressures with hydrographs provided in Appendix C.

3.1 Shallow OSPs and Private Bores

Plots showing the groundwater levels in the Shallow OSPs and Private bores are provided in Appendix A. P54a and P54b have been dry since commencement of groundwater monitoring.

There was some decline in groundwater levels observed in P55a, P55c, P56c and GW104659 in December 2022. However, given the below average rainfall experienced in November and December, and significantly higher than long-term average rainfall prior to this, the decline may be a response to these varying climatic conditions. Further data is required to establish a trend.

3.2 Shallow VWPs (sensors <200 metres)

Groundwater pressures at TBC032 HBSS 131m declined by approximately 6 metres through November and December 2022 (all hydrographs provided in Appendix B). A depressurisation of 4 metres was observed over the same period in TBC 032 HBSS 95m. The two deepest sensors in TBC032 (BHCS 181m and BGSS 200m) also presented depressurisations of 5.8 and 5.5 metres respectively. Interestingly, the mid-point sensor, HBSS 168m recorded a depressurisation of approximately 2 metres over the same period.

Shallow sensors at site TBC027 recorded a groundwater depressurisation ranging from 1.3m to 2.6m during the reporting period, being greatest in HBSS-132m (2.6m) and lowest in BGSS-198m (0.3m). The groundwater depressurisation started in mid-late November 2022.

The shallow sensors at TBC09 and TBC018 recorded no significant changes in groundwater pressure.

3.3 Deep VWPs (sensors > 200 metres)

The deep VWPs predominantly indicated minimal depressurisation over the reporting period (all hydrographs provided in Appendix C):

- Sensors in TBC09 (all depths) indicated depressurisation between 0.3 and 1.8 metres.
- TBC18 deep sensors indicated depressurisation between 0.4 and 0.76 metres.
- TBC20 BGSS (mid) 211 m indicated the greatest level of depressurisation of the deep sensors, of 4.8 metres, commencing late November. The remaining deep sensors showed depressurisation between 0 and 0.8 metres.
- TBC26 BUSM 432 m indicated a depressurisation of 4.8 metres commencing early October. The remaining deep sensors showed depressurisation between 0 and 0.2 metres.
- TBC32 BGSS 200 m indicated a depressurisation of 5.4 metres commencing mind-November. The remaining deep sensors showed depressurisation between 0.4 and 0.7 metres.
- TBC39 BGSS 299 m indicated a depressurisation of 1.2 metres commencing early-November. The remaining deep sensors showed depressurisation between 0.2 and 0.4 metres.
- Given the short period of depressurisation, conclusions regarding trends are not suitable at this time. Majority of sensors are aligning with the predicted depressurisation predicted via the groundwater modelling.

4 Groundwater Quality Conditions

Groundwater quality has been monitored monthly in the OSPs (monitoring network and private bores) since the commencement of extraction. As per the groundwater level data, the limited record during extraction coupled with the highly variable climatic conditions make it illogical to define trends in the quality and ascertain their relationship to extraction or not. Consequently, a general discussion of the groundwater quality conditions is provided at this stage. The time-series plots for groundwater quality are provided in Appendix D.

4.1.1 EC and pH

The pH and EC across all bores show some level of fluctuation with no apparent trends across the full record. It is proposed that a trend analysis be undertaken with more data points available.

A very high pH (greater than 12) was recorded at the following bores in October 2022, which suggest either an issue with the bore construction (e.g. grout contamination) or an error in pH measurements. These results were:

- P51B (pH = 14.22)
- P56B (pH = 12.22)
- P56C (pH = 15.12)
- GW104659 (pH = 13.15)

Further monitoring in November and December 2022 showed that the pH returned within baseline levels.

4.1.2 Metals

Metals across all bores showed some variations, most likely attributable to climatic conditions and not extraction. Although, this review and detailed trend analysis will continue as further data is collected.

A review of the baseline trigger levels will be considered, as multiple points recorded ‘triggers’ outside of baseline conditions for the October 2022 sampling event which occurred prior to commencement of extraction (therefore, technically within the baseline period).

The trigger level was calculated using a short baseline period which could result in a conservative trigger level for metals. As of December 2022, it is quite difficult to assess short-term increases in metal concentrations as seen during the reporting period is mining related. Further monitoring data is required to assess and confirm trends.

5 Thirlmere Lakes Bores

No recent groundwater levels and quality (EC) has been made available online at the existing Thirlmere Lakes sites (i.e. no groundwater data available past August 2022). SLR has contacted DPE and WaterNSW to obtain further information regarding access to groundwater data at those sites. Water NSW responses noted the telemetry has been decommissioned from Thirlmere Lakes bores and data will be downloaded every three to four months depending on weather and access (*WaterNSW, pers. comm., 16 February 2023*).

Potential impacts to the Thirlmere Lakes via extraction of LWS1A–S6A is to be assessed via the TARP WMP 13 (Table A5). Groundwater levels at "early warning bores" (i.e. P51A, P51B, GW062068, GW104659, TBC039-65m) are observed within Normal Condition during the reporting period.

6 TARP Review

The Trigger Action Response Plans were developed via the Water Management Plan and approved prior to commencement of extraction. The Water Management Plan, in accordance with Condition E7 (b-e) of the Consent, will be reviewed within three months of the submission of an Annual Review under Condition E13.

This review aligns with the continuous improvement strategy presented in the Water management Plan, adopting the 'Plan-Do-Check-Act" model (see Figure 4).

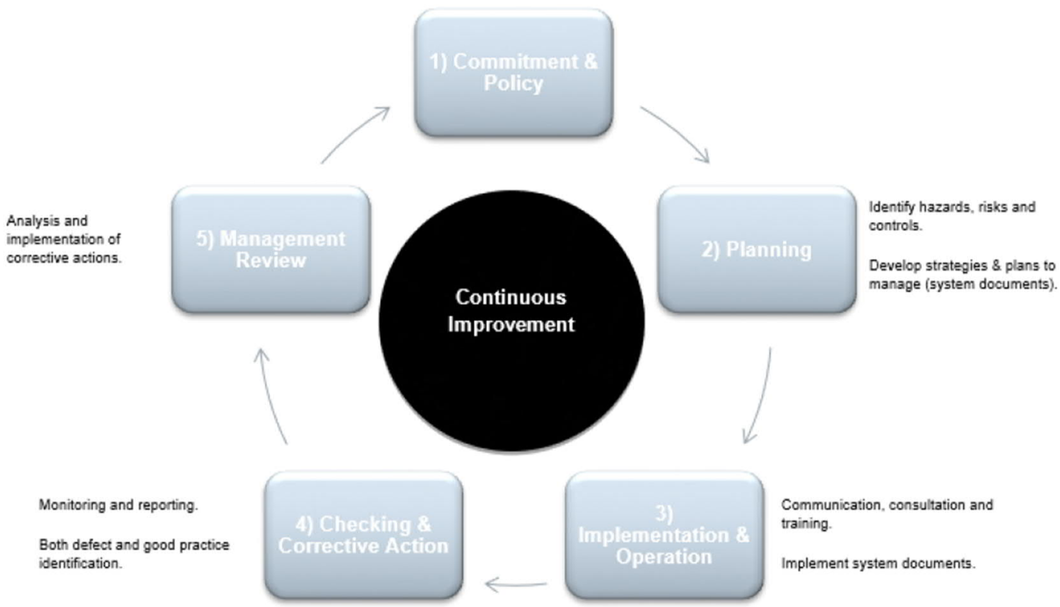


Figure 4 Continuous Improvement Model

In accordance with this model, a review of the current TARPS in light of their applicability and suitability for purpose has been conducted.

For context, the following TARPS in the Water Management Plan are pertinent to groundwater:

- Water Management Plan TARP – WMP8 – Shallow Groundwater Level (Open Standpipes and Private Bores)
- Water Management Plan TARP – WMP9 – Shallow Groundwater Pressures (VWP sensors < 200 metres depth)
- Water Management Plan TARP – WMP10 – Groundwater Level/Pressure Deep VWP (> 200 metres depth excluding monitoring the Bulli Coal Seam)
- Water Management Plan TARP – WMP11 – Groundwater Quality (Open Standpipes and Private Bores)
- Water Management Plan TARP – WMP12 – Groundwater – Surface Water Interaction
- Water Management Plan TARP – WMP13 – Groundwater Bores Monitoring for Thirlmere Lakes

The need to amend the TARPs was identified during the short reporting period (October through December), during which a number of TARPs were triggered that did not align with the overarching objectives of the TARPs. During October to December 2022, a number of TARP triggers were noted to have occurred in accordance with the following groundwater TARPs:

- TARP WMP9 Shallow Groundwater Pressure (VWP Sensors < 200 m Depth): Potential Level 2 for TBC032 HBSS recorded at 131m in December 2022;
- TARP WMP10 Groundwater Level / Pressure Deep VWPs (> 200 m Depth excluding Bulli Coal Seam): Level 1 triggered since October 2022 for TBC09 (BGSS – 322m), TBC09 (BGSS-343m), TBC018 (BGSS-282m), TBC018 (BGSS-366m), TBC18 (BUSM-404m), TBC20 (WBCS-397m), TBC20 (BGSS-375m), TBC26 (BUSM-432m), TBC32 (BGSS-237m), TBC32 (BGSS-294m); since November 2022 for TBC09 (WWCO-391m), TBC09 (WO-397m), TBC18 (W0-432m), TBC020 (211m), TBC32 (BGSS-200m), TBC39 (BGSS-299m); December 2022 for TBC020 (293m);
- TARP WMP11 Groundwater Quality (Open Standpipes and Private Bores): Level 1 triggered for P53B (pH upper), GW112473 (EC and pH lower), P52 (EC), P53A (EC) for November; P55A (EC) for November and December; numerous exceedances of heavy metals (Fe, MN, Cu, Pb, Zn, Ni, Al, As, Li, Ba, Sr) at P51B, P52, P53A-C, P55A-C, P56B-C, GW062068, GW104008, GW104323, GW104659, GW105395, GW109257 and GW112473 in November and December 2022; and
- TARP WMP13 Groundwater Bores Monitoring for Thirlmere Lakes: Level 1 triggered due to Level 1 triggers of TARP WMP11 for “early warning” bores P51B (Al, As), GW062068 (Fe, Cu, Zn, Ni), and GW104659 (Mn, Al, Li, Ba) recorded in November and December 2022.

The above TARP triggers were notified to DPE on 28 February 2022 via the Planning Portal.
However, it was identified that these TARP triggers were not representative of incurred variations to the system that required further analysis as per the objectives of the TARPs. This was primarily due to the temporal scales in many of the TARP trigger descriptions being either incorrect, insufficient or lacking. Without an appropriate temporal scale, isolated fluctuations and seasonal variations were resulting in triggers to the TARPs, which was unrepresentative of trends that would indicate potential environmental consequences from longwall extraction. Further, where modelled drawdown was relied upon to define trigger levels, insufficient allowance was given for the known and accepted level of accuracy with modelled drawdowns (i.e. an exceedance of 20 cm beyond modelled drawdown would trigger a Level 1, although this can be considered within the bounds of the model results and not representative of trends of exceedance of model outputs). Specific reasoning pertinent to each proposed change is provided in column three of Table 4

A comprehensive review of the TARPS and their functionality was conducted, in conjunction with the feedback provided by the IAPUM and DPE-Water during the consultation phase of the WMP. This review has identified areas for improvement of the TARPS, which have been summarised in Table 4.

The original TARPs as per the current version of the Water Management Plan are provided in Appendix E. Appendix F provides a marked-up version of the original TARPs so that the changes made throughout are evident and clear.

Following the revision of the TARPs, a re-assessment of the data against the TARPs noted that there were no residual TARP triggers for this reporting period. The LW S1A-S6A Water Management Plan and associated documents will be updated to reflect the changes made to the groundwater TARPs following the submission of the Annual Review (and this Six Monthly Subsidence Impact Report).

Upon submission of the Annual Compliance Reporting and TARP amendments, the Water Management Plan and associated documents (i.e. Groundwater Technical Report) will be updated to reflect these changes.

Table 4 Summary of proposed TARP updates

TARP	Proposed Changes	Reasoning
WMP9	Normal Conditions – additions of second dot point '*greater than 5 metre water level reduction in VWP intakes following the commencement of extraction for a period of less than 6 months*' Level 1 – addition of wording '*for a period of greater than 6 months*' Level 2 – addition of wording '*for a period of greater than 6 months*' Level 3 – addition of wording '*for a period of greater than 6 months*'	The current wording has no timeframe associated with the change in groundwater levels. Addition of a temporal scale provides greater clarity around trends in the water level (i.e. if only one month exceeds trigger but then we see a recovery it is unlikely due to mining impacts). A minimum of six months allows for trend analysis prior to enacting the TARP. Section 6.1.2.2 of the GTR* states: "Regionally, climatic variations have been observed to cause reductions in water levels of up to 5 m in shallow (< 200 m depth) VWPs. Therefore, a water level reduction of greater than 5 m for shallow VWP loggers for a period beyond 6 months is considered to be a possible indicator of greater than predicted impacts to groundwater (even if greater drawdown was predicted, the concept is to use this magnitude of drawdown as an early warning)." This approach was successfully adopted in the Western Domain Water Management Plan and TARPs. This informs the temporal scale of 6 months for inclusion into the TARP.
WMP10	Normal Conditions – update wording to reflect that within 30 metres of modelled drawdown is considered 'normal conditions', or if drawdown exceeds modelled impacts by greater than 30 metres for a period of less than three months. Level 1 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than three consecutive months. Level 2 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than six consecutive months.	The current trigger levels has NO level of variation below modelled drawdown which is too sensitive. The revision also adds a temporal scale in order to determine trends rather than triggers from isolated fluctuations. For example: Level 1: initially stated '*within 30 metres of predicted drawdown for a period of less than six months*'. If exceedance beyond model drawdown is by 2 cm for one month this would trigger Level 1. However, this is considered to be within the bounds of the model accuracy and not representative of a trend and therefore does not warrant a trigger. IAPUM feedback stated: *"For the trigger level wording:* *- the normal condition should be more clearly stated as 'observed levels are within (some measurable value – 10m?) of predicted impacts',*

TARP	Proposed Changes	Reasoning
	Level 3 – Observed drawdown exceeds the modelled predicted drawdown, by greater than 30 metres for more than twelve consecutive months.	*- for each of the levels 1,. 2 and 3 start with the words observed drawdown exceeds….' "* The 'normal' condition should allow for some reasonable variation from predicted impacts (not 'does not exceed' as is current). It is believed, in consideration of the overall level of predicted depressurisation, 30 metres beyond model predictions may be cause for review. Historically, the 30 metres has proven to be a successful and reasonable measure when utilised in the Western Domain WMP and TARPs. Within 30 metres of the modelled predicted drawdown should be considered 'normal conditions'. Given the point accuracy of the groundwater model at each point, using a value of less than 30 metres here is considered unreasonable, with review undertaken at the model review every three years. Additionally, if predicted impacts are exceeded by greater than 30 metres but for a period of less than 3 months, this is not considered representative of a trend and is still within 'normal conditions'. To enact various TARP Levels, the temporal scale over which we observe this variation from modelled drawdown will be instated. This is a logical and realistic approach to identify potential exceedances in impact via extraction to the groundwater system. Wording edited from 'for a period of' to 'consecutive months' for consistency and clarity across the TARPs.
WMP11	Level 1 – amend wording to state 'Observed salinity and/or metals or pH outside of defined trigger levels1 for *3 consecutive months or more'* Level 2 – amend wording to state 'Observed salinity and/or metals or pH outside of defined trigger levels1 for *3 consecutive months or more'*	The current wording does not include a timeframe associated with changes in water quality. Propose inclusion of a temporal scale to the TARP levels in order to determine trends rather than typical fluctuations in water quality. Without a temporal scale, isolated fluctuations are triggering TARPs which are unrepresentative of any trends associated with potential response to longwall extraction.

TARP	Proposed Changes	Reasoning
	Level 3 – edit temporal scale from 3 to 6 months of consecutive breach of trigger.	
WMP13	Instate P50 as an early warning bore (as soon as commissioned), to replace P51. Rewording associated with GW075409–1, GW075409–2, GW075410, GW075411 to clarify that these are part of the broader monitoring network, however are not trigger bores.	Due to land access issues the location of P51 required alteration and is now located above LWS5A and is not considered a suitable early warning bore. As the TARP currently reads, the Thirlmere Lakes Bores (GW075409–1, GW075409–2, GW075410, GW075411) would require specific trigger levels as part of GWMP8 and WMP11. However, given their distal proximity to the mine development and the purpose of WMP8 and WMP11, inclusion of these bores is considered inappropriate. It is proposed that the most suitable approach to identifying potential impacts to the Lakes is to use the 'early warning bores' to enact the trigger, which will then subsequently review the Thirlmere Lakes bores for potential impacts. The wording in the TARP has been amended to reflect this approach.

* GTR – Groundwater Technical Report (SLR, 2022)

7 Trigger Level Review

A review of the monitoring data compared to the trigger levels has been conducted to identify if any triggers have occurred that would enact the TARP.

Given the identified sensitivities with the current TARPs, the following sections report both triggers against the original and the modified TARPs. In light of the proposed amendments, there are no TARPs triggered over the reporting period, October through December 2022.

7.1 WMP8 - Shallow OSPs and Private Bores (WMP8)

There are no proposed changes to WMP8, and all bores were within normal conditions for the reporting period (Table 5).

Table 5 TARP Level Review – WMP8

Bore	Groundwater Level prior to LW S1A (m AHD)	TARP Level Triggers			Maximum drawdown since LW S1A start (m)	Drawdown as of December 2022 compared to pre-mining GWL (m)
		Oct-22	Nov-22	Dec-22		
Shallow standpipes						
P51A	298.1				-	-
P51B	299.2				-	-
P52A	249.6				-	-
P53A	257.2				2.8	2.8
P53B	257.2				-	-
P53C	255.9				-	-
P54A	DRY	DRY	DRY	DRY	NA	NA
P54B	DRY	DRY	DRY	DRY	NA	NA
P55A	273				2	2
P55B	268.7				0.7	0.7
P55C	262.7				4.7	4.7
P56A	291				-	-
P56B	280.5				0.8	0.8
P56C	259.6				3.4	3.4
REA4	250.3				0.3	0.3
Private Bores						
GW062068	276.3				-	-
GW104008	235.2				-	-
GW104323	259.1			*	-	-
GW104659	252.4				-	-
GW105395	324				-	-
GW109257	282.7				-	-
GW112473	296				-	-

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

7.2 WMP9 - Shallow VWPs (sensors <200 metres)

The TARP WMP9 required amendment, and consequently, presented in Table 6 are the triggered TARP levels for both the original and updated TARPS, represented on the lower left and upper right quadrants respectively.

It is noted, that groundwater pressures at TBC032 HBSS 131m declined by approximately 6 metres through November and December 2022 which as per the original WMP would trigger Level 2. However, this only occurred temporarily and has since observed some recovery in the pressure. This validates the requirement for a temporal scale on the TARP levels. Under the revised TARPs, this is not yet triggering a response.

Table 6 TARP Level Review – WMP9 (original (lower left) and updated (upper right))

Bore	Groundwater Level prior to LW S1A (m AHD) [TARP Groundwater Reference Level]	TARP Level Triggers			Maximum drawdown since LW S1A start (m)	Drawdown as of December 2022 compared to pre-mining GWL (m)
		Oct-22	Nov-22	Dec-22		
Shallow VWPs (<200 mbgl)						
TBC09HBSS-30m	326.6 [287.6]				0.3	0.3
TBC09HBSS-75m	325.1 [309.4]				-	-
TBC09BHCS-182m	308.3 [293]				0.1	0.1
TBC09 BGSS-192m	292.7 [290.4]				-	-
TBC018 WWFM/HBSS-70m	250.5 [250.5]				0.7	0.7
TBC018 WWFM/HBSS-117m	253.6 [251.9]				0.6	0.6
TBC018 - HBSS (lower) -164m	249.9 [250.7]				0.7	0.7
TBC018 BHCS -179m	248.4 [248.5]				0.6	0.6
TBC018 BGSS -198m	244.4 [244.7]				0.7	0.7
TBC024 HBSS-117m	322.4 [287.6]				-	-
TBC024 HBSS-139m	256.0 [287.0]	#	#	#	-	-
TBC024 BHCSS-168m	300.7 [289.5]				-	-
TBC024 BGSS-185m	308.6 [289.3]				-	-
TBC027 HBSS-95m	321.8 [320.1]				1.3	1.3
TBC027 HBSS-132m	313.6 [312.8]				2.6	2.6
TBC027 HBSS-169m	312.9 [312.2]				2.5	2.5
TBC027 BHCS-181m	309.9 [310.7]				2.1	2.1
TBC027 BGSS-198m	308 [310.3]				0.3	0.3
TBC032 HBSS-95m	262.6 [262.3]				4.3	4.3
TBC032 - HBSS-131m	255.6 [255.0]				6.6	6.6
TBC032 - HBSS-168m	280.7 [266.9]				2.1	2
TBC032 - BHCS-181m	243.8 [242.8]				5.8	5.8
TBC032 - BGSS-200m	245.1 [243.8]				5.5	5.5
TBC034 HBSS-65m	372.4 [371.8]				-	-
TBC034 HBSS-113m	507.2 [368.0]	~	~	~	-	-
TBC034 HBSS-161m	358.0 [358.4]				-	-
TBC034 BHCS-176m	233.3 [354.9]	~	~	~	-	-
TBC034 BGSS-196m	360.9 [358.3]				-	-
TBC039 HBSS-65m	313.6 [313.5]				-	-

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

7.3 WMP10 - Deep VWPs (sensors > 200 metres)

WMP10 resulted in numerous Level 1 TARPs triggered based on the original wording, as noted in the bottom left quadrants of Table 7. However, as presented in Column 6, the maximum drawdowns since commencement of LW S1A are overall very small. Consequently, the updated TARP now allows for these small fluctuations that do not warrant TARP triggers. Based on the updated TARP, there are currently no TARP levels triggered over the reporting period (see top right quadrants of columns C, D and E of Table 7).

Table 7 TARP Level Review – WMP10 (original (lower left) and updated (upper right))

Bore	Groundwater Level prior to LW S1A (m AHD) [TARP Groundwater Reference Level]	TARP Level Triggers			Maximum drawdown since LW S1A start (m)	Drawdown as of December 2022 compared to pre-mining GWL (m)
		Oct-22	Nov-22	Dec-22		
Deep VWPs (greater than 200 mbgl)						
TBC09 BGSS-332m	236				0.3	0.3
TBC09 BGSS-343m	270.1				1	1
TBC09 SBSS-357m	202.6				0.8	0.8
TBC09 BUSM-381m	^	^	^	^	NA	NA
TBC09 WWCO-391m	243.6				1.1	1.1
TBC09 WWCO-397m	221.1				-	-
TBC18 BGSS-282m	238.6				0.76	0.76
TBC18 BGSS-366m	217.1				0.5	0.5
TBC18 WBCS-377m	~				~	~
TBC18 BUSM-404m	218.5				0.4	0.4
TBC18 WO-432m	215.1				0.5	0.5
TBC20 BGSS (mid)-211m	243.3				4.8	4.8
TBC20 BGSS (mid)-293m	239.3				0.4	0.4
TBC20 BGSS (mid)-375m	246.4				0.7	0.3
TBC20 WBCS-397m	^	^	^	^	0.8	0.3
TBC20 BGSS (upper)-411m	216.2				-	-
TBC20 WO-434m	220				-	-
TBC20 WO-439m	~	~	~	~	~	~
TBC26 BGSS (mid)-211m	203.2				-	-
TBC26 BGSS (mid)-278m	198.9				0.1	0.1
TBC26 BGSS (mid)-344m	204.1				0.2	0.2
TBC26 WBCS-409m	220.2				0.2	0.2
TBC26 BUSM-432m	114.5				4.8	4.8
TBC26 ECSL-440m	199				0.1	0.1
TBC26 ECSL-460m	221.1				-	-
TBC32 BGSS-200m	245				5.4	5.4
TBC32 BGSS-237m	234.7				0.4	0.4
TBC32 BGSS-294m	232.8				0.7	0.7
TBC39 BGSS-243m	214.2				-	-
TBC39 BGSS-299m	231.8				1.2	1.2
TBC39 SBSS-354m	250.1				0.2	0.2
TBC39 BUSM-375m	259.6				0.4	0.4
TBC39 WWCO-402m	266.3				0.3	0.3

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

"": no data available*

7.4 WMP11 – Groundwater Quality

Review of the groundwater quality against the revised trigger levels for the TARPS was only undertaken for November and December 2022, noting that at the time of monitoring in October 2022, extraction was yet to commence.

The groundwater quality triggers were developed based on a relatively short baseline period, and consequently, are unlikely to have captured the full range of natural variation. The original wording of the TARP as per the Water Management Plan does not have any temporal allowance, therefore not allowing for a trend to develop to indicate potential impact via mining. This approach does not allow for atypical measurements to be considered with adjacent data prior to triggering a TARP. For example, an erroneous data point or a response to an extreme climatic event may result in one point breaching a trigger level which will resolve the following month.

Table 8 presents the TARP Levels triggers for the OSPs and Private Bores, for the original TARPs in the lower left quadrant, and revised TARPs in the upper right quadrant. Based on the revisions to the TARPs, there are no triggers identified across the reporting period.

Table 8 TARP Level Review – WMP 11 ((original (lower left) and updated (upper right))

Bore	Month	TARP Level Exceeded														
		EC (µS/cm)	pH lower	pH upper	Fe	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr	Se
Shallow OSP																
P51A	Nov															
	Dec															
P51B	Nov															
	Dec															
P52	Nov															
	Dec															
P53A	Nov															
	Dec															
P53B	Nov															
	Dec															
P53C	Nov															
	Dec															
P54A	Nov		*	*												
	Dec		*	*												
P54B	Nov															
	Dec		*	*												
P55A	Nov															
	Dec		*	*												
P55B	Nov															
	Dec															
P55C	Nov															
	Dec															
P56A	Nov															
	Dec															
P56B	Nov															
	Dec															
P56C	Nov															
	Dec															
GW062068	Nov															
	Dec															
GW104008	Nov															
	Dec															
GW104323	Nov															
	Dec															
GW104659	Nov															
	Dec															
GW105395	Nov															
	Dec															
GW109257	Nov															
	Dec															
GW112473	Nov															
	Dec															

Normal Condition TARP Level 1 TARP Level 2 TARP Level 3

"": no data available*

7.5 WMP12 – Groundwater Surface Water Interaction

There were no changes recommended to WMP12, or WMP8 upon which is references. Given there were no TARP levels triggered for WMP8 it is considered that the Groundwater – Surface Water interactions are within normal conditions.

A discussion with ACTWilliams, the surface water consultant, confirmed that there was no need for additional investigation into groundwater – surface water interaction with no surface water TARPs triggered during the reporting period.

7.6 WMP13 – Groundwater Bore Monitoring for Thirlmere Lakes

WMP13 references WMP8 and WMP11, specifically for the early warning bores identified. As there were no TARP levels triggered for either of these, the groundwater bores monitoring for Thirlmere Lakes can be considered to be within normal conditions.

8 Groundwater Take – Mine Inflows

For the period 2009 to December 2022 (latest record used in calculations up to 31th December 2022), observed inflows to Tahmoor Mine have been within the range of 2 to 6 ML/d.

Figure 5 shows the cumulative groundwater inflows (as calculated from the mine water balance and pump-out records) for each water year since the 2019-2020 water year (i.e. since the commencement of mining on the Western Domain).

The reporting period October-December 2022 falls within the water year calendar 2022-23. The observed cumulative groundwater make for the water 2022-23 is 546 ML and remains below the groundwater entitlement of 1,642 ML per annum (i.e. water year) as of December 2022 (Figure 5). This is below the water licence on a pro-rata basis.

The Western Domain blocks have been sealed in October 2022 and since then an average groundwater inflow of 2.3 ML/day is reported from the Tahmoor North/South workings.

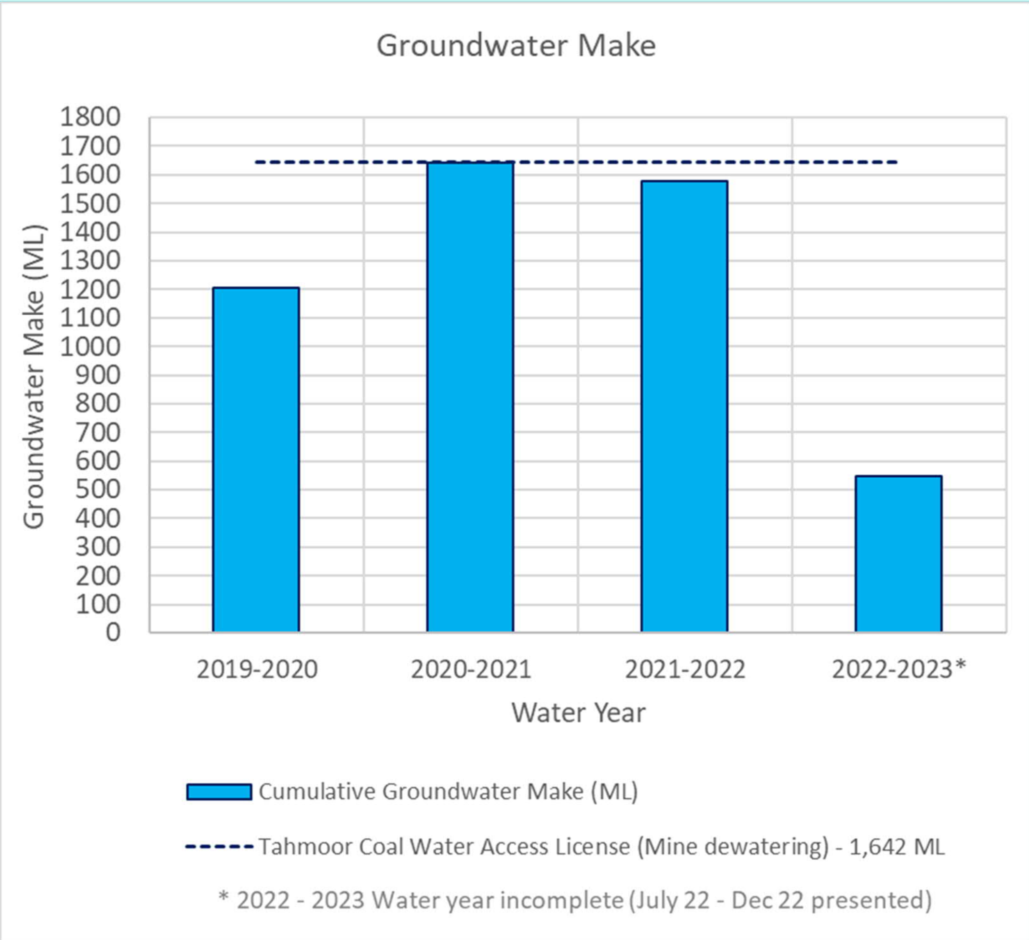


Figure 5 Groundwater Make per Water Year (from 2019-20 to 2022-23)

9 Recommendations

Based on the findings of this review, the following recommendations are made:

- Revision of the TARPs be undertaken as prescribed in Table 4 to make them less sensitive and fit for purpose;
- At the next 6-monthly reporting period, review the baseline data in conjunction with the additional data collected to that point. If no impact from mining has been identified, consider incorporating the additional data points into the ‘baseline’ period and recalculating the triggers to capture the natural variability of the system.
- Install and commence monitoring at P50, in order to replace P51 as an early warning bore in WMP13.

10 References

SLR, 2022. Extraction Plan Groundwater Technical Report. Prepared for Tahmoor Coal, October 2022. SLR Report: 610.30637.00000-R01

Tahmoor Coal Pty Ltd, 2022. Water Management Plan – Tahmoor South Domain – Longwalls South 1A-South 6A. May 18,2022. Report: TAH-HSEC-00361.

Appendix A:

Hydrographs for Shallow OSPs and Private Bores

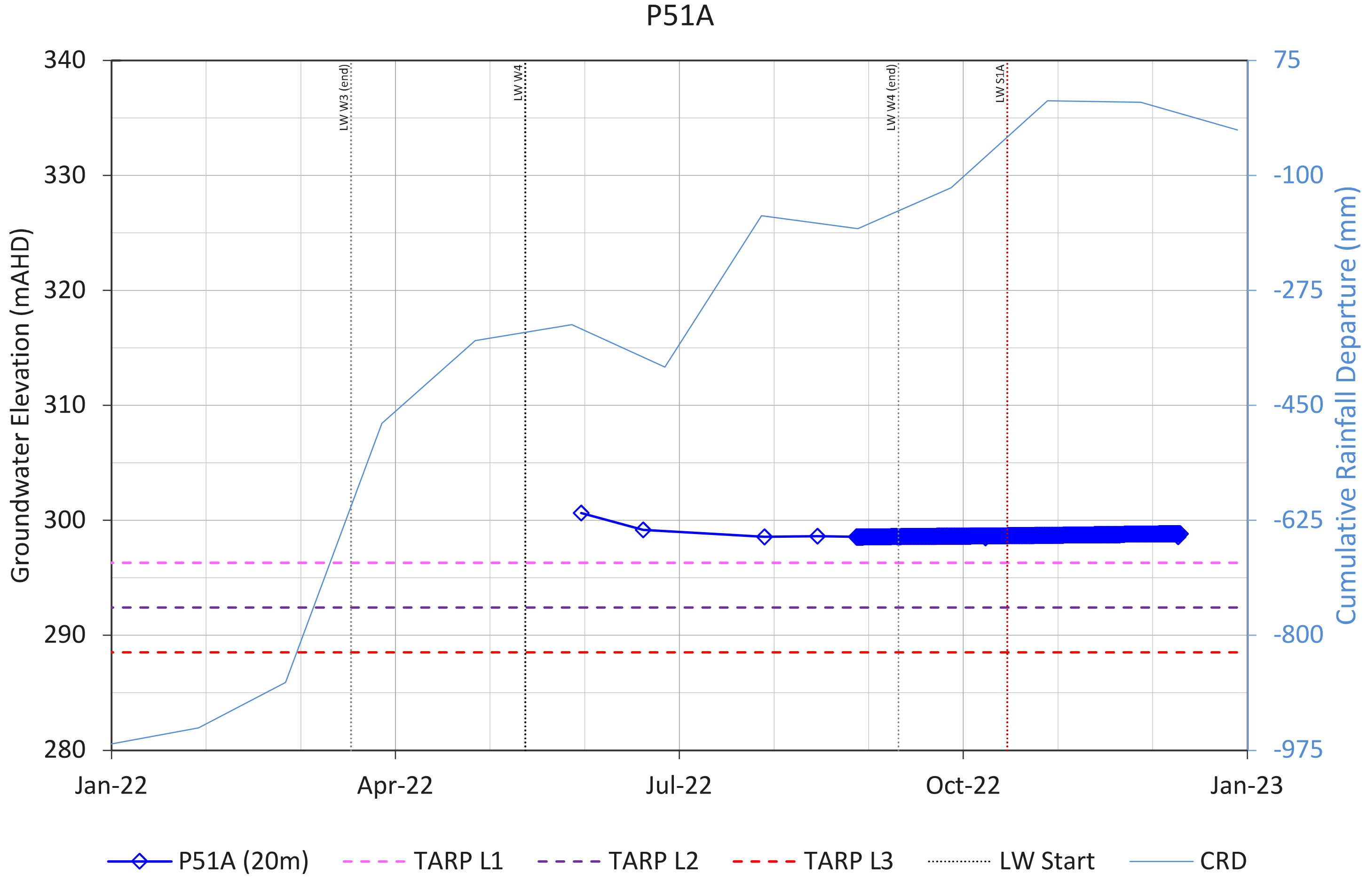


Figure A1

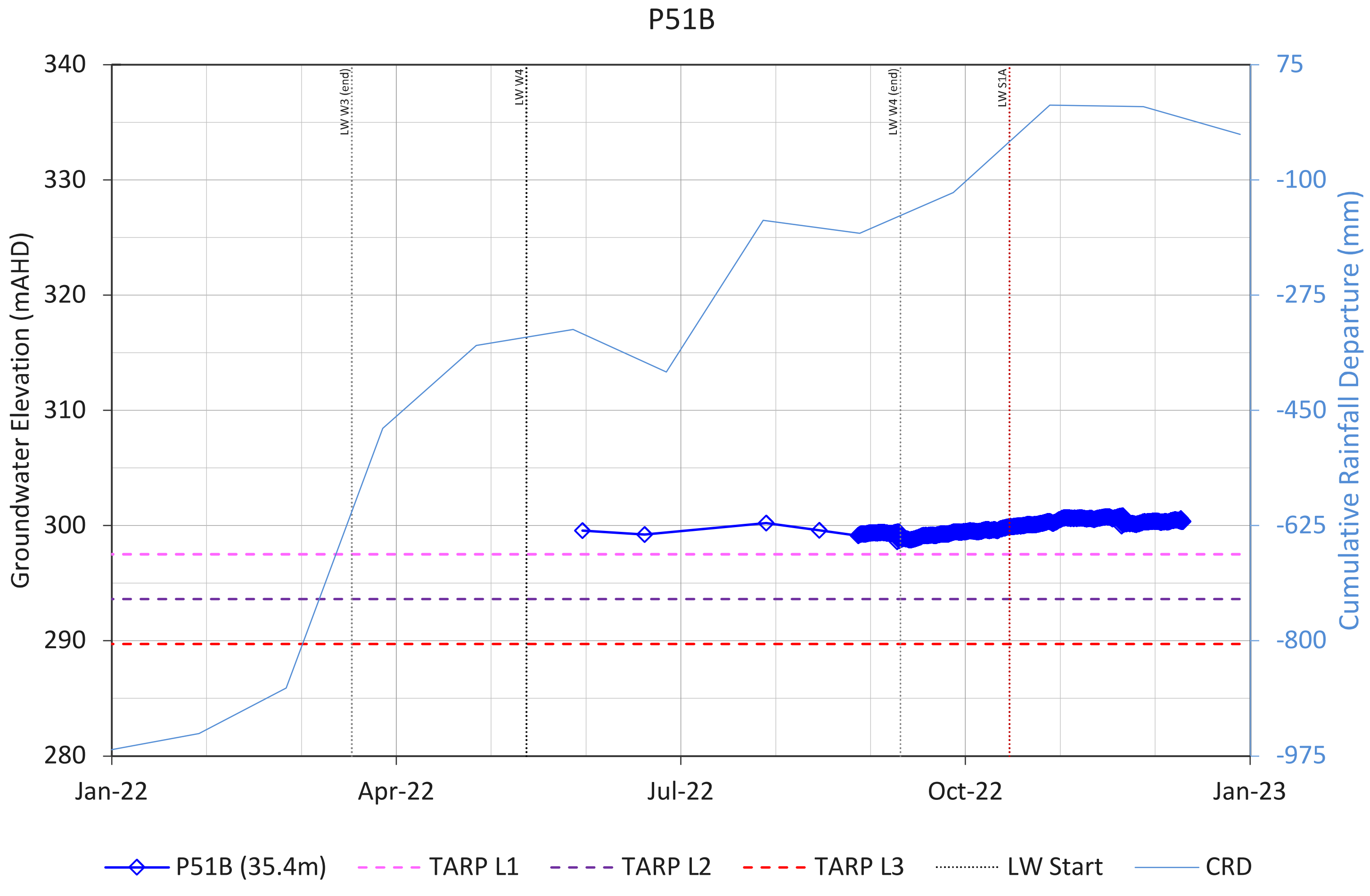


Figure A2

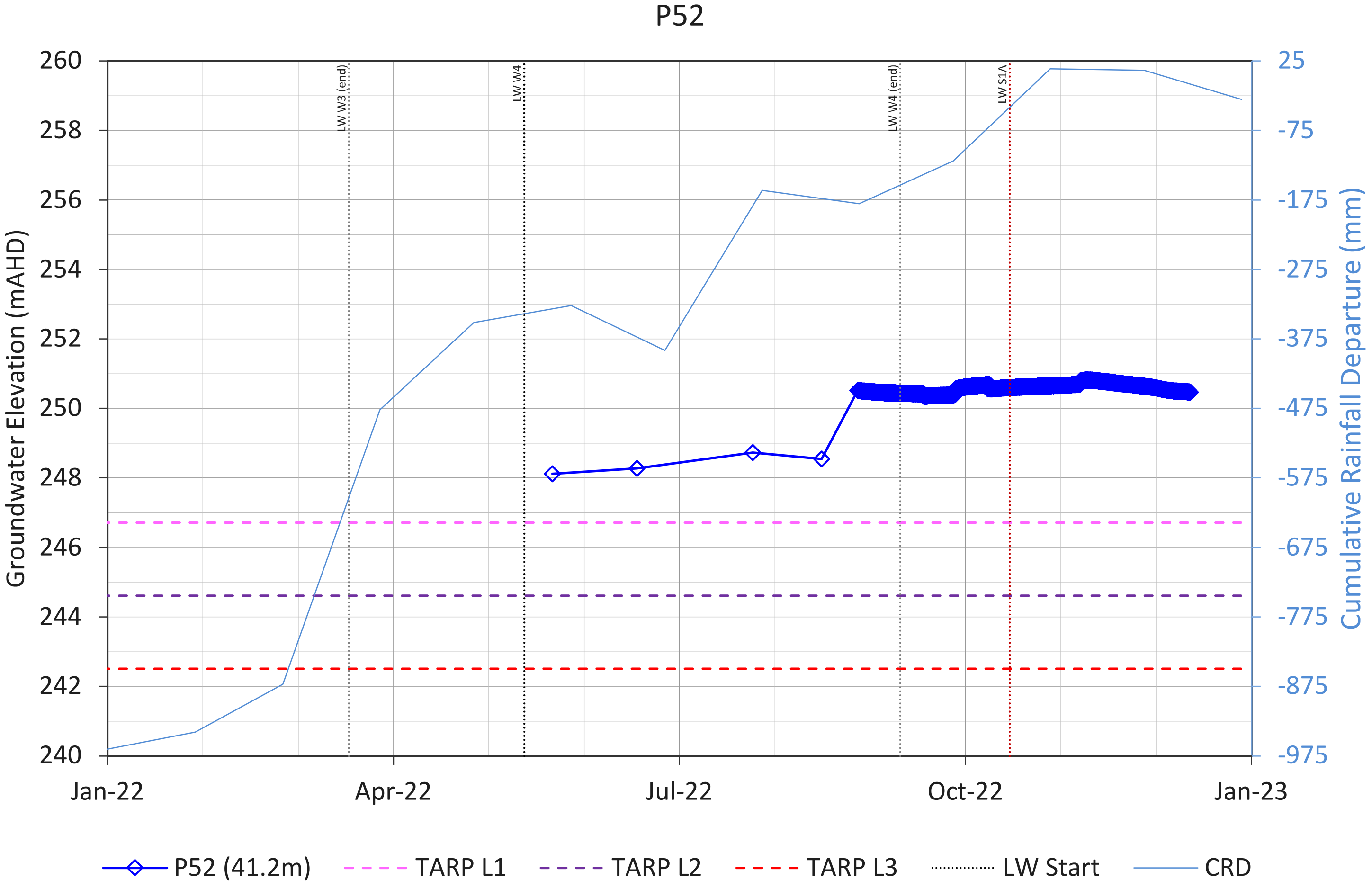


Figure A3

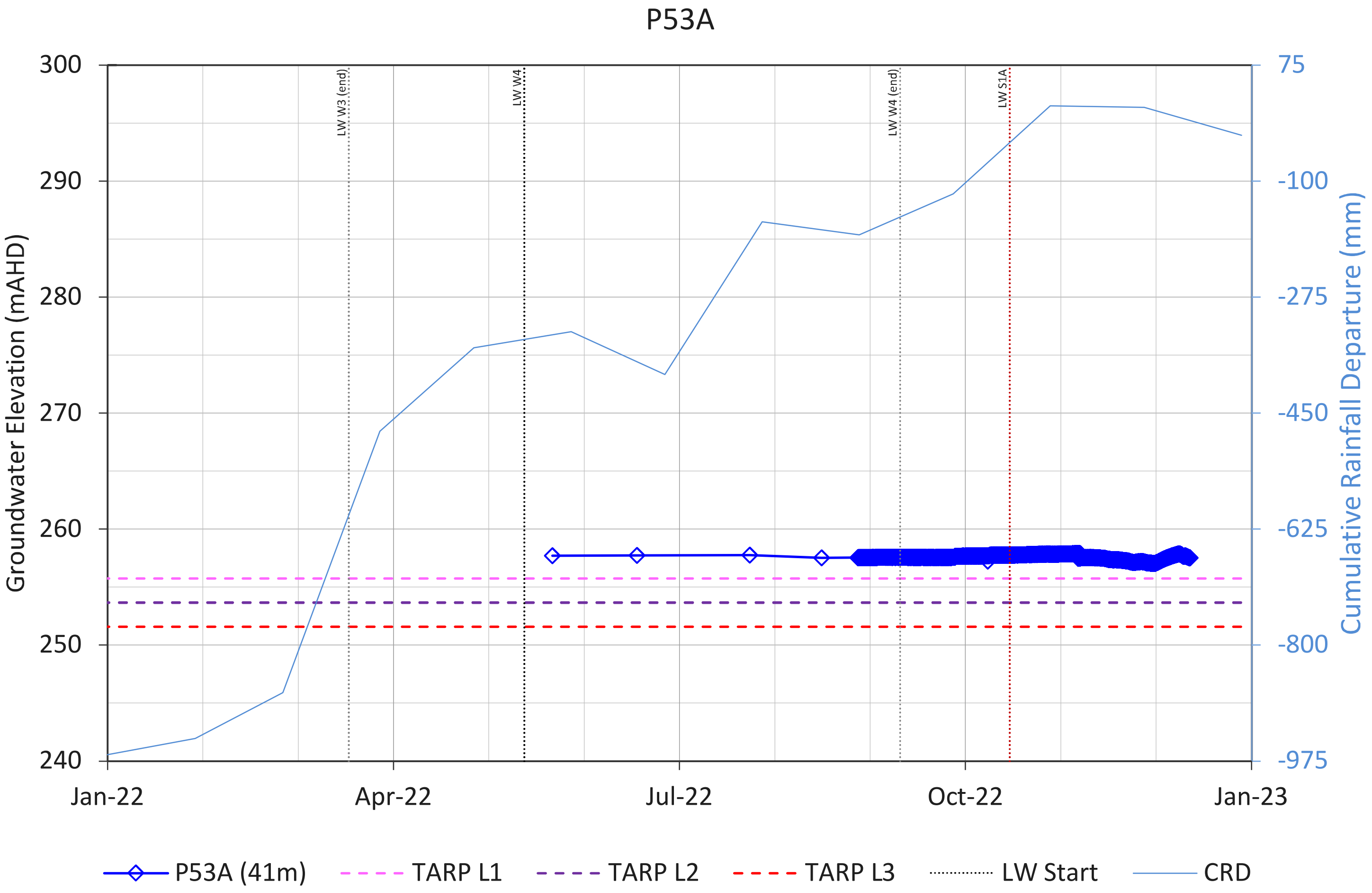


Figure A4

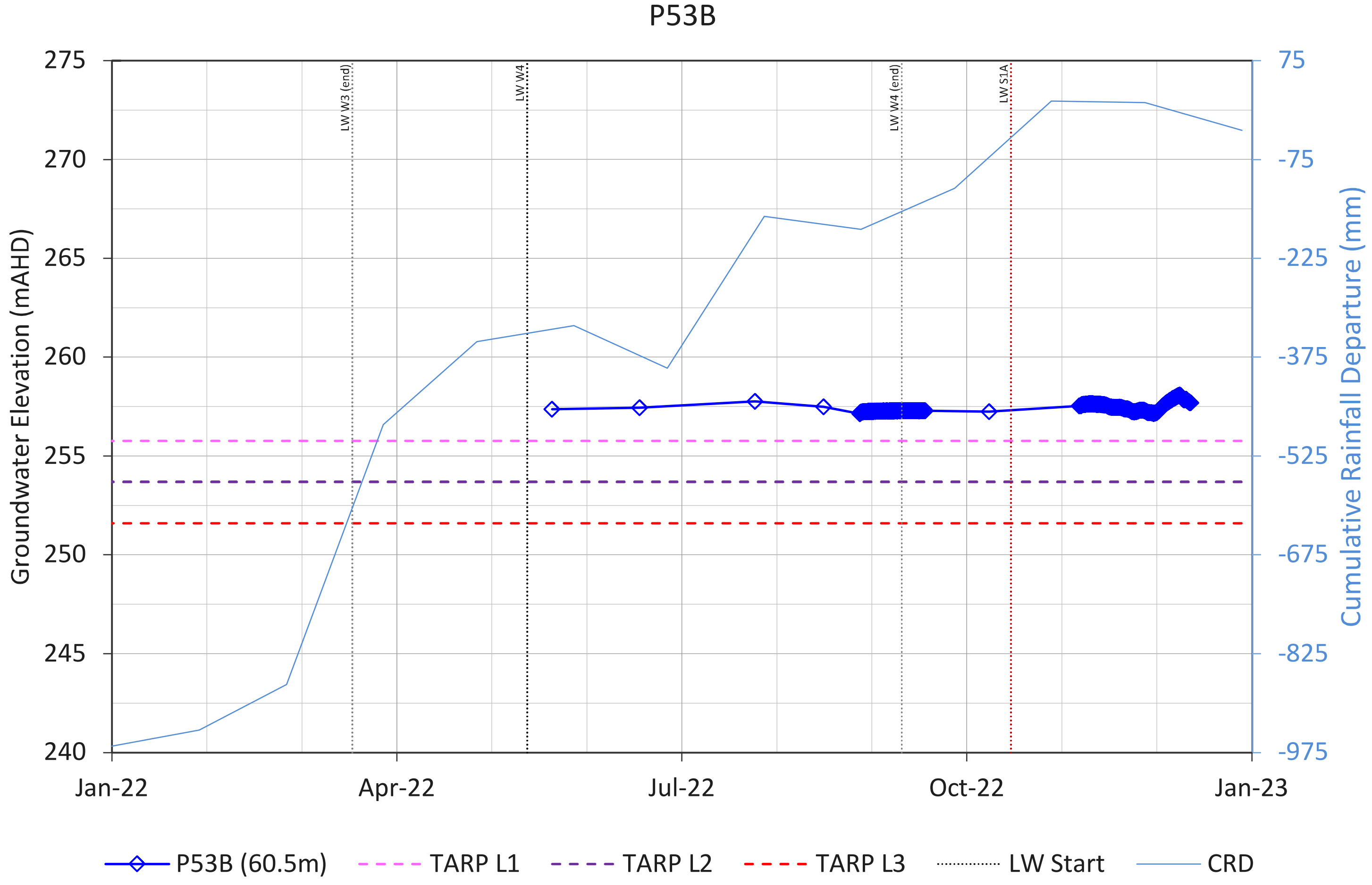


Figure A5

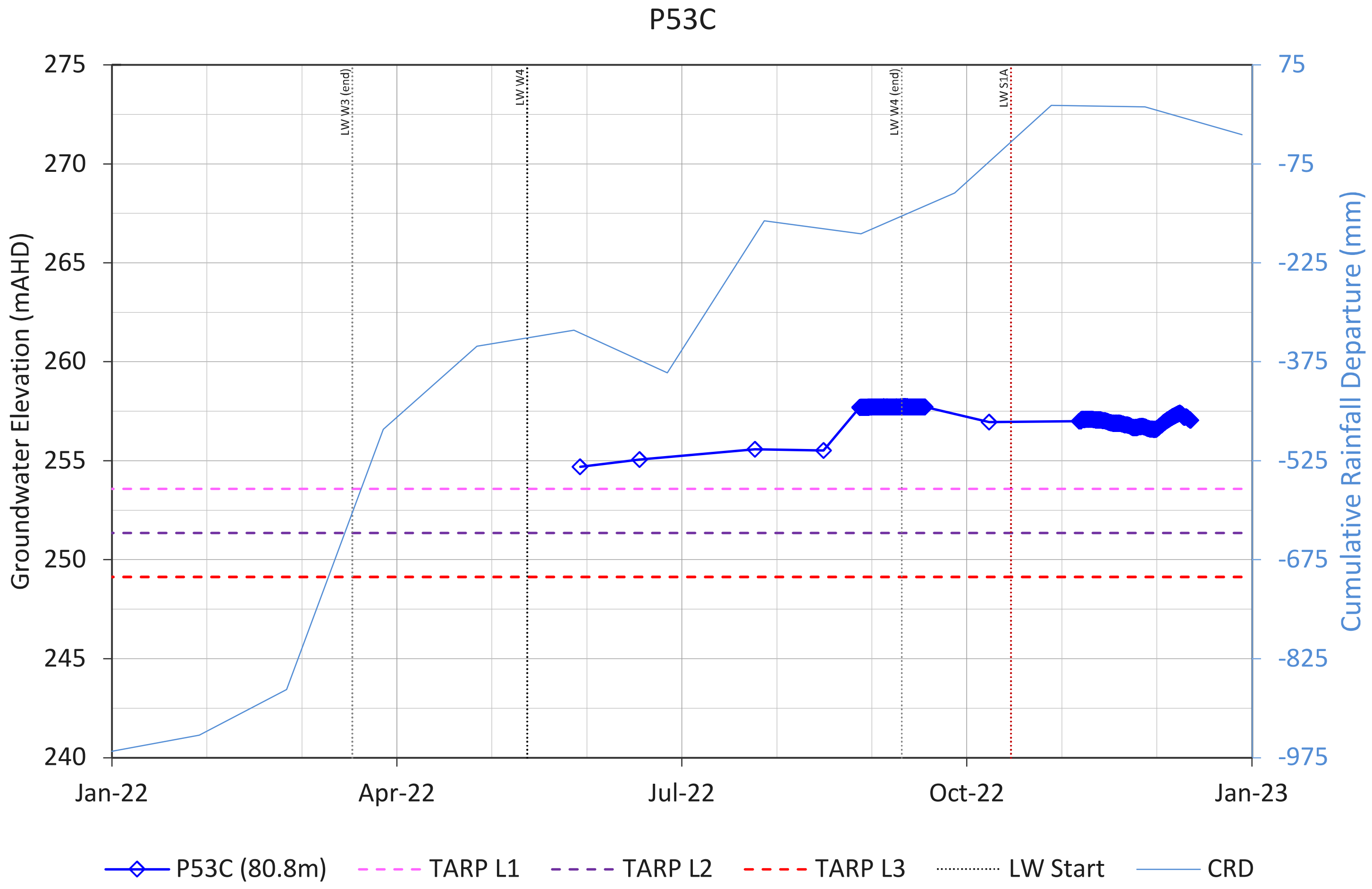


Figure A6

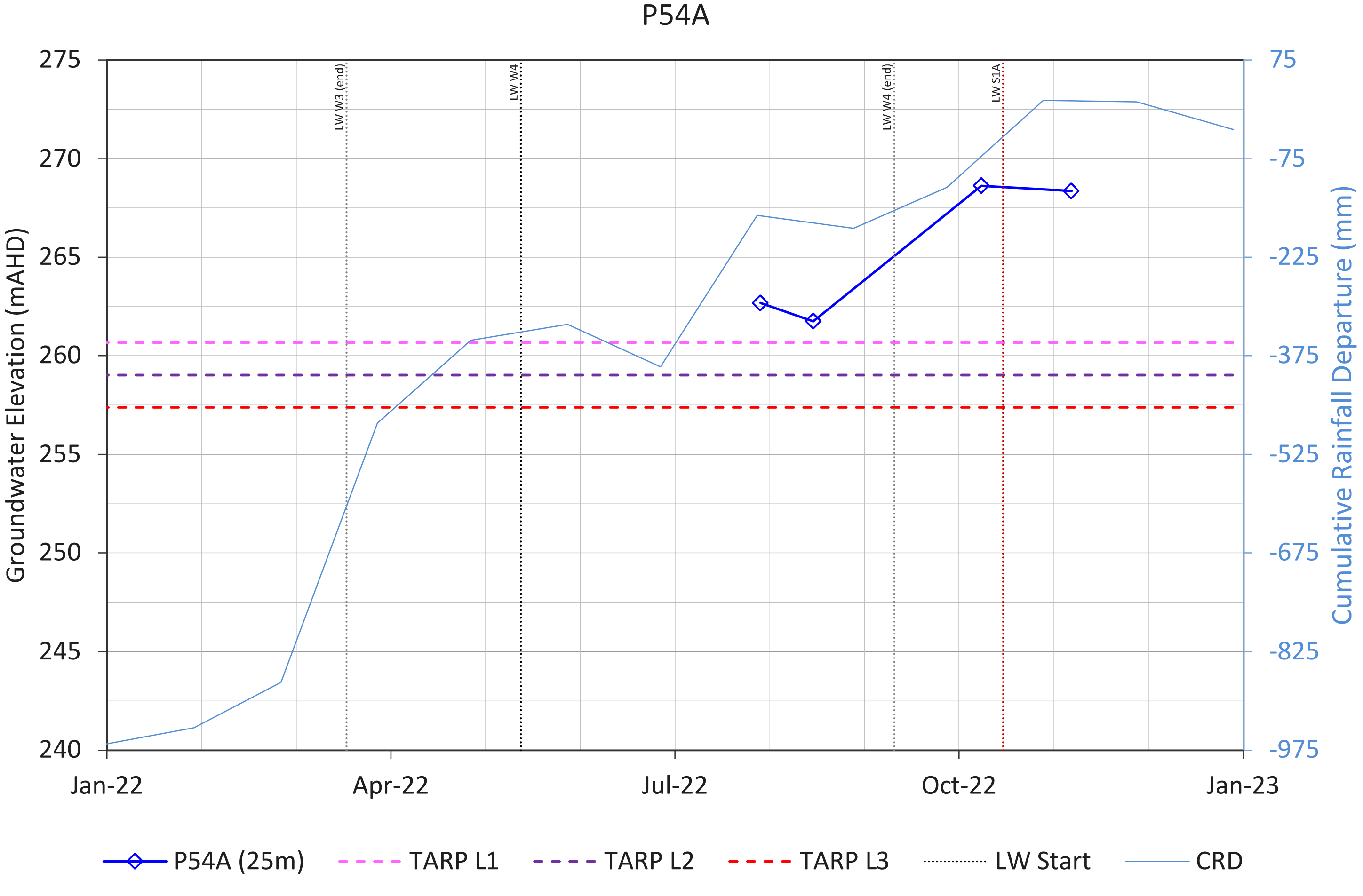


Figure A7

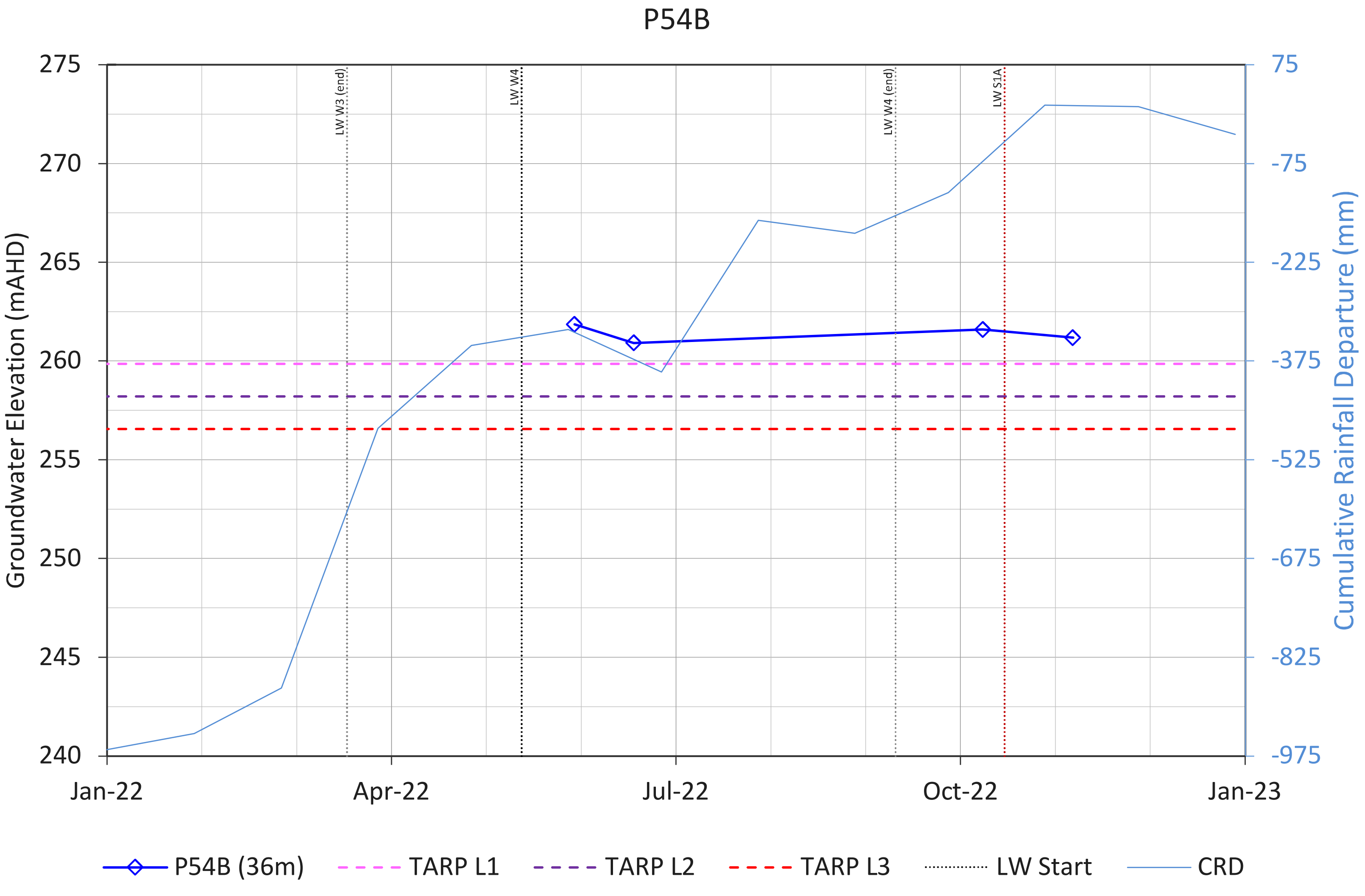


Figure A8

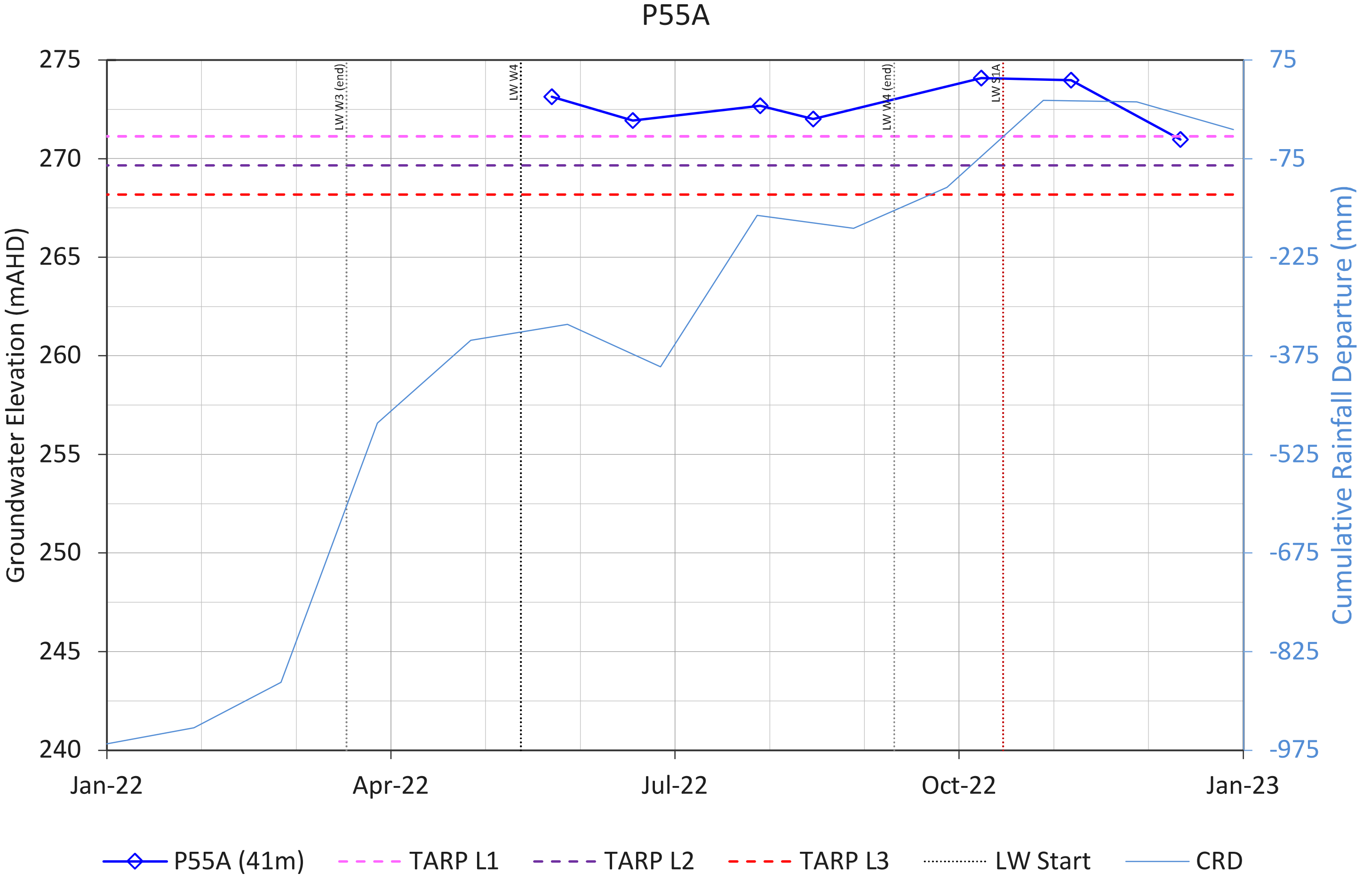


Figure A9

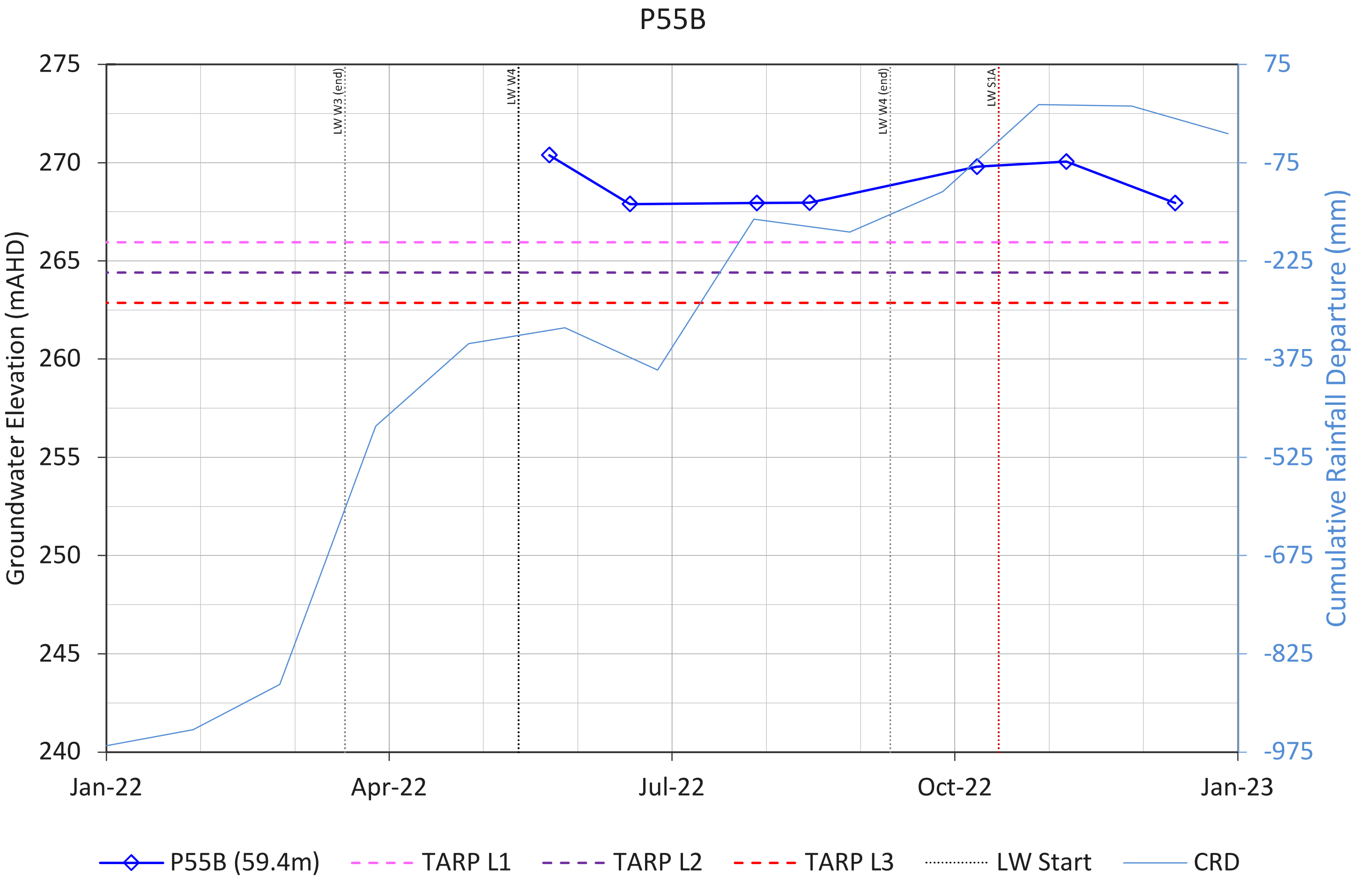


Figure A10

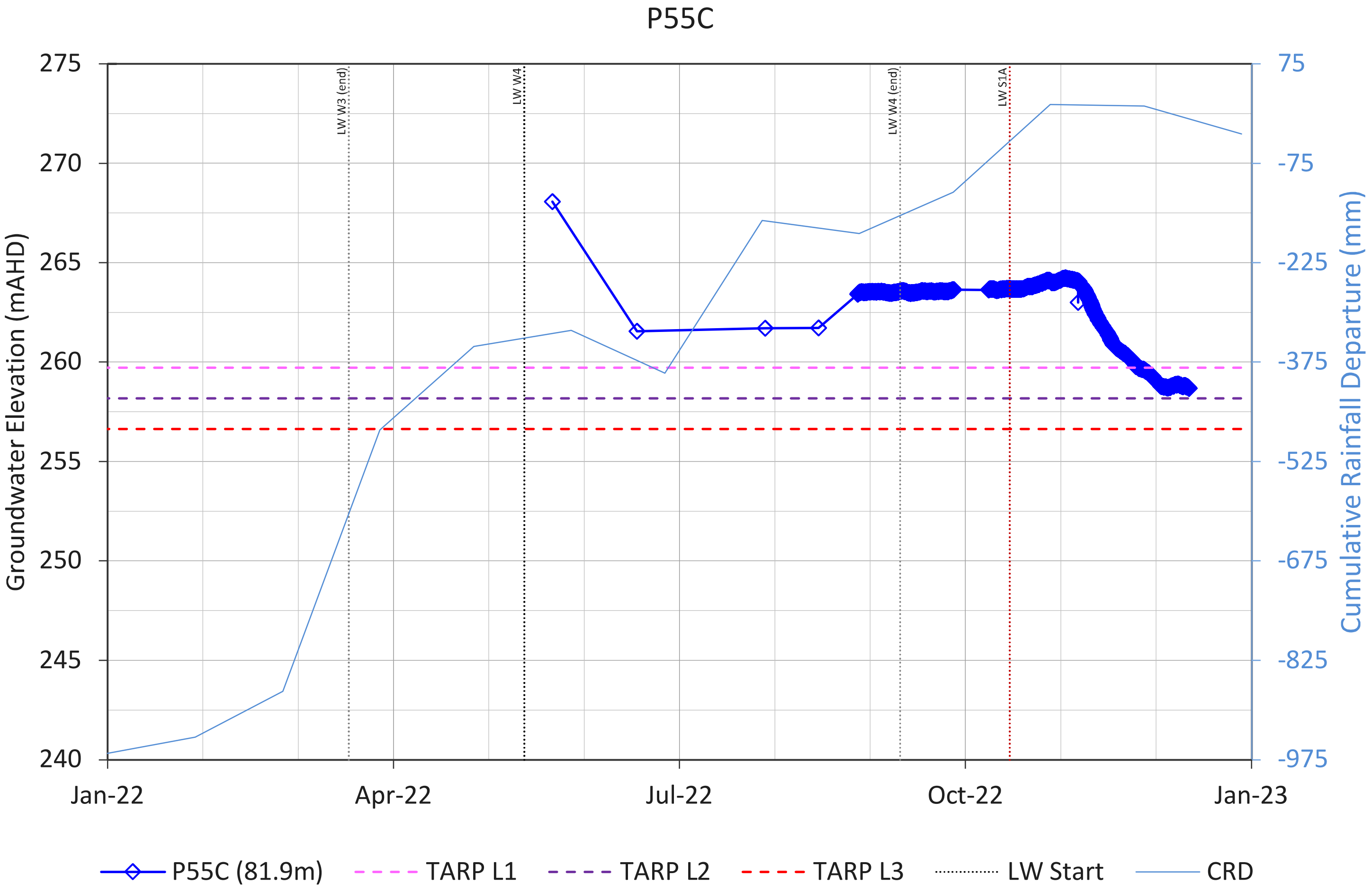


Figure A11

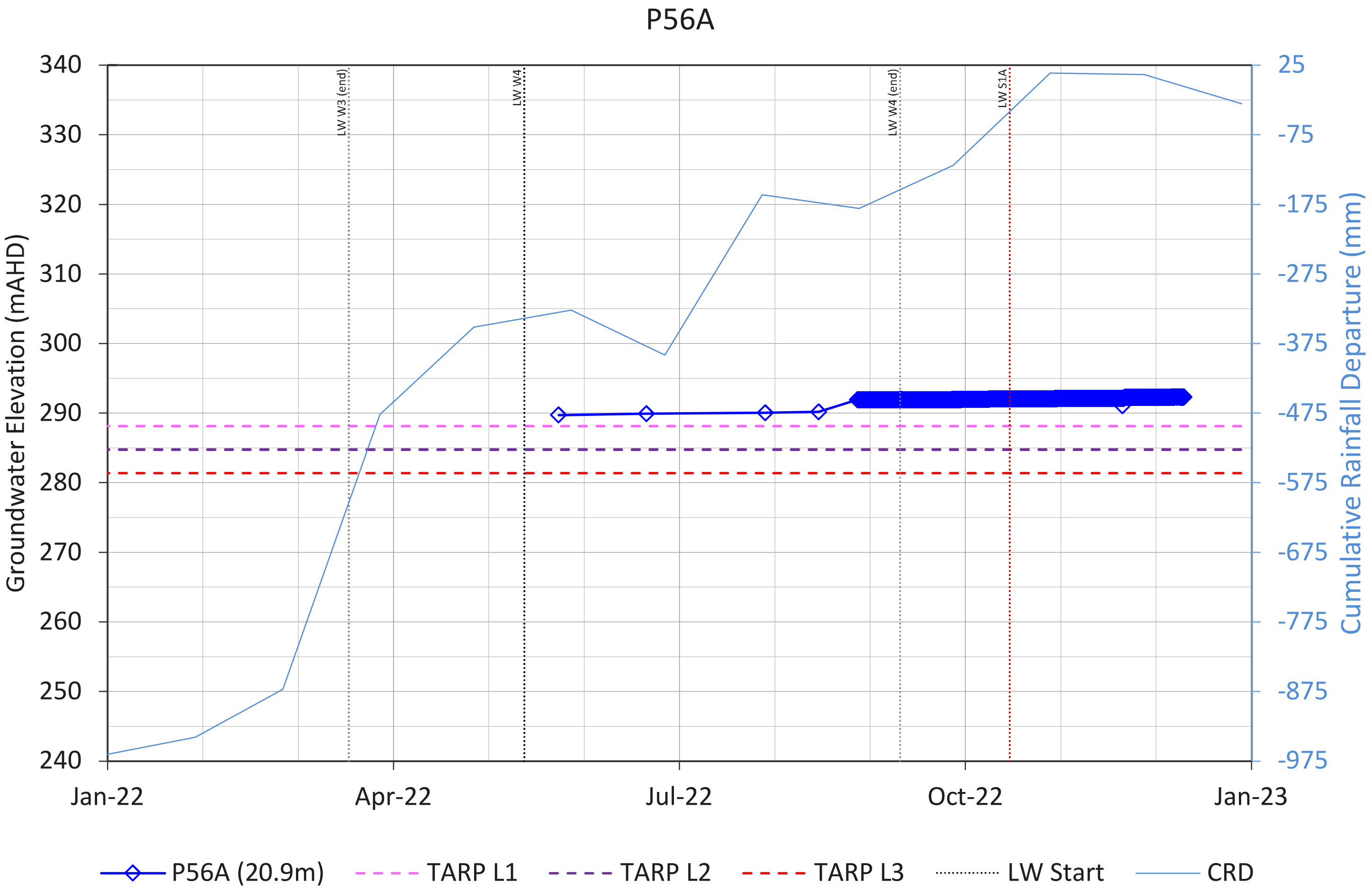


Figure A12

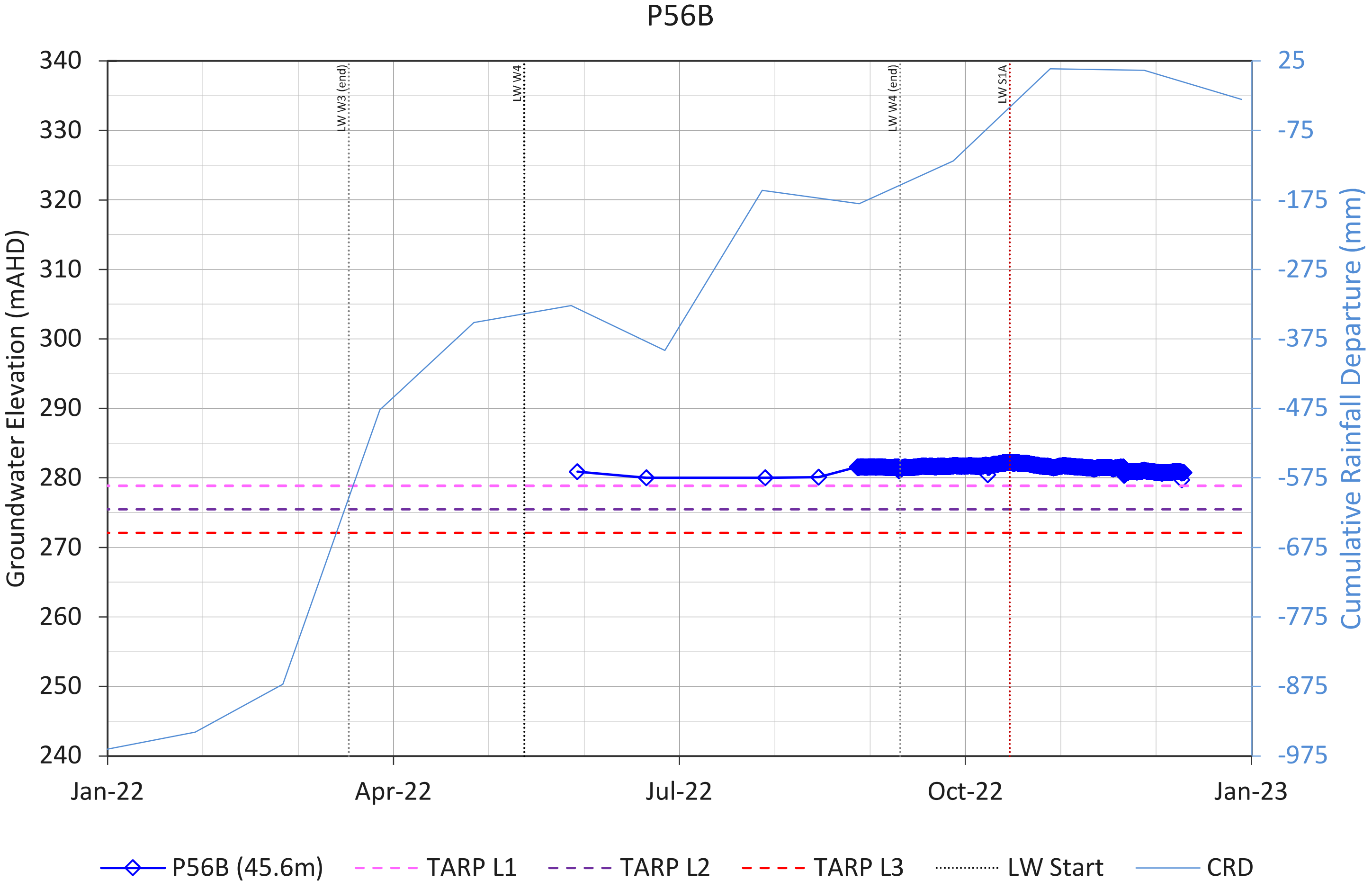


Figure A13

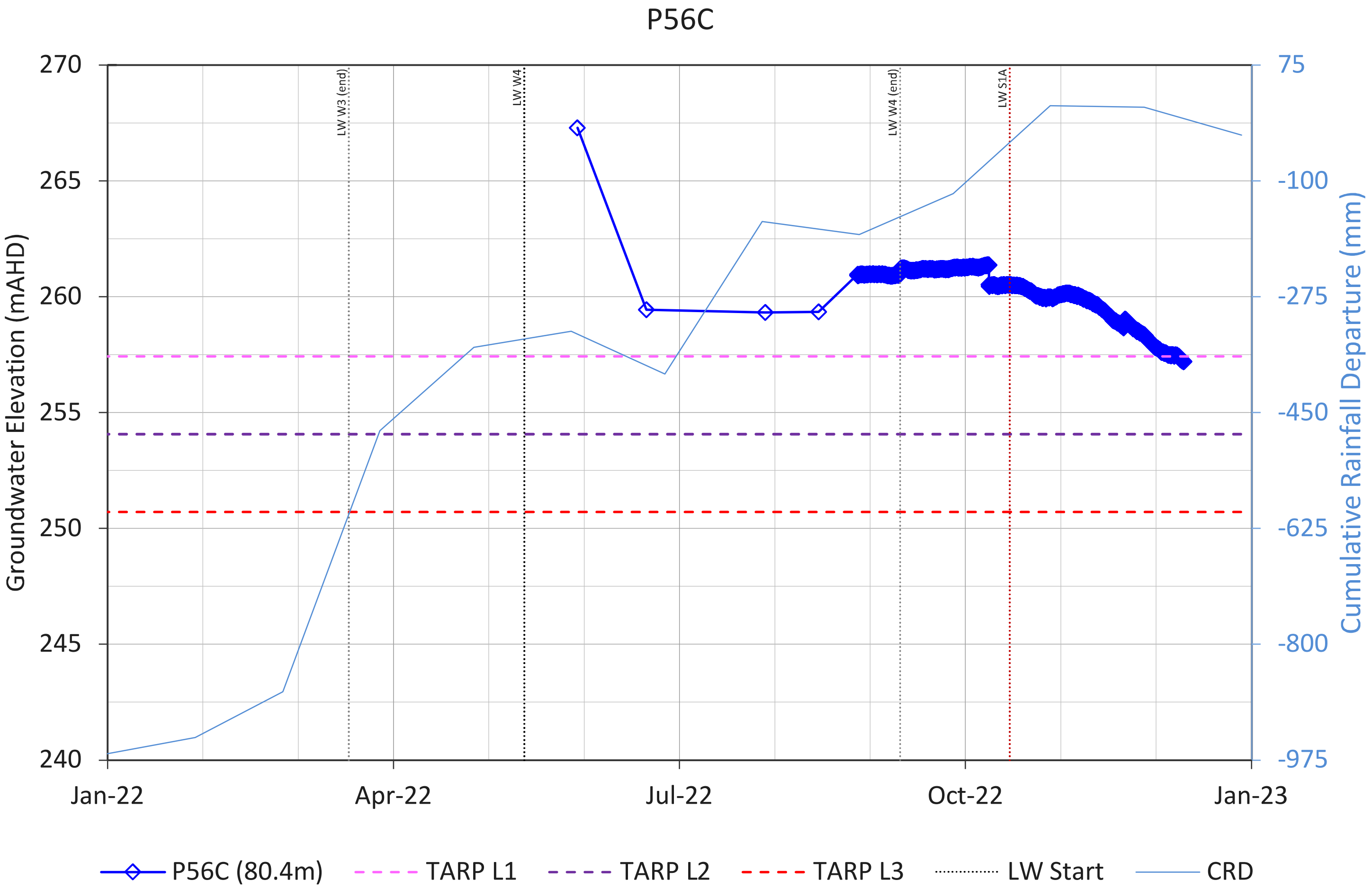


Figure A14

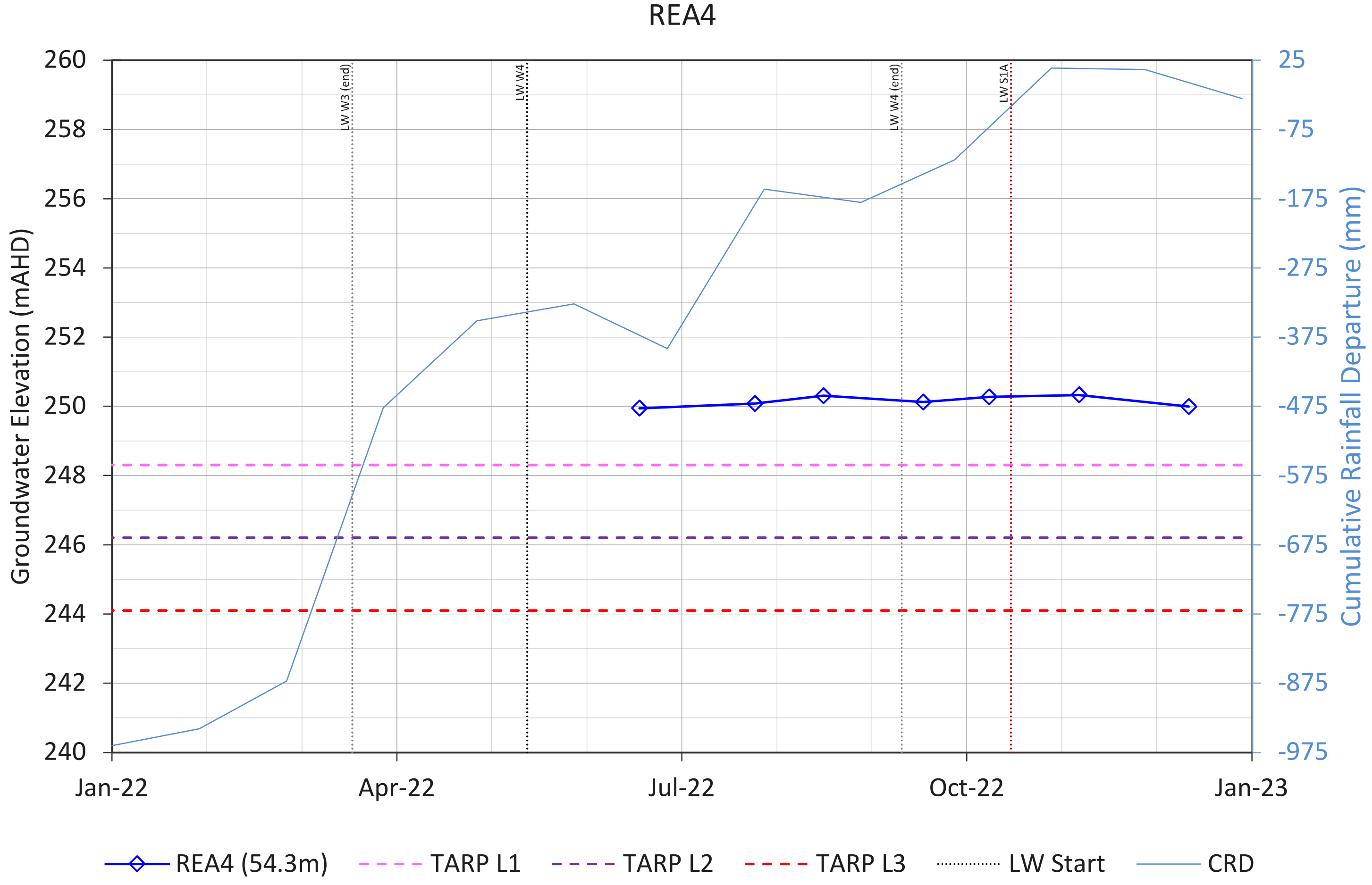
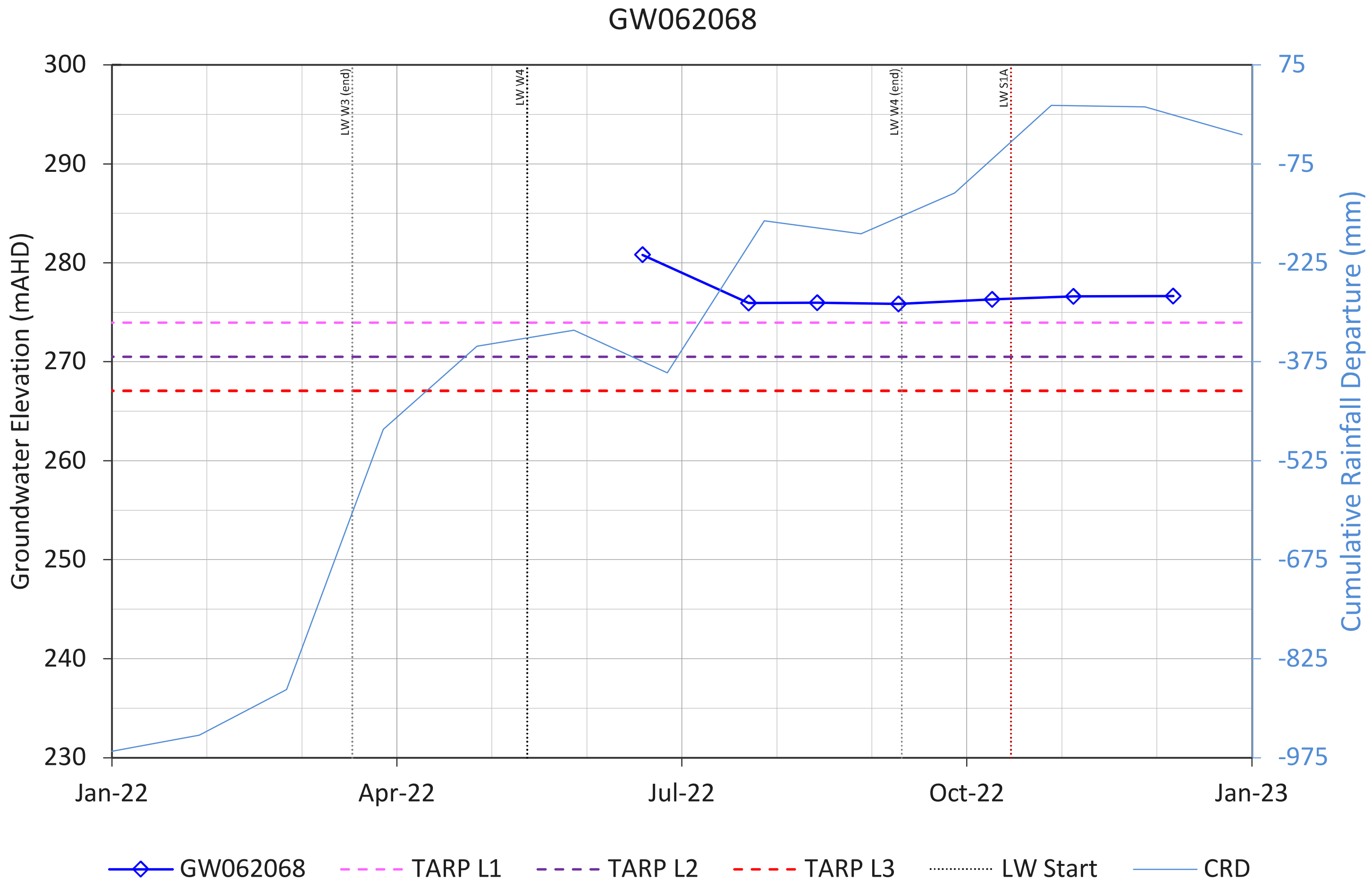


Figure A15



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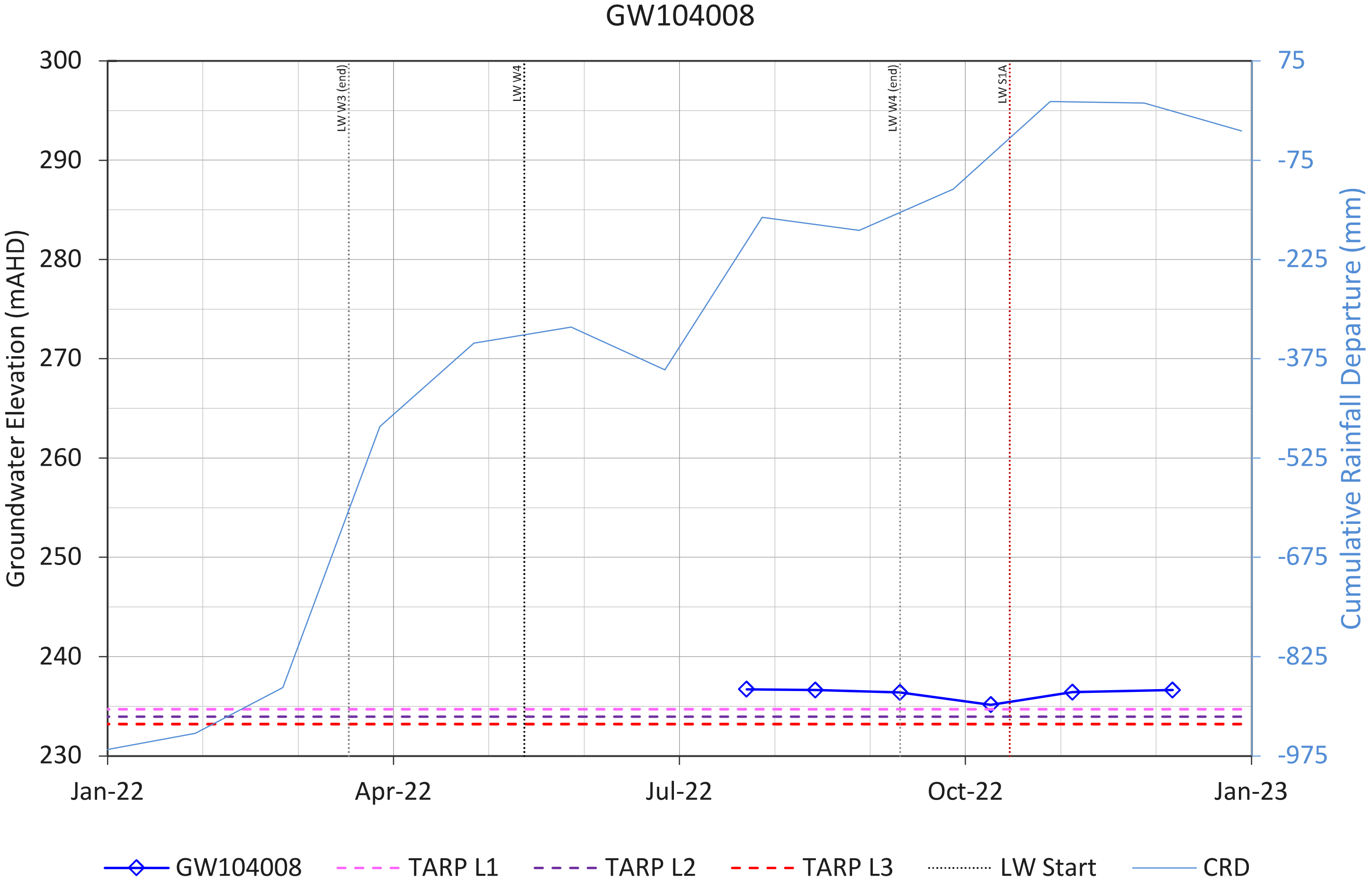

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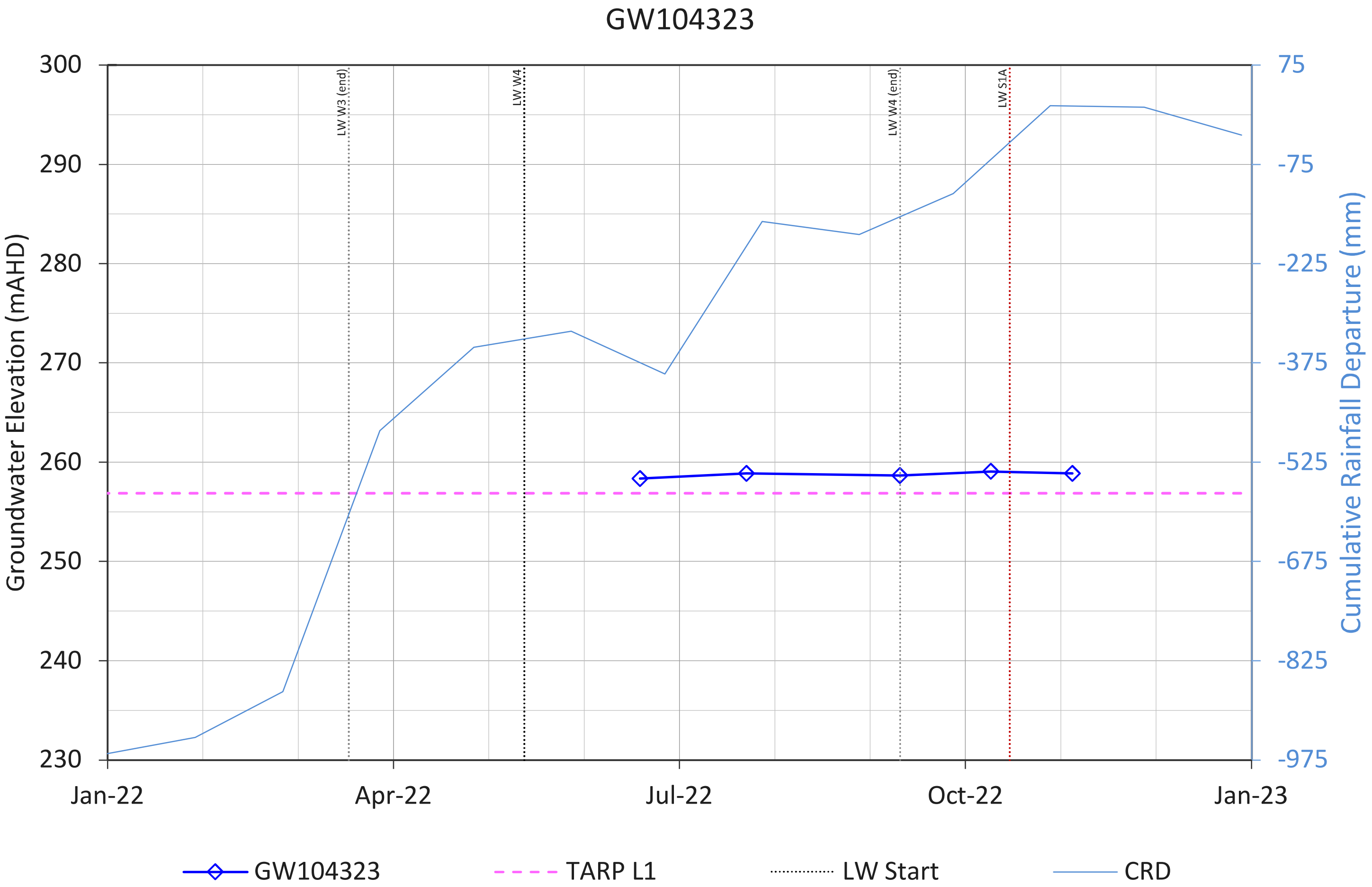

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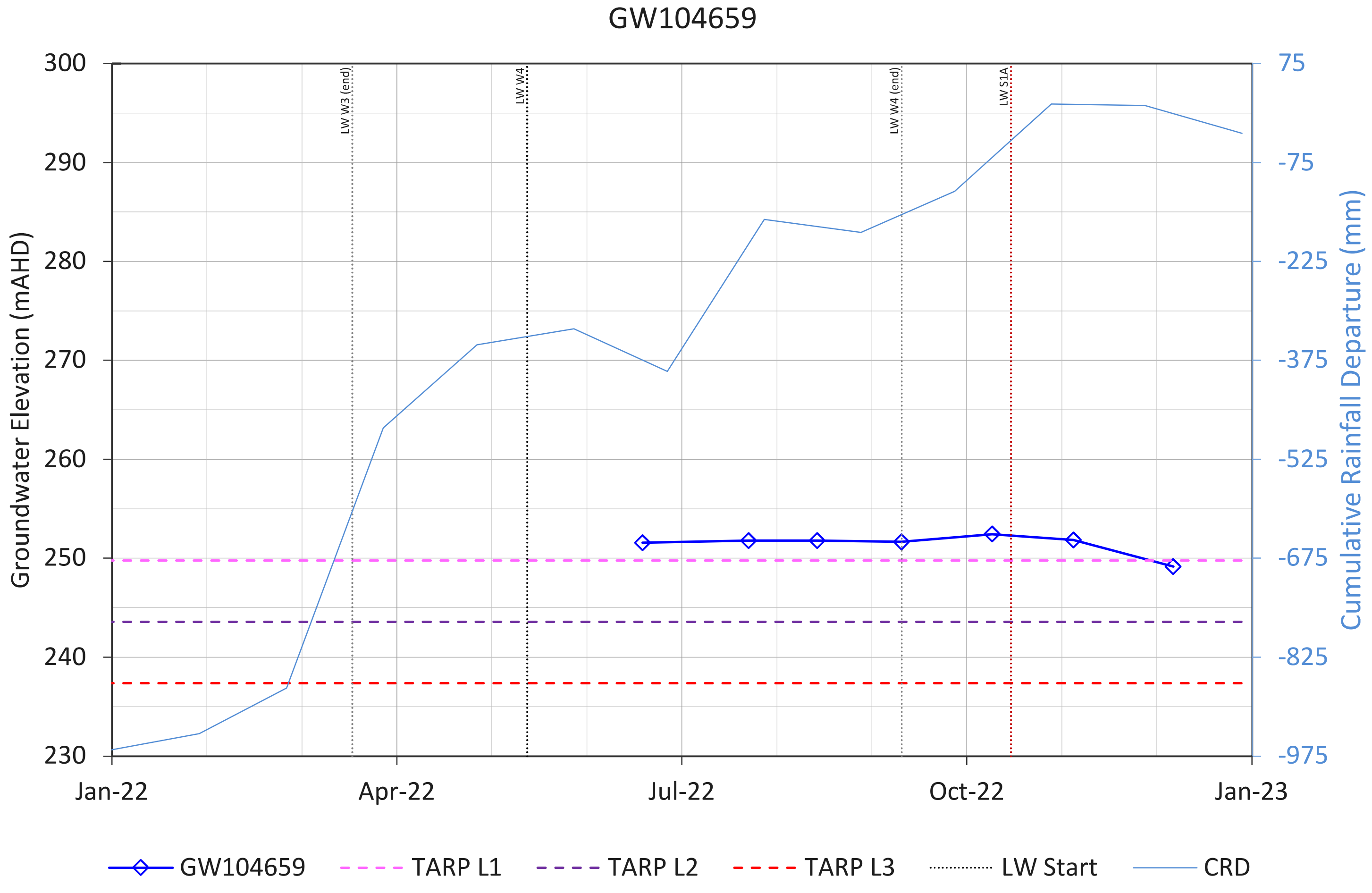

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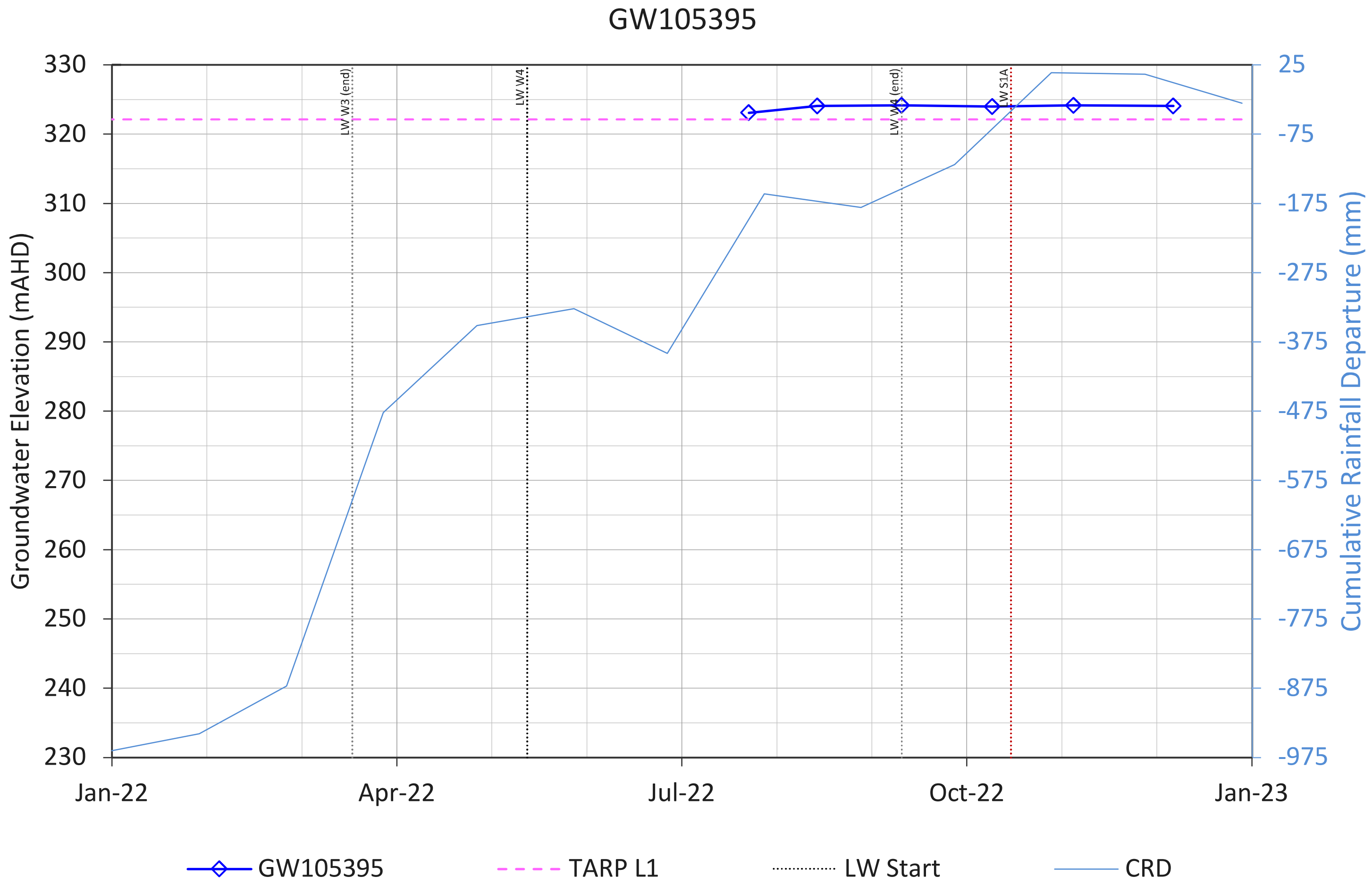

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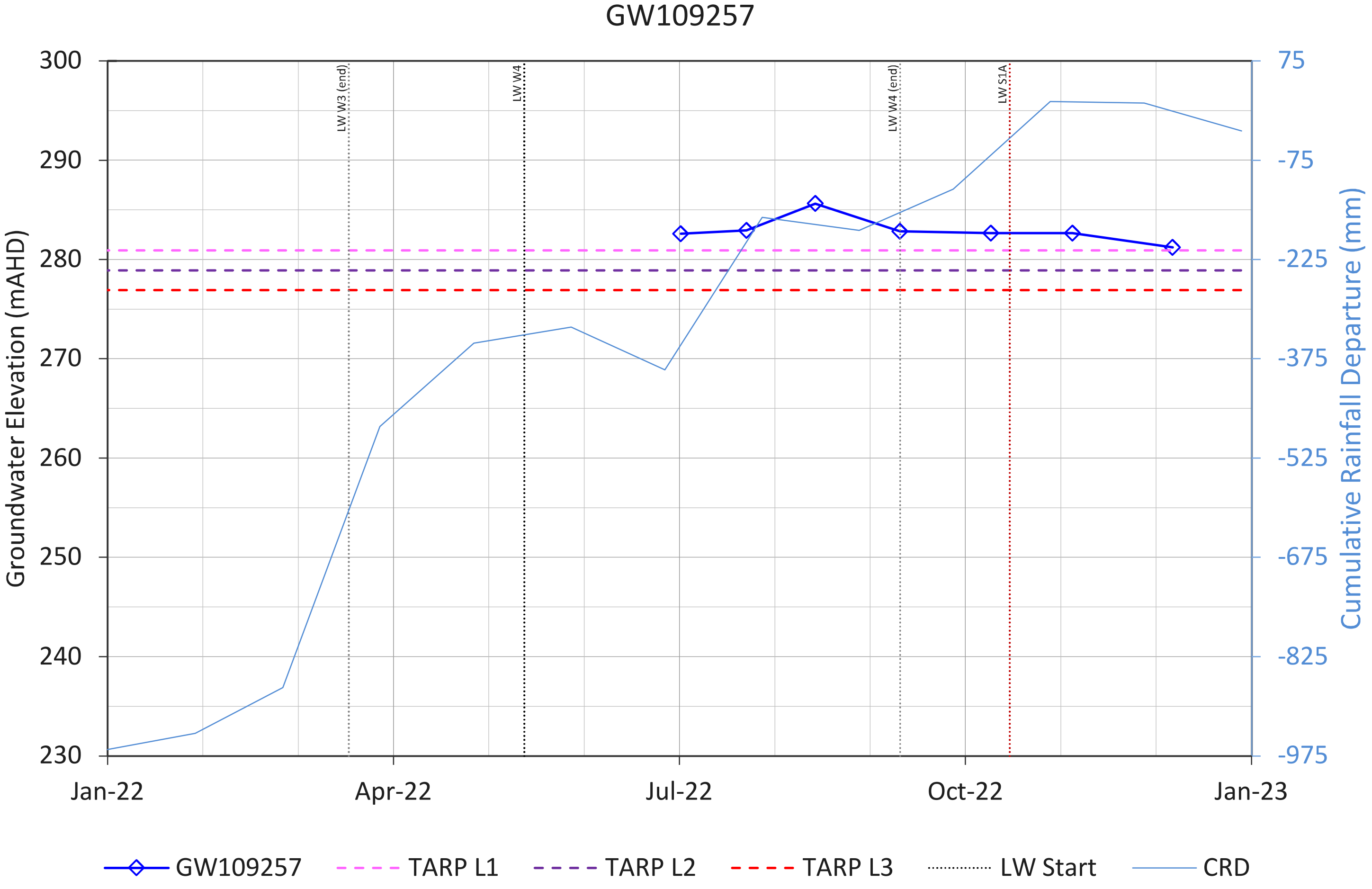


Figure A21

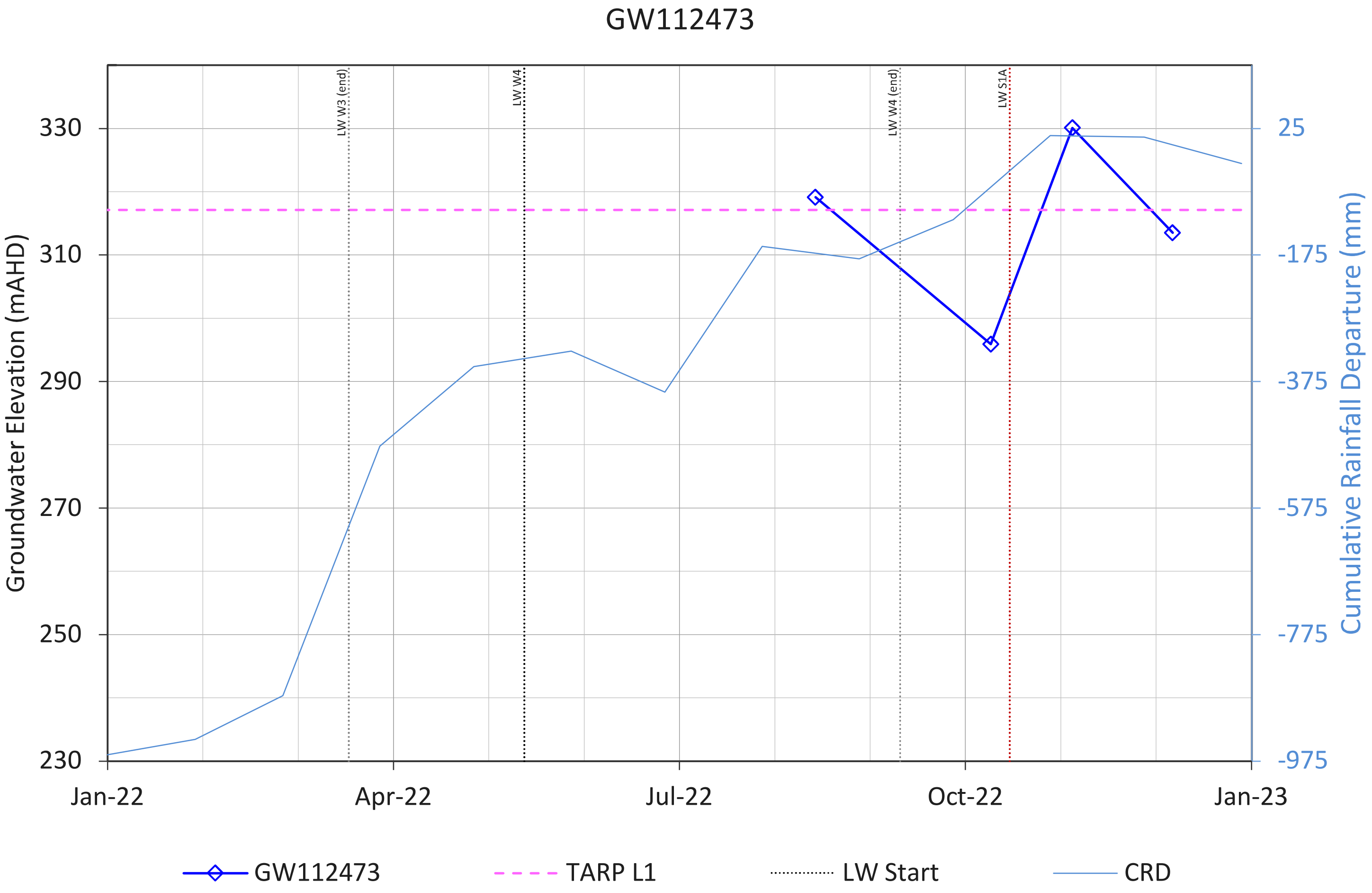


Figure A22

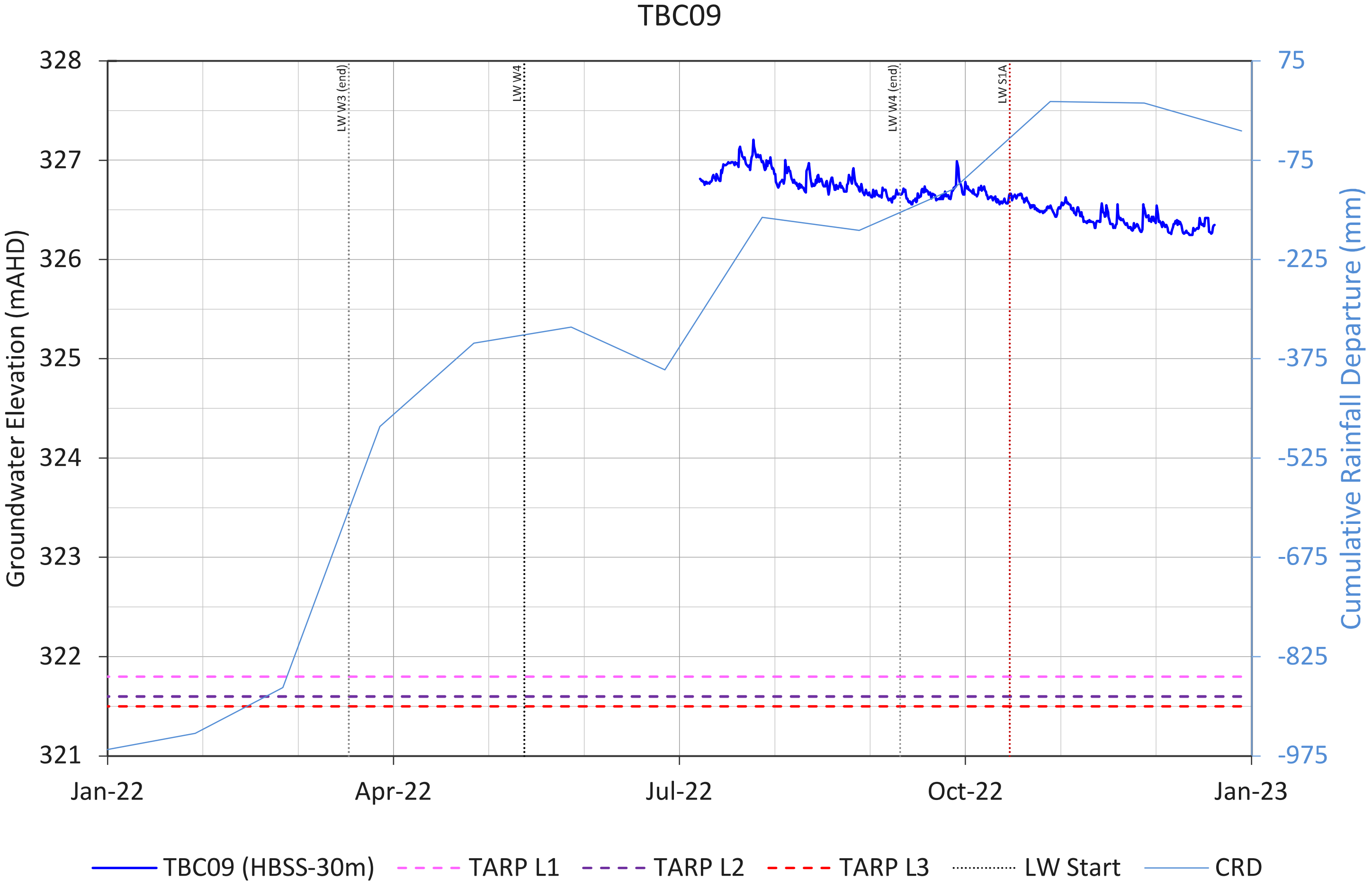


Figure B23

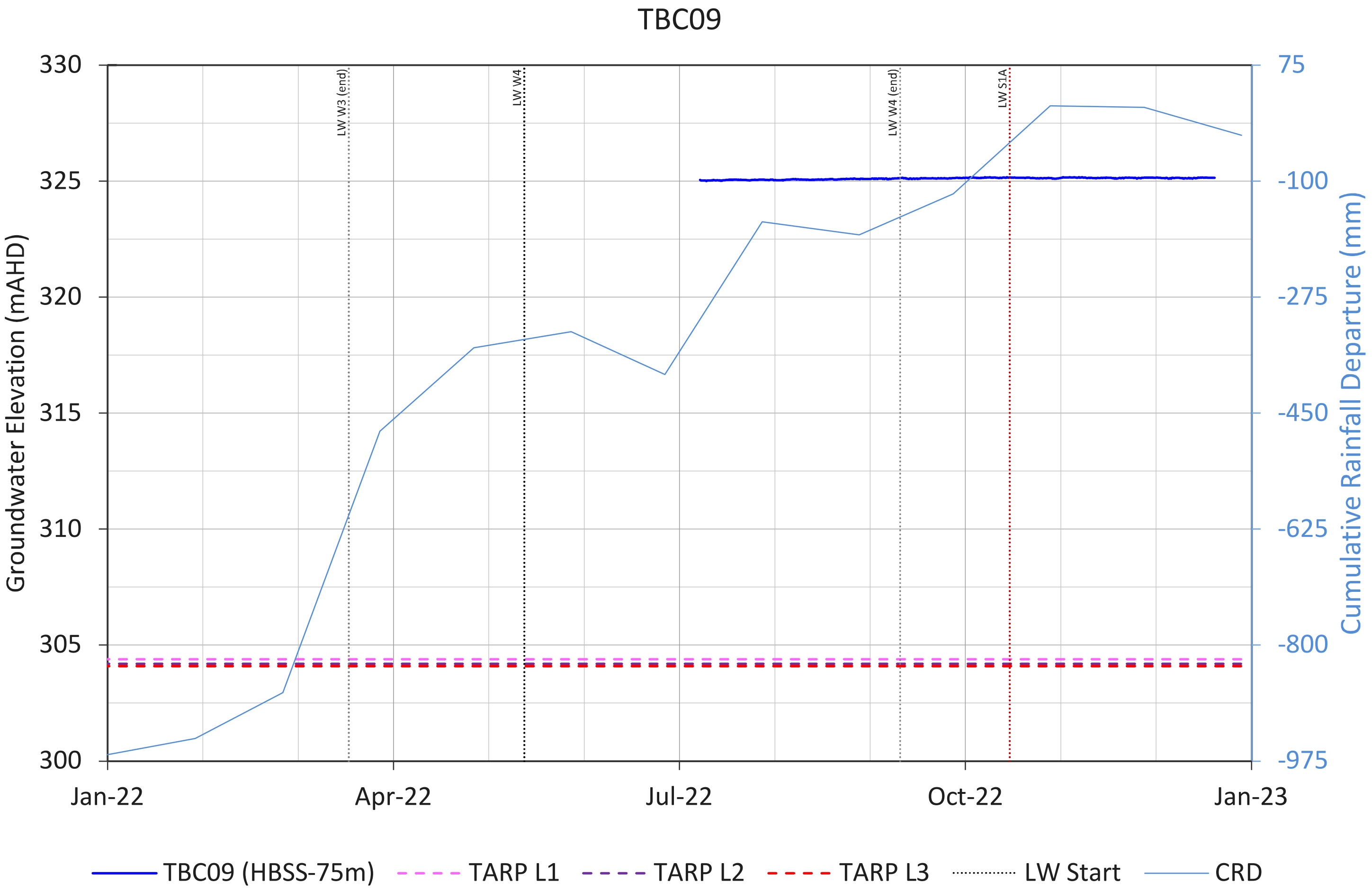


Figure B24

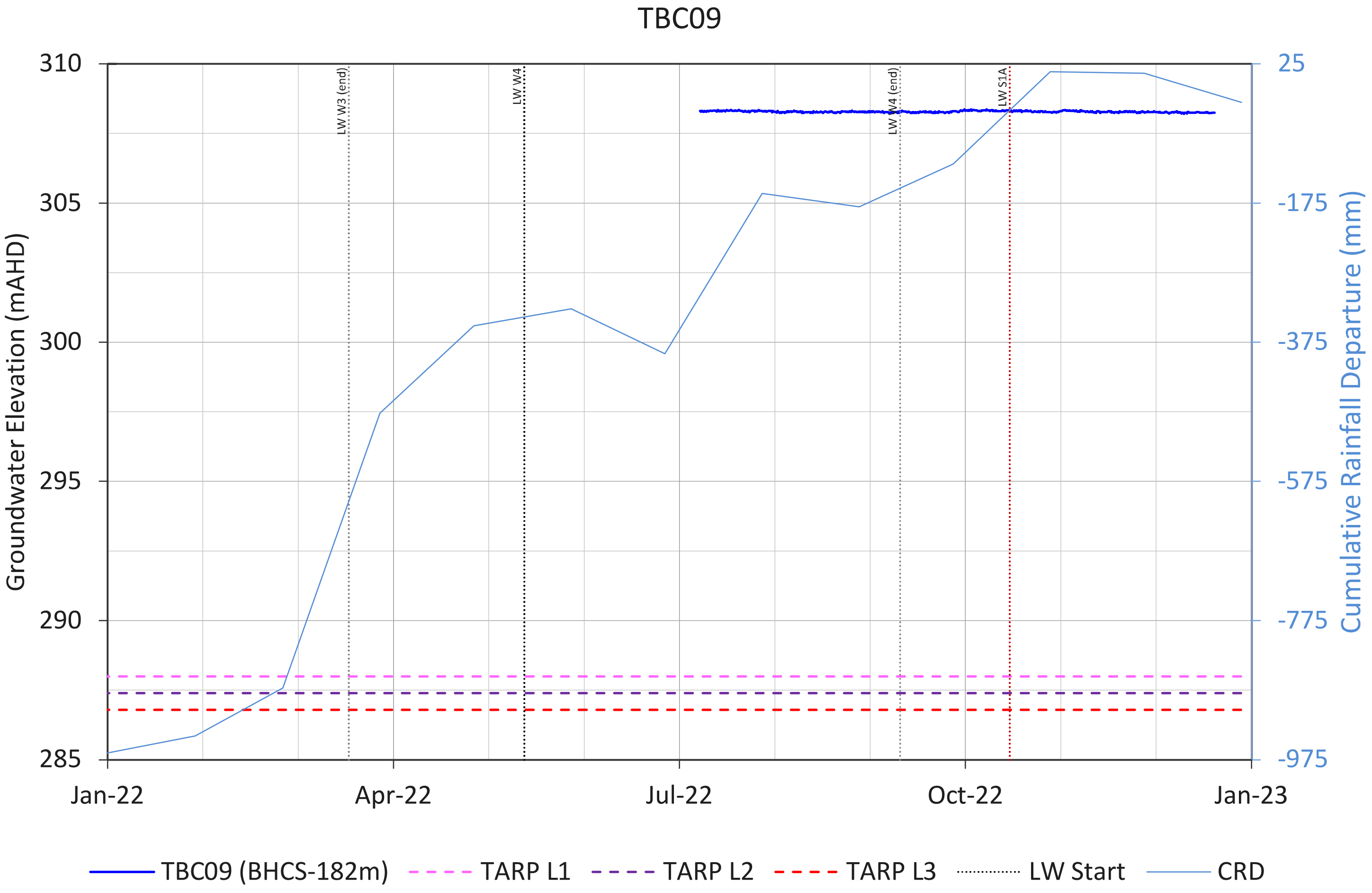
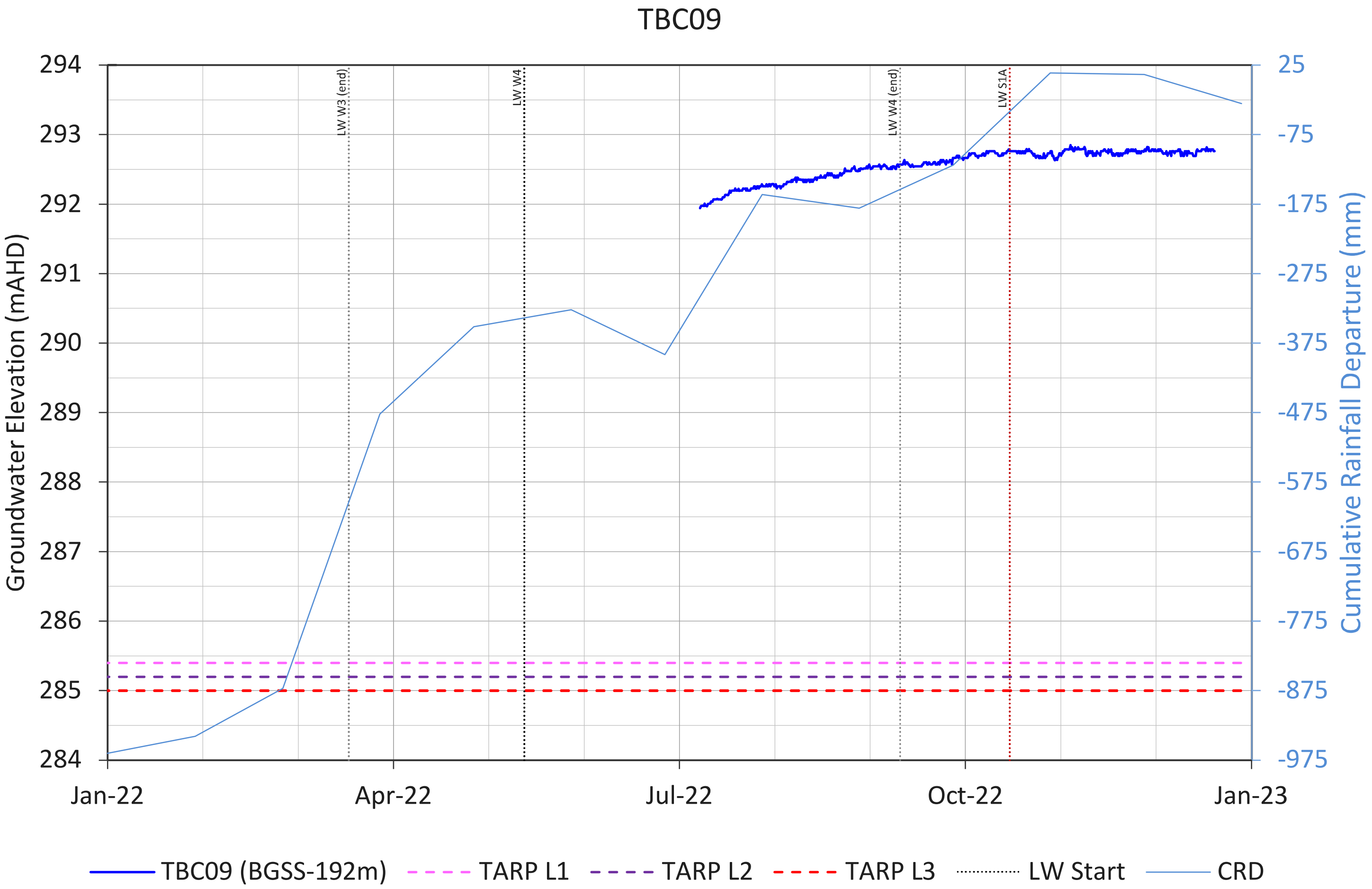


Figure B25



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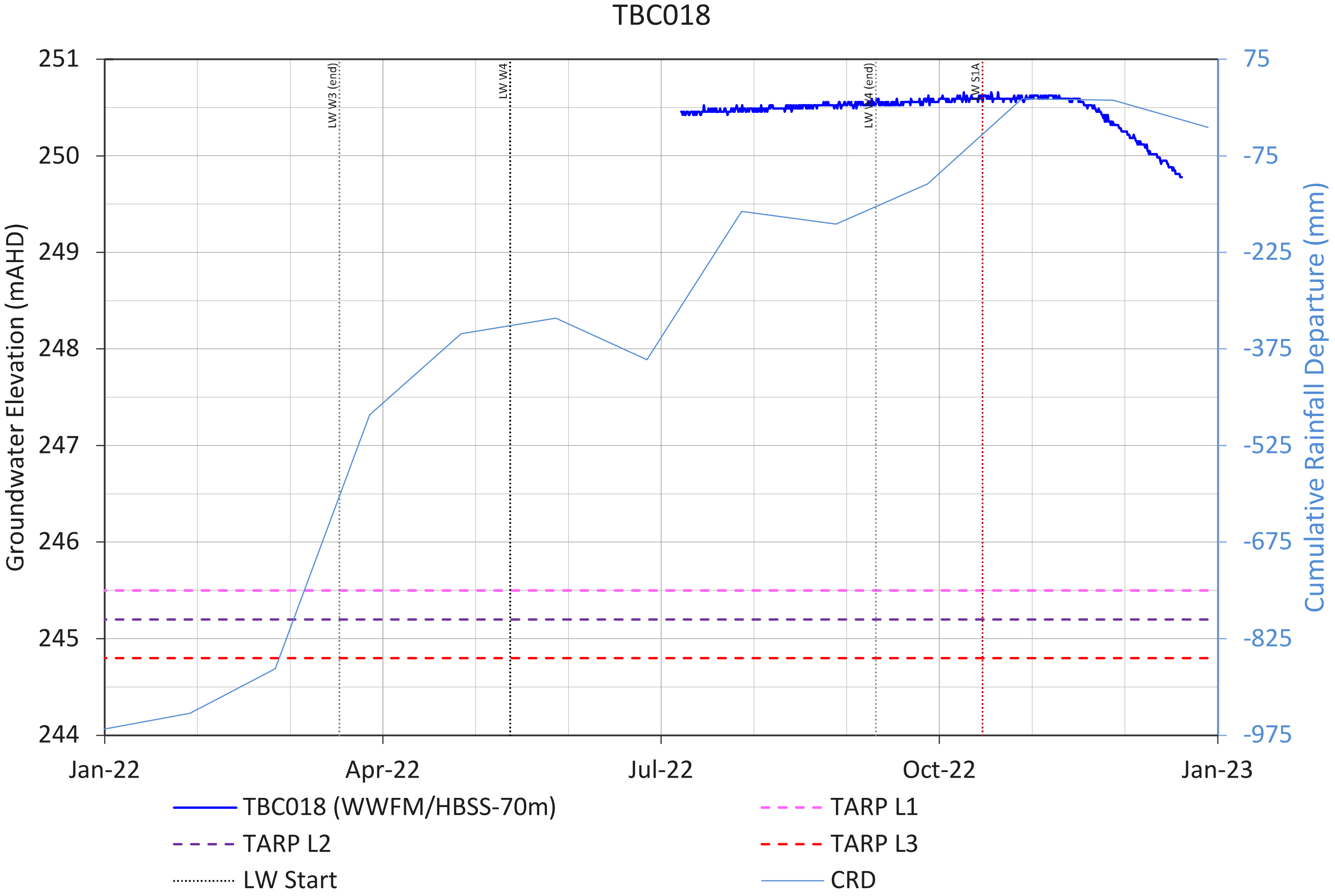

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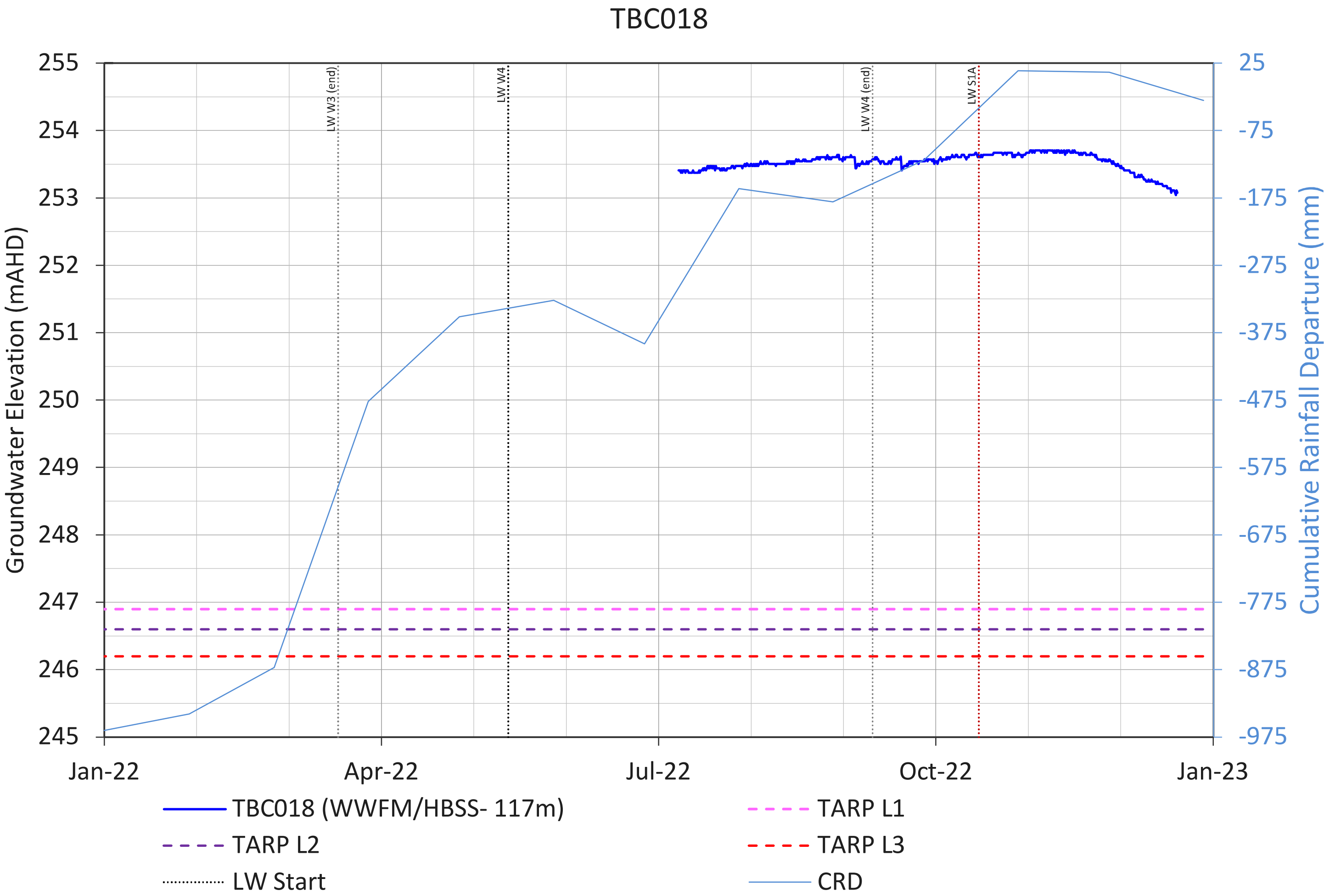

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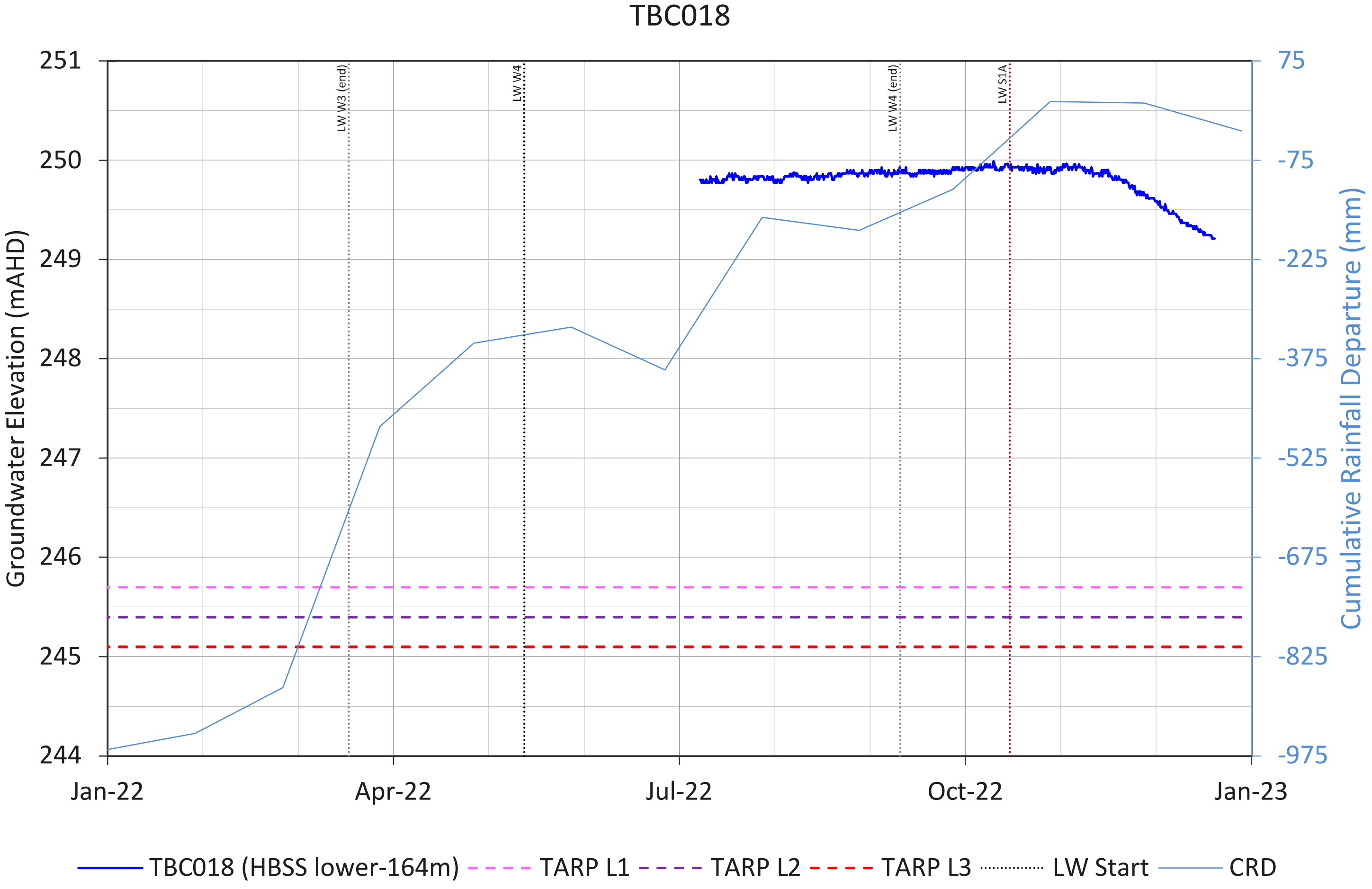

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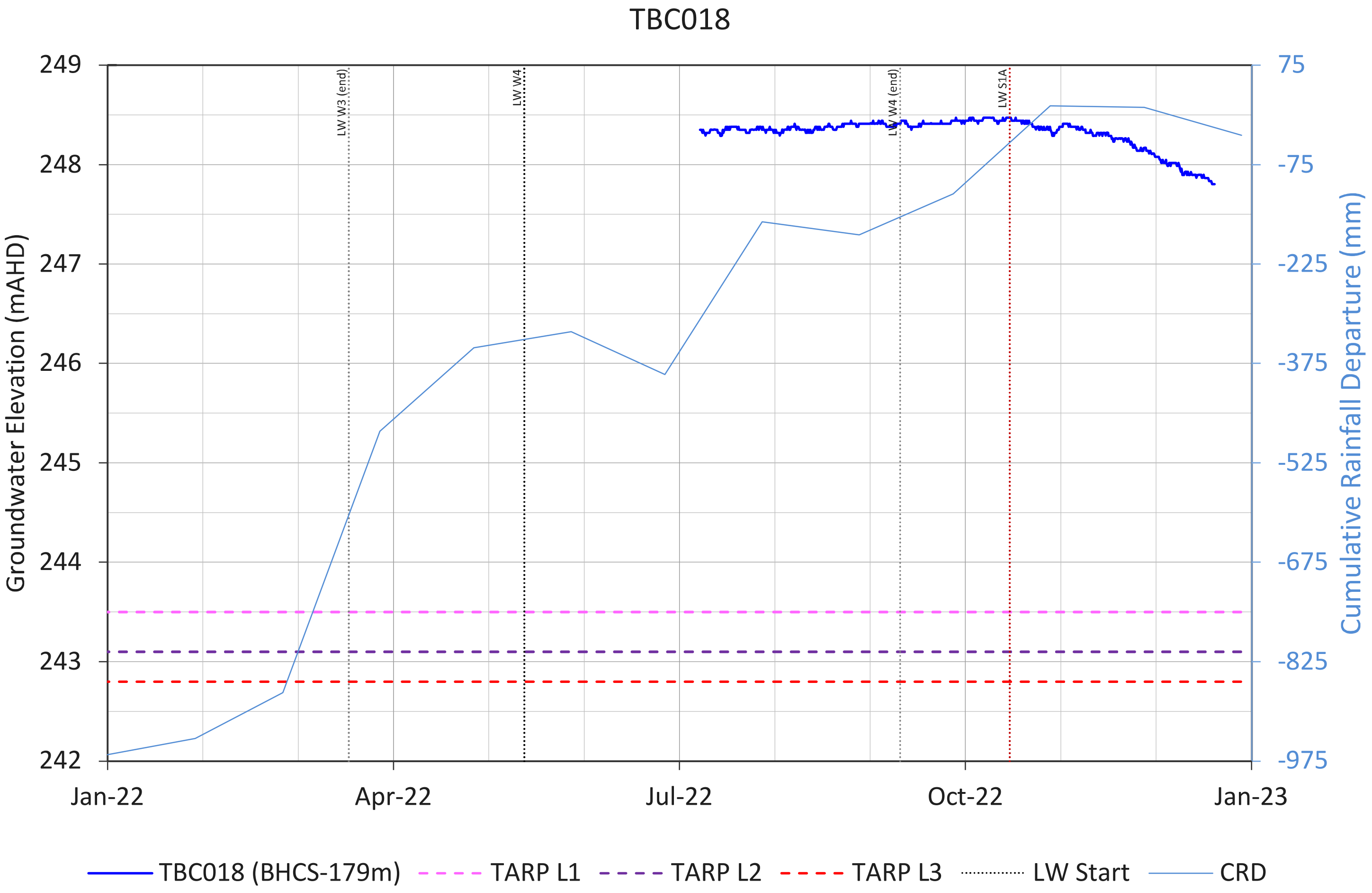

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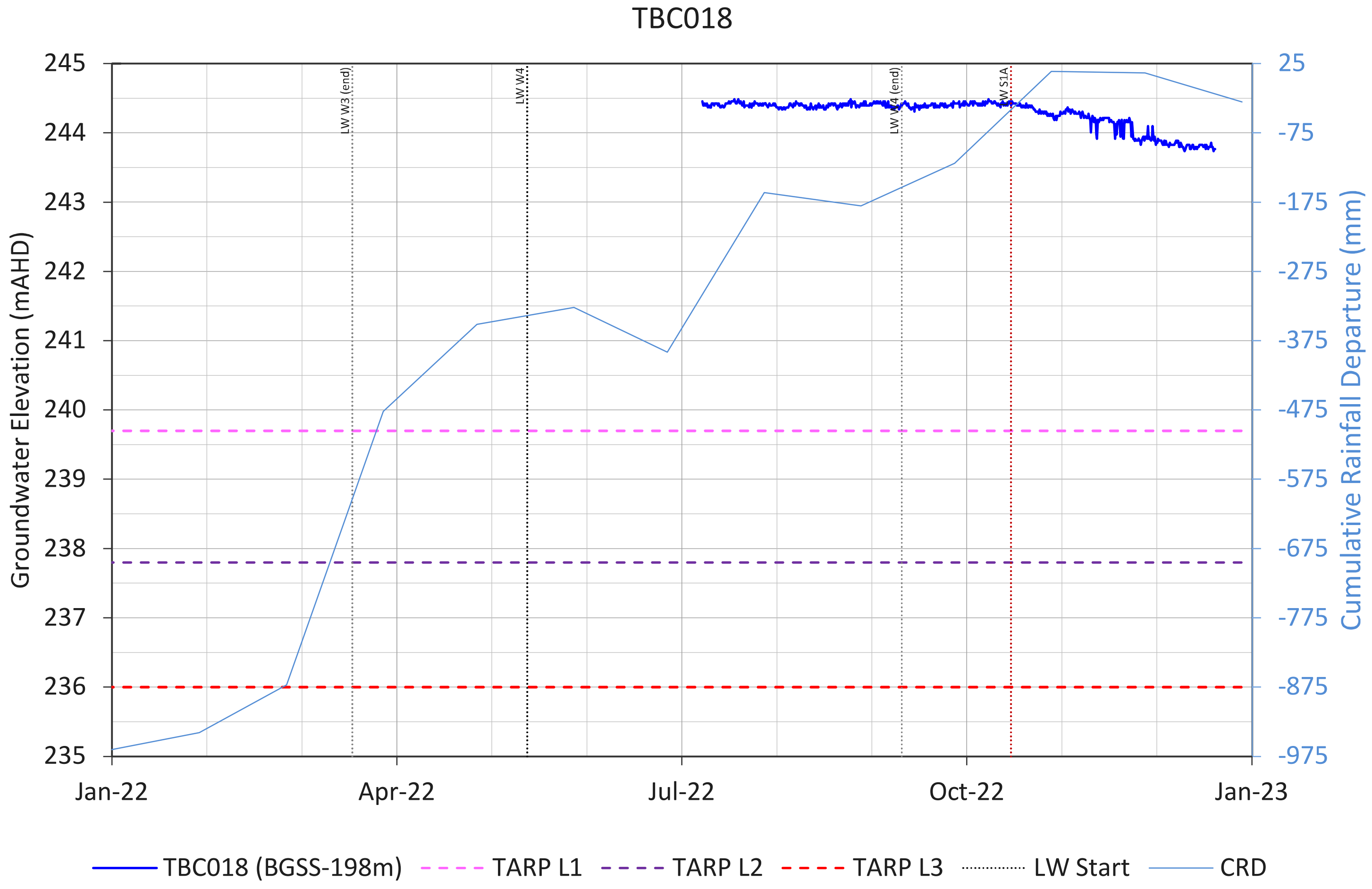

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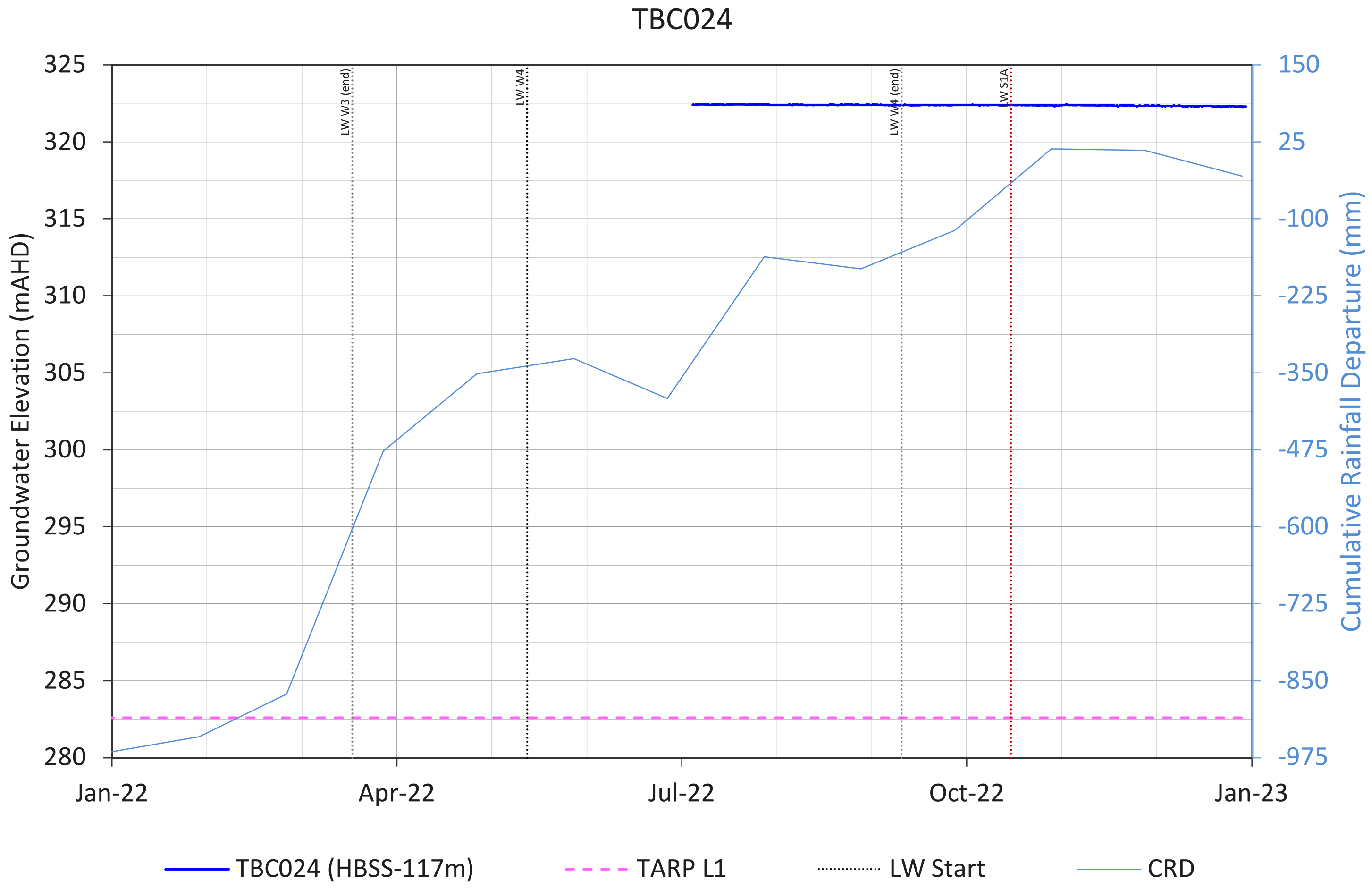

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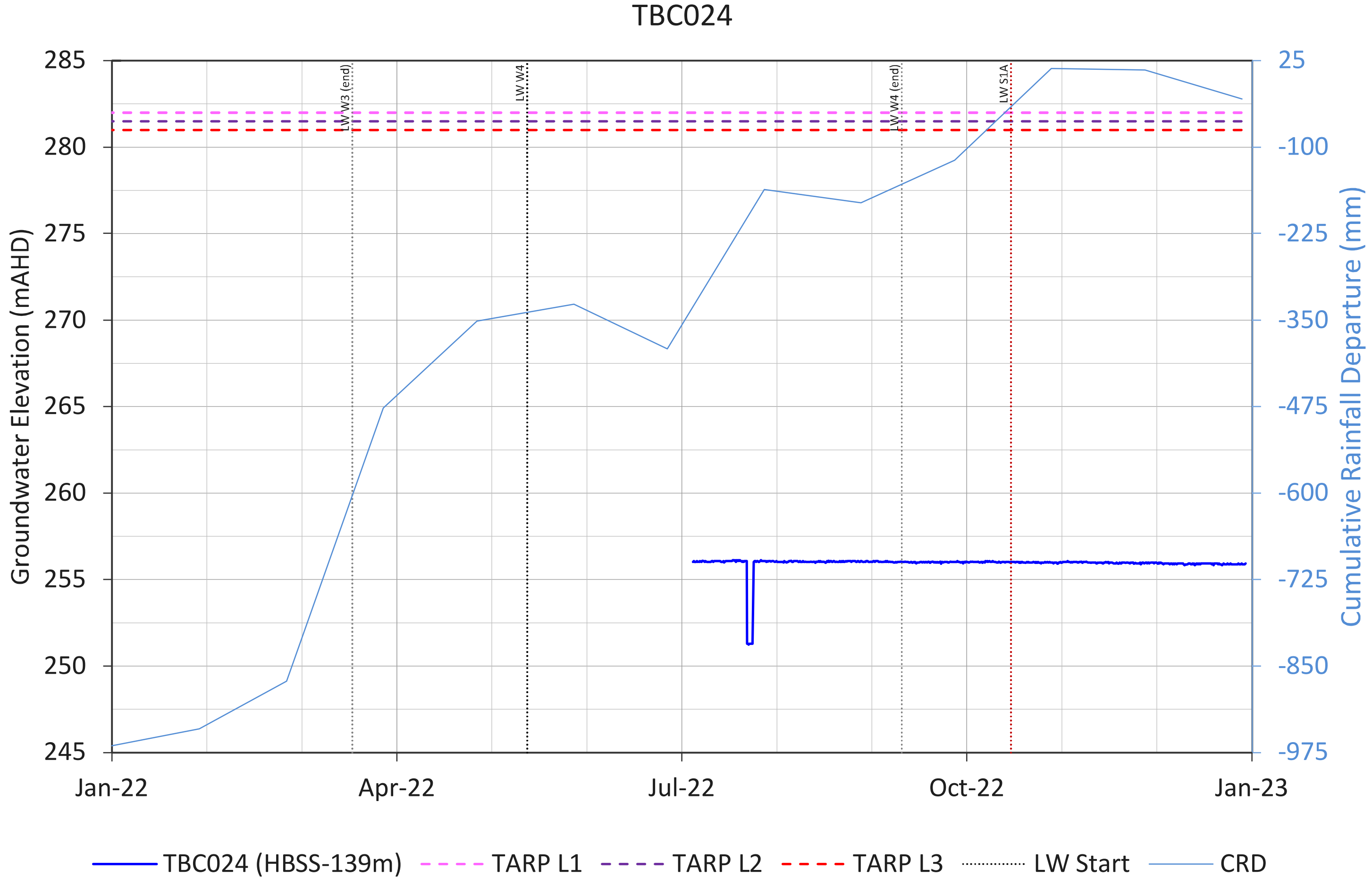

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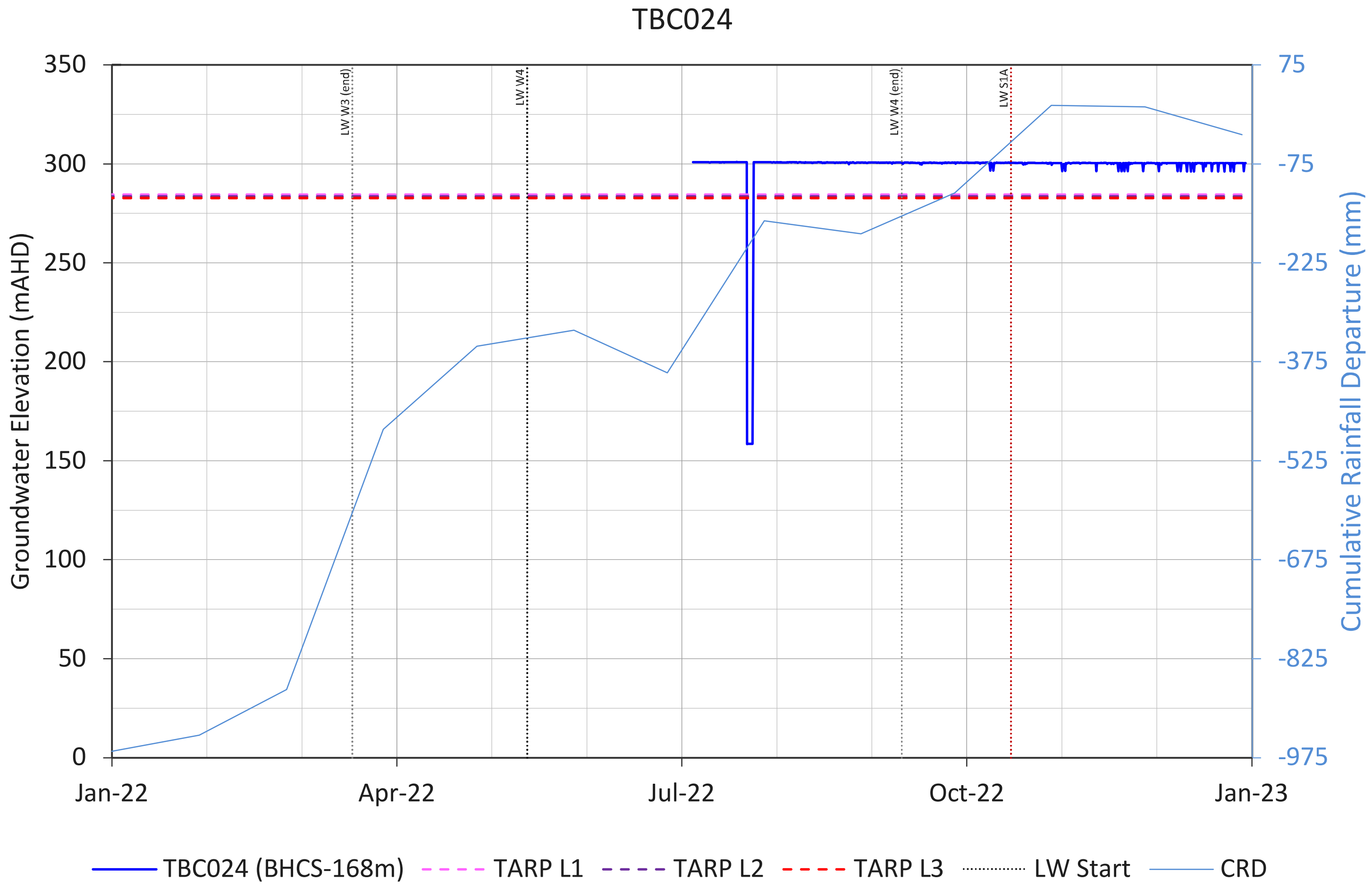

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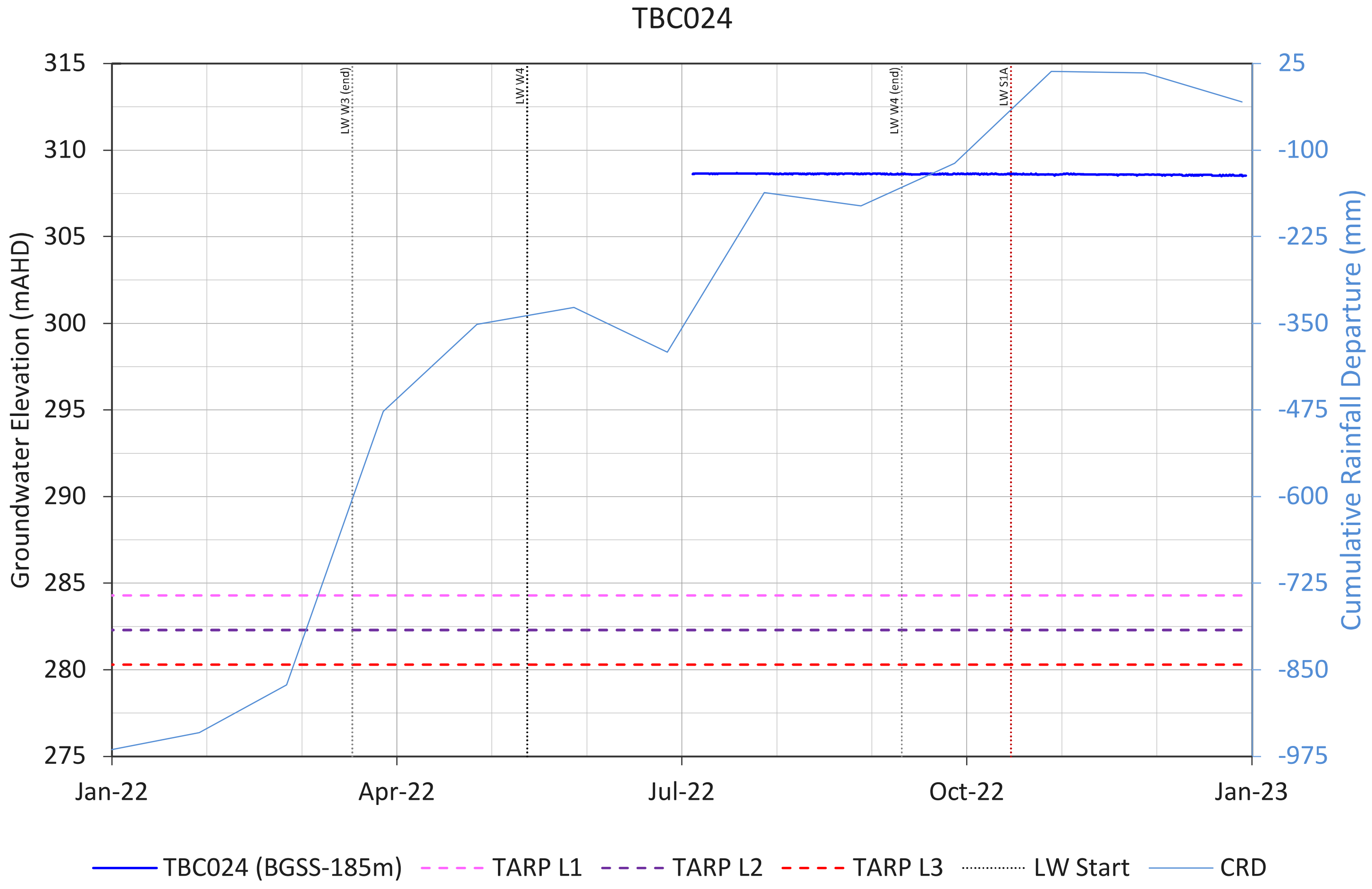

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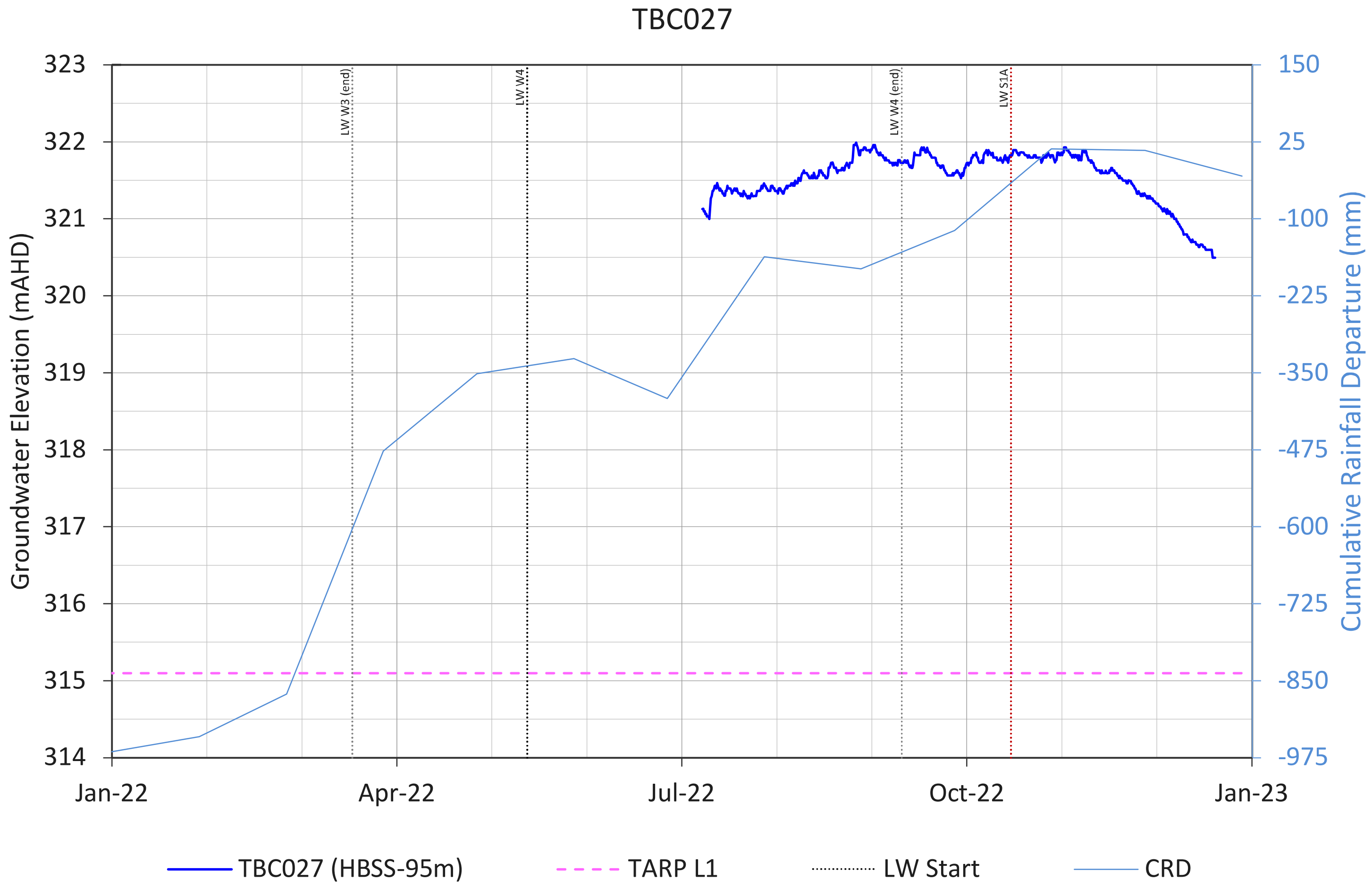

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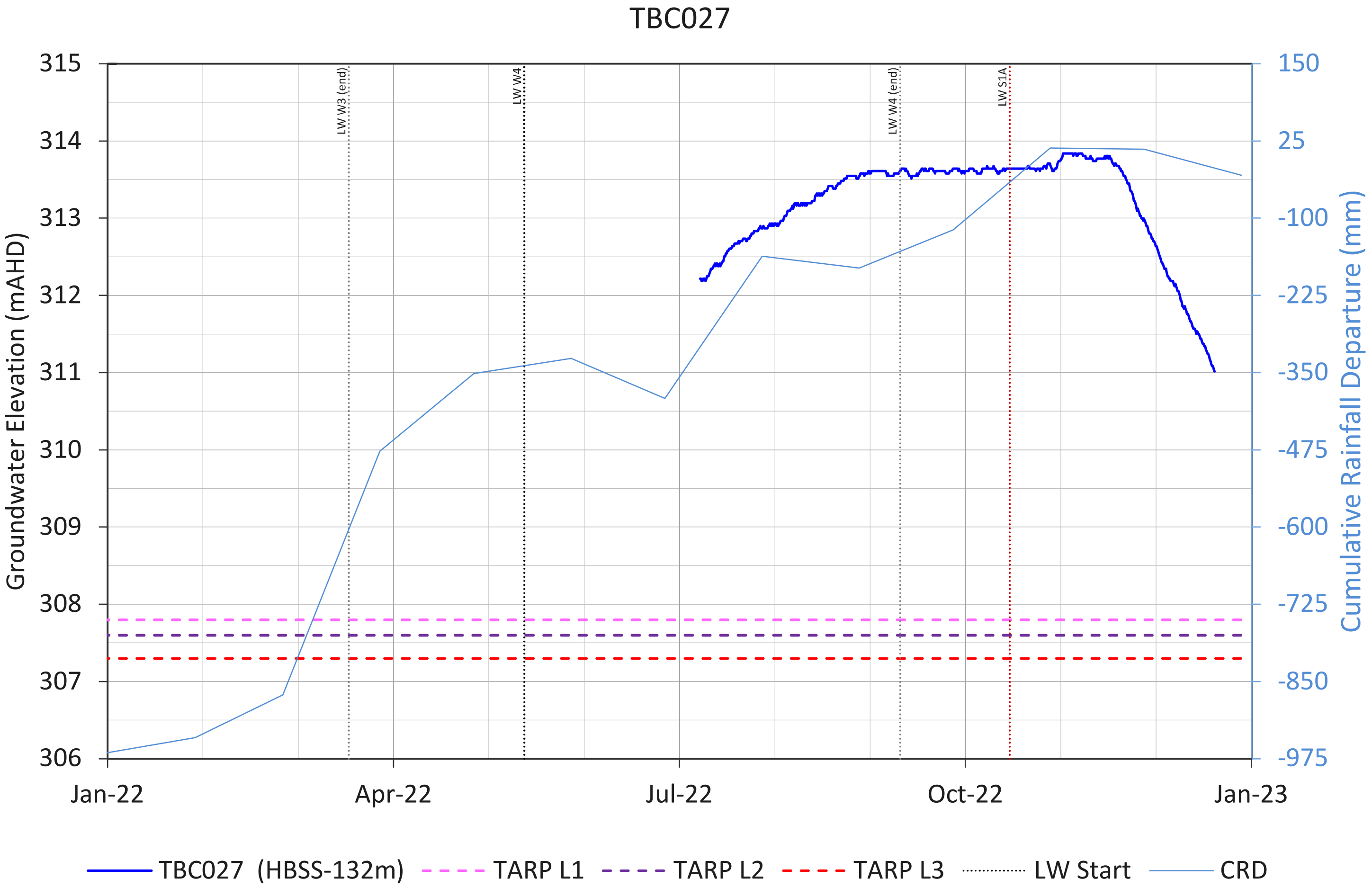

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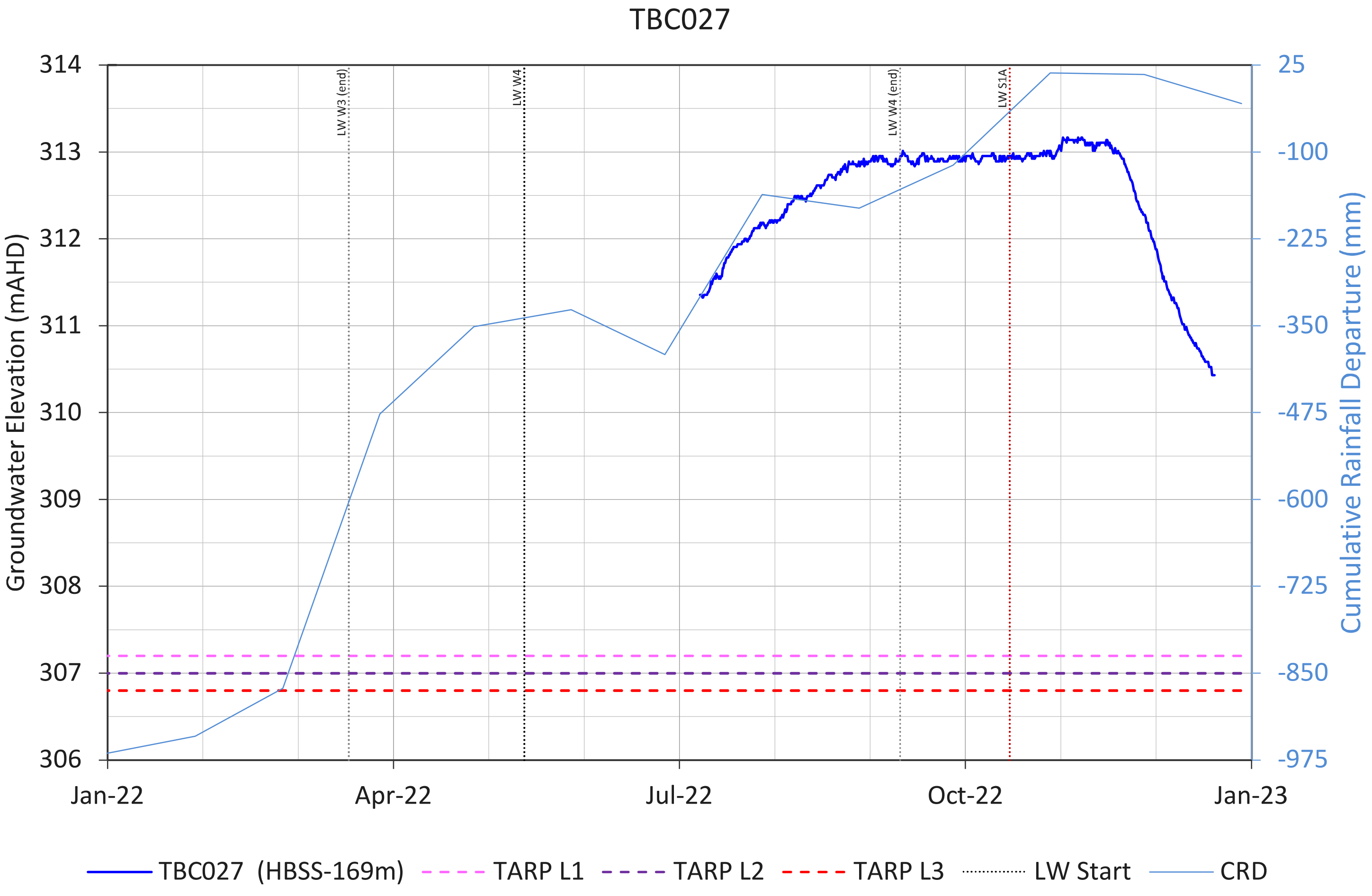
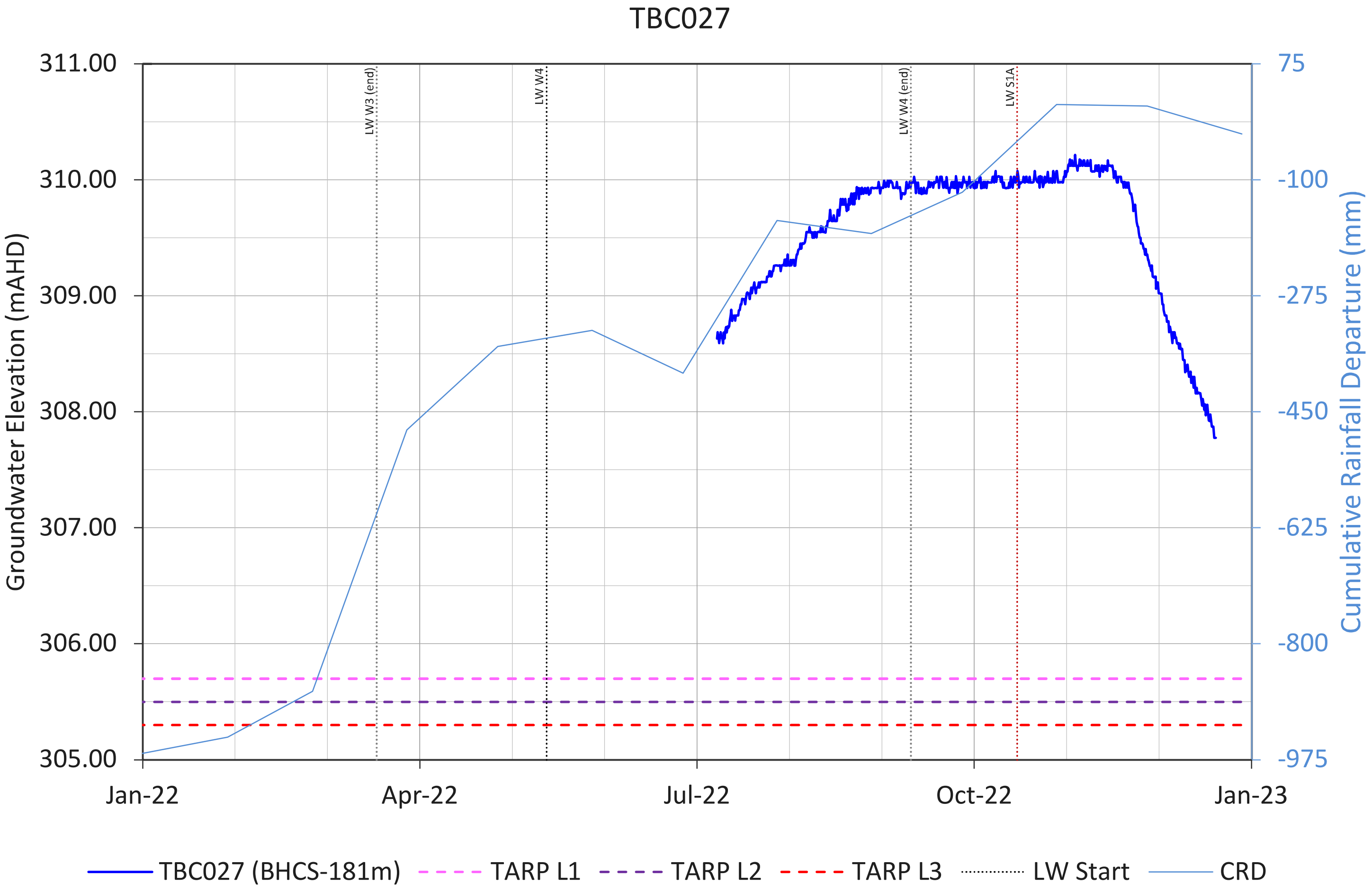


Figure B38



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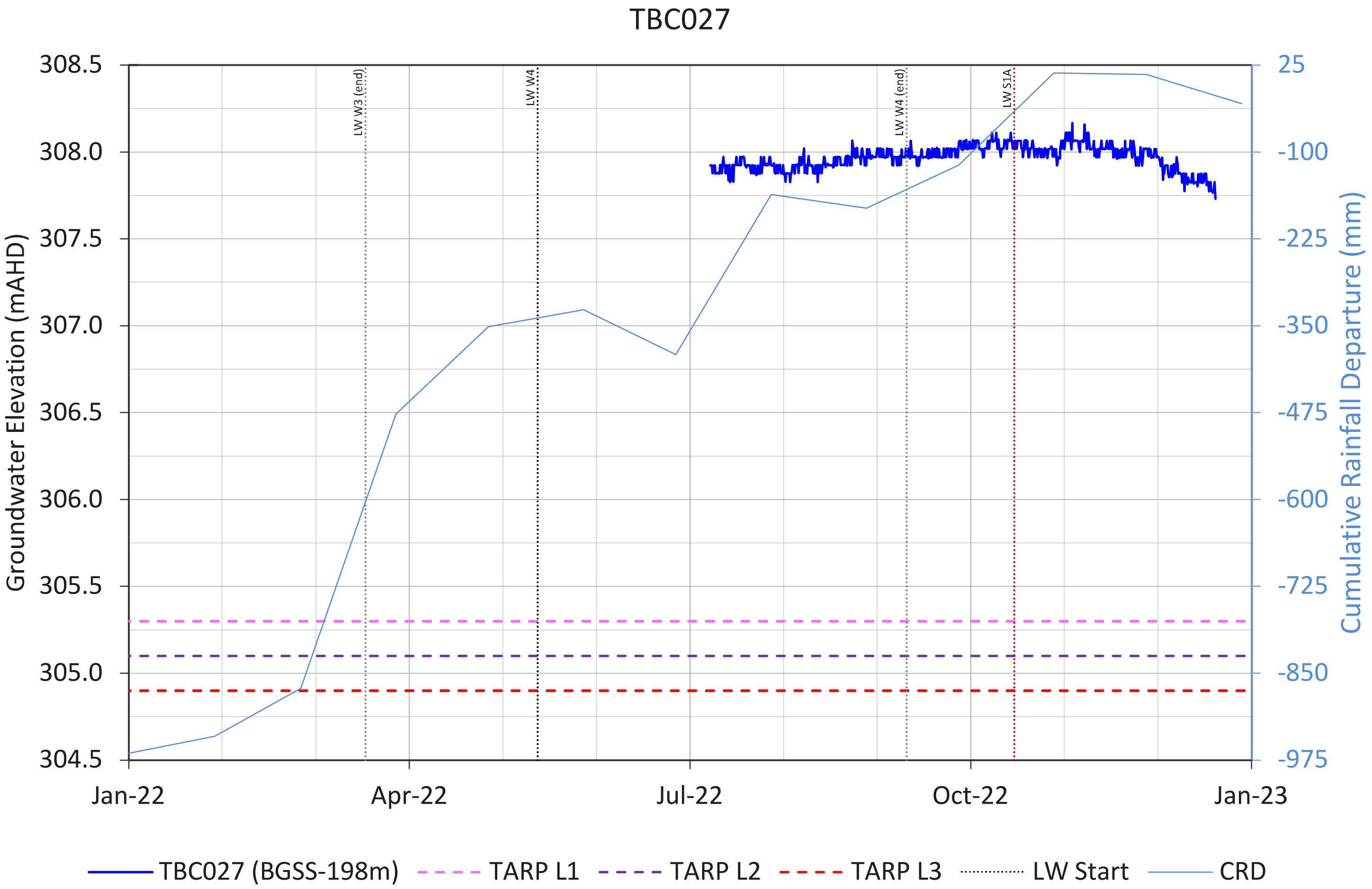


Figure B40

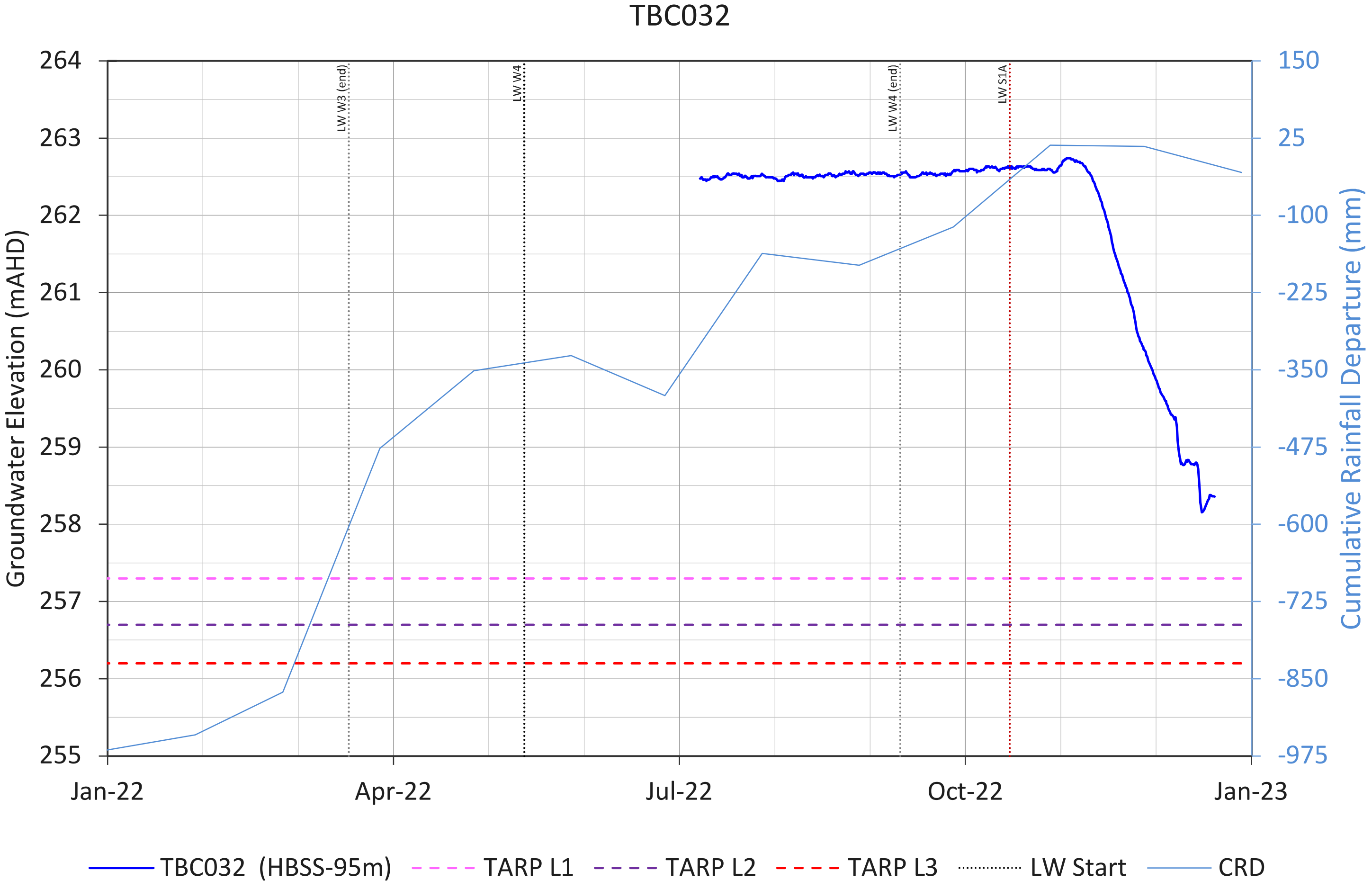


Figure B41

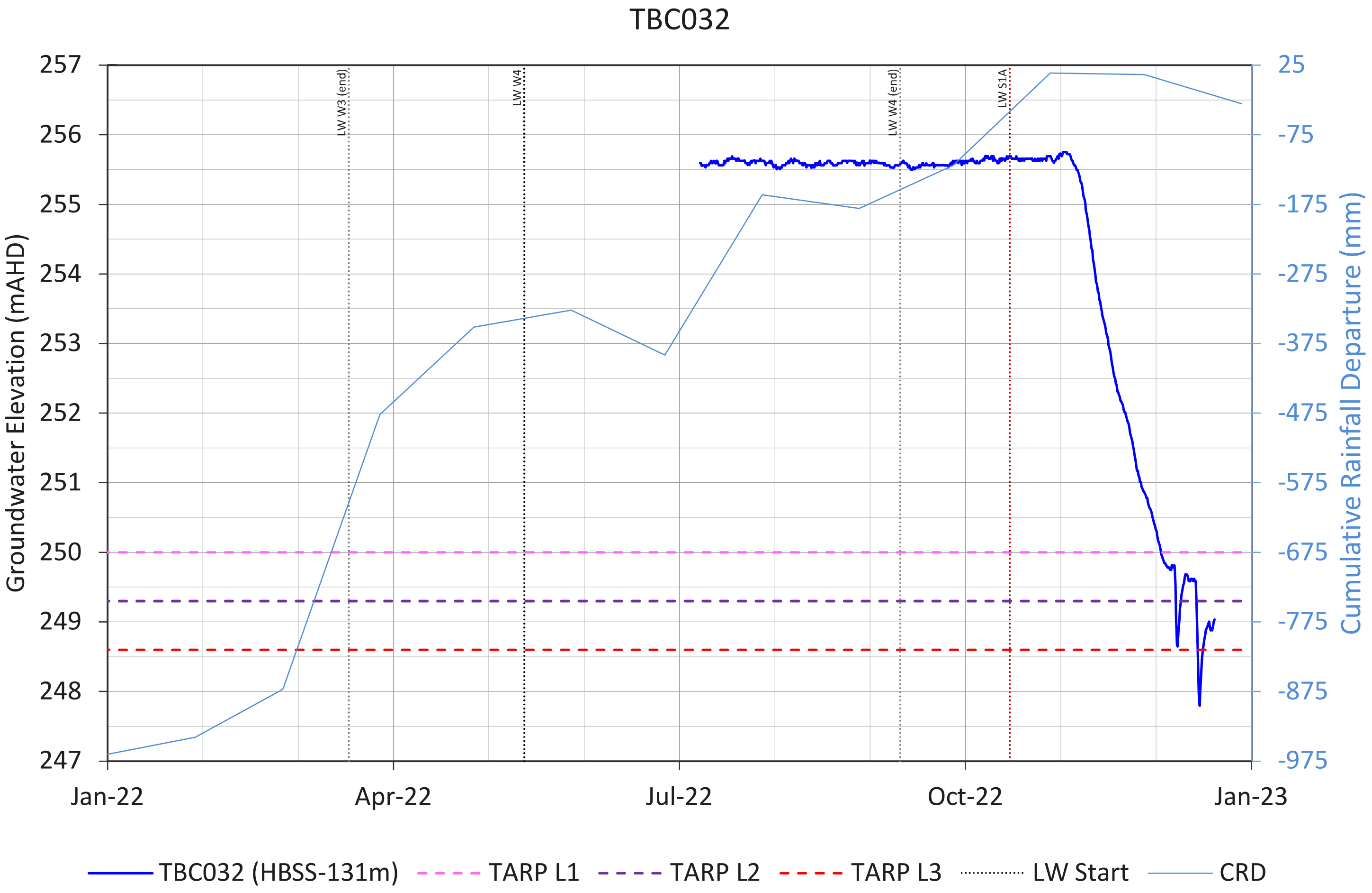


Figure B42

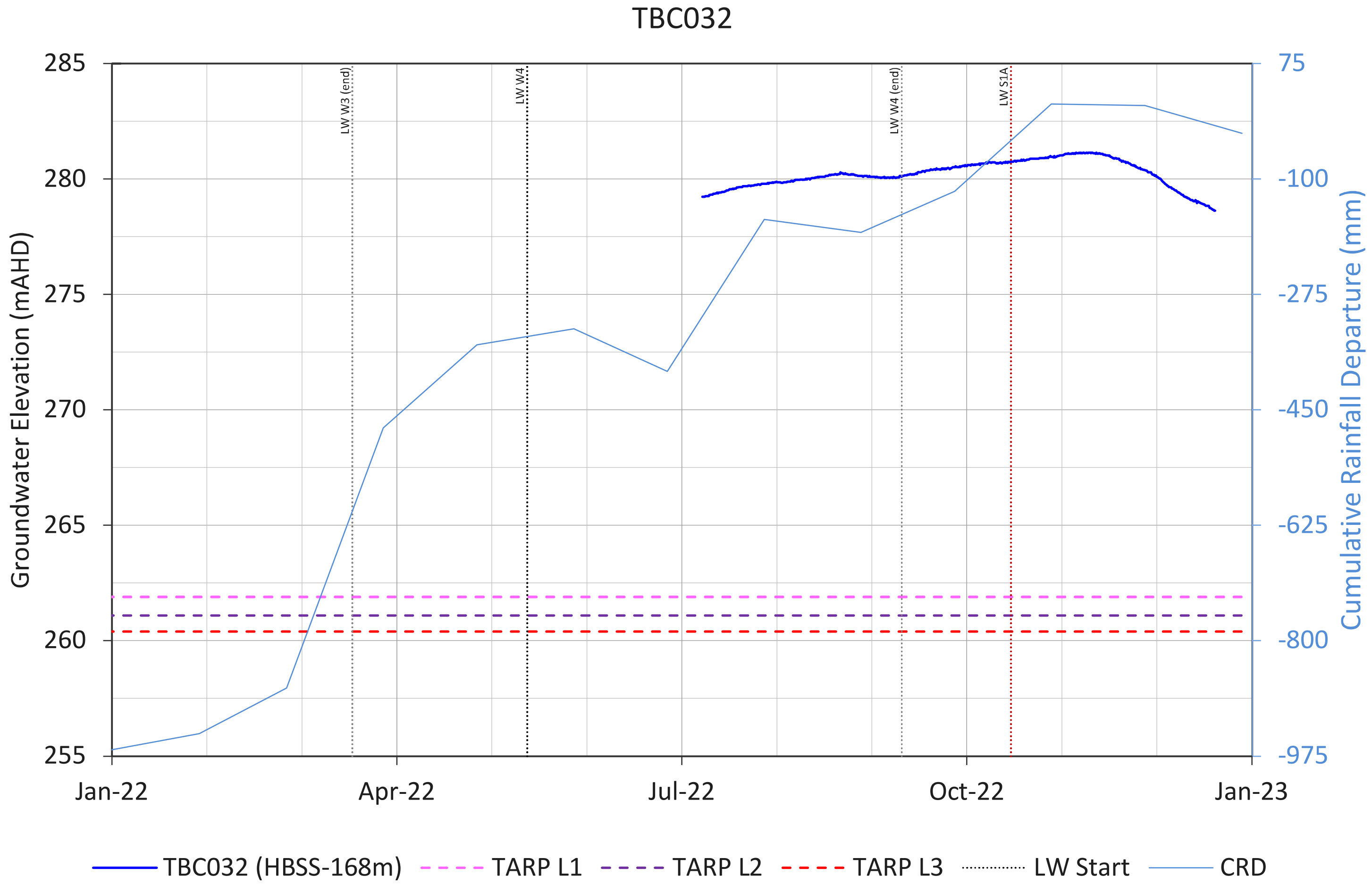


Figure B43

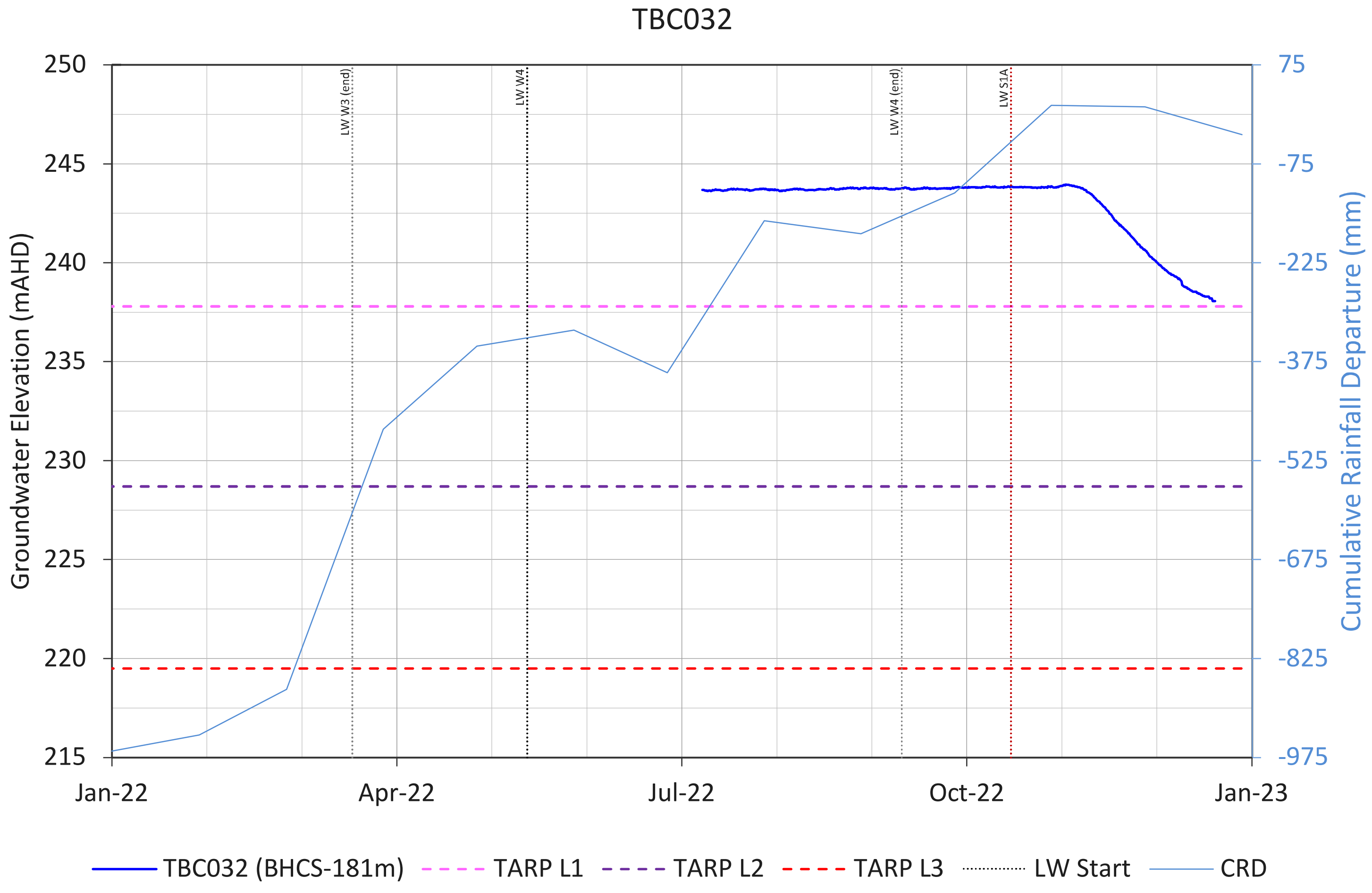


Figure B44

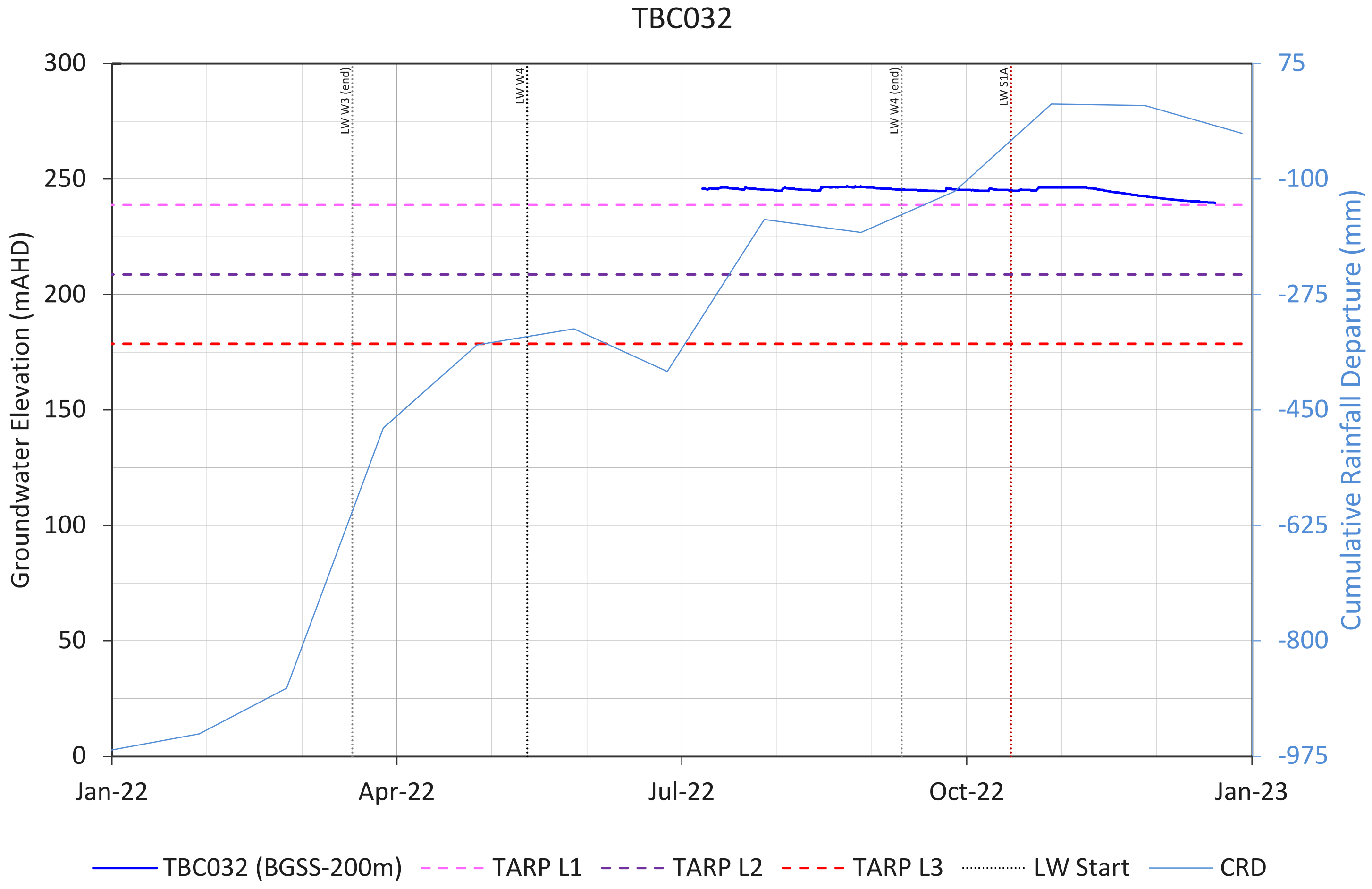


Figure B45

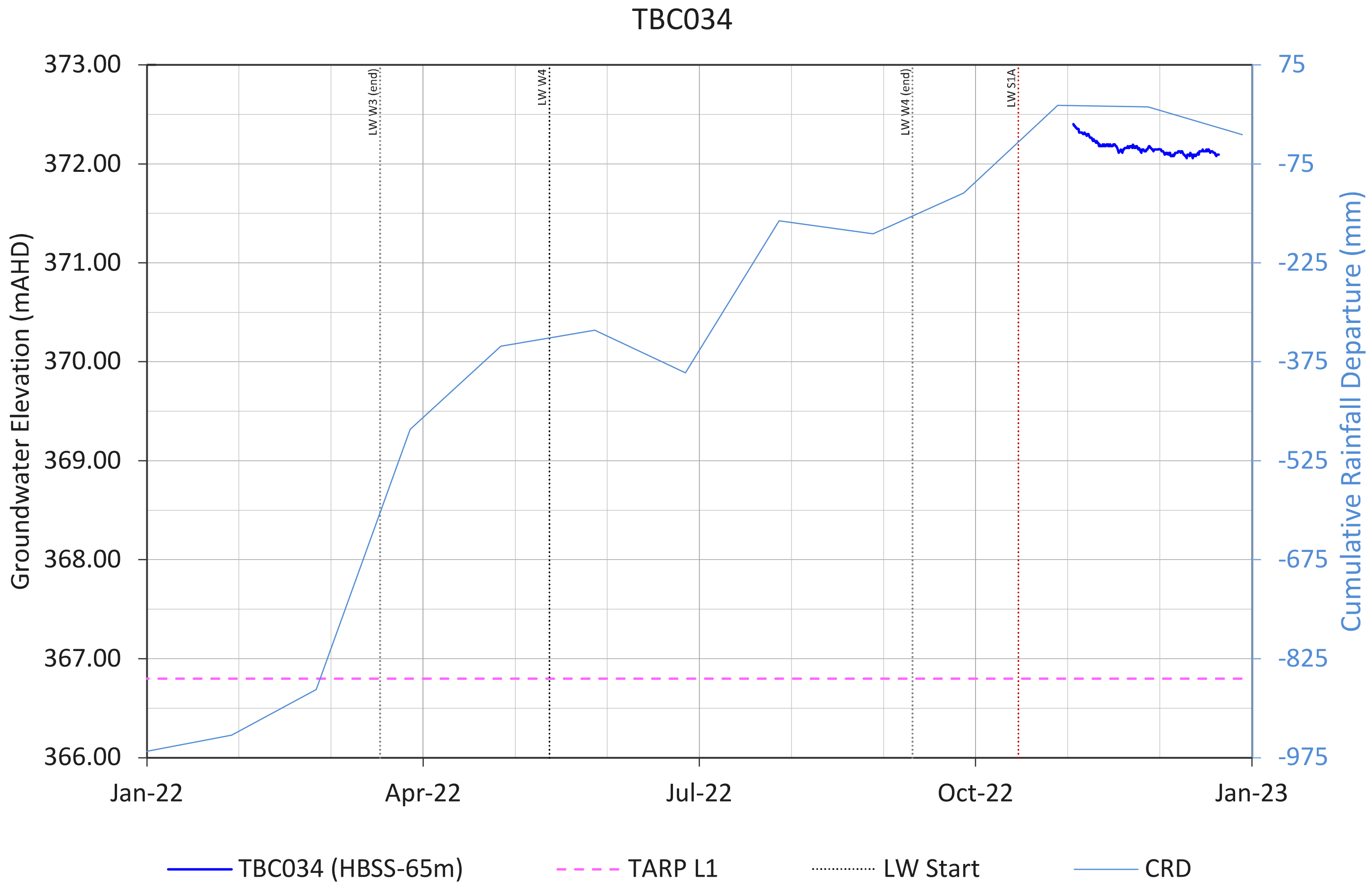
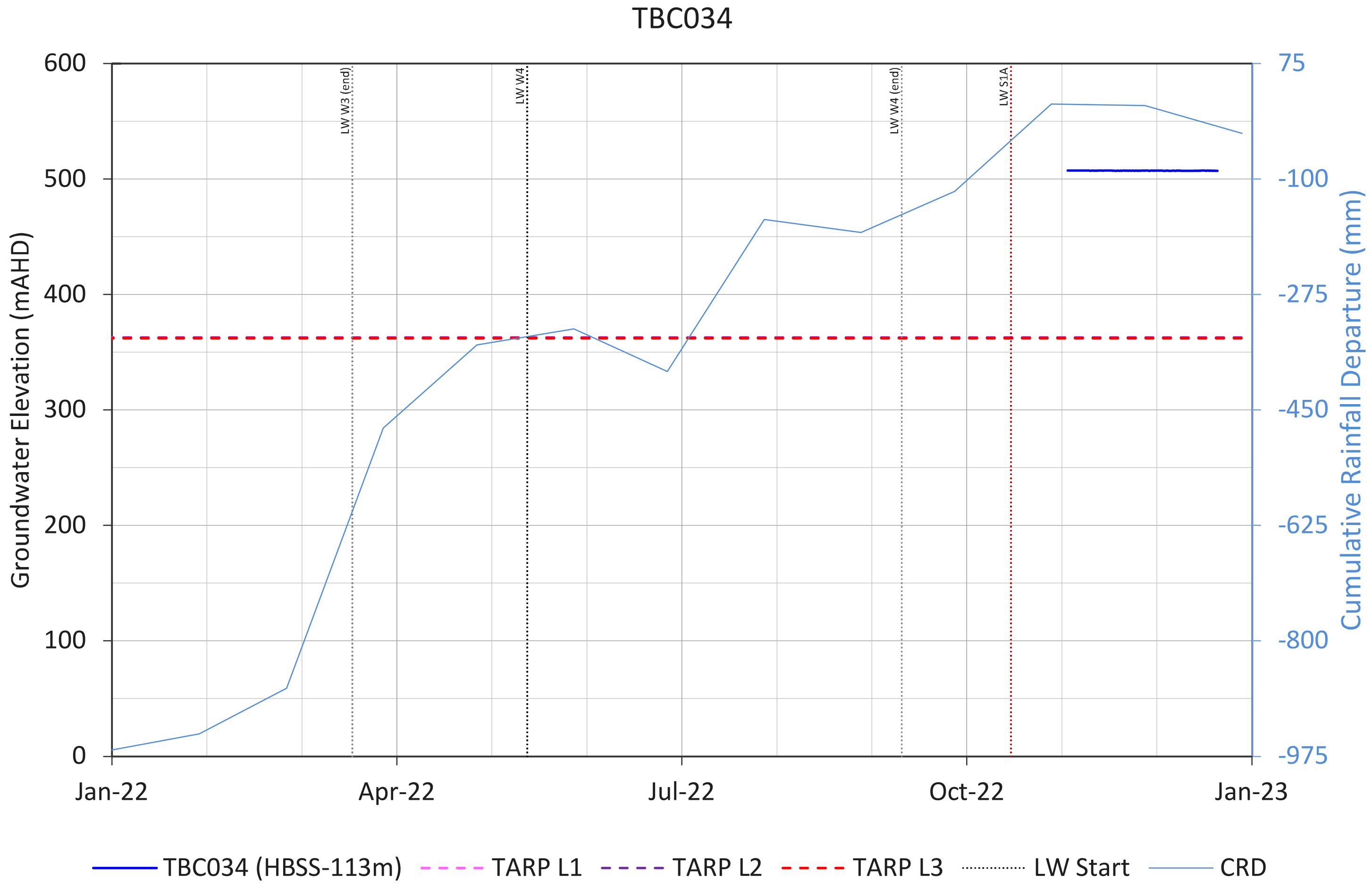


Figure B46



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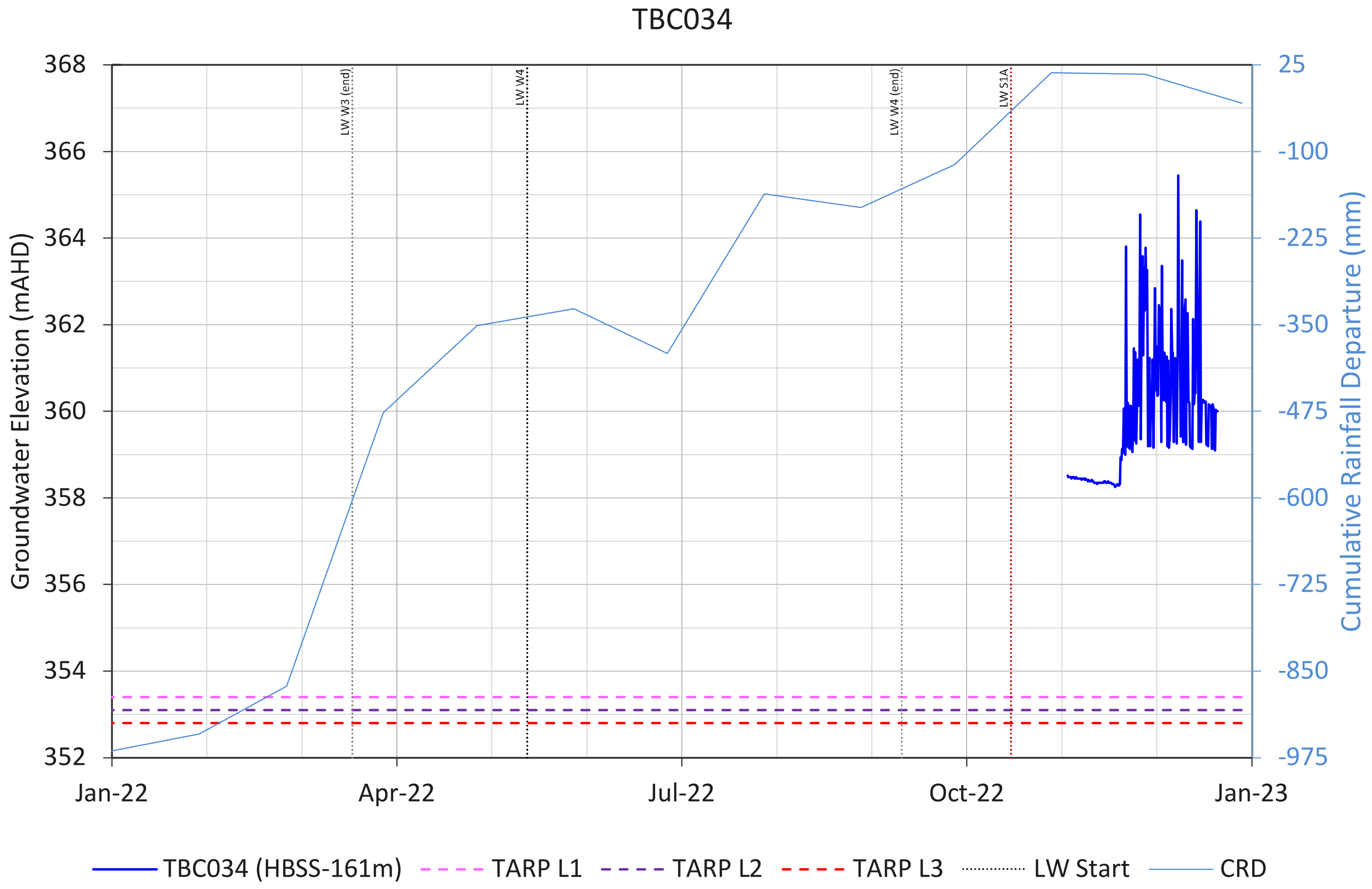


Figure B48

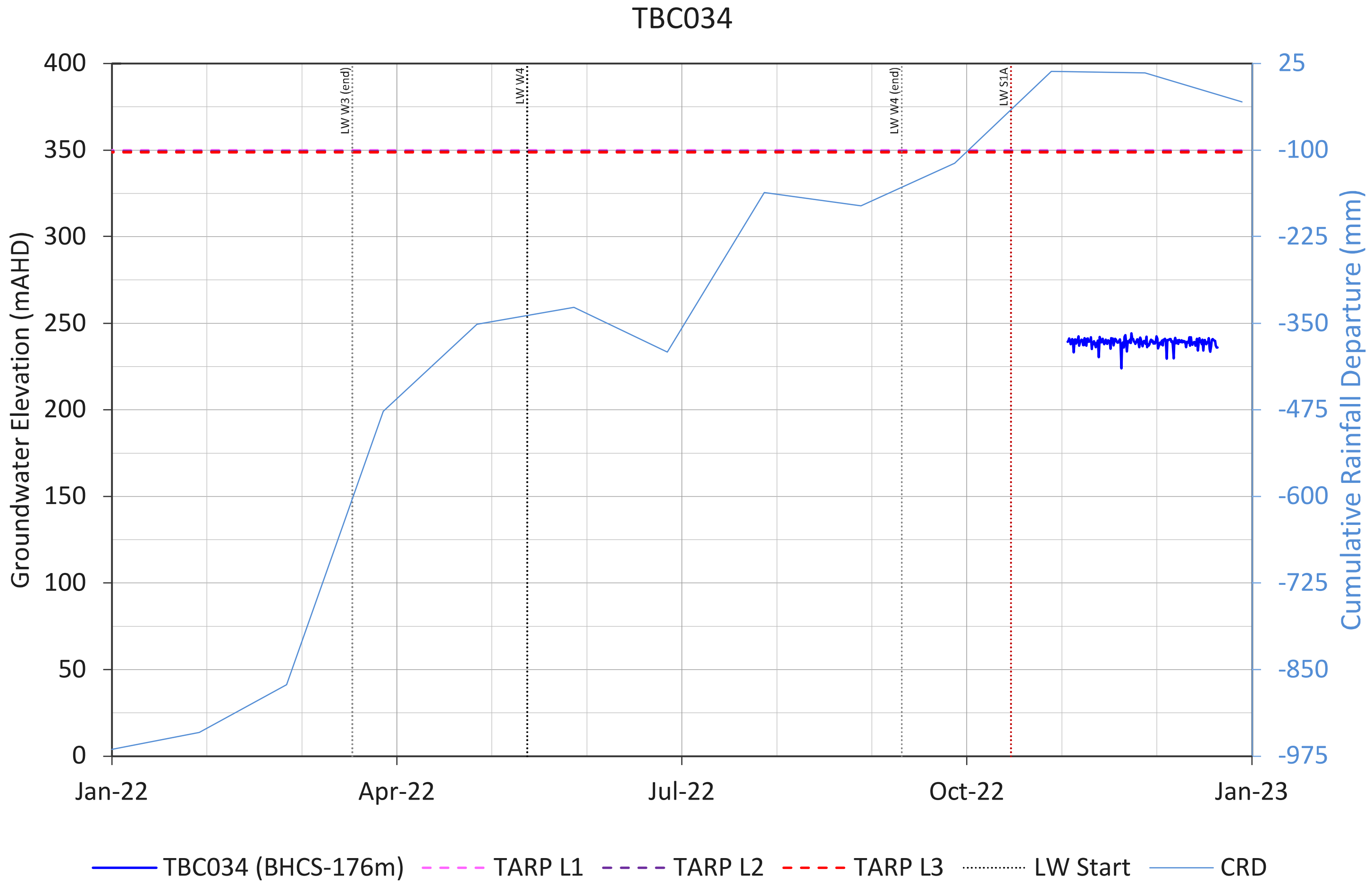


Figure B49

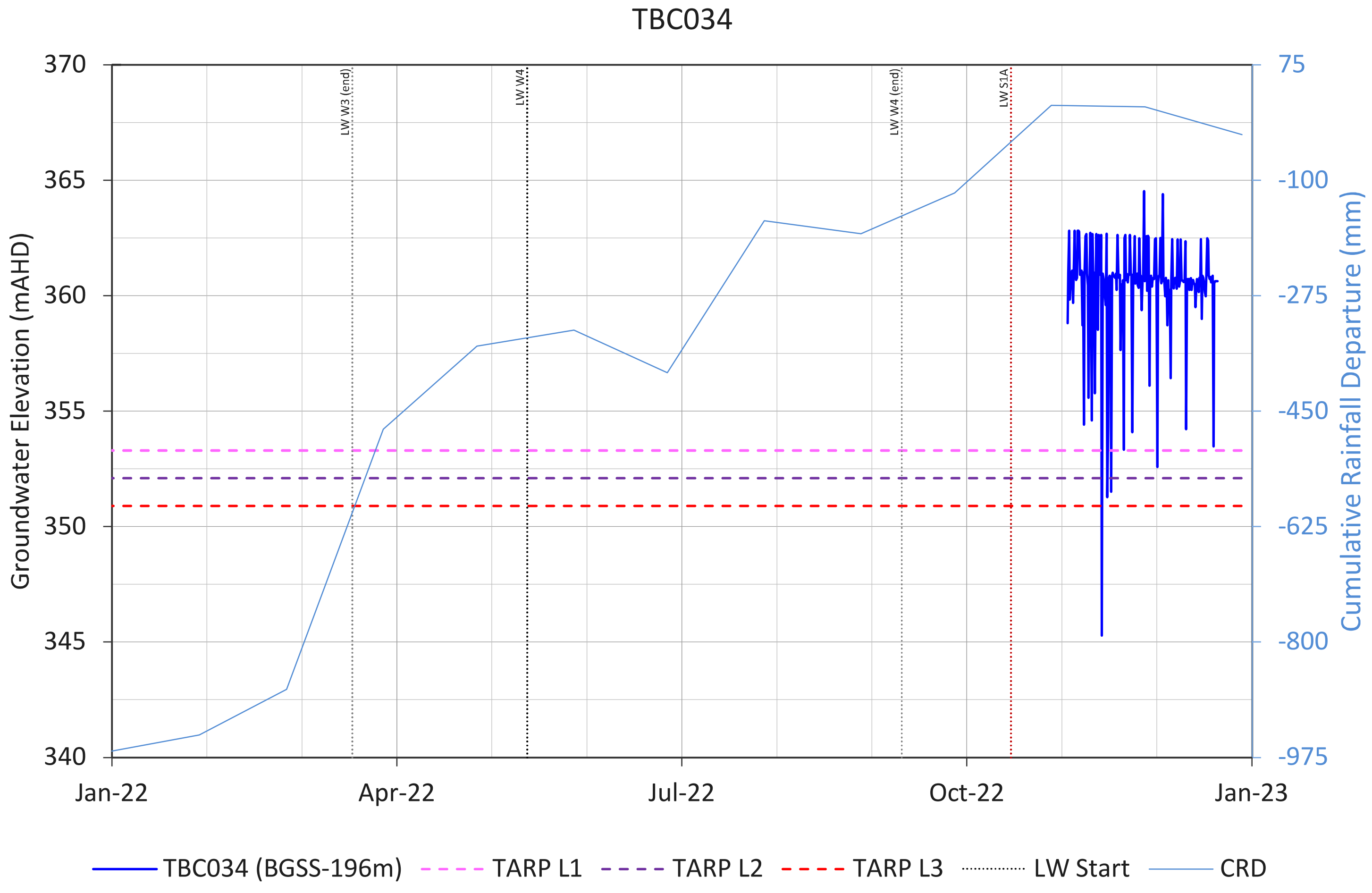


Figure B50

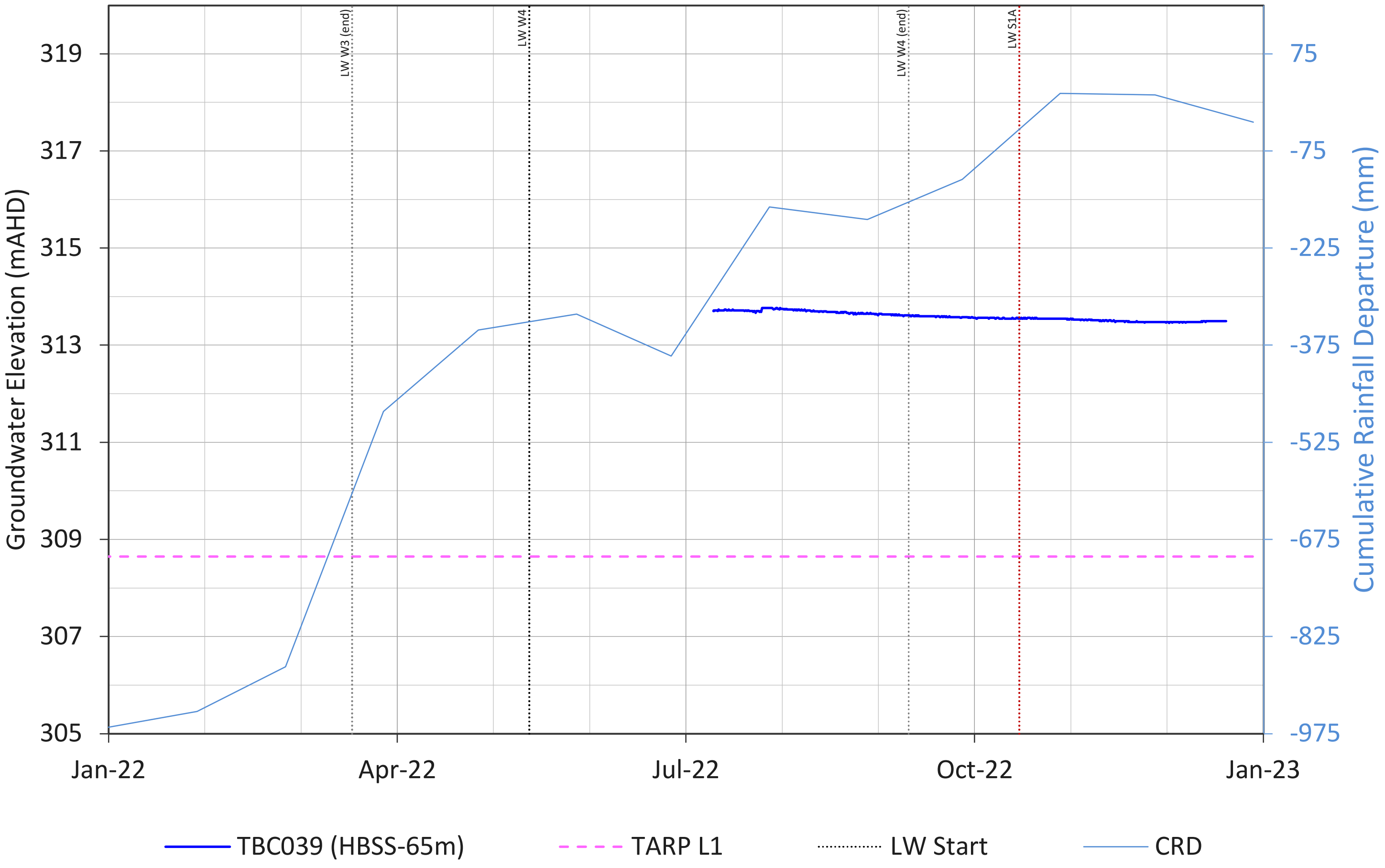
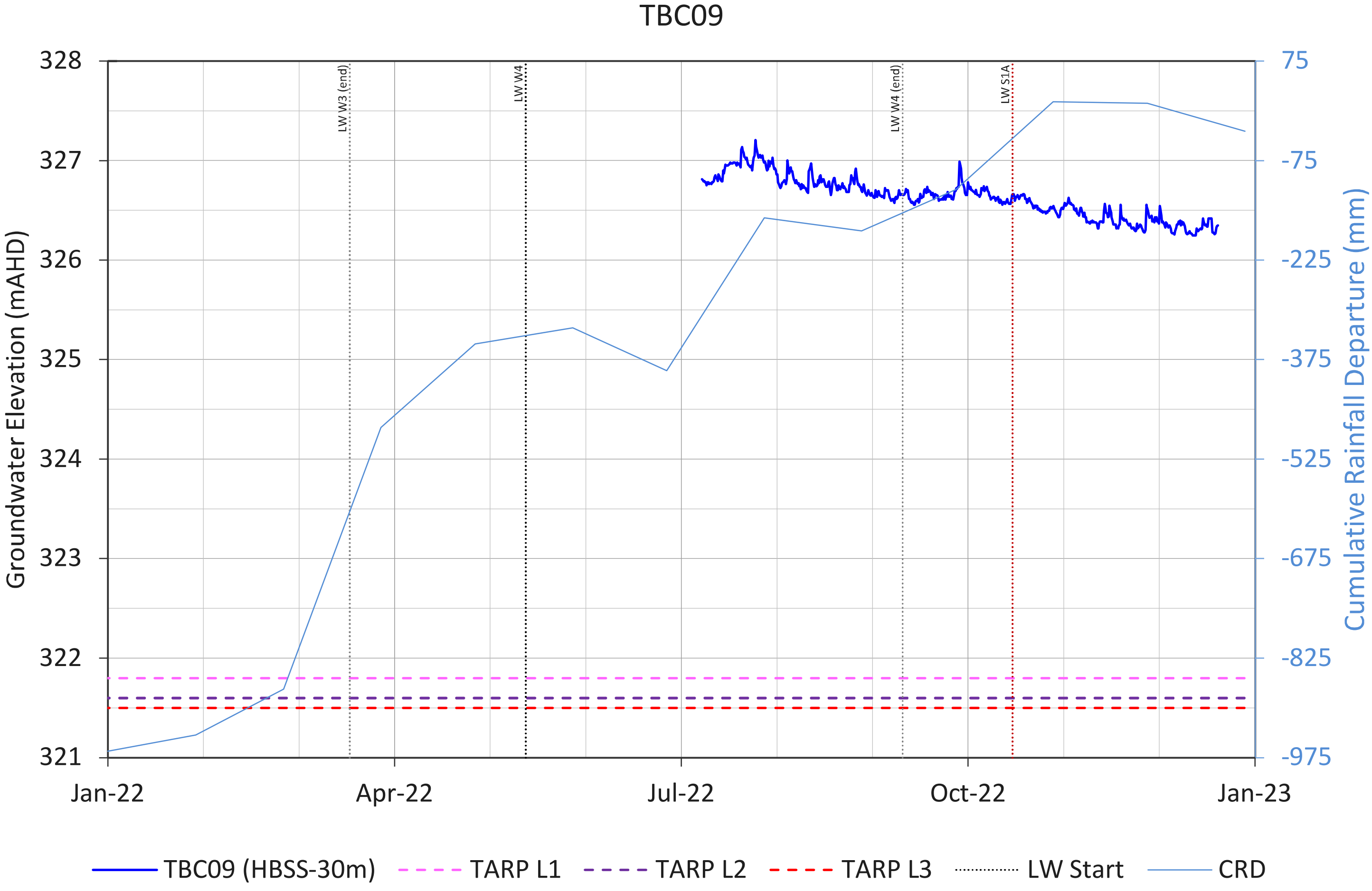

LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
319
317
315
313
311
309
307
305
75
-75
-225
-375
-525
-675
-825
-975
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
TBC039 (HBSS-65m)
TARP L1
LW Start
CRD

Figure B51

Appendix B:

Hydrographs for Shallow VWPs (<200m)



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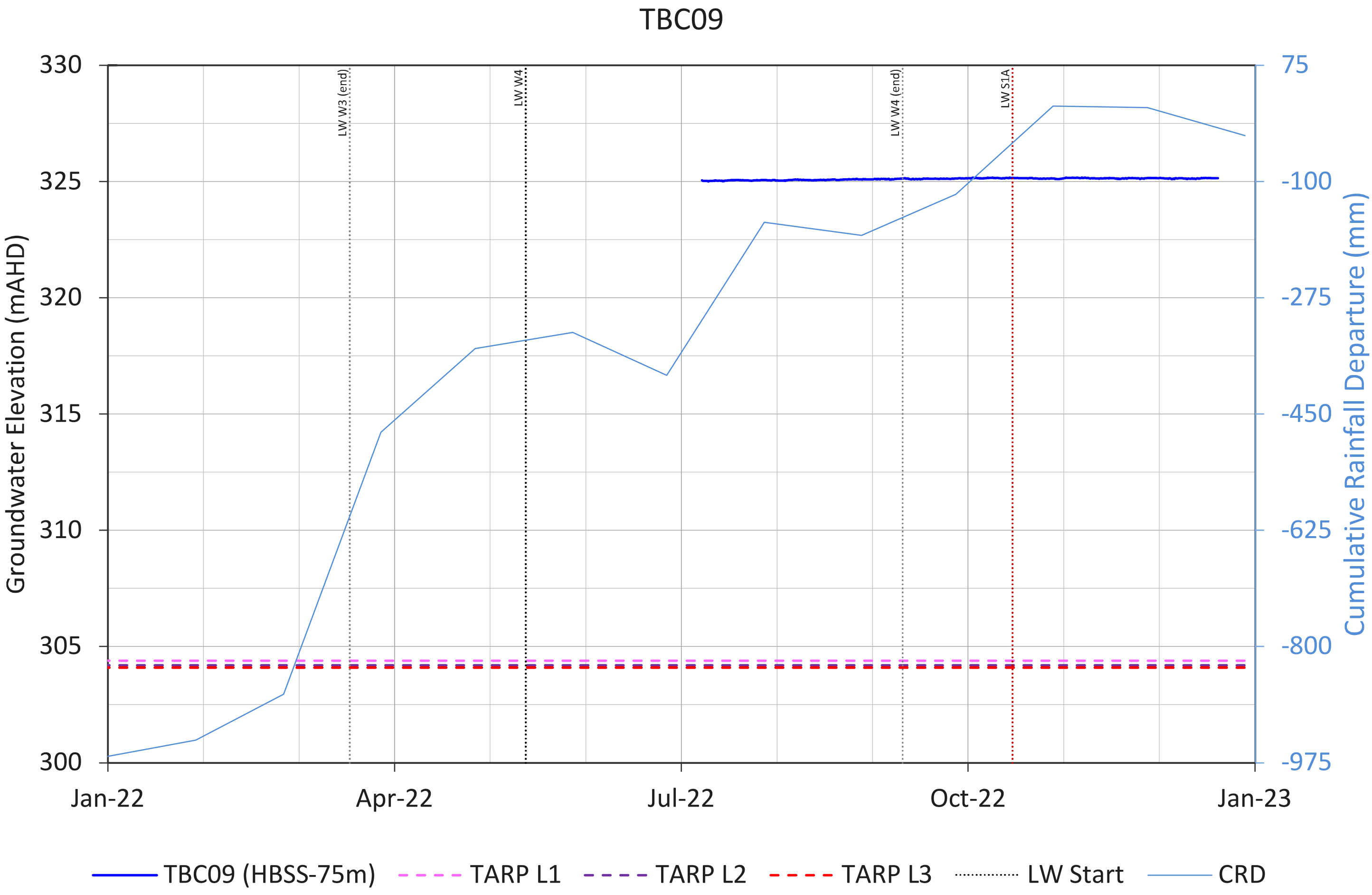


Figure B2

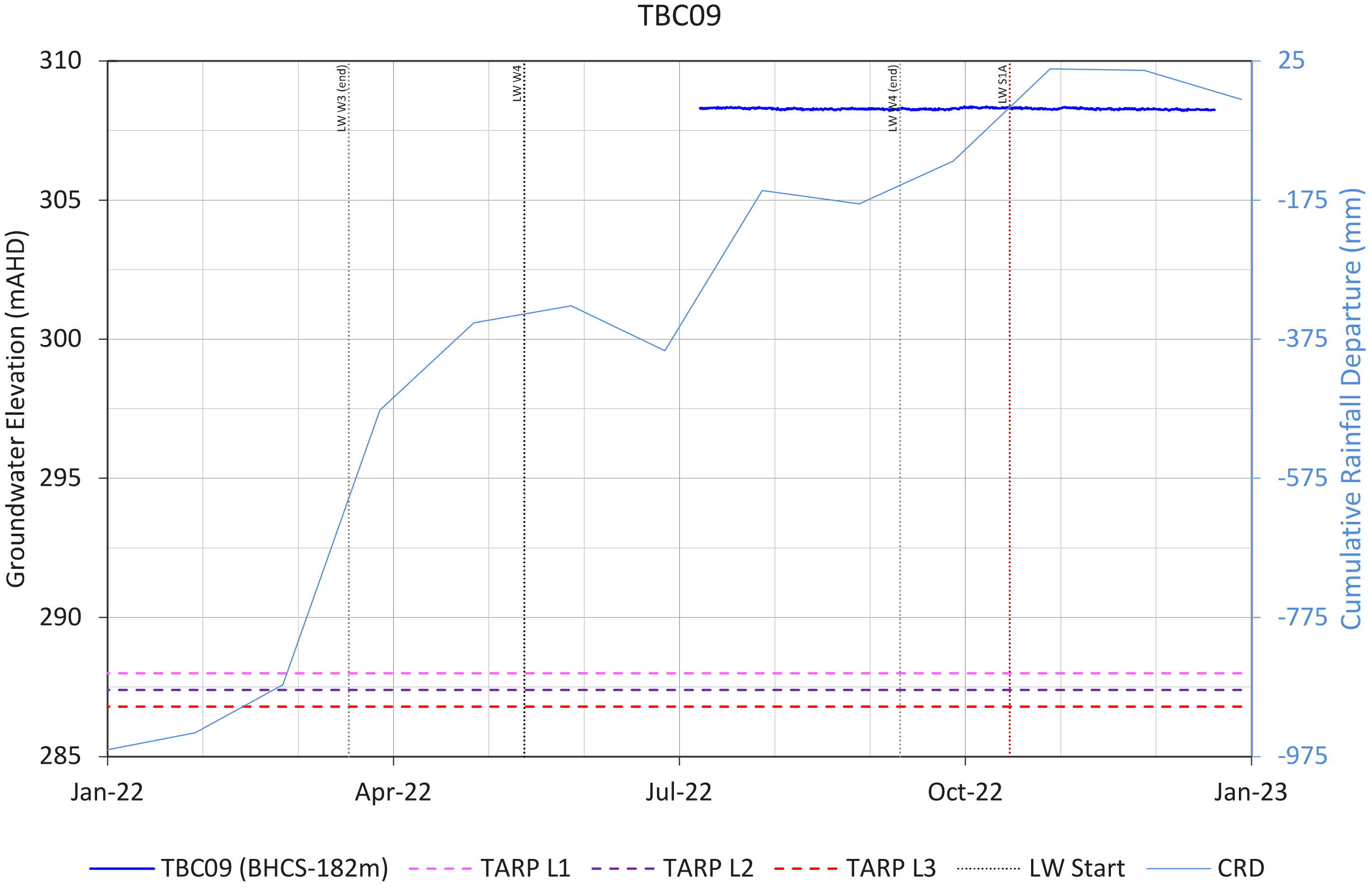


Figure B3

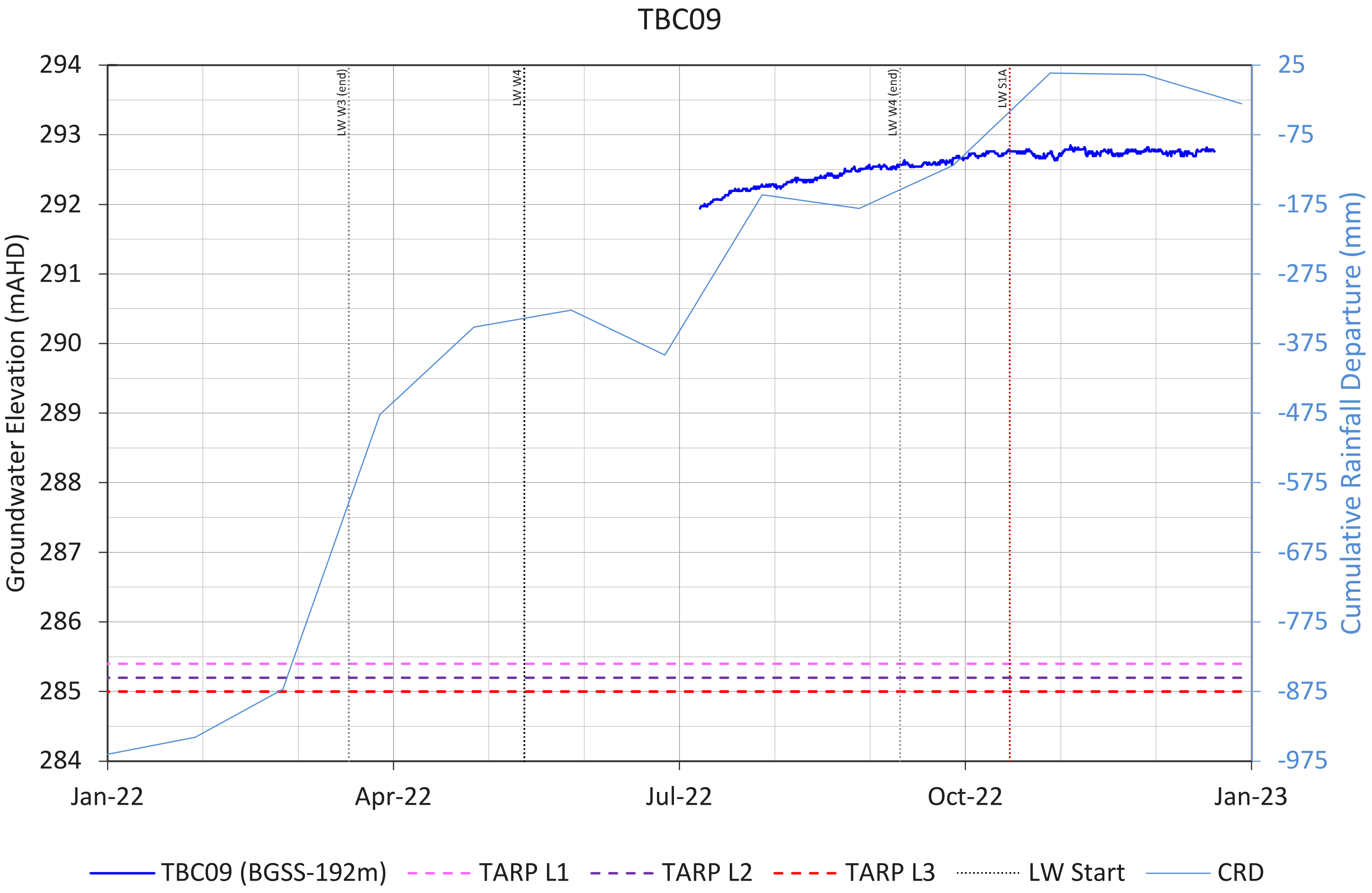


Figure B4

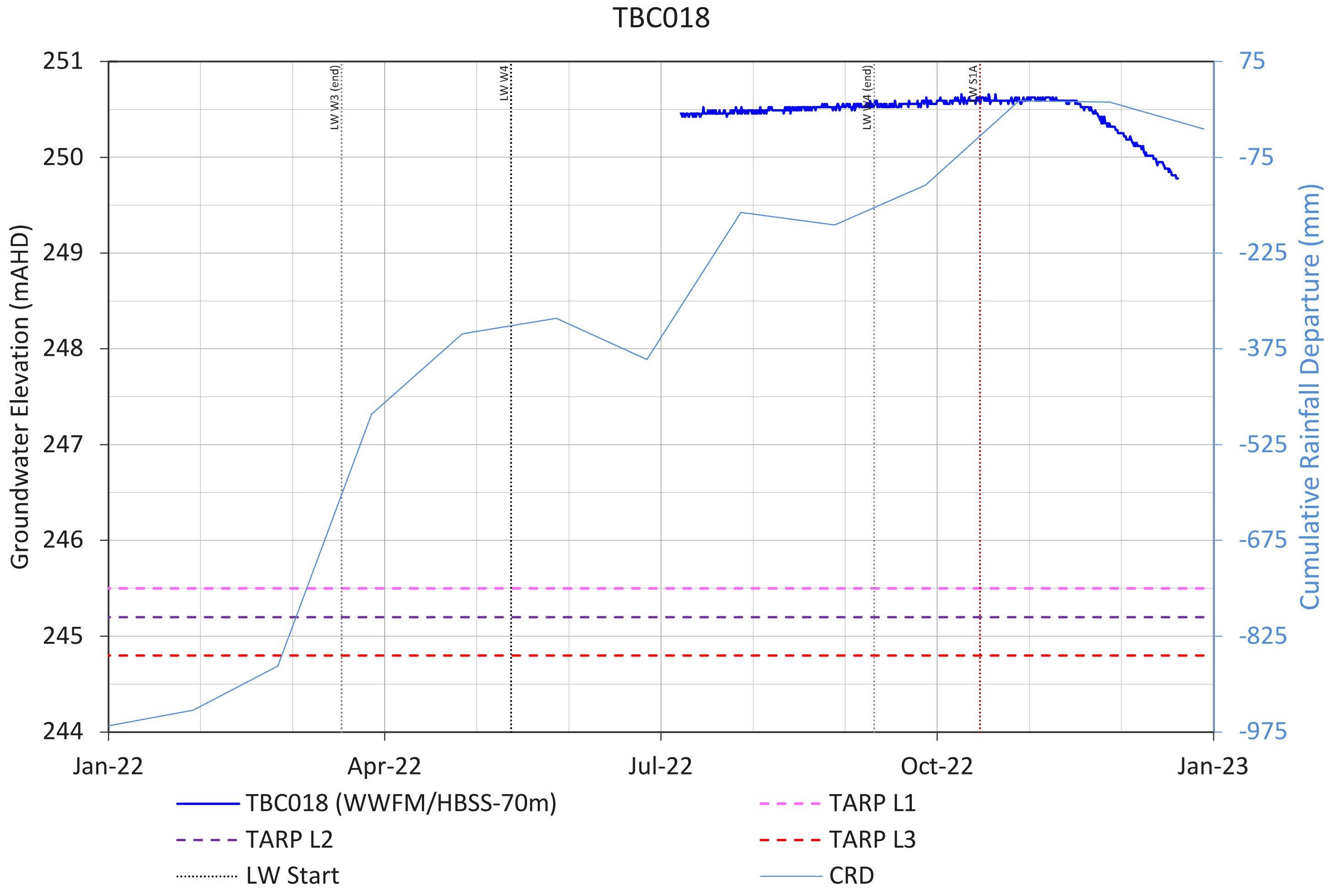


Figure B5

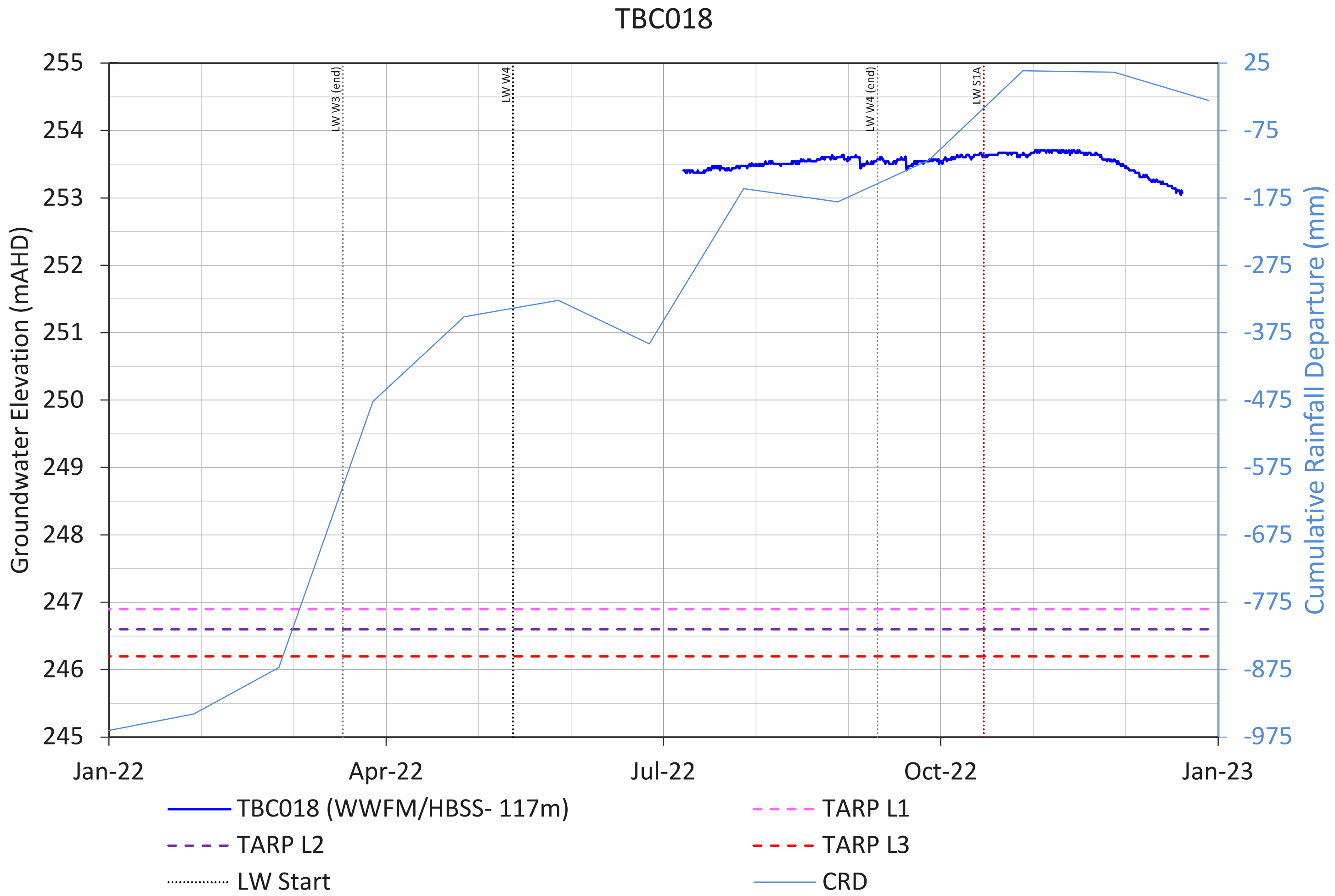


Figure B6

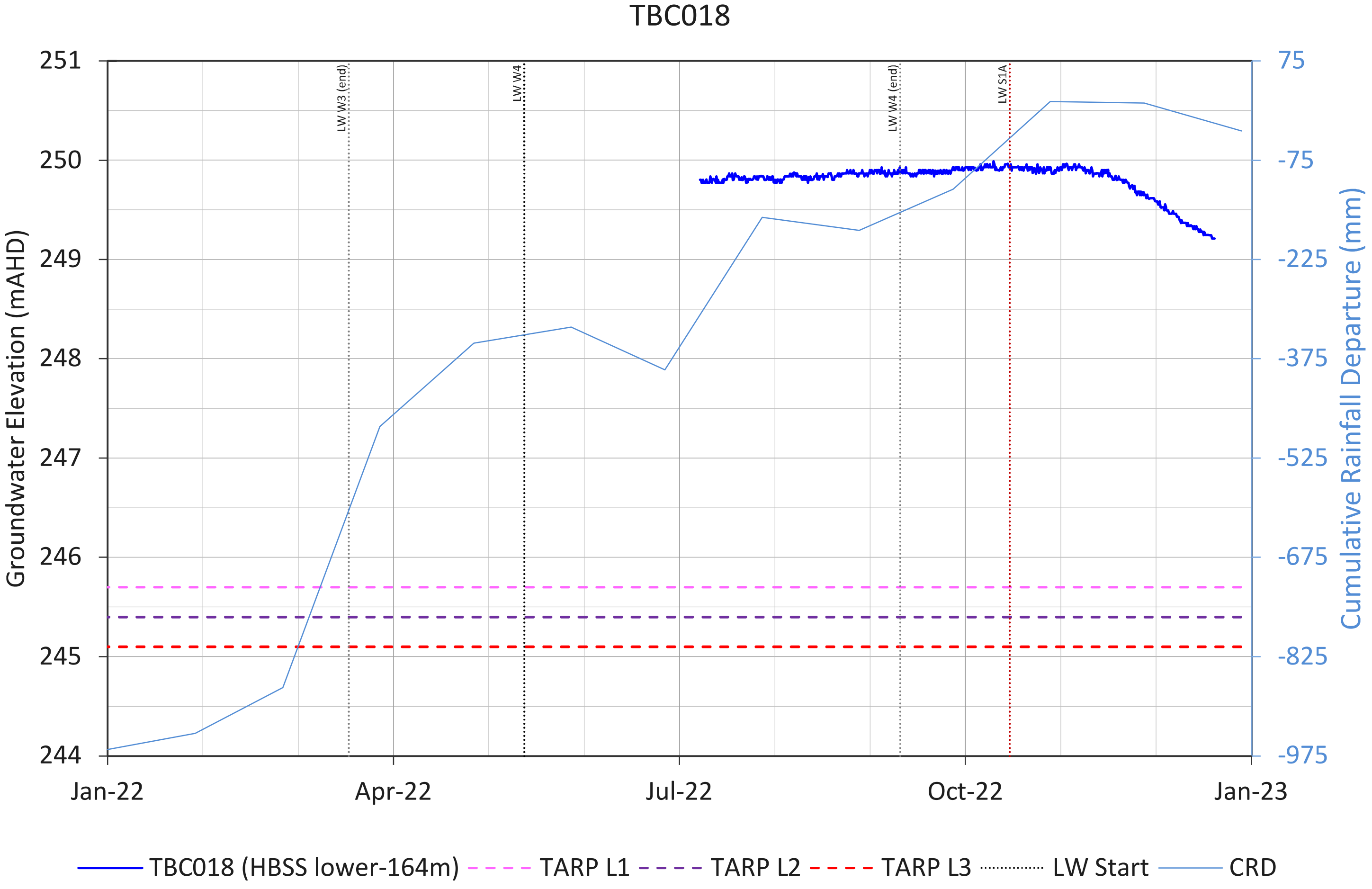


Figure B7

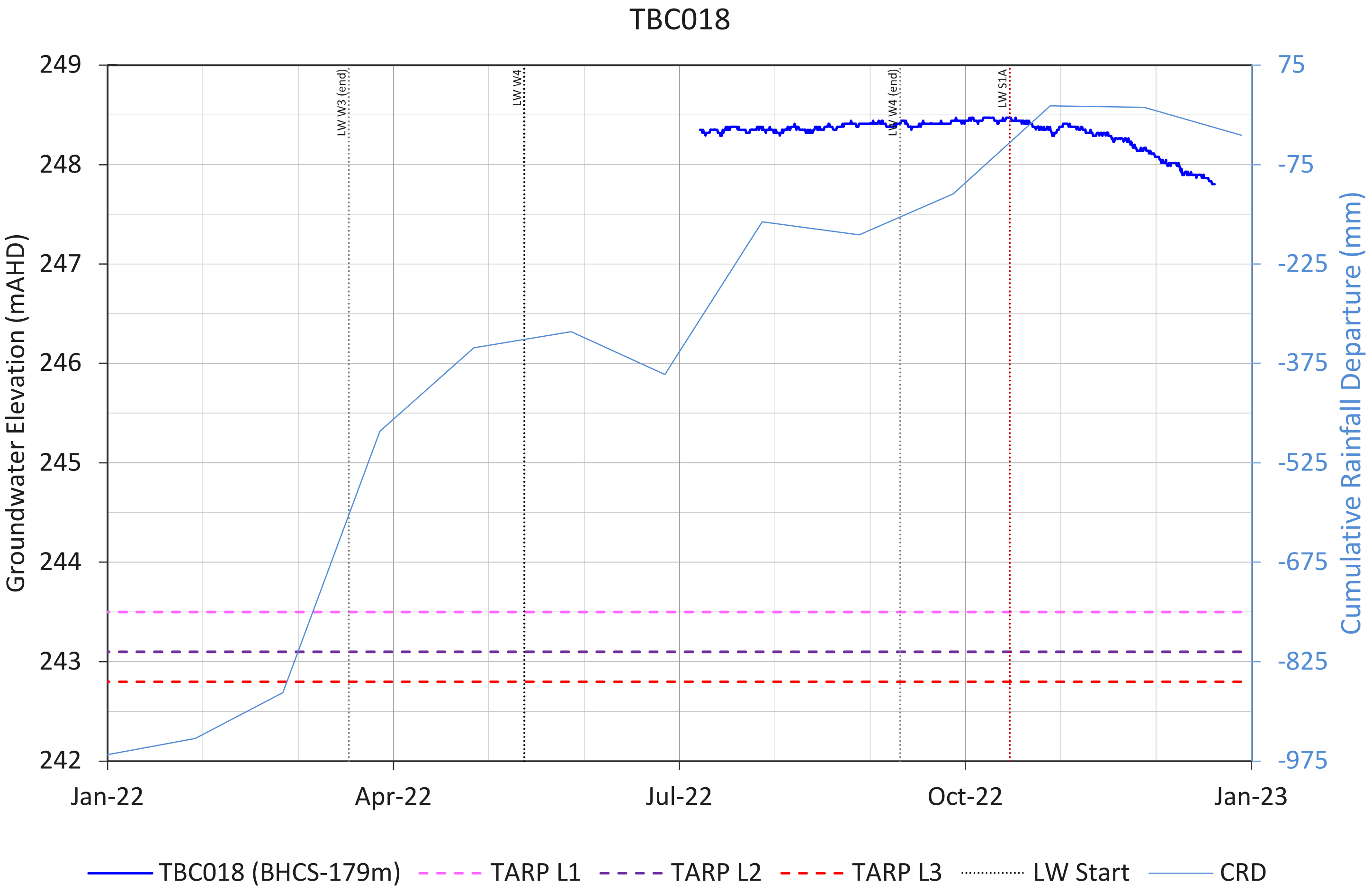


Figure B8

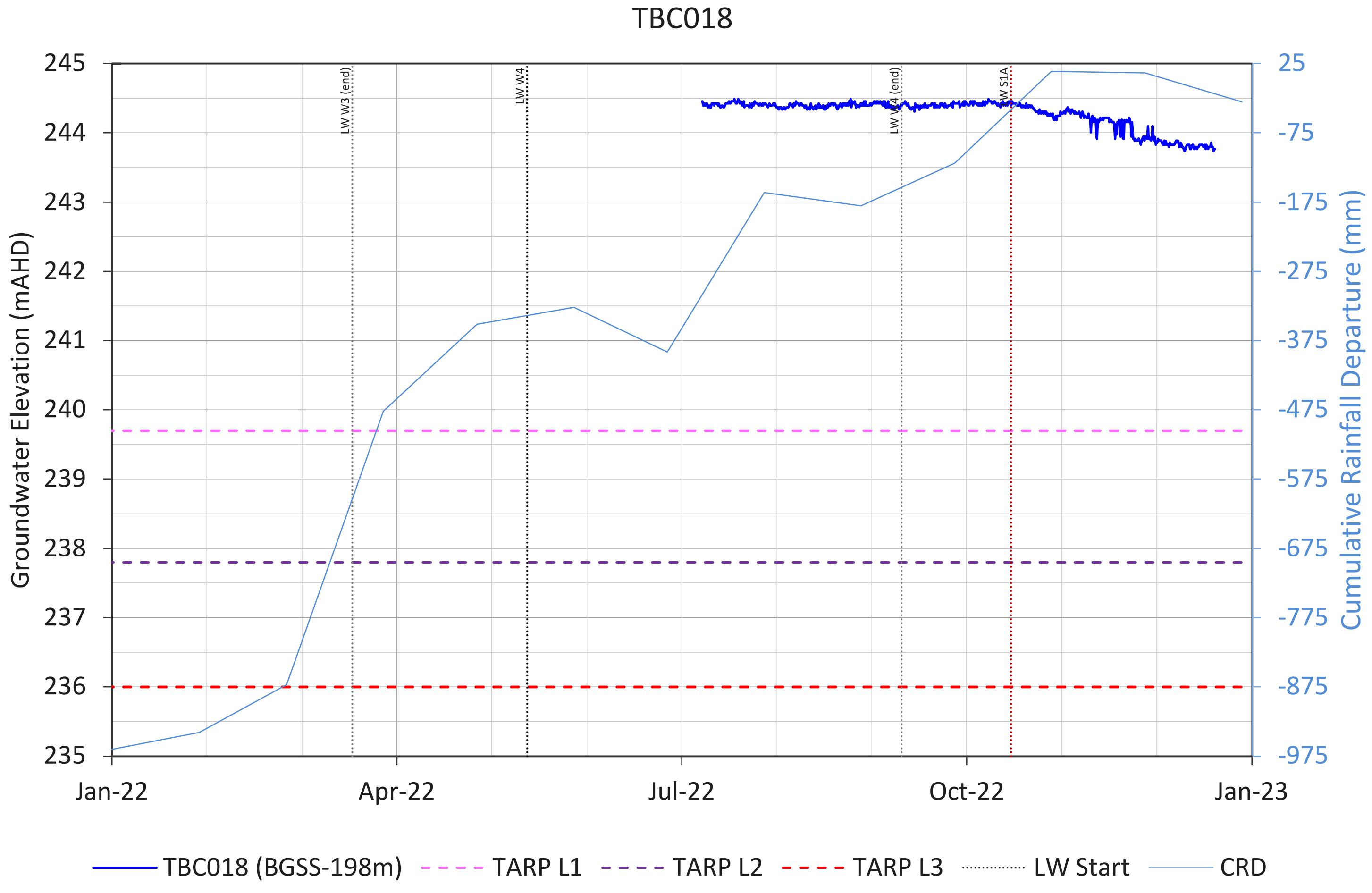


Figure B9

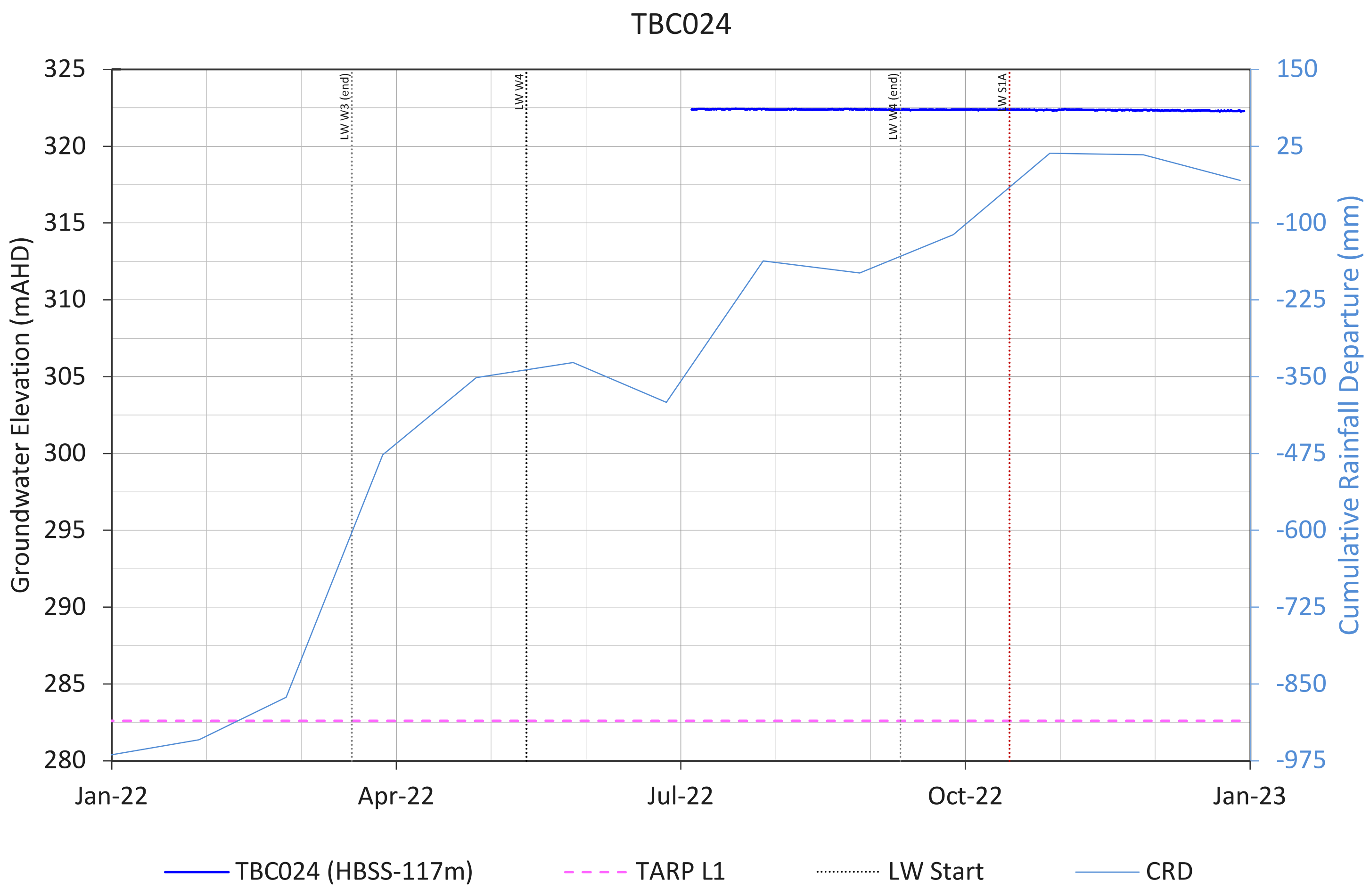


Figure B10

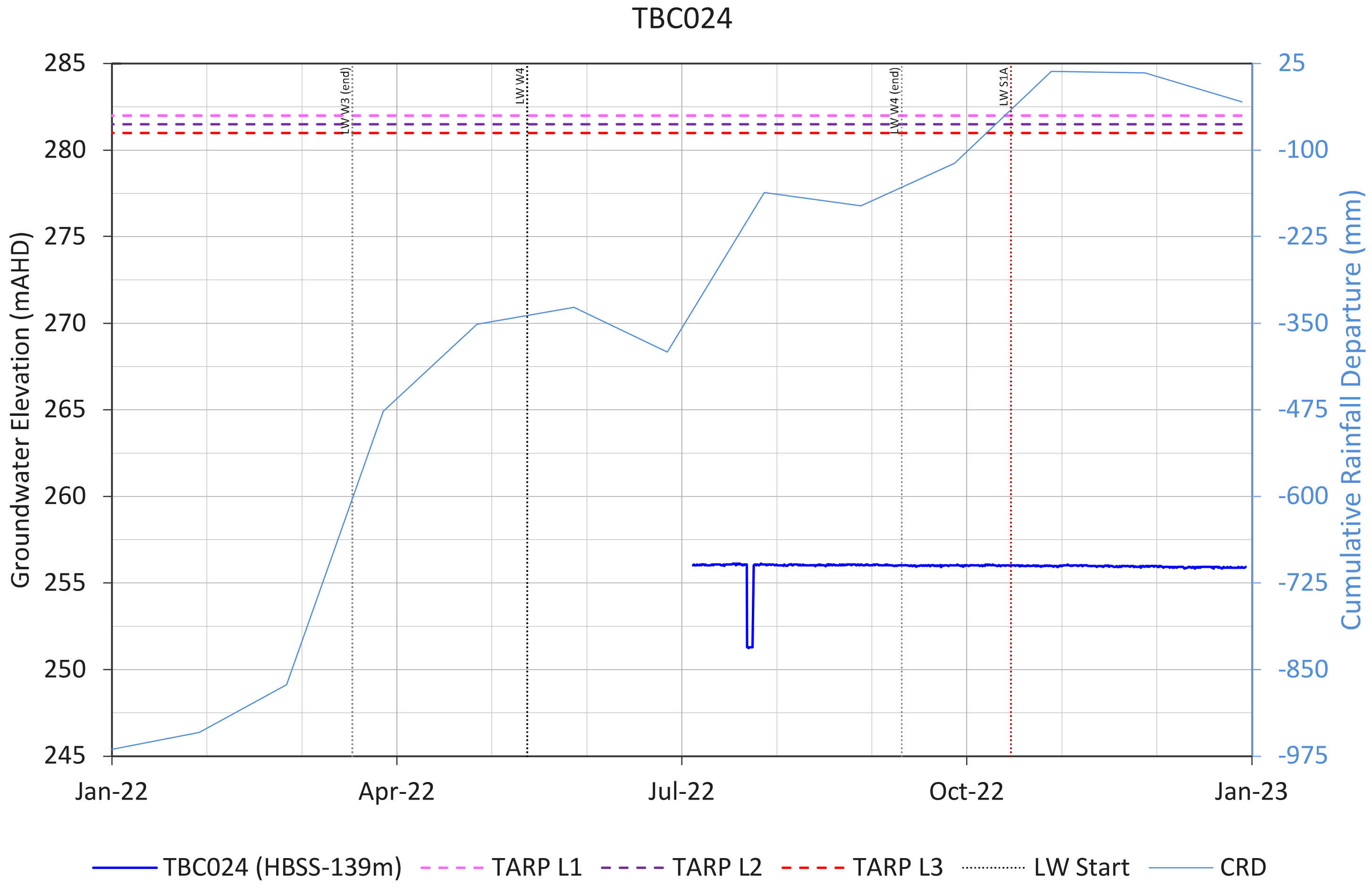


Figure B11

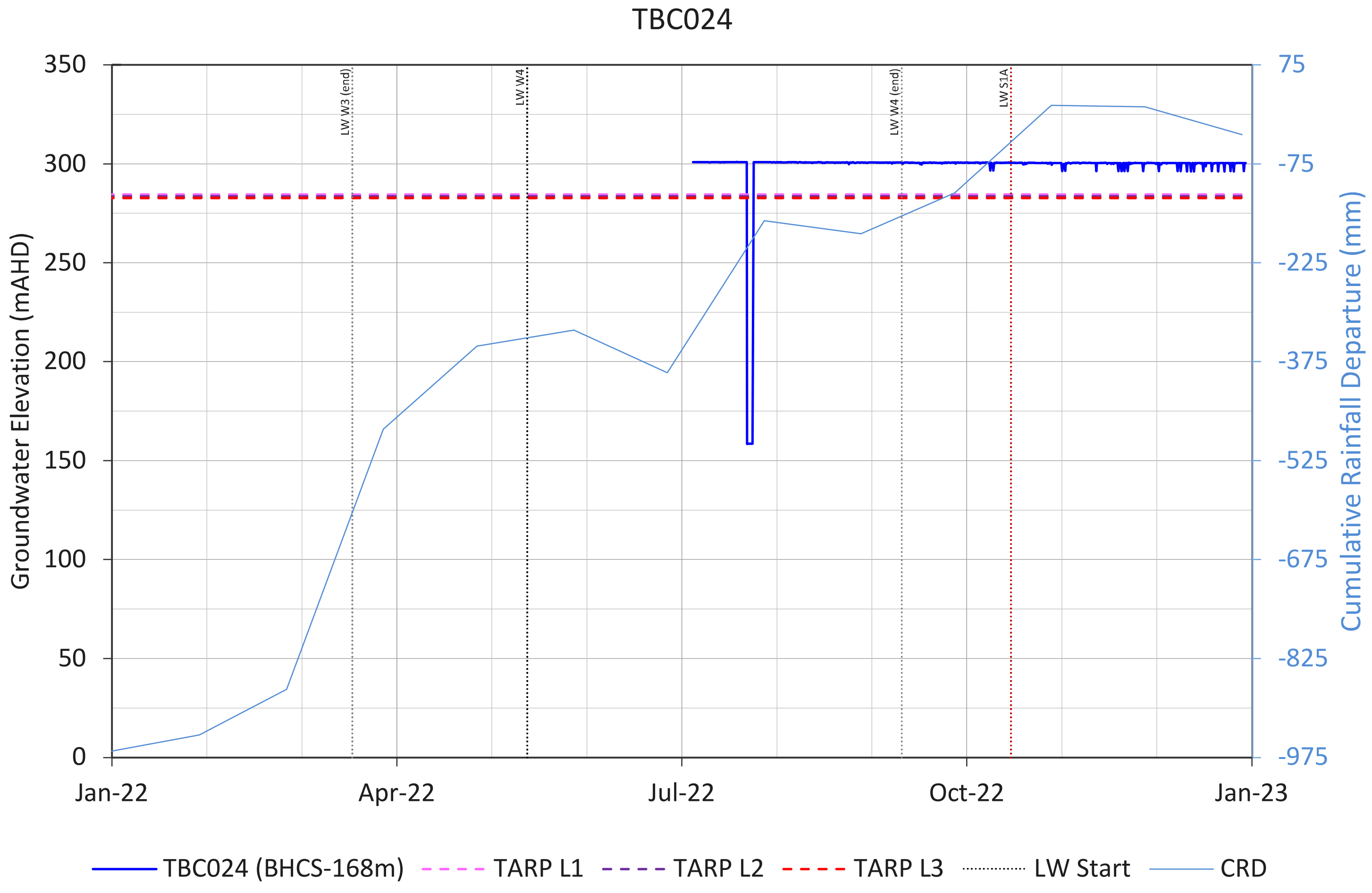


Figure B12

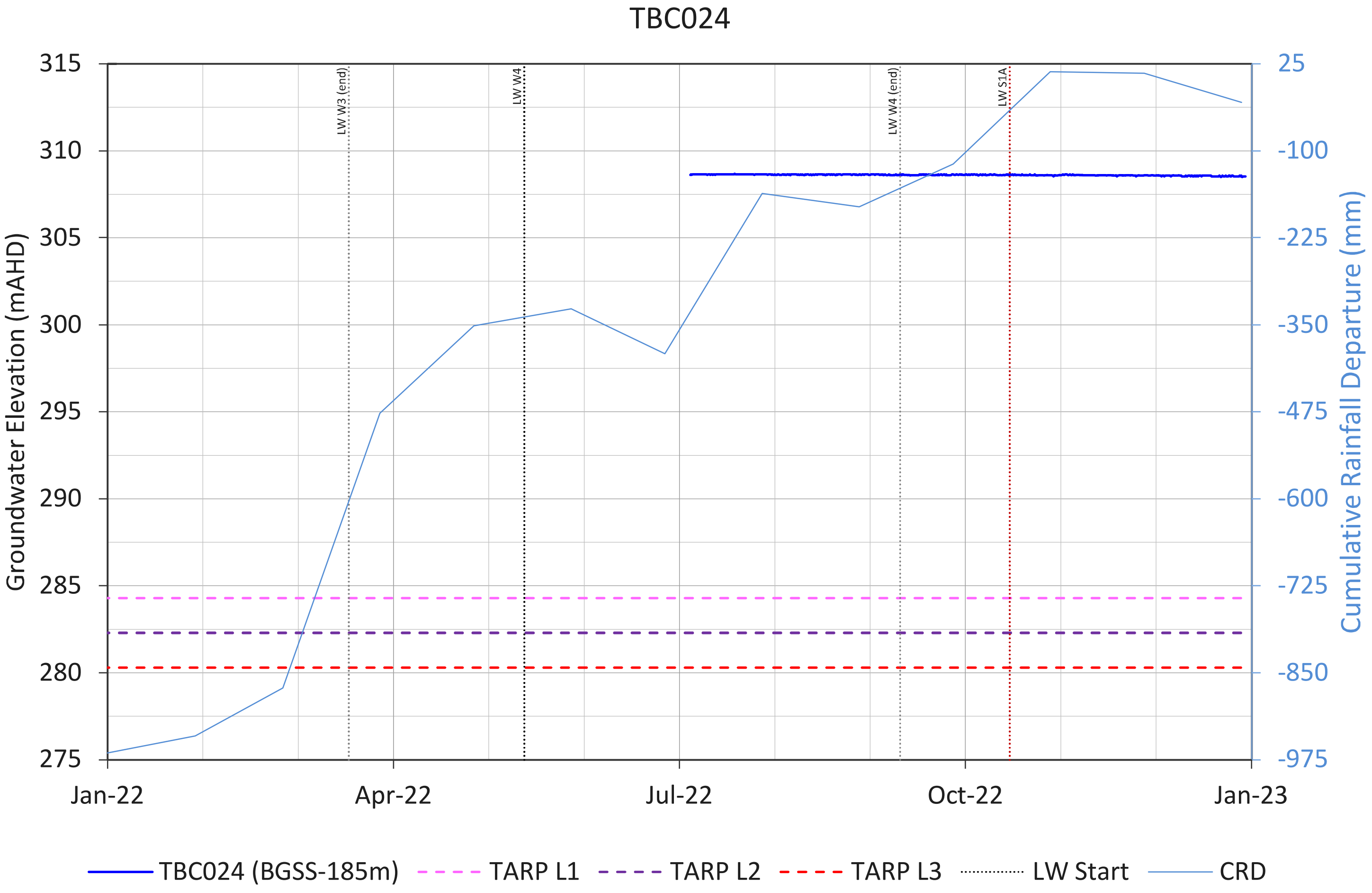


Figure B13

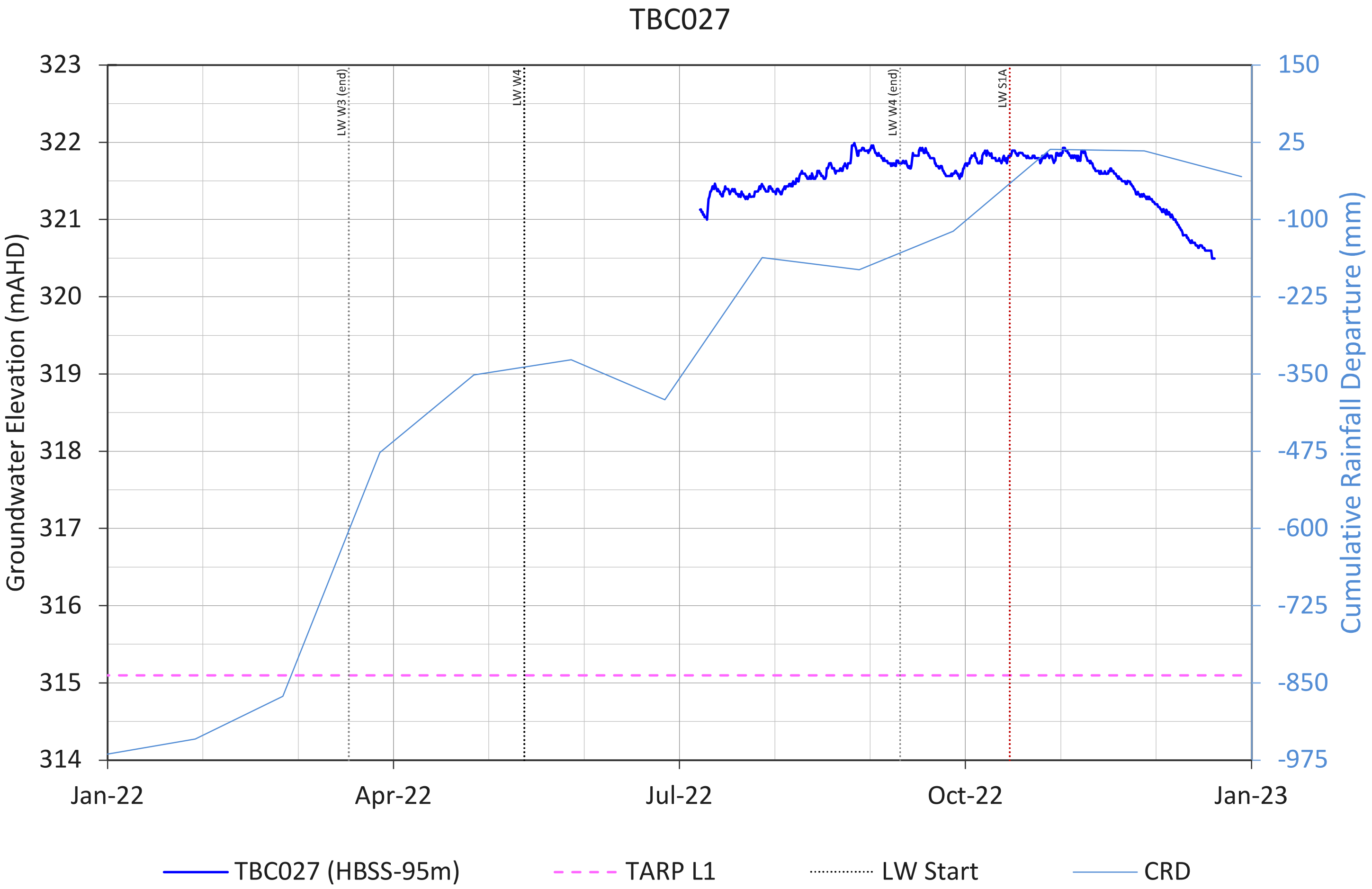


Figure B14

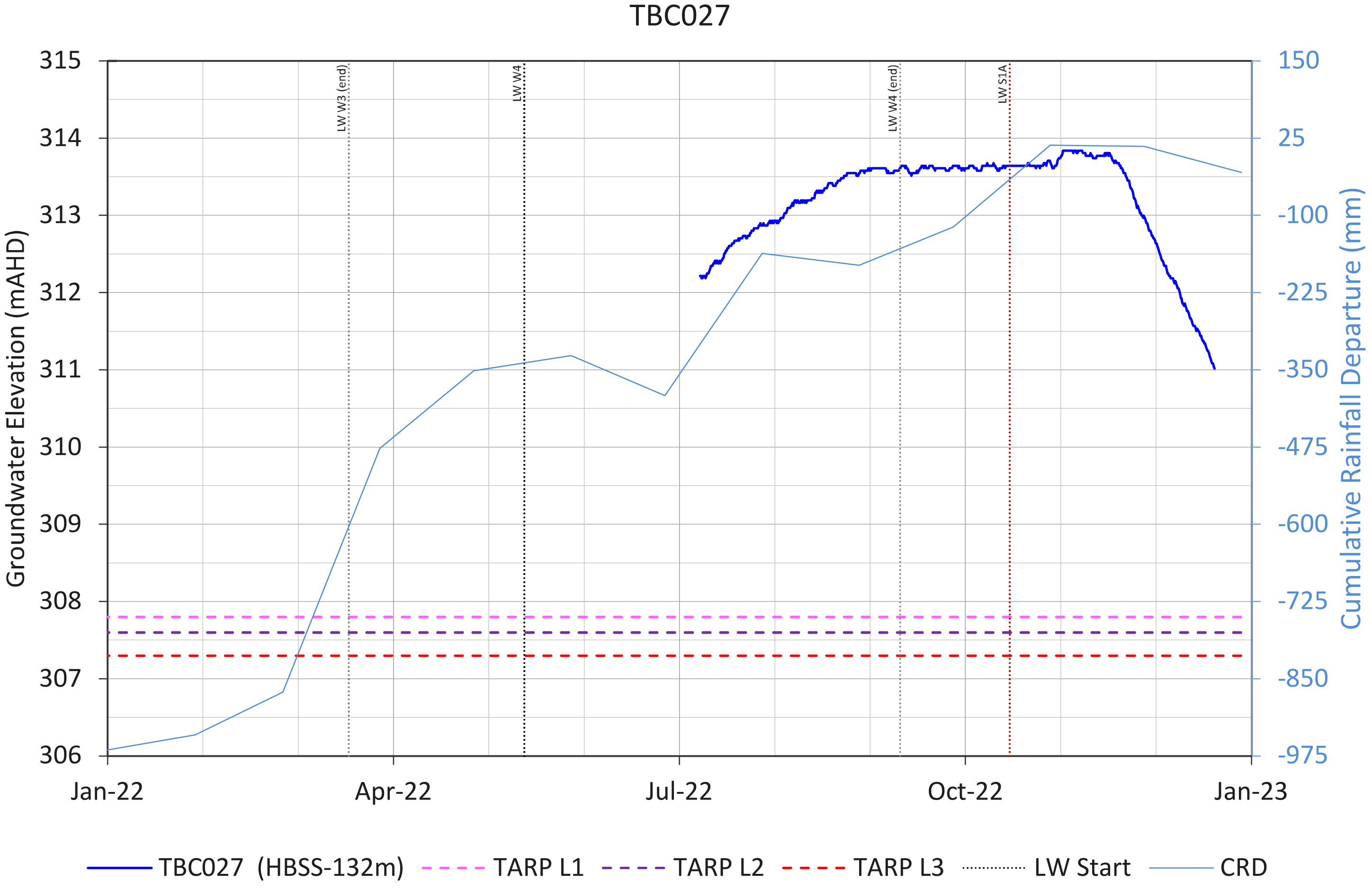


Figure B15

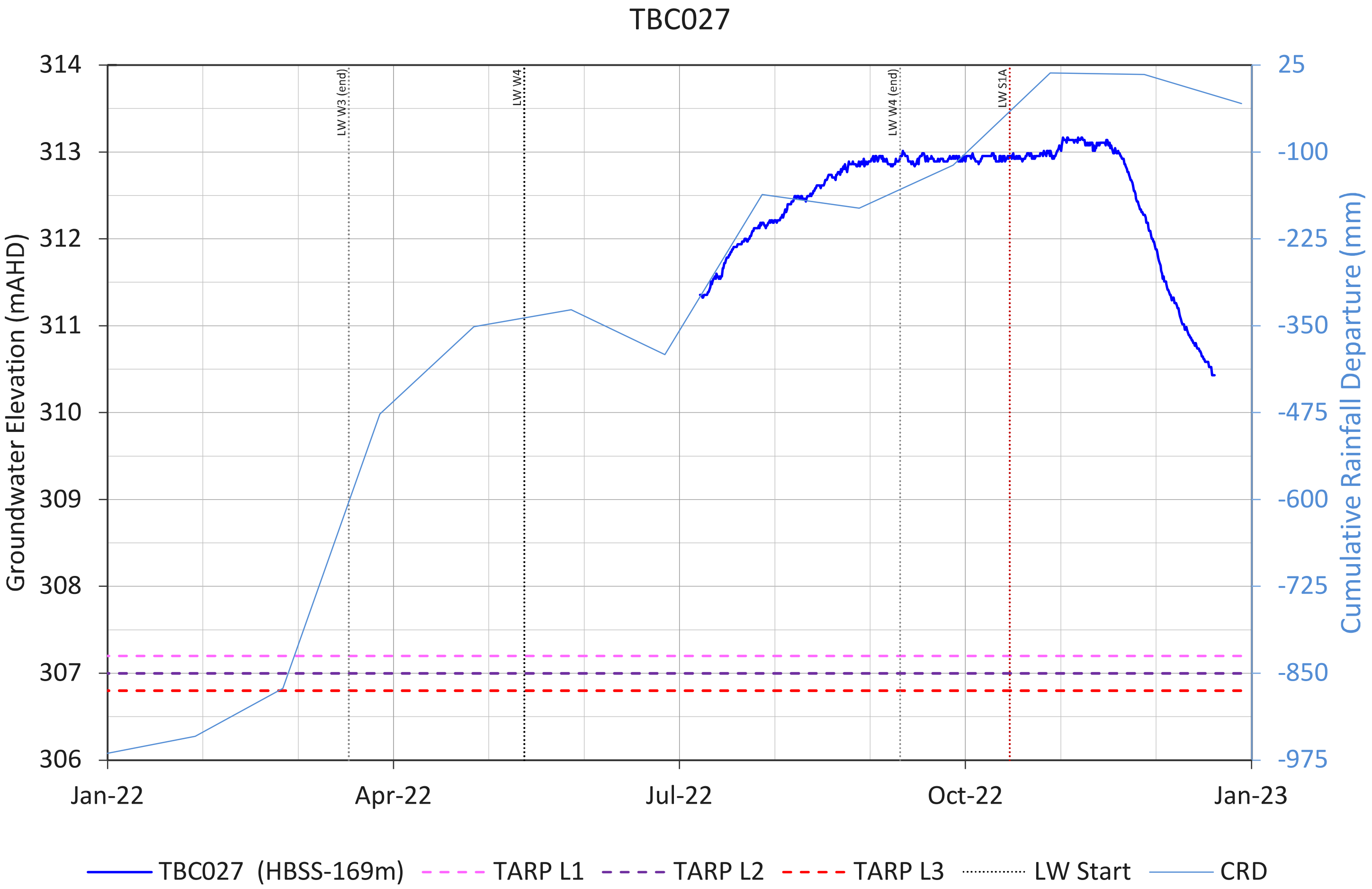


Figure B16

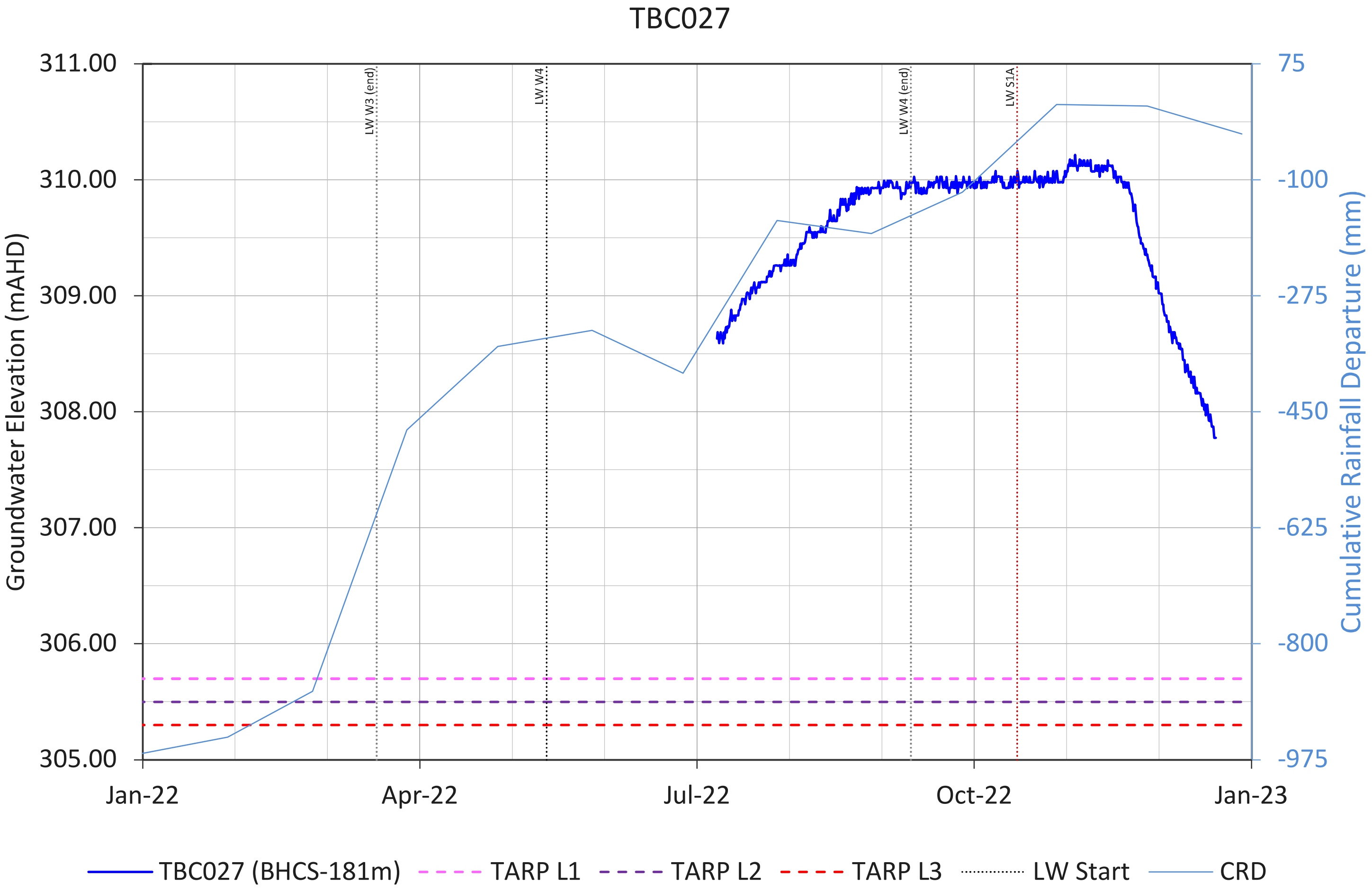


Figure B17

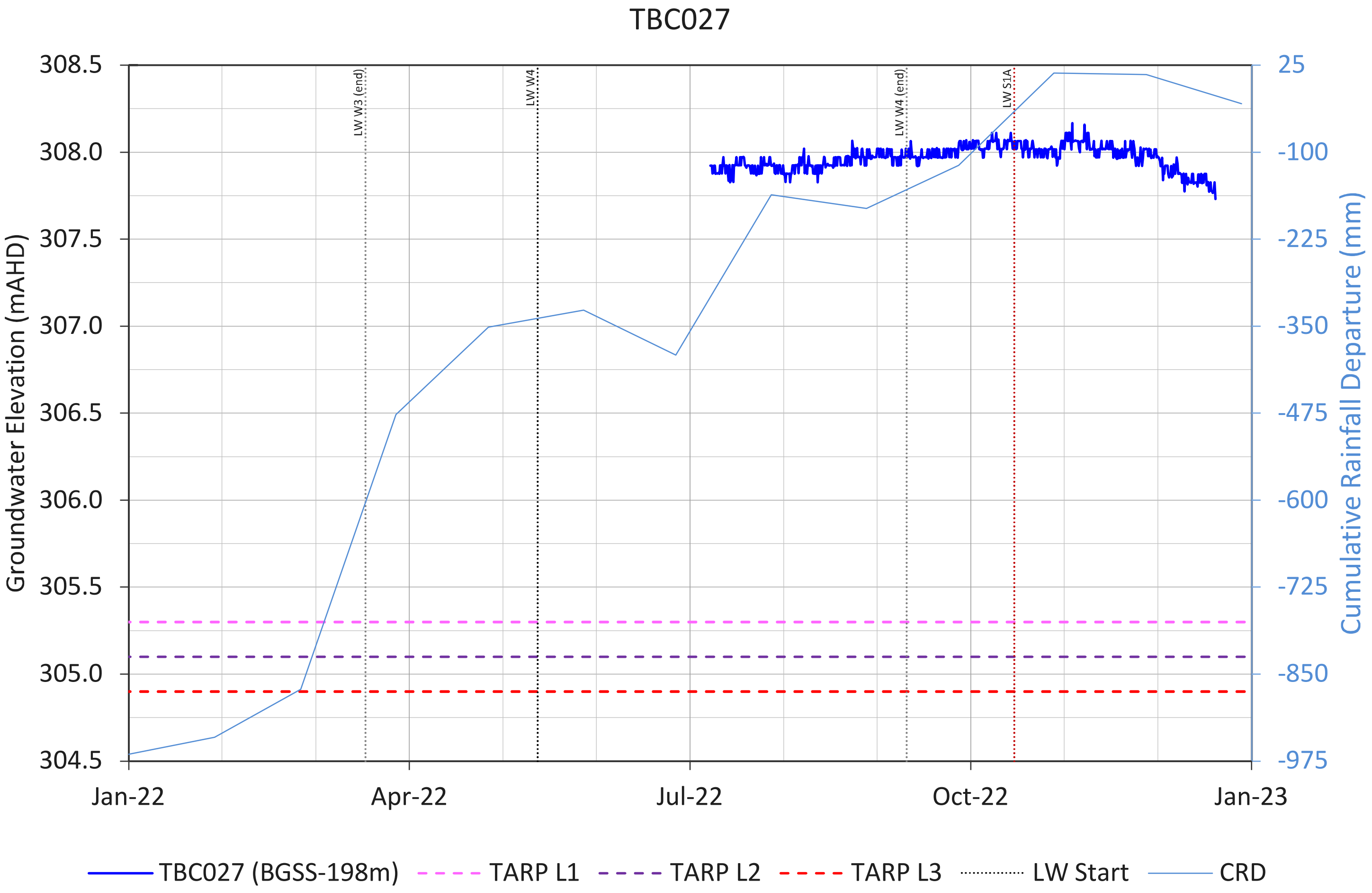


Figure B18

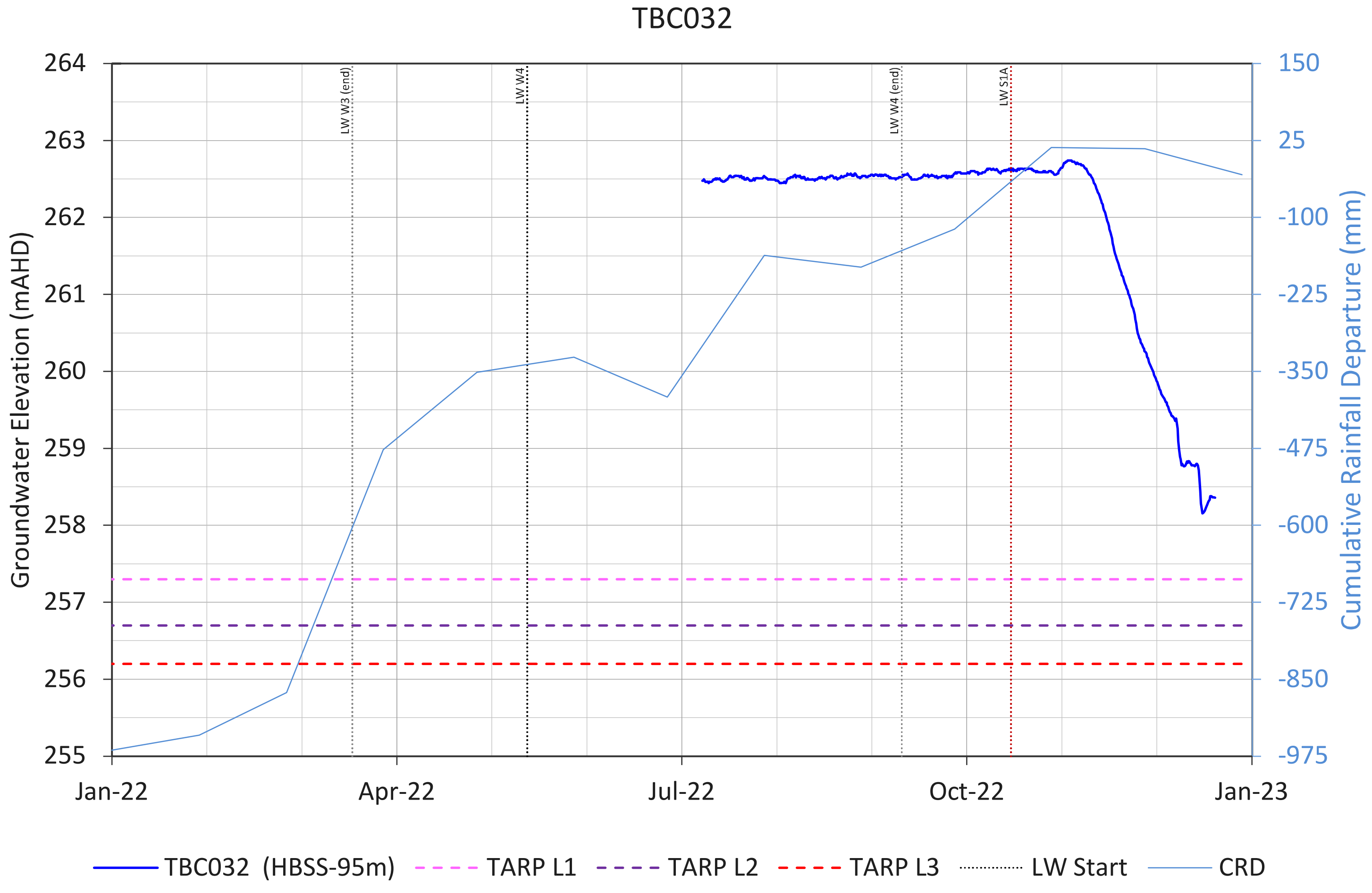


Figure B19

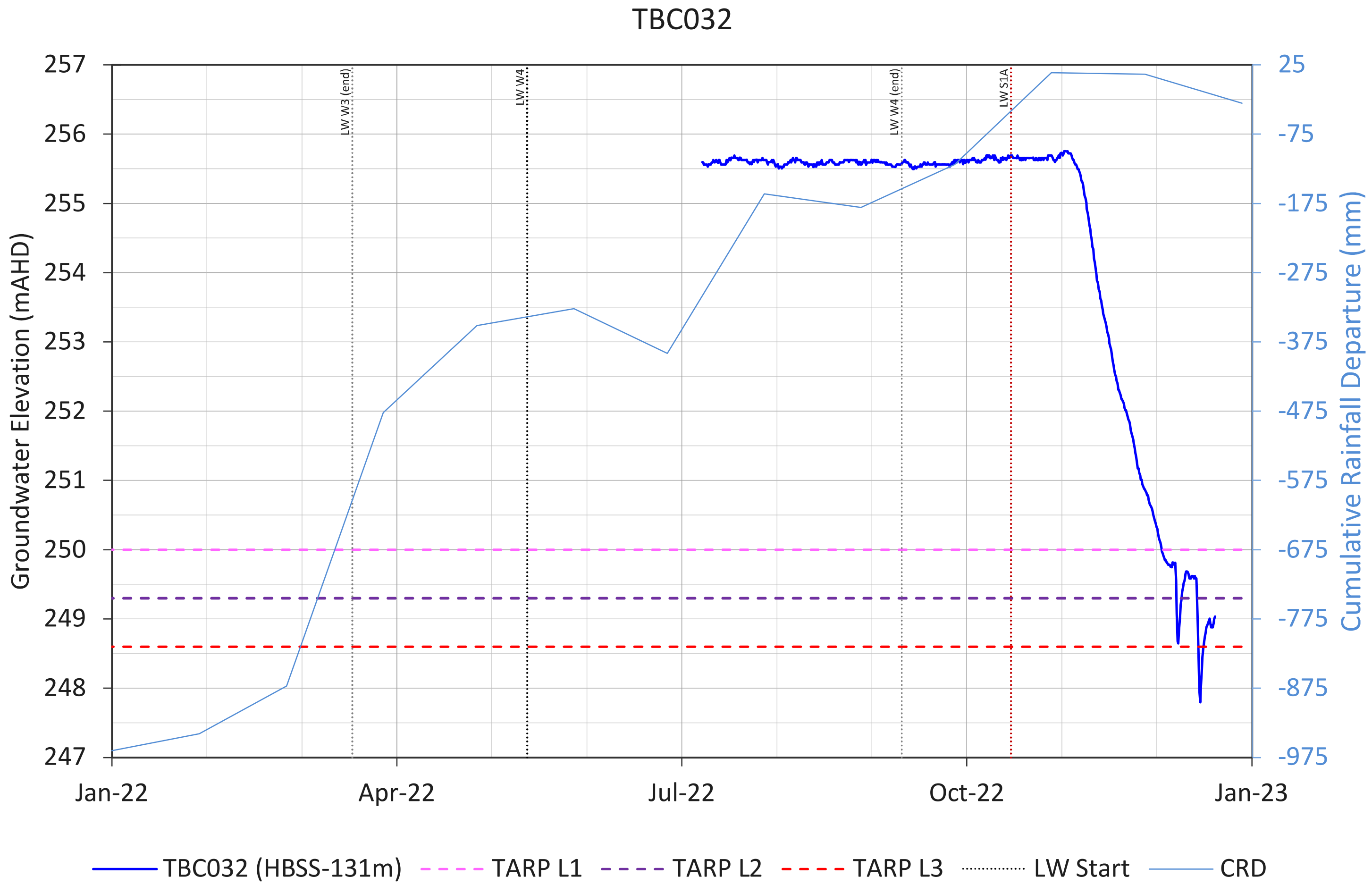


Figure B20

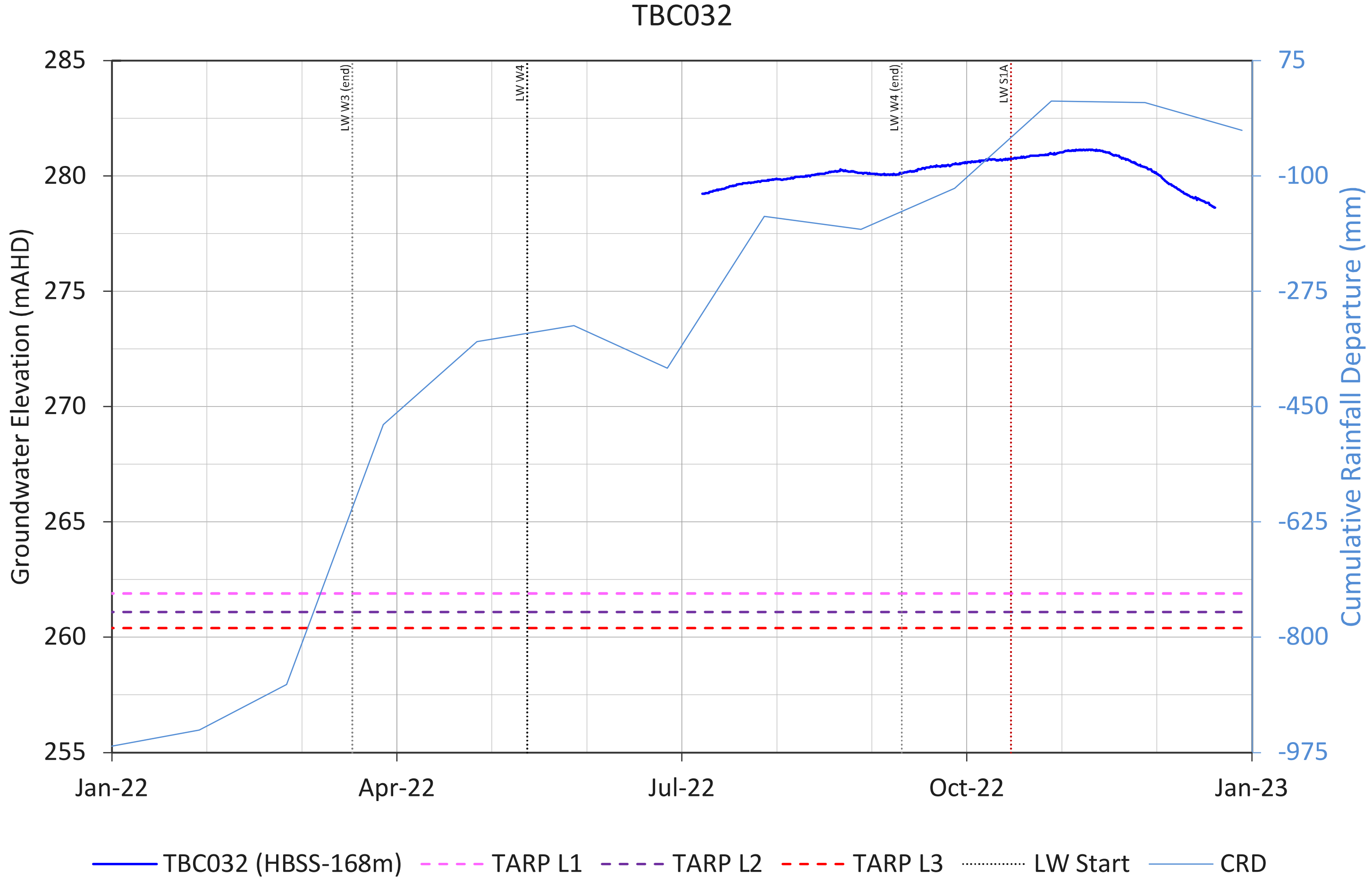


Figure B21

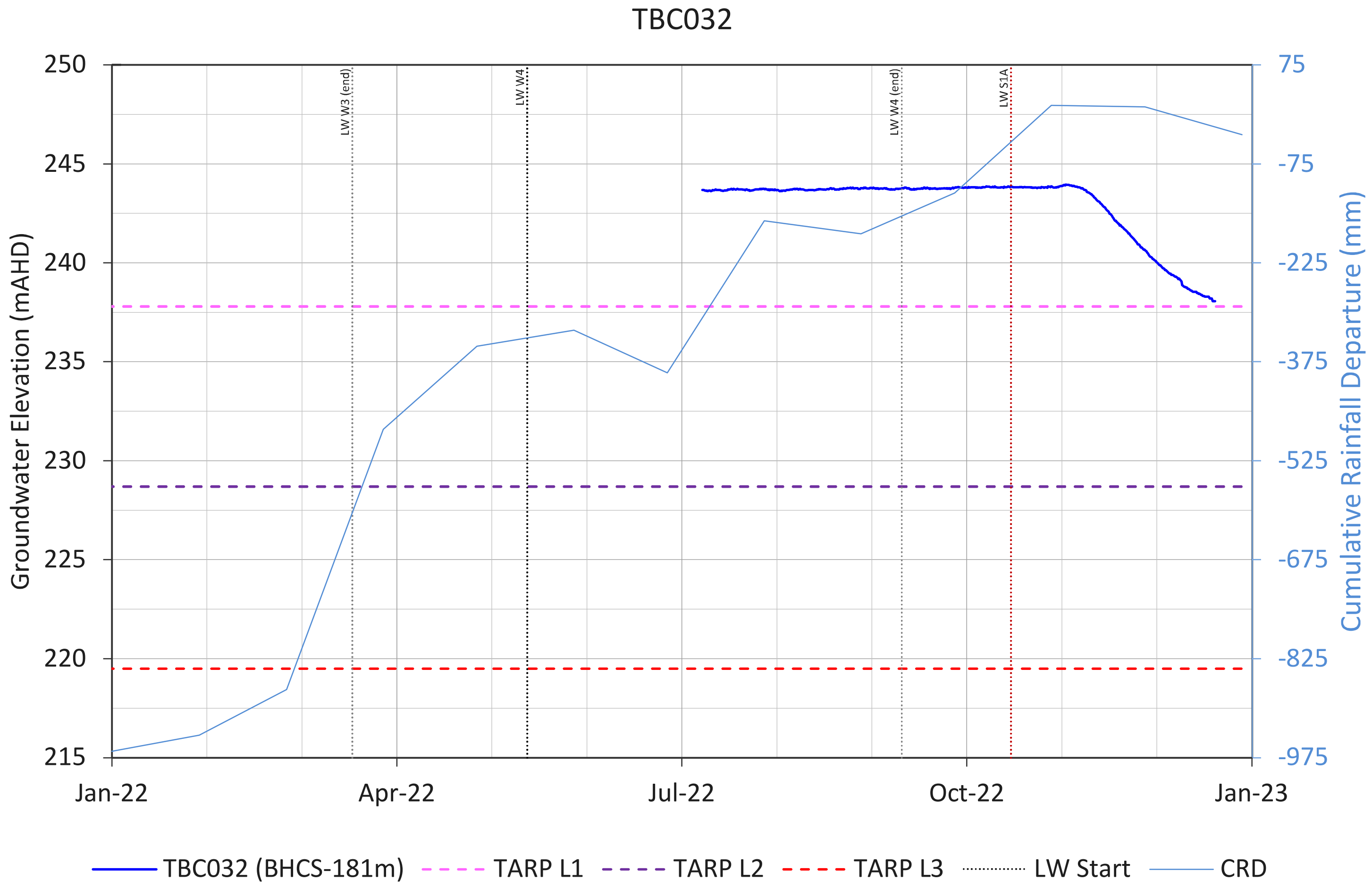


Figure B22

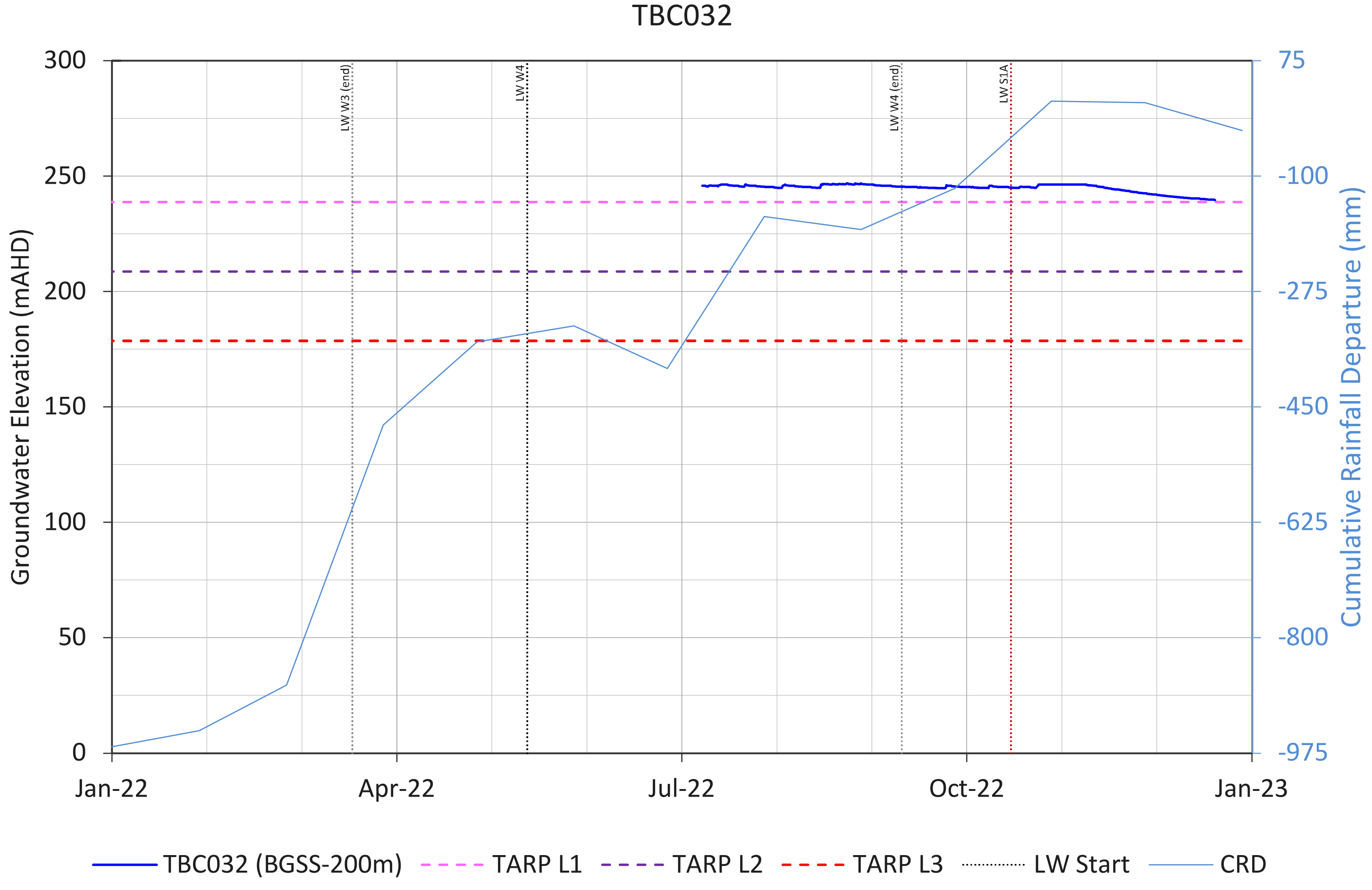


Figure B23

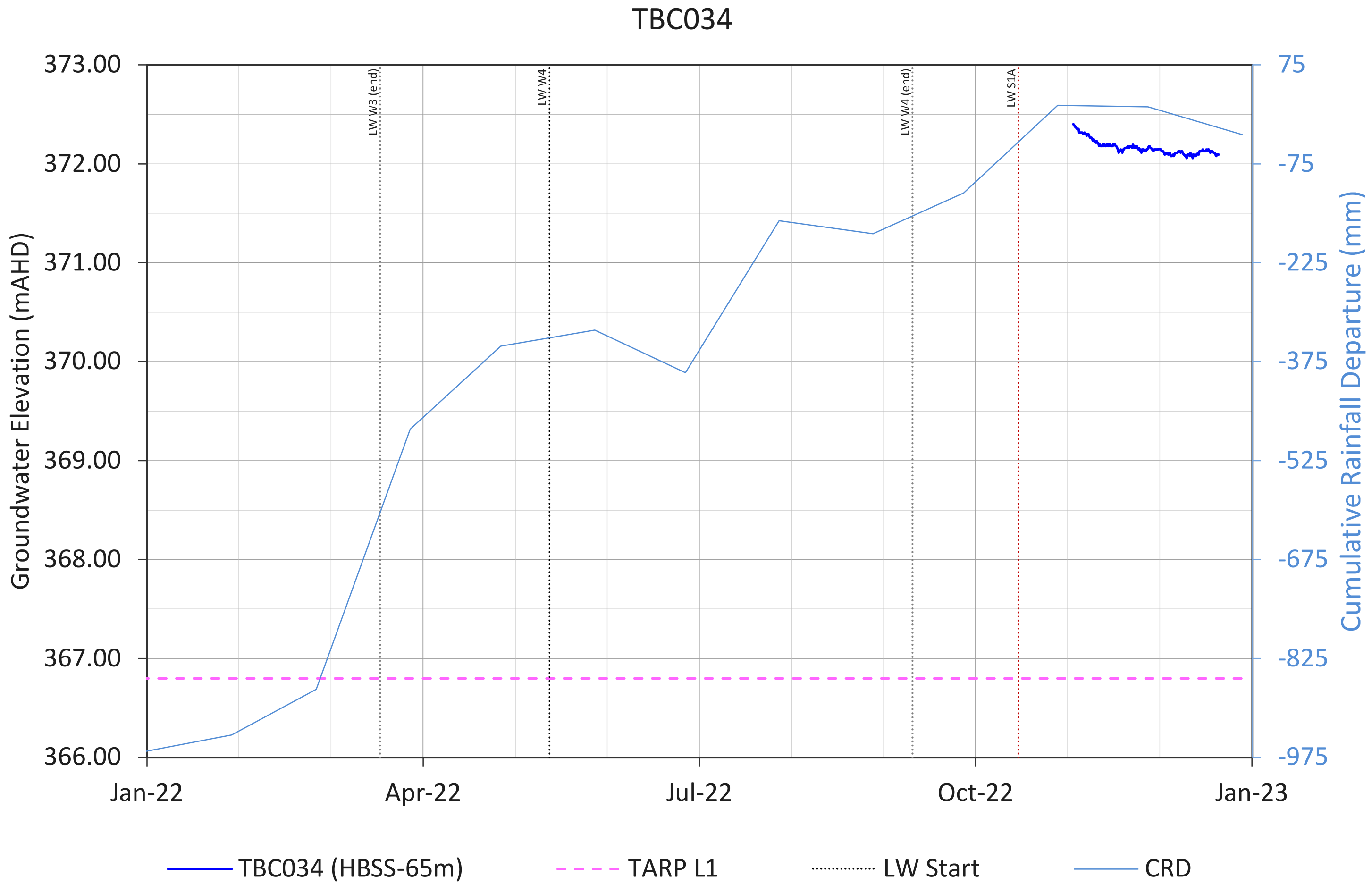


Figure B24

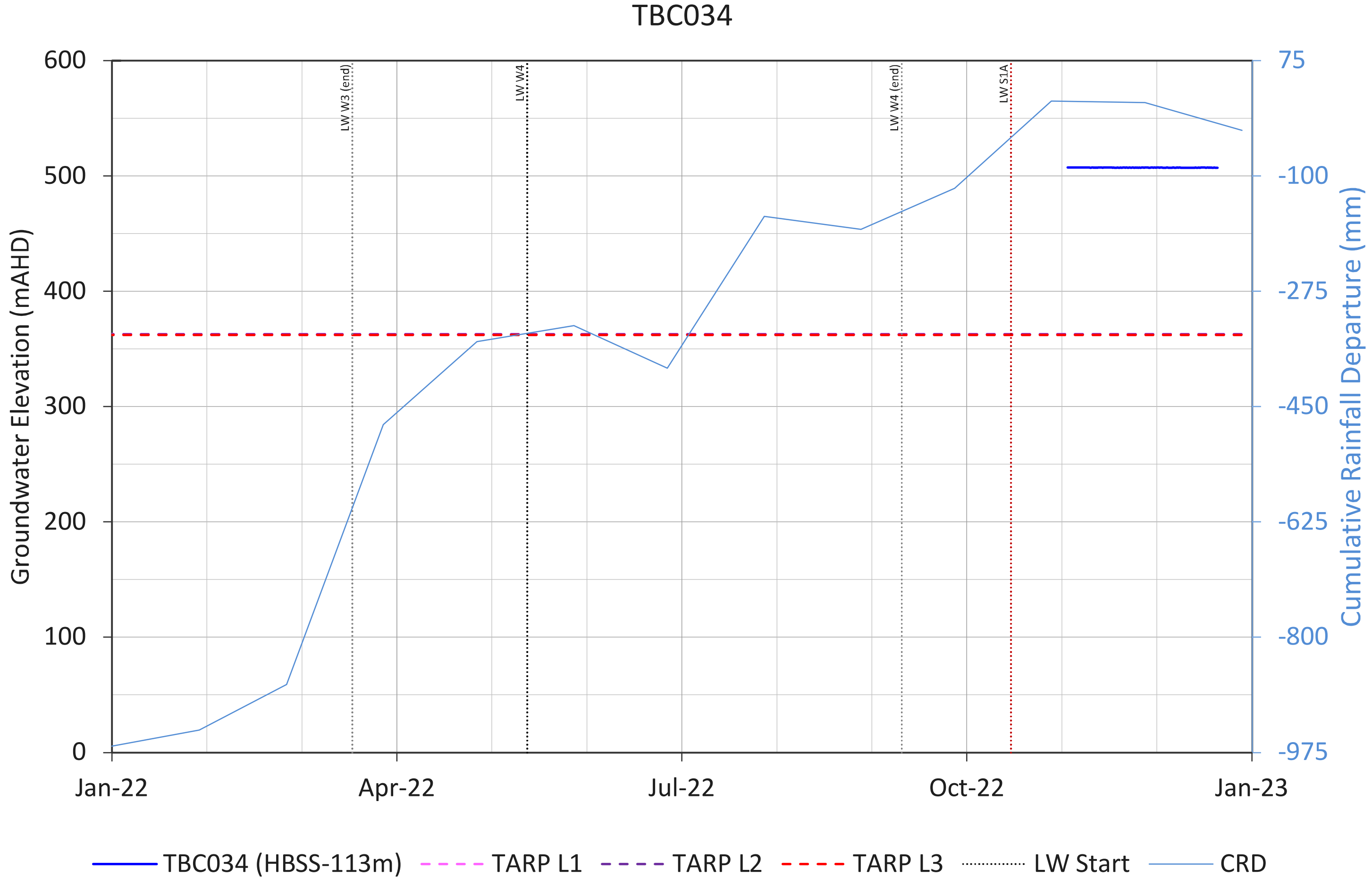


Figure B25

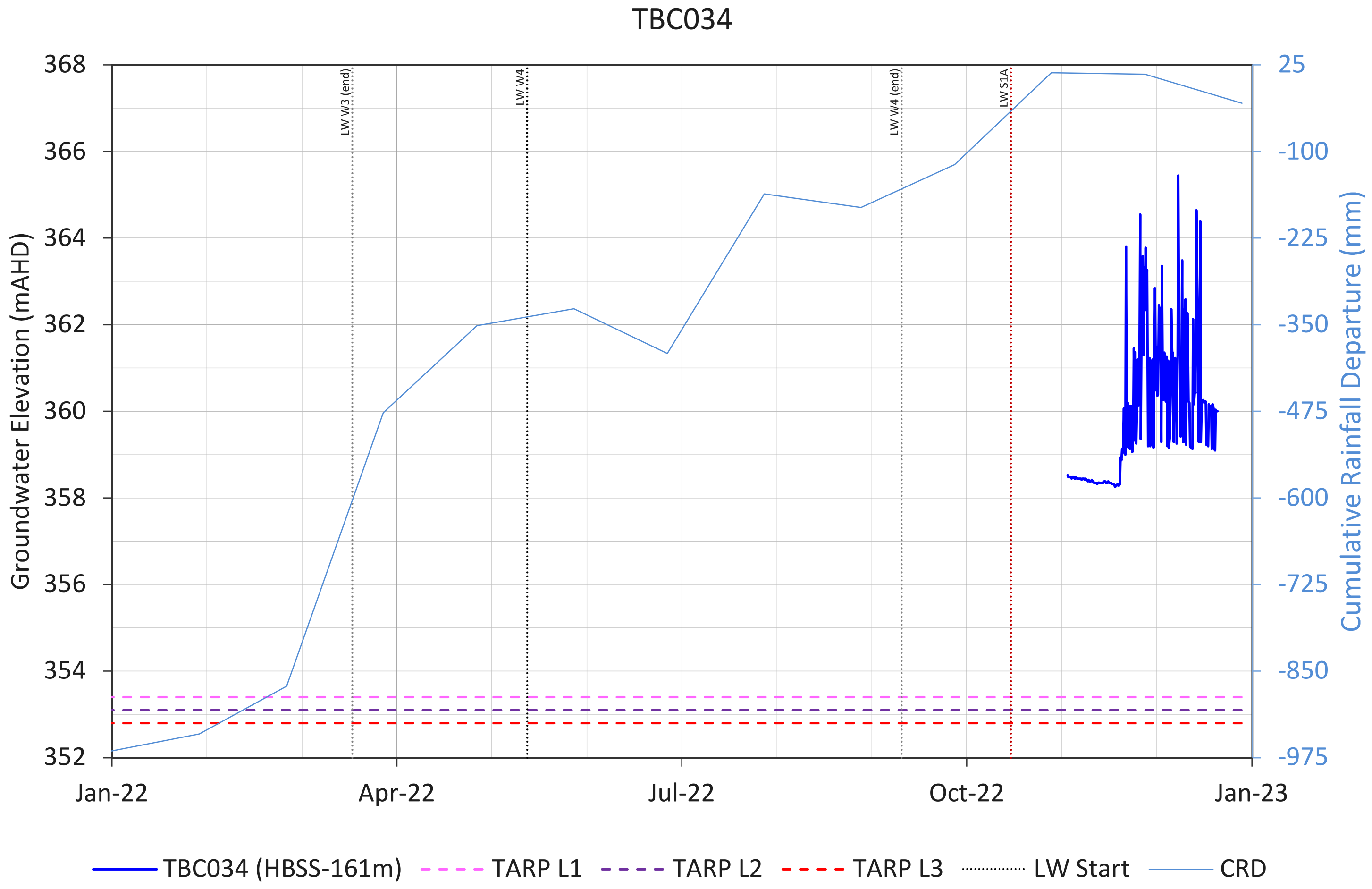
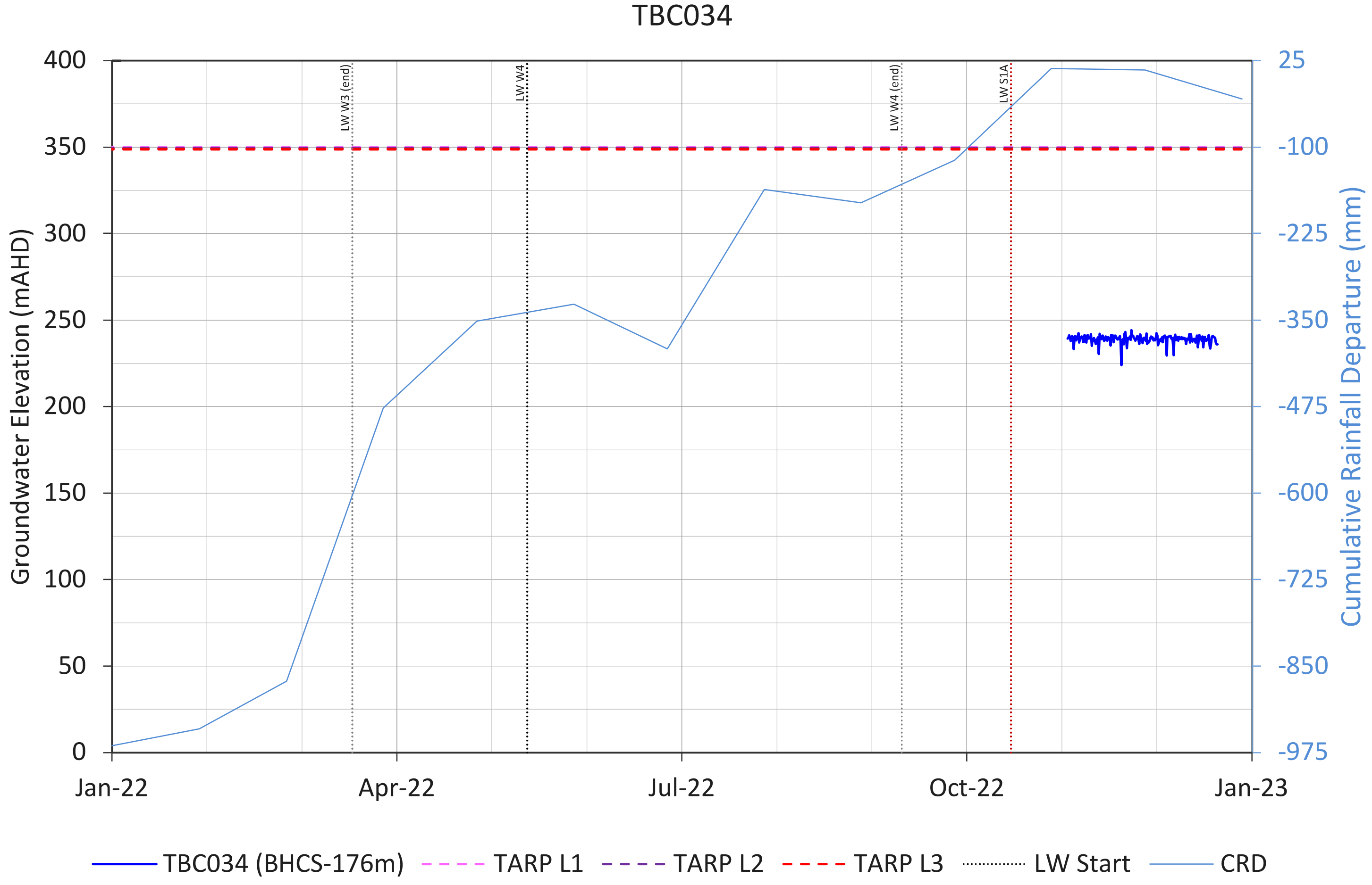


Figure B26



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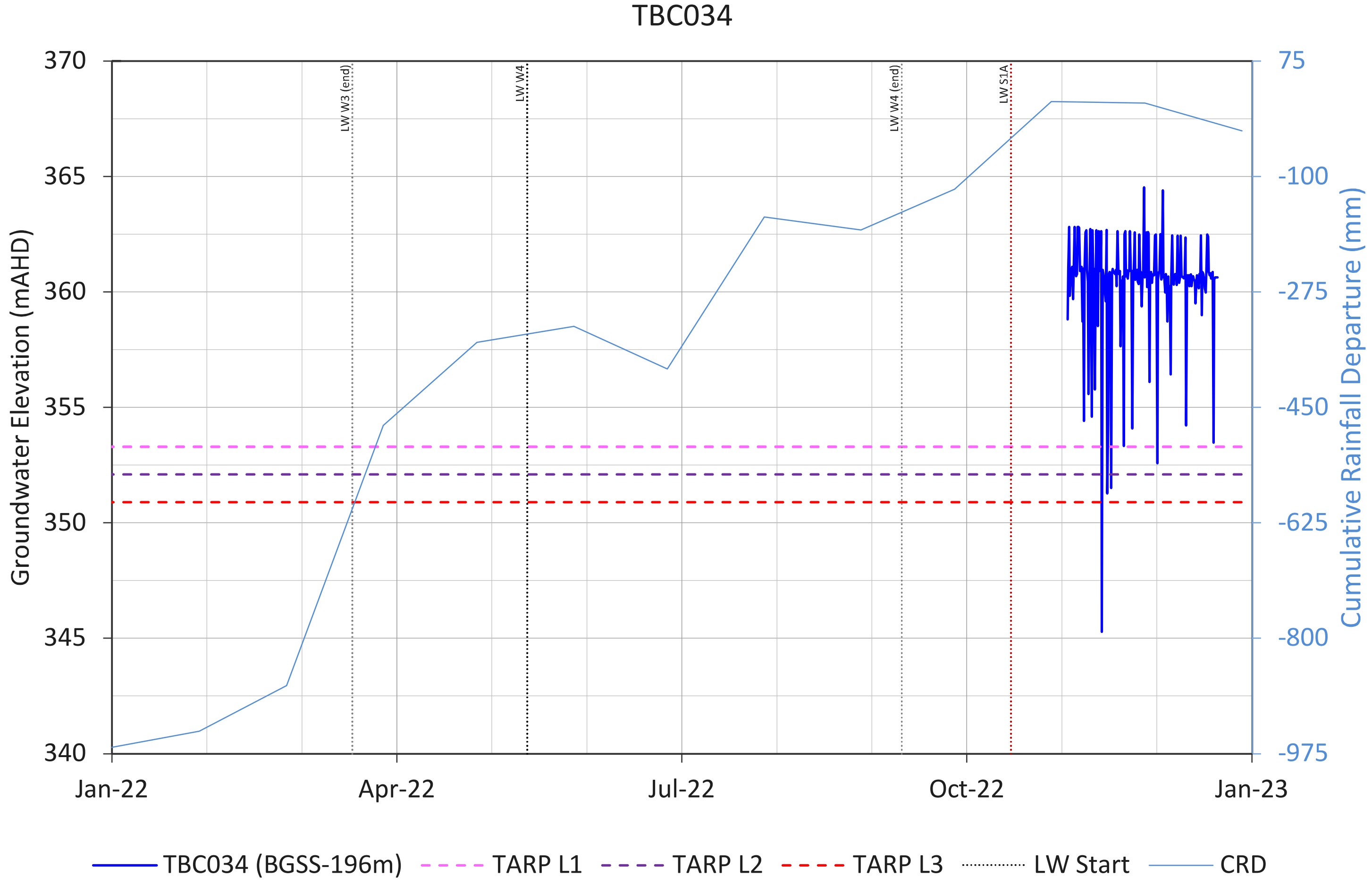

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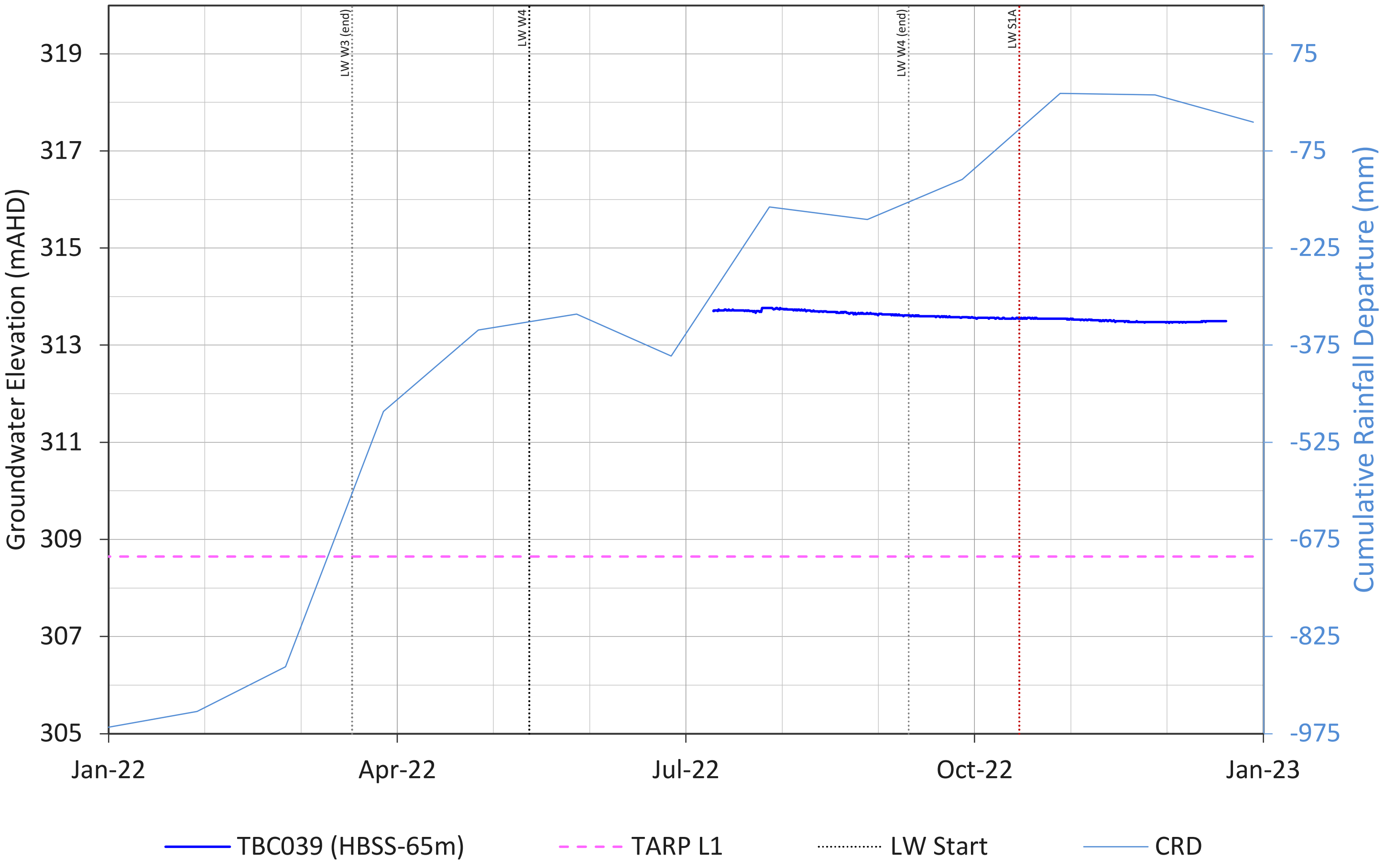


Groundwater Elevation (mAHD)
Cumulative Rainfall Departure (mm)
319
317
315
313
311
309
307
305
75
-75
-225
-375
-525
-675
-825
-975
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
TBC039 (HBSS-65m)
TARP L1
LW Start
CRD

Figure B29

Appendix C:

Hydrographs for Deep VWPs (>200m)

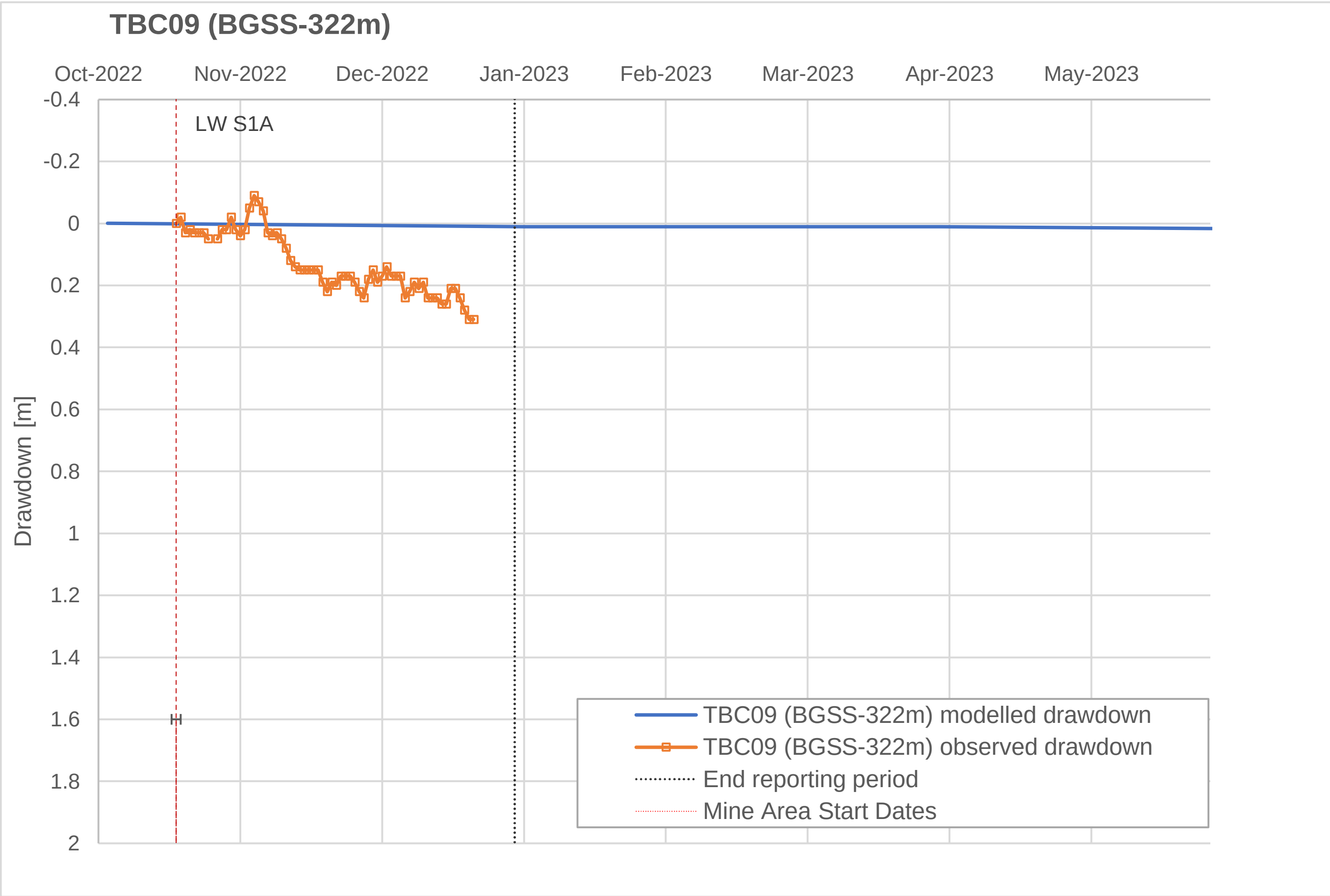
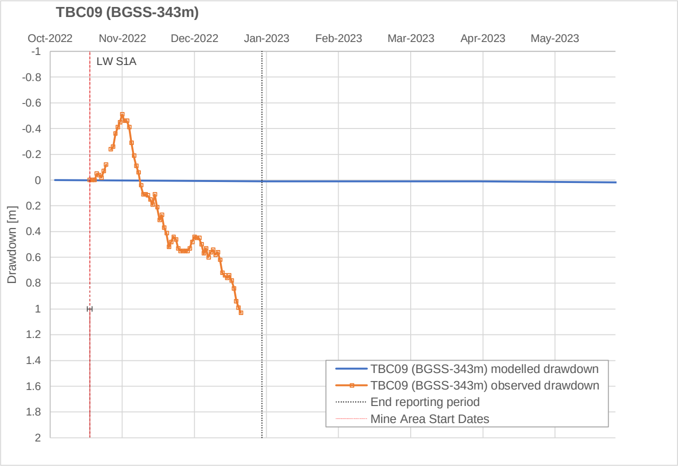

TBC09 (BGSS-322m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC09 (BGSS-322m) modelled drawdown
TBC09 (BGSS-322m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C1



TBC09 (BGSS-343m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC09 (BGSS-343m) modelled drawdown
TBC09 (BGSS-343m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C2

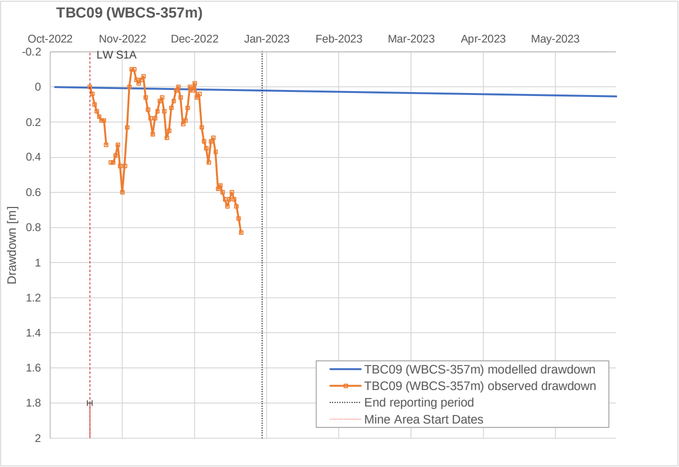

TBC09 (WBCS-357m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC09 (WBCS-357m) modelled drawdown
TBC09 (WBCS-357m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C3

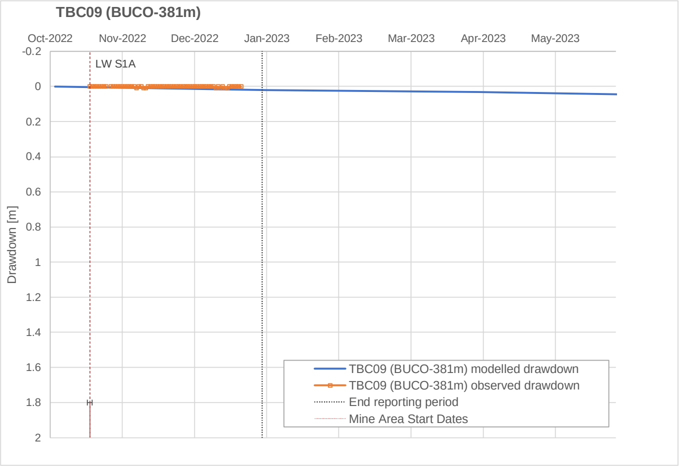

TBC09 (BUCO-381m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC09 (BUCO-381m) modelled drawdown
TBC09 (BUCO-381m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C4

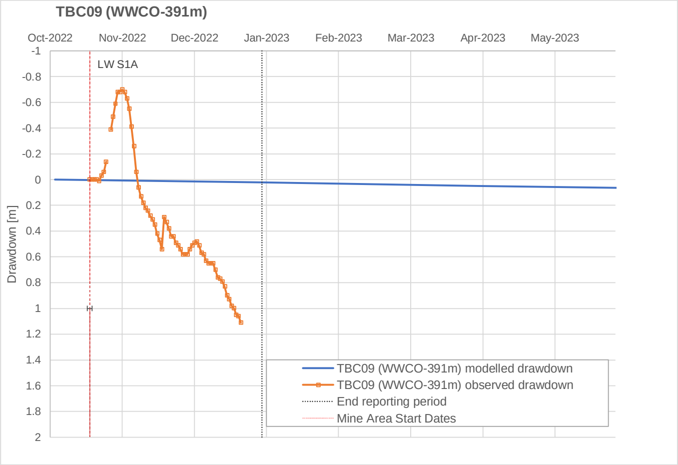
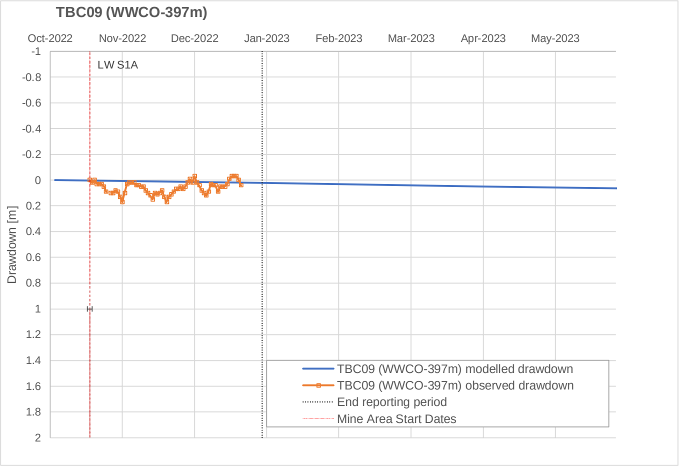

TBC09 (WWCO-391m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
TBC09 (WWCO-391m) modelled drawdown
TBC09 (WWCO-391m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C5



TBC09 (WWCO-397m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC09 (WWCO-397m) modelled drawdown
TBC09 (WWCO-397m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C6

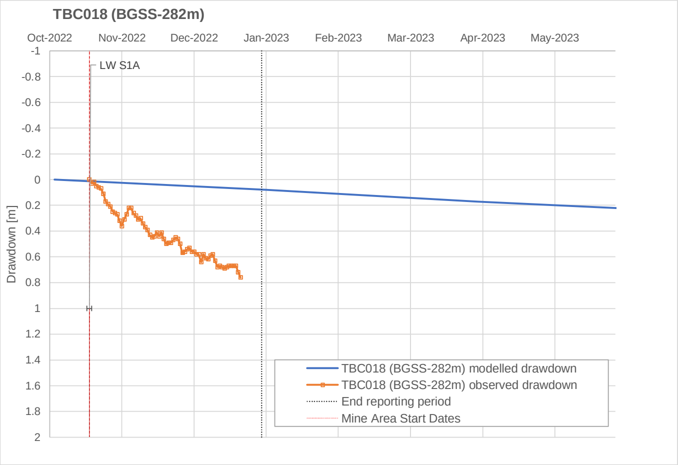

TBC018 (BGSS-282m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC018 (BGSS-282m) modelled drawdown
TBC018 (BGSS-282m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C7

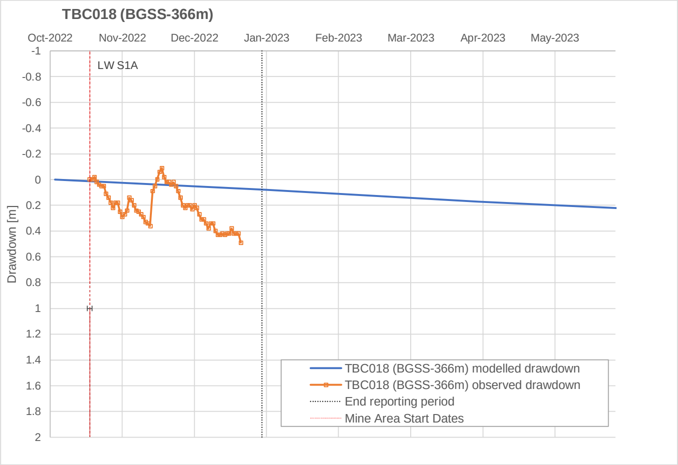
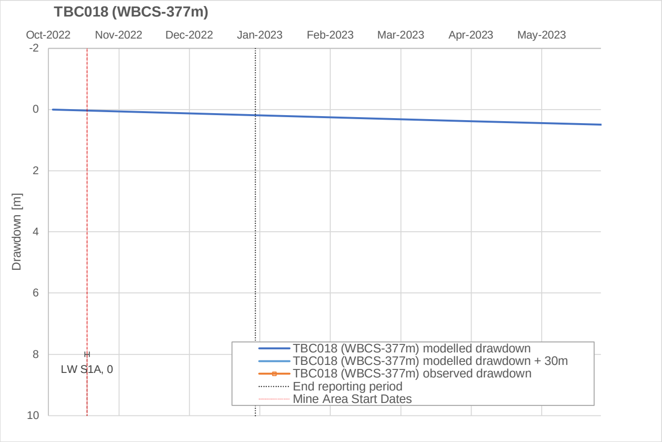
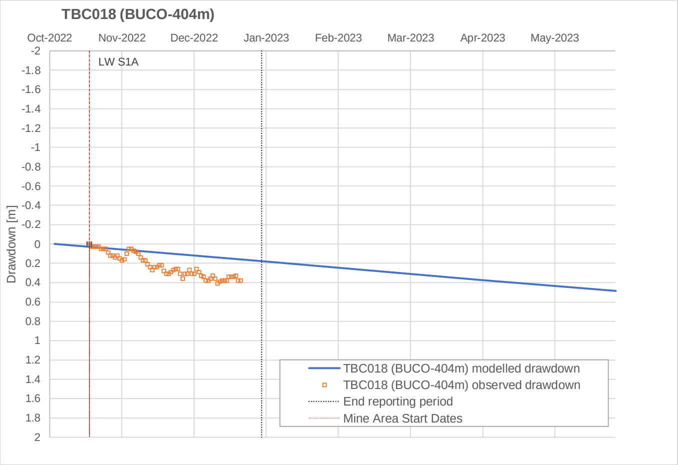

TBC018 (BGSS-366m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC018 (BGSS-366m) modelled drawdown
TBC018 (BGSS-366m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C8



additionnal monitoring required to confirm trends

Figure C9



TBC018 (BUCO-404m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
-1.8
-1.6
-1.4
-1.2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
TBC018 (BUCO-404m) modelled drawdown
TBC018 (BUCO-404m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C10

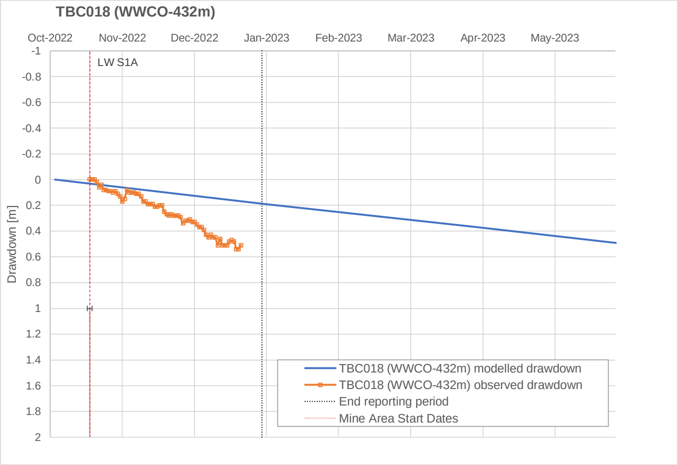
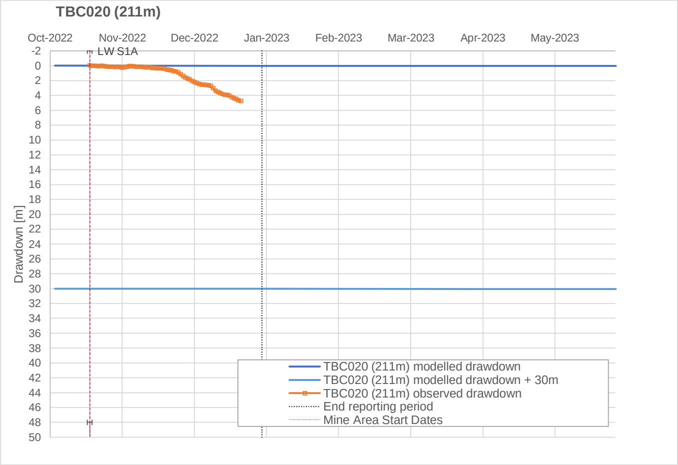
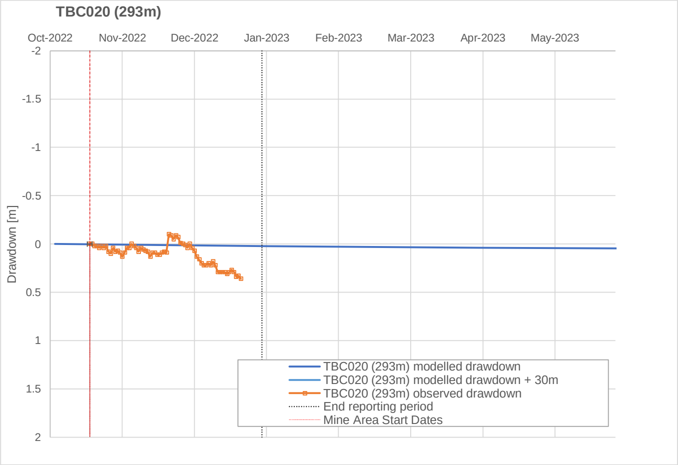

TBC018 (WWCO-432m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
TBC018 (WWCO-432m) modelled drawdown
TBC018 (WWCO-432m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C11



TBC020 (211m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC020 (211m) modelled drawdown
TBC020 (211m) modelled drawdown + 30m
TBC020 (211m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C12



TBC020 (293m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Drawdown [m]
TBC020 (293m) modelled drawdown
TBC020 (293m) modelled drawdown + 30m
TBC020 (293m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C13

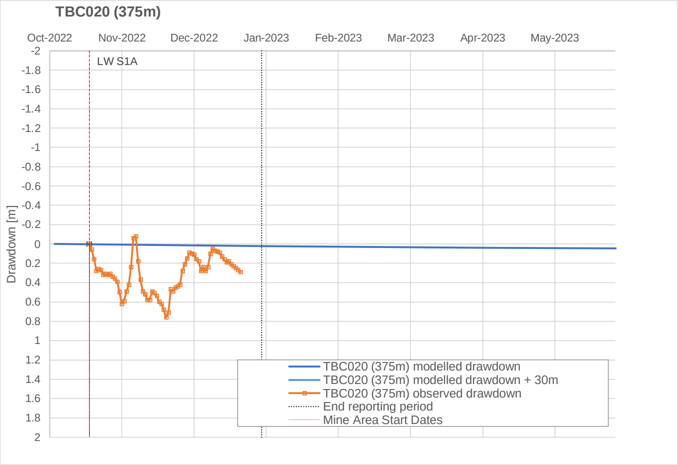
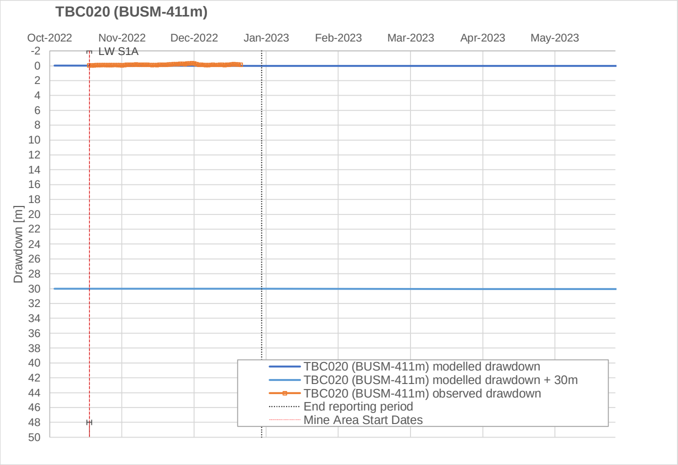

TBC020 (375m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
-1.8
-1.6
-1.4
-1.2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
TBC020 (375m) modelled drawdown
TBC020 (375m) modelled drawdown + 30m
TBC020 (375m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C14



TBC020 (BUSM-411m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC020 (BUSM-411m) modelled drawdown
TBC020 (BUSM-411m) modelled drawdown + 30m
TBC020 (BUSM-411m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C15

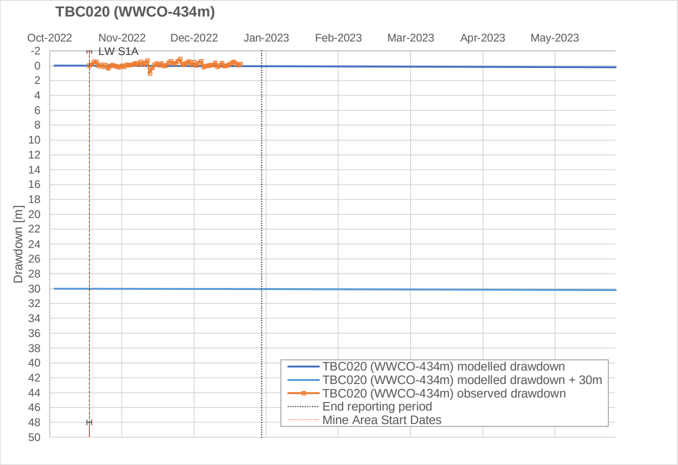
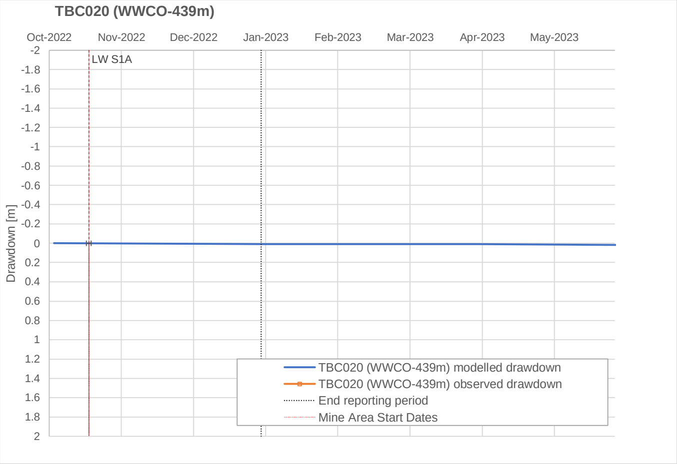
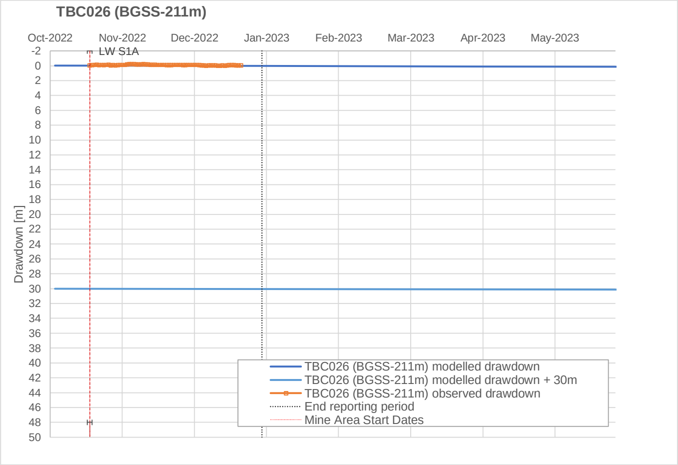

TBC020 (WWCO-434m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC020 (WWCO-434m) modelled drawdown
TBC020 (WWCO-434m) modelled drawdown + 30m
TBC020 (WWCO-434m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C16



additionnal monitoring required to confirm trends

Figure C17



TBC026 (BGSS-211m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
Drawdown [m]
TBC026 (BGSS-211m) modelled drawdown
TBC026 (BGSS-211m) modelled drawdown + 30m
TBC026 (BGSS-211m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C18

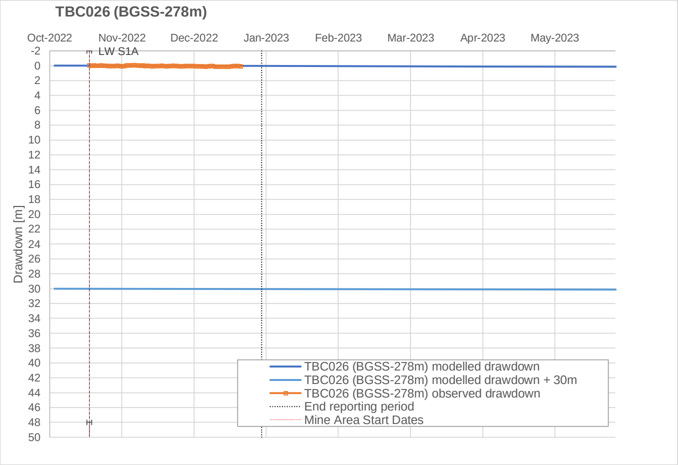
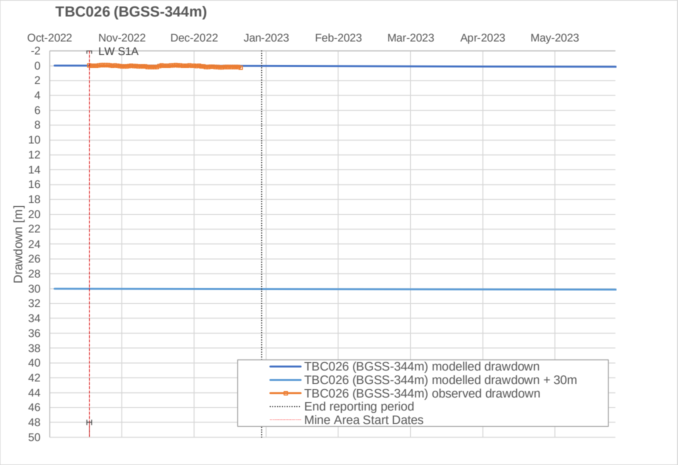

TBC026 (BGSS-278m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC026 (BGSS-278m) modelled drawdown
TBC026 (BGSS-278m) modelled drawdown + 30m
TBC026 (BGSS-278m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C19



TBC026 (BGSS-344m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC026 (BGSS-344m) modelled drawdown
TBC026 (BGSS-344m) modelled drawdown + 30m
TBC026 (BGSS-344m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C20

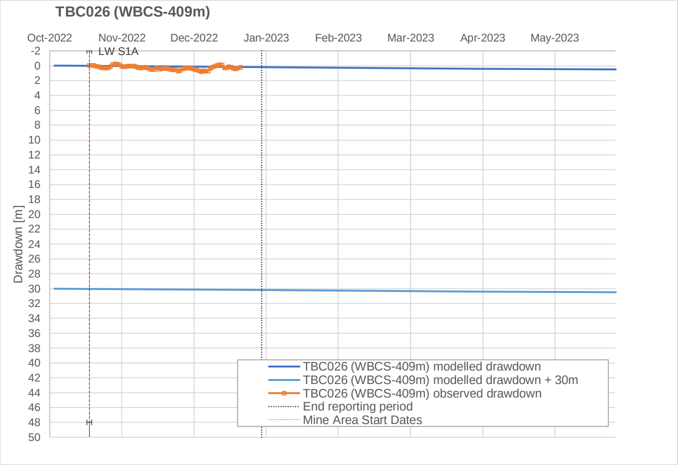
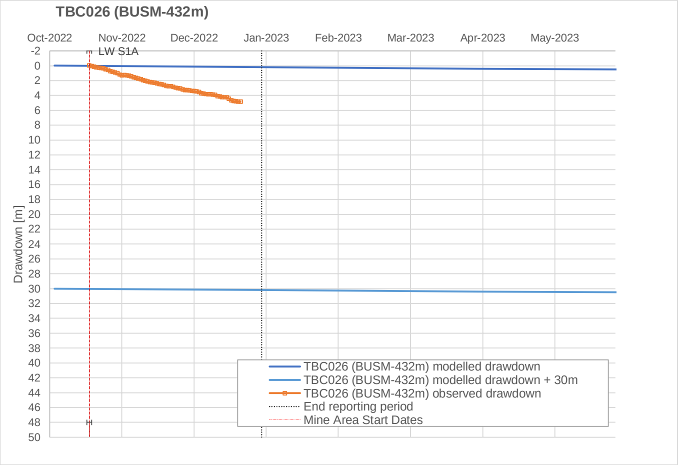
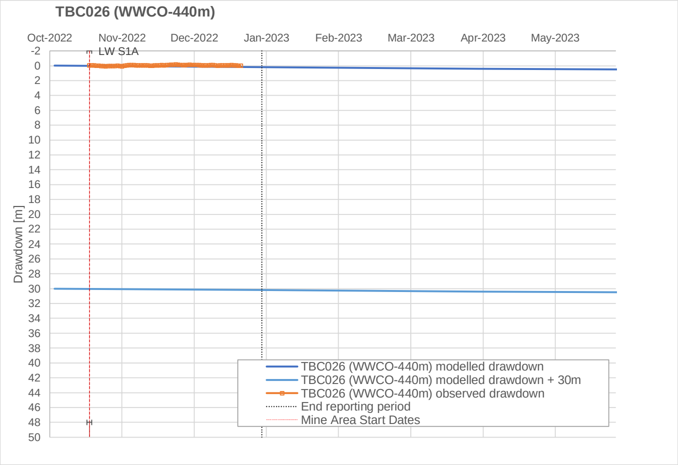

TBC026 (WBCS-409m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC026 (WBCS-409m) modelled drawdown
TBC026 (WBCS-409m) modelled drawdown + 30m
TBC026 (WBCS-409m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C21



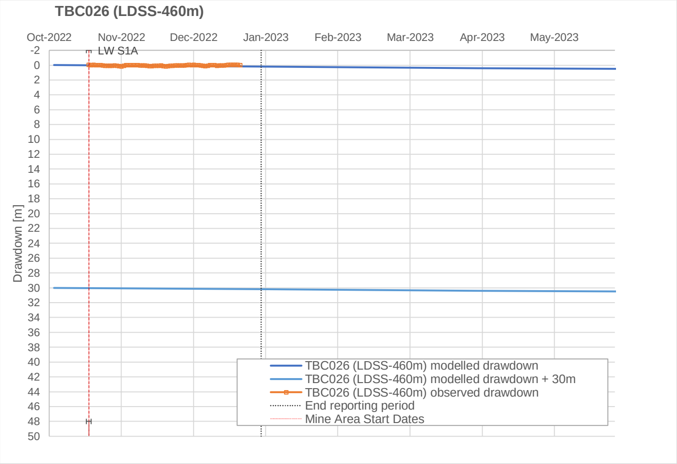
TBC026 (BUSM-432m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC026 (BUSM-432m) modelled drawdown
TBC026 (BUSM-432m) modelled drawdown + 30m
TBC026 (BUSM-432m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C22



TBC026 (WWCO-440m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC026 (WWCO-440m) modelled drawdown
TBC026 (WWCO-440m) modelled drawdown + 30m
TBC026 (WWCO-440m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C23



TBC026 (LDSS-460m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC026 (LDSS-460m) modelled drawdown
TBC026 (LDSS-460m) modelled drawdown + 30m
TBC026 (LDSS-460m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C24

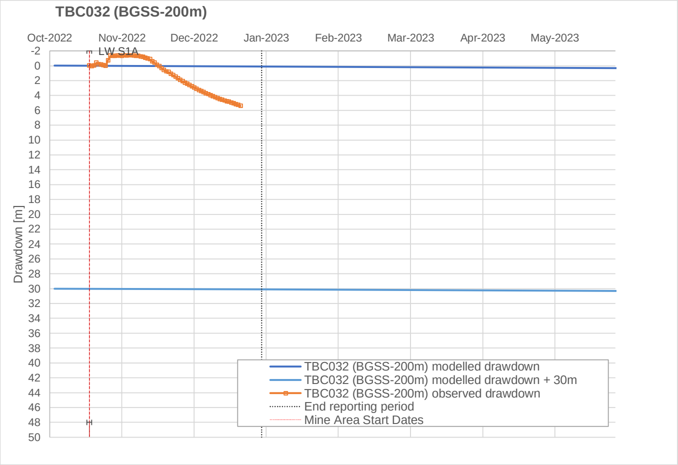

TBC032 (BGSS-200m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
TBC032 (BGSS-200m) modelled drawdown
TBC032 (BGSS-200m) modelled drawdown + 30m
TBC032 (BGSS-200m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C25

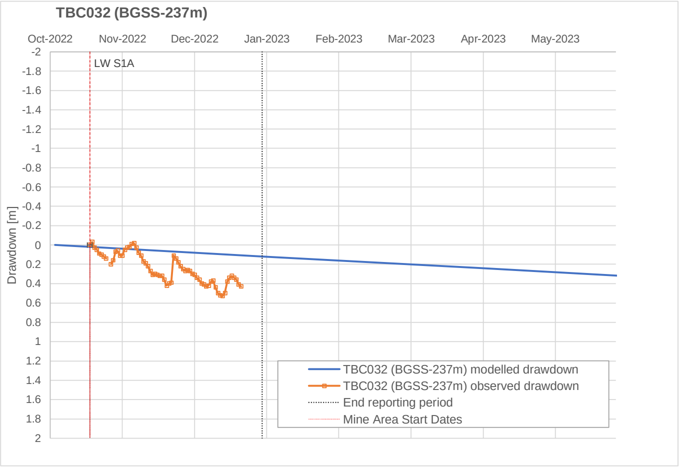

TBC032 (BGSS-237m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
-1.8
-1.6
-1.4
-1.2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
TBC032 (BGSS-237m) modelled drawdown
TBC032 (BGSS-237m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C26

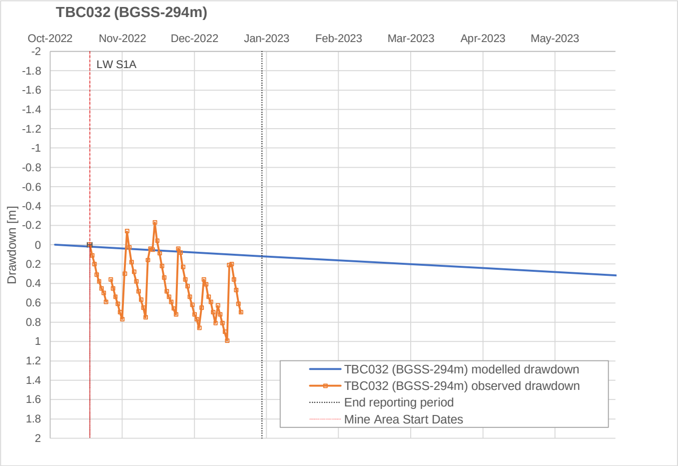

TBC032 (BGSS-294m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
Drawdown [m]
-2
-1.8
-1.6
-1.4
-1.2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
LW S1A
TBC032 (BGSS-294m) modelled drawdown
TBC032 (BGSS-294m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C27

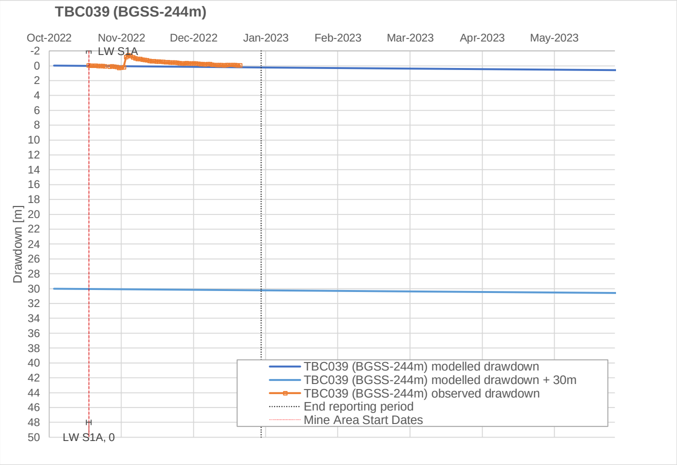
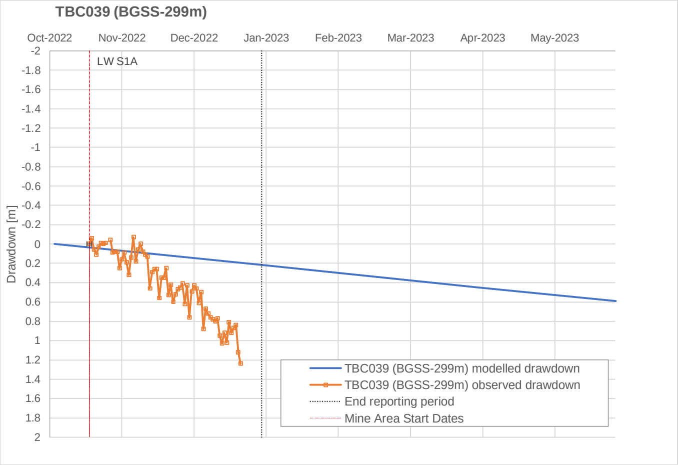

TBC039 (BGSS-244m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-2
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
Drawdown [m]
LW S1A
LW S1A, 0
TBC039 (BGSS-244m) modelled drawdown
TBC039 (BGSS-244m) modelled drawdown + 30m
TBC039 (BGSS-244m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C28



TBC039 (BGSS-299m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
LW S1A
Drawdown [m]
-2
-1.8
-1.6
-1.4
-1.2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
TBC039 (BGSS-299m) modelled drawdown
TBC039 (BGSS-299m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C29

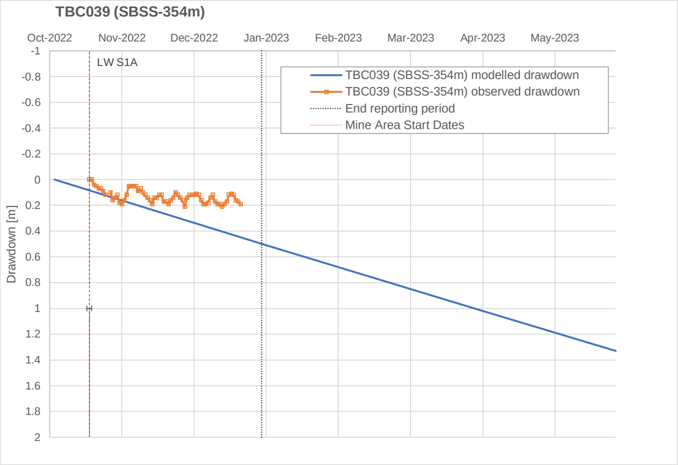
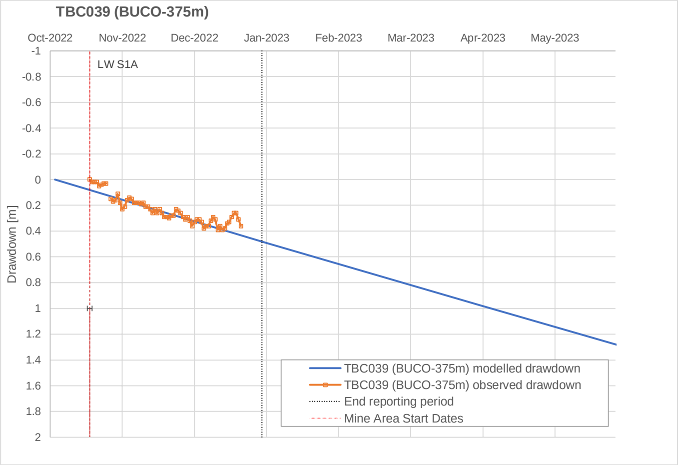

TBC039 (SBSS-354m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC039 (SBSS-354m) modelled drawdown
TBC039 (SBSS-354m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C30



TBC039 (BUCO-375m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Drawdown [m]
LW S1A
TBC039 (BUCO-375m) modelled drawdown
TBC039 (BUCO-375m) observed drawdown
End reporting period
Mine Area Start Dates

Figure C31

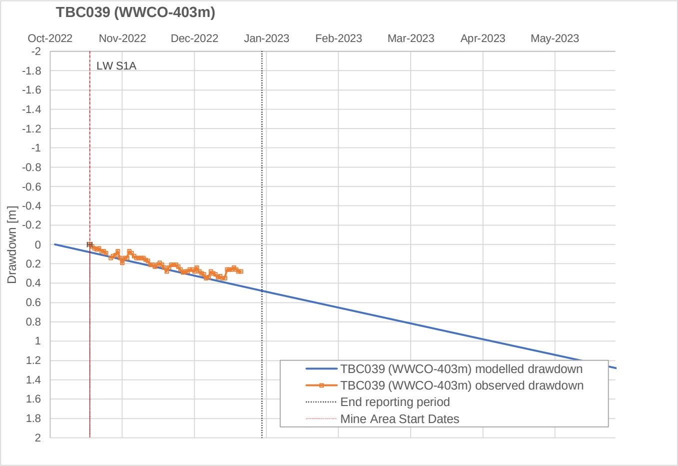
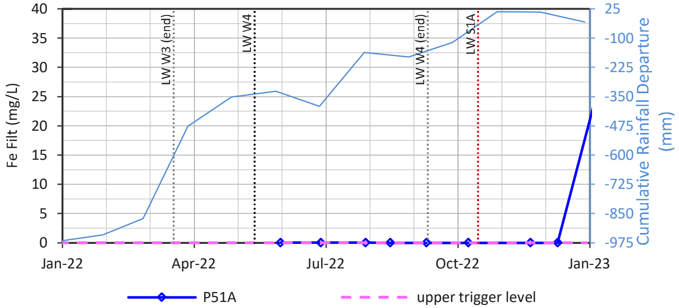
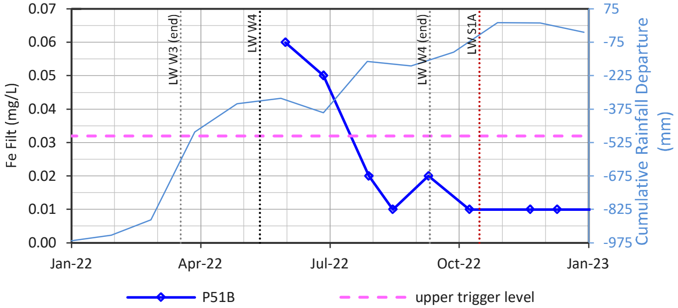

TBC039 (WWCO-403m)
Oct-2022
Nov-2022
Dec-2022
Jan-2023
Feb-2023
Mar-2023
Apr-2023
May-2023
Drawdown [m]
-2
-1.8
-1.6
-1.4
-1.2
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
LW S1A
TBC039 (WWCO-403m) modelled drawdown
TBC039 (WWCO-403m) observed drawdown
End reporting period
Mine Area Start Dates

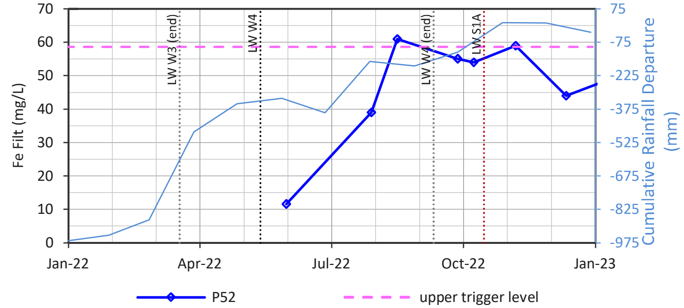
Figure C32

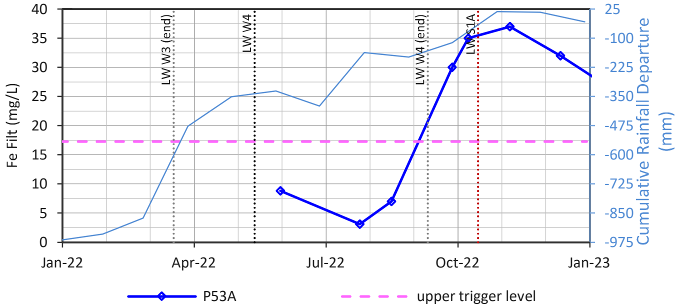
Appendix D:

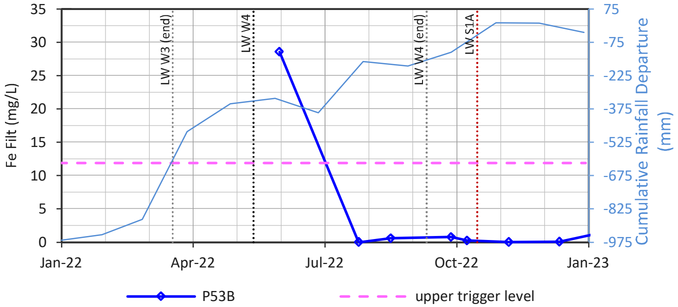
Groundwater Quality Time-series plots for Shallow OSPs and Private Bores

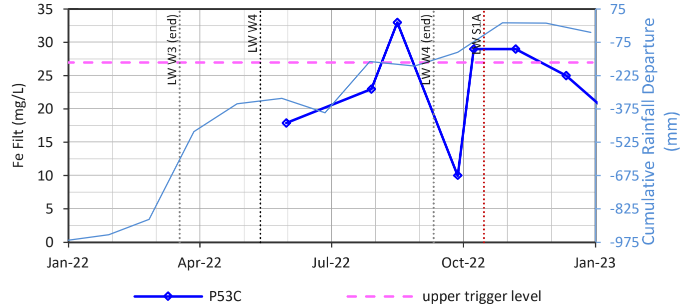

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P51A
upper trigger level

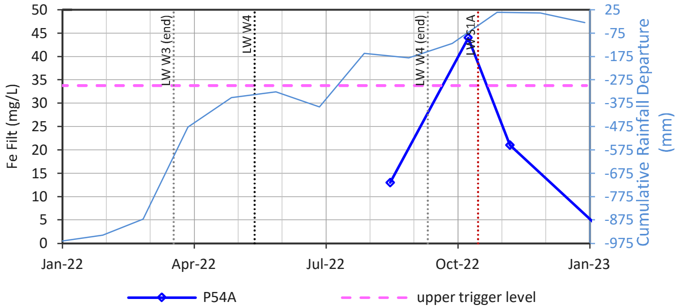

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P51B
upper trigger level

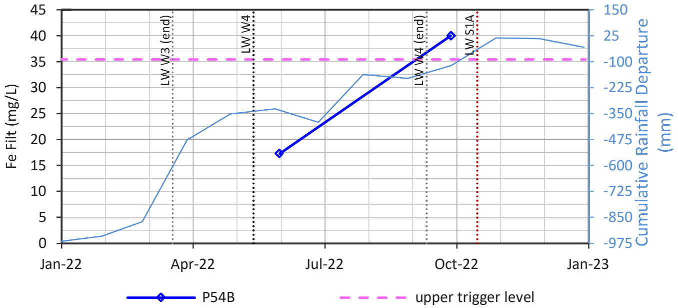

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P52
upper trigger level

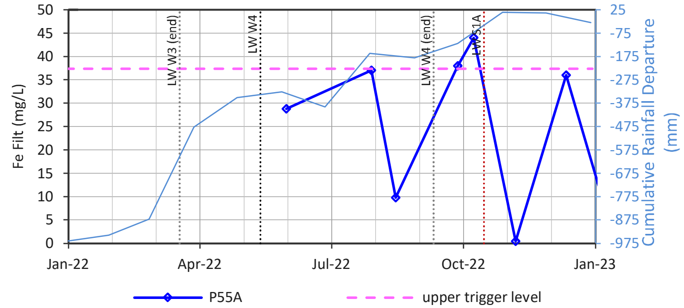

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53A
upper trigger level

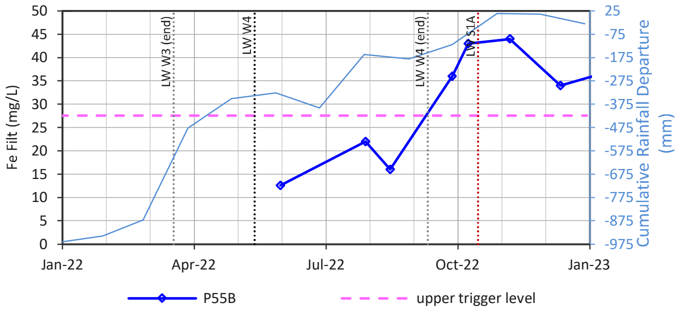

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53B
upper trigger level

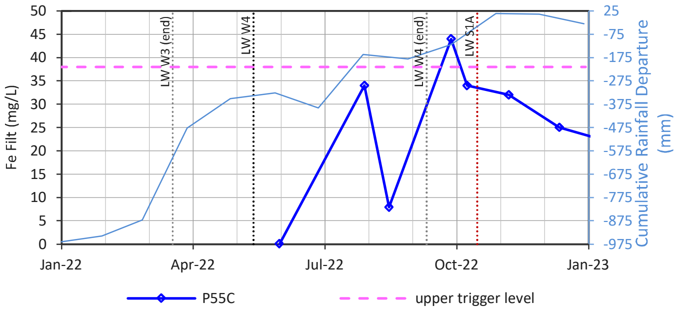

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53C
upper trigger level

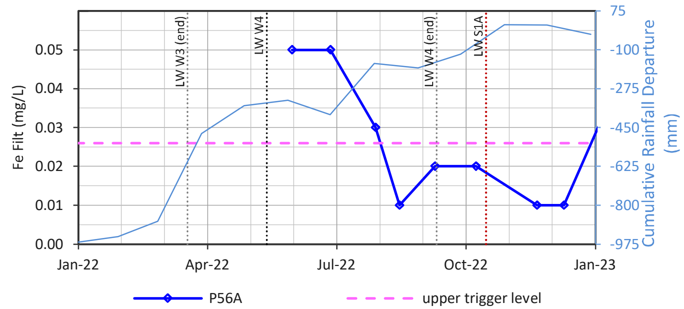

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P54A
upper trigger level

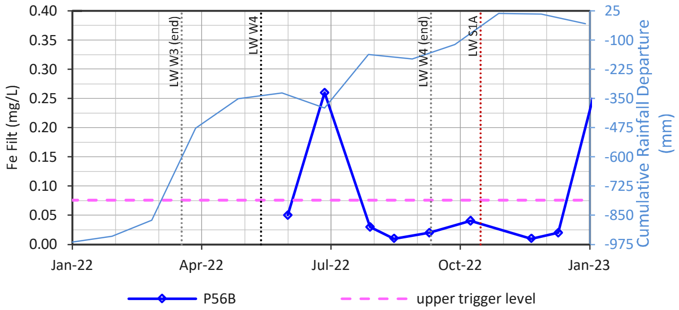

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P54B
upper trigger level

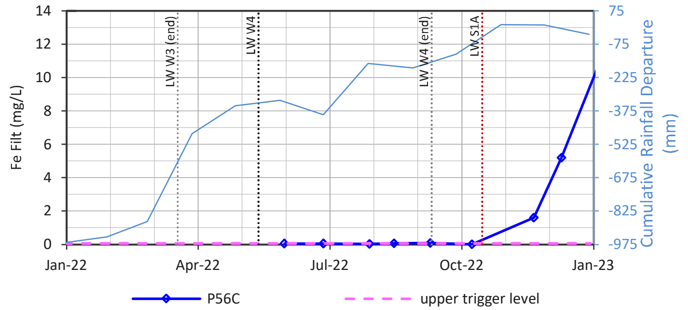

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55A
upper trigger level

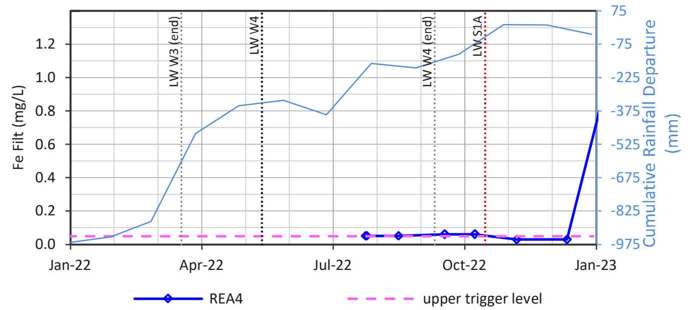

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55B
upper trigger level

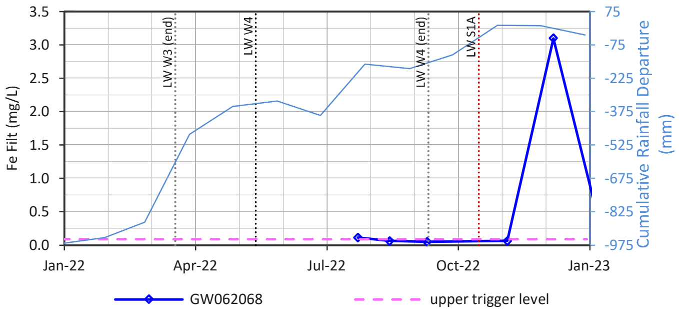

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55C
upper trigger level

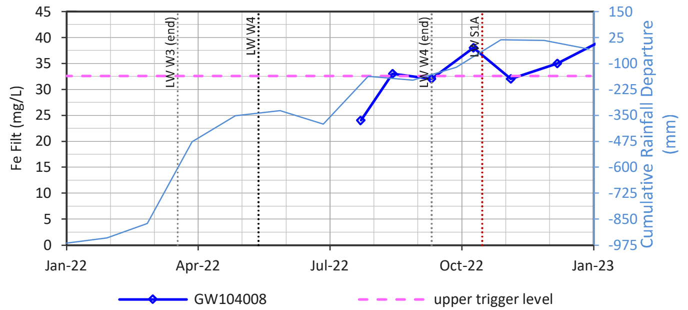

Fe Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56A
upper trigger level

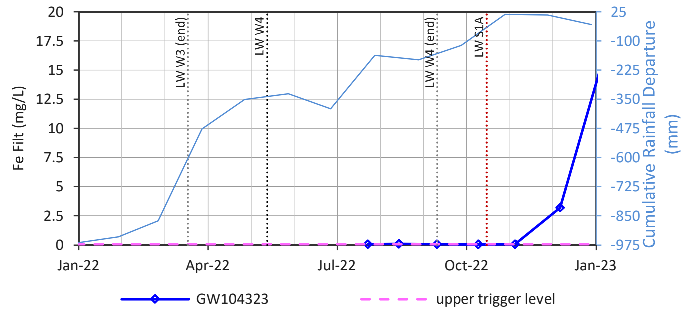


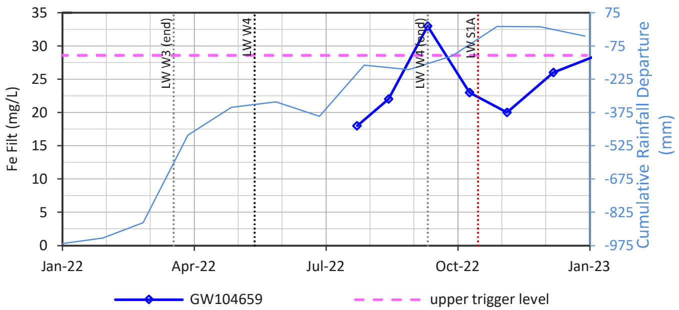


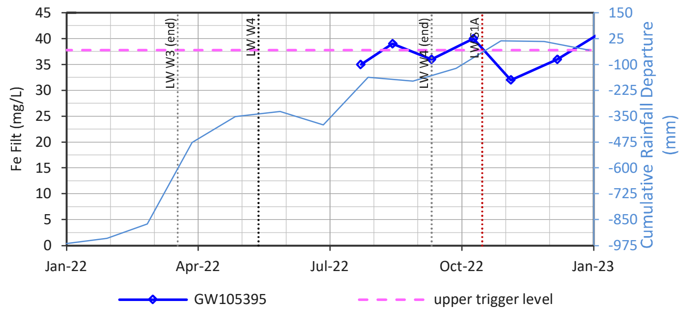


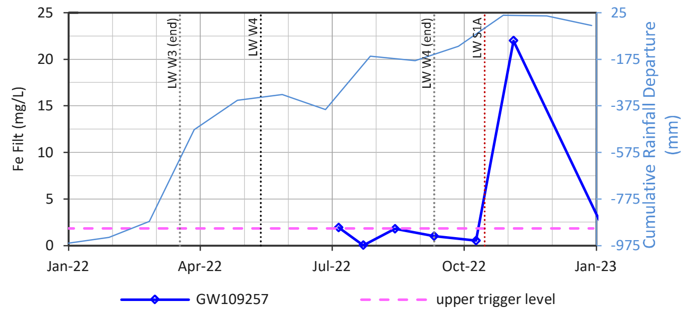


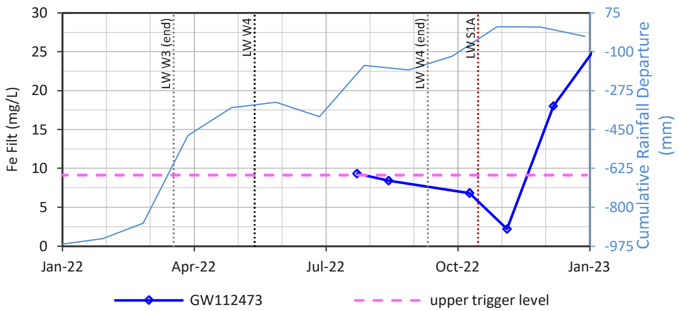




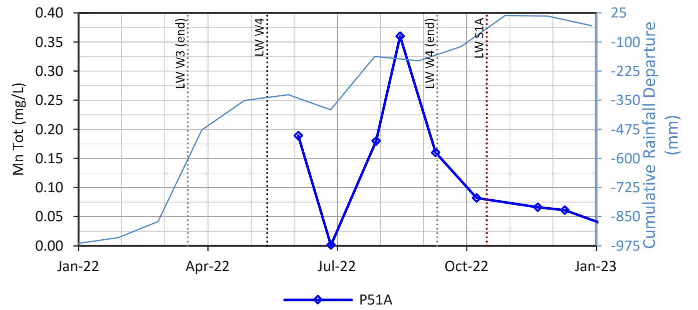


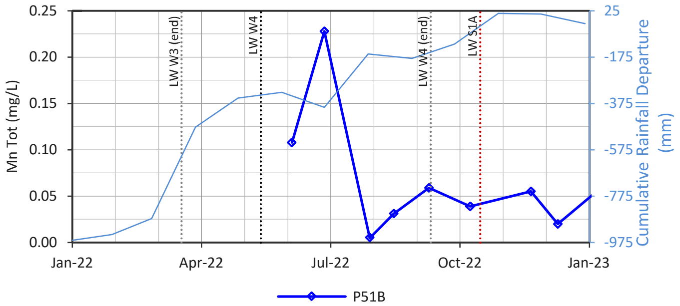


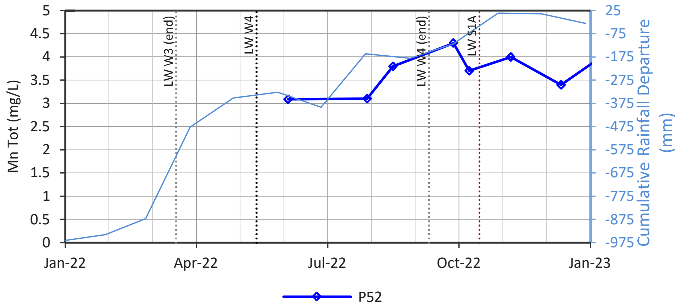


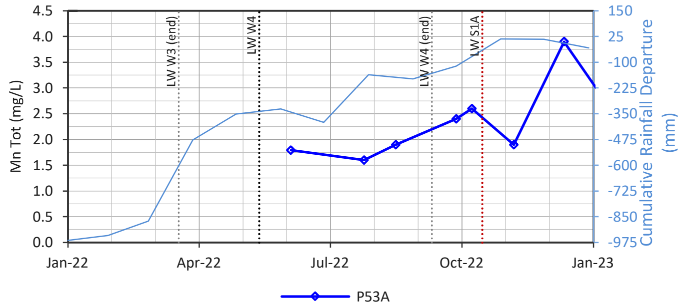


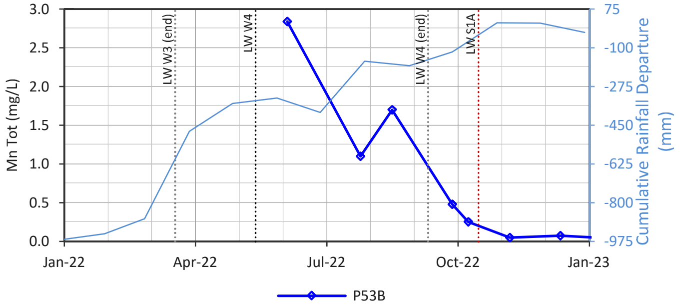
No Data Available for Fe Filt (mg/L)

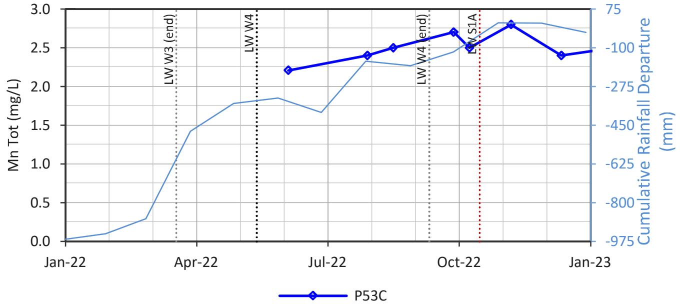


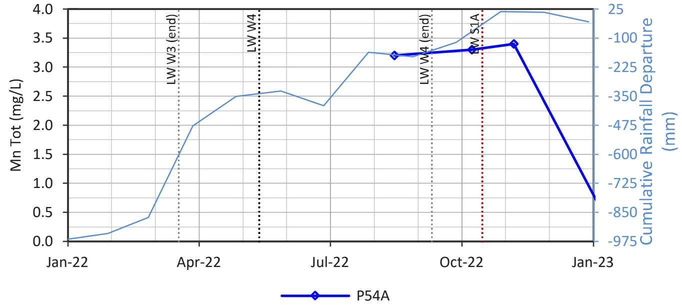

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P51B

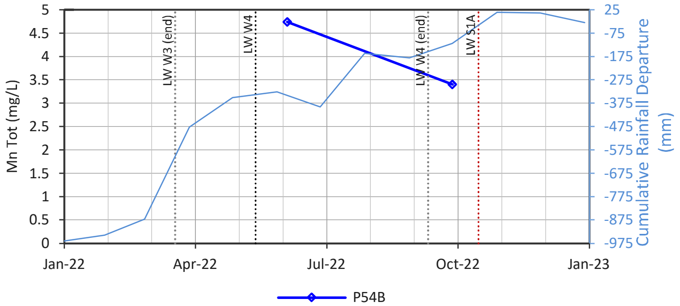

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P52

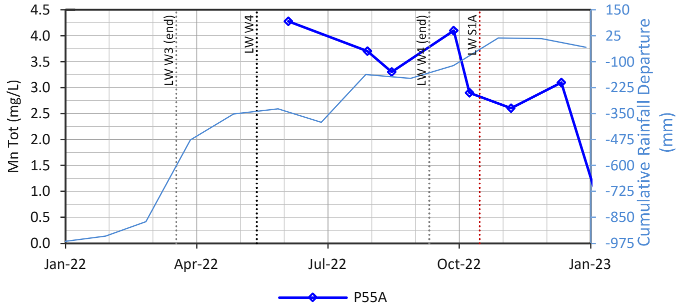

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53A

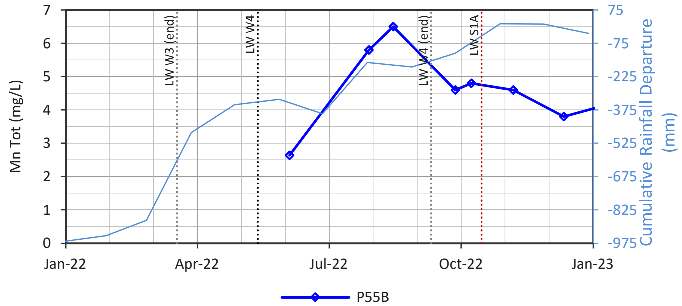

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53B

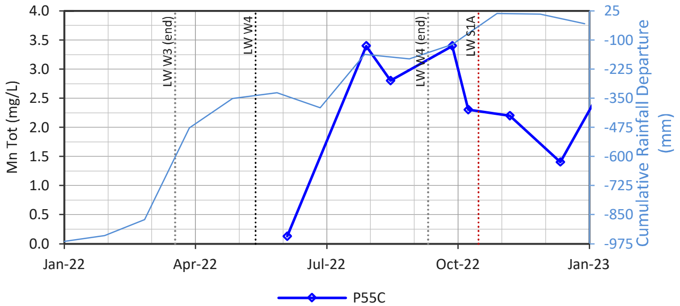

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53C

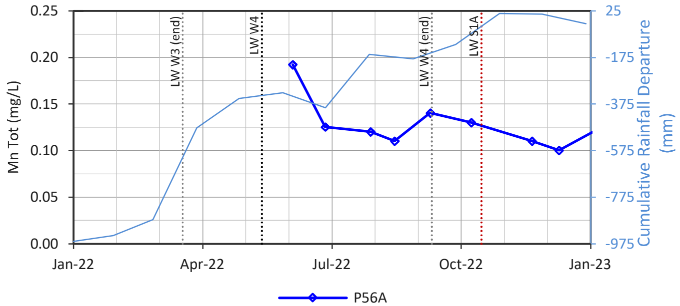

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P54A

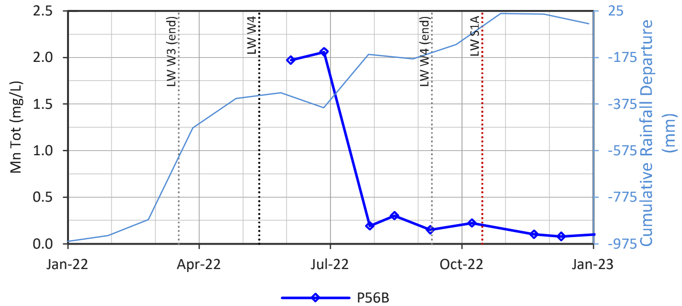

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P54B

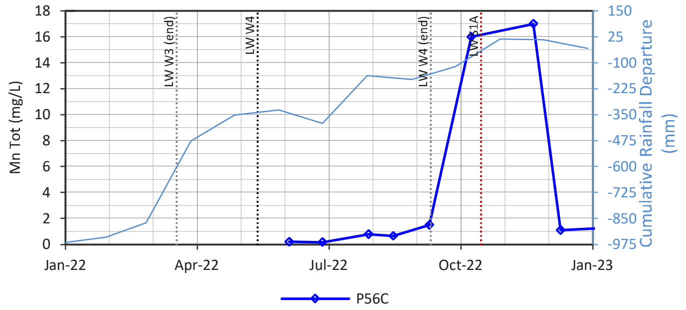

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55A

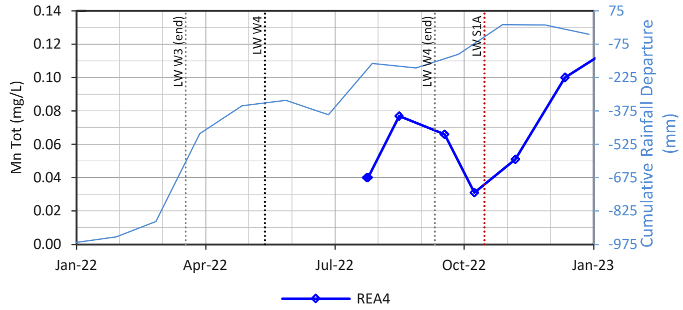

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55B

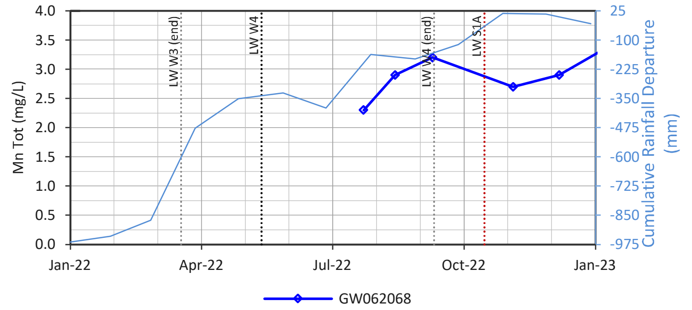

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55C

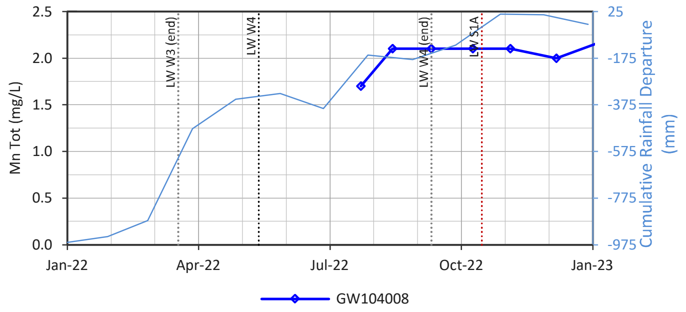

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56A

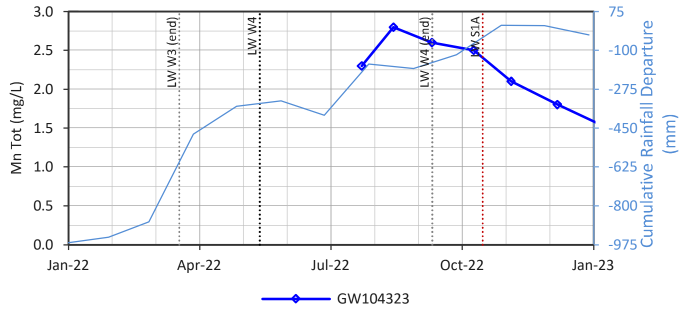

Mn Tot (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56B

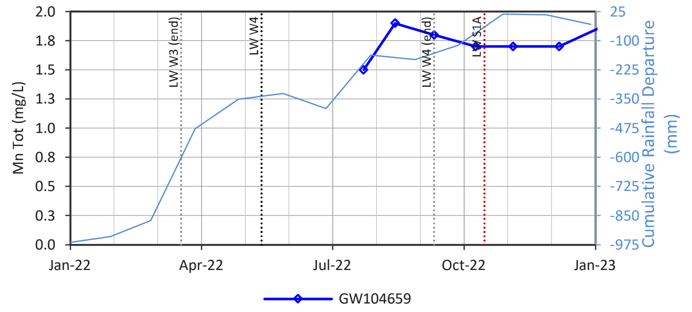


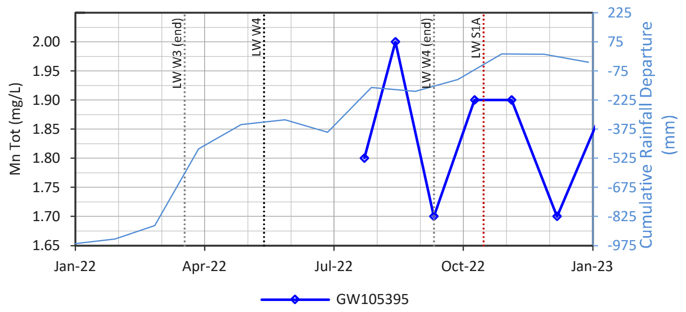


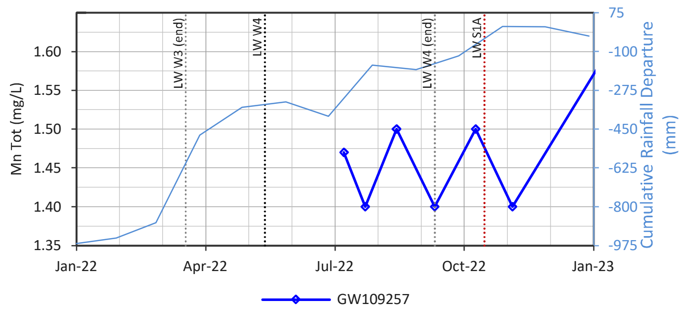


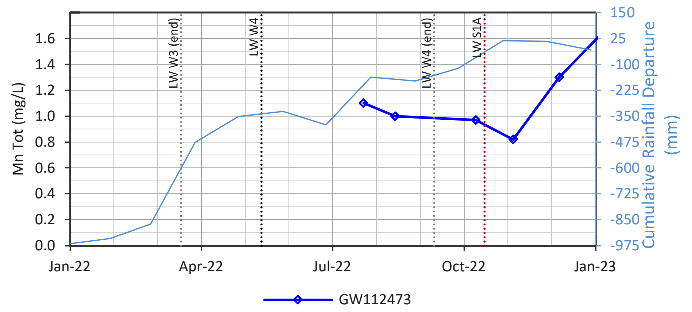




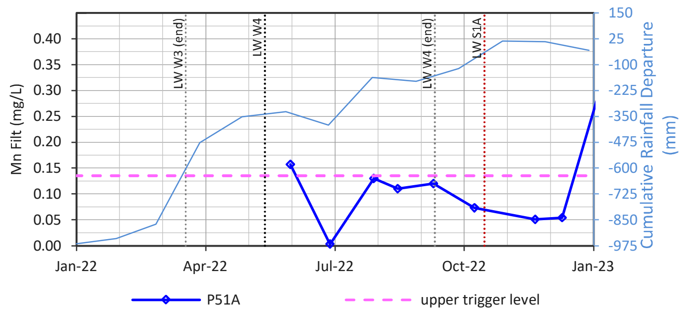


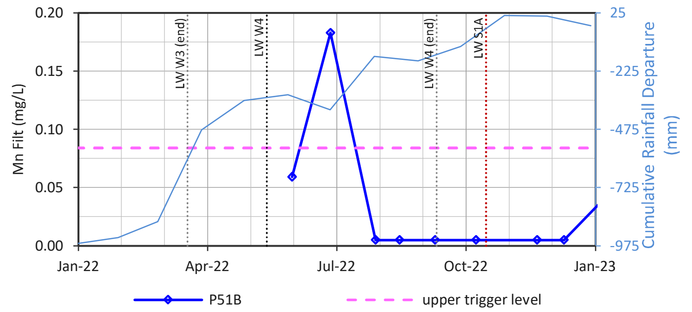


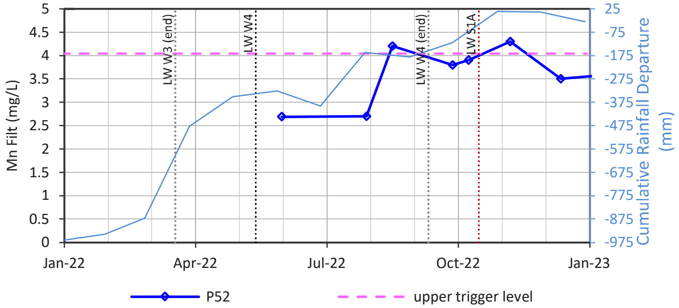


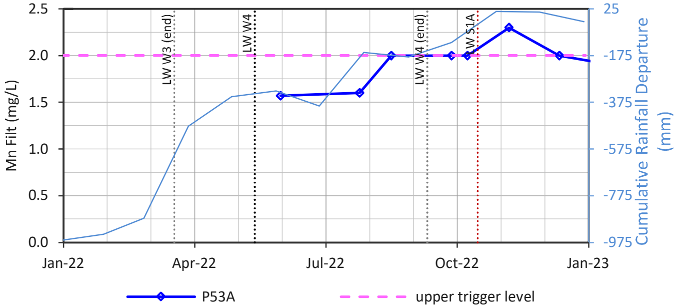


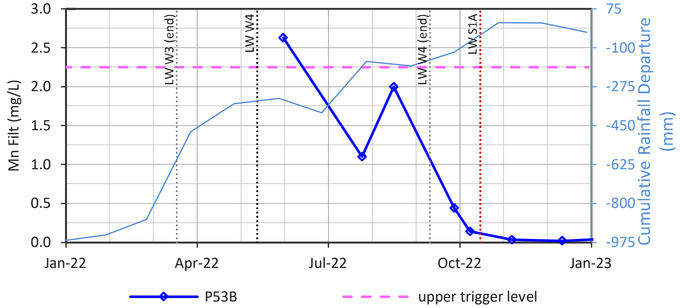
No Data Available for Mn Tot (mg/L)

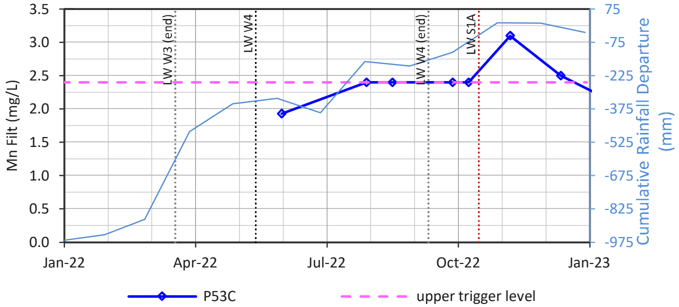


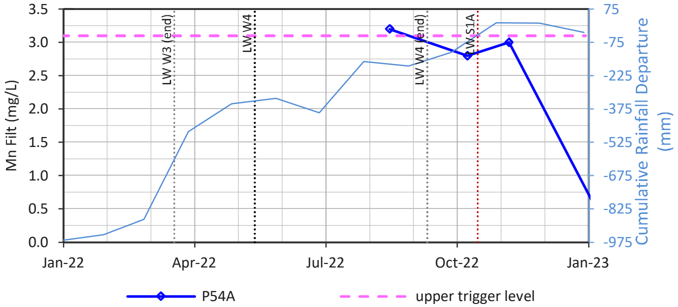


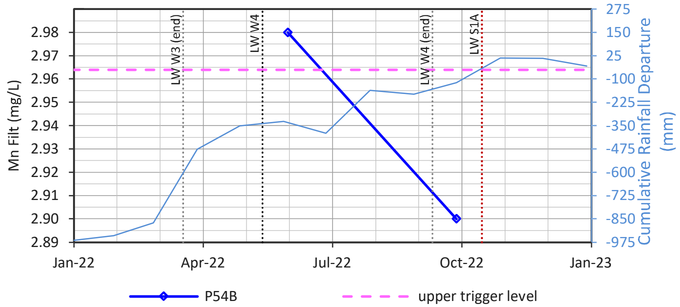

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level

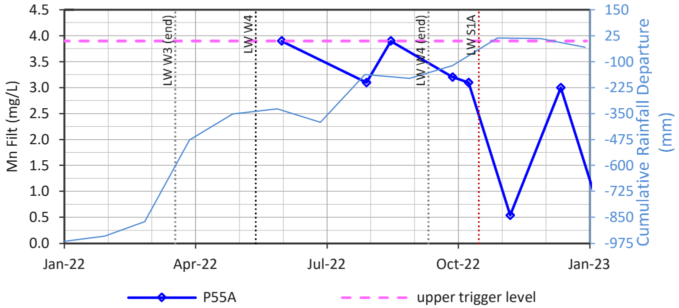

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

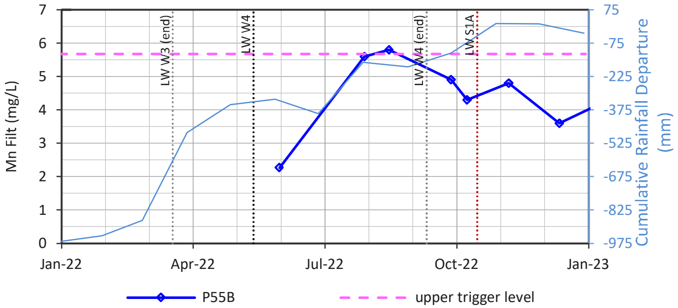

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

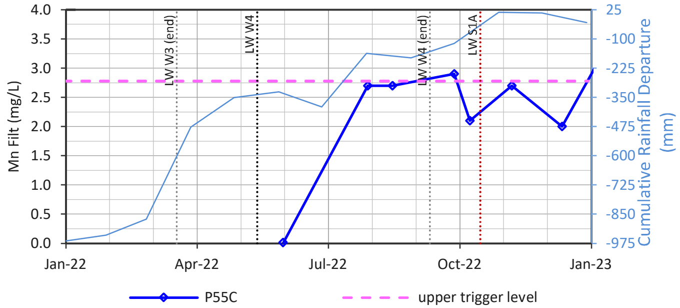

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

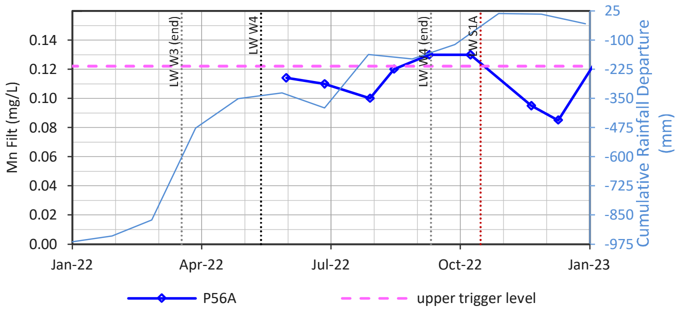

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

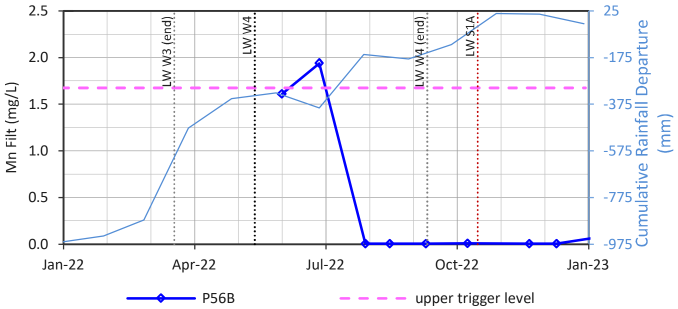

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

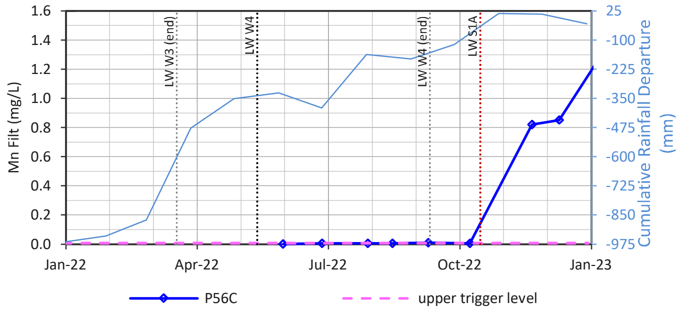

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

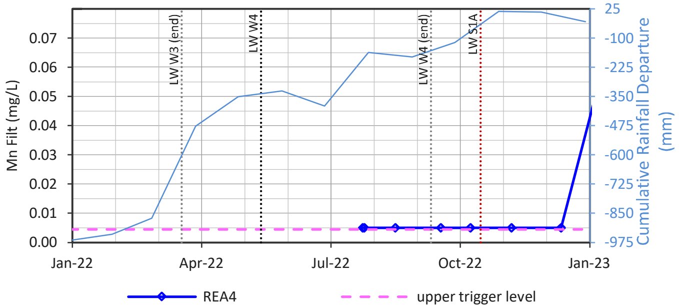

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

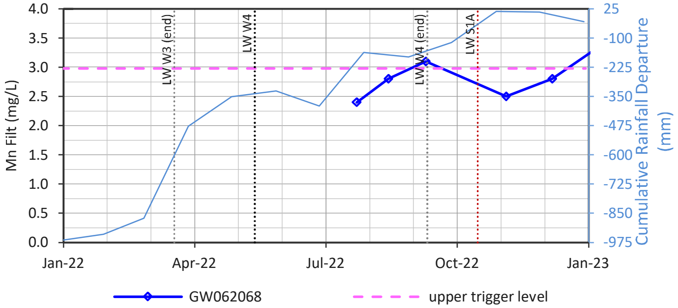

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

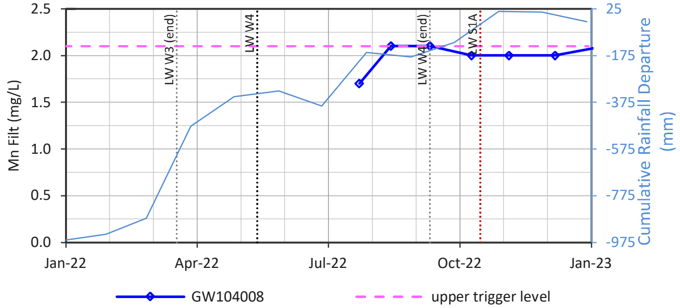

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

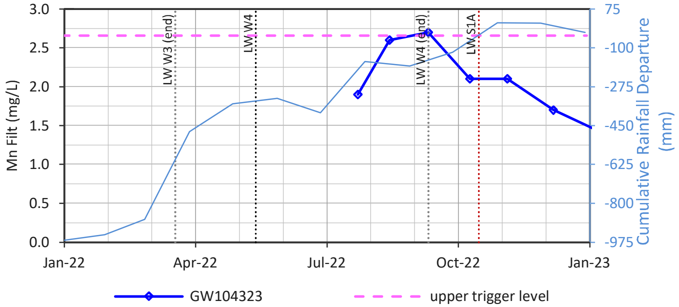

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

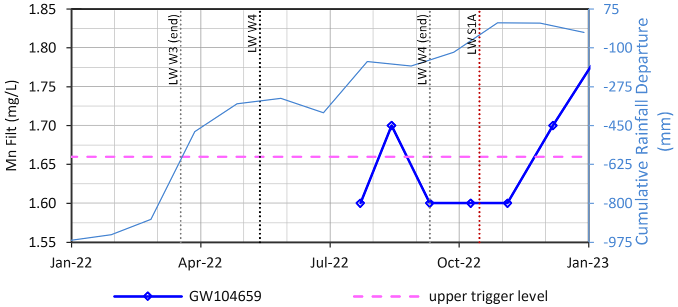

Mn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

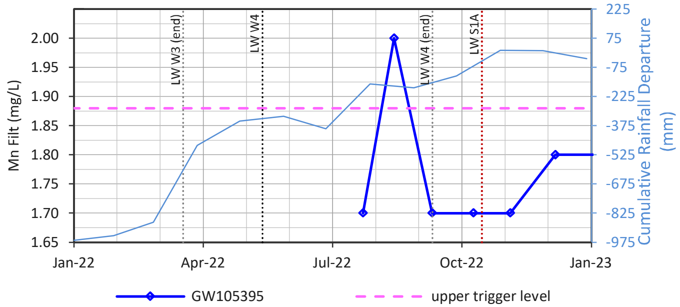


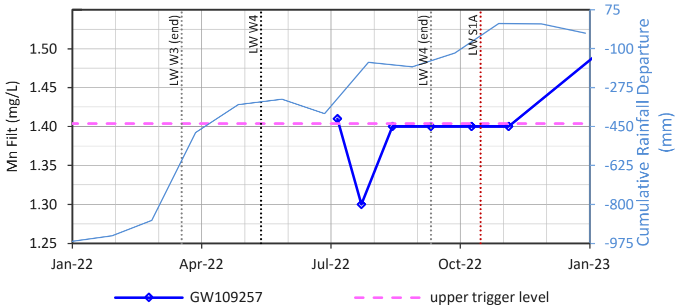


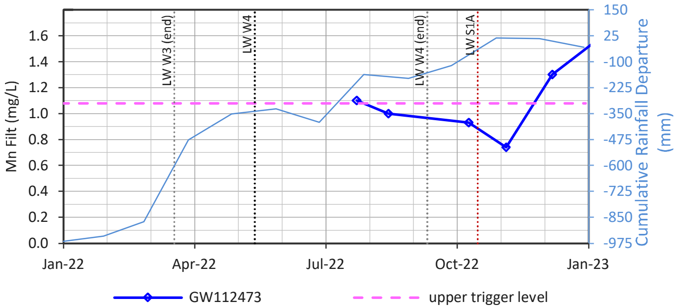




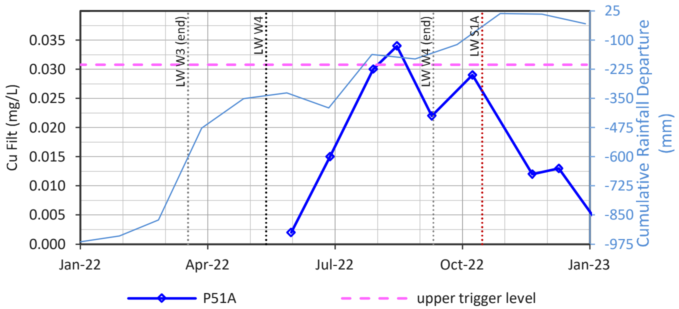


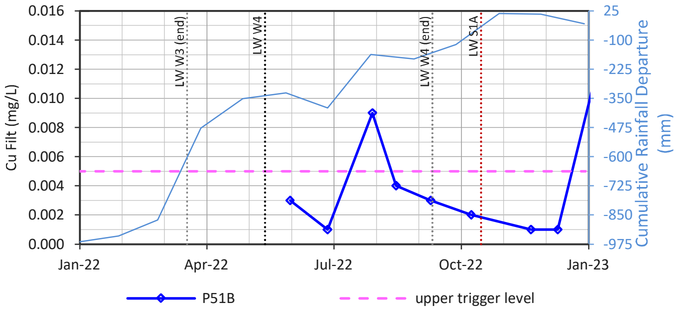


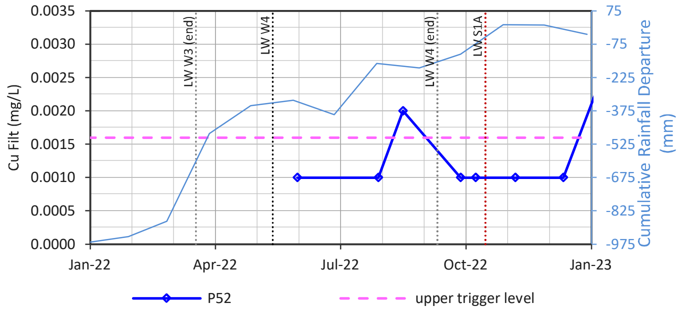


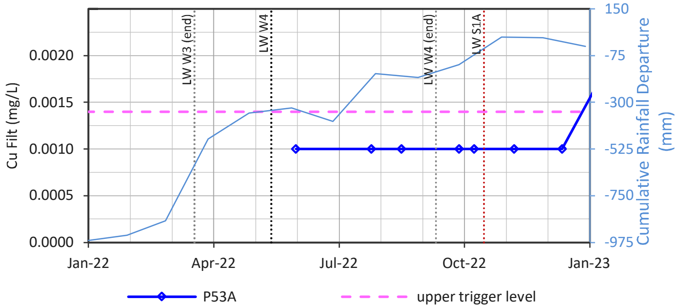


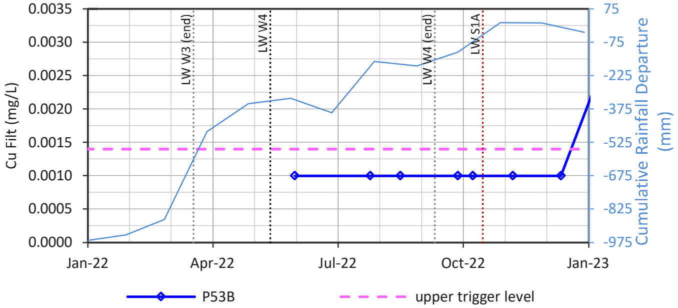
No Data Available for Mn Filt (mg/L)

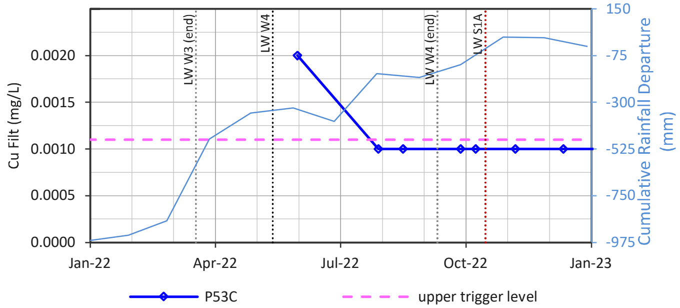


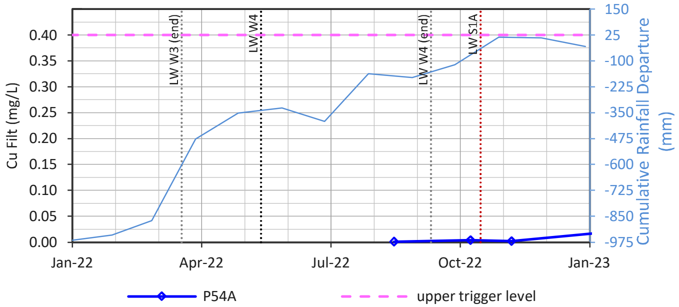


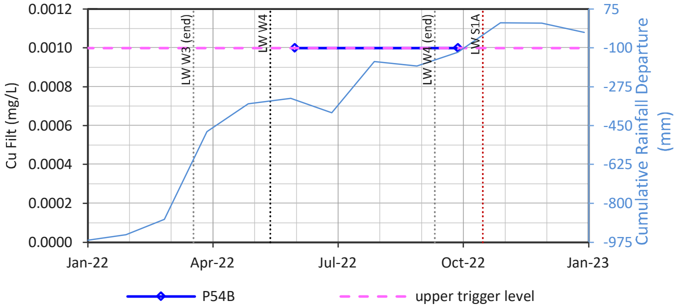


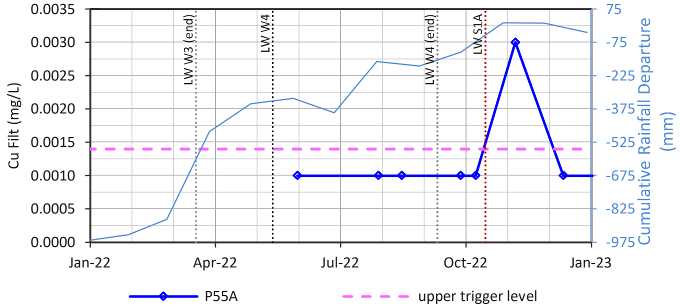

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53A
upper trigger level

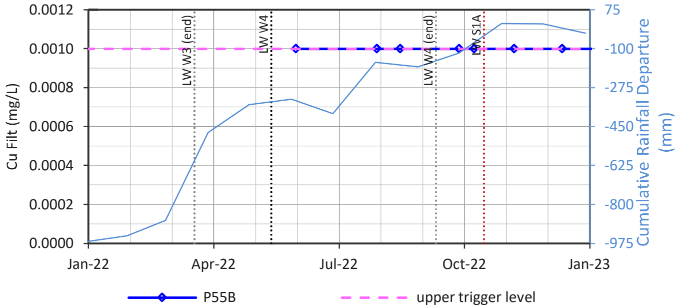

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53B
upper trigger level

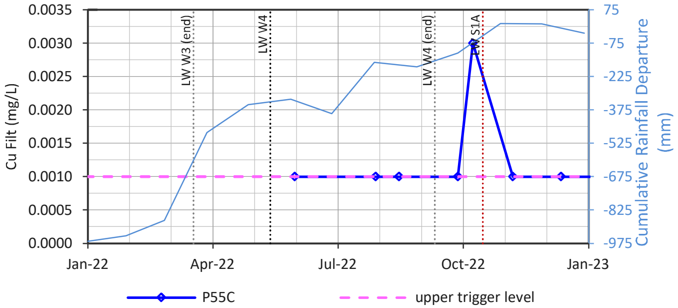

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53C
upper trigger level

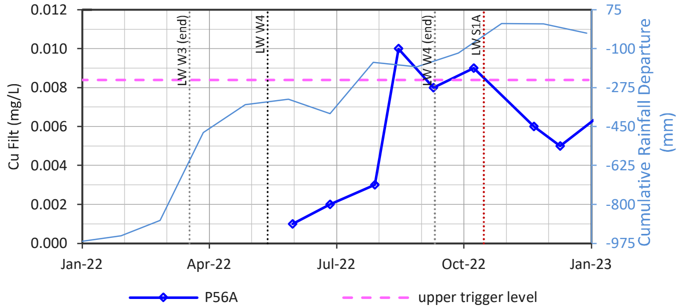

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P54A
upper trigger level

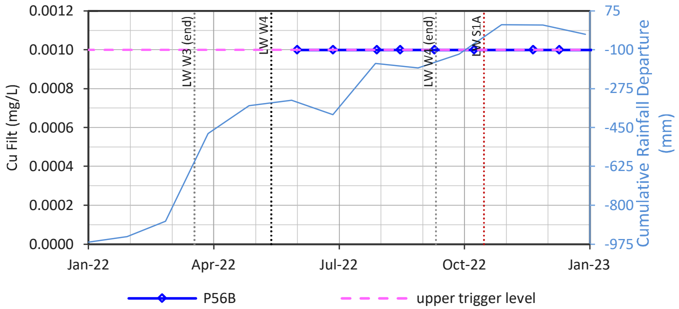

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P54B
upper trigger level

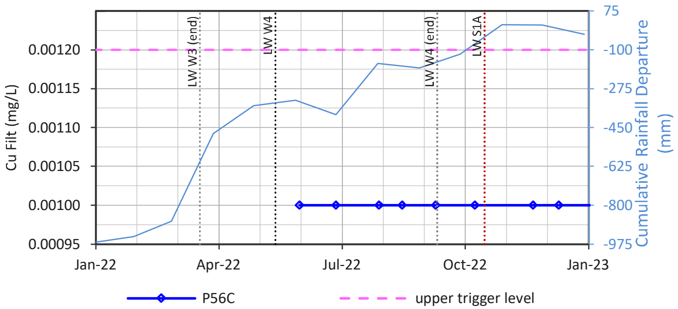

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55A
upper trigger level

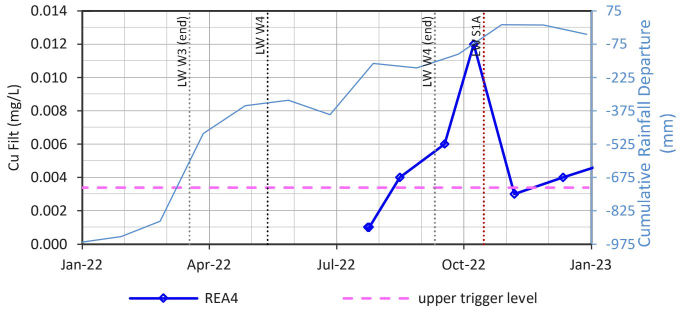

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55B
upper trigger level

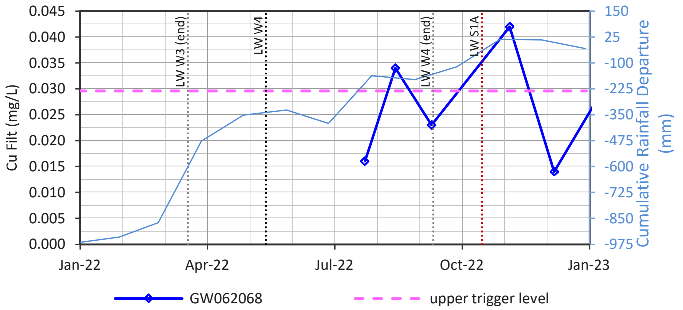

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55C
upper trigger level

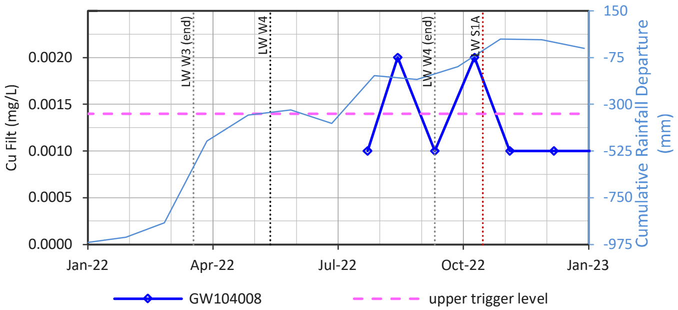

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56A
upper trigger level

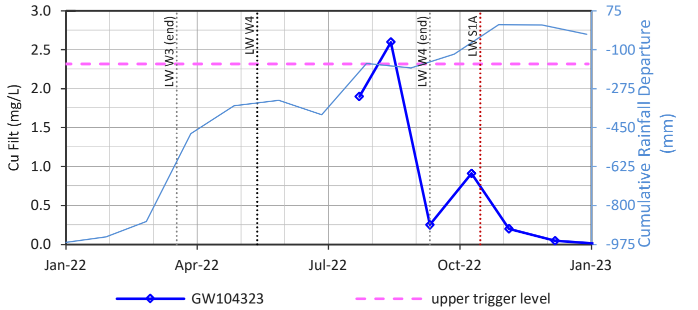

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56B
upper trigger level

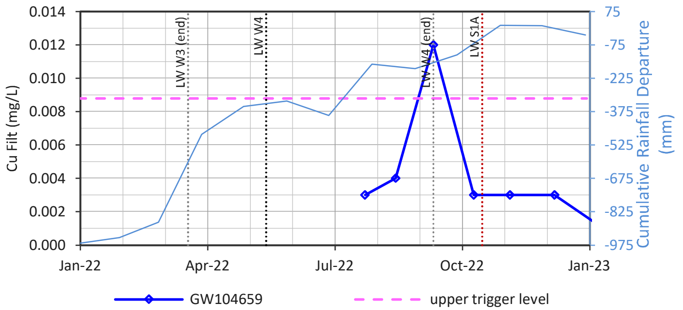

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56C
upper trigger level

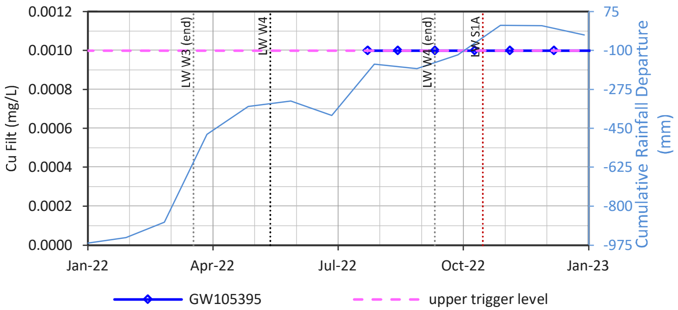

Cu Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
REA4
upper trigger level

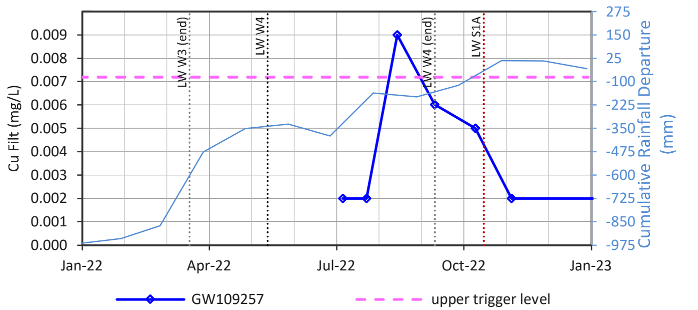


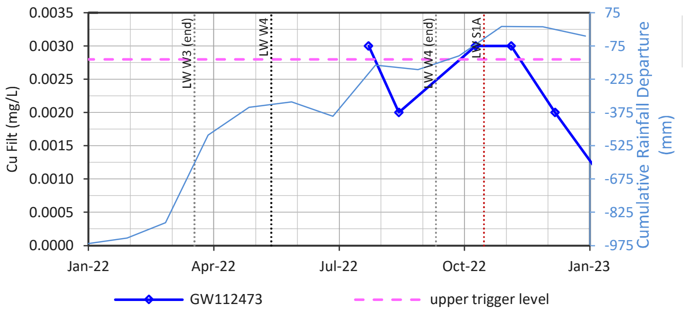




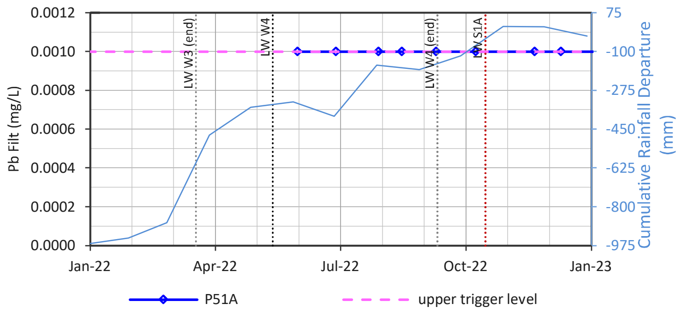


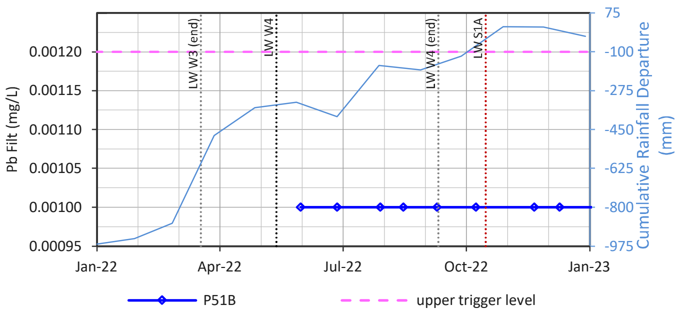


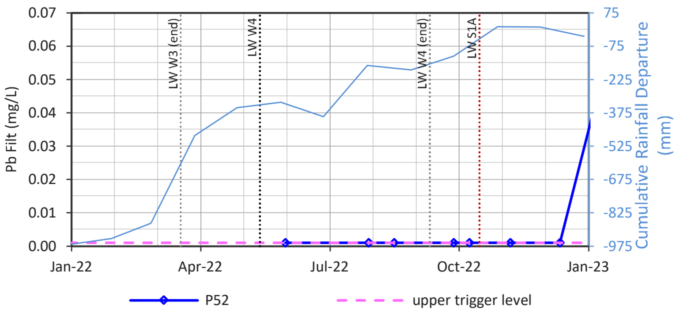


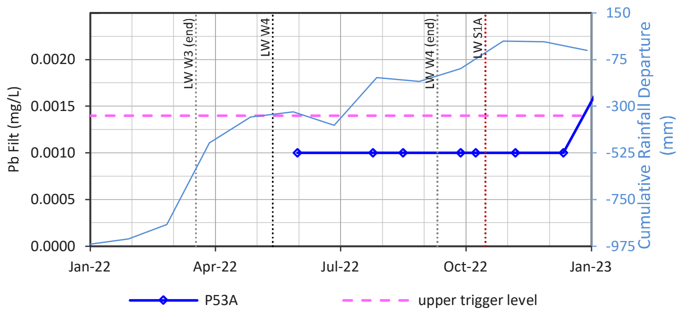


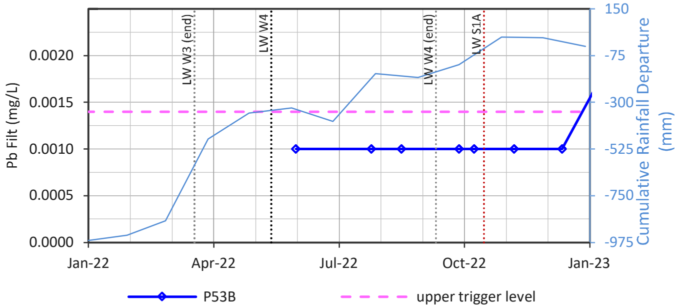
No Data Available for Cu Filt (mg/L)

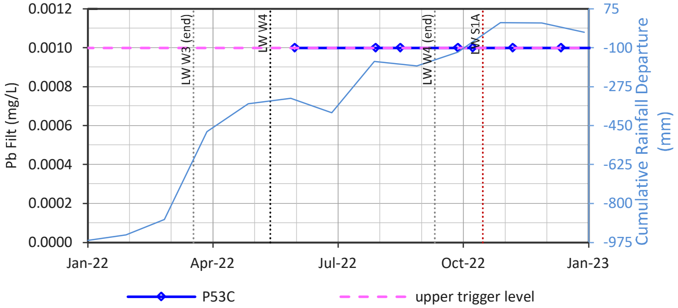


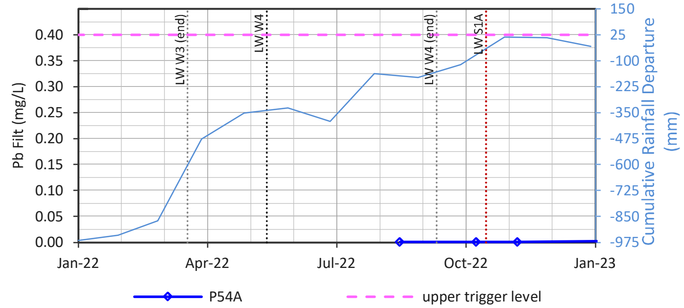


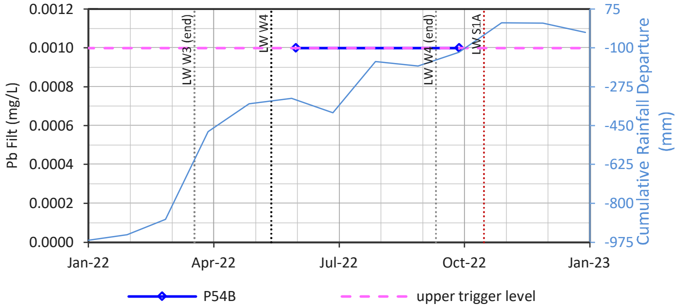


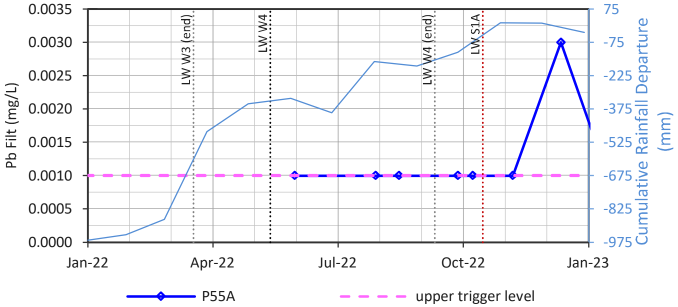


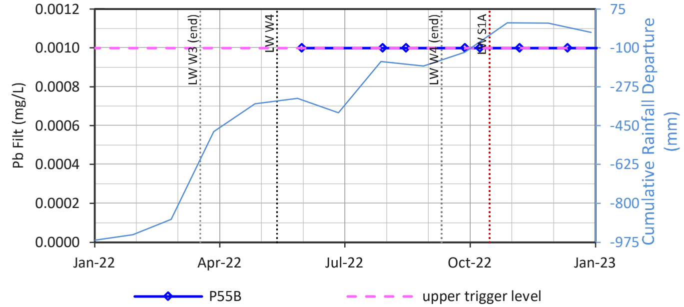

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level


Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level


Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level


Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level


Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level


Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
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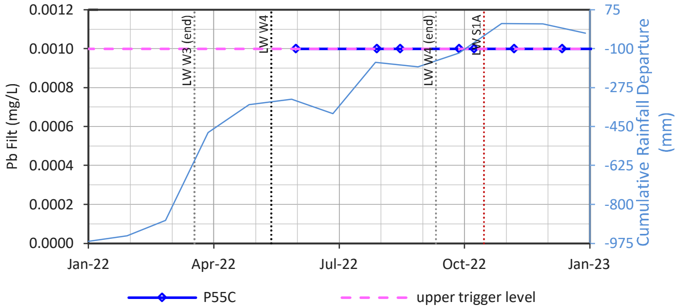
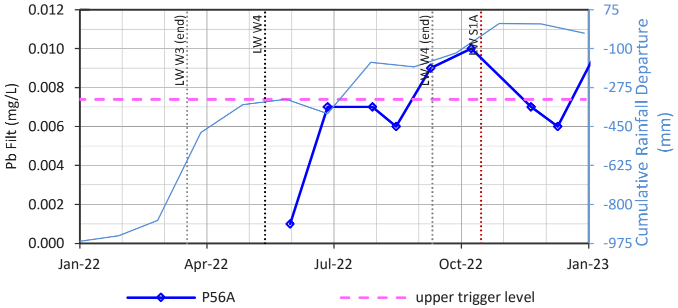
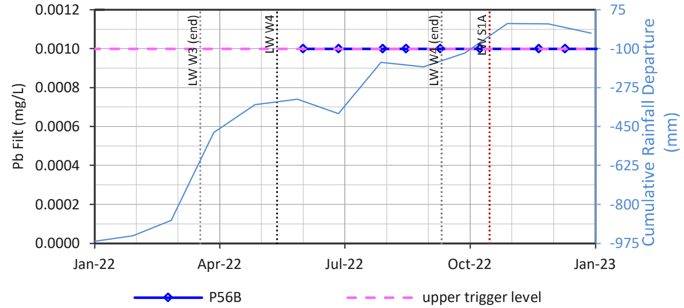
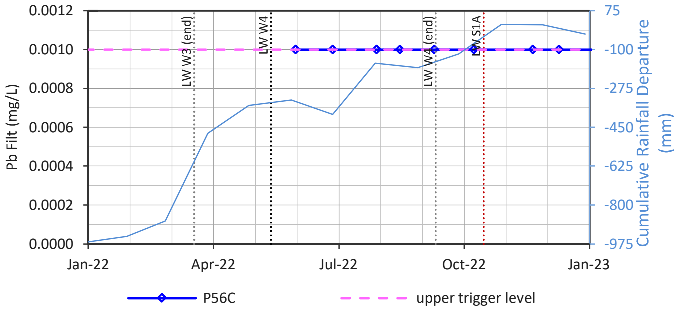
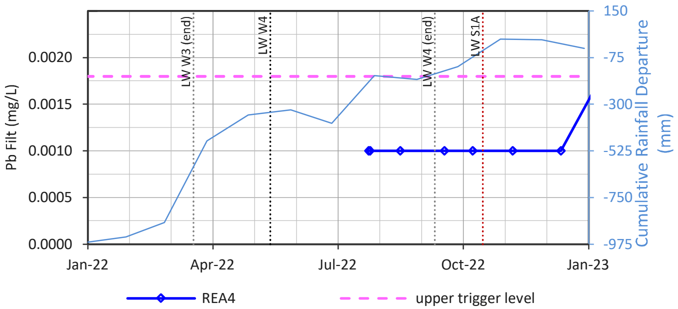
Jan-23
P55B
upper trigger level

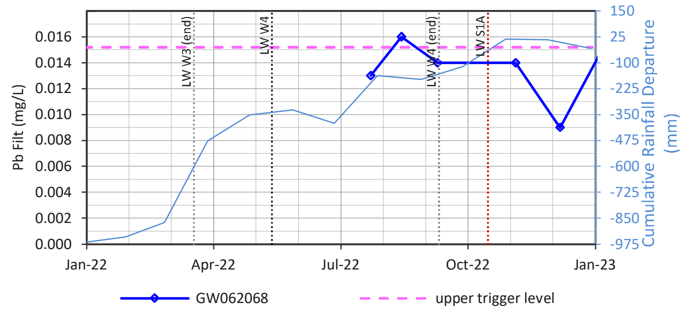

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

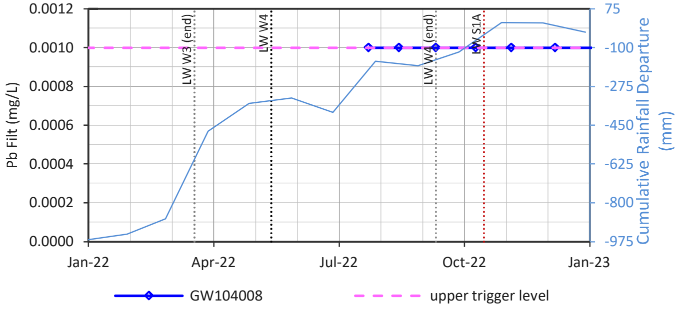

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

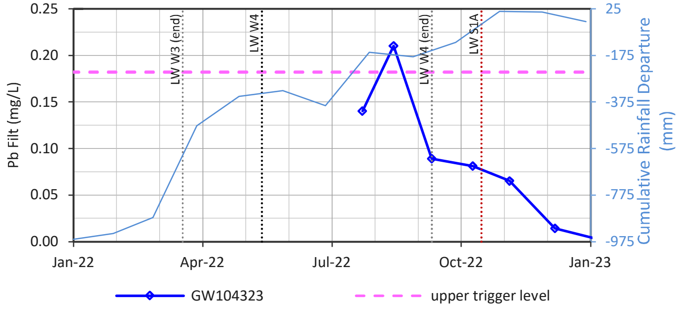

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

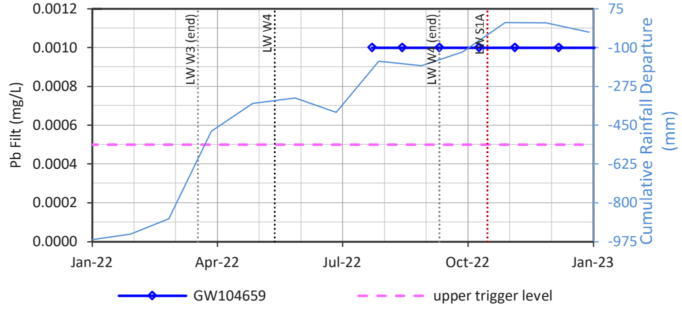

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

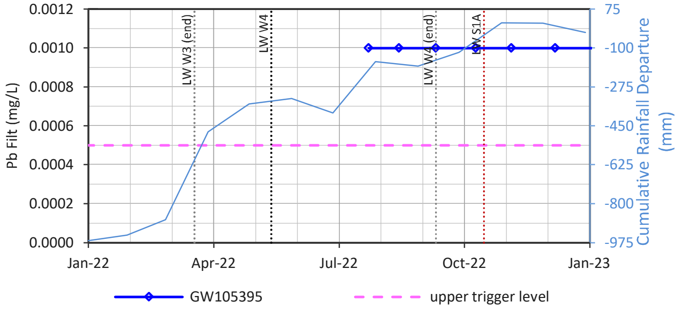

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

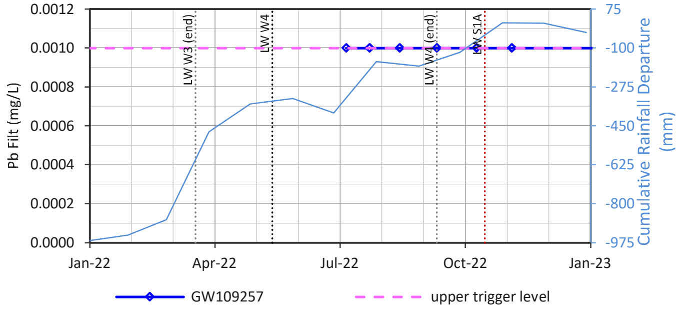

Pb Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

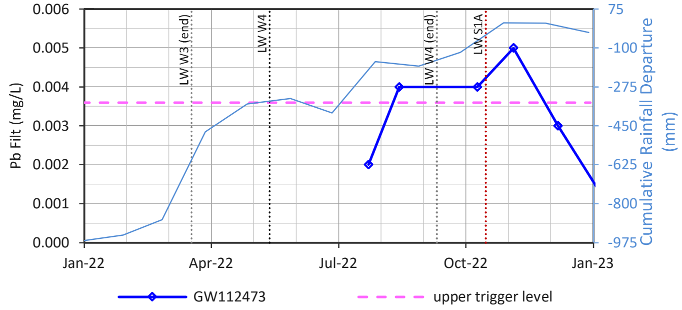




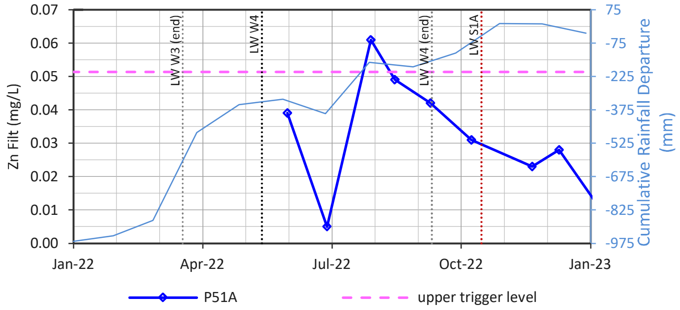


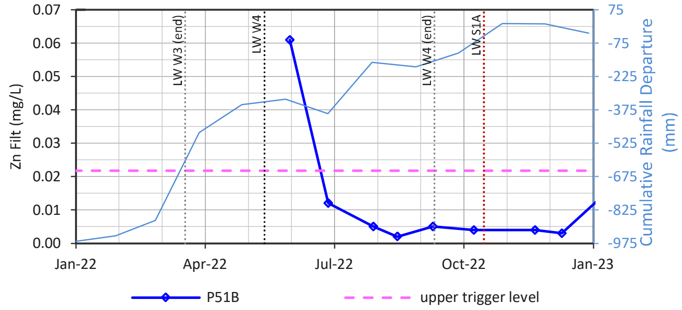


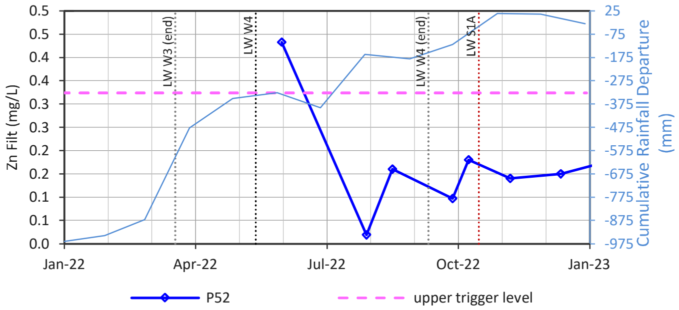


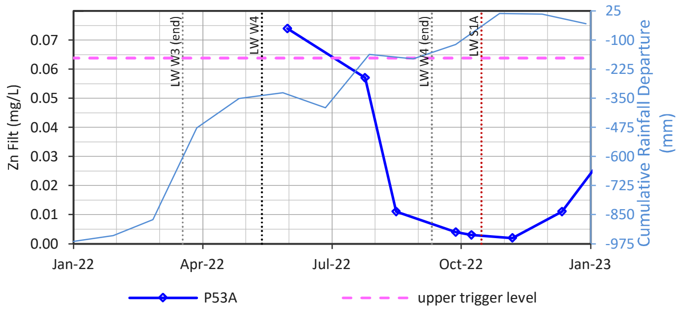


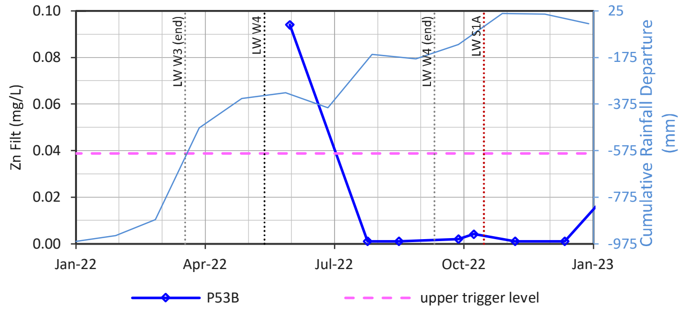
No Data Available for Pb Filt (mg/L)

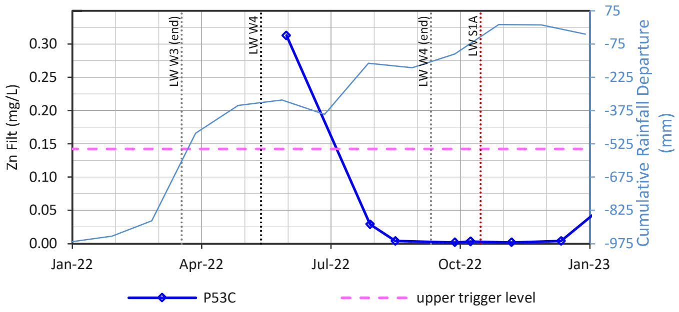


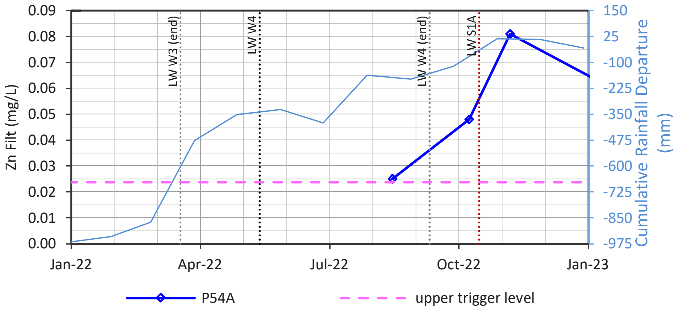


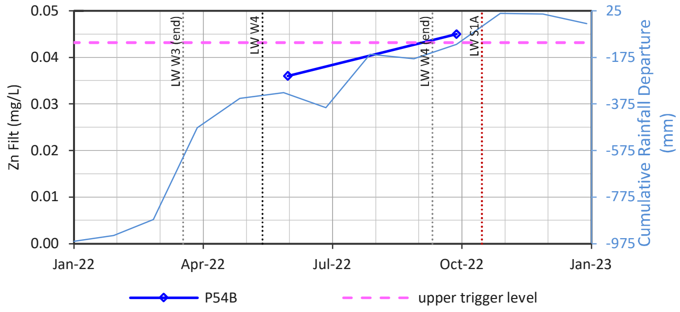


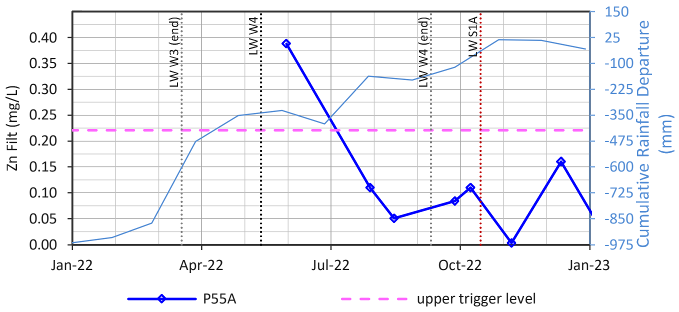


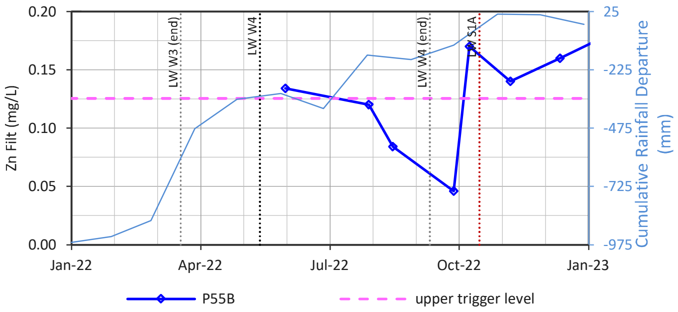


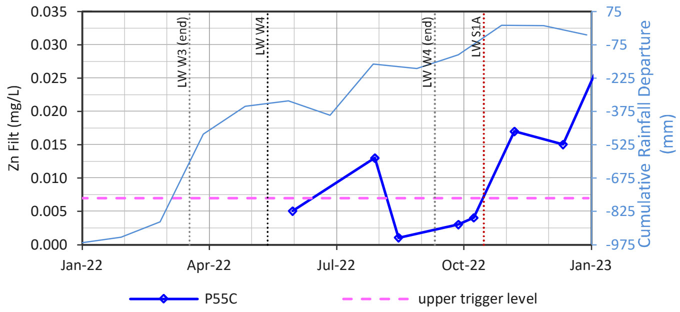

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

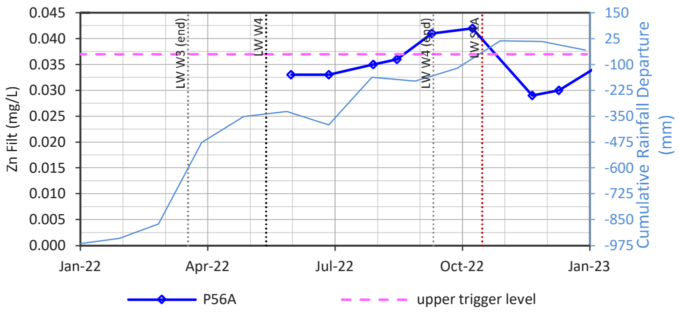

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

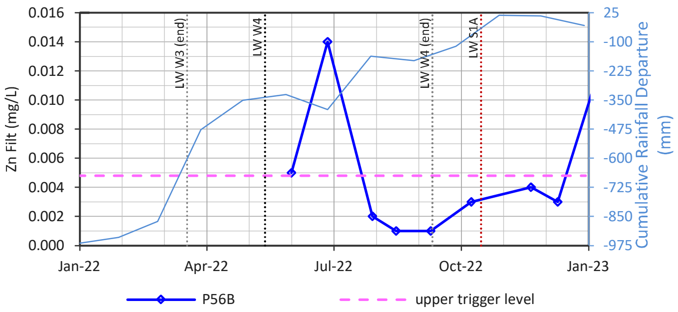

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

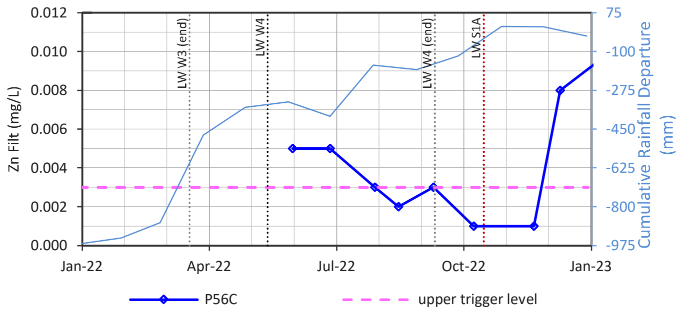

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

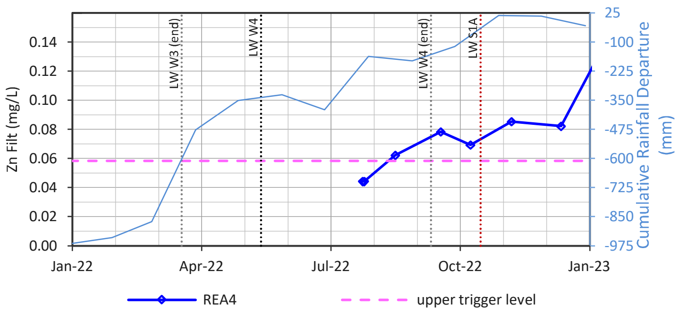

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

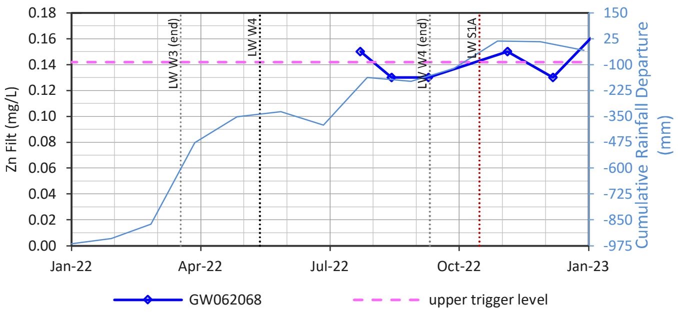

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

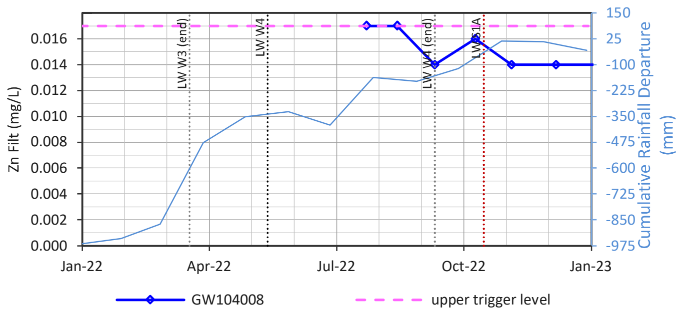

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

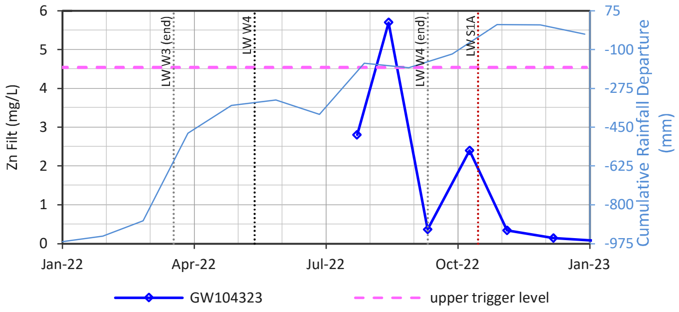

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

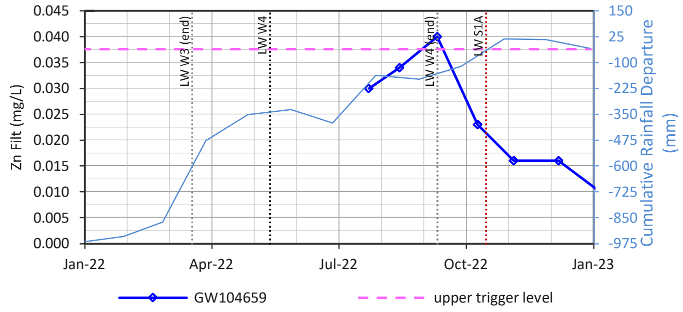

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

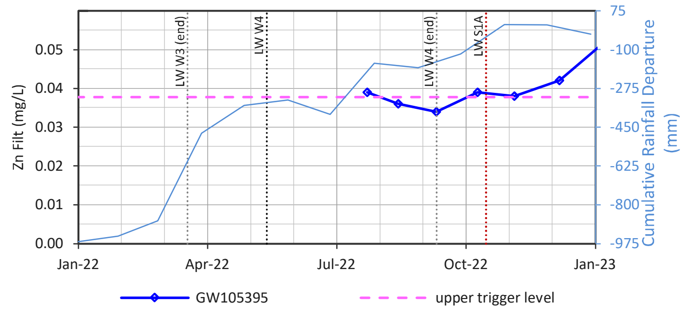

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

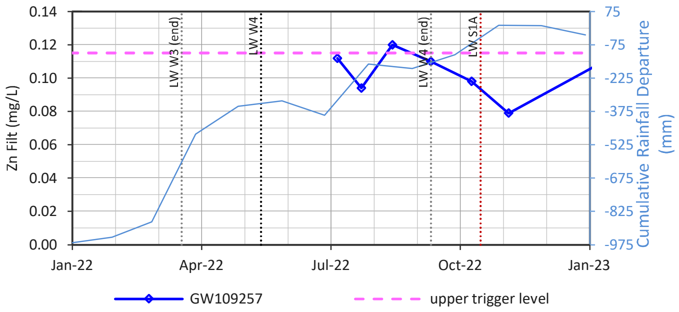

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

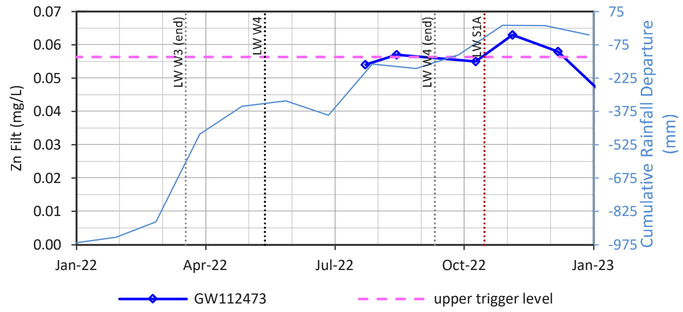

Zn Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level



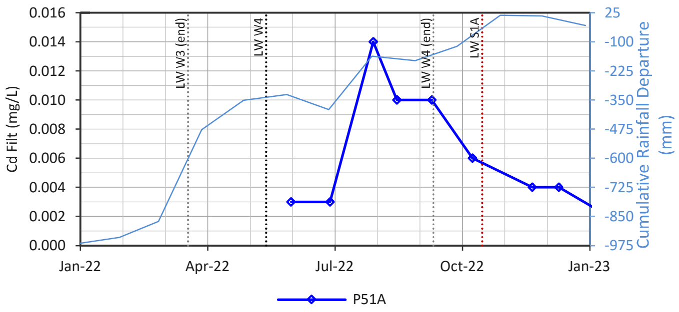


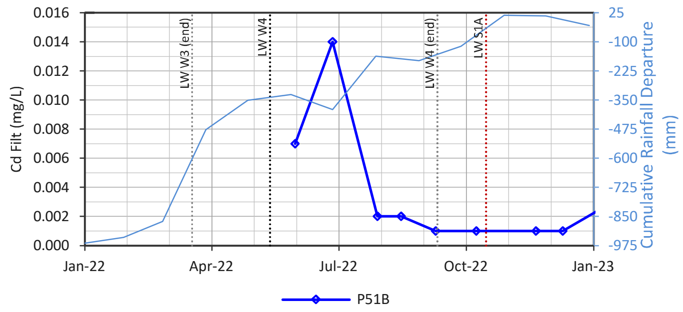


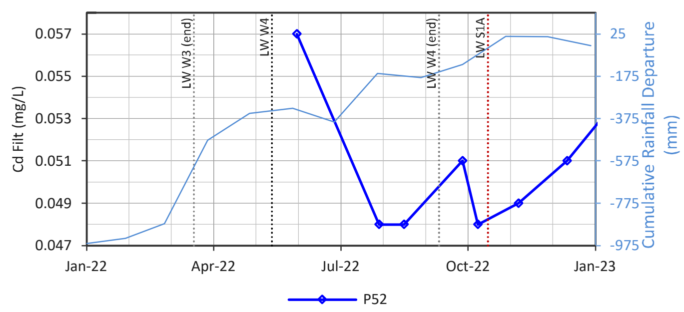


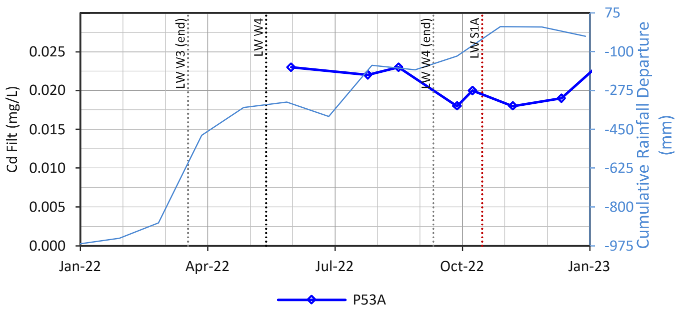


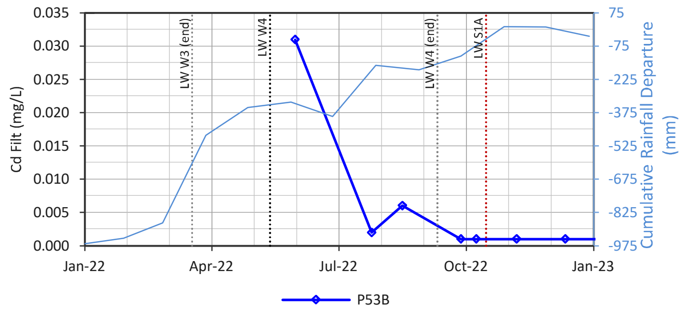
No Data Available for Zn Filt (mg/L)

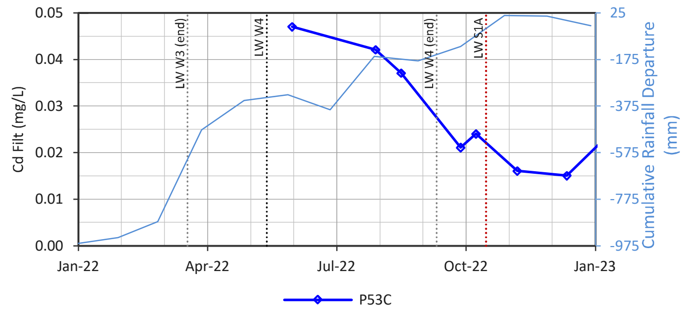


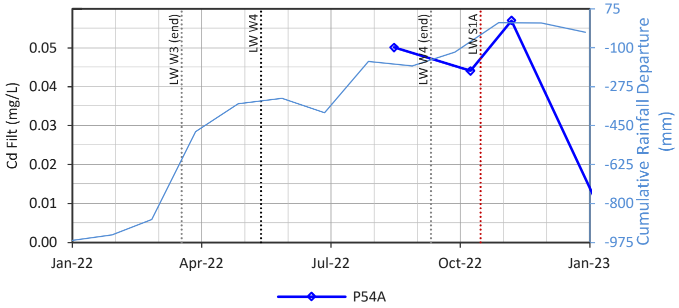


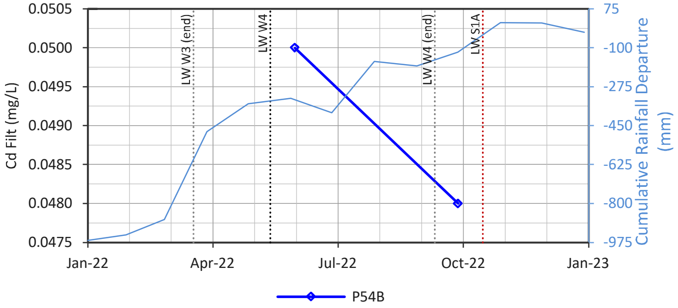


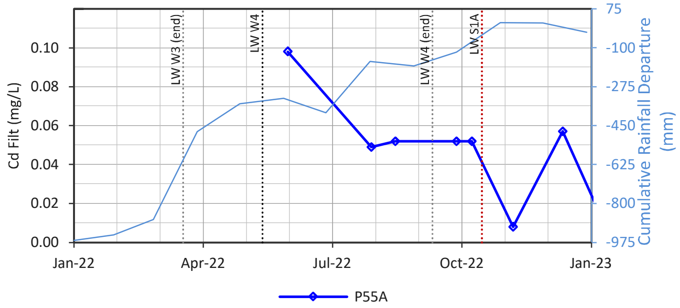


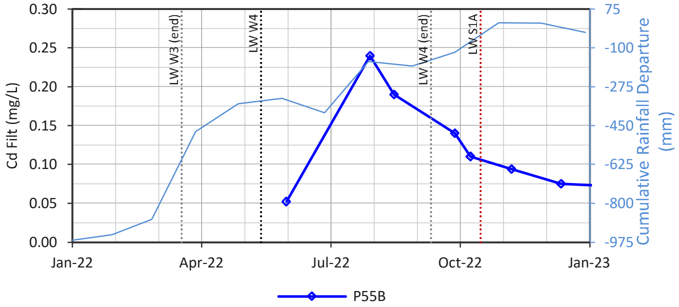


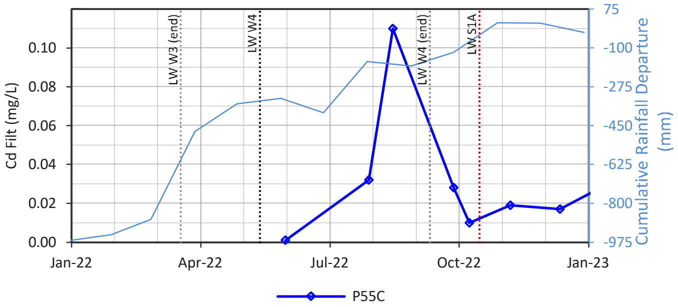


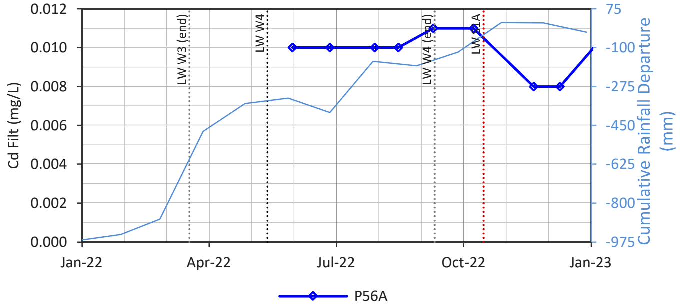

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A

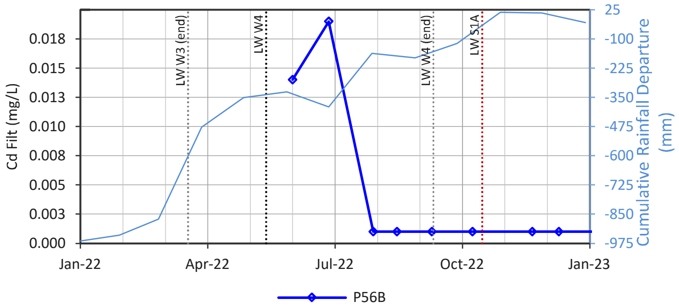

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B

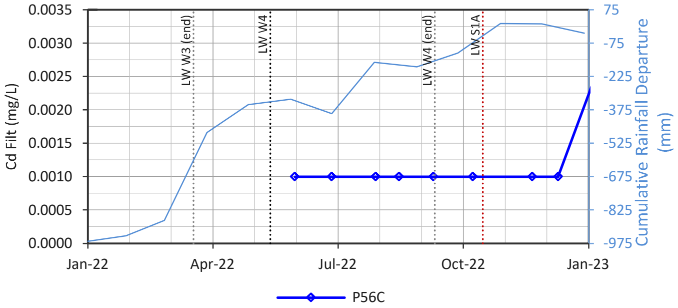

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A

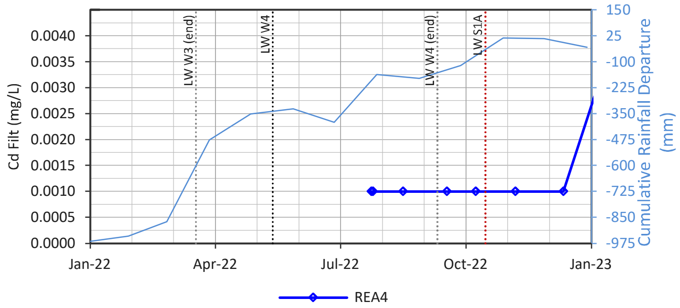

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B

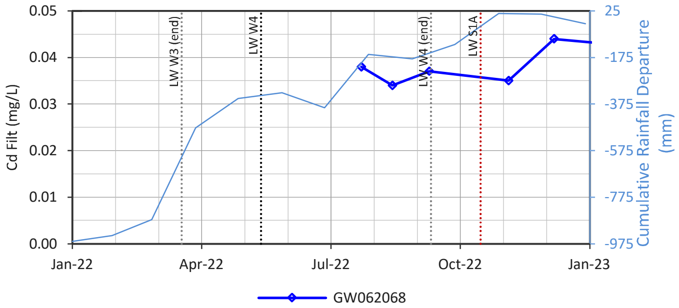

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C

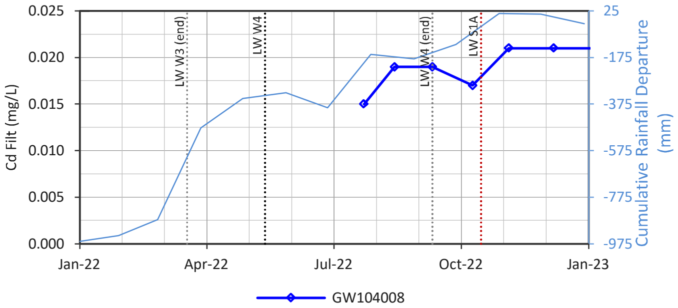

Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
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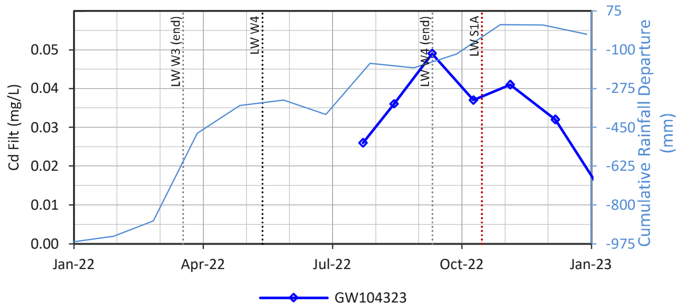
Oct-22
Jan-23
GW104008


Cd Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
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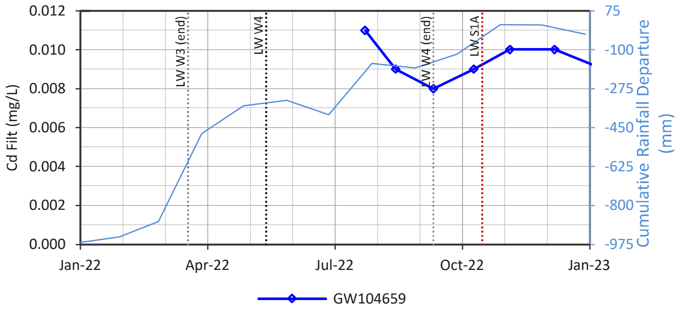
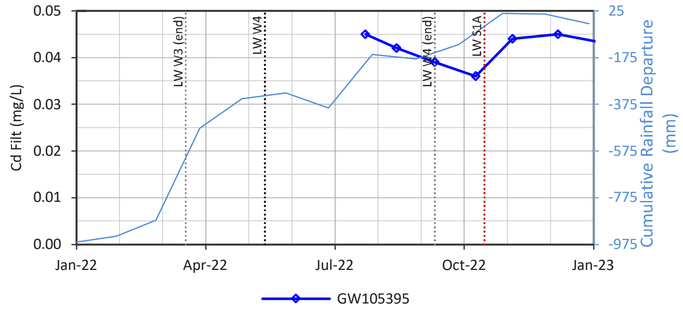
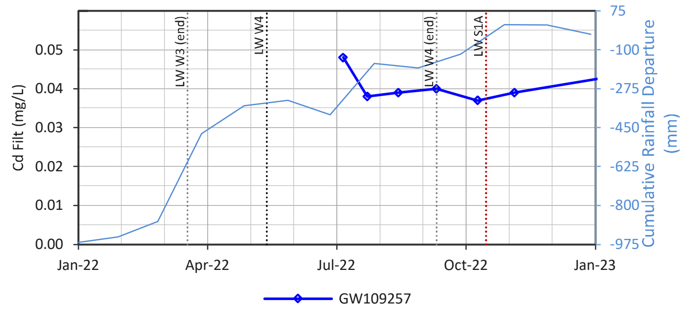
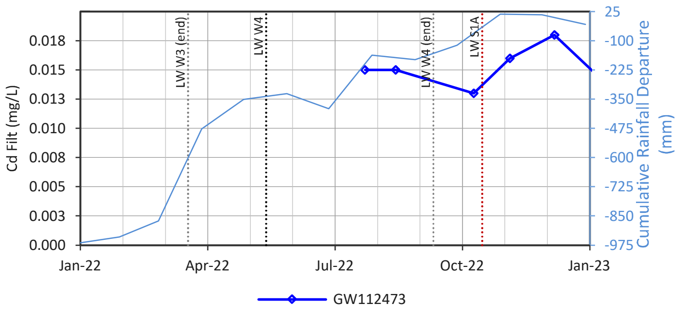
Oct-22
Jan-23
GW104323

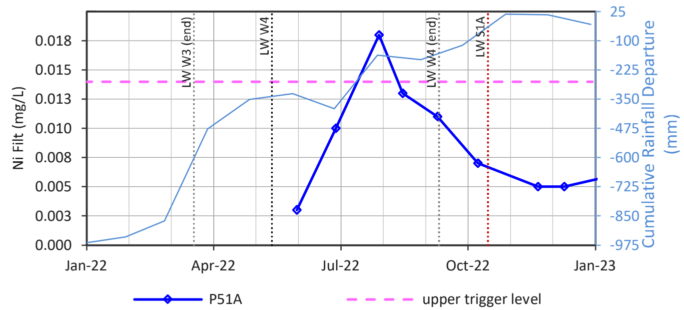


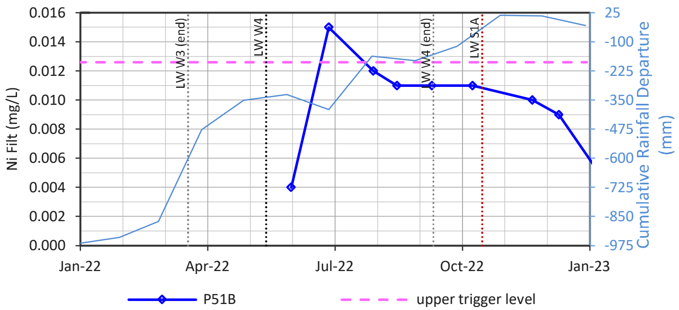


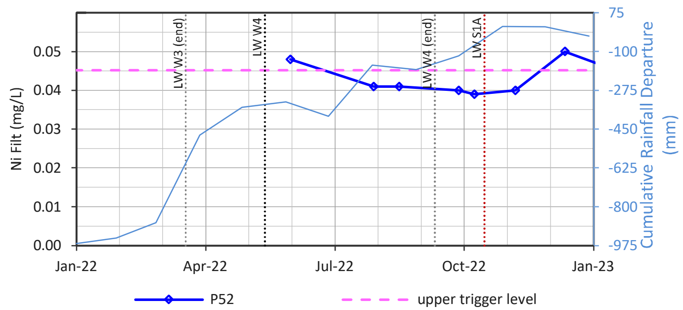


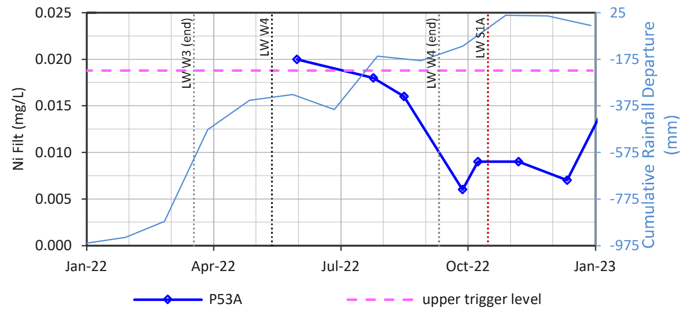


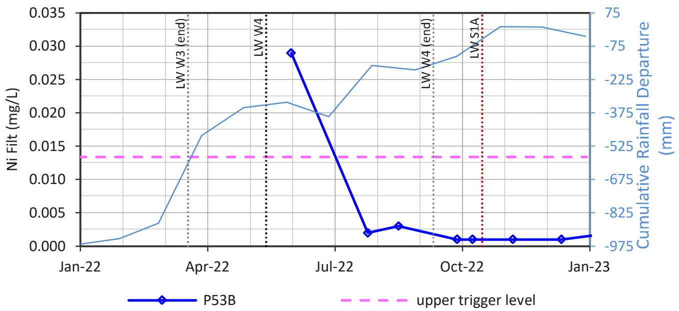
No Data Available for Cd Filt (mg/L)

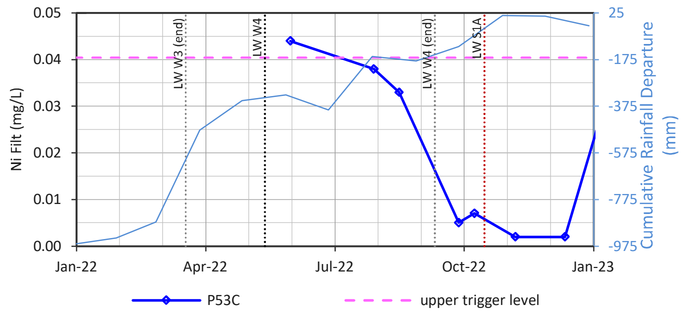


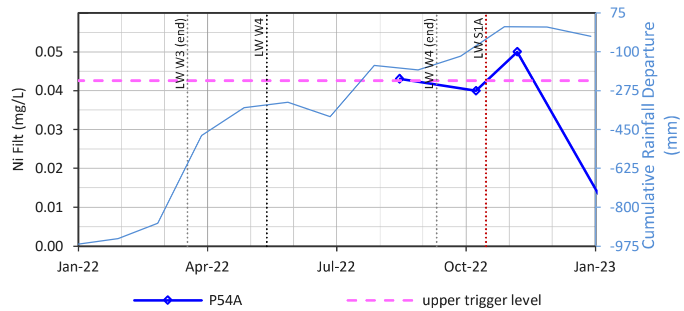


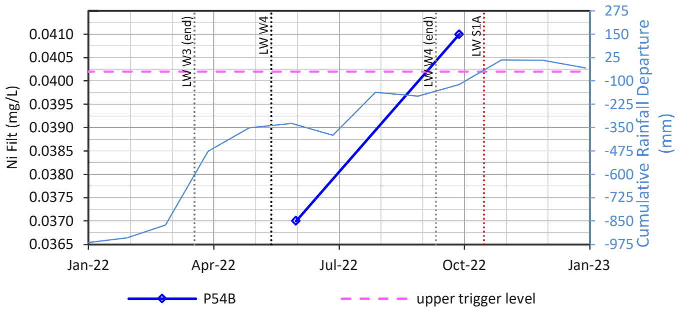


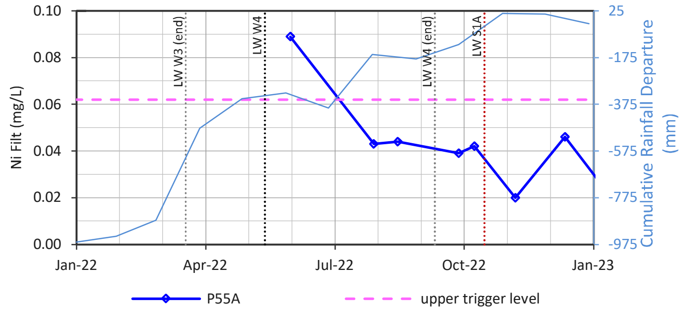


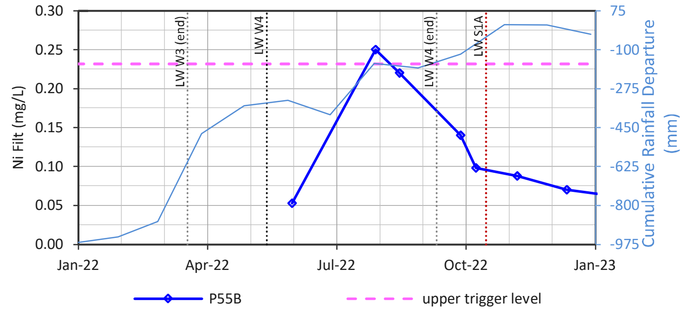


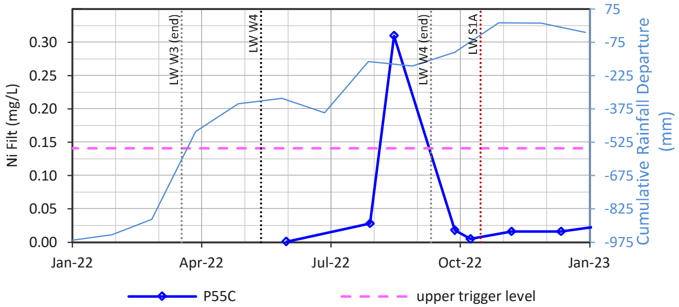


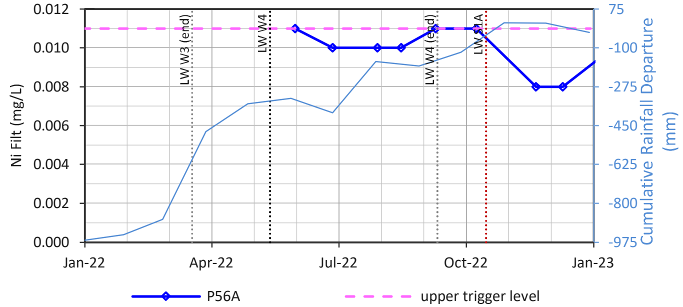


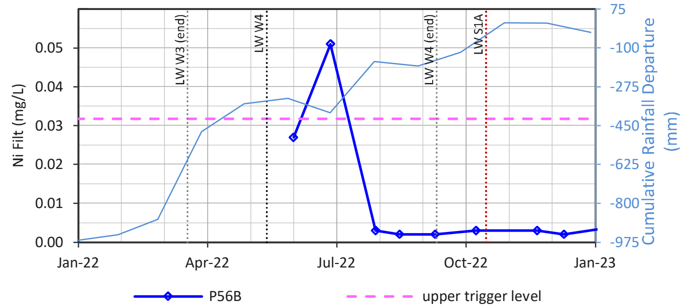

Ni Filt (mg/L)
0.0410
0.0405
0.0400
0.0395
0.0390
0.0385
0.0380
0.0375
0.0370
0.0365
Cumulative Rainfall Departure (mm)
275
150
25
-100
-225
-350
-475
-600
-725
-850
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

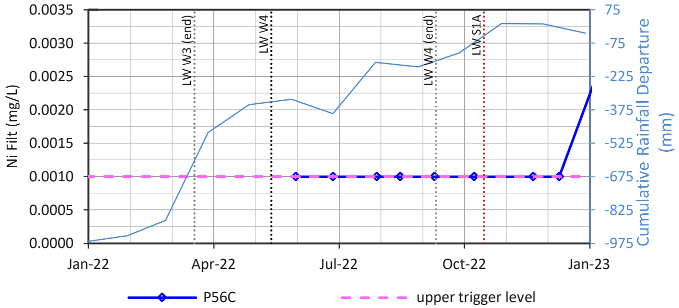

Ni Filt (mg/L)
0.10
0.08
0.06
0.04
0.02
0.00
Cumulative Rainfall Departure (mm)
25
-175
-375
-575
-775
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

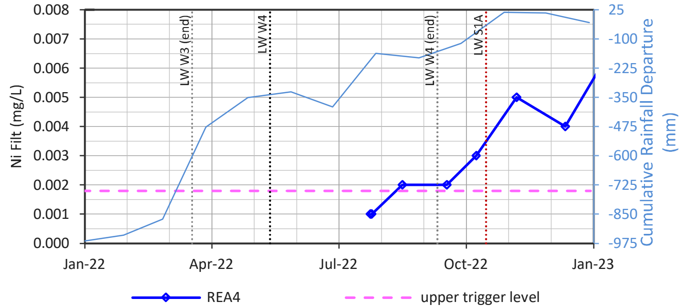

Ni Filt (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Cumulative Rainfall Departure (mm)
75
-100
-275
-450
-625
-800
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

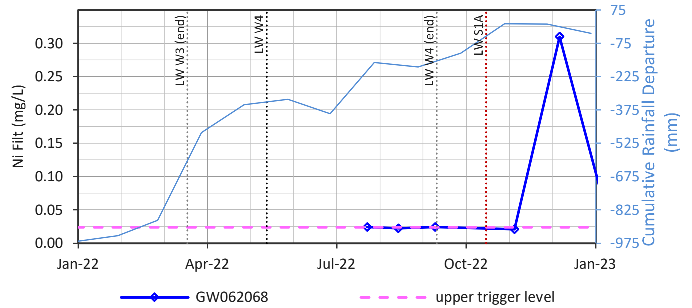

Ni Filt (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Cumulative Rainfall Departure (mm)
75
-75
-225
-375
-525
-675
-825
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

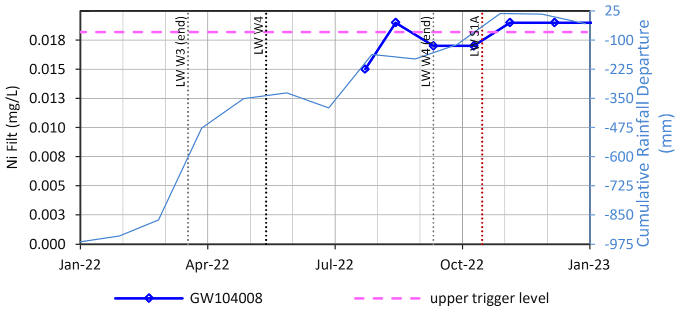

Ni Filt (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Cumulative Rainfall Departure (mm)
75
-100
-275
-450
-625
-800
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

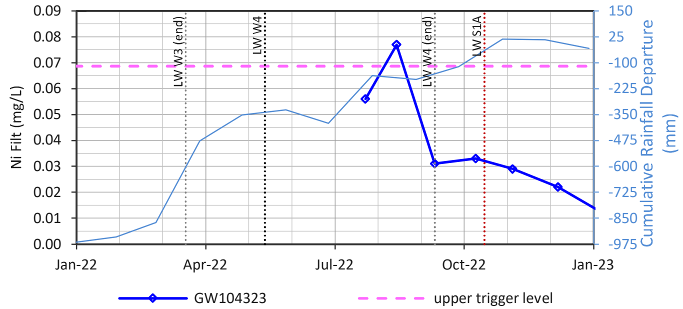

Ni Filt (mg/L)
0.05
0.04
0.03
0.02
0.01
0.00
Cumulative Rainfall Departure (mm)
75
-100
-275
-450
-625
-800
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

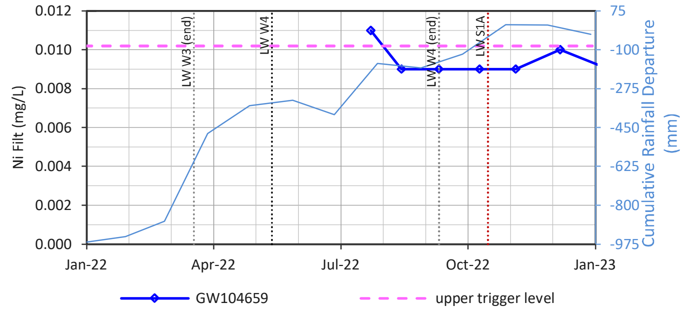

Ni Filt (mg/L)
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
Cumulative Rainfall Departure (mm)
75
-75
-225
-375
-525
-675
-825
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56C
upper trigger level

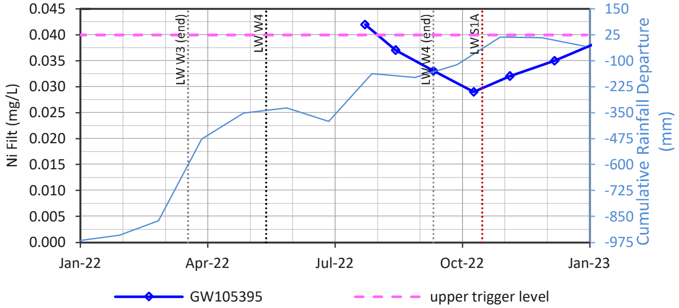

Ni Filt (mg/L)
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
Cumulative Rainfall Departure (mm)
25
-100
-225
-350
-475
-600
-725
-850
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
REA4
upper trigger level

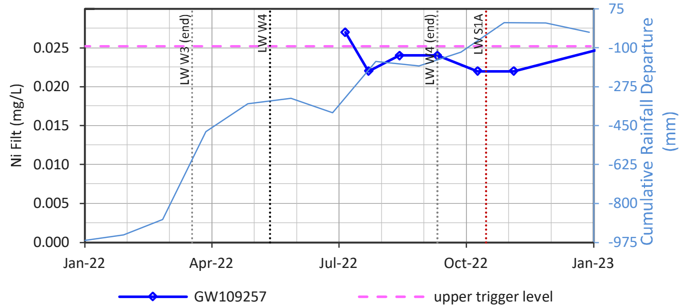

Ni Filt (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Cumulative Rainfall Departure (mm)
75
-75
-225
-375
-525
-675
-825
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW062068
upper trigger level

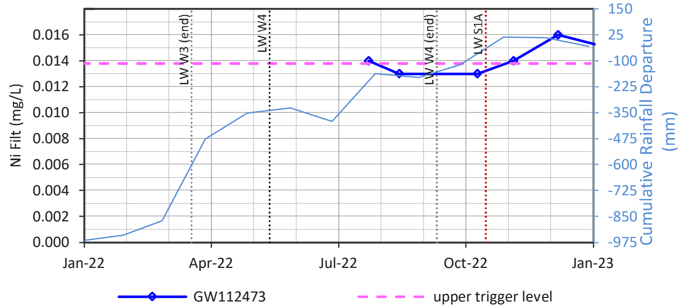

Ni Filt (mg/L)
0.018
0.015
0.013
0.010
0.008
0.005
0.003
0.000
Cumulative Rainfall Departure (mm)
25
-100
-225
-350
-475
-600
-725
-850
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104008
upper trigger level


Ni Filt (mg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Cumulative Rainfall Departure (mm)
150
25
-100
-225
-350
-475
-600
-725
-850
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104323
upper trigger level

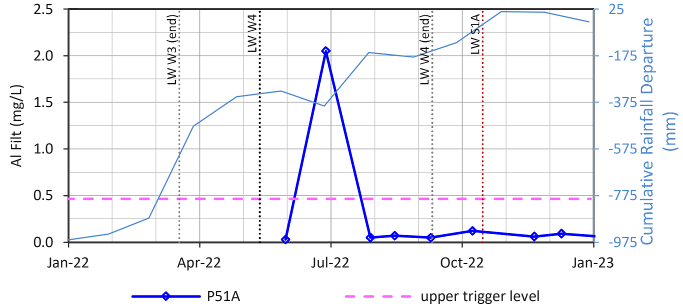

Ni Filt (mg/L)
0.012
0.010
0.008
0.006
0.004
0.002
0.000
Cumulative Rainfall Departure (mm)
75
-100
-275
-450
-625
-800
-975
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
GW104659
upper trigger level

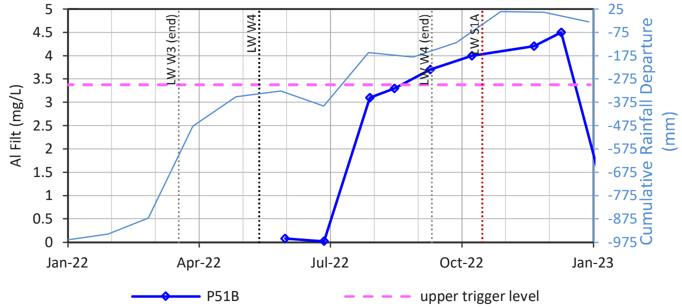


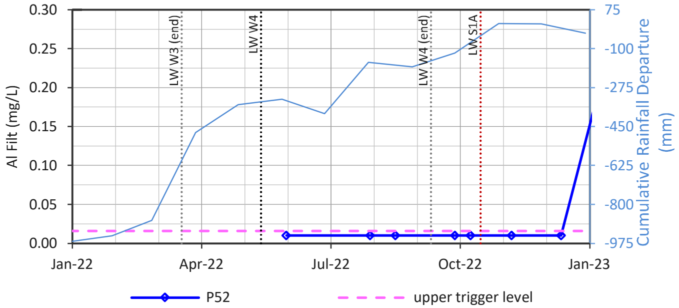


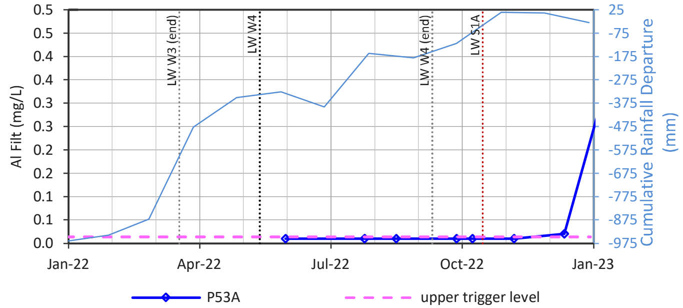


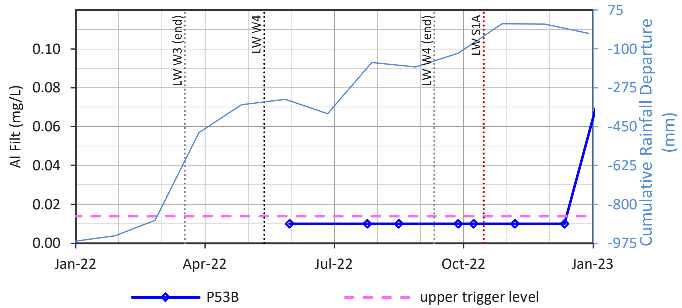
No Data Available for Ni Filt (mg/L)

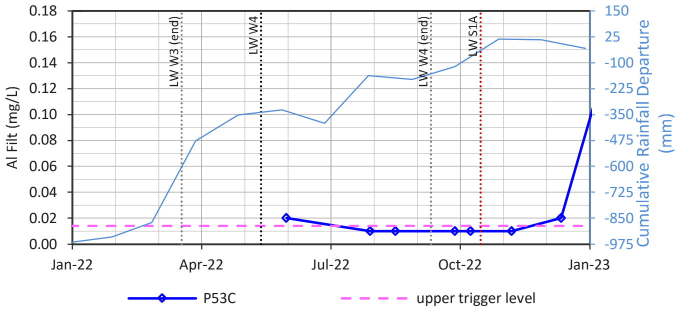


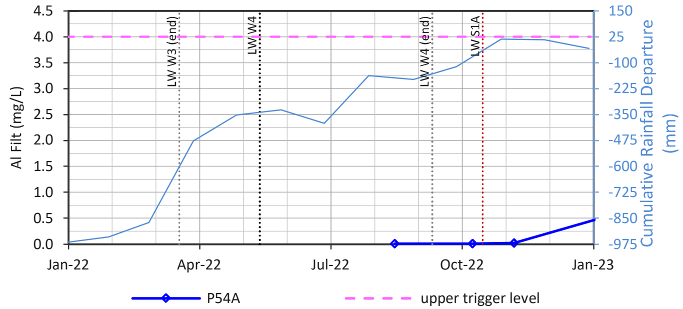


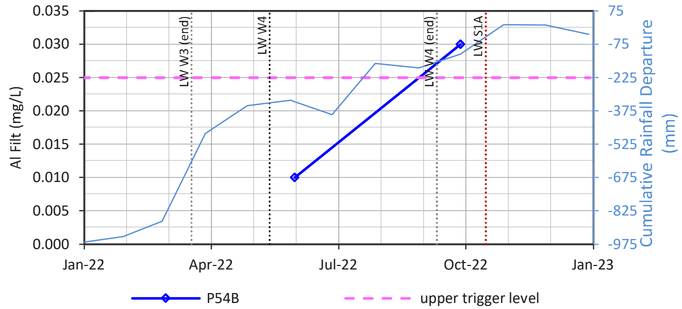


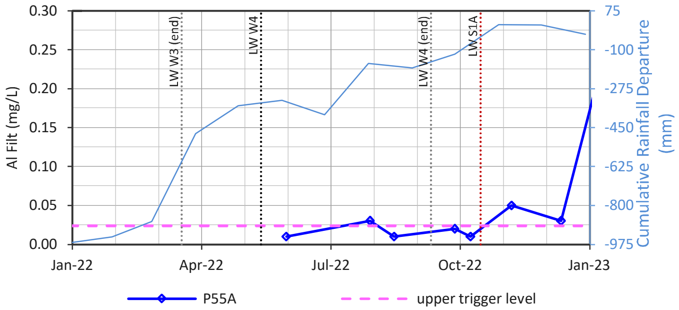


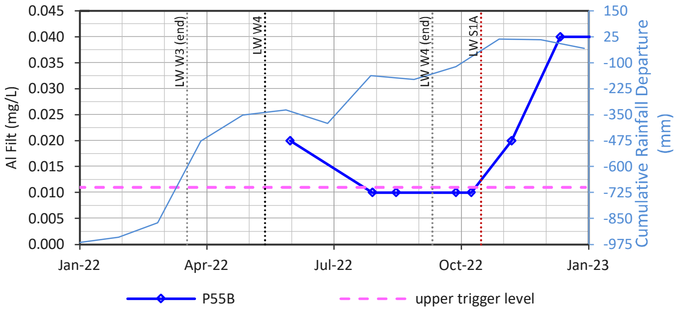


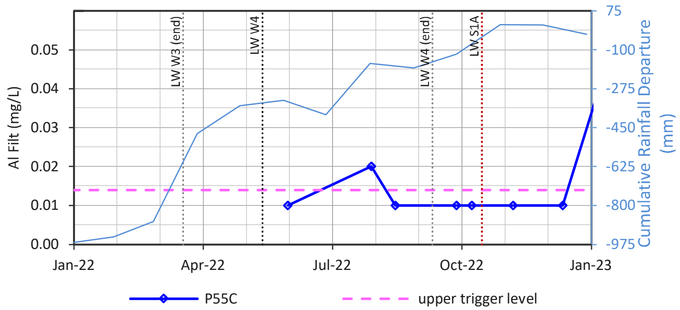


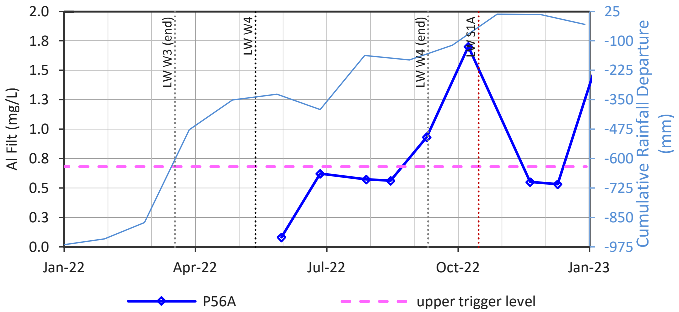


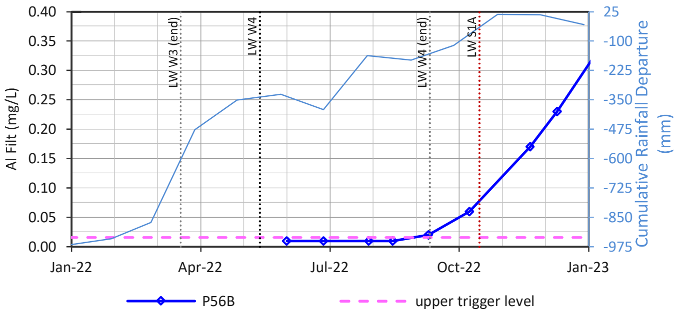


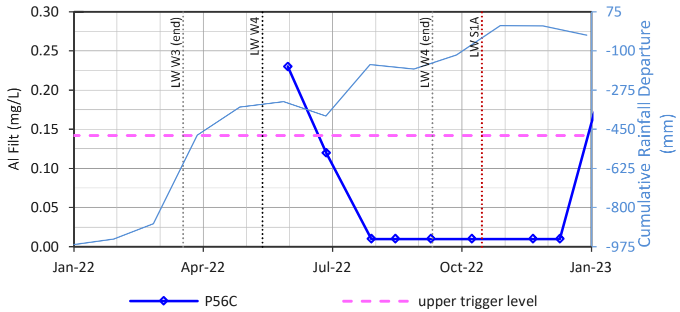

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55A
upper trigger level

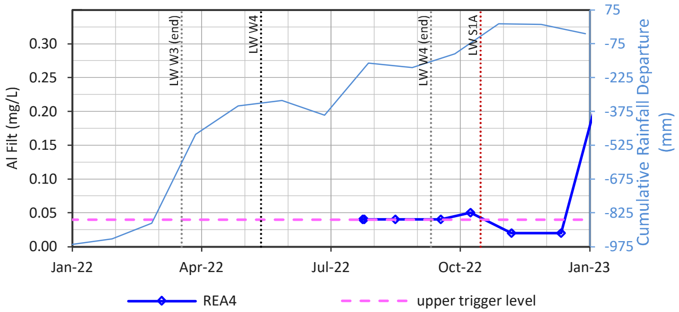

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55B
upper trigger level

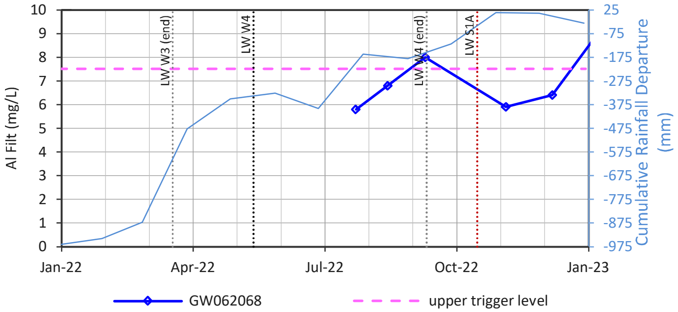

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55C
upper trigger level

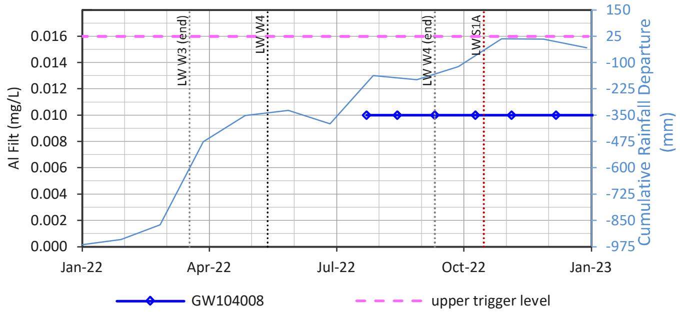

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56A
upper trigger level

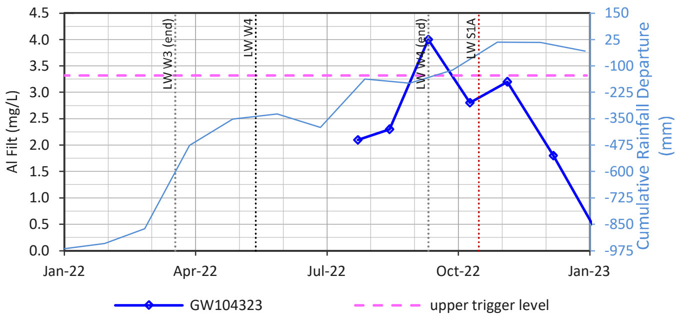

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56B
upper trigger level

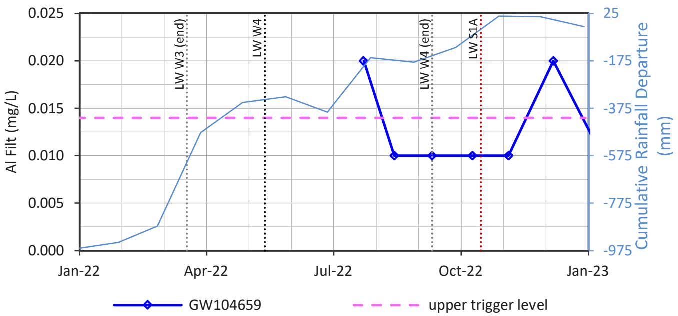

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56C
upper trigger level

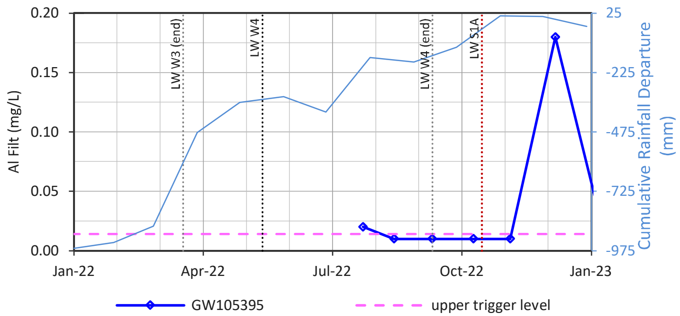

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
REA4
upper trigger level

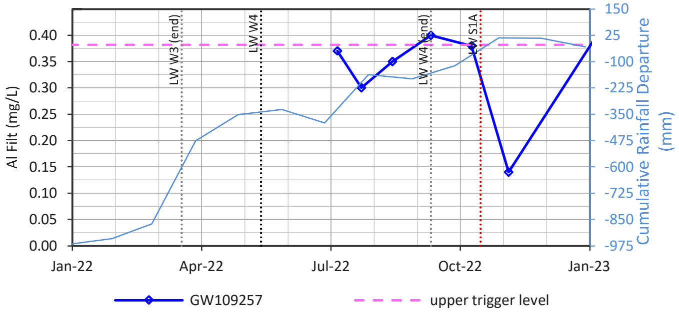

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW062068
upper trigger level

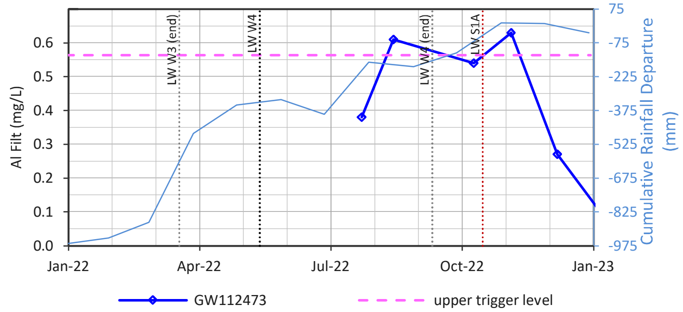

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104008
upper trigger level


Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104323
upper trigger level

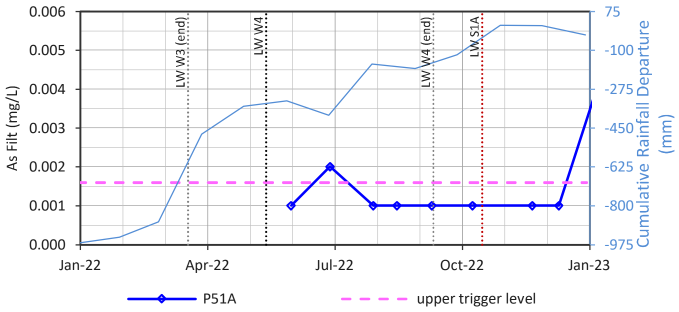

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104659
upper trigger level

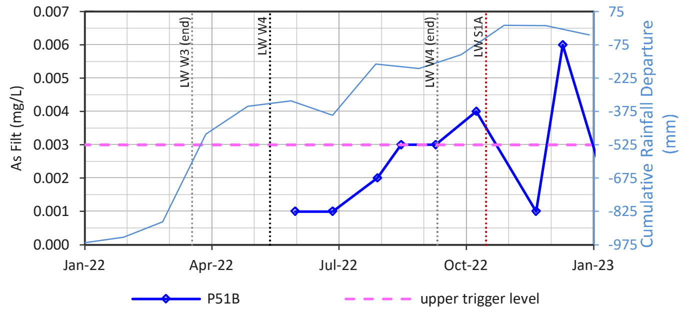

Al Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105395
upper trigger level

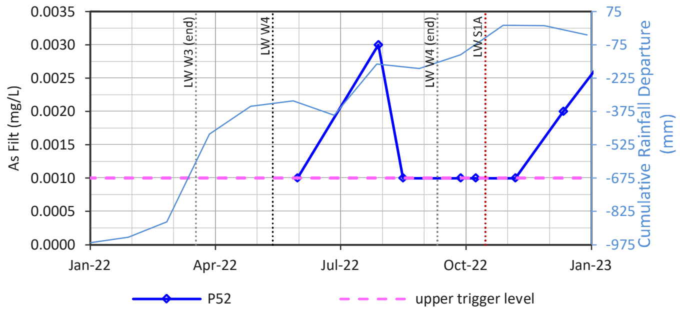


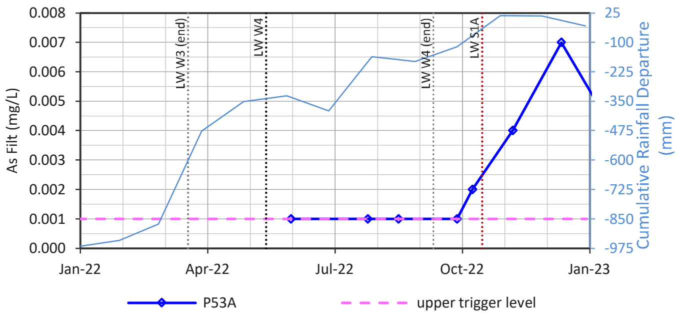


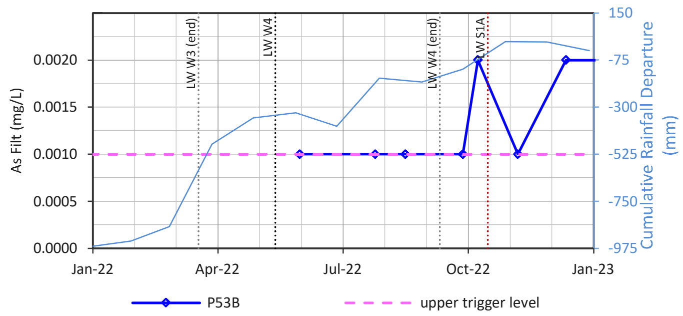
No Data Available for Al Filt (mg/L)

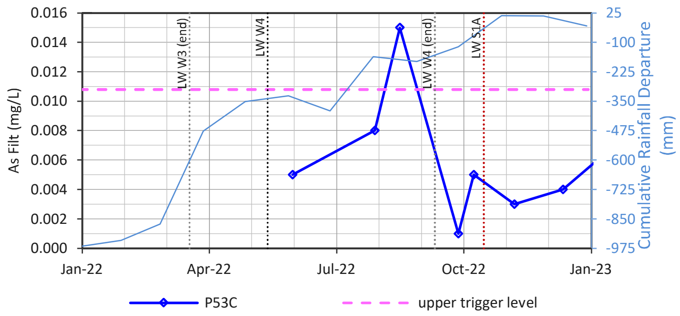


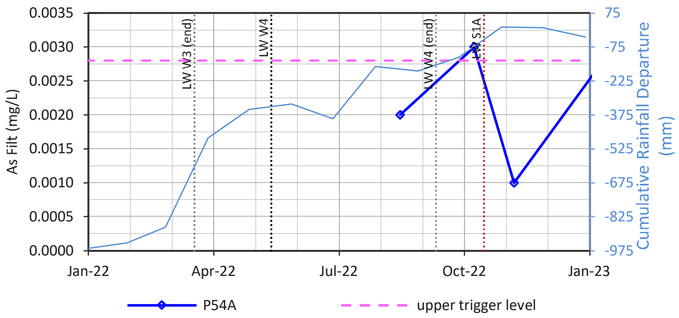


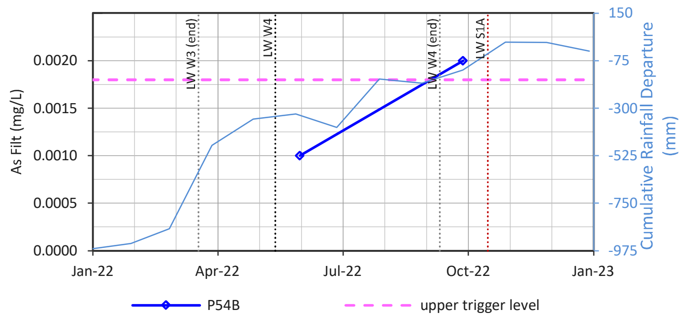


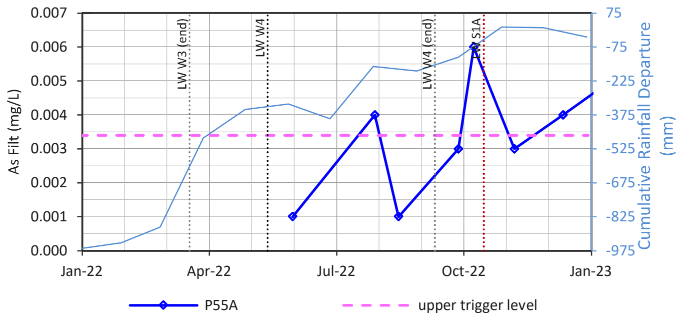


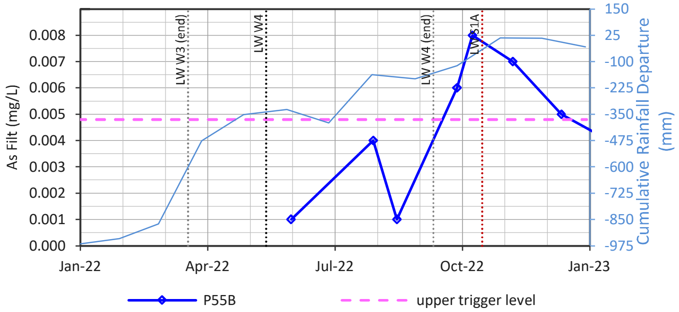


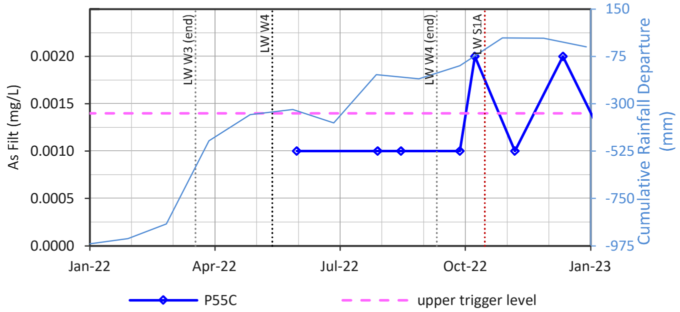


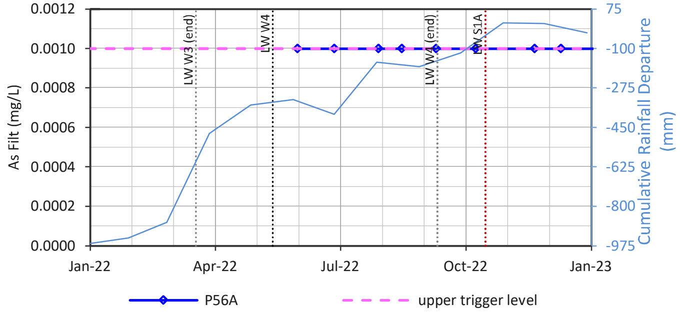


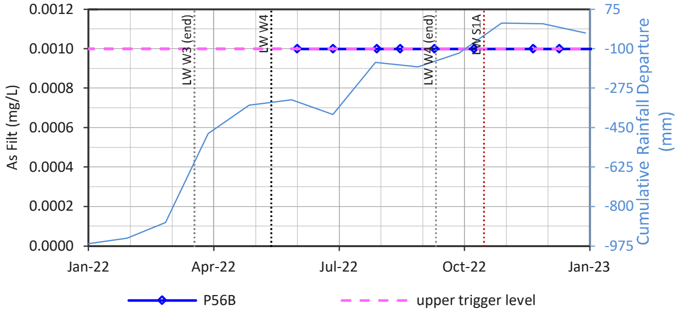


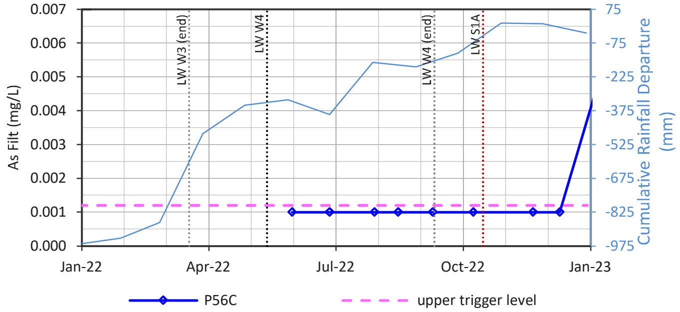


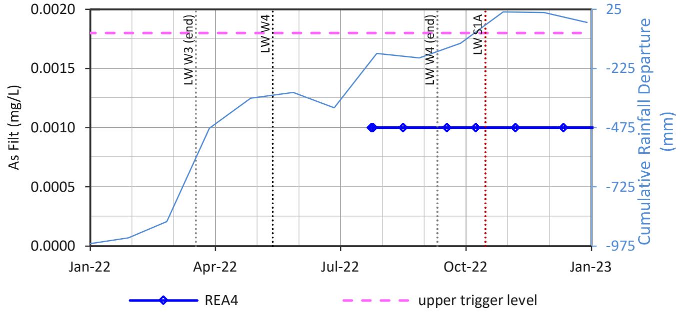

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55B
upper trigger level

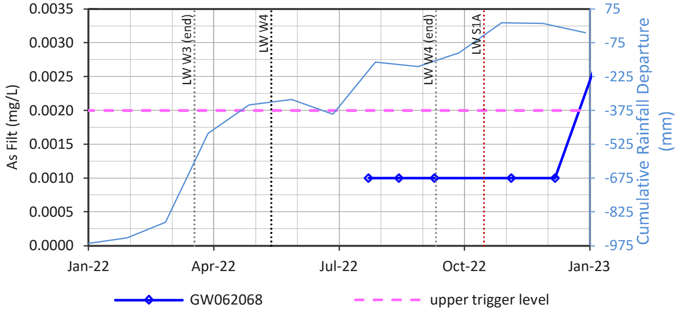

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55C
upper trigger level

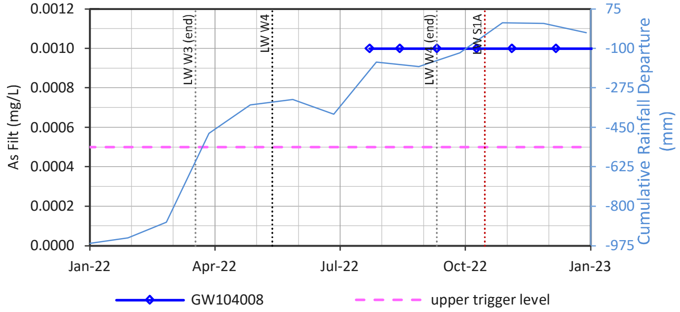

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56A
upper trigger level

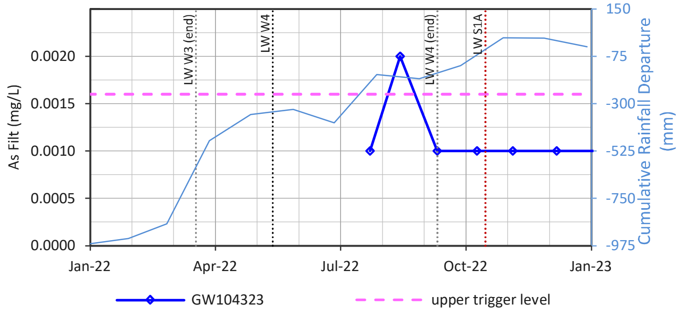

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56B
upper trigger level

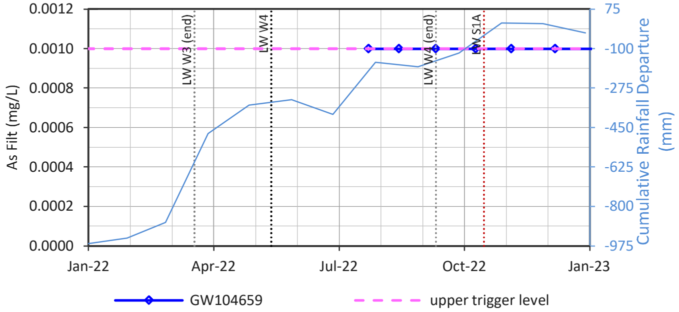

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56C
upper trigger level

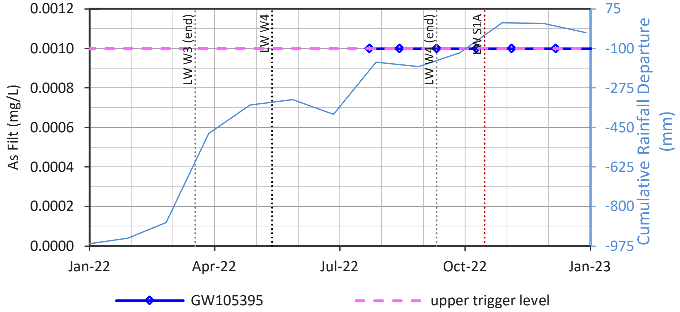

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
REA4
upper trigger level

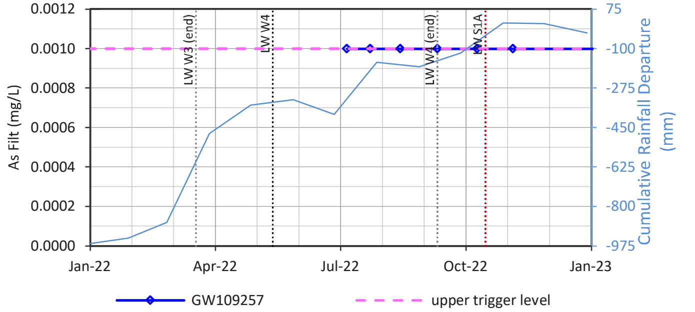

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW062068
upper trigger level

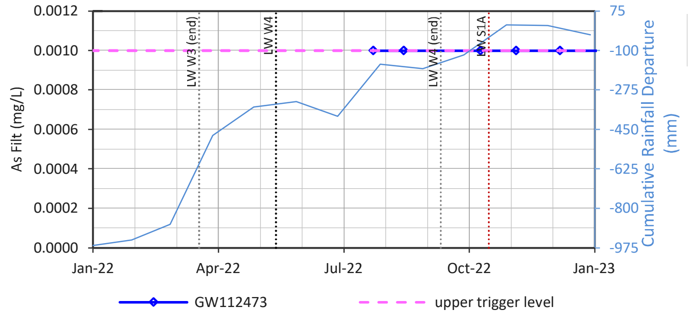

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104008
upper trigger level


As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104323
upper trigger level

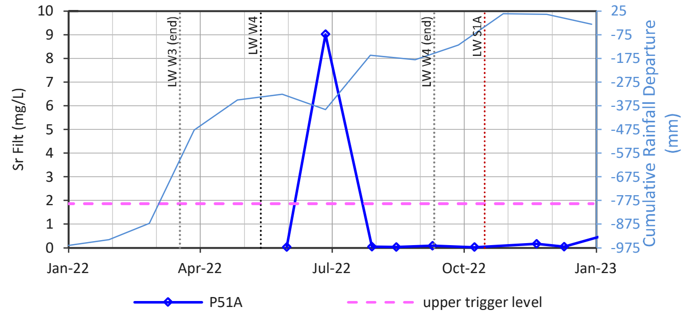

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104659
upper trigger level

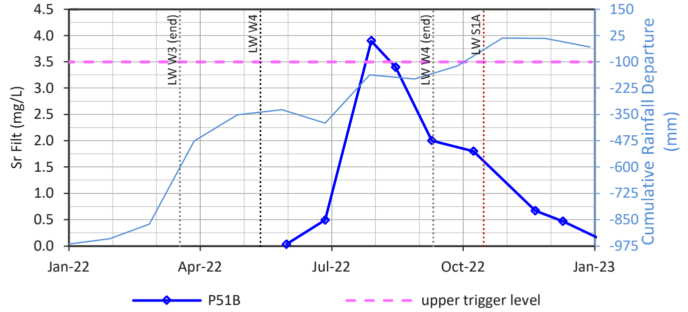

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105395
upper trigger level

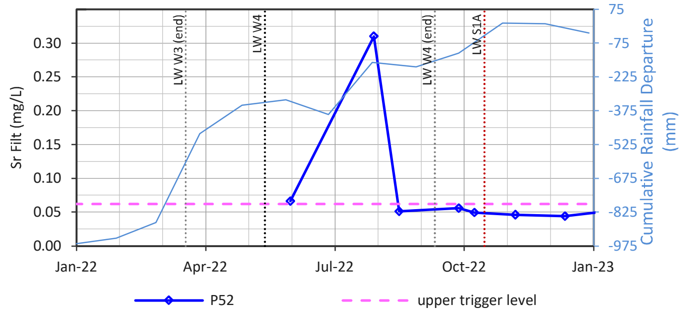

As Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW109257
upper trigger level

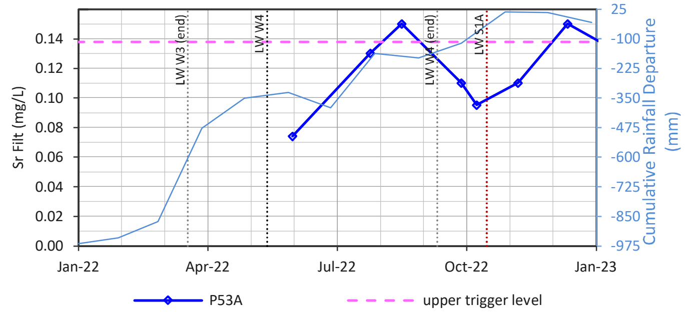


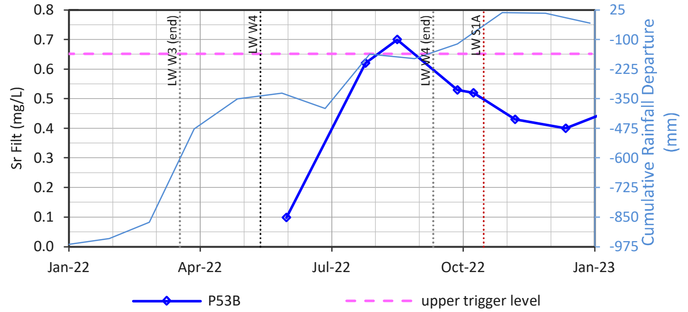
No Data Available for As Filt (mg/L)

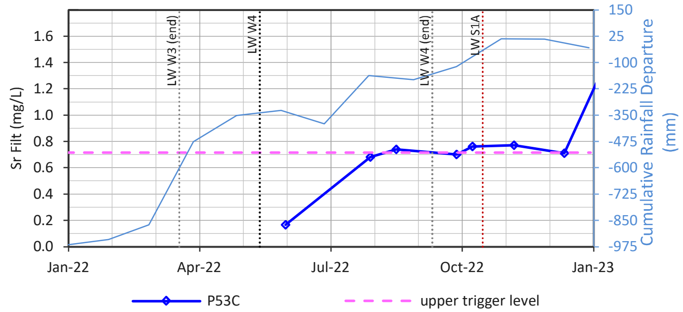


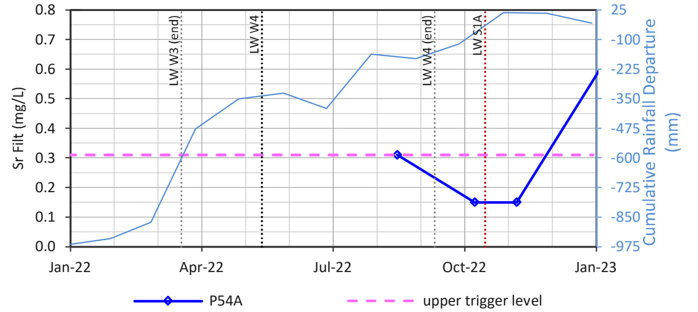


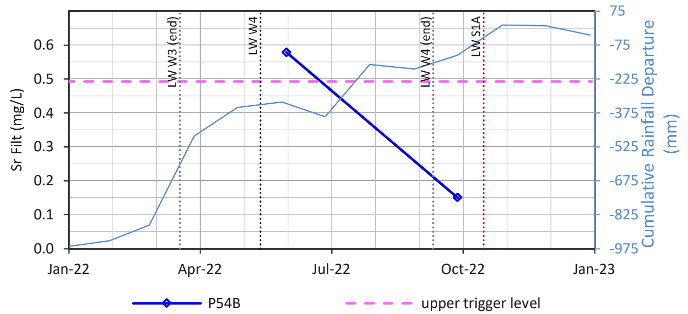


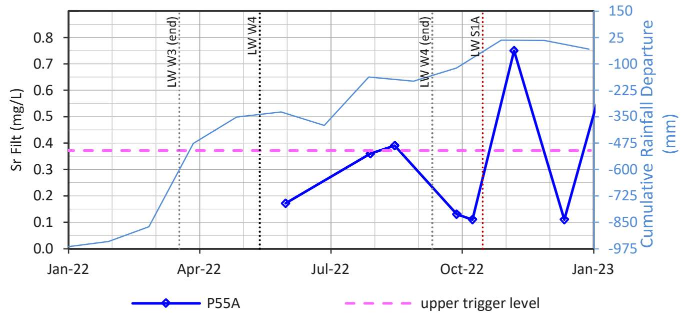


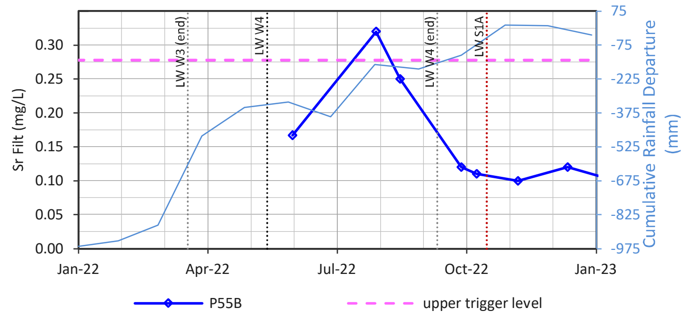


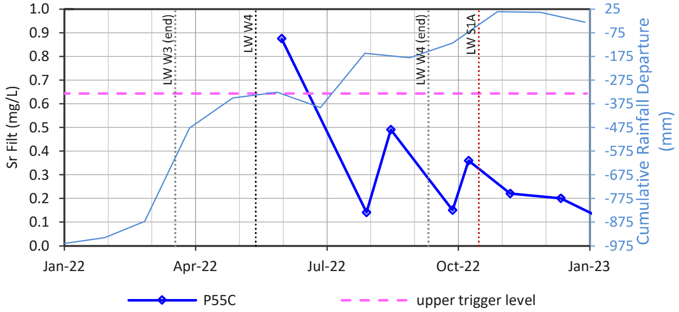


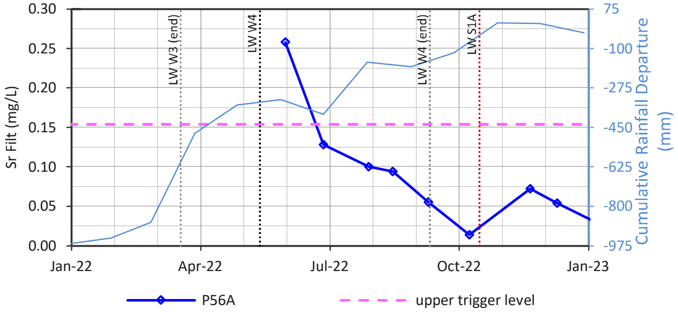


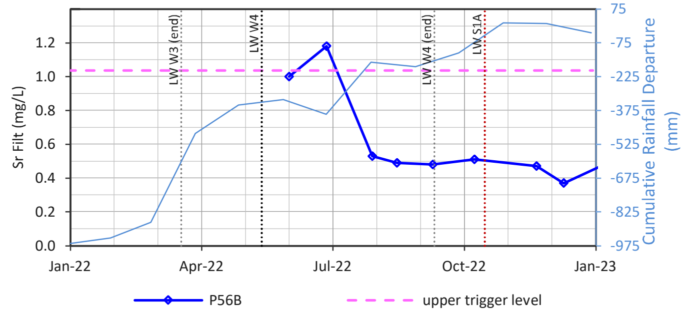


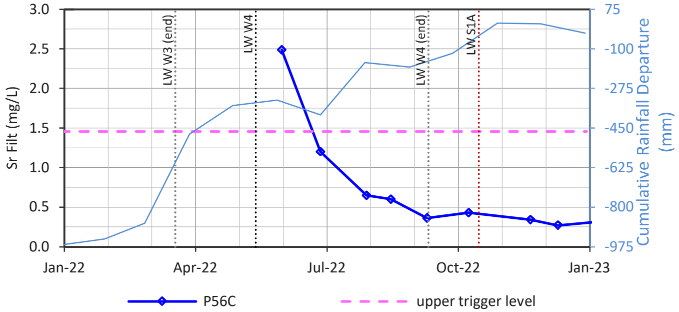


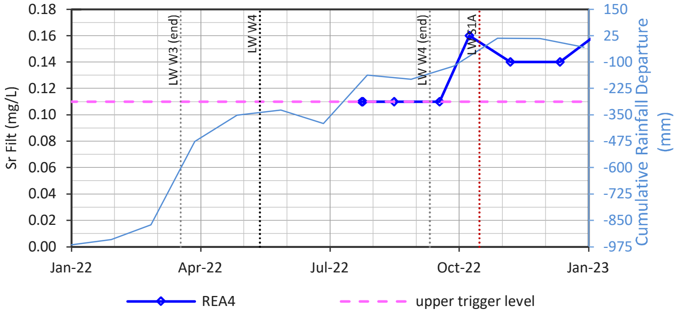


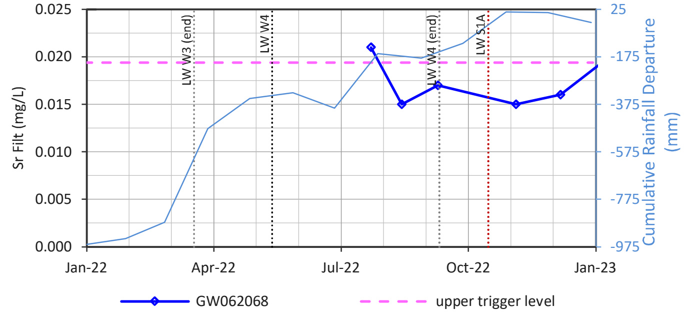

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55C
upper trigger level

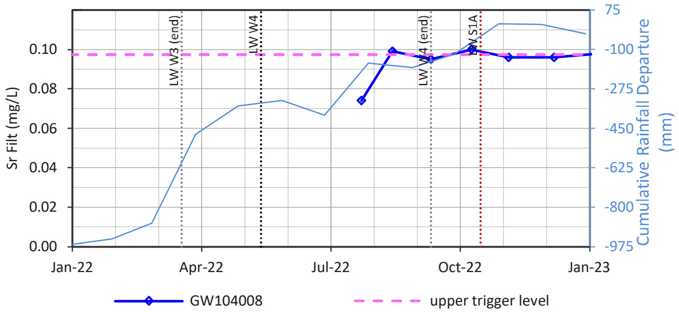

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56A
upper trigger level

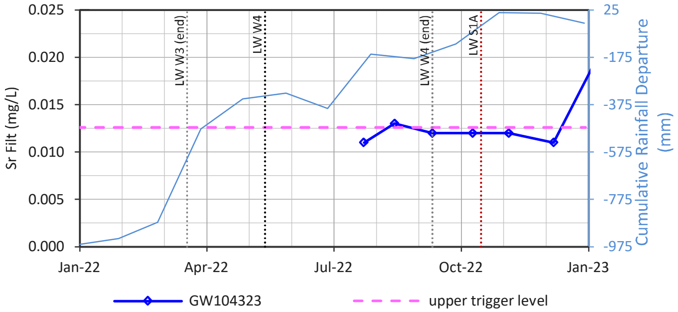

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56B
upper trigger level

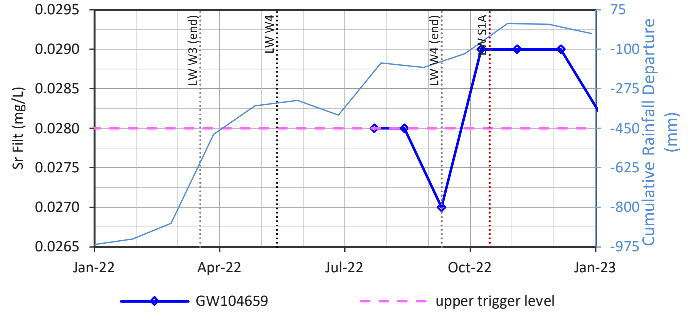

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P56C
upper trigger level

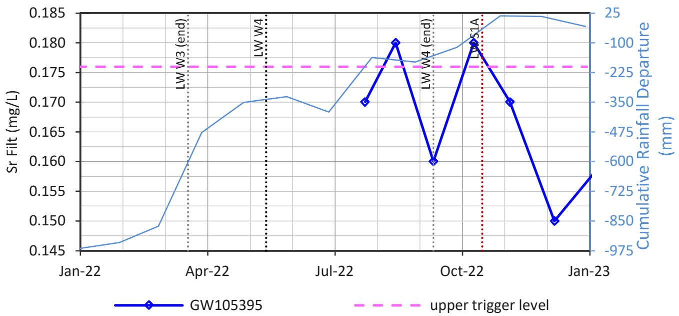

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
REA4
upper trigger level

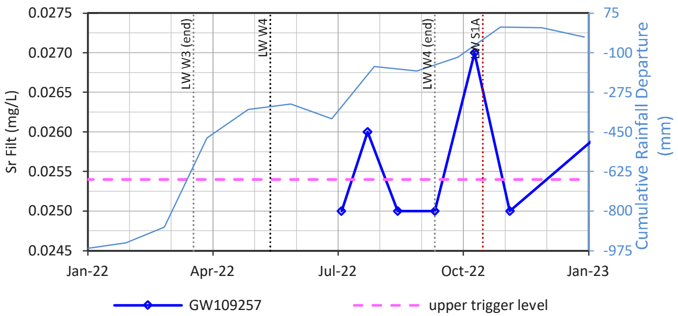

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW062068
upper trigger level

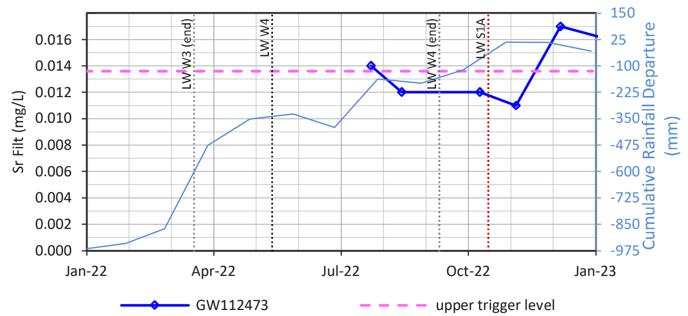

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104008
upper trigger level


Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104323
upper trigger level

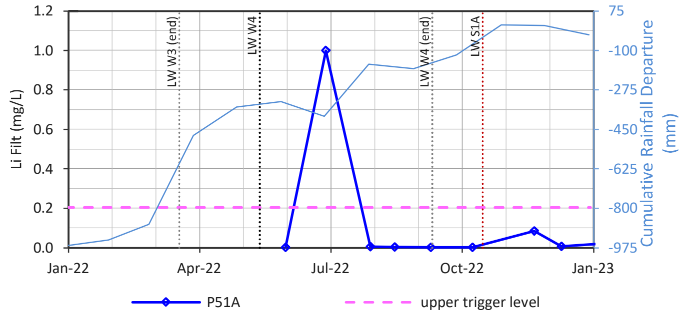

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW104659
upper trigger level

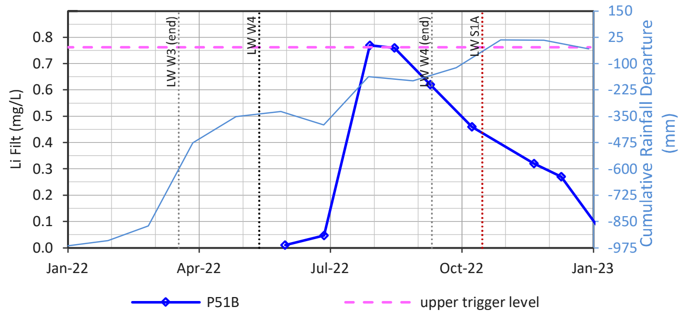

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW105395
upper trigger level

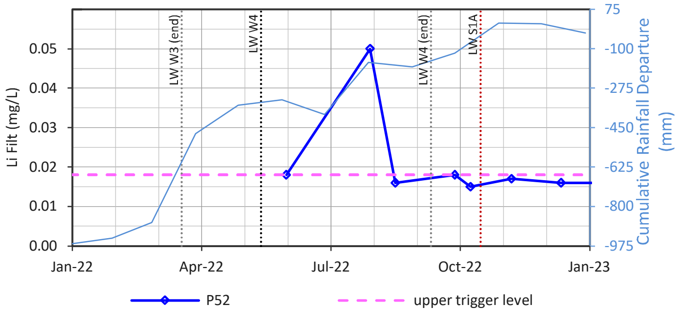

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW109257
upper trigger level

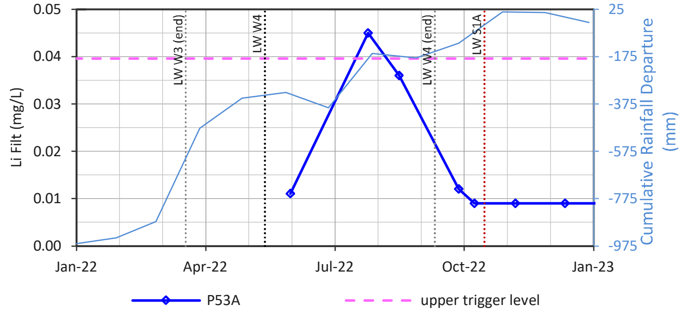

Sr Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW112473
upper trigger level

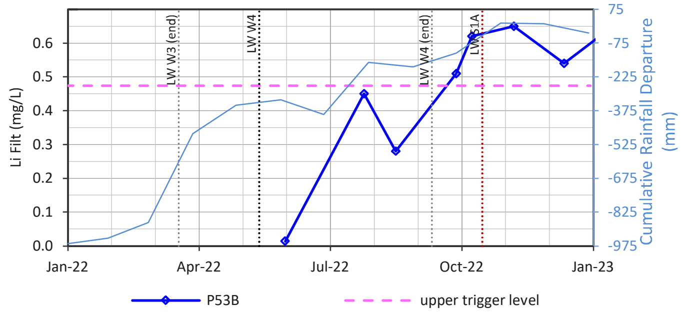
No Data Available for Sr Filt (mg/L)

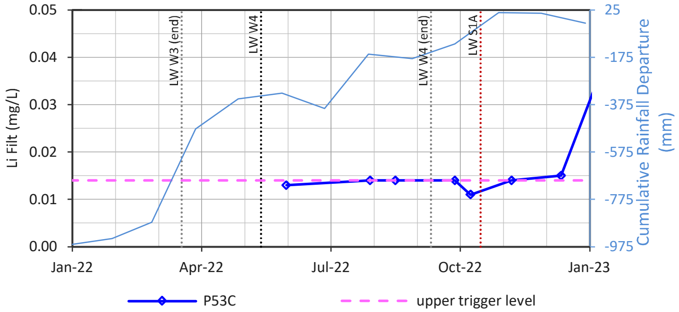


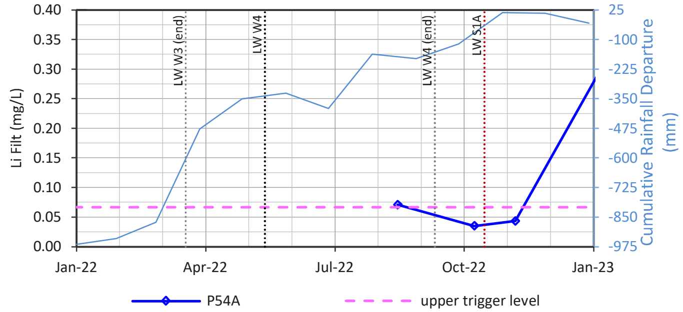


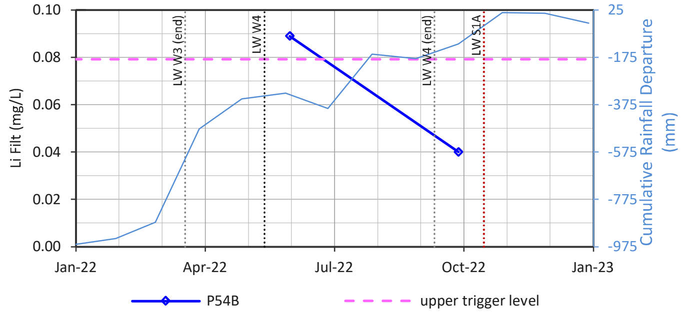


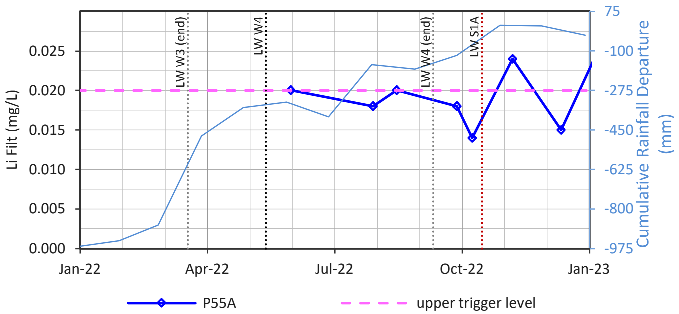


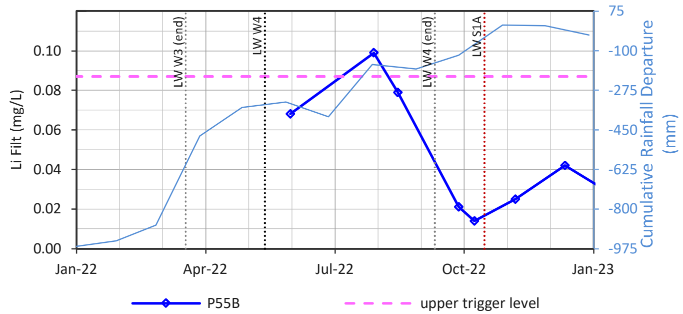


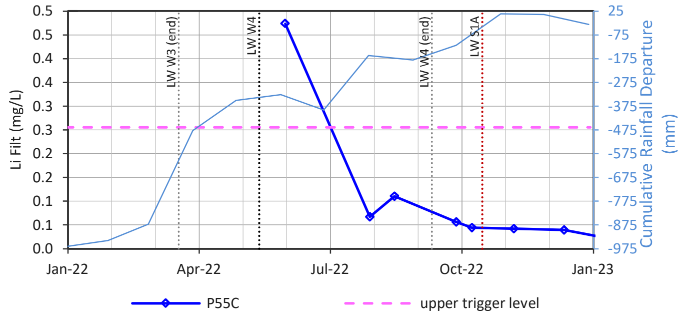


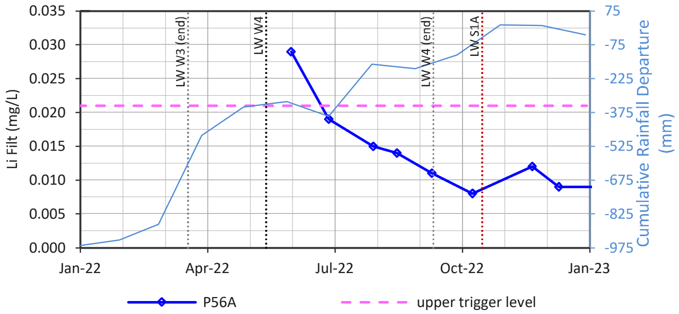


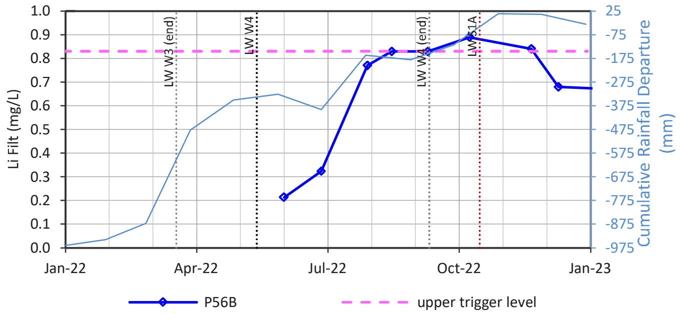


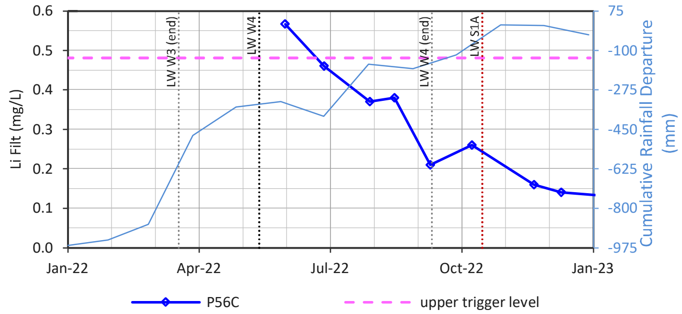


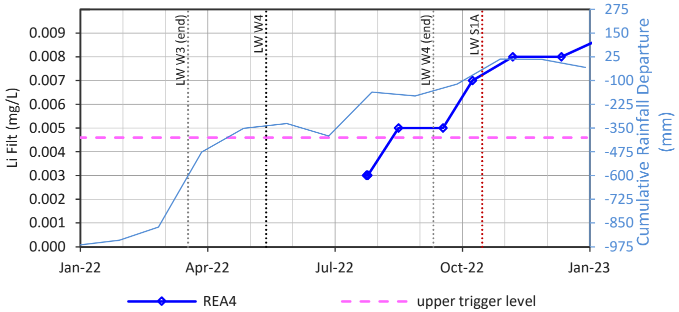


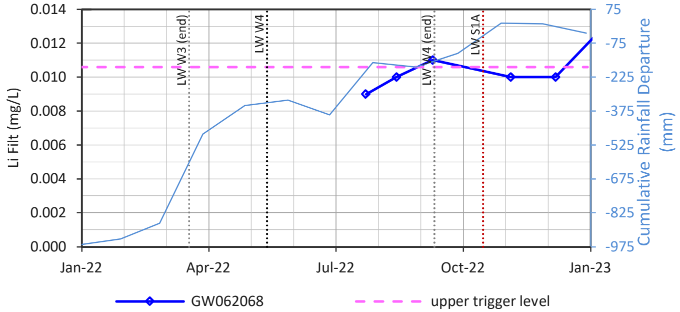


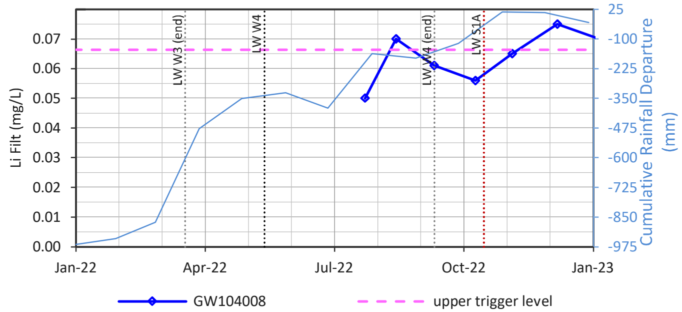


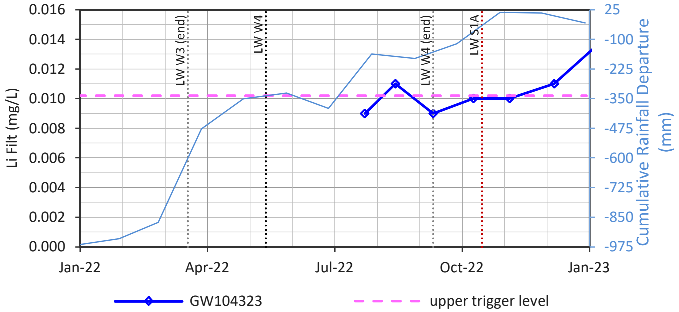


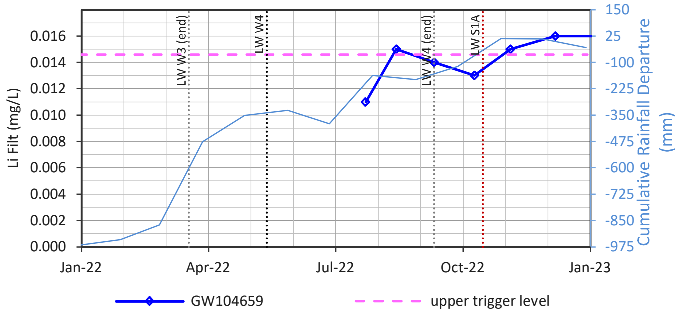


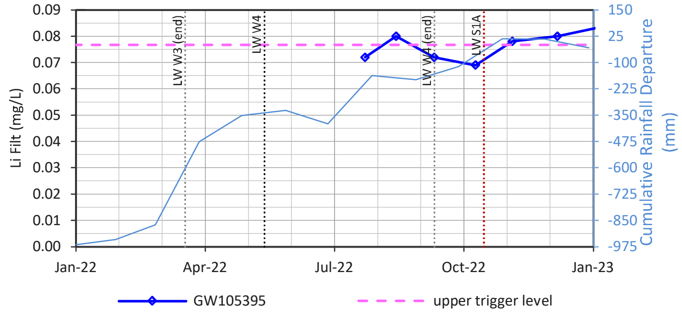


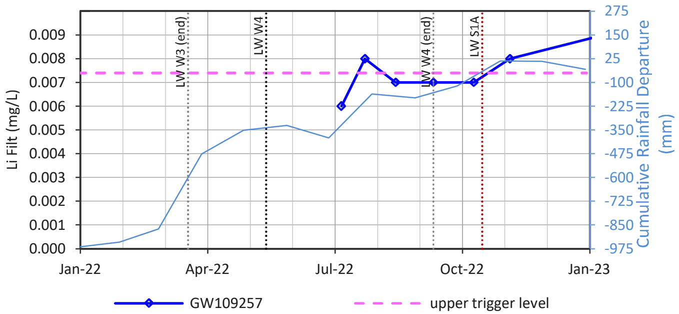


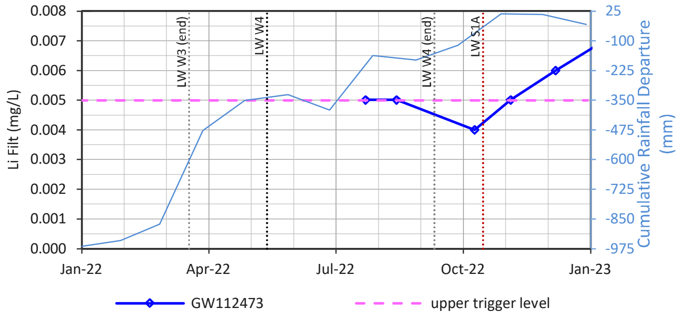




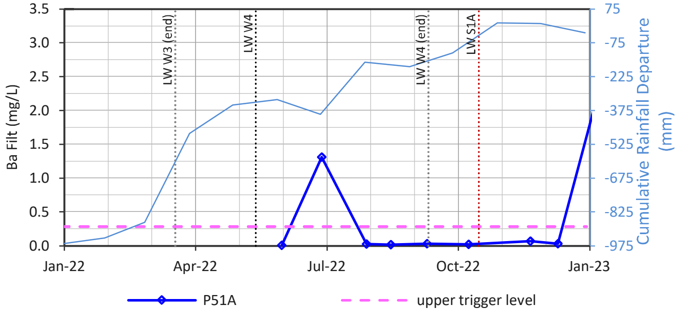


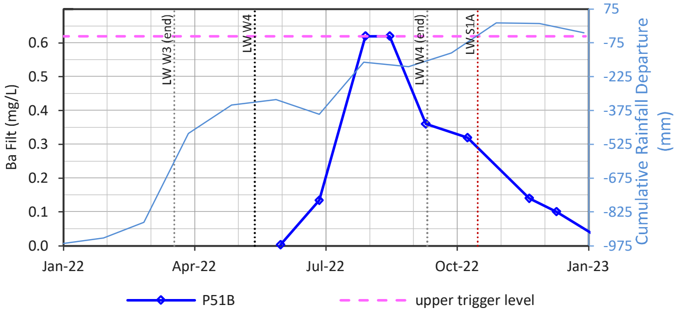


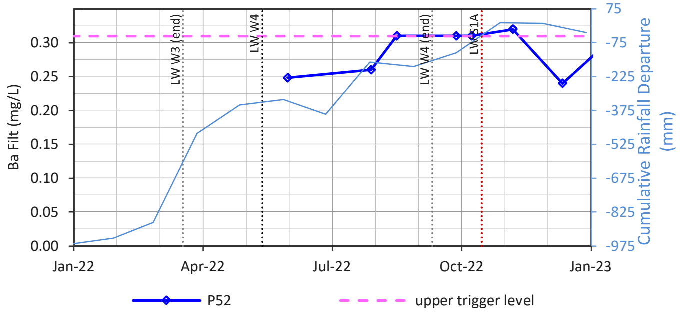


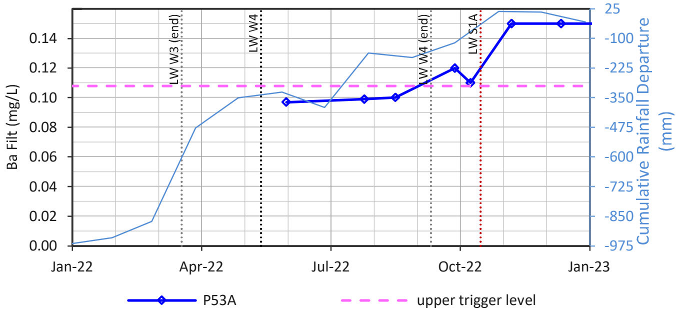


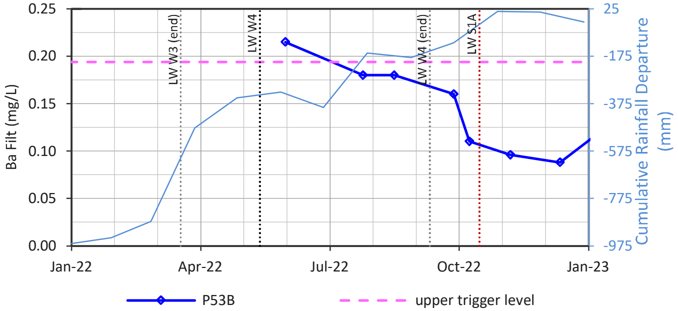
No Data Available for Li Filt (mg/L)

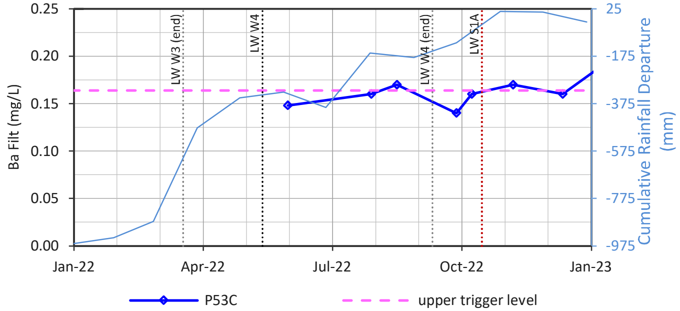

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51A
upper trigger level

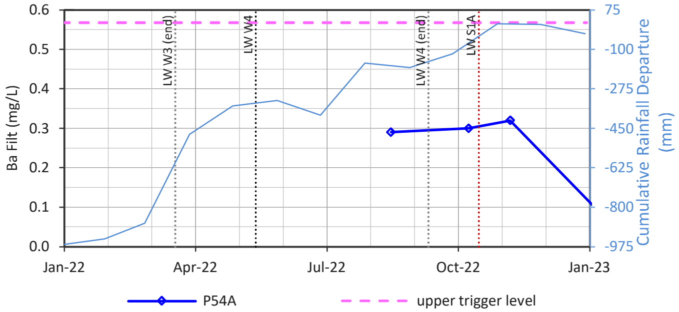

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51B
upper trigger level

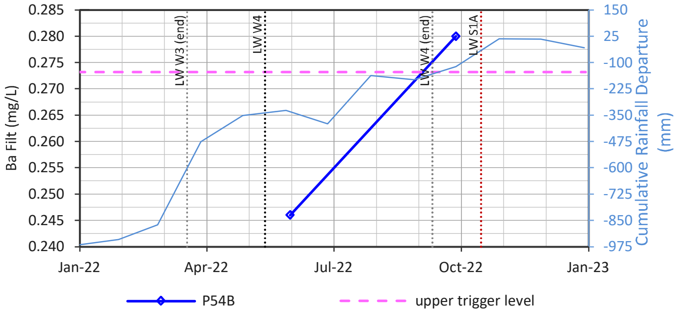

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level

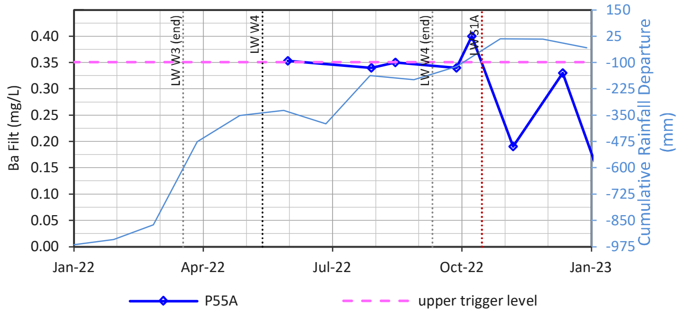

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level

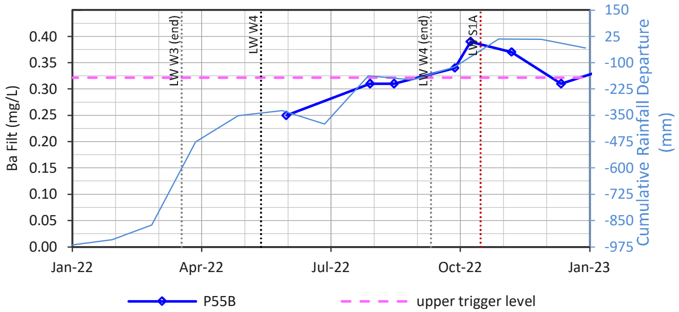

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level

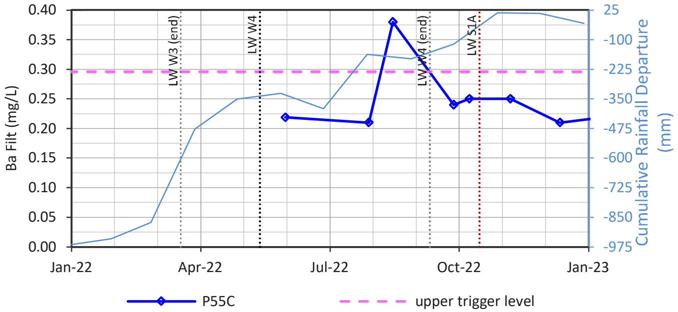

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level

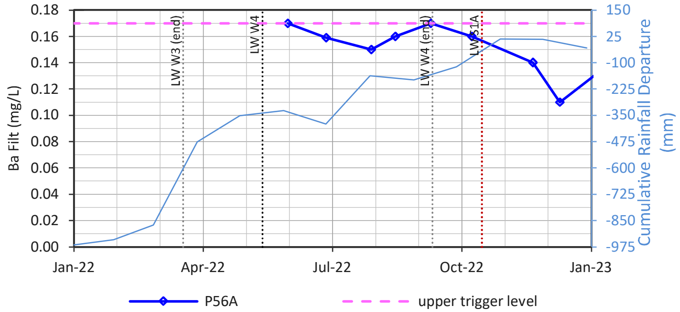

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level

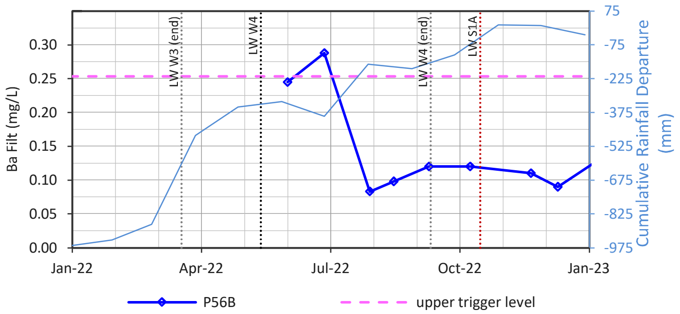

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level

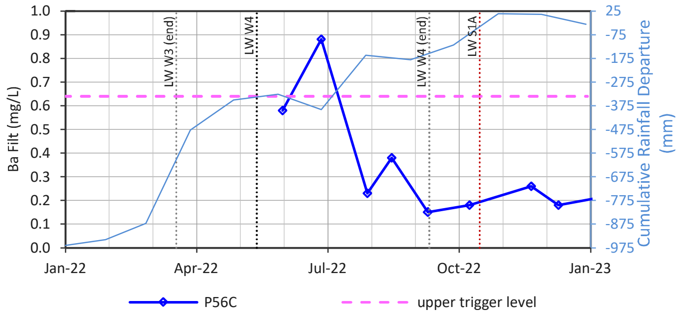

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level

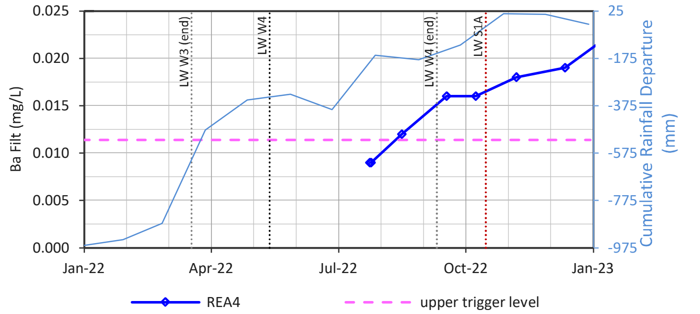

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level

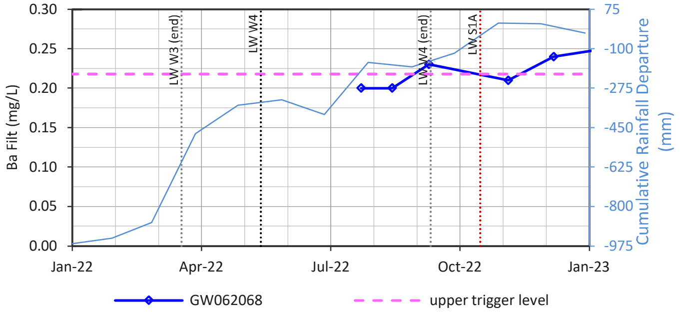

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

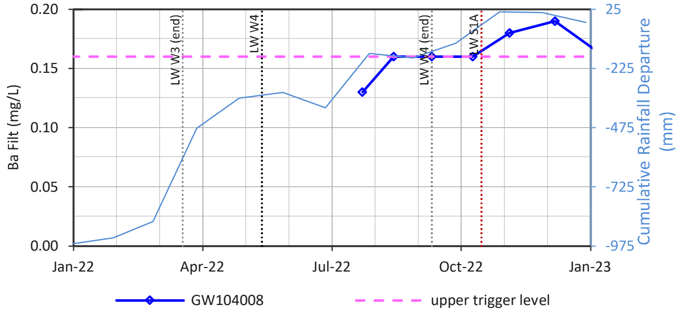

Ba Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

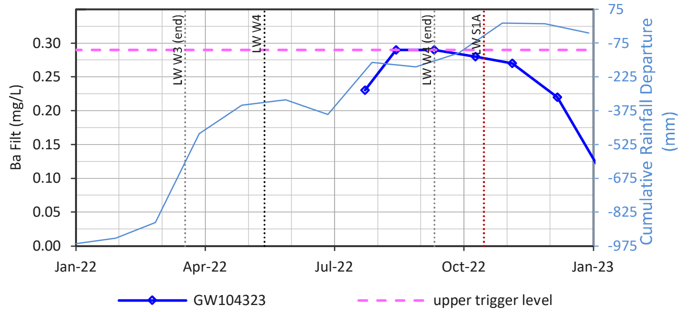


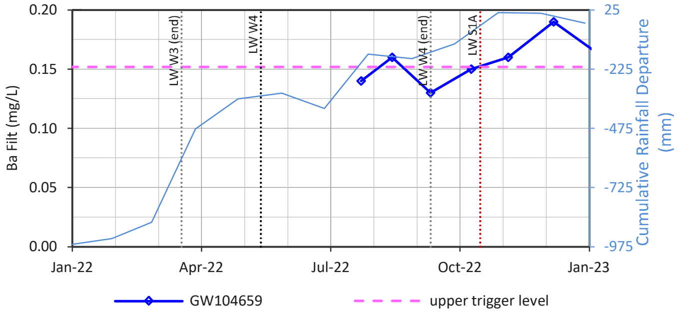


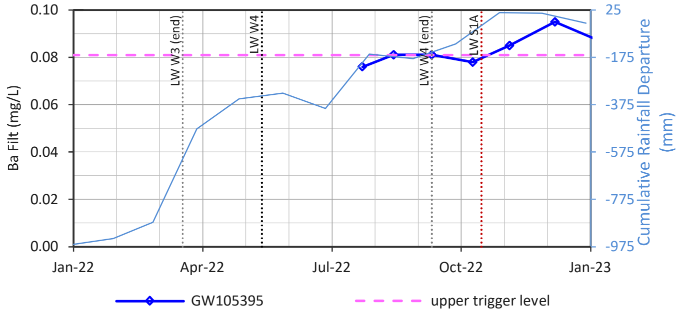


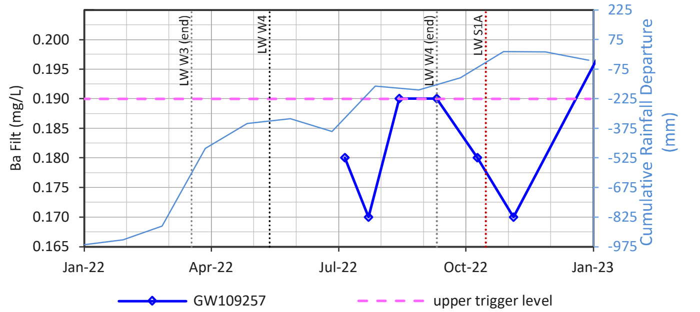


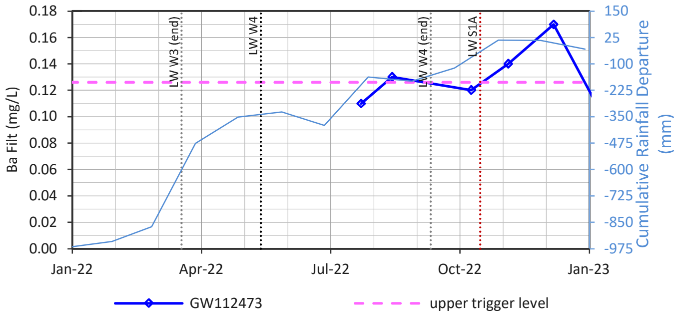












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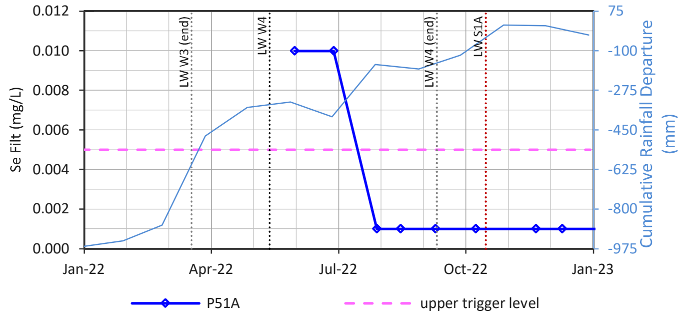
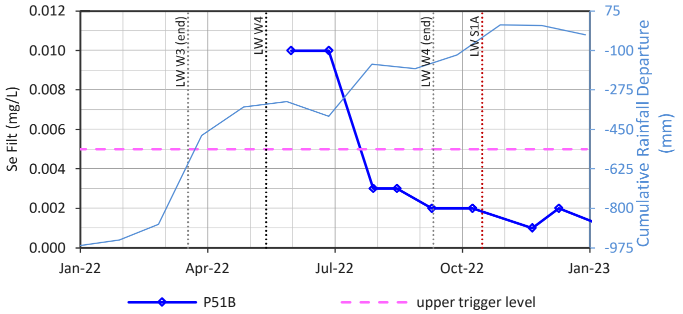
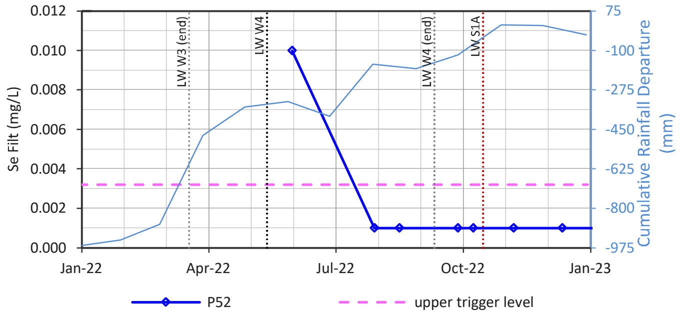
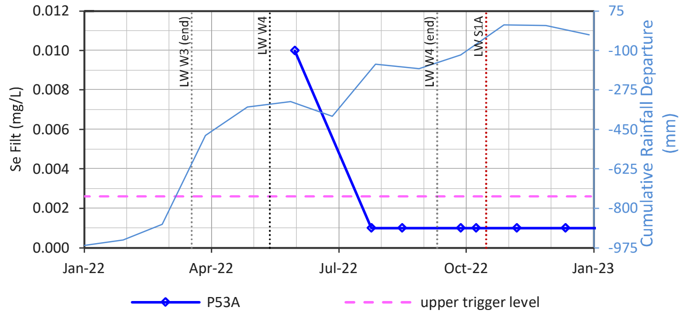




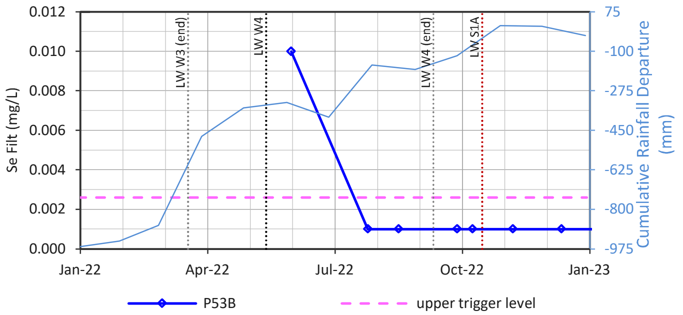
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P51B
upper trigger level



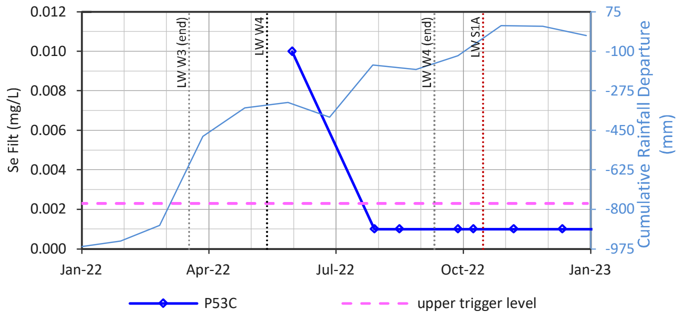
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P52
upper trigger level



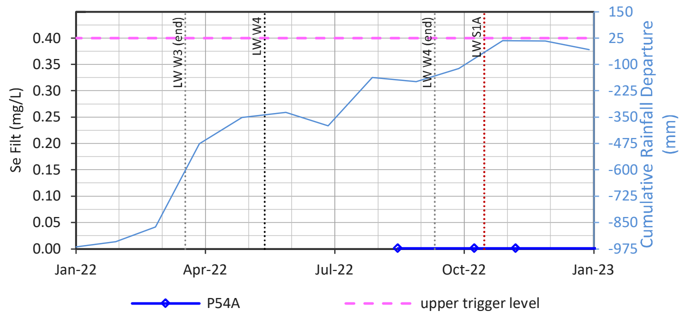
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53A
upper trigger level



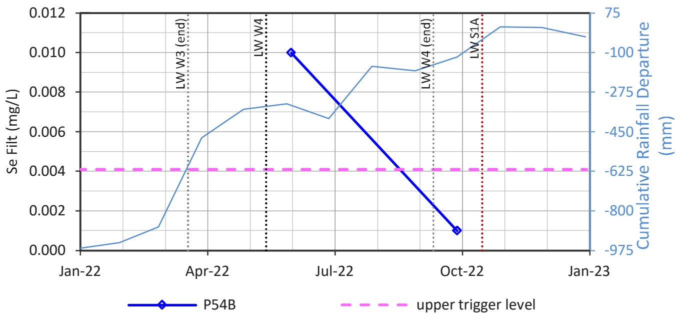
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53B
upper trigger level



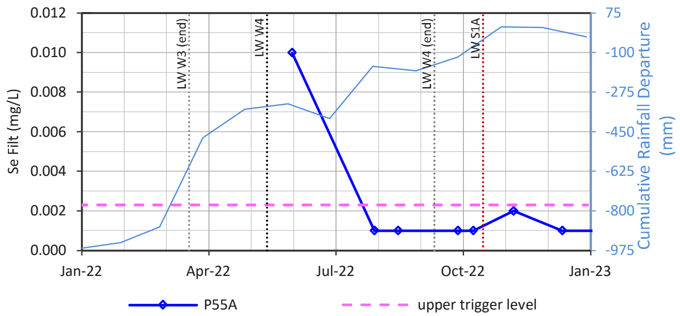
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P53C
upper trigger level



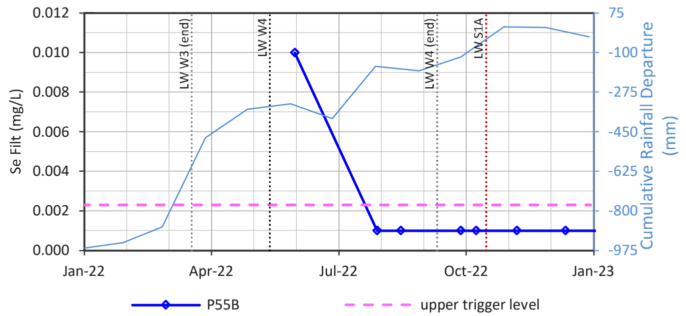
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54A
upper trigger level



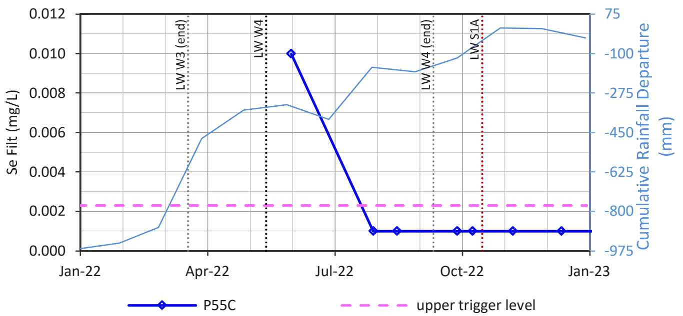
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P54B
upper trigger level



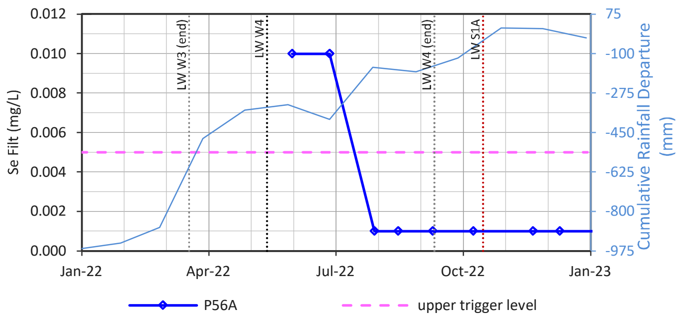
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55A
upper trigger level



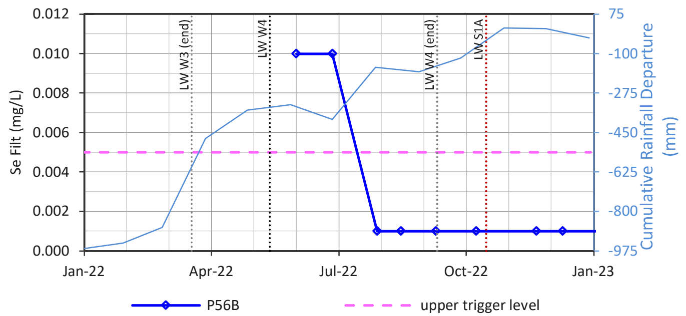
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55B
upper trigger level



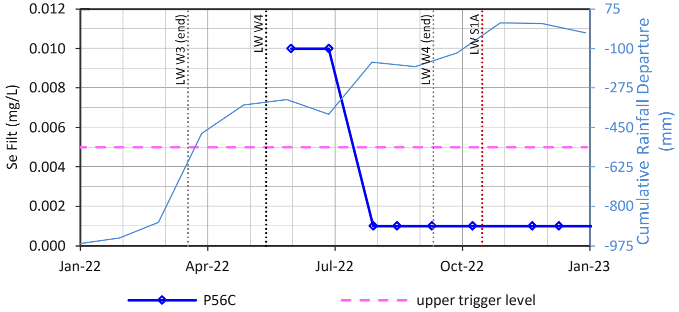
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P55C
upper trigger level

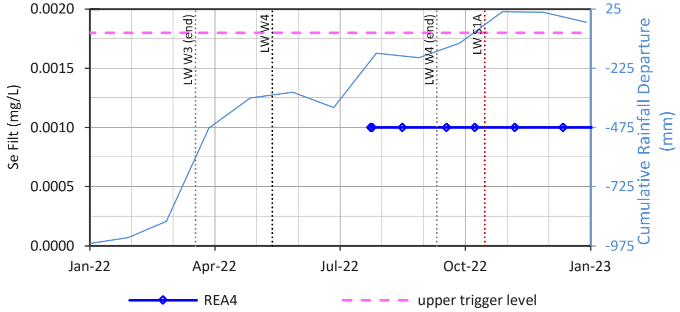


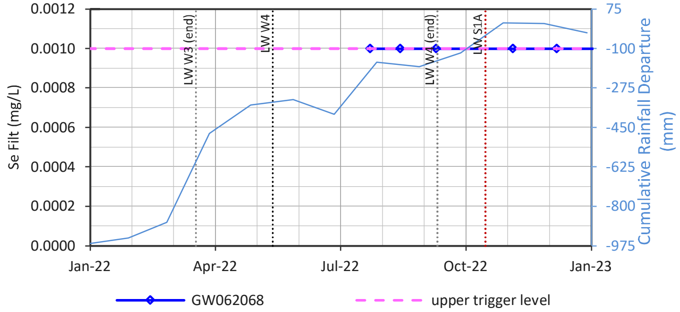
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56A
upper trigger level

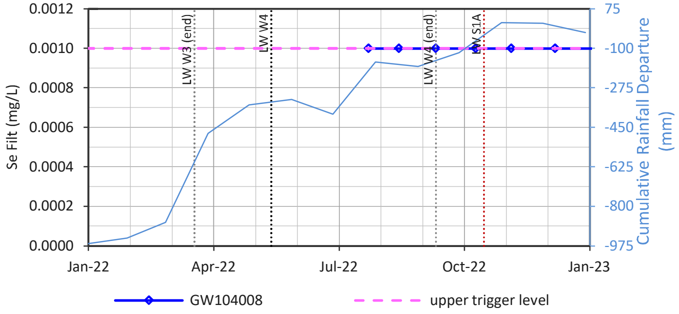


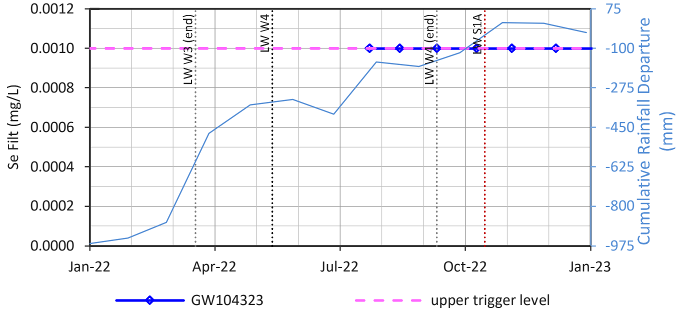
Se Filt (mg/L)
Cumulative Rainfall Departure (mm)
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
P56B
upper trigger level

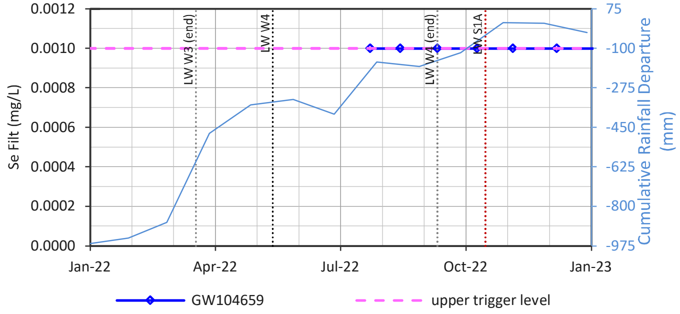


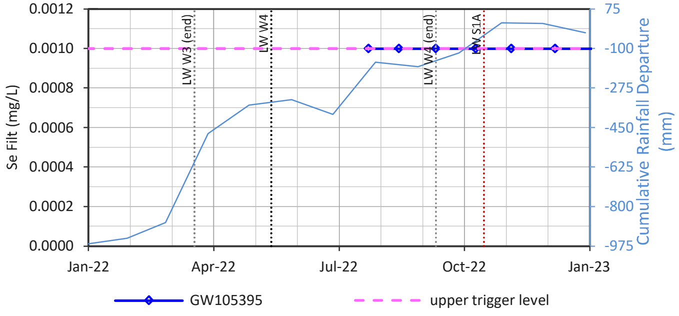


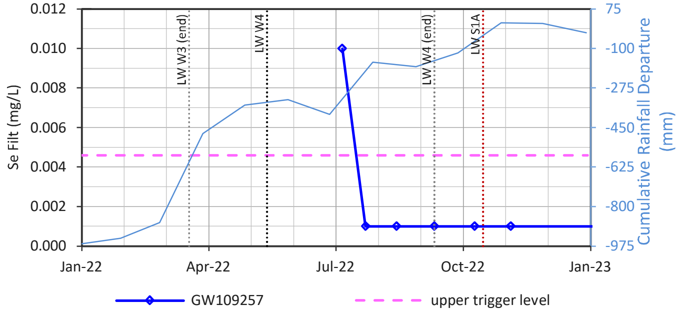


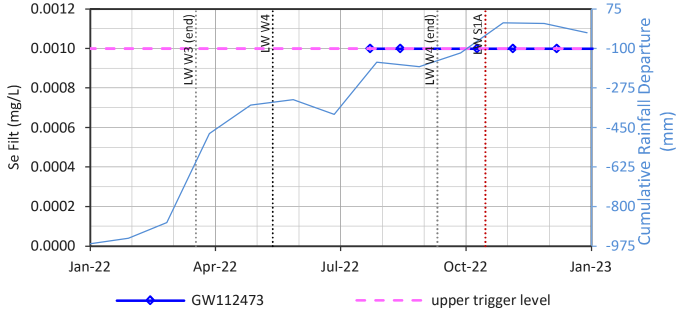












No Data Available for Se Filt (mg/L)

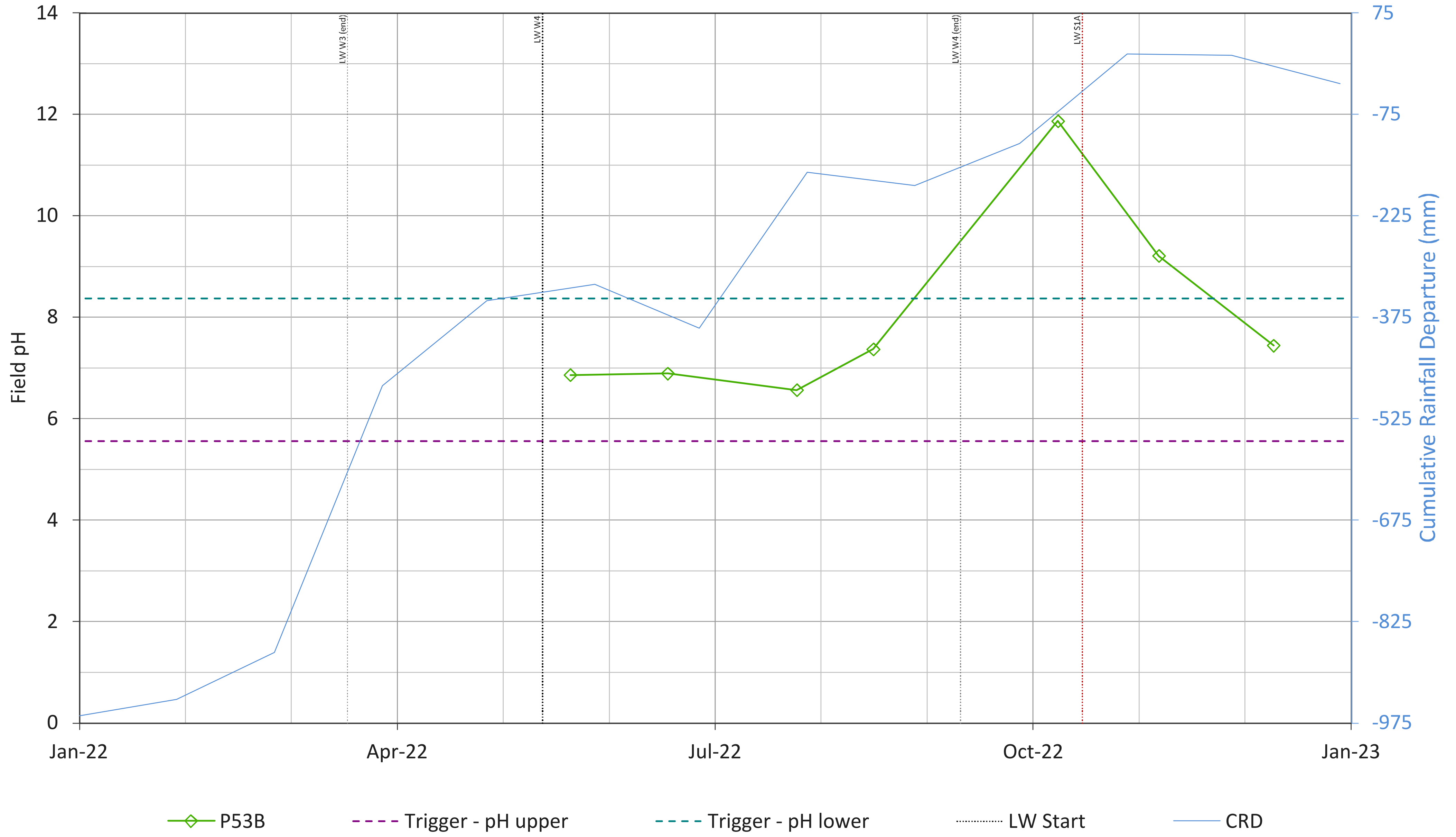

14
12
10
8
6
4
2
0
Field pH
75
-75
-225
-375
-525
-675
-825
-975
Cumulative Rainfall Departure (mm)
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53B
Trigger - pH upper
Trigger - pH lower
LW Start
CRD

Figure D-1

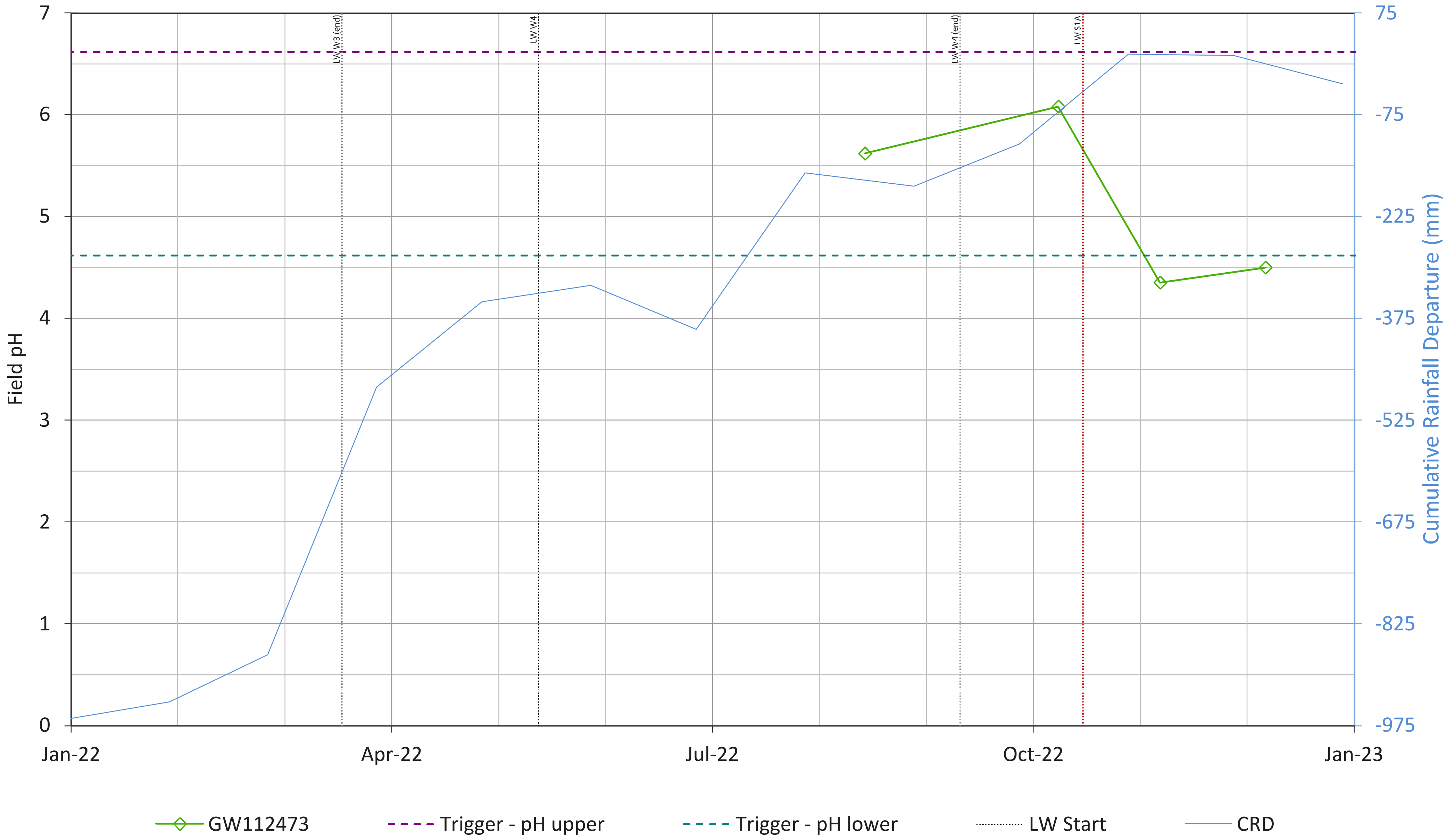
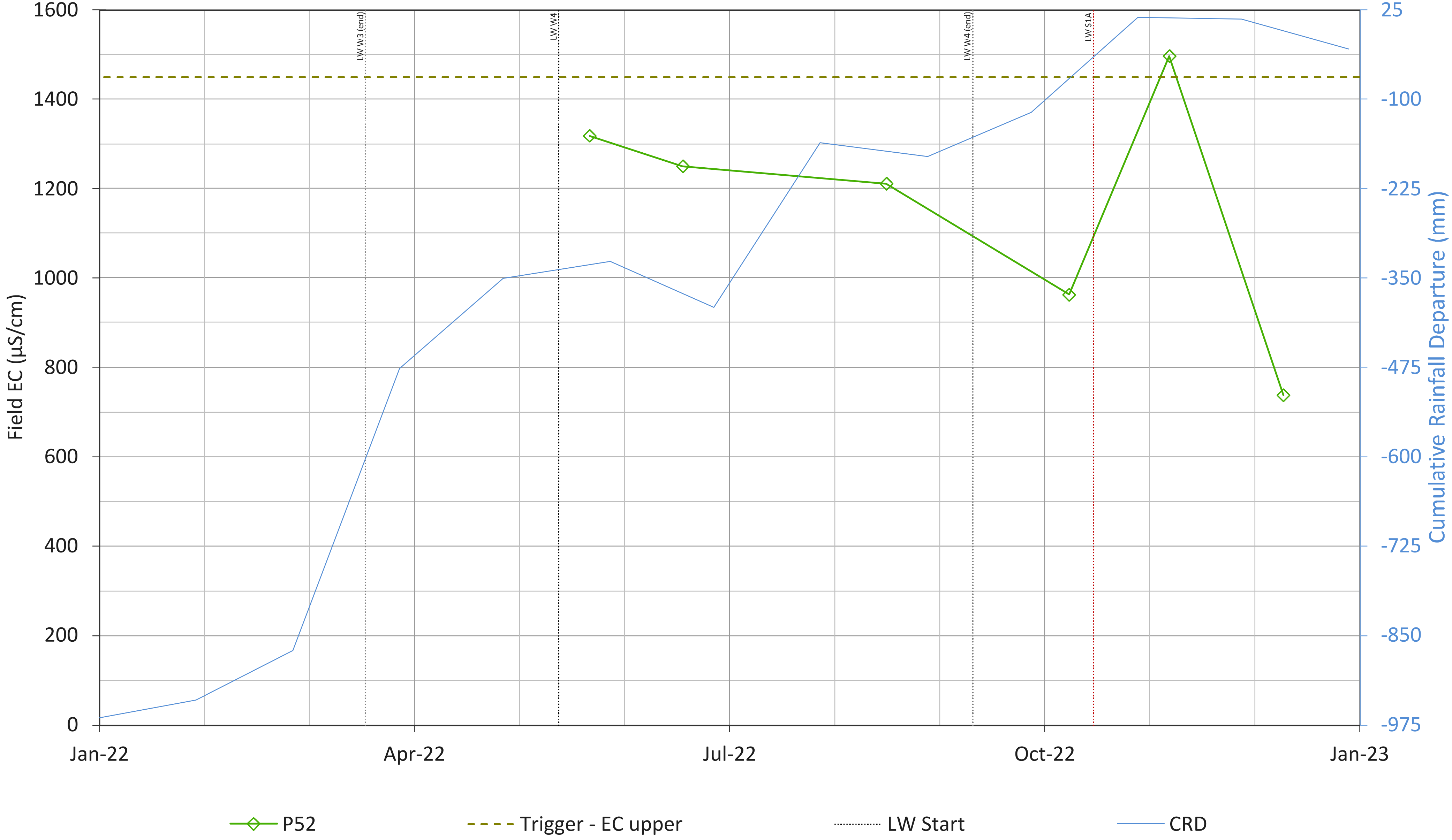

7
6
5
4
3
2
1
0
Field pH
75
-75
-225
-375
-525
-675
-825
-975
Cumulative Rainfall Departure (mm)
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW112473
Trigger - pH upper
Trigger - pH lower
LW Start
CRD

Figure D-2



1600
1400
1200
1000
800
600
400
200
0
Field EC (µS/cm)
25
-100
-225
-350
-475
-600
-725
-850
-975
Cumulative Rainfall Departure (mm)
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P52
Trigger - EC upper
LW Start
CRD

Figure D-3

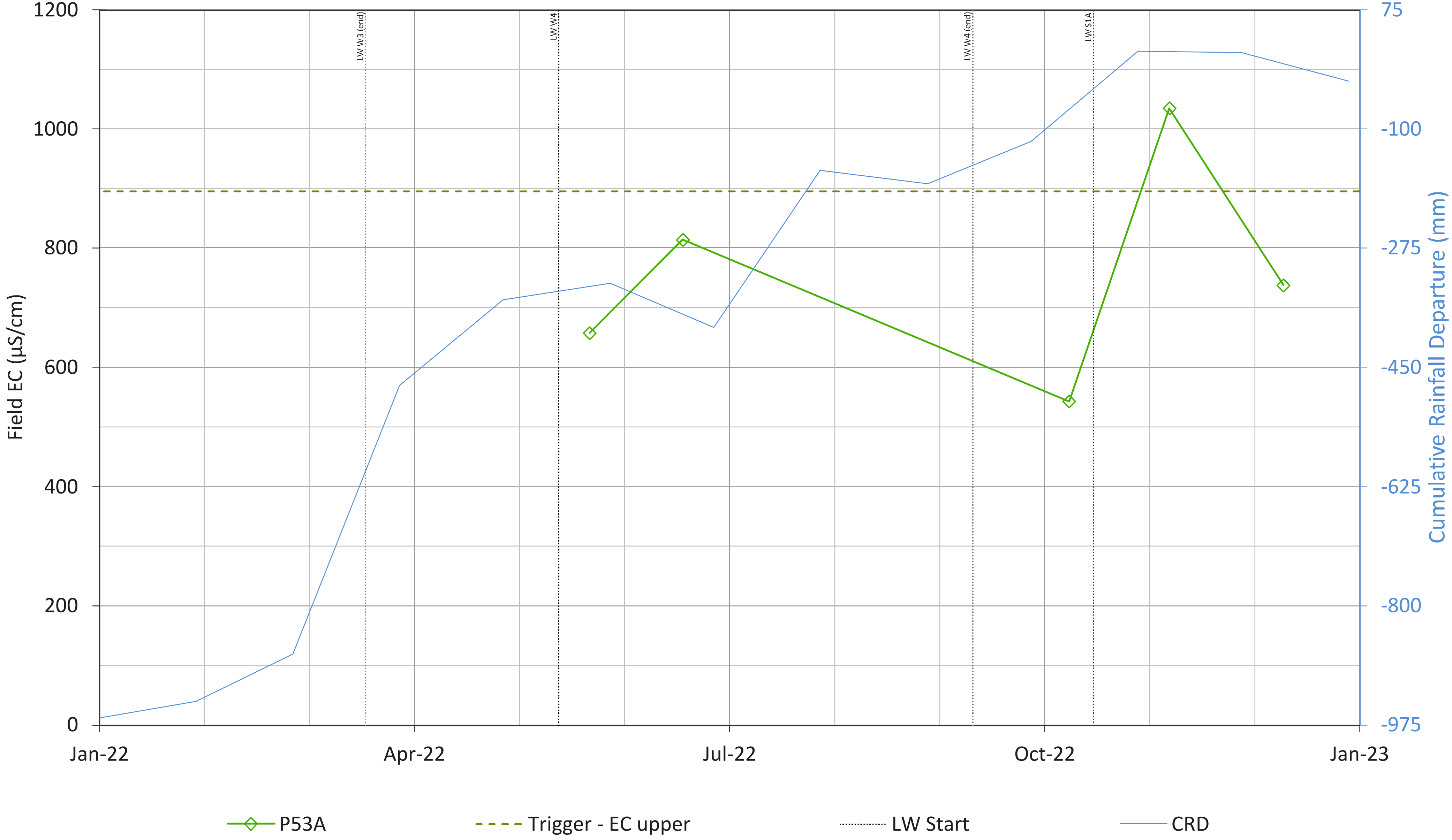

1200
1000
800
600
400
200
0
75
-100
-275
-450
-625
-800
-975
Field EC (µS/cm)
Cumulative Rainfall Departure (mm)
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P53A
Trigger - EC upper
LW Start
CRD

Figure D-4

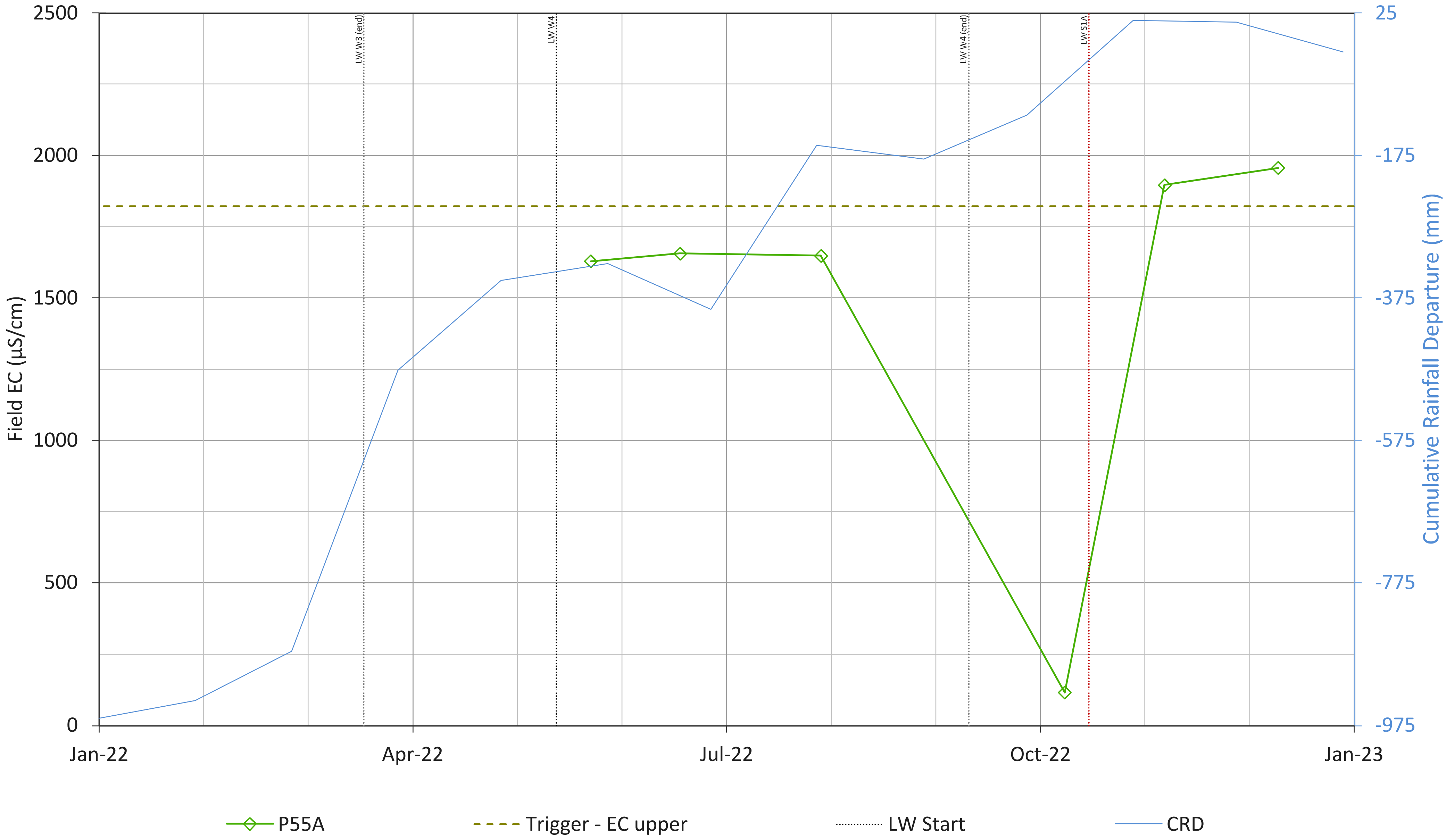

2500
2000
1500
1000
500
0
Field EC (µS/cm)
25
-175
-375
-575
-775
-975
Cumulative Rainfall Departure (mm)
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
P55A
Trigger - EC upper
LW Start
CRD

Figure D-5

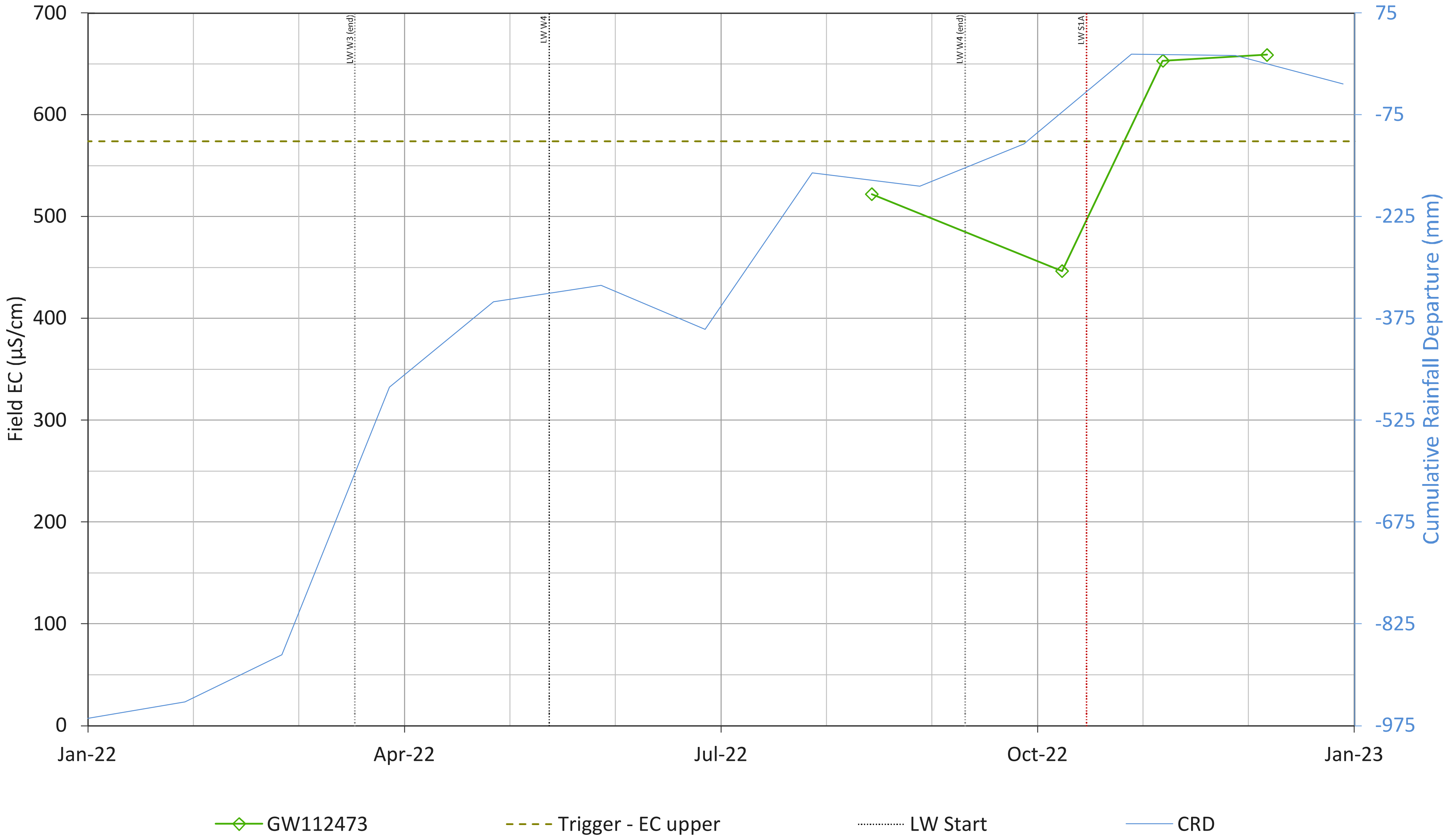

700
600
500
400
300
200
100
0
Field EC (µS/cm)
75
-75
-225
-375
-525
-675
-825
-975
Cumulative Rainfall Departure (mm)
Jan-22
Apr-22
Jul-22
Oct-22
Jan-23
LW W3 (end)
LW W4
LW W4 (end)
LW S1A
GW112473
Trigger - EC upper
LW Start
CRD

Figure D-6

Appendix E:

Groundwater TARPs (original as per current Water Management Plan)

WATER MANAGEMENT PLAN TARP – WMP8 SHALLOW GROUNDWATER LEVEL (OPEN STANDPIPES AND PRIVATE BORES)

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management: Trigger	Action	Response
Performance Measure Feature No performance measure relevant. **TARP Objective** This TARP defines levels of deviation in groundwater level from 'normal' or baseline conditions and the actions to be implemented in response to each level deviation. This TARP supports TARP WMP13, where groundwater levels as they pertain to groundwater dependent ecosystems (GDEs) (Thirlmere Lakes) are covered. **Assessment Criteria** Bore specific trigger values based on baseline data for each reporting level.	**Locations** **Open standpipes** Existing sites: P51a, P51b, P52, REA4, P53a, P53b, P53c, P54a, P54b, P55a, P55b, P55c, P56a, P56b, P56c Proposed sites: P50a, P50b, P50c, P57a, P57b **Private bores** GW109257, GW104008, GW112473, GW104659, GW062068, GW105395, GW104323 All monitoring locations are shown in Figure 23 of the Water Management Plan. **Monitoring Frequency** **Pre-mining** Continuous record and monthly manual measurements of water level. Data downloaded prior to the commencement of secondary extraction of the relevant longwall. **During Mining** Continuous record and monthly manual measurements of water level. Data downloaded and reviewed monthly. **Post-mining** Continuous record and quarterly manual measurements of water level for 12 months following the completion of LW S6A, or as required in accordance with a Rehabilitation Management Plan.	**Normal Condition**		
		• Groundwater level remains consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two meters.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Greater than 2 m water level reduction[1] for a period of 6 months following the commencement of extraction.	For Private Bores and Open Standpipe Monitoring Bores: • *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and determine if mining related. • Undertake investigation to demonstrate if the decline will impact the long-term viability of the affected water supply works. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level monitoring results). **If the changes have been confirmed to be related to mining effects:** For Private Bores only: • Initiate negotiations with impacts landowners as soon as practicable. Consider and decide on reasonable and feasible options for remediation as relevant (e.g. extending the depth of the bore, establishment of additional bores, etc - as per Section 6.2.1.4 of the Water Management Plan). For Open Standpipe Monitoring Bores only: • For monitoring sites relevant to Thirlmere Lakes or associated with surface water monitoring sites, initiate groundwater – surface water interaction TARP.	For Private Bores and Open Standpipe Monitoring Bores: • Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. **If the changes have been confirmed to be related to mining effects:** For Private Bores only: • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. extending the depth of the bore, establishment of additional bores, compensation to affected landowners as detailed in Section 6.2.1.4 of the Water Management Plan). • Implement CMAs, subject to land access (finalise negotiations and implement the agreed "make-good" arrangements) • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Water level declines below the average between the 'maximum modelled drawdown' (Level 3 trigger) and the '2 m drawdown' (Level 1 trigger)[1] for a period of greater than 6 months following the commencement of extraction. AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	For Private Bores and Open Standpipe Monitoring Bores: • *Actions as stated in Level 1.* • Consider increasing monitoring and review of data at sites where Level 2 has been reached, subject to land access. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change). • Compare against base case and deterministic model scenarios[2]. • Review Water Management Plan and modify if necessary. For Private Bores only: • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.	For Private Bores and Open Standpipe Monitoring Bores: • *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. For Private Bores only: • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access.
		Level 3		
		• Water level reduction greater than the maximum modelled drawdown[1] for a period of 6 months following the commencement of extraction. AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	For Private Bores and Open Standpipe Monitoring Bores: • *Actions as stated in Level 2.* • Increase monitoring and review of data frequency for sites where Level 3 has been reached, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate).	For Private Bores and Open Standpipe Monitoring Bores: • *Responses as stated in Level 2.* For Private Bores only: • Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders. • Implement Rehabilitation Management Plan, subject to land access.

Notes:
[1] Level 1, 2 and 3 triggers for water level reduction is provided in Table 6-3 in Appendix E of the Water Management Plan.
[2] "Deterministic" model scenario refers to the predictive scenario modelling utilised to determine the trigger level.

WATER MANAGEMENT PLAN TARP – WMP9 SHALLOW GROUNDWATER PRESSURE (VWP SENSORS < 200 m DEPTH)

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="8">Performance Measure Feature
No performance measure relevant.

TARP Objective
This TARP defines levels of deviation in groundwater level from ‘normal’ or baseline conditions and the actions to be implemented in response to each level deviation.

Assessment Criteria
Bore specific trigger values based on baseline data for each reporting level.</td><td rowspan="8">Locations
Baseline / Impact sites: TBC032, TBC033, TBC009, TBC018
Reference Sites: TBC024, TBC027, TBC034, TBC038

Monitoring of all VWP < 200 m depth.

All monitoring locations are shown in Figure 23 of the Water Management Plan.

Monitoring Frequency
Pre-mining
VWPs recording pressure readings hourly. The system is telemetered so that data is transmitted continuously and can be accessed at any point in time.

During Mining
VWPs recording pressure readings hourly. The system is telemetered so that data is transmitted continuously and can be accessed at any point in time.

Post-mining
Monitoring of data (transmitted continuously) for 12 months following the completion of LW S6A.</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• No recorded mining induced change at VWP depth.</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Greater than 5 m water level reduction at VWP depth[1] following the commencement of extraction.</td><td>• Actions as required for Normal Condition.
• Undertake an investigation to assess cause and determine if mining related.
• Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level monitoring results).</td><td>• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Water level declines below the calculated Level 2 trigger[2] following the commencement of extraction.
AND
• The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.</td><td>• Actions as stated in Level 1.
• Review deeper VWP data at monitored sites. Determine whether additional review of data is required. Determine if review of additional existing VWP sites is required. Reasons for not increasing frequency of data review could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change).
• Compare against base case and deterministic model scenarios[3].
• Review Water Management Plan and modify if necessary.</td><td>• Responses as stated in Level 1.
• Advise DPE and key stakeholders of any required amendments to Water Management Plan.</td></tr>
<tr><td colspan="3">Level 3</td></tr>
<tr><td>• Water level reduction greater than the maximum modelled drawdown[1] following the commencement of extraction.
AND
• The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.</td><td>• Actions as stated in Level 2.
• Increase review of data frequency for sites where Level 3 has been reached.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate).
• Undertake investigative to review model results in conjunction with field data.</td><td>• Responses as stated in Level 2.</td></tr>
<tr><td colspan="5">Notes:
[1] Level 1, 2 and 3 triggers for water level reduction is provided in Table 6-3 in Appendix E of the Water Management Plan.
[2] Level 2 trigger is calculated as being the average of Level 1 (5 m drawdown) and Level 3 (the ‘maximum modelled drawdown’).
[3] “Deterministic” model scenario refers to the predictive scenario modelling utilised to determine the trigger level.</td></tr>
</table>

WATER MANAGEMENT PLAN TARP – WMP10 GROUNDWATER LEVEL / PRESSURE DEEP VWPS (> 200 m DEPTH EXCLUDING MONITORING THE BULLI COAL SEAM)

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management – Trigger	Management – Action	Management – Response
Performance Measure Feature No performance measure relevant. **TARP Objective** This TARP defines levels of deviation in groundwater level from 'normal' or baseline conditions and the actions to be implemented in response to each level deviation. **Assessment Criteria** Bore specific trigger values based on modelled data for each reporting level. Model layers utilised to define predicted drawdown for each VWP logger provided in Table below.	**Locations** Baseline / Impact sites: TBC009, TBC0018, TBC020, TBC026, TBC032, TBC033, TBC039 Reference sites: TBC024, TBC027, TBC034, TBC038 Monitoring of all VWP > 200 m depth excluding those monitoring the Bulli Coal Seam. All monitoring locations are shown in Figure 23 of the Water Management Plan. **Monitoring Frequency** **Pre-mining** VWPs recording pressure readings hourly. The system is telemetered so that data is transmitted continuously and can be accessed at any point in time. **During Mining** VWPs recording pressure readings hourly. The system is telemetered so that data is transmitted continuously and can be accessed at any point in time. **Post-mining** Monitoring of data (transmitted continuously) for 12 months following the completion of LW S6A.	**Normal Condition**		
		• Recorded data within (do not exceed) modelled impacts (predicted drawdown)[1].	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Recorded drawdown is within 30 m of modelled predicted drawdown[1], for a period less than 6 months.	• *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and determine if mining related. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level monitoring results).	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Recorded drawdown exceeds modelled predicted drawdown[1] by less than 30 metres for a period of greater than 6 months. OR • Recorded drawdown exceeds modelled predicted drawdown[1] by greater than 30 m, for a period of 6 to 12 months.	• *Actions as stated in Level 1.* • Assess suitability of increasing frequency of data review at sites where Level 2 has been reached. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change). • Review data in conjunction with VWP data from additional existing VWP sites. • Compare against base case and deterministic model scenarios[2]. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Inclusion of more regional VWPs into data review to assess likely extent and depth of depressurisation. • Advise DPE and key stakeholders of any required amendments to Water Management Plan.
		Level 3		
		• Recorded drawdown exceeds modelled predicted drawdown[1] by 30 m, for a period of 12 months or more.	• *Actions as stated in Level 2.* • Increase review of data frequency for sites where Level 3 has been reached. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate). • Review base case and deterministic model scenarios[2] in conjunction with water pressure data and report findings.	• *Responses as stated in Level 2.*

Notes:
[1] Predicted drawdown refers to the drawdown as generated by the groundwater model and varies over time as extraction progresses. Recorded drawdown will be plotted on a monthly basis against the predicted drawdown to assess if a trigger has occurred. Therefore, as the predicted drawdown will be constantly changing according to extraction progression, it is not possible to set a specific trigger limit.
[2] "Deterministic" model scenario refers to the predictive scenario modelling utilised to assess the trigger level.

Sensor	Model Layer	Model Geology	Sensor	Model Layer	Model Geology	Sensor	Model Layer	Model Geology	Sensor	Model Layer	Model Geology
TBC09_322	8	BUSS Mid	TBC20_211	8	BUSS Mid	TBC26_440	16	Eckersley	TBC39_243	8	BUSS Mid
TBC09_343	8	BUSS Mid	TBC20_293	8	BUSS Mid	TBC26_460	16	Eckersley	TBC39_299	8	BUSS Mid
TBC09_357	12	SBSS Lower	TBC20_375	8	BUSS Mid	TBC32_200	8	BUSS Mid	TBC39_354	11	SBSS Upper
TBC09_381	10	SPCS	TBC20_397	13	WBCS	TBC32_237	8	BUSS Mid	TBC39_375	16	Eckersley
TBC09_391	15	Bulli Seam	TBC20_411	7	BUSS Upper	TBC32_257	8	BUSS Mid	TBC39_402	16	Eckersley
TBC09_397	17	Wongawilli	TBC20_434	17	Wongawilli	TBC32_294	8	BUSS Mid			
TBC18_282	8	BUSS Mid	TBC20_439	4	HBSS Mid	TBC32_314	8	BUSS Mid			
TBC18_366	8	BUSS Mid	TBC26_211	8	BUSS Mid	TBC33_247	8	BUSS Mid			
TBC18_377	13	WBCS	TBC26_278	8	BUSS Mid	TBC33_306	8	BUSS Mid			
TBC18_404	15	Bulli Seam	TBC26_344	8	BUSS Mid	TBC33_363	11	SBSS Upper			
TBC18_426	17	Wongawilli	TBC26_409	13	WBCS	TBC33_384	16	Eckersley			
TBC18_432	17	Wongawilli	TBC26_432	15	Bulli Seam	TBC33_408	16	Eckersley			

WATER MANAGEMENT PLAN TARP – WMP11 GROUNDWATER QUALITY (OPEN STANDPIPES AND PRIVATE BORES)

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management – Trigger	Management – Action	Management – Response
<u>Performance Measure Feature</u> No performance measure relevant. **<u>TARP Objective</u>** This TARP defines levels of deviation in groundwater level from 'normal' or baseline conditions and the actions to be implemented in response to each level deviation. This TARP supports TARP WMP13, where groundwater quality as it pertains to groundwater dependent ecosystems (GDEs) (Thirlmere Lakes) is covered. **<u>Assessment Criteria</u>** Bore specific trigger values based on baselines data for each reporting level.	**<u>Locations</u>** **Open standpipes** Existing sites: P51a, P51b, P52, REA4, P53a, P53b, P53c, P54a, P54b, P55a, P55b, P55c, P56a, P56b, P56c Proposed sites: P50a, P50b, P50c, P57a, P57b **Private bores** GW109257, GW104008, GW112473, GW104659, GW062068, GW105395, GW104323 All monitoring locations are shown in Figure 23 of the Water Management Plan. **<u>Monitoring Frequency</u>** **Pre-mining** Monthly water quality sampling. **During Mining** Monthly water quality sampling. **Post-mining** Quarterly manual measurements of water quality for 12 months following the completion of LW S6A, or as required in accordance with a Rehabilitation Management Plan. Water quality sample parameters: **Field Parameters**: PH, EC, TDS, DO, ORP **Laboratory Analysis**: Total alkalinity as CaCO3, HCO3, CO3, DOC Dissolved Major Cations (Ca, K, Na, Mg, F, Cl, SO4) Dissolved Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe) Total Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe) Total Nitrogen Total Phosphorus Ionic Balance (Total Anions and Total Cations)	**Normal Condition**		
		• No recorded changes in salinity, pH or metals outside of the baseline variability.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Recorded salinity and/or metals or pH outside of defined trigger levels[1] for 3 consecutive months or less. The effect does not persist after a significant rainfall recharge event. AND • A similar trend or response is noted at other monitored bores or private groundwater bores.	For Private Bores and Open Standpipe Monitoring Bores: • *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and assess if mining related. • Undertake investigation to demonstrate if the change in quality will impact the long-term viability of the affected water supply works. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level monitoring results). **If the changes have been confirmed to be related to mining effects:** For Private Bores only: • Initiate negotiations with impacted landholders as soon as practicable. Consider and decide on reasonable and feasible options for remediation as relevant. This could include potential for implementation of make-good provisions as per Section 6.2.1.4 of the Water Management Plan for affected private bore owners (e.g. provision of access to an alternative source of water). For Open Standpipe Monitoring Bores only: • For monitoring sites relevant to Thirlmere Lakes or associated with surface water monitoring sites, initiate groundwater – surface water interaction TARP.	For Private Bores and Open Standpipe Monitoring Bores: • Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. **If the changes have been confirmed to be related to mining effects:** For Private Bores only: • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. provision of access to an alternative source of water as detailed in Section 6.2.1.4 of the Water Management Plan). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Recorded salinity and/or metals or pH outside of defined trigger levels[1], for 3 consecutive months or less. The effect persists after a significant rainfall recharge event. AND • The change in water quality is assessed not to be controlled by climatic or external anthropogenic factors.	For Private Bores and Open Standpipe Monitoring Bores: • *Actions as stated in Level 1.* • Consider increasing monitoring and review of data at sites where Level 2 has been reached, subject to land access. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water quality change). • Review Water Management Plan and modify if necessary. For Private Bores only: • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.	For Private Bores and Open Standpipe Monitoring Bores: • *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. For Private Bores only: • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access.
		Level 3		
		• Recorded salinity and/or metals or pH outside of defined trigger levels[1], for greater than 3 consecutive months. AND • The change in water quality is assessed not to be controlled by climatic or external anthropogenic factors.	For Private Bores and Open Standpipe Monitoring Bores: • *Actions as stated in Level 2.* • Increase monitoring and review of data frequency for sites where Level 3 has been reached, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate). • Undertake investigative report to demonstrate if the water quality change will impact the long-term viability of any affected water supply works.	For Private Bores and Open Standpipe Monitoring Bores: • *Responses as stated in Level 2.* **If ascertained impact is due to mining activities and has potential to impact long-term viability of supply for private groundwater bores:** For Private Bores only: • Develop a Rehabilitation Management Plan in consultation with DPE and landowner. • Implement Rehabilitation Management Plan, subject to land access.

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	**Action**	**Response**

Notes:
[1] Defined trigger levels for groundwater quality are listed in Table 6-5 of Appendix E of the Water Management Plan.

WATER MANAGEMENT PLAN TARP – WMP12 GROUNDWATER - SURFACE WATER INTERACTION

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="8">Performance Measure Feature
No performance measure relevant[1].

TARP Objective
This TARP defines levels of deviation in surface water - groundwater interactions from ‘normal’ conditions and the actions to be implemented in response to each level deviation.
The instigation of this TARP will be dictated by triggers exceedances in pertinent groundwater or surface water sites requiring further investigation of groundwater – surface water interactions.

Assessment Criteria
Bore specific trigger values based on baselines data for each reporting level. For this TARP, the aligned groundwater and surface water sites would be considered collectively to interpret potential changes/impacts to groundwater – surface water interaction.</td><td rowspan="8">Locations
Open standpipes
P51a, P51b, P52, REA4, P53a, P53b, P53c
P54a, P54b, P54c, P55a, P55b, P55c

The aligned surface water and groundwater sites are as follows:
• P51a, P51b with surface water site BR2-QLa
• P52, REA4 with surface water site-TT14-QLa
• P53a, P53b, P53c with surface water site-TT14-QLa
• P54a, P54b, P54c with surface water site TT3-QLa
• P55a, P55b, P55c with surface water site TT1-QRLa

All monitoring locations are shown in Figure 23 of the Water Management Plan.

Monitoring Frequency
Pre-mining
Continuous record and monthly manual measurements of water level. Data downloaded prior to the commencement of secondary extraction of the relevant longwall.

During Mining
Continuous record and monthly manual measurements of water level. Data downloaded and reviewed monthly.

Post-mining
Continuous record and quarterly manual measurements of water level for 12 months following the completion of LW S6A, or as required in accordance with a Rehabilitation Management Plan.</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• Recorded (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Recorded (or inferred where not immediately neighbouring a surface water site) groundwater levels at surface water monitoring site decline below Level 1 (in TARP WMP8) following the commencement of extraction.</td><td>• Actions as required for Normal Condition.
• Undertake an investigation to assess cause and assess if mining related.
• Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level monitoring results, biodiversity monitoring results).</td><td>• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
If the changes have been confirmed to be related to mining effects:
• Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. extending the depth of the bore, establishment of additional bores, compensation to affected landowners as detailed in Section 6.2.1.4 of the Water Management Plan).
• Implement CMAs, subject to land access.
• Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Recorded (or inferred where not immediately neighbouring a surface water site) groundwater levels at aligned surface water monitoring site decline below Level 2 (in TARP WMP8) following the commencement of extraction.
AND
• The reduction in water level is assessed not to be controlled by climatic or external anthropogenic factor.</td><td>• Actions as stated in Level 1.
• Increase frequency of data review to fortnightly at sites where Level 2 has been reached, subject to land access. Reasons for not increasing frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change).
• Compare against base case and deterministic model scenarios[2].
• Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline.
• Review surface water data to assess for surface water level decline at relevant site.
• Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.
• Review Water Management Plan and modify if necessary.</td><td>• Responses as stated in Level 1.
• Provide findings of CMA review to DPE and key stakeholders for consultation.
• Implement additional CMAs, subject to land access.
• Advise DPE and key stakeholders of any required amendments to Water Management Plan, including reporting on relationship of observations to baseline and deterministic model scenarios, as necessary.</td></tr>
<tr><td colspan="3">Level 3</td></tr>
<tr><td>• Recorded (or inferred where not immediately neighbouring a surface water site) groundwater levels at aligned surface water monitoring site decline below Level 3 (in TARP WMP8) following the commencement of extraction.
AND
• The reduction in water level is assessed not to be controlled by climatic or external anthropogenic factor.</td><td>• Actions as stated in Level 2.
• Increase frequency of data review for sites where Level 3 has been reached, subject to land access.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate).</td><td>• Responses as stated in Level 2.
• Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders.
• Implement Rehabilitation Management Plan, subject to land access.</td></tr>
<tr><td colspan="5">Notes:
[1] Where groundwater – surface water connectivity indicates a gaining stream, there is potential for riparian vegetation to be supported by groundwater. Consequently, riparian vegetation in these situations could be a Groundwater Dependent Ecosystem (GDE). Riparian GDEs are addressed through the Riparian Vegetation TARP (BMP3). Discussion of findings through the Tahmoor Coal Environmental Response Group will enable linkage of this TARP to BMP3 to consider groundwater – surface water relationships when pertinent.
[2] “Deterministic” model scenario refers to the predictive scenario modelling utilised to assessed the trigger level.</td></tr>
</table>

WATER MANAGEMENT PLAN TARP – WMP13 GROUNDWATER BORES MONITORING FOR THIRLMERE LAKES

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management – Trigger	Management – Action	Management – Response
Performance Measure Feature GDEs including Thirlmere Lakes[1]. **Performance Measure** Negligible impacts including: • Negligible change in groundwater levels; and • Negligible change in groundwater quality. **Performance Indicator** The performance measure will be considered to be exceeded if the groundwater levels or groundwater quality decline below Level 3 (in the relevant groundwater TARP triggers for water level and water quality – TARP WMP8 or WMP11) following the commencement of extraction, and the investigation outcomes indicate a mining related impact based on monitoring data for the Thirlmere Lakes. **TARP Objective** This TARP defines levels of deviation at Thirlmere Lakes from ‘normal’ conditions and the actions to be implemented in response to each level deviation. **Assessment Criteria** Bore specific trigger values based on baselines data for each reporting level.	**Locations** **“Early warning” bores** Existing sites: P51a, P51b, GW062068, GW104659, TBC039 (sensor at 65 metres in Hawkesbury Sandstone (HBSS)) **Thirlmere Lakes bores** Existing sites: GW075409–1, GW075409–2, GW075410, GW075411 (paired with gauging station 212066) Proposed sites: P50a, P50b, P50c All monitoring locations are shown in Figure 23 of the Water Management Plan. **Monitoring Frequency** **Pre-mining** Continuous record and monthly manual measurements of water level and water quality. Data downloaded prior to the commencement of secondary extraction of the relevant longwall. **During Mining** Continuous record and monthly manual measurements of water level and water quality. Data downloaded and reviewed monthly. **Post-mining** Continuous record and quarterly manual measurements of water level and water quality for 12 months following the completion of LW S6A or as required in accordance with a Rehabilitation Management Plan. Water quality sample parameters: **Field Parameters** PH, EC, TDS, DO and ORP **Laboratory Analysis** Total alkalinity as CaCO3, HCO3, CO3, DOC Dissolved Major Cations (Ca, K, Na, Mg, F, Cl, SO4) Dissolved Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe) Total Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe) Total Nitrogen Total Phosphorus Ionic Balance (Total Anions and Total Cations)			
		Normal Condition		
		• Groundwater levels and water quality remain consistent with baseline variability and/pre-mining trends, and changes in groundwater levels/quality not persisting after significant rainfall recharge events.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Level 1 trigger of TARP WMP8 for a minimum of two “early warning” bores. OR • Level 1 trigger of TARP WMP11 for a minimum of two “early warning” bores.	• *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and assess if mining related. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level monitoring results). If the changes have been confirmed to be related to mining effects: • Consider and decide on reasonable and feasible options for remediation as relevant (e.g. extending the depth of the bore, establishment of additional bores). This could include potential for implementation of make-good provisions as per Section 6.2.1.4 of the Water Management Plan for affected private bore owners. • For monitoring sites relevant to Thirlmere Lakes or associated with surface water monitoring sites, initiate groundwater – surface water interaction TARP.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. If the changes have been confirmed to be related to mining effects: • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. extending the depth of the bore, establishment of additional bores, compensation to affected landowners as detailed in Section 6.2.1.4 of the Water Management Plan). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Level 2 trigger of TARPs WMP8 for a minimum of three bores (“early warning” bores and Thirlmere Lakes bores) OR • Level 2 trigger of TARPs WMP11 for a minimum of three bores (“early warning” bores and Thirlmere Lakes bores).	• *Actions as stated in Level 1.* If the changes have been confirmed to be related to mining effects: • Consider increasing monitoring and review of data at sites where Level 2 has been reached, subject to land access. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change). • Compare against base case and deterministic model scenarios[2]. • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • Review surface water data to assess for surface water level decline at relevant site. • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options. • Review Water Management Plan and modify if necessary. • Undertake an investigation to assess if an exceedance of the performance measure is likely.	• *Responses as stated in Level 1.* • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access. • Advise DPE and key stakeholders of any required amendments to Water Management Plan. • If relevant, notify DAWE of any predictions of an exceedance of a performance measure within two business days.
		Exceeds Performance Measure		
		• Level 3 trigger of TARPs WMP8 for a minimum of four bores (“early warning” bores and Thirlmere Lakes bores) OR • Level 3 trigger of TARPs WMP11 for a minimum of four bores (“early warning” bores and Thirlmere Lakes bores).	• *Actions as stated in Level 2.* If the changes have been confirmed to be related to mining effects: • Increase monitoring and review of data frequency for sites where Level 3 has been reached, subject to land access. • Investigate reasons for the performance measure exceedance. • Review predictions of subsidence impacts and environmental consequences associated with further longwall extraction based on the outcomes of the investigation. • Consider modifying mine plan.	• *Responses as stated in Level 2.* • Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed by DPE) describing remediation options and any preferred remediation measures or other course of action. • Implement any reasonable remediation measures as directed by DPE, subject to land access. • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project). • Update numerical groundwater model and re-run predictive scenarios to assess the likely extent and depth of depressurisation in the vicinity of Thirlmere Lakes, and to assess whether any additional management actions are required such as modifying the mine plan.

Notes:
[1] It is noted that the only Groundwater Dependent Ecosystem (GDE) pertinent to the Tahmoor South Project is that of Thirlmere Lakes[2] “Deterministic” model scenario refers to the predictive scenario modelling utilised to assess the trigger level.

Appendix F:

Groundwater TARPs (revised with track changes)

WATER MANAGEMENT PLAN TARP – WMP8 SHALLOW GROUNDWATER LEVEL (OPEN STANDPIPES AND PRIVATE BORES)

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management		
		Trigger	Action	Response
Performance Measure Feature No performance measure relevant. TARP Objective This TARP defines levels of deviation in groundwater level from 'normal' or baseline conditions and the actions to be implemented in response to each level deviation. This TARP supports TARP WMP13, where groundwater levels as they pertain to groundwater dependent ecosystems (GDEs) (Thirlmere Lakes) are covered. Assessment Criteria Bore specific trigger values based on baselines data for each reporting level.	Locations Open standpipes Existing sites: P51a, P51b, P52, REA4, P53a, P53b, P53c, P54a, P54b, P55a, P55b, P55c, P56a, P56b, P56c Proposed sites: P50a, P50b, P50c, P57a, P57b Private bores GW109257, GW104008, GW112473, GW104659, GW062068, GW105395, GW104323 All monitoring locations are shown in Figure 23 of the Water Management Plan. Monitoring Frequency Pre-mining Monthly manual measurements of water level. During Mining Monthly manual measurements of water level. Post-mining Quarterly manual measurements of water level for 12 months following the completion of LW S6A, or as required in accordance with a Rehabilitation Management Plan.	**Normal Condition**		
		• Groundwater level remains consistent with baseline variability and pre-mining trends with reductions in groundwater level less than two meters.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Greater than 2 m water level reduction[1] for a period of 6 months following the commencement of extraction.	For Private Bores and Open Standpipe Monitoring Bores • *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and determine if mining related. • Undertake investigation to demonstrate if the decline will impact the long-term viability of the affected water supply works. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level results). The investigation will be commenced/completed as efficiently as practicable. If the changes have been confirmed to be related to mining effects: For Private Bores: • Initiate negotiations with impacts landowners as soon as practicable. Consider all reasonable and feasible options for remediation as relevant (e.g. extending the depth of the bore, establishment of additional bores, etc - as per Section 6.2.1.4 of the Water Management Plan. " For Open Standpipe Monitoring Bores • For monitoring sites relevant to Thirlmere Lakes or associated with surface water monitoring sites, initiate groundwater – surface water interaction TARP.	For Private Bores and Open Standpipe Monitoring Bores • Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. If the changes have been confirmed to be related to mining effects: For Private Bores: • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. extending the depth of the bore, establishment of additional bores, compensation to affected landowners as detailed in Section 6.2.1.4 of the Water Management Plan). • Implement CMAs, subject to land access (finalise negotiations and implement the agreed "make-good" arrangements) • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Water level declines below the average between the 'maximum modelled drawdown' (Level 3 trigger) and the '2 m drawdown' (Level 1 trigger)[1] for a period of greater than 6 months following the commencement of extraction. AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	For Private Bores and Open Standpipe Monitoring Bores • *Actions as stated in Level 1.* • Consider increasing monitoring and review of data at sites where Level 2 has been reached, subject to land access. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change). • Compare against base case and deterministic model scenarios[2]. • Review Water Management Plan and modify if necessary. For Private Bores: • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.	For Private Bores and Open Standpipe Monitoring Bores • *Responses as stated in Level 1.* • Advise DPE and key stakeholders of any required amendments to Water Management Plan. For Private Bores: • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access.
		Level 3		
		• Water level reduction greater than the maximum modelled drawdown[1] for a period of 6 months following the commencement of extraction. AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	For Private Bores and Open Standpipe Monitoring Bores • *Actions as stated in Level 2.* • Increase monitoring and review of data frequency for sites where Level 3 has been reached, subject to land access. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate).	For Private Bores and Open Standpipe Monitoring Bores • *Responses as stated in Level 2.* For Private Bores: • Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders. • Implement Rehabilitation Management Plan, subject to land access.

Notes:
[1] Level 1, 2 and 3 triggers for water level reduction is provided in Table 6-3 in Appendix E of the Water Management Plan.
[2] "Deterministic" model scenario refers to the predictive scenario modelling utilised to determine the trigger level.

WATER MANAGEMENT PLAN TARP – WMP9 SHALLOW GROUNDWATER PRESSURE (VWP SENSORS < 200 M DEPTH)

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="8"><u>Performance Measure Feature</u>
No performance measure relevant.

<u>TARP Objective</u>
This TARP defines levels of deviation in groundwater level from 'normal' or baseline conditions and the actions to be implemented in response to each level deviation.

<u>Assessment Criteria</u>
Bore specific trigger values based on baselines data for each reporting level.</td><td rowspan="8"><u>Locations</u>
TBC032, TBC033, TBC009, TBC018
Monitoring of all VWP < 200 m depth intakes.

Reference Sites: TBC024, TBC027, TBC034, TBC038

All monitoring locations are shown in Figure 23 of the Water Management Plan.

<u>Monitoring Frequency</u>
Pre-mining
VWPs sensors take pressure readings hourly. The system is now telemetered so data is streamed continuously and can be accessed at any point in time.

During Mining
VWPs sensors take pressure readings hourly. The system is now telemetered so data is streamed continuously and can be accessed at any point in time.

Post-mining
Monitoring of data (streamed continuously) for 12 months following the completion of LW S6A.</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• No observable mining induced change at VWP intakes.
OR
• Greater than 5 m water level reduction in VWP intakes[1] following the commencement of extraction for a period of less than six months.</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Greater than 5 m water level reduction in VWP intakes[1] following the commencement of extraction for a period of greater than six consecutive months.</td><td>• Actions as required for Normal Condition.
• Undertake an investigation to assess cause and determine if mining related, commence/complete as soon as practicable.
• Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level results).</td><td>• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Water level declines below the calculated Level 2 trigger – being the average of Level 1 (-the '5 m drawdown'[1]) and Level 3 (the 'maximum modelled drawdown') – following the commencement of extraction for a period of greater than six consecutive months.
AND
• The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.</td><td>• Actions as stated in Level 1.
• Review deeper VWP data at monitored sites. Determine whether additional review of data is required. Determine if review of additional existing VWP sites is required. Reasons for not increasing frequency of data review could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change).
• Compare against base case and deterministic model scenarios[2].
• Review Water Management Plan and modify if necessary.</td><td>• Responses as stated in Level 1.
• Advise DPE and key stakeholders of any required amendments to Water Management Plan.</td></tr>
<tr><td colspan="3">Level 3</td></tr>
<tr><td>• Water level reduction greater than the maximum modelled drawdown[1] following the commencement of extraction for a period of greater than six consecutive months.
AND
• The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.</td><td>• Actions as stated in Level 2.
• Increase review of data frequency for sites where Level 3 has been reached.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate). Commence/complete as soon as practicable
• Undertake investigative to review model results in conjunction with field data.</td><td>• Responses as stated in Level 2.</td></tr>
<tr><td colspan="5">Notes:
[1] Level 1, 2 and 3 triggers for water level reduction is provided in Table 6-4 in Appendix E of the Water Management Plan).
[2] "Deterministic" model scenario refers to the predictive scenario modelling utilised to determine the trigger level.</td></tr>
</table>

WATER MANAGEMENT PLAN TARP – WMP10 GROUNDWATER LEVEL / PRESSURE DEEP VWPS (> 200 M DEPTH EXCLUDING MONITORING THE BULLI COAL SEAM)

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management: Trigger	Management: Action	Management: Response
Performance Measure Feature No performance measure relevant. TARP Objective This TARP defines levels of deviation in groundwater level from 'normal' or baseline conditions and the actions to be implemented in response to each level deviation. Assessment Criteria Bore specific trigger values based on modelled data for each reporting level. Model layers utilised to define predicted drawdown for each VWP logger provided in Table below.	Locations TBC009, TBC0018, TBC020, TBC026, TBC032, TBC033, TBC039 Reference sites: TBC024, TBC027, TBC034, TBC038 Monitoring of all VWP > 200 m depth intakes excluding those monitoring the Bulli Coal Seam. All monitoring locations are shown in Figure 23 of the Water Management Plan. Monitoring Frequency Pre-mining VWPs sensors take pressure readings hourly. The system is now telemetered so data is streamed continuously and can be accessed at any point in time. During Mining VWPs sensors take pressure readings hourly. The system is now telemetered so data is streamed continuously and can be accessed at any point in time. Post-mining Monitoring of data (streamed continuously) for 12 months following the completion of LW S6A.	**Normal Condition**		
		• ~~Recorded data within (do not exceed) modelled impacts (predicted drawdown)~~Observed data does not exceed- modelled impacts predicted drawdown by greater than 30 metres[1]. OR • Observed drawdown ~~is within 30 m of~~ exceeds the modelled predicted drawdown[1]-, by greater than 30 metres for ~~a period less than 6 months.~~~~of~~ less than three consecutive months	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Observed drawdown ~~is within 30 m of~~ exceeds the modelled predicted drawdown[1], by greater than 30 metres, for ~~a period less than 6 months.~~~~greater~~more than three consecutive months.	• *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and determine if mining related, to be commenced/completed as soon as practicable. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level results).	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Observed drawdown is exceeds modelled predicted drawdown[1] , by ~~less~~ ~~more~~greater than 30 metres, ~~for a period of greater~~ for more than 6 consecutive months. • ~~Observed drawdown exceeds modelled predicted drawdown[1] by greater than 30 m, for a period of 6 to 12 months.~~	• *Actions as stated in Level 1.* • Determine suitability of increasing frequency of data review at sites where Level 2 has been reached. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change). • Review data in conjunction with VWP data from additional existing VWP sites. • Compare against base case and deterministic model scenarios[2]. • Review Water Management Plan and modify if necessary.	• *Responses as stated in Level 1.* • Inclusion of more regional VWPs into data review to determine likely extent and depth of depressurisation. • Advise DPE and key stakeholders of any required amendments to Water Management Plan.
		Level 3		
		• Observed drawdown exceeds modelled predicted drawdown[1] greater than~~by~~ 30 metres, for ~~a period of~~ 12 consecutive months or more.	• *Actions as stated in Level 2.* • Increase review of data frequency for sites where Level 3 has been reached. • Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate). To be commenced/completed as soon as practicable. • Review base case and deterministic model scenarios[2] in conjunction with water pressure data and report findings.	• *Responses as stated in Level 2.*

Notes:
[1] Predicted drawdown refers to the drawdown as generated by the groundwater model and varies over time as extraction progresses. Observed drawdown will be plotted on a monthly basis against the predicted drawdown to determine if a trigger has occurred. Therefore, as the predicted drawdown will be constantly changing according to extraction progression, it is not possible to set a specific trigger limit.
[2] "Deterministic" model scenario refers to the predictive scenario modelling utilised to determine the trigger level.

Sensor	Model Layer	Model Geology		Sensor	Model Layer	Model Geology
TBC09_322	8	BUSS Mid		TBC26_344	8	BUSS Mid
TBC09_343	8	BUSS Mid		TBC26_409	13	WBCS
TBC09_357	12	SBSS Lower		TBC26_432	15	Bulli Seam
TBC09_381	10	SPCS		TBC26_440	16	Eckersley
TBC09_391	15	Bulli Seam		TBC26_460	16	Eckersley
TBC09_397	17	Wongawilli		TBC32_200	8	BUSS Mid
TBC18_282	8	BUSS Mid		TBC32_237	8	BUSS Mid
TBC18_366	8	BUSS Mid		TBC32_257	8	BUSS Mid

TBC18_377	13	WBCS		TBC32_294	8	BUSS Mid
TBC18_404	15	Bulli Seam		TBC32_314	8	BUSS Mid
TBC18_426	17	Wongawilli		TBC33_247	8	BUSS Mid
TBC18_432	17	Wongawilli		TBC33_306	8	BUSS Mid
TBC20_211	8	BUSS Mid		TBC33_363	11	SBSS Upper
TBC20_293	8	BUSS Mid		TBC33_384	16	Eckersley
TBC20_375	8	BUSS Mid		TBC33_408	16	Eckersley
TBC20_397	13	WBCS		TBC39_243	8	BUSS Mid
TBC20_411	7	BUSS Upper		TBC39_299	8	BUSS Mid
TBC20_434	17	Wongawilli		TBC39_354	11	SBSS Upper
TBC20_439	4	HBSS Mid		TBC39_375	16	Eckersley
TBC26_211	8	BUSS Mid		TBC39_402	16	Eckersley
TBC26_278	8	BUSS Mid				

WATER MANAGEMENT PLAN TARP – WMP11 GROUNDWATER QUALITY (OPEN STANDPIPES AND PRIVATE BORES)

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="8">Performance Measure Feature
No performance measure relevant.

TARP Objective
This TARP defines levels of deviation in groundwater level from ‘normal’ or baseline conditions and the actions to be implemented in response to each level deviation.
This TARP supports TARP WMP13, where groundwater quality as it pertains to groundwater dependent ecosystems (GDEs) (Thirlmere Lakes) is covered.

Assessment Criteria
Bore specific trigger values based on baselines data for each reporting level.</td><td rowspan="8">Locations
Open standpipes
Existing sites:
P51a, P51b, P52, REA4, P53a, P53b, P53c, P54a, P54b, P55a, P55b, P55c, P56a, P56b, P56c

Proposed sites:
P50a, P50b, P50c, P57a, P57b

Private bores
GW109257, GW104008, GW112473, GW104659, GW062068, GW105395, GW104323

All monitoring locations are shown in Figure 23 of the Water Management Plan.

Monitoring Frequency
Pre-mining
Monthly water quality sampling.

During Mining
Monthly water quality sampling

Post-mining
Quarterly water quality sampling.

Water Quality sample parameters:

Field Parameters
PH
EC
TDS
DO
ORP

Laboratory Analysis
Total alkalinity as CaCO3, HCO3, CO3, DOC
Dissolved Major Cations (Ca, K, Na, Mg, F, Cl, SO4)
Dissolved Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe)
Total Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe)
Total Nitrogen
Total Phosphorus
Ionic Balance (Total Anions and Total Cations)</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• No observable changes in salinity, pH or metals outside of the baseline variability.</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Observed salinity and/or metals or pH outside of defined trigger levels[1] for ~~less than~~ 3~~3~~ consecutive months or ~~less~~more. The effect *does not persist* after a significant rainfall recharge event.
AND
• A similar trend or response is noted at other monitored bores or private groundwater bores.</td><td>For Private Bores and Open Standpipe Monitoring Bores
• *Actions as required for Normal Condition.*
• Undertake an investigation to assess cause and determine if mining related.
• Undertake investigation to demonstrate if the change in quality will impact the long-term viability of the affected water supply works.
• Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level results).
If the changes have been confirmed to be related to mining effects:
For Private Bores:
• Initiate negotiations with impacted landholders as soon as practicable. Consider all reasonable and feasible options for remediation as relevant. This could include potential for implementation of make-good provisions as per Section 6.2.1.4 of the Water Management Plan for affected private bore owners (e.g. provision of access to an alternative source of water).
For Open Standpipe Monitoring Bores
• For monitoring sites relevant to Thirlmere Lakes or associated with surface water monitoring sites, initiate groundwater – surface water interaction TARP.</td><td>For Private Bores and Open Standpipe Monitoring Bores
• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
If the changes have been confirmed to be related to mining effects:
For Private Bores:
• Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. provision of access to an alternative source of water as detailed in Section 6.2.1.4 of the Water Management Plan).
• Implement CMAs, subject to land access.
• Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Observed salinity and/or metals or pH outside of defined trigger levels[1]-, for 3 consecutive months or ~~less~~more. The effect *persists* after a significant rainfall recharge event.
AND
• The change in water quality is determined not to be controlled by climatic or external anthropogenic factors.</td><td>For Private Bores and Open Standpipe Monitoring Bores
• *Actions as stated in Level 1.*
• Consider increasing monitoring and review of data at sites where Level 2 has been reached, subject to land access. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water quality change).
• Review Water Management Plan and modify if necessary.
For Private Bores:
• Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.</td><td>For Private Bores and Open Standpipe Monitoring Bores
• *Responses as stated in Level 1.*
• Advise DPE and key stakeholders of any required amendments to Water Management Plan.
For Private Bores:
• Provide findings of CMA review to DPE and key stakeholders for consultation.
• Implement additional CMAs, subject to land access.</td></tr>
<tr><td colspan="3">Level 3</td></tr>
<tr><td>• Observed salinity and/or metals or pH outside of defined trigger levels[1]-, for greater than 6~~3~~ consecutive months.
AND
• The change in water quality is determined not to be controlled by climatic or external anthropogenic factors.</td><td>For Private Bores and Open Standpipe Monitoring Bores
• *Actions as stated in Level 2.*
• Increase monitoring and review of data frequency for sites where Level 3 has been reached, subject to land access.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate).
• Undertake investigative report to demonstrate if the water quality change will impact the long-term viability of any affected water supply works.</td><td>For Private Bores and Open Standpipe Monitoring Bores
• *Responses as stated in Level 2.*
For Private Bores:
If ascertained impact is due to mining activities and has potential to impact long-term viability of supply for private groundwater bores:
• Develop a Rehabilitation Management Plan in consultation with DPE and landowner.
• Implement Rehabilitation Management Plan, subject to land access.</td></tr>
<tr><td colspan="5">Notes:
[1] Defined trigger levels for groundwater quality are listed in Table 6-5 of Appendix E of the Water Management Plan.</td></tr>
</table>

WATER MANAGEMENT PLAN TARP – WMP12 GROUNDWATER - SURFACE WATER INTERACTION

<table>
<tr><th rowspan="2">Performance Measure and Indicator, TARP Objective and Assessment Criteria</th><th rowspan="2">Monitoring Program</th><th colspan="3">Management</th></tr>
<tr><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td rowspan="8"><u>Performance Measure Feature</u>
No performance measure relevant.

<u>TARP Objective</u>
This TARP defines levels of deviation in surface water - groundwater interactions from 'normal' conditions and the actions to be implemented in response to each level deviation.
The instigation of this TARP will be dictated by triggers exceedances in pertinent groundwater or surface water sites requiring further investigation of groundwater – surface water interactions.

Where groundwater – surface water connectivity indicates in a gaining stream, there is potential for groundwater supporting riparian vegetation. Consequently, Riparian vegetation in these situations could be a Groundwater Dependent Ecosystem (GDE), and the pertinent Performance Measure applicable:
Negligible impacts including:
• Negligible change in groundwater levels; and
• Negligible change in groundwater quality.

Riparian GDEs are addressed through the Riparian Vegetation TARP (BMP3). Consultation through the ERG will link this TARP (WMP12) to BMP3 via actions in BMP3 to consider groundwater – surface water relationships when pertinent.

<u>Assessment Criteria</u>
Bore specific trigger values based on baselines data for each reporting level. For this TARP, the aligned groundwater and surface water sites would be considered collectively to interpret potential changes/impacts to groundwater – surface water interaction.</td><td rowspan="8"><u>Locations</u>
Open standpipes
P51a, P51b, P52, REA4, P53a, P53b, P53c
P54a, P54b, P54c, P55a, P55b, P55c

The aligned surface water and groundwater sites are as follows:
• P51a, P51b with surface water site BR2-Qla
• P52, REA4 with surface water site-TT14-QLa
• P53a, P53b, P53c with surface water site-TT14-Qla
• P54a, P54b, P54c with surface water site TT3-QLa
• P55a, P55b, P55c with surface water site TT1-QRLa

All monitoring locations are shown in Figure 23 of the Water Management Plan.

<u>Monitoring Frequency</u>
Pre-mining
Monthly manual measurements of water level and water quality.

During Mining
Monthly manual measurements of water level and water quality.

Post-mining
Quarterly manual measurements of water level for 12 months following the completion of LW S6A, or as required in accordance with a Rehabilitation Management Plan.</td><td colspan="3">Normal Condition</td></tr>
<tr><td>• Observed (or inferred where not immediately neighbouring a surface water site) groundwater and surface water interaction remains consistent with baseline variability and/or pre-mining trends, and decrease in groundwater inflow not persisting after significant rainfall recharge events.</td><td>• Continue monitoring and review of data as per monitoring program.</td><td>• No response required.</td></tr>
<tr><td colspan="3">Level 1</td></tr>
<tr><td>• Observed (or inferred where not immediately neighbouring a surface water site) groundwater levels at surface water monitoring site decline below Level 1 (in TARP WMP8) following the commencement of extraction.</td><td>• Actions as required for Normal Condition.
• Undertake an investigation to assess cause and determine if mining related.
• Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level results).</td><td>• Report trigger exceedance to DPE and key stakeholders.
• Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review.
If the changes have been confirmed to be related to mining effects:
• Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. extending the depth of the bore, establishment of additional bores, compensation to affected landowners as detailed in Section 6.2.1.4 of the Water Management Plan).
• Implement CMAs, subject to land access.
• Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.</td></tr>
<tr><td colspan="3">Level 2</td></tr>
<tr><td>• Observed (or inferred where not immediately neighbouring a surface water site) groundwater levels at aligned surface water monitoring site decline below Level 2 (in TARP WMP8) following the commencement of extraction.
AND
• The reduction in water level is determined not to be controlled by climatic or external anthropogenic factor.</td><td>• Actions as stated in Level 1.
• Increase frequency of data review to fortnightly at sites where Level 2 has been reached, subject to land access. Reasons for not increasing frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change).
• Compare against base case and deterministic model scenarios[1].
• Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline.
• Review surface water data to assess for surface water level decline at relevant site.
• Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options.
• Review Water Management Plan and modify if necessary.</td><td>• Responses as stated in Level 1.
• Provide findings of CMA review to DPE and key stakeholders for consultation.
• Implement additional CMAs, subject to land access.
• Advise DPE and key stakeholders of any required amendments to Water Management Plan, including reporting on relationship of observations to baseline and deterministic model scenarios, as necessary.</td></tr>
<tr><td colspan="3">Level 3</td></tr>
<tr><td>• Inferred groundwater levels at surface water monitoring site decline below Level 3 (in TARP WMP8) following the commencement of extraction.
AND
• The reduction in water level is determined not to be controlled by climatic or external anthropogenic factor.</td><td>• Actions as stated in Level 2.
• Increase frequency of data review for sites where Level 3 has been reached, subject to land access.
• Undertake a detailed investigation to assess if the change in behaviour is related to mining effects (e.g. whether there has been subsidence induced fracturing, other catchment changes, effect unrelated to mining or the prevailing climate). Report to be commenced and completed as soon as practicable.</td><td>• Responses as stated in Level 2.
• Develop a Rehabilitation Management Plan in consultation with DPE and key stakeholders.
• Implement Rehabilitation Management Plan, subject to land access.</td></tr>
<tr><td colspan="5">Notes:
[1] "Deterministic" model scenario refers to the predictive scenario modelling utilised to determine the trigger level.</td></tr>
</table>

Performance Measure and Indicator, TARP Objective and Assessment Criteria	Monitoring Program	Management: Trigger	Management: Action	Management: Response
Performance Measure Feature GDEs including Thirlmere Lakes[1]. Performance Measure Negligible impacts including: • Negligible change in groundwater levels; and • Negligible change in groundwater quality. Performance Indicator The performance measure will be considered to be exceeded if the groundwater levels or groundwater quality decline below Level 3 (in the relevant groundwater TARP triggers for water level and water quality – TARP WMP8 or WMP11) following the commencement of extraction, and the investigation outcomes indicate a mining related impact based on monitoring data for the Thirlmere Lakes. TARP Objective This TARP defines levels of deviation at Thirlmere Lakes from ‘normal’ conditions and the actions to be implemented in response to each level deviation. Assessment Criteria Bore specific trigger values based on baselines data for each reporting level.	Locations “Early warning” bores Existing sites: ~~P51a, P51b~~, GW062068, GW104659, TBC039 (sensor at 65 metres in Hawkesbury Sandstone (HBSS)) Proposed sites: P50a, P50b, P50c Thirlmere Lakes bores (not trigger bores) Existing sites: GW075409–1, GW075409–2, GW075410, GW075411 (paired with gauging station 212066) ~~Proposed sites:~~ ~~P50a, P50b, P50c~~ All monitoring locations are shown in Figure 23 of the Water Management Plan. Monitoring Frequency (for “early warning” bores) Pre-mining Monthly manual measurements of water level and water quality. During Mining Monthly manual measurements of water level and water quality. Post-mining Quarterly manual measurements of water level for 12 months following the completion of LW S6A, or as required in accordance with a Rehabilitation Management Plan. Water Quality sample parameters: **Field Parameters** PH EC TDS DO ORP **Laboratory Analysis** Total alkalinity as CaCO3, HCO3, CO3, DOC Dissolved Major Cations (Ca, K, Na, Mg, F, Cl, SO4) Dissolved Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe) Total Metals (Al, As, Ba, Co, Cu, Pb, Li, Mn, Ni, Se, Sr, Zn, Fe) Total Nitrogen Total Phosphorus Ionic Balance (Total Anions and Total Cations)	**Normal Condition**		
		• Groundwater levels and quality remain consistent with baseline variability and/or pre-mining trends, and changes in groundwater levels/quality not persisting after significant rainfall recharge events.	• Continue monitoring and review of data as per monitoring program.	• No response required.
		Level 1		
		• Level 1 trigger of TARP WMP8 for a minimum of two “early warning” bores. OR • Level 1 trigger of TARP WMP11 for a minimum of two “early warning” bores.	• *Actions as required for Normal Condition.* • Undertake an investigation to assess cause and determine if mining related. • Discuss findings and obtain other relevant information from key specialists (e.g. subsidence monitoring results, surface water level results). If the changes have been confirmed to be related to mining effects: • Consider all reasonable and feasible options for remediation as relevant (e.g. extending the depth of the bore, establishment of additional bores). This could include potential for implementation of make-good provisions as per Section 6.2.1.4 of the Water Management Plan for affected private bore owners. • For monitoring sites relevant to Thirlmere Lakes or associated with surface water monitoring sites, initiate groundwater – surface water interaction TARP.	• Report trigger exceedance to DPE and key stakeholders. • Report trigger exceedance and investigation outcomes in Six Monthly Subsidence Impact Report and Annual Review. If the changes have been confirmed to be related to mining effects: • Provide DPE and key stakeholders with proposed corrective management actions (CMAs) for consultation (e.g. extending the depth of the bore, establishment of additional bores, compensation to affected landowners as detailed in Section 6.2.1.4 of the Water Management Plan). • Implement CMAs, subject to land access. • Monitor and report on success of CMAs in Six Monthly Subsidence Impact Report and Annual Review.
		Level 2		
		• Level 2 trigger of TARP~~s~~ WMP8 for a minimum of three bores ~~(~~“early warning” bores ~~and Thirlmere Lakes bores)~~ OR • Level 2 trigger of TARP~~s~~ WMP11 for a minimum of three bores (“early warning” bores and Thirlmere Lakes bores).	• *Actions as stated in Level 1.* If the changes have been confirmed to be related to mining effects: • Consider increasing monitoring and review of data at sites where Level 2 has been reached, subject to land access. Reasons for not increasing monitoring frequency could include solid identification causation that do not require further monitoring (e.g. singular anthropogenic impact resulting in water level change). • Review monitoring data from Thirlmere Lakes ~~monitoring bores data~~. • Compare against base case and deterministic model scenarios[2]. • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • Review surface water data to assess for surface water level decline at relevant site. • Review CMAs in light of findings from further investigations and consider additional reasonable and feasible options. • Review Water Management Plan and modify if necessary. • Undertake an investigation to determine if an exceedance of the performance measure is likely. To be commenced/completed as soon as practicable.	• *Responses as stated in Level 1.* • Provide findings of CMA review to DPE and key stakeholders for consultation. • Implement additional CMAs, subject to land access. • Advise DPE and key stakeholders of any required amendments to Water Management Plan. • If relevant, notify DAWE of any predictions of an exceedance of a performance measure within two business days.
		Exceeds Performance Measure		
		Level 3 trigger of TARPs WMP8 for a minimum of four bores ~~(~~“early warning” bores ~~and Thirlmere Lakes bores~~) OR • Level 3 trigger of TARPs WMP11 for a minimum of four bores (“early warning” bores ~~and Thirlmere Lakes bores~~). AND • Review of data from Thirlmere Lakes bores indicated potential impacts resulting from extraction.	• *Actions as stated in Level 2.* If the changes have been confirmed to be related to mining effects: • Increase monitoring and review of data frequency for sites where Level 3 has been reached, subject to land access. • Investigate reasons for the performance measure exceedance. To be commenced/completed as soon as practicable. • Review predictions of subsidence impacts and environmental consequences associated with further longwall extraction based on the outcomes of the investigation. • Consider modifying mine plan.	• *Responses as stated in Level 2.* • Submit a report to DPE (in accordance with Condition E4 of SSD 8445) within 14 days of the exceedance occurring (or other timeframe agreed by DPE) describing remediation options and any preferred remediation measures or other course of action. • Implement any reasonable remediation measures as directed by DPE, subject to land access. • Notify DAWE of any detection or predictions of an exceedance of a performance measure within two business days. • Submit an Impact Response Plan to DAWE (in accordance with Condition 11 of the DAWE Consent for the Tahmoor South Project). • Update numerical groundwater model and re-run predictive scenarios to determine the likely extent and depth of depressurisation in the vicinity of Thirlmere Lakes, and to determine whether any additional management actions are required such as modifying the mine plan

Notes:
[1] It is noted that the only Groundwater Dependent Ecosystem (GDE) pertinent to the Tahmoor South Project is that of Thirlmere Lakes[2] “Deterministic” model scenario refers to the predictive scenario modelling utilised to determine the trigger level.

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