

Figure 1: Map Showing latest swamp triggers in Swamp 15a. Inset shows frame in relation to Dendrobium mining operations.

Table 1: Extract from TARP of Dendrobium Swamp Impact, Monitoring, Management and Contingency Plan.

<p><b>Minor changes</b> in the ecosystem functionality of the swamps</p>	<p>Falls in surface or near-surface groundwater levels in swamps</p> <p><i>NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i></p>	<p><u>Level 1:</u> Groundwater level lower than baseline level at any monitoring site within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at any monitoring site (measured as average mm/day during the recession curve).</p> <p><u>Level 2:</u> Groundwater level lower than baseline level at <b>50%</b> of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at a <b>50%</b> of monitoring sites (within 400m of mining) within the swamp.</p> <p><u>Level 3:</u> Groundwater level lower than baseline level at <b>&gt;80%</b> of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at <b>&gt;80%</b> of monitoring sites (within 400 m of mining) within the swamp.</p>	<ul style="list-style-type: none"> <li>a) upfront mine planning</li> <li>b) groundwater monitoring</li> <li>c) implementation of swamp research program</li> <li>d) weeding</li> <li>e) fire management reporting</li> <li>g) update future predictions</li> </ul>		<p>Triggers for groundwater decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars</p>
<p><b>Minor changes</b> in the ecosystem functionality of the swamps</p>	<p>Falls in soil moisture levels in swamps</p> <p><i>NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i></p>	<p><u>Level 1:</u> Soil moisture level lower than baseline level at <b>any</b> monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).</p> <p><u>Level 2:</u> Soil moisture level lower than baseline level at <b>50%</b> of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p> <p><u>Level 3:</u> Soil moisture level lower than baseline level at <b>&gt;80%</b> of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p>	<ul style="list-style-type: none"> <li>a) upfront mine planning</li> <li>b) soil moisture monitoring</li> <li>c) water spreading</li> <li>d) weeding</li> <li>e) fire management reporting</li> <li>g) update future predictions</li> </ul>		<p>Triggers of soil moisture decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars</p>



Table 2: Impacts and triggers since June 2023. Highlighted row indicates observations featured in this report.

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Report/s Dated
DA3C_LW21_001	Rock Fracturing	Outcrop	06/06/2023	1	Rock fracturing to a small rock outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_002	Rock Fracturing and Rock Movement	LW21_RO1	06/06/2023	2	Rock fracturing and rock movement to a small rock outcrop at Landscape Monitoring Site LW21_RO1.	9/06/2023
DA3C_LW21_003	Rock Fracturing and Rockfall	Outcrop and Step	06/06/2023	2	Rock fracturing and rockfall to an outcrop and a step west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_004	Rock Fracturing	Outcrop	06/06/2023	2	Rock fracturing on an outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_005	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracture on a rock outcrop northeast of <i>WC20</i> .	19/06/2023
DA3C_LW21_006	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracturing on a rock outcrop northeast of <i>WC20</i> .	19/06/2023
DA3C_LW21_007	Rock Fracturing and Rockfall	Outcrop	15/06/2023	2	Rock fracturing and rock fall on an outcrop northeast of <i>WC20</i> .	19/06/2023
DA3C_LW21_008	Rock Fracturing and Soil Cracking	Rock Step	19/06/2023	1	Rock fracturing/soil cracking to a rock step and bushland northeast of <i>WC20</i> .	20/06/2023
DA3C_LW21_009	Rock Fracturing	Rock Step	19/06/2023	1	Rock fracturing to a rock step west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_010	Rock Fracturing and Rock Movement/ Displacement	Outcrop	19/06/2023	2	Rock fracturing and associated rock movement/displacement at an outcrop west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_011	Rock Fracturing, Rock Displacement and Soil Cracking	Outcrop and Bushland	19/06/2023	1	Soil cracking, rock fracturing and associated rock displacement to an outcrop and bushland west of <i>Fire Road 6F</i> .	20/06/2023
144_01	Groundwater	Swamp 144	22/06/2023	3	Groundwater recession rate greater than baseline	28/06/2023
S144_01	Soil Moisture	Swamp 144	27/06/2023	3	Average soil moisture level below the baseline level	28/06/2023
DA3C_LW21_012	Rock Fracturing	Rock Step	27/06/2023	1	Rock fracturing to rock step west of <i>Fire Road 6F</i> .	28/06/2023
DA3C_LW21_013	Rock Fracturing	Outcrop	03/07/2023	1	Rock fracturing to rock outcrop west of <i>Fire Road 6F</i> .	04/07/2023
DA3C_LW21_014	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to rockbar on tributary <i>WC20</i> .	17/07/2023
DA3C_LW21_015	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to channel on tributary <i>WC20</i> .	17/07/2023

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Report/s Dated
DA3C_LW21_016	Rockfall	Rock Step	11/07/2023	1	Small rockfall to step north of tributary WC20.	17/07/2023
Swamp 15a	Groundwater	Swamp	12/07/2023	1	Groundwater trigger at one site in Swamp 15a. (Longwall 19 mining area)	17/07/2023
Swamp 15a	Soil Moisture	Swamp	12/07/2023	2	Soil moisture triggers at three sites within Swamp 15a. (Longwall 19 mining area)	17/07/2023
DA3C_LW21_016 (Update)	Rockfall	Rock Step	26/07/2023	2	Rockfall to step north of tributary WC20.	31/07/2023
DA3C_LW21_017	Rock Fracturing	Watercourse	26/07/2023	1	Rock fracturing and uplift to WC20_Rockbar 15.	31/07/2023
DA3C_LW21_018	Rock Fracturing	Rock Outcrop/Ledge	26/07/2023	1	Rock fracturing to rock outcrop/ledge.	31/07/2023
DA3C_LW21_019	Rock Fracturing	Rock Step	1/08/2023	1	Rock fracturing to rock step west of Fire Road 6F.	2/08/2023
DA3C_LW21_020	Iron Staining	Watercourse	1/08/2023	1	Iron staining in tributary WC24.	2/08/2023
DA3C_LW21_021	Iron Staining	Rock Step	1/08/2023	1	Iron staining on the Swamp 144 basal step. Reported under the Watercourse TARP as iron occurs in the general drainage line and headwaters of WC20.	2/08/2023
DA3C_LW21_022	Rockfall	Rock Step	7/08/2023	1	Rockfall to rock outcrop/step west of Fire Road 6F	9/08/2023
Swamp 145	Soil Moisture	Swamp	4/08/2023	3	Soil moisture trigger at one site in Swamp 145	9/08/2023
Swamp 9	Groundwater	Swamp	4/08/2023	2	Groundwater trigger at one site in Swamp 9	9/08/2023
Swamp 15a (update)	Soil Moisture	Swamp	11/08/2023	3	Soil moisture trigger recorded two additional sites (total now five) in Swamp 15a.	18/08/2023

## **CONSULTATION**

### **Summary of consultation undertaken in relation to the subsidence impact report**

The impact report was emailed to DPE, WaterNSW, BCD and the Resources Regulator on 18 August 2023 for review and feedback.

The Resources Regulator responded via email on 18 August 2023 and issued reference number MAAG0016513 indicating that an assessment officer would be in contact should further information be required. No further correspondence was received.

WaterNSW responded via email with a letter dated 30 August 2023 with a combined response to three impact reports from 17 and 31 July and 18 August 2023 as detailed below. Correspondence is provided in Attachment 1.

BCD responded via email with a letter dated 30 August 2023 requesting further data. Correspondence is provided in Attachment 2.

### **Summary of the comments received during consultation**

#### ***WaterNSW***

WaterNSW responded to impact reports dated 17 and 31 July and 18 August 2023 noting impacts to Swamp 144 and Swamp 15a:

- Level 3 trigger for Swamp 144 (Longwall 21) - groundwater recession rate greater than baseline and average soil moisture level below the baseline level. There is one monitoring location in Swamp 144.
- Level 2 trigger for Swamp 15a (Longwall 19) - soil moisture level lower than baseline level at 50% of monitoring sites reported on 31 July; and
- Level 3 trigger for Swamp 15a (Longwall 19) - soil moisture level lower than baseline level at 80% of monitoring sites reported on 18 August.

WaterNSW expressed concern that the performance measures for Swamps 144 and 15a will be exceeded and that these Level 3 triggers occurred at distances greater than 61 m from Longwall 21 and 19 footprints suggesting the 61 m setback distance from Longwalls is inadequate to prevent hydrological impacts to swamps over Dendrobium Mine and warrant further and more rigorous assessment.

#### ***Biodiversity and Conservation Division (BCD)***

BCD responded via email with a letter dated 30 August 2023 requesting further data:

- For Swamp 15A, all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby.

### **Summary of actions taken by Illawarra Metallurgical Coal in response to comments received during consultation**

In response to comments and recommendations from WaterNSW and BCD, IMC have undertaken the following actions:

- IMC responded to WaterNSW 8 September 2023 by providing supporting reports by Watershed HydroGeo regarding a review of distance to swamp impacts . Note: This review and supporting reports were also provided in response to previous WaterNSW concerns in regards to Impact Report dated 14 March 2023. These reports were also uploaded to the Major Projects Planning Portal.
- Data requested by BCD in letter dated 30 August 2023 was uploaded to the BCD MoveItCloud folder on 3 October 2023.

IMC will implement the corrective management actions (CMAs) as detailed within this impact report.

Email correspondence is provided in the Attachments

**ATTACHMENT 1 – Correspondence with WaterNSW**

30 August 2023

Contact: *Maria Dubikova*

email: *environmentalassessments@waternsw.com.au*

Our ref: *D2023/63840*

Linda Zano tto  
Principal Approvals  
Illawarra Metallurgical Coal  
Email: [Linda.Zano tto@South32.net](mailto:Linda.Zano tto@South32.net)

Dear Ms Zano tto

### **Subsidence Impact Reports - Swamps 144 and 15a**

According to the TARP action plan IMC is required to report all identified landscape impacts to key stakeholders. WaterNSW has received Subsidence Impacts Reports dated 17/07/2023, 31/07/2023 and 18/08/2023 that identified:


- Level 3 trigger for Swamp 144 (Longwall 21) - groundwater recession rate greater than baseline and average soil moisture level below the baseline level. There is one monitoring locations in Swamp 144.
- Level 2 trigger for Swamp 15a (Longwall 19) - soil moisture level lower than baseline level at 50% of monitoring sites reported on 31 July; and
- Level 3 trigger for Swamp 15a (Longwall 19) - soil moisture level lower than baseline level at 80% of monitoring sites reported on 18 August.

While soil moisture and groundwater levels are not specifically linked to a swamp performance measure, WaterNSW considers that observed decline in soil moisture and groundwater levels are early and reliable indicators of irreversible changes in swamp hydrology on which ecosystem functionality is dependent. WaterNSW is concerned that a performance measure of minor environmental consequences for Swamp 144 and negligible environment consequences for Swamp 15a will be exceeded.

Moreover, the reported Level 3 exceedances for Swamp 144 and Swamp 15a occurred at distances greater than 61 m from Longwall 21 and Longwall 19 footprints. These monitoring results indicate that the 61m setback distance from longwalls is inadequate to prevent hydrological impacts to swamps over Dendrobium mine and warrant further and more rigorous assessment.

Please feel free to contact Maria Dubikova if you would like to discuss any of the above matters further.

Yours sincerely

A handwritten signature in blue ink that reads "Girja Sharma".

**Girja Sharma**  
Catchment Assessments Manager



**From:** [Zanotto, Linda](#)  
**To:** [Camilla Edmunds](#); [Maria Dubikova](#); [Girja Sharma](#); [Glen Capararo](#); [Ravi Sundaram](#)  
**Cc:** [Brassington, Gary](#); [gabrielle.allan@dpie.nsw.gov.au](mailto:gabrielle.allan@dpie.nsw.gov.au)  
**Subject:** Dendrobium Mine - Review of distance to swamp impacts  
**Date:** Friday, 8 September 2023 12:17:00 PM  
**Attachments:** [Ltr WaterNSW - DA3 Distance to Swamp Impacts\\_08092023.pdf](#)  
[Att 1 - Dendrobium Area 3A Update Report 230314\\_V2.pdf](#)  
[Att 2 - WaterNSW letter - Dendrobium Impact Report 231314.pdf](#)  
[Att 3 - 20230706c\\_ImpactReport-Hydrology-Swamp35b01\\_and 15a\\_19.pdf](#)  
[Att 4 - R053c\\_Dendrobium-Distance to Swamp Impacts to June2023.pdf](#)

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Dear Camilla,

Please find attached letter and supporting reports in relation to WaterNSW request regarding a review of distance to swamp impacts in Subsidence Impact Report dated 14 March 2023.

If you have any questions, please don't hesitate to reach out.

Kind Regards,

**Linda Zanotto**  
Principal Mining Approvals  
Illawarra Metallurgical Coal

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[south32.net](http://south32.net)



**ATTACHMENT 2 –Correspondence with BCD**

Ms Linda Zanotto  
Illawarra Metallurgical Coal

By email: [Linda.Zanotto@South32.net](mailto:Linda.Zanotto@South32.net)

**Re: Dendrobium Area 3A – Impact report – 18<sup>th</sup> August 2023**

Dear Linda

I refer to the Dendrobium 3A Impact Report for 18<sup>th</sup> August 2023. This Report detailed the following impacts:

- Swamp 15a (update) Soil moisture trigger recorded at two additional sites (total now five) in Swamp 15a, Level 3 trigger

Further data is required for BCD analysis. Please send us the following raw data, in excel format:

- For Swamp 15A, all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby.

In addition to the above, please send current files for the following data requested previously:

1. For swamps 144, WC 20, WC24, WC24A: all monitoring data, including groundwater, soil moisture, flow data and pool data.
2. All vegetation data from all swamps at Dendrobium Area 3, especially Swamp 15A, S144, S 148, S34, S35a, S35b, S7, S150, S151.

If you wish to discuss, please contact Vanessa Allen, Senior Conservation Planning Officer, on 0242244186 or at [Vanessa.Allen@environment.nsw.gov.au](mailto:Vanessa.Allen@environment.nsw.gov.au).

Yours sincerely



Vanessa Allen date: 30/8/2023

**Senior Conservation Planning Officer (Planning Illawarra)  
Biodiversity and Conservation Division**

**From:** [Zanotto, Linda](#)  
**To:** [Vanessa Allen](#)  
**Cc:** [Chris Page](#)  
**Subject:** RE: Dendrobium Area 3C Impact reports 8092023 14082023  
**Date:** Tuesday, 3 October 2023 3:05:00 PM  
**Attachments:** [image001.png](#)

Hi Vanessa,

Requested data packs are currently being uploaded to the MoveItCloud folder - refer to table below. You should receive confirmation emails when these are available. Please let me know if you do not receive these today.

Impact Report Date	Request Doc	Data	Data Files/Comments	Collated Data Pack
19/05/2023	BCD Response Dendrobium Area 3A - 9th May 2023.pdf	Raw data in excel format - All data for Swamp 148	See folders: Swamp GW; Soil Moisture	September_2023.zip
n/a	n/a	Longwall 19 End of Panel Data Pack	LW19 EoP Data Pack.zip	LW19 EoP Data Pack.zip
28/06/2023	BCD Response - Dendrobium Area 3C - 28th June 2023.pdf	Groundwater for Swamps 7, 9, 144, 145	See folder: Swamp GW.	September_2023.zip
		Bores <del>51845</del> and 51892	See 51892_dend 99 (1).xlsx <i>51845 no longer monitored as previously advised.</i>	September_2023.zip
17/07/2023	BCD Response - Dendrobium Area 3A and 3C - 17th July 2023.pdf	For WC20 and Swamp 144 all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water	September_2023.zip
		For Swamp 15A, all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby	See folders: Swamp GW; Soil Moisture; Surface Water; Sandstone Boreholes	September_2023.zip
		All vegetation data from all swamps at Dendrobium Area 3, especially Swamp 15A, S144, S148, S34, S35a, S7, S150, S151	See Ecology folder in September 2023 data pack and Terrestrial Ecology folder in LW19 EoP data pack	September_2023.zip
31/07/2023	BCD Response Dendrobium Area 3C - 31st July 2023	Raw Data in excel format: For WC20 and Swamp 144 all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
2/08/2023		Raw Data in excel format: For Swamps 144, WC20, WC24, WC24A: all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
9/08/2023		Raw Data in excel format: For Swamps 144, 145 and 9, all monitoring data, including groundwater, soil moisture and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
18/08/2023	BCD Response - Dendrobium Area 3A and 3C - 18th August 2023.pdf	For Swamp 15A, all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby	See folders: Swamp GW; Soil Moisture; Surface Water; Sandstone Boreholes	September_2023.zip
		For Swamps 144, WC20, WC24, WC24A: all monitoring data, including groundwater, soil moisture, flow data and pool data	See folders: Swamp GW; Soil Moisture; Surface Water.	September_2023.zip
		All vegetation data from all swamps at Dendrobium Area 3, especially Swamp 15A, S144, S148, S34, S35a, S7, S150, S151	See Ecology folder in September 2023 data pack and Terrestrial Ecology folder in LW19 EoP data pack	September_2023.zip
4/09/2023	BCD Response Dendrobium Area 3 - 4th September 2023.pdf	For Swamps 12, 150, 9: all monitoring data, including groundwater, soil moisture and hard rock piezometer data both in the swamp and nearby.	See folders: Swamp GW; Soil Moisture; Surface Water; Sandstone Boreholes	September_2023.zip
		GIS shapefiles for all swamps in Area 3	See Swamp Shapefile folder	September_2023.zip

Kind Regards,  
Linda

**Linda Zanotto**  
 Principal Mining Approvals  
 Illawarra Metallurgical Coal

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-----Original Message-----

From: Vanessa Allen <Vanessa.Allen@environment.nsw.gov.au>  
 Sent: Tuesday, 19 September 2023 3:30 PM  
 To: Zanotto, Linda <Linda.Zanotto@south32.net>  
 Cc: Chris Page <Chris.Page@environment.nsw.gov.au>  
 Subject: Dendrobium Area 3C Impact reports 8092023 14082023

Hi Linda

Please see attached BCD responses to Impact Reports

Regards, Vanessa

Vanessa Allen  
Senior Conservation Planning Officer

Biodiversity and Conservation Division | Department of Planning and Environment T 02 42244186 |  
E [Vanessa.Allen@environment.nsw.gov.au](mailto:Vanessa.Allen@environment.nsw.gov.au)  
Level 1, 84 Crown street, Wollongong NSW 2500 PO Box 514, Wollongong NSW 2520  
<https://aus01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.dpie.nsw.gov.au%2F&data=05%7C01%7CLinda.Zanotto%40south32.net%7C28dc21e2b249461ce0f308dbb8d18708%7Cd05d5e5b385d4774b496d0cf85bfa5f4%7C1%7C0%7C638306982430079924%7CUnknown%7CTWFpbGZsb3d8eyJWljojMC4wLjAwMDAiLCJQjoiV2luMzliLCJBTiI6I1haWwiLCJXVCi6Mn0%3D%7C3000%7C%7C&sdata=qwv3%2BUPIS9LbDuplhjkjKBMk5HyjaW%2Fjg7%2BDVaNZb9Y%3D&reserved=0>

Office is located on Dharawal Country  
The Department of Planning and Environment acknowledges that it stands on Aboriginal land. We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment and Heritage.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL



**From:** [Carlton, Josh via South32 Notification Service](#)  
**To:** [Zanotto, Linda](#)  
**Subject:** New File in Folder "BCD"  
**Date:** Tuesday, 3 October 2023 2:43:43 PM  
**Attachments:** [ATT00001.png](#)

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## New File Notification

A new file has arrived into the "/ Illawarra Coal - Energy and Engineering / BCD" folder.

**Name:** September\_2023.zip  
**Tracking ID:** 995948500  
**Original Size:** 162,511,234 bytes



*For non-repudiation purposes, it has been confirmed that the file received by MOVEit Transfer is IDENTICAL to the file uploaded by Carlton, Josh.*

Please use the following URL and your username/password to DOWNLOAD or view the current status of this file, including its full upload and download history.

( [https://south32.moveitcloud.com/human.aspx?  
OrgID=9904&Arg12=fileview&Arg07=995948500&Arg06=957756355](https://south32.moveitcloud.com/human.aspx?OrgID=9904&Arg12=fileview&Arg07=995948500&Arg06=957756355) )

Regards,  
South32 Notification Service

Monitoring of watercourses, swamps and landscape features is undertaken to identify subsidence impacts. These features are monitored by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to mining, weekly during mining and monthly during the post-mining period. Monitoring is conducted in accordance with the approved Longwall 18, Longwall 19 and Longwall 21 Subsidence Managements Plans (SMP). Extraction of Longwall 18 started on 2 December 2021 and was completed on 17 May 2022, extraction of Longwall 19 started on 19 June 2022 and was completed on 29 March 2023, and extraction of Longwall 21 started on 25 April 2023 and was completed on 6 August 2023. During the latest inspection for Longwall 21, two new subsidence impacts were identified. Recent analysis of shallow groundwater and soil moisture data in Swamp 12, Swamp 150 and Swamp 9 identified triggers at sites *S12\_04*, *S150\_01*, *09\_01*, *S09\_01* and *S09\_02*.

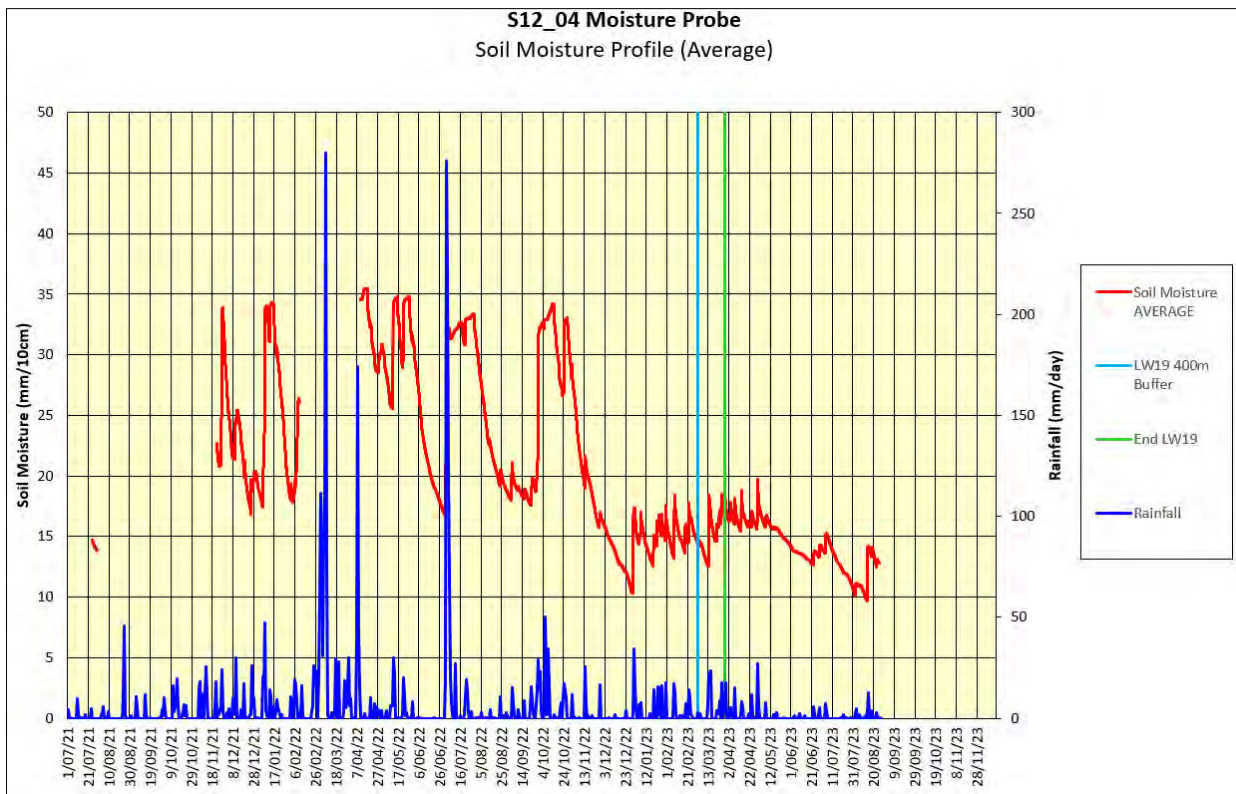
### Swamp 12 (Longwall 19)

A soil moisture trigger was identified at monitoring site *S12\_04* in Swamp 12 during recent analysis of moisture data. *S12\_04* is located 395 m north from the western end of Longwall 19 (Figure 1). The site entered the Longwall 19, 400m active mining area on 3 March 2023 and remained within the active mining area until the end of extraction. On 1 August 2023 the average soil moisture value receded below the lowest level recorded during the baseline monitoring period (Graph 1).

As *S12\_04* is the only soil moisture site in Swamp 12 within 400 m of Longwall 19 mining, these results contribute to a Level 3 trigger according to the Dendrobium Swamps TARP (Table 1), specifically:

**Level 3:** Soil moisture level lower than baseline level at >80% of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).

It is important to note that *S12\_04* has previously been within 400m of the active mining area during the extraction of Longwall 6, Longwall 7 and Longwall 8 (between 2010 and 2012). The baseline monitoring period for this site occurred during a period of unusually high rainfall in 2021 and 2022. In contrast, 2023 has been the driest year during the *S12\_04* monitored period and the third driest year-to-date in the 22 years of rainfall records from Cordeaux Colliery. There were no impacts recorded when the site was within the Longwall 19 active mining area.



Graph 1: Average soil moisture levels at site S12\_04, logged hourly, date range: 27/07/2021 to 25/08/2023

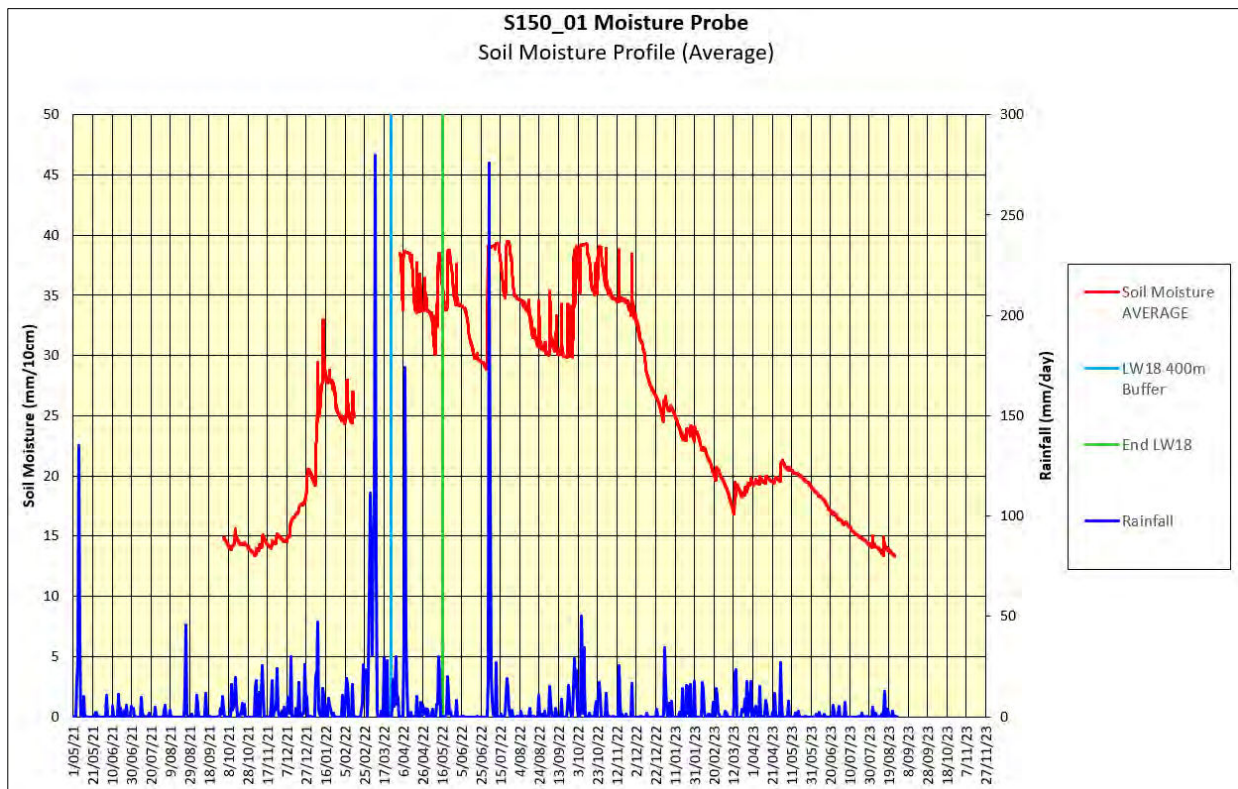
### Swamp 150 (Longwall 18)

A soil moisture trigger was identified at monitoring site *S150\_01* in Swamp 150 during recent analysis of soil moisture data. *S150\_01* is located 280 m south of the eastern end of Longwall 18 (Figure 2). The site entered the Longwall 18, 400m active mining area on 24 March 2022 and remained in the active mining area until the end of extraction. On 24 August 2023, (one year and three months after completion of Longwall 18), the average soil moisture value receded below the lowest level recorded during the baseline monitoring period (Graph 2).

As the soil moisture probe *S150\_01* is the only one installed in Swamp 150, these results contribute to a Level 3 trigger according to the Dendrobium Swamps TARP (Table 1), specifically:

**Level 3:** Soil moisture level lower than baseline level at >80% monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).

Monitoring for this site has predominately occurred during a period of unusually high rainfall in 2021 and 2022. In contrast, 2023 has been the driest year during the *S150\_01* monitored period and the third driest year-to-date in the 22 years of rainfall records from Cordeaux Colliery. There were no impacts recorded when the soil moisture probe was within the Longwall 18 active mining area.



Graph 2: Average soil moisture levels at site S150\_01, logged hourly, date range: 02/10/2021 to 25/08/2023

### Swamp 9 (Longwall 21)

Near-surface groundwater and soil moisture triggers were recorded in Swamp 9 (Piezometer 09\_01, moisture probes S09\_01 and S09\_02) during recent analysis of data.

Site 09\_01 is located 368 m east of the eastern end of Longwall 21 (Figure 3). The site was within the 400m active mining area between 25 April 2023 and 2 May 2023. On 25 August 2023 the water level in the borehole 09\_01 receded below the lowest level recorded during the baseline monitoring period (Graph 3) and on 28 August 2023 the average soil moisture value at S09\_01 receded below the lowest level recorded before mining (Graph 4).

Site S09\_02 is located 350 m east of the eastern end of Longwall 21 (Figure 3). The site was within the 400m active mining area between 25 April 2023 and 4 May 2023. On 1 August 2023 the average soil moisture value in the probe S09\_02 receded below the lowest level recorded before mining (Graph 5). The groundwater trigger in site 09\_02 was reported on 9 August 2023.

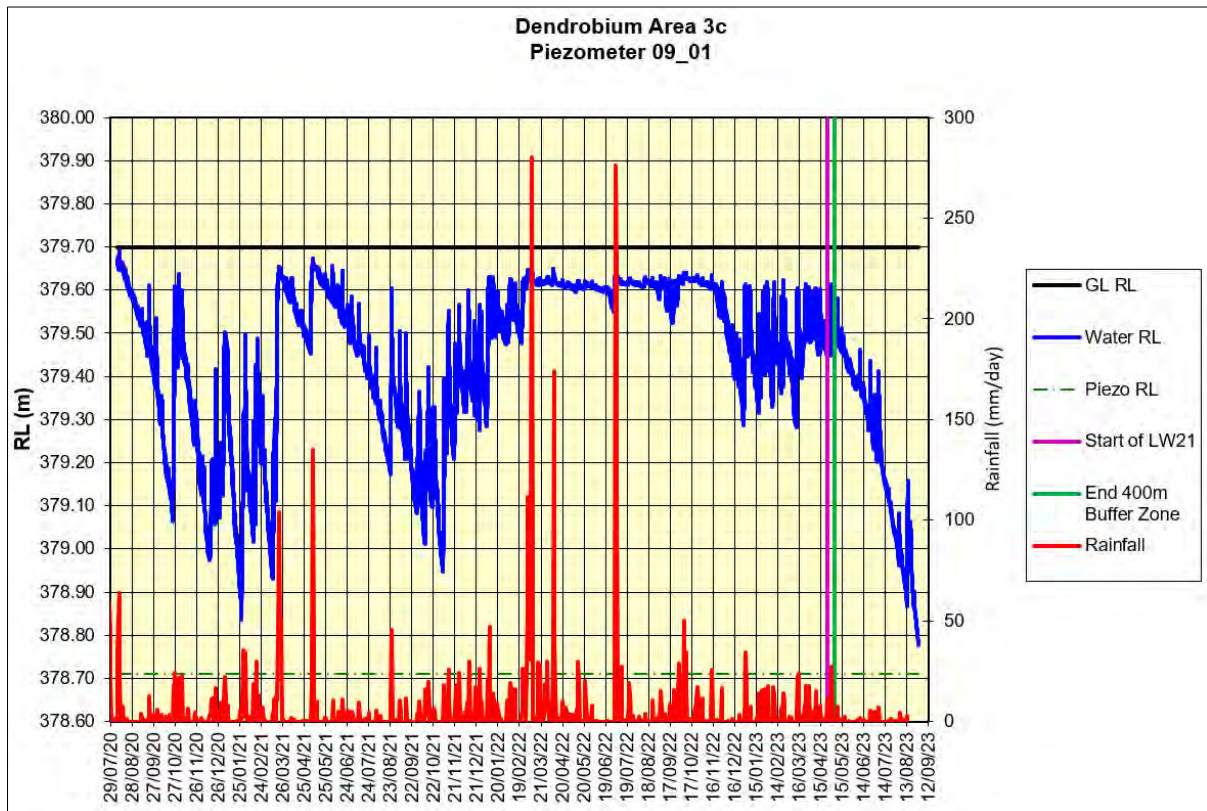
These results contribute to Level 3 groundwater and soil moisture triggers according to the SIMMCP (Table 1), specifically:

**Level 3:** Groundwater level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).

**Level 3:** Soil moisture level lower than baseline level at >80% monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).

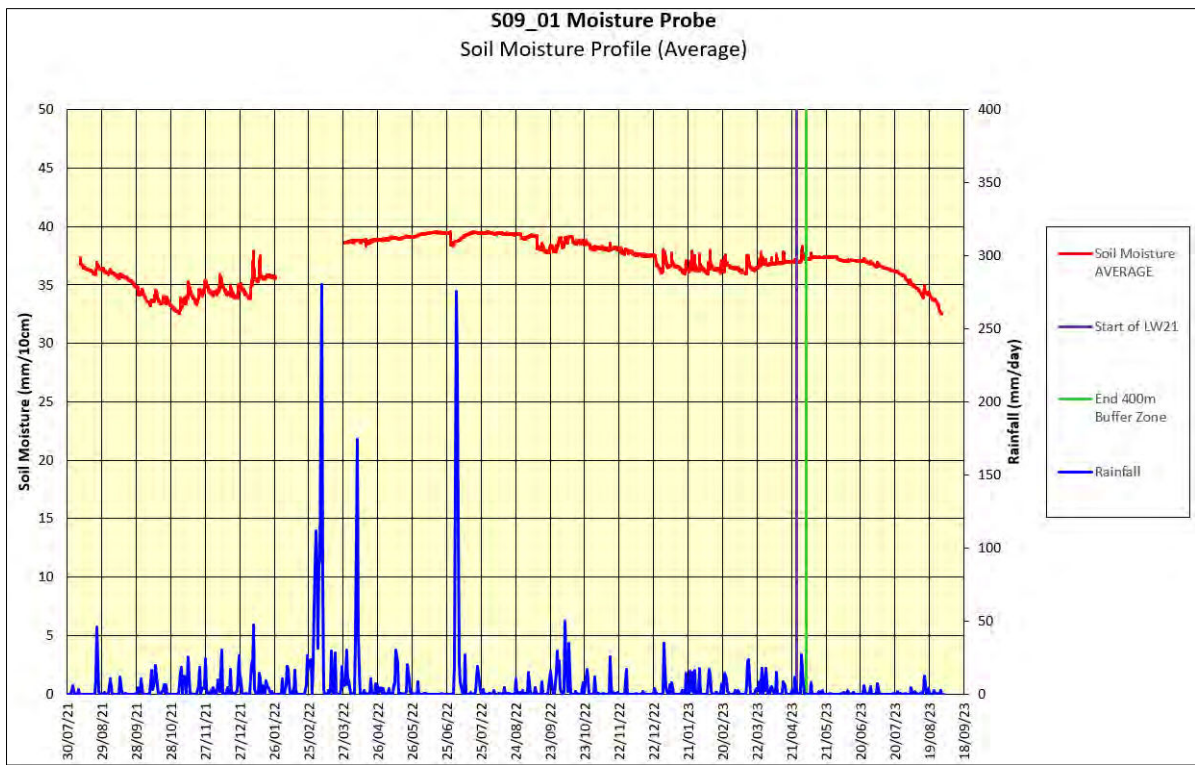
It is important to note the baseline monitoring period occurred during a period of unusually high rainfall.

The comparison of the results to reference swamps, stated in the TARP definition, will be undertaken as part of specialist analysis and reported as part of the four-monthly monitoring reporting and End of Panel reporting.

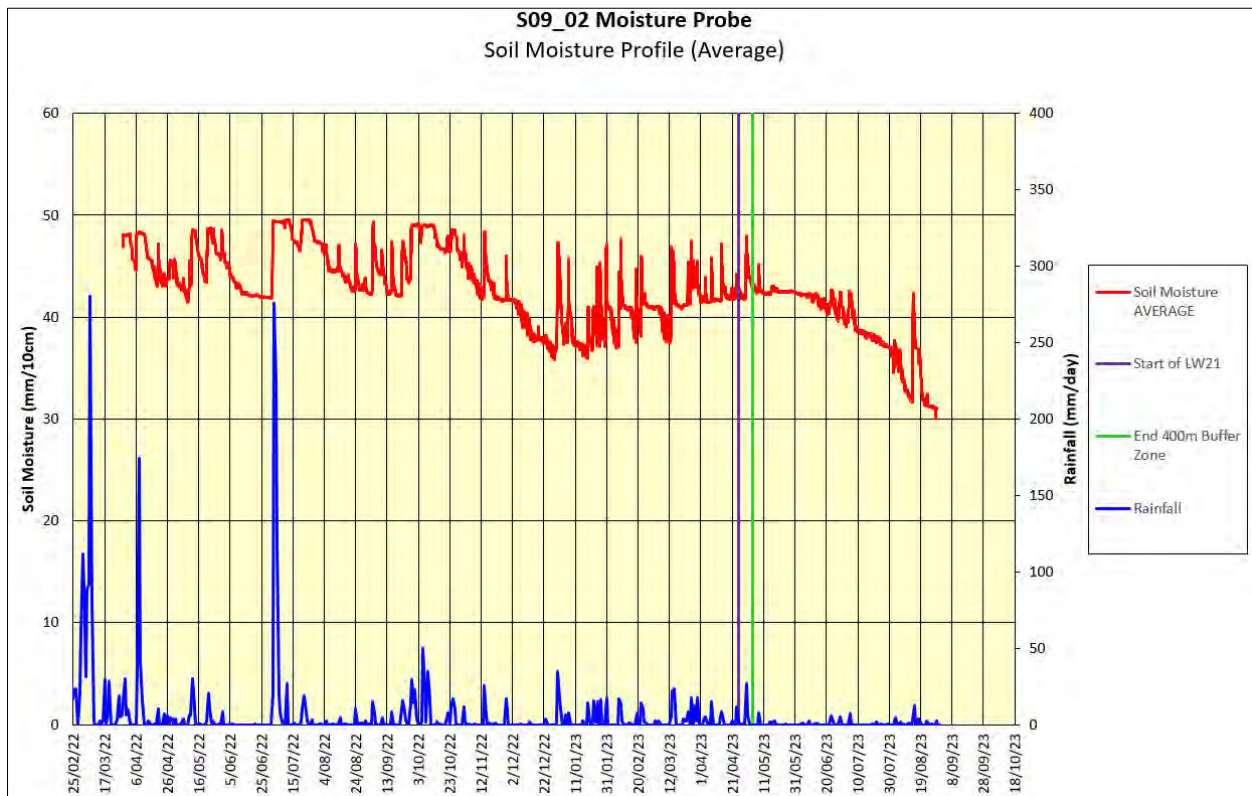


Graph 3: Shallow groundwater levels at 09\_01, logged hourly, date range: 07/08/2020 to 29/08/2023





Graph 4: Average soil moisture levels at site S09\_01, logged hourly, date range: 10/08/2021 to 29/08/2023.



Graph 5: Average soil moisture levels at site S09\_02, logged hourly, date range: 28/03/2022 to 29/08/2023



**DA3C\_LW21\_023 (E 291206, N 6194204)**

DA3C\_LW21\_023 is located approximately 100m north of tributary WC20 (Figure 3). The impact consists of a fracture to a rock outcrop (Photo 1 to Photo 3). The impact has a maximum continuous length of 2.10m, a maximum width of 0.004m and a maximum measurable depth of 1.30m.

DA3C\_LW21\_023 is a Level 1 trigger as per the Dendrobium Landscape TARP (Table 2), specifically:

- Crack or fracture up to 100mm width;
- Crack or fracture up to 10m length;



Photo 1: DA3C\_LW21\_023, section of the rock fracture. Taken: 31/08/2023.



Photo 2: DA3C\_LW21\_023, section of the rock fracture. Taken: 31/08/2023.



Photo 3: DA3C\_LW21\_023, maximum width of the rock fracture. Taken: 31/08/2023.



### DA3C\_LW21\_024 (E 291250, N 6194199)

DA3C\_LW21\_024 is located approximately 100m north of WC20 (Figure 3). The impact consists of a fracture to a rock outcrop (Photo 4 and Photo 5). The impact has a maximum continuous length of 3.80m and a maximum width of 0.005m.

DA3C\_LW21\_024 is a Level 1 trigger as per the Dendrobium Landscape TARP (Table 2), specifically:

- Crack or fracture up to 100mm width;
- Crack or fracture up to 10m length;



Photo 4: DA3C\_LW21\_024, section of the rock fracture.  
Taken: 31/08/2023.

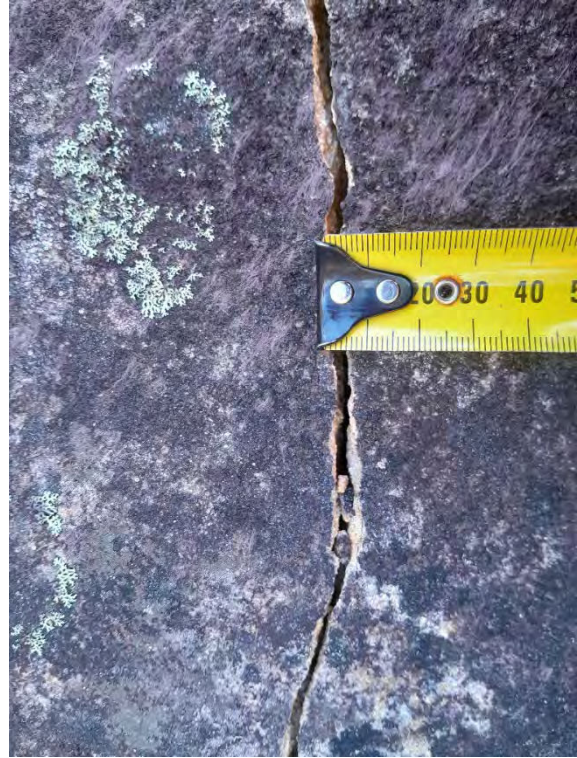


Photo 5: DA3C\_LW21\_024, maximum width of the rock fracture.  
Taken: 31/08/2023.

### Corrective Management Actions (CMAs)

The following management actions have been initiated:

- Continue monitoring program
- Submit an Impact Report to key stakeholders
- Seek advice on any other CMAs
- Report in the End of Panel Report
- Summarise actions and monitoring in AEMR



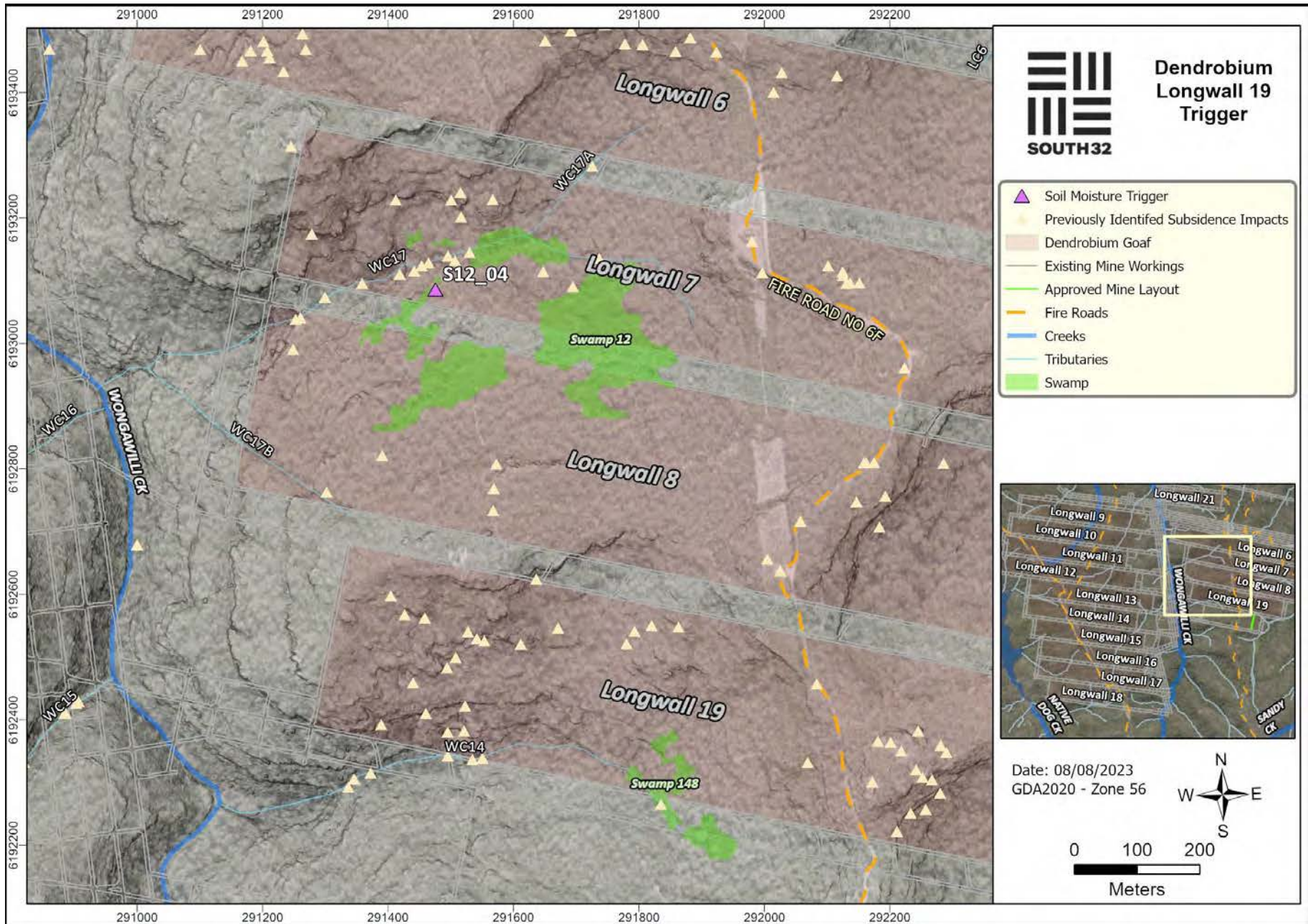


Figure 1: Map showing latest swamp triggers in Swamp 12. Inset shows frame in relation to Dendrobium mining operations.



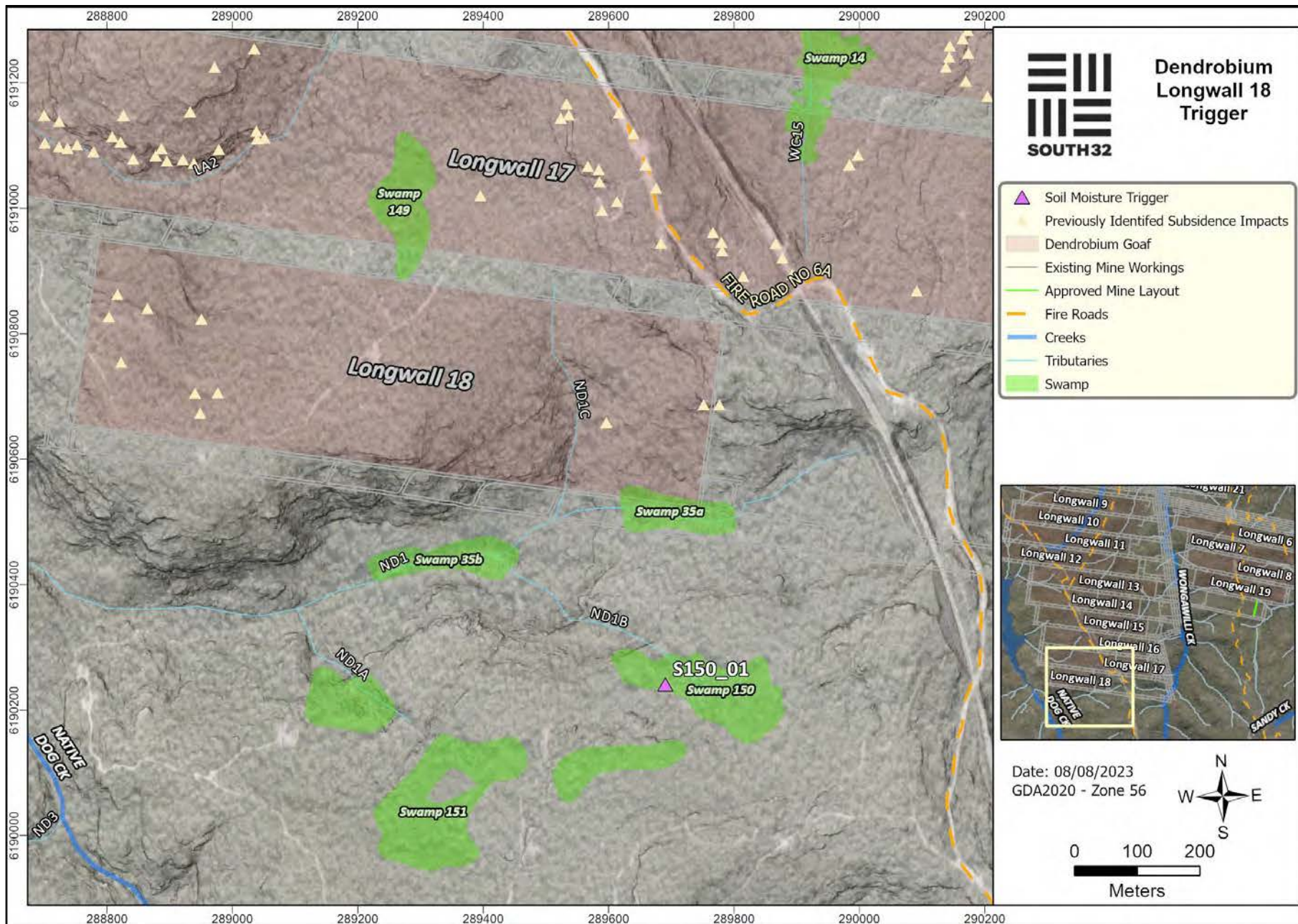


Figure 2: Map showing latest swamp triggers in Swamp 150. Inset shows frame in relation to Dendrobium mining operations.



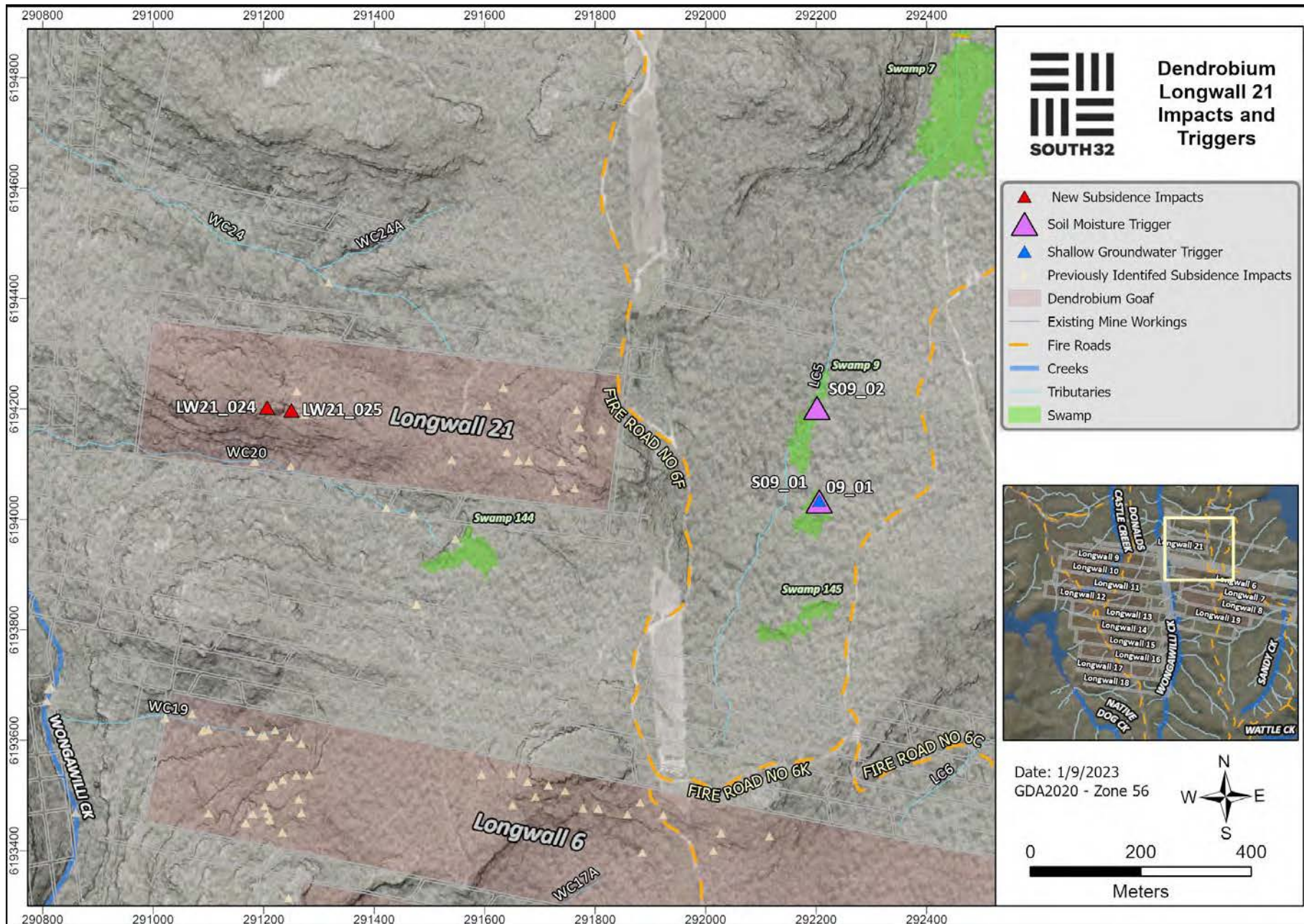


Figure 3: Map showing latest swamp triggers in Swamp 09. Inset shows frame in relation to Dendrobium mining operations.

Table 1: Extract from TARP of Dendrobium Swamp Impact, Monitoring, Management and Contingency Plan.

<p><b>Minor changes</b> in the ecosystem functionality of the swamps</p>	<p>Falls in surface or near-surface groundwater levels in swamps</p> <p><i>NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i></p>	<p><u>Level 1:</u> Groundwater level lower than baseline level at any monitoring site within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at any monitoring site (measured as average mm/day during the recession curve).</p> <p><u>Level 2:</u> Groundwater level lower than baseline level at <b>50%</b> of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at a <b>50%</b> of monitoring sites (within 400m of mining) within the swamp.</p> <p><u>Level 3:</u> Groundwater level lower than baseline level at <b>&gt;80%</b> of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or</p> <p>Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at <b>&gt;80%</b> of monitoring sites (within 400 m of mining) within the swamp.</p>	<ul style="list-style-type: none"> <li>a) upfront mine planning</li> <li>b) groundwater monitoring</li> <li>c) implementation of swamp research program</li> <li>d) weeding</li> <li>e) fire management</li> <li>f) reporting</li> <li>g) update future predictions</li> </ul>		<p>Triggers for groundwater decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars</p>
<p><b>Minor changes</b> in the ecosystem functionality of the swamps</p>	<p>Falls in soil moisture levels in swamps</p> <p><i>NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.</i></p>	<p><u>Level 1:</u> Soil moisture level lower than baseline level at <b>any</b> monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps).</p> <p><u>Level 2:</u> Soil moisture level lower than baseline level at <b>50%</b> of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p> <p><u>Level 3:</u> Soil moisture level lower than baseline level at <b>&gt;80%</b> of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps).</p>	<ul style="list-style-type: none"> <li>a) upfront mine planning</li> <li>b) soil moisture monitoring</li> <li>c) water spreading</li> <li>d) weeding</li> <li>e) fire management</li> <li>f) reporting</li> <li>g) update future predictions</li> </ul>		<p>Triggers of soil moisture decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars</p>



Table 2: Extract from Dendrobium Landscape TARP.

Monitoring	Trigger	Action
<b>LANDSCAPE FEATURES</b>		
<p><b>AREA 2</b></p> <p><b>Cliffs</b> A2-CL1 (above LW4)</p> <p><b>Steep Slopes</b> A2-SL1 and A2-SL2 (above LWs 4 &amp; 5)</p> <p><b>Watercourses</b> A2-WC10 and A2-WC11 (above LW3) A2-WC13 &amp; A2-WC16 (above LWs 4 &amp; 5)</p> <p><b>Swamp</b> A2-SW1 (above LWs 4 &amp; 5)</p> <p><b>4WD Track</b> A2-FT1 (above LWs 4 &amp; 5)</p> <p><b>Crininite Surface Extent</b> A2-CN1 &amp; A2-CN2 (above LWs 3 &amp; 4)</p>	<p><b>Level 1 *</b></p> <ul style="list-style-type: none"> <li>Rock fall from a cliff which is left mostly intact (&lt;10% length), resulting in insignificant ground disturbance</li> <li>Surface movement or rock displacement with negligible soil surface exposed</li> <li>Crack at the surface, which should not result in any significant erosion or further ground movement</li> <li>Crack in a fire trail which should not result in erosion or impede access</li> <li>Crack or fracture up to 100mm width</li> <li>Crack or fracture up to 10m length</li> <li>Erosion in a localised area which would be expected to naturally stabilise without CMA and within the period of monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Continue monitoring program</li> <li>Report impacts to key stakeholders</li> <li>Summarise impacts and Report in the End of Panel Report and AEMR</li> </ul>
<p><b>AREA 3A</b></p> <p><b>Cliffs</b> All mapped cliff sites in subsidence area (Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites)</p> <p><b>Steep Slopes</b> All mapped steep slopes in subsidence area Refer to Dendrobium Area 3A SMP Figures 19.3 for location of sites</p> <p><b>Watercourses/ Swamps</b> All mapped watercourse and swamps in subsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p><b>Fire Trails</b> All mapped fire trails in subsidence area Refer to Dendrobium Area 3A SMP Figure 19.3</p> <p><b>AREA 3B</b></p> <p><b>Cliffs</b> All mapped cliff sites in subsidence area Refer to Dendrobium Area 3B SMP Figures 18.1 for location of sites</p>	<p><b>Level 2 *</b></p> <ul style="list-style-type: none"> <li>Rock fall or overhang collapse at a cliff site, where characteristics of the cliff have changed, and there has been significant ground disturbance</li> <li>Surface movement or rock displacement that has exposed significant areas of soil</li> <li>A crack at the surface, which could result in significant erosion or movement at the surface</li> <li>A crack at the surface with potential risk to safety and/or fauna entrapment</li> <li>A crack in the fire trail, which could result in significant erosion or impede vehicle access</li> <li>Crack or fracture between 100 and 300mm width</li> <li>Crack or fracture between 10 and 50m length</li> <li>Significant erosion at any location, which is not likely to naturally stabilise within the period of monitoring, or is located in a sensitive area e.g. swamps, creek, lake shore, and may result in increased sediment transport to Cordeaux Dam, or has been previously identified as Level 1, but is not likely to naturally stabilise within the monitoring period</li> </ul>	<ul style="list-style-type: none"> <li>Actions as stated for Level 1</li> <li>Review monitoring frequency</li> <li>Notify relevant technical specialists and seek advice on any CMA required</li> <li>Provide safety signage and barricades as appropriate</li> <li>Implement approved repairs to ensure safety and serviceability on fire trails</li> <li>Implement agreed CMAs as approved</li> </ul> <p><i>Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts</i></p>
	<p><b>Level 3 *</b></p> <ul style="list-style-type: none"> <li>Major cliff collapse where the characteristics of the cliff change significantly and there is significant ground disturbance that is unlikely to naturally stabilise within the monitoring period</li> </ul>	<ul style="list-style-type: none"> <li>Actions as stated for Level 2</li> <li>Immediately notify DoPI, DPIM, SCA, resource managers and relevant technical specialists and seek advice on any CMA required</li> <li>Site visits with stakeholders if required</li> </ul>

Table 3: Impacts and triggers since June 2023. Highlighted row indicates observations featured in this report.

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Report/s Dated
DA3C_LW21_001	Rock Fracturing	Outcrop	06/06/2023	1	Rock fracturing to a small rock outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_002	Rock Fracturing and Rock Movement	LW21_RO1	06/06/2023	2	Rock fracturing and rock movement to a small rock outcrop at Landscape Monitoring Site LW21_RO1.	9/06/2023
DA3C_LW21_003	Rock Fracturing and Rockfall	Outcrop and Step	06/06/2023	2	Rock fracturing and rockfall to an outcrop and a step west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_004	Rock Fracturing	Outcrop	06/06/2023	2	Rock fracturing on an outcrop west of <i>Fire Road 6F</i> .	9/06/2023
DA3C_LW21_005	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracture on a rock outcrop northeast of <i>WC20</i> .	19/06/2023
DA3C_LW21_006	Rock Fracturing	Outcrop	15/06/2023	1	Rock fracturing on a rock outcrop northeast of <i>WC20</i> .	19/06/2023
DA3C_LW21_007	Rock Fracturing and Rockfall	Outcrop	15/06/2023	2	Rock fracturing and rock fall on an outcrop northeast of <i>WC20</i> .	19/06/2023
DA3C_LW21_008	Rock Fracturing and Soil Cracking	Rock Step	19/06/2023	1	Rock fracturing/soil cracking to a rock step and bushland northeast of <i>WC20</i> .	20/06/2023
DA3C_LW21_009	Rock Fracturing	Rock Step	19/06/2023	1	Rock fracturing to a rock step west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_010	Rock Fracturing and Rock Movement/ Displacement	Outcrop	19/06/2023	2	Rock fracturing and associated rock movement/displacement at an outcrop west of <i>Fire Road 6F</i> .	20/06/2023
DA3C_LW21_011	Rock Fracturing, Rock Displacement and Soil Cracking	Outcrop and Bushland	19/06/2023	1	Soil cracking, rock fracturing and associated rock displacement to an outcrop and bushland west of <i>Fire Road 6F</i> .	20/06/2023
144_01	Groundwater	Swamp 144	22/06/2023	3	Groundwater recession rate greater than baseline	28/06/2023
S144_01	Soil Moisture	Swamp 144	27/06/2023	3	Average soil moisture level below the baseline level	28/06/2023
DA3C_LW21_012	Rock Fracturing	Rock Step	27/06/2023	1	Rock fracturing to rock step west of <i>Fire Road 6F</i> .	28/06/2023
DA3C_LW21_013	Rock Fracturing	Outcrop	03/07/2023	1	Rock fracturing to rock outcrop west of <i>Fire Road 6F</i> .	04/07/2023
DA3C_LW21_014	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to rock-bar on tributary <i>WC20</i> .	17/07/2023
DA3C_LW21_015	Rock Fracturing	Watercourse	11/07/2023	2	Rock fracturing to channel on tributary <i>WC20</i> .	17/07/2023

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Report/s Dated
DA3C_LW21_016	Rockfall	Rock Step	11/07/2023	1	Small rockfall to step north of tributary WC20.	17/07/2023
Swamp 15a	Groundwater	Swamp	12/07/2023	1	Groundwater trigger at one site in Swamp 15a. (Longwall 19 mining area)	17/07/2023
Swamp 15a	Soil Moisture	Swamp	12/07/2023	2	Soil moisture triggers at three sites within Swamp 15a. (Longwall 19 mining area)	17/07/2023
DA3C_LW21_016 (Update)	Rockfall	Rock Step	26/07/2023	2	Rockfall to step north of tributary WC20.	31/07/2023
DA3C_LW21_017	Rock Fracturing	Watercourse	26/07/2023	1	Rock fracturing and uplift to WC20_Rockbar 15.	31/07/2023
DA3C_LW21_018	Rock Fracturing	Rock Outcrop/Ledge	26/07/2023	1	Rock fracturing to rock outcrop/ledge.	31/07/2023
DA3C_LW21_019	Rock Fracturing	Rock Step	1/08/2023	1	Rock fracturing to rock step west of Fire Road 6F.	2/08/2023
DA3C_LW21_020	Iron Staining	Watercourse	1/08/2023	1	Iron staining in tributary WC24.	2/08/2023
DA3C_LW21_021	Iron Staining	Rock Step	1/08/2023	1	Iron staining on the Swamp 144 basal step. Reported under the Watercourse TARP as iron occurs in the general drainage line and headwaters of WC20.	2/08/2023
DA3C_LW21_022	Rockfall	Rock Step	7/08/2023	1	Rockfall to rock outcrop/step west of Fire Road 6F	9/08/2023
S145_01	Soil Moisture	Swamp	4/08/2023	3	Soil moisture trigger at one site in Swamp 145	9/08/2023
09_02	Groundwater	Swamp	4/08/2023	2	Groundwater trigger at one site in Swamp 9	9/08/2023
Swamp 15a (update)	Soil Moisture	Swamp	11/08/2023	3	Soil moisture trigger recorded two additional sites (total now five) in Swamp 15a.	18/08/2023
S12_04	Soil Moisture	Swamp	29/08/2023	3	Soil moisture trigger recorded in Swamp 12 (Longwall 19 mining area).	4/09/2023
S150_01	Soil Moisture	Swamp	29/08/2023	3	Soil moisture trigger recorded in Swamp 150 (Longwall 18 mining area).	4/09/2023
09_01	Groundwater	Swamp	30/08/2023	3	Groundwater trigger at second site in Swamp 9 (Longwall 21 mining area).	4/09/2023
S09_01	Soil Moisture	Swamp	30/08/2023	3	Soil moisture trigger recorded in Swamp 9 (Longwall 21 mining area).	4/09/2023
S09_02	Soil Moisture	Swamp	30/08/2023	3	Soil moisture trigger recorded in Swamp 9 (Longwall 21 mining area).	4/09/2023

Site ID	Impact/Trigger Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Report/s Dated
<i>DA3C_LW21_023</i>	Rock Fracturing	Rock Outcrop	31/08/2023	1	Rock fracturing to a rock outcrop north of tributary WC20.	4/09/2023
<i>DA3C_LW21_024</i>	Rock Fracturing	Rock Outcrop	31/08/2023	1	Rock fracturing to a rock outcrop north of tributary WC20.	4/09/2023

Monitoring of watercourses, swamps and landscape features is undertaken to identify subsidence impacts. These features are monitored by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to mining, weekly during mining and monthly during the post-mining period. Monitoring is conducted in accordance with the approved Longwall 21 Subsidence Management Plan (SMP). Extraction of Longwall 21 started on 25 April 2023 and was completed on 6 August 2023. During the latest inspection for Longwall 21, five new subsidence impacts were identified.

***DA3C\_LW21\_025 (E 291112, N 6194193)***

*DA3C\_LW21\_025* is located approximately 80m north of tributary WC20 (Figure 1). The impact consists of fracturing, rockfall and rock displacement to a rock overhang and outcrop (Photo 1 to Photo 3). Some of the measurements have been estimated due to safety concerns. The impact has a maximum continuous length of  $\approx 5$ m, a maximum width of  $\approx 0.03$ m. Total rockfall volume was estimated to be  $\approx 0.7$ m<sup>3</sup>. Caution tape barricading is in place at the site as a safety precaution.

*DA3C\_LW21\_025* is a Level 1 trigger as per the Dendrobium Landscape TARP (Table 1), specifically:

- Crack or fracture up to 100mm width;
- Crack or fracture up to 10m length;
- Rockfall from a cliff which is left mostly intact resulting in insignificant ground disturbance.





Photo 1: DA3C\_LW21\_025, section of the rock fracture in overhang. Taken: 06/09/2023.



Photo 2: DA3C\_LW21\_025, section of the rock fracture. Taken: 06/09/2023.



Photo 3: DA3C\_LW21\_025, section of the rock fracture. Taken: 06/09/2023.



**DA3C\_LW21\_026 (E 291034, N 6194170)**

DA3C\_LW21\_026 is located approximately 50m north of tributary WC20 (Figure 1). The impact consists of a rockfall and rock fracturing to a rock overhang (Photo 4 to Photo 7). Some measurements were estimated due to safety concerns. The rockfall volume was estimated to be  $\approx 1\text{m}^3$  in total, the rock fracturing has a maximum length of 1.7m and maximum width of 0.032m.

DA3C\_LW21\_026 is a Level 1 trigger as per the Dendrobium Landscape TARP (Table 1), specifically:

- Crack or fracture up to 100mm width;
- Crack or fracture up to 10m length;
- Rockfall from a cliff which is left mostly intact resulting in insignificant ground disturbance.



Photo 4: DA3C\_LW21\_026, section of rock fracture and rockfall. Taken 06/09/2023



Photo 5: DA3C\_LW21\_026, close up section of rockfall. Taken 06/09/2023.



Photo 6: DA3C\_LW21\_026, section of rock fracture and rockfall. Taken 06/09/2023



Photo 7: DA3C\_LW21\_026, Width of rock fracture. Taken 06/09/2023