

14 April 2023

Reference No. PS135469-002-L-Rev0

Hunny Churcher
Dixon Sand Pty Ltd

REVIEW OF MAXIMUM EXTRACTION DEPTH FOR HAERSES ROAD QUARRY - DA 165-7-2005

Dear Hunny,

1.0 INTRODUCTION

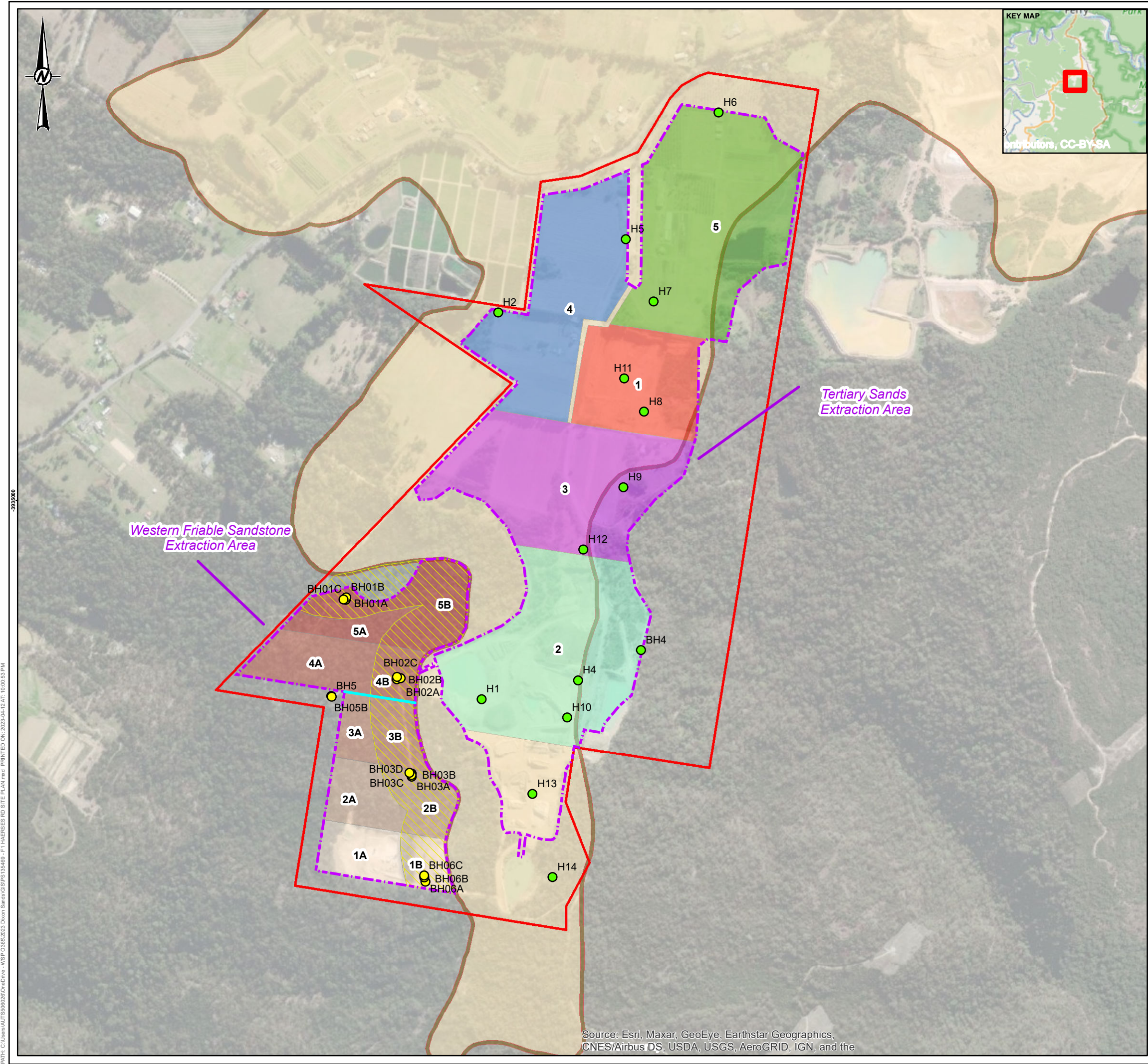
Dixon Sand Pty Ltd (Dixon Sand) operates the Haerses Road Quarry, Maroota, north of greater Sydney. The site covers 128 ha and straddles Haerses Rd (refer Figure 1).

The Haerses Road Quarry development consent was approved by the Minister for Planning 14 February 2006 and has received five modifications since this approval. The latest, modification occurred in June 2022.

Dixon Sand commissioned the last review of quarry maximum extraction depths in March 2020¹. An Independent Environmental Audit was completed on 18th October 2022, thus triggering a revision of the Maximum Extraction Depth Map, in accordance with Schedule 2, Condition 22(b) of the Development Consent (refer Table 1.1).

Dixon Sand have engaged WSP Golder to complete this review and revision of the Maximum Extraction Depth Map, which is undertaken to fulfil Dixon Sand's development consent requirements.

¹ Golder, 2020. *Extraction Depth for DA 165-7-2005*. Letter report 1780381-L007-Rev1, 27 March 2020.



LEGEND

MTSGS (Etheridge 1980)

100m Buffer of MTSGS

SITE BOUNDARY

APPROVED EXTRACTION AREA

STAGE NAME

1

2

3

4

5

1A

1B

2A

2B

3A

3B

4A

4B

5A

5B

BH Series Bores

H Series Bores

NOTE(S)

1. AERIAL PHOTOGRAPH SOURCED FROM ESRI.

REFERENCE(S)

1. NA

CLIENT

DIXON SAND (PENRITH) PTY LTD

PROJECT

2023 MAXIMUM EXTRACTION GROUNDWATER ASSESSMENT

TITLE

HAERSES ROAD SITE PLAN

CONSULTANT	YYYY-MM-DD	12-04-2023
	DESIGNED	TDS
	PREPARED	TDS
	REVIEWED	JVDA
	APPROVED	JVDA

PROJECT NO.	CONTROL	REV.	FIGURE
PS135469	001-R	0	1

PATH: C:\Users\AUTSS0026\OneDrive - WSP\OneDrive - WSP\0369\2023 Dixon Sand\GIS\PS135469 - F1 HAERSES RD SITE PLAN.mxd PRINTED ON: 2023-04-12 AT: 10:00:53 PM

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3 25mm

Table 1.1 : Relevant Development Consent Conditions

Development Consent	Description of the Development	Relevant Section of the Development Consent
DA 165-7-2005 (Haerses Road Quarry)	Sand quarry on the following: Lot 170 DP 664766; Lot 170 DP 664767; Lots A and B DP 407341; Lots 176 and 177 DP 752039 and Lot 216 DP 752039; Haerses Road; and the intersection of Wiseman's Ferry Road and Haerses Road	Schedule 2 – Condition 22(b): The Applicant must review and update the Maximum Extraction Depth Map within 3 months of the completion of each Independent Environmental Audit (see conditions 13 of Schedule 5), to the satisfaction of the Secretary

2.0 EXTRACTION AREA CONSENT CONDITIONS

This section summarises the development consent limits of extraction with respect to groundwater and the underlying relevant aquifers

Extraction at Haerses Road occurs from two areas known as the Tertiary Sands Extraction Area and the Western Friable Sandstone Extraction area. These areas are shown on Figure 1. Extraction within the two areas is governed by their respective underlying aquifers:

- Tertiary Sands Extraction Area is underlain by the Maroota Tertiary Sands Groundwater Source (MTSGS) and
- Western Friable Sandstone Extraction Area is underlain by the Sydney Central Basin Groundwater Sands (SCBGS).

The following consent conditions relevant to groundwater apply to extraction:

Condition 19 of development consent Schedule 2: The applicant must not undertake any extraction within 2 metres of the highest recorded wet weather groundwater level of both the MTSGS and the SCBGS.

Condition 19 is administered through the development of a Maximum Extraction Depth Map which establishes an inferred surface based on the maximum wet weather groundwater elevations and is determined through the quarry groundwater monitoring network.

- Extraction depths within the Tertiary sands extraction area are restricted to 2 m above the wet weather elevation of the underlying Maroota Tertiary Sands Groundwater Source (MTSGS).
- Extraction depths within the western friable sandstone extraction area are restricted to 2 m above the wet weather elevation of the underlying Sydney Central Basin Groundwater Source (SBCGS).

In accordance with development consent Condition 22 of Schedule 2, a review and update of the Maximum Extraction Depth Map is triggered by an Independent Environmental Audit.

Buffer Zones

Under the development consent, a buffer zone has been administered, extending 100 m from the western boundary of the MTSGS, which is referred to as the MTSGS buffer zone (Figure 1).

This buffer zone overlies the friable sandstone, however in accordance with Condition 17 of the consent, Dixon Sand must not commence quarrying operations within the MTSGS buffer zone without the prior approval of the Secretary (and groundwater monitoring results have shown that quarrying can be undertaken in this area without incurring water loss from the MTSGS). Approval to extract was provided by NSW DPIE on 11 June 2011.

Other buffer zones that prohibit extraction are noted, but these are related to land uses rather than for hydrogeological purposes.

2.1 Summary of operations conditions at March 2023

The original DA approved extraction activities across Stages 1 through 5. As of quarter one, 2023:

- Quarrying activities at Stage 1 are ongoing, although minimal.
- Commencement of rehabilitation activities across Stage 1 area is planned and imminent.
- Extraction currently occurs in Stage 2; sandstone is quarried at the southwest margin.
- All water storage is now in the southeast corner of the Stage 2 area. A permanent water storage has been re-instated.
- Extraction currently occurs at Stages 1a, 1b and 2b from Sandstone Extraction Area A and Sandstone Extraction Area B.

3.0 MAXIMUM GROUNDWATER LEVEL ASSESSMENT

3.1 Groundwater elevation and extraction depth

The maximum wet weather groundwater elevations for the MTSGS and SCBGS were calculated based on the maximum water level recorded in applicable monitoring bores, following a 50 mm (or greater) rainfall event in a 24-hour period. Previously, the SCBGS maximum water levels were based on the highest recorded groundwater level to date due to the limited monitoring period. However in 2023, there are four years of monitoring data and this is considered sufficient for a wet weather maximum groundwater assessment.

Historical daily rainfall records for the nearest Bureau of Meteorology rainfall recording station at Maroota (station ID 67014) were used to identify the wet weather events. Since 2005, the station has observed 40 events with rainfall exceeding 50 mm. In some instances, the wet weather event/s occurred over multiple days, these have been considered as a single event. These data and commentary are presented in Attachment A.

Table 3.1 presents the determined peak groundwater level measurement for each of the bores completed for monitoring the MTSGS (namely the H series bores). Table 3.2 presents the determined peak groundwater level measurements for bores completed for monitoring the SCBGS (namely the BH A series bores). Results from the previous 2020 assessment are included for comparison.

Groundwater monitoring from shallow screened monitoring bores, that target perched groundwater (namely BH -B and C series bores) their purpose is to assess water loss from the adjacent MTSGS. These bores are excluded from the assessment and are shown for reference only as they are not considered reflective the regional groundwater system.

The maximum groundwater wet weather elevation contour map has been generated for the site, using the krigging interpolation method. The map is presented in Figure 2 and shows the maximum wet weather surfaces beneath the quarry areas at 2 m contour intervals.

Bores BH02A and BH03A have been excluded from the wet weather assessment for the following reasons:

- BH02A is located immediately west of the existing water storage, a review of the time series data showed a very subdued rising water level when compared to climatic influence observed in other BH – A series bores. The data is not considered reflective of the regional system.
- BH03A relative water levels are >20 m below adjacent nearby monitoring bores BH5 and BH06A. Data from this bore was previously excluded as levels do not fit the regional trend. As a conservative approach, the same method is adopted in 2023, noting that the bore is scheduled for decommissioning in 2023 as quarrying progresses. Dixon Sands are planning a replacement bore west of the BH3 and BH6 cluster bore sites to confirm water levels in the south.

Table 3.1: Peak Water Level After >50 mm/day Rainfall Event – Tertiary Sands Extraction area

Aquifer	Monitoring Bore ID	Wet weather groundwater elevation maximum (m AHD)	
		2020	2023
MTSGS	*H1	176.87	175.96
	H2	182.05	182.05
	*H4	183.37	183.09
	*H5	178.6	178.50
	H6	184.46	187.25
	H7	182.6	185.10
	*H8	187.59	187.59
	H9	186.93	187.68
	*H10	176.68	176.68
	*H11	184.8	184.80
	H12	183.69	185.51
	*H13	171.30	171.30
	H14	177.19	178.58

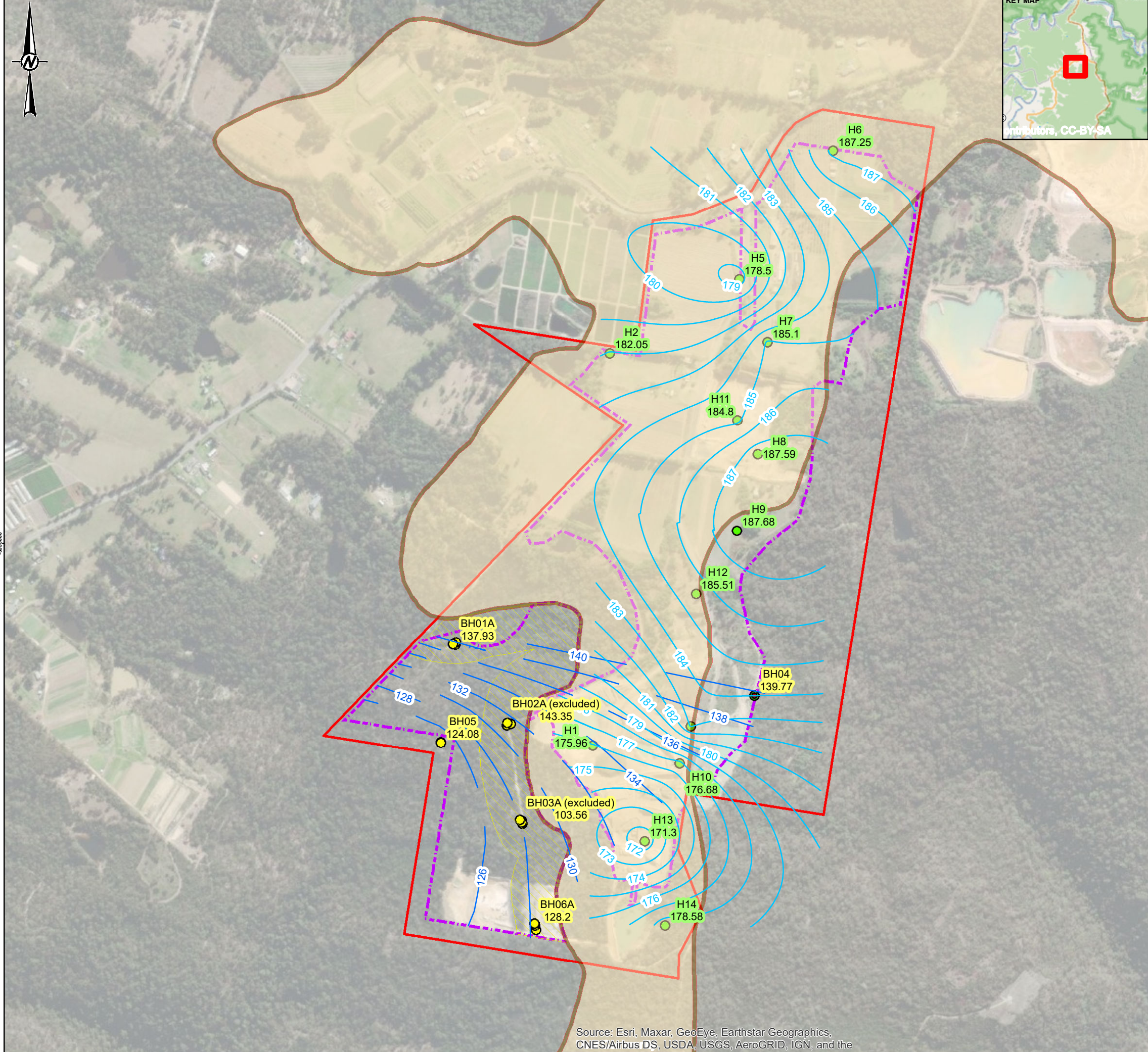
*Denotes obsolete monitoring bores

Table 3.2: Peak Water Level After >50 mm/day Rainfall Event – Tertiary Sands Extraction area

Aquifer	Monitoring Bore ID	Wet weather groundwater elevation maximum (m AHD)	
		2020	2023
SBCGS	BH01A	133.26	137.93
	BH02A^	136.72	143.35
	BH03A*	101.33	103.56
	BH06A	127.66	128.20
	BH04	140.18	140.18
	BH05	123.2	124.08

*groundwater level doesn't reflect the regional trend and has been excluded from the wet weather groundwater elevation contours.

^groundwater level excluded from assessment due to trend reflective of influence from adjacent water storage body.



LEGEND

- MTSGS MAX WET WEATHER GW SURFACE
- SCBGS MAX WET WEATHER GW SURFACE
- MTSGS (Etheridge 1980)
- 100m Buffer of MTSGS

SITE BOUNDARY

APPROVED EXTRACTION AREA

BH #
Max GW RWL

H #
Max GW RWL

Note:
BH06A was decommissioned in 2021.
BH03A is scheduled for decommission in 2023.
At the time of drafting, Dixon Sand are considering commissioning a new bore in proximity to BH3A and BH6A to refine understanding of the regional water level surface. Future monitoring in the south west corner of the site may influence the current maximum wet weather groundwater surface.

0 250 500
1:10,000 METRES

NOTE(S)
1. AERIAL PHOTOGRAPH SOURCED FROM ESRI.

REFERENCE(S)
1. NA

CLIENT
DIXON SAND (PENRITH) PTY LTD

PROJECT
2023 MAXIMUM EXTRACTION GROUNDWATER ASSESSMENT

TITLE
MAXIMUM WET WEATHER GROUNDWATER LEVELS AND INTERPOLATED SURFACES (IN MAHD)

CONSULTANT	YYYY-MM-DD	12-04-2023
	DESIGNED	TDS
	PREPARED	TDS
	REVIEWED	JVDA
	APPROVED	JVDA

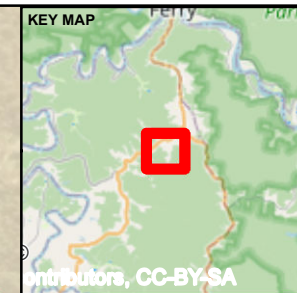
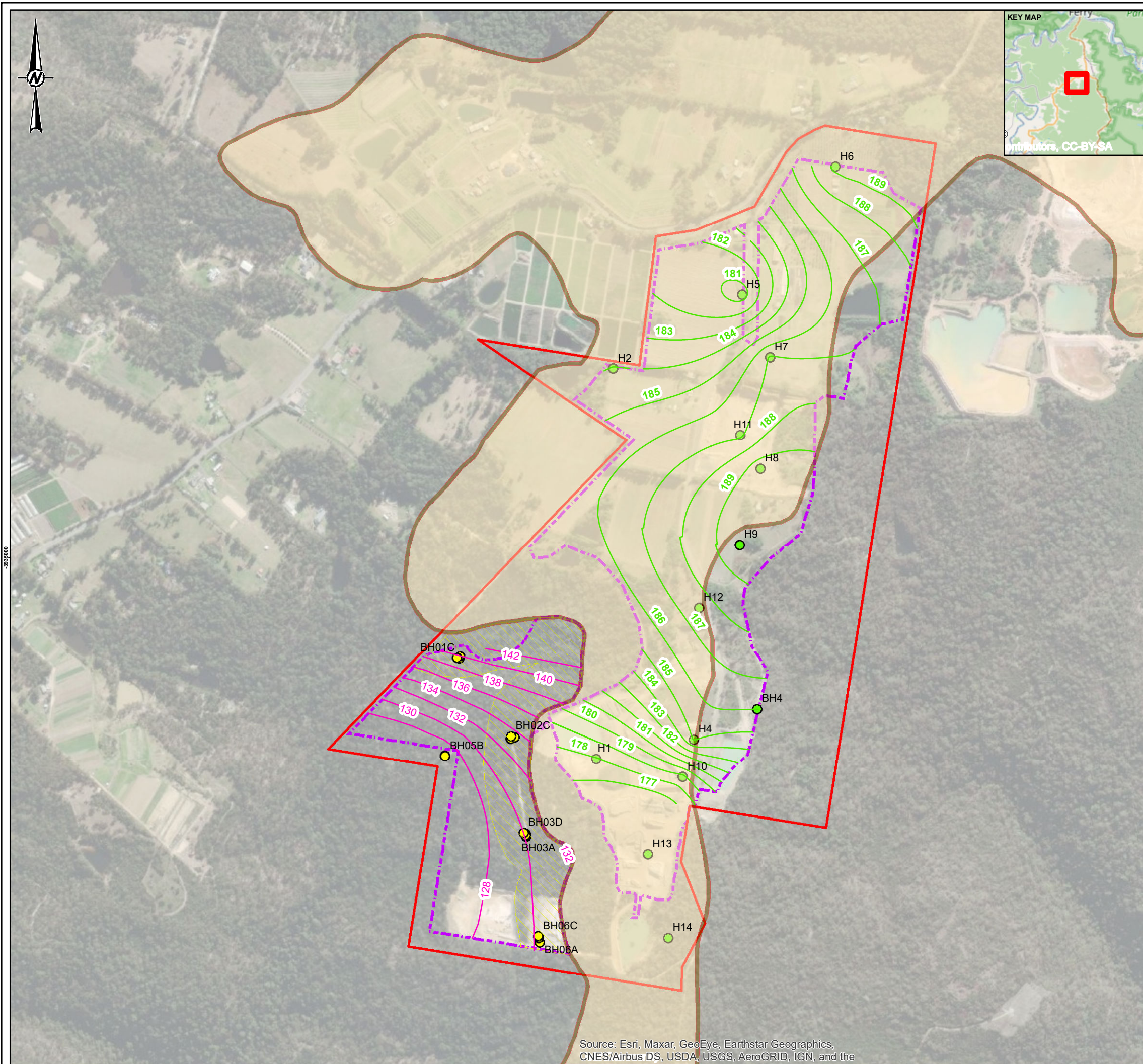
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4.0 DETERMINATION OF MAXIMUM EXTRACTION DEPTH

Contours of maximum extraction depth have been created by adding 2 m to each wet weather groundwater level and these are presented in Figure 3. Extraction depth contours are now included across the MTSGS buffer zone, now that approval to extract within the buffer has been endorsed by the Secretary.

Based on the revised groundwater level assessment, the maximum extraction depth map shows:


- Maximum extraction depth over the Tertiary Sands extraction area should be limited to a depth not greater than 189 m AHD in the east and to the north, gradually reducing to 177 m AHD in the south and 182 m AHD in the west.
- Maximum extraction depth over the Western Friable Sandstone extraction (including the MTSGS buffer zone) should be limited to a depth not greater than 142 m AHD in the north, gradually reducing to 128 m AHD in the south.
- The maximum extraction depth at BH03A is almost 30 m above the maximum wet weather groundwater level. Conservatively, this bore has been excluded from the assessment and the surface is interpolated between BH05 and BH06A. Bore BH06A was decommissioned in 2021 and Bore BH03A is soon to be scheduled for decommissioning as quarrying progresses into Stage 2b. A replacement bore is currently planned on the western boundary of Stage 1a/2a to confirm regional water levels in the south and provide further confidence on wet weather groundwater level maximums in this sector of the quarry.



LEGEND

2023 MAX EXTRACTION DEPTH CONTOURS
(mAHD)

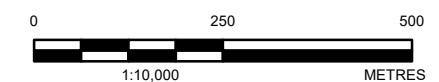
— 2023 SCBGS MAX EXTRACTION DEPTH
CONTOURS (mAHD)

 MTS GS (Etheridge 1980)

 100m Buffer of MTSGS

SITE BOUNDARY

APPROVED EXTRACTION AREA



NOTE(S)

NOTE(S)
1. AERIAL PHOTOGRAPH SOURCED FROM ESRI.

REFERENCE(S)

1. NA

CLIENT

DIXON SAND (PENRITH) PTY LTD

PROJECT

2023 MAXIMUM EXTRACTION GROUNDWATER ASSESSMENT

TITLE

MAXIMUM EXTRACTION DEPTH CONTOURS (MAHD)

CONSULTANT

CONSULTANT	YYYY-MM-DD	31-03-2023
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	DESIGNED	TDS
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WSD GOLDER PREPARED TDS

REVIEWED	JVDA
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REVIEWED	JVDA
APPROVED	JVDA

PROJECT NO. _____

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FIGURE

4.1

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5.0 CLOSING

Thank you for considering WSP Golder to assist with this project. We trust the above assessment satisfies your requirements, please contact the undersigned if you would like to discuss the findings.

6.0 IMPORTANT INFORMATION

Your attention is drawn to the document Important Information Attachment B of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by WSP Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Yours sincerely

Golder Associates Pty Ltd



Tim Smith
Associate Hydrogeologist



Jason van den Akker
Principal Hydrogeologist

TS/JvdA/qn

CC: Mark Dixon

Attachments: A – Historical rainfall events and wet weather groundwater RWLs
B – Important Information

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ATTACHMENT A

**Historical rainfall events and
wet weather groundwater RWLs**

Maroota Daily Rainfalls for events exceeding 50 mm 2006 to 2022					Peak water level after >50 mm rainfall event																			
					MTSGS Buffer Zone												SCBGS							
Year	Date	Rainfall amount (mm)	Comment	Period over which rainfall was measured (days)	H1	H2	H4	H5	H6	H7	H8	H9	H10	H11	H12	H13	H14	BH01A	BH02A	BH03A	BH06A	BH04	BH05	
	26 Feb	39																						
	27 Feb	9.6																						
	28 Feb	8.8																						
	01 Mar	13																						
	02 Mar	114		1		181.61			186.51	182.31		187.62			185.1		178.22	137.47	141.22	103.05		139.56	123.945	
	03 Mar	92		1																				
	04 Mar	27																						
	05 Mar	13.6																						
	06 Mar	66		1																				
	07 Mar	55		1																				
	08 Mar	48																						
	09 Mar	45																						
	08 Apr	63.2		1		181.66			186.72	184.69		187.51			184.92		178.33	137.64	141.56	103.09		139.55	123.985	
	03 Jul	68	332mm over 4 days (3-6 July 2022)	1																				
	04 Jul	70		1		181.78			187.25	185.1		187.68			185.21		178.58					139.67		
05 Jul	148		1																					
06 Jul	46																							
2022	09 Oct	58		1		180.34			185.64	183.45		185.81			182.61		177.71	137.82	143.24	103.5		139.75	124.055	
2023	30 Jan	64	87mm over 2 days (31-31st January 2023)			180.5			184.78	182.82		185.75			182.02		177.4	137.93	143.35	103.56		139.77	124.075	
2023	31 Jan	23																						
Average peak water level after a >50mm rainfall event					174.36	180.70	183.09	178.50	183.26	181.21	185.32	185.67	176.42	184.18	182.40	170.30	175.68	135.58	139.57	102.48	126.72	138.84	123.51	
Highest peak water level after a >50mm rainfall event					175.96	182.05	183.09	178.50	187.25	185.10	187.59	187.68	176.68	184.80	185.51	171.30	178.58	137.93	143.35	103.56	128.20	139.77	124.08	

RED - data excluded from assessment

EXCLUDED

ATTACHMENT B

Important Information

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Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

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