Aus 10 Rhyolite Pty Limited

ABN: 90 002 325 144

2022 Annual Review

for the

Tinda Creek Quarry

Prepared by:

RWCorkery&co

April 2023

ACKNOWLEDGEMENT

R.W. Corkery & Co. acknowledge and pay our respects to the Traditional Custodians of the lands comprising NSW and Australia on which our projects are located. We appreciate the knowledge, advice and involvement of the Elders and extended Aboriginal community that contribute to our Projects and extend our respect to all Aboriginal and Torres Strait Islander peoples.

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Tinda Creek Quarry

Period: 1 January 2022 to 31 December 2022

Prepared for:

Aus 10 Rhyolite Pty Limited
ABN: 90 002 325 144

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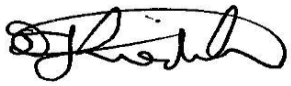
RWCorkery&co

Table A
Title Block

Name of operation	Tinda Creek Sand Quarry
Name of operator	Aus 10 Rhyolite Pty Limited t/a Hy-Tec Concrete and Aggregates
Development consent / project approval #	SSD_4978
Name of holder of development consent / project approval	Aus 10 Rhyolite Pty Limited
Mining Lease #	No Mining Lease applicable to site under *Mining Act* (1992).
Name of holder of mining lease	N/A
Water licence #	WAL 24367 / WAL 24381 / WAL 42446
Name of holder of water licence	Aus 10 Rhyolite Pty Limited
MOP/RMP start date	N/A
MOP/RMP end date	N/A
Annual Review start date	1 January 2022
Annual Review end date	31 December 2022
I, Darryl Thiedeke, certify that to the best of my knowledge this audit report is a true and accurate record of the compliance status of the Tinda Creek Quarry for the period 1 January 2022 to 31 December 2022 and that I am authorised to make this statement of behalf of Aus 10 Rhyolite Pty Limited. *Note.* *a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.* *b) The Crimes Act 1900 contains other offences relating to false and misleading information: Section 192G (Intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); Section 307A, 307B and 307C (false or misleading application/information/documents – maximum penalty 2 years imprisonment or $22,000, or both).*	
Name of authorised reporting officer	Darryl Thiedeke
Title of authorised reporting officer	National Planning and Development Manager
Signature of authorised reporting officer	
Date	6 April 2023

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LIST OF ACRONYMS

AHD	Australian height datum
ANZECC	Australian and New Zealand Environment. Conservation Council
ARI	average recurrence interval
AUSRIVAS	Australian River Assessment System
CCC	Community Consultative Committee
DD	deposited dust
DPE	Department of Planning and Environment
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EMM	EMM Consulting Pty Ltd
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
EPL	Environment Protection License
MAC	Muller Acoustic Consulting Pty Ltd
PM	particulate matter
RCE	Riparian and Channel and Environment Inventory Assessment
RFS	Rural Fire Service
RWC	R.W. Corkery and Co. Pty Limited
SIGNAL	stream invertebrate grade number average level
SSD	State Significant Development
TRH	total recoverable hydrocarbon
TSP	total suspended particulate
WAL	Water Access Licence

1. STATEMENT OF COMPLIANCE

Table 1
Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	Yes / No
DC # SSD_4978	No
EPL # 12007	No

Table 2
Non-compliances

Relevant Approval	Condition #	Condition Description (summary)	Compliance Status	Comment	Where Addressed in Annual Review
SSD_4978	2 (1)	This condition relates to specific performance criteria established under the consent and the requirement to prevent and/or minimise material harm to the environment.	Medium	Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Incident reporting following the events confirmed that material harm to the environment had not occurred. DPE reviewed the non-compliance issues associated with discharge of water from the Quarry and issued Hy-Tec with an Official Caution on 21 December 2022.	Section 7.2.5, Section 11.2, **Appendix 1**
SSD_4978	2 (2)	This condition relates to operation of the Quarry in accordance with the conditions of consent.	Administrative	Non-compliance with six conditions of SSD_4978 occurred during the reporting period precluding the achievement of compliance with this condition.	Section 7.2.5, Section 11.3, **Appendix 1**
SSD_4978	3 (12)	This condition relates to compliance with Section 120 of the POEO Act unless authorised by an EPL and the requirement not to discharge water from the Quarry.	Medium	Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Incident reporting following the events confirmed that material harm to the environment had not occurred. DPE reviewed the non-compliance issues associated with discharge of water from the Quarry and issued Hy-Tec with an Official Caution on 21 December 2022.	Section 7.2.5, Section 11.3, **Appendix 1**

Table 2 (Cont'd)
Non-compliances

Relevant Approval	Condition #	Condition Description (summary)	Compliance Status	Comment	Where Addressed in Annual Review
SSD_4978	3 (13)	This condition relates to implementation of an approved Water Management Plan.	Medium	A Water Management Plan has been prepared and approved by the Secretary and is being implemented at the Quarry. Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). DPE reviewed the non-compliance issues associated with discharge of water from the Quarry and issued Hy-Tec with an Official Caution on 21 December 2022.	Section 7.2.5, Section 11.3, **Appendix 1**
SSD_4978	3 (16)	This condition provides a deadline to secure the on-site Offset Area	Low	Land intended for the On-site Offset Area will be transferred to the Office of the NSW Minister of Environment and Heritage in early 2023. It is noted that the area is not being disturbed and environmental management is implemented in accordance with an approved Landscape Management Plan.	Section 7.2.5, Section 11.3, **Appendix 1**
SSD_4978	3 (21)	This condition relates to the preparation of an estimate for a Rehabilitation and Conservation Bond	Administrative	Land intended for the On-site Offset Area will be transferred to the Office of the NSW Minister of Environment and Heritage in early 2023. It is noted that the area is not being disturbed and environmental management is implemented in accordance with an approved Landscape Management Plan.	Section 11.3, **Appendix 1**
EPL 12007	A3.2	This condition relates to activities being carried out in accordance with SSD_4978	Medium	The non-compliances recorded under SSD_4978 preclude the achievement of compliance with this condition.	Section 7.2.5, Section 11.4, **Appendix 2**
EPL 12007	L1.1	This condition relates to compliance with Section 120 of the POEO Act and the EPL	Medium	Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Incident reporting following the events confirmed that material harm to the environment had not occurred.	Section 7.2.5, Section 11.4, **Appendix 2**

Compliance Status Key

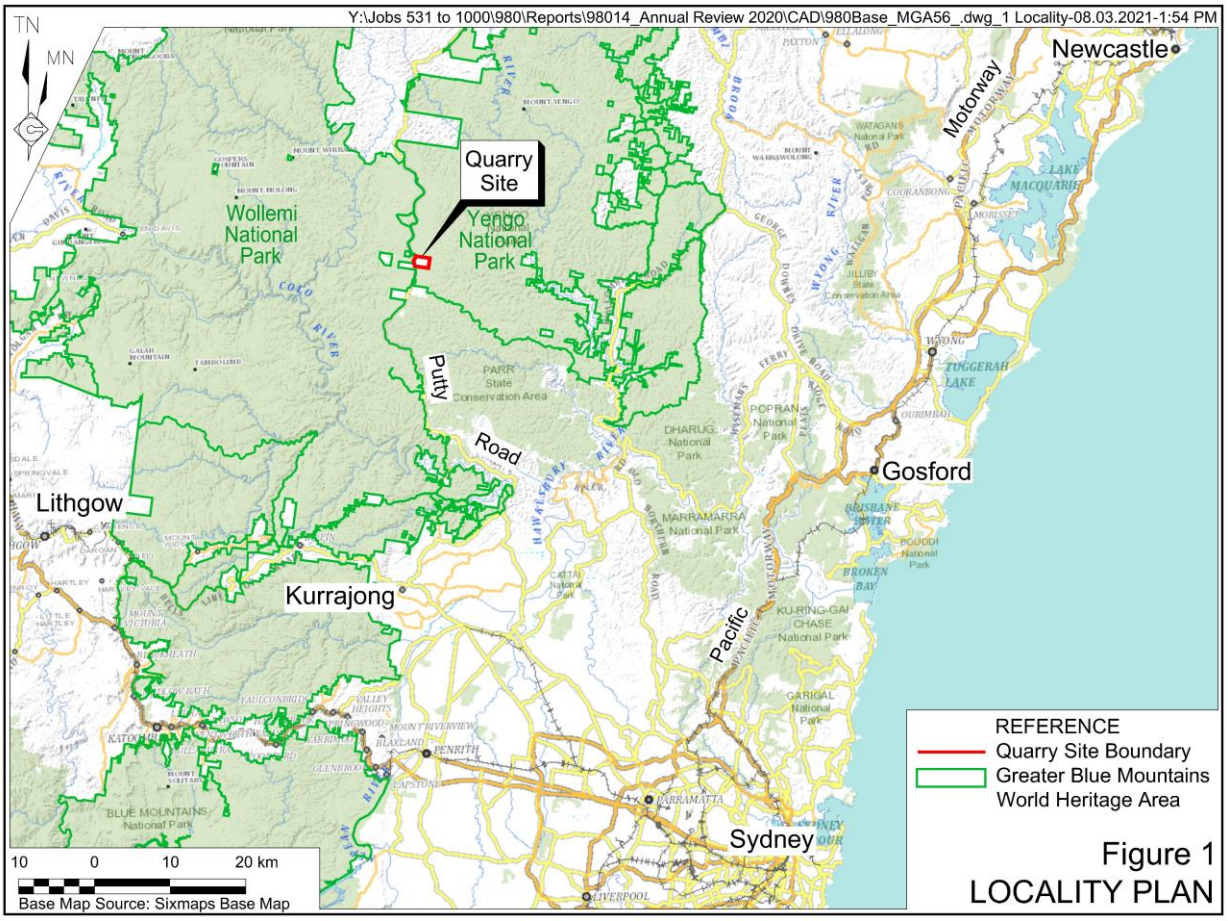
Risk level	***Colour code***	***Description***
High	*Non-compliant*	*Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.*
Medium	*Non-compliant*	*Non-compliance with:* • *potential for serious environmental consequences, but is unlikely to occur; or* • *potential for moderate environmental consequences but is likely to occur.*
Low	*Non-compliant*	*Non-compliance with:* • *potential for moderate environmental consequences, but is unlikely to occur; or* • *potential for low environmental consequences but is likely to occur.*
Administrative non-compliance	*Non-compliant*	*Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions).*

2. INTRODUCTION

2.1 SCOPE AND FORMAT

This *Annual Review* has been compiled by R.W. Corkery & Co. Pty Limited (RWC) on behalf of Aus 10 Rhyolite Pty Limited. This report is applicable for the period 1 January 2022 to 31 December 2022 ("the reporting period"). The information presented within this *Annual Review* has been prepared based upon observations made during a site visit on 9 November 2022 and information provided by Hy-Tec.

The Tinda Creek Sand Quarry (the Quarry) is owned and operated by Aus 10 Rhyolite Pty Limited trading as Hy-Tec Concrete and Aggregates hereafter referred to as Hy-Tec. The Quarry Site is located approximately 67km north of Windsor along Putty Road, NSW (see **Figure 1**). Development Consent SSD_4978 (SSD_4978) was granted on 10 April 2015 to permit the extraction and despatch of up to 300 000 tonnes of sand from the Quarry each year for the duration of the Project. **Figure 2** displays the layout of the Quarry.



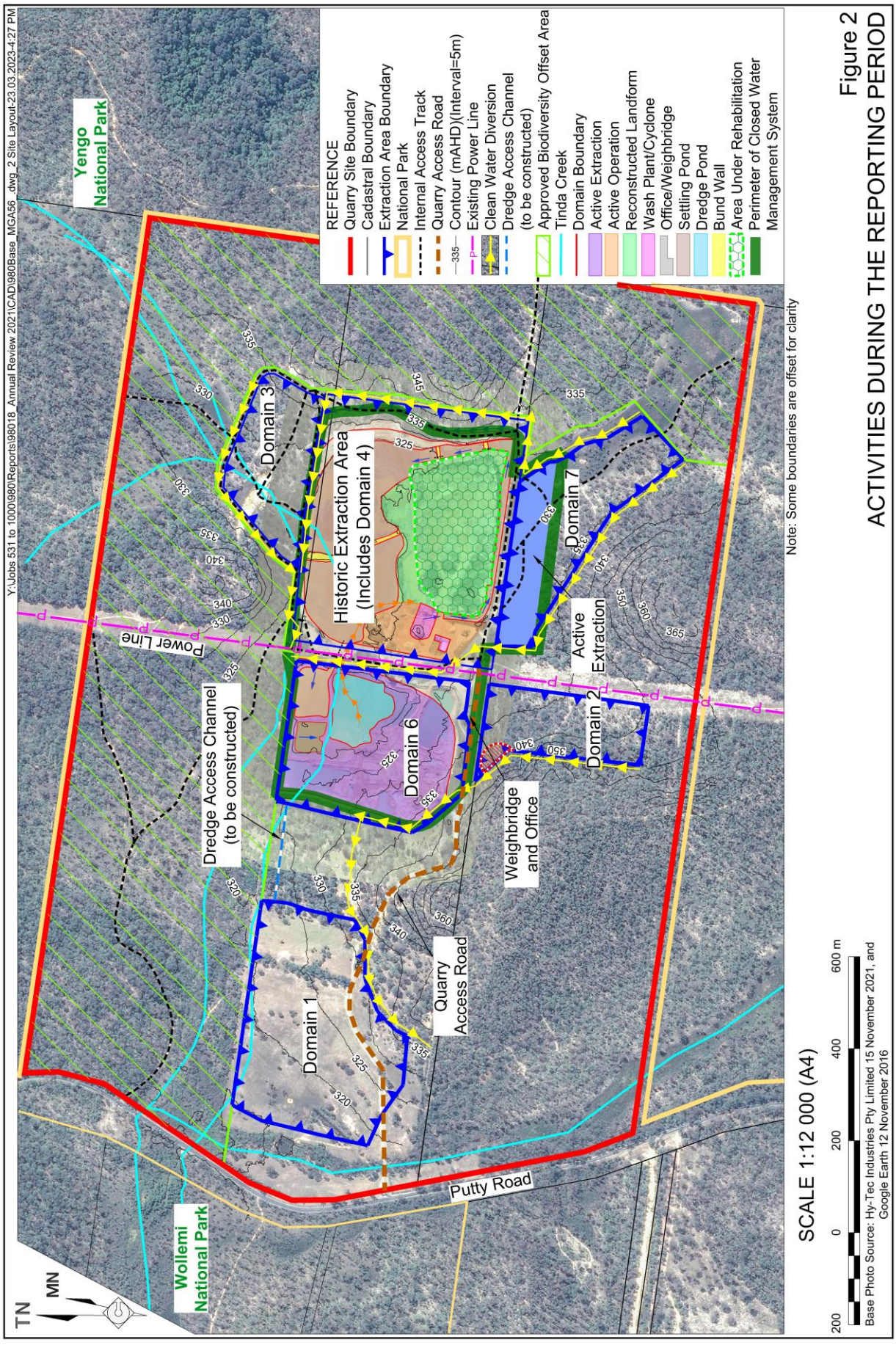


Figure 2
ACTIVITIES DURING THE REPORTING PERIOD

This *Annual Review* has been prepared in accordance with *Condition 5(4)* of Development Consent SSD_4978 to record the activities and environmental monitoring undertaken at the Quarry during the reporting period and to outline the activities and environmental monitoring planned throughout the next reporting period (1 January 2022 to 31 December 2022). *Condition 5(4)* requires the preparation of a report which must:

a) *describe the development (including rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year* (Sections 4, 8 and 11);

b) *include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against*:

- *the relevant statutory requirements, limits or performance measures/criteria;*
- *the monitoring results of previous years; and*
- *the relevant prediction in the EIS* (Sections 6, 7 and 9);

c) *identify any non-compliance over the last year, and describes what actions were (or are being) taken to ensure compliance* (Section 10);

d) *identify any trends in the monitoring data over the life of the development* (Section 6 and 7);

e) *identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies* (Section 6 and 7); and

f) *describe what measures will be implemented over the current calendar year to improve the environmental performance of the development* (Sections 6, 7 and 11).

2.2 KEY PERSONNEL CONTACT DETAILS

The key personnel contact names, position and phone numbers are as follows.

Name	Position	24 Hour Contact
Bryan Grant	Quarry Manager	0400 967 633
Ethan Pettiford	NSW Quarry Operations Manager	0437 147 778

3. APPROVALS

Hy-Tec is required to operate the Tinda Creek Quarry in accordance with the conditions of development consent under the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and four licences as described in **Table 3**.

Table 3
Tinda Creek Sand Quarry – Approvals and Licences

Consent/Lease/Licence	Issue Date	Expiry Date	Details / Comments
Development Consent SSD_4978	10/04/2015	31/12/2045	Issued by Department of Planning and Environment
Approval EPBC 2013/7028	04/10/2016	31/12/2045	Issued by the Department of the Environment and Energy
Environment Protection Licence No 12007	03/03/2017	12 May+	Issued by Environment Protection Authority
Water Access License 24381 40 Units	01/09/2014	Continuing	Nominated Water Supply Works (Excavation) approval number 10WA112523 issued on 01/07/2011. Valid until 08/11/2025
Water Access License 24367 15 Units	02/02/2012	Continuing	Nominated Water Supply Works (Bore) approval number 10WA112531 amended on 11/11/2020. Valid until 13/04/2025*
Water Access License 42446 60 Units	20/06/2019	Continuing	Nominated Water Supply Works (Bore) approval number 10WA112531 amended on 11/11/2020. Valid until 13/04/2025*

+ Anniversary Date

* Works Approval 10WA112531 has a conditional limit of 44ML per annum.

No modifications or variations to the development consent or licenses outlined in **Table 3** were sought within the reporting period. SEARS were sought in December 2022 for a modification that will be applied for in 2023.

SSD_4978 was granted in accordance with Part 4 of the EP&A Act by the Minister for Planning on 10 April 2015 to extract and transport no more than 300 000 tonnes of sand products from the Quarry Site each calendar year until 31 December 2045. SSD_4978 superseded DA134/95 after it was formally surrendered on 10 December 2015. Sand extraction within the new approved extraction area commenced in September 2015. Condition 15 of Schedule 3 of SSD_4978 requires Hy-Tec to secure an On-site Offset Area of at least 106.6ha in accordance with the biodiversity offset strategy for the operation. On 30 June 2022, the NSW Minister for Environment and Heritage approved the transfer of land designated for the On-site Offset Area to the office of the Minister for Environment and Heritage to be managed by the National Parks and Wildlife Service (NPWS) as in inholding in Yengo National Park. The transfer was conditional upon:

- Hy-Tec gaining access to the offset land in order to continue biodiversity management actions and environmental monitoring for the life of the quarry; and

- that the land be held under Part 11 of the National Parks and Wildlife Act 1974 (NPW Act), and that the reservation of the land as national park be delayed until the quarrying operations are complete, expected to be 25 years.

The NPWS has advised Hy-Tec that it will issue a licence or lease under section 150 (2) of the NPW Act for ongoing access. Hy-Tec is in the process of finalising the transfer of land and arranging the necessary lease agreement. It is expected that Hy-Tec would retain responsibility for monitoring and management of the land in accordance with the approved Landscape Management Plan until operations cease and the Quarry is closed.

Hy-Tec also operates in accordance with Approval EPBC 2013/7028 granted under the EPBC Act. This approval relates principally to operations that may impact the threatened Koala and small flower Grevillea identified within the Quarry Site. This approval also recognises the international recognition of natural heritage values of the nearby Greater Blue Mountains Area. A compliance review of the conditions of EPBC 2013/7028 is completed annually and placed on the Hy-Tec website. During the reporting period, Hy-Tec remained compliant with the conditions of EPBC 2013/7028.

Hy-Tec also operates the Tinda Creek Quarry in accordance with Environment Protection Licence (EPL) 12007. This licence incorporates standard conditions for extractive industries and includes limits for noise emissions from the Quarry Site.

An independent environmental audit of quarrying operations was undertaken in July 2022 and covered the period from 10 October 2019 to 14 July 2022. An internal compliance review of the conditions of SSD_4978 and EPL 12007 for the remainder of the reporting period is presented as **Appendix 1** with the outcomes discussed in Section 1 and Section 10.

Water Access Licence (WAL) 24381 (40 units), WAL 42446 (60 units) and WAL 24367 (15 units) have been issued to permit extraction of water from the Sydney Basin North Groundwater Source. Water within this source is managed through the water sharing plan for the *Greater Metropolitan Region Groundwater Sources 2011*. The WALs permit extraction of groundwater in accordance with the conditions provided in the licences. Two Water Supply Works approvals have been issued to Hy-Tec to permit extraction of groundwater associated with the WALs.

WAL 24381 and the nominated works approval 10WA112523 permit the use of water accessed from the groundwater setting through extraction activities and principally accounts for evaporation from exposed faces. Anecdotally, Quarry personnel have observed very little seepage into operating domains, however this license accounts for the possible evaporation.

WAL 42446 and WAL 24367 and the nominated works approval 10WA112531 permit the use of groundwater sourced via a production bore from the underlying aquifer. This water, when required is used to top up the dredge pond to ensure the dredge can operate efficiently. Water Supply Works (Bore) approval number 10WA112531 has a conditional limit of 44ML per annum. This limit has been imposed to account for potential impacts to the groundwater setting including groundwater dependent ecosystems in the vicinity of the existing production bore. Hy-Tec intends to install a second production bore and is currently investigating a suitable location to source the remaining 31ML groundwater allocation under existing entitlements which is anticipated to be completed during the next reporting period.

4. OPERATIONS SUMMARY

4.1 INTRODUCTION

The following subsections provide a summary of activities undertaken during the reporting period. Activities were generally consistent with those described in previous environmental management reporting. **Plates 1** to **5** display a series of photographs of the Tinda Creek Quarry taken on 9 November 2022 that are representative of existing conditions at the Quarry.

4.2 CLOSED WATER MANAGEMENT SYSTEM

Condition 12 of Schedule 3 of SSD_4978 requires that the catchment of the closed water system must not exceed 40ha at any one time. The closed water management system includes the area within the clean water diversions (**Figure 2**).

During the reporting period the closed water management system covered an area of approximately 36ha and remained unchanged from the previous year.

4.3 EXTRACTION OPERATIONS

Extraction and processing during the reporting period continued within Domain 6 and begun in Domain 7 (see **Figure 2**). The total volume of sand produced was 97,358 which is within the limits specified in Condition 6 of Schedule 2 of SSD_4978. Sand was extracted via excavator then loaded onto a single articulated dump truck and hauled to the dredge where the material was tipped into a dump pocket in front of the dredge throughout the reporting period (refer **Plate 2**).

The dredging process involves the removal of water, sand, silt and clay in the form of a slurry which is then pumped to the processing area, further washed and then the clean sand is stockpiled prior to transportation (refer **Plate 3**). Sand transported from site during the reporting period and forecast for the 2023 reporting period is displayed in **Table 4**.

Table 4
Sand Transportation from Site

Material	Approved annual limit (SSD_4978)	2018 reporting period	2019 reporting period	2020 reporting period	2021 reporting period	2022 reporting period	2023 reporting period (approximate forecast)
Sand	300 000 t	116 865t	46 942t	93 488t	96 703t	103 180t	139 021t
Source: Hy-Tec							

A copy of the annual return for extractive materials submitted to MEG for 2021/2022 is included within **Appendix 2**.

During the reporting period, the reported sand transported from site (103,180t) was slightly more than the volume of sand produced (97,358t) which is below the 300 000tpa limit approved within the development consent.

During the reporting period (and for all historic operations) extraction operations did not exceed the limit of 15m below the natural ground surface described in *Condition 2(6)* of SSD_4978. Hy-Tec has established a site-based standard procedure for survey and confirmation of the depth of extraction. The site-based procedure is undertaken on a monthly basis.

It is expected that sand processing and transportation from Site will increase in 2023.

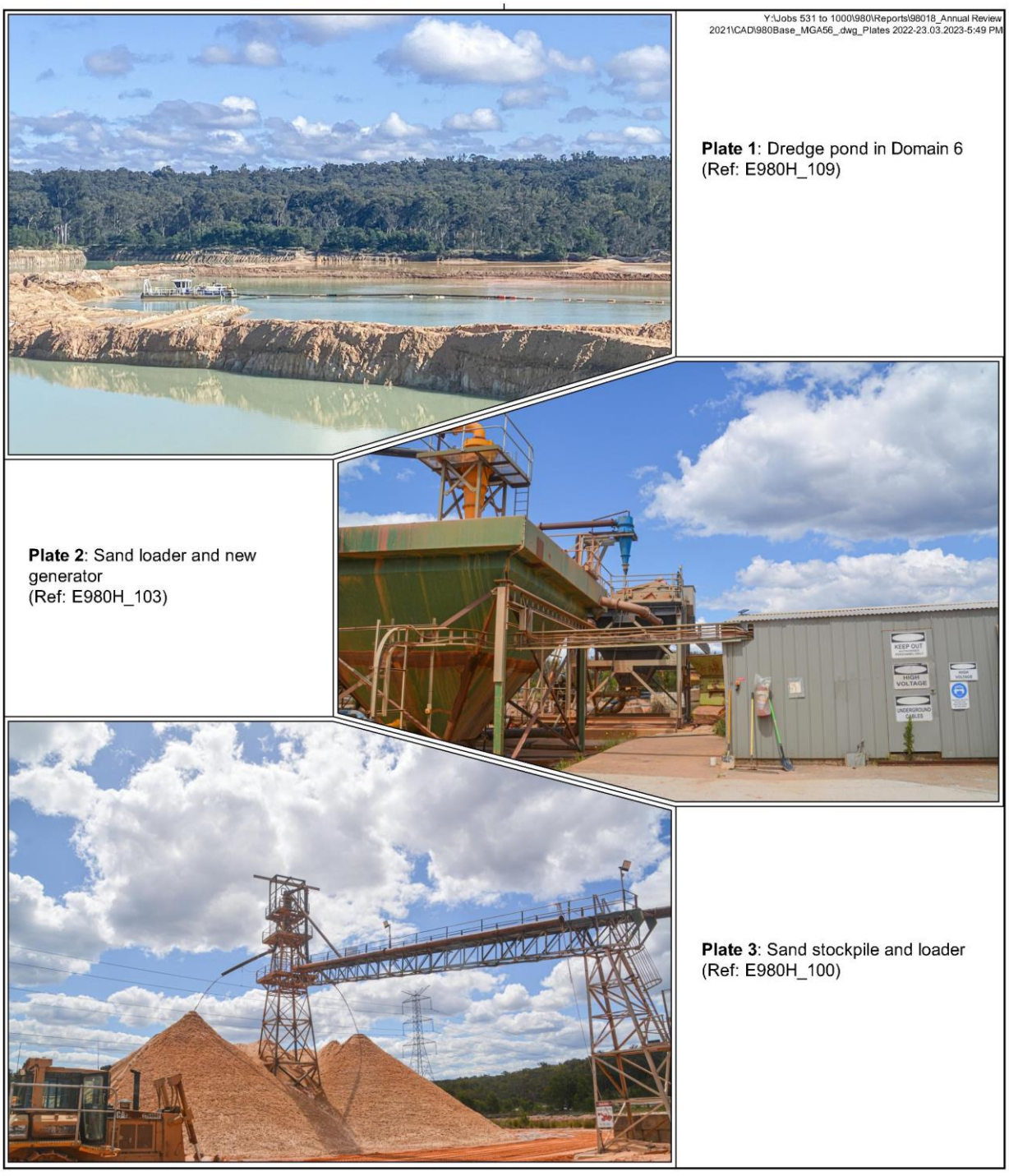


Plate 1: Dredge pond in Domain 6
(Ref: E980H_109)

Plate 2: Sand loader and new generator
(Ref: E980H_103)

Plate 3: Sand stockpile and loader
(Ref: E980H_100)

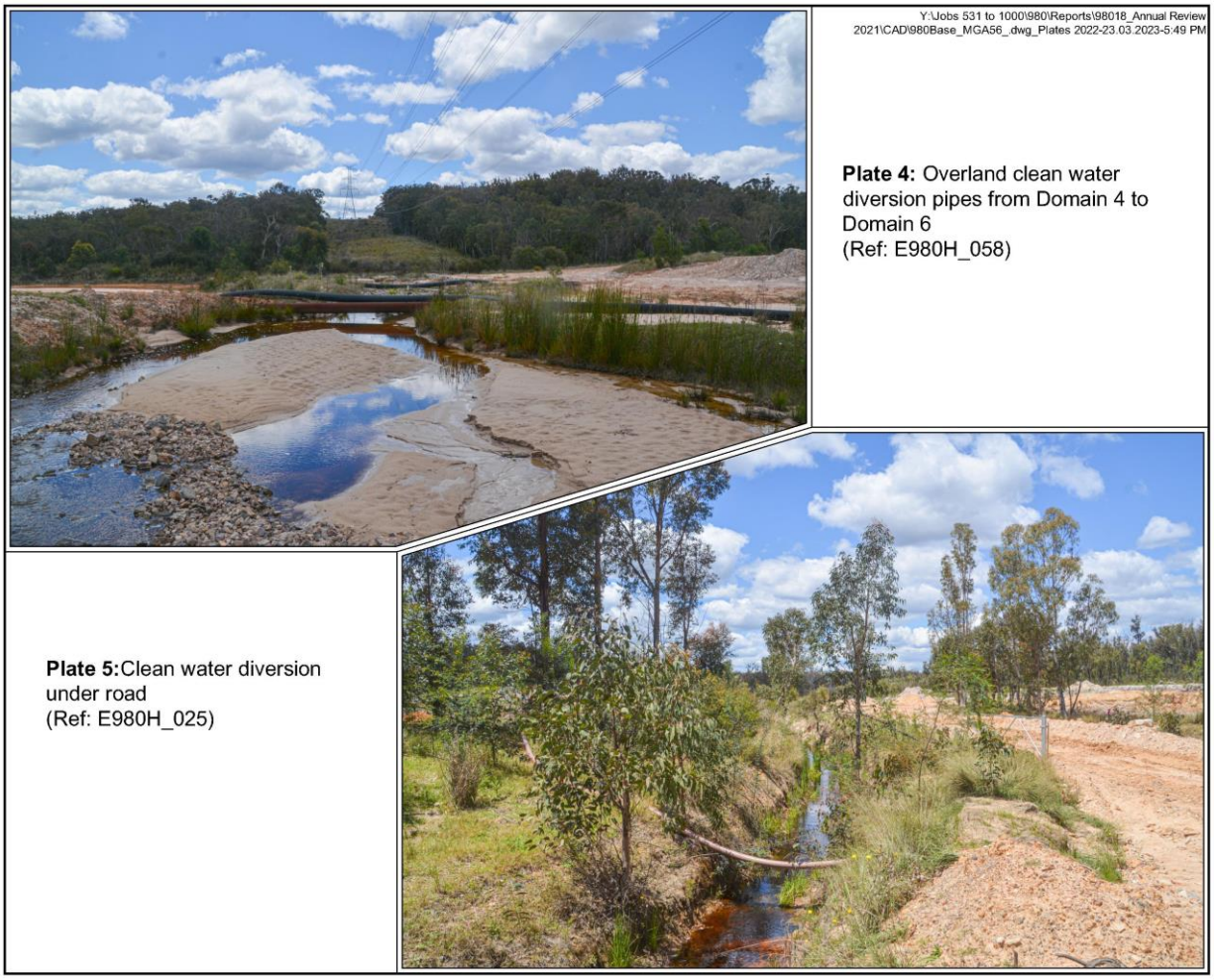


Plate 4: Overland clean water diversion pipes from Domain 4 to Domain 6
(Ref: E980H_058)

Plate 5: Clean water diversion under road
(Ref: E980H_025)

4.4 HOURS OF OPERATION

The permissible operating hours as set out in *Condition 3(3)* of SSD_4978 were adhered to throughout the reporting period. Extended hours for major supply contracts were not required during the reporting period.

4.5 TRANSPORT LEVELS

SSD_4978 specifies that haulage activities at Tinda Creek Quarry should not exceed 34 trucks per day, averaged over a calendar month. A total of 2 755 laden loads were despatched from the Quarry during the reporting period. A summary of the vehicle movements at Tinda Creek Quarry is provided from the Hy-Tec website and are summarised in **Table 5**. There were no recorded exceedances of average daily vehicle movements (based on a calendar month averaging period) within the reporting period.

Table 5
Monthly Laden Truck Movements at Tinda Creek Quarry

Month	Laden Truck Loads	Mean Daily Laden Truck Loads[1]
January	158	5.1
February	160	5.7
March	104	3.4
April	97	3.2
May	169	5.5
June	311	10.4
July	193	6.2
August	343	11.1
September	303	10.1
October	273	8.81
November	375	12.5
December	269	8.68
Annual Total	**2755**	**-**
Annual Daily Average	**7.5**	**-**
Note 1: Daily despatch averaged over the calendar month is presented, consistent with the requirements of Condition 7 of Schedule 2 of SSD_4978.		
Source: Hy-Tec		

4.6 CONSTRUCTION ACTIVITIES

During the reporting period a new generator was purchased and installed to replace a previously used generator. The generator is in the same location as at the former one, however this one is a silenced unit and as a result emits less noise.

4.7 IMPORTATION OF VENM/ENM

No VENM/ENM was imported onto the site during this reporting period.

4.8 WASTE MANAGEMENT

Waste management practices continued in accordance with the provisions of the *Protection of the Environment Operations* (Waste) *Regulation 2014* throughout the reporting period. Hy-Tec has engaged licensed waste contractors to recycle and dispose of waste throughout the reporting period.

4.9 NEXT REPORTING PERIOD

Sand extraction and processing from Domain 7 will continue in the 2023 reporting period, with the dredge now in Domain 7 as of mid-January. Extraction is unlikely to proceed into Domains 1, 2 or 3.

Other construction activities due to commence during 2023 include the installation of a new section of the wash plant. This section will include a dewatering screen and radial stacker, as well as a cyclone. The old tower will subsequently be decommissioned.

Rehabilitation within areas of the former Domain 4 will continue to be rehabilitated throughout the next reporting period. Weed management is proposed to continue and topsoil removed from Domain 7 will be applied to the surface. Once the existing weeds are under control, direct seeding of the area will be undertaken in accordance with the approved Landscape Management Plan.

Processing activities will continue, consistent with historic processing activities. Average daily laden truck levels will remain within approved limits.

5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

No actions were required as a result of the Department's review of the Annual Review 2021.

6. ENVIRONMENTAL PERFORMANCE

6.1 METEOROLOGICAL MONITORING

Hy-Tec installed a meteorological station in July 2016 in accordance with the requirements of *Condition 3(10)* of SSD_4978. The meteorological station complies with the requirements in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* guideline. The location of the meteorological station is shown on **Figure 3**.

6.1.1 Rainfall

A summary of the rainfall data for the reporting period is provided in **Table 6**. A total of 1,663.6mm of rain was recorded from 1 January 2022 to 31 December 2022. Total rainfall during 2022 was 892.8mm more than in 2021, more than doubling the previous year. Rainfall varied between individual months, with major rainfall events throughout March, July and October.

Table 6
Summary of Rainfall Records Since 2007

	Year															
Month	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Jan	50.5	95.5	29.0	48.5	66.5	133.0	138.0	8.0	163.0	272.0	36.2*	25.6	30.0	64.8	61.8	87.0
Feb	152.0	146.5	137.5	119.5	47.0	179.0	202.0	64.0	46.5	0.0	34.2*	58.4	25.2	208.4	81	99.4
Mar	80.5	43.0	30.0	85.5	97.0	145.0	103.0	135.2	96.5	0.0	208.0	64.4	86.8	134.2	205.8	752.8
Apr	61.5	81.5	117.0	26.0	60.0	64.0	63.5	60.5	285.5	0.0	22.4^	13.4	12.4	57.6	30.2	68.8
May	29.0	10.5	56.5	59.5	96.0	-	31.0	0.0	56.5	0.0	16.6	6.2	4.4	20.0	39.6	43.2
Jun	210.0	94.0	39.5	43.0	85.5	29.0	84.5	29.0	20.5	126.0	54.0	33.0	22.0	12.8	30.4	6.2
Jul	13.0	24.5	17.5	38.5	25.5	27.0	18.5	13.0	34.0	55.0	2.6	5.0	12.2	114.6	25.6	221.0
Aug	107.0	40.5	4.0	13.5	90.0	4.0	11.0	74.5	26.5	36.5	11.6	10.0	26.0	51.4	53.8	51.2
Sep	18.5	58.5	21.0	18.0	69.0	27.5	31.5	29.0	26.5	45.5	0.0	20.0	51.6	37.6	13.8	92.8
Oct	22.0	93.5	85.5	85.0	65.5	17.5	26.5	48.0	34.0	40.4	61.6	88.8	19.6	66.6	29.2	168.4
Nov	157.5	75.0	31.5	127.5	159.0	70.5	106.5	16.5	141.0	72.2	35.8	13.2	24.4	34.2	169.2	52.0
Dec	76.0	71.0	103.5	120.5	72.5	18.5	27.0	150	116.0	69.0	65.0	2.8	0.0	186.0	30.4	20.8
Totals (mm)	**977.5**	**834.0**	**672.5**	**785.0**	**933.5**	**715.0**	**843.0**	**627.7**	**1046.5**	**716.6**	**548.0**	**340.8**	**314.6**	**988.2**	**770.8**	**1663.6**

* Estimated from Putty Tea RMS as Quarry weather station out of service.

^ Data downloaded between 31/3/2017 – 9/4/2017 due to weather station fault

6.2 AIR QUALITY

6.2.1 Introduction

Air quality monitoring is required to be undertaken in accordance with the approved *Air Quality Management Plan***.**

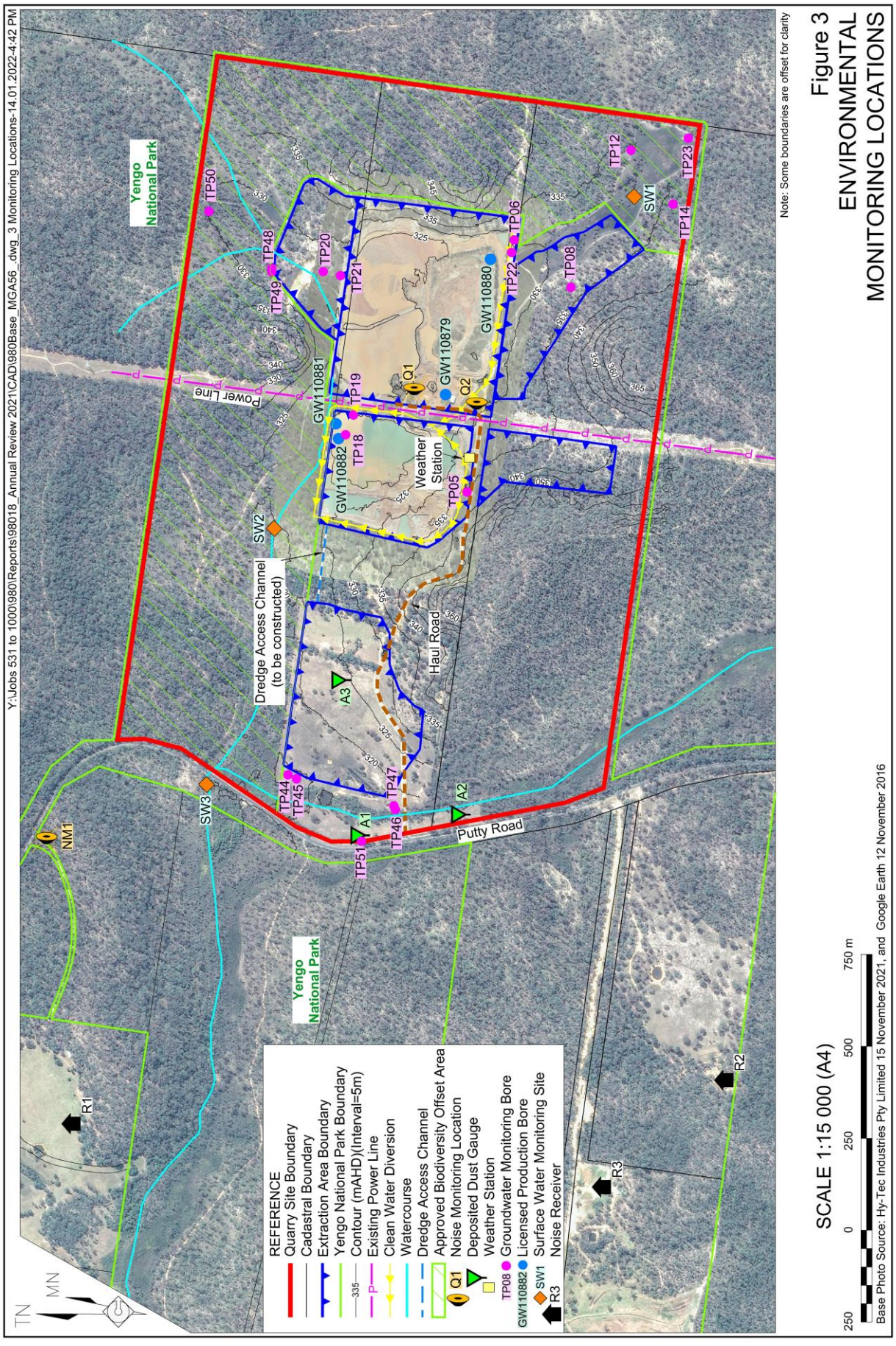


Figure 3
ENVIRONMENTAL MONITORING LOCATIONS

RWCorkery&co

6.2.2 Air Quality Criteria

The air quality criteria for the Quarry are provided in *Condition 3(7)* of SSD_4978 and are summarised in **Table 7**. Deposited dust (DD) is currently the only air quality parameter that is required to be monitored as specified in the approved *Air Quality Management Plan.* The level of monitoring is considered appropriate as all extraction and processing is essentially a 'wet' process and generates limited dust. Deposited dust levels are used as an indicator of the overall air quality performance of operations.

Table 7
Air Quality Criteria

Pollutant	Criterion	Averaging Period
Total suspended particulates (TSP)	90µg/m^3	Annual mean
Particulate matter <10µm (PM_{10}) <10µm (PM_{10})	30µg/m^3	Annual mean
Particulate matter <10µm (PM_{10})	50µg/m^3	24-hour average
Deposited dust	4 g/m^2/month*	Annual mean
* or 2g/m^2/month above the annual background level		

6.2.3 Air Quality Monitoring Results

Monthly deposited dust monitoring was undertaken throughout the reporting period. The location of dust monitoring gauges DG1, DG2 and DG3 are shown on **Figure 3**. **Figure 4** and **Table 8** present the results of the deposited dust monitoring program over the reporting period. It is noted that the approved *Air Quality Management Plan* requires deposited dust monitoring at location DG1 only. Monitoring at locations DG2 and DG3 is undertaken on a voluntary basis and therefore is not subject to compliance under SSD 4978.

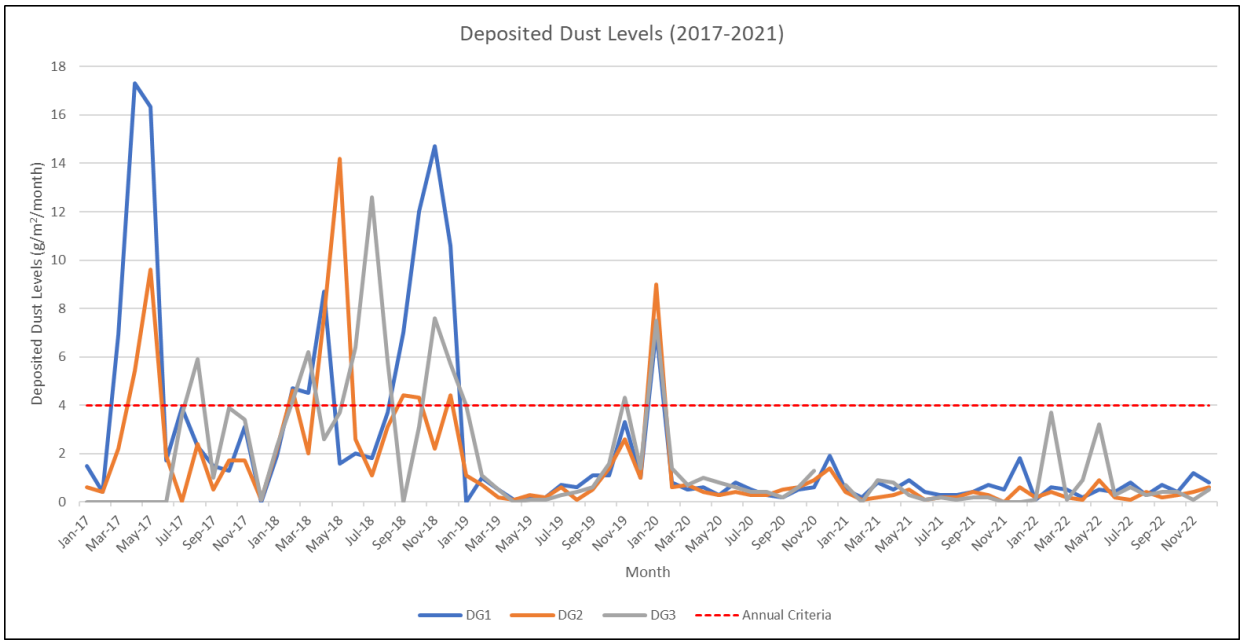


Figure 4 Deposited Dust Levels 2017 to 2022

Table 8
Measured Performance – Deposited Dust

	Deposited Dust Level[1]			
Date	**DG1**	**DG2**	**DG3**	**Criterion**
January	0.1	0.2	0.1	-
February	0.6	0.4	3.7	-
March	0.5	0.2	0.1	-
April	0.2	0.1	0.9	-
May	0.5	0.9	3.2	-
June	0.4	0.2	0.3	-
July	0.8	0.1	0.6	-
August	0.3	0.4	0.3	-
September	0.7	0.2	0.4	-
October	0.4	0.3	0.4	-
November	1.2	0.4	0.1	-
December	0.8	0.6	0.5	-
Annual Average	**0.5**	**0.3**	**0.9**	4
Note 1: Units – g/m^2/month				

6.2.4 Analysis of Results

Deposited dust levels were all well below the trigger value at each dust gauge throughout the reporting period.

Deposited dust levels remained lower than 2017 and 2018 due to the installation of bird deterrence collars on 4 January 2019, which prevented the entry of insects, organic matter, and bird droppings in samples. As a result of the low records, the annual average level is well below the criteria level for the reporting period.

It is noted that the EIS does not include a quantitative assessment of potential air quality impacts as the operation is essentially a 'wet' process and significant air quality impacts were not anticipated.

6.3 OPERATIONAL NOISE

6.3.1 Introduction

Noise monitoring is required to be undertaken in accordance with the conditions listed in the development consent, EPL and approved *Noise Management Plan*. The following subsections provide a brief summary of noise criteria that apply at the Quarry, the results of noise monitoring activities and a discussion of the results recorded during the reporting period.

Following discussions with DPE in January 2017, it was agreed that additional monitoring would be undertaken to provide an estimate of the contribution of the Quarry to noise levels at residential locations. The results of this monitoring for 2022 are presented in Section 6.3.5 and in **Appendix 3**.

6.3.2 Noise Criteria

Condition 3(4) of SSD_4978 is relevant to noise compliance assessment and sets the criteria for noise generated by the development at any residence on privately-owned land as outlined in **Table 9**.

Table 9
Noise Monitoring Criteria SSD_4978 (dB(A))

Receiver	Day / Evening	Night	
	LAeq (15 min)	LAeq (15min)	LA1 (max)
All receivers	35	35	45

Condition L3 of EPL 12007 is relevant to the noise compliance assessment and stipulates the noise criteria at any monitoring point established under the EPL as outlined in **Table 10**.

Table 10
Noise Monitoring Criteria EPL 12007 (dB(A)) – All Receivers

Time Period	Measurement Parameter	Noise level dB(A)
All hours	LAeq (15 minute)	35
Night	Lmax OR LA1, 1min	45

6.3.3 Noise Monitoring Results

Attended noise monitoring was undertaken by Muller Acoustic Consulting Pty Ltd (MAC) on 13 April 2022 in accordance with the approved *Noise Management Plan*. A report prepared by MAC is included as **Appendix 3**.

A summary of the attended noise monitoring results at NM1 is provided in **Table 11**. In all instances the Quarry contribution to noise levels was <35dB$_{LAeq\ (15\ minute)}$.

Table 11
Summary of Attended Noise Monitoring at Receiver NM1

Page 1 of 2

Time (hrs)	Measure (dBA re 20µPa)			Descriptor and Noise Contribution (dBA)
	LAmax	LAeq	LA90	
Morning Shoulder (6:03am)	83	58	23	Traffic 29-43 Birds 20-48 Quarry Hum <20
Morning Shoulder (6:18am)	89	62	22	Traffic 35-89 Birds 29-44 Quarry Hum 20-25 Wind Turbulence 30-33
Morning Shoulder (6:33am)	75	42	23	Traffic 36-75 Birds 30-45 Quarry Hum 20-25

Table 11 (Cont'd)
Summary of Attended Noise Monitoring at Receiver NM1

Time (hrs)	Measure (dBA re 20µPa)			Descriptor and Noise Contribution (dBA)
	LAmax	LAeq	LA90	
Morning Shoulder (6:48am)	83	60	26	Traffic 30-83 Birds 29-38 Wind Turbulence 30-31 Quarry Hum <20
Tinda Creek Quarry Contribution				<25
Day (7:03am)	83	57	25	Traffic 40-83 Birds 29-31 Wind Turbulence 30-32 Quarry Hum 20-25
Day (7:18am)	85	61	26	Traffic 35-85 Birds 40-50 Wind Turbulence 30-33 Quarry Hum 20-25
Day (7:33am)	85	63	29	Traffic 37-85 Birds 29-44 Aircraft 30-33 Quarry Hum <20
Day (7:48am)	106	69	30	Traffic 35-82 Birds 29-44 Wind Turbulence 30-33 Operator noise 105-106 Quarry operations 20-25
Tinda Creek Quarry Contribution				<25

6.3.4 Attended Noise Measurement Compliance Assessment

The compliance assessment summary for R1 (see **Figure 3**) is presented in **Table 12** for day and morning shoulder assessment periods and compares operational contributions against the relevant criteria.

Table 12
Day and Morning Shoulder Noise Compliance Assessment at R1

Period	Quarry Noise Contribution $L_{Aeq(15min)}$	Quarry Noise Criteria $L_{Aeq(15min)}$	Compliant
Day	<25	35	Yes
Morning Shoulder	<25	35	Yes

The overall contribution of the Quarry to ambient noise was found to be less than 20dB(A) at the time of the monitoring which is within the limits set by both SSD_4978 and EPL 12007. These results indicate that the Quarry is complying with all relevant noise assessment criteria.

The results of the noise monitoring program are also comparable with historic noise monitoring data from Tinda Creek Quarry. Attended noise monitoring conducted from 2016 to 2021 estimated Quarry noise contribution to vary between be <25dB(A) and <20bB(A) in each reporting period. This indicates that current noise mitigation measures are effective in restricting noise to an acceptable level.

6.3.5 Quarry Noise Predictions at Residences

On 20 January 2017, the DPE requested that Hy-Tec undertake additional noise monitoring to record existing noise levels (sound power levels) that were being produced at the Quarry and undertake an assessment to predict the noise impact of the Quarry at nearby privately-owned residences. The request was only made for the year 2017, however Hy-Tec has taken on the initiative to continue to assess the noise levels at surrounding residences that could potentially be impacted by noise generated from Quarry operations.

Sound power levels were measured at locations Q1 and Q2 (see **Figure 3**) with the results of this assessment presented in **Appendix 3**. In summary, it was concluded that Quarry noise at R1, R2, and R3 after taking into consideration the attenuation caused from distance and topography is 21dB(A), 20dB(A), and 21dB(A) at the respective residences. These results all fall well below the criteria nominated by both the SSD_4978 and the EPL12007 of 35dB(A). It is noted that the noise levels are also well below the predicted noise levels modelled during the preparation of the EIS which ranged from <30dB(A) to 35dB(A) at the nearest receivers.

6.4 ABORIGINAL HERITAGE

No actions or impacts related to Aboriginal heritage occurred during the reporting period.

6.5 NON-ABORIGINAL HERITAGE

No actions or impacts related to non-Aboriginal heritage occurred during the reporting period.

7. WATER MANAGEMENT

7.1 GROUNDWATER

7.1.1 Groundwater Quality Monitoring

Groundwater quality monitoring was conducted by Hy-Tec in accordance with the approved *Water Management Plan*. Groundwater quality monitoring was undertaken at six-month intervals over the reporting period at the locations shown on **Figure 3**. The groundwater quality assessment trigger values recorded in the approved *Water Management Plan* are presented in **Table 13**.

Table 13
Groundwater Quality Trigger Criteria

Analyte	Lower Trigger Value	Upper Trigger Value
pH	<4.5	>7.0
Conductivity (µS/cm)	N/A	900
Nitrate (mg/L)	N/A	7.5
Ammonia (mg/L)	N/A	0.2
TRH (C6-C9) (mg/L)	N/A	5.0
TRH (C10-C14) (mg/L)	N/A	5.0
TRH (C15-C28) (mg/L)	N/A	5.0
TRH (C29-C36) (mg/L)	N/A	5.0
Source: Water Management Plan (RWC, 2019) – Table 18		

The results of the groundwater quality monitoring data are outlined in **Tables 14** and **15**. All results for Total Recoverable Hydrocarbon (TRH) were below the limit of recording and it is assumed there was none present. TRH is not discussed further in this review.

7.1.2 Analysis of Groundwater Quality Results

General observations from the groundwater quality monitoring data are as follows:

- There have been no exceedances of the relevant criteria throughout the reporting period.
- The slightly acidic pH is consistent with historic data and likely to represent the breakdown of plant material.
- The outcomes for EC are consistent with historic data and within the assumed trigger levels.
- It is highly unlikely that quarrying activities are impacting groundwater quality.
- pH, conductivity, nitrate and ammonia results are consistent with groundwater monitoring data obtained during previous monitoring campaigns. No distinct temporal trends are evident within the measured parameters.

Table 14
Water Monitoring Results – 29 March 2022

Bore Hole	pH	EC (µS/cm)	Nitrate (mg/L)	Ammonia (mg/L)
TP05	5.9	185	<0.1	<0.1
TP06	5.9	60	<0.1	<0.1
TP08	5.5	90	<0.1	<0.1
TP12	5.6	60	0.13	<0.1
TP14	5.8	55	<0.1	<0.1
TP20	5.8	60	0.62	<0.1
TP21	5.8	60	0.66	<0.1
TP22	5.4	55	1.5	<0.1
TP23	5.6	225	<0.1	<0.1
TP44	5.7	190	0.13	<0.1
TP45	6.1	95	<0.1	<0.1
TP46	6.2	120	<0.1	<0.1
TP47	6.2	110	<0.1	<0.1
TP48	5.5	240	0.27	<0.1
TP49	5.3	330	<0.1	<0.1
TP50	6.2	90	<0.1	<0.1
TP51	5.8	60	0.62	<0.1

Table 15
Water Monitoring Results – 28 November 2022

Bore Hole	pH	EC (µS/cm)	Nitrate (mg/L)	Ammonia (mg/L)
TP05	5.6	180	<0.1	<0.1
TP06	5.4	45	<0.1	<0.1
TP08	4.9	70	<0.1	0.3
TP12	5.7	55	0.18	<0.1
TP14	5.6	55	0.22	<0.1
TP20	6.0	100	1.9	2.9
TP21	5.7	55	2.6	<0.1
TP22	5.7	50	<0.1	<0.1
TP23	5.1	60	0.31	<0.1
TP44	6.7	220	<0.1	<0.1
TP45	6.8	170	<0.1	<0.1
TP46	7.0	90	0.13	<0.1
TP47	5.9	100	<0.1	<0.1
TP48	6.5	290	<0.1	0.8
TP49	5.3	220	0.31	<0.1
TP50	5.0	270	<0.1	<0.1
TP51	5.7	95	<0.1	<0.1

The EIS noted that the groundwater tended to be slightly acidic due to the generation of organic acid from the breakdown of plant material (min pH = 4.6, max pH = 6.7). The EIS further noted that conductivity was generally very low (min µS/cm = 55, max µS/cm = 330). The groundwater quality results are generally consistent with those presented in the EIS and it is unlikely that extractive operations are impacting on the quality of the groundwater.

It is noted that bores TP18 and TP19 had been removed as a part of the development of Domain 6. Additional monitoring bores TP44, 45, 46, 47, 48, 49, 50 and 51 were installed in 2017.

7.1.3 Groundwater Level Monitoring

Groundwater levels at the monitoring bores were monitored monthly in accordance with the approved *Water Management Plan*.

Groundwater levels in the monitoring bores are used to assess the impacts of Quarry operations on the surrounding aquifers. This analysis involves assessing the risk of Quarry operations impacting on the Greater Blue Mountains Heritage Area. No significant impacts were anticipated to groundwater flow as a result of quarrying activities.

Table 16 presents the drilled depth and groundwater investigation trigger level for each bore within the groundwater monitoring network.

Table 16
Groundwater Investigation Trigger Levels

Bore	Drilled Depth (m)	Trigger Level mBGL
TP22	12	4.43
TP06	18	5.91
TP12	15	6.67
TP23	15	6.77
TP14	20	9.08
TP08	18	6.76
TP05	15	8.75
TP18*	18	3.30
TP19*	12	4.79
TP20	12	5.84
TP21	12	5.84
TP44	18.5	3.11
TP45	9	3.36
TP46	20	1.71
TP47	12	0.69
TP48	18	5.85
TP49	10	5.80
TP50	20	7.67
TP51	16	2.49
* Bore no longer accessible		
Source: Water Management Plan (RWC, 2019) - Table 17		

Groundwater level monitoring has been undertaken at 11 groundwater bores since October 2010 (bores TP05, TP06, TP08, TP12, TP14, TP18, TP19, TP20, TP21, TP22, TP23). In March 2018, monitoring also commenced at a further five bores located to the west of the Quarry (TP44, TP45, TP46, TP47, and TP51) and three bores in the vicinity of Domain 7 (TP49, TP48 and TP50). The locations of the monitoring bores are shown on **Figure 3**.

The results of the 2022 groundwater levels monitoring are outlined in **Table 17** and displayed in **Figure 5**. The historical groundwater levels are presented in **Figure 6** and **Figure 7**. Monitoring results are displayed for both the original monitoring bores and the newly constructed bores.

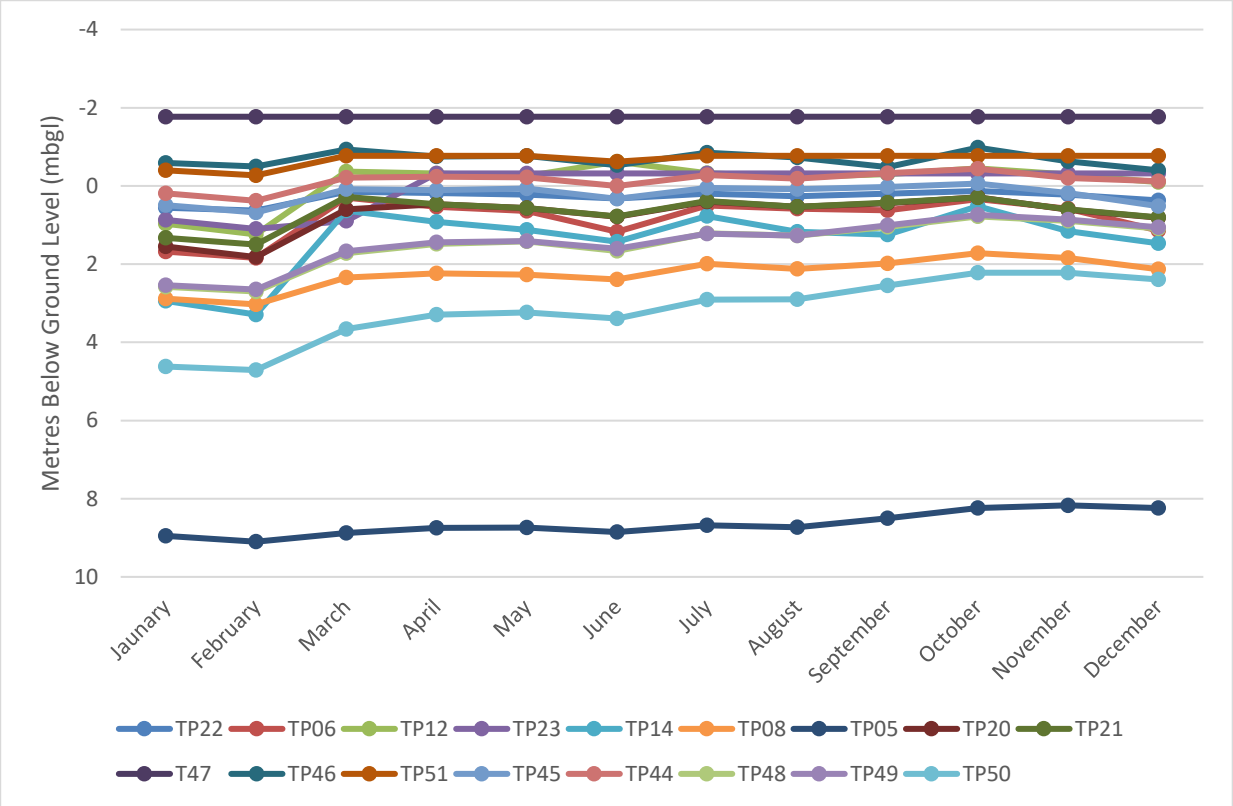


Figure 5 2022 Groundwater Level Monitoring Results

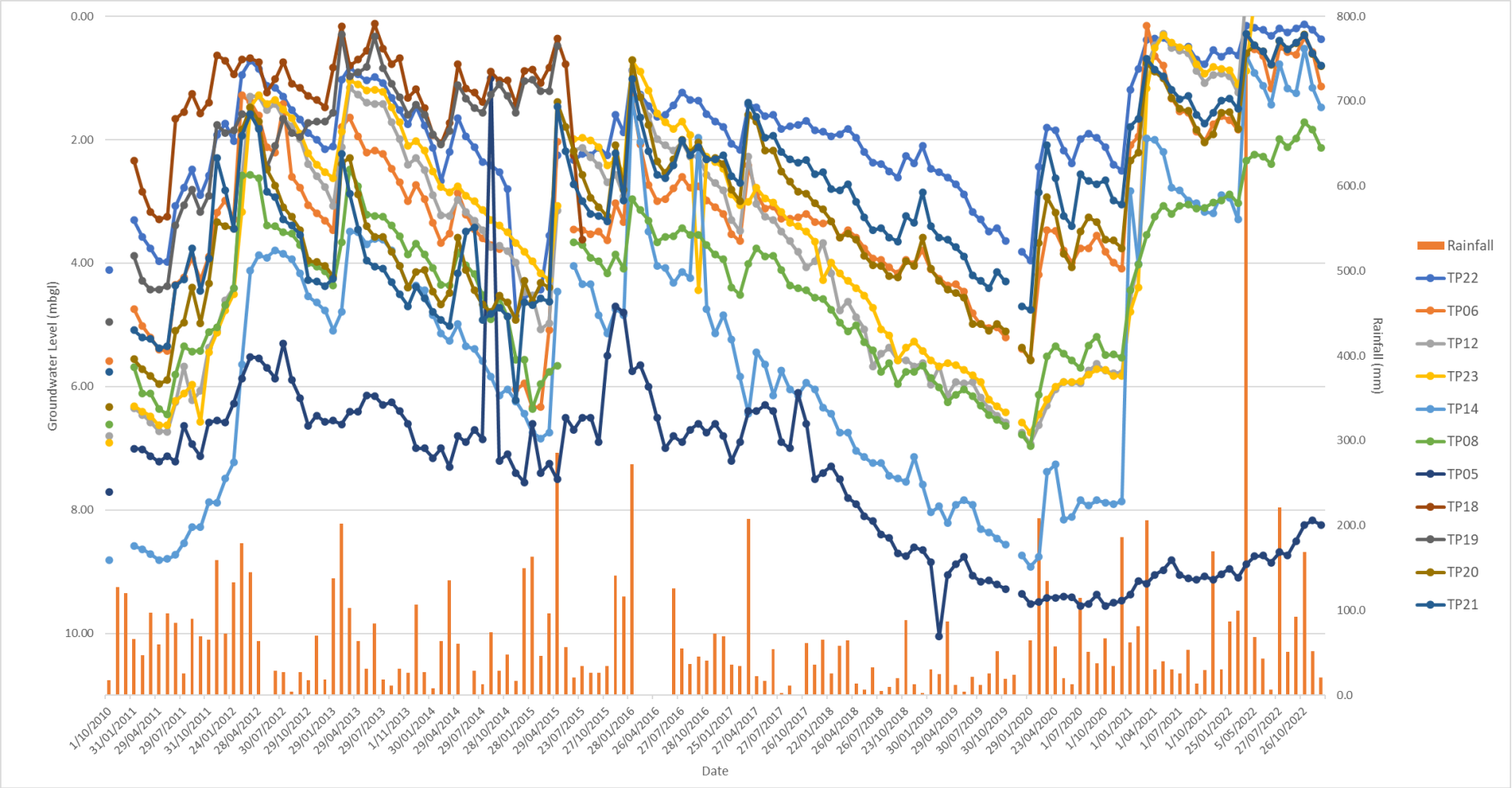


Figure 6 Hydrography for Site Bores with Monthly Rainfall (Historic Bores)

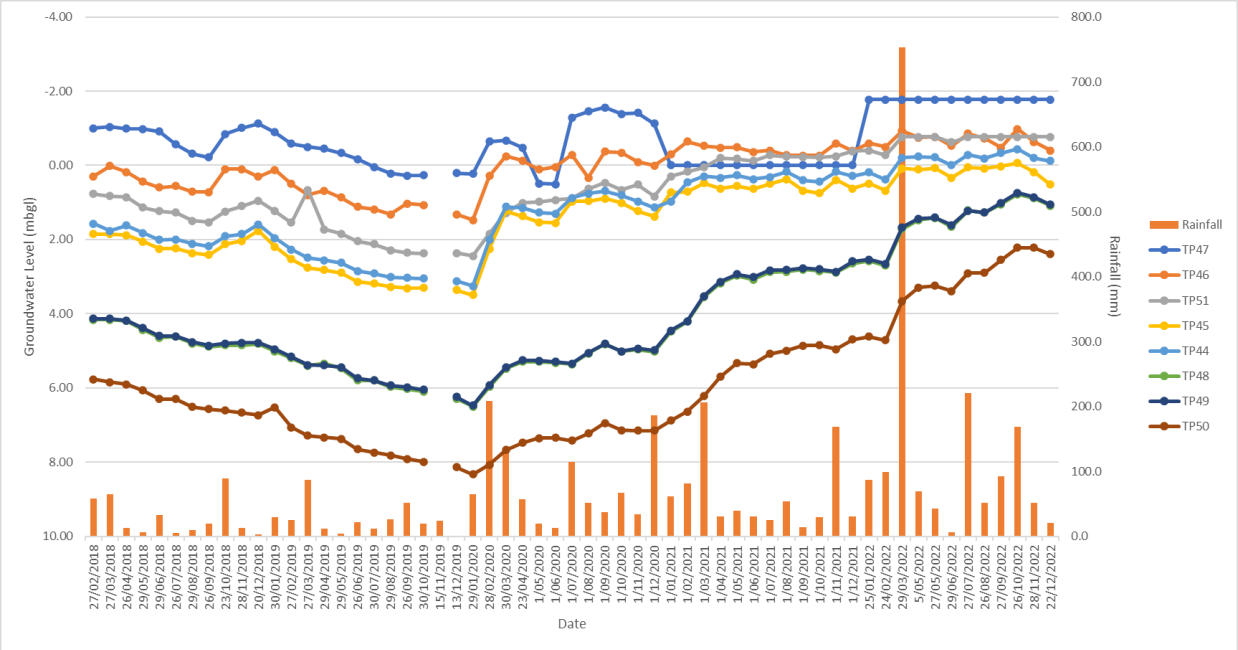


Figure 7 Hydrography for Site Bores with Monthly Rainfall (New Bores)

Table 17
Results of 2022 Groundwater Levels Monitoring Program

Bore Hole	Trigger	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		Depth to water (mbgs)											
TP22	**4.43**	0.56	0.63	0.15	0.18	0.22	0.32	0.20	0.26	0.20	0.13	0.22	0.37
TP06	**5.91**	1.68	1.84	0.30	0.53	0.64	1.17	0.50	0.58	0.62	0.34	0.58	1.14
TP12	**6.67**	0.97	1.24	-0.37	-0.32	-0.25	-0.62	-0.33	-0.23	-0.30	-0.45	-0.29	-0.10
TP23	**6.77**	0.87	1.10	0.89	-0.32	-0.32	-0.32	-0.32	-0.32	-0.32	-0.32	-0.32	-0.32
TP14	**9.08**	2.94	3.29	0.63	0.92	1.12	1.43	0.77	1.17	1.25	0.52	1.16	1.47
TP08	**6.76**	2.88	3.03	2.34	2.24	2.27	2.39	1.99	2.12	1.98	1.72	1.84	2.13
TP05	**8.75**	8.95	9.10	8.88	8.75	8.74	8.85	8.68	8.73	8.50	8.24	8.17	8.24
TP20	**5.84**	1.55	1.82	0.6	0.47	0.57	0.79	0.4	0.53	0.44	0.29	0.61	0.81
TP21	**5.84**	1.33	1.5	0.28	0.47	0.57	0.78	0.39	0.53	0.43	0.3	0.6	0.8
TP47	**0.69**	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77	-1.77
TP46	**1.71**	-0.59	-0.5	-0.93	-0.75	-0.77	-0.53	-0.85	-0.73	-0.48	-0.98	-0.63	-0.4
TP51	**2.49**	-0.4	-0.27	-0.77	-0.77	-0.77	-0.62	-0.77	-0.77	-0.77	-0.77	-0.77	-0.77
TP45	**3.36**	0.49	0.68	0.08	0.11	0.07	0.33	0.05	0.08	0.03	-0.06	0.18	0.52
TP44	**3.11**	0.19	0.38	-0.21	-0.24	-0.22	0	-0.28	-0.19	-0.33	-0.44	-0.2	-0.12
TP48	**5.85**	2.58	2.7	1.72	1.48	1.42	1.66	1.21	1.27	1.05	0.78	0.89	1.09
TP49	**5.80**	2.54	2.65	1.67	1.44	1.41	1.61	1.22	1.27	1.01	0.74	0.86	1.06
TP50	**7.67**	4.62	4.71	3.66	3.29	3.24	3.39	2.91	2.9	2.55	2.22	2.22	2.39
Red text indicates exceed trigger levels													

7.1.4 Analysis of Groundwater Level Results

Figure 5 indicates that over the reporting period groundwater levels have remained relatively stable. However, when viewed in conjunction with historic records (**Figure 6** and **Figure 7**) it is evident that groundwater levels have recovered or stabilised following a period of drought. An increase in water level was observed in all bores in March 2022, followed by a slight decrease/stabilisation over the rest of the year. Several bores continue to indicate artesian conditions in the aquifer resulting in water levels above ground level in the monitored bores (within the casing). This is considered to likely represent confined aquifer conditions with subsequent pressure forcing water into the bore and then stabilising within the casing. A number of bores including TP23, TP47 and TP51 experienced overtopping for the majority of the reporting period.

Groundwater levels in monitoring bore TP05 were below the investigation trigger levels for the first half of the reporting period. Groundwater levels at this bore have consistently been below the trigger levels, established in the Water Management Plan, for the past four years. These results have been assessed by a hydrogeologist and determined not to be caused by quarrying activities. It is indicated that this trigger level may no longer be appropriate for this bore.

Historically, TP05, which is close to the active Domain 6 has not been as responsive to recharge as other bores. At the upgradient north-eastern site of the Site the water levels continued rising, while at the south-eastern upgradient corner of the Site the groundwater levels declined slightly or remained stable.

Monitoring bores TP46, TP47 and TP51 located downgradient of the Quarry retain high groundwater level (artesian) conditions, however TP47 and TP51 do not accurately measure the water level as they continue flowing at an elevation of 1.7 m and 0.77 m above ground level. The continued rise in groundwater levels in the upgradient areas following above average rainfall and artesian conditions at the downgradient areas indicates regional groundwater recharge with continued discharge downgradient. All bores continued to respond to rainfall/recharge consistent with historical trends.

7.1.5 Groundwater Usage

Hy-Tec have the capacity to extract 44 megalitres (ML) of water per year under its water access licences and water supply works approvals (see Section 3 and **Table 3**). Water extracted from the deeper aquifers are primarily used to fill the dredge pond and for use in dust suppression during extended dry periods.

The approved *Water Management Plan* requires that the quantity of water obtained from production bores is monitored on a monthly basis. **Table 18** presents a summary of the groundwater usage from January 2022 until December 2022.

A total of 0.20ML of groundwater was utilised over the reporting period which represents a decrease of 0.94ML compared to 2021. Hy-Tec is approved to use 44ML of water per annum (based on a water year (July to June)). It is noted that between July 2021 to June 2022 a total of 1.09ML of water was used.

Table 18
Groundwater Usage – Meter Reading and Monthly Usage

Date	Meter Reading (KL)	Usage (ML)
January	54961	0.011
February	54981	0.02
March	55008	0.027
April	55064	0.056
May	55072	0.008
June	55085	0.013
July	55093	0.008
August	55096	0.003
September	55111	0.015
October	55122	0.011
November	55130	0.008
December	55151	0.021
Total	**660874**	**0.201**

The overall reduced water use during the reporting period resulted from higher than average rainfall that was captured in the closed water management system and used rather than water sourced from the production bore.

7.2 SURFACE WATER

7.2.1 Introduction

The Tinda Creek Quarry is situated near the top of the Tinda Creek catchment. Tinda Creek itself typically experiences intermittent, short duration flows immediately following heavy rainfall events. Previous monitoring, conducted in 2008 and 2015, indicates that quarrying activities have not impacted negatively on the Tinda Creek system and the downstream portions of the creek remain consistent with other creek systems in the vicinity of the Quarry.

The Quarry utilises a closed water management system in order to minimise any potential impacts on downstream water quality, flow regimes and habitats. This system has been successfully implemented for the past 30 years and involves a number of pump lines and catch drains.

Clean water diversion drains have been constructed within the Quarry Site in order to prevent clean runoff entering the operations area. The diversion drain system shown on **Figure 3** comprises the following components.

- Southern Diversion
- Southern Diversion Extension
- Existing Diversion.

Clean water diversion for operations in Domain 6 were constructed in 2017. During the reporting period the clean water diversion drain was moved to the southern side of the access road.

During the reporting period the closed water management system covered an area of approximately 36ha and remained within the limit of 40ha at any one time, as described in *Condition 3(12)* of SSD_4978.

7.2.2 Surface Water Monitoring

Surface water monitoring was conducted generally in accordance with the approved *Water Management Plan* over the reporting period. A summary of the required surface water monitoring is provided in **Table 19**.

Table 19
Surface Water Monitoring Regime

Monitoring Type	Location	Parameters Monitored	Frequency of Monitoring	Monitoring Method
Dredge Pond Level	Dredge Pond	Level (depth below ground)	Monthly	Observation or dip
Surface Water Quality	Upstream and downstream of Quarry	pH, EC, turbidity	Monthly if water is flowing in Tinda Creek. Samples will also be taken after more than 50mm of rain in 24 hours if water is flowing.	Grab Sample
Drainage Lines and Diversion Drains	Upstream and downstream of quarry	Stability, erosion, and sediment build up	Monthly and event based	Observation and photography
Closed Water Management System	Quarry	Stability, erosion, and sediment build up	Monthly and event based	Observation and photograph

7.2.3 Dredge Pond Water Levels

The *Water Management Plan* requires that dredge pond water levels are assessed on a monthly basis. The depth of water in any operating dredge pond is to remain more than 5m to avoid triggering further investigations. Documented monthly monitoring of dredge pond levels was undertaken by Hy-Tec from January 2022 to December 2022. Water levels were recorded at approximately 10.7mbgs during each survey. On the basis of these results no further investigations were required.

7.2.4 Surface Water Quality

Surface water quality monitoring was conducted by Hy-Tec in accordance with the approved *Water Management Plan*. The surface water quality assessment trigger values recorded in the approved *Water Management Plan* are presented in **Table 20**.

Insufficient water was available to sample upstream and downstream of the Quarry during January of the reporting period. The results from the remainder of the reporting period are presented in **Table 21**.

Table 20
Surface Water Quality Triggers

Parameter	ANZECC Trigger*
pH	6.5-8.0
Electrical Conductivity	30-350
Turbidity	2-25
* ANZECC (2000) guideline triggers are based on values for upland streams in NSW (see Table 3.3.2 and Table 3.3.3 of ANZECC (2000)).	

Table 21
Surface Water Quality Results – 2022

Month	Monitoring Location	Parameter		
		pH	Electrical Conductivity	Turbidity
January	SW1	NM	NM	NM
	SW2	NM	NM	NM
	SW3	NM	NM	NM
February	SW1	7.17	64	2.5
	SW2	7.04	61	96.5
	SW3	6.63	173	9.1
March	SW1	5.91	42	224
	SW2	5.88	43	220
	SW3	6.1	46	283
April	SW1	5.82	46	3.5
	SW2	6.3	51	11.3
	SW3	6.52	79	5.7
May	SW1	5.81	55	3.5
	SW2	5.97	57	13.4
	SW3	5.99	74	12.3
June	SW1	5.58	64	3.2
	SW2	6.15	66	14.2
	SW3	5.99	68	16.9
July	SW1	5.63	49	3
	SW2	5.96	45	10
	SW3	5.87	68	4.9
	Gibba	6.16	48	15.5
August	SW1	6.01	54	2.4
	SW2	6.31	52	12.7
	SW3	6.4	74	17
	Gibba	6.56	53	16
September	SW1	6.26	56	4.7
	SW2	6.41	52	18.9
	SW3	6.44	78	5.7
	Gibba	6.65	53	12.2
October	SW1	6.33	57	4.1
	SW2	6.37	57	20.1
	SW3	6.43	50	19.1
	Gibba	6.36	50	7
November	SW1	6.39	66	3.7
	SW2	6.53	73	10.1
	SW3	6.55	79	12.8
	Gibba	7.3	107	12.9
December	SW1	6.26	76	12.6
	SW2	6.07	72	10.1
	SW3	5.88	79	8.74

The pH values recorded at the Quarry are below the ANZECC (2000) trigger for upland creek systems, however, runoff from sedgelands tends to have lower pH due to the presence of humic acid in the surface litter and the upper soil profile. This can result in pH values as low as 4.5 to 5.0 in surface runoff. These results are consistent with the baseline results presented in the approved *Water Management Plan*. The exceedance in turbidity in SW2 is attributed to heavy rainfall and the impacts of the 2019 bushfires which removed most of the groundcover and shrub layer, thereby exacerbating the runoff of suspended sediment into these ponds.

7.2.5 Surface Water Discharge Events

On four occasions during 2022 Hy-Tec initiated controlled discharge of water from the Quarry Site in response to significant rainfall events. The dates when discharge was initiated were 7 March 2022, 30 March 2022, 5 July 2022 and on 11 October 2022. On 3 July 2022, a significant rainfall event occurred upstream of the Quarry which caused short term uncontrolled discharge. The rainfall event was considered to be consistent with descriptions of "rain bomb" events that were occurring at the time. Over 200mm was recorded at the site at the same time however the event was likely to have been substantially higher than that elsewhere. The event occurred over a weekend when the site was not attended. The following presents the outcomes of the water quality monitoring at the time of discharge including an overview of the rainfall experienced at the time. Compliance matters relating to the discharge incidents are discussed in Section 11.2.

7.2.5.1 Rainfall

Recent records identify that above average rainfall has occurred in the vicinity of the Quarry. For context, a summary of recent rainfall, recorded at Bureau of Meteorology (BoM) stations and a Department operated flow gauging station near the Quarry as well as data obtained from the Scientific Information for Landowner's (SILO) data service is presented in **Table 22** below.

Table 22
Recorded and Average Annual Rainfall in the Vicinity of the Quarry

Source	ID	Period of Record	Annual Rainfall (mm/year)			
			2020	2021	2022	Average
Quarry Site	None	2007 – present	985.8	769.6	1,637.2[1]	796.7
Putty (the Gibba)	BoM ID 61336	2001 – present	761[1]	888	998[1]	627.2
Putty Tea Rooms	BoM ID 61209	1962 – present	1,100.8	893	1,306.2[1]	743.8
Macdonald River at Howes Valley	Gauge ID 212021	2014 – present	1,066.6	837.4	759.4[1]	658.4[2]
SILO	-33.15S, 150.70E	1889 – present	1,082.7	896.7	1,159.5[1]	854.7

Notes
1: Incomplete annual record
2: Highest daily flow (31,034.44 megalitres) recorded 5 July 2022 (average daily flow = 89.62ML/day).

As shown in **Table 22**, annual rainfall at each location over the past three years has exceeded that location's average, excluding the Quarry Site records in 2021. This despite some years (particularly 2022) having incomplete annual records. Quarry Site records for 2022 are almost double the average and substantially higher than previous records, with the next highest annual rainfall recorded in 2015 (1046.5mm). The nearest BoM station to the Quarry (the Gibba) has

also recorded higher than average rainfall, with 2022 rainfall presently 37% above average. This has led to significant saturation of catchments such that their response to rainfall events is much higher than would normally be anticipated. This is demonstrated by the highest ever daily flow (31,034.5 megalitres) recorded at the Macdonald River gauge following 197.6mm of rainfall over the preceding five days in July 2022. This catchment saturation has also led to much higher runoff volumes entering the closed water management system and requiring subsequent management via controlled discharge as these inflows exceed what was originally envisaged and planned to occur during normal Quarry operations.

7.2.5.2 Water Quality Data Collection

Locations

Where safe to do so, the Quarry has endeavoured to collect water quality samples for laboratory analysis either during or following discharge events. These samples are collected at representative locations upstream and downstream of the Quarry, at the point of discharge and a location hydrologically disconnected from the Quarry (the Gibba).

In effect the upstream location provides an indication of receiving water quality whilst the downstream location provides an indication of water quality following the mixing of Quarry discharge with receiving waters. The hydrologically disconnected location at the Gibba provides a refence point for data comparison.

Water quality samples were taken daily while discharge was occurring to test pH, electrical conductivity and turbidity with the following samples taken for each event.

- 7 March 2022 – 10 samples
- 30 March 2022 – 3 samples
- 3/5 July 2022 – 10 samples
- 11 October 2022 – 6 samples

In addition, the Quarry conducted a separate monitoring event on 22 November 2022 and submitted the collected samples to an extended analytical suite that included:

- Major and minor ions;
- Dissolved metals;
- Nutrients; and
- Hydrocarbons.

7.2.5.3 Results and Discussion

Summary statistics for this data and the trigger values recommended in ANZECC (2000)[1] for eastern draining upland streams of south-eastern Australia is presented in **Tables 23** to **25** below. Box and whisker plots (refer **Figures 8** to **10**) using these summary statistics have been compiled

[1] It is recognized that the water quality guidelines for Australia and New Zealand were updated in 2018, However, this update did not result in a complete revision of ANZECC (2000), hence reference to this document as the relevant guidance.

and used to present the results of discharge water quality sampling. This type of plot is extremely useful in providing a visual representation of the statistical interpretations recommended in ANZECC (2000) for condition assessment. All plots present data as maximum, minimum, median, 20th and 80th percentiles. The median has been chosen for comparison to trigger values and is the current approach recommended in Section 7.4.4 of ANZECC (2000). This approach is not intended as an instrument to assess compliance but as a mechanism for the management of potential impacts.

Table 26 presents the results of the 22 November 2022 monitoring event and a comparison with applicable trigger values for the protection of aquatic ecosystems (95th percentile species protection).

As shown in **Table 23** and **Figure 8** the median measured pH at all locations were below the minimum trigger value recommended by ANZECC and the recorded maxima were all within the recommended range. This is likely reflective of meteoric rainfall that typically has sub-neutral pH. Notably, Quarry discharge pH was similar to that recorded upstream whilst that recorded downstream was similar to recorded pH at the Gibba. This would suggest that Quarry discharge does not alter pH in the receiving environment that is naturally lower than guideline values.

Table 23
Summary Statistics for Discharge Water Quality Monitoring: pH

Location	Minimum	20th	Median	80th	Max
Upstream	4.4	5.3	5.7	6.1	6.4
Dredge Pond	4.4	5.2	5.6	5.8	6.2
Downstream	4.9	5.5	6.0	6.2	7.1
Gibba	5.4	5.8	6.2	6.4	7.0
Trigger[1]	6.5				7.5
Note 1: ANZECC (2000) Table 3.3.2					

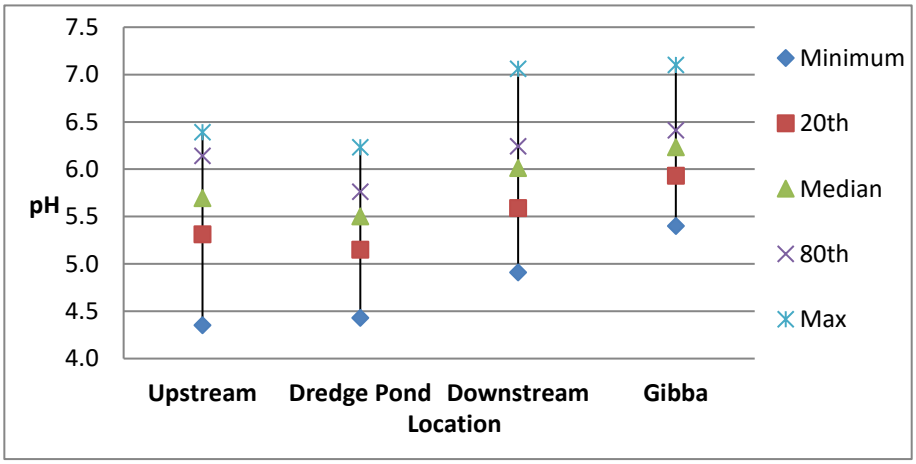


Figure 8 **Summary Statistical Plot for Discharge Water Quality Monitoring: pH**

As shown in **Table 24** and **Figure 9** the measured EC at all locations were within the bounds recommended by ANZECC. Of note are the maximum values recorded in Quarry discharge and downstream that are not coincident (Quarry = 7 October 2022, Downstream = 1 April 2021). This suggests runoff from other sources is potentially influencing water quality downstream of the Quarry.

Table 24
Summary Statistics for Discharge Water Quality Monitoring: Electrical Conductivity

Location	Minimum	20th	Median	75th	Max
Upstream	15	32.6	41	42.8	64
Dredge Pond	16	37	40	45.8	93
Downstream	15	35	43	55	77
Gibba	27	37	42	61.2	70
Trigger[1]	30				350
Note 1: ANZECC (2000) Table 3.3.3					

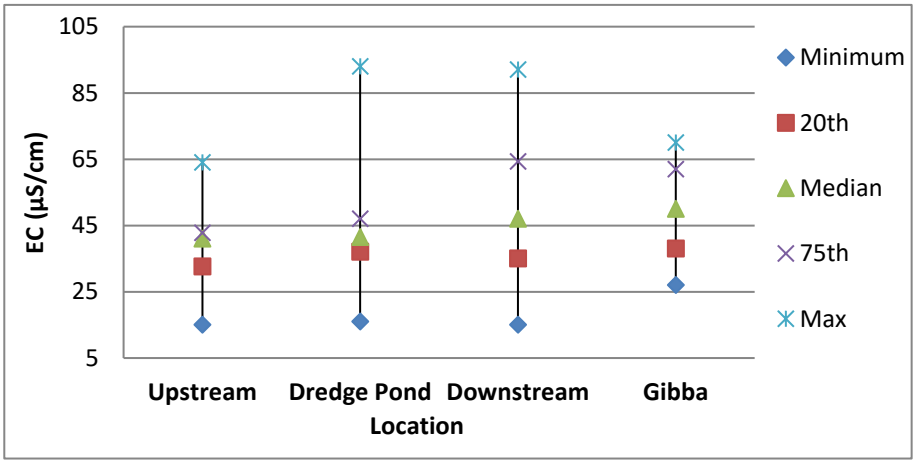


Figure 9 **Summary Statistical Plot for Discharge Water Quality Monitoring: Electrical Conductivity**

Whilst **Table 25** and **Figure 10** identifies elevated turbidity in Quarry discharge, the calculated median at the Gibba also exceeds the upper threshold recommended by ANZECC (2000). This suggests that elevated turbidity is (periodically) representative of natural conditions. This is noted in ANZECC that states high values may be observed during high flow events. It is however recognised that, whilst not measured in orders of magnitude, turbidity in Quarry discharge is higher than that recorded at other locations. This is likely attributable to the placement of the pump inlet during discharge which may have led to the collection of deposited materials. However, again the record maxima in discharge and downstream of the Quarry are not coincident with the date of the Quarry maximum (9 March 2022) returning a turbidity of 48.4NTU, similar to the calculated median (50NTU).

Table 25
Summary Statistics for Discharge Water Quality Monitoring: Turbidity

Location	Minimum	20th	Median	80th	Max
Upstream	3	7	18	96	274
Dredge Pond	13	204	454	499	686
Downstream	12	24	53	81	556
Gibba	13	16	23	32	86
Trigger[1]	2				25
Note 1: ANZECC (2000) Table 3.3.3					

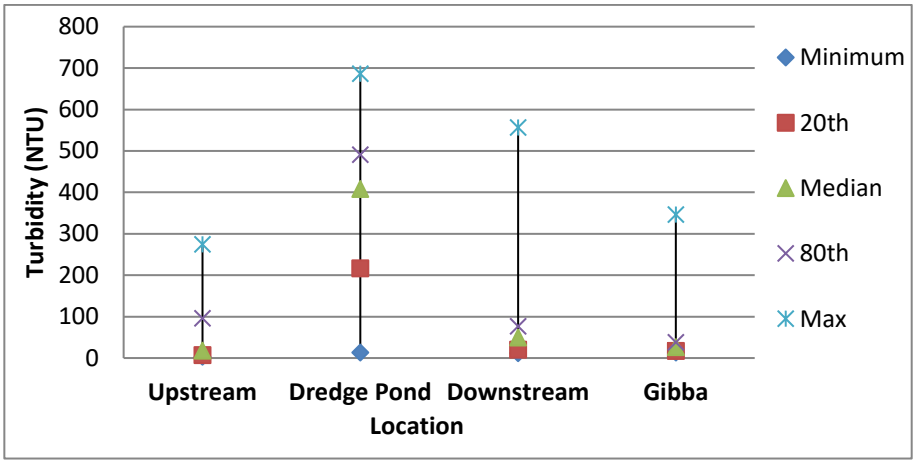


Figure 10 Summary Statistical Plot for Discharge Water Quality Monitoring: Turbidity

As shown on **Table 26** the extended analytical suite did not identify any exceedance of applicable trigger values in either the Quarry's dredge pond (reflective of discharge water quality) or the receiving environment. Of significant relevance is an absence of detectable dissolved metals concentrations in the dredge pond that could potentially adsorb onto suspended particles that may then be discharged from the Quarry. However, it is noted that chromium was detected at levels greater than the trigger value both upstream and downstream of the Quarry. Whilst the reduction of organic material and complexation with dissolved ions can limit the availability of this metal, it is apparent that it is reflective of the catchment. This notwithstanding, **Table 26** clearly demonstrates that water quality of the dredge pond is similar to that of the receiving environment and, on the basis of this sampling round, suggests that no material harm to the environment would arise from either controlled and uncontrolled discharge from the Quarry.

7.2.5.4 Summary

The area in which the Quarry is situated has experienced prolonged high (and at times extreme) rainfall during the reporting period. This has led to the need for the Quarry to discharge water from its closed water management system as inflows have been in excess of what was originally envisaged and planned for normal Quarry operations.

The Quarry has undertaken monitoring of water quality at representative locations either during or following these discharge events. The results of this monitoring identify that, with the exception of turbidity, the quality of water discharged from the Quarry is similar to that of the receiving surface water environment. In the case of turbidity, it is acknowledged that values are elevated however it is considered that this is the result of equipment positioning and can be readily rectified should further discharge be warranted. Furthermore, the results of an extended analytical suite indicate that the quality of water within the closed water management system meets the criteria established in published water quality guidance for aquatic ecosystems. Therefore, based on the results of water quality analyses to date, discharge from the Quarry would not have resulted in material harm to the environment.

Table 26
Extended Analytical Suite 22 November 2022

Location	Unit	Trigger	Upstream	Dredge Pond	Downstream	Gibba
Major Ions						
Calcium	mg/L	None available	<1	<1	1	3
Magnesium	mg/L	None available	<1	<1	2	2
Sodium	mg/L	None available	11	15	10	8
Potassium	mg/L	None available	2	1	2	2
Sulfate	mg/L	None available	<10	<1	<10	<10
Chloride	mg/L	None available	14	24	11	10
Dissolved Metals						
Arsenic	mg/L	0.013	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.0002	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	**0.002**	<0.001	**0.001**	<0.001
Copper	mg/L	0.0014	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.0034	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	0.011	<0.001	<0.001	0.009	0.001
Zinc	mg/L	0.008	<0.005	<0.005	0.012	<0.005
Mercury	mg/L	0.0006	<0.00004	<0.00004	<0.00004	<0.00004
Fluoride	mg/L	None available	<0.1	0.1	<0.1	<0.1
Nutrients						
Ammonia (as N)	mg/L	0.013	<0.01	<0.01	<0.01	<0.01
Total Nitrogen (Ammonia, Nitrate and Nitrite)	mg/L	0.25	<0.1	0.14	0.01	<0.1
Reactive Phosphorus	mg/L	0.015	<0.01	<0.01	<0.01	0.01
Total Recoverable Hydrocarbons						
C6 - C10 Fraction	µg/L	None available	<20	<20	<20	<20
C6 - C10 Fraction minus BTEX	µg/L	None available	<20	<20	<20	<20

The results of this review identify that, with the exception of turbidity, the quality of water discharged from the Quarry is similar to that of the receiving surface water environment. Given the high level of sediment in the receiving environment (as noted in upstream and analogue records), it is considered unlikely that discharge from the Quarry has resulted in material harm to the environment. Hy-Tec is in the process of preparing a modification to SSD6084 to permit the occasional controlled discharge of water from the Quarry. A series of triggers for discharge would be established through this process as well as protocols to ensure discharge water quality is appropriate and discharge does not result in geomorphic impacts to Tinda Creek.

7.2.6 Drainage Lines, Diversion Drains and Water Management System

Hy-Tec have implemented a range of measures to ensure sediment movement within the Quarry (in clean water diversion drains) is limited. These measures include the following.

- Construction and maintenance of spoon drains.
- Lining of drains with geofabric and rock armouring.

- Installation of a gabion mattress at the end of drain in the vicinity of Domain 6 to capture sediment and slow the flow of water.
- Installation of rows of hay bales and silt fencing.
- Re-seeding of the drain to establish a suitable ground cover.

Condition M2.1 of the EPL 12007 requires that the licensee undertake monthly inspections of the surface water system at the premises. The monthly inspection must:

- be undertaken immediately upstream and downstream of the Quarry disturbance area;
- include visual inspection for litter, oil and grease and sediment within the surface water system, including diversion channels;
- include visual inspection of the physical integrity of the surface water system, including any signs of erosion; and
- include visual inspection of the water level/flow in Tinda Creek.

A summary of the monitoring data as required by EPL 12007 is presented in **Table 27**.

Table 27
Results of Surface Water Monitoring – 2022

Observation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Litter	No	No	No	No	No	No	No	No	No	No	No	No
Oil/Grease	No	No	No	No	No	No	No	No	No	No	No	No
Sediment	No	No	No	No	No	No	No	No	No	No	No	No
Erosion	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No
Water Level/Flow	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

8. REHABILITATION AND LANDSCAPE MANAGEMENT

8.1 REHABILITATION MANAGEMENT

Rehabilitation objectives for the Quarry are described in Schedule 3, Condition 17 of SSD_4978 and reiterated in the approved *Landscape Management Plan* for the Quarry. The objectives for progressive and final rehabilitation of the Quarry include the following.

- The Quarry Site is safe, stable and non-polluting.
- Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native species and habitat, including at least 0.35ha of Mellong Sandmass Sedgeland.
- Surface infrastructure is to be decommissioned and removed (unless the Secretary agrees otherwise).
- Minimise the size, depth, batter slope and the drainage catchment of the final void.
- Ensure that the volume of VENM and ENM detailed in the EIS is imported for rehabilitation of the site.
- Ensure that the surface area of the final voids is no greater than 16ha in total.
- Ensure that final voids are separated from the surface water drainage system, unless the Secretary agrees otherwise.
- Restore alignment and hydraulic function of watercourses, as far as practical.
- Ensure public safety.

Rehabilitation works continued in the 2ha domain in the south-eastern quadrant of the Quarry Site and the north-eastern corner of the historic extraction area of Domain 4 as shown on **Figure 2**. Rehabilitation works comprised primarily landform construction through backfilling the area with overburden, silt and clay material with coarse woody debris applied as available to enhance the natural regeneration. This activity was consistent with the methods and timing presented in the *Landscape Management Plan*.

Hy-Tec considers that the potential for successful rehabilitation of the Quarry Site remains positive following the Gospers Mountain Bush Fire in early 2020. During the life of the Quarry, natural regeneration following bush fire has demonstrated the natural resilience of the vegetation. The resilience of the vegetation is evident and the speed of regeneration (following rainfall) evident. This is consistent with the response to fires that occurred in October 2013, with Quarry personnel reporting that within a matter of months the vegetation was re-establishing and within one year there was almost no evidence of the fire.

8.2 LANDSCAPE MANAGEMENT

Landscape management was undertaken generally in accordance with the approved *Landscape Management Plan* which was prepared in accordance with *Condition 3(19)* of SSD_4978. Activities involved predominantly weed management, maintenance of clean water diversions and some vegetation maintenance.

Local Land Services initiated a 1080 Wild Dog Baiting Program within the Hawkesbury and Blue Mountains region in May and September 2022. This included the Quarry Site. A total of six baits were placed in May, three of which were taken a week after implementation, and five baits were put out in September.

The *Landscape Management Plan* includes a range of monitoring activities to be undertaken by Hy-Tec to demonstrate compliance with the objectives and performance criteria for landscape and rehabilitation management. A summary of these activities is provided in **Table 28**.

Table 28
Ecological Monitoring Requirements at Tinda Creek Quarry

Type of Monitoring	Parameters Monitored	Frequency	Monitoring Method	Responsibility
Rehabilitation	Inspections of survey markers, drainage lines, water management systems and rehabilitation areas.	Monthly	Visual Inspection	Quarry Manager
	Survey of 9 x BAM plot as per Section 13.2.2.	Annually	Field Survey	Quarry Manager / Ecologist
Koala	Targeted Spot Assessment Technique, Call playback surveys, Spotlight surveys.	Bi-annually (every two years)	Field Survey	Quarry Manager / Ecologist
Grevillea parviflora subsp. *parviflora*	Surveys during known flowering period (July to December), stem counts in permanent plots, photo monitoring, habitat quality.	Annually	Field Survey	Quarry Manager / Ecologist
Nest Boxes	Condition assessment.	Annually (if required).	Field Survey	Quarry Manager / Ecologist
Voluntary Undertaking	Natural regeneration.	Annually	Visual Inspection / Photographs	Quarry Manager
Aquatic Monitoring	Stream width and edge habitat, stream features including substrate, vegetation and organic material, site observation including catchment description and local land use practises, and riparian characteristics.	Annually	Field Survey and Photography	Quarry Manager / Ecologist

8.2.1 Rehabilitation Monitoring

Visual inspections of the areas under active rehabilitation were undertaken monthly during the reporting period (rather than six-monthly) and cross-over with requirements for monitoring of erosion and sediment controls and surface water quality in accordance with the *Water Management Plan*. A summary of the outcomes of monitoring during the reporting period is provided in **Table 29**. Visual inspections of the Quarry Site were supplemented by monitoring undertaken by EMM in November and December 2022 (EMM, 2023) with the outcomes of this monitoring presented in **Appendix 4**.

Table 29
Rehabilitation Inspections

Rehabilitation Monitoring Aspect	Comment
Monitoring is to include: • soil conditions and erosion (i.e. stability); • drainage and sediment control structures; • runoff water quality; • germination rates; • plant health; • natural regeneration; and • weed infestation.	Visual inspections were undertaken monthly by the Quarry Manager with photographic evidence of drain conditions and stability recorded. It is considered that existing erosion and sediment controls were functioning appropriately (see **Plate 5** and Section 7.2.5). Drainage structures are stabilised with vegetation, with some of the monitored areas amongst sedge vegetation containing original vegetation. Following the construction of a raised northern bund to the silt ponds, hydromulching was applied. However, at the time reporting was completed there was little evidence that seeding had been successful. During the reporting period campaigns of weed spraying and manual removal via scalping has occurred.

8.2.2 Long-Term Rehabilitation Monitoring

Long-term rehabilitation monitoring was undertaken by EMM in December 2022 (EMM, 2023). The outcomes of this monitoring are described in detail in the monitoring report presented as **Appendix 4** of this report. **Table 30** presents an overview of key monitoring aspects and outcomes.

Table 30
Long-Term Rehabilitation Monitoring

Rehabilitation Monitoring Aspect	Comment
Monitoring is to: • compare results against rehabilitation objectives and targets • identify possible trends and continuous improvement • link to records of rehabilitation to determine causes and explain results • assess effectiveness of environmental controls implemented • where required, identify modifications required for the monitoring program, rehabilitation practices or areas requiring research • compare flora species present against original seed mix and/or analogue sites • assess vegetation health • assess vegetation structure (e.g. upper, mid. and lower storey) • the presence and abundance of any weed species • assessment of natural regeneration/recruitment of new species • where applicable, assess native fauna species diversity and the effectiveness of habitat creation for target fauna species	The majority of the rehabilitation objectives do not yet apply, however progressive rehabilitation and management of the rehabilitating landscape remains consistent with these objectives (described in Section 8.1). It is noted that impacts from the Gospers Mountain bush fire have significantly impacted previously rehabilitated areas. EMM (2023) observed that native species richness is lower than analogue sites within the rehabilitation area, however it has increased from 2020 to 2022 in all vegetation communities apart from Mellong Sandmass Swamp Woodland. This increase is a sign that the vegetation communities have stabilised following 2019 Gospers Mountain bushfire. Weed species are present within the BOA but these areas are generally in good condition with little exotic cover. These areas are anticipated to continue to improve as the post-fire recovery process continues. Weed species are present across the Quarry Site including the regeneration areas. Weed cover varies across the rehabilitation areas with recent weed management applied in the areas closest to the site infrastructure. Weed cover and abundance is substantially greater within the rehabilitation area to the west (90% cover), influenced mostly by African Lovegrass. The cover of African Lovegrass has increased since the 2021 monitoring survey. Weed control will be required as the African Lovegrass density will negatively affect native plant species germination and growth post-fire. Pest species including deer, feral cat and wild dogs occur throughout Wollemi and Yengo National Parks directly adjacent to the Quarry Site. Control will therefore be impossible given that these species will continue to move from the national parks into unoccupied habitat within the Quarry Site.

8.2.3 Biodiversity Offset Area Monitoring

Monitoring within the Biodiversity Offset Area was undertaken by EMM in December 2022 in accordance with the *Landscape Management Plan*. The monitoring plots that were re-visited with the approximate locations presented in **Figure 11**. However, the Gospers Mountain bush fire destroyed many of the timber marker pegs making the exact location of some plots difficult to determine. As such, it was not possible to make a direct comparison between the 2021 monitoring data and previous years. **Table 31** presents the monitoring aspects and general conclusions of the monitoring campaign. A more detailed review of the monitoring outcomes and the data collected from monitoring plots is provided in **Appendix 4**.

Table 31
Biodiversity Offset Area Monitoring

Biodiversity Offset Area Monitoring Aspect	Comment
Monitoring is to include: • general vegetation health • evidence of natural seedling recruitment • occurrence and abundance of weed species • structure and floristics of vegetation cover • signs of disturbance (by stock, people or feral animals) • nature and extent of erosion • evidence of fire • characteristic of ground cover (e.g. leaf litter, rocks, logs and soil) • nectar or fruit resources and perch sites • water resources • secondary evidence of fauna use such as scats, tree scratches or diggings.	EMM (2023) noted no obvious adverse effects from the Quarry on vegetation communities within the Biodiversity Offset Area. The area was significantly impacted by the Gospers Mountain bush fire. Extensive regeneration has occurred post-fire since significant rain events. A number of threatened species occur within the Biodiversity Offset Area, including a population of Grevillea parviflora. The Grevillea population has increased during the reporting period. No Koala were identified during survey by EMM (2023) and no scats were evident in surveyed BAM plots. Some scratches were recorded during the surveys, which EMM (2023) noted could be due to an abundance of Possum and Lace Monitor who could be responsible for many of the marks left on the trees. Weeds occur along some of the access tracks within the Biodiversity Offset Area with enough cover and abundance to be considered for control methods. No weed species recorded are listed as 'Weeds of National Significance'.

8.2.4 Koala Monitoring

EMM undertook Koala population monitoring surveys in November and December (EMM, 2023) in areas of potential koala habitat.

Koala spotlighting and call playback was conducted on one night within Domains 2 and 3 as the other domains were identified as unsuitable habitats. Additionally, evidence of Koalas was searched for using the Spot Assessment Technique (SAT) within the BAM plots. SAT surveys record evidence of Koalas (scat) under 30 trees per site. Every mature eucalyptus tree within each of the BAM plots was carefully inspected by ecologists familiar with Koala signs. These inspections included scat searches across the entirety of the plot and observing for scratches on the trees. The tree canopy was also thoroughly searched for individual Koalas.

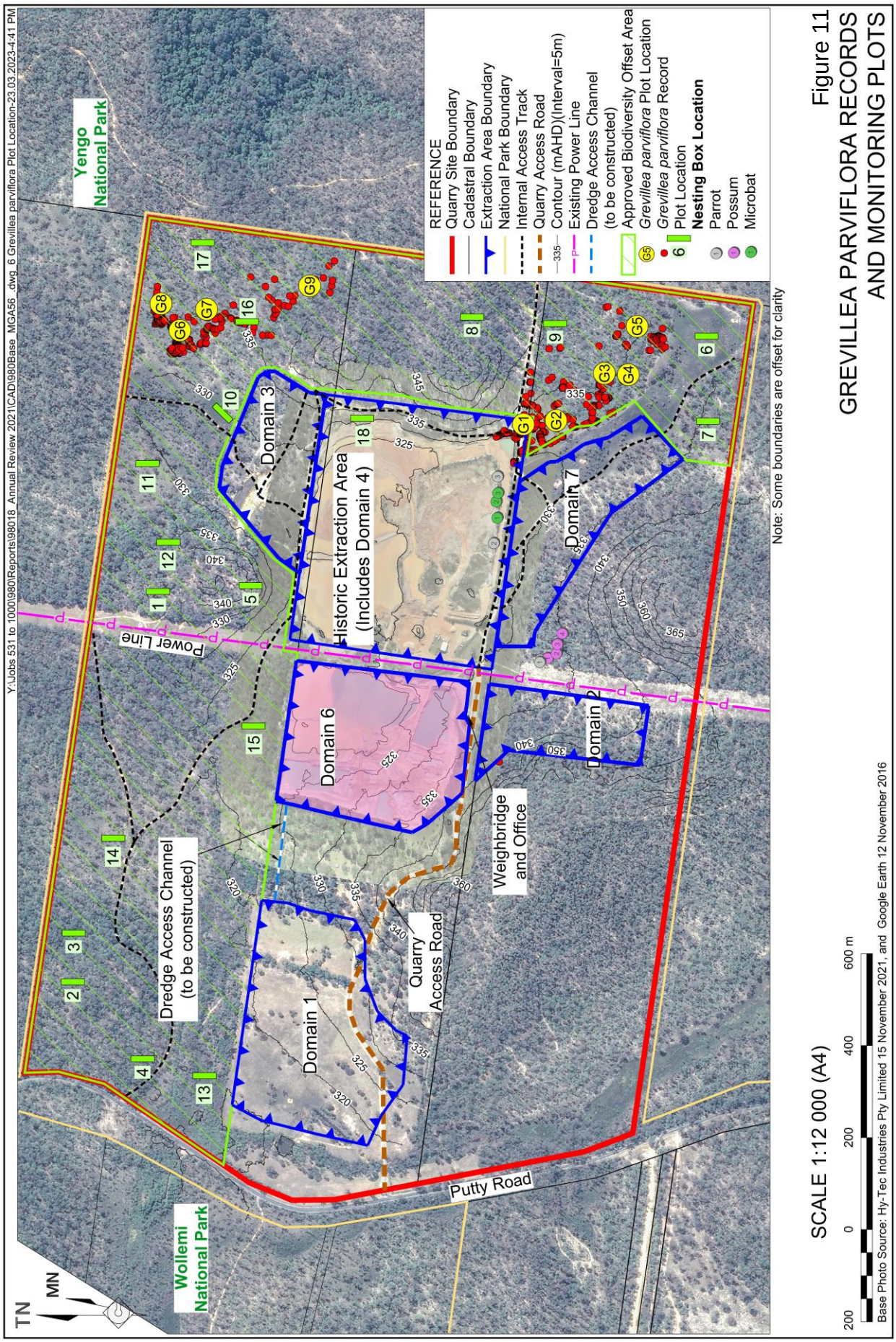


Figure 11
GREVILLEA PARVIFLORA RECORDS AND MONITORING PLOTS

No Koala were identified during the surveys, however potential Koala scats and scratches were identified within the Biodiversity Offset Area. An abundance of Possum and Lace Monitor could be responsible for many of the marks left on the trees and therefore tree scratches by themselves are not considered a reliable indicator for the presence of Koalas.

The species presence has been confirmed by motion-activated cameras provided by Hy-Tec within the study area (EnviroKey, 2021). EMM undertook a desktop search to determine the presence of Koalas within the vicinity of the study area which indicated 10 Koala records within a 10 km buffer of the study area, however no Koalas have been recorded in the vicinity since 2018.

The approved *Landscape Management Plan* for the Quarry contains a Koala Plan of Management (Appendix 1 of the plan) that specifies performance criteria for Koala management. These include the following:

- No koalas will be harmed as a result of any tree-clearing practices that take place as a result of this Project.
- Potential quarry-induced impacts will not result in the alteration to the floristics, structure or condition of non-cleared areas of potential koala habitat.

Quarry personnel have reported no incidents involving Koala vehicle strikes. There is no evidence that there are Quarry-related impacts occurring to Koala habitat.

8.2.5 Aquatic Monitoring

On 9 November 2022, Niche (2023) undertook aquatic monitoring to monitor the river health of Tinda Creek and its tributaries and to assess any potential impacts from Quarry development. A report detailing the methods, outcomes and conclusions of the aquatic monitoring program is provided as **Appendix 5**. The monitoring program is consistent with the previous monitoring presented as Appendix 2 of the *Landscape Management Plan* (Umwelt, 2016).

The monitoring program in 2022 included the following:

- Assessment of stream condition using Riparian and Channel and Environment inventory assessment (RCE).
- Assessment of habitat condition using AUSRIVAS proforma.
- Assessment of water quality against default ANZECC trigger values.
- Assessment of the macroinvertebrate community condition using Stream Invertebrate Grade Number Average Level (SIGNAL) and AUSRIVAS.

In comparison to the comparatively dry sampling season of 2021, many sites held water in spring 2022 after above average and consistent rain events throughout the year. Aquatic environments downstream of the Quarry were found to have a good level of riparian growth, having recovered from the 2019-2020 bushfire events, as well as stable channel morphology. The macroinvertebrate communities had recorded generally poor SIGNAL2 and AUSRIVAS results, however these results were comparable between the test site and reference sites, and equivalent or improved when compared to previous results. As such, the streams are likely being influenced by natural stress associated with intermittent/ephemeral streams and reflect conditions experienced within the locality, and not impacts associated with the operation of the Quarry.

Based on the evidence available, there appears to be no obvious disturbance resulting from the Quarry operations at downstream sites. However elevated turbidity (suspended sediment levels) was recorded at all monitoring sites including the sites not directly associated with any discharge from the Quarry. This is most likely due to continued runoff across the catchment that contains sediment from mostly sandy substrate and generally dispersive soils in the region.

Low pH levels were recorded at all sites, however these pH levels do not appear to have resulted in impairment to the macroinvertebrate communities present.

8.2.6 Nest Box Monitoring

During the reporting period 10 nesting boxes were installed on site. These were installed in October by the Site Manager. A mixture of nesting boxes for Microbats, Possums and Parrots were installed, the locations of which can be seen in **Figure 8** and coordinates in **Table 32**. These will be monitored annually with outcomes presented in future reports.

Table 32
Nesting Boxes

Type	Nesting Box no.	Latitude	Longitude
Possum	1	-33.168198	150.704772
	2	-33.16837	150.704882
	3	-33.168391	150.705098
	4	-33.168494	150.705342
Parrot	1	-33.16804	150.704686
	2	-33.16719	150.70748
	3	-33.167294	150.709030
Microbat	1	-33.167267	150.708069
	2	-33.167255	150.708450
	3	-33.167294	150.708649

8.2.7 Threatened Species Monitoring

Threatened fauna monitoring was undertaken by EMM in December 2022, predominantly focused on the Biodiversity Offset Area (EMM, 2023). The outcomes of these surveys are presented in **Appendix 4**.

The Site is a known and potential habitat for 18 threatened fauna species, however no threatened fauna species were identified during the monitoring.

During monitoring for the previous reporting period (EMM, 2022), two flora species that are listed as vulnerable under the *Biodiversity Conservation Act 2016* were identified within the study area. These were *Hibbertia puberula subsp. extensa* and *Callistemon linearifolius*. *Hibbertia puberula subsp. extensa* was identified again in monitoring for this reporting period (EMM, 2023). EMM (2023) has recommended more comprehensive survey for these species during the next reporting period to confirm their presence. The individuals identified in previous surveys

are outside of the current extraction area and would not be disturbed during the next reporting period. A protocol for management of this species would be developed following the next program of ecological monitoring that is planned for the fourth quarter of 2023.

8.2.8 Grevillea parviflora Monitoring

Monitoring of the condition and persistence of the small flower *Grevillea parviflora* subsp. *parviflora* was undertaken in December 2022 and is considered to provide an indication of the condition of this species for the reporting period. A series of nine 10m x 10m plots were revisited within the approved Biodiversity Offset Area to facilitate annual stem counts of the species. The locations of these plots can be seen on **Figure 11**. The goal of this monitoring program is to assess the ongoing viability and health of the species and to ensure the habitat is maintained or improved over the life of the operations. The monitoring results are included in **Table 33**.

Despite inherent inaccuracies in *Grevillea parviflora* subsp. *parviflora* monitoring plot boundary locations (and difficulty in separating resprouting / clonal plants from new seedlings), the results of the survey plot counts provide a general indication of population condition. A total of 1,115 plants were recorded within the nine plots during the survey. This is an increase of 830 plants recorded compared with 2021. It is noted that the methodology applied to survey was different between monitoring events; Niche counted stems but accounted for separate stems at ground level, EnviroKey counted individual plants but also considered separation at ground level, and EMM counted individual each stem individually. EMM (2023) concluded that plot monitoring indicates the distribution of *Grevillea parviflora* subsp. *parviflora* is increasing within all sites excluding sites 4 and 8.

Table 33
Ecological Monitoring Requirements at Tinda Creek Quarry

Plot Number	2018^[1] Count	2019* Count	2020* Count	2021^ Count	2022^ Count
G1	18	38	0	21	80
G2	50	7	0	103	650
G3	32	25	18	14	20
G4	44	1	10	53	35
G5	20	19	35	9	40
G6	23	35	16	26	100
G7	16	0	0	25	120
G8	14	0	0	12	5
G9	3	0	1	22	65
Total	**220**	**125**	**80**	**285**	**1115**
Note 1: Average number of stems from March 2018 and September 2018. * Count of number of individual plants. ^ Count of number of stems.					
Source: EMM (2023) – Table 3.6					

8.2.9 Conclusion

Consistent with previous years, Hy-Tec has continued to operate the Quarry with minimal evident impact to the surrounding landscape or within the Quarry Site, the Biodiversity Offset Area or in aquatic environments downstream of the Quarry. High sediment levels were recorded at all aquatic monitoring sites which was likely due to the continuous input of suspended sediment into these sampling points from the surrounding area following heavy rainfall events. This is not considered indicative of any trends in aquatic ecology impact. Rehabilitation progress during the reporting period has been steady, with regeneration evident within the Quarry Site.

EMM supported the recommendation from EnviroKey (2021) suggesting the monitoring program should be reduced in the Biodiversity Offset Area and increased in the rehabilitation areas. This is due to the lack of any evident impact from Quarry operations in the Biodiversity Offset Area and the need to monitor and improve conditions in areas that are subject to rehabilitation.

Weed coverage within the rehabilitation area has increased. EMM (2023) recommends an integrated approach of multiple techniques conducted seasonally to control the African Lovegrass population on the Tinda Creek Site. Dependent on suitable climatic conditions, additional weed management and planned seeding is planned to take place in 2023.

Within the Biodiversity Offset Area EMM (2023) recommended closure of unused tracks to allow vegetation to regenerate naturally (providing they are not required for monitoring). Weed control is also recommended using spot spray techniques on foot and by hand only (as to prevent the spread of weed seeds by vehicles). Weeds should be monitored visually every three months and sprayed as necessary.

It is apparent from the recent ecological monitoring that the flora species richness has increased as well as the number of *Grevillea parviflora* present in the monitored plots. However, weed coverage in rehabilitation areas and the biodiversity offset area has also increased and will require further targeted weed management.

Aquatic ecological monitoring has identified that the streams are likely being influenced by natural stress associated with intermittent/ephemeral streams and reflect conditions experienced within the locality, and not impacts associated with the operation of the Quarry

9. COMMUNITY

9.1 COMMUNITY COMPLAINTS

The complaints register for 2022 is provided in **Appendix 6**. The register is available from the Hy-Tec website and updated each month.

Complaints will continue to be logged within the complaints register and investigated fully when they are received. The complaints register will continue to be kept in the weighbridge office and updated on the Hy-Tec website on a monthly basis.

9.2 COMMUNITY LIAISON

A single Tinda Creek Quarry Community Consultative Committee (CCC) meeting was conducted during the reporting period. It was held on site on Tuesday 24 May 2022. Minutes of the meetings are provided in **Appendix 7**.

There were no issues raised during the CCC meetings that were considered to be complaints or required investigation by Hy-Tec.

Given the remote location of the Quarry, no further community engagement activities occurred within the reporting period.

10. INDEPENDENT ENVIRONMENTAL AUDIT

An independent environmental audit of quarrying operations was undertaken between 5 and 14 July 2022. The audit was undertaken by Mr James Hart (Lead Environmental Auditor - Exemplar Global No. 12105). The audit was the third for the Quarry and covered the period from 10 October 2019 to 14 July 2022.

The outcomes of the audit report and Hy-Tec's response to the matters raised are presented in **Table 34**, with the full audit report and response available from the Hy-Tec website[2]. All matters raised in the audit report have been addressed or are in the process of being addressed. Compliance matters relating to water discharge from the Quarry are discussed in more detail in Section 11.2.

The next independent environmental audit will be commissioned before July 2025.

[2] See https://www.hy-tec.com.au/quarry-documentation

Table 34
Response to the Non-Compliance Issues

Issue No.	Condition	Requirement	Issue sighted	Recommendation	Comments
01	Schedule 2 Condition 2	The Applicant shall carry out the development generally in accordance with the: • EIS; • Statement of Commitments; and • conditions of this consent.	Three non-compliances have been identified against the requirements of the conditions of consent, triggering a non-compliance with Schedule 2 Condition 2.	It is recommended that all non-compliances identified are addressed and closed out.	Hy-Tec believes that all matters raised in the audit have previously been addressed and closed or are in the process of being addressed.
02	Schedule 2 Condition 12	The Applicant shall: a) comply with Section 120 of the POEO Act, unless an EPL authorises otherwise; b) ensure that the catchment of the water management system is not larger than 40ha, unless the Secretary agrees otherwise; c) maintain the dredge and silt ponds to capture a 1 in 100 ARI storm event plus adequate freeboard to ensure no offsite discharge; and d) ensure that the loss of groundwater and surface water to Tinda Creek is no greater than predicted in the EIS in the dredge and silt ponds.	The closed water management system had not been maintained to ensure adequate freeboard to prevent offsite discharge.	Review the adequacy of the capacity of the closed water management system to prevent uncontrolled discharge. Include in the Water Management Plan a process for the management of discharging water from the closed water system Revise and update the Water Management Plan to following the review.	The closed water management system including the dredge and silt ponds has been constructed with a capacity to capture a 1% annual exceedance probability rainfall event and has been extended during the audit period to increase the capacity to manage significant rainfall events. The discharge of water from the closed water management system occurred on seven occasions during the audit period. These events either exceeded the design capacity of the system or were caused by operational or mechanical failures. For each of the incidents, Hy-Tec communicated with DPE and other relevant agencies regarding the matter and prepared detailed incident reports. Each event is summarised as follows. • In March 2020, uncontrolled discharge occurred following an un-forecasted late evening / early morning storm event. Water transfer pipes had been left closed at this time. • On 4 November 2020, an operational planning error led to a delay in opening the water transfer pipes between the sediment pond and the dredge pond. Following this event an overflow safety mechanism was put in place. • In March 2021, Hy-Tec undertook controlled discharge of water from the closed water management system in response to a significant rainfall event (228mm over 5-days). • On 2 March 2021 a dredge transfer pipe transferring high solids slurry from the dredge pond to the site's wash plant ruptured. All materials that were discharged were contained within the drainage channel and removed. • In early March 2022 Hy-Tec undertook controlled discharge of water from the closed water management system in response to a significant rainfall event (56mm over 5-days). • In late March and early April 2022 Hy-Tec undertook controlled discharge of water from the closed water management system in response to a significant rainfall event (89mm over 9-days). • In early July 2022 uncontrolled discharge of water occurred from the closed water management system as a result of a significant rainfall event (248mm over 5-days). An update to the Water Management Plan for the Quarry is currently in preparation alongside the assessments being undertaken for the Modification 1 application. The updated plan will include a description of the discharge process should extreme events require it. Investigations following each event concluded that material harm to the environment had not occurred. Hy-Tec has adapted its water management procedures to account for the transition from extremely dry conditions experienced in 2018/2019 to the more recent significant rainfall events.
03	Schedule 3 Condition 16	Within 2 years of this consent, unless otherwise agreed with the Secretary, the Applicant shall make suitable arrangements to provide appropriate long-term security for the offset area, to the satisfaction of the Secretary. *Note: Mechanisms to provide appropriate long-term security to the land within the biodiversity offset strategy include a Biobanking Agreement, Voluntary Conservation Agreement or an alternative mechanism that provides for a similar conservation outcome. Any mechanism must remain in force in perpetuity.*	Agreement on the long-term security of the offset area had not been obtained. In principle agreement with NPWS Offset area.	The agreement for the long-term security of the offset area should be finalised.	Hy-Tec has reached an agreement with the NSW National Parks and Wildlife Service (dated 30 June 2022) for the transfer of land dedicated as an offset area to the Minister for Environment and Heritage for future dedication to Yengo National Park. Hy-Tec is currently making arrangements for the formal subdivision of the land to enable transfer. The deadline for securing the offset area was extended to 29 April 2022, however no further extension has been granted. It is anticipated that this process will be completed by the middle of 2023. It is noted that Hy-Tec has continued to manage the land that is the subject of the offset arrangement in accordance with its approved Landscape Management Plan since commencement of operations and under the agreement with NSW National Parks and Wildlife Service will continue to manage the land for the life of the Quarry.

Table 34 (Cont'd)
Response to the Non-Compliance Issues

Issue No.	Condition	Requirement	Issue sighted	Recommendation	Comments
04	Schedule 3 Condition 21	Within 3 months of each Independent Environmental Audit (see condition 9 of schedule 5), the Applicant shall review, and if necessary, revise, the sum of the Conservation and Rehabilitation Bond to the satisfaction of the Secretary. This review must consider the: a) effects of inflation; b) likely cost of implementing the biodiversity offset strategy and rehabilitating the site (taking into account the likely surface disturbance over the next 3 years of the development); and c) performance of the implementation of the biodiversity offset strategy and rehabilitation of the site to date.	The Conservation and Rehabilitation Bond. had not been reviewed and updated within 3 months of the previous independent environmental audit.	Hy-Tec should ensure that the Conservation and Rehabilitation Bond is reviewed and, if necessary, reviewed within 3 months of the independent environmental audit.	A Conservation and Rehabilitation Bond was submitted to DPE on 10 August 2021. Although the estimate was overdue at the time, no response has been received from DPE. An updated Conservation and Rehabilitation Bond is currently in preparation.
05	Schedule 5 Condition 5 Water Management Plan Section 18	Within 3 months of a modification to this consent or following the submission of an: a) annual review under condition 4 above: b) incident report under condition 7 below; or c) audit report under condition 9 below, the Applicant shall review, and if necessary, revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.	Records available did not demonstrate that strategies, plans, and programs had been reviewed following submission of incident reports.	Where incidents have occurred, Hy-Tec should ensure that relevant management plans, strategies and programs are reviewed, and if necessary updated to incorporate any recommended measures to improve the environmental performance of the development.	Hy-Tec notes this comment and has committed to review and update (where necessary) all management plans and strategies following completion of the Annual Review, an incident report or audit report. It is noted that updates to the following management plans will be updated following the determination of the Modification 1 application. • Water Management Plan • Noise Management Plan • Air Quality Management Plan • Transport Management Plan • Heritage Management Plan • Environmental Management Strategy
06	WAL MW2337-00001	The following information must be recorded in the logbook for each period of time that water is taken: A. date, volume of water, start and end time when water was taken as well as the pump capacity per unit of time, and B. the access licence number under which the water is taken, and C. the approval number under which the water is taken, and D. the volume of water taken for domestic consumption and/or stock watering.	While an electronic logbook had been maintained, the records do not include the start time and end time when water was taken.	Hy-Tec should update the WAL logbook to include provision for the recording of the start and end time when water was taken.	Hy-Tec has adjusted procedures for management of the production bore to allow for records of the start and end time when water was taken to be included.

11. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

11.1 INTRODUCTION

The following subsections outline incidents and non-compliances that occurred during the reporting period. An internal review of compliance with the conditions of SSD_4978 was undertaken by Hy-Tec and RWC and is included as **Appendix 1**. The operation remained generally compliant with development conditions throughout the reporting period with the exception of the non-compliances listed below.

11.2 INCIDENTS

Four incidents were reported to the DPE during the reporting period relating to water discharge events at the Quarry. The incidents occurred as follows.

- Controlled discharge of water on 7 March 2022.
- Controlled discharge of water on 30 March 2022.
- Uncontrolled discharge of water on 3 July 2022 and subsequent controlled discharge of water on 5 July 2022.
- Controlled discharge of water on 11 October 2022.

Each of the discharge events was caused by high rainfall with conditions within the closed water management system reaching a level where it was not safe to hold water within storage structures.

Water quality monitoring was undertaken daily during controlled discharge events where it was safe to access the dredge pond. A summary of the outcomes of water quality monitoring during discharge events is presented in Section 7.2.5. Given the monitoring results sampled during discharge, it is considered unlikely that discharge from the Quarry has resulted in material harm to the environment.

On 10 October 2022, DPE issued Hy-Tec with a notice of intention to issue a Development Control Order regarding water discharge events at the Quarry. The notice identified the continued breaches of Condition 2 of Schedule 2 of SSD_4978 as the reason for possibly issuing a Development Control Order. Hy-Tec responded to the intention to issue a Development Control Order on 24 October 2022 and on 14 November 2022, DPE notified Hy-Tec that a Development Control Order would not be issued as Hy-Tec had:

- lodged a modification of the Consent to permit discharges from the quarry;
- carried out a volumetric survey of the quarry to confirm compliance with Schedule 3, Condition 12 of the Consent; and
- been cooperative with the Department's enquiries.

Subsequently DPE issued Hy-Tec with a Show Cause Notice relating to an alleged breach of Section 4.2(1)(b) of the *Environmental Planning and Assessment Act 1979* by carrying out development not in accordance with the conditions of the development consent SSD_4978. A further detailed response to the Show Cause Notice was provided to DPE on 2 December 2022.

On 21 December 2022, DPE confirmed its decision to issue Hy-Tec with an Official Caution in relation to the controlled water discharges from Quarry.

Hy-Tec acknowledges that the discharge events at the Quarry are not in compliance with the conditions of SSD_4978. However, given the prolonged heavy rainfall that has been experienced at the Quarry and generally across NSW, Hy-Tec considers that controlled discharge was the only available option to maintain the safety of the operation and to avoid uncontrolled discharges (which have higher environmental consequences). Hy-Tec's approach to addressing these non-compliance issues is summarised as follows.

- Seek recognition within the conditions of SSD_4978 for the occasional need to discharge water from the Quarry in a controlled manner. This would be done through a modification to SSD_4978. This process has commenced with consultation with DPE, EPA, NPWS and DPE Water[3].
- Assess risks of controlled and uncontrolled discharge through water balance assessment and predictive analysis.
- Establish triggers and protocols for discharge processes.
- Present the triggers and protocols in an updated Water Management Plan.
- Establish a discharge point that limits environmental risks from discharge velocity and sedimentation to the satisfaction of the EPA.
- Ensure that the closed water management system is designed and progressively constructed to avoid uncontrolled discharge in the future.

Assuming the successful implementation of the above, that environmental impacts associated with future discharge events (when needed) may be avoided and/or mitigated to an acceptable level.

11.3 DEVELOPMENT CONSENT SSD_4978

Hy-Tec was not compliant with Conditions 2(1), 2(2), 3(12) and 3(13) of SSD_4978 due to the discharge events described in Section 11.2. Hy-Tec considers that none of these events resulted in material harm to the environment.

A number of administrative non-compliance issues were identified in the Independent Environmental Audit and include the following.

- Condition 2(2) relating to carrying out the development in accordance with the EIS, Statement of Commitments, and conditions of SSD_4978 – Non-compliance with this condition reflects other non-compliance issues identified above and below.
- Condition 3(16) relating to the requirement to secure the Onsite Offset Area – as noted in Section 3, an agreement has been reached with NPWS for the transfer of this land to the office of the Minister for Environment and Heritage. Hy-Tec is awaiting advice on ongoing lease arrangements from NPWS.

[3] See https://www.planningportal.nsw.gov.au/major-projects/projects/modification-1-water-management

- Condition 3(21) relating to an update to Rehabilitation Bond for the Quarry – Hy-Tec is in the process of preparing an update to the Rehabilitation and Conservation Bond for the Quarry, noting that agreement on ongoing landscape management requirements would be needed from NPWS following the transfer of land to secure the Onsite Offset Area.
- Condition 5(5) relating to the scheduled review of environmental management plans following submission of an Annual Review, modification application or incident – Hy-Tec will review and update all environmental management plans following the pending modification to SSD_4978 to update water management protocols at the Quarry. The Landscape Management Plan will also be updated after the Onsite Offset Area is transferred to the office of the Minister for Environment and Heritage.

11.4 ENVIRONMENT PROTECTION LICENCE

Hy-Tec was non-compliant with Conditions, A3.2, L1.1 and of EPL 12007. These non-compliances resulted directly from the discharge events described in Section 11.2. The relevant authorities were advised of the non-compliances at the time of each incident.

In response to the water discharge events during the reporting period the EPA requested that Hy-Tec prepare a Remedial Action Plan to repair clean water diversion across the Quarry Site and remediate or improve the discharge location used for controlled discharge of water. Hy-Tec is in the process of preparing the Remedial Action Plan and undertaking remediation works for these structures.

11.5 WATER ACCESS LICENCES

Works Approval 10WA112531 permits extraction of 44ML of water per annum via the production bore based on a water year (i.e. July to June). A total of 1.1ML of water was used between July 2021 to June 2022.

The independent environmental audit identified that logbook for recording water use at the Quarry did not record all required information. Specifically, the logbook records did not include the start and end time when water was taken.

11.6 VOLUNTARY UNDERTAKING

During a site inspection and audit by officers of DPE on 6 June 2017, it was identified that equipment and other materials historically stored within the southeast corner of the Quarry Site constituted a breach of *Condition 3(30)* of SSD_4978 in relation to waste management at the Quarry. The material was subsequently removed by Hy-Tec and the Company entered into a voluntary undertaking regarding revegetation in this area. The requirements of the voluntary undertaking were completed in February 2020 after DPIE requested additional evidence of vegetation regeneration. Hy-Tec has committed to undertake annual visual inspections of the affected area until 2025 (unless otherwise directed). It is noted that this area was significantly impacted by the Gospers Mountain Bush Fire and much of the regrowth vegetation was burnt. Inspection of the area was undertaken by site personnel during the reporting period and it was noted that the area has re-established after the bush fire event in 2019/2020.

12. ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

The following operational activities are planned throughout the 2023 reporting period.

- Extraction and clearing will continue in Domain 7 including construction of diversion channel and bundings (see **Figure 12**).
- Hy-Tec anticipates that the transfer of the Onsite Offset Area to Yengo National Park will be finalised once agreement is reached on ongoing access arrangements. Once this agreement is reached, Hy-Tec will notify the Department of the details of the agreement.
- Hy-Tec intends to apply for a modification to SSD_4978 during the reporting period to recognise the possible future need for water management to include occasional controlled discharge of water from the Quarry Site.
- A Variation to EPBC 2013/7028 is expected to occur in relation to final arrangements to secure the Onsite Offset Area.
- The production forecast for 2023 is to extract, process and transport approximately 139 021t of sand product.
- Ongoing monitoring and maintenance of erosion and sediment controls and diversion drains.
- Maintenance and improvement to processing infrastructure would be continued to enhance washing processes and improve water re-use in production.
- Maintenance of the Quarry Access Road.
- Continuation of progressive rehabilitation as practicable. This will primarily continue within the south-eastern rehabilitation area, utilising topsoil to begin revegetation of the area.
- Continuation of water management and dust control measures.
- Continue to monitor deposited dust and confirm the success of bird control measures through review of results against historic trends.
- Waste will continue to be collected by licensed contractors and volumes and dates recorded.
- Continuation of minimum of annual aerial Survey or other aerial imagery capture of the Quarry Site.
- Continued implementation of all requirements and conditions prescribed under Development Consent SSD_4978, EPL 12007 and approved management plans.

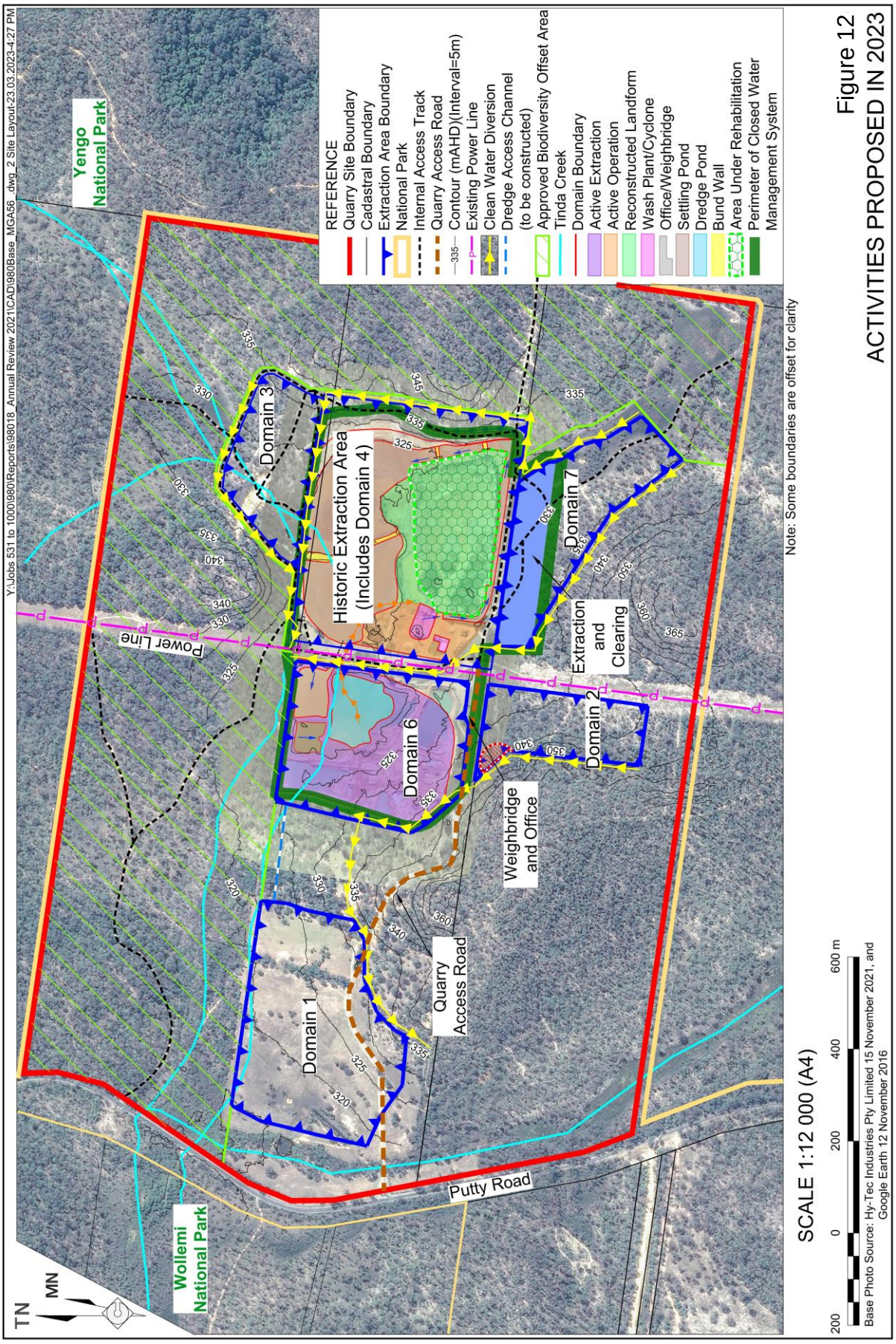


Figure 12
ACTIVITIES PROPOSED IN 2023

Appendices

Appendix 1	Internal Compliance Audit (SSD_4978) – 15 July 2022 to 31 December 2022
Appendix 2	Annual Return 2021 / 2022
Appendix 3	Noise Monitoring Report
Appendix 4	Offset Vegetation, Revegetation and Koala Monitoring Report – 2022
Appendix 5	Aquatic Monitoring Report – Spring 2022
Appendix 6	Complaints Register 2022
Appendix 7	Minutes of Tinda Creek Quarry Community Consultative Committee Meetings

Appendix 1

Internal Compliance Audit (SSD_4978) – 15 July 2022 to 31 December 2022

(Total No. of pages including blank pages = 28)

Table A1
Internal Compliance Audit of Relevant Conditions of Development Consent SSD_4978 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 2: ADMINISTRATION CONDITIONS				
Obligation to Minimise Harm to the Environment				
1.	In addition to meeting the specific performance criteria established under this consent, the Applicant shall implement all reasonable and feasible measures to prevent and/or minimise any material harm to the environment that may result from the construction, operation, or rehabilitation of the development.	N	Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Incident reporting following the events confirmed that material harm to the environment had not occurred.	O/D
TERMS OF CONSENT				
2.	The Applicant shall carry out the development generally in accordance with the: (a) EIS; (b) Statement of Commitments; and (c) conditions of this consent.	N	Non-compliance with seven conditions of SSD_4978 occurred during the reporting period precluding the achievement of compliance with this condition.	O/D
3.	If there is any inconsistency between the above documents, the most recent document shall prevail to the extent of the inconsistency. However, the conditions of this consent shall prevail to the extent of any inconsistency.	Noted		
4.	The Applicant shall comply with any reasonable requirement/s of the Secretary arising from the Department's assessment of: (a) any strategies, plans, programs, reviews, audits, reports or correspondence that are submitted in accordance with this consent; (b) any reports, reviews or audits commissioned by the Department regarding compliance with this consent; or (c) the implementation of any actions or measures contained in these documents.	Y	No requests were received from DPE during the reporting period.	D

Yes = Complied with during 2022 No = Not Complied with during 2022 ND = Not Determined
NYA = Not Yet Applicable HNC = Historical Non-Compliance ANC = Administrative Non-Compliance
* = Basis for assessment of compliance D = Documentation/Discussion O = Observation during audit
Yes# / No# = Complied / not complied with and compliance no longer required to be assessed

Table A1 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Development Consent SSD_4978 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 2: ADMINISTRATION CONDITIONS (Cont'd)				
LIMITS ON CONSENT				
Extraction Operations				
5.	The Applicant may undertake extraction operations on the site until 31 December 2045.	Noted		
Production Limits				
6.	The Applicant shall not: (a) extract or process more than 300,000 tonnes of sand in any calendar year; or (b) undertake extraction operations beyond 15 m below the natural ground surface.	Y	Approximately 97,358 tonnes of sand were extracted and processed and depth restrictions were not exceeded during the reporting period.	D
Transportation Limits				
7.	The Applicant shall not: (a) transport more than 300,000 tonnes of sand from the site in a calendar year; and (b) dispatch more than 34 trucks per day or receive more than 34 trucks per day, averaged over a calendar month.	Y	Product despatch was limited to 103,180 tonnes and truck level limits were not exceeded during the reporting period.	D
SURRENDER OF EXISTING DEVELOPMENT CONSENT				
8.	Within 6 months of the date of this consent, unless the Secretary agrees otherwise, the Applicant shall surrender the development consent (DA 0134/95) for the existing operations on the site in accordance with Section 104A of the EP&A Act. Prior to the surrender of development consent DA 0134/95, the conditions of this consent shall prevail to the extent of any inconsistency with the conditions of that consent.	Y	DA 1034/95 was surrendered on 10 December 2015.	D
STRUCTURAL ADEQUACY				
9.	The Applicant shall ensure that any new buildings and structures, and any alterations, or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.	Noted	No new buildings and structures were constructed during the reporting period.	O
DEMOLITION				
10.	The Applicant shall ensure that all demolition work on site is carried out in accordance with Australian Standard AS 2601-2001: The Demolition of Structures, or its latest version.	Noted	No demolition occurred during the reporting period.	O
11.	The Applicant shall: (a) repair, or pay the full costs associated with repairing, any public infrastructure that is damaged by the development; and	Noted	There was no damage or necessary relocation of public infrastructure during the reporting period.	O

Yes = Complied with during 2022 No = Not Complied with during 2022 ND = Not Determined
NYA = Not Yet Applicable HNC = Historical Non-Compliance ANC = Administrative Non-Compliance
* = Basis for assessment of compliance D = Documentation/Discussion O = Observation during audit
Yes# / No# = Complied / not complied with and compliance no longer required to be assessed

Table A1 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Development Consent SSD_4978
for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 2: ADMINISTRATION CONDITIONS (Cont'd)				
PROTECTION OF PUBLIC INFRASTRUCTURE				
	(b) relocate, or pay the full costs associated with relocating, any public infrastructure that needs to be relocated as a result of the development. *Note: This condition does not apply to any damage to roads caused as a result of general road usage.*			
OPERATION OF PLANT AND EQUIPMENT				
12.	The Applicant shall ensure that all plant and equipment used on site is: (a) maintained in a proper and efficient condition; and (b) operated in a proper and efficient manner.	Y	All equipment was maintained and operated in an acceptable manner during the reporting period.	D
UPDATING & STAGING STRATEGIES, PLANS OR PROGRAMS				
13.	With the approval of the Secretary, the Applicant may submit any strategies, plans or programs required by this consent on a progressive basis. To ensure the strategies, plans or programs under the conditions of this consent are updated on a regular basis, the Applicant may at any time submit revised strategies, plans or programs to the Secretary for approval. With the agreement of the Secretary, the Applicant may prepare any revised strategy, plan or program without undertaking consultation with all parties under the applicable condition of this consent.	Noted	Not required during the reporting period.	D
14.	Until they are replaced by an equivalent strategy, plan or program approved under this consent, the Applicant shall implement the existing strategies, plans or programs for the site that have been approved under DA 0134/95.	Noted	All management strategies, plans and programs have been updated and approved.	D
PRODUCTION DATA				
15.	The Applicant shall: (a) provide annual quarry production data to DRE using the standard form for that purpose; and (b) include a copy of this data in the Annual Review (see condition 4 of schedule 5).	Y	See **Appendix 2**.	
DEVELOPER CONTRIBUTIONS				
16.	The Applicant shall pay Council road maintenance contributions consistent with Council's Section 94 Contributions Plan, or its latest version.	Y	Road maintenance contributions are paid monthly.	D

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<table>
<tr><th>Condition No.</th><th>Paraphrased Requirement</th><th>Compliance</th><th>Comment</th><th>Basis*</th></tr>
<tr><td colspan="5">SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS</td></tr>
<tr><td colspan="5">IDENTIFICATION OF APPROVED LIMITS OF EXTRACTION</td></tr>
<tr><td>1.</td><td>Prior to undertaking extraction operations under this consent, the Applicant shall:
(a) engage a registered surveyor to mark out the boundaries of the approved limits of extraction within the site; and
(b) submit a survey plan of these boundaries with applicable GPS coordinates to the Secretary.</td><td>Y</td><td>All relevant boundaries have been surveyed and marked to comply with this condition.</td><td></td></tr>
<tr><td>2.</td><td>While extraction operations are being carried out, the Applicant shall ensure that these boundaries are clearly marked at all times.</td><td>Noted</td><td>All boundaries were clearly marked during the reporting period.</td><td></td></tr>
<tr><td colspan="5">HOURS OF OPERATION</td></tr>
<tr><td>3.</td><td>The Applicant shall comply with the operating hours set out in Table 1.
Table 1: Operation Hours
<table>
<tr><th>Activity</th><th>Operating Hours</th></tr>
<tr><td>Extraction operations and deliveries</td><td>7 am to 6 pm, Monday to Friday
7 am to 3 pm, Saturday
No activities on Sundays or Public Holidays</td></tr>
<tr><td>Dispatch</td><td>5 am to 10 pm, Monday to Friday
6 am to 3 pm, Saturday</td></tr>
<tr><td>Construction activities</td><td>7 am to 6 pm, Monday to Friday
8 am to 1 pm, Saturday
No construction to be undertaken on Sundays or Public Holidays</td></tr>
<tr><td>Maintenance activities</td><td>24 hours a day, 7 days per week, providing maintenance activities are inaudible at any privately-owned residence</td></tr>
</table></td><td>Y</td><td>Hy-Tec complied with all approved operating hours during the reporting period.</td><td>D</td></tr>
<tr><td colspan="5">NOISE</td></tr>
<tr><td colspan="5">Noise Criteria</td></tr>
<tr><td>4.</td><td>The Applicant shall ensure that the noise generated by the development does not exceed the criteria in Table 2 at any residence on privately-owned land.
Table 2: Noise criteria dB(A)
<table>
<tr><th rowspan="2">Receiver</th><th>Day/Evening</th><th colspan="2">Night</th></tr>
<tr><th>$L_{Aeq(15\ min)}$</th><th>$L_{Aeq(15\ min)}$</th><th>$L_{A1(max)}$</th></tr>
<tr><td>All receivers</td><td>35</td><td>35</td><td>45</td></tr>
</table></td><td>Y</td><td>Noise monitoring undertaken during the reporting period demonstrates that Hy-Tec complied with this criteria. There were no noise complaints during the reporting period.</td><td>D</td></tr>
</table>

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Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)				
NOISE (Cont'd)				
Operating Conditions				
5.	The Applicant shall: (a) implement all reasonable and feasible mitigation measures to minimise the construction, operational and road noise of the development; (b) regularly assess noise monitoring data and relocate, modify and/or stop operations on site to ensure compliance with the noise criteria in this consent; (c) minimise the noise impacts of the development during meteorological conditions under which the noise criteria in this consent do not apply (see Appendix 6); and (d) carry out regular noise monitoring to determine whether the development is complying with the relevant conditions of this consent, to the satisfaction of the Secretary.	Y	See previous response. Hy-Tec has not been required to modify operations due to noise-related concerns during the reporting period.	
Noise Management Plan				
6.	The Applicant shall prepare and implement a Noise Management Plan for the development to the satisfaction of the Secretary.	Y	A Noise Management Plan has been approved by the Secretary and is implemented at the Quarry. The Noise Management Plan is available from the Hy-Tec website.	
AIR QUALITY				
Air Quality Criteria				
7.	The Applicant shall implement all reasonable and feasible avoidance and mitigation measures so that particulate matter emissions generated by the development do not exceed the criteria in Tables 3 to 5 at any residence on privately-owned land. Table 3: Long-Term Criteria for Particulate Matter **Pollutant** / **Averaging period** / **[d] Criterion** Total suspended particulates (TSP) / Annual / [a] 90 µg/m3 Particulate matter < 10µm (PM_{10}) / Annual / [a] 30 µg/m3	Y	Dust monitoring undertaken during the reporting period indicates that the operation complied with the criteria in this condition. The introduction of bird deterrence on deposited dust gauges in January 2019 has reduced deposited dust levels significantly. This indicates that previously elevated deposited dust levels are not attributable to Quarry operations.	D

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<tr><td colspan="5">SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)</td></tr>
<tr><td colspan="5">AIR QUALITY (Cont'd)</td></tr>
<tr><td colspan="5">Air Quality Criteria (Cont'd)</td></tr>
<tr><td></td><td>Table 4: Short-Term Criteria for Particulate Matter
<table>
<tr><th>Pollutant</th><th>Averaging period</th><th>[d] Criterion</th></tr>
<tr><td>Particulate matter < 10µm (PM_{10})</td><td>24 hour</td><td>[a] 50 µg/m3</td></tr>
</table>
Table 5: Long-Term Criteria for Deposited Dust
<table>
<tr><th>Pollutant</th><th>Averaging period</th><th>Maximum increase in deposited dust level</th><th>Maximum total deposited dust level</th></tr>
<tr><td>[c] Deposited dust</td><td>Annual</td><td>[b] 2g/m^2/month</td><td>[a] 4g/m^2/month</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Operating Conditions</td></tr>
<tr><td>8.</td><td>The Applicant shall:
(a) implement all reasonable and feasible measures to minimise the dust emissions of the development;
(b) minimise surface disturbance of the site; and
(c) monitor and report on compliance with the relevant air quality criteria in this consent;
to the satisfaction of the Secretary.</td><td>Y</td><td>Dust impacts were effectively managed during the reporting period.</td><td>D</td></tr>
<tr><td colspan="5">Air Quality Management Plan</td></tr>
<tr><td>9.</td><td>The Applicant shall prepare and implement an Air Quality Management Plan for the development to the satisfaction of the Secretary.</td><td>Y</td><td>An Air Quality Management Plan has been approved by the Secretary and is implemented at the Quarry.
The Air Quality Management Plan is available from the Hy-Tec website.</td><td>D</td></tr>
<tr><td colspan="5">METEOROLOGICAL MONITORING</td></tr>
<tr><td>10.</td><td>For the life of the development, the Applicant shall ensure that there is a suitable meteorological station operating in the vicinity of the site that complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline.</td><td>Y</td><td>A meteorological station was installed in July 2016.</td><td>D</td></tr>
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SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)				
SOIL AND WATER				
Water Supply				
11.	The Applicant shall ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations under the consent to match its available water supply to the satisfaction of the Secretary.	Noted	Hy-Tec is approved to use 44ML of water per annum (based on a water year (July to June)). A total of 1.1ML was used between July 2021 to June 2022.	D
Operating Conditions				
12.	The Applicant shall: (a) comply with Section 120 of the POEO Act, unless an EPL authorises otherwise; (b) ensure that the catchment of the water management system is not larger than 40 ha, unless the Secretary agrees otherwise; (c) maintain the dredge and silt ponds to capture a 1 in 100 ARI storm event plus adequate freeboard to ensure no offsite discharge; and (d) ensure that the loss of groundwater and surface water to Tinda Creek is no greater than predicted in the EIS.	N	Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Incident reporting following the events confirmed that material harm to the environment had not occurred.	D
Water Management Plan				
13.	The Applicant shall prepare and implement a Water Management Plan for the development to the satisfaction of the Secretary.	N	A Water Management Plan has been prepared and approved by the Secretary and is being implemented at the Quarry. Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled).	D

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Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)				
HERITAGE				
Heritage Management Plan				
14.	The Applicant shall prepare and implement a Heritage Management Plan for the development to the satisfaction of the Secretary.	Y	A Heritage Management Plan has been approved by the Secretary and is implemented at the Quarry. The Heritage Management Plan is available from the Hy-Tec website	
LANDSCAPE AND REHABILITATION				
Biodiversity Offset Strategy				
15.	The Applicant shall implement the biodiversity offset strategy described in the EIS, as summarised and revised in Table 6, and shown conceptually in Appendix 5, to the satisfaction of the Secretary. Table 6: Biodiversity Offset Strategy (ha) **Area** / **Offset Type** / **Minimum Size (ha)** On-site Offset Area / Existing vegetation to be enhanced / 106.6	NYA	Hy-Tec has reached an agreement with NPWS regarding the transfer of land to satisfy the offsetting requirements of SSD_4978. The transfer of this land is pending.	
Security of Offsets				
16.	Within 2 years of this consent, unless otherwise agreed with the Secretary, the Applicant shall make suitable arrangements to provide appropriate long-term security for the offset area, to the satisfaction of the Secretary.	N	Land intended to represent the On-site Offset Area will be transferred to the Office of the NSW Minister of Environment and Heritage in early 2023. It is noted that the area is not being disturbed and environmental management is implemented in accordance with an approved Landscape Management Plan.	
Rehabilitation Objectives				
17.	The Applicant shall rehabilitate the site to the satisfaction of the Secretary. The final landform must: (a) be generally consistent with the proposed rehabilitation strategy in the EIS, and the final landform shown conceptually in Appendices 4 and 5. and	Y	Progressive rehabilitation is consistent with the EIS. The final landform is yet to be developed.	O

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<tr><td colspan="5">LANDSCAPE AND REHABILITATION (Cont'd)</td></tr>
<tr><td colspan="5">Rehabilitation Objectives (Cont'd)</td></tr>
<tr><td></td><td>(b) comply with the objectives in Table 7.
Table 7: Rehabilitation Objectives
<table>
<tr><th>Feature</th><th>Objective</th></tr>
<tr><td>Site (as a whole)</td><td>• Safe, stable and non-polluting
• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native species and habitat, including at least 0.35 ha of Mellong Sandmass Sedgeland</td></tr>
<tr><td>Surface Infrastructure</td><td>• To be decommissioned and removed (unless the Secretary agrees otherwise)</td></tr>
<tr><td>Final Voids</td><td>• Minimise the size, depth, batter slope and the drainage catchment of the final void
• Ensure that the volume of VENM and ENM detailed in the EIS is imported for rehabilitation of the site
• Ensure that the surface area of the final voids is no greater than 16 ha in total
• Separated from the surface water drainage system, unless the Secretary agrees otherwise</td></tr>
<tr><td>Watercourses</td><td>• Restore alignment and hydraulic function, as far as practical</td></tr>
<tr><td>Community</td><td>• Ensure public safety</td></tr>
</table></td><td>Y</td><td>Progressive rehabilitation complied with these objectives during the reporting period.</td><td>O</td></tr>
<tr><td colspan="5">Progressive Rehabilitation</td></tr>
<tr><td>18.</td><td>The Applicant shall rehabilitate the site progressively, that is, as soon as reasonably practicable following disturbance. Interim stabilisation measures must be implemented where reasonable and feasible to control erosion (both wind and water) in disturbed areas that are not active and which are not ready for final rehabilitation.</td><td>Y</td><td>Rehabilitation continued in Domain 4 during the reporting period with this landform progressively being stabilised prior to revegetation.</td><td>O</td></tr>
<tr><td colspan="5">Landscape Management Plan</td></tr>
<tr><td>19.</td><td>The Applicant shall prepare and implement a Landscape Management Plan for the development to the satisfaction of the Secretary.</td><td>Y</td><td>A Landscape Management Plan has been approved by the Secretary and is being implemented at the Quarry.
The Landscape Management Plan is available from the Hy-Tec website.
An updated Landscape Management Plan is currently in preparation to revise ongoing management and monitoring measures.</td><td>D</td></tr>
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Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)				
LANDSCAPE AND REHABILITATION (Cont'd)				
Conservation and Rehabilitation Bond				
20.	Within 6 months of the approval of the Landscape Management Plan, the Applicant shall lodge a Conservation and Rehabilitation Bond with the Department to ensure that the biodiversity offset strategy and rehabilitation of the site are implemented in accordance with the performance and completion criteria set out in the plan and relevant conditions of this consent. The sum of the bond shall be determined by: (a) calculating the cost of implementing the biodiversity offset strategy over the next 3 years; (b) calculating the cost of rehabilitating the site, taking into account the likely surface disturbance over the next 3 years of extraction operations; and (c) employing a suitably qualified quantity surveyor or other expert to verify the calculated costs, to the satisfaction of the Secretary.	Y	A Conservation and rehabilitation bond was lodged with DPE on 11 December 2017.	D
21.	Within 3 months of each Independent Environmental Audit (see condition 9 of schedule 5), the Applicant shall review, and if necessary revise, the sum of the Conservation and Rehabilitation Bond to the satisfaction of the Secretary.	N	An Independent Environment Audit was undertaken between 5 and 14 July 2022. An updated bond estimate is in preparation but has yet to be submitted to DPE.	D
TRANSPORT				
Monitoring of Product Transport				
22.	The Applicant shall keep accurate records of all laden truck movements to and from the site (hourly, daily, weekly, monthly and annually) and publish these records on its website every 6 months.	Y	See Section 4.5 of the Annual Review. Truck movement records are also available from the Hy-Tec website.	D

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SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)				
TRANSPORT (Cont'd)				
Operating Conditions				
23.	The Applicant shall ensure that: (a) all laden vehicles have appropriate signage, including a contact phone number, so they be easily identified by road users; (b) all laden vehicles entering or exiting the site have their loads covered; (c) all laden vehicles exiting the site are cleaned of sand and other material that may fall on the road, before leaving the site; and (d) no trucks queue at the entrance to the site before 6am.	Y	All laden vehicles complied with these requirements during the reporting period.	D
Access Road and Intersection Construction				
24.	Within 12 months from the date of this consent, unless the Secretary agrees otherwise, the Applicant shall upgrade the site access road and its intersection with Putty Road in accordance with applicable AUSTROADS standards, and to the satisfaction of RMS.	Y	Intersection upgrade completed in November 2015.	D
Transport Management Plan				
25.	The Applicant shall prepare and implement a Transport Management Plan for the development to the satisfaction of the Secretary.	Y	A Transport Management Plan has been approved by the Secretary and is implemented at the Quarry. The Transport Management Plan is available from the Hy-Tec website	D
VISUAL				
26.	The Applicant shall: (a) implement all reasonable and feasible measures to minimise the visual and off-site lighting impacts of the development on local residences and road users; and (b) ensure that all external lighting associated with the development complies with the relevant Australian Standards…. to the satisfaction of the Secretary.	Y	Visual amenity was managed effectively during the reporting period. No complaints were received during the reporting period regarding visual impacts.	
BUSHFIRE MANAGEMENT				
27.	The Applicant shall ensure that the development is suitably equipped to respond to any fires on site; and assist the Rural Fire Service, emergency services and National Parks and Wildlife Service as much as practicable if there is a fire in the surrounding area.	Y	Firefighting equipment is readily available at the Quarry.	D

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Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 3: ENVIRONMENTAL PERFORMANCE CONDITIONS (Cont'd)				
WASTE				
28.	The Applicant shall ensure that only certified VENM and ENM is imported to the site to aid in the minimisation of final voids.	Y	No material was imported during the reporting period.	D
29.	The Applicant shall manage on-site sewage treatment and disposal in accordance with the requirements of its EPL, and to the satisfaction of the EPA and Council.	Y	There were no compliance issues with regards to sewerage management during the reporting period.	D
30.	The Applicant shall: (a) minimise the waste generated by the development; (b) ensure that the waste generated by the development is appropriately stored, handled, and disposed of; and (c) report on waste management and minimisation in the Annual Review, to the satisfaction of the Secretary.	Y	Waste is being managed appropriately at the Quarry Site.	O
SCHEDULE 4: ADDITIONAL PROCEDURES				
NOTIFICATION OF LANDOWNERS				
1.	As soon as practicable after obtaining monitoring results showing an exceedance of any relevant criteria in schedule 3, the Applicant shall notify affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the development is again complying with the relevant criteria.	Y	Hy-Tec did not receive monitoring results that indicated impacts at a nearby residence.	D
INDEPENDENT REVIEW				
2.	If an owner of privately-owned land considers the development to be exceeding the relevant criteria in schedule 3, then he/she may ask the Secretary in writing for an independent review of the impacts of the development on his/her land. If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision the Applicant shall:	NYA	No requests for an independent review of impacts of the Quarry were received during the reporting period.	
SCHEDULE 5: ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING				
ENVIRONMENTAL MANAGEMENT				
Environmental Management Strategy				
1.	The Applicant shall prepare and implement an Environmental Management Strategy for the development to the satisfaction of the Secretary.	Y	An Environmental Management Strategy has been approved by the Secretary and is implemented at the Quarry. The Environmental Management Strategy Plan is available from the Hy-Tec website.	D

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SCHEDULE 5: ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING (Cont'd)				
ENVIRONMENTAL MANAGEMENT (Cont'd)				
Adaptive Management				
2.	The Applicant shall assess and manage development-related risks to ensure that there are no exceedances of the criteria and/or performance measures in schedule 3. Any exceedance of these criteria and/or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria and/or performance measures has occurred, the Applicant shall, at the earliest opportunity: (a) take all reasonable and feasible measures to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement remediation measures as directed by the Secretary; to the satisfaction of the Secretary.	Y	All non-compliance issues that occurring during the reporting period were addressed in a manner consistent with this condition.	D
Management Plan Requirements				
3.	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: (a) detailed baseline data; (b) a description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; and • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; (c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Y	All management plans and strategies have been approved by the Secretary.	D

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SCHEDULE 5: ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING (Cont'd)				
ENVIRONMENTAL MANAGEMENT (Cont'd)				
Management Plan Requirements (Cont'd)				
	(d) a program to monitor and report on the: • impacts and environmental performance of the development; and • effectiveness of any management measures (see (c) above); (e) a contingency plan to manage any unpredicted impacts and their consequences; (f) a program to investigate and implement ways to improve the environmental performance of the development over time; (g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and (h) a protocol for periodic review of the plan.			
Annual Review				
4.	By the end of December each year, or other timing as may be agreed by the Secretary, the Applicant shall review the environmental performance of the development to the satisfaction of the Secretary.	Y	This document.	D
Revision of Strategies, Plans and Programs				
5.	Within 3 months of a modification to this consent or following the submission of an: (a) annual review under condition 4 above: (b) incident report under condition 7 below; or (c) audit report under condition 9 below, the Applicant shall review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. *Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.*	Y	Hy-Tec have advised that a review has been carried out accordingly,	D

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SCHEDULE 5: ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING (Cont'd)				
ENVIRONMENTAL MANAGEMENT (Cont'd)				
Community Consultative Committee				
6.	The Applicant shall establish and operate a Community Consultative Committee (CCC) for the development to the satisfaction of the Secretary. This CCC must be operated in general accordance with the Guidelines for Establishing and Operating Community Consultative Committees for Mining Developments (Department of Planning, 2007, or its latest version), and be operating within 6 months of the date of this consent.	Y	A CCC Meeting was held at the Quarry Site on 24 May 2022.	D
REPORTING				
Incident Reporting				
7.	The Applicant shall immediately notify the Secretary and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. For any other incident associated with the Development, the Applicant shall notify the Secretary. Within 7 days of the date of the incident, the Applicant shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.	Y	DPE and EPA were notified of the controlled and uncontrolled discharge events during the reporting period. A detailed report was provided following each event with the timeframe for submission provided by the relevant agency.	D
Regular Reporting				
8.	The Applicant shall provide regular reporting on the environmental performance of the development on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent.	Y	All relevant documents and monitoring results are available from the Hy-Tec website.	O
INDEPENDENT ENVIRONMENTAL AUDIT				
9.	Within a year of the date of this consent, and every 3 years thereafter, unless the Secretary directs otherwise, the Applicant shall commission and pay the full cost of an Independent Environmental Audit of the development.	Y	An Independent Environment Audit was undertaken between 5 and 14 July 2022.	D

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Table A1 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Development Consent SSD_4978 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Condition No.	Paraphrased Requirement	Compliance	Comment	Basis*
SCHEDULE 5: ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING (Cont'd)				
INDEPENDENT ENVIRONMENTAL AUDIT (Cont'd)				
10.	Within 6 weeks of the completion of this audit, unless the Secretary agrees otherwise, the Applicant shall submit a copy of the audit report to the Secretary, together with its response to any recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report. If the Applicant intends to defer the implementation of a recommendation, reasons must be documented.	Y	The audit report and response from Hy-tec were provided to DPE on 15 August 2022	D
11.	Within 6 months of the date of this consent, the Applicant shall: (a) make copies of the following publicly available on its website: • the EIS; • current statutory approvals for the development; • approved strategies, plans and programs required under the conditions of this consent; • a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs; • a complaints register, which is to be updated monthly; • minutes of CCC meetings; • the annual reviews of the development (for the last 5 years); • any independent environmental audit of the development, and the Applicant's response to the recommendations in any audit; • any other matter required by the Secretary; and (b) keep this information up-to-date, to the satisfaction of the Secretary.	Y	All relevant documents and monitoring results are available from the Hy-Tec website.	D

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Table A2
Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
1. Administrative Conditions				
What the licence authorises and regulates				
A1.1	This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation. Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.	Yes	Scheduled Activity Fee Based Activity Scale > 100 000 – 500 000m^3 annual extractive capacity	D
	Scheduled Activity / **Fee Based Activity** / **Scale**			
	Extractive activities / Water-based extractive activity / >100000 – 500000m3 annual extractive capacity			
A1.2	Notwithstanding condition A1.1, the scale of the water-based extractive activity authorised under this licence must not exceed more than 300,000 tonnes of sand extracted or processed in any calendar year, being the amount equivalent to the annual extraction limit approved by the development consent granted under the Environmental Planning and Assessment Act 1979 for the premises specified in A2.	Yes	Water-based extractive activity did not exceed more than 300 000 tonnes of sand extracted or processed during the reporting period.	D
Premises or plant to which this licence applies				
A2.1	The licence applies to the following premises: TINDA CREEK QUARRY 6102 PUTTY ROAD MELLONG NSW 2756 LOT 1 DP 628806, LOT 2 DP 628806, LOT 3 DP 628806 AS DEPICTED IN THE MAP OF THE APPROVED PROJECT AREA FOR SSD 4978 IN CONDITION A2.2	N/A		
A2.2	The premises location is shown on the map below	N/A		

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Table A2 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
1. Administrative Conditions (Cont'd)				
Information supplied to the EPA				
A3.1	Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence. In this condition the reference to "the licence application" includes a reference to: a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.	Y	Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Incident reporting following the events confirmed that material harm to the environment had not occurred.	D
A3.2	Works and activities must be carried out in accordance with the Development Consent for State Significant Development 4978 approved by the Department of Planning and Environment on 10 April 2015.	N	The non-compliances recorded under SSD_4978 preclude the achievement of compliance with this condition.	D
2. Discharges to Air and Water and Applications to Land				
P1 Location of monitoring/discharge points and areas				
P1.1	The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.	Yes	A Noise Management Plan has been approved by the Secretary and is implemented at the Quarry. The Noise Management Plan is available from the Hy-Tec website and identifies monitoring locations.	D

EPA ID No.	Type of monitoring point	Location Description
1	Noise monitoring	The boundary of "Receiver 1" as detailed in Figure 6.1 of the document titled "Tinda Creek Sand Quarry Noise Management Plan Final October 2015", submitted to the EPA on 18 November 2015

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Table A2 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

<table>
<tr><th>Cond. No.</th><th>Paraphrased Requirement</th><th>Compliance</th><th>Comment</th><th>Basis*</th></tr>
<tr><td colspan="5">3. Limit Conditions</td></tr>
<tr><td colspan="5">L1 Pollution of waters</td></tr>
<tr><td>L1.1</td><td>Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.</td><td>N</td><td>Both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled).
Incident reporting following the events confirmed that material harm to the environment had not occurred.</td><td>D</td></tr>
<tr><td colspan="5">L2 Waste</td></tr>
<tr><td>L2.1</td><td>The licensee must not cause, permit or allow any waste generated outside the premises to be received at the premises for storage, treatment, processing, reprocessing or disposal or any waste generated at the premises to be disposed of at the premises, except as expressly permitted by the licence.</td><td>Yes</td><td>No waste material was received on site during the reporting period.</td><td>D</td></tr>
<tr><td>L2.2</td><td>This condition only applies to the storage, treatment, processing, reprocessing or disposal of waste at the premises if those activities require an environment protection licence.</td><td>Yes</td><td>No waste material was received on site during the reporting period.</td><td>D</td></tr>
<tr><td colspan="5">L3 Noise Limits</td></tr>
<tr><td>L3.1</td><td>Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.
POINT 1
<table>
<tr><th>Time period</th><th>Measurement parameter</th><th>Measurement frequency</th><th>Noise level dB(A)</th></tr>
<tr><td>All hours</td><td>LAeq (15 minute)</td><td>-</td><td>35</td></tr>
<tr><td>Night</td><td>Lmax OR LA1,1min</td><td>-</td><td>45</td></tr>
</table></td><td>Yes</td><td>Noise monitoring undertaken during the reporting period demonstrates that Hy-Tec complied with the criteria. There were no noise complaints during the reporting period.</td><td>D</td></tr>
<tr><td>L3.2</td><td>For the purposes of the table under Condition L3.1 "Night" has the same meaning as in the NSW Industrial Noise Policy (EPA, 2000).</td><td>Noted</td><td></td><td></td></tr>
</table>

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Table A2 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
3. Limit Conditions (Cont'd)				
L4 Hours of Operation				
L4.1	Unless permitted by another condition of this licence, activities at the premises must: a) only be undertaken between 7:00 am and 6:00 pm Monday to Friday; b) only be undertaken between 7:00 am and 3:00 pm Saturday; and c) not be undertaken on Sundays or public holidays.	Yes	Hy-Tec reports that all hours of operation were complied with during the reporting period.	D
L4.2	In addition to the limitations imposed by Condition L4.1, construction activities must not be undertaken: a) between 7:00 am and 8:00 am Saturdays; and b) between 1:00 pm and 3:00 pm Saturdays.	Yes	No construction activities were undertaken in the reporting period with the exception of raising the northern wall of the sediment pond. Hy-Tec reports that hours of operation were adhered to.	D
L4.3	In addition to the hours of operation specified in Condition L4.1, dispatch activities may be undertaken: a) between 5:00 am and 10:00 pm Monday to Friday; and b) between 6:00 am and 3:00 pm Saturdays	Yes	Hy-Tec reports that dispatch occurred during the approved hours throughout the reporting period.	D
L4.4	Maintenance activities may be undertaken at any time if those activities are inaudible at all residential premises.	Yes	Hy-Tec has confirmed that all maintenance activities were inaudible at residential premises. No noise complaints were received through the reporting period.	D
4. Operating Conditions				
O1 Activities must be carried out in a competent manner				
O1.1	Licensed activities must be carried out in a competent manner. This includes: a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.	Yes	Due to record rainfall recorded across NSW during the period, both controlled and uncontrolled discharge of water from the closed water management system occurred during the reporting period (one uncontrolled, four controlled). Hy-Tec personnel responded to the events appropriately and in most cases controlled discharge was occurred to mitigate material harm to the environment.	D

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Table A2 (Cont'd)
Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
4. Operating Conditions (Cont'd)				
O2 Maintenance of plant and equipment				
O2.1	All plant and equipment installed at the premises or used in connection with the licensed activity: a) must be maintained in a proper and efficient condition; and b) must be operated in a proper and efficient manner.	Yes	Hy-Tec reports that all plant and equipment was maintained and operated in a proper and efficient manner.	D
O3 Dust				
O3.1	The premises must be maintained in a condition which minimises or prevents the emission of dust from the premises.	Yes	Hy-Tec reports that quarry-generated dust was minimal throughout the reporting period. No complaints relating to dust impacts were received.	D
O3.2	The licensee must ensure that all laden vehicles exiting the site have their loads covered.	Yes	Hy-Tec reports that all loads were covered during the reporting period.	D
5. Monitoring and Recording Conditions				
M1 Monitoring Records				
M1.1	The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.	Yes	All monitoring was conducted and retained in accordance with M1 of EPL 12007	D
M1.2	All records required to be kept by this licence must be: a) in a legible form, or in a form that can readily be reduced to a legible form; b) kept for at least 4 years after the monitoring or event to which they relate took place; and c) produced in a legible form to any authorised officer of the EPA who asks to see them.	Yes	All records have been kept in accordance with condition M1 of EPL 12007.	D
M1.3	The following records must be kept in respect of any samples required to be collected for the purposes of this licence: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and d) the name of the person who collected the sample.	Yes	Hy-Tec confirms that all relevant details have been recorded for monitoring activities.	D

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Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
5. Monitoring and Recording Conditions (Cont'd)				
M2 Environmental Monitoring				
M2.1	a) The licensee must undertake monthly inspections of the surface water management system at the premises. b) The monthly inspections must: (i) be undertaken immediately upstream and downstream of the quarry disturbance area; (ii) include visual inspection of litter, oil and grease and sediment levels within the surface water system, including diversion channels; (iii) include visual inspection of the physical integrity of the surface water management system, including any signs of erosion; and (iv) include visual inspection of the water level and flow in Tinda Creek.	Yes	Monthly inspections of the surface water management system were undertaken throughout the reporting period in accordance with condition M2 of EPL 12007.	D
M3 Recording of pollution complaints				
M3.1	The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.	Yes	A complaints register is maintained with no complaints received during the reporting period.	D
M3.2	The record must include details of the following: a) the date and time of the complaint; b) the method by which the complaint was made; c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect; d) the nature of the complaint; e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and f) if no action was taken by the licensee, the reasons why no action was taken.	Yes	A complaints register is maintained with no complaints received during the reporting period.	D
M3.3	The record of a complaint must be kept for at least 4 years after the complaint was made.	Yes	A complaints register is maintained with no complaints received during the reporting period.	D
M3.4	The record must be produced to any authorised officer of the EPA who asks to see them.	NYA	No requests were provided during the reporting period.	D
M4 Telephone complaints line				
M4.1	The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.	Yes	A telephone complaints line was maintained, however, no complaints were received during the reporting period.	D

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Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
5. Monitoring and Recording Conditions (Cont'd)				
M4 Telephone complaints line (Cont'd)				
M4.2	The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.	Yes	The telephone complaints number is displayed on a sign at the front gate of the Quarry.	D
M4.3	The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.	Noted		
M5 Noise Monitoring				
M5.1	To assess compliance with the noise limits specified within this licence, the licensee must undertake operator attended noise monitoring at each specified noise monitoring point in accordance with the table below. POINT 1 Assessment period: All hours when in use; Minimum frequency in a reporting period: Yearly; Minimum duration within assessment period: 1 hour; Minimum number of assessment period: 1 operation day	Yes	Noise monitoring was undertaken by Muller Acoustic Consultants in April 2022 in accordance with the approved Noise Management Plan.	D
M5.2	The licensee must undertake noise monitoring as directed by an authorised officer of the EPA.	NYA	No request was made for additional noise monitoring during the reporting period.	D
M5.3	All noise monitoring required by this licence must be undertaken in accordance with Australian Standard AS 2659.1 - 1998: Guide to the use of sound measuring equipment - Portable sound level meters, or any revisions of that standard that may be made by Standards Australia, and the compliance monitoring guidance provided in the NSW Industrial Noise Policy.	Yes	Noise monitoring was undertaken in accordance with Australian Standard AS 2659.1 – 1998.	D
6. Reporting Conditions				
R1 Annual Return Documents				
R1.1	The licensee must complete and supply to the EPA an Annual Return in the approved form comprising: 1. a Statement of Compliance, 2. a Monitoring and Complaints Summary, 3. a Statement of Compliance - Licence Conditions, 4. a Statement of Compliance - Load based Fee, 5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan, 6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and 7. a Statement of Compliance - Environmental Management Systems and Practices. At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.	Yes	Annual Return submitted to EPA on 08/07/2022	D

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Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007
for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
6. Reporting Conditions (Cont'd)				
R1 Annual Return Documents (Cont'd)				
R1.2	An Annual Return must be prepared in respect of each reporting period, except as provided below.	Noted		
R1.3	Where this licence is transferred from the licensee to a new licensee: a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.	Noted		
R1.4	Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on: a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.	Noted		
R1.5	The Annual Return for the reporting period must be supplied to the EPA via eConnect EPA or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').	Y	Annual Return submitted to EPA 08/07/2022.	D
R1.6	The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.	Noted		
R1.7	Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by: a) the licence holder; or b) by a person approved in writing by the EPA to sign on behalf of the licence holder.	Y	Compliance declaration was signed by a Director and Company Secretary.	D
R2 Notification of environmental harm				
R2.1	Notifications must be made by telephoning the Environment Line service on 131 555.	Noted	Notifications during the reporting period were not made using this number but to the relevant EPA Officer. In all instances the Officer acknowledged receipt of the information.	

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Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
6. Reporting Conditions (Cont'd)				
R2 Notification of environmental harm (Cont'd)				
R2.2	The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.	Y	The EPA were notified of uncontrolled discharge event on 2 March 2021, the same day the event occurred.	D
R3 Written Report				
R3.1	Where an authorised officer of the EPA suspects on reasonable grounds that: a) where this licence applies to premises, an event has occurred at the premises; or b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence, and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.	Y	No requests for written reports of an event were made by the EPA.	D
R3.2	The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.	Y	No requests for written reports of an event were made by the EPA.	D
R3.3	The request may require a report which includes any or all of the following information: a) the cause, time and duration of the event; b) the type, volume and concentration of every pollutant discharged as a result of the event; c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event; d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort; e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants; f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and g) any other relevant matters.	Y	No requests for written reports of an event were made by the EPA.	D

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Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
6. Reporting Conditions (Cont'd)				
R3 Written Report (Cont'd)				
R3.4	The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.	Noted	No feedback has been received by EPA in relation to an R3 written Report.	D
R4 Other reporting conditions				
Noise Monitoring Results				
R4.1	a) The licensee must submit the results of any noise monitoring undertaken in accordance with the requirements of Condition M5.1 or Condition M5.2 to the EPA within three weeks of the noise monitoring being undertaken. b) The noise monitoring results submitted to the EPA must include: (i) a map of each noise monitoring location in relation to the noise source, including relevant distances; (ii) an analysis of the noise monitoring results; (iii) any detected exceedance of the noise limits specified in Condition L4.1; (iv) details of any remedial action taken or proposed to be taken in relation to any exceedance of the noise limits specified in Condition L4.1; (v) details of the prevailing meteorological conditions during the period when the noise monitoring was undertaken; and (vi) confirmation that noise monitoring was/was not undertaken in accordance with Condition M5.3.	Yes	A copy of the Noise Monitoring Assessment is available on the Hy-Tec website and was provided to the EPA within the allocated timeframe. No exceedances were recorded during the reporting period.	D
Surface Water Management System reporting				
R4.2	In accordance with section 5.3 of the approved Water Management Plan for the premises, the licensee must notify the EPA when surface water triggers are exceeded and provide a written report to the EPA.	NYA	No surface water triggers were exceeded during the reporting period.	D
R4.3	The report to the EPA must include: a) the results of surface water management system inspections required in condition M2.1 for the month related to the exceedance, including photographs; and b) appropriate mitigation and contingency measures to be implemented within one month of the exceedance being detected.	NYA	No surface water triggers were exceeded during the reporting period.	D

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Internal Compliance Audit of Relevant Conditions of Environment Protection Licence 12007 for Tinda Creek Sand Project from 15 July 2022 to 31 December 2022

Cond. No.	Paraphrased Requirement	Compliance	Comment	Basis*
6. Reporting Conditions (Cont'd)				
R4 Other reporting conditions (Cont'd)				
R4.4	The report must be submitted to the EPA within one month of surface water triggers being detected and be directed to the Manager, Sydney Industry Section by email to metro.regulation@epa.nsw.gov.au	NYA	No request was received for written reports during the reporting period.	D
7. General Conditions				
G1 Copy of licence kept at the premises or plant				
G1.1	A copy of this licence must be kept at the premises to which the licence applies.	Yes	A copy of the licence is available at the Quarry.	D
G1.2	The licence must be produced to any authorised officer of the EPA who asks to see it.	Noted		
G1.3	The licence must be available for inspection by any employee or agent of the licensee working at the premises.	Noted		

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NYA = Not Yet Applicable HNC = Historical Non-Compliance ANC = Administrative Non-Compliance
* = Basis for assessment of compliance D = Documentation/Discussion O = Observation during audit
Yes# / No# = Complied / not complied with and compliance no longer required to be assessed

Appendix 2

Annual Return 2022

(Total No. of pages including blank pages = 3)

Extractive Materials Return 2021-2022

NSW GOVERNMENT | Regional NSW

Form S1 – Period Ending 30 June 2022

Quote RIMS ID in all correspondence

Quarry Id: Rims ID: 401060 Operators Name: AUS-10 RHYOLITE T/AS HY-TEC INDUSTRIES Address: PO BOX 6770 SILVERWATER NSW 1811 Email: darryl.thiedeke@hy-tec.com.au Quarry Name: TINDA CREEK QUARRY Quarry Address: 6102 PUTTY RD, MELLONG NSW 2756	**Inquiries** please telephone: (02) 4063 6713 **Completed or Nil Returns** Email – mineral.royalty@planning.nsw.gov.au Postal Address (see below) ***Please amend name, postal address and location of mine or quarry if incorrect or incomplete.***

The return should be completed and forwarded to **Senior Advisory Officer, RESOURCE ECONOMICS, STRATEGY, PERFORMANCE & INDUSTRY DEVELOPMENT, DEPARTMENT OF REGIONAL NSW, PO BOX 344 HUNTER REGION MAIL CENTRE NSW 2310 on or before 31 October 2021**. If completion of the return is unavoidably delayed, an application for extension of time should be requested **before** the due date. If no work was done during the year, a **NIL** return must be forwarded.

The return should relate to the **above quarrying establishment** and should cover the operations of quarrying and treatment (such as crushing, screening, washing etc.) carried out at or near the quarry. A return is required even if the operations are solely of a developmental nature and whether the area being worked is held under a mining title or otherwise.

Director, Resources Policy

Please complete all the following information to assist in identifying the location of the Quarry

Typical Geology **Friable Sandstone / Lacustrine**

Nearest Town to Quarry **Wilberforce**

Local Council Name **Hawkesbury Shire Council**

Deposited Plan and Lot Number/s of Quarry **Lots 1 to 3 DP628806**

Email Address of Operator **As above**

Name of Owner or Licensee **As above**

Postal Address of Licensee **As above**

Licence/Lease Number/s (if any)

From Mining, Exploration & Geoscience (NSW Mineral Resources) **N/A**

From Crown Lands or other NSW Department **N/A**

If any output was obtained from land NOT held under licence from the above Departments, state the Name/s and Address/es of the Owners of the land **N/A**

To the best of my knowledge, information entered in this return is correct and no blank spaces left where figures should have been inserted.

- **SIGNATURE of PROPRIETOR or MANAGER** _____ **DATE** 30.11.2022
- **CONTACT PERSON for this return** **Darryl Thiedeke**
- **NAME** (Block letters) **DARRYL THIEDEKE** **Telephone** **02 96472866**

Extractive Materials Return 2021-2022

NSW GOVERNMENT | Regional NSW

Form S1 – Period Ending 30 June 2022

Sales During 2021-2022

Production information may be published in aggregated form for statistical reporting. However, production data for individual operations is kept strictly confidential.

Product	Description	Quantity Tonnes
Virgin Materials		
Crushed Coarse Aggregates		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand	Washed fine sand	**74,506**
Manufactured Sand		
Prepared Road Base & Sub Base		
Other Unprocessed Materials		
Recycled Materials		
Crushed Coarse Aggregates		
Over 75mm		
Over 30mm to 75mm		
5mm to 30mm		
Under 5mm		
Natural Sand		
Manufactured Sand		
Prepared Road Base & Sub Base		
Other Unprocessed Materials		
River Gravel		
Over 30mm		
5mm to 30mm		
Under 5mm		
Construction Sand	Excluding Industrial	
Industrial Sand		
Foundry, Moulding		
Glass		
Other (Specify)		
Dimension Stone	Building, Ornamental, Monumental	
Quarried in Blocks		
Quarried in Slabs		
Decorative Aggregate	Including Terrazzo	
Loam	Soil for Topdressing, Garden soil, Horticultural purposes)	
TOTAL SITE PRODUCTION		**74,506t**
Gross Value ($) of all Sales		**$1.9M**
Type of Material		
Number of Full-Time Equivalent (FTE) Employees	**Employees** 6	**Contractors** 1

Please Note: A return for clay-based products can be obtained by contacting the inquiry number.

Appendix 3

Noise Monitoring Assessment

Prepared by Muller Acoustic Consulting Pty Ltd

(Total No. of pages including blank pages = 23)

Noise Monitoring Assessment

Tinda Creek Quarry
Tinda Creek, NSW

April 2022

Prepared for: RW Corkery & Co Pty Limited
April 2022
MAC180647-01RP5

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Tinda Creek Quarry

Tinda Creek, NSW

Prepared for: RW Corkery & Co Pty Limited
Level 1, 12 Dangar Road
Brooklyn NSW 2083

Prepared by: Muller Acoustic Consulting Pty Ltd

PO Box 678, Kotara NSW 2289

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

DOCUMENT ID	DATE	PREPARED	SIGNED	REVIEWED	SIGNED
MAC180647-01RP5	28 April 2022	Robin Heaton	Robin Heaton	Oliver Muller	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by RW Corkery & Co Pty Limited (RWC) on behalf of Hy-Tec Industries Pty Ltd (Hy-Tec) to complete a Noise Monitoring Assessment (NMA) for the Tinda Creek Quarry, Tinda Creek, NSW (the 'project').

The monitoring has been conducted in accordance with the approved Tinda Creek Quarry Noise Management Plan and in general accordance with Conditions L3.1 and M5 of EPL#12007 (EPL).

The assessment was conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Environment Protection Licence EPL#12007;
- Umwelt Pty Ltd, Tinda Creek Quarry Noise Management Plan (NMP); and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

The assessment was undertaken on Wednesday 13 April 2022 and forms part of the noise monitoring program to address conditions of EPL#12007 and the Noise Management Plan.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

2.1 Attended Noise Compliance

Section L3.1 of the Tinda Creek EPL, approved on 3 March 2017, outlines the applicable noise criteria for all privately owned residential receivers surrounding the project. The operating criteria specified in the EPL at all receivers is 35dB $LA_{eq(15min)}$ for all periods and 45dB LA_{max} during the night time period. **Table 1** presents the criteria for privately owned residential receivers surrounding the project, as outlined in the EPL.

Table 1 Receiver Locations

Receiver	All Hours dB(A) $LA_{eq(15min)}$	Night (10pm to 7am) dB(A) LA_{max}
All privately owned residences	35	45

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3 Methodology

3.1 Locality

The project is located on Putty Road, Tinda Creek, NSW, approximately 67km north of Windsor, NSW. Receivers in the locality surrounding the project are primarily rural/residential. Putty Road is situated to the west of the site with the Yengo National Park bordering the site in all other directions.

3.2 Noise Monitoring Locations

Section M5.1 of the EPL specifies that noise monitoring is to be conducted for a minimum duration of one hour at the boundary of R1, (6255 Putty Road, Mellong) as detailed in Figure 6.1 of the Tinda Creek Noise Management Plan.

It should be noted that access to the property was not possible during the time of the noise measurements. Therefore, attended measurements were conducted at the boundary gate (NM1) of the property, as shown in **Figure 1**.

Following a request from the Department of Environment and Planning (DPE) on 20 January 2017, two additional near-field monitoring locations were selected to quantify project noise levels and limiting noise influence from Putty Road. The locations include a position adjacent to the dam and a second location adjacent to the main plant. The noise levels monitored at these locations were used to quantify the overall sound power of the onsite operations, which was then used to calculate the noise contribution at surrounding noise sensitive receivers (ie R2 and R3).

The three monitoring locations, their MGA 56 coordinates and duration of measurement period are outlined in **Table 2** and are presented visually in the locality plan shown in **Figure 1**.

Table 2 Receiver Locations

Receiver ID	Receiver Location	MGA56 Coordinates		Duration	Periods Monitored
		Easting	Northing		
R1	6255 Putty Road	284801	6329055	1 Hour	Morning Shoulder, Day
Q1	Dam Plant	285984	6327973	15 mins	Morning Shoulder, Day
Q2	Main Plant	285991	6327885	15 mins	Morning Shoulder, Day

3.3 Assessment Methodology

All noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the EPL. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

Attended noise measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 13 April 2022. Four noise measurements of 15 minutes in duration were conducted at NM1 (R1) monitoring location during the day and morning shoulder monitoring periods. Where possible, throughout each survey, the operator quantified the contribution of each significant noise source.

Additionally, unattended noise monitoring was conducted at nearfield locations for a period of one hour during the day and morning shoulder monitoring periods to quantify the noise emissions from the quarry. These measurements were carried out using Svantek Type 1, 977 and Svantek Type 1, 971 noise analysers.

3.4 Operational Log

Transportation activities commenced at 5.30am and work shifts including operation of processing equipment commenced at 7am on the day of the survey. Morning shoulder measurements were conducted from 6am to 7am to capture the onsite loading and transportation operations. Daytime operations commenced at approximately 7am with the daytime monitoring conducted from 7.30am to 8.30am.

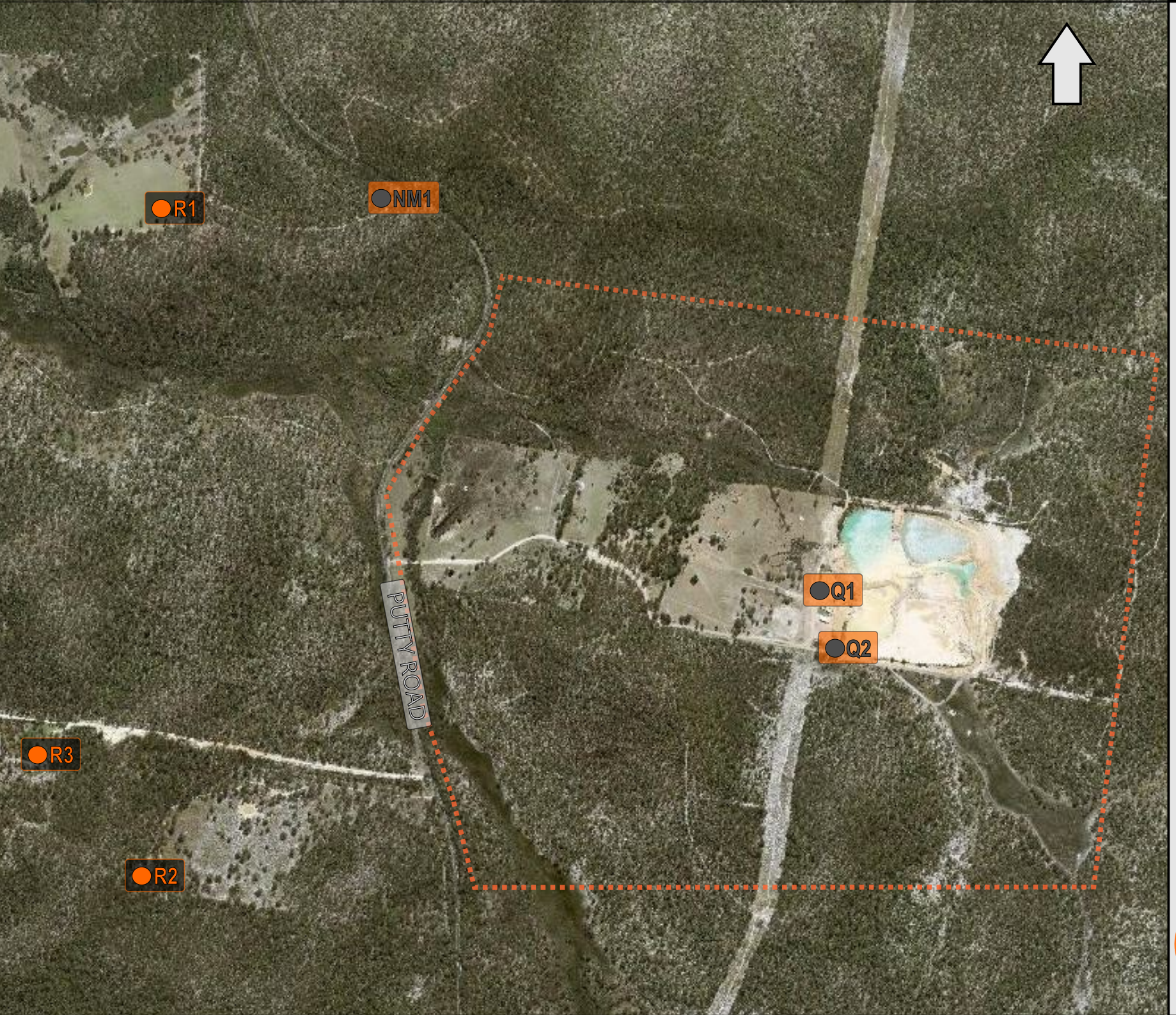

FIGURE 1

LOCALITY PLAN

REF: MAC180647

0 500m

KEY

- R1 — RECEIVER LOCATION
- NM1 — NOISE MONITORING LOCATION
- PROJECT BOUNDARY

MAC
Muller Acoustic Consulting

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4 Results

4.1 Morning Shoulder Results

Four attended noise measurements of 15-minutes in duration were completed during the morning shoulder assessment period at NM1 on Wednesday 13 April 2022. **Table 3** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 3 Operator-Attended Noise Survey Results – Morning Shoulder Period, Location NM1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
13/04/2022	06:03	83	58	23	WD: S WS: 0.3m/s Rain: Nil	Birds 29-43 Passing traffic 33-83 Quarry inaudible
	06:18	89	62	22	WD: S WS: 0.2m/s Rain: Nil	Birds 29-44 Passing traffic 35-89 Wind turbulence 30-33 Quarry operations 20-25
	06:33	75	42	23	WD: S WS: 0.1m/s Rain: Nil	Birds 30-45 Passing traffic 36-75 Quarry operations 20-25
	06:48	83	60	26	WD: S WS: 0.1m/s Rain: Nil	Birds 29-38 Wind turbulence 30-31 Passing traffic 30-83 Quarry inaudible
Tinda Creek Contribution						<25

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

Unattended noise monitoring was completed during the morning shoulder assessment period at Q1 and Q2 on Wednesday 13 April 2022. **Table 4** presents the monitored 15-minute noise levels, noted on-site activities and meteorological conditions at the time of measurements.

Table 4 Unattended Noise Survey Results – Morning Shoulder Period, Location Q1 and Q2

Location	Date / Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Onsite Activities
		L_{Amax}	L_{Aeq}	L_{A90}		
Q1	13/04/2022 06:30	81	69	65	WD: S WS: 0.1m/s Rain: Nil	Vehicle loading 51-81
Q2		71	57	51		

4.2 Day Assessment Results

Four attended noise measurements of 15-minutes in duration were completed during the day assessment period at NM1 on Wednesday 13 April 2022. **Table 5** presents the monitored noise level contributions and observed meteorological conditions for each measurement.

Table 5 Operator-Attended Noise Survey Results – Day Period, Location NM1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{aeq}	L_{A90}		
13/04/2022	07:03	83	57	25	WD: S WS: 0.1m/s Rain: Nil	Birds 29-31 Passing traffic 40-83 Wind turbulence 30-32 Quarry operations 20-25
	07:18	85	61	26	WD: S WS: 0.1m/s Rain: Nil	Birds 40-50 Passing traffic 35-85 Wind turbulence 30-33 Quarry operations 20-25
	07:33	85	63	29	WD: S WS: 0.1m/s Rain: Nil	Birds 29-44 Passing traffic 37-85 Aircraft 30-33 Quarry inaudible
	07:48	106	69	30	WD: S WS: 0.1m/s Rain: Nil	Birds 29-44 Passing traffic 35-82 Wind turbulence 30-33 Operator noise 105-106 Quarry operations 20-25
	Tinda Creek Contribution					<25

Note 1: Day – the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening – the period from 6pm to 10pm; Night – the remaining periods.

Unattended noise monitoring was completed during the day assessment period at Q1 and Q2 on Wednesday 13 April 2022. **Table 6** presents the monitored 15-minute noise levels, noted on-site activities and meteorological conditions at the time of measurements.

Table 6 Unattended Noise Survey Results – Day Period, Location Q1 and Q2

Location	Date / Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Onsite Activities
		L_{Amax}	L_{Aeq}	L_{A90}		
Q1	13/04/2022 07:30	74	71	69	WD: S WS: 0.1m/s Rain: Nil	Vehicle loading Processing operations Generator noise 52-74
Q2		69	57	52		

5 Noise Compliance Assessment

5.1 Attended Noise Monitoring Compliance Assessment

The compliance assessment summary results for R1 are presented in **Table 7** for day and morning shoulder assessment periods and compares project contributions against relevant criteria.

Table 7 Day and Morning Shoulder Noise Compliance Assessment

Period	Quarry Noise Contribution	Quarry Noise Criteria	Compliant
	dB $LA_{eq(15min)}$	dB $LA_{eq(15min)}$	
Day	<25	35	✓
Morning Shoulder	<25	35	✓

5.2 Calculated DPE Assessment Methodology

From the noise measurements at monitoring location Q1 and Q2 the $LA_{eq(15min)}$ sound power of the quarry was calculated to be 107dBA. The contribution at each of the receivers R1 to R3 has been calculated taking into account loss due to distance and topography. The quarry sound power level was propagated to the surrounding noise sensitive receivers, with the calculated received noise level presented in **Table 8.** Results of the calculations generally correlate with the measured noise contributions from the project and therefore validate compliance.

Table 8 Calculated DPE Compliance Assessment

Receiver	Quarry Sound Power dB	Distance to Receiver m	Distance attenuation dB	Attenuation due to Topography dB	Calculated Quarry Contribution dB $LA_{eq(15min)}$
R1	107	2050	74	12	21
R2	107	2210	75	12	20
R3	107	2030	74	12	21

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6 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment for RW Corkery & Co Pty Limited on behalf of Hy-Tec Industries Pty Ltd for the Tinda Creek Quarry, Tinda Creek, NSW. The assessment was completed to assess the quarry's compliance with the relevant criteria outlined in EPL#12007 for the nominated residential receiver surrounding the quarry.

Operator attended noise monitoring was undertaken on Wednesday 13 April 2022 at the nominated monitoring locations with quarry noise contributions compared against the relevant criteria.

The assessment has identified that noise emissions generated by Tinda Creek Quarry comply with relevant noise criteria specified in EPL#12007 at the assessed receiver location for both the morning shoulder and daytime monitoring periods.

Furthermore, the calculated noise contribution at two nearfield reference locations demonstrate that project noise contributions satisfy relevant criteria at R1, R2 and R3.

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Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Acoustical Terms

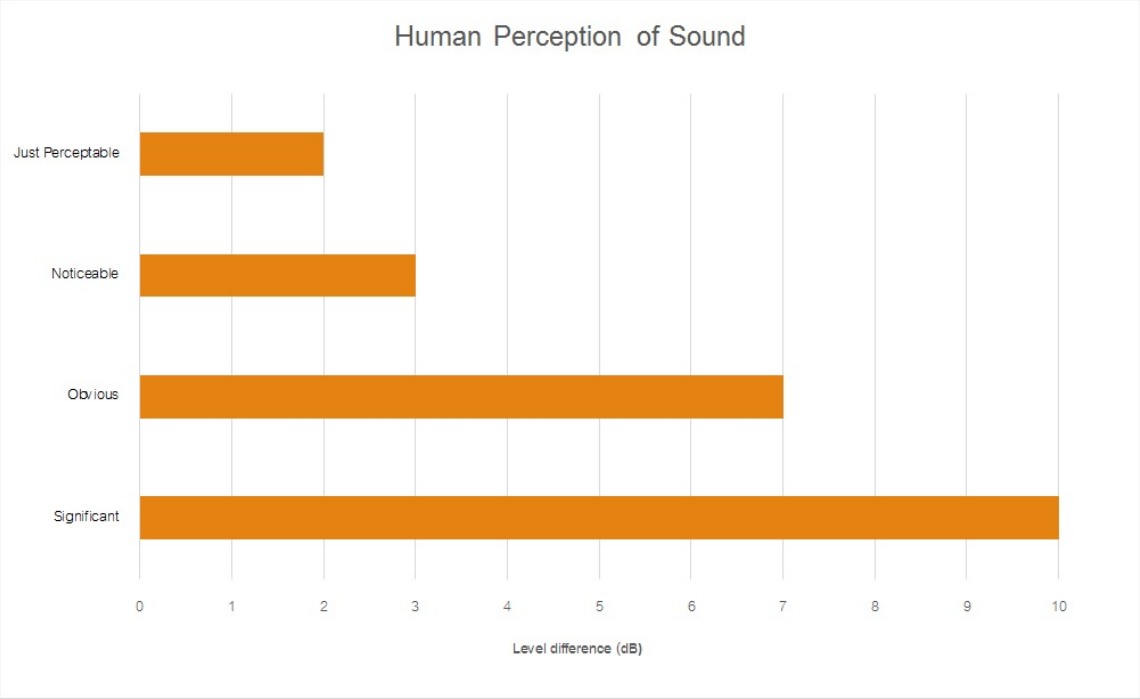
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Appendix 4

Offset Vegetation, Revegetation and Koala Monitoring Report 2022

(Total No. of pages including blank pages = 55)

Tinda Creek Quarry

Biodiversity Monitoring 2022

Prepared for Hy-tec Concrete and Aggregates (Hy-Tec)

April 2023

Tinda Creek Quarry

Biodiversity Monitoring 2022

Hy-tec Concrete and Aggregates (Hy-Tec)

E221058 RP1

April 2023

Version	Date	Prepared by	Approved by	Comments
1.0	13 January 2023	Jennifer Lindsay	Sarah Perry	Draft
1	5 April 2023	Jennifer Lindsay	Sarah Perry	Final

Approved by

Sarah Perry
Associate Ecologist

5 April 2023

Level 3 175 Scott Street
Newcastle NSW 2300

TABLE OF CONTENTS

Appendices

Tables

Figures

Plates

1 Introduction

1.1 Background

EMM Consulting Pty Limited (EMM) was engaged by Hy-Tec Concrete and Aggregates (Hy-Tec) to carry out the fifth year of biodiversity monitoring as defined in the Landscape Management Plan (LMP) for the Tinda Creek Quarry (RW Corkery & Co, 2022). The first monitoring survey was undertaken by Niche Environment and Heritage (Niche) in December 2018 (Niche, 2019). The methods used by Niche (2019) to undertake the monitoring were based on the monitoring framework described in the previous iteration of the LMP, prepared by Umwelt (2016).

Monitoring surveys were completed by EnviroKey during year two (EnviroKey, 2020) and year three (EnviroKey, 2021) , and by EMM in year four (EMM, 2022).

1.2 The project

The Tinda Creek Quarry Extension Project involves the extraction of up to 300,000 tonnes per annum (tpa) of sand from six extraction domains. Throughout the project planning process, Hy-Tec committed to the application of the avoid and minimise hierarchy on potential biodiversity impacts. This included avoiding and minimising impacts to key vegetation communities and threatened flora and fauna habitat. An area of 106.6 hectares (ha) of adjacent land, referred to herein as the Biodiversity Offset Area (BOA), has been retained to offset the proposed disturbance area and will be managed for conservation in perpetuity with likely transfer into Yengo National Park. The study area, which includes the BOA, is illustrated in Figure 1.1.

1.3 Purpose and objectives

The LMP (RW Corkery & Co, 2022) identified the following key ecological values present within the Tinda Creek Quarry project area.

- known and potential habitat for at least 18 threatened fauna species, listed under the *Biodiversity Conservation Act 2016* (BC Act) and/or the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- a large population of *Grevillea parviflora* subsp. *parviflora*, listed as Vulnerable under the BC Act and EPBC Act; and
- the presence of groundwater dependent ecosystems (GDEs), Mellong Sandmass Swamp Woodland and Mellong Sandmass Sedgeland, these are naturally rare and isolated communities considered to be of high conservation value.

This monitoring report aims to assess the success of site management, rehabilitation, and the possible impacts to the BOA with reference to performance targets. The surveys were conducted in line with the LMP (RW Corkery & Co, 2022) .

1.4 Terminology

Table 1.1 Terminology

Term	Definition
BAM	Biodiversity Assessment Method
BBAM	BioBanking Assessment Methodology
BC Act	Biodiversity Conservation Act 2016
BOA	Biodiversity Offset Area
EMM	EMM Consulting Pty Limited
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GDEs	Groundwater dependent ecosystems
GPS	Global Positioning System
Ha	Hectares
Hy-Tec	Hy-Tec Concrete and Aggregates
LMP	Landscape Management Plan
OEH	NSW Office of Environment and Heritage
SAT	Spot Assessment Technique
tpa	Tonnes per annum

KEY

- Study area
- Major road
- Minor road
- Named watercourse
- Named waterbody
- Local government area
- NPWS reserve
- State forest

DRAFT

Regional setting

Tinda Creek Quarry
Biodiversity Monitoring 2022
Figure 1.1

EMM
creating opportunities

Source: EMM (2023); ABS (2021); DFSI (2020, 2021); ESRI (2022); GA (2011)

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KEY

- Study area
- Biodiversity offset area
- Area under rehabilitation
- Extraction area
- Quarry access road
- Internal access track
- Major road
- Minor road
- Watercourse/drainage line
- NPWS reserve

DRAFT

Identification of the Study Area and Biodiversity Offset Area (BOA)

Tinda Creek Quarry
Biodiversity Monitoring 2022
Figure 1.2

creating opportunities

Source: EMM (2023); DFSI (2020, 2021); ESRI (2023); GA (2011)

0 250 500 m

GDA2020 MGA Zone 56

N

\\emmsvr1\EMM2\2022\E221058 - Tinda Creek Quarry Biodiversity Monitoring 2022\GIS\02_Maps\BM002_StudyArea_20230109_01.mxd 9/01/2023

2 Methodology

This section provides a brief description of the methodology used to monitor the biodiversity values within the study area.

2.1 Qualification and experience of personnel

Preparation of this report and associated fieldwork were undertaken by ecologists Jennifer Lindsay and Taliah Darcy-Shaw under the authority of a Scientific License (SL10049).

2.2 Vegetation monitoring

Field surveys were conducted from 30 November to 2 December 2022 by ecologists Jennifer Lindsay and Taliah Darcy-Shaw.

The monitoring design and methodology follows the methods specified in the LMP (RW Corkery & Co, 2022), including:

- utilisation of the Biodiversity Assessment Method (BAM) data collection method for analysis of vegetation condition
- establishment of BAM plots in areas that have been subject to rehabilitation
- BAM plots in analogue sites within areas of native vegetation corresponding to vegetation communities to be rehabilitated to provide vegetation condition benchmarks, and
- comparison of data monitoring within rehabilitation areas and analogue sites to monitor and determine if rehabilitation completion criteria are met.

During the 2018 monitoring survey (Niche, 2019) monitoring plots were established, however, the 2019 Gospers Mountain Wildfire resulted in damage to field equipment including timber marker pegs. These plots comprised of a 50 x 20 m plot-transect conducted in accordance with the 'Biometric' method, as used in the BioBanking Assessment Methodology (BBAM) (OEH, 2014), with a number of extra parameters also recorded (Niche, 2019).

The LMP (RW Corkery & Co, 2022) specified the locations of three new BAM plots (B1, B2 and B3) in the rehabilitation area (Figure 1.2) and six BAM plots (B4 to B9 analogue sites) within areas of remnant vegetation to provide a benchmark in terms of species composition, diversity and structure. These analogue sites will be used for future monitoring assessment to determine if rehabilitation completion criteria are met. Monitoring will be undertaken annually within analogue sites throughout the operational period of the Quarry. BAM plot data is provided in Appendix A.

Plot B1 was checked, however it is understood that this area of the quarry (Domain 4) is under active quarry workings and the landform has not been completed to a stage where rehabilitation can be established. The plot will be deferred until a time when rehabilitation has been established (refer to Section 2.5.1ii and Plate 2.1).

Plate 2.1 BAM Plot 1 – surveys deferred until rehabilitation has been undertaken

BAM plot locations are illustrated within Figure 2.1 and Global Positioning System (GPS) coordinates of EMM's BAM plots are presented in Table 2.1.

Table 2.1 EMM's BAM plot locations

BAM plot	Location	
	Latitude	Longitude
B1	-33.1665	150.7060
B2	-33.1659	150.7087
B3	-33.1649	150.7106
B4	-33.1653	150.6937
B5	-33.1655	150.6947
B6	-33.161	150.7075
B7	-33.1628	150.7126
B8	-33.1668	150.7131
B9	-33.1713	150.7122

Photos were taken at each BAM plot to allow for visualisation of the changes in vegetation and habitat type over time. Photo reference points from the 2022 monitoring survey are presented in Appendix B.

2.3 *Grevillea parviflora* spp. *parviflora* monitoring

All nine of the 10 m x 10 m *Grevillea parviflora* subsp. *parviflora* monitoring plots established during the initial 2018 monitoring surveys (Niche, 2019), were resurveyed. The survey technique involved counting the number of stems of *Grevillea parviflora* subsp. *parviflora* within the monitoring plots (OEH, 2022a). Threatened flora plot locations are illustrated in Figure 2.1 and GPS coordinates of EMM's threatened flora plots are represented in Table 2.2.

Table 2.2 *Grevillea parviflora* subsp. *parviflora* plot locations

Grevillea plot	Location	
	Latitude	Longitude
1	-33.16782	150.710237
2	-33.168618	150.710302
3	-33.16935	150.711094
4	-33.16987	150.711109
5	-33.170039	150.712354
6	-33.161185	150.712342
7	-33.161596	150.712797
8	-33.161022	150.713246
9	-33.163537	150.713348

In accordance with the methodology outlined in the Threatened Biodiversity Profile Search for *Grevillea parviflora* subsp. *parviflora* (OEH, 2022a) the stems of the *Grevillea parviflora* subsp. *parviflora* were counted rather than the individual plants. This is due to the particular reproductive and growth habits of this species which include suckering from rootstock and spreading vegetatively.

It is recommended that future *Grevillea parviflora* subsp. *parviflora* monitoring plots are undertaken in line with the (OEH, 2022a) methodology so that comparing results is more accurate.

Photo monitoring points for *Grevillea parviflora* spp. *Parviflora* can be found in Appendix C.

KEY

- Study area
- BAM plot
- Grevillea plot
- Biodiversity offset area

Vegetation community

- Disturbed area
- Hawkesbury Hornsby Plateau exposed woodland
- Hawkesbury Hornsby Plateau exposed woodland - derived grassland
- Mellong sandmass dry woodland
- Mellong sandmass dry woodland - derived grassland
- Mellong sandmass sedgeland
- Mellong sandmass swamp woodland
- Mellong sandmass swamp woodland (modified - overstorey absent)
- Stringybark-Ironbark forest

DRAFT

Ecological monitoring locations

Tinda Creek Quarry
Biodiversity Monitoring 2022
Figure 2.1

EMM
creating opportunities

Source: EMM (2023); DFSI (2020, 2021); ESRI (2023); GA (2011)

0 250 500 m

GDA2020 MGA Zone 56

N

\\emmsvr1\EMM2\2022\E221058 - Tinda Creek Quarry Biodiversity Monitoring 2022\GIS\02_Maps\BM003_EcologicalMonitoringLocations_20230109_01.mxd 9/01/2023

2.4 Koala population monitoring

The Koala (*Phascolarctos cinereus*), listed as Endangered under both the EPBC Act and the BC Act, has been historically recorded in the Tinda Creek region, during the 2018 monitoring survey (Niche, 2019), and during the 2020 survey (EnviroKey, 2021).

The LMP (RW Corkery & Co, 2022) recommends Koala surveys to be undertaken every two years in Domains 1, 2, 3 and 7. Domain 1 consists predominantly of isolated patches of unsuitable habitat (namely, *Casaurina* species), while Domain 7 has been cleared since the LMP came into effect.

Koala spotlighting and call playback was conducted on one night within Domains 2 and 3. Additionally, evidence of Koalas was searched for using the Spot Assessment Technique (SAT) within the BAM plots. SAT surveys records evidence of Koalas (scat) under 30 trees per site. Every mature eucalyptus tree within each of the BAM plots was carefully inspected by ecologists familiar with Koala signs. These inspections included scat searches across the entirety of the plot and observing for scratches on the trees. The tree canopy was also thoroughly searched for individual Koalas.

2.5 Limitations

2.5.1 Vegetation monitoring

i Gospers Mountain Wildfire

Due to the 2019 Gospers Mountain Wildfire and the subsequent destruction of pegged plots, the BAM plot locations were identified in 2021 (EMM) using Figure 9 of the draft LMP (R.W. Corkery and Co.2021) and undertaken as close as visually identified. It is important to note that comparisons in vegetation floristics, composition, structure, and function before and after the 2019 Gospers Mountain Wildfire must take into account the effects of fire on the ecology within the study area.

ii BAM Plot B1

Monitoring in BAM Plot B1 was not undertaken during the 2022 survey period as it is understood that vegetation rehabilitation works have not commenced due to ongoing earthworks and landform alterations which have yet to be completed in this area.. At the time of survey, the plot was being utilised as a stockpile area for vegetation removed from the clearing of Domain 7 (Plate 2.1). Monitoring at BAM Plot B1 will be deferred until rehabilitation works have been undertaken.

3 Results

3.1 Vegetation monitoring

3.1.1 Species richness and composition

The year five monitoring period (2022) recorded a total of 178 flora species within the BAM plots, comprising 167 native species and 11 exotic species (Appendix A). The average species richness per vegetation community between 2019-2022 is displayed in Table 3.1. With the exception of Mellong Sandmass Swamp Woodland, average native species richness increased in all vegetation communities when compared to the 2020 monitoring year data. The highest increase between 2020 to 2022 was 10 species recorded within the Mellong Sandmass Swamp Woodland. The average increase in species richness between 2020-2022 is a sign that the vegetation communities have stabilised following 2019 Gospers Mountain bushfire.

Table 3.1 Average native species richness per vegetation community in 2019, 2020, 2021 and 2022 within 400 m^2 plots

Vegetation Community	2018[1]	2019	2020	2021	2022
Hawkesbury Hornsby Plateau Exposed Woodland	-	30.5	32.0	51	53
Mellong Sandmass Dry Woodland	-	30.4	29.6	35.5	36
Mellong Sandmass Sedgeland	-	12.5	12	25	28
Mellong Sandmass Swamp Woodland	-	21.0	21.3	18	28
Stringybark – Ironbark Forest	-	23.7	31.0	40	47
Regenerating Mellong Sandmass Woodland	-	27	18	25.5	28.5

Note: 1 – BAM plot monitoring was not undertaken during the 2018 monitoring period.

Plots B1, B2 and B3 were undertaken within the areas under rehabilitation (Figure 1.2). Native species richness, tree count, hollow bearing tree count, length of lots and average litter cover recorded within the rehabilitation site (Plot B2 and Plot B3) has been compared with Plot B7 (an analogue site containing benchmark values).

Table 3.2 BAM plot values within rehabilitation sites and plot B7 (analogue site)

BAM plot	Site type	Native species richness	Tree count: ≥30 cm DBH	Tree count: <30 cm DBH	Number of hollow trees	Length of logs (m)	Average litter cover (%)
B1[1]	Rehabilitation	-	-	-	-	-	-
B2	Rehabilitation	24	0	1	0	0	7
B3	Rehabilitation	33	0	2	0	3	19
B7	Analogue	36	4	4	1	14	56

Note: Monitoring at this location has been deferred until rehabilitation has progressed.
- metric not measured.

3.1.2 Occurrence and abundance of weeds

Exotic species were recorded across multiple locations within the study area, particularly along the Quarry Access Road, vehicle tracks and within some previously disturbed non-operational areas. Weeds recorded that are considered of particular environmental risk include the exotic perennial grasses African Lovegrass (*Eragrostis curvula*), Whiskey Grass (*Andropogon* virginicus), Narrow-leafed Carpet Grass (*Axonopus fissifolius*), and Paspalum (*Paspalum dilatatum*).

Plots B5 to B9 contained vegetation in generally good condition with minimal exotic cover. Vegetation condition in these areas is anticipated to continue to improve as the post-fire recovery process continues.

The number of weed species recorded during 2020 (EnviroKey), 2021 and 2022 are presented in Table 3.3. Plots established by the LMP (RW Corkery & Co, 2022) (Plots B1, B2, B4 and B5) have no equivalent plots to compare.

Table 3.3 Diversity of weed species in 2020, 2021 and 2022

2021 BAM Plots	2020 BBAM Plots (EnviroKey 2021)	Number of weed species (2020) (EnviroKey 2021)	Number of weed species (2021)	Number of weed species (2022)
B1[1]	-	-	-	-
B2	-	-	3	3
B3	Plot 18	2	3	3
B4	-	-	7	7
B5	-	-	3	3
B6	Plot 12	0	2	2
B7	Plot 16	0	0	0
B8	Plot 8	1	0	0
B9	Plot 6	0	1	0

Note: Monitoring at this location has been deferred until rehabilitation has progressed.
- metric not measured.

The diversity and associated cover of exotic species recorded within rehabilitation sites and analogue site is presented in Table 3.4.

Table 3.4 Diversity and cover of exotic species in the rehabilitation site and analogue site

2022 BAM plots	Site type	Number of exotic species	Cover (%)
B1[1]	Rehabilitation	3	80
B2	Rehabilitation	3	30
B3	Rehabilitation	3	90
B7	Analogue	0	0

Note: Monitoring at this location has been deferred until rehabilitation has progressed.
- metric not measured.

Weed occurrence and abundance in all plots remains consistent to that described in the 2021 monitoring period (EMM 2022), i.e. low to moderate abundance. The exception to this is Plot B3 within the rehabilitation area that contained substantial regrowth of native vegetation but also a high exotic cover (90%), made up mostly of exotic grasses such as African Lovegrass.

3.1.3 Composition, structure and function

The composition, structure and function for each BAM plot is provided in Table 3.5.

Table 3.5 Composition, structure and function of the BAM plots surveyed

BAM plot	Vegetation Community	Tree count: 80 cm plus	Tree count: 50–79 cm	Tree count: 30–49 cm	Tree count: 20–29 cm	Tree count: 10–19 cm	Tree count: 5–9 cm	Tree count: <5 cm	Number of hollow trees	Length of logs (m)	Subplot 1 – Litter cover (%)	Subplot 2 – Litter cover (%)	Subplot 3 – Litter cover (%)	Subplot 4 – Litter cover (%)	Subplot 5 – Litter cover (%)
B1	Regenerating Mellong Sandmass Dry Woodland	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B2	Regenerating Mellong Sandmass Dry Woodland	0	0	0	0	0	0	1	0	0	5	15	0	5	10
B3	Regenerating Mellong Sandmass Dry Woodland	0	0	0	0	1	0	1	0	3	15	10	20	40	10
B4	Mellong Sandmass Swamp Woodland Modified -Overstory Absent	0	0	0	1	1	0	1	0	0	50	20	20	10	10
B5	Mellong Sandmass Dry Woodland Derived Native Grassland	1	0	0	0	1	0	1	0	3	25	70	70	30	40
B6	Stringybark – Ironbark Forest	0	0	1	1	1	1	1	0	124	60	80	50	40	80
B7	Mellong Sandmass Dry Woodland	2	1	1	1	1	1	1	1	14	80	70	50	40	40
B8	Hawkesbury Hornsby Plateau Exposed Woodland	0	0	1	1	1	1	1	2	74	10	5	40	40	50
B9	Mellong Sandmass Sedgeland	0	0	0	0	0	0	1	0	0	0	0	0	0	0

3.2 *Grevillea parviflora* spp. *parviflora* monitoring

Grevillea parviflora subsp. *parviflora* was recorded within all 2022 *Grevillea* monitoring plots (Table 3.6). Year three (2020), recorded the species within five of the nine plots (EnviroKey, 2021). Year four (2021) plot monitoring recorded the presence of *Grevillea parviflora* subsp. *parviflora* within all monitoring plots (EMM, 2022). Year five (2022) plot monitoring indicates the distribution of *Grevillea parviflora* subsp. *parviflora* is increasing within all sites excluding sites 4 and 8.

Table 3.6 Results from 2019-2022 Grevillea parviflora plot monitoring

Site	2018 Count	2019 count	2020 count[1]	2021 count[2]	2022 count[2]
1	18	38	0	21	80
2	51	7	0	103	650
3	33	25	18	14	20
4	47	1	10	53	35
5	20	19	35	9	40
6	16	35	16	26	100
7	11	0	0	25	120
8	14	0	0	12	5
9	2	0	1	22	65
Total	**212**	**125**	**80**	**285**	**1,115**

Notes:

1. Count of number of individuals.
2. Count of stems.

3.3 Koala population monitoring

3.3.1 Koala distribution and abundance

The Koala is known to occur within the study area, with scats and potential signs such as scratches (Section 3.3.3) recorded during the 2018 (Niche, 2019), 2019 (EnviroKey, 2020), 2020 (EnviroKey, 2021) and 2021 (EMM, 2022) monitoring surveys. The species presence has been confirmed by motion-activated cameras provided by Hy-Tec within the study area (EnviroKey, 2021).

EMM undertook a desktop search to determine the presence of Koalas within the vicinity of the study area. The search indicated 10 Koala records within a 10 km buffer of the study area (OEH, 2022b) , with the most recent record of the Koala within the vicinity recorded in 2018.

3.3.2 Availability of habitat

The study area contains two preferred feed tree species for the Koala, Grey Gum (*Eucalyptus punctata)* and Parramatta Red Gum (*E. parramattensis*) (DECC, 2008) . These trees, and vegetation within the study area (including BOA) were significantly impacted by the 2019 Gospers Mountain Wildfire, the results of which were still visible in the 2022 monitoring period.

3.3.3 Spot assessment technique

No Koala scats were recorded during the 2022 monitoring surveys. As suggested in the 2018 monitoring by Niche (2019), potential scats and scratch trees are consistent but not definitive evidence of Koala presence. Whilst some scratches were recorded during the surveys, an abundance of Possum and Lace Monitor could be responsible for many of the marks left on the trees. Therefore, tree scratches by themselves are not considered a reliable indicator for the presence of Koalas.

4 Discussion

4.1 Vegetation monitoring

A comparison of 2021 and 2022 monitoring survey results indicate plant species richness has increased within all vegetation communities identified in Table 3.1. The vegetation community which recorded the largest increase in plant species richness was the Mellong Sandmass Swamp Woodland, with an increase of 10 species. These results coincide with two consecutive years of above average rainfall, which has encouraged plant growth and post fire effects (since the Gospers Mountain Wildfire of 2019) which has favoured fire-tolerant species.

Native species richness within rehabilitation sites has remained consistent or increased from the 2021 survey period (Table 3.2). Plot B2 had an increase in native species richness, with an additional six native species recorded.

4.1.1 Vegetation composition, structure and function

BAM plots undertaken outside of the rehabilitation area show composition, structure, and function values that are consistent with their vegetation community. When compared to the analogue site, the plots undertaken in the rehabilitation site contain no trees other than those recorded in the smallest range (<5 cm) and one in the 10-19 cm range, while the analogue site has trees present in all range categories (Table 3.5). The analogue site also has notably higher scores in the remaining categories, those being: the number of hollow trees present, the length of logs, and the percentage of litter cover.

The composition, structure and function of the rehabilitation area is expected to improve over time and with effective weed management, as native species establish ground cover and mid and over storey species progress into their respective ranges.

4.1.2 Weeds

The transmission line which traverses the study area and regeneration area, as well as Putty Road to a lesser extent, are likely to be source populations for weeds. Further disturbance within new areas of the study area is likely to encourage weeds to become established in those areas. Key weed infestations within native vegetation are illustrated in Table 4.1. We recommend these be key monitoring and control locations.

There continues to be an opportunity to close vehicle tracks that are not essential for other monitoring programs within the BOA to allow for natural regeneration. Some weed species continue to invade the track and within 1 m either side. By allowing the vegetation to regenerate over the track, weed invasion into adjoining native vegetation would be greatly minimised. Weed management along essential tracks should continue as per the LMP (RW Corkery & Co, 2022).

The rehabilitation area has high exotic cover. Plot B3 (equivalent to Plot 18 from the 2020 monitoring work) recorded an exotic cover of 90% during the 2022 monitoring period, compared to 46% in 2020 and 45.3% in 2021. Plot B2 is disturbed and has a low cover of vegetation however, most of the vegetation recorded was native. Plot B1 was not undertaken as the landform of this site is yet to be complete and rehabilitation works undertaken. If weeds are left unchecked in the rehabilitation area, they could intrude into the BOA and other areas of native vegetation, thereby negatively impacting the biodiversity values of these areas.

4.2 Grevillea parviflora spp. *parviflora*

The total number of *Grevillea parviflora* subsp. *parviflora* observed within the *Grevillea* monitoring plots has increased within the last monitoring period. Stem counts increased significantly at all *Grevillea* monitoring sites with the exception of sites 4 and 8. Stem counts in sites 4 and 8 decreased marginally. Monitoring site 2 recorded the largest increase in stem count, with an increase of 547 stems from the previous monitoring record of 103 stems in 2021.

The NSW Office of Environment and Heritage (OEH) notes that 'Plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire. This can make counts of individual genets in a population very difficult, and stem counts are usually an acceptable means of assessment for management purposes.' (OEH, 2022c). As such, a substantial increase in *Grevillea parviflora* spp. *parviflora* stem counts, as well as observed flowering in some individuals, suggests that the local population of *Grevillea parviflora* subsp. *parviflora* is recovering following the 2019 Gospers Mountain Wildfire and two consecutive years of above average rainfall.

4.3 Koala monitoring

A Koala was recorded using remote cameras provided by Hy-Tec within the study area in 2020 (EnviroKey, 2021). Signs of habitat use by Koala, such as scats and tree scratching, were noted in 2018 (Niche, 2019) , 2019 (EnviroKey, 2020) , 2020 (EnviroKey, 2021) and 2021 (EMM, 2022) monitoring periods. The previous monitoring result indicated Koalas were using the site after the 2019/20 bushfires.

Surveys conducted during 2022 identified many trees with scratches however, no Koala scats were found. Scratch marks are not a reliable indicator of Koala presence as the can be attributed to other fauna species, such as goannas or possums. Equally, the survey results do not indicate Koala's are absent from the study area. As per the LMP (RW Corkery & Co, 2022) the 2022 biodiversity monitoring included spot lighting and call playback targeting Koala. No further signs of Koalas were recorded during these survey efforts.

KEY

- Study area
- Biodiversity offset area
- Area under rehabilitation
- Weed control
- Recommended weed monitoring and control location
- Major road
- Minor road
- Vehicular track
- Watercourse/drainage line
- NPWS reserve

DRAFT

Recommended weed monitoring and control locations

Tinda Creek Quarry
Biodiversity Monitoring 2022
Figure 4.1

EMM
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\\emmsvr1\EMM2\2022\E221058 - Tinda Creek Quarry Biodiversity Monitoring 2022\GIS\02_Maps\BM004_WeedMonitoring_20230109_01.mxd 9/01/2023

Source: EMM (2023); DFSI (2020, 2021); ESRI (2023); GA (2011)

0 250 500 m
GDA2020 MGA Zone 56
N

4.4 Landscape Management Plan performance criteria

The approved LMP (RW Corkery & Co, 2022) details completion criteria and performance indicators for the rehabilitation area and the BOA. The below table (Table 4.1) details the matters reviewed during monitoring surveys within the rehabilitated areas.

Table 4.1 Completion criteria, performance indicators and monitoring strategy – rehabilitated areas

Objectives	Completion criteria	Performance measurement / indicator	Monitoring strategy	Comments
Ensure that the Quarry Site is safe, stable and non-polluting.	The final landform achieves the nominated design of the EIS or subsequent Rehabilitation Plan.	Completed to the satisfaction of the Secretary.	Survey following completion of landform establishment activities.	Not within the scope of this monitoring report.
	The size, depth, batter slopes and the drainage catchment of the final void are consistent with nominated design of the EIS or subsequent Rehabilitation Plan.			Not within the scope of this monitoring report.
	The surface area of the final voids is no greater than 16 ha in total.			Not within the scope of this monitoring report.
	Final voids are separated from the surface water drainage system unless the Secretary agrees otherwise.			Not within the scope of this monitoring report.
Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native species and habitat, including at least 0.35 ha of Mellong Sandmass Sedgeland.	Revegetation within the Quarry Site is generally consistent with the vegetation communities displayed on Figure 8.	At least 75% of trees are healthy. At least 0.35 ha of Mellong Sandmass Sedgeland established withinQuarry Site.	Monitoring undertaken as per Section 13.2	Trees recorded within rehabilitated areas were observed growing and healthy; however, they would not be considered to have achieved 'sustained growth and development' (as specified in Section 11.3.2 of the LMP). Mellong Sandmass Sedgeland is not mapped within the current rehabilitation area, and as such, is not currently intended to be re-established within this area. This vegetation community is however, mapped within domains 3 and 7.
Decommission and remove surface infrastructure (unless theSecretary agrees otherwise).	Infrastructure not required for future land use removed.	Completed to the satisfaction of the Secretary.	Survey of infrastructureto be completed.	Not within the scope of this monitoring report.

The below table (Table 4.2) details the matters reviewed during monitoring surveys within the BOA.

Table 4.2 Completion criteria, performance indicators and monitoring strategy – BOA

Objectives	Completion criteria	Performance measurement / indicator	Monitoring strategy	Comments
Establish and secure a BOA.	BOA dedicated to Yengo National Park.	Land secured for conservation.	Monitoring of Koala, *Grevillea parviflora* subsp. *parviflora* and nest boxes as per Sections 13.3, 13.4 and 13.5 throughout the life of the Quarry.	Monitoring of Koalas was undertaken within the nine BAM plots, and Spotlighting and call play back undertaken within Domains 2 and 3. Monitoring of *Grevillea parviflora* subsp. *parviflora* was undertaken in the dedicated plots for this species.
Maintain and where possible improve biodiversity values withinthe BOA.	Controlled access to the BOA achieved and maintained.	Unauthorised access to the BOA is prevented.	Monthly and quarterly inspections and/or weed control programs.	The BOA was observed to be fenced and signed, and with no obvious signs of vegetation trampling or damage via uncontrolled access. It is recommended that tracks running through the BOA which are not essential for operations be closed and rehabilitated, where practical.
	No significant weed infestation.	There is no weed infestation greater than exists within the analogue sites and there are no contiguous areas of weeds that are greater than 25 m2 in area.		Weeds were prominent along access tracks within the BOA and are considered to be in greater abundance and cover than the analogue sites. There is also substantial weed cover in Plot B3.
	Feral animal control.	Site does not harbour feral animals.	Monthly inspections.	Not within the scope of this monitoring report.

5 Recommendations

5.1 General recommendations

EMM suggests additional surveys to map the extent of *Hibbertia puberula subsp. Extensa* across the study area. This species, listed as vulnerable under both the BC Act and EPBC Act, was recorded both incidentally and within BAM plots B3 and B9, and incidentally during the 2021(EMM, 2022) and 2022 surveys.

Additionally, surveys are recommended to confirm the presence of Netted Bottle Brush (*Callistemon linearifolius*) within the study area. This species is listed as vulnerable under the BC Act and was recorded incidentally at several locations within the study area during the 2021 surveys (EMM, 2022). Additional surveys would assist in informing the development of appropriate management measures to reduce the risk of impacts to these species and preserve both species if found to be present within the study area.

EMM recommends an integrated approach of multiple techniques conducted seasonally to control the African Lovegrass population on the Tinda Creek Site:

- priority of slashing/ mechanical removal and/or burning (if feasible) of Lovegrass in Winter to remove cover
- priority of follow-up spraying of existing lovegrass extent and new shoots/growth in cleared/ burned areas at the beginning of spring and into summer
- re-seeding of bare soil with a native grass or non-invasive cover crop to reduce lovegrass re-establishment in cleared areas, and
- repeat process yearly or as required to prevent establishment of new plants and remove new seeds from the growth cycle.

General year-round measures of helping to control the spread of African Lovegrass include:

- avoidance of vehicles and persons entering areas of lovegrass infestation where practical, and
- where practicable, inspection for and cleaning of lovegrass seed/ foliage from vehicles and clothing if contact with lovegrass has occurred.

5.2 Specific actions in the rehabilitation area

The following recommendations have been made within the rehabilitation area:

- continued weed-control efforts combined with direct seeding to be implemented;
- for direct seeding, species should be sourced from the native tree and shrub seed bank indicated in the 2018 monitoring report. If this is not available, they should be sourced from local provenance only;
- weed control should target African Lovegrass as this currently covers almost half of the area surveyed in Plot B3. Weed control should follow the measures outlined in Section 9.3.2 of the LMP (RW Corkery & Co, 2022), which includes quarterly inspections; and
- key weed infestations within native vegetation are illustrated in Figure 4.1. We recommend these be key monitoring and control locations.

5.3 Specific actions in the BOA

The following recommendations have been made within the BOA:

- Closure and rehabilitation of non-essential tracks, where practical, to allow native vegetation to regenerate and stabilise these areas.
- Weed control to be implemented within plots B5 and B6 given the presence of exotic species. Enough weed cover and abundance were detected in plots B5 and B6 to be considered for control measures. B4, while outside the BOA, is also considered suitable for weed control measures also.
- Continued spot spraying of weeds on foot and by hand only, to minimise weed seed being spread by vehicles and avoid herbicide overspray killing native plants nearby. It is important that adjacent native plants remain alive to maintain competition against weed.
- Monitor weeds visually at least every three months and spray as necessary to prevent seed-set. Always assess the efficacy of the control method over time (e.g. if native plants are inadvertently killed and weed cover is not decreasing, cease weed control and reassess methods), and
- Key weed infestations within native vegetation are illustrated in Figure 4.1. We recommend these be key monitoring and control locations.

6 Conclusion

Year five of monitoring (2022) was completed by EMM during December 2022 by two suitably qualified ecologists. This report details the methodology and results of the year five monitoring period.

The data captured within this report demonstrates that the biodiversity values of the BOA are improving, with native species richness increasing and weed numbers stable. The quarry operations do not appear to be having an adverse impact on the BOA.

The rehabilitation area requires further action to establish vegetation communities to benchmark conditions. Weed cover within this area (i.e. Plot B3) remains high, and composition attributes such as tree numbers and leaf litter cover are below that of the analogue site. It is understood that weed management is being undertaken, with a particular focus on controlling African lovegrass (*Eragrostis curvula*) present on the site. If these weeds are left unchecked, they could intrude into the BOA and other areas of native vegetation, thereby negatively impacting the biodiversity values of these areas.

The total number of *Grevillea parviflora* subsp. *parviflora* has increased in the last monitoring period. A substantial increase in stem counts within the majority of the monitoring sites, indicating the local population of *Grevillea parviflora* subsp. *parviflora* is recovering following the 2019/2020 bushfires.

Monitoring surveys conducted for the Koala were unable to conclude presence or absence of the species. While no scats or other signs of presence were recorded, it is important to note that Koalas are a highly mobile species, and their absence during monitoring does not indicate their absence from the study area or because of quarry operations.

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Appendix A
BAM Plot Data

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BAM Site – Field Survey Form

Plot ID:	B2	**Date:**	30/11/22	**Project number:**	E221058			**Plot dimensions:**	
Datum:	GDA94	**Easting:**	286,333	**Recorders:**	JL TDS				
Zone:	56	**Northing:**	6,327,996	**IBRA region:**	Sydney Basin (Wollemi)			**Midline bearing:**	140
Plant Community Type:						**Condition class:**		**PCT confidence:**	
Vegetation Class:						**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	1
	Shrubs:	6
	Grasses etc.:	9
	Forbs:	8
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.1
	Shrubs:	1.1
	Grasses etc.:	1.1
	Forbs:	0.8
	Ferns:	0
	Other:	0
High Threat Weed cover:		0.3

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	5	15	0	5	10
Average litter cover (%):	7				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

BAM Site – Field Survey Form

Plot ID:	B3	**Date:**	01/12/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	286,504	**Recorders:**	JL TDS			
Zone:	56	**Northing:**	6,328,099	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	353
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	1
	Shrubs:	16
	Grasses etc.:	5
	Forbs:	11
	Ferns:	0
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.7
	Shrubs:	2.4
	Grasses etc.:	0.8
	Forbs:	1.31
	Ferns:	0
	Other:	0
High Threat Weed cover:		0.9

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	3
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	15	10	20	40	10
Average litter cover (%):	19				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B3	**Date:**	01/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Acacia ulicifolia (Prickly Moses)*	0.1	20		N
	Andropogon virginicus (Whisky Grass)	0.1	200		HTE
Shrub (SG)	*Bossiaea heterophylla (Variable Bossiaea)*	0.1	50		N
Shrub (SG)	*Brachyloma daphnoides (Daphne Heath)*	0.1	60		N
Shrub (SG)	*Bursaria spinosa (Native Blackthorn)*	0.1	50		N
Shrub (SG)	*Callistemon rigidus (Stiff Bottlebrush)*	0.1	4		N
Forb (FG)	*Calochilus spp.*	0.1	2		N
	Centaurium tenuiflorum (Branched Centaury, Slender centaury)	0.1	20		E
Shrub (SG)	*Conospermum ericifolium*	0.1	5		N
Forb (FG)	*Dampiera spp.*	0.1	3		N
Grass & grasslike (GG)	*Eragrostis brownii (Brown's Lovegrass)*	0.1	150		N
	Eragrostis curvula (African Lovegrass)	0.8	2000		HTE
Tree (TG)	*Eucalyptus haemastoma (Broad-leaved Scribbly Gum)*	0.7	5		N
Forb (FG)	*Gonocarpus teucrioides (Germander Raspwort)*	0.1	30		N
Shrub (SG)	*Hibbertia fasciculata*	0.2	140		N
Shrub (SG)	*Hibbertia puberula*	0.2	55		N
Forb (FG)	*Laxmannia gracilis (Slender Wire Lily)*	0.1	40		N
Shrub (SG)	*Leptospermum polygalifolium (Tantoon)*	0.1	10		N
Shrub (SG)	*Leptospermum trinervium (Slender Tea-tree)*	0.4	50		N
Grass & grasslike (GG)	*Lomandra cylindrica*	0.3	40		N
Grass & grasslike (GG)	*Lomandra obliqua*	0.2	17		N
Shrub (SG)	*Melaleuca thymifolia (Thyme Honey-myrtle)*	0.1	5		N
Shrub (SG)	*Melichrus procumbens (Jam Tarts)*	0.1	1		N
Forb (FG)	*Microtis unifolia (Common Onion Orchid)*	0.01	1		N
Grass & grasslike (GG)	*Panicum simile (Two-colour Panic)*	0.1	10		N
Forb (FG)	*Patersonia glabrata (Leafy Purple-flag)*	0.1	10		N
Shrub (SG)	*Persoonia oblongata*	0.2	2		N
Shrub (SG)	*Persoonia spp.*	0.1	1		N
Shrub (SG)	*Pimelea latifolia*	0.2	65		N
Shrub (SG)	*Platysace ericoides*	0.2	40		N
Forb (FG)	*Pomax umbellata (Pomax)*	0.1	5		N
Forb (FG)	*Scaevola ramosissima (Purple Fan-flower)*	0.1	1		N
Forb (FG)	*Stylidium graminifolium (Grass Triggerplant)*	0.1	10		N
Grass & grasslike (GG)	*Themeda triandra*	0.1	50		N
Forb (FG)	*Trachymene spp. (Trachymene)*	0.3	100		N
Forb (FG)	*Xanthosia atkinsoniana*	0.2	300		N

BAM Site – Field Survey Form

Plot ID:	B4	**Date:**	02/12/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	284,937	**Recorders:**	JL TDS			
Zone:	56	**Northing:**	6,328,029	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	340
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	2
	Shrubs:	7
	Grasses etc.:	9
	Forbs:	8
	Ferns:	2
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.4
	Shrubs:	0.9
	Grasses etc.:	1.6
	Forbs:	0.8
	Ferns:	0.2
	Other:	0
High Threat Weed cover:		0.3

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	1	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	50	20	20	10	10
Average litter cover (%):	22				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B4	**Date:**	02/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Acacia spp. (Wattle)*	0.1	15		N
	Andropogon virginicus (Whisky Grass)	0.1	100		HTE
Tree (TG)	*Angophora bakeri (Narrow-leaved Apple)*	0.1	10		N
Grass & grasslike (GG)	*Aristida ramosa (Purple Wiregrass)*	0.2	20		N
Grass & grasslike (GG)	*Aristida vagans (Threeawn Speargrass)*	0.2	2000		N
	Axonopus fissifolius (Narrow-leafed Carpet Grass)	0.2	1500		HTE
Shrub (SG)	*Brachyloma daphnoides (Daphne Heath)*	0.1	1		N
Shrub (SG)	*Bursaria spinosa (Native Blackthorn)*	0.1	30		N
Forb (FG)	*Caesia parviflora var. minor (Small Pale Grass-lily)*	0.1	1		N
Forb (FG)	*Caladenia spp.*	0.1	10		N
	Centaurium tenuiflorum (Branched Centaury, Slender centaury)	0.1	10		E
Fern (EG)	*Cheilanthes distans (Bristly Cloak Fern)*	0.1	250		N
Forb (FG)	*Chrysocephalum apiculatum (Common Everlasting)*	0.1	200		N
	Conyza bonariensis (Flaxleaf Fleabane)	0.1	5		E
Grass & grasslike (GG)	*Cyperus spp.*	0.1	10		N
Forb (FG)	*Dianella prunina*	0.1	10		N
Grass & grasslike (GG)	*Dichelachne spp. (A Plumegrass)*	0.3	30		N
Shrub (SG)	*Dillwynia glaberrima*	0.1	6		N
Shrub (SG)	*Dodonaea multijuga*	0.1	1		N
Forb (FG)	*Drosera spatulata*	0.1	5		N
Grass & grasslike (GG)	*Echinopogon caespitosus (Bushy Hedgehog-grass)*	0.1	20		N
Grass & grasslike (GG)	*Eragrostis brownii (Brown's Lovegrass)*	0.2	250		N
Tree (TG)	*Eucalyptus haemastoma (Broad-leaved Scribbly Gum)*	0.3	65		N
	Gamochaeta spp.	0.1	150		E
Forb (FG)	*Gonocarpus teucrioides (Germander Raspwort)*	0.1	70		N
	Hypochaeris radicata (Catsear)	0.1	10		E
Shrub (SG)	*Leptospermum trinervium (Slender Tea-tree)*	0.3	100		N
Grass & grasslike (GG)	*Lomandra glauca (Pale Mat-rush)*	0.2	850		N
Grass & grasslike (GG)	*Lomandra longifolia (Spiny-headed Mat-rush)*	0.2	50		N
Forb (FG)	*Microtis unifolia (Common Onion Orchid)*	0.1	60		N
Shrub (SG)	*Persoonia oblongata*	0.1	10		N
Forb (FG)	*Pomax umbellata (Pomax)*	0.1	10		N
	Richardia brasiliensis (Mexican Clover)	0.1	1		E
Fern (EG)	*Schizaea bifida (Forked Comb Fern)*	0.1	20		N
Grass & grasslike (GG)	*Themeda triandra*	0.1	30		N

BAM Site – Field Survey Form

Plot ID:	B5	**Date:**	01/12/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	285,023	**Recorders:**	JL TDS			
Zone:	56	**Northing:**	6,327,996	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	324
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	4
	Shrubs:	17
	Grasses etc.:	11
	Forbs:	7
	Ferns:	1
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.5
	Shrubs:	2.7
	Grasses etc.:	2
	Forbs:	1.3
	Ferns:	0.1
	Other:	0
High Threat Weed cover:		0.1

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	3
80 + cm:	1		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	25	70	70	30	40
Average litter cover (%):	47				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B5	**Date:**	01/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Acacia penninervis (Mountain Hickory)*	0.1	10		N
Tree (TG)	*Allocasuarina littoralis (Black She-Oak)*	0.2	35		N
Grass & grasslike (GG)	*Aristida spp. (A Wiregrass)*	0.2	500		N
Grass & grasslike (GG)	*Aristida vagans (Threeawn Speargrass)*	0.3	1500		N
	Axonopus fissifolius (Narrow-leafed Carpet Grass)	0.1	5		HTE
Tree (TG)	*Banksia serrata (Old-man Banksia)*	0.1	1		N
Shrub (SG)	*Bossiaea spp.*	0.1	15		N
Shrub (SG)	*Brachyloma daphnoides (Daphne Heath)*	0.1	10		N
Shrub (SG)	*Bursaria spinosa (Native Blackthorn)*	0.1	20		N
	Centaurium tenuiflorum (Branched Centaury, Slender centaury)	0.1	20		E
Shrub (SG)	*Choretrum spp.*	0.2	15		N
Shrub (SG)	*Comesperma ericinum (Pyramid Flower)*	0.2	60		N
Shrub (SG)	*Cryptandra amara (Bitter Cryptandra)*	0.1	3		N
Grass & grasslike (GG)	*Cyathochaeta diandra*	0.3	40		N
Forb (FG)	*Dianella revoluta (Blueberry Lily)*	0.2	22		N
Shrub (SG)	*Dillwynia glaberrima*	0.1	20		N
Grass & grasslike (GG)	*Empodisma minus*	0.1	2		N
Grass & grasslike (GG)	*Eragrostis brownii (Brown's Lovegrass)*	0.1	100		N
Tree (TG)	*Eucalyptus haemastoma (Broad-leaved Scribbly Gum)*	0.1	10		N
Tree (TG)	*Eucalyptus punctata (Grey Gum)*	0.1	2		N
Shrub (SG)	*Exocarpos cupressiformis (Cherry Ballart)*	0.1	30		N
Shrub (SG)	*Gompholobium spp.*	0.1	5		N
Forb (FG)	*Gonocarpus teucrioides (Germander Raspwort)*	0.5	150		N
Shrub (SG)	*Hibbertia spp.*	0.1	1		N
Forb (FG)	*Hypericum gramineum (Small St John's Wort)*	0.1	50		N
	Hypochaeris radicata (Catsear)	0.1	7		E
Forb (FG)	*Laxmannia spp.*	0.2	5000		N
Shrub (SG)	*Leptospermum juniperinum (Prickly Tea-tree)*	0.1	10		N
Shrub (SG)	*Leptospermum polygalifolium (Tantoon)*	0.2	300		N
Shrub (SG)	*Leptospermum trinervium (Slender Tea-tree)*	0.8	400		N
Grass & grasslike (GG)	*Lepyrodia scariosa*	0.2	30		N
Grass & grasslike (GG)	*Lomandra cylindrica*	0.1	20		N
Grass & grasslike (GG)	*Lomandra longifolia (Spiny-headed Mat-rush)*	0.2	30		N
Shrub (SG)	*Melichrus procumbens (Jam Tarts)*	0.1	1		N
Forb (FG)	*Patersonia sericea (Silky Purple-Flag)*	0.1	10		N
Shrub (SG)	*Persoonia linearis (Narrow-leaved Geebung)*	0.1	10		N
Shrub (SG)	*Persoonia oblongata*	0.1	5		N
Forb (FG)	*Pomax umbellata (Pomax)*	0.1	20		N
Fern (EG)	*Pteridium esculentum (Bracken)*	0.1	5		N
Grass & grasslike (GG)	*Rytidosperma tenuius (A Wallaby Grass)*	0.1	5		N
Forb (FG)	*Stylidium graminifolium (Grass Triggerplant)*	0.1	20		N
Grass & grasslike (GG)	*Themeda triandra*	0.3	500		N
Grass & grasslike (GG)	*Xyris gracilis*	0.1	10		N

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B5	**Date:**	01/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE

BAM Site – Field Survey Form

Plot ID:	B6	**Date:**	01/12/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	286,216	**Recorders:**	JL TDS			
Zone:	56	**Northing:**	6,328,526	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	301
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	4
	Shrubs:	13
	Grasses etc.:	10
	Forbs:	11
	Ferns:	3
	Other:	6
Sum of Cover of native vascular plants by growth form group	Trees:	1.1
	Shrubs:	1.8
	Grasses etc.:	2
	Forbs:	1.3
	Ferns:	0.7
	Other:	0.6
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	124
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	1		
20 – 29 cm:	1	Tree hollow count	0
10 – 19 cm:	1		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	60	80	50	40	80
Average litter cover (%):	62				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B6	**Date:**	01/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Acacia falcata*	0.1	5		N
Shrub (SG)	*Acacia mearnsii (Black Wattle)*	0.4	16		N
Shrub (SG)	*Acacia ulicifolia (Prickly Moses)*	0.1	10		N
Tree (TG)	*Allocasuarina torulosa (Forest Oak)*	0.2	10		N
Tree (TG)	*Angophora floribunda (Rough-barked Apple)*	0.3	2		N
Fern (EG)	*Asplenium flabellifolium (Necklace Fern)*	0.1	2		N
Grass & grasslike (GG)	*Austrostipa spp. (A Speargrass)*	0.1	4		N
Other (OG)	*Billardiera scandens (Hairy Apple Berry)*	0.1	3		N
Shrub (SG)	*Brachyloma daphnoides (Daphne Heath)*	0.1	1		N
Shrub (SG)	*Bursaria spinosa (Native Blackthorn)*	0.2	20		N
Grass & grasslike (GG)	*Carex inversa (Knob Sedge)*	0.1	2		N
	Cirsium vulgare (Spear Thistle)	0.1	2		E
Other (OG)	*Clematis aristata (Old Man's Beard)*	0.1	10		N
	Conyza sumatrensis (Tall fleabane)	0.1	10		E
Grass & grasslike (GG)	*Cyperus gracilis (Slender Flat-sedge)*	0.1	30		N
Forb (FG)	*Dianella revoluta (Blueberry Lily)*	0.1	10		N
Forb (FG)	*Dichondra repens (Kidney Weed)*	0.1	10		N
Grass & grasslike (GG)	*Echinopogon caespitosus (Bushy Hedgehog-grass)*	0.1	10		N
Grass & grasslike (GG)	*Entolasia marginata (Bordered Panic)*	0.1	10		N
Tree (TG)	*Eucalyptus crebra (Narrow-leaved Ironbark)*	0.2	2		N
Tree (TG)	*Eucalyptus fibrosa (Red Ironbark)*	0.4	5		N
Shrub (SG)	*Exocarpos cupressiformis (Cherry Ballart)*	0.1	10		N
Forb (FG)	*Galium spp.*	0.1	5		N
Other (OG)	*Glycine clandestina (Twining glycine)*	0.1	20		N
Other (OG)	*Glycine microphylla (Small-leaf Glycine)*	0.1	20		N
Forb (FG)	*Gonocarpus teucrioides (Germander Raspwort)*	0.1	1		N
Other (OG)	*Hardenbergia violacea (False Sarsaparilla)*	0.1	10		N
Fern (EG)	*Histiopteris incisa (Bat's Wing Fern)*	0.1	2		N
Shrub (SG)	*Hovea speciosa*	0.1	2		N
Forb (FG)	*Hydrocotyle laxiflora (Stinking Pennywort)*	0.1	500		N
Grass & grasslike (GG)	*Imperata cylindrica (Blady Grass)*	0.5	300		N
Forb (FG)	*Lobelia purpurascens (whiteroot)*	0.3	2000		N
Grass & grasslike (GG)	*Lomandra multiflora subsp. dura*	0.1	10		N
Other (OG)	*Macrozamia communis (Burrawang)*	0.1	1		N
Grass & grasslike (GG)	*Microlaena stipoides (Weeping Grass)*	0.6	500		N
Grass & grasslike (GG)	*Oplismenus imbecillis*	0.1	50		N
Forb (FG)	*Oxalis perennans*	0.1	10		N
Shrub (SG)	*Persoonia linearis (Narrow-leaved Geebung)*	0.1	5		N
Shrub (SG)	*Persoonia oblongata*	0.1	1		N
Shrub (SG)	*Podolobium ilicifolium (Prickly Shaggy Pea)*	0.1	2		N
Shrub (SG)	*Polyscias sambucifolia (Elderberry Panax)*	0.2	10		N
Fern (EG)	*Pteridium esculentum (Bracken)*	0.5	150		N
Shrub (SG)	*Pultenaea retusa*	0.1	4		N

Project name:	E221058				
Recorders:	JL TDS	Plot ID:	B6	Date:	01/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Grass & grasslike (GG)	*Rytidosperma spp.*	0.2	20		N
Shrub (SG)	*Senna spp.*	0.1	1		N
Forb (FG)	*Sigesbeckia orientalis subsp. orientalis (Indian Weed)*	0.1	10		N
Forb (FG)	*Solanum pungetium (Eastern Nightshade)*	0.1	2		N
Forb (FG)	*Veronica plebeia (Trailing Speedwell)*	0.1	5		N
Forb (FG)	*Wahlenbergia gracilis (Sprawling Bluebell)*	0.1	10		N

BAM Site – Field Survey Form

Plot ID:	B7	**Date:**	01/12/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	286,687	**Recorders:**	JL TDS			
Zone:	56	**Northing:**	6,328,331	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	303
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	3
	Shrubs:	17
	Grasses etc.:	8
	Forbs:	6
	Ferns:	2
	Other:	0
Sum of Cover of native vascular plants by growth form group	Trees:	0.8
	Shrubs:	2.5
	Grasses etc.:	1.8
	Forbs:	1
	Ferns:	0.6
	Other:	0
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	14
80 + cm:	2		
50 – 79 cm:	1		
30 – 49 cm:	1		
20 – 29 cm:	1	Tree hollow count	1
10 – 19 cm:	1		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	80	70	50	40	40
Average litter cover (%):	56				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B7	**Date:**	01/12/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Acacia ulicifolia (Prickly Moses)*	0.1	2		N
Tree (TG)	*Angophora bakeri (Narrow-leaved Apple)*	0.5	8		N
Grass & grasslike (GG)	*Austrostipa spp. (A Speargrass)*	0.1	10		N
Shrub (SG)	*Banksia marginata (Silver Banksia)*	0.2	5		N
Tree (TG)	*Banksia serrata (Old-man Banksia)*	0.1	30		N
Shrub (SG)	*Bossiaea heterophylla (Variable Bossiaea)*	0.1	20		N
Shrub (SG)	*Bursaria spinosa (Native Blackthorn)*	0.1	10		N
Shrub (SG)	*Cryptandra spinescens*	0.1	2		N
Grass & grasslike (GG)	*Cyathochaeta diandra*	0.4	1000		N
Forb (FG)	*Dampiera stricta*	0.1	20		N
Grass & grasslike (GG)	*Dichelachne spp. (A Plumegrass)*	0.1	7		N
Shrub (SG)	*Dillwynia glaberrima*	0.1	2		N
Tree (TG)	*Eucalyptus haemastoma (Broad-leaved Scribbly Gum)*	0.2	3		N
Forb (FG)	*Gonocarpus teucrioides (Germander Raspwort)*	0.1	30		N
Shrub (SG)	*Grevillea parviflora subsp. parviflora (Small-flower Grevillea)*	0.1	10		N
Shrub (SG)	*Hakea dactyloides (Finger Hakea)*	0.4	10		N
Shrub (SG)	*Hibbertia spp.*	0.1	10		N
Shrub (SG)	*Isopogon anemonifolius (Broad-leaf Drumsticks)*	0.1	5		N
Forb (FG)	*Laxmannia gracilis (Slender Wire Lily)*	0.5	80		N
Shrub (SG)	*Leptospermum juniperinum (Prickly Tea-tree)*	0.1	5		N
Shrub (SG)	*Leptospermum trinervium (Slender Tea-tree)*	0.1	10		N
Grass & grasslike (GG)	*Lepyrodia scariosa*	0.7	300		N
Fern (EG)	*Lindsaea linearis (Screw Fern)*	0.1	50		N
Grass & grasslike (GG)	*Lomandra cylindrica*	0.1	50		N
Grass & grasslike (GG)	*Lomandra longifolia (Spiny-headed Mat-rush)*	0.1	10		N
Shrub (SG)	*Melaleuca thymifolia (Thyme Honey-myrtle)*	0.2	40		N
Shrub (SG)	*Melichrus procumbens (Jam Tarts)*	0.1	3		N
Shrub (SG)	*Persoonia lanceolata (Lance Leaf Geebung)*	0.1	2		N
Shrub (SG)	*Persoonia linearis (Narrow-leaved Geebung)*	0.1	5		N
Shrub (SG)	*Platysace ericoides*	0.4	150		N
Fern (EG)	*Pteridium esculentum (Bracken)*	0.5	200		N
Grass & grasslike (GG)	*Rytidosperma tenuius (A Wallaby Grass)*	0.1	2		N
Forb (FG)	*Stylidium graminifolium (Grass Triggerplant)*	0.1	1		N
Grass & grasslike (GG)	*Themeda triandra*	0.2	100		N
Forb (FG)	*Wahlenbergia spp. (Bluebell)*	0.1	25		N
Forb (FG)	*Xanthosia spp.*	0.1	15		N

BAM Site – Field Survey Form

Plot ID:	B8	**Date:**	30/11/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	286,752	**Recorders:**	JL TDS			
Zone:	56	**Northing:**	6,327,887	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	338
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	4
	Shrubs:	18
	Grasses etc.:	13
	Forbs:	14
	Ferns:	0
	Other:	4
Sum of Cover of native vascular plants by growth form group	Trees:	1.4
	Shrubs:	3
	Grasses etc.:	3.1
	Forbs:	2.2
	Ferns:	0
	Other:	0.4
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	74
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	1		
20 – 29 cm:	1	Tree hollow count	2
10 – 19 cm:	1		
5 – 9 cm:	1		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	10	5	40	40	50
Average litter cover (%):	29				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	JL TDS	**Plot ID:**	B8	**Date:**	30/11/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Acacia penninervis (Mountain Hickory)*	0.3	90		N
Shrub (SG)	*Acacia spp. (Wattle)*	0.3	72		N
Grass & grasslike (GG)	*Aristida vagans (Threeawn Speargrass)*	0.4	1000		N
Grass & grasslike (GG)	*Austrostipa pubescens*	0.1	10		N
Tree (TG)	*Banksia serrata (Old-man Banksia)*	0.2	10		N
Other (OG)	*Billardiera scandens (Hairy Apple Berry)*	0.1	5		N
Shrub (SG)	*Bossiaea neo-anglica*	0.1	20		N
Other (OG)	*Cassytha pubescens (Downy Dodder-laurel)*	0.1	100		N
Tree (TG)	*Corymbia eximia (Yellow Bloodwood)*	0.5	11		N
Tree (TG)	*Corymbia gummifera (Red Bloodwood)*	0.5	5		N
Shrub (SG)	*Cryptandra spinescens*	0.4	13		N
Grass & grasslike (GG)	*Cyathochaeta diandra*	0.2	20		N
Forb (FG)	*Dianella revoluta (Blueberry Lily)*	0.3	10		N
Grass & grasslike (GG)	*Dichelachne spp. (A Plumegrass)*	0.2	10		N
Grass & grasslike (GG)	*Entolasia marginata (Bordered Panic)*	0.1	10		N
Grass & grasslike (GG)	*Entolasia stricta (Wiry Panic)*	0.1	400		N
Grass & grasslike (GG)	*Eragrostis benthamii*	0.8	220		N
Tree (TG)	*Eucalyptus eugenioides (Thin-leaved Stringybark)*	0.2	20		N
Shrub (SG)	*Exocarpos cupressiformis (Cherry Ballart)*	0.3	400		N
Shrub (SG)	*Gompholobium grandiflorum (Large Wedge Pea)*	0.1	4		N
Forb (FG)	*Gonocarpus teucrioides (Germander Raspwort)*	0.1	10		N
Forb (FG)	*Goodenia heterophylla*	0.1	10		N
Forb (FG)	*Haemodorum corymbosum*	0.1	8		N
Other (OG)	*Hardenbergia violacea (False Sarsaparilla)*	0.1	15		N
Shrub (SG)	*Hibbertia acicularis*	0.1	50		N
Shrub (SG)	*Isopogon anemonifolius (Broad-leaf Drumsticks)*	0.1	20		N
Forb (FG)	*Lagenifera stipitata (Blue Bottle-daisy)*	0.4	200		N
Grass & grasslike (GG)	*Lepidosperma laterale (Variable Sword-sedge)*	0.2	8		N
Shrub (SG)	*Leptospermum trinervium (Slender Tea-tree)*	0.2	20		N
Forb (FG)	*Lobelia purpurascens (whiteroot)*	0.1	30		N
Grass & grasslike (GG)	*Lomandra cylindrica*	0.2	23		N
Grass & grasslike (GG)	*Lomandra obliqua*	0.1	100		N
Shrub (SG)	*Melichrus procumbens (Jam Tarts)*	0.1	3		N
Grass & grasslike (GG)	*Microlaena stipoides (Weeping Grass)*	0.5	50		N
Forb (FG)	*Opercularia diphylla (Stinkweed)*	0.2	16		N
Grass & grasslike (GG)	*Panicum simile (Two-colour Panic)*	0.1	50		N
Forb (FG)	*Patersonia glabrata (Leafy Purple-flag)*	0.3	30		N
Forb (FG)	*Patersonia sericea (Silky Purple-Flag)*	0.1	1		N
Shrub (SG)	*Persoonia levis (Broad-leaved Geebung)*	0.1	5		N
Shrub (SG)	*Persoonia linearis (Narrow-leaved Geebung)*	0.1	30		N
Shrub (SG)	*Persoonia oblongata*	0.2	2		N
Shrub (SG)	*Persoonia spp.*	0.1	1		N
Shrub (SG)	*Phyllanthus hirtellus (Thyme Spurge)*	0.2	20		N

Project name:	E221058				
Recorders:	JL TDS	Plot ID:	B8	Date:	30/11/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Platysace ericoides*	0.1	50		N
Forb (FG)	*Plectranthus parviflorus*	0.1	1		N
Shrub (SG)	*Podolobium ilicifolium (Prickly Shaggy Pea)*	0.1	2		N
Forb (FG)	*Pomax umbellata (Pomax)*	0.1	1000		N
Shrub (SG)	*Poranthera corymbosa*	0.1	3		N
Forb (FG)	*Scaevola ramosissima (Purple Fan-flower)*	0.1	15		N
Forb (FG)	*Stackhousia viminea (Slender Stackhousia)*	0.1	3		N
Grass & grasslike (GG)	*Themeda triandra*	0.1	100		N
Other (OG)	*Xanthorrhoea media*	0.1	1		N
Forb (FG)	*Xanthosia atkinsoniana*	0.1	10		N

BAM Site – Field Survey Form

Plot ID:	B9	**Date:**	30/11/22	**Project number:**	E221058		**Plot dimensions:**	
Datum:	GDA94	**Easting:**	286,677	**Recorders:**	TDS JL			
Zone:	56	**Northing:**	6,327,397	**IBRA region:**	Sydney Basin (Wollemi)		**Midline bearing:**	207
Plant Community Type:					**Condition class:**		**PCT confidence:**	
Vegetation Class:					**EEC:**		**EEC confidence:**	

Record easting and northing at 0 m on midline. Dimensions (Shape) of 0.04 ha base plot.

BAM Attribute (400 m2 plot)		Sum values
Count of Native Richness	Trees:	1
	Shrubs:	4
	Grasses etc.:	12
	Forbs:	10
	Ferns:	0
	Other:	1
Sum of Cover of native vascular plants by growth form group	Trees:	0.1
	Shrubs:	1.1
	Grasses etc.:	2.8
	Forbs:	2
	Ferns:	0
	Other:	0.2
High Threat Weed cover:		0

BAM Attribute (1000 m2 plot) DBH			
DBH	Tree stem count	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0
80 + cm:	0		
50 – 79 cm:	0		
30 – 49 cm:	0		
20 – 29 cm:	0	Tree hollow count	0
10 – 19 cm:	0		
5 – 9 cm:	0		
< 5 cm:	1		

Counts apply when no. of tree stems within a size class is ≤ 10. Estimates can be used when > 10 (eg. 10, 20, 30..., 100, 200, 300...). For multi-stemmed tree, only largest living stem is included in the count. Tree stems must be living.
For hollows, count only the presence of a stem containing hollows. For a multi-stemmed tree, only the largest stem is included in the count/estimate. Stems may be dead and may be shrubs.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				
Subplot:	1	2	3	4	5
Subplot score (%):	0	0	0	0	0
Average litter cover (%):	0				

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography and site features

Plot Disturbance

GF Code: see Growth Form definitions in Appendix 1; N: native, E: exotic, HTE: high threat exotic; GF – circle code if 'top 3'; Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover)
Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Project name:	E221058				
Recorders:	TDS JL	**Plot ID:**	B9	**Date:**	30/11/22

GF Code	Scientific name	Cover	Abundance	Voucher	N, E or HTE
Shrub (SG)	*Callistemon citrinus (Crimson Bottlebrush)*	0.4	4		N
Grass & grasslike (GG)	*Chorizandra cymbaria*	0.4	400		N
Grass & grasslike (GG)	*Cyperus spp.*	0.1	2		N
Grass & grasslike (GG)	*Deyeuxia spp. (A Bent Grass)*	0.1	25		N
Grass & grasslike (GG)	*Entolasia stricta (Wiry Panic)*	0.2	500		N
Tree (TG)	*Eucalyptus spp.*	0.1	6		N
Forb (FG)	*Euchiton spp. (A Cudweed)*	0.1	10		N
Grass & grasslike (GG)	*Gahnia spp.*	0.2	25		N
Forb (FG)	*Gonocarpus micranthus*	0.1	200		N
Forb (FG)	*Goodenia paniculata*	0.6	300		N
Grass & grasslike (GG)	*Hemarthria uncinata (Matgrass)*	0.3	400		N
Shrub (SG)	*Hibbertia spp.*	0.1	10		N
Forb (FG)	*Hydrocotyle spp.*	0.2	200		N
Forb (FG)	*Hypericum gramineum (Small St John's Wort)*	0.1	150		N
Forb (FG)	*Hypoxis hygrometrica (Golden Weather-grass)*	0.1	20		N
Grass & grasslike (GG)	*Juncus usitatus*	0.2	20		N
Grass & grasslike (GG)	*Lepidosperma spp.*	0.1	1		N
Shrub (SG)	*Leptospermum juniperinum (Prickly Tea-tree)*	0.1	2		N
Grass & grasslike (GG)	*Lepyrodia spp.*	0.3	50		N
Shrub (SG)	*Melaleuca thymifolia (Thyme Honey-myrtle)*	0.5	10		N
Grass & grasslike (GG)	*Rytidosperma spp.*	0.6	300		N
Grass & grasslike (GG)	*Schoenus brevifolius*	0.2	3000		N
Forb (FG)	*Utricularia dichotoma (Fairy Aprons)*	0.1	2		N
Forb (FG)	*Veronica spp.*	0.1	50		N
Forb (FG)	*Villarsia spp.*	0.1	3		N
Forb (FG)	*Viola betonicifolia (Native Violet)*	0.5	100		N
Other (OG)	*Xanthorrhoea media*	0.2	20		N
Grass & grasslike (GG)	*Lachnagrostis filiformis*	0.1	5		N

Appendix B

BAM plot photo point monitoring

EMM
creating opportunities

B.1 BAM plot photo point monitoring

Plot B1

Plot B2

Plot B3

Plot B4

Plot B5

Plot B6

Plot B7

Plot B8

Plot B9

Appendix C

Grevillea parviflora subsp. *parviflora* photo point monitoring

EMM
creating opportunities

C.1 *Grevillea parviflora* subsp. *parviflora* photo point monitoring

Grevillea Plot 1

Grevillea Plot 2

Grevillea Plot 3

Grevillea Plot 4

Grevillea Plot 5

Grevillea Plot 6

Grevillea Plot 7

Grevillea Plot 8

Grevillea Plot 9

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Appendix 5

Aquatic Monitoring Report Spring 2022

Prepared by Niche Environment and Heritage Pty Ltd

(Total No. of pages including blank pages = 35)

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Aquatic Monitoring Report

Spring 2022

Prepared for Tinda Creek Quarry Pty Ltd | 15 February 2023

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Document control

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Executive summary

An aquatic monitoring program was established as a requirement of the Landscape Management Plan (LMP) for the Tinda Creek Quarry. The program involves survey and analytical methods for measuring macroinvertebrates, stream health, water quality and catchment-riparian conditions.

The aim of the monitoring program is to monitor the river health of Tinda Creek and its tributaries. The monitoring includes:

- Assessment of stream condition using Riparian and Channel and Environment inventory assessment (RCE)
- Assessment of habitat condition using AUSRIVAS proforma recording forms
- Assessment of water quality against default ANZG trigger values
- Assessment of the macroinvertebrate community condition using Stream Invertebrate Grade Number Average Level (SIGNAL2) and AUSRIVAS.

In comparison to the relatively dry sampling season of 2021, many sites held water in spring 2022 after above average and consistent rain events throughout the year. Aquatic environments downstream of Tinda Creek Quarry infrastructure were found to have a good level of riparian growth, having recovered from the 2019-2020 bushfire events, as well as stable channel morphology.

The macroinvertebrate communities recorded generally poor SIGNAL2 and AUSRIVAS results, however these results were comparable between the test sites and reference sites. While the reference sites recorded results comparable to those previously recorded as part of the program test sites showed a slight decrease in AUSRIVAS results, although test sites 4 and 7 were sampled this monitoring round due to the availability of water after several years of dry conditions.

Importantly, the overall stream health results recorded at test Sites 4, 6 and 7 were equivalent to or better when compared to recent surveys and clustered together with those recorded at the reference sites. This indicates comparable conditions to the references sites and as such no impacts to aquatic systems associated with the operation of the Tinda Creek Quarry are identified in the spring 2022 data.

The streams are likely being influenced by natural stress associated with intermittent/ephemeral streams and reflect conditions experienced within the locality, not impacts associated with the operation of the Tinda Creek Quarry.

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Glossary and abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council.
ANZG	Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality.
Anthropogenic	Caused or produced by humans.
Aquatic macroinvertebrates	Animals that have no backbone, are visible with the naked eye and spend all or part of their life in water.
AUSRIVAS	Australian Rivers Assessment System.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
DTVs	Default Trigger Values.
Ecology	The study of the relationship between living things and the environment.
Ephemeral	Existing for a short amount of time.
Habitat	The place where a species, population or ecological community lives (whether permanently, periodically or occasionally).
LMP	Landscape Management Plan.
RCE inventory	Riparian and Channel and Environment inventory assessment.
Riparian	Relating to the banks of a natural waterway.
SIGNAL2	Stream Invertebrate Grade Number Average Level. SIGNAL2 scores are indicative only and pollution does not refer to just anthropogenic sources. Environmental stress may result in poor water quality occurring naturally in waterways such as those conditions found in ephemeral streams. Low family richness and the occurrence of pollution tolerant invertebrates can give a low SIGNAL score even though they are a natural condition.
Stress	Response to a stressor such as an environmental condition or a stimulus.

1. Introduction

1.1 Background

As part of the Tinda Creek Quarry Landscape Management Plan (LMP), a macroinvertebrate monitoring program within the Tinda Creek system and its tributaries was established to monitor changes to the system over time and assess possible influence from Quarry operations. The program includes methods for assessing stream health through the monitoring of macroinvertebrates, water quality and catchment-riparian conditions.

A baseline survey and assessment of eight sites was conducted in August 2007 shortly after a period of heavy rainfall and runoff. Following the 2015 approval for expansion of the Quarry, another survey was conducted in November 2015 to update the baseline data. Hy-Tec has committed to annual monitoring under the approved LMP. Niche were engaged to conduct aquatic monitoring in spring 2018, 2019, 2020, 2021 and 2022.

1.2 Catchment characteristics

The aquatic habitats surrounding the Tinda Creek Quarry include:

- Tinda Creek, a tributary of Wollemi Creek which joins the Colo River approximately 16 km to the west of the project area
- Ephemeral drainage lines that flow to Tinda Creek
- Artificially created diversion channels
- Farm dam sites.

Tinda Creek is an ephemeral/intermittent stream which flows to the west, away from the Quarry grounds. It has been diverted around the eastern and northern boundaries of the current operation zone via small earth drainage channels.

Tinda Creek is met by ephemeral second order drainage lines on the northern boundary of the Quarry. These lines do not hold water due to the substrate having a high concentration of sand and silt, and as such, are usually dry due to the high permeability of the sandy substrate.

Two small former farm dams are located within the property to the north of the Quarry. These dams have been overgrown with vegetation in recent monitoring periods, however, have been cleared to some extent due to the recent bushfires and are currently regenerating.

1.3 Aim

The aim of the aquatic monitoring program is to assess the health of Tinda Creek and its tributaries to ensure that the expanded quarry operations do not result in adverse impacts to the health of the downstream creek system. Specifically, in regard to aquatic environment and aquatic habitat health of the Greater Blue Mountains World Heritage Area. The monitoring includes:

- Assessment of stream condition using RCE
- Assessment of habitat condition using AUSRIVAS
- Assessment of water quality against default ANZECC trigger values
- Assessment of the macroinvertebrate community condition using SIGNAL2 and AUSRIVAS.

2. Methods

2.1 Location of monitoring sites

A total of eight sites were surveyed along the Tinda Creek system and its tributaries (Figure 1, Table 1) consistent with the baseline monitoring conducted in 2015 and monitoring in 2018-2021. This included sites upstream and sites downstream of operations of the Quarry and therefore provides both reference and test sites for monitoring.

Table 1: Location of monitoring sites

Site	Stream	Location	Easting	Northing
Reference sites				
Site 1	Tinda Creek	Tinda Creek Upstream of Quarry	286599	6327354
Site 2	Tinda Creek	Tinda Creek Upstream of Quarry	286400	6328390
Site 5	Tributary of Tinda Creek	Tinda Creek Tributary	284913	6328247
Site 8	Tributary of Tinda Creek	Tinda Creek tributary (outside of Quarry influence)	284476	6329656
Test sites				
Site 3	Tinda Creek Diversion Channel	Tinda Creek Diversion channel within Quarry	286405	6327957
Site 4	Tinda Creek	Tinda Creek Downstream of Quarry	285711	6328427
Site 6	Tinda Creek	Tinda Creek downstream of Quarry	284048	6328633
Site 7	Tinda Creek	Tinda Creek downstream of Quarry	282998	6328847

2.1.1 Site 1 – Tinda Creek, Upstream of Quarry

Site 1 is situated on the upper reaches of Tinda Creek, upstream and to the southeast of Quarry activities. In this location, Tinda Creek lacks a defined drainage channel, being characterised by an open, sandy floodplain. As Site 1 is located upstream of the quarry, it is monitored as a reference site.

2.1.2 Site 2 – Tinda Creek, Upstream of Quarry

Site 2 is located upstream and to the north of the Quarry and is downstream of a former farm dam. Site 2 is located on a section of an upper tributary of Tinda Creek formed as a constructed drainage channel with an open floodplain. As Site 2 is located upstream of the Quarry, it is monitored as a reference site.

2.1.3 Site 3 – Tinda Creek Quarry – Clean Water Diversion

Site 3 is situated along a clean water diversion channel that was constructed to divert overland flows around the eastern edge of the Quarry and to the north towards Tinda Creek. The diversion channel is generally less than 2 m in width. As a constructed diversion channel, Site 3 is included in the program as a test site.

2.1.4 Site 4 – Downstream of the Quarry

Site 4 is located downstream of the Quarry along a section of Tinda Creek that occurs just upstream of a small former farm dam. Tinda Creek at Site 4 comprises a defined drainage channel which supports a number of small, isolated pools. As Site 4 is situated downstream of the Quarry, it is monitored as a test site.

2.1.5 Site 5 – Tinda Creek Tributary

Site 5 comprises a tributary of Tinda Creek that runs generally parallel to the eastern side of Putty Road and joins Tinda Creek just upstream of the road culvert. The tributary at this site comprises a series of wide pools interspersed with narrower sections. Site 5 is monitored as a reference site.

2.1.6 Site 6 – Tinda Creek, West of Putty Road

Site 6 is situated on Tinda Creek, approximately 0.75 km downstream of Putty Road. Site 6 comprises a shallow channel with broad floodplain. As Site 6 is downstream of the quarry, it is monitored as a test site.

2.1.7 Site 7 – Tinda Creek, Far West of Putty Road

Site 7 is positioned along Tinda Creek, approximately 2 km downstream of Putty Road. Site 7 comprises a broad, open channel. As Site 7 is downstream of the Quarry, it is monitored as a test site.

2.1.8 Site 8 – Tinda Creek Tributary, North West of the Quarry

Site 8 is located upstream of Putty Road within a tributary of Tinda Creek to the north of the Quarry that is not influenced by Quarry operations. The site is directly above the culvert under Putty Road and comprises a broad open channel. Given that Site 8 occurs in a tributary that could not be affected by the quarry operations it is monitored as a reference site.

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Niche PM: David Wilkinson
Niche Proj. #: 7557 Client: Hy-Tech

Subject Area

Tinda Creek Aquatic Monitoring

Figure 1

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2.2 Field methods

The field survey was undertaken on the 9 November 2022 by David Wilkinson (Aquatic Ecology Consultant) and Matthew Russel (Associate – Aquatic Ecology) of Niche. Field methods were consistent with standardised techniques for field sampling as prescribed by AUSRIVAS (Turak *et al*. 2004) and previous monitoring surveys. The AUSRIVAS methods of sampling both pools and riffles has been modified for this program, as no suitable in-stream riffle features were present.

A summary of the survey methods used at each of the eight sites is provided in Table 2. The application of some methods were limited at some of the sites as the sites were dry at the time of the survey and these are identified below.

Table 2: Summary of methods at each site

Site	Macroinvertebrate sampling	AUSRIVAS habitat assessment	RCE assessment	Photo monitoring
Reference site				
Site 1	-	-	X	X
Site 2	-	-	X	X
Site 5	X	X	X	X
Site 8	X	X	X	X
Test site				
Site 3	-	-	X	X
Site 4	X	X	X	X
Site 6	X	X	X	X
Site 7	X	X	X	X

2.2.1 Aquatic habitat and stream condition

Riparian, Channel and Environment inventory assessment (RCE)

The RCE Inventory (Chessman *et al*. 1997) provides a comparative measure of stream condition by assessing both the stream and its riparian environment in terms of habitat diversity, habitat condition and the degree of human-induced disturbance. Thirteen categories each receive a score between one and four based on their condition, resulting in an accumulated score of between 13 and 52. The maximum score (52) indicates a stream with little or no obvious physical disruption and the lowest score (13) indicates a heavily channelled stream without any riparian vegetation. This assessment provided an assessment of the general condition of the stream and must be interpreted accordingly.

Habitat description

A description of aquatic habitat was also produced using the AUSRIVAS proforma. The survey is a rapid visual assessment used to describe the habitat based on the following parameters:

- Geomorphology
- Channel diversity
- Bank stability
- Riparian vegetation and adjacent land use
- Water quality
- Macrophytes

- Local impacts and land use practices.

Macro-invertebrate sampling

Macro-invertebrate sampling was to be undertaken at sites 4-8 in accordance with AUSRIVAS protocol (Turak et al., 2004), where possible. This is due to the fact that sites 1-3 do not typically hold sufficient water to allow for sampling. The lack of sufficient water in these sites is a result of the ephemeral nature of the streams in the project area and the sandy substrate.

2.2.2 Water quality

Surface water quality was measured *in situ* using a Yeokal 618 water quality probe at each site. The following variables were recorded:

- Temperature (°C)
- Conductivity (µS/cm)
- pH
- Dissolved oxygen (DO)(% saturation and mg/L)
- Turbidity (NTU).

Alkalinity (mg $CaCO_3$/L) was measured with a standard titration kit. Water quality data were compared with the Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality Default Trigger Values (DTVs) for the region as a benchmark for comparison for the program. Currently, no updated ANZG DTVs for the region have been provided. As such the DTVs applied in this report are the ANZECC (2000) physical and chemical stressors for protection of slightly upland aquatic ecosystems in South-Eastern Australia default guideline values. This is consistent with previous iterations of the monitoring program.

2.2.3 Macroinvertebrates

Samples of macroinvertebrates were collected from pool edges for a length of 10 metres, either as a continuous line or in disconnected segments. Sampling in segments was often undertaken to ensure the sampling of sub-habitats such as macrophyte beds, bank overhangs, submerged branches and root mats. Segmented sampling was also employed where pool length was short and it was logistically difficult to sample in a continuous line (e.g. in-stream logs). A 250 µm dip net was drawn through the water with short sweeps towards the bank to dislodge benthic fauna while scraping submerged rocks and debris, sides of the stream bank and the bed substrate (Plate 1). Further sweeps in the water column targeted the suspended fauna.

Plate 1: Sampling method

Each sample was rinsed from the net onto a white sorting tray from which animals were picked using forceps, pipettes and or paint brushes. Each tray was picked for a minimum period of 40 minutes, after which they were picked at 10 minute intervals for either a total of one hour or until no new specimens had been found. Care was taken to collect cryptic and fast moving animals, in addition to those that were conspicuous or slow. The animals collected at each site were placed into a labelled jar containing 70% ethanol.

Laboratory methods-invertebrate identification

Macroinvertebrate samples were identified to family level with the exception of Oligochaeta (to class), Polychaeta (to class), Ostracoda (to subclass), Nematoda (to phylum), Nemertea (to phylum), Acarina (to order) and Chironomidae (to subfamily). Keys used to identify taxa included:

- Centre for Freshwater Ecosystems (n.d.) – Identification Key and Ecology of Australian Freshwater Invertebrates. http://www.mdfrc.org.au/bugguide/.
- Dean, J., Rosalind, M., St Clair, M., and Cartwright, D. (2004) Identification keys to Australian families and genera of caddis-fly larvae (Trichoptera) Cooperative Research Centre for Freshwater Ecology.
- Gooderham, J. and Tsyrlin, E. (2002) The Waterbug Book: A guide to the Freshwater Macroinvertebrates of Temperate Australia, CSIRO Publishing.
- Hawking and Theischinger (1999) A guide to the identification of larvae of Australian families and to the identification of ecology of larvae from NSW.
- Madden, C. (2010) Key to genera of Australian Chironomidae. Museum Victoria Science Reports 12, 1-31.
- Madden, C. (2011) Draft identification key to families of Diptera larvae of Australian inland waters La Trobe University.
- Smith, B. (1996) Identification keys to the families and genera of bivalve and gastropod molluscs found in Australian inland waters Murray Darling Freshwater Research Centre.

2.3 Data analysis

2.3.1 SIGNAL2: (Stream Invertebrate Grade Number Average Level) scores

The revised SIGNAL2 biotic index developed by Chessman (2003a and 2003b) was used to determine the "environmental quality" of sites. This method assigns grade numbers to each macroinvertebrate family or taxa found, based largely on their response to a range of environmental conditions (Table 3). The sum of all grade numbers for that habitat is then divided by the total number of families recorded in each habitat to calculate the SIGNAL2 index.

Table 4 provides a broad guide for interpreting the health of the site according to the SIGNAL2 score of the site.

A weighted SIGNAL2 score was also calculated (see Chessman 2003b). The SIGNAL2 index therefore uses the average sensitivity of macroinvertebrate families to present a snapshot of biotic integrity at a site. The number of taxa and weighted SIGNAL scores were used to create a bi plot using categories provided in Table 5.

Table 3: SIGNAL grade and the level of pollution tolerance for individual taxa

SIGNAL grade	Pollution tolerance
10-8	Indicates a greater sensitivity to pollution
7-5	Indicates a sensitivity to pollution
4-3	Indicates a tolerance to pollution
2-1	Indicates a greater tolerance to pollution

Table 4: Guide to interpreting the SIGNAL2 scores

SIGNAL2 score	Habitat quality
Greater than 6	Healthy habitat
Between 5 and 6	Mild pollution
Between 4 and 5	Moderate pollution
Less than 4	Severe pollution

(Source: Gooderham and Tsyrlin 2002)

*Note that SIGNAL2 scores are indicative only and that pollution does not refer to just anthropogenic pollution. Environmental stress may result in poor water quality occurring naturally in waterways. Low family richness and the occurrence of pollution tolerant invertebrates can give a low SIGNAL score even when they are in natural condition.

Table 5: Bi-plot interpretation

Bi plot category	SIGNAL2	Number of taxa
Toxic pollution, harsh physical conditions	>5	<17
Urban Industrial or agricultural pollution	<5	<17
High salinity or nutrients	<5	>17
Favourable habitat	>5	>17

2.3.2 Opportunistic observations

Opportunistic visual observations of aquatic fauna were recorded during the surveys at each site.

3. Results

3.1 Weather conditions

The survey was conducted on 9 November 2022, with a low level of rainfall leading up to the survey date (Figure 2). In the 10 days preceding the survey, a total of 11.2 mm of rain was recorded. The total rainfall recorded in October was 154.6 mm, which is double the median for the Colo Heights (Mountain Pines) station of 62.3 mm (1962 – 2022). These wetter than average conditions were reflected in the levels of water present within the study area, with all sites holding water during the spring 2022 sampling survey. The conditions at the time of spring sampling were far wetter than average with the total rainfall recorded in 2022 (January to November) being 1865.9 mm. That is more than double the 709.4 mm total median total annual rainfall for the station (1962 – 2022), indicating wetter than average conditions over the course of the year.

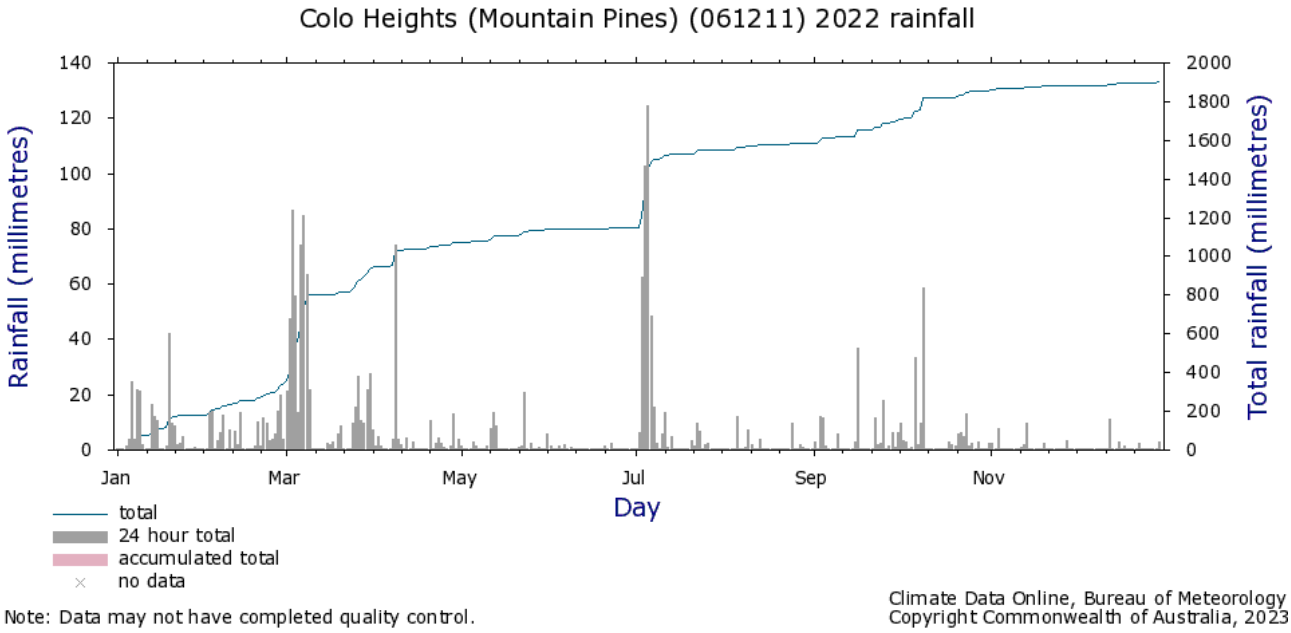


Figure 2: Rainfall data for January-December 2022 (station no. 061211)

3.2 Aquatic habitat/condition

The aquatic habitat of the study area comprised of pools habitat only with no active riffles. All except two sites had 'good' riparian and channel health (RCE score 40 or above) (Table 6). Most sites exhibited stable banks and regenerating native riparian cover. Site 6 and Site 7 are continuing to recover from bushfires, with regrowth of ground cover vegetation observed.

Table 6: RCE inventory scores (2022)

Site	Spring 2022
Reference site	
Site 1	42
Site 2 (Constructed diversion channel)	35
Site 5	46
Site 8	48
Test site	
Site 3 (Constructed diversion channel)	30

Site	Spring 2022
Site 4	45
Site 6	48
Site 7	48

An RCE score greater than 40 indicates a stream considered to be in good condition with potential for higher biodiversity values. RCE Scores of 20-40 indicate a stream is in moderate condition and below 20 indicates that the stream is in very poor condition

3.2.1 Site 1 Tinda Creek upstream of the Quarry (reference)

The key aquatic habitat features at Site 1 (Plate 2) at the time of the spring 2022 monitoring surveys are described in Table 7.

Table 7: Site 1 habitat results

Criteria	Attribute	Site 1
Riparian	RCE score	42.
	Vegetation	Canopy absent. Scattered Parramatta Red Gum (*Eucalyptus parramattensis)* regenerating within this location. Mid-story absent. Groundcover dominated by sedge, low shrub, herb and grasses including *Leptocarpus tenax; Juncus* sp.*; Lepyrodia scariosa; Schoenus brevifolius; Entolasia stricta; Gonocarpus micranthus; Melaleuca thymifolia; Micromyrtus ciliata* and *Dampiera stricta.*
	Stream shading	Low <5%.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	<1 m.
	Substrate	Majority sand and silt.
	Flow/depth	Low flow across floodplain
	Macrophytes/algae	Algae present
	Water quality observations	Clear
Comments		Very shallow and generally narrow channel form (<1 m). Open sandy floodplain with the flow channel identified by the change in vegetation, indicating the more permanent presence of surface water or subsurface flow.
Plate 2: Site 1	**Downstream**	

Criteria	Attribute	Site 1
	Upstream	

3.2.2 Site 2 Tinda Creek upstream of the Quarry (reference site)

The aquatic habitat at Site 2 (Plate 3) at the time of the spring 2022 monitoring surveys is detailed in Table 8.

Table 8: Site 2 habitat results

Criteria	Attribute	Site 2
Riparian	RCE score	35 (Constructed drainage channel).
	Vegetation	Canopy consisted of sparse Scribbly Gums (*Eucalyptus haemastoma*), with a scattered grass/shrub land dominated by *Chorizandra spaerocephala.*
	Stream shading	Low/moderate.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	<1 m.
	Substrate	Sand 80%, Silt 20%.
	Flow/depth	No flow.
	Macrophytes/algae	Absent.
	Water quality	Clear
Comments		Constructed channel to drain farm dam.
Plate 3: Site 2	Downstream	

Criteria	Attribute	Site 2
	Upstream	

3.2.3 Site 3 Tinda Creek diversion channel within Quarry (test site)

The aquatic habitat at Site 3 (Plate 4) at the time of the spring 2022 monitoring surveys is detailed in Table 9.

Table 9: Site 3 habitat results

Criteria	Attribute	Site 3
Riparian	RCE score	30 (Constructed channel).
	Vegetation	Canopy and mid-story absent. Groundcover dominated by *Chorizandra spaerocephala.*
	Stream shading	Low/none.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	<2 m.
	Substrate	Sand 70%, silt 30%.
	Flow/depth	No flow.
	Macrophytes/algae	Absent.
	Water quality observations	Clear
Comments		Very loose and unstable banks.
Plate 4: Site 3	Downstream	
	Upstream	

3.2.4 Site 4 Tinda Creek downstream of Quarry (test site)

The aquatic habitat at Site 4 (Plate 5) at the time of the spring 2022 monitoring surveys is detailed in Table 10.

Table 10: Site 4 habitat results

Criteria	Attribute	Site 4
Riparian	RCE score	45
	Vegetation	Canopy composed of *Eucalyptus haemastoma (<5%).* Mid-story dominated by small trees and tall shrubs. Ground cover was sparse with signs of slight post fire regrowth and dominated by *Chorizandra spaerocephala.*
	Stream shading	Low.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	2 m.
	Substrate	80% silt, 20% sand.
	Flow/depth	Low flow
	Macrophytes/algae	Macrophytes and algae present
	Water quality observations	Dark tannin colour
Comments		None.
Plate 5: Site 4	Downstream	
	Upstream	

3.2.5 Site 5 Tinda Creek Tributary (reference site)

The aquatic habitat at Site 5 (Plate 6) at the time of the spring 2022 monitoring surveys is detailed in Table 11.

Table 11: Site 5 habitat results

Criteria	Attribute	Site 5
Riparian	RCE score	46.
	Vegetation	Canopy present and comprised of *Eucalyptus haemastoma*, Mid-story supporting dense cover of small trees and tall shrubs (*Acacia* spp and *Cassurina* spp). There were signs of regrowth of ground covering including regenerative Cat-tailed bulrush (Typha) and Round headed bristle sedge (*Chorizandra spaerocephala*).
	Stream shading	Low-moderate.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	6 m.
	Substrate	Silt 90%, sand 10%.
	Flow/depth	No flow/deep >1 m.
	Macrophytes/algae	Cat tail Bulrush (*Typha* sp.) and floating macrophyte *Potamogetan sulcus*
	Water quality observations	Water availability was relatively high; conditions were highly turbid.
Comments		Riparian and macrophyte vegetation present, European carp (*Cyprinus carpio*) was present in dam
Plate 6: Site 5	Downstream	
	Upstream	

3.2.6 Site 6 Tinda Creek downstream of Quarry (test site)

The aquatic habitat at Site 6 (Plate 7) at the time of the spring 2022 monitoring surveys is detailed in Table 12.

Table 12: Site 6 habitat results

Criteria	Attribute	Site 6
Riparian characteristics	RCE score	48.
	Vegetation	Forest Red Gum (*Eucalyptus tereticornis*), White Stringybark (*E. globoidea)* dominated the canopy vegetation. The mid-storey was dominated by small trees and tall shrubs. The ground cover consisted of regenerating native grasses, herbs and ferns.
	Stream shading	Low/moderate.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	4 m.
	Substrate	Sand 20%, silt 80%.
	Flow/depth	No flow/ >1 m deep.
	Macrophytes/algae	Green algae present.
	Water quality observations	Water availability was relatively high; conditions were highly turbid.
Comments		Good level of post bushfire regrowth.
Plate 7: Site 6	Downstream	
	Upstream	

3.2.7 Site 7 Tinda Creek downstream of Quarry (test site)

The aquatic habitat at Site 7 (Plate 8) at the time of the spring 2022 monitoring surveys is detailed in Table 13.

Table 13: Site 7 habitat results

Criteria	Attribute	Site 7
Riparian characteristics	RCE score	48.
	Vegetation	Canopy vegetation included Grey Gums (*Eucalyptus punctata*) and Scribbly Gums (*Eucalyptus haemastoma*). The ground cover consisted of by native grasses, herbs and ferns, as well as macrophytes.
	Stream shading	Low/moderate.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	<5 m.
	Substrate	Silt 100%.
	Flow/depth	Low flow
	Macrophytes/algae	Cat tail Bulrush (*Typha* sp.), Saw sedge (*Gahnia* sp.).
	Water quality observations	Visually clear and tannin colour
Comments		Overgrown creek bed flattened by high flows.
Plate 8: Site 7	Downstream	
	Upstream	

3.2.8 Site 8 Tinda Creek tributary (reference site, outside of Quarry influence)

The aquatic habitat at Site 8 (Plate 9) at the time of the spring 2022 monitoring surveys is detailed in Table 14.

Table 14: Site 8 habitat results

Criteria	Attribute	Site 8
Riparian characteristics	RCE score	48.
	Vegetation	Canopy vegetation included Grey Gums (*Eucalyptus punctata*) and Scribbly Gums (*Eucalyptus haemastoma*). The mid-storey was heavily damaged due to bushfires. The ground cover consisted of by native grasses, herbs and ferns along with Eucalyptus and Casuarina regeneration post fires.
	Stream shading	Low/moderate.
	Exotic vegetation	-
Stream characteristics	Modal width (m)	3 m.
	Substrate	Pebble 30%, sand 20%, silt 50%.
	Flow/depth	Low flow
	Macrophytes/algae	A green macro algae was present
	Water quality observations	Turbid, low flow conditions.
Comments		
Plate 9:Site 8	Downstream	
	Upstream	

3.3 Water quality

The collection of water samples was only possible at five of the eight sites due to the levels of water present. The results show that temperature ranged between 16.02 – 22.64 °C; the highest being Site 4 (Table 15). Conductivity ranged between 45-102 µs/cm; the highest recorded in Site 7. All sites were within the ANZG DTVs for conductivity (30-350 µS/cm). Turbidity ranged between 10.8-51 NTU all exceeding the adopted DTVs except for sites 4 and 6, with the highest reading recorded at Site 5. Dissolved Oxygen (DO) values were below DTVs at all sites except for site 5, with values ranging between 64.8 and 86 % saturation. All sites had pH levels below DTVs (6.5 – 8). Alkalinity was low, recording 20 $CaCO_3$/L for all sites.

Table 15: Water quality results

Site acronym	Temp (C°)	Conductivity (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (% sat)	pH*	Alkalinity (mg $CaCO_3$/L)
Reference site						
Site 1	-	-	-	-	-	-
Site 2	-	-	-	-	-	-
Site 5	16.02	65	**51**	86	**6.12**	20
Site 8	17.43	45	**25**	**78.1**	**6.29**	20
Test site						
Site 3	-	-	-	-	-	-
Site 4	22.64	51	10.8	**74.7**	**5.92**	20
Site 6	19.9	72	12.2	**64.8**	**6.03**	20
Site 7	20.83	102	**30.8**	**65.8**	**5.97**	20

ANZG DTVs for upland streams: Electrical conductivity (30-350 µS/cm), Turbidity (2-25 NTU), pH (6.5-8), Dissolved Oxygen (80-110%). Text in bold indicate those variables that exceed the DTVs.

Note: For some waterways, DTVs do not reflect typical background water quality and chemistry. Therefore an assessment of water quality monitoring data against default values can suggest the condition of the waterway is outside the normal range, or polluted, when in fact it is 'clean', or vice versa.

3.4 Macroinvertebrates

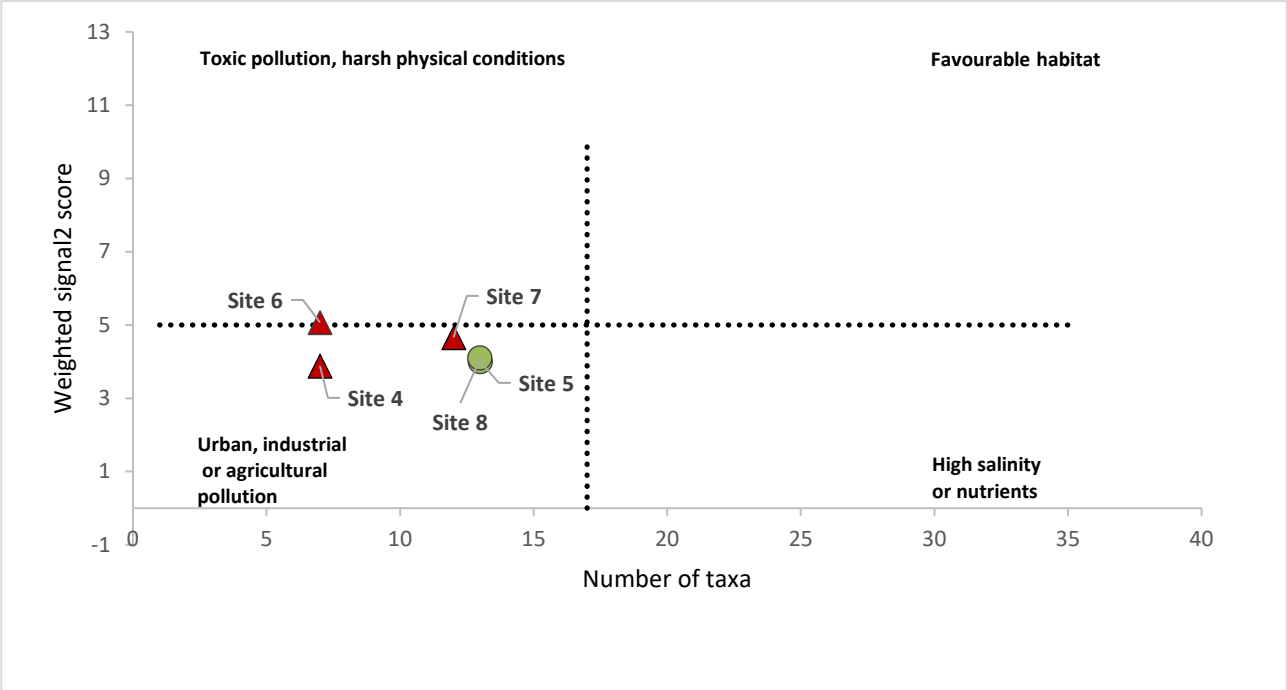
AUSRIVAS results and SIGNAL2 scores for the five sampled sites are provided in Table 16. Raw data is provided in Annex 1.

Table 16: Macroinvertebrate results

Site acronym	Number of Taxa	SIGNAL2 weighted score	AUSRIVAS Band
Reference site			
Site 1	-	-	-
Site 2	-	-	-
Site 5	13	4.00	B
Site 8	13	4.09	B
Test site			
Site 3	-	-	-
Site 4	7	3.88	C
Site 6	7	5.07	D
Site 7	12	4.66	C

The number of taxa at the three sites ranged from 7 to 13, with the fewest taxa observed at test Site 4 and 6. AUSRIVAS scores for reference sites recorded Band B (significantly impaired) results. These results indicate levels of stream impairment, as they recorded fewer families than expected based upon the modelled macroinvertebrate communities using the reference site in the AUSRIVAS model. While the test sites recorded Band C and D (Severely and Extremely impaired).

The low weighted scores SIGNAL2 scores recorded at all sites in spring 2022 indicate that the macroinvertebrate assemblage present in the streams is dominated by predominantly pollution-tolerant taxa (Figure 3). The Biplot, indicates that no sites have favourable aquatic habitat, and all locations are exhibiting some form of pollution or natural stress. However, this appears typical for streams in the area as two references sites also cluster together in this quadrant. Pollution-sensitive taxa recorded include Mayfly Leptophlebidae (SIGNAL 8) observed at all sites, Caddis Fly Hydrobiosidae (SIGNAL 8) observed at sites 6 and 7, flies Dixidae (SIGNAL 7) at Site 5 and Beetle Elmidae (SIGNAL 7) at site 8.



Note: reference sites represented as green circles, while test sites represented as red triangles.

Figure 3: SIGNAL2 Bi-plot – Spring 2022

There appears to be no general trend over time in SIGNAL2 scores when the spring 2021 results for all sites sampled are considered in the context of previous results (Table 17). The SIGNAL2 results for Site 8 have steadily increased over five surveys (Table 17) with the 2022 results being similar to those from 2021. With wetter conditions in spring 2022 this has meant that more test sites could be sampled when compared to the drier spring in 2021. The other reference Site 5 recorded its highest SIGNAL2 score to date. Test Site 6 also recorded an increased SIGNAL2 score when compared to the previous spring 2021, recording the highest score at this site to date. Other test sites, Site 4, site 6 and Site 7, also recorded the highest scores for each site to date (site 7 matching its score from 2015). Overall, the results indicate stream health conditions that are consistent with or, better than, those previously recorded as part of the aquatic monitoring program.

Table 17: Weighted SIGNAL2 scores (2015, 2018, 2019, 2020, 2021 and 2022)

Site	SIGNAL2 weighted Spring 2015	SIGNAL2 weighted Spring 2018	SIGNAL2 weighted Spring 2019	SIGNAL2 weighted Spring 2020	SIGNAL2 weighted Spring 2021	SIGNAL2 weighted Spring 2022
Reference site						
Site 5	2.00	3.54	3.35	2.86	3.34	4.00
Site 8	2.50	3.00	3.19	3.71	4.11	4.09
Test site						
Site 4	2.25	DRY	DRY	2.83	DRY	3.99
Site 6	3.50	2.6	DRY	2.73	3.71	5.07
Site 7	4.66	DRY	DRY	Low water level – not sampled.	DRY	4.66

AUSRIVAS scores (Table 18) in general have been observed to improve over time, while the reference sites show a high degree of stability the test site are more variable. Test Site 6 has recorded a reduced AUSRIVAS Band score in 2022 when compared to the Band B results previously recorded during the program in spring 2021, although previous results have been in Band C. Sites 4 and 7 although recording Band C scores are an improvement over being unsamplable in 2021.

Table 18: AUSRIVAS (2018 - 2022)

Site	Spring 2018	Spring 2019	Spring 2020	Spring 2021	Spring 2022
Reference site					
Site 5	D	B	B	B	B
Site 8	C	B	B	B	B
Test site					
Site 4	DRY	DRY	B	DRY	C
Site 6	C	DRY	C	B	D
Site 7	DRY	DRY	Low water level – not sampled.	DRY	C

3.5 Other fauna

European Carp (*Cyprinus carpio*) was present at Site 5 in the dam.

4. Discussion

4.1 RCE scores

RCE scores were approximately 40 or above, indicating good or near good condition, with the exception of two sites (Sites 2 and 3). The low scores are due to the nature of these sites as they have been modified by human activity and do not exhibit any indicators of declined habitat conditions in Spring 2022, when compared to previous monitoring. Most sites have moderately increased vegetation cover in spring 2022. Downstream sites affected by bushfire (Site 6 and Site 7) showed considerable regrowth since 2019-20 bushfires as was noted in the spring 2021 report (Niche 2021). These sites continue to show an increasing level of ground cover vegetation that has re-established itself nicely.

While useful as a broadscale comparison, the RCE checklist does not provide a great deal of insight into specific microhabitats present, which is an important factor in understanding the availability and condition of habitats available from macroinvertebrates and other stream biota. It is recommended that to provide a more detailed assessment of aquatic habitat conditions, a HABSCORE assessment (following Barbour et al. 1999) should be adopted in future monitoring iterations. This assessment technique provides a rapid visual grading of key stream habitat features such as water availability and flow heterogeneity, substrate condition, riparian vegetation extent and condition, bank erosion and epifaunal habitat cover, with specific relevance to aquatic biota and their habitats. Each criteria receives an individual grade out of ten, with the total of these equating to an overall score that may be categorised into Optimal, Sub-optimal, Marginal and Poor groupings. This assessment not only allows an assessment of the condition of aquatic habitats present and description of stream health conditions, but it also facilitates the ability to compare overall scores or individual criteria across sites and time periods.

4.2 Water quality

Field parameters measured during this monitoring period were within the expected range of typical disturbances found within intermittent streams. Most sites had elevated turbidity levels, with reference sites recording higher levels than the test sites. Reference Site 5 recorded the highest turbidity level, substantially above that of the test sites. Other sites also had elevated turbidity, which may be the results of continued inputs of suspended sediment that were exacerbated by 2022 high rainfall events.

Low pH levels were recorded at all sites, however these pH levels do not appear to have resulted in impairment to the macroinvertebrate communities present.

4.3 SIGNAL2 scores and macroinvertebrate communities

Five sites were sampled during this monitoring period. These included Site 4, Site 6 and Site 7 (test sites), along with reference sites, Site 5 and Site 8. Despite poor AUSRIVAS and low-moderate SIGNAL2 scores, the streams appear to be in reasonable health particularly considering the 2019-2020 bushfire event, as well as the high frequency flooding events during 2022. The results are indicative of macroinvertebrate assemblages and stream condition that are typical of intermittent streams which are under natural ephemeral stress. The results are considered to be representative of similar streams in the locality, with the results for the reference sites clustering together with those of the test site. As such, there appears to be no obvious disturbance resulting from the Tinda Creek Quarry operations at downstream sites.

The results in general are consistent with macroinvertebrate community's representative of low flows and intermittent streams, the fauna of which consist of generally pollution-tolerant organisms resulting in the streams having low-moderate SIGNAL2 and AUSRIVAS scores.

The AUSRIVAS scores recorded at reference sites in spring 2021 were similar to the previous surveys. While the test sites showed either lower results or in the case of site 7, the first time a sample has been collected since 2019 due to the availability of water. This is not considered to be indicative of impacts resultant from Quarry operations as habitat conditions were observed to be stable, no indicators of acute water quality impacts were identified, and most importantly the SIGNAL2 scores were comparable, or better, than the results previously recorded as part of the program. In fact, all sites recorded the highest SIGNAL2 score at each site to date. The variability of AUSRIVAS scores at the test sites is attributed primarily to the more intermittent nature of flows at these locations, which are less stable than reference sites 5 and 8. When considering the multiple methods of data collected, the weight of evidence approach suggests that overall, stream health conditions in Spring 2022 were consistent, or improved in comparison to previous years. However, the AUSRIVAS results should be re-visited in detail in the next monitoring round to determine if this is part of an ongoing trend, or whether it is part of the inherent variability of these streams. The additional standardised aquatic habitat assessment (HABSCORE) identified in the previous section would assist in resolving this point.

The increase in SIGNAL2scores are attributed to an increase in rainfall over the recent survey period (2018 – 2022), which has functioned to improve the condition and extent of habitat available for aquatic biota. Conditions were very wet at the time of sampling in 2022, with above average rainfall across the year leading to more permanent water levels sustaining habitats within the study area throughout the year.

4.4 Overflow

As a result of the significant wet weather events throughout 2022, a series of uncontrolled discharge events into downstream environments occurred at Tinda Creek (Niche 2022). The three sites downstream of the quarry (Site 4, Site 6 and Site 7) were at risk of being affected by the water released from these events. Observations made during the spring 2022 survey showed no obvious signs of contamination, erosion, or additional sedimentation at any of the three downstream sites. The sites appear to have a similar geomorphological form and condition to previous surveys and intact native riparian vegetation. All three downstream sites also had the pollution sensitive aquatic macroinvertebrate taxa Leptophlebidae present at the time of sampling.

Comparisons to previous macroinvertebrate assemblage results at these sites are difficult due to the variability of data and prevailing dry conditions previously. However, no obvious indicators of impacts to stream health conditions through the anticipated potential impact pathways (erosion and sedimentation, poor water quality) have been identified. Furethermore, as the monitoring results suggests that overall, stream health conditions in Spring 2022 were consistent, or improved in comparison to previous years, there are no obvious indications of lasting impacts from the discharge events.

5. Conclusion and recommendations

5.1 Conclusions

The general health of the vegetation and waterways of the eight sites was found to be in moderate to good health, with a greater level of available aquatic habitat compared to previous surveys due to the wetter conditions. All sites but two had RCE scores above 40. Five out of the 8 total sites (test Sites 4, 6 and 7, and reference Sites 5 and 8) were sampled using AUSRIVAS method, including water quality sampling.

Sites downstream of Tinda Creek Quarry operations continue to exhibit good riparian and channel morphology with the native riparian vegetation showing regeneration, including reestablishment of native groundcovers that were absent in spring 2021 monitoring.

The macroinvertebrate community at test and reference sites is in reasonable health despite some poor AUSRIVAS and low to moderate SIGNAL2 scores. The water quality results were consistent with what would be expected for ephemeral/intermittent streams in the locality.

Importantly, the stream health results recorded at test Sites 4, 6 and 7 were equivalent to or better when compared to recent surveys and clustered together with those recorded at the reference sites. This indicates comparable conditions to the references sites and as such no impacts to aquatic systems associated with the operation of the Tinda Creek Quarry are identified in the spring 2022 data.

5.2 Recommendations

The AUSRIVAS results should be re-visited in detail in the next monitoring round to determine if the low scores are part of an ongoing trend, or whether it is part of the inherent variability of these streams.

It is recommended that to provide a more detailed assessment of aquatic habitat conditions, a HABSCORE assessment (following Barbour et al. 1999) should be adopted in future monitoring iterations. This assessment not only allows an assessment of the condition of aquatic habitats present and description of stream health conditions, but it also facilitates the ability to compare overall scores or individual criteria across sites and time periods. This would contribute to an improved assessment of aquatic habitats, but also assist in interpreting and resolving any patterns in macroinvertebrate assemblage scores (such as those mentioned above).

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Websites

http://ausrivas.ewater.com.au/

http://www.mdfrc.org.au/bugguide/

Annex 1. Macroinvertebrate survey results

Table 19: Macroinvertebrate survey results in spring 2022

Taxa	Site 4	Site 5	Site 6	Site 7	Site 8
Planorbidae				1	
Corbiculidae					1
Oligochaeta				1	
Acarina		15			4
Ceinidae					2
Atyidae		8			
Dytiscidae					2
Elmidae					1
Tipulidae				1	
Dixidae		6			
Simuliidae			2		
Tanypodinae	7		3	2	3
Orthocladiinae				2	
Chironominae		2		9	1
Baetidae		3			
Leptophlebiidae	3	5	40	34	14
Corixidae	2	21	2	1	9
Notonectidae	2	2			
Coenagrionidae	2	26	10	1	44
Megapodagrionidae			1		
Aeshnidae	1				2
Gomphidae		1			
Synthemistidae				1	
Hemicorduliidae	13	1		2	5
Hydrobiosidae			6	3	
Ecnomidae		1			
Leptoceridae		5			2

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Our services

Ecology and biodiversity
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Wildlife Schools and training

Heritage management
Aboriginal heritage
Historical heritage
Conservation management
Community consultation
Archaeological, built and landscape values

Environmental management and approvals
Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting
Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)

Appendix 6

Complaints Register 2022

(Total No. of pages including blank pages = 3)

Tinda Creek Quarry Complaints Register

Month / Year	Number of Complaints Registered	Details of Complaint
2023		
Dec-23		
Nov-23		
Oct-23		
Sep-23		
Aug-23		
Jul-23		
Jun-23		
May-23		
Apr-23		
Mar-23		
Feb-23		
Jan-23		
2022		
Dec-22	**0**	
Nov-22	**0**	
Oct-22	**0**	
Sep-22	**0**	
Aug-22	**0**	
Jul-22	**0**	
Jun-22	**0**	
May-22	**0**	
Apr-22	**0**	
Mar-22	**0**	
Feb-22	**0**	
Jan-22	**0**	
2021		
Dec-21	**0**	
Nov-21	**0**	
Oct-21	**0**	
Sep-21	**0**	
Aug-21	**0**	
Jul-21	**0**	
Jun-21	**1**	Community member rang re Hy-Tec truck going quickly on Putty Rd 2 weeks previous. Investigated and found no Hy-Tec truck was on the road during the time period alluded to by the community member.
May-21	**0**	
Apr-21	**1**	Community member rang re truck being driven poorly on Putty Rd. At the time of the call, the community member was advised that the trucking business as named, does not do any business with the Quarry.
Mar-21	**0**	
Feb-21	**0**	
Jan-21	**0**	
2020		
Dec-20	**1**	Community member rang re having to take evasion action on Putty Rd approx 30Km from Quarry to avoid a truck. Incident followed up by Quarry staff. Advice provided that fallen trees had been seen in this area. Community member advised of the follow up
Nov-20	**0**	
Oct-20	**0**	
Sep-20	**0**	
Aug-20	**0**	
Jul-20	**0**	
Jun-20	**0**	
May-20	**0**	
Apr-20	**0**	
Mar-20	**0**	
Feb-20	**0**	
Jan-20	**0**	
2019		
Dec-19	**0**	
Nov-19	**0**	
Oct-19	**0**	
Sep-19	**0**	Ongoing discussions held with the individual from the July 2019 notice
Aug-19	**0**	Ongoing discussions held with the individual from the July 2019 notice
Jul-19	**1**	Previous complainant left voicemail and sent a number of text messages between 17 July 2019 and the end of July. The voicemail and text messages informally presented allegations about a broad range of topics and concerns, including water, rehabilitation, and historical grievances arising from the period when the quarry was controlled by the previous owner and operator
Jun-19	**0**	
May-19	**0**	
Apr-19	**0**	
Mar-19	**0**	
Feb-19	**0**	
Jan-19	**0**	

2018		
Dec-18	**0**	
Nov-18	**0**	
Oct-18	**0**	
Sep-18	**0**	
Aug-18	**0**	
Jul-18	**0**	
Jun-18	**0**	
May-18	**0**	
Apr-18	**0**	
Mar-18	**0**	
Feb-18	**0**	
Jan-18	**0**	
2017		
Dec-17	**0**	
Nov-17	**0**	
Oct-17	**1**	Further correspondence received from the same member of public relating to issues raised in June 2017.
Sep-17	**0**	
Aug-17	**0**	
Jul-17	**0**	
Jun-17	**1**	Query raised by member of public re Development Consent conditions
May-17	**0**	
Apr-17	**0**	
Mar-17	**0**	
Feb-17	**0**	
Jan-17	**0**	
2016		
Dec-16	**0**	
Nov-16	**0**	
Oct-16	**0**	
Sep-16	**0**	
Aug-16	**0**	
Jul-16	**1**	18/07 - Community complaint re slow moving truck on the Putty Road - Colo River area REF cc003236
Jun-16	**0**	
May-16	**0**	
Apr-16	**0**	
Mar-16	**0**	
Feb-16	**0**	
Jan-16	**0**	
2015		
Dec-15	**0**	
Nov-15	**0**	
Oct-15	**1**	A member of the public sent facsimiles dated 15 June 2015, 16 June 2015, 19 June 2015, 24 June 2015, 26 June 2015, 29 June 2015, 30 June 2015, 2 July 2015, 3 July 2015, 11 August 2015, 25 August 2015, 31 August 2015, 12 October 2015 and 13 October 2015. The facsimiles related to a variety of compliance matters, particularly regarding information, consultation, rehabilitation and water related concerns and principally related to historical grievances regarding the time when the quarry was owned and controlled by the previous owner.
Sep-15	**0**	
Aug-15	**0**	
Jul-15	**0**	
Jun-15	**0**	
May-15	**0**	
Apr-15	**0**	

Appendix 7

Minutes of Tinda Creek Quarry Community Consultative Committee Meetings

(Total No. of pages including blank pages = 4)

TINDA CREEK SAND PROJECT
COMMUNITY CONSULTATIVE COMMITTEE
MINUTES OF MEETING HELD ON SITE
TUESDAY 24 MAY 2022

	NAME	ORGANISATION
PRESENT	Lisa Andrews (LA)	Independent Chairperson
	Darryl Thiedeke (DT)	Hy-Tec – National Planning & Development Manager
	Bryan Grant (BG)	Hy-Tec – Quarry Manager
	Ethan Pettiford (EP)	Hy-Tec – Quarries Operations Manager NSW
	Brigitte Lewis (BL)	Community Representative
	Ray Campbell (RC)	Community Representative
	David Cilento (DC)	Hy-Tec – NSW General Manager
APOLOGIES	Jane Robinson (JR)	Putty Community Association delegate
	Bruce Mansell (BM)	Community Representative

WELCOME & INTRODUCTIONS	The chair opened the meeting at 10.02pm with LA welcoming all present and introducing the new Quarry Manager, Bryan Grant (replacing Michael Walton). BG provided some of his professional background and work history on the TC site.	
APOLOGIES	As above.	
DECLARATION OF INTEREST	LA advised that she is an approved Independent Chairperson with the Department of Planning and Environment, appointed by the Secretary to chair this CCC and engaged by Hy-Tec. BG to fill in governance forms and return. **Action.**	**No changes to members' previous declarations**
BUSINESS ARISING	In accordance with the guidelines, the minutes from the previous meeting held remotely on 11 October 2021 were finalised on 30 October 2021 and emailed to members. Action Items – Nil.	
CORRESPONDENCE	• 11/10/21 – Email to members with the presentation, inviting members to review and provide and questions for response by the proponent. Responses received and incorporated into the draft minutes. • 20/10/21 – Email to CCC members with the draft minutes for review • 30/10/21 - Email to CCC members with the finalised minutes • 30/10/21 – Letter to Ray Campbell with the same information • 14/4/22 – Email to members with the Meeting Notice & Agenda for this meeting. • 14/4/22 – Letter to Ray Campbell with the same information. • 21/5/22 - Email to members with the reminder for this meeting.	

REPORT/PROJECT UPDATE	BG commenced the report by advising of the staff changes on site. BG has replaced Michael Walton as the new Manager, there is a new supervisor (to replace him) and they have employed one new full time employee (operator), another Colo Heights resident, which confirms Hy-Tec's commitment of endeavouring to recruit from the local community when positions become available. Sand sales drastically reduced in late last year and this year from lack of available resource in the old domain and delays accessing the new area. March 2022 flooding was bigger than last year causing a 2 week closure of the site and significant damage to areas as a result of this weather. Ongoing repairs to outer-lying access tracks will take time to recover due to the conditions on site. EP explained that staff continued to be employed during this 2 week shutdown. Average rainfall over the last 15 years was 738mm, however, the current YTD figure is already sitting at 1041mm. The weather station outside the office captures the data. Many of the groundwater monitoring bores are actually about ground level. The hydrologist says it's the highest that they have seen since monitoring began with Hy-Tec. There was a further week closure in April 2022 due to the Putty Road being completely closed for landslide remediation works. BL commented on the difficulty that this closure caused for local residents and business owners. The detour was via Wheelbarrow Ridge Road. Access to Domain 7 is underway, however, site conditions are challenging due to high groundwater levels. Major plant upgrades are underway to increase product quality and reduce water loss through production. Recent new works in the rehabilitation area have begun with stripping of weed infested soil and replacing with new soil from Domain 7. Plans are underway to introduce tube stock natives. RC asked if the previous land owner had left anything on site. DT advised that everything had been cleaned up prior to the bush fires. BG advised that all water sampling was undertaken in that area and has come back normal and compliant.	**Pictures were shown by BG to members.**

	Pest control program running currently with BG undertaking a wild dog baiting program on behalf of the NSW Government Local Land Services. Defibrillator has been donated by Hy-Tec to the RFS at Colo Heights. BL thanked Hy-Tec on behalf of the community and advised that they have the money to buy a third defibrillator. RC asked if the people in Putty Valley know that they are available. DC advised that there is one on site at Tinda Creek Sand Mine and one at the RFS, Colo Heights. BL advised that the third one will probably be positioned at the saw mill. DT advised that they Hy-Tec are continuing to work on the offset arrangement with NP&WS, who will take over ownership of this land. Hy-Tec will lease the land back from NP&WS for the life of the mine.	
GENERAL BUSINESS	• BL thanked Hy-Tec again for the defibrillator. • RC asked how the water affected the property next door and whether the land at the front was going to be developed. DT advised that it will be developed in the future, but not for quite some time. DC confirmed that this will be the last cell for the project, possibly 10-15 years away. • BG advised that there are reduced truck movements to and from the site. It should be noted that all Hy-Tec haulers have phone numbers on the sides of the truck and dogs and can be identified.	
NEXT MEETING	Tuesday 11th October 2022 at 10am.	**On site.**

The meeting was closed by the chair at 10.37am with LA thanking all for their attendance.