2021-2022 WAGGA WAGGA QUARRY ANNUAL REVIEW

Wagga Wagga Quarry

ANNUAL REVIEW

Table 0.1: Document Control

Document Title	Environmental Management Annual Review – Wagga Wagga Quarry			
Document Number	WWQAR21-22			
Document Owner	Hanson Construction Materials Pty Ltd			
	Issue Date	**Originator**	**Reviewed**	**Approved**
Draft	30.08.2021	Belinda Pignone	Gemma Vote	Belinda Pignone
Final				
Resubmission				

Table 0.2: Annual Review title block

Name of operation	**Wagga Wagga Quarry**
Name of operator	Hanson Construction Materials Pty Ltd
Development consent / project approval #	MP 07_0069
Name of holder of development consent / project approval	Hanson Construction Materials Pty Ltd
Water licence #	40BL190719 and 40BL190720 for groundwater extraction of 360 ML/year; and WAL37001 (and the associated Water Supply Works Approvals) entitled the quarry to pump 100 ML/year from the Murrumbidgee River.
Name of holder of water licence	Hanson Construction Materials Pty Ltd
Annual Review start date	1 July 2021
Annual Review end date	30 June 2022

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Table 0.3: List of Abbreviations

DPE	**NSW Department of Planning and Environment.**
DPE Water	Division of Water within the NSW Department of Planning and Environment.
DRE	Division of Resources & Energy within the NSW Department of Industry.
EPA	Environment Protection Authority.
RMP	Rehabilitation Management Plan or equivalent plan required under the conditions of a relevant approval
WAL	Water Access Licence
DDG	Deposited Dust Gauge
Relevant approval	Includes the following approvals where they are material to the conduct of the operation: a development consent, project approval, mining lease or water access licence.
Reporting period	Financial year, unless specified otherwise in the relevant conditions of approval or agreed in writing with DPE and DRE.

1. STATEMENT OF COMPLIANCE

Table 1.1: Statement of compliance

Were all conditions of the relevant approval(s) complied with?	
DC MP 07_0069	~~YES~~/NO

Table 1.2: Non-compliances

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in Annual
DP 07_0069	Sch 2, Con 2	Twelve non-compliances were raised within the 2017-2020 IEA where compliance with the conditions of consent was not demonstrated.	Non-compliant	Non-compliance within the 2017-2020 IEA.	Section 7.
DP 07_0069	Sch 3, Con 7	AQMP states PM10 monitoring will be conducted using a HVAS.	Non-compliant	This is for a campaign monitoring event, which was interrupted due to health order travel restrictions. PM10 monitoring continuously occurred via the DustTrak real-time monitor.	Section 6.4.5,

Table 1.3: Compliance status key for Table 1.2

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		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 prepared for the Wagga Wagga Quarry (the Quarry) in accordance with the requirements of *Condition 3(5)* of *Project Approval MP 07_0069 (MP 07_0069)*. The Quarry is owned and operated by Hanson Construction Materials Pty Ltd (Hanson) and located on the floodplain of the Murrumbidgee River five kilometres (km) west of the city of Wagga Wagga, in the Riverina region of NSW, approximately 460km southwest of Sydney (refer to **Figure 1**). This report documents the works undertaken and environmental performance from 1 July 2021 to 31 June 2022 (the reporting period).

MP 07_0069 was granted by the Minister for Planning and Environment (formally Minister for Planning and Infrastructure) on 22 November 2011 and was modified to permit a slight increase of transport movements in the afternoon period in October 2018. A copy of MP *07_0069* is reproducted as **Appendix 1**. *Condition 3(5)* is reproduced below:

> *"By the end of June 2012, and annually thereafter, the Proponent must review the environmental performance of the project to the satisfaction of the Secretary. This review must:*
>
> *a) describe the development (including any rehabilitation) that was carried out in the past year, and the development that is proposed to be carried out over the next year;*
>
> *b) include a comprehensive review of the monitoring results and complaints records of the project over the past year, which includes a comparison of these results against the:*
>
> - *relevant statutory requirements, limits or performance measures/criteria;*
> - *monitoring results of previous years; and*
> - *relevant predictions in the documents referred to in condition 2 of Schedule 2;*
>
> *c) identify any non-compliance over the past year, and describe what actions were (or are being) taken to ensure compliance;*
>
> *d) identify any trends in the monitoring data over the life of the project;*
>
> *e) identify any discrepancies between the predicted and actual impacts of the project, and analyse the potential cause of any significant discrepancies; and*
>
> *f) describe what measure will be implemented over the next year to improve the environmental performance of the project.*

The information presented within this *Annual Review* has been prepared based on information compiled by Hanson.

2.2. THE COMPANY

Hanson Construction Materials Pty Ltd operates over 50 quarries in Australia and supplies aggregates, sand, and premixed concrete materials for the construction industry. The Company also produces precast concrete. The Company is a subsidiary company of Heidelberg Cement which internationally employs approximately 60 000 people at more than 3 000 locations in around 60 countries.

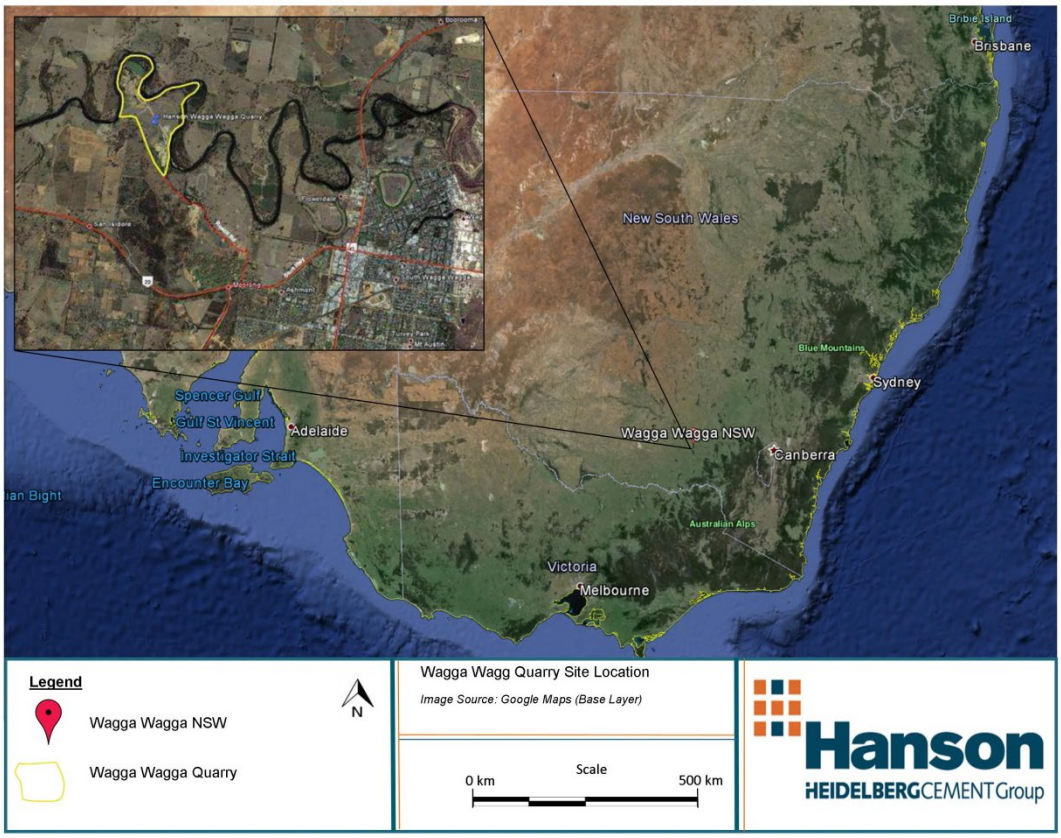

Figure 1: Site location

2.3. OVERVIEW OF OPERATIONS

2.3.1. Approved Activities

The approved activities at the Quarry comprise the following:

- Development and use of an extraction area to extract sand and gravel using standard rip and tear, washing, load and haul techniques.
- Use of a wash plant to process extracted sand and gravel to produce a range of quarry products, and stockpiling of the resulting products within an identified infrastructure area.
- Use of a site access road and interaction with Roach Road.
- Transportation of up to 150,000t per year of quarry products via Roach Road using truck and dog trucks.
- Establishment of native vegetation to provide visual screening for quarry operations.

2.3.2. Hours of Operation

The approved hours of operation are as follows:

- Monday to Friday – 6am to 6m
- Saturdays – 8am to 1pm
- Sundays and Public Holidays – no activities

All activities during the reporting period were undertaken within the approved hours of operation.

2.3.3. Employment

During the reporting period, employment at the Quarry remained at three operational staff, one truck driver, one casual plant operator and the quarry manager. Employment is expected to remain consistent with this level during the next reporting period.

2.4. KEY PERSONNEL CONTACT DETAILS

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

Table 2.1: Key personnel contact details

Name	Position	Contact details
Gemma Vote	Quarry Manager	Gemma.vote@hanson.com.au 0429 940 172
Belinda Pignone	Environmental Planning and Compliance Coordinator	Belinda.pigone@hanson.com.au 0439 131 941

2.5. MANAGEMENT OF DOCUMENT PREPARATION

This document has been prepared by Ms Belinda Pignone (B.Env.Mgt.Sc.) with assistance from Ms Gemma Vote, Quarry Manager. Hanson provided technical input and information on Quarry operations and environmental performance during the reporting period.

Figure 2: General Project Layout

Figure 3: Site Map and Nearest Receivers

3. APPROVALS

Table 3.1 presents the approvals and licences held in relation to the Quarry.

Table 3.1: Approvals and Licence

Consent/Lease/Licence	Issue Date	Expiry Date	Details/Comments
Project Approval 07_0069	22/11/2011 Modified 30/10/2018	31 December 2036	Issued by the Department of Planning and Environment
Environmental Protection Licence EPL 2433	17/01/2000 Variation 03/08/2001 Variation 06/09/2001 Variation 21/06/2004 Variation 11/06/2008 Variation 07/03/2014 Variation 30/11/2015 Variation 04/08/2020	-	Issued by the Environment Protection Authority
Groundwater Access Licence xxxx		-	Issued by the Department of Primary Industries – Office of Water Share component xxML
Surface Water Access Licence xxxx		-	Issued by the Department of Primary Industries – Office of Water Share component xxML

Project MP 07_0069 was approved under Section 75J of the *Environmental Planning and Assessment Act 1979* (EP&A Act). On 30 October 2018, Hanson received approval for a modification (MOD1) to MP 07_0069 to permit an increase from three dispatches to six dispatches between the weekday hours of 3pm to 5pm.

All management plans are regularly reviewed in accordance with *Condition 4 of Schedule 5 of MP 07_0069*. Management Plans will be reviewed in the third quarter of the 2022.

4. OPERATIONS SUMMARY

4.1. INTRODUCTION

Figure 2 presents an overview of the Quarry layout at the end of the current reporting period.

4.2. EXTRACTION OPERATIONS

Wagga Wagga Quarry have continued extraction of sand and gravel from Cell 1/Stage 1 of the quarry by either a front-end loader or excavator and hauled to the processing plant where it is sorted into sellable product. Overburden stripped for preparation and accessibility to Cell 2 extraction activities was stockpiled for future use in rehabilitation and any amenity bunds within the property boundary.

The operational production performance of the Wagga Wagga quarry is shown in **Table 4.1**. The quarry continues to operate well within its allowable limit under the development consent.

Table 4.1: Production summary

Material (specify source)	Approved limit	Previous reporting period (actual)	This reporting period (actual)	Next reporting period (forecast)
Sand & gravel	150,000 tonnes/year	100,000 tonnes	100,000 tonnes	100,000 tonnes

4.3. OTHER OPERATIONS

During the reporting period, progressive construction of Cell 2 continued, principally in relation to cell wall construction. Processing operations required use of the fixed wash plant during the reporting period.

Product transported off site during the reporting period was approximately 100,000 tonnes of material, which is below the approved annual transportation volume of 150,000 tonnes.

There have been no infrastructure upgrades over the 2020-2021 reporting period. There have been no upgrades to the fleet over the 2020-2021 reporting period. Quarry management continue to plant approved native plants in and around Pit 1.

4.4. NEXT REPORTING PERIOD

Extraction operations are expected to continue during the next reporting period, subject to market and internal demand from the Company's other operations. The Company anticipates that production will remain consistent with that achieved in 2021 (see **Table 4.1**). Construction activities related to Cell 2 will continue during the next reporting period.

Processing activities using the Processing Plant are to continue during the next reporting period, with the amount of material to be processed dependant on the demand for the Quarry's products from internal and external customers.

Product transport during the next reporting period will depend on client demand over the year but any change from movement numbers that occurred in the reporting period will not exceed the approved transport volume.

Rehabilitation activities during the next reporting period will extend to the progressive shaping and revegetation of the the site, pending rainfall, as well as active pest control (weeds).

5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

Correspondence from the Department of Planning and Environment regarding the Annual Review 2020-2021 was provided on 4 July 2021. It is noted that the Department had reviewed the Annual Review and considered it to satisfy the reporting requirements of the Consent. Additionally, it was noted that the self-reported non-compliances was reviewed and determined to record the non-compliances with no further enforcement action. It was also reminded that the Annual Review is required to be submitted to the Department by 30 September each year.

6. ENVIRONMENTAL PERFORMANCE

6.1. INTRODUCTION

Environmental monitoring is undertaken to determine the degree of impact the construction and production operations are having on the environment. Assessment of these results can establish if environmental management systems are being successfully applied in the short term and if the management systems need to be amended.

Appropriate environmental monitoring, apart from satisfying necessary statutory requirements, demonstrates to the local community and relevant authorities the Company's commitment to the protection of the environment.

The following sub-sections present the results of the various monitoring programs undertaken throughout the reporting period. Where appropriate, results of the previous years' monitoring are also presented for comparative purposes.

Figure 3 and **Figure 4** provide monitoring locations and residences referred to in this section.

6.2. METEOROLOGICAL MONITORING

Table 6.1 presents the meteorological monitoring and long term-average climate data from the Bureau of Meteorology-operated Wagga Wagga AWS (Station No 74127).

Total rainfall during 2021-2022 period was significantly higher than that in 2020-2021, however individual months varied. When compared with the long-term average recorded at the Wagga Wagga AWS, there is significant variance across the year.

Wind rose data (9:00am and 3:00pm) recorded at the Wagga Wagga meteorological station (Station No. 74127) is provided in **Figure 5**.

Table 6.1: Production summary

Year		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Ann
14-15	Max													
	Min													
15-16	Max													
	Min													
16-17	Max													
	Min													
17-18	Max													
	Min													
18-19	Max													
	Min													
19-20	Max													
	Min													
20-21	Max													

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21-22	Max													
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Long Term Av	Max													
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14-15	Total													
	No. Rain Days													
	Max Daily Rainfall													
15-16	Total													
	No. Rain Days													
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	Max Daily Rainfall													
19-20	Total													
	No. Rain Days													
	Max Daily Rainfall													
20-21	Total													
	No. Rain Days													
	Max Daily Rainfall													
21-22	Total							77.4	78.2	111.2	2.4	32.2	74.2	
	No. Rain Days							5	5	8	2	6	10	
	Max Daily Rainfall							39.6	60.4	32.6	2.0	14.4	30.2	

6.3. NOISE

6.3.1. Predicted Impacts and Performance Criteria

Condition 1 of *Schedule 3* of the *MP 07_0069* stipulates environmental performance conditions for the monitoring and management of noise for the Quarry. The Project Approval specifies; operating hours (**Table 6.2**), noise limit criteria (**Table 6.3**), operating conditions and the preparation of a Noise Management Plan. The locations of the nearest sensitive receivers and the corresponding monitoring locations are shown in **Figure 4**.

Table 5.3 identifies the predicted operating noise levels at two representative residences surrounding the Quarry (**Figure 4**). The EIS concluded that noise levels were predicted to be below the noise limit criterion at all surrounding sensitive receivers.

Table 6.2: Noise Impact Assessment Criteria (dB(A) LAeq(15min)

Location	Day
Kulleroo 2	39
Riverglen	40
All other privately owned land	36

Table 6.3: Approved Operating Hours

Activity	Day	Time
All quarrying operations	Monday – Friday (except Public Holidays)	6am – 6pm
	Saturdays	8am – 1pm
	Sundays and Public Holidays	No activities
Transportation off-site	Monday – Friday (except Public Holidays)	6am – 6pm
	Saturdays	8am – 1pm
	Sundays and Public Holidays	No activities

The Proponent managed noise compliance through the project's Noise Management Plan and the Project Approval conditions of consent. Noise monitoring is to occur on the commencement of a new cell. As the Project has not progressed to the next development stage, no noise monitoring has occurred in the 2021-2022 reporting period. There has been no noise complaints during the reporting period.

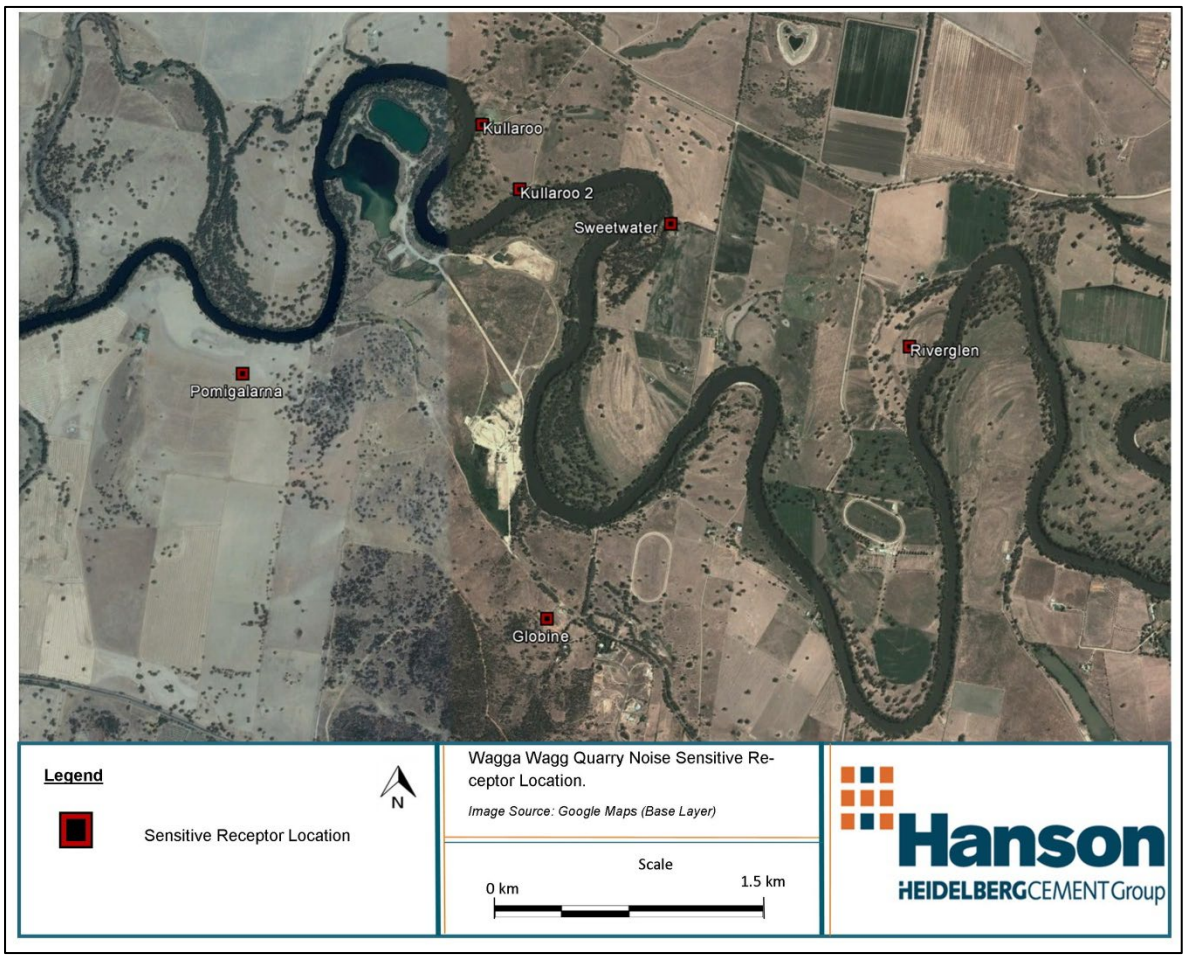

Figure 4: Noise and Air Sensitive Receptors

6.3.2. Measured Performance

No noise monitoring was required to be undertaken during the monitoring period. Previous measured noise levels at all monitoring locations continue to be at or immediately below the predicted noise levels in the 2011 EIS for the attended monitoring assessments.

6.3.3. Discussion and Analysis (Comparison to previous years and EIS)

Monitoring results from previous years (2012-2021) indicated that there was no breach in compliance at the commencement of works of Cell 1 and Cell 2.

There were no noise complaints over the 2021-2022 period, no change from the previous year.

Table 6.4: Noise related complaints

Previous Reporting Period	Internal Complaints	External Complaints
2017-2018	Nil	Nil
2018-2019	Nil	Nil
2019-2020	Nil	Nil
2020-2021	Nil	Nil
2021-2022	Nil	Nil

6.3.4. Non-Compliance and Corrective Actions during the 2021-2022 reporting period

There was no noise related non-compliance during the 2021-2022 reporting period.

6.3.5. Measures Implemented Over 2021-2022

Noise management measures that were implemented over the 2021-2022 period include:

- Prompt response to any community issues of concern.
- Refinement of onsite noise mitigation measures and quarry operating procedures, where practical.

6.4. AIR QUALITY

6.4.1. Predicted Impacts and Performance Criteria

Hanson has continued to operate against the conditional requirements provided in *Schedule 3, Conditions 2, 5, 6* and *7* of *MP 07_0069* and EPL 2433 as well as the approved Air Quality Management Plan. All reasonable and feasible avoidance and mitigation measures must be employed so that particulate matter emissions and dust generated by the Quarry does not cause exceedances in conditions set out in MP 07_0069 and EPL 2433

The EIS concluded that dust deposition levels were predicted to be below the air quality criterion at all surrounding sensitive receivers. **Table 6.5** presents the predicted cumulative air quality impacts at the closest potentially affected residences to the Quarry (**Figure 4**). Cumulative annual TSP and PM_{10} concentrations are predicted to satisfy the air quality criterion at all surrounding sensitive receptor locations for all modelled scenarios. Annual average TSP and PM10 concentrations were predicted to satisfy the air quality criterion at all sensitive receivers. This has been the case at the Quarry, including this Annual Review.

Table 6.5: Predicted Annual Average (Background + Increment) PM10 Concentration (ug/m3)

	PM10 – Annual Average (ug/m3)			
Receptor	***Background***	***Increment***	***Background + Increment***	***Project Goal***
Kullaroo 1	48.7	0.0	48.7	50
Kullaroo 2	48.7	0.2	48.9	50
Sweetwater	48.7	1.0	49.7	50
Riverglen	48.7	0.8	49.5	50
Globine	48.7	0.1	48.8	50
Pomingalarna	48.7	0.1	48.8	50

Tables 6.6, **6.7** and **6.8** present the air quality performance criteria presented in *Condition 5(3)* of *MP 07_0069*.

Table 6.6: PM10 - Annual Limits

Pollutant	**Averaging Period**	**Criteria**
Total Solid Particulates (TSP)	Annual	90 µg/m^3
Particulate matter <10 µm (PM_{10})	Annual	30 µg/m^3

Table 6.7: PM10 - 24-hour Limits

Pollutant	Averaging Period	Criteria
Particulate matter <10 µm (PM_{10})	24hr	50 µg/m^3

Table 6.8: Deposited Dust - Annual and Monthly Limits

Pollutant	Averaging Period	Maximum Project Contribution	Maximum Total Deposited Dust Level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

Particulate matter emissions (PM10) are monitored at the Quarry through the DustTrak system located at the weigh station. PM_{10} emissions have remained compliant with the limits established in *MP 07_0069*.

Five dust gauges are used to monitor deposited dust levels at the sensitive receptor locations. The results of monthly monitoring have generally demonstrated compliance with the annual average deposited dust limits established in *MP 07_0069*.

The Air Quality Management Plan was prepared by PAE Holmes detailing the assessment criteria, the monitoring locations and procedures, and the compliance checking procedures for the subsequent reporting in accordance with the Department of Planning and Environment (DPE) and the Environmental Protection Authority (EPA) requirements. The locations of the closest sensitive receptors are shown in **Figure 4** and **Table 6.9**.

Table 6.9: Closest sensitive receptors

Residence ID	Distance to Site Boundary	Distance to processing Plant	East (m)	North (m)
Kullaroo	0.2	1.7	527572	6117801
Sweetwater	0.2	1.4	528569	6117275
Riverglen	0.7	1.2	529831	6116625
Globine	0.5	1.0	527908	6115201
Pomigalama	0.4	1.5	526301	6116493

All monitoring locations conform to the requirements of AS 3580.1.1:2007, subject to local site constraints. Monitoring activities are outlined in **Table 6.10** and shown in **Figure 5**.

Table 6.10: Monitoring activities and locations

Site No.	Location	Parameter	Instrument	Frequency
DDG1	Dust deposition gauge located to the west of Roach Road just past the entrance to quarry.	Dust Deposition	DDG	30 Days (± 2 days)
DDG2	Dust deposition gauge located approximately 220m northeast of the quarry pit.	Dust Deposition	DDG	30 Days (± 2 days)
DDG3	Dust deposition gauge located 66m south of the primary sedimentation pond and 155m east of the main access road.	Dust Deposition	DDG	30 Days (± 2 days)
DDG4	Dust deposition gauge located approximately 115m north of the quarry pit.	Dust Deposition	DDG	30 Days (± 2 days)
DDG5	Dust deposition gauge located approximately 216m southeast of the quarry pit.	Dust Deposition	DDG	30 Days (± 2 days)
Met Station	Proximity to Site Offices	Meteorological Parameters	AWS	Continuous
DustTrak	Proximity to Weigh Bridge	PM_{10}	DustTrak	Continuous
HVAS	Proximity to Site Offices	PM_{10} (TSP)	HVAS	1-in-6 day monitoring for three months (completed, second campaign ongoing)

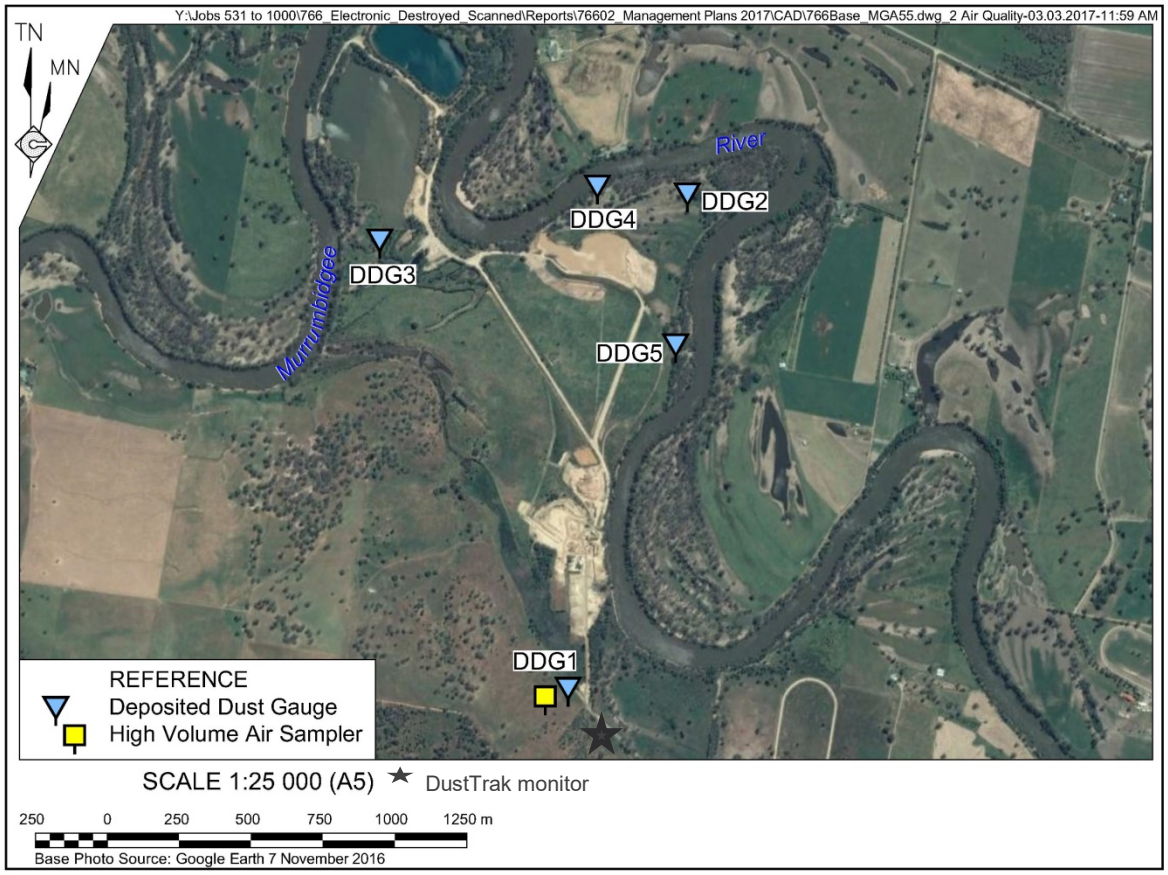

Figure 5: Location of Air Monitors

Under the EPL 2433, air quality emissions are to be monitored on a quarterly basis, as outlined in **Table 6.11**. Each monitoring point location is detailed in the EPL. All air monitoring results is required to be monitored and reported in the yearly annual return documents required by the EPL licencing conditions.

Table 6.11: EPL air monitoring requirements

Locations	Pollutant	Units of Measure	Frequency	Sampling method
DDG 1 (2), DDG 2 (3), DDG 3 (4), DDG 4 (5), DDG 5 (6)	Total Solid Particles	Grams per square metre per month	Quarterly	Australian Standard 3580.10.1-2003

6.4.2. Measured Performance

6.4.2.1. Total Suspended Particulate Matter

TSP was not monitored in the vicinity of the Quarry. The Air Quality Impact Assessment determined that the PM_{10} to TSP ratio was calculated to be 50%. This was applied to the 2021-2022 PM_{10} data to obtain an indicative TSP value in the absence of the TSP readings. Annual PM10 for 2021-2022 was recorded as 10.03 µg/m^3. Therefore, the TSP reading for 2021-2022 period is approximately 20.06 µg/m^3 (**Table 6.12**). This is below the 90 µg/m^3 TSP criteria and hence the Quarry is deemed compliant during the reporting period.

Table 6.12: Total Suspended Particles annual compliance

PM_{10} annual average	PM10 to TSP ratio	Calculated TSP	TSP criteria	Compliant
13.09 µg/m³	50%	26.18 µg/m³	90 µg/m³	YES

6.4.2.2. Deposited Dust

Charles Sturt University performs monthly monitoring on deposited dust at the Quarry. Monitoring over the twelve-month period indicates that there was one instance of monthly levels (Nov 2021) that was higher than 4g/m²/month. All dust deposition gauges fell within the annual criterion of 4g/m²/month.

Deposited dust monitoring commenced at monitoring locations DDG1, DDG2, DDG3, DDG4 and DDG5 on approval of the consent and continued on a monthly basis during the reporting period. The locations of the deposited dust monitoring locations are shown on **Figure 5**. **Table 6.13** presents the results of the deposited dust monitoring program for the 2021-2022 monitoring period and previous monitoring period averages for comparison.

All samples recorded in 2021-2022 varied between 0.2g/m2/month and 8.1g/m2/month. The highest deposited dust level recorded during the reporting period was at DDG3 with one month result above 4g/m²/month(November 2021). This high result is not reflected in the other DDG monitoring locations during this period. Further investigation was undertaken by the consultant with analysis indicating organic contamination of DDG3 (local earthworks).

Table 6.13: Measured Performance – Deposited Dust[1]

Month	Total Insoluble Matter (g/m²/month)					Comment
	DDG1	DDG2	DDG3	DDG4	DDG5	
July	0.9	0.9	1.2	0.5	0.8	
August	0.6	0.5	0.6	0.8	0.3	
September	0.4	0.2	0.2	0.2	0.2	
October	1.5	1.1	1.4	1.6	1.1	
November	3.3	1.2	**8.1**	3	2.3	
December	3.6	1	4.1	1.3	1.8	
January	2.4	1.3	2.3	1.3	1.8	
February	1.1	0.3	2.3	0.2	1	
March	2.3	1.4	2.6	0.9	2	
April	1	0.2	0.6	1	0.7	
May	0.5	0.2	0.2	0.4	0.2	
June	0.8	0.4	0.3	0.2	1.3	
Yearly Average[2]	*1.5*	*0.7*	*2.0*	*1.0*	*1.1*	Annual average compliant at all DDG locations.
2020-2021 Average[2]	*1.3*	*0.9*	*1.1*	*1.1*	*1.1*	
Note1: Units – g/m²/month **Note 2: Averaged over 12-month period** **Note 3: B – Monitoring equipment broken**						
Source: Hanson Construction Materials Pty Ltd						

The 2021-2022 annual average results for dust deposition gauges are similar or lower than results from 2020-2021. Deposited dust monitoring results indicate that average annual rates of dust deposition in the vicinity of the Quarry remain below the criterion levels at each location.

6.4.2.3. Particulate Matter Emissions (PM10 Concentration)

The concentration of PM10, namely that component of suspended particulates with an aerodynamic diameter of 10µm or less, commenced on approval of the consent using a DustTrak PM10 monitor (**Figure 5**). **Figure 6** presents the results of the PM10 dust monitoring during the reporting period. The monitored result for average annual PM10 was 10.03 µg/m^3 during the reporting period, which is below the annual average criteria level of 30µg/m^3.

Wagga Wagga BoM 2021-2022 PM10 24-hour dust concentration is provided in **Figure 7** as an indication of background levels experienced at Wagga Wagga Quarry. The annual average for the North Wagga Wagga BoM was 14.3 µg/m^3.

24-hour averaging period for PM_{10} readings generally fell below the applicable 50 µg/m^3 criterion however there were multiple instances recorded PM_{10} level for the 24-hour averaging period that were at or just below the criteria of 50 µg/m^3. The majority of the instances had the high levels occur outside of site operational hours. This indicates that site air quality management and mitigation during manned hours at the Quarry was reasonable and effective.

Based on this review PM_{10} emissions have been compliant with the limits established in *MP07_0069* and EPL 2433.

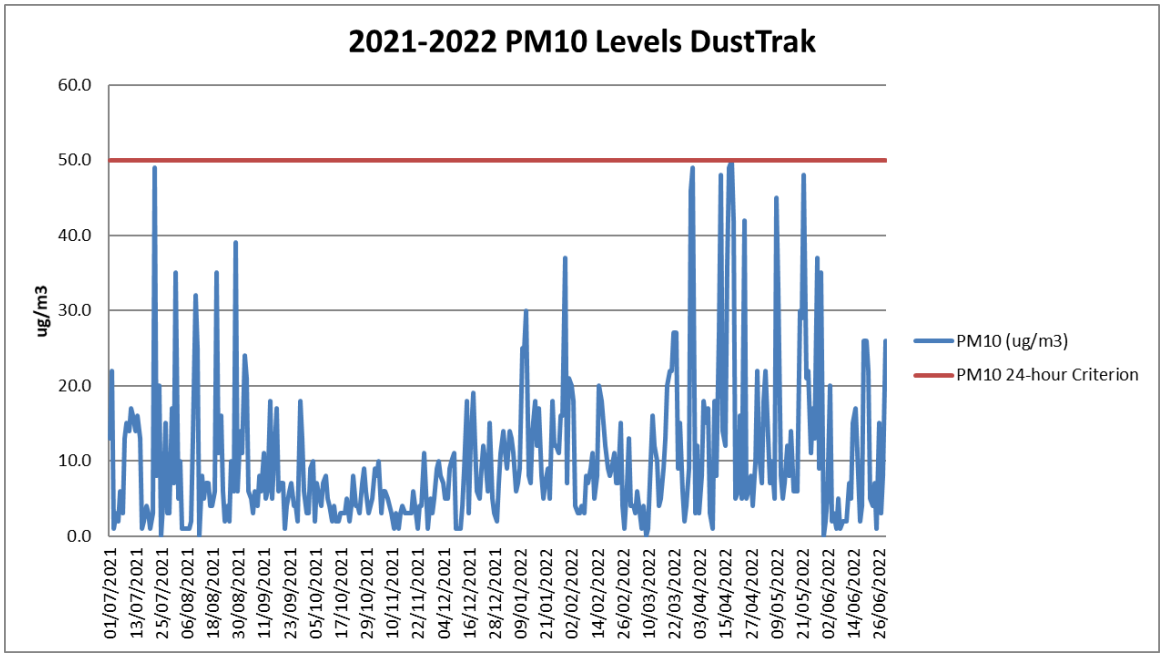

Figure 6: Site PM_{10} monitoring over the 2021-2022 period.

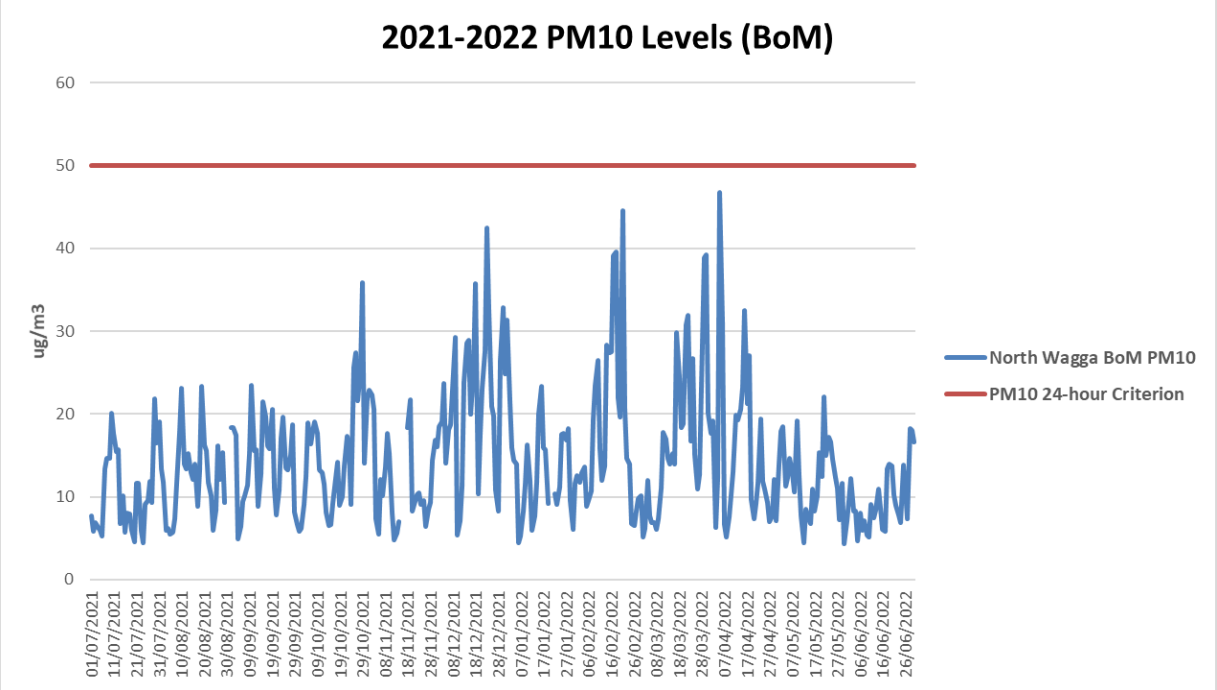

Figure 7: North Wagga Wagga BoM PM_{10} monitoring over the 2021-2022 period.

6.4.3. Monitoring Results from Previous Years

There has been a decrease in 2020-2021 DDG results when compared to previous years (**Table 6.14**). This is most likely contributed to drought conditions ending and limited bush fire events occurring in the reporting period.

Table 6.14: Air monitoring comparison 2015-2021

Year	PM_{10}(µg/m³)	TSP (µg/m³)	DDG (g/m²/month) annual average
2017-2018	21.0 µg/m³ (Compliant)	42.0 µg/m³ (Compliant)	DDG1: 1.8 g/m²/month Compliant DDG2: 3.4 g/m²/month Compliant DDG3: 1.8 g/m²/month Compliant DDG4: 1.3 g/m²/month Compliant DDG5: 1.2 g/m²/month Compliant
2018-2019	35.0 µg/m³ (Non-Compliant)	70.0 µg/m³ (Compliant)	DDG1: 2.4 g/m²/month Compliant DDG2: 2.7 g/m²/month Compliant DDG3: 2.5 g/m²/month Compliant DDG4: 1.7 g/m²/month Compliant DDG5: 2.7 g/m²/month Compliant
2019-2020	25.9 µg/m³ (Compliant)	51.8 µg/m³ (Compliant)	DDG1: 2.0 g/m²/month Compliant DDG2: 1.8 g/m²/month Compliant DDG3: 1.4 g/m²/month Compliant DDG4: 2.0 g/m²/month Compliant DDG5: 1.6 g/m²/month Compliant
2020-2021	13.09 µg/m³ (Compliant)	26.18 µg/m³ (Compliant)	DDG1: 1.3 g/m²/month Compliant DDG2: 0.9 g/m²/month Compliant DDG3: 1.1 g/m²/month Compliant DDG4: 1.1 g/m²/month Compliant

			DDG5: 1.1 g/m^2/month Compliant
2021-2022	10.3 µg/m^3 (Compliant)	20.6 µg/m^3 (Compliant)	DDG1: 1.5 g/m^2/month Compliant DDG2: 0.7 g/m^2/month Compliant DDG3: 2.0 g/m^2/month Compliant DDG4: 1.0 g/m^2/month Compliant DDG5: 1.1 g/m^2/month Compliant

6.4.4. Discussion and Analysis

The results of dust and particulate monitoring during the reporting period demonstrated similar results compared to past years. DDG3 experienced one month where results above 4g/m2/month which is most likely due to localised earthworks.

Review of historic deposited dust and particulate matter monitoring indicates the following.

- There is no discernible trend in deposited dust monitoring results with deposited dust levels generally remaining within criteria levels.
- Particulate matter emissions have increased over levels recorded in 2016 and 2017 which may have resulted from the increased intensity of operations as they have increased to the approved levels.
- Particulate matter emissions have fluctuated over the last three years (2019, 2020, 2021) due to weather and climate changes (drought into El Nina).

6.4.5. Non-Compliance and Corrective Actions

The HVAS monitoring was not undertaken in the 2021-2022 reporting period. The HVAS is for a campaign monitoring event, which was interrupted due to health order travel restrictions. The campaign will be completed in next reporting period.

It's important to note that PM10 monitoring continuously occurred via the DustTrak real-time monitor.

6.4.6. Measures Implemented 2021-2022

Specific dust management practices and mitigation measures are practiced at Wagga Wagga Quarry as detailed in the Air Quality Management Plan and continued throughout the 2021-2022 reporting period. Utilisation of the watercart prior to weekend shutdown is undertaken, especially when weather conditions are predicted to impact air quality levels when the quarry is not operating.

6.5. TRANSPORT

6.5.1. Overview

Truck movements are monitored through SAP Transportation Management System that registers the orders that leave the Quarry. This system ensures that the existing limits on hourly product truck despatch are not exceeded. However, in some cases customers request that a single truck order is despatched on two orders with the result that a single truck despatch is counted twice. This process has resulted in some non-compliance records, however, does not represent an exceedance of truck limits.

The Environmental Impact Statement (EIS) states that no matters should arise from the Quarry expansion other than noise attenuation. This matter was further explored in the application to modify the shoulder morning period truck movements in 2018-2019.

6.5.2. Relevant Statutory Requirements and Criteria

Schedule 3, Condition 17 of the *Project Approval* requires Hanson to keep accurate records of transported product material. Schedule 2, Condition 6 states:

The Proponent shall not:

(a) transport more than 150,000 tonnes of product from the site per calendar year;

(b) permit more than six heavy vehicle movements per hour (total of all quarry haulage truck movements into and out of the site) between 3:00pm and 6:00pm on any weekday, unless in the case of emergency or under the direction of police or other relevant authority.

Schedule 3, Condition 22 of Project Approval requires the implementation of a Transport Management Plan and Driver's Code of Conduct. The objectives of the Transport Management Plan are to:

- Ensure compliance with the conditions included under Schedules 2 & 3 of the Department of Planning and Infrastructure consent conditions with respect to traffic and transport matters;
- Encourage compliance and acceptance of the Truck Driver Code of Practice by all heavy vehicle drivers using the Quarry.
- Minimise traffic and transport impacts of the Quarry on the community,
- Foster an understanding and awareness within the company of community expectations and legislative requirements;
- Protect and enhance public safety through compliance with relevant road rules; and
- Increase occupational health and safety (OH&S) understanding in relation to fatigue, vehicle operation in public areas and obligation to general public.
- Heavy vehicle drivers hauling from Wagga Wagga Quarry must;
- Have undertaken a site induction carried out by an approved member of the Quarry staff or suitably qualified person under the direction of the Quarry management;
- Hold a valid driver's licence for the class of vehicle that they operate;
- Operate the vehicle in a safe manner within and external to the Quarry site;
- Comply with the direction of authorised site personnel when within the site; and
- Comply with the Australian Road Rules external to the site.

6.5.3. Monitoring Results

The potential exceedance and corresponding reasoning for potential exceedances during the 2020-2021 period is reported in **Table 6.15**. The full list of movements of the 2020-2021 period is found in **Appendix A.**

Table 6.15: Movement exceedance between 1/07/2021 to 30/06/2022

Date	Time	Number allowed	Number dispatched	Reason	Compliant
19.08.2021	15-16	6	7	No Breach (system counted split load as two dispatches).	Yes
03.11.2021	15-16	6	7	No Breach (system counted split load as two dispatches).	Yes

6.5.4. Monitoring Results of Previous Years

As seen in Table **6.16**, there has been a decrease in the number of breaches over the last three years.

Table 6.16: Truck dispatch yearly comparison

Reporting Period	Number of truck dispatch exceedances
2017-2018	There were two (2) instances where the transportation movements exceeded the stipulated 3 dispatches per hour between the hours of 3pm-6pm and four (4) instances where the Saturday dispatch hours were exceeded.
2018-2019	There were no instances where transportation movements exceeded the stipulated 3 dispatches (now 6 as of October 2018) between the hours of 3pm-6pm (now 3pm-5pm and 3 dispatches between 5pm-6pm as of October 2018). There were no instances where the Saturday dispatch hours were exceeded.
2019-2020	There were no instances where transportation movements exceeded the stipulated 6 dispatches between the hours of 3pm-5pm and 3 dispatches between 5pm-6pm. There were no instances where the Saturday dispatch hours were exceeded.
2020-2021	There were no instances where transportation movements exceeded the stipulated 6 dispatches between the hours of 3pm-5pm and 3 dispatches between 5pm-6pm. There were no instances where the Saturday dispatch hours were exceeded.
2021-2022	There were no instances where transportation movements exceeded the stipulated 6 dispatches between the hours of 3pm-5pm and 3 dispatches between 5pm-6pm. There were no instances where the Saturday dispatch hours were exceeded.

6.5.5. Non-Compliance and Corrective Actions

There were no exceedance in truck movements during the 2021-2022 period.

There were no traffic incidents in the 2021-2022 reporting period, as seen in **Table 6.17**.

Table 6.17: Traffic incidents

Reporting period	Number of incidents	Details of incident
2017-2018	0	n/a
2018-2019	0	n/a
2019-2020	0	n/a
2020-2021	0	n/a
2021-2022	0	n/a

6.5.6. Measures Implemented over 2020-2021

The Quarry continued to operate the SAP counting system to monitor and manage truck dispatch numbers. New rules incorporated into the SAP reporting software has reduced the number of false positives such as split loads.

6.6. WATER MANAGEMENT

Water level monitoring is undertaken in seven (7) groundwater monitoring bores, while surface water quality is tested monthly. The implementation of the *Water Improvement Program* (Evans & Peck, 2013) has resulted in the Quarry adopting the use of a recycled processing water system. The consequential environmental improvement is the cessation of the need to draw processing water directly from the Murrumbidgee River. Accordingly, Hanson has removed the two river pumps and installed these within the internal water recycling system.

The water balance modelling undertaken in the 2011 EIS noted that the average demad for water at all stages of the quarry project range between 285ML to 360ML. 2021 water take of xxML is within the estimated take the Project.

6.6.1. Surface Water

6.6.1.1. Predicted Impacts and Performance Criteria

The water management system involves:

- Extraction of material from the active cell (known as Cells 1 – 5) with dewatering redirecting groundwater to Process Plant Basin.
- The Process Plant Basin supplies the process plant with water.
- Waste (process) water from the process plant is either: - Discharged to the Process Plant Basin for recycling; or - Be used in the hydrocyclone sand processing plant then discharged to the wetland west of the process plant or if full, redirected to the Process Plant Basin for recycling.
- Process water directed to the Process Plant Basin shall be treated by settling and used for operation of the plant. Excess water shall discharge to Pit 2 with the existing open drain being extended to discharge to Pit 2.
- Pit 2 is to be used as a settling pond and storage for supply of the Process Plant Basin when required.
- Surplus from Pit 2 shall be transferred to Pit 1 then, subject to Environmental Protection License 2433 (EPL) water quality criteria being achieved, discharged to the Murrumbidgee River.
- Open voids (such as the active cell) capture direct rainfall which then forms part of the above system.
- Water extraction from the Murrumbidgee shall generally not be required, however, periodic use may occur if water quality in Pit 2 is inadequate for plant operating purposes

Condition L2.5 of the Quarry's Environment Protection Licence 20190 requires that water discharged from licenced discharge point W1 complies with the following water quality performance criteria.

- Total Suspended Solids – 50mg/L.
- Oil and Grease – 10mg/L.
- pH – between 6.5 and 8.5.

The Soil and Water Management Plan indicates that monitoring would be undertaken monthly during discharge. In addition, the Soil and Water Management Plan identifies that the following data will be recorded in this Annual Review.

- Volume of water used for dust suppression purposes.
- Volume of water imported to Site.
- Specific measures implemented as part of the water use reduction program, and their effectiveness.

The site is required to comply with Section 120 of the *Protection of the Environment Operations Act 1997*. The site has one (1) licenced discharge point to the Murrumbidgee River. The site's EPL stipulates performance criteria for discharge of water from site. Water discharged from the discharge point waters is not to exceed a water quality of TSS concentration of 50 mg/L during discharges.

6.6.1.2. Measured Performance

No water discharge occurred in 2021-2022 monitoring period. However, water quality monitoring still occurred in Pit 2 on a monthly basis, **Table 6.18**.

Table 6.18: 2021-2022 Discharge Surface Water Quality Results

Month	Location	Test Type	Results	Criteria
July 2021	River	Lab	Conductivity – 140 µS/cm pH – 6.8 TSS – 50 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 450 µS/cm pH – 6.8 TSS – <2 mg/L	
August 2021	River	Lab	Conductivity – 141 µS/cm pH – 8.0 TSS – 9 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 458 µS/cm pH – 7.8 TSS – <2 mg/L	
September 2021	River	Lab	Conductivity – 175 µS/cm pH – 7.0 TSS – 29 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 460 µS/cm pH – 7.7 TSS – <2 mg/L	
October 2021	River	Lab	Conductivity – 103 µS/cm pH – 7.4 TSS – 20 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 467 µS/cm pH – 7.5 TSS – 7 mg/L	
November 2021	River	Lab	Conductivity – 180 µS/cm pH – 6.6 TSS – 36 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 468 µS/cm pH – 7.2 TSS – <2 mg/L	
December 2021	River	Lab	Conductivity – 121 µS/cm pH – 7.6 TSS – 23 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 485 µS/cm pH – 7.4 TSS – <2 mg/L	
January 2022	River	Lab	Conductivity – 114 µS/cm pH – 6.2 TSS – 25 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 496 µS/cm pH – 6.8 TSS – 7 mg/L	
February 2022	River	Lab	Conductivity – 105 µS/cm pH – 7.9 TSS – 16 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 515 µS/cm pH – 8.2 TSS – 2 mg/L	
March 2022	River	Lab	Conductivity – 144 µS/cm pH – 6.6 TSS – 584 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 508 µS/cm pH – 7.3	

			TSS – 2 mg/L	
April 2022	River	Lab	Conductivity – 164 µS/cm pH – 7.9 TSS – 7 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 535 µS/cm pH – 7.1 TSS – <2 mg/L	
May 2022	River	Lab	Conductivity – 121 µS/cm pH – 8.1 TSS – 14 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 531 µS/cm pH – 7.9 TSS – <2 mg/L	
June 2022	River	Lab	Conductivity – 519 µS/cm pH – 8.7 TSS – 7 mg/L	pH – 6.5 and 8.5 TSS – 50mg/L Oil and Grease – 10mg/L
	Pit 1		Conductivity – 122 µS/cm pH – 8.8 TSS – 13 mg/L	

6.6.1.3. Discussion and Analysis

Water use during the reporting period was within the licenced allocation per annum (see **Appendix C**). No water discharge occurred in the reporting period.

6.6.2. Groundwater

The implementation of the Water Improvement Program (11 March 2013), Evans & Peck, in particular the Water management Option 1 identified in that report, has resulted in the quarry adopting the use of a recycled processing water system. The consequential environmental improvement is the cessation of the need to draw processing water directly from the Murrumbidgee River. Accordingly, Hanson has removed the two river pumps and installed these within the internal water recycling system. The current licensed groundwater allocation in this period is 475.3 ML with total groundwater take from all pits sitting at 457.5 ML/year.

Groundwater data is recorded hourly using Dipper Logger Heron Software. This data is stored in the Dipper Logger and is collected periodically and uploaded digitally. The compensated water depth (MB GL) of groundwater from the seven monitoring bores is depicted in **Figure 8**.

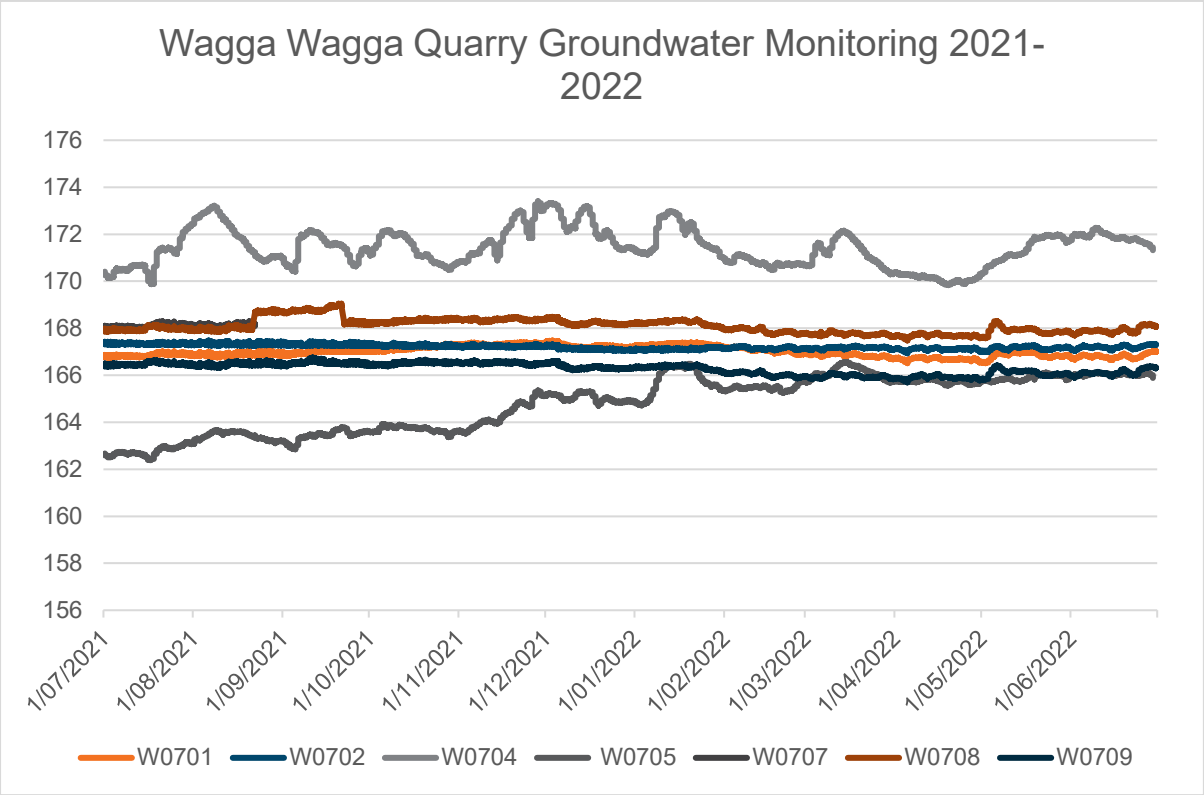

Figure 8: Groundwater Monitoring Bore Results

In 2021 Hanson gained approval from the Secretary to allow extraction to a depth of 152 m AHD for Stage 1 to 5 of the Project, fulfilling the requirements within Condition 7 of Schedule 2.

The water management performance verification report concluded that the site has implicated the recommendations of the CMR and achieved all of the requirements of Condition 16 of the Project Approval Conditions. Assessment of groundwater monitoring and review of groundwater modelling concludes that the deepening of the Wagga Wagga Quarry to 152 m AHD shall not result in any groundwater drawdown in excess of that anticipated in the EA.

Table 6.19: Quarry water licencing entitlements

WAL #	Water sharing plan, source and management zone (as applicable)	Entitlement
WAL37001	Murrumbidgee regulated river water source	100 Units
WAL3788	Murrumbidgee regulated river water source	50 Units
WAL33474	Wagga Wagga alluvial groundwater source	360 Units
SWC784733 & SWC784450	Temporary water allocation.	143 Units

6.6.2.1. Predicted Impacts and Performance Criteria

Potential groundwater-related impacts associated with the approved Quarry include drawdown of the regional aquifer of approximately 0.6m as the Extraction Area is extended to its final depth. No significant impacts are anticipated on groundwater quality and flow, surrounding groundwater users, or Groundwater Dependent Ecosystems.

Section 11.3 of the Soil and Water Management Plan identifies the following groundwater level performance criteria for surrounding non-Quarry related bores.

- standing water level below 10th percentile measured level; or
- standing water level below intake during normal operation of the bore.

6.6.2.2. Measured Performance

Monitoring of groundwater standing levels was undertaken using automated data loggers which record standing water levels every six hours. It is noted that standing water levels are also measured manually each quarter by Geolyse. Figure 10 presents the results of monitoring of standing water levels between 1 January 2021 and 31 December 2021 within bore holes BH1 to BH5 (bore locations are provided on Figure 3). Long-term monitoring results between 1 January 2013 and 31 December 2021 are presented in Figure 11.
(figure)Groundwater Standing levels (July 2021 to June 2022) inc monthly rainfall totals
(figure) Groundwater Standing Water Levels (if possible, five years of data)

Annual groundwater quality monitoring continued in 2021, with field analysis undertaken in April, July, and November 2021.

6.6.3. Flooding History at the Site

Wagga Wagga Quarry is located on the banks of a large meander of the Murrumbidgee River. Due to the locality of the quarry, it has been subject to four major flooding events.

December 2010 where the Murrumbidgee River reached 9.702m (15.5 years ARI); and

March 2012 in which the Murrumbidgee River reached 10.602m (58years ARI). Data was taken from the Wagga Wagga gauge (410001).

13 September 2016 where the Murrumbidgee River reached 8.318m.

5 October 2016 where the Murrumbidgee River reached 8.952m.

In both flooding events of 2016, the repairs riverbank and fuse plug/spillway of Pit 2 performed as per its design.

Cell 1 levee suffered damage during the flood event on 13 September 2016. The damage area was under repair when the river flooded again three weeks later on 5 October 2016. This flood was higher than the 13 September flood and the flood waters caused further damage which resulted in a scoured breach from the Cell 1 pit to the river as well as the loss of bore 705.

It should be noted that the river levels only raised high enough to fill the low-lying channels and gullies adjacent to the Cell 1 levees. The perched water caused the levees to become saturated and resulted in localised collapses. The breach has since been repaired and the Cell 1 pit is in the stages of completing repair works to the damaged areas.

6.6.4. Discussion and Analysis

6.6.4.1. Standing Water Levels

The monitoring data presented in Figure 10 indicate that standing water levels within all bores experiencing increases in standing water levels through the reporting period. Upon review of the long-term records, it can be concluded that the groundwater table in the vicinity of these bores is experiencing infiltration during heavy rainfall experienced in 2021. It is expected that the groundwater table will return to equilibrium once La Nina has pasted, similar to what was experienced after 2016 high rainfall event.

Consistent with previous years, there was limited variation in water levels in bore hole BH5 when compared to BH1-BH4, demonstrating its relatively slow equilibration that has been noted in previous Annual Reviews. Hydraulic testing of this bore for the original Environmental Assessment (Hanson, 2009) indicated a permeability of less than 0.0001m/day. The yield of bore BH5 was assessed to be significantly lower than the remaining four monitoring bores as a result of weathering in the vicinity of these bores and the nature of the basalt surrounding bore BH5. Therefore, the Company considers that the fluctuations in groundwater levels at this bore are the result of water within the bore being removed for sampling and very slowly returning to an equilibrium level.

The Company notes that all ground-disturbing activities were well above the regional water table during the reporting period. As a result, the Company contends that the fluctuations in groundwater levels are wholly attributable to natural causes.

Continued water quality monitoring is completed in accordance with EPL, Project Approval Conditions and Water Management Plans.

Wagga Wagga Quarry has seven (7) active borehole water depth loggers located on site collecting and recording continuous water depth and temperature readings. The locations of these monitoring boreholes are depicted in **Figure 7**.

Figure 9: Location of Groundwater Monitoring Bores (no logger in 706)

Surface Water Results

Water is tested monthly from the “Settling Pond” and the “River”. All results during the reporting period comply with the limits stipulated within the EPL. No discharges occurred during the 2019-2020 period.

Table 6.20: Surface Water Monitoring Results

Month	Location	Conductivity	pH	TSS
July	Settling Pond	393	8.1	4
	River	208	8.0	31
August	Settling Pond	137	7.7	25
	River	304	7.0	18
September	Settling Pond	104	7.7	13

	River	307	8.3	37
October	Settling Pond	311	8.0	78
	River	61	8.2	25
November	Settling Pond	400	8.6	8
	River	61	8.7	24
December	Settling Pond	N/A	N/A	N/A
	River	N/A	N/A	N/A
January	Settling Pond	N/A	N/A	N/A
	River	N/A	N/A	N/A
February	Settling Pond	340	7.9	21
	River	160	7.5	203
March	Settling Pond	411	8.3	8
	River	127	7.8	10
April	Settling Pond	408	8.4	5
	River	278	8.2	9
May	Settling Pond	405	8.0	6
	River	204	8.1	8
June	Settling Pond	399	8.0	9
	River	180	8.0	16

6.6.5. Monitoring Results of Previous Years

Results are consistent with those of the 2020-2021 reporting period.

Table 6.21: Comparison between previous reporting periods

Reporting Year	Exceedances
2015 - 2016	Nil
2016 - 2017	Nil
2017 – 2018	Nil
2018 – 2019	Nil
2019 - 2020	Nil
2020-2021	Nil

6.6.6. Non-Compliance and Corrective Actions

There has been no discharge during 2020-2021 period with no monthly monitoring results outside of the EPL levels therefore no non-compliances. Groundwater levels have remained consistent.

6.7. REHABILITATION PERFORMANCE DURING THE REPORTING PERIOD

The site operates in accordance with the Wagga Wagga Quarry Rehabilitation Management Plan. The site has not conducted any vegetation clearance during the reporting period.

Self-seeding has been the predominant rehabilitation strategy applied at Wagga Wagga quarry. Mature *Eucalyptus camaldulensis* dominate the banks of the Murrumbidgee River. Pollination by insects, birds and small mammals, enables the species to release numerous fertilised seeds per year. If the conditions are acceptable, these seeds will germinate into viable saplings. The succession of vegetation in these areas will develop soil structure integrity and promote associated ecological system benefits.

Hanson has endeavoured to implement management measures in accordance with the Project Approval to minimise impact on threatened species, populations and EECs. Under Schedule 3, Condition 38 of MP 07_0069, the Quarry is required to rehabilitate the site in accordance with objectives in **Table 6.22**.

The Project Approval requires a Rehabilitation Management Plan. The Statement of Commitments stipulates the following:

- Vegetation Clearance Management Plan
- Revegetation Plan
- Feral Animal Control Management Plan
- Weed Management Plan

The Wagga Wagga Quarry Rehabilitation Management Plan includes a Vegetation Clearance Management Plan, Revegetation Plan, Feral Animal Control Management Plan and Weed Management Plan.

Table 6.22: Performance against the Rehabilitation Management Plan

Objective Outlined in Management Plan	Compliance over the reporting period
Clearing of native vegetation, hollow stumps and fallen timber	
Any hollow logs currently present within Cell 1 of the proposal will be removed and stockpiled for use in restoration following the completion of extraction at each stage. Logging waste will be stockpiled on the outer of Cell 1 (to the North-East) away from the area which is to be excavated for the quarry pit.	*Logs were re-allocated on site.*
Vegetation to be retained outside of the extraction areas will be fenced off to protect it from machinery.	*Rehabilitation area has been fenced off.* *Vegetation is excluded by the strategic construction and use of haul roads on site and identified workings areas, preventing off road transit.*
Top soil will be stockpiled and used in rehabilitation work as each stage is exhausted. It is expected that Cell 1 and about 80m to the south will be filled back to the existing ground level and revegetated on completion of extraction in Cell 1. The remainder of Cells 2 and 3 will be flooded and used for water storage upon their completion of extraction.	*Top soil is stockpiled when it is not used for works on site directly. Cell 1 has not been exhausted and therefore the majority of this recommendation has not been triggered.*

Quarry sand and gravel material will be extracted using a 40T excavator and material will be transported to the crushing plant in the south of the property via 35T dump trucks.	*Noted.*
The banks of each stage will be revegetated with native plant species similar to the surrounding vegetation community (river red gum forest/woodland), ultimately resulting in a series of dams similar to the restored area in the north-west of the existing Pit 1.	*Not yet triggered.*
A fauna expert/trained wildlife rescue person will be called in the event that any wildlife is found during the removal of the hollow bearing tree within Cell 4. This person will be trained in handling and identification of a range of fauna, particularly birds and bats and be vaccinated for rabies as protection against the bat lyssavirus.	*Not triggered*
Revegetation and prevention of feral animals	
Baiting of rabbits, foxes and cats within the confines of the quarry as required.	*Not required during the reporting period*
Areas outside the quarry pit areas that are revegetated, including the riparian vegetation along the Murrumbidgee River, will be fenced to prevent cattle from entering. Fences will be maintained in good repair and will be regularly patrolled. The use of barbed wire will be avoided as squirrel gliders and other fauna are known to become tangled and could suffer a long and painful death.	*The fences around the property were replaced following the 2012 Floods. The fences are inspected by quarry staff approximately every quarter. In addition, the adjacent landholder inspects fencing regularly as part of his cattle farming operations.*
Revegetation will allow a natural regrowth of trees, shrubs and groundcovers. River Red Gums are likely to spread from local seed, however shrubs and groundcovers may need to be planted. Only species natural to the River Red Gum Forest/Woodland will be planted.	*Noted*
New hauls roads will be constructed to eliminate and impact on existing riparian habitats.	*The site uses designated haul roads*
Weed management control	
Systematic surveys and inspections of land within the control area.	*Quarry manager informally surveys the site for weeds on a regular basis.*
Plan strategic weed management programs for the control area and keep records of such programs	*During the reporting period, Wagga Wagga Quarry was inspected for weeds by Wagga Wagga City Local Council. It was deemed that no significant weeds were identified on site and general hygiene practises on site were deemed satisfactory and actual excavation area free of weed material.*
Treat weeds with an herbicide registered for control in the manner according to the label or any permit for that herbicide.	*During the reporting period, Wagga Wagga Quarry was inspected for weeds by Wagga Wagga City Local Council. It was deemed that no significant weeds were identified on site and general hygiene practises on*

	site were deemed satisfactory and actual excavation area free of weed material.
Coordinate the implementation of weed management plans.	*Noted.*
Control Re-growth annually.	*Noted.*

A Vegetation Management Plan for the Riverbank Repair was prepared June 2013 by Geoff Cunningham Natural Resource Consultants Pty Ltd.

Table 6.23: Performance against the Vegetation Management Plan for the Riverbank Repair

VMP Requirement	Action
The River Red Gums to be established should be grown from locally sourced seed to ensure that the establishing trees have the same genetic qualities as the River Red Gums that are already growing in the vicinity.	In progress.
The trees should be planted from the top of the bank [levee] to the point where the natural growth of the gallery trees ends closer to the river's normal channel. Figure 1 shows the area that is proposed to be planted on both the inside [quarry side] face of the repaired bank and on the river side.	In progress.
A suggested irregular spacing is between 5 and 10 metres.	Noted.
Around each planted seedling an area 3m x 3m square should be protected by rock armouring comprised of stones about 15cm in diameter.	Not implemented. This is considered to be a low risk threat. Fallen tree logs may be substituted where appropriate.
Each seedling should also be protected by a welded mesh tree guard to protect it from grazing by rabbits, kangaroos and wayward sheep or cattle.	In progress.
WITHOUT FAIL, the Quarry Manager should have the tree guards removed as soon as there is an indication that the site is about to experience a flood or high river level. The guards should be progressively removed as the river rises and then replaced at it falls.	In progress.
Any seedlings that die should be immediately replaced as should any that are washed out by floodwater.	In progress.
Any introduced shrubs and trees such as Blackberry, Briar Rose, fruit trees, exotic ornamentals or Willows should be treated with herbicide to remove them from the area being revegetated as soon as they appear.	Not yet triggered.
A maintenance period of four years should apply to the works proposed. This should allow the planted trees to establish sufficiently to allow the tree	Not yet triggered.

guards and star pickets to be removed and an adequate ground cover to establish.	

6.7.1. Monitoring Results

The Project has engaged manual seedling over the riverbank repaired area. Seed base of native grasses has been established with pleasing results. Planting of Red River Gums has been completed at the riverbank repair works. Red River Gum is a species that is planted in accordance with the *Rehabilitation Management Plan*. There have been some dieback of the plantings due to Kangaroos on the site which are being replaced in the seasonally appropriate period of 2020.

Wagga Wagga quarry will continue to operate as is current, which does not include active spraying or removal of weeds on site. Should weeds alter in terms of the species on site, or the spread of weeds, the quarry management will assess site applicable weed maintenance/removal measures.

6.7.2. Monitoring Results of Previous Years

Monitoring results are similar to previous years.

6.7.3. Non-Compliance and Corrective Actions

There have been no non-compliance or corrective actions required in the 2020-2021 period.

6.7.4. Measures Implemented over 2020-2021

Hanson continues to provide maintenance of plantings at the Pit 1 rehabilitation area. Site observations are undertaken to ensure weed management is being undertaken correctly.

7. INDEPENDENT AUDIT

An Independent Environmental Audit of operations under *07_0069* occurred in September 2020. The audit report identified a variety of non-compliances, which can be reviewed via the IEA – available on the Hanson website.

The majority of non-compliances were addressed by Hanson following review of the audit results. A timeline for outstanding matters has been provided to DPE with the majority of non-compliances closed out by June 2021. The next Independent Environmental Audit will take place in the 2023 reporting period.

8. COMMUNICATION

8.1. STAKEHOLDER AND COMMUNITY CONSULTATION

The Wagga Wagga Quarry Community Consultative Committee (WWQCC) was established in accordance with the NSW Government Guidelines for Establishing and Operating a Community Consultative Committee for Mining Projects (Guidelines), (Department of Planning 2007). The committee is made up of representatives of the following:

- Riverview Estate – 4 representatives
- Hanson – 2 representatives, plus a minute taker
- Chair – Independent Chair
- Wagga Wagga City Council – 1 representative

There has been one CCC meeting held during the reporting period (21 November 2021). The Minutes of the Community Consultative Committee Meetings are publicly available on the Hanson website.

The next CCC meeting will either be online or in person, depending on Health Order restrictions and company policy. Next meeting to be held November 2021.

8.2. GOVERNMENT AGENCY CONSULTATION

Correspondence received from government agencies is summarised below:

- Wagga Wagga Quarry Extension Project (MP 07_0069) Annual Review July 2020 - June 2022 (September 2021).
- Wagga Wagga Quarry Environmental Management Strategy approved 1 July 2022.

9. INCIDENT REPORTING

Hanson shall notify the relevant government authorities of any incident associated with the Quarry immediately after the Company becomes aware of the incident, as per the Wagga Wagga Quarry Pollution Incident Response Management Plan. Within 7 days of the date of the incident, Hanson will provide the relevant agencies with a detailed report on the incident.

No incidents have occurred in the 2021-2022 reporting period.

10. CONCLUSION

Hanson has incorporated environmental monitoring and management as an integral component in the operations at Wagga Wagga Quarry. This is shown in Project Approval compliance and lack of complaints pertaining to the project. Hanson's major concern since the 2016 flooding event has been the repair of the riverbank to ensure project compliance and facilitation of the return to standard quarry practices. This reporting period has documented structural completion of these works and the implementation of the *Water Management Improvement Program.*

The project will continue extraction in Cell 1 while prepping Cell 2 for extraction during the next reporting period utilising the same extraction and processing methods.

Hanson's Wagga Wagga Quarry has been operating based on a collegial relationship between the surrounding amenity, community and environment and will endeavour to continue this over the project life.

Appendix A

Transport Movements

Wagga Wagga QuarryTransport Movements Q3 2021 (July - September)

Delivery Da	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-0
01.07.2021								2		1	1	3												
02.07.2021							1		1		2				1									
03.07.2021										1														
05.07.2021							1	3	2		3	1		1		1								
06.07.2021								1	1			2	1	1	3	3								
07.07.2021								1			1		1	1	3									
08.07.2021									2	1	1	3	1	2	1	3								
09.07.2021								2	2		2	3	1	2	1									
12.07.2021								3	3	1	2	2	2	3	3	3								
13.07.2021										3	1		1	1	1	1								
14.07.2021							1	1	3	1		6	3			2								
15.07.2021										1	1			1	1									
16.07.2021									1	1	1					1								
19.07.2021								1	1															
20.07.2021								1			1	1	2											
21.07.2021												1		1	1									
22.07.2021								2		1	1	3	1	2	2	1	1							
23.07.2021							1				1			2	1									
26.07.2021								3	2	1						1								
27.07.2021							1		1		1		1		1	2	1							
28.07.2021								3	1		1	1		1	1	1								
29.07.2021								1		1	1		1	2	1									
30.07.2021								2	1		3	2		1	1	2								
02.08.2021									1	1		2	3	2	4	1								
03.08.2021								2	1	2	1	3	2											
04.08.2021										1			1											
05.08.2021							1		3		2	2	2	2	1	1								
06.08.2021								3	2	1	1			3	2	1								
09.08.2021								5	1	1	1	2		1	2	2								
10.08.2021							1	1		1	1	2	1	1	5	1								
11.08.2021								5	2	2	5	2	2		1	1								
12.08.2021								3	1		1	1	1	2	2									
13.08.2021								1	4	3	4	4	1	2	4									
16.08.2021								3	3	4	1	3			2	1								
17.08.2021									2	2	1	1	2	2	1	1	1							
18.08.2021								1	1	1	3	1	1	3	2	1	1							
19.08.2021								2	3	3		4	2	2	3	7								
20.08.2021								1				4	6	8	6									
23.08.2021								1			1	1				1	1							
24.08.2021							2		1	1	1		1	1		2								
25.08.2021								4		1	1	1		1	2									
26.08.2021								3		5	1	1			1									
27.08.2021								1	2			1				1								
28.08.2021										1	5	4	2											
30.08.2021								1		1	2	5	5	6	6	3								
31.08.2021							1	2	1	2	3	3	4		2									
01.09.2021								3	1	1	2		1	3	2	1								
02.09.2021								3	1	2	2	2	1			1								
03.09.2021									1	2	1	1	1			1								
04.09.2021													1											
06.09.2021								8	2		2		1	1	2	2								
07.09.2021								2	2	2	1	1	1	1	3									
08.09.2021								4		1		1		2	2	5	1							
09.09.2021								4	3	2	1	2	2	4		1								
10.09.2021												1	1		2	1								
11.09.2021									3	1	2	1												
13.09.2021												1	1	3	2	4	1							
14.09.2021								1				2			2	1								
15.09.2021							1	1	1	2	2	1	3	1	3	2								
16.09.2021								2			1	2			1	3								
17.09.2021											1	2	2	1	1	2								
20.09.2021								2	7	2	2			2										
21.09.2021								1	2			1	2	1	2	4								
22.09.2021								4	1		1		1	2	2									
23.09.2021														2	4	1								
24.09.2021										1	2		1		1									
25.09.2021									1															
27.09.2021								2	1		2	1	1	2	3	4								
28.09.2021							1	4		1	3	4		3	2	4								
29.09.2021								1	1	1	2		1	1	1	1								
30.09.2021								2																

* red cells are a split load.

Wagga Wagga QuarryTransport Movements Q4 2021 (October - December)

Delivery Da	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-0
01.10.2021							1	2							2	1								
05.10.2021								4		1		1			1	1								
06.10.2021								1	2	1		1			1	1								
07.10.2021							1		1	1			2	4										
08.10.2021								3	3				3	3	1									
11.10.2021										2	1	3		1										
12.10.2021								1						1		1								
13.10.2021								3	2	1	1	3	1	1		1								
14.10.2021										1		1	1	1	1									
15.10.2021								1	1	2	1	3	2	2	4	2								
19.10.2021							1	2		1	2			2		1								
20.10.2021								2		3	2	3	1	1	1	1	1							
21.10.2021								1	1	2	1													
22.10.2021									2	1	1	2	2	1	3	1								
25.10.2021								2	1	3	1	4	1	2	2									
26.10.2021								1	4		2	2	1	1	1									
27.10.2021									1	1	1	1			1	2	2							
28.10.2021									1		1													
29.10.2021								3			3	3	1	5	2									
30.10.2021										1	1	1												
01.11.2021								2	2		2	2			1	2								
02.11.2021								4		3	1			1	2	1								
03.11.2021								2	2	1	2			3	2	7								
04.11.2021									1		1	1	1		1	2								
05.11.2021									1						1	1								
08.11.2021									1	1			2		4	1								
09.11.2021								1	1	1	1		2	3	2									
10.11.2021								1	1				4	1		1								
11.11.2021								2			1	1	3	1										
12.11.2021							1		1	1	1	2	2	1	2									
13.11.2021											1													
15.11.2021								3			2				2	3								
16.11.2021							1	1	1	1	1	2		2	2	2								
17.11.2021										2	1	1		3	1		2							
18.11.2021										4	1				1	1	1							
19.11.2021								3	1	2	1		1	2	1	2	2							
20.11.2021										1														
22.11.2021								1	3	2	1	2	3	4	2		2							
23.11.2021								1	1	1	1		1	2	1	1	2							
24.11.2021										2	1	2	1	1	2									
25.11.2021								1																
29.11.2021								1		4	3	2	2	3	2		1							
30.11.2021								2	3		2		1	1		1								
01.12.2021								2	1	1	7	4	3	3		3								
02.12.2021											1		1	1	1	2	2							
03.12.2021								3	4	3	2			2	3	3								
04.12.2021												1												
06.12.2021											1		1		1									
07.12.2021							1	5	1	3	1	2	2	3	4	4								
08.12.2021								4	2	4	2	4	2	2	4	3	1							
09.12.2021							1	3	1	4	4	3	3	2	2	3	3	1						
10.12.2021								2		2	2	1	1	1	1									
13.12.2021								1	2	1	4	4	4	6	6	4								
14.12.2021								2	2	2	3		2	1		2	2							
15.12.2021							1	3	5	1		2	2		5									
16.12.2021							1	2	2	3	3	3		2	2	2	1							
17.12.2021							1	4	2	2	2	1	3	1	4									
18.12.2021									2															
20.12.2021								2	7	3	5	5	3	2	4	3								
21.12.2021								2	3	5	5	5	4	4	2									
22.12.2021								1	3	5	4	5												

* red cells are a split load.

Wagga Wagga QuarryTransport Movements Q1 2022 (January - March)

Delivery Da	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-0
10.01.2022									1		1		2		1									
11.01.2022								1		2		1	2	1										
12.01.2022											1	1		2										
13.01.2022									1	2		1												
14.01.2022							1		1	2				2										
15.01.2022									1															
17.01.2022										2		1	1	1		2	1							
18.01.2022								3	1	2	5	2	4	3	3	1								
19.01.2022								2	1	1	1	2	1	1	1	1								
20.01.2022								2		2	2	2	2	2	1	1								
21.01.2022							1	5	5	3	4	4	3	2	5									
22.01.2022											1													
24.01.2022								1						2		1								
25.01.2022								1	1	1	3	3	5	6	1	1								
27.01.2022							2	3	3	3	2	3	4	2	2	4	1							
28.01.2022							1		2	1	1		2	4										
29.01.2022									2															
31.01.2022							1	3	1	4	2	1	2	4	3	5								
01.02.2022							1	3	1	2	2	3	2		1									
02.02.2022							1	4	1	2	2	5	3	4	1	5								
03.02.2022							2	3	4	2	1	4	2	4	4	2								
04.02.2022							1	2	2	3	1	2	3	1	1	3								
07.02.2022							1	1	2	2	1	4	1		2									
08.02.2022							2		1	1	1		1	2			1							
09.02.2022							1	1	1	1	2		2	2	2									
10.02.2022							1			1	3		1	1	1									
11.02.2022									1	2		1	3											
12.02.2022										1														
14.02.2022								5	1	2	2						1							
15.02.2022								1	1	1	1	1	4	2	4	3								
16.02.2022							1	3		4		2	2	2	3	3	2							
17.02.2022							1	3		1	2		1	1	1	1	1							
18.02.2022								3	3	2	2	2	1	1	2	3								
19.02.2022									1	1														
21.02.2022							1	3	3	3	3	1	3	1	2									
22.02.2022								1	1			2	2	1	1	5								
23.02.2022							1	1	1	1	1	2	1	1	3									
24.02.2022							1	2	2	1	2	1		1	2	2								
25.02.2022									2		1	5			2									
26.02.2022										1			3											
28.02.2022							1	2	2		1	1		3	1									
01.03.2022							2		1	1	1	1	1		3	2								
02.03.2022											2	2	2	2										
03.03.2022									2		1	1		1	2	1	1							
04.03.2022							1	3	2	3	2		1	4	3		1							
05.03.2022									1	1	1	1												
07.03.2022							1		2	1	1	1	2		1	1								
08.03.2022							1	4	3	1	1													
09.03.2022								6	1	2	2	2	2	3	2	1								
10.03.2022							1	3	3	2	1	2		3	1	2	1							
11.03.2022							1	1	1	3		4	2	7	3									
12.03.2022									2	1	1	1												
14.03.2022							1	3	1	4	1	2	1	3	2									
15.03.2022								1	1	1	2				1	1								
16.03.2022								3	3	1	2		1	2	2	1	1							
17.03.2022								1	1	1	2		1	2	1	1								
18.03.2022							1	3	1	2	3			2	2									
19.03.2022											1													
21.03.2022											3	2	4	3										
22.03.2022								2		1	1	1	1	1										
23.03.2022							1	2	4	4	3	4	4	2	3	1								
24.03.2022							1	1	1	1	1	1		2	2	1								
25.03.2022							1	2	2	3	1		4	1										
28.03.2022								1					1		3	3								
29.03.2022								2	2	4	1	3	2	1	2		1							
30.03.2022							2	1	3	1	3	1	3	2	3		1							
31.03.2022							1	1		4	2	2	1	4	2	1								

Wagga Wagga QuarryTransport Movements Q2 2022 (April - June)

Delivery Da	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-0
01.04.2022							1	1	1	1	6	1	2	1	4									
04.04.2022							1	1		3	2	1		1										
05.04.2022								1		1	4	2	1	1	2									
06.04.2022							1	2	4	2	4	2	1	1	1									
07.04.2022							1	3					2											
08.04.2022								3		2														
11.04.2022								2	1	1	2	1		1	1	1								
12.04.2022							1	1	4	2	2	3	2	2	4	6	4							
13.04.2022								2		1	4	3	4	1	3	4								
14.04.2022								3	2		1	2	1	1										
19.04.2022							1	1	1	2	3	1	1											
20.04.2022								1	1															
21.04.2022												2	2	3	1	1								
22.04.2022								1		1		1	1	1										
26.04.2022									4	4	3		1	3	1									
27.04.2022							1	1	1	3		1		2	2	1								
28.04.2022							1		1	1		1		2	1	1								
29.04.2022							1	5	4	3	3	1	2			1								
02.05.2022							1	1			3	2		1										
03.05.2022								1		2														
04.05.2022								3	2	1	2	2	2	1		2								
05.05.2022													2	2	1	2								
06.05.2022								1		2	2		2	1										
09.05.2022										2	2	1	1	2	1									
10.05.2022								1	1	1	1		1											
11.05.2022								1	1	1	3		2	1	3									
12.05.2022							3	4	2	1	2		1	3	3	1								
13.05.2022								1	1	1	1	1	1	1										
16.05.2022								2	1		3		1	2	2									
17.05.2022								2	2	1		2	2	3	2	1								
18.05.2022							1	3	4	2	3	3	1			1	1							
19.05.2022							2	2	2	1	1	1	2	2	3	4								
20.05.2022								4	1		1	1	1	2	1	1								
23.05.2022							2	1	3	4					2.00									
24.05.2022							1	1		2	1	2	2	2	1	2								
25.05.2022								2	1		1	1			2	1								
26.05.2022							2	3	2	1		1		5	1		1							
27.05.2022								5	3	1	1	1	2	2		1								
28.05.2022										1														
30.05.2022								2	2	2	4	1												
31.05.2022									3		1	1												
01.06.2022							1								1	1								
02.06.2022								1	2	2	1		1	1	1	1								
03.06.2022							2	4			3	2	1	2	1									
04.06.2022									1															
06.06.2022									2															
08.06.2022									2		1	3		2										
09.06.2022							1	2	3	2	2	2	1	1	2									
10.06.2022								1	1	3		1	1											
14.06.2022								1	4	2		2	2	1	3	2								
15.06.2022								1	2	2	1	1	2	5	5	4								
16.06.2022								6	2	2	8	1	5	1	1	1								
17.06.2022								6	4	2	3	5	3	3	1									
18.06.2022									1															
20.06.2022									1			1		1	1	1								
21.06.2022								4	4	6	6		1											
22.06.2022							1	3		2	3		4		3	1								
23.06.2022							1	4		4	2	1	2	1										
24.06.2022							2	1	2	2	2			1	6									
25.06.2022									2		1	1												
27.06.2022								3	2	1	4	2	1	1										
28.06.2022								1					1											
29.06.2022								1	2		1			1		3								
30.06.2022							1		2	2	2	2	5	1		2								

Appendix B

Air and Water Quality Monitoring

Dust Deposition Gauge Monthly Monitoring

DDG 1				DDG 2				DDG 3				DDG 4				DDG 5			
Month and Year	Monitoring Period	Total Solid Particles	Rolling Annual Average	Month and Year	Monitoring Period	Total Solid Particles	Rolling Annual Average	Month and Year	Monitoring Period	Total Solid Particles	Rolling Annual Average	Month and Year	Monitoring Period	Total Solid Particles	Rolling Annual Average	Month and Year	Monitoring Period	Total Solid Particles	Rolling Annual Average
2022																			
June 2022	*31.05 - 30.06*	0.8	1.5	*June 2022*	*31.05 - 30.06*	0.4	0.7	*June 2022*	*31.05 - 30.06*	0.3	2.0	*June 2022*	*31.05 - 30.06*	0.2	1.0	*June 2022*	*31.05 - 30.06*	1.3	1.1
May 2022	*28.04 - 31.05*	0.5	1.5	*May 2022*	*28.04 - 31.05*	0.2	0.7	*May 2022*	*28.04 - 31.05*	0.2	2.0	*May 2022*	*28.04 - 31.05*	0.4	1.0	*May 2022*	*28.04 - 31.05*	0.2	1.0
April 2022	*25.03 - 28.04*	1	1.7	*April 2022*	*25.03 - 28.04*	0.2	0.8	*April 2022*	*25.03 - 28.04*	0.6	2.1	*April 2022*	*25.03 - 28.04*	1	1.0	*April 2022*	*25.03 - 28.04*	0.7	1.1
March 2022	*24.02 - 25.03*	2.3	1.7	*March 2022*	*24.02 - 25.03*	1.4	0.8	*March 2022*	*24.02 - 25.03*	2.6	2.1	*March 2022*	*24.02 - 25.03*	0.9	1.1	*March 2022*	*24.02 - 25.03*	2	1.1
February 2022	*31.01 - 24.02*	1.1	1.7	*February 2022*	*31.01 - 24.02*	0.3	0.8	*February 2022*	*31.01 - 24.02*	2.3	2.1	*February 2022*	*31.01 - 24.02*	0.2	1.1	*February 2022*	*31.01 - 24.02*	1	1.1
January 2022	*21.12.21 - 31.01.22*	2.4	1.8	*January 2022*	*21.12.21 - 31.01.22*	1.3	0.9	*January 2022*	*21.12.21 - 31.01.22*	2.3	2.1	*January 2022*	*21.12.21 - 31.01.22*	1.3	1.3	*January 2022*	*21.12.21 - 31.01.22*	1.8	1.0
2021																			
December 2021	*30.11 - 21.12*	3.6	1.7	*December 2021*	*30.11 - 21.12*	1	0.8	*December 2021*	*30.11 - 21.12*	4.1	2.1	*December 2021*	*30.11 - 21.12*	1.3	1.3	*December 2021*	*30.11 - 21.12*	1.8	1.0
November 2021		3.3	1.5	*November 2021*		1.2	0.8	*November 2021*		8.1	1.9	*November 2021*		3	1.3	*November 2021*		2.3	0.9
October 2021		1.5	1.4	*October 2021*		1.1	0.8	*October 2021*		1.4	1.3	*October 2021*		1.6	1.2	*October 2021*		1.1	0.8
September 2021		0.4	1.4	*September 2021*		0.2	0.8	*September 2021*		0.2	1.2	*September 2021*		0.2	1.1	*September 2021*		0.2	0.9
August 2021		0.6	1.4	*August 2021*		0.5	0.8	*August 2021*		0.6	1.2	*August 2021*		0.8	1.1	*August 2021*		0.3	0.9
July 2021		0.9	1.4	*July 2021*		0.9	0.8	*July 2021*		1.2	1.2	*July 2021*		0.5	1.1	*July 2021*		0.8	0.9

Wagga Wagga Quarry PM10 data (2021)

Date	PM10 (ug/m2)
01/07/2021	13.0
02/07/2021	22.0
03/07/2021	1.0
04/07/2021	3.0
05/07/2021	2.0
06/07/2021	6.0
07/07/2021	3.0
08/07/2021	13.0
09/07/2021	15.0
10/07/2021	14.0
11/07/2021	17.0
12/07/2021	16.0
13/07/2021	14.0
14/07/2021	16.0
15/07/2021	13.0
16/07/2021	1.0
17/07/2021	2.0
18/07/2021	4.0
19/07/2021	3.0
20/07/2021	1.0
21/07/2021	3.0
22/07/2021	49.0
23/07/2021	8.0
24/07/2021	20.0
25/07/2021	0.0
26/07/2021	4.0
27/07/2021	15.0
28/07/2021	3.0
29/07/2021	3.0
30/07/2021	17.0
31/07/2021	7.0
Monthly Average	*9.9*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2021)

Date	PM10 (ug/m2)
01/08/2021	35.0
02/08/2021	5.0
03/08/2021	10.0
04/08/2021	1.0
05/08/2021	1.0
06/08/2021	1.0
07/08/2021	1.0
08/08/2021	2.0
09/08/2021	13.0
10/08/2021	32.0
11/08/2021	25.0
12/08/2021	0.0
13/08/2021	8.0
14/08/2021	5.0
15/08/2021	7.0
16/08/2021	7.0
17/08/2021	4.0
18/08/2021	4.0
19/08/2021	6.0
20/08/2021	35.0
21/08/2021	11.0
22/08/2021	16.0
23/08/2021	6.0
24/08/2021	2.0
25/08/2021	4.0
26/08/2021	2.0
27/08/2021	10.0
28/08/2021	6.0
29/08/2021	39.0
30/08/2021	6.0
31/08/2021	14.0
Monthly Average	*10.3*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2021)

Date	PM10 (ug/m2)
01/09/2021	11.0
02/09/2021	24.0
03/09/2021	21.0
04/09/2021	6.0
05/09/2021	5.0
06/09/2021	3.0
07/09/2021	6.0
08/09/2021	4.0
09/09/2021	8.0
10/09/2021	6.0
11/09/2021	11.0
12/09/2021	5.0
13/09/2021	6.0
14/09/2021	18.0
15/09/2021	5.0
16/09/2021	10.0
17/09/2021	17.0
18/09/2021	6.0
19/09/2021	7.0
20/09/2021	7.0
21/09/2021	1.0
22/09/2021	4.0
23/09/2021	6.0
24/09/2021	7.0
25/09/2021	4.0
26/09/2021	4.0
27/09/2021	2.0
28/09/2021	18.0
29/09/2021	13.0
30/09/2021	6.0
Monthly Average	*8.4*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2021)

Date	PM10 (ug/m2)
01/10/2021	3.0
02/10/2021	3.0
03/10/2021	9.0
04/10/2021	10.0
05/10/2021	2.0
06/10/2021	7.0
07/10/2021	5.0
08/10/2021	4.0
09/10/2021	7.0
10/10/2021	8.0
11/10/2021	5.0
12/10/2021	4.0
13/10/2021	2.0
14/10/2021	4.0
15/10/2021	2.0
16/10/2021	2.0
17/10/2021	3.0
18/10/2021	3.0
19/10/2021	3.0
20/10/2021	5.0
21/10/2021	2.0
22/10/2021	4.0
23/10/2021	8.0
24/10/2021	4.0
25/10/2021	4.0
26/10/2021	3.0
27/10/2021	7.0
28/10/2021	9.0
29/10/2021	6.0
30/10/2021	3.0
31/10/2021	4.0
Monthly Average	*4.7*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2021)

Date	PM10 (ug/m2)
01/11/2021	5.0
02/11/2021	9.0
03/11/2021	8.0
04/11/2021	10.0
05/11/2021	3.0
06/11/2021	6.0
07/11/2021	6.0
08/11/2021	5.0
09/11/2021	4.0
10/11/2021	3.0
11/11/2021	1.0
12/11/2021	3.0
13/11/2021	1.0
14/11/2021	3.0
15/11/2021	4.0
16/11/2021	3.0
17/11/2021	3.0
18/11/2021	3.0
19/11/2021	3.0
20/11/2021	6.0
21/11/2021	4.0
22/11/2021	1.0
23/11/2021	4.0
24/11/2021	4.0
25/11/2021	11.0
26/11/2021	6.0
27/11/2021	1.0
28/11/2021	5.0
29/11/2021	3.0
30/11/2021	5.0
Monthly Average	*4.4*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2021)

Date	PM10 (ug/m2)
01/12/2021	9.0
02/12/2021	10.0
03/12/2021	8.0
04/12/2021	7.0
05/12/2021	5.0
06/12/2021	5.0
07/12/2021	9.0
08/12/2021	10.0
09/12/2021	11.0
10/12/2021	1.0
11/12/2021	1.0
12/12/2021	1.0
13/12/2021	4.0
14/12/2021	9.0
15/12/2021	18.0
16/12/2021	3.0
17/12/2021	12.0
18/12/2021	19.0
19/12/2021	12.0
20/12/2021	6.0
21/12/2021	5.0
22/12/2021	9.0
23/12/2021	12.0
24/12/2021	9.0
25/12/2021	6.0
26/12/2021	15.0
27/12/2021	5.0
28/12/2021	3.0
29/12/2021	2.0
30/12/2021	7.0
31/12/2021	11.0
Monthly Average	*7.9*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2022)

Date	PM10 (ug/m2)
01/01/2022	14.0
02/01/2022	11.0
03/01/2022	9.0
04/01/2022	14.0
05/01/2022	13.0
06/01/2022	11.0
07/01/2022	6.0
08/01/2022	7.0
09/01/2022	9.0
10/01/2022	25.0
11/01/2022	25.0
12/01/2022	30.0
13/01/2022	8.0
14/01/2022	7.0
15/01/2022	14.0
16/01/2022	18.0
17/01/2022	12.0
18/01/2022	17.0
19/01/2022	8.0
20/01/2022	5.0
21/01/2022	7.0
22/01/2022	9.0
23/01/2022	5.0
24/01/2022	18.0
25/01/2022	12.0
26/01/2022	12.0
27/01/2022	11.0
28/01/2022	16.0
29/01/2022	16.0
30/01/2022	37.0
31/01/2022	7.0
Monthly Average	*13.3*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*25 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2022)

Date	PM10 (ug/m2)
01/02/2022	21.0
02/02/2022	20.0
03/02/2022	18.0
04/02/2022	4.0
05/02/2022	3.0
06/02/2022	3.0
07/02/2022	4.0
08/02/2022	3.0
09/02/2022	8.0
10/02/2022	7.0
11/02/2022	9.0
12/02/2022	11.0
13/02/2022	5.0
14/02/2022	8.0
15/02/2022	20.0
16/02/2022	18.0
17/02/2022	15.0
18/02/2022	12.0
19/02/2022	9.0
20/02/2022	8.0
21/02/2022	9.0
22/02/2022	11.0
23/02/2022	7.0
24/02/2022	7.0
25/02/2022	15.0
26/02/2022	4.0
27/02/2022	1.0
28/02/2022	7.0
Monthly Average	*9.5*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*30 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2022)

Date	PM10 (ug/m2)
01/03/2022	13.0
02/03/2022	4.0
03/03/2022	4.0
04/03/2022	3.0
05/03/2022	6.0
06/03/2022	3.0
07/03/2022	1.0
08/03/2022	4.0
09/03/2022	0.0
10/03/2022	1.0
11/03/2022	7.0
12/03/2022	16.0
13/03/2022	12.0
14/03/2022	10.0
15/03/2022	4.0
16/03/2022	5.0
17/03/2022	9.0
18/03/2022	13.0
19/03/2022	20.0
20/03/2022	22.0
21/03/2022	22.0
22/03/2022	27.0
23/03/2022	27.0
24/03/2022	9.0
25/03/2022	15.0
26/03/2022	6.0
27/03/2022	2.0
28/03/2022	4.0
29/03/2022	9.0
30/03/2022	46.0
31/03/2022	49.0
Monthly Average	*12.0*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*30 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2022)

Date	PM10 (ug/m2)
01/04/2022	3.0
02/04/2022	12.0
03/04/2022	3.0
04/04/2022	8.0
05/04/2022	18.0
06/04/2022	15.0
07/04/2022	17.0
08/04/2022	3.0
09/04/2022	1.0
10/04/2022	18.0
11/04/2022	8.0
12/04/2022	27.0
13/04/2022	48.0
14/04/2022	14.0
15/04/2022	12.0
16/04/2022	36.0
17/04/2022	49.0
18/04/2022	50.0
19/04/2022	42.0
20/04/2022	5.0
21/04/2022	6.0
22/04/2022	16.0
23/04/2022	5.0
24/04/2022	42.0
25/04/2022	5.0
26/04/2022	6.0
27/04/2022	8.0
28/04/2022	4.0
29/04/2022	10.0
30/04/2022	22.0
Monthly Average	*17.1*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*30 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2022)

Date	PM10 (ug/m2)
01/05/2022	11.0
02/05/2022	7.0
03/05/2022	18.0
04/05/2022	22.0
05/05/2022	13.0
06/05/2022	7.0
07/05/2022	10.0
08/05/2022	5.0
09/05/2022	45.0
10/05/2022	33.0
11/05/2022	8.0
12/05/2022	5.0
13/05/2022	7.0
14/05/2022	12.0
15/05/2022	8.0
16/05/2022	14.0
17/05/2022	6.0
18/05/2022	6.0
19/05/2022	6.0
20/05/2022	30.0
21/05/2022	29.0
22/05/2022	48.0
23/05/2022	21.0
24/05/2022	22.0
25/05/2022	11.0
26/05/2022	17.0
27/05/2022	13.0
28/05/2022	37.0
29/05/2022	9.0
30/05/2022	35.0
31/05/2022	0.0
Monthly Average	*16.6*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*30 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Wagga Wagga Quarry PM10 data (2022)

Date	PM10 (ug/m2)
01/06/2022	2.0
02/06/2022	5.0
03/06/2022	20.0
04/06/2022	2.0
05/06/2022	3.0
06/06/2022	1.0
07/06/2022	5.0
08/06/2022	1.0
09/06/2022	2.0
10/06/2022	2.0
11/06/2022	2.0
12/06/2022	7.0
13/06/2022	5.0
14/06/2022	15.0
15/06/2022	17.0
16/06/2022	11.0
17/06/2022	2.0
18/06/2022	4.0
19/06/2022	26.0
20/06/2022	26.0
21/06/2022	22.0
22/06/2022	5.0
23/06/2022	4.0
24/06/2022	7.0
25/06/2022	1.0
26/06/2022	15.0
27/06/2022	3.0
28/06/2022	8.0
29/06/2022	26.0
30/06/2022	20.0
Monthly Average	*9.0*

In accordance with Condition 18 of Schedule 3 within Project Approval 06_0193: The Proponent must ensure that the dust emissions generated by the project do not cause additional exceedances of the criteria listed below

Pollutant	***Averaging Period***	***Criterion***
Particulate Matter <10 um (PM10)	*Annual*	*30 ug/m3*
Particulate Matter <10 um (PM10)	*24 hour*	*50 ug/m3*

Appendix C

Annual Water Balance (Martens, 2022)

Appendix D

Water Management Performance Verification Report: Hanson Quarry (Martens, 2021)

Hanson Construction Materials Pty Ltd

Water Management Performance Verification Report: Hanson Quarry, Roach Road, Wagga Wagga, NSW.

P1806423JR01V01
November 2020

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a water management performance verification report in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Hanson Pty Ltd (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which may include for example site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc*. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Introduction

1.1 Background

This document comprises a water management performance verification report for the existing Hanson Construction Materials Wagga Wagga Quarry. It is written to demonstrate compliance of the water management program with the project approval conditions and progress made regarding the recommendations in the Comprehensive Water Audit (CWA) and Water Management Improvement Program (WMIP). This report is prepared to address Condition 16 of the project approval (Application Number: 07_0069; November 2011).

1.2 Project Approval Conditions

Conditions 8 – 11 of the project approval required the preparation of a surface and groundwater audit (CWA) and a Water Management Improvement Program (WMIP). The Comprehensive Water Management Review (CWMR; Evans and Peck; March 2013) comprised the combined CWA and WMIP.

Condition 16 of the project approval required that:

> *After implementing the approved Water Monitoring Program for at least two years, the Proponent shall prepare and submit to the Director-General a Water Management Performance Verification Report, to the satisfaction of the Director-General. The report shall be prepared to:*
>
> *(a) Demonstrate and verify the predictions made in the EA* (Environmental Assessment)*, particularly with respect to water requirements, pit inflows and recycling / reuse opportunities;*
>
> *(b) Demonstrate progress against the recommendations made in the Comprehensive Water Audit and the Water Management Improvement Program.*
>
> *(c) Verify the surface water and groundwater impacts of the project, through an updated water balance and groundwater model, calibrated using groundwater monitoring data; and*
>
> *(d) Demonstrate that the project would not have an unacceptable surface water or groundwater impact, through application of the calibrated groundwater model referred to above, if extraction was conducted on site below 158 metres AHD.*

1.3 Report Objectives

The broad objectives of this report include:

1. Confirm predictions in the EA regarding water use, pit inflows and recycling / reuse opportunities.
2. Provide an update on the progress made implementing the recommendations of the CWMR.
3. Assess adequacy of groundwater modelling completed in the EA to confirm its adequacy for prediction of further pit deepening.
4. Confirm the acceptability of any impacts on local groundwater and surface water if quarry is deepened to 152 mAHD.
5.

1.4 Recommendations of the Comprehensive Water Management Review

Table 1 provides a summary of the recommendations from the CWMR and the relevant sections of this report which detail the progress made regarding each recommendation.

Table 1: Summary of Comprehensive Water Management Review (CWMR) recommendations (Evans & Peck, 2013).

CWMR Recommendation	Relevant Report Section(s)
1. Adopt Option 1 as the water management process strategy. This Option consists of: a. Dewatering of active cell to top up Pit 2, supply the wetland for conservation purposes and transfer surplus water to Pit 1 prior to discharge to the river. b. Use Pit 2 as a settling pond and supply for the process plant with recycled water. c. Direction of wastewater from process plant back to Pit 2. d. Refill of Cell 1 with subsequent cells' overburden once extraction was complete.	Sections 2.1 – 2.7
2. Using groundwater inflow to Cell 1 as the primary source of water for site operations once extraction from Cell 1 commences.	Section 2.2
3. Direction of sufficient groundwater from Cell 1 to maintain the wetland.	Section 2.2
4. Directing excess groundwater from Cell 1 into the Settling Pond (Pit 2) as required or to the Murrumbidgee River via Pit 1 where the water is of sufficient quality.	Section 2.2

CWMR Recommendation	Relevant Report Section(s)
5. Building a transfer system to take silt-laden water from the Processing Plant to the Settling Pond (Pit 2).	Section 2.2
6. Cease taking water from the Murrumbidgee River directly for use in the Processing Plant.	Section 2.2
7. Upgrading equipment to improve efficiency of resource extraction and minimisation of water loss in processing through recycling and cyclone use.	Section 2.6
8. Monitoring and monthly recording of volumes of water moved around the site from the Active Cell to the Wetland, Settling Pond and river via Pit 1, between the Settling Pond and the Processing Plant and climate monitoring onsite of rainfall and evaporation to and from open water bodies on site.	Sections 2.3 – 2.5

2 Water Review

2.1 Condition 16 a) – Predicted Water Requirements, Pit Inflows and Water Reuse from Environmental Assessment

The Environmental Assessment (EA, Hanson, April 2010) made a number of water management predictions specifically with respect to water requirements of site operations, pit inflows and water reuse opportunities. These predictions are compared with the data used in the Water Management Review (Evans and Peck, 2013), Water Management Plan (Martens, August 2017) and 2018 Water Balance (Martens, 2019) to verify the predictions made in the EA summarised in Table 2.

Table 2: Summary of water management predictions made in Environmental Assessment (Hanson, 2010).

Site Water Management Parameter	Project Environmental Assessment	Comparison
Surface water balance	The EA report predicted that the operating the plant would require 410 ML/year. Of this 100 ML was to be drawn from the Murrumbidgee River and 125 ML/year (minimum) would be drawn from the quarry extraction cells through groundwater dewatering. The EA assessment concluded that, once accounting for losses, the plant required 49% of the wastewater produced to be recycled. If all the generated process wastewater was recycled then the water balance had a 190 ML/year excess meaning that extraction from the river or groundwater could be reduced.	The CWMR concluded that Murrumbidgee River extraction could be ceased by increasing recycling to satisfy site water demand. Murrumbidgee River extraction for process plant operation stopped prior to the period assessed in the 2018 water balance. Extraction from the river has not recommenced. The 2018 water balance assessment recorded approximately 463 ML transferred to the process plant basin from Pit 2 and the active cell. 223 ML was used by the processing plant (including hydrocyclone sand plant). No data was recorded for return flows to the process plant basin from the process plant. The 2019 water balance assessment estimated approximately 420 ML transferred to the process plant basin from Pit 2 and the active cell. 223 ML was used by the process and hydrocyclone plants combined. No data was recorded for return flows to the process plant basin from the process plant. The 2018 and 2019 water balance assessments confirmed that the plant is operated using only extracted groundwater and recycled process water.

Site Water Management Parameter	Project Environmental Assessment	Comparison
Groundwater management	The EA made predictions relating to inflows of groundwater to the operational pits.	Groundwater model has been updated to assess the validity of the EA assessment (See Section 2.3). Conclusion is that the site is being operated in accordance with the Water Management Act licensing requirements and that groundwater drawdown is less than that modelled and is therefore acceptable.
Integrated site water cycle management plan (ISWCMP)	EA recommended the implementation of an ISWCMP including sediment, groundwater dewatering and recharge and surface water management components. Primary objectives of the ISWCMP were: 1. Ensure effective sedimentation prior to discharge of process waters. 2. Ensure net volume of groundwater extracted was less than licensed allocation. 3. Ensure site operations did not exceed surface water licence allocation of 100 ML / year.	Measures have been adopted to ensure suitable treatment of water prior to river discharge. Water balance assessment confirms that the site has maintained adequate Water Management Act licence for groundwater take. The site has not extracted river water for at least 2 years and is therefore compliant in this regard.

2.2 Condition 16 b) – Progress Against Recommendations in Comprehensive Water Management Review

Hanson have adopted Option 1 from the CWMR as the site water management system, modified as follows:

1. . All dewatering of groundwater from the active cell is directed to the process basin adjacent to the process plant. This basin also receives process wastewater flows from the process plant for sedimentation and recycling.

2. Process water used in site operations is sourced from the process basin, no surface water is extracted from the Murrumbidgee River.

3. Pit 2 is not used for supplying process water to the plant. It is instead used for treatment of overflows from the process basin. Overflows from Pit 2 are recycled to the process water basin or directed to Pit 1.

4. Pit 1 is used for final sedimentation prior to discharge of treated water to the river once licence conditions are met.

5. A portion of the dewatering flows are directed to the site wetland.

6. No equipment upgrades have been required to date to achieve efficiency improvements (i.e. cessation of river extraction).

Whilst not identical to the recommendations given in the CWMR for Option 1, the purpose is achieved by the above measures.

Site flow monitoring has been established to allow for auditing of water use in general accordance with the recommendations in the CWMR. This includes a series of flow monitoring points measuring flows from the active cell and Pit 2 to the process basin and between the process basin and the process plant. Groundwater level monitoring is also undertaken.

Weather data is recorded by an automated weather station located on site. Data recorded includes rainfall which is used to inform site water balance calculations.

Hanson have constructed the required barrier between Pit 2 and the river to enable Pit 2's use as a settling pond. Process basin overflows are directed, via earth swale to Pit 2 for storage, reuse or eventual discharge to river via Pit 1.

Backfilling of Cell 1 with overburden has not yet commenced as Cell 1 is currently actively excavated.

2.3 Condition 16 c) – Verify Surface and Groundwater Impacts through Updated Water Balance and Calibrated Groundwater Model

Adequacy of the EA groundwater model and its suitability to predict impacts of quarry deepening to 152 mAHD has been completed. Modelling used Hanson's site groundwater monitoring data for the period July 2016 – August 2019. The developed groundwater data together with the pit dewatering data has been assessed using the EA groundwater model to confirm the reliability of the EA model (Martens, April 2020).

The results of the groundwater monitoring for the period July 2016 – August 2019 have been compared with predicted groundwater levels at each monitoring point as reported by the groundwater model (modified to represent present site conditions). The results of this comparison are detailed in attached Martens report (P0802296JC11V01, April 2020, Attachment A).

Results demonstrate that observed groundwater levels are generally higher than levels predicted by the model, that is, that the drawdown due to Cell 1 operation are less than those predicted by the approved groundwater model. It is therefore concluded that a further lowering of

the quarry floor level of Cell 1 to 152 mAHD shall not result in impacts in excess of those predicted by the approved model.

Continued groundwater monitoring is recommended to allow for confirmed assessment of impacts.

Martens have undertaken a water balance for 2018 and 2019 (P1806423JC05V02, April 2019, P1806423JC08V01, September 2020, Attachment B and Attachment C) using data provided by Hanson. Key findings of the assessments are:

- Groundwater monitoring confirmed that Pit 1 was not connected to local groundwater.
- Water balance figures showed that in 2018, Pit 2 was recharging local groundwater by approximately 88.2 ML/year, less recycled flows from the Process Plant as this data was not available for the 2018 water balance.

Total groundwater extraction for 2018 and 2019 was less than the total licensed groundwater extraction allowance for the site (permanent and temporary allocation for 2018/19). Calculated groundwater extraction does not take into account any recharge of local groundwater from Pit 2, despite this recharge offsetting extraction from a practical perspective.

2.4 Condition 16 d) – Demonstration that Project would not have Unacceptable Surface or Groundwater Impacts

Licensing of water extraction on the site authorised all uses of site water resources. The extraction of surface water from the river has ceased and all process water requirements met by dewatering of Cell 1 and recycling of process plant wastewater.

Groundwater model confirms that extraction to a depth below 158 mAHD will not adversely impact on local groundwater , with the site monitoring showing a predicted water level higher than the predicted levels given in the calibrated model (Section 2.3)

3 Conclusion

This water management performance verification report shows that Hanson have implemented the recommendations of the CMR and achieved all of the requirements of Condition 16 of the Project Approval Conditions.

Assessment of groundwater monitoring and review of groundwater modelling concludes that the deepening of the Wagga Wagga quarry to 152 mAHD shall not result in any groundwater drawdown in excess of that anticipated in the EA. Hanson has consistently maintained WALs in excess of groundwater take thus authorising all groundwater take on the site.

4 References

Evans & Peck (2013) *Wagga Wagga Quarry Extension Project: Water Management Review.*

Hanson Construction Materials (2010) *Environmental Assessment Report: Sand and Gravel Quarry Extension, Wagga Wagga, NSW, Volume 1.*

Martens and Associates (August 2017) *Water Management Plan: Wagga Wagga Quarry Extension.*

Martens and Associates (April 2019) *2018 Annual Groundwater Balance – Hanson Wagga Wagga Quarry.*

Martens and Associates (September 2020) *2019 Annual Groundwater Balance – Hanson Wagga Wagga Quarry.*

Martens and Associates (April 2020) *Assessment of Observed Groundwater Drawdown (April 2020) and Comparison to Model Predictions, Cell 1, Hanson Quarry, Roach Road, Wagga Wagga, NSW.*

5 Attachment A – Groundwater Assessment

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Courier		
By Hand		

Contact: Andrew Norris
Our Ref: P0802296JC11V01
Pages: 7
cc. Belinda.pignone@hanson.com.au

28 April 2020

Hanson Construction Materials Pty Ltd
Attn: Andrew Driver
By email

Dear Andrew,

RE: ASSESSMENT OF OBSERVED GROUNDWATER DRAWDOWN (APRIL 2020) AND COMPARISON TO MODEL PREDICTIONS, CELL 1, HANSON QUARRY, ROACH ROAD, WAGGA WAGGA, NSW

1. Introduction

This letter, prepared by Martens and Associates (MA), provides a review of observed groundwater drawdown (July 2018 to August 2019) and dewatering rate for Cell 1 at Hanson's Roach Road Quarry, Wagga Wagga, NSW, and a comparison of site data to modelling results using a slightly modified version of the groundwater model developed for the project Environmental Assessment (EA).

Martens and Associates (MA) were commissioned by Hanson to undertake the comparison in order to, in part, address Condition 16 in Schedule 3 of the project's approval (NSW Government Department of Planning, 22 November 2011).

Modelled drawdown and dewatering rate predictions were taken from a slightly modified version of the groundwater model documented in MA's letter of May 2011 to the then NSW Department of Planning (DoP) whilst observed drawdown and dewatering rate were based on groundwater level and dewatering rate data provided by Hanson.

2. Groundwater Monitoring Results

Groundwater logger data has been provided by Hanson for the period 1/7/2016 to 31/8/2019, it was plotted with daily rainfall and is provided in Figure 1. Quarrying operations have been ongoing with progressive lowering of the pit floor in the monitoring period. Therefore, the most recent data is considered to be of higher importance to the current analysis – see Figure 2 for the groundwater monitoring data for the period 1/7/2018 to 31/8/2019. See Figure 3 for a map of monitoring well locations.

3. Comparison of Observed and Modelled Groundwater Levels

To determine the observed groundwater levels, the average groundwater level for the period 15/4/2019 to 31/8/2019 for each monitoring well was calculated. This period was used because it can be seen that groundwater levels stabilise in this time indicating equilibrium conditions (see Figure 2).

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In order to compare modelled and observed groundwater levels and drawdown, the previously reported "pre-extraction" model was modified to simulate the current conditions at the quarry. The following steps were taken to modify the model:

1. Cell 1 was modelled by lowering the grid top elevations to 158 mAHD and applying a drain boundary condition with an elevation of 157.99 mAHD to model the current pit floor levels.

2. The quarry void to the north west, now used as a settling pond was modelled as a river boundary condition.

This approach is consistent with the approach of the previously reported models for the quarry operation stages.

The modelled groundwater levels at each observation bore were then recorded and compared to the observed levels and the modelled pre-extraction levels (Table 1).

Table 1: Comparison of modelled and observed drawdown for Cell 1 at 158 mAHD.

Bore	Bore Surface Level (mAHD) [1]	Pre-extraction Groundwater Level (mAHD) [2]	2020 Predicted Groundwater Level (mAHD)	Predicted Drawdown (m)	Observed Groundwater Level (mAHD) [3]	Observed Drawdown (m)	Predicted Level – Observed Level (m)
WG0701	176.2	167.65	166.83	0.82	166.84	0.81	-0.01
WG0702	175.8	167.43	164.96	2.47	167.36	0.07	-2.40
WG0703	175.7	166.47	161.64	4.83	164.81	1.66	-3.17
WG0704	174.6	167.07	165.65	1.42	N/A	N/A	N/A
WG0707	176.9	167.70	167.66	0.04	168.07	-0.37	-0.41
WG0708	178.0	162.05	166.17	-4.12	167.91	-5.86	-1.74
WG0709	176.0	162.70	166.69	-3.99	166.28	-3.58	0.41

Notes:
1. Source: Hanson (2020).
2. Pre-extraction modelled levels (previously reported).
3. Source: Average of Hanson hourly monitoring data (15/4/2019 – 22/08/2019).

4. Comparison of Observed and Modelled Dewatering Rates

Hanson has provided pumping data for the site for the period 1/1/2019 to 31/10/2019. Total water pumped from the active cell during this time is 420 ML which is equivalent to 1.38 ML/d. To determine the predicted dewatering rates, the modified model discussed in the previous section was used. A zone budget was applied to the active pit area to quantify the amount of water being removed from the model by the drain boundary conditions. The model calculated this to be 1.48 ML/d. These results are summarised below in Table 2.

Table 2: Comparison of modelled and observed dewatering rates for Cell 1.

2020 Groundwater Model Predicted Dewatering Rate (ML/d)	Actual Dewatering Rate (ML/d)
1.48	1.38

5. Discussion

Groundwater levels at all bores except WG0709 were modelled lower than the observed values from April to August 2019. That is, the assessment model over-predicted the impact (drawdown) on the aquifer. In this way the assessment is considered to have been conservative. The lower observed level in WG0709 is not considered consequential because this monitoring well is located more than 1km away (to the north west) from the active pit area. The difference between the observed and the predicted level (0.41 m) is within the range that would occur naturally due to climatic conditions. Critically, WG0709 is located between the original quarry voids, which are now used as settling basins, and the Murrumbidgee River. It is therefore highly unlikely that the observed drawdown is a result of the quarry extraction processes, rather it is likely to be a result of river level variability or other processes.

Although there is no monitoring data for WG0704 during April to August 2019, Figure 2 shows that all the previously observed levels in this bore are higher than the predicted level (165.65 mAHD) by more than 1 metre. Therefore, the predicted drawdown is greater than the observed drawdown and the model is therefore conservative in its predictions in regards to groundwater levels.

The observed dewatering rate from the active pit was less than the predicted dewatering rate. The model is therefore also conservative in regards to its predictions of dewatering rates for the pit.

As discussed in Section 3, the modified model used in this assessment is consistent with the approach used in the previously reported models for this project. This model over-predicts both aquifer drawdown and pit dewatering rate, and is therefore conservative. Therefore, it can be concluded the impact assessment models used in the preparation og the project EA are also conservative. It is therefore assessed that the previously reported impacts of the proposed extraction represent a worse-case scenario and that groundwater impacts as a result of pit lowering to 152 mAHD will not exceed those determined in the EA.

6. Conclusion and Recommendations

Comparison of observed and predicted groundwater levels and dewatering rates has found that the current observed groundwater impacts on the site are less than (i.e. less aquifer drawdown and less dewatering) the impacts predicted by the previously approved groundwater model. MA therefore consider that further refinement and validation of the model is not necessary prior to deepening of the extraction in Cell 1 to 152 mAHD.

We recommend that the current monitoring regimes for groundwater levels and dewatering rates are maintained so that any future assessment required will have the same level of data available.

If you require any further information, please do not hesitate to contact the undersigned.

For and on behalf of
MARTENS & ASSOCIATES PTY LTD

ANDREW NORRIS

BSc (Hons), MEngSc, MAWA
Director, Principal Engineer

7. Figures

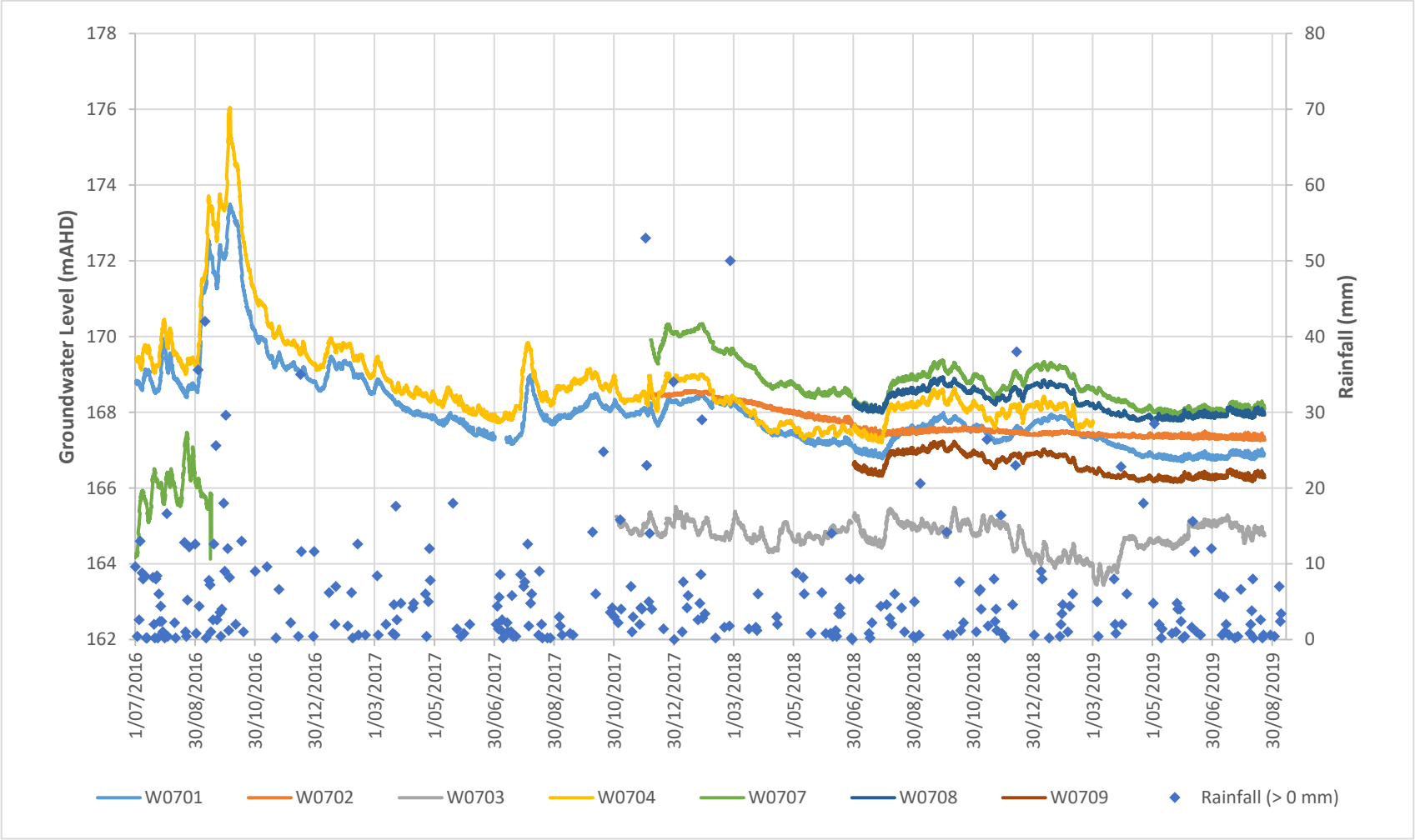

Figure 1: Groundwater monitoring data for 1/7/2016 - 31/8/2019.

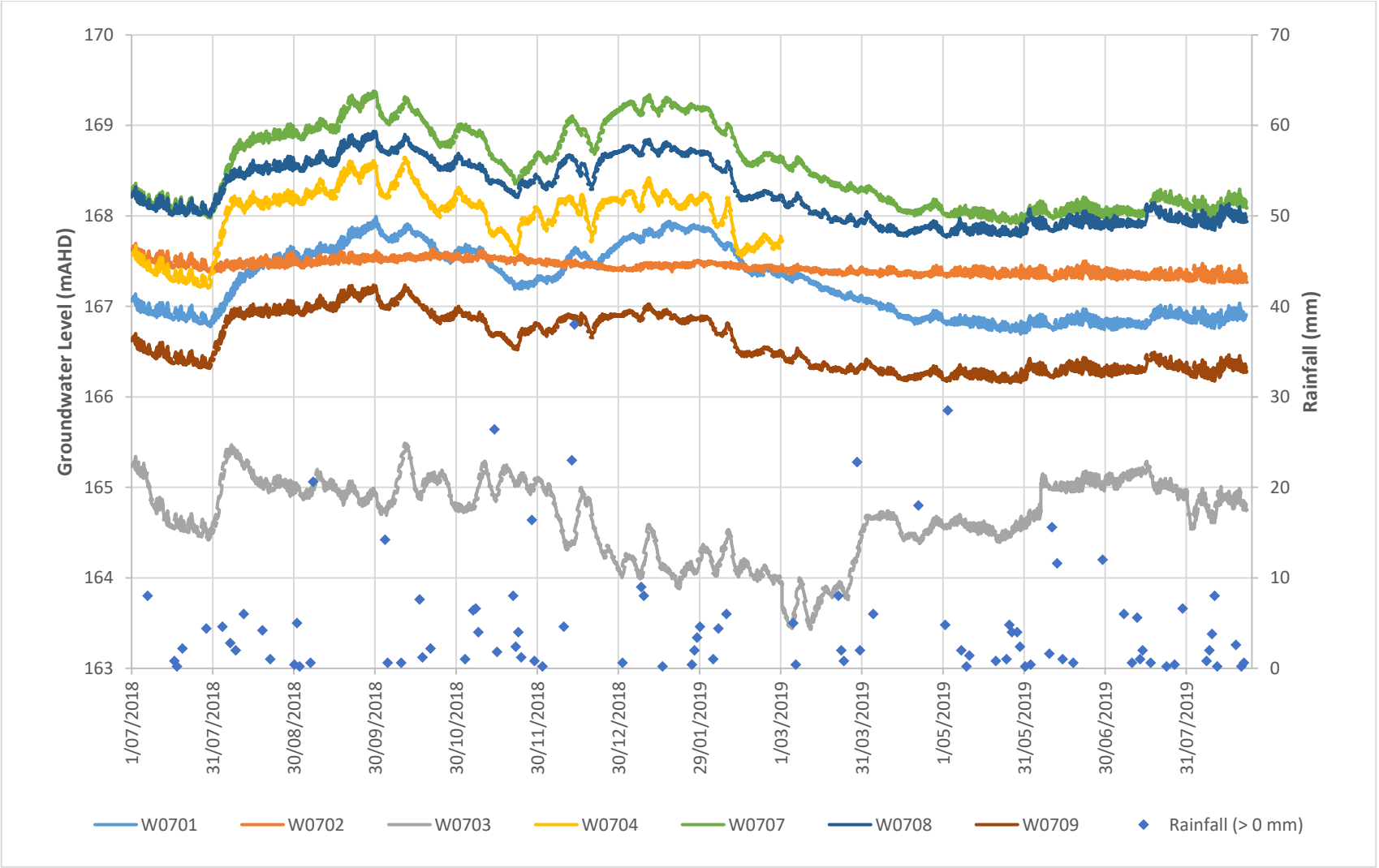

Figure 2: Groundwater level monitoring data for 1/7/2018 to 31/8/2019.

Figure 3: Borehole location map.

6 Attachment B – 2018 Water Balance

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By Hand		
Contact:		
Our Ref:		P1806423JC05V02
Pages:		3
cc.		

30 April 2019

Hanson Construction Materials P/L
Att: Andrew Driver
By email

Dear Andrew,

RE: 2018 ANNUAL GROUNDWATER BALANCE – HANSON WAGGA WAGGA QUARRY.

INTRODUCTION

In accordance with the Wagga Wagga Quarry *Water Management Plan* (Martens and Associates, 2017) we have completed the Annual Groundwater Balance to estimate total groundwater extraction for the site and determine if additional groundwater license volume is required. We understand the site presently holds:

- WAL 33474 which licenses 360 ML/year of extraction.
- An additional 274 ML of temporary allocation for the 2018/2019 water season (Application Number: SWC770618).

The following provides an outline of calculations completed, assumptions made and outcomes of the assessment.

DATA SOURCES AND ASSUMPTIONS

Table 1 summarises data inputs, data sources and any assumptions made during water balance calculations.

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Table 1: Water Balance Data Summary and Sources.

Data Input	Source	Details/Assumptions
Annual Pan A Evaporation	Bureau of Meteorology Wagga Wagga AMO (Station 072150)	Monthly data during 2018
Lake Surface Area	Measured from 2018 aerial survey data provided by Hanson.	-
Lake Catchment	Measured from 2018 aerial survey data provided by Hanson.	-
Pan A	Bureau of Meteorology Wagga Wagga AMO (Station 072150)	-
Stage storage relationship for each pit/cell	Pit 1 – not required as Hanson confirmed pit floor above groundwater level. Pit 2 – Created by MA based on available survey information provided by Hanson. Active cell – 2017/2018 aerial survey provided by Hanson.	As no survey information for Pit 2 was available, a composite surface was created using 2018 aerial survey data and 2010 aerial survey data for prior to Pit 2 filling with water.
Change in water level for each pit/cell	No monitoring completed. Water level estimates from aerial survey provided by Hanson.	Level from 02/11/2017 and 27/10/2018 aerial survey.
Water pumped from Active Cell to Process Plant Basin (M2)	Hanson	422.41 ML - Meter readings completed by Hanson.
Water pumped from Pit 2 to Process Plant Basin (M3)	Hanson	40.86 ML - Meter readings completed by Hanson.
Dust suppression	Hanson	3.4 ML - Water cart use recorded during December 2018 and January 2019 with annual use interpolated.
Flow from Process Plant Basin to Process Plant (M4)	Hanson	140.57 ML - Meter readings completed by Hanson.
Flow from Process Plant Basin to Hydrocyclone Sand Plant (M5)	Hanson	82.82 ML - Meter readings completed by Hanson.

RESULTS OF ANNUAL WATER BALANCE ASSESSMENT

Following the process outlined in Section 2 and Attachment E of the approved Water Management Plan, and based on the data provided and assumptions summarised in Table 1, the groundwater balance assessment was completed for 2018. The following conclusions are made based on this assessment:

1. Assessment of groundwater levels at monitoring bores (by Hanson) adjacent to Pit 1 confirms that Pit 1 is not groundwater connected. Therefore no groundwater assessment is required.

2. Calculations indicate that Pit 2 is recharging the groundwater table by a minimum of approximately 88.2 ML/year (row 'L', Attachment A). This recharge value is an underestimate, as flows returning from the Process Plant were not measured. This rate is to be measured by a v-notch weir and transducer (see Figure 1 of Water

Management Plan) which has not occurred. For the 2018 monitoring period, this return flow was approximately 223 ML (i.e. M4 + M5) plus rainfall; less evaporation, product losses and discharges to the wetland. This return flow is therefore likely to be a significant amount.

3. Groundwater extraction ('TAKE' in row 'L' of Attachment A) for the Active Cell is 420.4 ML/year.

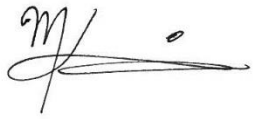
4. Total licensable groundwater extraction for the site is 420.4 ML for the 2018 assessment. The current site allocation (including permanent and temporary 2018/19 allocations) is 634 ML which exceeds this take. Recharge from Pit 2 to groundwater (calculated as a minimum of 88.2 ML) is not considered in this calculation, although it does offset the extraction in a practical sense.

The annual water balance assessment is provided in Attachment A.

Please call our offices if you have any further queries regarding this matter.

For and on behalf of

MARTENS & ASSOCIATES PTY LTD



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BEnvs(Hons 1), GradCert EnvPl
Environmental Planner/Scientist

ATTACHMENT A – 2018 ANNUAL GROUNDWATER BALANCE ASSESSMENT

ATTACHMENT A - 2018 ANNUAL GROUNDWATER BALANCE ASSESSMENT

		Pit 2	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	
Groundwater Connected		N	Y	N	N	N	N	
Only proceed with calculation where groundwater connection is confirmed								
Annual Pan A Evaporation (PAN EVAP)	BOM (Wagga Wagga Agricultural Institute) mm / 1000	2.0434	2.0434					**_____m (a)**
Lake Surface Area (SA)	Site measured based on a typical lake extents through year	108890	1560					**_____m^2 (b)**
Lake Catchment (CATCH)	Site measured to crest of levee (excludes lake surface)	240380	54840					**_____m^2 (c)**
Pan A	Factor to determine open water evaporation from Pan A evaporation data (Wagga Wagga AMO)							**(d)**
EVAP	(PAN EVAP x SA x Pan A) / 1000	206.93	2.96					**_____ML (e)** **(e) = (a) x (b) x (d)/1000**
Volume Change (ΔV)	Change in retained volume in void (calculated based on change in water level over monitoring period and surveyed stage storage relationship)	-54.81	0					**_____ML (f)**
REUSE	Difference between Process Plant Basin inflows and outflows – see calculation '4' in Figure 1 of Water Monitoring Plan (Martens, 2017).	230.93	0.00					**_____ML (g)**
Annual Dewatering (USE) [1, 2]	Meter readings for dewatering (see Figure 1 of Water Monitoring Plan	M3 + M6 + ⌘	M2 + ⌘	TBC + ⌘	TBC + ⌘	TBC + ⌘	TBC + ⌘	**_____ML (h)**
		-13.92	422.41					
Mean Annual Rainfall (RAIN) [1, 2]	BOM (Wagga Wagga Agricultural Institute) mm / 1000 or site monitoring	0.2779	0.2779					**_____m (i)**
Volume RAIN captured (GAIN)	Volume of direct rainfall onto open voids and runoff from batter	50.301	5.006					**_____ML (j)** **(j) = (b + c x 0.3^3) x (i) /1000**
Net Evaporation loss ($EVAP_{LOSS}$)	EVAP - GAIN	156.629	-2.041					**_____ML (k)** **(k) = (e) – (j)**
Groundwater take (TAKE)	Net evaporation loss + dewatering volume - REUSE	-88.22	420.37					**_____ML (l)** **(l) = (k) + (h) – (g)**
Total TAKE [5]	Total groundwater TAKE from all pits	420.37						**_____ML (l_{TOTAL})**
Current groundwater license allocation (LICENSE) [4]	Current licensed groundwater allocation	634 ML						**(m)**
Additional allocation requirements ($LICENSE_{REQ}$) [6]	Additional license allocation requirements to extract anticipated TAKE (k)	0.0						**_____ML (n)** **(n) = (m) - (l_{TOTAL})**

Note:

1 When using to make an estimate for following year, USE from previous year's operation is to be used and PAN EVAP and RAIN for Wagga to be used.

2 When using to determine years water balance at end of year USE to be determined for meter and average PAN EVAP and RAIN to be obtained from BOM for year.

3 0.3 factor to account for batter runoff coefficients.

4 LICENSE is to be updated each year depending on how licensing conditions was amended for the following year's operational requirements. 360 ML in permanent allocation plus 274 ML in temporary allocation (2018/2019 season) available.

5 Total TAKE to be the sum of TAKE of each pit/void for each stage to give a total site groundwater take.

6 $LICENSE_{REQ}$ for the future year's operation will therefore be an estimate based on the former year's operation. Water balance auditing is to be completed 3-monthly and, if required, additional license allocation sought.

7 Attachment C – 2019 Water Balance

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Emailed	X	Andrew.Driver@hanson.com.au
Courier		
By Hand		
Contact:		M. Dumas
Our Ref:		P1806423JC08V01
Pages:		5
cc.		

3 September 2020

Hanson Construction Materials P/L
Att: Andrew Driver
By email

Dear Andrew,

RE: 2019 ANNUAL GROUNDWATER BALANCE – HANSON WAGGA WAGGA QUARRY.

INTRODUCTION

In accordance with the Wagga Wagga Quarry *Water Management Plan* (Martens and Associates, 2017) we have completed the Annual Groundwater Balance for 2019 to estimate total groundwater extraction for the site and determine if additional groundwater license volume is required. We understand the site presently holds:

- WAL 33474 which licenses 360 ML/year of extraction.
- An additional 442.6 ML of temporary allocation consisting of:
    1. 299.6 ML leftover from the temporary water purchase for the 2018/2019 water season (Application Number: SWC770618).
    2. 98 ML of temporary allocation for the 2019/2020 water season (Application Number: SWC784733).
    3. 45 ML of temporary allocation for the 2019/2020 water season (Application Number: SWC784450).

The following provides an outline of calculations completed, assumptions made and outcomes of the assessment.

DATA SOURCES AND ASSUMPTIONS

Table 1 summarises data inputs, data sources and any assumptions made during water balance calculations for the 2019 calendar year.

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Table 1: Water Balance Data Summary and Sources.

Data Input	Source	Details/Assumptions
Annual Pan A Evaporation	Bureau of Meteorology Wagga Wagga AMO (Station 072150)	Monthly data during 2019
Lake Surface Area	Measured from 2019 aerial photo from Nearmap.	Dated 17/11/2019.
Lake Catchment	Measured from 2018 aerial survey data provided by Hanson.	-
Pan A	Bureau of Meteorology Wagga Wagga AMO (Station 072150)	-
Stage storage relationship for each pit/cell	Pit 1 – not required as Hanson confirmed pit floor above groundwater level. Pit 2 – Created by MA based on available survey information provided by Hanson. Active cell – 2017/2018 aerial survey provided by Hanson.	As no survey information for Pit 2 was available, a composite surface was created using 2018 aerial survey data and 2010 aerial survey data for prior to Pit 2 filling with water.
Change in water level for each pit/cell	Water level monitoring for groundwater bores adjacent to Pit 2 provided by Hanson (Hanson reference W0708 and W0709).	Levels from data logger between 1/1/2019 and 31/12/2019.
Water pumped from Active Cell to Process Plant Basin (M2)	Hanson	400 ML – Estimate by Hanson.
Water pumped from Pit 2 to Process Plant Basin (M3)	Hanson	23.80 ML - Meter readings completed by Hanson, adjusted for 12 month period.
Dust suppression	Hanson	3.4 ML – Estimate based on water cart use recorded during December 2018 and January 2019 with annual use interpolated.
Flow from Process Plant Basin to Process Plant (M4)	Hanson	188.93 ML - Meter readings completed by Hanson, adjusted for 12 month period.
Flow from Process Plant Basin to Hydrocyclone Sand Plant (M5)	Hanson	78.56 ML - Meter readings completed by Hanson, adjusted for 12 month period.

RESULTS OF ANNUAL WATER BALANCE ASSESSMENT

Following the process outlined in Section 2 and Attachment E of the approved Water Management Plan, and based on the data provided and assumptions summarised in Table 1, the groundwater balance assessment was completed for 2019. The following conclusions are made based on this assessment:

1. Assessment of groundwater levels at monitoring bores (by Hanson) adjacent to Pit 1 confirms that Pit 1 is not groundwater connected. Therefore no groundwater assessment is required. This is consistent with the 2018 assessment (MA reference P1806421JC05V02, April 2019).

2. Calculations indicate that approximately 104.3 ML/year of groundwater was removed from Pit 2 (row 'L', Attachment A). This value is likely to be higher that the actual take, as flows returning from the Process Plant were not measured for 2019.

This rate is to be measured by a v-notch weir and transducer (Martens reference P1806421JC07, April 2020) which has not yet been constructed. For the 2019 monitoring period, this return flow was approximately 267 ML (i.e. M4 + M5) plus rainfall; less evaporation, product losses and discharges to the wetland (estimated to be 116 ML). This return flow is therefore likely to be a significant amount.

3. Groundwater extraction ('TAKE' in 'L' of Attachment A) for the Active Cell is 404.6 ML/year.

4. Total licensable groundwater extraction for the site is less than 508.8 ML for the 2019 assessment. The current site allocation (including permanent and temporary allocations) is 802.6 ML which exceeds this take.

The annual water balance assessment is provided in Attachment A.

Please call our offices if you have any further queries regarding this matter.

For and on behalf of

MARTENS & ASSOCIATES PTY LTD

MICHAEL DUMAS
BEng(Environmental)
Environmental Engineer

ATTACHMENT A – 2019 ANNUAL GROUNDWATER BALANCE ASSESSMENT

ATTACHMENT A - 2019 ANNUAL GROUNDWATER BALANCE ASSESSMENT

		Pit 2	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	
Groundwater Connected		N	Y	N	N	N	N	
Only proceed with calculation where groundwater connection is confirmed								
Annual Pan A Evaporation (PAN EVAP)	BOM (Wagga Wagga Agricultural Institute) mm / 1000	2.1588	2.1588					**_____m (a)**
Lake Surface Area (SA)	Site measured based on a typical lake extents through year	108700	5900					**_____m^2 (b)**
Lake Catchment (CATCH)	Site measured to crest of levee (excludes lake surface)	240570	50500					**_____m^2 (c)**
Pan A	Factor to determine open water evaporation from Pan A evaporation data (Wagga Wagga AMO)	0.93						**(d)**
EVAP	(PAN EVAP x SA x Pan A) / 1000	218.24	11.85					**_____ML (e)** **(e) = (a) x (b) x (d)/1000**
Volume Change (∀)	Change in retained volume in void (calculated based on change in water level over monitoring period and surveyed stage storage relationship)	71.72	0					**_____ML (f)**
REUSE	Difference between Process Plant Basin inflows and outflows – see calculation '4' in Figure 1 of Water Monitoring Plan (Martens, 2017).	146.9	0					**_____ML (g)**
Annual Dewatering (USE) [1] [2]	Meter readings for dewatering (see Figure 1 of Water Monitoring Plan	M3 + M6 + ∀	M2 + ∀	TBC + ∀	TBC + ∀	TBC + ∀	TBC + ∀	**_____ML (h)**
		95.516	400					
Mean Annual Rainfall (RAIN) [1, 2]	BOM (Wagga Wagga Agricultural Institute) mm / 1000 or site monitoring	0.3461	0.3461					**_____m (i)**
Volume RAIN captured (GAIN)	Volume of direct rainfall onto open voids and runoff from batter	62.599	7.285					**_____ML (j)** **(j) = (b + c x 0.3^3) x (i) /1000**
Net Evaporation loss ($EVAP_{LOSS}$)	EVAP - GAIN	155.636	4.560					**_____ML (k)** **(k) = (e) – (j)**
Groundwater take (TAKE)	Net evaporation loss + dewatering volume - REUSE	104.26	404.56					**_____ML (l)** **(l) = (k) + (h) – (g)**
Total TAKE [5]	Total groundwater TAKE from all pits	508.82						**_____ML (l_{TOTAL})**
Current groundwater license allocation (LICENSE)[4]	Current licensed groundwater allocation	802.6						**_____ML (m)**
Additional allocation requirements ($LICENSE_{REQ}$)[6]	Additional license allocation requirements to extract anticipated TAKE (k)	0 ML						**_____ML (n)** **(n) = (m) - (l_{TOTAL})**

Note:

1. When using to make an estimate for following year, USE from previous year's operation is to be used and PAN EVAP and RAIN for Wagga to be used.
2. When using to determine years water balance at end of year USE to be determined for meter and average PAN EVAP and RAIN to be obtained from BOM for year.
3. 0.3 factor to account for batter runoff coefficients.
4. LICENSE is to be updated each year depending on how licensing conditions was amended for the following year's operational requirements. 360 ML in permanent allocation plus 442.6 ML in temporary allocation (2018/2019 + 2019/2020 season) available.
5. Total TAKE to be the sum of TAKE of each pit/void for each stage to give a total site groundwater take.
6. $LICENSE_{REQ}$ for the future year's operation will therefore be an estimate based on the former year's operation. Water balance auditing is to be completed 3-monthly and, if required, additional license allocation sought.