Hanson

ABN: 90 009 679 734

Wagga Wagga Quarry

WATER MONITORING PROGRAM

Hanson Construction Materials Pty Ltd

Water Monitoring Program:

Wagga Wagga Quarry Extension

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

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

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1 Introduction

1.1 Scope and Overview

This water monitoring program has been prepared as a requirement of the Project Approval (PA) 07_0069 issued by the NSW Department of Planning and Environment (DoPE) on November 22, 2011 for the approved extension of Wagga Wagga Quarry, Roach Road, Wagga Wagga, NSW (the Site).

This document has been prepared in order to satisfy Condition 15 of Schedule 3 by preparing a program that includes monitoring of:

- Key elements of Site water balance regime.
- Groundwater.

It provides for monitoring of water flow and quality at the Site and is summarised as follows:

1. Water flow metering at:
    - Active pit dewatering point.
    - Process water to plant.
    - Process wastewater from plant.
    - Surplus water discharged to the Murrumbidgee River.
    - Wetland transfers.
2. Continuous groundwater level monitoring at five of the seven monitoring bores.
3. Event based groundwater quality at each of the seven monitoring bores.

The program details requirements for record keeping, data analysis and provides contingency plans in the event of a monitored adverse or unexpected outcome of the project works.

1.2 Approved Development

The proponent proposes to extend extraction operations at the Site through quarrying sand and gravel from 5 extraction cells (to be developed in a series of stages). Extraction is expected to provide 25

years of product. The Environmental Assessment Report (EA) (Hanson, 2010) provides further details regarding the proposed development.

The approved Site plan is provided in Attachment A.

1.3 Subject Site

The Site is located approximately 5 km west of Wagga Wagga Town Centre and is identified by title as Lot 2 of DP610795 and Lot B of DP 381991. The Site is bordered by the Murrumbidgee River to the north, east and west, rural land to the south west and south east and Pomingalama Park to the south. Roach Road provides access to the Site and also traverses the Site between Lot 2 DP610795 and Lot B

DP381991. Approximately 51.6 ha of the 200 ha Site is proposed to accommodate the subject extension.

Further details regarding the Site and surrounding conditions are provided in the EA (Hanson Construction Materials, 2010).

1.4 Agency Consultation

Consultation with the following agencies was undertaken in preparation of this document:

- NSW Department of Primary industries – Water (DPI Water).
- NSW Office of Environment and Heritage (OEH).

Details of correspondence are provided in Attachment E.

1.5 Reference Documentation

This document should be read in conjunction with:

- Martens and Associated (2017) Water Management Plan; Wagga Wagga Extension.
- Evans and 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.
- Martens and Associates (2009) Surface and Groundwater Assessment: Roach Road, Wagga Wagga Quarry.
- Lane Piper (2008) Hydrogeological Assessment Report; Proposed Extension Sand and Gravel Quarry Wagga Wagga, NSW.

2 Site Water Balance Monitoring Program

2.1 Outline

This water balance assessment has been prepared in accordance with Clause 15(a) of Schedule 3 of the PA and provides a program for all key elements of the Site water balance.

2.2 Water Management Regime

As outlined in Martens (2017) the proposed 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 shall supply the process plant with water.
- Waste (process) water from the process plant shall be 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.

A schematic of the proposed water management system is provided in Figure 1 (Attachment B).

2.3 Water Balance Monitoring Program

2.3.1 Pit Dewatering

The proponent currently holds water licenses for groundwater extraction of 360 ML/year (WAL 33474; bore license 40BL190719 and 40BL190720). As outlined within the Water Management Plan (Martens, 2017) an annual water balance is required to determine licensable take for operations.

All dewatering from the active cell shall be metered and daily readings recorded in the Site water balance audit (Attachment C). These figures are to be used to inform the quarterly water balance audit required by the Water Management Plan (Martens, 2017). Monitoring of dewatering volume is required to ensure Site activities operate within license entitlements.

2.3.2 Process Water and Reuse

Process water shall be primarily sourced from the Process Plant Basin or, if required, extracted from Pit 2 (Settling Pond) and pumped to the process plant for reuse. Water used in this plant is to be metered and daily readings recorded in the Site water balance audit (Attachment C).

Process wastewater shall be discharged to Process Plant Basin for reuse in the plant or in the hydrocyclone sand processing plant then discharged to the wetland west of the process plant. Process wastewater is to be metered so water loss during production can be monitored and, where required, production efficiency considered.

Monitoring of process water extracted from the Process Plant Basin and returned to the Wetland shall provide an indication of water loss in production or in product losses.

Monitoring of product moisture content shall be undertaken to allow estimates of water lost in product versus production losses.

2.3.3 Wetland Transfers

According to Table 4 of Evans and Peck (2013) approximately 70 ML/year of process wastewater is to be used in the hydrocyclone sand plant and transferred to the Site wetland for conservation purposes. All wetland transfers are to be metered and recorded in the Site water balance audit.

2.3.4 Environmental Release

Water released to the environment will be recorded as follows:

1. Evaporation – the annual water balance (Water Management Plan by Martens, 2017) provides calculation of estimated annual evaporation from open water bodies. Some evaporation from Site drainage features and the Site wetland is also expected, however this loss does not require monitoring.

2. Infiltration – Groundwater seepage is noted in Evans and Peck (2013) as occurring from the Site wetland at a rate of approximately 25 ML/year. This is a loss from the system but does not require monitoring as it is already accounted for in wetland discharge.

3. River discharge – Surplus water from Pit 1 is discharged to the Murrumbidgee River. In the event that discharge is required, water quality sampling is required to ensure TSS levels comply with Site EPL requirements. In accordance with EPA requirements (Attachment E), a monthly monitoring regime is to continue when release is required.

   Any water discharged is to be metered to ensure volume released to the environment does not exceed EPL requirements (350 kL/hr).

2.4 Monitoring Locations

A summary of monitoring is provided in Table 1 and shown schematically in Figure 1 (Attachment B).

Table 1: Monitoring locations.

Monitoring Location Identification	Location
M1	Pit 1 – discharge to Murrumbidgee River
M2	Active Cell discharge to Process Plant Basin
M3	Pit 2 to Process Plant Basin transfer
Site Dust Suppression	Record of each water load used by water cart to be kept in vehicle log book
M4	Process Plant Basin to Process Plant
M5	Process Plant Basin discharge to Hydrocyclone Sand Plant
M6	Pit 2 to Pit 1 transfers
Wetland Supply	Recorded based on Hydrocyclone Sand Plant's discharge direction. Volume discharged calculated based on M5 reading and volume retained in product
Process Plant Basin Recycle	Volume of wastewater returned to basin measures using vee-notch weir on return channel from Process and Sand Plant.
Water Retained in Product	Calculated based on moisture analysis of product and sales volume data

The vee-notch weir is to be constructed as follows:

1. Weir to be constructed in drain returning wastewater to Process Plant Basin, weir to be located to preventing any flow bypassing.

2. Weir to be formed in durable plate metal – Minimum 100 mm each way surrounding vee to be not thicker than 2 mm, support and thickening may then be used to provide structural support of vee plate.

3. Pressure transducer to be mounted on upstream side of weir on concrete pad to allow time series monitoring of water level through weir.

Flow over weir is to be calculated using transducer water level time series data and the equation:

$$Q = c_d \times \frac{8}{15} \times tan\theta \times \sqrt[2]{2 \times g \times h^5}$$

Where θ= angle of vee – notch – 90 degrees

C_d = weir coefficient – 0.59 or as calibrated on-Site

H =- water depth

Data from transducer to be recovered monthly and analysed to calculate flow.

2.5 Trigger Volume

Quarterly water balance auditing is required by the Water Management Plan (Martens and Associates, 2017) to ensure annual allocated licensed groundwater extraction/take is not exceeded. A trigger volume of n/4 ('n' being the current quarter number) of the annual allowable take shall be adopted to ensure annual allocation will not be exceeded (e.g. based on an annual allocation of 360 ML, after one quarter the trigger volume is 90 ML, after two 180 ML etc).

If water balance auditing demonstrates that trigger volume is exceeded further investigations are required. In this instance, dewatering shall cease until additional allocation is secured or until calculated take falls below the trigger volume for subsequent quarters.

2.6 Reporting

To address PA requirements (specifically Clause 15(a)), the following readings and additional calculations are to be undertaken and reported:

- Pit dewatering volumes for each pit – Readings to be taken and reported from M2,M3 and M6.
- Water used in processing – Readings to be taken and reported from M4 and M5.
- Water used for recycling and/or reuse – Readings to be taken and reported from vee-notch weir.
- Water released to the constructed wetland system (calculated from M5, water in product and direction of Sand Plant wastewater flow).
- Water released to the environment by:
    - Evaporation, infiltration and discharge – see Section 2.3.4.
    - Entrained in product – calculated from product moisture analysis and sales volume data.

3 Groundwater Monitoring Program

3.1 Hydrogeological Overview

Detailed groundwater assessment completed by Martens (2009) revealed the following regarding regional hydrogeological conditions:

- The Murrumbidgee Valley in the area of the Site comprises of two distinct hydrogeological units: the upper unconfined Cowra Formation and the underlying semi-confined Lachlan Formation.
- The majority of local groundwater extraction is from the Lachlan Formation.
- Site drilling (Martens, 2009) confirmed the presence of the Cowra Formation (comprising sands, gravels, silts and clays) to depths in excess of 42 mBGL.
- Hydrogeological modelling indicated drawdown in the Lachlan Aquifer over Site active cells to be of the order of 1m. The project is therefore expected to have negligible impact on the Lachlan Formation.
- The radius of influence resulting from drawdown in the Cowra Formation was found to be of the order of 300 – 500m for each stage of production.

3.2 Site Groundwater Monitoring Bore Network

Site operation impacts on groundwater are currently monitored from a network of seven groundwater monitoring bores (GMB) (Figure 2, Attachment B). This network monitors water level and groundwater quality within the Cowra Formation. Table 2 summarises construction details of Site GMB.

Table 2: GMB Construction Details (Lane Piper, 2008).

GMB	Bore Depth (m)	Concrete (m)	Grouted (m)	Bentonite Seal	PVC Casing (m)	Packing Sand (m)	Washed Gravel (m)	Slotted Screen (m)	Sump Casing (m)	End Cap (m)
WG701 [1]	30	-	-	-	-	5-19	-	13 -19	19-20	20
WG702 [2]	24	0 – 0.5	0.5 - 7	7 – 8	0 - 9	8 - 16	-	9 - 15	15 - 16	16
WG703 [3]	42	0 – 0.5	0.5 - 3	2 - 3	0 – 17.5	-	3 – 24.5	17.5 – 23.5	23.5 – 24.5	24.5
WG704 [4]	30	0 – 0.5	0.5 - 6	6 - 7	0 - 13	-	7 – 20	13 - 19	19 - 20	20
WG705 [5]	24	0 – 0.5	0.5 - 6	6 - 7	0 - 9	-	7 - 16	9 - 15	15 - 16	16
WG706 [6]	30	0 – 0.5	0.5 - 6	5 - 6	0 – 9.5	-	6 -- 16	9.5 – 15.5	15-5 – 16.5	16.5
WG707 [7]	27.5	0 – 0.5	0.5 - 10	8 - 9	0 – 9.6	-	6 – 16.6	9.6 – 15.6	15.6 – 16.6	16.6

Notes:

[1] Borehole collapse from 20 – 30m.

[2] Borehole collapse from 16 – 24m

[3] Borehole collapse from 24.5 - 42m

[4] Borehole collapse from 20 - 30m

[5] Borehole collapse from 16 - 24m

[6] Borehole collapse from 16.5 - 30m

[7] Borehole collapse from 16.6 – 27.5m

In order to identify any groundwater impacts as a result of the proposed expansion works, monitoring from these bores shall continue for the duration of the project. As requested by NSW DPI Water's, an additional 2 monitoring bores (WG0708 and WG0709) (Figure 2) shall be installed in the vicinity of Pit 2 and Pit 1 (respectively) to define groundwater levels in this area during operations and inform water balance accounting (Water Management Plan, 2017). These wells shall be constructed and data loggers installed once this Monitoring Program has been endorsed. Section 3.2, 3.4 and 3.5 of this report shall be updated accordingly.

In the event that a bore is compromised/removed by extraction works within new cell areas, it shall be replaced, if deemed necessary, in accordance with the following procedure:

1. A new location shall be proposed to DPI Water in writing with justification based on location of damaged/destroyed well and historic groundwater observation.

2. DPI Water to confirm the revised location is acceptable. Consultation to continue until a mutually acceptable solution is achieved.

3. The new groundwater monitoring well is to be constructed.

4. A data logger is to be installed in the new well.

3.3 Surrounding Groundwater Users

3.3.1 Riverina Water County Council

The Riverina Water County Council's (RWCC) West Wagga Wagga Borefield is located approximately 3 km east of the Site's eastern boundary. According to RWCC (2014) five bores are licensed to extract water for water supply purposes – however only four are currently commissioned as production bores due to extremely high iron levels in Bore 3. Bore 4 is also showing signs it may reach untreatable iron levels.

3.3.2 Privately Owned Groundwater Users

Martens (2009) groundwater assessment included review of public domain groundwater bore records within the NSW Natural Resource Atlas (CANRI). Sixteen bores were located within approximately 2km of the Site, twelve of which are licensed for use as domestic/stock, domestic/irrigation/stock or irrigation (Figure 3, Attachment B). With the exception of test holes, the nearest licensed bore to proposed Site

works (GW404649) is located approximately 700m north of the proposed Stage 1 excavation (Cell 1).

3.4 Baseline Groundwater Data

3.4.1 OnSite Monitoring Bores

Data loggers have been installed in five of the seven GMB's to allow monitoring of groundwater levels and temperature. Data is recorded hourly and downloaded 1 – 2 times annually. During download a manual dip for groundwater depth is also completed. Logger records from June 2012 have been reviewed and results summarised in Table 3. It is noted that data for GMB WG0701 was not available at the time of reporting. GMB WG0703 and WG0706 do not contain data loggers.

Table 3: Baseline groundwater data provided by Hanson

GMB	Average Depth (m from top of well monument)	Average Temperature (°C)
WG0702 [1]	9.03	17.58
WG0704	6.99	16.66
WG0705	9.79	17.85
WG0707	13.28	16.94

Notes:

[1] Data only available until 23/10/2014 for well WG0702.

Groundwater quality monitoring results from wells during the period April 2007 and March 2008 was reported and summarised in Martens (2009) assessment for preparation of the project EA. The following analytes were monitored:

- Dissolved oxygen
- Conductivity
- Salinity
- pH
- Turbidity
- Temperature

Table 4 summarises baseline groundwater quality conditions.

Table 4: Baseline groundwater quality conditions (Martens, 2009).

Analyte	WG0701			WG0702			WG0703			WG0704			WG0705			WG0706			WG0707		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Dissolved Oxygen (%)		24.0 [1]		8.7	19.5	40.2	7.4	16.2	39.6	7.8	20.5	71.9	10.1	21.4	32.7	6.6	13.7	19.1	5.9	15.5	36.4
Conductivity (µS/cm)	107.4	457.0	642.0	1068.3	2358.3	3110.0	122.5	276.7	399.0	73.2	144.1	397.0	156.7	351.0	5140.0	317.0	865.3	1326.0	1015.0	1648.8	2130.0
Salinity (ppm)		NT		641.0	754.5	868.0	73.5	95.8	118.0	43.9	44.8	45.6	95.5	97.0	98.4	203.0	208.0	213.0	609.0	625.0	641.0
pH	6.37	6.59	6.80	5.68	6.46	7.35	5.88	6.69	7.36	4.98	6.54	7.36	5.76	6.52	7.36	5.11	6.74	7.58	5.44	7.07	7.50
Eh (mV)		130 [1]		36	78	143	32	77	123	32	78	195	33	75	112	31	75	212	35	75	223
Turbidity (NTU)	25.4	36.2	47.0	0.5	80.2	750.0	0.8	6.5	64.0	0.0	7.0	171.1	0.2	20.4	138.8	0.3	27.5	307.0	0.0	19.4	267.0
Temp (°C)	18.5	20.1	22.0	17.5	19.4	22.3	15.2	18.4	21.0	17.0	18.4	20.5	15.5	18.7	20.6	17.9	19.9	23.4	17.4	19.1	22.1

Note:

NT = Not tested

[1] 1 result for this analyte provided only

Results of monitoring indicated that analytes were consistent between GMB's except conductivity. Conductivity values were however consistent with values typical of the alluvial aquifer.

Baseline monitoring of proposed new wells WG0708 and WG0709 shall be completed for a minimum 6 month period, and Table 2 and Table 3 of this WMP updated accordingly.

3.4.2 OffSite Monitoring Bores

Review of available groundwater data for off-Site bores has been undertaken using the (then) NSW Office Water's 'allwaterdata' webSite. The review identified the following data for surrounding bores:

Table 5: Available off-Site groundwater bore data

Identification	License Status	Approximate distance from Site (km)	Direction from Site	Groundwater depth (m)	Stratum description	Approximate distance to nearest extraction cell (km)
GW39261	ND [1]	0.6	North west	7.6	Clay sand	0.6
GW039264	ND [1]	0.2	North east	7.0	Sand gravel	0.2
GW400991	ND [1]	0.6	North east	ND [1]	ND [1]	1.05
GW404649	Converted	0.2	North east	11.0	Gravel	0.2
GW403503	Cancelled	0.6	North east	9.3	Gravel	1.35
GW030455	ND [1]	0.5	East	ND [1]	ND [1]	1.35
GW400203	Cancelled	0.5	East	7.0	Gravel	1.05
GW039274	ND [1]	1.0	East	9.5	Gravel	0.75
GW020218	Converted	1.0	South east	6.7	Sand	1.35
GW403806	Converted	0.7	South east	7.0	Silty sand	0.9
GW020231	Abandoned	0.7	South east	1.2	Clay	1.0
GW402526	Converted	0.5	South east	6.0	Gravel and clay	0.9
GW402141	Converted	0.3	South east	7.8	Clay	0.7

Notes:

[1] No data/information provided.

OffSite bore locations are provided in Figure 4. As part of the PA, a groundwater census of all off Site bores shall be completed (with the approval of individual private landholders) to obtain baseline data prior to onSite works being commenced. This census shall be completed within 12 months of endorsement of this WMP by DoPE.

Testing at each bore shall include pump testing to measure groundwater yield, and water quality sampling and testing of dissolved oxygen, conductivity, salinity and pH, to measure groundwater quality. This WMP shall be updated following collection of data to include information obtained for each offSite bore sampled and tested.

3.5 Groundwater Monitoring Program

3.5.1 Commencement of Program

Once this Water Monitoring Plan has been endorsed by NSW DPE the monitoring program shall commence immediately. Monitoring data collected shall be reviewed in the context of data collected prior to document endorsement.

3.5.2 Monitoring Regime

The following ongoing groundwater monitoring regime is proposed for the Site:

- Hourly monitoring of groundwater depth and temperature in GMB WG0701, WG0702, WG0704, WG0705, WG0707, WG0708 and WG0709 using existing data loggers.
- Data to be downloaded and reported annually.
- Manual measurement of groundwater depth at all GMB's at the time of logger data download.

- Event-based groundwater quality monitoring; i.e. in the event that a pollution event occurs onSite, groundwater quality is to be sampled from each of the seven GMB's and tested for the following analytes:
    - Dissolved oxygen
    - Conductivity
    - Salinity
    - pH
    - Major ions
    - Other analytes as appropriate based on nature of pollution event.

  Results of monitoring are to be compared to baseline data trends to detect any impact and respond accordingly.

3.5.3 Sampling Register

Sampling events, quarterly climatic conditions (rainfall and evaporation) and any additional observations are to be recorded in a Site register (Attachment D). Any event based monitoring is to also include a record of laboratory results.

3.5.4 Groundwater Performance Criteria and Trigger Values

<u>Water Quality</u>

Completed baseline monitoring has allowed ambient groundwater water conditions and typical seasonal variation to be determined. Baseline conditions form the trigger values for monitoring to be completed during operational and expansion works. This will allow comparison of groundwater quality monitoring data against the expected ranges and conditions for a specific location, time of the year and against typical data ranges.

Should water quality data during Site operations vary from the baseline dataset by 10% or more (Table 7), further investigation of the change and assessment of potential for impacts on surrounding groundwater users and the environment should be investigated. If a level of impact is detected, dewatering is to cease and appropriate mitigating/management measures are to be undertaken, which will include:

- Additional monitoring and groundwater quality sampling.
- Review of extraction and dewatering practices.
- Review of sediment and erosion control measures. In the case of a pollution event:
    - Install temporary measures to minimise spread of pollution.
    - Notify DPI Water of pollution event.
    - Undertake rehabilitation works in consultation with DPI Water.
    - Update Water Monitoring Program as required.

Groundwater Levels

Following consultation with NSW DPI Water, predicted maximum drawdown for each cell and each stage is considered an appropriate trigger for groundwater level monitoring. Table 6 provides the maximum drawdown (trigger value) for Stage 1 (cell 1) based on groundwater modelling completed by Martens and Associates following completion of the EA. For subsequent stages, prior to excavation intercepting groundwater in each cell, groundwater modelling is to be completed to determine maximum drawdown values. This WMP (and Table 6) is to be updated to document trigger values as they are known.

Table 6: Maximum drawdown (groundwater level trigger) values.

Well	Drawdown (m)				
	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5
0701	1.70				
0702	3.60				
0703	7.06				
0704	2.12				
0705	15.28				
0706	1.58				
0707	0.90				
0708	NA				
0709	NA				

Notes:

Drawdown values for WG0708 and WG0709 not available for Stage 1 (cell 1) but are to be included for subsequent stages.

Should groundwater monitoring indicate that 90% of the predicted maximum drawdown has been reached; works will be reassessed and investigated more closely in consultation with DPI Water. Should drawdown in excess of 100% of the predicted maximum drawdown occur, dewatering is to cease and appropriate mitigating/management measures are to be developed and undertaken in consultation with DPI Water; which will include review of quarrying and dewatering practices and subsequent updates to the Water Monitoring Program.

Table 7: Trigger values; groundwater quality monitoring.

Analyte	Data Range													
	WG0701		WG0702		WG0703		WG0704		WG0705		WG0706		WG0707	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Dissolved Oxygen (%)	21.6	26.4	7.8	44.2	6.7	43.6	7.0	79.1	9.1	36.0	5.9	21.0	5.3	40.0
Conductivity (µS/cm)	n/a	706.2	961.5	3421.0	110.3	438.9	65.9	436.7	141.0	5654.0	285.3	1458.6	913.5	2343.0
Salinity (ppm)	NT		576.9	954.8	66.2	129.9	39.5	50.2	86.0	108.2	182.7	234.3	548.1	705.1
pH	6.36	6.81	5.67	7.36	5.87	7.37	4.97	7.37	5.75	7.37	5.10	7.59	5.43	7.51

Notes:

Trigger values for WG0708 and WG0709 are to be included once baseline monitoring of these bores has been completed.

3.5.5 Operational Monitoring Regime

3.5.5.1 Pit Dewatering

Groundwater inflows to active cells during quarry operations shall be monitored as part of the Site water balance (Section 2.3.1). Pit dewatering volumes are to be recorded (Attachment C) to ensure that the Site operates strictly within groundwater extraction license entitlements.

3.5.5.2 Regional Groundwater

Groundwater modelling (Martens, 2009) concluded that the proposed expansion works shall:

- Have a negligible impact on the Lachlan Formation.
- Generate an area of localised groundwater drawdown in the area of the active extraction pit for each stage. The radius of influence resulting from this draw down is of the order of 300 – 500m, and is largest for Stage 1 at 550m.

To monitor these groundwater impacts during operation, groundwater monitoring regime shall continue to ensure any impacts are identified to allow for management, assessment and, where required, mitigation.

3.5.5.3 Surrounding Groundwater Users

1. RWCC –RWCC borefield extracts water from the Lachlan formation, the proposed development is expected to have a negligible impact on levels in the formation and therefore on the volume of level of water available to the borefield.
2. Privately-owned bores – Of the 16 bores located within close proximity to the Site, GW404649 is nearest to proposed works at 700m north of proposed Cell 1. Given the predicted radius of influence of drawdown in the Cowan Formation is a maximum 550m for Cell 1, negligible impact on privately-owned groundwater bores is expected.

No additional monitoring is therefore required to assess impacts to groundwater supply on nearby users.

3.5.5.4 Groundwater Dependent Ecosystems

The Site and its surrounds do not contain any groundwater dependent ecosystems that may be compromised by the proposed expansion.

Approximately 70 ML of groundwater dewatered from the active cell shall be transferred to the existing Site wetland for conservational purposes. Approximately 25 ML of this will be infiltrated back to groundwater.

Given the Site is closely connected with the Murrumbidgee River, groundwater levels are primarily driven by river hydrology and so any associated environments (such as riparian vegetation) is unlikely to be impacted by any localised impacts resulting from the proposed quarry works.

Ongoing monitoring from Site GMB's will ensure any impact on groundwater levels are detected prior to any adverse impacts and appropriately managed.

3.5.6 Contingency and Response Plan

In the event that monitoring indicates that groundwater conditions vary from baseline conditions (i.e. trigger criteria) by ± 10% or more the following actions should be taken:

1. Consult NSW DPI Water to evaluate significance of impact.
2. If required, extraction operations to cease.
3. Additional groundwater sampling and laboratory testing (where required) shall be undertaken.
4. If laboratory testing results confirms trigger values are exceeded:
    a. Further investigation by appropriately qualified environmental engineer/scientist is to be undertaken. The cause of the non-compliance is to be determined, where possible.
    b. If Site works are determined to be the cause of non-compliance this is to be rectified by the Site operator under the supervision and recommendations of the environmental engineer/scientist.
    c. Sampling is to be repeated to ensure the desired conditions have been achieved.

Continued or repeated non-compliance with trigger criteria may indicate a redesign of the quarrying operation and proposal to ensure an acceptable Site groundwater outcome.

In the unlikely event that a neighbouring owner of a licensed groundwater bore advised Hanson that they believe an adverse impact on their bore has occurred due to the quarry's operation the following measures would be undertaken, subject to the bore owner's approval:

1. Bore shall be surveyed to confirm level of top of bore and set datum for monitoring.

2. Bore shall be instrumented to allow for continual monitoring of well water level.

3. Data from the bore shall be compared to data from Site bores in the context of the ongoing quarry operation. Analysis shall then confirm if there is detrimental change in the bore's levels and, if so, if they are likely a result of quarry operation.

3.5.7 Verification of Water Management Performance

After implementation of the Water Monitoring Program for a minimum 2 years, a Verification of Water Management Performance report is to be prepared in accordance with Clause 16, Schedule 3 of the PA. This document is to include:

- Results of monitoring completed.
- Any impacts of the project.
- Any modifications to Site operations or management regime resulting from monitoring or detected groundwater impacts.

The report is to be submitted to DoPE and NSW DPI Water for review and consideration. This Water Monitoring Program is to be updated based on the findings of the verification report.

4 References

Evans and Peck (2008) *Surface Water Management Report*

Evans and 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*.

Lane Piper (2008) *Hydrogeological Assessment Report; Proposed Extension Sand and Gravel Quarry Wagga Wagga, NSW*

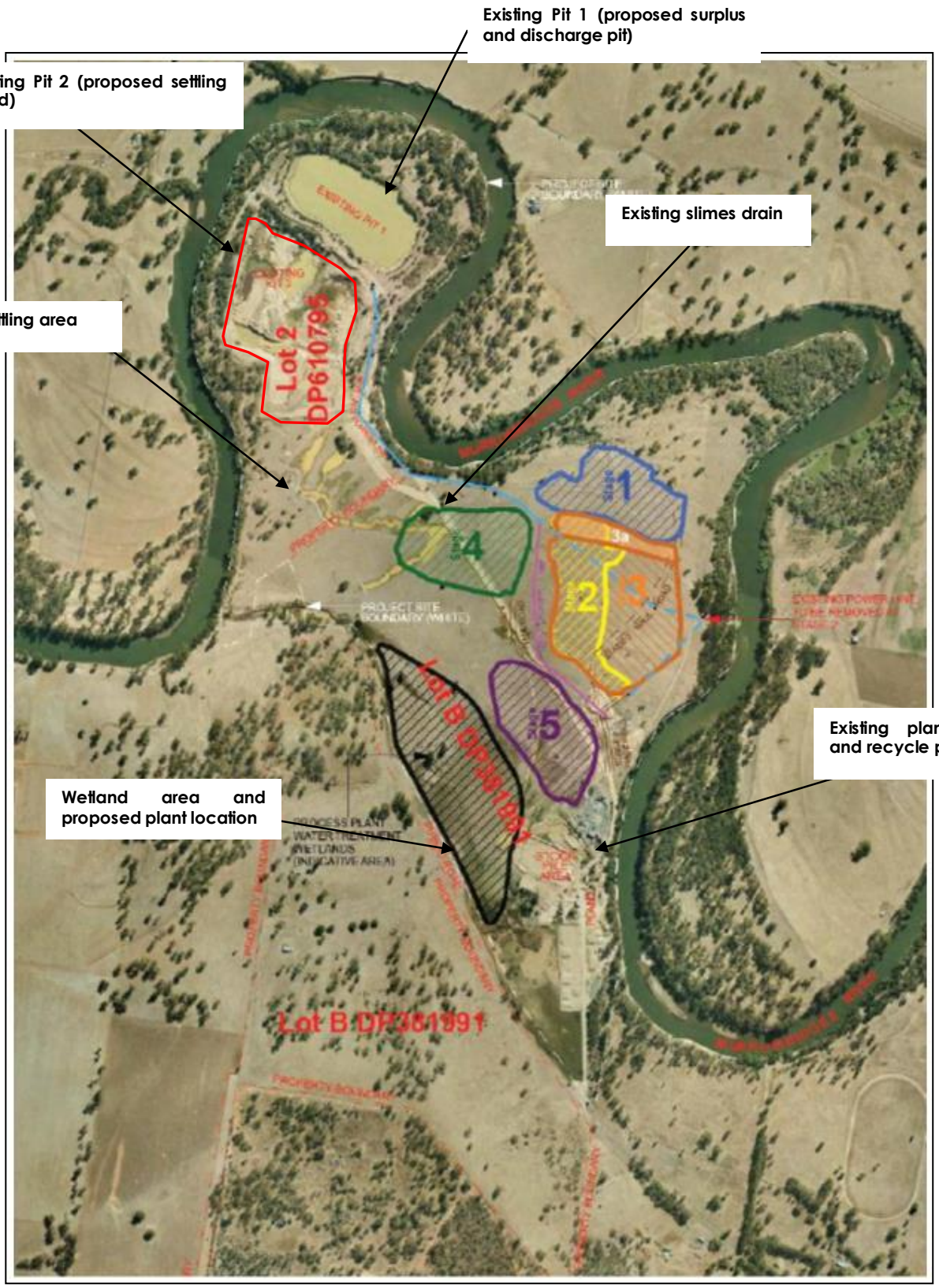
Landcom (2004) *Managing Urban Stormwater: Soils and Construction Handbook*.

Landcom (2008) *Managing Urban Stormwater: Soils and Construction Volume 2e: Mines and Quarries*.

Martens and Associates (2009) *Surface and Groundwater Assessment: Roach Road, Wagga Wagga Quarry, NSW*.

Project Approval (07_0069) issued by NSW DoPE on November 22, 2011

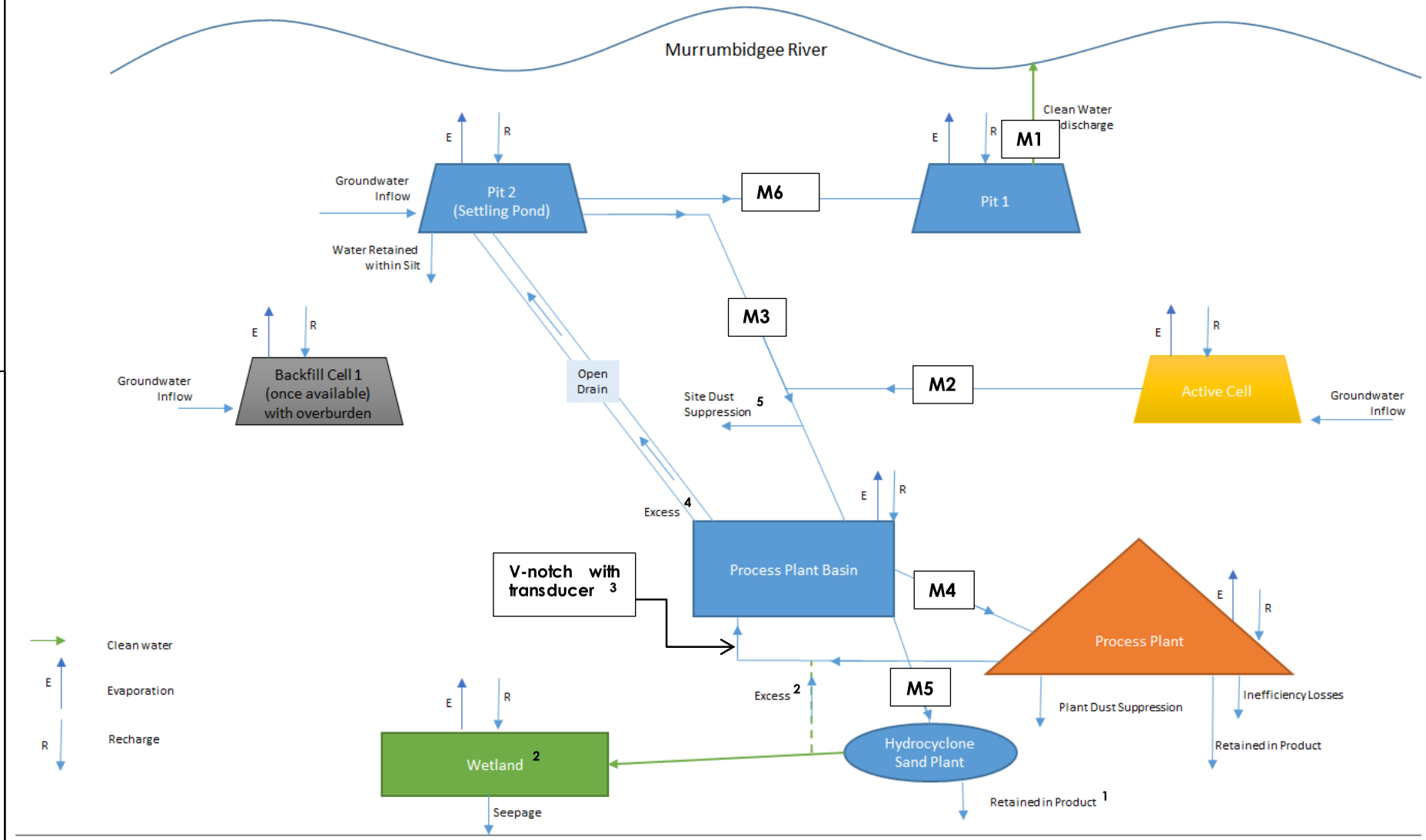
5 Attachment A – Proposed Site Plan



Proposed Stage / Cell

Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Site Aerial and Proposed Extension Layout (Hanson, 2010)**	**ATTACHMENT A**
Approved:	AN		
Date:	17.02.2015		
Scale:	NA		Job No: P1203330

6 Attachment B –Figures



1 Estimate based on product moisture content testing through year and sales data.
2 Calculated by difference of M5 and retained in product.
3 Process Plant Basin return flow measured at V-notch weir used to estimate inefficiency losses etc using M4 & M5 totals less estimate of water retained in product.
4 Calculated as difference between Process Plant Basin inflows (M2 + M3 – dust suppression + direct rainfall) and outflows (M4, M5, evaporation).
5 Water cart dust suppression use logged by counting truck fills.

martens

Martens & Associates Pty Ltd ABN 85 070 240 890

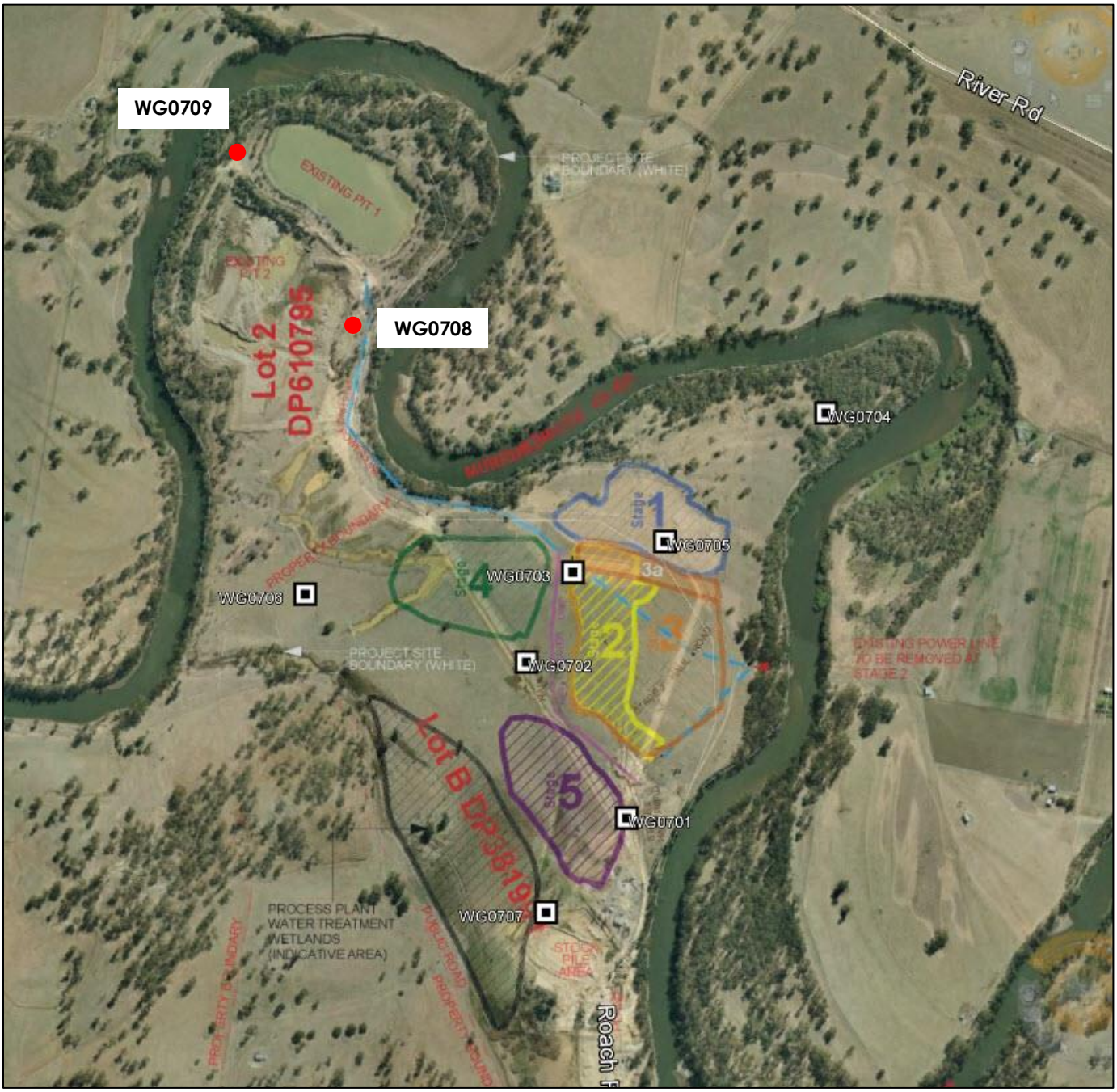
Environment | Water | Wastewater | Geotechnical | Civil | Management

Drawn: MLK
Approved: AN
Date: 02.08.2016
Scale: NA

Schematic of Proposed Water Management System (Evans and Peck, 2013)

FIGURE 1

Job No: P1203330

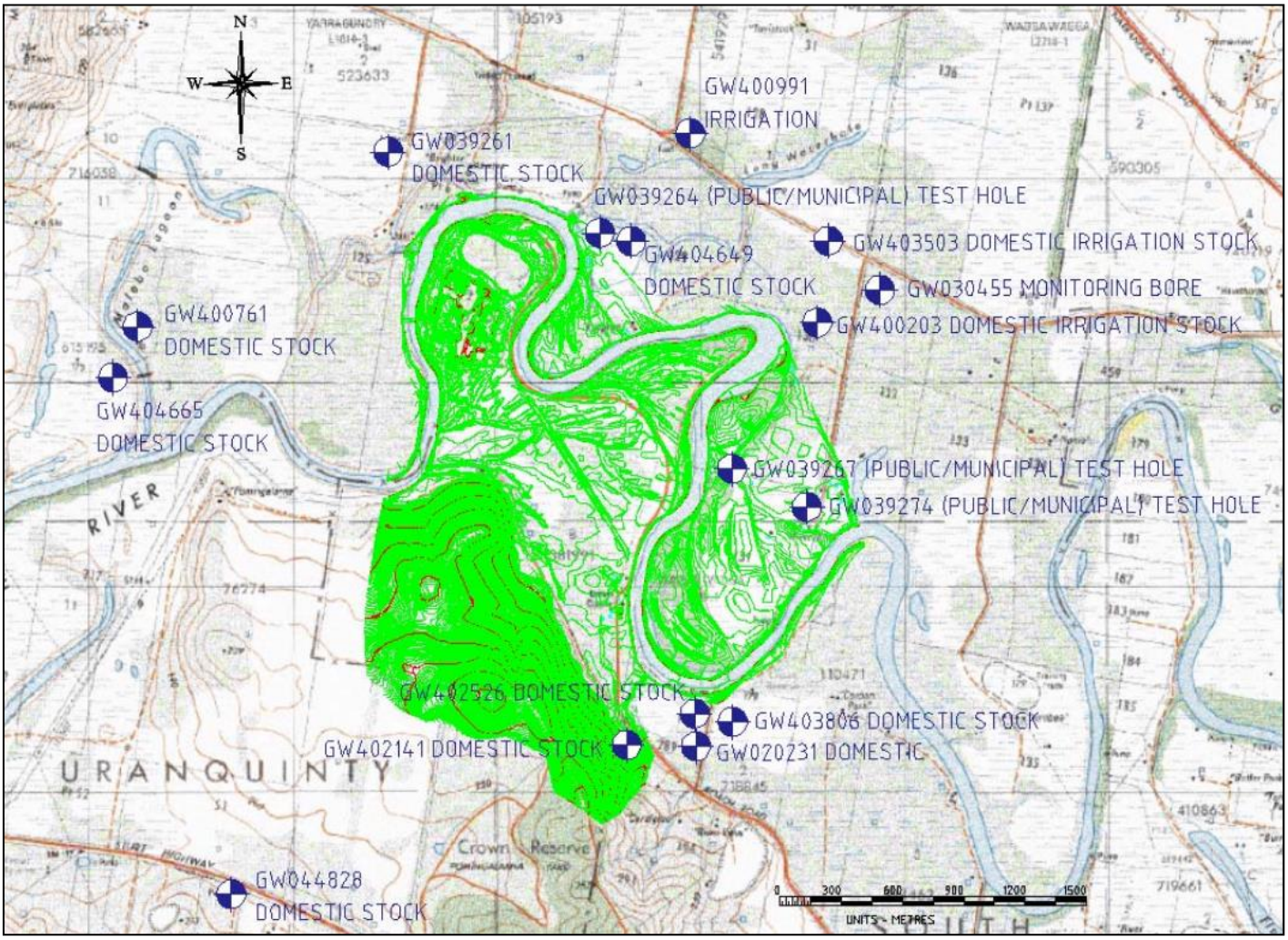


Existing Monitoring Bore

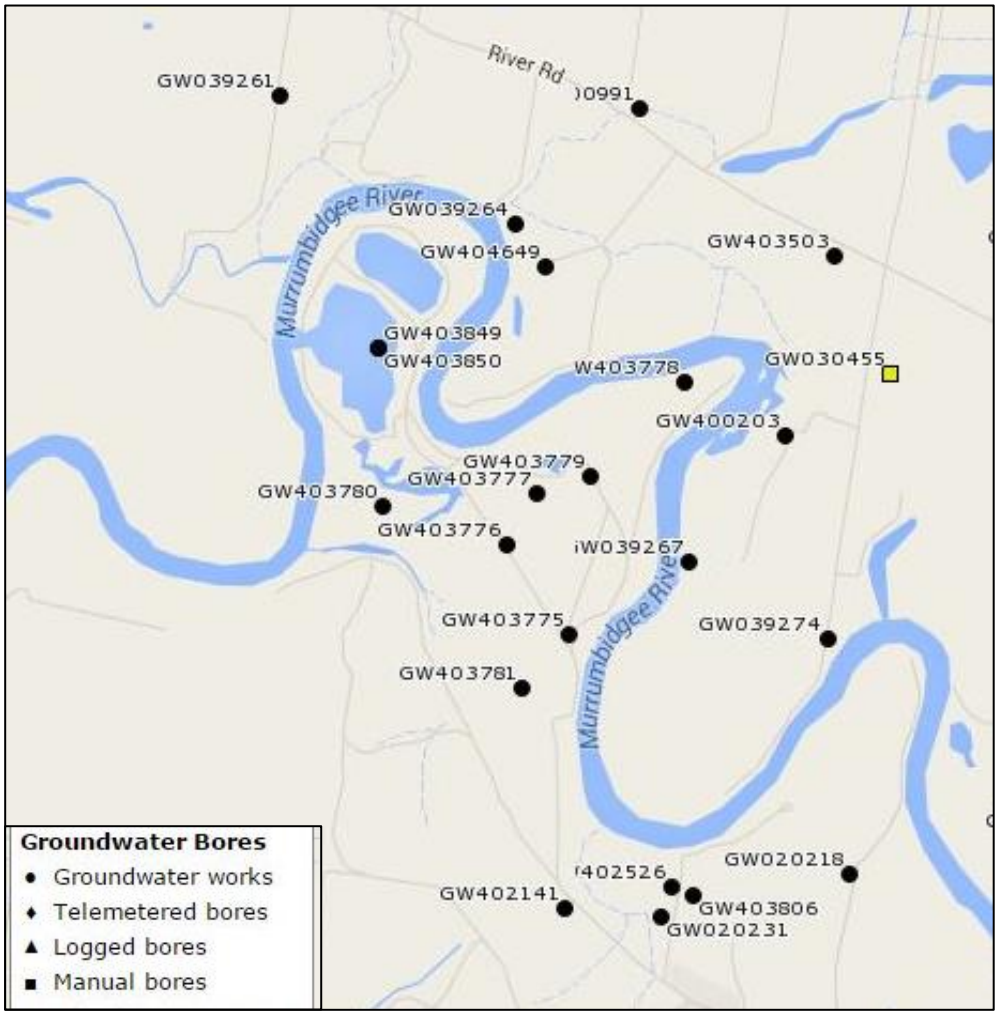
Additional Monitoring Boreas requested by NSW DPI Water

Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**GMB Network (Source: Hanson, 2017)**	**FIGURE 2**
Approved:	AN		
Date:	17.02.2015		
Scale:	NA		Job No: P1203330

martens



Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Regional Privately Owned Groundwater Bores and Use (Source: Martens, 2009)**	**FIGURE 3**
Approved:	AN		
Date:	17.02.2015		
Scale:	NA		Job No: P1203330



Martens & Associates Pty Ltd ABN 85 070 240 890		**Environment | Water | Wastewater | Geotechnical | Civil | Management**	
Drawn:	MLK	**Privately Owned Groundwater Bore Locations (Source: Allwaterdata, 2016)**	**FIGURE 4**
Approved:	AN		
Date:	26.07.2016		
Scale:	NA		Job No: P1203330

martens

7 Attachment C –Water Balance Audit

WATER BALANCE AUDIT – ROUTINE METER READINGS

Date	Murrumbidgee River Discharge Water (M1)	Dewatering Volumes			Process Water Use		Process Plant Basin Return Flow – vee notch weir	Sand Plant Wastewater to:	
		Active Cell (M2)	Pit 2 to Process Plant (M3)	Pit 2 to Pit 1 (M6)	Process Plant (M4)	Sand Plant (M5)		(circle one only)	
								Wetland	Process Plant Basin
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8 Attachment D – Groundwater Monitoring Register

GROUNDWATER MONITORING REGISTER – QUARTERLY MONITORING					
Sampling date	**Sampling Time**	**Sampling Personnel**	**Quarterly Rainfall (BOM (Wagga Wagga Agricultural Institute)**	**Quarterly Evaporation (BOM (Wagga Wagga Agricultural Institute)**	**General Observations**

9 Attachment E – Agency Consultation

Department of Primary Industries
Water

Contact: Tim Baker
Phone: 02 6841 7403
Mobile: 0428 162 097
Fax: 02 6884 0096
Email: tim.baker@dpi.nsw.gov.au

Megan Kovelis
Martens & Associates Pty Ltd
Suite 201, 20 George Street
HORNSBY NSW 2077

Our ref: OUT17/33483

15 August 2017

Dear Megan

Wagga Wagga Quarry – Amended Water Management Plan and Water Monitoring Program

I refer to your emails dated 11th July 2017 providing DPI Water an opportunity to comment on the Wagga Wagga Quarry Amended Water Management Plan and Amended Water Monitoring Program. This request follows previous advice provided by DPI Water in a letter dated 24th January 2017 and an email dated 15th March 2017. DPI Water has reviewed the amended documents and considers the issues raised previously in regards to the Water Management Plan have been adequately addressed. In regards to the Water Monitoring Program DPI Water acknowledges the inclusion of two additional monitoring bores near existing Pit 1 and 2. If practically possible DPI Water requests monitoring bore WG078 be located closer to the pit than the river to aid in interpretation of the monitoring results. No further comment is required.

Should you have any further queries in relation to this submission please do not hesitate to contact Tim Baker on (02) 6841 7403.

Yours sincerely

Guy Ohandja
A/Manager, Regional Water Regulation
Department of Primary Industries Water

Megan Kovelis

From: Tim Baker <tim.baker@dpi.nsw.gov.au>
Sent: Tuesday, 15 August 2017 3:17 PM
To: Megan Kovelis
Cc: Water Referrals
Subject: DPI Water response - Wagga Wagga Quarry - updated Water Management Review
Attachments: DPI Water Comments - Wagga Wagga Quarry - Updated WMP & Water Monitoring Program.pdf

Hi Megan,

Please see attached DPI Water's response. If you need to discuss please give me a call.

Regards

Tim

Tim Baker | Senior Water Regulation Officer
NSW Department of Primary Industries | Water
209 Cobra St | Dubbo NSW 2830 | PO Box 717, Dubbo NSW 2830
T: 02 6841 7403 | F: 02 6884 0096 | M: 0428 162 097 | E: Tim.Baker@dpi.nsw.gov.au
W: www.water.nsw gov.au | www.dpi.nsw.gov.au

On 11 July 2017 at 11:56, Megan Kovelis <mkovelis@martens.com.au> wrote:

Morning Tim,

Email 2 of 2. Find attached the Monitoring Program.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis

Environmental Scientist

BEnvSc (Hons1)

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From: Megan Kovelis
Sent: Tuesday, 11 July 2017 11:56 AM
To: Tim Baker (tim.baker@dpi.nsw.gov.au); 'lauren.evans@planning.nsw.gov.au'
Cc: Nicholas Warren (nick@rwcorkery.com) (nick@rwcorkery.com); Driver, Andrew (Parramatta) AU <Andrew.Driver@hanson.com.au> (Andrew.Driver@hanson.com.au); Andrew Norris
Subject: 3330; OUT17/3204 Wagga Wagga Quarry - Water Management Review

Good morning Tim,

Please find attached the amended Water Management Plan for your review. This now incorporates all recent comments/feedback provided from DPI Water as discussed throughout our consultation. The Water Monitoring Program will follow in a subsequent email.

Can you please review and confirm that we have now satisfied DPI Water's concerns in relation to this project. As I am sure you are aware, DPE is awaiting DPI Water 'sign off' before progressing the application. As such we would appreciate you completing your review asap. Can you please provide me with a timeframe within which this will be done, so that I can inform DPE?

Thanks again,

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis

Environmental Scientist

BEnvSc (Hons1)

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Megan Kovelis

From: Tim Baker <tim.baker@dpi.nsw.gov.au>
Sent: Wednesday, 5 April 2017 2:31 PM
To: Megan Kovelis
Cc: Andrew Norris; lauren.evans@planning.nsw.gov.au; Water Referrals
Subject: Re: 4420; OUT17/3204 Wagga Wagga Quarry - Water Management Review

Hi Megan,

Please see the below comments for further consideration.

- DPI Water understands the initial groundwater level interpretation across the site was based on the existing monitoring bores which are not in close proximity to Pit 1 and 2. There was therefore an element of uncertainty of the actual groundwater level in relation to Pit 1 and 2.
- DPI Water provides specific advice on groundwater monitoring requirements during review of Water Management Plans, rather than during the project application. This enables consideration of the final approved project and its impacts, and enables consideration of the conditions of the project approval.
- The information in the EA that supported the latest project approval was carried forward into the Water Management Review (2012). I understand no further bores were installed to verify the groundwater levels in relation to Pit 1 and 2.
- DPI Water advised on review of the Water Management Review (2012) that the adequacy of the groundwater monitoring network would need to be considered by the former NOW as part of a complete review of the information prepared for the Water Management and Water Monitoring. The WMP is considered to be that opportunity.
- DPI Water maintains the original recommendation to have monitoring bores to enable verification of groundwater levels in relation to all pits at the site. This is to enable confirmation of licensing requirements and impacts, and to meet the groundwater monitoring requirements of the project approval.

It is recommended further consultation with Department of Planning and Environment if concerns remain with the above comments and recommendations.

Regards

Tim

Tim Baker | Senior Water Regulation Officer
NSW Department of Primary Industries | Water
209 Cobra St | Dubbo NSW 2830 | PO Box 717, Dubbo NSW 2830
T: 02 6841 7403 | F: 02 6884 0096 | M: 0428 162 097 | E: Tim.Baker@dpi.nsw.gov.au
W: www.water.nsw gov.au | www.dpi.nsw.gov.au

On 29 March 2017 at 08:09, Megan Kovelis <mkovelis@martens.com.au> wrote:

Morning Tim,

Following on from our conversation yesterday, I have spoken with the Proponent on DPI Water's concerns raised in relation to understanding the relationship between groundwater and individual pits and request for additional groundwater monitoring in the vicinity of Pit 1 and Pit 2.

The Proponent questions the need for additional bores in the vicinity of Pit 1 and 2 for a number of reasons:

1. During preparation of the EAR and its subsequent approval, there was no request made for additional groundwater monitoring bores.

2. Post approval there was a further requirement for the proponent to undertake a comprehensive Water Audit and Improvement Assessment. This was conducted by Evans & Peck in consultation with NOW/DPI Water.

3. The groundwater conditions at the site are well understood as a result of numerous studies, assessment and monitoring having been completed. The Proponent has also committed to ongoing monitoring and assessment in the future as part of the Water Monitoring Plan.

4. Studies completed as a condition of the Project Approval (Evans and Peck 2012 Water Management Review) have concluded that Pit 1 is not connected to groundwater. Pit 2 is connected to groundwater. The existing groundwater bore network is therefore considered sufficient.

5. Installation and ongoing monitoring of these additional 2 bores will incur a cost that is not feasible and not practical for a small sand quarry such as that at Wagga Wagga.

We ask that DPI Water considers the above and reviews their request for additional monitoring bores near Pit 1 and 2.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis

Environmental Scientist

BEnvSc (Hons1)

Office Hours: Tues - Thurs

Megan Kovelis

From: Tim Baker <tim.baker@dpi.nsw.gov.au>
Sent: Wednesday, 15 March 2017 4:49 PM
To: Megan Kovelis
Subject: Re: 4420; OUT17/3204 Wagga Wagga Quarry - Water Management Review

Hi Megan,

Please see the comments below in response to your email below in same numbers.

WMP

1. DPI Water accepts the proposal. Onus is on the operator to ensure compliance with water entitlements.

2. DPI Water's concern is that due to variations in the relationship between groundwater level and water level/base in the pits across the site (due to water stored in pits, pit depth or pit location) they will need to be considered individually, and this relationship may change during operations. To be able to justify this and to confirm changes during operations additional monitoring bores near the pits is required.

3. Revised water accounting is noted.

4. Removal of reference is noted.

5. Proposed amendments to figures and text is noted.

Water Monitoring Program

1. DPI Water considers additional groundwater level monitoring is required to confidently define the groundwater levels in the vicinity of the pits now and during operations and to meet the groundwater monitoring requirements of the project approval.

2. DPI Water accepts the proposal. Onus is on the operator to ensure compliance with water entitlements.

3. The table of construction details would be appreciated.

4. Additional groundwater monitoring is still requested to confirm groundwater levels to enable justification of water take requirements and to satisfy the requirement of the groundwater monitoring requirements of the project approval.

5. DPI Water accepts proposal.

6. Trigger related to groundwater quality and levels are noted. In regards to the water level trigger its recommended to use a trigger set less than the predicted maximum to give an opportunity to review the drawdown trend and the potential for exceedance of maximum predictions and the need to consider mitigating measures.

7. Monitoring program to commence immediately once WMP is endorsed is noted.

8. DPI Water accepts proposal.

9. WAL detail to be included is noted.

10. Amended figure to be provided is noted.

Regards

Tim

Tim Baker | Senior Water Regulation Officer
NSW Department of Primary Industries | Water
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W: www.water.nsw gov.au | www.dpi.nsw.gov.au

On 8 March 2017 at 15:58, Megan Kovelis <mkovelis@martens.com.au> wrote:

Afternoon Tim,

Thanks for speaking with me this morning. As requested, we have summarised comments and queries in relation to DPI Water's most recent review (January 24, 2017) below. Our comments following the same numbering system as DPI Water's.

Water Management Plan

1. We are concerned that increasing water accounting frequency from quarterly to monthly will be overly onerous on the operator, but understand DPI Water's desire to ensure groundwater 'take' does not exceed the license allocation. We propose accounting be completed quarterly unless the take is assessed as exceeding the prorated allocation. If take exceeds allocation, then accounting is to be increased to monthly for the balance of the year or until take is reduced to below prorated level. Please confirm if DPI accept this solution.

2. We are unsure what DPI Water seeks to achieve by this change. The water accounting will result in the same figure regardless of whether the surface area in each pit and active cell is used in calculation individually and then aggregated, or if areas are aggregated then used. Can you please provide further clarification of DPI Water's concern.

3. We will revise our water accounting (Attachment E) to include inflows and outflows to Pit 1 and Pit 2 as follows:

- Inflows into Pit 2 from the PPB are to be calculated as described in the Water Monitoring Plan (see '4' in Figure 1, Attachment B).

- Change in water level in Pit 2 over the period and a stage-storage relationship based on survey of the pit will be used to calculate changes in volume in the retained pit.

- Transfers from Pit 2 into Pit 1 will be metered.

- Pit 1 outflows (into the River) are already metered.

- Transfers from Pit 2 to PPB are already proposed to be monitored (Figure 1, Attachment B of report).

Please confirm the above is acceptable.

4. We will remove the reference as requested.

5. The fuse plug figures are being amended to reflect the levee heights and fuse plug locations. The text in the report will be updated to be consistent.

Water Monitoring Plan

1. As part of our water accounting calculations, we assume that Pit 2 is connected to groundwater, this is based on site knowledge regarding historic inflows when the pit was active. We do not believe additional groundwater analysis is required.

With regards to Pit 1, documentation from Evans and Peck confirm that the pit is not connected to the groundwater table, and so it is disregarded from calculation. We can provide this is required. Please confirm.

2. Assuming quarterly water accounting the groundwater take 'trigger volume' shall be n/4 of the annual estimate (e.g. 360 ML is annual allowable take, after 1 quarter trigger is 90 ML after two it is 180 ML). If take exceeds trigger volume further investigations will be required and dewatering shall cease until additional take is secured or until take falls below trigger.

3. A table of construction details shall be provided.

4. If DPI Water support our findings of Point 1 (comparison of groundwater level to bed level of Pit 1 and Pit 2), then additional groundwater monitoring in the vicinity of Pit 1 and 2 is not required.

5. We will include major ions to groundwater water quality sampling regime.

6. The 10% variation trigger applies to groundwater quality only (the text in the report will be adjusted for clarity). For groundwater levels, we will use predicted maximum drawdown for each cell and each stage. Currently, modelling for only Stage 1 is available as the model has been updated since the EA. We will amend the WMP to include draw down levels for Stage 1. WMP with require additional groundwater modelling to provide drawdown for subsequent stages prior to excavation intercepting groundwater in each subsequent cell. The WMP will include a table of trigger levels for each well for each stage.

7. A section in the report will be included to require that, once the WMP is endorsed, the monitoring program immediately commence.

8. We propose the following methodology for selection of replacement groundwater monitoring sites:

a) A new location shall be proposed to DPI Water in writing with justification based on location of damaged/destroyed well and historic groundwater observation.

b) DPI Water to confirm the revised location is acceptable. Consultation to continue until a mutually acceptable solution is achieved.

c) New groundwater monitoring well be constructed.

d) A data logger is to be installed in the new well.

9. The WAL detail will be included as requested.

10. An amended figure will be provided combining details as requested.

As we discussed, we are working to a tight timeframe with the Department, so if I can get comments/feedback on each point this week it would be appreciated.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis

Environmental Scientist

BEnvSc (Hons1)

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Megan Kovelis

From: Tim Baker <tim.baker@dpi.nsw.gov.au>
Sent: Wednesday, 25 January 2017 11:43 AM
To: Megan Kovelis
Cc: Water Referrals
Subject: Re: 3330: Wagga Quarry Letter - water management review
Attachments: OUT17 3204 DPI Water Response - Wagga Quarry Water Management Plan & Water Monitoring Program.pdf

Hi Megan,

Please see attached DPI Water's response on the revised documents. If you need to discuss please give me a call.

Regards

Tim

Tim Baker | Senior Water Regulation Officer
NSW Department of Primary Industries | Water
209 Cobra St | Dubbo NSW 2830 | PO Box 2830, Dubbo NSW 2830
T: 02 6841 7403 | F: 02 6884 0096 | M: 0428 162 097 | E: Tim.Baker@dpi.nsw.gov.au
W: www.water.nsw gov.au | www.dpi.nsw.gov.au

On 15 November 2016 at 10:50, Megan Kovelis <MeganKovelis@martens.com.au> wrote:

Morning Tim,

In relation to the above site and project and following from email consultation below, please find attached revised reporting for your review and comment.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis

Environmental Scientist

BEnvSc (Hons1)

Office Hours: Tues - Thurs

Department of Primary Industries
Water

Contact: Tim Baker
Phone: 02 6841 7403
Mobile: 0428 162 097
Fax: 02 6884 0096
Email: tim.baker@dpi.nsw.gov.au

Megan Kovelis
Martens & Associates Pty Ltd
Suite 201, 20 George Street
HORNSBY NSW 2077

Our ref: OUT17/3204

24 January 2017

Dear Megan

Wagga Wagga Quarry – Water Management Review

I refer to your email dated 15th November 2016 requesting comments on the revised Water Management Plan (WMP) and Water Monitoring Program for the Wagga Wagga Quarry. DPI Water has reviewed the submitted documentation and provides key comments and recommendations below.

1. Comments

- DPI Water's previous review of the Water Management Audit identified significant concerns with the method used to estimate inflows into the extractive cells and the numerical modelling. These aspects have not been addressed in the revised WMP or the Water Monitoring Program.
- The proposed methodology for the calculation of the site water balance is generally robust however a number of recommendations have been made below to improve the reliability of the assessment.
- Numerous references are included in the WMP for water discharged into the river to be credited against licensed surface water take. DPI Water advises there is currently no regulatory mechanism to enable re-crediting of water returned to a water source. Further comments on this issue were detailed in a response dated 12 September 2014 to Hanson Construction during a review of the Water Management Review for this site.
- The proposed water monitoring program provides limited baseline data, which could be enhanced by providing additional information, such as; bore construction information, groundwater level hydrographs and analysis of groundwater quality data.
- Additional information is required on the trigger values and the actions to be implemented if they are exceeded.

2. Recommendations

Water Management Plan

1. Uncertainty in the estimates of inflows to the cells requires the water accounting of take and evaporative loss to be completed monthly rather than quarterly to ensure that take does not exceed the available allocation.

2. The surface area of the water in each pit and active cell to be calculated individually and not as a total. This is due to the groundwater level potentially not being uniform across the site, especially in the vicinity of the active extraction cell(s) where there is active dewatering.
3. The water balance accounting to include inflows into Pit 1 and Pit 2 from the Process Plant Basin in addition to outflows. This will assist in completing the water balance and verifying the volume of evaporation minus rainfall.
4. References to "*water discharged into the River is to be credited against licensed surface water take*" need to be removed. Implications of not being able to re-credit entitlement need to be considered for water licensing requirements at the site.
5. Review the location of the fuse plugs in Figures C1-C5. The figures indicate a fuse plug on both the upstream and downstream sides of the cells rather than just on the downstream side as proposed in Section 5.2.3.

Water Monitoring Program

1. The analysis of any significant variations in the groundwater levels during the year and their influence on extractive cells and pit 1 and pit 2 water levels.
2. Establishment of a trigger volume that is assessed monthly to account for take and evaporative loss from the pits and active cell, due to concerns about the reliability of the method used to estimate inflows into the extractive cells.
3. A table on the construction details of the monitoring bores.
4. Identification of additional groundwater level monitoring sites(s) in the vicinity of pits 1 and 2 to enable the monitoring of the groundwater level in the pits.
5. Inclusion of major ions in the groundwater quality sampling as this may assist in the identification of any impacts.
6. Clarify if the 10% variation trigger applies to groundwater levels and/or water quality. Further information is also required on when and what actions will be taken if the 10% variation is exceeded, if there is a level of impact that operations would cease and viable mitigating/management measures.
7. Commencing the proposed monitoring program as soon as possible once endorsed, as the development was approved in 2011. Data collected prior to the current date will be important in reviewing the ongoing monitoring results.
8. A methodology for the selection of replacement groundwater monitoring sites if an existing site is damaged or destroyed.
9. Identify the relevant Water Access Licence (WAL) in addition to the bore licence.
10. Provide extractive cell locations in the GMB network diagram (Figure 2). This will assist in identifying the proximity of these sites to the cells and the potential for the groundwater level at these sites to be influenced by the dewatering of the active cell.

Should you have any further queries in relation to this submission please do not hesitate to contact Tim Baker on (02) 6841 7403.

Yours sincerely

Patrick Pahlow
A/Manager, Regional Water Regulation

Department of Primary Industries Water

Megan Kovelis

From: Tim Baker <tim.baker@dpi.nsw.gov.au>
Sent: Monday, 16 February 2015 12:41 PM
To: Megan Kovelis
Subject: Re: 3330: Wagga Quarry Letter - water management review

Hi Megan,

In response to your email below dated 30 January 2015 I can provide the following comments to your three queries.

1. As detailed in NOWs letter dated 12 September 2014 regarding the Water Management Review, the volume of the pit/cells bounded by a levee that is minimised to the area of extraction do not need to be considered under harvestable rights.

2. Where groundwater is intercepted within pits the accounting for groundwater take is generally based on the volume of GW inflow induced through evaporation. Hence this is generally the difference between the rainfall and runoff versus evaporation rates where evaporation is higher. In situations where excavated material is removed which holds water and/or there is direct water extraction this would be an additional take to be considered in the water balance and final accounting.

3. The adequacy of the groundwater monitoring network would need to be considered by NOW as part of a complete review of the information prepared for the Water Management and Water Monitoring.

If you need to discuss further please give me a call and a formal response to the complete information prepared will be provided by NOW once submitted.

Regards

Tim

Tim Baker | Senior Water Regulation Officer
Department of Primary Industries | Office of Water
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On 30 January 2015 at 09:42, Megan Kovelis <mkovelis@martens.com.au> wrote:

Hi Tim,

Good to speak with you last week and thank you for forwarding that documentation. As discussed, we have been engaged by Hanson to satisfy requirements of the Project Approval relating to Water Management and Water Monitoring – and so most comments made within NOW's feedback you provided will be addressed within our documentation. Others, particularly related to post-operation management of the site, will be dealt with at a later date by Hanson. As requested we provide the following summary of the points raised in NOW's feedback and how they are addressed within the Management and Monitoring Plans.

1. Harvestable Rights

   - Surface water licensing and application of Harvestable Rights will be addressed.

   - Note 'dirty' water sources will be from the Process Plant (process waste water) and the active cell. Water from both of these locations shall be directed to the Settling Pond and either reused in the Plant or discharged into the Murrumbidgee when water quality meets the site's EPL requirements (i.e. < 50 ppm TSS).

2. Flooding

   - The Water Management Plan shall include a Flood Management Plan including:

     a) Levee design, location and height information.

     b) Fuse plug design specifications.

     c) Flood contingency plan in the event damage occurs to the site during a flood event.

   - Flood management infrastructure requirements following the completion of site quarrying operations will be addressed separately by Hanson

3. Groundwater Modelling

   - As I mentioned on the phone, the Water Management Plan shall include a Water Balance and provide approximate values for site water 'take' and 'losses'. However, the nature of the operation means that accurate annual volumes of 'take' from groundwater shall be assessed on an ongoing basis to ensure values are correct.

   - To ensure this is appropriately undertaken; our water balance assessment outlines a process for estimating groundwater take for future years operation based on the previous year. The calculations account for rainfall, evaporation and metered readings of dewatering.

   - The total anticipated 'take' shall be calculated and additional groundwater license allocation obtained should anticipated take exceed the site's current WAL of 360 ML.

   - The water balance shall be reviewed at 3-monthly intervals to ensure actual take is consistent with estimates. In the event that allocation requirements has been under-estimated, additional WALs shall be obtained prior to the operation exceeding the annual allocation.

4. Groundwater Assessment Limitations

   - Shall be addressed by the above.

5. Water Licensing

   - As per above, operational Harvestable Rights licensing requirements shall be addressed. Post-operational requirement shall be addressed separately by Hanson.

   - On closure, the site shall maintain a groundwater license for ongoing groundwater 'take' via evaporative loss.

   - A plan shall be provided detailing the water management scheme (including dirty and clean water management and cycling).

In addition to the above, we have a number of queries in relation to water management and monitoring that we seek comment on:

1. The proposed extraction cells shall be leveed and so will not have a catchment (i.e. will effectively operate as a turkeys nest dam) and will only capture direct rainfall. Does NOW agree that this volume does not contribute to the site's harvestable rights dam volume calculation.

2. Any rainfall captured within the active cell, the Settling Pond (existing Pit 2) and the Discharge Pond (existing Pit 1) will sit as the top layer of water within these water bodies due to water quality differences with groundwater. Rainwater will therefore be preferentially evaporated rather than groundwater.

   We believe that direct rainfall captured within these cells should therefore offset evaporative loss and thus the calculated groundwater 'take' when considering WAL requirements. Does NOW support this methodological approach?

3. In relation to groundwater monitoring, the site has an existing network of 7 groundwater monitoring bores from which sampling is already undertaken. We propose to continue monitoring groundwater height from these wells using data loggers and propose groundwater quality sampling on an 'event' basis (e.g. pollution event) as general site operations are not anticipated to impact groundwater quality – does NOW agree that this is suitable?

Your feedback on the above is much appreciated.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis

Environmental Scientist

BEnvSc (Hons1)

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PLEASE NOTE MARTENS HAS MOVED TO GEORGE ST, HORNSBY

From: Tim Baker [mailto:tim.baker@dpi.nsw.gov.au]
Sent: Friday, 23 January 2015 4:29 PM
To: Megan Kovelis
Subject: Wagga Quarry Letter - water management review

Hi Megan,

Further to your phone call today please see attached letter from NSW Office of Water to Hanson regarding the Wagga Quarry water management review.

If you need to discuss further please give me a call.

Regards

Tim

Tim Baker | Senior Water Regulation Officer

Department of Primary Industries | Office of Water

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This message is intended for the addressee named and may contain confidential information. If you are not the intended recipient, please delete it and notify the sender. Views expressed in this message are those of the individual sender, and are not necessarily the views of their organisation.

Megan Kovelis

From: Amanda Baldwin <Amanda.Baldwin@epa.nsw.gov.au>
Sent: Wednesday, 21 January 2015 1:51 PM
To: Megan Kovelis
Subject: RE: 3330; Hanson Wagga Wagga Expansion - OEH Consultation

Hi Megan,

Thank you for your email. Just confirming and adding to your email below:

The **EPA** require the Water Management Plan and the Water Monitoring Plan to acknowledge the requirements issued under Hanson's Environment Protection Licence (EPL No. 2433). In relation to water management, these requirements include:

- Discharge volume into the Murrumbidgee River not to exceed 350 KL/hr
- Discharge pollutant concentration not to exceed 50 mg/L of Total Suspended Solids

The proponent is also required to demonstrate compliance with the above pollutant concentration and volume limits. The EPA view a monthly monitoring regime to be satisfactory in demonstrating compliance, noting that this is only required when the proponent is actually discharging to the Murrumbidgee River.

I believe that is all that needs to be included with regards to water management specifically. Please let me know if you need clarification with any of the above or further confirmation.

Thank you,
Amanda

Amanda Baldwin
Regional Operations Officer, Albury Unit| **NSW Environment Protection Authority** |
☎: (02) 6932 9123 | Mobile ☎: 0417 203 094 | 🖷: (02) 6932 9110|🖱: **Amanda.baldwin@epa.nsw.gov.au**

From: Megan Kovelis [mailto:mkovelis@martens.com.au]
Sent: Wednesday, 21 January 2015 10:54 AM
To: Baldwin Amanda
Cc: Andrew Norris
Subject: 3330; Hanson Wagga Wagga Expansion - OEH Consultation

Morning Amanda,

Thank you for your time this morning. Just to summarise the outcomes of our discussion, OEH require the Water Management Plan and Water Monitoring Plan to both require the proponent to comply with EPL requirements. Specifically (and in relation to water management):

- Discharge volume into the Murrumbidgee River not to exceed 350 KL/hr
- TSS of water discharged is to be < 50 ppm

I also note that, although not related to water management or monitoring, you mentioned it is also important for the site to comply with extraction volume limits or update the EPL to reflect proposed extraction volumes.

Can you please confirm that I have understood our conversation correctly. Feel free to add any further comments if required.

Kind Regards,

Martens & Associates Pty Ltd

Megan Kovelis
Environmental Scientist
BEnvSc (Hons1)

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