



DEWATERING AND GROUNDWATER MANAGEMENT PLAN

**Former Kirrawee
Brick Works
564-594 Princess Highway
Kirrawee NSW**

Prepared for

South Village Pty Ltd
c/o Ionic Management Pty Ltd
Shop 1, 22 Gadigal Avenue
Zetland NSW 2017

Prepared by

DLA Environmental

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October 2013

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1.0 INTRODUCTION

DLA Environmental (DLA) have been commissioned by South Village Pty Ltd to prepare a Dewatering and Groundwater Management Plan for the dewatering of the former Kirrawee Brick Pit located on the property identified as Lot 2 DP589977 at 566-594 Princes Highway, Kirrawee (the Site). The Site covers an area of approximately 4.2 hectares and is located thirty (30) kilometres south of the Sydney CBD.

The proposed development plans include the draining of the existing water-filled excavation followed by partial backfilling with select fill material and construction of various buildings and parkland across the footprint of the former quarry.

The brick pit is approximately 215m in length, 90m wide, up to 6m deep and the survey conducted by AWT in 2006 estimated the water body to have a volume of 42,717m³. Water contained in the Brick Pit is believed to be the combined result of surface runoff and groundwater inflow.

Refer to **Figure 1 -Site Location** and **Figure 2 – Site Survey**.

Previous environmental investigations conducted on the Site have not highlighted any significant environmental concerns. Irrespective of this, a responsible strategy for safeguarding environmental concerns and ensuring there will be no short or long-term detrimental impacts to the receiving waters during the dewatering process needs to be implemented.

This dewatering and groundwater management plan provides initiatives for the management of dewatering and groundwater issues that may occur during the dewatering exercise from an environmental perspective.

2.0 WATER QUALITY ASSESSMENTS

Previous water quality assessments on the water contained within the Brick Pit have been conducted by:

- *Stage 2 Environmental Site Investigation – Kirrawee Brick Pit, 566-594 Princes Highway prepared by Australian Water Technologies dated December 2001;*
- *Water Quality Assessment: Former Kirrawee Brick Pit prepared by URS dated 2006;*
- *Hydrogeological Data Report – Redevelopment of Former Brick Pit, Kirrawee prepared by C.M. Jewell & Associates dated October 2010; and*
- *Preliminary Site Environmental Assessment prepared by DLA Environmental dated July 2013.*

Based on the water quality information presented in previous reports, including DLA's most recent water quality assessment conducted in July 2013 (see **Table 1** below), the physical and chemical parameters of the water contained within the brick pit shows no evidence of unacceptable impact by natural or anthropogenic influences, and is compliant with Australian and New Zealand Guidelines for Fresh Water Quality (*for 95% level of protection*) (ANZECC 2000).

Table 1 – Brick Pit Water Quality Results July 2013

Parameters	Surface water		Depth 2.0m	
	S1	S2	S1	S2
pH	7.8	7.7	8.0	8.0
Electrical Conductivity (µS/cm)	950	980	930	930
Total Suspended Solids (TSS) (mg/L)	20	20	81	51
Total Dissolved Solids (TDS) (mg/L)	480	530	490	460
Oil & Grease (LLE)	<5	<5	<5	<5
Arsenic	1	2	2	1
Cadmium	<0.1	<0.1	<0.1	<0.1
Chromium	<1	<1	<1	<1
Copper	<1	<1	<1	<1
Lead	<1	<1	1	<1
Mercury	<0.05	<0.05	<0.05	<0.05
Nickel	<1	<1	<1	<1
Zinc	6	9	5	4

3.0 GROUNDWATER ASSESSMENT

Groundwater in the vicinity of the Site flows predominantly within discontinuities such as joints, bedding plane partings and other fractures, which form a fractured rock aquifer within the shale and underlying weathered sandstone. Groundwater flow direction beneath the site coincides with both the local topographic expression and the regional inclination of the Hawkesbury Sandstone, with groundwater flowing from the north-western corner of the site to the east and south-east. It was also noted in the AWT Report that the brick pit excavation is likely to drain localised groundwater from the north of the excavation, and that the surface water level contained within the brick pit excavation is connected to the local groundwater.

Previous groundwater assessments had been conducted by Australian Water Technologies (AWT) in 1999 and 2001. Concentrations of copper, lead, mercury, zinc and nickel (lower level range only) detected in groundwater samples collected exceeded the NEPC (1999) Groundwater Investigation Levels (GIL) for the protection of aquatic ecosystems (Freshwater). Further groundwater assessments were conducted by Douglas Partners and CM Jewell & Associates, both in 2008. Douglas Partners have been conducting quarterly water level monitoring at the Site, with the most recent monitoring event occurring in March 2013.

The presence of contaminant concentrations in exceedance of the adopted Groundwater Investigations Levels (GILs) in the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No.1) triggers further investigation of aquifer conditions to assess the source(s) of contamination and the lateral and vertical extent of the contamination. The adopted GILs are based on the *Australian Water Quality Guidelines 2000* (AWQG) and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)* 95% Freshwater Criteria, and are presented in Table 2 below:

Table 2 – Groundwater Investigation Levels

Analytes	Fresh Waters (µg/L)	Marine Waters (µg/L)
Benzene	950	500
Toluene	-	-
Ethylbenzene	-	-
O-Xylene	350	-
P-Xylene	200	-
Arsenic (III)	24	-
Arsenic (V)	13 ⁺	7
Cadmium	0.2	0.7
Chromium (VI)	1	4.4
Copper	1.4	1.3
Lead	3.4	4.4
Mercury (inorganic)	0.06	0.1
Nickel	11	7
Zinc	8	15
PAH's		
Naphthalene	16	50
B(a)P	-	-

DLA conducted groundwater sampling in July 2013 from wells previously installed by AWT in 1999. Overall results indicate that groundwater presents no major concerns from a quality perspective.

The findings of DLA's most recent investigations into on-site groundwater conditions were consistent with those identified in earlier assessments, which identified concentrations of copper, lead and zinc in excess of the trigger values set for the protection of 95% of species in freshwater in the ANZECC Guidelines. It is the opinion of DLA that these concentrations are typical of urban groundwater in low-permeability formation in the Sydney metropolitan area, and reflecting the impact of diffuse urban pollution that has been concentrated during recharge.

It is anticipated that groundwater recharge of the brick pit will occur during dewatering and as such will require regular weekly monitoring for changes in water table depth and groundwater quality.

4.0 DEWATERING

The brick pit water quality presents no concerns in its present state, and as such it is considered reasonable to allow discharge to the stormwater system provided controls are put in place and contingency plans are initiated in the event the present water quality changes. The challenge will be to keep the quality consistent, particularly as to sediment loading (Total Suspended Solids) during discharge.

The most appropriate dewatering method has been determined to be discharging the standing water via the existing stormwater drainage network. As the Site lies on the crest of a ridge that divides the lower Woronora River and Hacking River drainage systems, there is the potential to discharge the water into two (2) separate receiving waterways:

- Southwards into Dents Creek, which discharges into the North-West Arm of GyMEA Bay; and,
- Northwards into Oyster Gully, which discharges into Oyster Bay on the Georges River.

The Brick Pit can be dewatered by way of piping directly via two (2) discharge points into the local stormwater system. Water discharged to the south towards the freshwater Dents Creek would enter the Creek approximately 750m south-east of the Site, approximately 650m of which through a concrete encased culvert. Water discharged to the north towards Oyster Gully would enter the existing stormwater line on the corner of Oak Road North and the Princes Highway and flow via concrete culvert approximately 150m before entering the Gully.

An existing pipe located on the northern bank of the Brick Pit uncovered during the recent clearing of the Site may be suitable to transfer water contained within the pit to the existing stormwater system located on the Princes Highway. Water discharged to this location would also feed into Dents Creek.

All discharged water will pass through a suitably designed containment device located on-site, before being released into the stormwater system. The anticipated discharge rate would be limited to 25L/sec per pump to ensure no damage is caused to Council infrastructure and to minimise any disturbance to local residents and businesses.

5.0 SCHEDULE

The schedule for the dewatering procedure will be dependent upon authorisation to utilise two (2) pumps. In the event that the use of only one (1) pump is approved, then the estimated timeframes for the dewatering process outlined below would be doubled.

At the discharge rates of 25L/sec per pump and assuming operational hours are 7am – 5pm (900,000L per pump / day), the extraction and discharge of 42ML would take approximately:

One pump ~ 47 days

Two pumps ~24 days

If discharge were to be permitted 24hrs/day (2,160,000L per pump / day):

One pump ~ 19 days

Two pumps ~10 days

6.0 ASSESSMENT CRITERIA

For protection of Groundwater and Receiving Waters threshold concentrations based on the ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000 (95% freshwater) are used.

In order to ensure adequate response times in the event of detection of undesirable concentrations of contaminants, a **Trigger and Action** level for target contaminants has been formulated. The trigger level being 50% of the recommended threshold with the action level set at 75% of the relevant threshold.

Trigger – implement more rigid monitoring and investigation.

Action – cease off-site discharge until water quality improves and implement Contingency Plans

Table 3 - Contaminant Trigger and Action Levels

Parameters	Trigger	Action
pH		<6.5 - >8.5
Suspended Solids (TSS)	Visually turbid	50mg/L
EC	750µs/cm	1000µs/cm
Total Dissolved Solids (TDS)	500mg/L	750mg/L
Oil & Grease	5.0mg/L	7.5mg/L
Benzene	475µg/L	315µg/L
P-Xylene	190µg/L	285µg/L
Metals		
Arsenic	12µg/L	37µg/L
Cadmium	0.1µg/L	0.2µg/L
Chromium	0.5µg/L	0.74µg/L
Copper	0.7µg/L	1.1µg/L
Lead	1.7µg/L	2.5µg/L
Mercury	0.03µg/L	0.05µg/L
Nickel	5.5µg/L	0.9µg/L
Zinc	4µg/L	6µg/L

Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000

7.0 MONITORING

Regular monitoring and analysis of water quality would be undertaken daily from set locations during the early and final stages of the dewatering process. It is anticipated the monitoring regime will be reduced to twice weekly once the operation is underway and provided initial monitoring results are satisfactory.

Discharged water will be required to meet the following ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000 (95% freshwater) criteria:

- Total Suspended Sediment (TSS) must be less than 50mg/L
- Turbidity must be less than 150 NTU
- Oil & Grease must be less than 10mg/L
- pH must be between 6.5 – 8.5
- BOD 5 must be less than 30mg/L

Visual inspection and monitoring of stormwater discharge points into natural receiving waters is to occur at the discharged water entry points into Dents Creek and Oyster Gully.

6.1 Groundwater

Dewatering the Site has the potential to effect changes on groundwater levels within the local aquifer. These changes, if significant enough may impact on the Site and surrounding properties. It is therefore necessary to monitor the water table around the Site to ensure that potential impacts related to dewatering are identified and addressed immediately.

As it has been noted that a hydraulic connection between the water level within the brick pit and the groundwater of the local area is likely (URS, 2006), weekly monitoring of the water level in groundwater monitoring wells located on-site will be undertaken to monitor any changes occurring in surrounding groundwater levels as a result of the Brick Pit dewatering process. Groundwater level will play a role in determining the dewatering rate, which may be decreased if found to be negatively impacting on groundwater levels.

8.0 DEWATERING MANAGEMENT PROTOCOL

The management of the brick pit dewatering will be in accordance with the following:

Procedure

1. Establish dewatering system following an initial review of the likelihood of contaminants being present.
2. Test Brick Pit water in the area to be de-watered.
3. If results comply with site Trigger levels commence discharge. During discharge to the stormwater system, implement routine monitoring daily initially and twice per week when satisfied as to the long term water quality.
4. Continue to discharge while acceptable results are being recorded.
5. If initial results or subsequent monitoring exceed the trigger concentrations appropriate action is to be taken. If exceedances of the action level are recorded then discharge must cease. The contingency actions are to remain in place until an assurance can be given as to acceptable water quality.
6. Remedial action has been highlighted as a contingency in the event of contamination being above action levels long-term.

Remedial Actions

The Contingency Plan is outlined in more detail below:

Water Quality in Exceedance of Trigger Levels

Initial receipt of notification of contaminant(s) above trigger levels for discharge to storage pond or stormwater system.

Stage 1

Action:

1. Immediately collect water sample for confirmation of discharge water quality.
2. Warn Contractor of trigger exceedance event.
3. Return sample analysis details within 24hrs

Negative result (less than trigger value) - Return to water quality monitoring test regime

Intermediate Result (between trigger and action) - Implement monitoring every second day

Positive result (in excess of action level) - Proceed to Stage 2

Water Quality in Exceedance of Action Levels

Contaminant concentrations in excess of action levels for discharge to stormwater system.

Stage 2

Action:

Immediately cease discharge to the stormwater system.

1. Collect water sample for confirmation of contamination levels.
2. Return sample analysis details within 24hrs.

Negative result (less than trigger value) - Return to water quality monitoring test regime

Intermediate Result (between trigger and action) - Return to Stage 1

Positive result (in excess of action level) - Proceed to Stage 3

Water Quality Continued Exceedance of Action Levels

Continued analysis of contaminant(s) in excess of action levels for discharge to stormwater system.

Stage 3

Action:

1. Procure equipment and materials for establishment of treatment strategy.
2. Establish and commission treatment facility.
3. Sample and analyse initial discharge following treatment.
4. Return sample analysis details within 24hrs.

Negative result (less than action value) - Return to water quality monitoring test regime Stages 2 and 1.

Positive result (in excess of action level) - Cease discharge and re-assess treatment

9.0 CONTINGENCIES

In the event that inspections or monitoring note that key indicators are not compliant, some action will be required. Examples may include:

Unacceptable TSS levels from discharge pipe(s):

1. Check excessive sediments are not being extracted at intake. If so, take appropriate measures to rectify; and
2. Consider additional strategies, such as reducing the discharge rate or flocculation.

Erosion noted at Creek input areas:

1. Install dissipation devices ;
2. Reduce flow rate; and
3. Different discharge location.

Extended discharge time, due to reduced flow rates or weather:

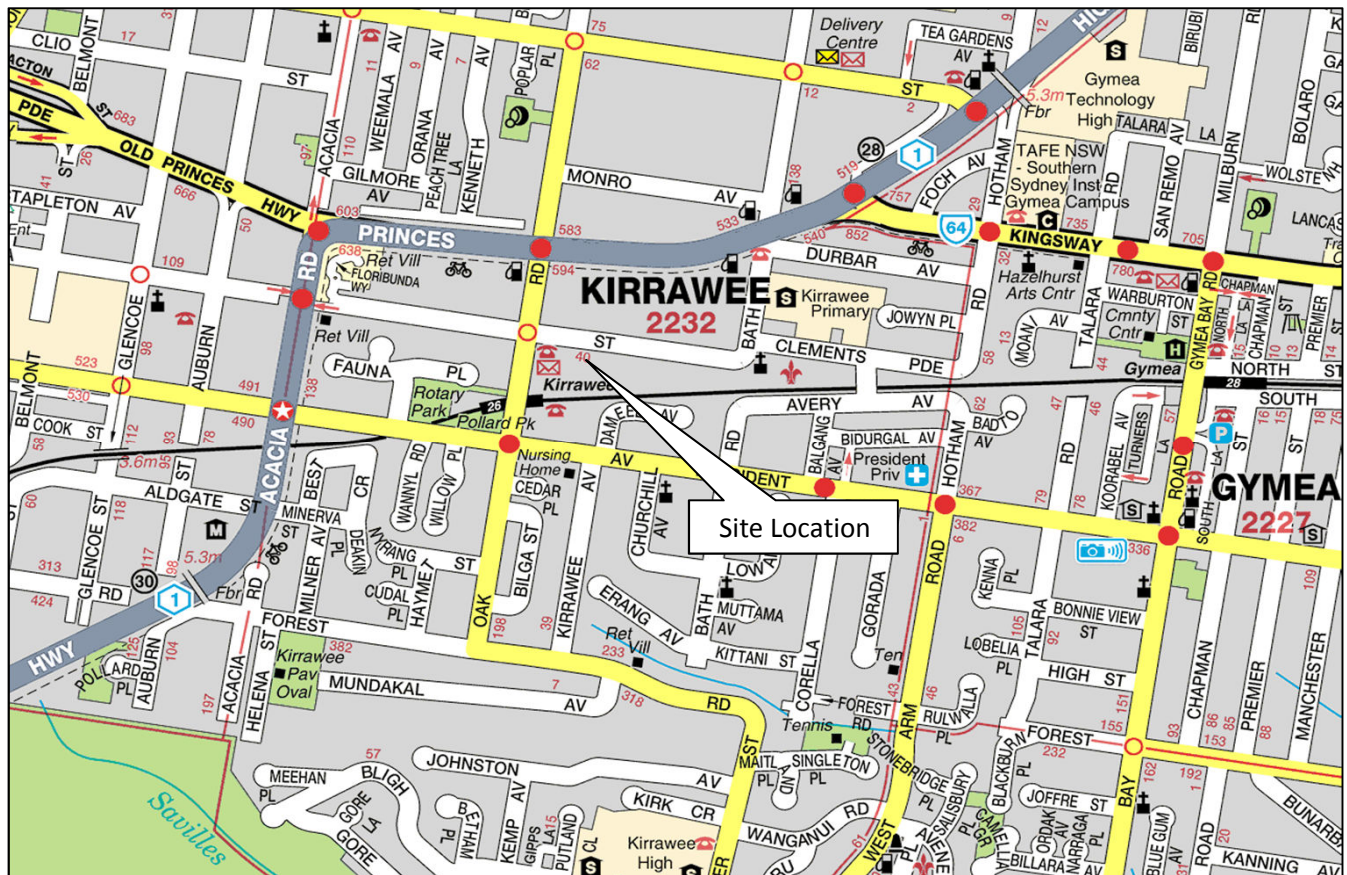
1. Consider additional pipes

10.0 CONCLUSION

This management plan has provided a means to manage the dewatering of the Brick Pit and groundwater on-site at 564-594 Princes Highway Kirrawee in a manner that does not threaten the local environment or cause health concerns for workers or local residences, including the loss of amenity. Adequate monitoring has been outlined to ensure that a low risk to the surrounding environment is maintained.

Figure 1

Site Location




 <p>Unit 2b/30 Leighton Place Hornsby, NSW 2077</p>	DESIGNED: DLA	SITE LOCATION	
	COMPILED: JC		
	PROJ. No. DL3060	CLIENT: Ionic Management	DRAWING: 9/07/2013
		LOCATION: Lot 2 DP 589977 566-594 Princes Highway Kirrawee	FIGURE: 1

Figure 2

Site Survey
