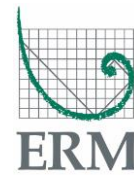


0448920\_S008419

Maddocks  
Angel Place, Level 27,  
123 Pitt Street  
Sydney, NSW, 2000



7<sup>th</sup> May 2018

Dear Patrick,

## Landfill Status Letter: 75 Townson Road, Schofields, NSW

As directed by Maddocks, ERM has prepared this letter to summarise information relating to the landfill located at 75 Townson Road, Schofields, NSW (the Site). This letter outlines the following details in order to assist with consideration of potential impact of landfill gas across proposed land re-zoning to the north and east of the Site:

- Brief background and history of the Site;
- Outline of previous investigations completed at the site relating to landfill gas concentrations;
- Works proposed / mitigation measures scheduled at the site associated with management of potential landfill gas concentrations (if present).

### Background

Refer to **Figure 1** – Site Location.

The Site is currently occupied by the CSR Brick factory and associated former quarry areas. Assessment of the Site history (DLA, 2012) identified that horticultural/agricultural land use activities previously occurred. Subsequent uses included waste disposal activities associated with operation of sections of the Site as a landfill. The landfill occupies the north-western corner of the Site and covers an area of approximately 47,100 m<sup>2</sup>.

Refer to **Figure 2** – Site Layout.

The landfill was licenced to accept non-putrescible wastes with landfilling activities commencing in February 1992 and completed in May 1995. The landfill was capped with clay liner material after closure as documented in the *Post Closure Review – PGH Landfill, Schofields'* report (CMPS&F, 1997).

As part of proposed redevelopment works of the former quarry, ERM (formerly DLA Environmental Services) were engaged by CSR to conduct an initial landfill gas assessment at the site.

In 2016, a review of CMPS&F (1997) and site observations by ERM indicated that the landfill cap did not comply with the *Environmental Guidelines: Solid Waste Landfills, Section Edition* (NSW EPA, 2016). ERM are currently overseeing landfill cap rectification works which are being conducted in accordance with the *Landfill Cap Rectification Works* report (DLA 2017, Ref. DL2882\_S007113). This report has been endorsed by a NSW EPA accredited site Auditor (Enviroview 2017, Ref. IA\_0301-1528\_16). Rectification works consist of importing appropriate clay liner material and compacting the material in accordance with *Environmental Guidelines: Solid Waste Landfills, Section Edition* (NSW EPA 2016).

ERM have installed a network of landfill gas wells within the landfill and along the perimeter of the landfill boundary. Data from monitoring of these wells was used to develop an initial landfill gas risk assessment.

## Concentrations of landfill gas

The *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases, 2012* (NSW EPA, 2012) provides a methodology for assessing, and developing management responses to, the presence of hazardous ground gases. The method considers both gas concentrations (methane and carbon dioxide) and borehole flow rates to define a characteristic condition for a site using a calculation of the Gas Screening Value (GSV).

The GSV is a multiple of the maximum gas flow rate (litres/hour) from a borehole and the maximum gas concentration (%v/v). From the GSV, the characteristic gas situation is determined based on *Table 6: Modified Wilson and Card Classification* from *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases, 2012* (NSW EPA 2012) and a corresponding risk classification assigned.

In accordance with Section 5.3 of the *Environmental Guidelines: Solid Waste Landfills, Second edition 2016* (NSW EPA, 2016), the threshold levels for further investigation and corrective action are detection of methane at concentrations above 1% v/v and carbon dioxide at concentrations of 1.5% v/v above established natural background levels.

ERM have installed 15 landfill gas wells along the perimeter of the landfill and 3 wells within the landfill. Monitoring of these wells was conducted and gas concentrations were compared to relevant threshold levels. Additionally, the GSV was calculated for each well and an initial conceptual site model was developed for the site. These results were presented in the following reports:

- *Monitoring Summary, 75 Townson Road, Schofields*, DLA 2016, (Ref. DL2882\_S004464)
- *Ground Gas Investigation, Sampling, Analysis and Quality Plan, 75 Townson Road, Schofields*, DLA 2017 (Ref. DL2882\_S0066926)

ERM attended the site to undertake landfill gas monitoring on the following dates:

- 8<sup>th</sup> October 2015
- 5<sup>th</sup> November 2015

- 5<sup>th</sup> February 2016
- 8<sup>th</sup> February 2016
- 30<sup>th</sup> March 2016
- 19<sup>th</sup> April 2016
- 7<sup>th</sup> March 2018

Observations during the most recent monitoring event are as follows:

Monitoring Well	Concentration of Methane Gas (v/v%)	Flow Rate (litres/hour)	GSC Risk
GM1	2.3%	0	<0.7 – Very Low
GM2	0%	0	<0.7 – Very Low
GM3	0.7%	0	<0.7 – Very Low
GM4	2%	0	<0.7 – Very Low
GM5	0%	0	<0.7 – Very Low
GM6	0%	0.3	<0.7 – Very Low
GM7	0%	0	<0.7 – Very Low
GM8	0%	0	<0.7 – Very Low
GM9	0%	0	<0.7 – Very Low
GM10	0%	0	<0.7 – Very Low
GM11	0%	0	<0.7 – Very Low
GM12	0%	0.4	<0.7 – Very Low
GM13	63.7	0.3	0.19 – Low
GM14	67.9%	0.6	0.41 – Low
GM15	1%	0.1	<0.7 – Very Low
GM16	52.2%	0	<0.7 – Very Low
GM17	71%	9.9	7.04 – Moderate to high
GM18	43%	0.1	0.04 – Very Low

Central landfill monitoring bores located on top of the landfill detected typical concentration levels of methane (23 – 71.1%) with moderate to high flow rates (2.8 – 17.4 litres/hour) resulting in a risk of ‘moderate to high’. These concentrations were expected given that the wells were within landfill material and not outside the landfill boundary.

## NSW EPA

NSW EPA (2016) establishes minimum standards that apply to the design, construction and operation of landfills in NSW. Section 10.2 of the guidelines lists a number of ‘stabilisation criteria’ which, if met, can show that the landfill is stable and non-polluting. The stabilisation criteria include that gas concentration levels in all perimeter gas wells have fallen to less than 1% methane (v/v) and less than 1.5% carbon dioxide (v/v) above the established natural background for a period of 24 months.

In this regard:

- The ‘stabilisation criteria’ are described in section 5.4 as being the standards above which further investigation and corrective action is required; and
- Section 10.3 of the guidelines states that development on or near closed landfills should be considered only if a number of conditions are met including that the landfill meets the stabilisation criteria.

As such, NSW EPA (2016) establishes a decision tree around the question of whether the stabilisation standards have been satisfied or not. If they have been for a period of 24 months, then no further action is required. If they have not been, then it is necessary for the risks to be appropriately managed which includes the consideration, and if necessary, the implementation, of mitigation measures.

On the northern and eastern perimeters, subsurface concentrations of methane gas were measured in excess of 1% v/v. In these circumstances, in accordance with NSW EPA (2016), risk mitigation measures should be considered and if appropriate, implemented (e.g. the Biofiltration Trench).

## Potential Risk

In a preliminary landfill gas risk assessment, it is necessary to consider the concentrations of landfill gas and whether there are any migration and exposure pathways. As discussed above, NSW EPA (2016) provides a criteria to apply in considering whether there is a potential risk resulting from landfill gas.

Estimates from initial landfill gas monitoring indicate that from the overall waste mass, the generation rate of landfill is relatively low at less than 200 m<sup>3</sup>/h. Although relatively impermeable surface clays and the low porosity sedimentary bedrock mass exist on the Site, a potential gas

migration pathway may exist from the landfill due to potential migration through fractures and joints within the weathered shale bedrock.

## Proposed Biofiltration Trench

Landfill gas was reported to exceed the 1% v/v threshold in gas wells on the north and east of the landfill boundary. The additional assessment of gas migration will inform on the potential for gas to have migrated past the boundary to the north/east of the landfill. In addition to assessing gas migration, mitigation measures will be put in place to reduce risk of gas migration in the future and make the land suitable for the proposed zoning purposes.

Mitigation measures primarily consist of the installation of a proposed biofiltration trench along the northern and eastern boundary of the landfill. The biofiltration trench will be installed to the lowest identified groundwater level to reduce the risk of gas migrating underneath it. The trench is to be filled with porous media which acts as a preferential pathway and intercepts gas moving through lower permeability material such as clay. To alleviate the venting of methane from the trench, a technique of microbial oxidation is introduced through placement of a biofilter media within the exhaust path of the gas. Microbial oxidation is a method to biologically convert methane to the less hazardous CO<sub>2</sub>.

Through the interception of gas and conversion of methane to CO<sub>2</sub>, the Biofiltration Trench, if properly designed and implemented, should be capable of reducing the risk of landfill gas migrating beyond its perimeter to acceptable levels.

ERM are currently preparing a detailed report that outlines the specifications and validation procedures required to construct the biofiltration trench. Validation of the success of the trench will include monitoring of sub-surface gasses on the outer perimeter of the trench to confirm that the trench installation complies with performance criteria. ERM understands the biofiltration trench will be installed following confirmation of development consent by Blacktown City Council.

## Further Assessment and Mitigation Measures

There is a potential for landfill gas to have migrated beyond the landfill cell both in the past and into the future.

In order to manage the risk of any further landfill gas migration beyond the perimeter of the landfill cell, mitigation measures would be appropriate as discussed above (e.g. the Biofiltration Trench).

In respect of landfill gas that may have already migrated beyond the landfill cell, a further assessment would be appropriate to determine what (if any) concentrations of landfill gas are present, and then to apply the decision-making process in NSW EPA (2016).

If the further assessment identifies that there is landfill gas that has migrated beyond the boundary of the landfill cell, this does not result in the landfill cell being unsuitable for development. Rather, NSW EPA (2016) would require a consideration of mitigation measures in any development.

Accordingly, the further assessment needs to be conducted to determine:

- If landfill gas has migrated beyond the boundary of the landfill cell;
- If so, the concentrations of landfill gas that have migrated beyond the boundary of the landfill cell;
- The risk presented by landfill gas that has migrated beyond the boundary of the landfill cell; and
- What mitigation measures are appropriate in accordance with NSW EPA (2016).

ERM are in the process of preparing a detailed Landfill Gas Risk Assessment for the landfill.

In addition to preparing an updated Landfill Gas Risk Assessment, ERM have proposed to install two series of gas wells to the north and north east of the landfill. The first series of wells will be placed at a radius approximately 30 m from the landfill boundary and the second series will be placed at a radius approximately 60 m from the landfill boundary/on the boundary of the site (the well will be placed at the furthest distance).

The purpose of installing the two rows of gas wells is to determine if landfill gas has migrated beyond the boundary of the landfill. Although methane has been detected above 1% v/v in the north and east wells on the boundary of the landfill, the extent of gas migration has not been constrained. Furthermore, having two sets of wells will be used to determine the lateral extent of potential migration, i.e. whether gas has migrated <30 m, between 30 m and 60 m, or >60 m from the boundary of the landfill.

Following installation and monitoring of additional gas wells, ERM will prepare a report that outlines the risk of gas migration to the north and east of the landfill.

If landfill gas exceeding threshold values is reported in the offset wells installed as part of the proposed additional assessment works, monitoring will continue post construction of the biofiltration trench to determine if gas concentrations reduce to acceptable levels. Alternatively, additional mitigation measures can be implemented to suit the proposed zoning purposes in any impacted area. Additional measures may include:

- Installation of gas-proof membranes beneath future buildings to prevent gas migration into the building
- Installation of passive venting systems installed beneath buildings
- Upgrading and sealing joints and penetrations in reinforced floor slabs

ERM is in the process of designing and installing the gas wells to be placed to the north and east of the landfill. Following completion of the installation, monitoring will be conducted for a minimum of three months on a weekly basis. Results and recommendations from this exercise will be presented in a validation report to CSR.



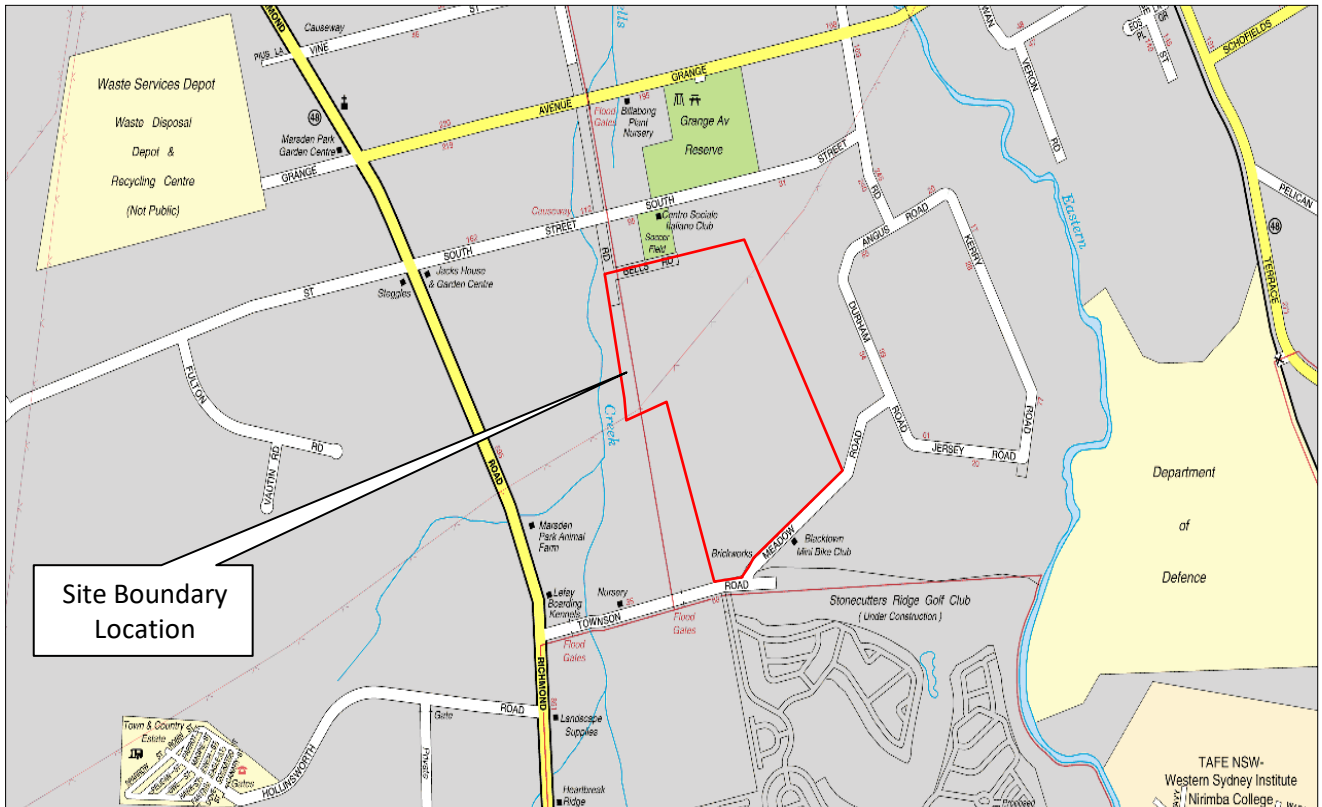
Yours sincerely

A handwritten signature in black ink, appearing to read "Nathan Nagle". The signature is fluid and cursive, with the first name being more prominent.

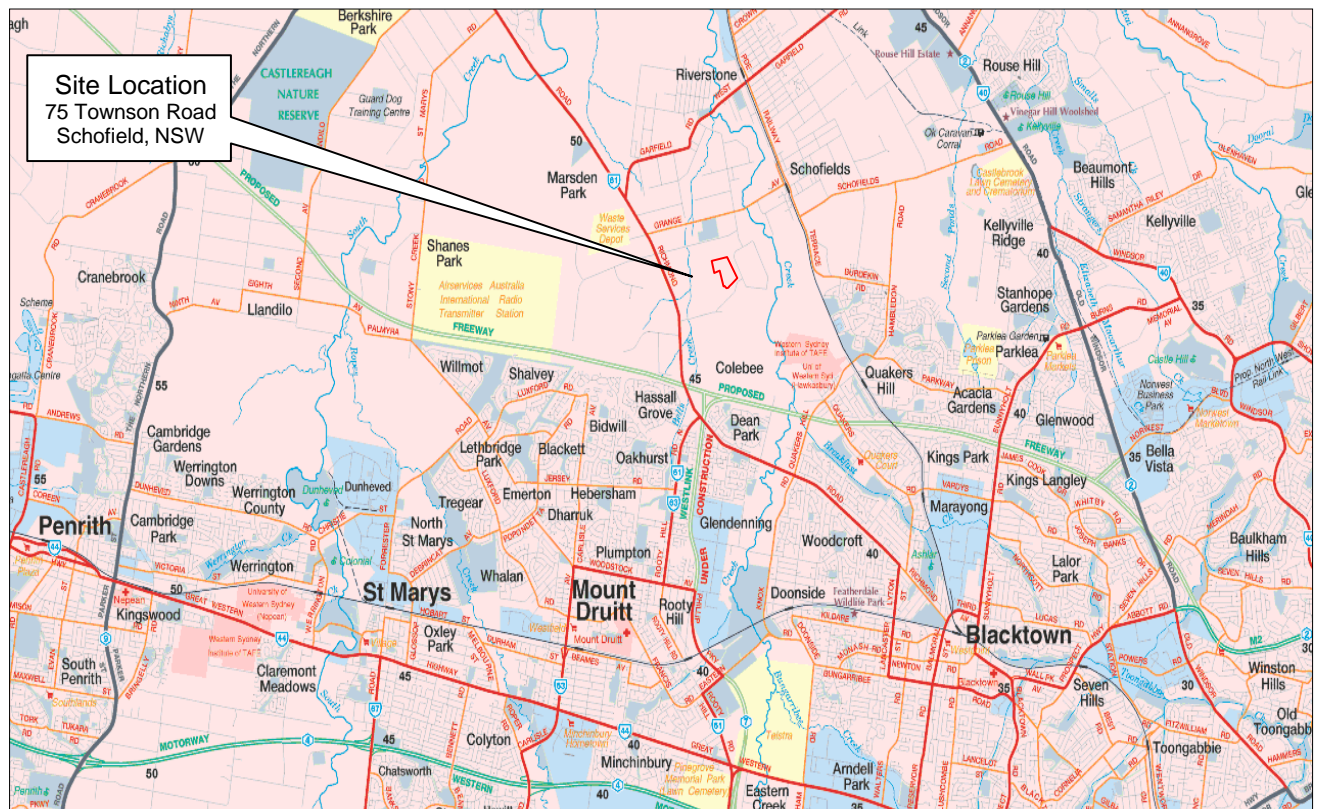
Nathan Nagle

Environmental Consultant


Figure 1 – Site Location



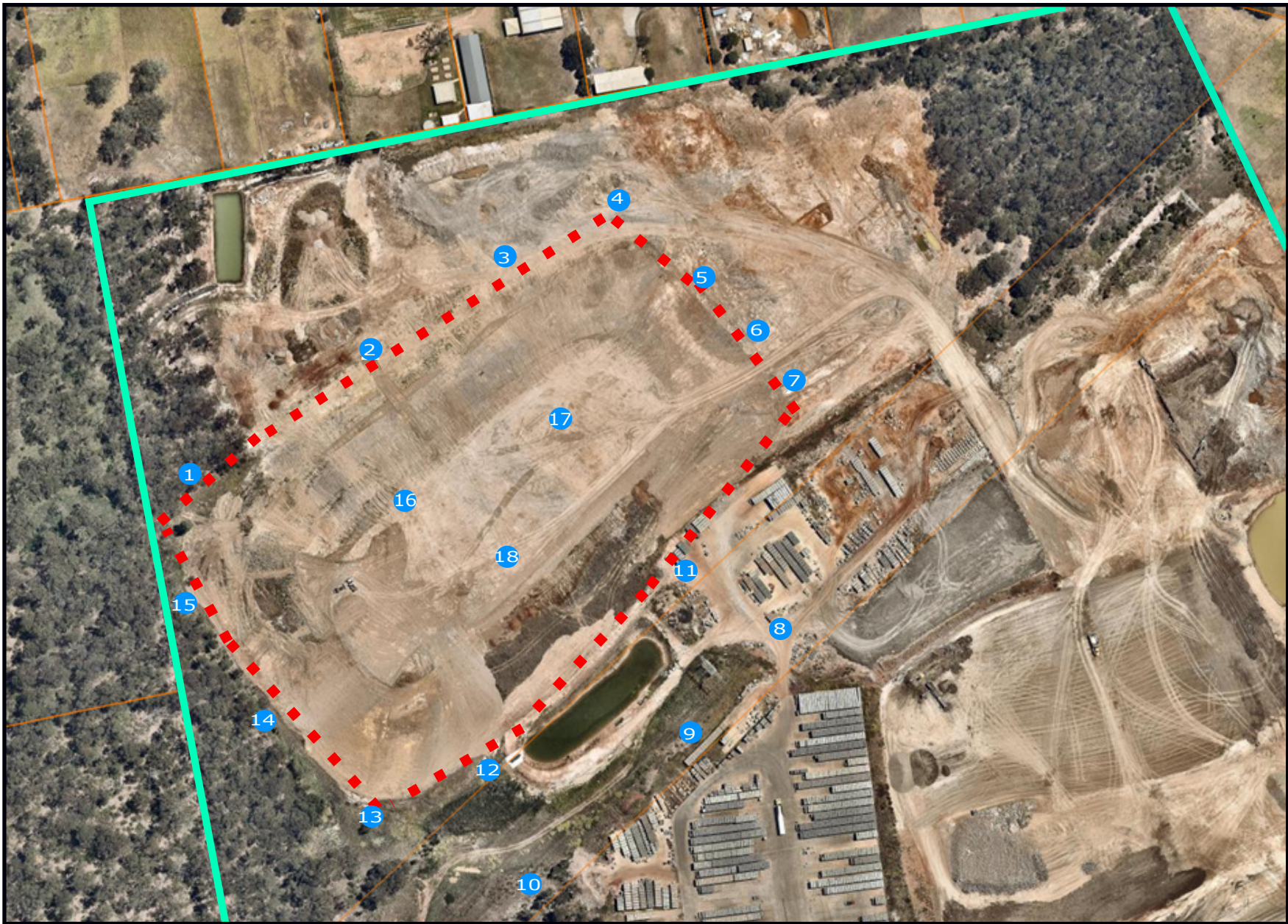
Site Boundary Location



Site Location  
75 Townson Road  
Schofield, NSW

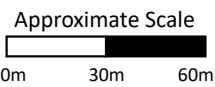
	<b>DESIGNED:</b> ERM	<b>SITE LOCATION</b>	
	<b>COMPILED:</b> NN	<b>CLIENT:</b> CSR Limited	<b>DRAWING:</b> 1/05/2018
	<b>PROJ. No.</b> 448920	<b>LOCATION:</b> 75 Townson Road Schofield, NSW 2762	<b>FIGURE:</b> 1

## Figure 2 – Site Layout



**Legend**

- Landfill Boundary
- Gas Monitoring Well
- Site Boundary



Title Landfill, Schofields ,NSW			
Client CSR Limited	Project No. 0448920	Figure No 2	Date 01/05/2018
	Scale As Shown	Compiled NN	Revision R0