Health Infrastructure

NMH Health Infrastructure

Part Lot 401

Site Investigation

September 2019

Executive summary

GHD Pty Ltd (GHD) was engaged by NSW Health Infrastructure (HI) to undertake a desk-top based Site Investigation for Part Lot 401 DP 755237 (the site), associated with the development of the New Maitland Hospital (NMH), Metford Road, Metford, NSW.

The Site Investigation report is intended to summarise the identified condition of the site based on investigations completed prior to 2018, to form the basis for determining what remediation or management requirements may apply to the proposed use of the site.

According to previous investigations the site is part of a property which commenced operation as a quarry and brick manufacturing facility in approximately 1960 (prior to which it was vacant). Site activities included the extraction of clay from on-site quarries (including “Pit 2”) and production of clay bricks (which ceased in 2006). The quarrying activities produced large stockpiles of excavated materials, some of which were not used prior to the end of production activities and remained on site prior to remediation.

Following the completion of quarrying activities, quarry voids (including those outside Part Lot 401) were filled with materials including:

- Waste from coal and oil furnace burning processes
- Waste and hydrocarbon-impacted soils associated with underground fuel storage tanks
- Metal oxides used as colorants in the brick manufacturing process
- Building waste products from building demolition and the manufacturing process
- Quarry overburden (unsuitable for brick manufacturing)

Numerous previous stages of investigation have been carried out at the site from 2011 to 2015. A number of former potentially contaminating activities were identified, associated with former brickworks activities. Potential sources of contamination and associated contaminants on the site were primarily identified as a fill berm, waste stockpiles, Pit 2 (former quarry void filled with material including waste building materials, ACM and hydrocarbon contaminated soils), and fill material over the natural embankment in the eastern portion of the site, including waste building materials.

GHD notes that previous investigations have indicated some uncertainties and data gaps remain due to the widespread nature of contamination at the site, the heterogeneous distribution of contamination and the uncontrolled history of filling at the site. These include:

- Contamination remaining within the unexcavated areas of Pit 2.
- Understanding of the depth and distribution of fill across the site, including the potential presence of asbestos.
- The exact locations of various historical activities and infrastructure.

The significance of these data gaps varies, and will depend on the proposed remediation and management approach.

It is understood that remediation and validation works have been carried out on site since the investigations completed prior to 2018, presumably resulting in changes to the site conditions and contamination status. Site inspections since February 2018 indicate significant changes to site conditions, including:

- The fill mound/berm in the western portion of the site is no longer present.
- The waste stockpiles are no longer present.
- Ground cover has been established across the site, generally sparse with the exception of the embankment in the eastern portion of the site, which is reasonably well-established.

Based on the review of previous investigations (and with consideration to the site inspection observations), and given the proposed carpark construction, GHD considers the information presented in this Site Investigation report is sufficient to form the basis for determining what remediation or management requirements may apply to the proposed use of the site (i.e. sufficient for preparation of a RAP/CMP addressing a number of possible contamination management scenarios, based on the findings of this Site Investigation report).

Further investigations prior to or during development work, and/or validation of remediation works that have already been undertaken, would address current data gaps and provide more specific information to enable management of the site (from a contamination perspective).

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Appendices

1. Introduction

1.1 General

GHD Pty Ltd (GHD) was engaged by NSW Health Infrastructure (HI) to undertake a desk-top based Site Investigation for Part Lot 401 DP 755237 (the site), associated with the development of the New Maitland Hospital (NMH), Metford Road, Metford, NSW.

The Site Investigation report contains a summary of the findings from previous investigations and incorporates them into a Conceptual Site Model (CSM).

The location and extent of Part Lot 401 (the site) is shown on Figure 1 in Appendix A.

1.2 Background

HI has advised that the site is to be remediated and handed back to the Crown by CSR (the current lease holder).

GHD previously carried out a site inspection and brief document review for Part Lot 401 (GHD, 2018)[1], to supplement the environmental site assessment (ESA) (GHD, 2015)[2] and remediation action plan (RAP) (GHD, 2016)[3], both of which relate solely to Lot 7314 DP 1162607. The letter report (GHD, 2018) was written to address the Stage 1 (Early Works) Secretary's Environmental Assessment Requirements (SEARs), based on the understanding that Part Lot 401 would be used by CSR for storage of contaminated material (if any) found during the development of Lot 7314, and that no development would be undertaken within Part Lot 401 associated with NMH.

However, we confirm that Part Lot 401 was not used for (temporary) storage of contaminated material found during the development of Lot 7314, and understand that HI now proposes to construct a carpark on Part Lot 401, which will likely require some excavation.

We note that HI has also commissioned GHD to prepare a Remediation Action Plan (RAP) / Contamination Management Plan (CMP), addressing a number of possible contamination management scenarios, based on the findings of this Site Investigation.

1.3 Objective

The Site Investigation report is intended to summarise the identified condition of the site based on investigations completed prior to 2018, to form the basis for determining what remediation or management requirements may apply to the proposed use of the site.

1.4 Scope of work

This Site Investigation comprised the following scope of work:

- Review of previous investigations listed in Section 4
- Site inspections as listed in Section 5
- Preparation of a report, summarising the findings of the desk-top investigation, and recommending further investigation, site management and/or remediation requirements (as may be required).

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[1] *New Maitland Hospital – Part Lot 401 site inspection and addendum to contamination investigations, and Lot 7314 site condition inspection – February 2018*. GHD reference 22/18003/02/115267 dated 8 May 2018.

[2] *New Maitland Hospital Stage 1 Development Area, Metford NSW – Phase 2 Environmental Site Assessment – Metford Road, Metford, NSW*. GHD reference 22/18003/111407 Revision 0 dated 17 December 2015.

[3] *New Maitland Hospital Stage 1 Development Area, Metford NSW – Remedial Action Plan / Contamination Management Plan*. GHD reference 22/18003113050 Revision 0 dated 4 July 2016.

2. Site information

2.1 Site location and description

As presented in Figure 1, Appendix A, the site (Part Lot 401 DP 755237) forms part of the 'Metford Triangle' – the area bounded by Metford Road to the north-west, the Northern Railway to the north-east, and residential properties (separated by a power easement) to the south – generally comprising Lot 7314 DP 1162607 (to the south), Lot 266 DP 755237 (to the east), and Lot 401 DP 755237 (to the north). The site has an approximate area of 2 ha.

GHD notes that the site is located within the expired mining lease (ML) 1523 and the proposed commercial/industrial land use boundary as shown in the *Closure Mine Operations Plan* (MOP) (VGT, 2015) *Figure 5*.

According to previous investigations the site is part of a property which commenced operation as a quarry and brick manufacturing facility in approximately 1960 (prior to which it was vacant). Site activities included the extraction of clay from on-site quarries (including "Pit 2") and production of clay bricks (which ceased in 2006). The quarrying activities produced large stockpiles of excavated materials, some of which were not used prior to the end of production activities and remained on site prior to remediation.

Following the completion of quarrying activities, the quarry voids (including those outside Part Lot 401) were filled with materials including:

- Waste from coal and oil furnace burning processes
- Waste and hydrocarbon-impacted soils associated with underground fuel storage tanks
- Metal oxides used as colorants in the brick manufacturing process
- Building waste products from building demolition and the manufacturing process
- Quarry overburden (unsuitable for brick manufacturing)

It is understood that remediation and validation works have been carried out on site, presumably resulting in changes to the site conditions and contamination status.

2.2 Surrounding land use

The surrounding land uses (and approximate distances) include:

- **North** – former PGH Bricks & Pavers sales and manufacturing (remaining northern portion of Lot 401) (adjacent), followed by the Northern Railway (300 m), East Maitland Cemetery (350 m), Raymond Terrace Road (450 m), and wetlands associated with Two Mile Creek (500 m).
- **East** – former PGH Bricks & Pavers quarry site (adjacent) (northern corner of Lot 7314 followed by Lot 266), followed by the Northern Railway (400 m), East Maitland Cemetery (portions unused and vegetated) (450 m), and Raymond Terrace Road (550 m).
- **South** – former PGH Bricks & Pavers quarry site (adjacent) (Lot 7314), followed by residential properties (300 m) separated by a power line easement (20 m wide).
- **West** – Metford Road (adjacent), followed by Fieldsend Oval (public sporting/football field) and western CSR/PGH site (50 m), and Two Mile Creek and industrial properties (250 m).

3. Site setting

The following information is sourced from previous investigations.

3.1 Topography

Based on the topographic map of NSW (Land and Property Information, maps.six.nsw.gov.au, accessed 4 July 2019), the site is at approximately 10-24 metres Australian Height Datum (mAHD). The site topography has been significantly altered by historical quarrying activities. In general, the central and western portions of the site appear to slope gradually to the south-west, while the far-eastern portion of the site slopes to the east.

3.2 Hydrology

The nearest surface water to the site includes depressions/pits in the disturbed northern portions of Lot 266 (adjacent, which ultimately drain into wetlands approximately 400 m north-east of the site, associated with Two Mile Creek) and Two Mile Creek (approximately 250 m west of the site). Runoff on site is expected to follow the variable landforms and drain towards either the depressions/pits (for the eastern portion of the site) or the stormwater drain along Metford Road (for the western portion of the site), which drains into Two Mile Creek.

3.3 Geology and soils

Review of the Geological Survey map of NSW Newcastle 1:100,000 sheet indicated that the regional geology comprises the Tomago Coal Measures consisting of shale, mudstone, sandstone, coal seams and clay layers.

Previous investigations describe the subsurface soil profile encountered as generally comprising clay, brick and ash fill material overlying variable clays, silt stones, fine grained sandstones, coal seams and shales.

3.4 Hydrogeology

Groundwater at the site is generally present at 10-15 metres below ground level (mbgl) and the inferred hydraulic gradient is to the east.

Perched groundwater was encountered in Pit 2 at approximately 6 mbgl during the initial investigations undertaken by DLA (2014).

An online search of groundwater bore information (accessed22 September 2019) reported 11 registered groundwater bores within a 500 m radius of the CSR/PGH site. Of the 11 groundwater bores, nine were registered for monitoring purposes (for the CSR/PGH site), and one was registered for unknown purpose. None of the listed bores were registered for drinking water purposes.

There are two existing monitoring bores on the site (MW61 and MW62) and five existing monitoring bores adjacent the site boundary (MW5, MW400S, MW400D, MW404S and MW404D) as shown in Figure 2 (Appendix A).

4. Previous investigations

A limited review of the following documents was undertaken by GHD and is summarised below:

- EA 2011 – Preliminary Contamination Assessment – February 2011
- LeVert 2011 – Stage 2 Soil Investigation – September 2011
- VGT 2014 – Mine Operation Plan and Mine Closure Plan – June 2014
- VGT 2015 – Closure Mine Operations Plan – March 2015
- DLA 2014 – Phase 2 Detailed Environmental Site Assessment – January 2014
- DLA 2015a – Additional Detailed Site Investigation (Pit 2 Area) – June 2015
- DLA 2015b – Additional Environmental Investigation – December 2015
- Golder 2015 – Screening Health and Environmental Risk Assessment – December 2015

4.1 General

Figure 1 from EA (2011) identifies a number of (former) potential contaminating activities or features in this area of the brickworks site, including the following:

- Calcium fluoride disposal area (also indicated on LeVert 2011 Figure 2 as a Calcium sulphate disposal area. Elsewhere in LeVert 2011 it is described as a fine white gravel which is spent calcium sulphate from the flue gas scrubbers).
- Filled areas (possibly within Part Lot 401).
- 'No. 2 Pit' (possibly within Part Lot 401).

A number of these features are also shown in figures from LeVert 2011 (these have not been attached, for brevity). The Calcium sulphate disposal area is noted as 2 m deep.

VGT (2014) Figure 9 "Domain Areas" 26/03/2014 identifies the following domains in Part Lot 401:

- Domain A – Disturbed floor and stockpiles
- Domain C – Natural steep face with good vegetation
- Domain G – Mixed revegetated land and shallow water bodies
- Lime stockpile (identified in EA 2011 as Calcium fluoride disposal area – a waste product produced from scrubbers)

DLA (2014) noted some site remediation had occurred to the south west of the former factory, creating several large stockpiles. The stockpiles consist of hydrocarbon impacted material undergoing bio-remediation, a large sorted brick, concrete and rubble stockpile with minor polycyclic aromatic hydrocarbon (PAH) detections and two large soil stockpiles, one designated 'clean' and the other 'marginal' both with detections of PAH. It is not known where these stockpiles were in relation to Part Lot 401.

The following is a brief summary of previous investigations undertaken within Lot 401 (focussing on Part Lot 401). This information has not been critically reviewed.

4.2 Soil

Intrusive soil investigations were undertaken by LeVert (2011) and DLA (2014-2015).

LeVert recommended further investigations into fill depth and contamination in the filled area south west of the factory, including former Pit 2 (potentially applicable to Part Lot 401).

DLA (2014) sampled approximately 40 test pits in the overall area of Lot 401, as indicated on Figures 3, 4 and 8 (attached, along with Figure 2 "Figure Reference Map"). One of these ("Pit 2") (adjacent/immediately to the north of Part Lot 401) was a large pit measuring approximately 30 m x 30 m wide and 9 m deep, with an additional shaft excavated to bedrock at 14.6 m deep. DLA also collected numerous samples from stockpiles in the area.

DLA (2014) identified the following soil samples exceeding adopted assessment criteria or exhibiting evidence of contamination:

- Total recoverable hydrocarbon (TRH) at 3.5 and 4.5 m depth in TP213.
- Benzo(a)pyrene (BaP) toxic equivalence quotient (TEQ) in Pit 2.
- TRH in test pit 225.
- DLA noted the material encountered within the Pit 2 excavation was relatively consistent throughout the dig, varying between clay with mixed gravel and coal chitter. TP225 was located along the western boundary of Pit 2 within the adjoining bund, and foreign materials were encountered approximately 2-3 m below the surrounding surface level, including processed timber, plastic, metal fragments, a large steel beam, material bags and old drums. DLA noted that although these materials were discovered during excavations into the edge of Pit 2 in this area, the large excavation directly into the Pit 2 area did not encounter any bulk foreign materials.
- Test Pits 191 and 213 were excavated within a 'bund' in the eastern portion of Part Lot 401. DLA noted the bund seemed to be comprised of two separate bunds most likely constructed at different times. The material from natural bedrock to approximately 4 m (about half way up the bund) seems to have been predominantly clean clays with low foreign material content. The upper half (approx. 4 to 5 m at TP191/TP213 location) seems to have been a lower quality source material, with mixed refuse including plastic, steel, emptied material storage bags and sacks, an old crushed 5000 L underground storage tank (UST), and large quantities of broken brick scattered throughout some layers. DLA considered it was highly possible that more USTs may be located in this area given the noted hydrocarbon odour through this upper bund material in at least three (3) separate test pits along the length of the bund. **GHD notes that this 'bund' has been now excavated to natural rock and reinstated with soil (and seeded) – refer to Section 5.**

Locations TP103-111, possibly TP188 and TP189, TP190, TP198, TP201, TP214, TP215, TP225, and TP243-245 were also excavated, but did not show evidence of contamination and analysed soil samples did not exceed the adopted assessment criteria.

DLA (2015a) investigations involved additional excavations in the vicinity Pit 2. From the DLA (2015a) report and with reference to attached Figure 1 "CSR/PGH Soil Sampling Locations - Pit 2" 29/08/2014, it appears these investigations comprised "Proposed Pit 2-2" (to the south of previous excavation "Pit 2") and "Proposed Pit 2-4" (to the north of previous excavation "Pit 2"). "Existing Pit 2-1" appears to have been the pit designated as "Pit 2" excavated as described in DLA (2014), and proposed Pit 2-3 does not appear to have been excavated based on subsequent discussion in the DLA (2015a) report. Proposed Pit 2-2 and the southern portion of the area designated as Proposed Pit 2-3 were within Part Lot 401.

Some 14 stockpiles were generated from these excavations (some of which are shown on attached DLA 2015a Figure 1 "Metford former brickworks Stockpile Locations" 7/11/2014), and variously contained materials such as asbestos, ash-like material, foreign materials (concrete, steel and timber), with contaminants including TRH, PAH and asbestos. The stockpiles were documented by DLA and either used to backfill the Pit 2 excavations, or remained on site (with some stockpiles undergoing land-farming). **GHD notes these stockpiles are no longer present on site – refer to Section 5**.

DLA's investigations included the following conclusions relevant to Part Lot 401 (refer to DLA Figure 1 "Pit 2" 29/08/2014 and Figure 1 "Stockpile Locations" 7/11/2014, noting discrepancies in pit extents):

> "… *the following contamination issues may potentially pose an unacceptable risk to human health, the environment and the general amenity of the Site*:
>
> – B(a)P concentrations in the western wall of Pit 2-2;
> – Asbestos-impacted soils in the north-east of Pit 2-2;

DLA (2015a) also concluded that "*It is important to note that this investigation involved excavation into three pits within the greater Pit 2 area… It is likely that contamination remains within the unexcavated areas of Pit 2. Additionally, the widespread nature of contamination at the Site, the heterogeneous distribution of contamination and the uncontrolled history of filling at the Site infer that chemical, asbestos and aesthetic impact is likely to remain at the Site, requiring both future delineation and possibly management*".

While DLA reported the presence of ACM fragments in various samples, including an instance where "*the ACM was observed to have broken into small fragments amongst heavy wet clay", they also reported that "No Asbestos Fines / Fibrous Asbestos (AF/FA) was detected in any of the samples submitted for asbestos analysis*". Brief review of the DLA (2015a) report indicates numerous soil samples (approximately 0.5 kg samples) were quantified for asbestos by the laboratory, with "no asbestos detected". However DLA's methodology in quantifying ACM in larger bulk samples is not detailed, and discussion of results (in DLA weekly reports) is limited to statements that sieve analysis was conducted and the material meets Commercial Industrial criteria. This information is insufficient to assess whether more sensitive criteria would be met. Assessment of the significance of any asbestos contamination will also depend on other considerations such as how asbestos contamination is to be managed.

Data gaps identified by Golder (2015) include the following:

- Understanding of the depth and distribution of fill across the Site
- The exact location of the various historical activities and infrastructure, particularly fuel and chemical storage
- Understanding and mapping of the presence of asbestos

The stated significance of these data gaps varies, and depends primarily on the proposed remediation and management approach.

4.3 Surface water/sediment

No previous surface water or sediment sampling appears to have been undertaken within Part Lot 401.

4.4 Groundwater

Refer to DLA Figure 1 “Groundwater Monitoring Well Locations” 10/12/2015.

DLA (2014) sampled 5 groundwater wells (MW5, MW7, MW4, MW9 and MW10). MW5 is just north of Part Lot 401. Copper, lead, nickel, and/or zinc concentrations exceeded ANZECC trigger values in a number of groundwater samples, which DLA presumed to be a regional groundwater quality issue. The wells were reported as existing, and no logs were provided.

DLA (2015b) sampled 14 wells in Lot 401 (including MW61 and MW61 within Part Lot 401, and MW5 adjacent as noted previously) and analysed groundwater samples for TRH, benzene, touluene, ethylbenzene and xylene (BTEX), PAH, volatile organic compounds (VOCs), 10 metals and fluoride. No PAH, BTEX or VOCs were reported above the laboratory limit of reporting (LOR). Low concentrations of TRH were detected in MW93 and MW203, downgradient and some distance to the north of Part Lot 401. Concentrations of various heavy metals exceeded the assessment criteria. DLA did not draw any conclusions regarding the groundwater results.

4.5 Previous soil vapour testing

DLA (2015b) also sampled soil vapour from 14 sub-soil locations and one sub-slab location (as shown in Figure 1 19/10/2015, incorrectly titled “Groundwater Monitoring Well Locations”), one of which (GW1) was located within Part Lot 401, and two (GW2 and GW6) nearby (to the north of Part Lot 401). Chloroform was detected in GW1 (and GW6), below the adopted assessment criteria (US EPA Regional Screening Levels for indoor commercial air quality).
Cis 1,2 - dichloroethene was detected in GW2, below the adopted assessment criteria (NEPM 1999, amended 2013) for all land use settings.

5. Site inspections

5.1 2018 site inspection

A site inspection was undertaken Monday 12 February 2018, by Jesse Simkus, an experienced senior environmental engineer who was familiar with the site and the proposed development. **GHD has undertaken more recent inspections throughout 2019, during site visits associated with the development of Lot 7314. Significant changes to the site conditions (since February 2018) are noted in Section 5.2 and in bold parenthesis in Table 5-1.**

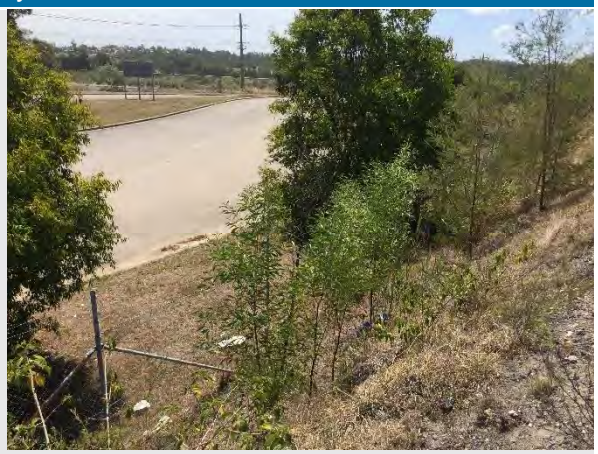
As of February 2018, CSR was active on Part Lot 401, predominantly using the area for storage and management of excavated fill material from Lot 401 remediation works. Site features and observations are summarised in Table 5-1. Refer also to the attached ADW Johnson survey figure ("SITE PLAN MAITLAND HOSPITAL DEVELOPMENT" 15/02/2018) with Nearmap aerial imagery (14/12/2017).

Table 5-1 Part Lot 401 site inspection observations and photographic log

Observations for Part Lot 401 – Monday 12 February 2018	
	
Photograph 1 Western corner of Part Lot 401, access track to Metford Road gate (for access to Lot 7314). Reed-lined channel on left (east of access track). View southwest.	**Photograph 2** Reed-lined channel east of the access track. Lot 7314 site compound in background. View south.
	
Photograph 3 Southern end of the reed-lined channel, continuing into (downgradient) unlined channel **[now grass lined]**. Lot 7314 site compound in background. View south.	**Photograph 4** Unlined channel **[now grass lined]** and concrete pipe culvert under access track. Metford Road gate in background. View southwest.

Observations for Part Lot 401 – Monday 12 February 2018

Photograph 5 Plastic pipe culvert under access track, small collection area to west of access track. View north.



Photograph 6 Former CSR access road, now main access to Lot 401 (northern corner), viewed from the fill mound/berm in northern corner of Part Lot 401 (berm continues northeast along northwestern boundary of Lot 401) **[berm no longer present]**. View north.

Photograph 7 Fill mound/berm running along northwestern boundary of Lot 401 **[no longer present]**. Surface predominantly soil with brick fragments. View northeast.

Photograph 8 Central portion of Part Lot 401 viewed from the fill mound/berm **[no longer present]**. Various stockpiles from Lot 401 remediation, predominantly fill material awaiting screening **[no longer present]**. View southeast.

Photograph 9 Western portion of Part Lot 401 viewed from the fill mound/berm **[no longer present]**. Various waste stockpiles, including vegetation (from clearing), soil and concrete **[no longer present]**. Lot 7314 site compound in background. View southwest.

Photograph 10 Concrete waste stockpile in western portion (northern corner) of Part Lot 401 **[no longer present]**. View southwest.

Observations for Part Lot 401 – Monday 12 February 2018

Photograph 11 Soil and vegetation waste stockpiles in western portion of Part Lot 401 **[no longer present]**. View west.

Photograph 12 Reed-lined channel and access track. Metford Road gate in background. View west.

Photograph 13 Groundwater monitoring well MW62 (see DLA Figure 1 "Groundwater Monitoring Well Locations" 10/12/2015), adjacent (east of) the reed-lined channel. View west.

Photograph 14 MW62. Soil and vegetation waste stockpiles **[no longer present]**. Fill mound/berm in background **[no longer present]**. View north.

Photograph 15 MW62. Reed-lined channel to right of frame. Security fence along southwest boundary of Part Lot 401 and northeastern boundary (western portion) of Lot 7314. Lot 7314 site compound in background. View southwest.

Photograph 16 MW62. Waste soil and vegetation stockpiles on left **[no longer present]**, fill material stockpiles from Lot 401 remediation in background **[no longer present]**. Security fence continuing along southwest boundary of Part Lot 401 and northeastern boundary (western portion) of Lot 7314. View southeast.

Observations for Part Lot 401 – Monday 12 February 2018

Photograph 17 Fill material stockpile from Lot 401 remediation **[no longer present]**. View southeast.

Photograph 18 Southwestern boundary (fence) of Part Lot 401. Fill material stockpiles from Lot 401 remediation on right **[no longer present]**. Metford Road in background. View northeast.

Photograph 19 'Top gate' in boundary fence between Part Lot 401 and Lot 7314. Soil and vegetation waste stockpile (from clearing) on Lot 7314 in background **[no longer present]**.

Photograph 20 Embankment in eastern portion of Part Lot 401, recently excavated to rock, top-soiled and seeded **[now well established]**. View northeast.

Photograph 21 Southern corner of Part Lot 401. Extent of security fence along the southwestern boundary of Part Lot 401. Continues to northeast as post-wire fence **[now security fence]**. View south (into Lot 7314).

Photograph 22 Fill stockpiles in eastern portion of Part Lot 401, believed to be from previous site works (not specifically associated with Lot 401 remediation) **[no longer present]**. View northeast.

Observations for Part Lot 401 – Monday 12 February 2018

Photograph 23 Fill stockpiles in eastern portion of Part Lot 401 **[no longer present]**. Lot 7314 in background. View southeast.

Photograph 24 Fill stockpiles in eastern portion of Part Lot 401 **[no longer present]**. Scrap metal on surface. Lot 7314 in background. View southeast.

Photograph 25 Eastern corner of Part Lot 401 viewing along estimated northeastern boundary. Seeded embankment **[now well established]** and fill material stockpiles (from Lot 401 remediation) **[no longer present]** in background. View northwest.

Photograph 26 Fill material from Lot 401 remediation, awaiting processing **[no longer present]**. View west.

Photograph 27 Groundwater monitoring well MW61 (see DLA Figure 1 "Groundwater Monitoring Well Locations" 10/12/2015). Remainder of Lot 401 in background. View north.

Photograph 28 MW61, viewing approximately along northeastern boundary of Part Lot 401 (no survey markers at time of inspection). Fill material stockpiles from Lot 401 remediation in background **[no longer present]**. View northwest.

Observations for Part Lot 401 – Monday 12 February 2018	
	
Photograph 29 MW61 (on left). Fill material stockpiled above the seeded embankment (as noted in Photograph 25 and Photograph 26) **[no longer present]**. View south.	**Photograph 30** Central portion of Part Lot 401. Fill material stockpiles from Lot 401 remediation **[no longer present]**. Southwestern boundary security fence in background. View southwest.

5.2 2019 (incidental) site inspections

Since the site inspection in February 2018, GHD has undertaken numerous incidental inspections of Part Lot 401 throughout 2019, during site visits associated with the development of Lot 7314. Significant changes to the site conditions (since February 2018) include:

- The fill mound/berm in the western portion of the site is no longer present.
- The waste stockpiles are no longer present.
- Ground cover has been established across the site, generally sparse with the exception of the embankment in the eastern portion of the site, which is reasonably well-established.

6. Conceptual site model

6.1 Sources

6.1.1 Contaminants of potential concern

The following contaminants of concern (CoPC) are based on investigations on the adjacent Lot 7314 (GHD, 2015) and the review of previous investigations relating to Part Lot 401:

- Total recoverable hydrocarbons (TRH)
- Benzene, toluene, ethylbenzene and xylene (BTEX)
- Polycyclic aromatic hydrocarbons (PAH)
- Metals (including arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, vanadium and zinc)
- Pesticides (including organochlorines, OCP)
- Polychlorinated biphenyls (PCB)
- Volatile organic compounds (VOC)
- Asbestos

The following potential sources of contamination (and associated CoPC) have been identified:

- Fill berm
- Waste stockpiles
- Pit 2 – former quarry void fill material including waste building materials (including ACM) and hydrocarbon-contaminated soils
- Existing natural embankment in the eastern portion of the site, subjected to fill material originally including waste building materials (including ACM) and a disused underground fuel storage tank (UST)
- Remaining surface soils

As mentioned previously, it is understood that remediation and validation works have been carried out on site (since the investigations summarised in Section 4), presumably resulting in changes to the site conditions and contamination status.

6.2 Pathways

6.2.1 Soil and geology

The main geological units expected at the site, in order of stratigraphic sequence, include:

- Fill material – heterogeneous fill material of variable origin and thickness is present over much of the site. Potential exists for sand, silt, clays and gravels and anthropogenic inclusions such as ash, plastic, timber, metals, brick, ceramics, concrete, and asbestos cement fragments. Expected to be highly permeable.
- Natural soils – clays. Expected to be low to moderate permeability.
- Natural rock – shale, mudstone, sandstone, coal seams (carbonaceous layers). Expected to have variable permeability.

The key transport mechanisms for soil contaminants include mobilisation through windborne dust, transportation as sediments via surface water runoff, or leaching to groundwater.

6.2.2 Groundwater

Groundwater provides a key transport mechanism for contaminants through horizontal and vertical migration of contaminated surface water/groundwater through the fill material (into the underlying aquifer), and then possible migration of the impact via advection and dispersion towards the creeks and into the wetlands.

There is a low potential for vertical migration of contaminated groundwater beyond the fill as subsurface materials are predominantly clays, which generally have low permeability.

6.2.3 Surface water

Surface water drainage over the majority of the site is judged to be predominantly via runoff. The site is predominantly unsealed and rainfall is expected to infiltrate into the surface soils or follow drainage contours (natural and channels) to existing water courses (to the east) or the stormwater system on Metford Road (to the west).

As noted in Section 3.2, runoff on site is expected to follow the variable landforms and drain towards either the depressions/pits (for the eastern portion of the site) or the stormwater drain along Metford Road (for the western portion of the site), which drains into Two Mile Creek.

Surface water has a potential to transport contaminants at the site, via lateral overland flow during rain events, causing re-deposition of contaminants on other areas of the site or off-site.

6.2.4 Exposure (contaminant uptake) pathways

Based on the identified receptors and the release, fate, and transport characteristics of the CoPC, pathways through which receptors may become exposed include inhalation, ingestion and dermal absorption. These are discussed briefly below in the context of the site setting:

- Inhalation Exposure Pathway: There is the potential for creation of dust from unsealed surfaces. Risk of potential inhalation of contaminated dusts and asbestos fibres.
- Ingestion Exposure Pathway: Ingestion of contaminants by current and future site occupants may occur through day-to-day activities and direct contact with contaminated soils or surface water.
- Groundwater: A risk to human health exposure if groundwater in the area is used for domestic or irrigation purposes. A risk to ecological receptors as groundwater is likely to discharge to Two Mile Creek.
- Dermal Exposure Pathway: Exposure may occur via sorption through biological membranes such as skin. This pathway may be a concern whenever contaminated soil, surface water or groundwater comes into direct contact with a biological membrane. This pathway could also be a concern if contaminated surface water (runoff from the site) was to come into direct contact with benthic and aquatic flora and fauna within off-site surface-water receiving environments.

6.3 Potential receptors

The investigation identified a number of potential human and environmental receptors of contamination, provided an exposure pathway exists. These receptors are listed below in the context of the current and proposed site use. These are:

- **Human Health Receptors**, including:
  - Future site users/visitors (including construction and maintenance workers, and potential for long-term patients and associated visitors e.g. family).
  - Off site receptors (e.g. residents on neighbouring properties, users of nearby water courses for recreational purposes, users of groundwater as potable resource).
- **Environmental Receptors**, including:
  - On-site flora and fauna.
  - Off-site ecosystems including down-gradient surface water environments (e.g. creeks and wetland).

7. Basis for contamination assessment

7.1 Relevant guidelines

The framework on which the contamination status of the site will be assessed is based on guidelines published or approved by the NSW EPA under *Section 105* of the *Contaminated Land Management (CLM) Act 1997*.

The guidelines that will be referenced include (but are not limited to) the following:

- ANZECC (2000). *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, October 2000*. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

  The Australian and New Zealand Governments (ANZG) (2018) criteria were endorsed by NSW EPA under s 105 of the CLM Act on 4 September 2018. At the same time the Australian and New Zealand Environmental Conservation Council (ANZECC) (2000) water quality guidelines were revoked. While the ANZG (2018) have been endorsed, preliminary review of these guidelines by GHD and others has identified a number of discrepancies with ANZECC (2000), which have yet to be clarified. As such, ANZECC (2000) criteria have still been adopted for the purposes of this SAQP until the issues with ANZAST (2018) have been resolved (at which time this SAQP may be revised, along with subsequent reports).
- CRC CARE (2017) *Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene*. CRC for Contamination Assessment and Remediation of the Environment, January 2017.
- Friebel, E and Nadebaum, P (2011). *Health screening levels for petroleum hydrocarbons in soil and Groundwater. CRC CARE Technical Report no. 10*. CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia, 2011.
- NEPC (2013). *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999.* National Environment Protection Council, as amended in May 2013.
- NHMRC/NRMMC (2011). *Australian Drinking Water Guidelines.* National Health and Medical Research Council and Natural Resource Management Ministerial Council of Australia and New Zealand, 2011 (updated November 2016).
- NSW EPA (1995). *Contaminated sites: Sampling Design Guidelines*. New South Wales Environment Protection Authority, 1995.
- NSW EPA (2014). *Waste Classification Guidelines, Part 1: Classifying Waste*. November 2014.
- NSW EPA (2015). *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. New South Wales Environment Protection Authority, 2015.
- NSW OEH (2011). *Contaminated sites: Guidelines for Consultants Reporting on Contaminated sites*. New South Wales Office of Environment and Heritage, 2011.

7.2 Soil assessment criteria

The NEPM includes a range of ecological investigation and screening levels, health investigation levels and health screening levels for a range of contaminants and for a range of land use and exposure scenarios.

The selection of the assessment criteria has been based on the following considerations, some of which are peculiar to the proposed development of the site as a hospital:

- The site will predominantly be sealed by the proposed carpark, with limited potential for direct contact within contaminated soils.
- There is a potential for vapour intrusion from hydrocarbon contamination for future buildings (although this is considered a low potential given the nature of the historical site use, with contaminants of concern unlikely to include volatile hydrocarbons, and also considering the distance to the nearest proposed building).
- The HILs developed for the commercial/industrial land use scenario are not applicable to a site used frequently by more sensitive groups such as children (within childcare centres, hospitals and hotels) and the elderly (within hospitals, aged care facilities and hospices). Notwithstanding this, the commercial/industrial HILs are considered applicable to the proposed use of Part Lot 401 as a car park.

Where investigation levels are not presented in the NEPM (as amended 2013), other references sources (such as the USEPA regional screening levels) will be used, e.g. for CoPC associated with brick manufacturing – barium, fluoride and manganese.

7.2.1 Health investigation and screening levels

Health investigation levels have been developed for a broad range of metals and organic substances and are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types. Site specific conditions determine the depth to which HILs apply for land uses other than residential (generally to depth of 3 m).

Health screening levels (HSLs) for petroleum compounds (which comprise TRH including BTEX) have been developed for assessing human health risk via the vapour exposure pathway. The HSLs apply to the same land use settings as HILs and include additional dimensions of soil type and depth.

Given the considerations outlined above in Section 7.2, the following assessment criteria, which are sourced from Schedule B1 of the NEPM 1999 (as amended 2013), will be adopted:

- HIL C – open space purposes (public open space such as parks, playgrounds, playing fields e.g. ovals, secondary schools and footpaths)
- HIL D – commercial / industrial for car parking areas
- HSL A and B – residential

No single summary statistic will fully characterise a site and appropriate consideration of relevant statistical measurements should be used in the data evaluation process and iterative development of the CSM. The preferred approach is to examine a range of summary statistics including the contaminant range, median, arithmetic/geometric mean, standard deviation and 95% upper confidence limit (UCL).

At the very least, the maximum and the 95% UCL of the arithmetic mean contaminant concentration should be compared to the relevant Tier 1 screening criteria. However, where there is sufficient data available, and it is appropriate for the exposure being evaluated, the arithmetic mean (or geometric mean in cases where the data is log normally distributed) should also be compared to the relevant Tier 1 investigation or screening level. The implications of localised elevated values (hotspots) should also be considered.

The results should also meet the following criteria:

- The standard deviation of the results should be less than 50% of the relevant investigation or screening level
- No single value should exceed 250% of the relevant investigation or screening level

Statistical assessment will be based on sample populations from similar soil profiles (e.g. fill material will be not be assessed with samples of underlying natural soils), and if appropriate, for similar or localised areas of the site (i.e. expected to be subject to the same impact).

In statistical assessments, only one result will be used per sample ID, with the greater of the primary or duplicate sample used where applicable. Where the analytical result is less than the laboratory detection limit, the detection limit is to be used for the statistical assessment.

7.2.2 US EPA Regional Screening Levels (RSLs)

The US EPA residential soil guidelines are risk-based screening levels (RSLs) that have been derived from equations combining exposure assumptions with chemical-specific toxicity values.

The RSLs will be used to assess the soil exposure pathway for contaminants in the absence of a HSL or HIL guideline value.

7.2.3 Ecological investigation levels and ecological screening levels

Ecological investigation levels (EILs) have been developed for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems. EILs depend on land use scenarios and generally apply to the top 2 m of soil. EILs have been developed for three generic land use settings including areas of ecological significance, urban residential areas and public open space, and commercial and industrial land uses.

Added contaminant limit (ACL) based EILs have been derived for As, Cu, Cr III, DDT, naphthalene, Ni, Pb and Zn. The application of ACL-based EILs is also dependent on site specific soil characteristics including pH and cation exchange capacity (CEC). These soil characteristics will be investigated to determine the ACL.

Generic EILs have been derived for aged As, fresh DDT and fresh naphthalene.

Ecological Screening Levels (ESLs) have been developed for selected petroleum hydrocarbon compounds and TRH fractions and are applicable for assessing risk to terrestrial ecosystems. ESLs also depend on land use scenarios (identical to EILs) and broadly apply to coarse- and fine-grained soils and various land uses. They are generally applicable to the top 2 m of soil.

Given the proposed development of the site, the following assessment criteria will be adopted:

- Soil Specific ACL-based EILs for urban residential and public open space
- Generic EILs (for arsenic and fresh DDT) for urban residential and public open space
- ESLs (for TRH and BaP) for urban residential areas and public open space

EILs / ESLs will not be applicable for areas covered by permanent paving.

7.2.4 Management limits

The NEPM includes “Management Limits” which are considered after application of the HSLs and ESLs, to address a number of policy considerations which reflect the nature and properties of petroleum hydrocarbons:

- Formation of observable light non-aqueous phase liquids (LNAPL)
- Fire and explosive hazards
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons

The management limits have been adopted in the NEPM as interim Tier 1 guidance to avoid or minimise these potential effects. The NEPM states that application of the management limits will require consideration of site-specific factors such as the depth of building basements and services and depth to groundwater, to determine the maximum depth to which the limits should apply, and that the management limits may have less relevance at operating industrial sites (including mine sites) which have no or limited sensitive receptors in the area of potential impact.

As part of the Tier 1 screening, GHD will consider the management limits for TPH fractions F1-F4 in soil for Residential, parkland and public open space.

7.2.5 Health screening levels for asbestos contamination in soil

The NEPM provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) *Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH 2009).

The NEPM guidance emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials and the potential for damage and resulting release of asbestos fibres. Therefore, for the purposes of assessing the significance of asbestos in soil contamination, three terms are used as summarised below:

- Bonded asbestos containing material” (Bonded ACM) – sound condition although possibly broken or fragments and the asbestos is bound in a matrix.
- Fibrous asbestos (FA) – friable asbestos materials such as severely weathered ACM and asbestos in the form of loose fibrous materials such as insulation.
- Asbestos fines (AF) – including free fibres of asbestos, small fibre bundles and also fragmented ACM that passes through a 7 mm x 7 mm sieve.

From a risk to human health perspective, FA and AF are considered to be equivalent to “friable” asbestos in Safe Work Australia (2011), which is defined therein as ‘material that is in a powder form or that can be crumbled, pulverised or reduced to a powder by hand pressure when dry, and contains asbestos’.

Bonded ACM in sound condition represents a low human health risk. However, both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres and may represent a significant human health risk if disturbed and fibres are made airborne.

As per Section 7.2.1, the following health screening levels have been adopted as the most appropriate to the site:

- Residential A – includes residential with gardens/accessible soils
- Recreational C – includes public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and unpaved footpaths
- Commercial / Industrial D – includes premises such as shops, offices, factories and industrial sites

	Health Screening Level (w/w)		
Form of Asbestos	Residential A	Recreational C	Recreational C
Bonded ACM	0.01%	0.02%	0.02%
FA and AF[a] (friable asbestos)	0.001%		
All forms of asbestos	No visible asbestos for surface soil		

a. The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres.

A tiered approach to risk assessment of asbestos contamination is recommended, including the development of an appropriate Conceptual Site Model (CSM). A weight of evidence approach is recommended with consideration given to factors such as the distribution of different fill types, the heterogeneity of the contamination and the uncertainty associated with the sampling methodology.

The NEPM states that if the Tier 1 screening levels are not exceeded, and an appropriate level of investigation has been carried out, then no contamination management actions are required except for ensuring the surface soil is free of visual asbestos. This may be achieved by multidirectional raking or tilling and hand-picking of exposed fragments of bonded ACM. Final visual inspection of the assessment and remediated areas should not detect any visible asbestos.

7.2.6 Aesthetics

An assessment of aesthetic issues will be undertaken as outlined in Schedule B(1) of the NEPM, which states that 'there are no specific numeric aesthetic guidelines, however site assessment requires balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity'.

General assessment considerations include:

- That chemically discoloured soils or large quantities of various types of inert refuse, particularly if unsightly, may cause ongoing concern to site users.
- The depth of the materials, including chemical residues, in relation to the final surface of the site.
- The need for, and practicality of, any long-term management of foreign material.

The NEPM notes that in some cases, documentation of the nature and distribution of the foreign material may be sufficient to address concerns relating to potential land use restrictions.

7.2.7 Selected criteria

The methodology used when assessing contamination levels in soils during the site investigation will be to use the EILs/ESLs and HILs/HSLs as cut off points to classify soils either as:

- Soils not contaminated, which pose no risk to the environment or human health and warrant no further action, i.e. concentrations less than or equal to the EILs/ESLs.
- Soils containing elevated concentrations of contaminants, which may pose a risk to the environment (in particular plant species or soil organisms) but pose no risk to human health under the proposed land use scenarios i.e. concentrations greater than the ecological values and less than the adopted HILs/HSLs. A qualitative risk assessment may be sufficient to evaluate the potential impact for the proposed land use.
- Soils significantly contaminated which pose a risk to both the environment and human health, i.e. concentrations significantly greater than relevant investigation or screening levels. Soils in this category would likely require site-specific health and/or ecological risk assessment (Tier 2 or 3) carried out as appropriate for the proposed land use. This will usually require the collection of additional site data. Alternatively, a conservative management approach may be adopted, depending on the likely cost effectiveness of further assessment when compared with the cost of conservative management.

7.3 Waste classification criteria

Materials that may require offsite disposal as part of site remediation will be classified using the *Waste Classification Guidelines – Part 1: Classification of Waste* (NSW EPA 2014). In accordance with NSW EPA 2014, the following six-step guide to the classification of waste and waste classification principles apply:

- Step 1: establish if the waste should be classified as a special waste.

  'Special waste' is a class of waste that has unique regulatory requirements. The potential environmental impacts of special waste need to be managed to minimise the risk of harm to the environment and human health. Special wastes are:

  – Clinical and related waste
  – Asbestos waste
  – Waste tyres

  Asbestos waste means any waste that contains asbestos. If asbestos is mixed with other waste to form asbestos waste, the waste must continue to be assessed in accordance with the guidelines to enable the disposal of the asbestos waste at an appropriate waste facility. Asbestos waste must be managed to meet the management and disposal requirements of both asbestos and the other class of waste with which it is mixed (if any).
- Step 2: If not a special waste, establish whether the waste should be classified as a liquid waste.
- Step 3: If not special waste or liquid waste, establish whether the waste is of a type that has already been pre classified. A number of commonly generated wastes have been pre-classified.
- Step 4: If the waste is not a special waste, liquid waste or is not suitable for pre classification, establish whether it has certain hazardous characteristics and should therefore be classified as hazardous.
- Step 5: If the waste does not possess hazardous characteristics, chemically asses to determine what class of waste.

- Step 6: The first test used to chemically assess waste is the Specific Contaminant Concentration (SCC) test, which determines the total concentration of each contaminant in the waste sample. The guidelines set different maximum levels for the total concentration of each contaminant in order for waste to be classified as either general solid waste or restricted solid waste.

  The toxicity characteristic leaching potential (TCLP) test estimates the potential for waste to release chemical contaminants into a leaching liquid. The guidelines set different maximum levels of the leachable concentration of each contaminant in order for waste to be classified as general solid waste, restricted solid waste or hazardous waste.

The following principles must be applied at all times when using the step-by-step waste classification process.

- If special waste is mixed with another class of waste, the waste must be managed to meet the requirements of both the special waste and the other class of waste.
- If asbestos waste is mixed with any other class of waste, all the waste must be classified as asbestos waste. For example, asbestos waste mixed with building and demolition waste must be managed as asbestos waste.
- If liquid waste is mixed with a hazardous or solid waste and retains the characteristics of liquid waste, the waste remains liquid waste.
- Two or more classes of waste must not be mixed in order to reduce the concentration of chemical contaminants. Dilution of contaminants is not an acceptable waste management option.
- Where practicable, it is desirable to separate a mixture of wastes before classifying them separately. For example, if waste tyres (a special waste) are mixed with lead acid batteries (a hazardous waste) it would be desirable to separate the wastes so that only the hazardous component needs to be managed as hazardous waste.

7.4 Groundwater assessment criteria

Analytical results will be assessed with reference to Schedule B1 of the NEPM 1999 (as amended in May 2013) Groundwater Investigation Levels (GILs). These guidelines are based on the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* ANZECC/ARMCANZ 2000 (ANZECC), the *Australian Drinking Water Guidelines* 2011 (ADWG), and the Guidelines for Managing Risk in Recreational Waters 2008 (GMRRW). The GILs for fresh and marine waters are based on the trigger values (TVs) applying to typical slightly to moderately disturbed systems which generally comprise the 95% protection level but also includes the 99% protection level as a default value for some parameters (to allow for chronic effects for particular species, or to allow for potential bioaccumulation). Given the end recipient of groundwater emanating from the site is likely Two Mile Creek, the freshwater (FW) GILs will be considered.

NSW EPA has advised that the low reliability trigger values from Table 8.3.7 of ANZECC (2000) should be considered if no other data is available.

Where more than one criterion is available for a parameter (e.g. multiple valence states or isomers), the lowest trigger value will be adopted.

The GMRRW recommend applying a multiplication factor of 10 to 20 to the ADWG for assessment of the acceptability of recreational water quality. GILs for other receptors should be obtained directly from the 'primary industries' section of ANZECC 2000 where relevant. Note that the recreational and aesthetics sections of ANZECC 2000 have been superseded by the GMRRW.

8. Conclusions

Numerous previous stages of investigation have been carried out at the site from 2011 to 2015. A number of former potentially contaminating activities were identified, associated with former brickworks activities. Potential sources of contamination and associated contaminants were primarily identified as a fill berm, waste stockpiles, Pit 2 (former quarry void filled with material including waste building materials, ACM and hydrocarbon contaminated soils), and fill material over the natural embankment in the eastern portion of the site, including waste building materials.

GHD notes that previous investigations have indicated some uncertainties and data gaps remain due to the widespread nature of contamination at the site, the heterogeneous distribution of contamination and the uncontrolled history of filling at the site. These include:

- Contamination remaining within the unexcavated areas of Pit 2
- Understanding of the depth and distribution of fill across the site, including the potential presence of asbestos
- The exact locations of various historical activities and infrastructure

The significance of these data gaps varies, and will depend on the proposed remediation and management approach.

It is understood that remediation and validation works have been carried out on site since the investigations described in Section 4, presumably resulting in changes to the site conditions and contamination status. Site inspections since February 2018 indicate significant changes to site conditions, including:

- The fill mound/berm in the western portion of the site is no longer present
- The waste stockpiles are no longer present
- Ground cover has been established across the site, generally sparse with the exception of the embankment in the eastern portion of the site, which is reasonably well-established.

Based on the review of previous investigations (and with consideration to the site inspection observations), and given the proposed carpark construction, GHD considers the information presented in this Site Investigation report is sufficient to form the basis for determining what remediation or management requirements may apply to the proposed use of the site (i.e. sufficient for preparation of a RAP/CMP addressing a number of possible contamination management scenarios, based on the findings of this Site Investigation report).

Further investigations prior to or during development work, and/or validation of remediation works that have already been undertaken, would address current data gaps and provide more specific information to enable management of the site (from a contamination perspective).

9. References

ANZECC (2000). National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), October 2000.

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10. Limitations

This Site Investigation report (report) has been prepared by GHD for NSW Health Infrastructure (HI) for the purpose as stated in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than HI arising from or in connection with this report.

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Appendices

Appendix A – Figures

Figure 1 “Site location”

Figure 2 “Existing groundwater monitoring wells”

BVN Drawing 01A-AX0-102 Issue 2 “Site Plan”

EA Figure 1 "Location and Property Boundaries" 22/2/2011

VGT Figure 9 “Domain Areas” 26/03/2014

DLA Figure 2 “Figure Reference Map” 29/11/2013

DLA Figure 3 "2011-2013 Soil Sample Locations" 11/11/2013

DLA Figure 4 "Factory Area Soil Sampling Locations 2013" 11/11/2013

DLA Figure 8 "Grass Area Sample Locations" 11/11/2013

DLA Figure 1 “Soil Sampling Locations - Pit 2” 29/08/2014

DLA Figure 1 “Stockpile Locations” 7/11/2014

DLA Figure 1 “Groundwater Monitoring Well Locations” 10/12/2015

DLA Figure 1 "Vapour Monitoring Well Locations" incorrectly titled “Groundwater Monitoring Well Locations” 19/10/2015

Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site boundary
- Metford Triangle
- Cadastre
- Railway
- Waterbody
- Watercourse (as per topographic mapping for area)

NSW Health Infrastructure
New Maitland Hospital
Part Lot 401
Contamination investigation

Job Number	22-19924
Revision	0
Date	24 Sept 2019

Site location

Figure 1

G:\22\18003\GIS\Maps\Deliverables\2219924\ContamInvestigation\2219924_CI001_SiteLocation_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: Geoscience Australia: 250k Topographic Data Series 3, 2006; LPI: DCDB & DTDB - 2012; Nearmap: Aerial Imagery Extracted 20180830. Created by: fmackay

Paper Size A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site boundary
- Cadastre
- Existing groundwater monitoring well

NSW Health Infrastructure
New Maitland Hospital
Part Lot 401
Contamination investigation

Existing groundwater monitoring wells

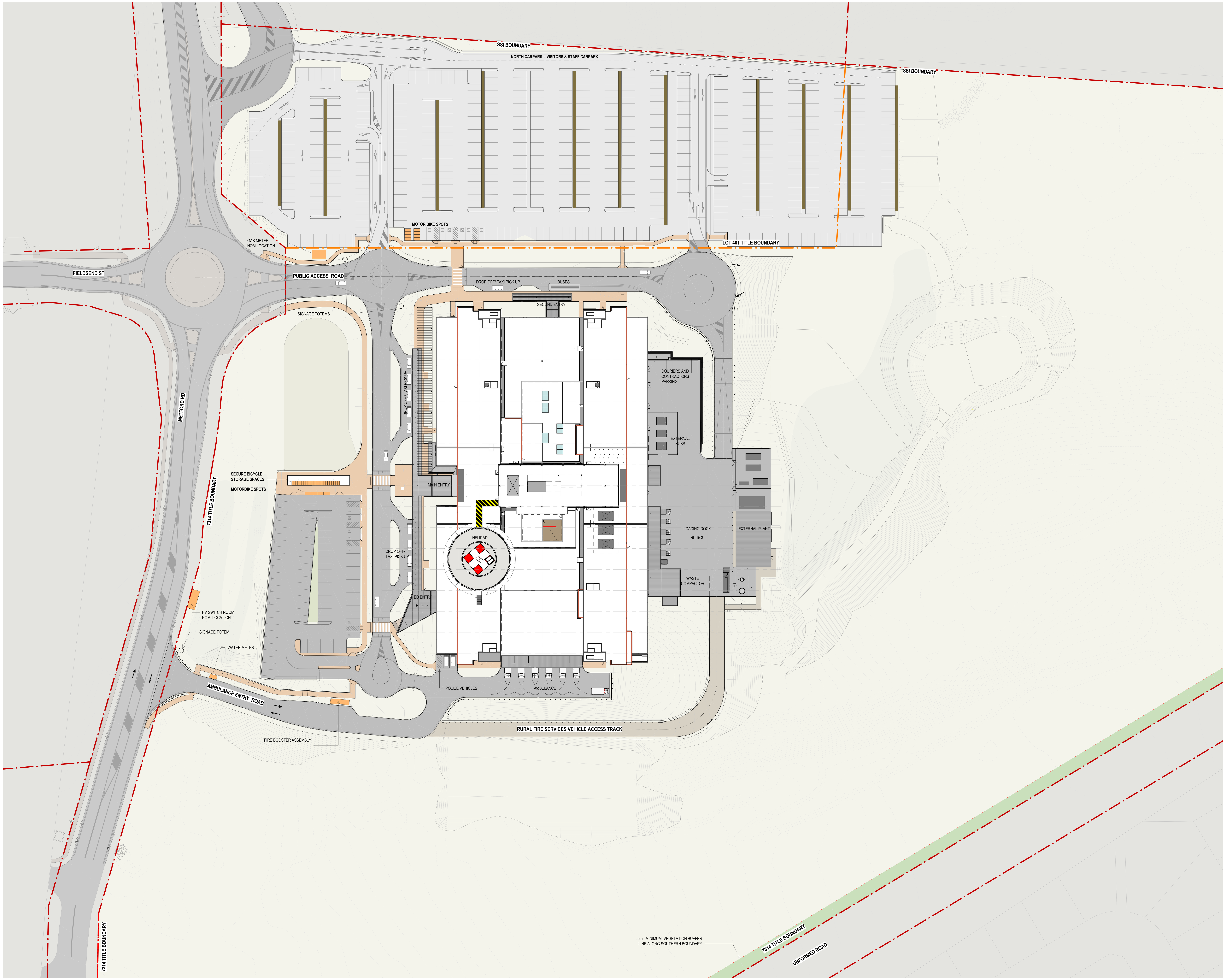
Job Number	22-19924
Revision	0
Date	24 Sep 2019

Figure 2

G:\22\18003\GIS\Maps\Deliverables\2219924\ContamInvestigation\2219924_CI002_Sampling_0.mxd

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com.au

Data source: LPI: DCDB & DTDB, 2012; Nearmap: Aerial Imagery Extracted 20180830. Created by: fmackay



FUTURE TRAFFICABLE LANDSCAPED SPACE

COURTYARD

FUTURE NON-TRAFFICABLE LANDSCAPED SPACE

ROOM BOUNDING

PUBLIC LIFT

PATIENT LIFT

HOT LIFT

SUMMERY OF CAR PARKS

- NORTH CARPARK:
589 PARKING SPOTS
6 ACCESSIBLE SPOTS
8 MOTORBIKE SPOTS

- WEST CARPARK:
79 PARKING SPOTS
8 ACCESSIBLE SPOTS
4 MOTORBIKE SPOTS

GENERAL NOTES:

-TOPOGRAPHY CONTOURS ARE INDICATIVE, REFER TO CIVIL DOCUMENTS FOR EXTENT OF EARTH WORKS.

-REFER TO CIVIL AND LANDSCAPE DOCUMENTS FOR EXTENT OF EXTERNAL LANDSCAPE WORKS AND ROAD WORKS.

-REFER CIVIL HYDRAULICS AND ELECTRICAL CONSULTANTS FOR SETOUT AND EXTENTS OF TRENCHING AND SERVICES ALLOCATIONS FOR ALL SITE INFRASTRUCTURE WORKS.

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7151 PHILLIP ROSSINGTON
4937 JAMES GROSE

NOTE
CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF WORK OR PREPARATION OF SHOP DRAWINGS. DO NOT SCALE THIS DRAWING

	ISSUE	DATE	DESCRIPTION
	1	06/09/19	SSI 2 ISSUE
	2	17/09/19	SSI 2 ISSUE

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HEALTH INFRASTRUCTURE
MANAGING CONTRACTOR
MULTIPLEX
PROJECT MANAGER
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TTW
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MECHANICAL / MEDICAL GASES / ESD
EMF Griffiths
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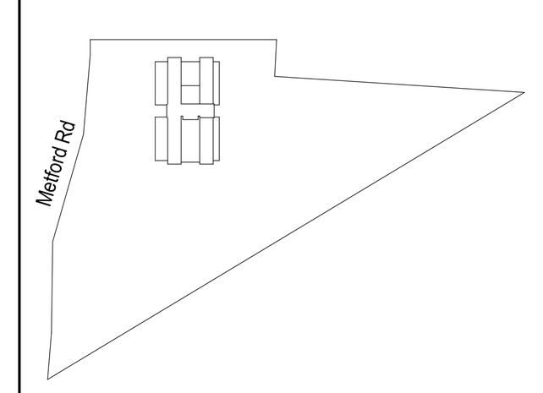
ELECTRICAL / COMMS / VERTICAL TRANSPORT
JHA
(02) 9437 1000
HYDRAULIC / FIRE
Warren Smith & Partners
(02) 9299 1312
PCA / BCA / DDA /
TBC
TBC
FIRE ENGINEERING
PGA

PROJECT
NEW MAITLAND HOSPITAL

550-560 High Street
Maitland NSW 2320
BVN PROJECT NUMBER
S1806011.000
DRAWING KEY



TRUE NORTH
PROJECT NORTH

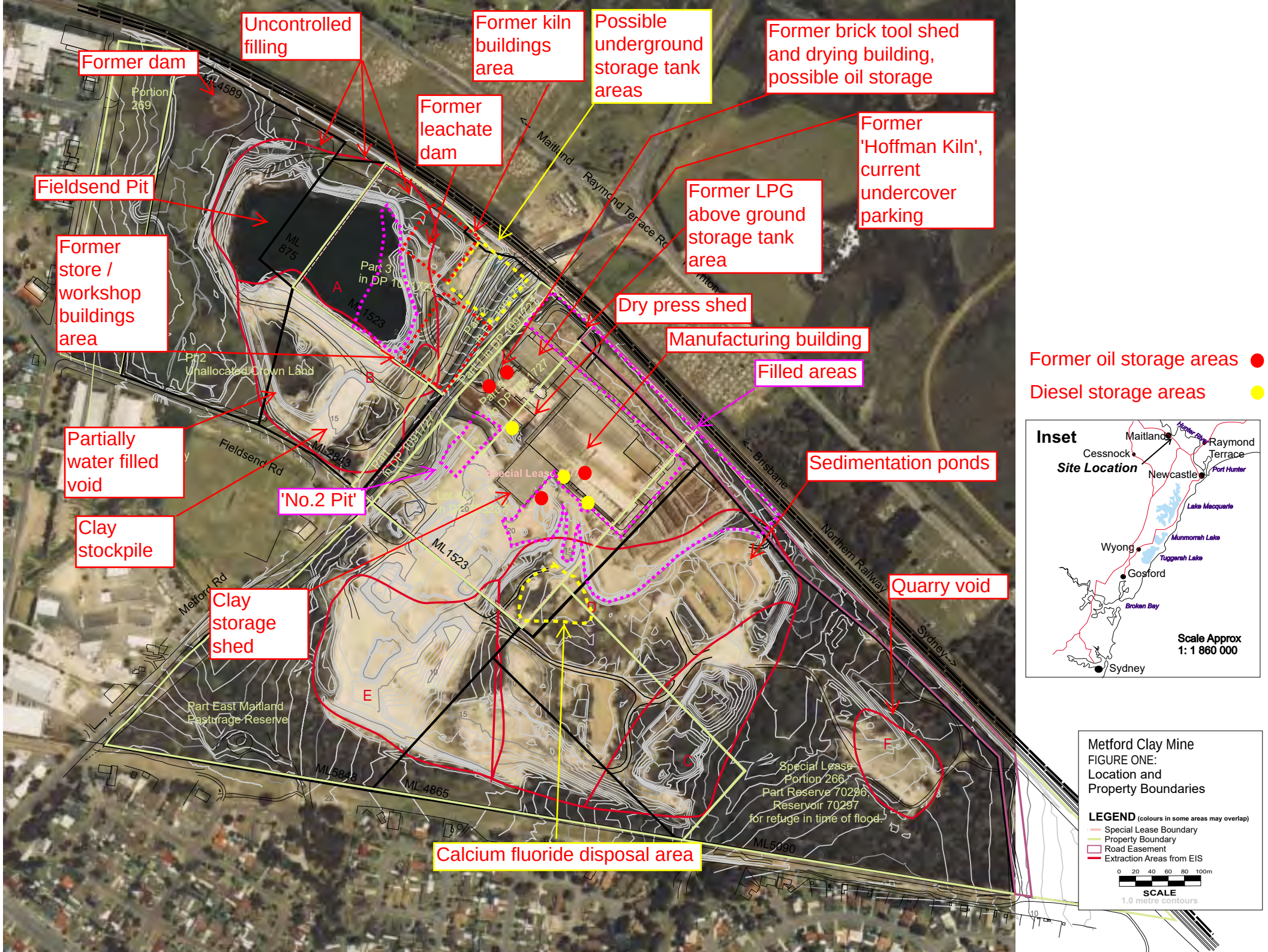
SCALE
As indicated@A0 DO NOT SCALE
0 1000 4000 8000
1:200

DRAWN BY: Author CHECKED BY: Checker
DESIGNED BY: Designer APPROVED BY: Approver

STATUS
DESIGN DEVELOPMENT

DRAWING
SITE PLAN

DRAWING NUMBER	ISSUE
01A-AX0-102	2


Former dam
Uncontrolled filling
Former kiln buildings area
Possible underground storage tank areas
Former brick tool shed and drying building, possible oil storage
Former leachate dam
Former 'Hoffman Kiln', current undercover parking
Fieldsend Pit
Former LPG above ground storage tank area
Former store / workshop buildings area
Dry press shed
Manufacturing building
Filled areas
Partially water filled void
Sedimentation ponds
'No.2 Pit'
Clay stockpile
Quarry void
Clay storage shed
Calcium fluoride disposal area
Former oil storage areas
Diesel storage areas
Inset
Site Location
Maitland
Cessnock
Raymond Terrace
Newcastle
Wyong
Gosford
Sydney
Lake Macquarie
Munmorrah Lake
Tuggerah Lake
Broken Bay
Scale Approx 1: 1 860 000
Metford Clay Mine
FIGURE ONE:
Location and Property Boundaries
LEGEND (colours in some areas may overlap)
Special Lease Boundary
Property Boundary
Road Easement
Extraction Areas from EIS
SCALE
1.0 metre contours