

## FINAL REPORT

# Long-term Environmental Management Plan, Platypus Site High Street, North Sydney NSW

Date:

**10 May 2018**

Prepared for:

**Sydney Harbour Federation Trust  
Building 28 Best Avenue  
Mosman NSW 2088**

Prepared by:

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# 1 INTRODUCTION

This Long-term Environmental Management Plan (EMP) has been prepared to set out the requirements for the management of the presence and potential presence of contaminated soils and groundwater in the surface and sub-surface environment at the property known as the Platypus Site, located at 118 High Street, North Sydney NSW (the Site) The location of the Site is shown on Figure 1 in Appendix A and the layout and boundaries of the Site are provided on Figure 1.

This EMP has been developed with reference to the relevant requirements of the NSW Office of Environment and Heritage (NSW OE&H) (2011) *Guidelines for Consultants Reporting on Contaminated Sites*, the National Environment Protection Council (NEPC) (2013) *National Environment Protection Measures (NEPM)*, the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme – 3rd Edition*, the relevant requirements of the *Work Health and Safety Regulation 2011* (WHS Regulation ) and on the information presented in the following reports:

- Coffey Environments Australia Pty Ltd '*Site Validation Report, Platypus Remediation Project – Stage 2 Remediation Works*' dated 19 January 2017 (the Validation Report);
- CONSARA Pty Ltd. '*Closure Report for Remediation and Validation Works, Platypus Site, High Street North Sydney*' dated 7 July 2017 (the Closure Report); and
- CONSARA Pty Ltd. '*Addendum to Closure Report for Remediation and Validation Works, Platypus Site, High Street North Sydney*' dated 30 April 2018 (the Addendum to Closure Report).

The Site has had a diverse history as manufactured gas works plant, a Naval torpedo maintenance facility, the HMAS Platypus submarine base and at the time of preparation of this EMP as an area to utilised for future public open space and recreational uses as well as for light commercial and retail businesses.

The implementation of this EMP will be undertaken by the Sydney Harbour Federation Trust (the Harbour Trust) which is a self-funded Federal Government Agency instituted under the Sydney Harbour Federation Trust Act 2001 (SHFT Act) that is responsible for the management of the Site. This EMP and its implementation is a requirement of the Harbour Trust's Comprehensive Plan (as amended in May 2009) which was made and is being implemented in accordance with Part 5 of the SHFT Act; and the detailed precinct Management Plan which was approved on 8 December 2016 in accordance with Section 11 of the Comprehensive Plan. Together, these two Harbour Trust plans constitute the 'Site Management Plan' for the Site under which the implementation of this EMP is required.

In addition the *Permanent Works Operation and Maintenance Manual*, (O&M Manual) for the Site, prepared by Thiess Services Pty Ltd and dated 2015 provides information regarding the operation and maintenance of the sub-surface drainage and seepage systems and equipment installed on the Site and is required to be implemented in conjunction with this EMP.

It is noted that within this EMP direct reference is made to specific guidelines, regulations and legislation that were in force at the time of preparation of this EMP. Over time it is likely that these references will be superseded by updated and revised versions. In applying this EMP those responsible must ensure that the relevant guidelines, regulations and legislation that are applied are those that are in force at that time.

## 1.1 Purpose of the EMP

This EMP was prepared to document procedures that are required to be implemented to manage identified risks to users of the Site to ensure that:

- The hardstand and other surface coverings present on the Site are maintained to ensure that users of the Site are not exposed to potentially contaminated soils and/or groundwater located beneath these surface coverings; and

- Works that require disturbance of ground surface coverings on the Site, particularly in the northern area of the Site, are undertaken in a manner that protects the health of the workers, users of these areas and members of the public.

The principal elements of this EMP are to:

- Detail the sub-surface conditions of the Site at the time of preparation of this EMP;
- Detail the surface conditions of the Site at the time of preparation of this EMP and detail the measures to be undertaken to ensure the integrity of these surfaces;
- Assign responsibilities for implementation of this EMP;
- Protect the health of users of the Site by ensuring maintenance of the surface coverings on the Site to prevent exposure to contaminants that may be present in the sub-surface environment; and
- Protect the health of maintenance workers on the Site if the surfaces are disturbed by works.

## 1.2 Terms used in this EMP

The Terms used in this EMP to refer to specific areas or installed features on the Site are defined below:

- **Cap** – comprises the various materials used to establish the capping layer across the areas of the Site in which stabilised contaminated fill and soils were re-instated for retention;
- **Northern Remediation Area** – the northern section of the Site in which the former gasworks infrastructure was primarily located and that was the focus of the remediation works completed as shown on Figure 3 provided in Appendix A. The final layout and survey plan of this area is provided in Appendix B;
- **Northern Remediation Containment Area** – Area within the Northern Remediation Area in which stabilised contaminated fill and soils were backfilled, compacted and covered with a series of materials that comprise the cap the extent of which is shown on the survey plan provided in Appendix C.

## 2 SITE CONDITIONS

### 2.1 Site Identification

The Site is located at 118 High Street, North Sydney, within the North Sydney local government area (refer Figure 1 in Appendix A). The main access to the Site is from High Street, with a secondary access to an upper car-park area via Kiara Close.

The Site is located on land owned by the Harbour Trust identified as DP109583 (Lot A). The land adjoining the Site to the east is referred to as Harbour Land and is comprises a wharf over Neutral Bay which is owned by the NSW Government. The area of the wharf is not subject to this EMP.

The Site is bound by:

- Adderstone Avenue and residential properties to the north;
- A wharf and Neutral Bay to the east;
- Residential properties, including the Iora development then High Street to the west; and
- High Street, residential properties and Kesterton Park to the south.

### 2.2 Site History

The Site has been utilised for various purposes since European settlement in the late 1700s, with its earliest recorded use being associated with whaling allotments from about 1828 and as a manufactured gaswork plant between 1876 and 1932. The Australian Federal Government resumed the Site in 1942 when it was used for torpedo maintenance workshops and then in 1967 as submarine base known as HMAS Platypus.

In 1999 HMAS Platypus including the torpedo workshops were closed and the Site was mothballed whilst the Department of Defence considered remediation and development plans. Investigations commissioned initially by Defence in the 1990s identified the presence of significant soil and groundwater contamination primarily as a result of the former gasworks operations on the Site. In 2005 the Site was transferred to the Harbour Trust for remediation and rehabilitation to allow for a mix of public open space and light commercial uses. Over the next few years the Harbour Trust undertook numerous stages of detailed investigations to inform the development of a plan of remediation for the Site. Remediation works were subsequently commissioned by the Harbour Trust in 2011 and were conducted over three stages:

- Stage 1 – Preparatory works including hazardous materials removal or stabilisation in all buildings, demolition of the administration building (Building No. 8 – see Figure 2 in Appendix A) and Store (Building No. 7- see Figure 2 in Appendix A) and wharf repairs;
- Stage 2 – Major remediation works comprised of the following:
  - On-site ex-situ stabilisation treatment of the most significantly contaminated materials such as pure coal tars and coal tar contaminated soils from the Northern Remediation Area for off-site disposal to landfill;
  - On-site ex-situ stabilisation of other less contaminated soils and bedrock from the Northern Remediation Area and placement of these stabilised materials into on-site containment area within the Northern Remediation Containment Area that was covered with a Cap;
  - Other ancillary remediation works included installation of a jet-grout cut off wall along the lower eastern boundary of the Site (alignment shown in Appendix D), in-situ stabilisation of soil materials beneath the former retort house (Building No. 11 see Figure 2 in Appendix A and plans in Appendix D), containment of existing contaminated and potentially contaminated soils beneath existing buildings and paved surfaces and construction of a seepage collection system at the base of the cut sandstone walls on Site;
- Stage 3– Landscaping works comprised the following:
  - Placement of layers of clean materials, including sands, topsoils, mulch, gravels and concrete to form the finished surfaces of the Cap across the Northern Remediation Containment Area and the Northern Remediation Area that was subject to the major remediation works;
  - Installation of shallow drainage and irrigation systems; and

- Planting of mass planting beds, trees and grasses.

These works commenced in 2011 and were completed in mid 2016. Comprehensive details of these works are provided in the Validation Report and Closure Report. In addition the O&M Manual provides information regarding the operation and maintenance of the sub-surface drainage and seepage systems and equipment installed during the remediation works and is required to be implemented in conjunction with this EMP.

## 2.3 Areas and Contaminants of Concern

The remediation works completed on the Site resulted in the retention of contaminated and potentially contaminated soils and groundwaters in the sub-surface beneath various areas of the Site. The contaminants of concern primarily comprise Total Petroleum Hydrocarbons (TPHs), Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs), Metals (Arsenic, Cadmium, Copper, Chromium, Nickel, Lead, Mercury and Zinc) and Asbestos.

These areas and the associated contaminants of concern are detailed below.

### 2.3.1 Cut-off Wall

The remediation works on the Site required the installation of an impermeable cut-off wall behind the existing seawall along the eastern boundary of the Site to contain the northern section and central section of the Site. The primary objective of the wall was to prevent the ingress of sea water from Neutral Bay and the discharge of groundwaters from the Site to Neutral Bay, whilst also protecting and stabilising the existing sea wall.

The cut-off wall was installed as a jet grout wall with a 'U-shaped' alignment around the north-eastern, eastern and south-eastern boundary of the Northern Remediation Area and then in a north-south alignment along the eastern boundary of the Site to the south of the Northern Remediation Containment Area. The as-builts of the installed jet-grout wall is provided as Appendix D of this report. The Validation Report and the Closure Report stated that the constructed jet-grout wall met the specified design criteria and acts as an impermeable hydrological barrier to the Site.

The jet-grout wall is comprised of a mixture of cement self hardening grout and the soils that were present in the areas that the wall was constructed. As such the jet grout wall itself has been formed utilising contaminated soils and as such contains some potential contaminants of concern such as PAHs, TPHs and heavy metals. It is noted that the jet-grout process serves to bind these contaminants in a stable matrix such that contaminants may only be able to be released if the jet grout is significantly disturbed or compromised.

### 2.3.2 Contained Stabilised Contaminated Materials – Northern Remediation Containment Area

The remediation works on the Northern Remediation Area, shown outlined in red on Figure 2 and 3 of Appendix A, resulted in the removal of all soil materials to bedrock. Whilst the most significantly contaminated materials were disposed off-site, the less contaminated materials were treated on the Site. This treatment served to stabilise the primary contaminants, PAHs and TPHs, in the soils. These stabilised soils were then reinstated into the deepest areas of the resultant excavation in compacted layers and were finished above the pre-existing surface levels to form the basis of the final landscaping works. A Cap comprised of various layers of materials was then placed over the stabilised soils. The extent of the retained stabilised materials is referred to as the Northern Remediation Containment Area as shown in plans provided in Appendix C and Appendix E. Details of the Cap are provided in detail below.

#### 2.3.2.1 Details of Cap over Northern Remediation Containment Area

The extent of the contained stabilised contaminated materials and the cap that covers the Northern Remediation Containment Area is shown on the figures provided in plans provided in Appendix C and Appendix E. The Cap is comprised of the following (in order of placement over the retained materials):



- **Geosynthetic Clay Liner (GCL)** – Single liner installed directly onto retained compacted materials – 10-20 mm thickness. The GCL is a high strength low permeability material made from polypropylene geotextiles and sodium bentonite powder and forms the primary barrier between the retained stabilised materials and the overlying surface treatments. The specifications for the GCL installed on the Site are provided in Appendix F;
- **Drainage blanket including a flow net** – Panel liners and a single layer of high-density polyethylene (HDPE) geonet installed directly over GCL – 10 mm thickness. The specifications for the panel liners and geonet installed on the Site are provided in Appendix F;
- **Drainage layer** – Layer comprising fine-grained, well graded, non-erodible cohesive material with stones of up to 25mm – Variable thickness – between 0.4 and 1.1 metres dependant on final surface covering;
- **Final surface treatments** - concrete, structural sands, sub-grade materials, soils, gravels, paving, topsoils, mulch, vegetation (plants, shrubs, grass etc) – Variable thickness between 0.2 and 0.5 metres dependant on final surface covering.

The registered survey of the top of the GCL and top of the drainage layer and as-builts for these features is provided in Appendix E and then the thickness of the capping layer over the top of the GCL to the finished surface levels of the Site is provided on the plan in Appendix C. The final surface levels and features across the Northern Remediation Area are generally provided in Appendix B. However, it is noted that as set out the Addendum to Closure Report, some changes have occurred to the surface features shown in Appendix B comprising the installation of staircases, additional paving, concrete and playground equipment, all of which were constructed above the finished surface RLs shown in Appendix B and that on these areas the resultant finished surfaces have higher RLs than those provided on Appendix B.

It is noted that a constructed drainage system was installed through the drainage layer and upper clean materials to divert waters and stormwaters laterally to a system of pits and pipes. Part of the as-builts for these systems is provided in Appendix G and it is noted that the full detail on this system is provided in the O&M Manual for the Site.

### 2.3.2.2 Cliff Line Seepage water Collection and Discharge System - Northern Remediation Containment Area

The Site has a number of expansive vertical sandstone rock cliff faces. Groundwaters present in sandstone beneath the higher areas of the Site and off-site continue to migrate to the east and discharge as seeps along the jointing, bedding planes or fractures in the sandstone rock at these faces. Concentrations of cyanide and some other metals in these seepage waters have been found to be elevated and as such a cliff line seepage water collection system was installed to collect seepage water for diversion for collection and ultimate disposal via tradewaste to sewer.

The system comprises a continuous series of grated drains installed along the base of the cliffs with the finished ground surfaces and a drainage layer present along the north-western corner of the Northern Remediation Containment Area. The grated drainage system extends along the driveway into the Site from High Street and continues to the north along the base of the cliff that runs behind Building No.2 and continues along the base of this cliff into the Northern Remediation Containment Area. Within the Northern Remediation Area the grated drain extends to where the Cap commences in the north-west.

Along the base of the cliff line where the Contained Stabilised Materials are present, a drainage layer was installed along the cliff face prior to the placement of these materials. This drainage layer consists of a plastic layer (Podrain CD18) fastened to the cliff with a water proof membrane (Emerproof HDPE) preventing water migration between the fill materials and the drainage layer. The drainage layer drains to the geofabric covered pipe which discharges to the south into the drainage system.

This system ultimately discharges seepage waters into a collection tank in the sub-surface of the Northern Remediation Containment Area for disposal to sewer under a Tradewaste Permit. The as-builts for this systems is provided in Appendix G and it is noted that the full detail on this system is provided in the O&M Manual for the Site.

### 2.3.3 Retained Contaminated Materials

In various areas across the Site, outside of the Northern Remediation Area, there remains the actual or potential for contaminated soils and/or groundwaters to have been retained in the sub-surface above bedrock and beneath pre-existing or newly installed surface coverings. A summary of these areas is provided below:

- **Driveway Area between the Workshops (Building No.10) and the Submarine School (Building No.2)** (as shown in Figure 10 of Appendix A) – The driveway that extends from High Street in an L-shape to the southern boundary of the Northern Remediation Containment Area was subject to excavation to depths of 1.2 metres below the ground surface (m bgs) or to/into sandstone bedrock, whichever was first encountered. Whilst the excavation for the driveway from High Street down to between the RANTME Factory (Building No.1) and the Administration Building (Building No.3) was completed into bedrock in the base and walls, between the Workshops (Building No.10) and the Submarine School (Building No.2) there were areas of the driveway excavation where soils materials were retained at depths greater than 1.2 m bgs. In this area a marker liner comprised of orange HDPE plastic was installed along the base of the excavation prior to backfilling. This liner was installed to alert future users who may access depths greater than 1.2 m bgs that potentially contaminated materials are retained beneath the liner. In order to prevent undermining of the buildings on either side, the excavation along the roadway was only able to extend laterally to the edges of the buildings. During these works it was observed (reported in Validation Report) that the soil materials retained in the walls and beneath the buildings contained fragments of asbestos containing materials. No marker liner was installed along the face of the walls;
- **RANTME Factory (Building No.1), Administration Building (Building No.3), Coal Bunker House (Building No.13) and Compressor House (Building No. 12)** (see Figure 2 of Appendix A) – These buildings were subject to various remedial works, including excavation and removal of contaminated materials present in the floors or sub-floors and, where practicable, re-surfacing with concrete. The final surfaces of these areas is shown on Figure 13 of Appendix A. However, there remains the potential for contaminated materials to have been retained beneath the ground floor slabs, retained on-ground slabs and footings and/or for hazardous building materials to be present; and
- **Guardhouse Building and surrounding garden area (see Figure 2 of Appendix A)** – The former guardhouse building and surrounding garden bed areas are located at the entrance to the Site from High Street and was not subject to any remedial works during the remediation and validation of the Site. Detailed investigations on this area of the Site were completed by CONSARA in April 2018 (as reported in ‘*Environmental Site Assessment, Guardhouse Site located within the Platypus Site, High Street North Sydney NSW*’ prepared by CONSARA and dated 27 April 2018). The results of this investigation identified that the building appears to be underlain by sands and then bedrock whilst the concrete sealed and unsealed garden bed areas surrounding the building were underlain by a shallow horizon of fill materials that were directly underlain by weathered sandstone and sandstone bedrock. There was no evidence of significant or gross contamination, however, the soil analytical results identified concentrations of carcinogenic PAHs in the fill materials present at the surface and in the sub-surface in various locations surrounding the building, both beneath concrete hardstand and unsealed garden areas, that were greater than the adopted assessment criteria for open space land use but were less than the criteria for commercial/industrial land use. Chrysotile asbestos as fibres was also identified in one sample of fill materials collected from a depth of 0.2-0.3 m bgs from the rear garden area at concentrations that were greater than the adopted assessment criteria for open space and commercial/industrial land use.

## 3 IMPLEMENTATION OF THIS EMP

This EMP is required to be implemented to ensure:

- Maintenance of the surface coverings of the Site in the condition described in this EMP; and
- Works that require the disturbance of the surface of the Site, described below as ‘minor works’ and ‘major works’, are conducted in accordance with the requirements set out in this EMP.

### 3.1 Maintenance of Surface Coverings

For the purpose of this EMP, the surface covering of the Site is defined as the pavements, roadways or slabs constructed of concrete, bitumen, asphaltic cement or other materials such as bricks, paving stones, growing mediums (topsoils, mulch or similar) vegetation etc, that cannot be removed readily without the use of tools. The surface coverings present at the time of preparation of this EMP across the Northern Remediation Area is provided as

#### 3.1.1 Hardstand Maintenance

The integrity hardstand surfaces on the Site (comprised primarily of concrete and/or bitumen or covered by building footprints) must be maintained to prevent contact with potentially contaminated soils and groundwater. Inspections must be undertaken to ensure that the hardstand pavements are not showing signs of deterioration.

Hardstand pavements are present across the Site in both indoor (in an enclosed space that comprises walls and roofing, such as a building or similar) and outdoor (open outdoor areas or where good ventilation is present at all times) areas. In both indoor and outdoor areas, where practicable, cracks or gaps within the hardstand pavement are to be no wider than 250 mm at the widest point.

Should a pothole or cracking wider than 250 mm be observed in the hardstand pavement, such that workers or users of this area could be practicably exposed to the underlying sub-surface materials present beneath the pavement and its associated sub-grade, nominally at depths greater than 0.2 metres (m) from the surface, (such as through dermal (skin) contact due to requirements to handle sediments or silts generated from such areas during weather events or similar) then repairs are required to be undertaken following the protocol set out below for minor or major works as appropriate.. Guidance on determining the period of time in which repairs must be made is as follows:

- Indoor Areas which are in regularly used and occupied by workers or users of the Site (For example - utilised at least twice per week for a work period of at least 4 hrs continuous each time or greater) – Repairs to hardstands must be made within a 4 week period;
- Indoor Areas which are not regularly used or occupied by workers or users of the Site (For example - utilised once to twice per week for a work period of up to 4 hrs continuous each time or less) – Repairs to hardstands must be made within a 10 week period);
- Outdoor Areas which are regularly used and occupied by workers of users of the Site (such as driveways, access walkways, entrances to buildings) – Repairs to hardstands must be made within an 8 week period;
- Outdoor Areas which are not regularly used or occupied by workers or users of the Site – Repairs to hardstands to be made within a timeframe considered to be reasonable by the Operator but no longer than a 4 month period.

#### 3.1.2 Unsealed Area Maintenance

The unsealed areas present across the Site and located primarily within the Northern Remediation Area, must be maintained to ensure the integrity of the Cap and to prevent contact with potentially contaminated soils and groundwater. These unsealed areas are located in outdoor areas and inspections must be undertaken to ensure that

no large scale erosion or removal of the surface coverings such as grasses, mulches, gravels etc has occurred that exposes the sub-surface materials present at depths greater than 0.2 metres (m) from the surface.

Should such erosion or similar be observed then repairs are required to be undertaken following the protocol set out below for minor or major works as appropriate.. Guidance on determining the period of time in which repairs must be made is as follows:

- Unsealed Areas within the Northern Remediation Area (area shown on Figure B) – Repairs to unsealed areas must be made within a 4 week period;
- Unsealed Areas outside of the Northern Remediation Area – Repairs to unsealed areas to be made within a timeframe considered to be reasonable by the Operator but no longer than a 4 month period.

## 3.2 Disturbance of the Surface Coverings

For the purpose of this EMP:

- **Minor works** comprise works that require minimal disturbance of the surface coverings and comprise activities such as:
  - Hardstand or pavement maintenance works at surface level only such as filling in of cracks, patching of holes or small scale replacement of sections of pavement where sub-surface retained soils are not required to be disturbed;
  - Landscaping works such as mowing, shallow planting, mulching, raking leaves, maintenance of gravel pathways or similar, where direct contact with the materials used in the surface treatment is possible, but no contact with the sub-surface retained soils (soils greater than 0.2 m depth) or contact with the geotextile marker layer is possible.
- **Major works** comprise larger scale disturbance to the surface coverings and the underlying materials and comprise activities such as:
  - Any works across the Northern Remediation Containment Area during which direct contact with the sub-surface soils and/or groundwater at depths greater than 0.2 m is possible;
  - Any works that directly affect or disturb the Cut-off Wall;
  - Construction and maintenance of sub-surface services, such as gas, electricity, stormwater, surface drainage, telephone, cabling and water supply;
  - Installation of equipment or undertaking of construction that requires excavation of the surface and sub-surface where direct contact with the retained materials is possible;
  - Installation and maintenance of features or equipment that require disturbance and/or disposal of the surface and/or sub-surface soils where direct contact with the sub-surface soils or groundwater is possible.

## 3.3 Responsibilities

The Harbour Trust, as the Site Owner, is responsible for the overall implementation and maintenance of this EMP and for ensuring that owners, occupiers, tenants and contractors working on the Site have been informed of the requirements of the EMP prior to commencement of works.

The supervisor or person-in-charge of works on the Site is responsible for implementing the requirements of the EMP during the planning process for any works to be conducted, during the course of any works that fall into the “Minor” or “Major” categories as defined below, and at the completion of any “Minor” or “Major” works. The specific responsibilities of the Site Owner and the supervisor or person in-charge of the works are outlined in Table 1 below.

**Table 1: Responsibility Matrix**

Position and Company/Entity	Responsibilities
The Site Owner (Harbour Trust OR nominated representative)	<ul style="list-style-type: none"> <li>- Advise persons occupying and working at the Site of the requirements of the EMP;</li> <li>- Ensure implementation of the EMP requirements on the Site;</li> <li>- Ensure appropriate consents and licences (as required) are obtained for the works;</li> <li>- Procure the training and induction of employees and contractors before and during the works, as appropriate and relevant;</li> <li>- Provide a copy of the EMP to the occupiers, supervisor or person-in-charge of occupier/tenant employees and/or contractor/s who are undertaking the works;</li> <li>- Ensure relevant and appropriate project/occupier/tenant staff and contractors comply with the requirements of the EMP;</li> <li>- Ensure relevant and appropriate project/occupier/tenant staff and contractors clearly understand the requirements of the EMP and ensure that compliance with the EMP is a condition of any agreement with these parties;</li> <li>- Ensure the conditions of the EMP are implemented and supplemented, if necessary, by conditions of any relevant planning consent;</li> <li>- Obtain advice if the conditions on the Site are changed, and, if necessary, arrange for an appropriately qualified person to update the EMP, informing other relevant and appropriate parties, including tenants, of the changes;</li> <li>- Ensure the Site is maintained in accordance with the EMP;</li> <li>- Ensure corrective action is undertaken where verified complaints are made;</li> <li>- Provide the EMP for inclusion on the relevant records maintained by project/occupier/tenant.</li> </ul>
Supervisor or person in charge of works (Owner/Occupier/Tenant/ Site Manager/Contractor/ Sub-Contractor/Environmental Consultant)	<ul style="list-style-type: none"> <li>- Implement the EMP to ensure compliance;</li> <li>- Complete the registers, databases and records required by the EMP;</li> <li>- Conduct works in an environmentally responsible manner;</li> <li>- Meet relevant Work and Occupational Health and Safety regulatory requirements;</li> <li>- Implement the works in a safe and responsible manner;</li> <li>- Notify the Site Owner if suspected contaminated fill materials is encountered during works on the Site;</li> <li>- Complete non-conformance and corrective action reports as required and undertake follow-up corrective actions, as required;</li> <li>- Conduct groundwater monitoring as required in the EMP;</li> <li>- Undertake audits of activities in accordance with the requirements of the EMP;</li> <li>- Ensure non-conformance and/or complaints are reported to the Site Owner</li> <li>- Undertake corrective actions in response to requests made by the Site Owner regarding specific environmental or safety issues;</li> <li>- Ensure all works comply with relevant regulatory requirements;</li> <li>- Inform the Site Owner if conditions change significantly from those documented in the EMP.</li> </ul>

### 3.4 Record of Implementation of the EMP

Records of the implementation of this EMP must be completed and maintained by the Site Owner and include, but may not be limited to, the following:

- EMP Induction Register – Register of persons inducted under the EMP. This register must include the name of the person, their employer, the date of induction, the nature of works being completed, whom the inductee is working on behalf of, the person that provided the induction and signatures of both the instructor and the inductee;
- Inspection Records – Records of inspections of the integrity of the Cap across the Site as set out in Section 4.3;
- Asbestos Materials Handling or Removal Records – Records of any works requiring the handling and removal of asbestos or other hazardous building materials as set out in Section 4.4;
- Waste Disposal Records – Records of any works requiring the off-site disposal of excavated soils or similar as set out in Section 4.5;
- Unexpected Finds Register – Records of any unexpected finds as set out in Section 4.6; and
- Complaints Register – Records of complaints and response works as set out in Section 4.7.

These records must be maintained by the Site Owner such that they are available to any external auditor for review on request.

### 3.5 Document Revision

This EMP is required to be reviewed if a change of use or redevelopment of the Site occurs that results in a material change to the surface coverings on the Site or on the Cap across the Northern Remediation Containment Area or to the Cut-off Wall as described in this EMP. Any amendments or revisions or similar of the EMP must be controlled by the Harbour Trust and be completed by a suitability qualified environmental consultant. In making any amendments or revisions the Harbour Trust must provide the appointed suitably qualified person with the reports referred to in Section 1 of this EMP.

Should the EMP be varied due to a change in use or redevelopment of the Site occurs that results in a material change to the surface coverings and/or use of the Site as described in this EMP, the revised EMP must be subject to review by a NSW EPA Accredited Site Auditor (Accreditation under the *Contaminated Land Management Act 1997*) for acceptance as appropriate and to ensure that the revised EMP continues to be able to be legally enforceable.

It is the responsibility of the Site Owner to ensure the EMP supplied to any person is the current updated or amended version.

It is the responsibility of the supervisor or person-in-charge of works proposed to be undertaken to ensure they have the current version of the EMP.

The up-to-date version of the EMP will be available from the Site Owner.

The EMP is required to be continually implemented (in perpetuity) to ensure that the Site remains suitable for use for open space recreational and commercial/industrial land uses.

## 4 RISK CONTROL MEASURES

This section provides summary information on mechanisms whereby exposure to the contamination present in the sub-surface soils or groundwater could occur (known as exposure pathways) and guidance on precautionary control measures for activities on the Site that have the potential to result in exposure to these materials.

It should be noted, however, that this EMP provides general guidance only and does not constitute a health and safety plan, job safety analysis, risk assessment or any other considerations under the Work Health & Safety Act 2011 (WHS Act) and Occupational Health and Safety Regulation 2011 (OH&S Regulation) (or relevant legislation current at the time of the proposed works).

Potential human health risks associated with the presence or potential presence of petroleum hydrocarbon, polycyclic aromatic hydrocarbon and heavy metal contaminated soils and groundwater and asbestos in soils beneath the Site are:

- Exposure to vapours, dust, soils or groundwaters generated during the completion of works that disturb the sub-surface; and
- Inappropriate handling and waste management of excavated or excess soil materials or groundwaters.

### 4.1 Exposure Pathways

The presence and potential presence of petroleum hydrocarbons, polycyclic aromatic hydrocarbons and some metals within the sub-surface soils and groundwater beneath the Site does not affect the present safe use of the Site under the current land use scenarios and whilst the existing surface coverings are undisturbed.

However, if these surface coverings are disturbed through Minor or Major works as defined in Section 3.2, it is possible that a risk of exposure may result. In order to develop appropriate measures to control this increased exposure, it is necessary to understand the potential exposure pathways.

A summary of the potential health effects and the exposure pathway for these potential contaminants is summarised in Table 2 below.

**Table 2: Exposure Pathways**

Contaminant of Concern	Source	Chemicals	Physiological Effect	Exposure Pathway
Petroleum Hydrocarbons (TPH), including Benzene, Toluene, Ethyl-benzene and Xylenes (BTEX)	Soils, soil vapour and groundwater present in sub-surface beneath the Cap in the Northern Remediation Containment Area and beneath buildings and pavement across remainder of Site.	TPH and BTEX	Inhalation of volatile hydrocarbons, if present, may cause central nervous system effects such as headaches, blurred vision and narcosis, when present in high concentrations. Repeated skin contact may result in allergic dermatitis and skin cancer. Skin contact may cause dermatitis. Long term or chronic exposure may result in liver damage, effects on the blood forming-systems.	Inhalation of vapours or contaminated dust and ingestion of contaminated soil/dust are the primary pathways for exposure. Dermal absorption is low to negligible
Polycyclic Aromatic Hydrocarbons (PAHs) – Carcinogenic PAHs	Soils, soil vapour and groundwater present in sub-surface beneath the Cap in the Northern Remediation Containment Area and beneath buildings and pavement across remainder of Site.	PAHs, including benzo(a)pyrene	Inhalation/ingestion of PAHs (as dusts with PAHs are not very volatile) may cause bronchitis and possibly cancer of the respiratory system and different types of tumours. B(a)P is a genotoxic carcinogen. Repeated skin contact may result in allergic dermatitis and skin cancer	Inhalation of vapours or contaminated dust and ingestion of contaminated soil/dust are the primary pathways for exposure. Dermal absorption is low to negligible
Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Mercury and/or Zinc)	Soils and groundwater present beneath the Cap in the Northern Remediation Containment Area and beneath buildings and pavement across remainder of Site.	Arsenic, Cadmium, Copper, Chromium, Nickel, Lead, Mercury and Zinc	Toxic to a wide range of organs and tissues, and variety of toxicological end points – reproductive toxicity, neurotoxicity, carcinogenicity	Ingestions of soil and dust is considered to be the most significant pathway of exposure for inorganics in soil. Dermal absorption is also considered but is generally considered to be negligible



Contaminant of Concern	Source	Chemicals	Physiological Effect	Exposure Pathway
Asbestos	Soils containing bonded and/or friable asbestos. It is noted that no respirable asbestos fibres have been previously identified in surface or shallow sub-surface soils on the Site.	Asbestos Containing Materials (ACM)	Inhalation of asbestos fibres can cause asbestosis, lung cancer and mesothelioma. The risk of contracting these diseases increases with the number of fibres inhaled and the risk of lung cancer from inhaling asbestos fibres is also greater if you smoke. People who get health problems from inhaling asbestos have usually been exposed to high levels of asbestos for a long time. The symptoms of these diseases do not usually appear until about 20 to 30 years after the first exposure to asbestos	Inhalation of loose/friable asbestos from disturbed soils.

## 4.2 Control Measures for Current Activities

Under the current land use and based on the existing surface coverings on the Site there is low to negligible risk of harm to the human health of users of the Site and to the ecological aquatic environment of Neutral Bay by the presence of materials that contain or may contain the above listed potential contaminants within the sub-surface of the Site. The surface coverings and cut-off wall are required to be maintained for the lifetime of this EMP to ensure that this low to negligible risk of exposure is maintained.

The surface coverings across the Site and Off-site Area are required to be regularly inspected, at least once per every 12 months. It is the responsibility of the Owner to ensure that these inspections are undertaken. As a conservative measure the inspections are to be undertaken as a walkover across the surface of the Site and Off-site Area. The inspection must make a written and photographic record of the following:

- General condition of hardstand pavement surfaces and unsealed surfaces;
- Presence of any subsidence, cracks, openings, degradation, erosion or similar in the surface coverings – the nature, extent and location needs to be recorded and rectification works are required to be implemented;
- Presence of any obvious repair/maintenance works to the surface coverings– the nature, extent and location needs to be recorded;
- Presence of any excavation works into the sub-surface and the control measures being undertaken; and
- Any other observations on the condition and/or integrity of the surface coverings.

Where rectification works are required to be implemented or where repair/maintenance works are being undertaken, the Owner must ensure that these works are undertaken in accordance with the measures set out in this EMP. On completion of such works, the Site Owner must conduct an inspection to ensure that the surface coverings have been adequately re-instated/restored.

The record of the required inspections is required to be kept and maintained by the Site Owner.

## 4.3 Control Measures for Future Activities

Minor Works do not require specific controls and as long as the sub-surface (at depths greater than 0.2 m depth) is not disturbed then no specific controls are required.

Where Major Works are required to be undertaken (where sub-surface at depths greater than 0.2 m are disturbed) additional control measures may be required depending on the scope of the works.

Whilst it is not possible to assess the impacts from all future activities, it is possible to consider exposure scenarios likely to be associated with a range of general maintenance and intrusive works.

The control measure required to be implemented for “Minor Works” and “Major Works” are set out in Table 3 below.

Table 3: Control Measures

Works	Examples of Types of Works	Possible Risks to Users	Possible Risks to the Environment	Control Measures Required
<b>MINOR WORKS</b>				
<p><b>Minor Works</b> Minor works comprise activities that only require disturbance at surface to depths of 0.2 metres below ground surface.</p>	<p><b>Pavement surface maintenance</b></p> <ul style="list-style-type: none"> <li>- Filling in of cracks, patching of holes</li> <li>-Small scale replacement of sections of pavement where sub-surface at depths greater than 0.2 m are not required to be disturbed</li> </ul> <p><b>Minor landscaping works</b></p> <ul style="list-style-type: none"> <li>-Mowing of grassed areas -Raking or placing of additional growing medium on top of existing growing mediums</li> <li>-removal of surface weeds or similar</li> </ul> <p><b>Internal or External Building façade works</b></p> <ul style="list-style-type: none"> <li>-Painting, pointing, plastering</li> <li>-Internal fitouts aboveground only</li> </ul> <p><b>Does not include:</b></p> <ul style="list-style-type: none"> <li>- planting or any similar landscaping activity that requires excavation into the growing medium or sub-surface at depths greater than 0.2 m.</li> <li>-maintenance of the groundwater/seepage collection system</li> <li>-maintenance of underground utilities</li> </ul>	<p>Inhalation of vapours or dusts potentially containing TPHs, BTEX, PAHs, metals, asbestos (though considered unlikely to be generated during Minor Works)</p>	<p>Low risk of runoff. May impact stormwater system if not appropriately contained.</p>	<ul style="list-style-type: none"> <li>-No eating, drinking, smoking; avoid contact with soil (wear gloves); wash hands and clothes after work and before eating or smoking.</li> <li>-A half-face respirator (fitted with organic cartridges) or dust-masks must be available for use at the Site in the event that significant odours or dust is generated during the works</li> <li>-Dust generation should be controlled by dampening the materials.</li> <li>- Where the integrity of surface coverings has been compromised such that the required repairs are considered to be Minor Works, an exclusion zone must be established around the impacted area to preclude exposure to the sub-surface by users of the Site until such time that repairs can be completed. The exclusion zone is to established by using physical barriers such as bollards, cones, tape or mesh. Timeframes in which the repairs that are classified as Minor Works are required to be completed are provided in Section 3.1.1 and 3.1.2 of this EMP.</li> </ul>

Works	Examples of Types of Works	Possible Risks to Users	Possible Risks to the Environment	Control Measures Required
<b>MAJOR WORKS</b>				
<p><b>Major Works</b> Major works comprise activities that require disturbance of sub-surface materials present at greater than 0.2 metres below ground surface and any works associated with the groundwater/seepage collection system</p>	<p><b>Landscaping, Maintenance or Other Works within Northern Remediation Containment Area:</b> -where direct contact with the sub-surface soils and/or groundwater at depths greater than 0.2 m is possible; -any works that directly affect or disturb the Cut-off Wall; <b>Construction and maintenance of sub-surface services</b> - gas, electricity, stormwater, surface drainage, telephone, cabling and water supply; -Maintenance of the groundwater and seepage water collection system <b>Other</b> -Installation of equipment or undertaking of construction that requires excavation of the surface and sub-surface where direct contact with the retained materials is possible; -Installation and maintenance of features or equipment that require disturbance and/or disposal of the surface and/or sub-surface soils where direct contact with the sub-surface soils or groundwater is possible.</p>	<p>Inhalation of vapours or dusts potentially containing TPHs, BTEX, PAHs, asbestos. Dermal exposure to soils and/or water potentially contain TPHs, BTEX, PAHs, metals Ingestion of dusts, waters, soils potentially containing TPHs, BTEX, PAHs, metals  Unexpected finds</p>	<p>Medium risk of runoff. May impact stormwater system if not appropriately contained.</p>	<p>-Workers/contractors undertaking the works are appropriately licenced in accordance with the requirements of the relevant OH&amp;S regulations and NSW Workcover. -Develop safety documentation for works. -No eating, drinking, smoking; avoid contact with soils or waters (wear gloves). -Any works to be conducted that may compromise the integrity of the Cap or Cut-off Wall must be approved by the Site Owner. The Site Owner must not approve such works until consultation with an appropriately qualified environmental consultant is undertaken and formal advice is provided on the affect on the Cap or Cut-off Wall and works that must be undertaken to ensure the integrity of the Cap. The environmental consultant must be provided with the Validation Report and Closure Report along with this EMP and the O&amp;M Manual prior to providing their advice. -- Where the integrity of surface coverings has been compromised such that the required repairs are considered to be Major Work or any works are undertaken that are Major Works, an exclusion zone must be established around the impacted area to preclude exposure to the sub-surface by users of the Site until such time that repairs or the works can be completed. The exclusion zone is to be established by using physical barriers such as secure lockable fencing or similar. Timeframes in which the</p>

Works	Examples of Types of Works	Possible Risks to Users	Possible Risks to the Environment	Control Measures Required
				<p>repairs that are classified as Major Works are required to be completed are provided in Section 3.1.1 and 3.1.2 of this EMP.</p> <p>-Should odours, sheens or similar be uncovered works must cease and the environmental consultant is required to be immediately notified to determine control measures, which are likely to require the following:</p> <ul style="list-style-type: none"> <li>- that a Photoionization Detector (PID) with a lamp voltage of at least 10.6 electron volt (eV) be used to monitor operator/ field staff breathing zone for volatile organic contaminants (VOCs) during excavation works conducted where disturbance of the soils will occur</li> <li>- that-Half-face respirators fitted with organic filters and coveralls/tyvex (chemical resistant) must also be available for use in the event that significant contamination /odours are encountered. If the Action levels and personal protective equipment (PPE) requirements for VOCs as presented in Table 5 below are to be applied within the breathing zone during the works.</li> </ul> <p>-At minimum Level D PPE must be worn during works including long sleeved shirts and long pants, steel-toed boots, gloves, high-visibility vest and safety glasses and a P2 dust mask during manual handling of soils and/or waters.</p> <p>-Wash hands and clothes after work.</p> <p>-Prevent dust by applying dust suppression prior to and during excavation.</p>

Works	Examples of Types of Works	Possible Risks to Users	Possible Risks to the Environment	Control Measures Required
				<p>-If soil materials are required to be excavated, excavate hardstand material separately, cover excavated materials with plastic, then place it back into original position prior to reinstating hardstand layer.</p> <p>-Ensure all potentially contaminated fill materials are placed in excavation pit prior to reinstatement of hardstand covering the ground surface.</p> <p>-Any materials excavated must be handled with care. Excavated soils or waters containing or suspected of containing contamination must not be left unattended. If it is necessary to leave materials unattended, the soils are required to be dampened to prevent generation of dust, and placed back in the excavation and the surface cover reinstated so that exposure to these materials cannot be gained by casual users or must be formed into stockpiles that are covered with heavy density polyurethane (HDPE) plastic or similar; waters are required to be stored in appropriate containers that can be sealed and secured.</p> <p>-Where off-site disposal is required ensure all excavated materials (soils and/or waters) are handled, managed and disposed off -site in accordance with NSW EPA (2014) <i>Waste Classification Guidelines</i> or equivalent and disposal to a facility licensed by NSW EPA to receive the class of waste material. Records of disposal to be maintained and recorded in a materials tracking register.</p>

**Table 4: Breathing Zone Action Levels**

Chemical Hazards:	Risk: H - High M - Med L - Low	TWA (mg/m <sup>3</sup> )	STEL (mg/m <sup>3</sup> )	IE (eV)	MUL Action levels (75% safety margin worked into MUL)				LEL (%)
					No APR	½ face APR	full face APR	IDLH reached	
<input checked="" type="checkbox"/> Benzene	H	16	-	-	5	37.5	187.5	3000	1.3-
** Remember - Max Use Limit (MUL) = (Protection Factor x Exposure Limit) x 75% ** PF= 10 for ½ face, 50 for full face, 10000 for SCBA									

### 4.4 Control Measures - Asbestos

Should fragments of asbestos containing materials (ACM) and/or bonded fibrous cement materials (potential ACM) and/or any quantity of friable material be encountered the following procedure is required to be implemented:

- Works must cease and the exposed area should be covered with substantial plastic sheeting that is securely anchored to the ground surface and be enclosed within a barrier to prevent access.
- The Site Manager must be immediately notified;
- The Site Manager must determine if appropriate signage should be displayed to warn of the presence of these materials;
- A suitably qualified Occupational Hygienist or equivalent must be contacted by the Site Manager to provide an assessment of risks and the required management response and control measures;
- No further works are to be undertaken on the Site until the Site Manager has provided approval for works to re-commence.
- Asbestos removal works must only be undertaken in accordance with the requirements of the relevant OH&S regulations and NSW Workcover;
- A bonded asbestos licence is required to be issued by NSW Workcover (or as superseded at the time of works) to remove, repair or disturb more than 10 square metres of bonded asbestos material such as fibro, corrugated cement sheeting and asbestos cement pipes. A friable asbestos licence is required to be issued by NSW Workcover to remove, repair or disturb any amount of friable asbestos, such as sprayed limpet, asbestos cloth, millboard and pipe lagging. This licence also allows the removal of bonded asbestos;
- NSW WorkCover must be notified seven days before removing bonded asbestos and a work site permit from NSW WorkCover is required to be obtained before removing any friable asbestos. Applications must be lodged at least seven days before the proposed work is due to start.

Should the procedures above be required to be implemented, records of such works will need to be completed and retained by the Supervisor or person in charge of works. Such records would include the location on the Site where materials were found, reason for the works, the type of asbestos, documentation of any monitoring or clearance works completed by the Occupational Hygienist, report on waste classification works completed by the environmental consultant on any removed materials and the receiving waste facility dockets.

### 4.5 Handling of Contaminated and Potentially Contaminated Materials

Any solid or liquid materials excavated from the surface and sub-surface of the Site must be handled with care and in accordance with the requirements set out above. Any materials that require disposal off-site will require the engagement of a suitably qualified environmental consultant to conduct appropriate sampling and analysis to determine the requirements for off-site disposal in accordance with NSW EPA (2014) guidelines or equivalent. Records of any materials excavated and then subsequently disposed off-site are required to be completed and

retained by the Site Owner. Such records would include the location on the Site where materials were excavated, reason for excavation works, the type of materials excavated, report on waste classification works completed by the environmental consultant on the excavated materials and the receiving waste facility dockets.

## 4.6 Unexpected Finds

In the event of unexpected finds e.g. presence of an underground storage tank, drums, pipework or similar, works must cease and the Site Manager and/or Site Owner must inspect the unexpected find and isolate the area until such time that an appropriately qualified environmental consultant conducts an inspection and provides a recommendation of what works are required to control/manage the unexpected find in accordance with the relevant NSW EPA endorsed guidelines, NSW regulations and legislation.

Records of any unexpected finds are required to be completed and retained by the Site Owner. Such records would include the location on the Site where the unexpected find was uncovered, how it was found, the follow up works undertaken, any reports, advice or similar provided by the environmental consultant, documentation, reports or similar on any rectification/remediation works undertaken and photographic record.

## 4.7 Reporting of Complaints and Incidents

If a complaint is made by a member of the public or by any other person with respect to any environmental management or control issue either during “Minor Works” or during “Major Works” or at any other time, appropriate corrective action is required to be undertaken as soon as practicable. The Site Owner is responsible for ensuring the corrective action is undertaken (as set out in Table 1).

Similarly, if an environmental incident occurs that has given or may give rise to pollution of soil, air or waters, appropriate corrective action is required to be undertaken as soon as practicable.

In addition to the above, complaints and environmental incidents are required to be notified to the Site Owner as soon as practicable after a complaint has been made or an environmental incident has occurred. If appropriate, and following the Site Owner’s instructions, notification may need to be made to the applicable regulatory authority.

Records of complaints and incidents are required to be entered into a register to be developed for the Site, but only after corrective action has been taken and the Site Owner has been notified.



## 5 LIMITATIONS

This Long-term Environmental Management Plan has been prepared for the sole purpose of documenting the procedures that are required to be implemented on the Site in accordance with generally accepted consulting practice. No other warranty or guarantee, expressed or implied is made as to the advice indicated in this report.

This report should not be used for any other purpose without our prior written consent. Accordingly, neither CONSARA nor any member or employee of CONSARA accepts responsibility or liability in any way whatsoever for the use of this report for any purpose other than that for which it has been prepared.

This report should not be released to any other party, in whole or in part, without the express written consent of CONSARA. CONSARA accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

CONSARA has relied upon and presumed accurate information provided by Sydney Harbour Federation Trust and/or any third party (or absence thereof) in making the assumptions made in this report. Nothing in this report should be taken to imply that CONSARA has verified or audited any of the information supplied to us other than as expressly stated in this report. We have assumed this information to be both adequate and accurate for the purposes of this report.

Where findings, observations and conclusions are based solely upon information provided by Sydney Harbour Federation Trust and/or a third party and CONSARA do not accept, to the maximum extent permitted by law, any liability for any losses, claims, costs, expenses, damages (whether in statute, in contract or tort for negligence or otherwise) suffered or incurred by Sydney Harbour Federation Trust or any third party as a result of or in connection with CONSARA's reliance on any such the information to the extent that such information is false, misleading or incomplete and CONSARA give no warranty or guarantee, express or implied as to such findings, observations and conclusions.

If further information becomes available, or additional assumptions need to be made, CONSARA reserves its right to amend any statements or opinions made in this report.

## 6 REFERENCES

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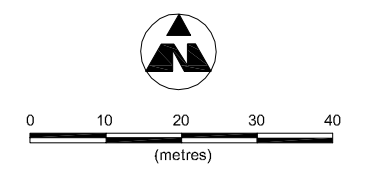
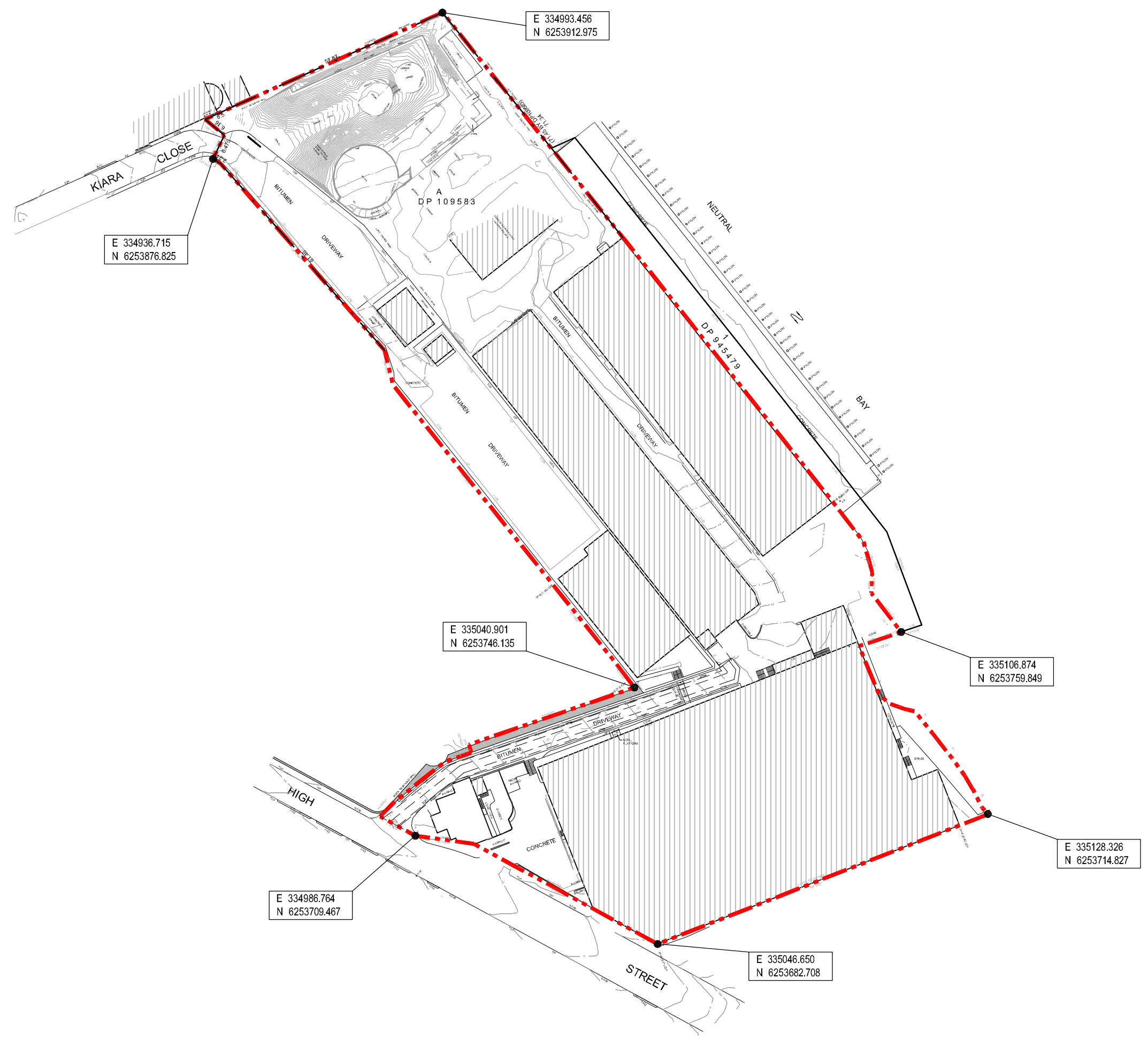
## FIGURES

Figure 1: Site Layout

PROJECT No. C121007  
 FILE NAME F004  
 DATE 25.04.18  
 DRAWN RR  
 APPROVED RO

LEGEND  
 SITE BOUNDARY

 COORDINATES IN M.G.A.



CLIENT  
**SYDNEY HARBOUR FEDERATION TRUST**

PROJECT  
 PLATYPUS SITE, HGH STREET,  
 NORTH SYDNEY, NSW

TITLE  
**SITE LAYOUT**

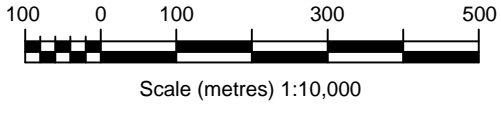
FIGURE No.

**1**

## **APPENDIX A: FIGURES FROM VALIDATION REPORT**



SOURCE: UBD STREET DIRECTORY GREGORYS SYDNEY, NEW SOUTH WALES 47TH EDITION, 2012, MAP: 7 & 8

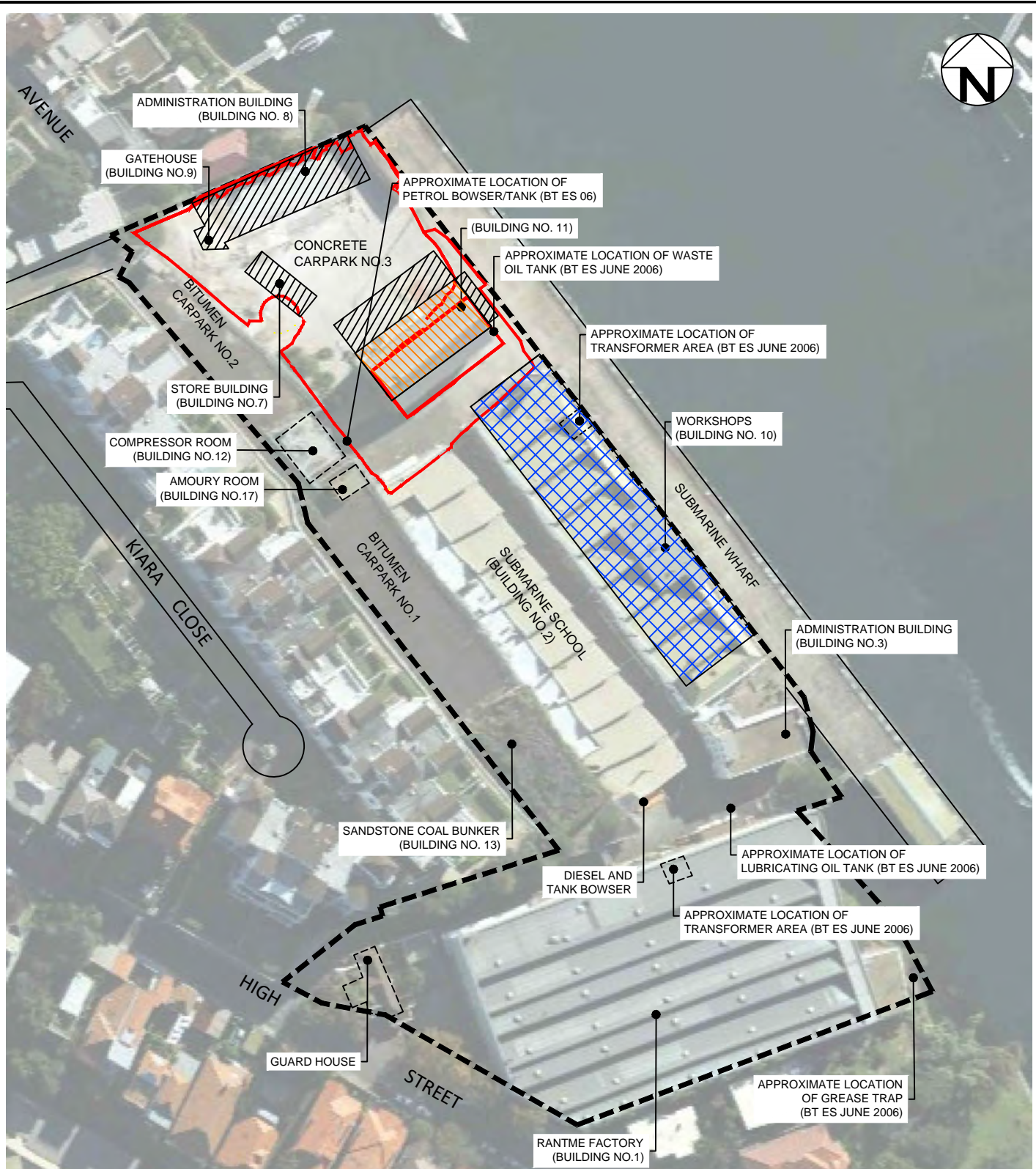


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approved	GB
date	05/09/14
scale	AS SHOWN
original size	A4



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project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES		
title:	SITE LOCATION PLAN		
project no:	ENAUHOD04128AB-R00A	figure no:	FIGURE 1
		rev.:	-



**LEGEND**

- APPROXIMATE SITE BOUNDARY
- BUILDING TO BE USED TO STORE BUILDING 11 (WHEN BUILDING 11 IS DISMANTLED)
- BUILDING 7 & 8 WERE DEMOLISHED IN 2010
- BUILDING OF FORMER RETORT HOUSE

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 5.2.1.1588  
 AERIAL IMAGE ©: 2012 SINCLAIR KNIGHT MERZ  
 2012 WHEREIS SENSIS PTY LTD



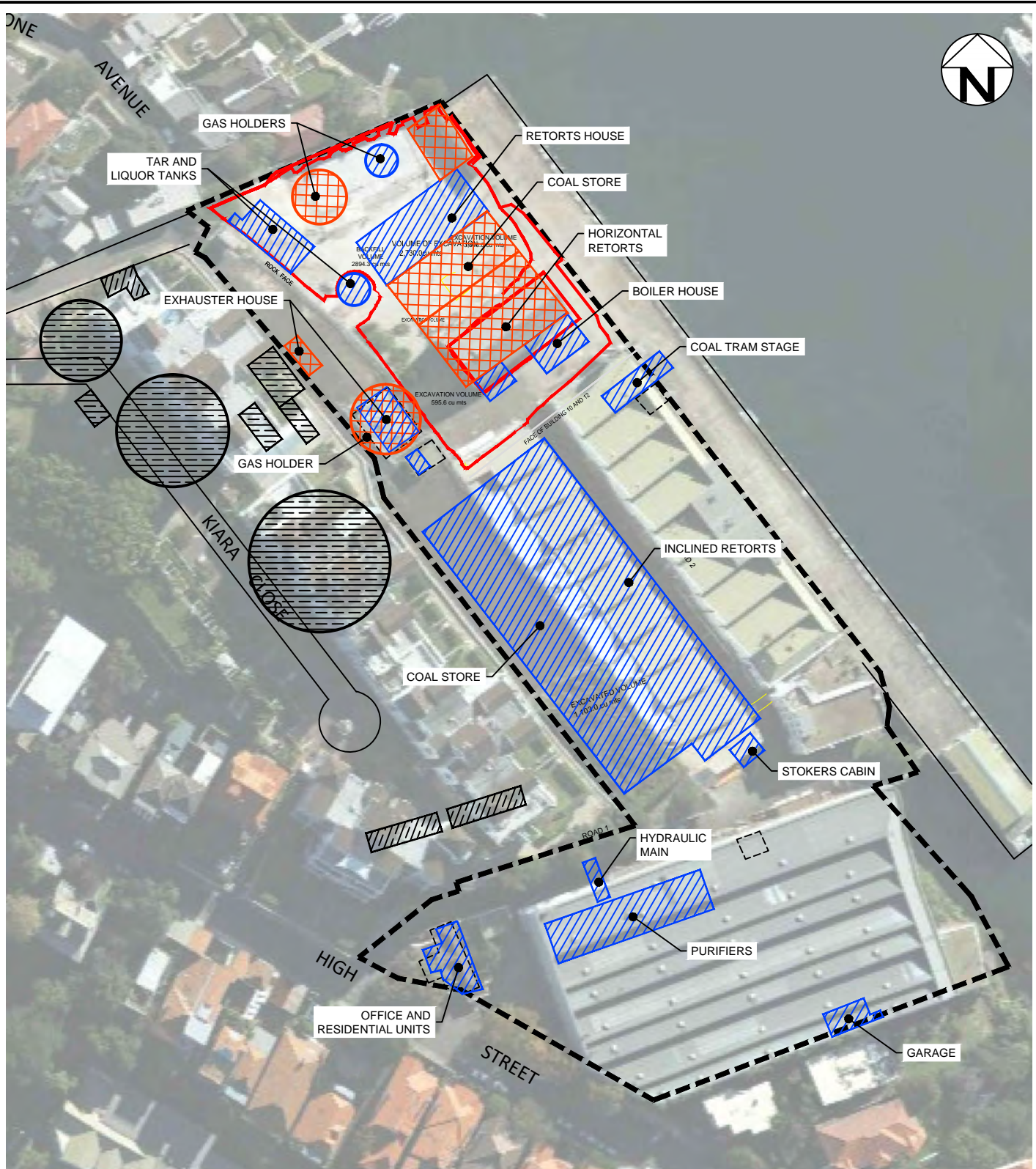
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approved	GB
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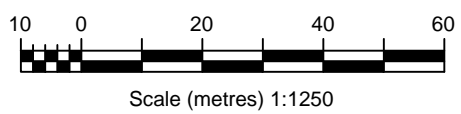
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project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES		
title:	SITE LAYOUT PLAN AND FEATURES		
project no:	ENAUHOD04128AB-R00A	figure no:	FIGURE 2
		rev.:	-



**LEGEND**

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE LOCATION OF FOR FORMER GASWORK STRUCTURES (1890)
- APPROXIMATE LOCATION OF FORMER GASWORK STRUCTURES (1913)
- APPROXIMATE LOCATION OF FORMER GAS STRUCTURES ON THE IORA SITE

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 5.2.1.1588  
 AERIAL IMAGE ©: 2012 SINCLAIR KNIGHT MERZ  
 2012 WHEREIS SENSIS PTY LTD



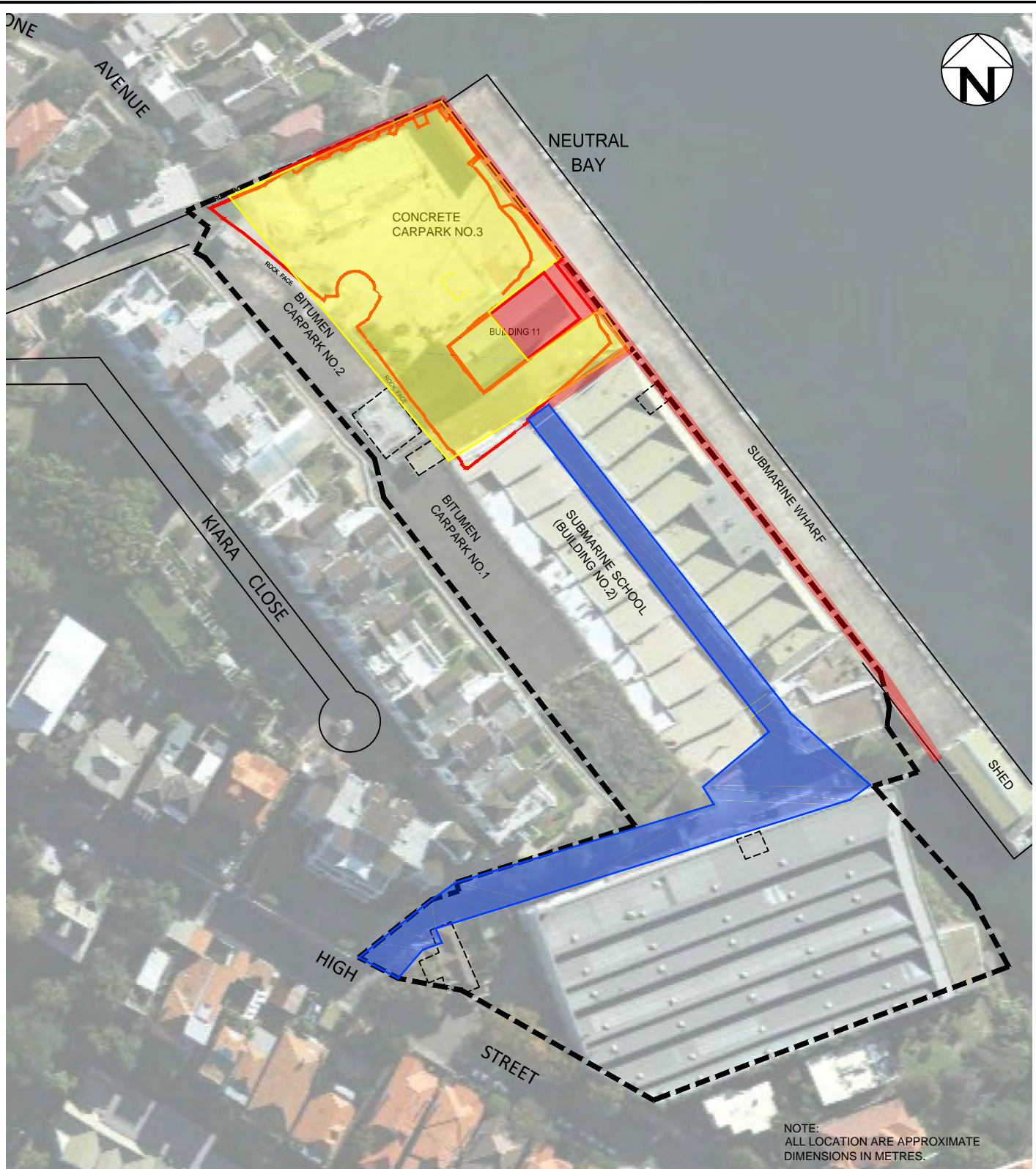
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drawn	MV
approved	GB
date	05/09/14
scale	AS SHOWN
original size	A4



client:	THIESS SERVICES		
project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES		
title:	SITE LAYOUT PLAN AND FORMER GASWORKS FEATURES		
project no:	ENAUHOD04128AB-R00A	figure no:	FIGURE 3
		rev.:	-

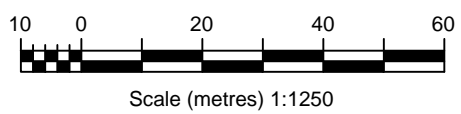




**LEGEND**

- SITE BOUNDARY
- CONTAINMENT
- DRIVEWAY
- JET GROUT WALL / IN-SITU CONTAINMENT

AERIAL IMAGE SOURCE: GOOGLE EARTH PRO 5.2.1.1588  
 AERIAL IMAGE ©: 2012 SINCLAIR KNIGHT MERZ  
 2012 WHEREIS SENSIS PTY LTD



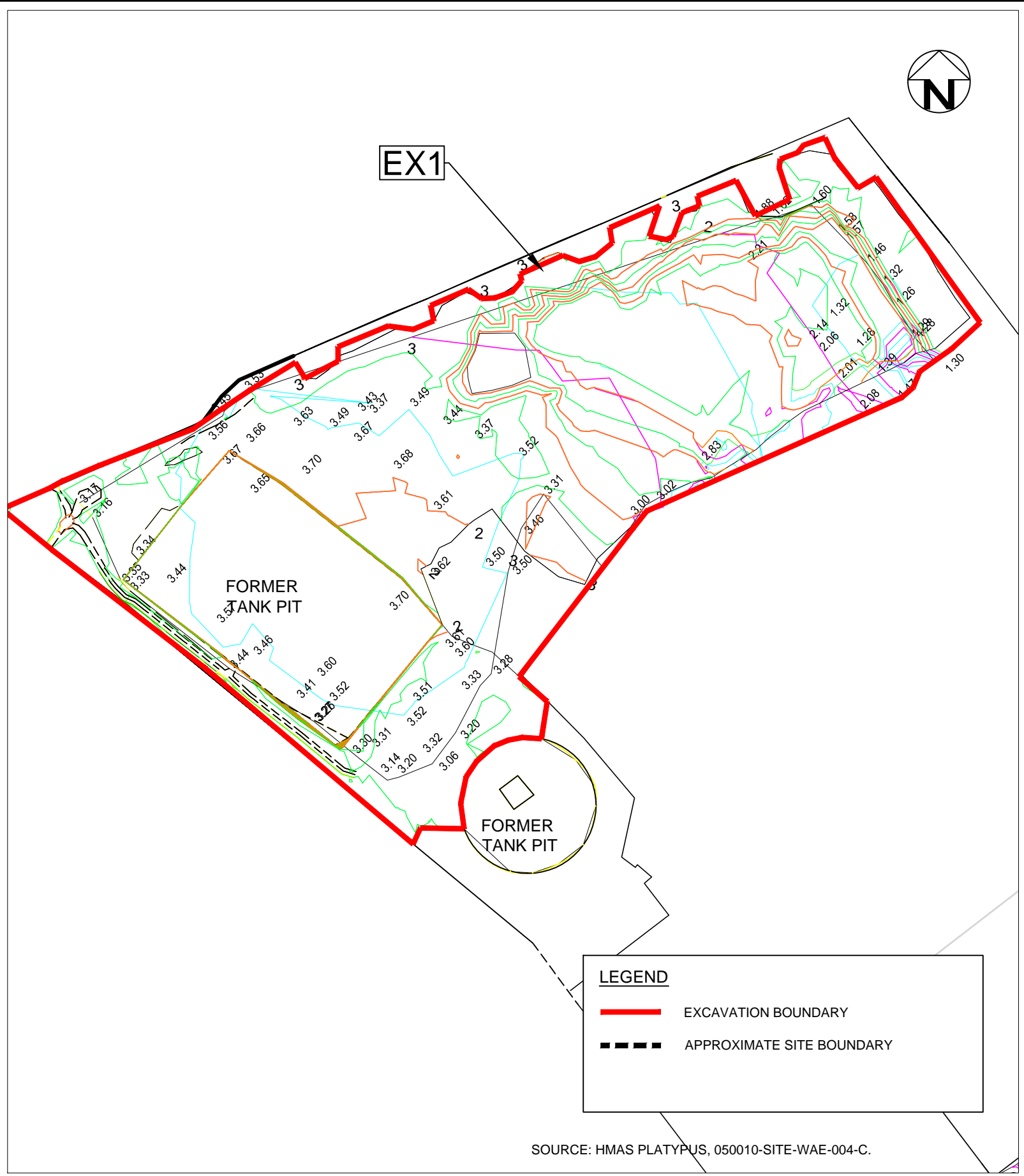
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drawn	MV
approved	GB
date	05/09/14
scale	AS SHOWN
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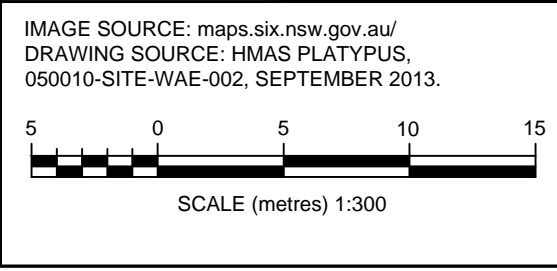


client:	THIESS SERVICES		
project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES		
title:	REMEDICATION LAYOUT - MAIN ELEMENTS		
project no:	ENAUHOD04128AB-R00A	figure no:	FIGURE 4
		rev.:	-

PLOT DATE: 22/01/2015 3:29:23 PM DWG FILE: F:\ENV\PROJECTS\ENAU\HOD04100-04\199\ENAU\HOD04128\AB\PLATYPUS REMEDIATION\DRAWINGS\ENAU\HOD04128\AB-R00A.DWG



revision	description	drawn	approved	date

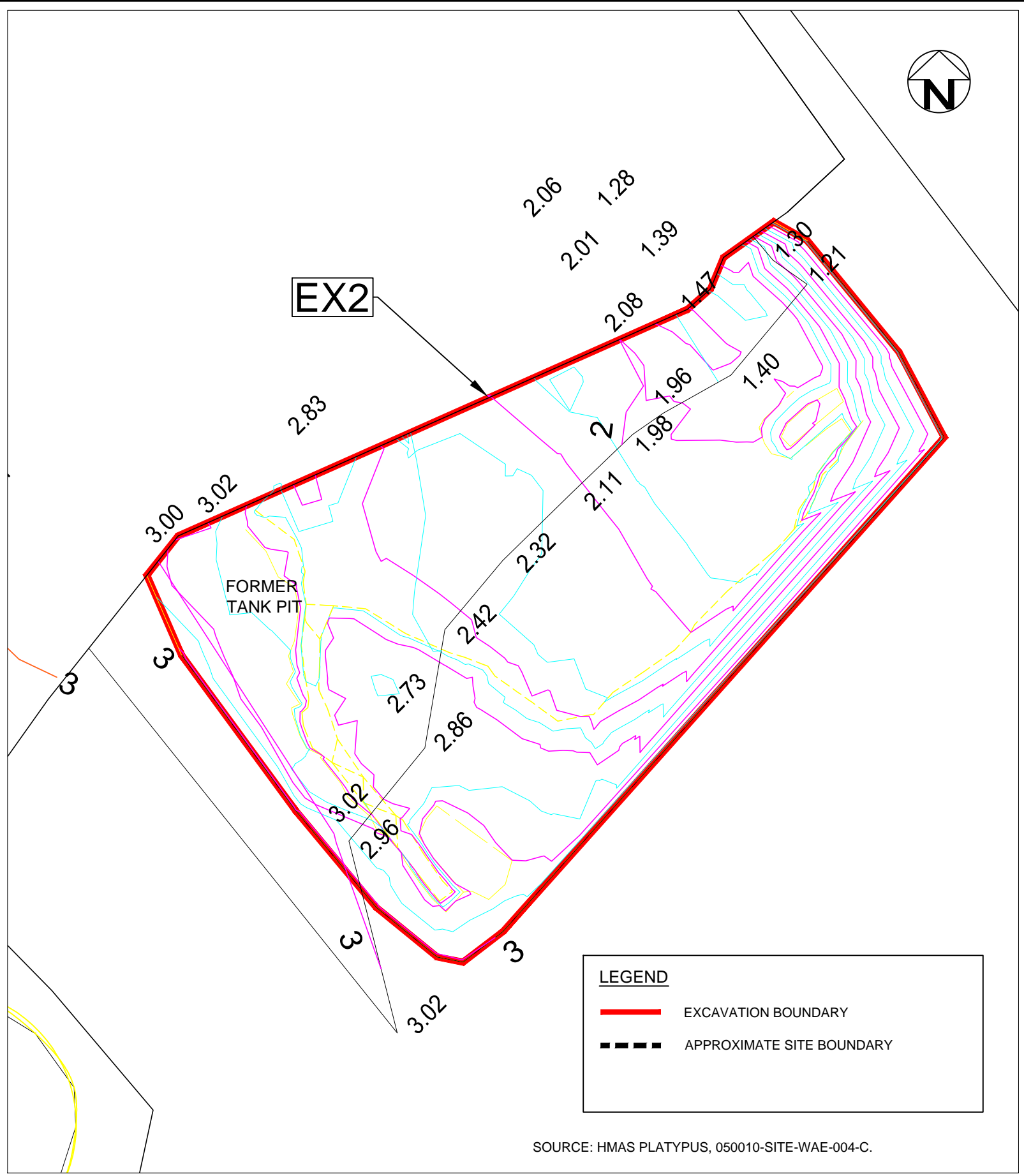


drawn	MV
approved	GB
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scale	AS SHOWN
original size	A3



client:	THIESS SERVICES
project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES
title:	REMEDIATION EXCAVATION 1
project no:	ENAUHOD04128AB-R00A
figure no:	FIGURE 6

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SOURCE: HMAS PLATYPUS, 050010-SITE-WAE-004-C.

revision	description	drawn	approved	date

IMAGE SOURCE: maps.six.nsw.gov.au/  
 DRAWING SOURCE: HMAS PLATYPUS,  
 050010-SITE-WAE-002, SEPTEMBER 2013.

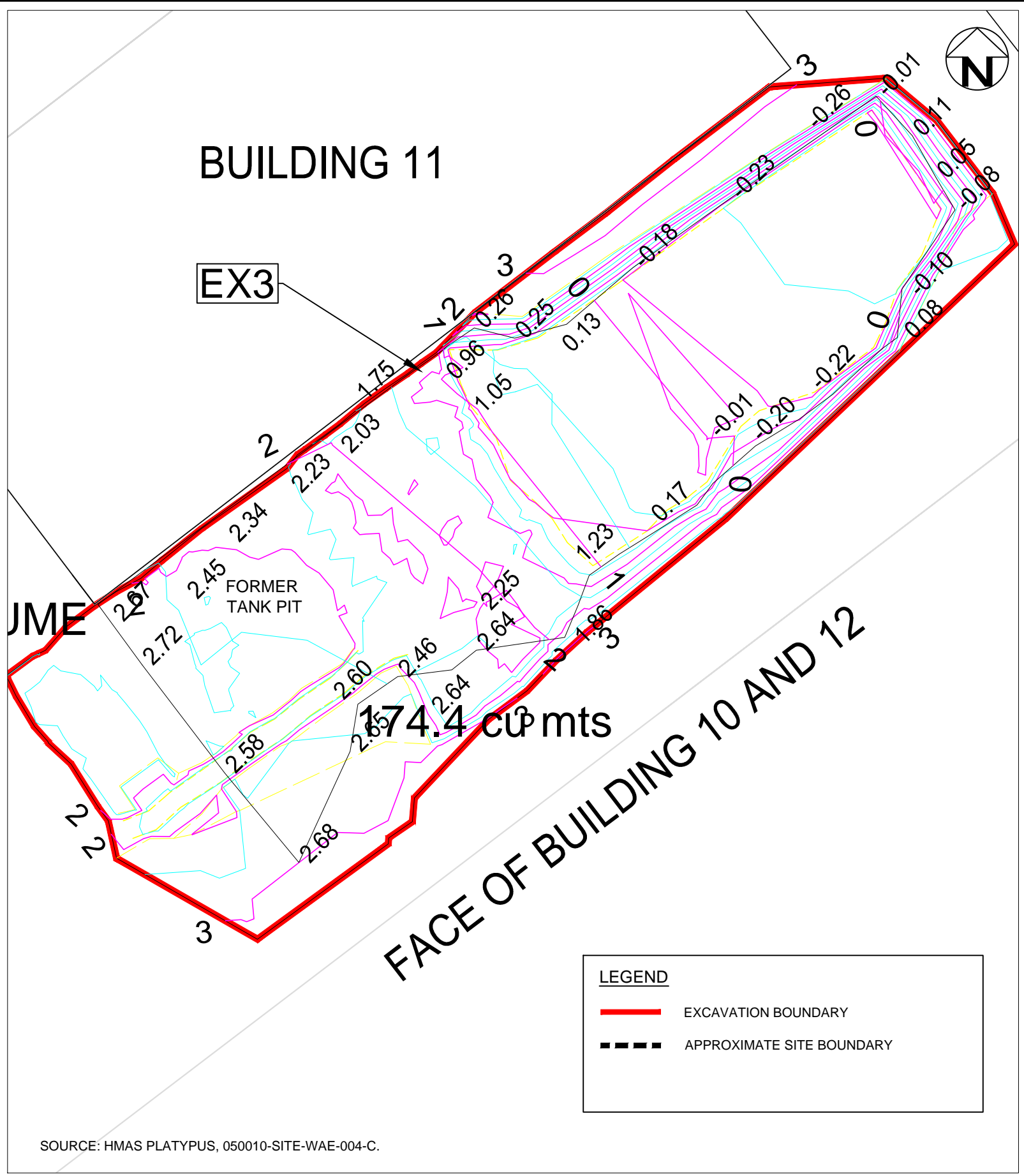
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drawn	MV
approved	GB
date	05/09/14
scale	AS SHOWN
original size	A3

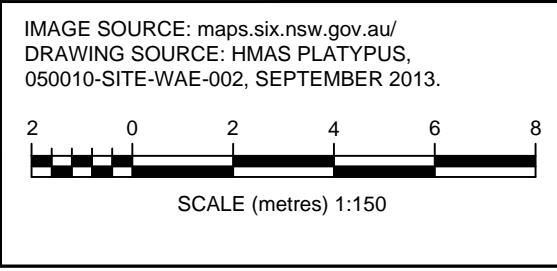


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title:	REMEDIATION EXCAVATION 2
project no:	ENAUHOD04128AB-R00A
figure no:	FIGURE 7

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revision	description	drawn	approved	date

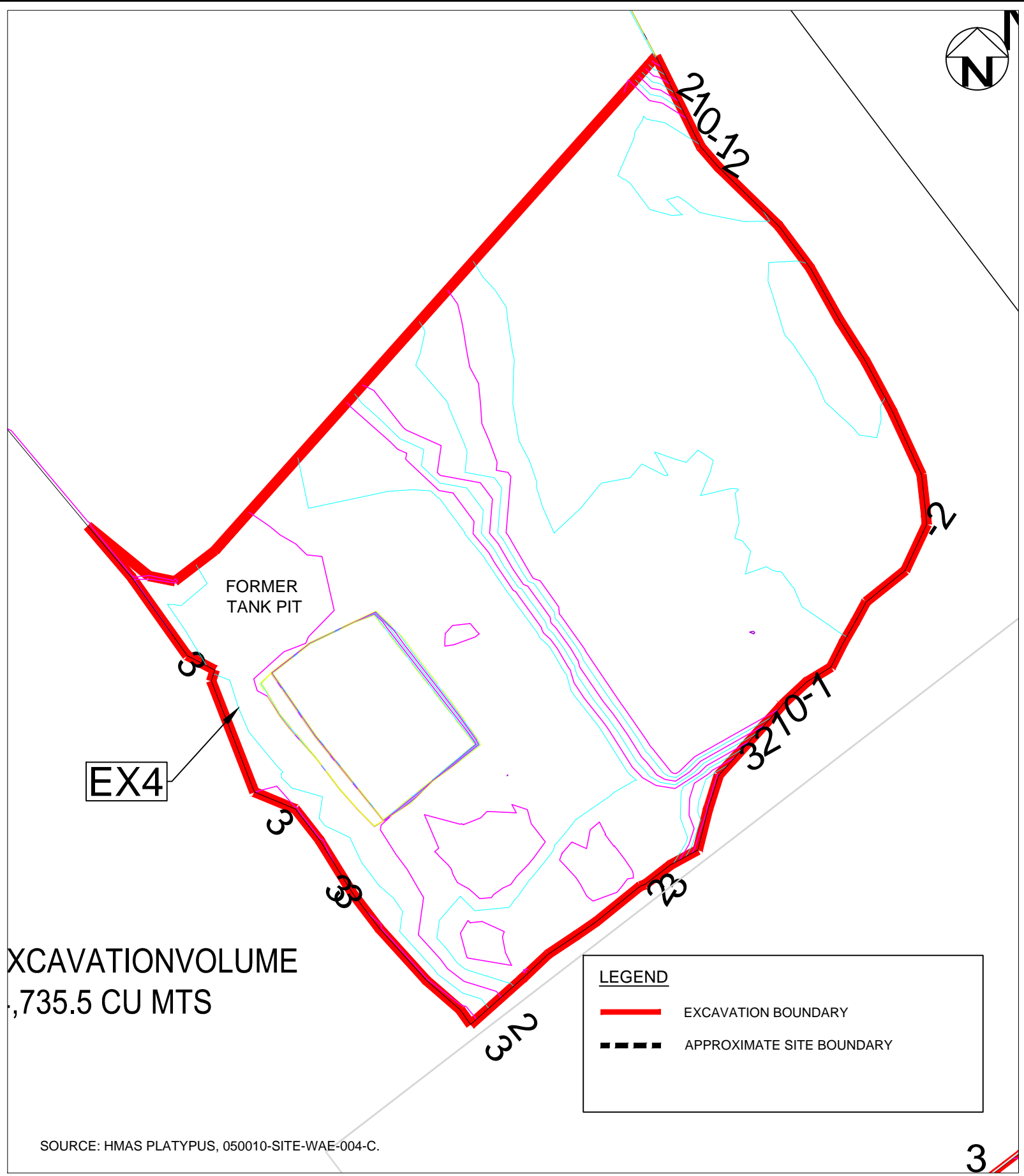


drawn	MV
approved	GB
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scale	AS SHOWN
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project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES
title:	REMEDIATION EXCAVATION 3
project no:	ENAUHOD04128AB-R00A
figure no:	FIGURE 8

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revision	description	drawn	approved	date

IMAGE SOURCE: maps.six.nsw.gov.au/  
 DRAWING SOURCE: HMAS PLATYPUS,  
 050010-SITE-WAE-002, SEPTEMBER 2013.

SCALE (metres) 1:150

drawn	MV
approved	GB
date	05/09/14
scale	AS SHOWN
original size	A3



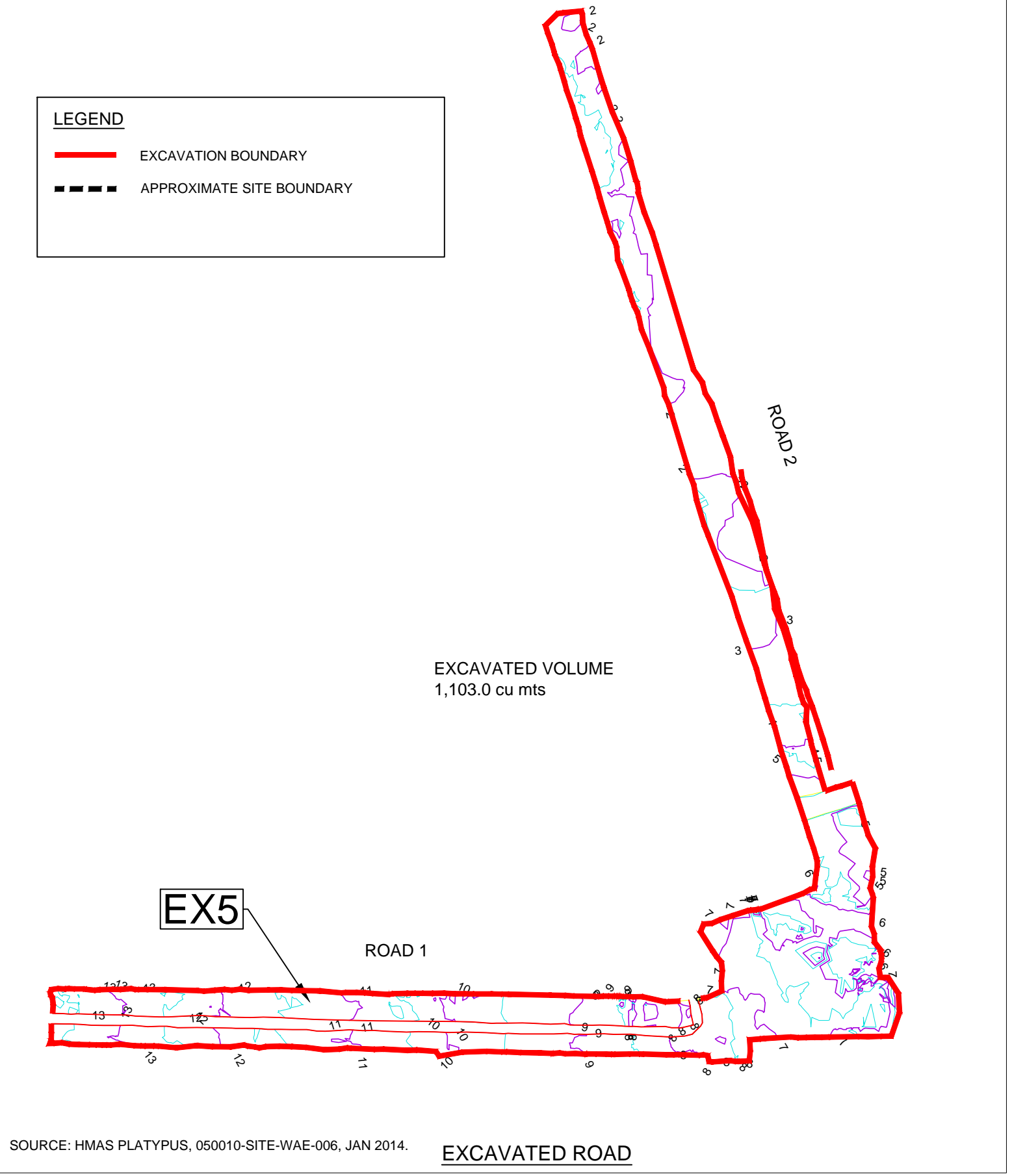
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project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES
title:	REMEDIATION EXCAVATION 4
project no:	ENAUROHOD04128AB-R00A
figure no:	FIGURE 9

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**LEGEND**

- EXCAVATION BOUNDARY
- APPROXIMATE SITE BOUNDARY



SOURCE: HMAS PLATYPUS, 050010-SITE-WAE-006, JAN 2014.

revision	description	drawn	approved	date

IMAGE SOURCE: maps.six.nsw.gov.au/  
DRAWING SOURCE: HMAS PLATYPUS,  
050010-SITE-WAE-002, SEPTEMBER 2013.

SCALE (metres) 1:500

drawn	MV
approved	GB
date	05/09/14
scale	AS SHOWN
original size	A3



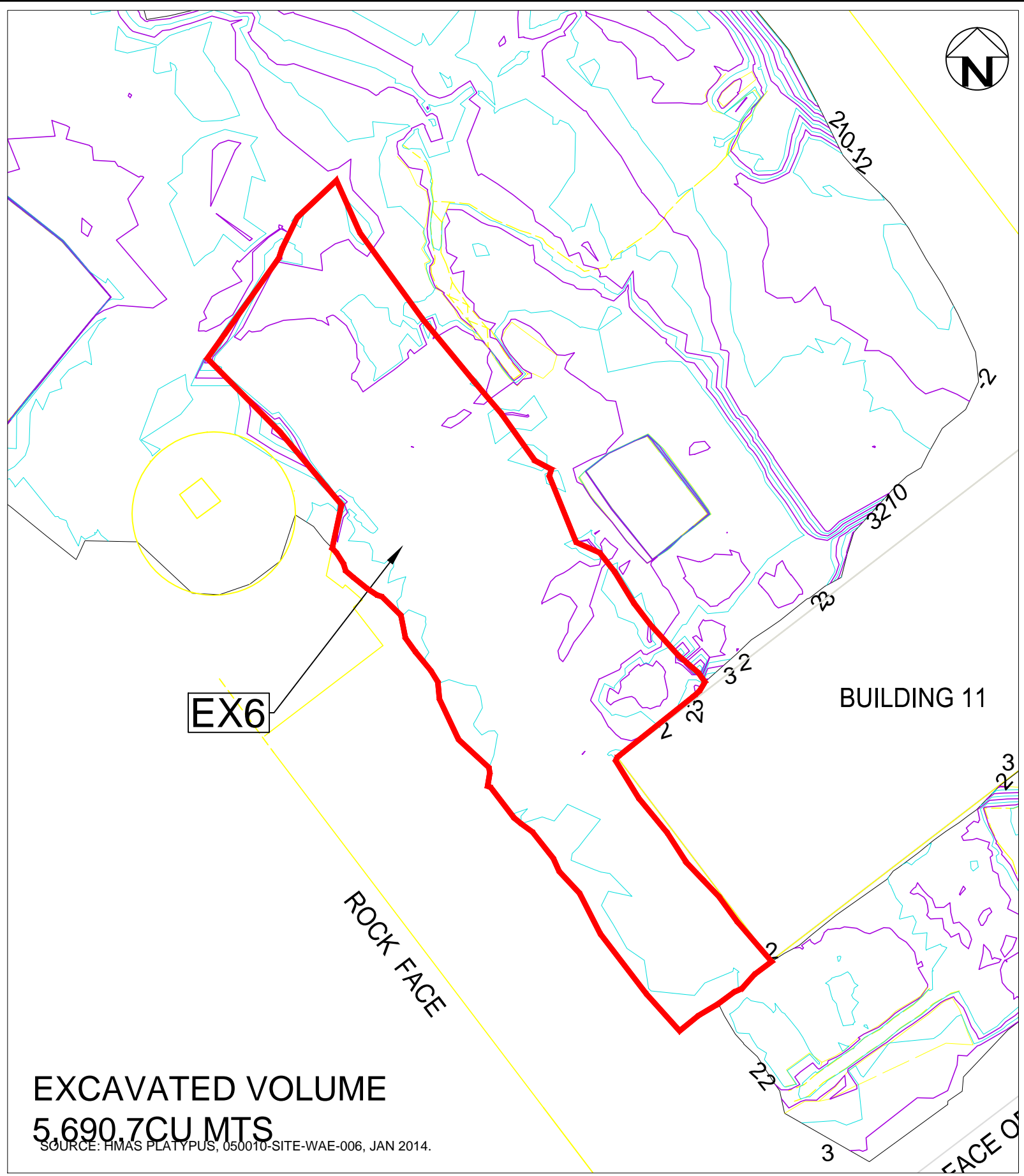
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project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES
title:	REMEDIATION EXCAVATION 5
project no:	ENAUHOD04128AB-R00A
figure no:	FIGURE 10

PLOT DATE: 22/01/2015 3:29:36 PM DWG FILE: F:\ENV\PROJECTS\ENAU\HOD04100-04\199\ENAU\HOD04128\THIESS\HMAS\PLATYPUS\REMEDIA\DRAWINGS\ENAU\HOD04128AB-R00A.DWG



**LEGEND**

- EXCAVATION BOUNDARY
- APPROXIMATE SITE BOUNDARY



**EXCAVATED VOLUME**  
**5,690.7CU MTS**  
SOURCE: HMAS PLATYPUS, 050010-SITE-WAE-006, JAN 2014.

revision	description	drawn	approved	date

IMAGE SOURCE: [maps.six.nsw.gov.au/](http://maps.six.nsw.gov.au/)  
DRAWING SOURCE: HMAS PLATYPUS, 050010-SITE-WAE-002, SEPTEMBER 2013.

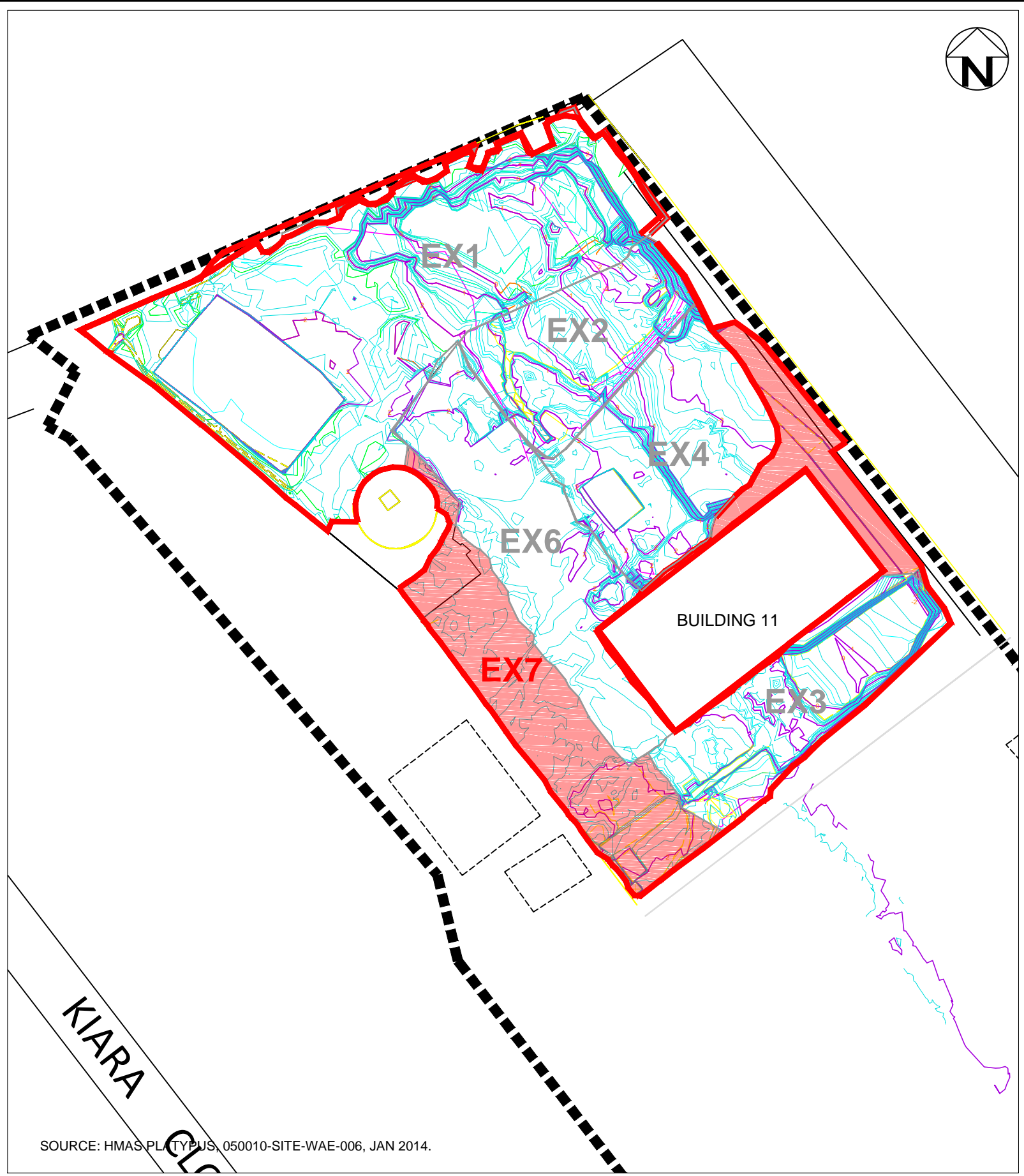
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approved	GB
date	05/09/14
scale	AS SHOWN
original size	A3



client:	THIESS SERVICES
project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES
title:	REMEDIAION EXCAVATION 6
project no:	ENAUHOD04128AB-R00A
figure no:	FIGURE 11

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revision	description	drawn	approved	date

IMAGE SOURCE: maps.six.nsw.gov.au/  
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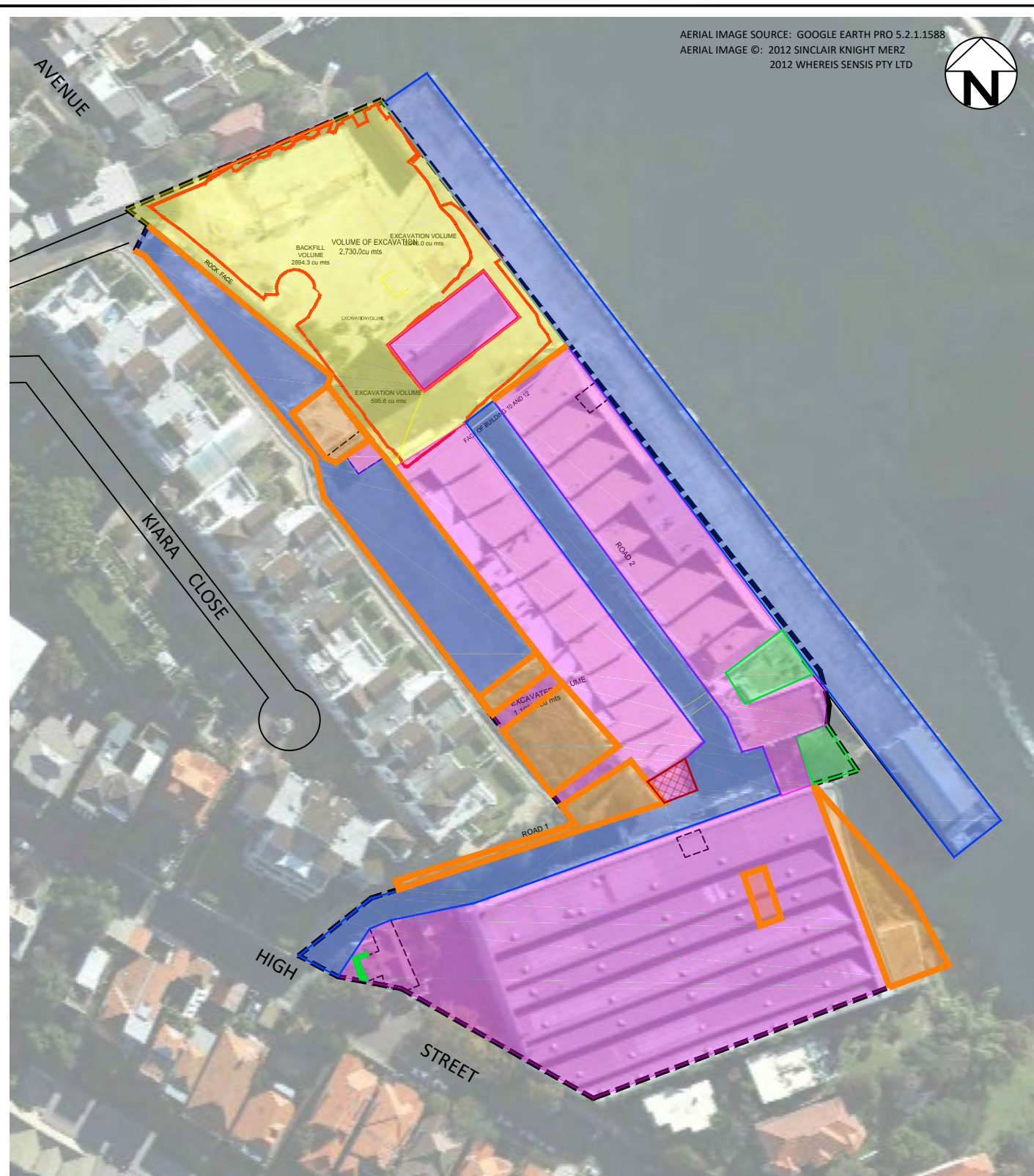
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approved	GB
date	05/09/14
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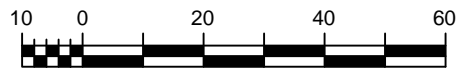
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title:	REMEDIATION EXCAVATION 7
project no:	ENAUROHOD04128AB-R00A
figure no:	FIGURE 12





**LEGEND**

- APPROXIMATE SITE BOUNDARY
- ASPHALT SEALED
- CONCRETE FLOOR SLABS
- EXPOSED SANDSTONE SURFACES
- GRASS
- EXPOSED CAP
- SUBSTATION



Scale (metres) 1:1250

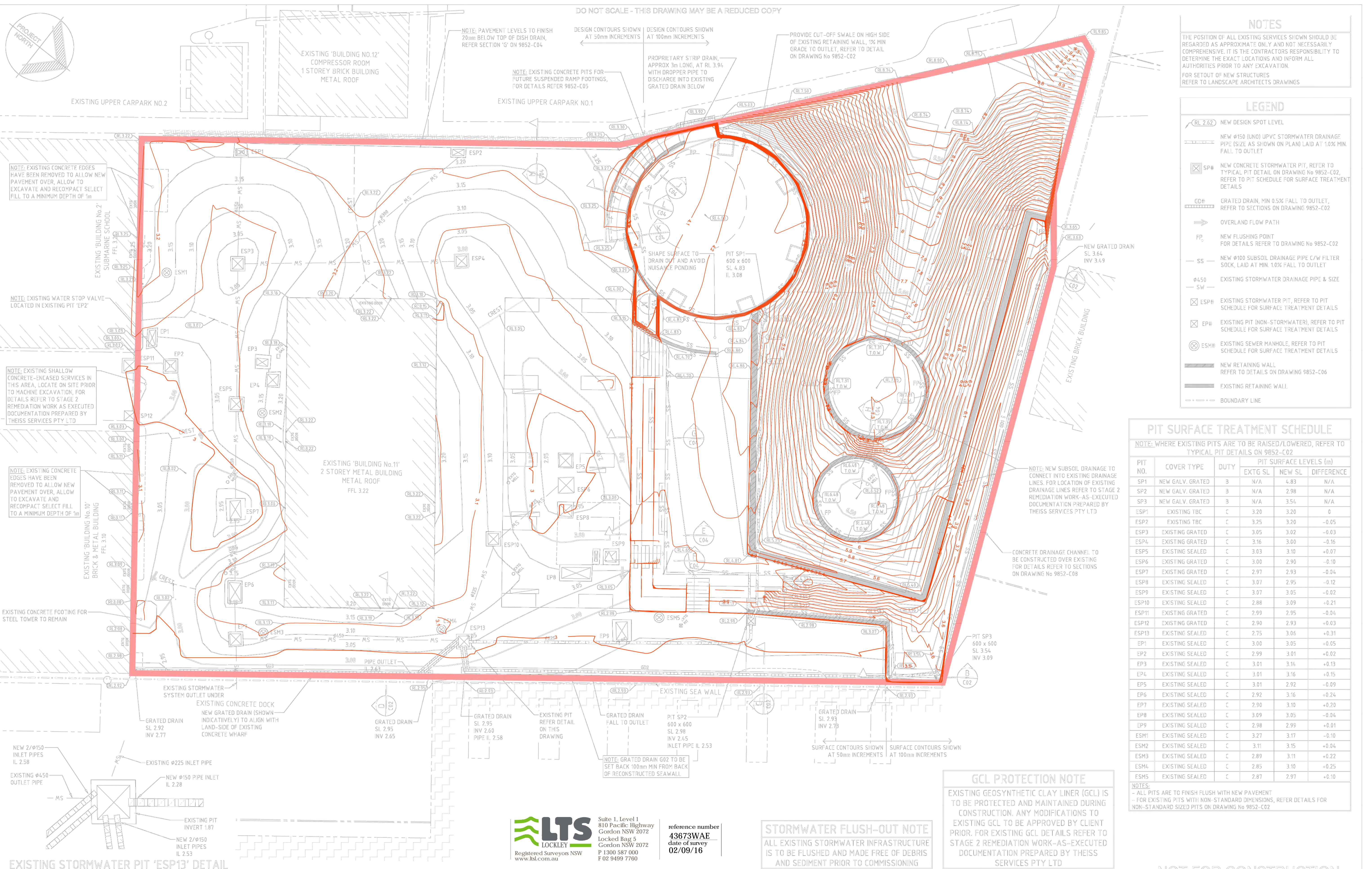
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drawn	MV
approved	GB
date	05/09/14
scale	AS SHOWN
original size	A4



client:	THIESS SERVICES		
project:	SITE VALIDATION, PLATYPUS REMEDIATION PROJECT, 118 HIGH STREET, NORTH SYDNEY, NEW SOUTH WALES		
title:	IN-SITU CONTAINMENT		
project no:	ENAUHOD04128AB-R00A	figure no:	FIGURE 13
		rev.:	-

## **APPENDIX B: REGISTERED SURVEY PLAN OF FINAL SURFACES OF NORTHERN REMEDIATION AREA**



DO NOT SCALE - THIS DRAWING MAY BE A REDUCED COPY

**NOTES**

THE POSITION OF ALL EXISTING SERVICES SHOWN SHOULD BE REGARDED AS APPROXIMATE ONLY AND NOT NECESSARILY COMPREHENSIVE. IT IS THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT LOCATIONS AND INFORM ALL AUTHORITIES PRIOR TO ANY EXCAVATION. FOR SETOUT OF NEW STRUCTURES REFER TO LANDSCAPE ARCHITECTS DRAWINGS

**LEGEND**

- NEW DESIGN SPOT LEVEL
- NEW 150 (UNO) UPVC STORMWATER DRAINAGE PIPE (SIZE AS SHOWN ON PLAN) LAID AT 1.0% MIN. FALL TO OUTLET
- NEW CONCRETE STORMWATER PIT, REFER TO TYPICAL PIT DETAIL ON DRAWING No 9852-C02, REFER TO PIT SCHEDULE FOR SURFACE TREATMENT DETAILS
- GRATED DRAIN, MIN 0.5% FALL TO OUTLET, REFER TO SECTIONS ON DRAWING 9852-C02
- OVERLAND FLOW PATH
- NEW FLUSHING POINT FOR DETAILS REFER TO DRAWING No 9852-C02
- NEW 100 SUBSOL DRAINAGE PIPE C/W FILTER SOCK, LAID AT MIN. 1.0% FALL TO OUTLET
- EXISTING STORMWATER DRAINAGE PIPE & SIZE
- EXISTING STORMWATER PIT, REFER TO PIT SCHEDULE FOR SURFACE TREATMENT DETAILS
- EXISTING PIT (NON-STORMWATER), REFER TO PIT SCHEDULE FOR SURFACE TREATMENT DETAILS
- EXISTING SEWER MANHOLE, REFER TO PIT SCHEDULE FOR SURFACE TREATMENT DETAILS
- NEW RETAINING WALL REFER TO DETAILS ON DRAWING 9852-C06
- EXISTING RETAINING WALL
- BOUNDARY LINE

**PIT SURFACE TREATMENT SCHEDULE**

NOTE: WHERE EXISTING PITS ARE TO BE RAISED/LOWERED, REFER TO TYPICAL PIT DETAILS ON 9852-C02

PIT NO.	COVER TYPE	DUTY	PIT SURFACE LEVELS (m)		
			EXTG SL	NEW SL	DIFFERENCE
SP1	NEW GALV. GRATED	B	N/A	4.83	N/A
SP2	NEW GALV. GRATED	B	N/A	2.98	N/A
SP3	NEW GALV. GRATED	B	N/A	3.54	N/A
ESP1	EXISTING TBC	C	3.20	3.20	0
ESP2	EXISTING TBC	C	3.25	3.20	-0.05
ESP3	EXISTING GRATED	C	3.05	3.02	-0.03
ESP4	EXISTING GRATED	C	3.16	3.00	-0.16
ESP5	EXISTING SEALED	C	3.03	3.10	+0.07
ESP6	EXISTING GRATED	C	3.00	2.90	-0.10
ESP7	EXISTING GRATED	C	2.97	2.93	-0.04
ESP8	EXISTING SEALED	C	3.07	2.95	-0.12
ESP9	EXISTING SEALED	C	3.07	3.05	-0.02
ESP10	EXISTING SEALED	C	2.88	3.09	+0.21
ESP11	EXISTING GRATED	C	2.99	2.95	-0.04
ESP12	EXISTING GRATED	C	2.90	2.93	+0.03
ESP13	EXISTING SEALED	C	2.75	3.06	+0.31
EP1	EXISTING SEALED	C	3.00	3.05	+0.05
EP2	EXISTING SEALED	C	2.99	3.01	+0.02
EP3	EXISTING SEALED	C	3.01	3.14	+0.13
EP4	EXISTING SEALED	C	3.01	3.16	+0.15
EP5	EXISTING SEALED	C	3.01	2.92	-0.09
EP6	EXISTING SEALED	C	2.92	3.16	+0.24
EP7	EXISTING SEALED	C	2.90	3.10	+0.20
EP8	EXISTING SEALED	C	3.09	3.05	-0.04
EP9	EXISTING SEALED	C	2.98	2.99	+0.01
ESM1	EXISTING SEALED	C	3.27	3.17	-0.10
ESM2	EXISTING SEALED	C	3.11	3.15	+0.04
ESM3	EXISTING SEALED	C	2.89	3.11	+0.22
ESM4	EXISTING SEALED	C	2.85	3.10	+0.25
ESM5	EXISTING SEALED	C	2.87	2.97	+0.10

NOTES:  
 - ALL PITS ARE TO FINISH FLUSH WITH NEW PAVEMENT  
 - FOR EXISTING PITS WITH NON-STANDARD DIMENSIONS, REFER DETAILS FOR NON-STANDARD SIZED PITS ON DRAWING No 9852-C02

**GCL PROTECTION NOTE**

EXISTING GEOSYNTHETIC CLAY LINER (GCL) IS TO BE PROTECTED AND MAINTAINED DURING CONSTRUCTION. ANY MODIFICATIONS TO EXISTING GCL TO BE APPROVED BY CLIENT PRIOR. FOR EXISTING GCL DETAILS REFER TO STAGE 2 REMEDIATION WORK-AS-EXECUTED DOCUMENTATION PREPARED BY THEISS SERVICES PTY LTD

**STORMWATER FLUSH-OUT NOTE**

ALL EXISTING STORMWATER INFRASTRUCTURE IS TO BE FLUSHED AND MADE FREE OF DEBRIS AND SEDIMENT PRIOR TO COMMISSIONING

**LTS**  
 LOCKLEY  
 Registered Surveyors NSW  
 www.lsl.com.au

Suite 1, Level 1  
 810 Pacific Highway  
 Gordon NSW 2072  
 Locked Bag 5  
 Gordon NSW 2072  
 P 1300 587 000  
 F 02 9499 7760

reference number  
**43673WAE**  
 date of survey  
**02/09/16**

**EXISTING STORMWATER PIT 'ESP13' DETAIL**

NOT TO SCALE

REVISIONS	No.	DATE	DRN	CHK	APP	DRAWING STATUS
	G	07.08.15	AC	MM	-	RF-ISSUED FOR TENDER
	F	28.07.15	AC	MM	-	RF-ISSUED FOR TENDER
	E	03.07.15	AC	MM	-	ISSUED FOR TENDER
	D	01.08.15	AC	MM	-	ISSUED FOR COORDINATION
	C	22.05.15	AC	MM	-	ISSUED FOR COORDINATION
	B	14.05.15	AC	MM	-	ISSUED FOR COORDINATION
	A	08.05.15	AC	MM	-	ISSUED FOR COORDINATION

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RESPONSIBLE PRINCIPAL SIGNATURE: \_\_\_\_\_ DATE OF RELEASE: \_\_\_\_\_

**Lindsay Dynan**  
 Consulting Engineers - A.C.N. 050 541 127  
 SYDNEY  
 Suite 2, Level 10, 71 Macquarie Street Sydney NSW 2000  
 Phone - 02 82485500 Facsimile - 02 92618689  
 Email - [sync@lindsaydynan.com.au](mailto:sync@lindsaydynan.com.au)  
 Web - [www.lindsaydynan.com.au](http://www.lindsaydynan.com.au)  
 Sydney | Perth | Newcastle | Central Coast

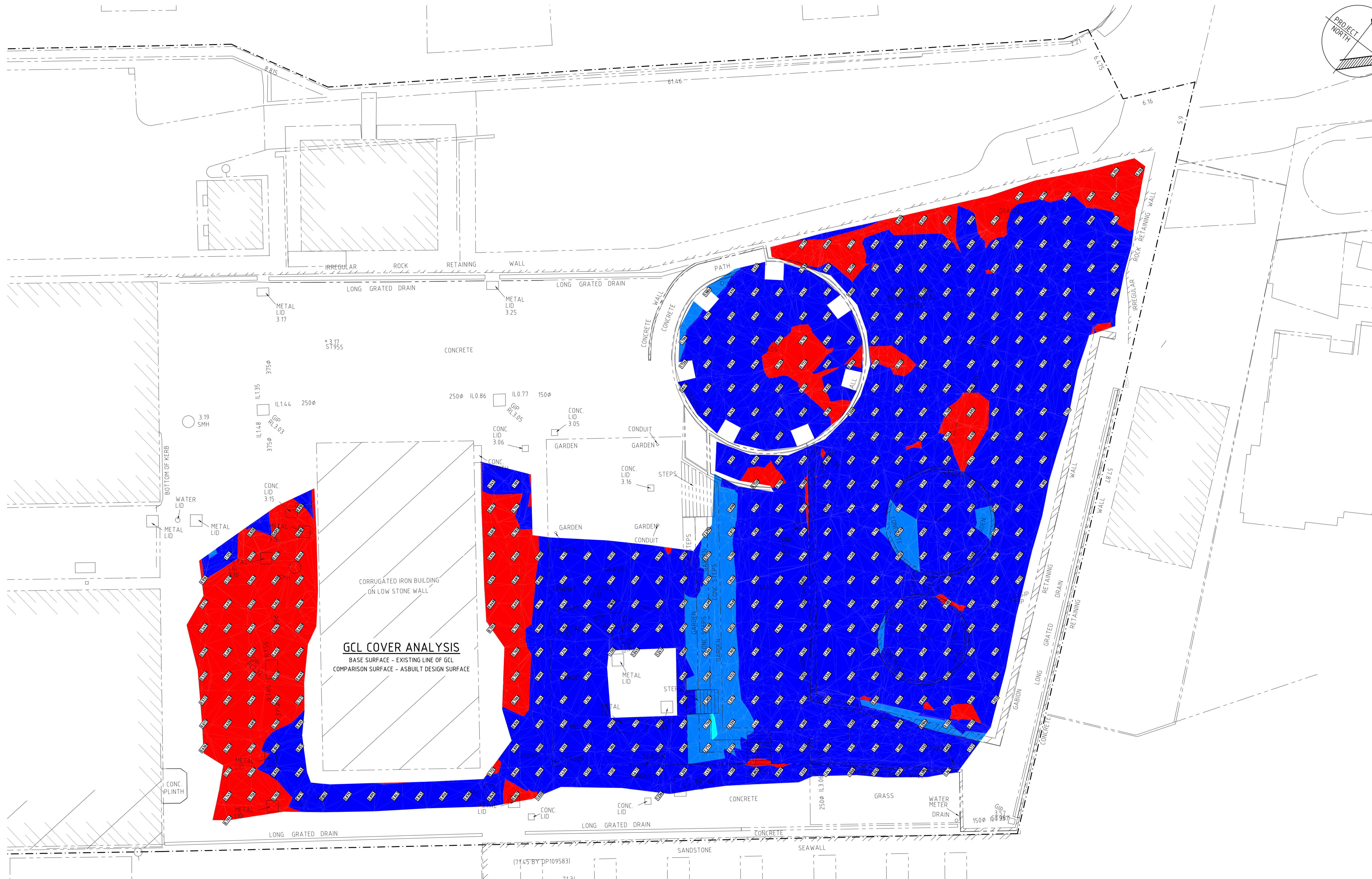
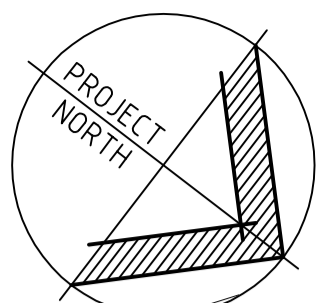
CLIENT  
**ASPECT STUDIOS**

TITLE  
**FINISHED SURFACE LEVELS AND STORMWATER DRAINAGE PLAN**

PROJECT  
**PLATYPUS URBAN PARK CIVIL WORKS NEUTRAL BAY, NSW**

DWG STATUS	FOR TENDER		SHEET SIZE
DRAFTSMAN AC	PROJECT MANAGER MM	SCALE A1 - 1:150	A1
PROJECT REF No. <b>9852</b>	DRAWING No. <b>C01</b>	REVISION <b>G</b>	

## **APPENDIX C: REGISTERED SURVEY PLAN OF CAP THICKNESS ACROSS NORTHERN REMEDIATION CONTAINMENT AREA**



**GCL COVER ANALYSIS**  
 BASE SURFACE - EXISTING LINE OF GCL  
 COMPARISON SURFACE - ASBUILT DESIGN SURFACE

**AS BUILT GCL COVER ANALYSIS**  
 SCALE 1:150

**NOT FOR CONSTRUCTION**

REVISIONS	No.	DATE	DRN	CHK	APP	DRAWING STATUS
	A	5/10/2016	CT	MM	-	ISSUED FOR INFORMATION

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**Lindsay Dynan Pty Limited**  
 Consulting Engineers - A.C.N. 050 541 127

**SYDNEY**  
 Suite 2, Level 10, 71 Macquarie Street Sydney NSW 2000  
 Phone - 02 82485500 Facsimile - 02 92516689  
 Email - syd@lindsaydynan.com.au  
 Web - www.lindsaydynan.com.au

Sydney | Perth | Newcastle | Central Coast

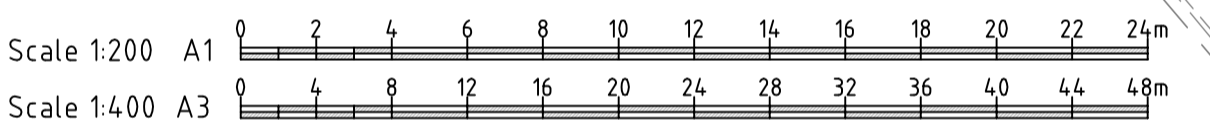
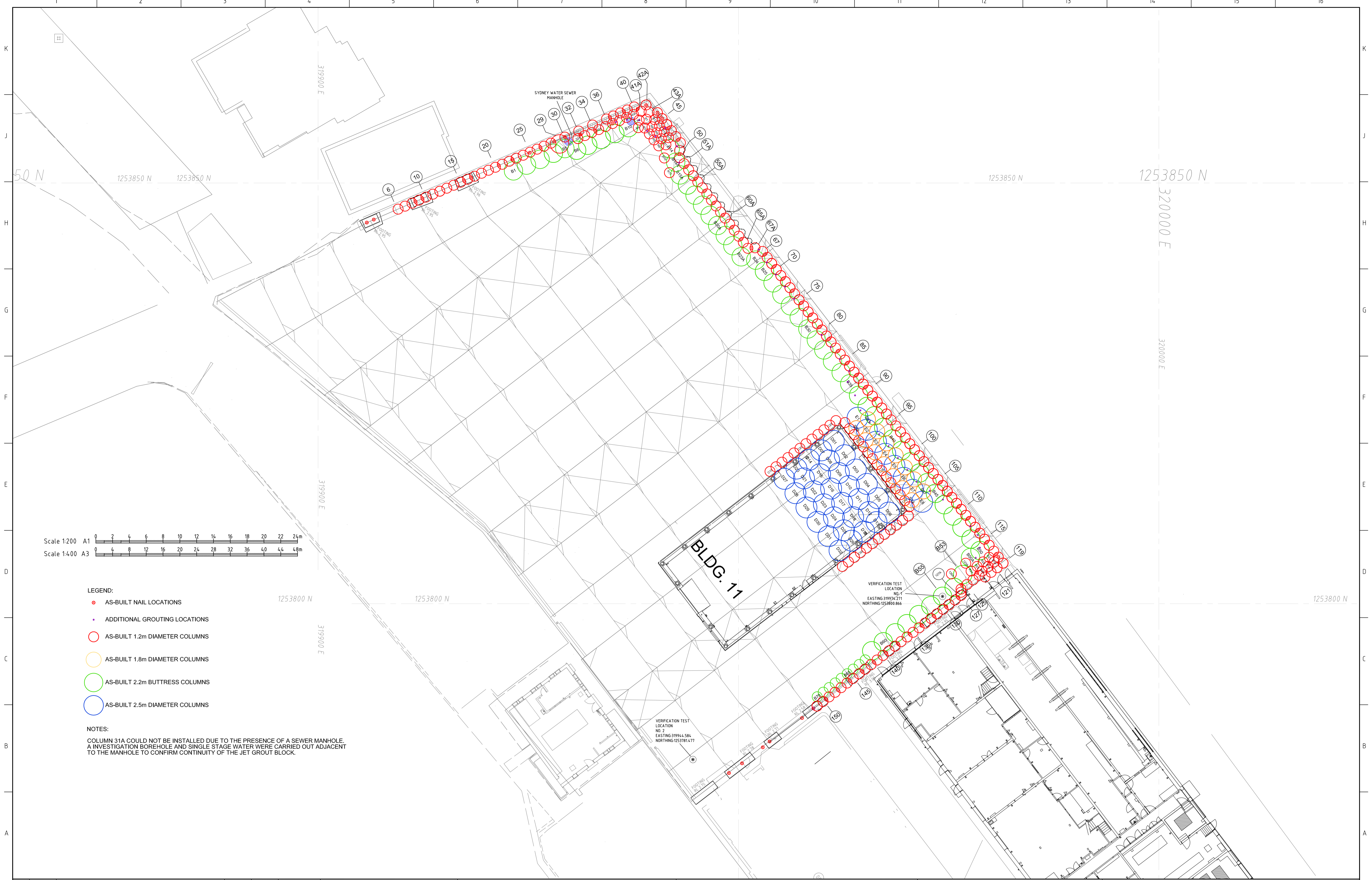
CLIENT  
**ASPECT STUDIOS**

TITLE  
**AS BUILT DESIGN COMPARISON WITH GCL LAYER**

PROJECT  
**PLATYPUS URBAN PARK**  
**CIVIL WORKS**  
**NEUTRAL BAY, NSW**

DWG STATUS		DRAFT COPY		SHEET SIZE
DRAFTSMAN	PROJECT MANAGER	SCALE	A1	
AC	MM	A1 - 1:150		
PROJECT REF No.		DRAWING No.		REVISION
9852		CSK10		A

## **APPENDIX D: CUT-OFF WALL LOCATION AND AS-BUILTS**



- LEGEND:**
- AS-BUILT NAIL LOCATIONS
  - ADDITIONAL GROUTING LOCATIONS
  - AS-BUILT 1.2m DIAMETER COLUMNS
  - AS-BUILT 1.8m DIAMETER COLUMNS
  - AS-BUILT 2.2m BUTTRESS COLUMNS
  - AS-BUILT 2.5m DIAMETER COLUMNS

**NOTES:**  
 COLUMN 31A COULD NOT BE INSTALLED DUE TO THE PRESENCE OF A SEWER MANHOLE. AN INVESTIGATION BOREHOLE AND SINGLE STAGE WATER WERE CARRIED OUT ADJACENT TO THE MANHOLE TO CONFIRM CONTINUITY OF THE JET GROUT BLOCK.

REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED
G	29.7.13	UPDATED FOR BLDG 11 WORKS	BG	DAC	SHB/MC
F	30.4.2013	FIX ERROR IN LEGEND	BG	DAC	SHB/NS
E	5.4.2013	UPDATED FOR SEAWALL INSTALLATION INFORMATION	BG	DAC	SHB/NS
D	7.2.2013	AS-BUILT NORTH & SOUTH WING WALLS	RK	DC	SHB/NS
C	5.2.2013	FOR REVIEW	RK	DC	SHB/NS
B	8.1.2013	AS-BUILT SHEET PILE WALL, COL LOCATIONS	RK	DC	SHB/NS
A	28.11.2012	ISSUED FOR REVIEW	RK	DC	SHB/NS



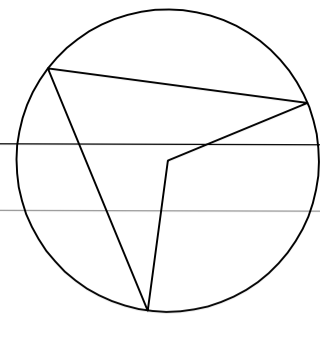
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DESIGN	RK	CHECKED	DC	DESIGN CONSULTANT APPROVED	D Chadwick
DRAWN	BG	DC	DC	DATE	29.07.13

REF: 050010-JGW-WAE-007, 050010-JGW-WAE-008 & 050010-JGW-WAE-012



<b>HMAS PLATYPUS STAGE 2 REMEDIATION WORKS</b>		
DRAWING TITLE		
<b>AS BUILT COLUMN AND NAIL LOCATIONS</b>		
<b>NORTHERN SECTION</b>		
<b>PLAN VIEW</b>		
SCALE	DRG NO.	REV
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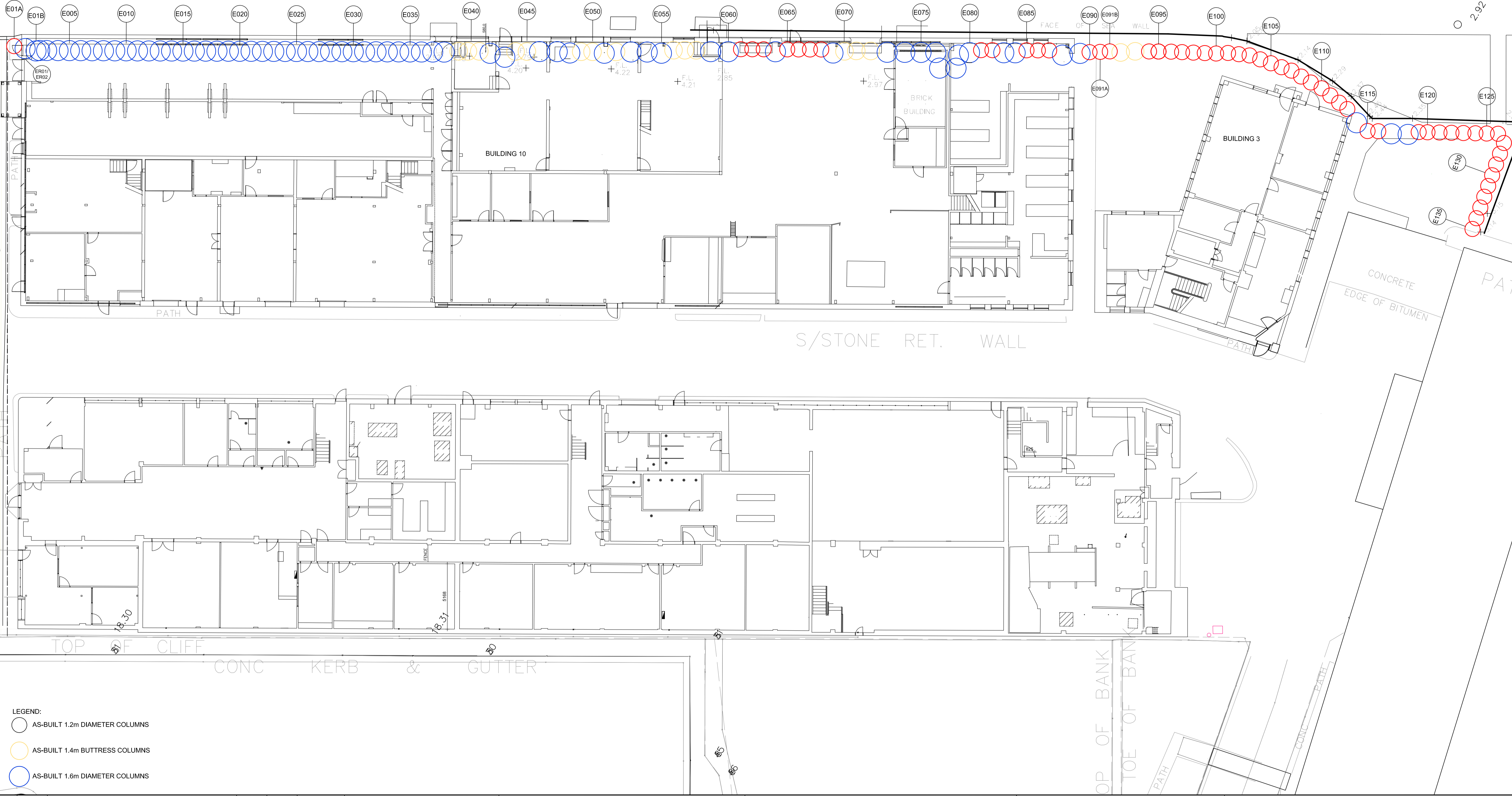
Scale 1:150 A1

Scale 1:300 A3

Notes:

1. Column diameters and positions shown are at slab level

EDGE OF CONCRETE  
KERB & GUTTER



- LEGEND:
- AS-BUILT 1.2m DIAMETER COLUMNS
  - AS-BUILT 1.4m BUTTRESS COLUMNS
  - AS-BUILT 1.6m DIAMETER COLUMNS

REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED
A	15.08.13	ISSUED FOR REVIEW	BG	DC	SHB/MC



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DESIGN	PREPARED	CHECKED	DESIGN CONSULTANT APPROVED
RK	RK	DC	D Chadwick
DRAWN	BG	DC	DATE 15.08.13

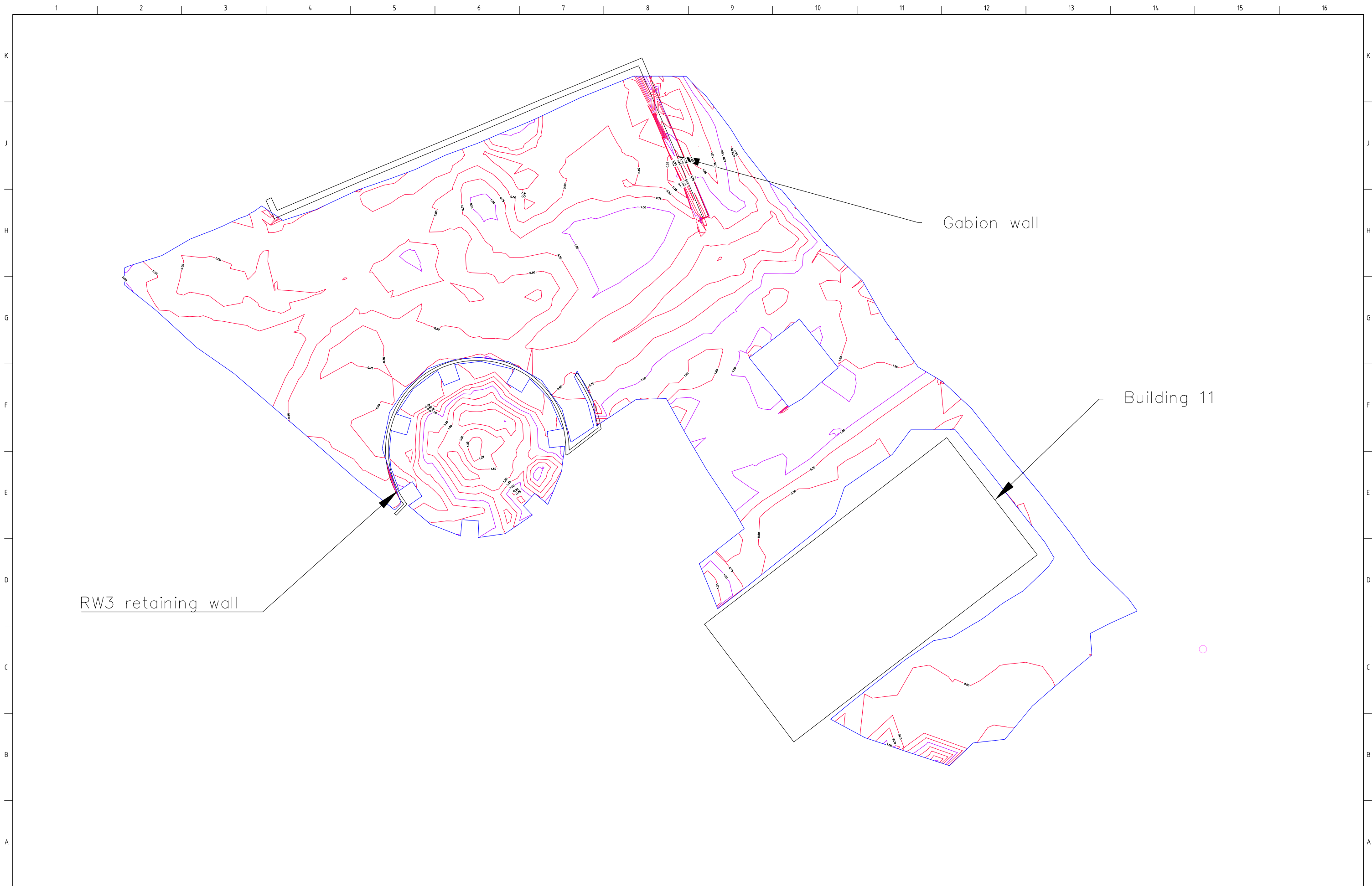
REF: 050010-JGW-WAE-006



HMAS PLATYPUS STAGE 2 REMEDIATION WORKS		
DRAWING TITLE		
AS BUILT COLUMN LOCATIONS		
CENTRAL SECTION		
PLAN VIEW		
SCALE	DRG NO.	REV
A1 1:150	050010-JGW-WAE-003	A



## **APPENDIX E: REGISTERED SURVEY OF EXTENT OF GCL AND AS-BUILTS**

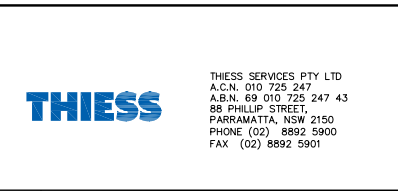


REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED
A	20.10.2014	ISSUED FOR REVIEW	SHB	SHB	BW

DESIGN	PREPARED	CHECKED	DESIGN CONSULTANT APPROVED
SHB	SHB	BW	S Barthelme
SHB	SHB	BW	DATE 20.10.2014

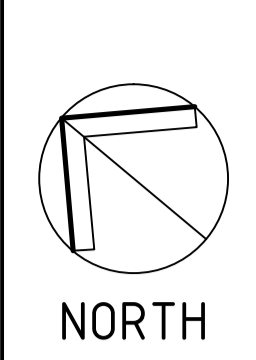
THE INFORMATION SHOWN ON THIS DRAWING IS FOR THE PURPOSES OF THIS PROJECT ONLY. NO WARRANTY IS GIVEN OR IMPLIED AS TO ITS SUITABILITY FOR ANY OTHER PURPOSE.

REF:



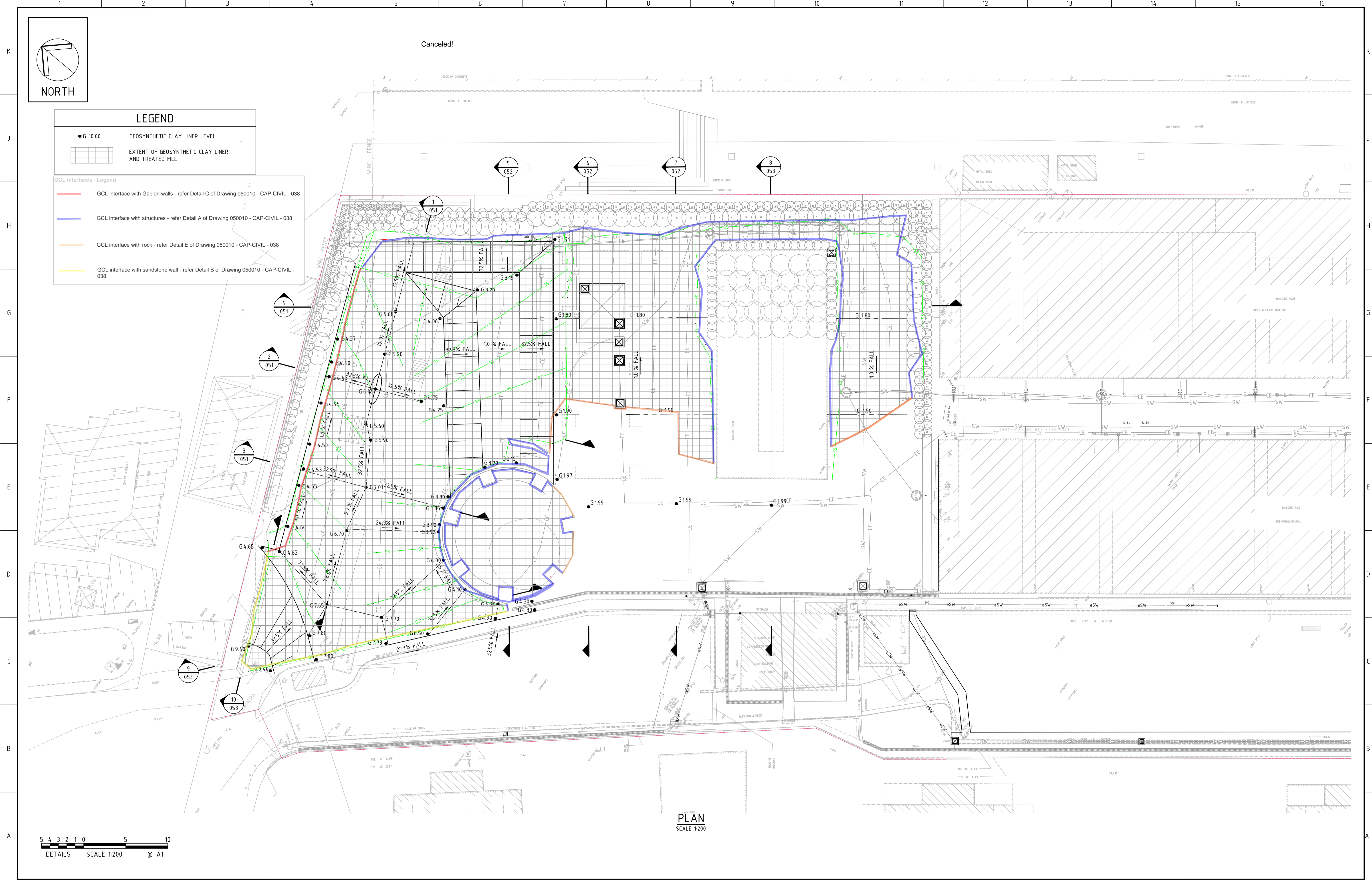
<b>HMAS PLATYPUS STAGE 2 REMEDIATION WORKS</b> DRAWING TITLE <b>BULK EARTHWORKS CAPPING DEPTH ABOVE GCL AS BUILT</b>		
SCALE	DRG NO.	REV
A1 1:150	050010-CAP-WAE-012	A

Cancelled!



**LEGEND**

- G 10.00 GEOSYNTHETIC CLAY LINER LEVEL
  - [Grid Pattern] EXTENT OF GEOSYNTHETIC CLAY LINER AND TREATED FILL
- GCL Interfaces - Legend
- [Red Line] GCL interface with Gabion walls - refer Detail C of Drawing 050010 - CAP-CIVIL - 038
  - [Blue Line] GCL interface with structures - refer Detail A of Drawing 050010 - CAP-CIVIL - 038
  - [Orange Line] GCL interface with rock - refer Detail E of Drawing 050010 - CAP-CIVIL - 038
  - [Yellow Line] GCL interface with sandstone wall - refer Detail B of Drawing 050010 - CAP-CIVIL - 038.



PLAN  
SCALE 1:200

5 4 3 2 1 0 5 10  
DETAILS SCALE 1:200 @ A1



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DESIGN	DC	CHECKED	RPH	DESIGN CONSULTANT APPROVED
DRAWN	DC		RBD	DATE 12.09.2013

REF: MMD-298850-C-DR-CC01-GEOSYNTHETIC DRAINAGE PLAN.dwg



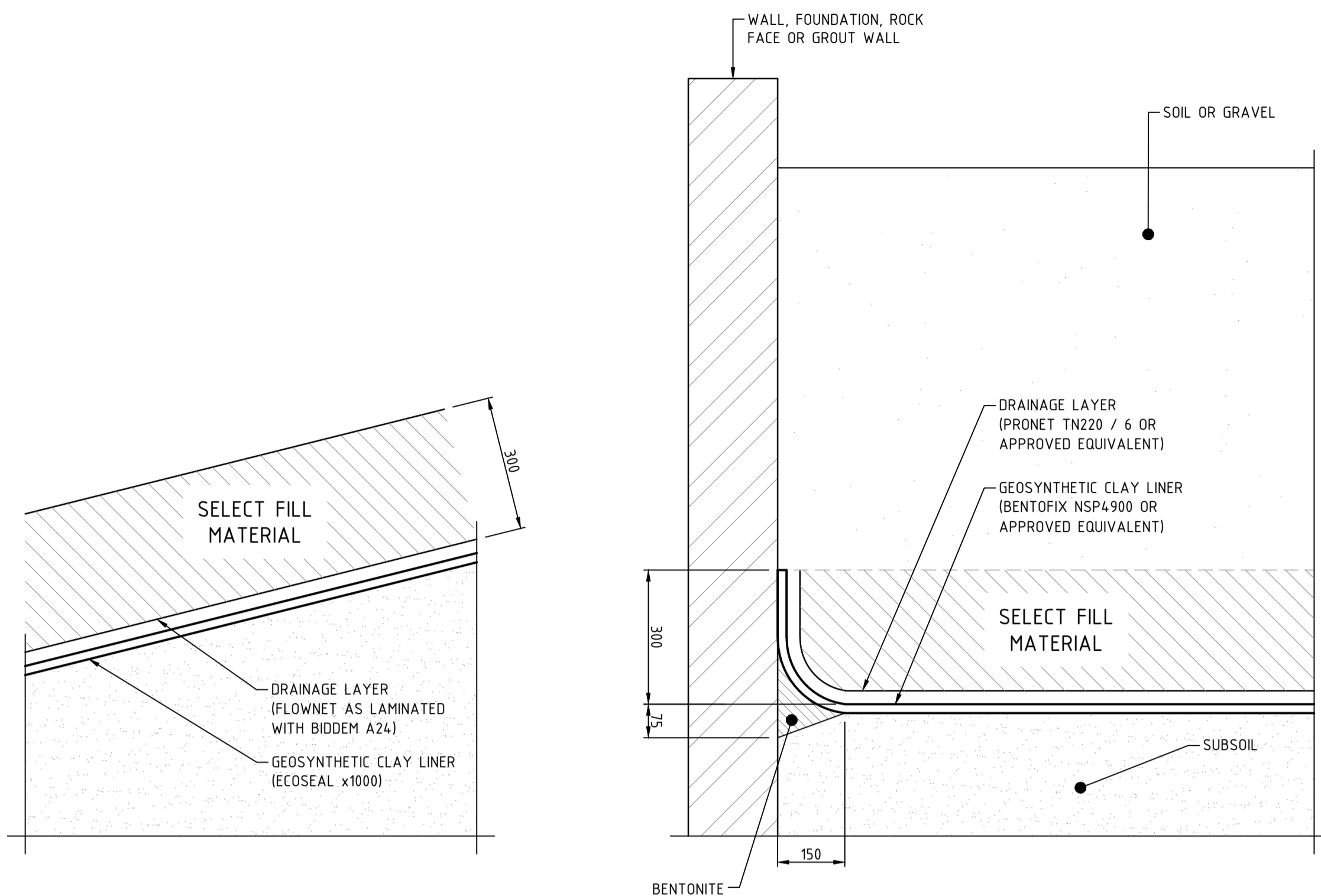
THIASS SERVICES PTY LTD  
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**HMAS PLATYPUS STAGE 2 REMEDIATION WORKS**

DRAWING TITLE  
**GEOSYNTHETIC DRAINAGE LAYER PLAN**

WAE	05.07.16	WORK AS EXECUTED	DRG	RPH	RBD
REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED

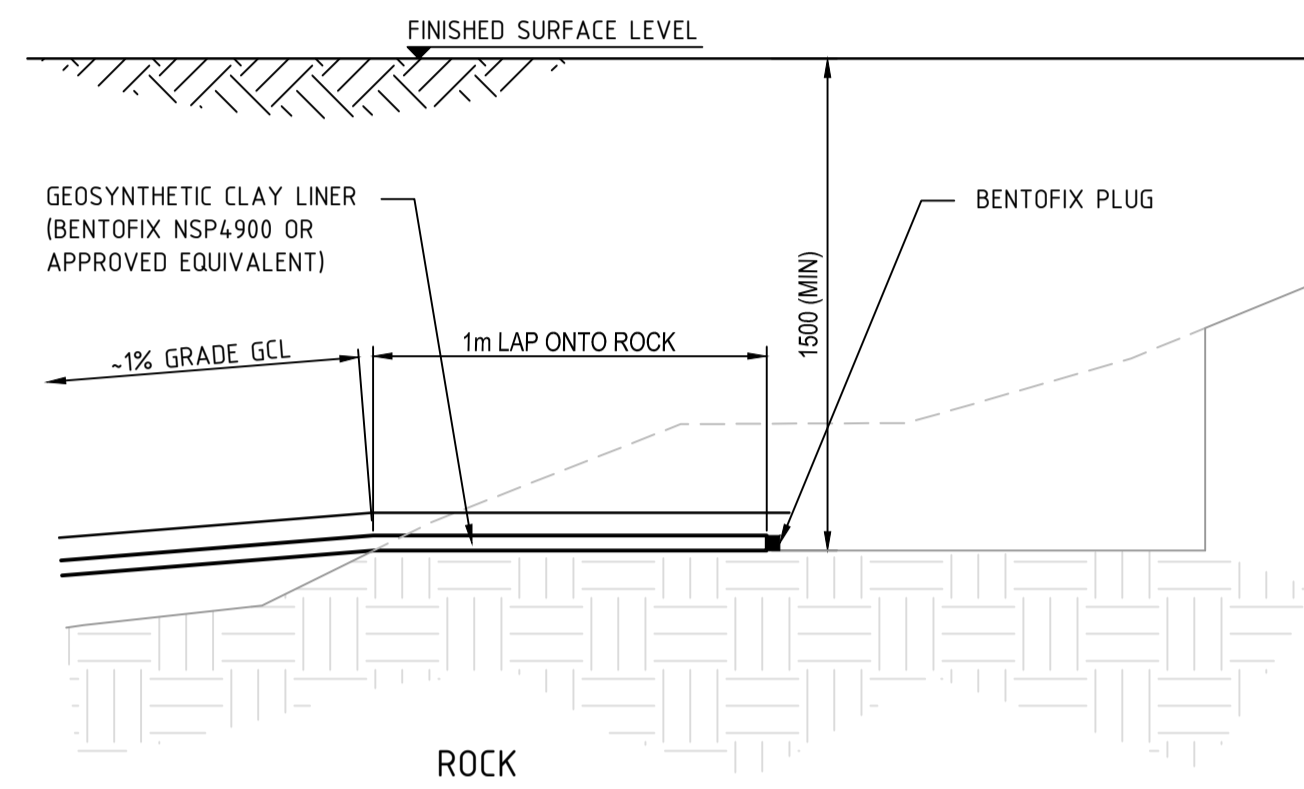
SCALE	A1 1:200	ORG NO	050010-CAP-CIVIL-037	REV	WAE
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**GEOSYNTHETIC CLAY LINER**

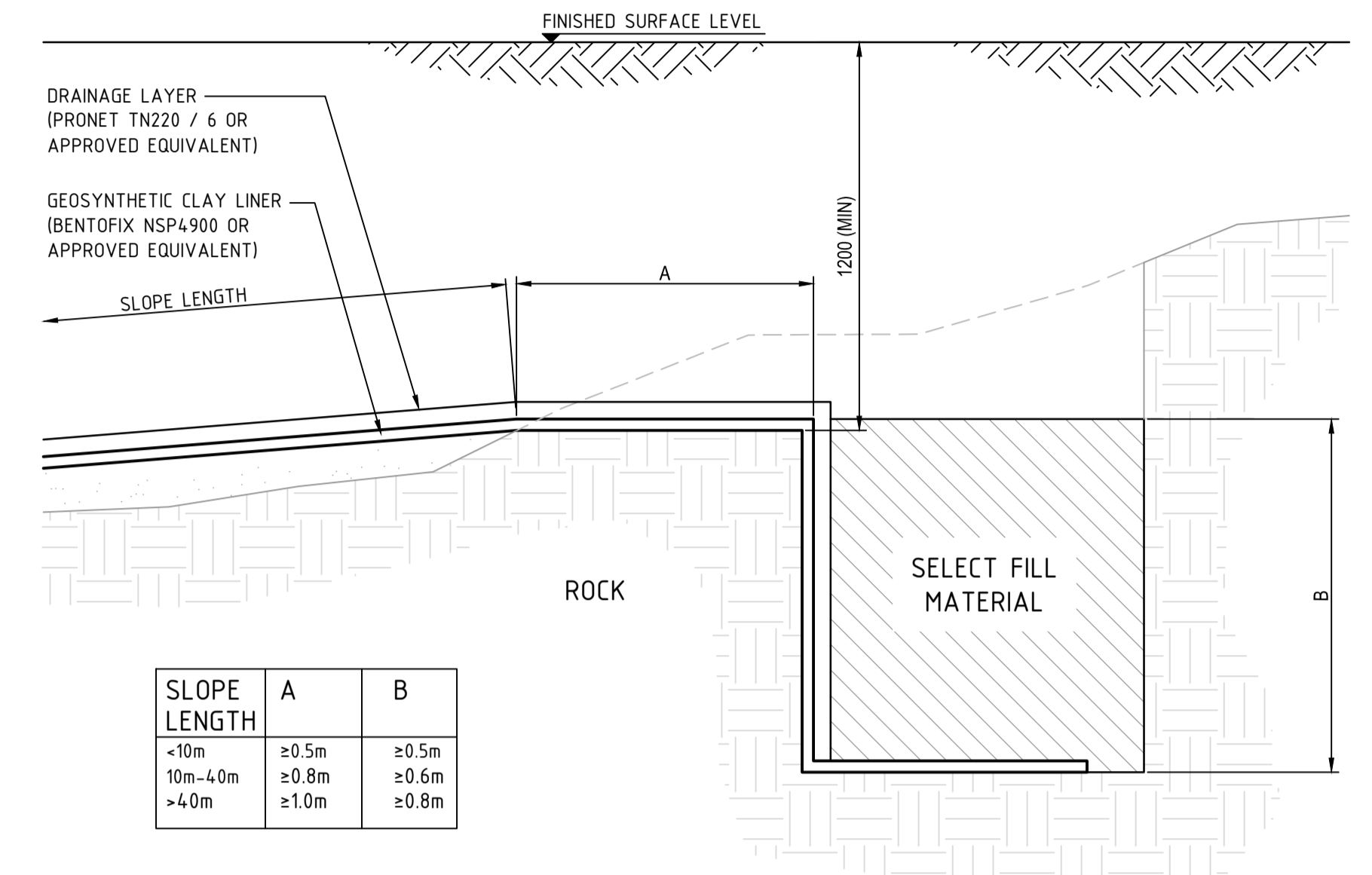
**DETAIL**  
SCALE 1:10

**SEALING GEOSYNTHETIC CLAY LINER TO STRUCTURES**



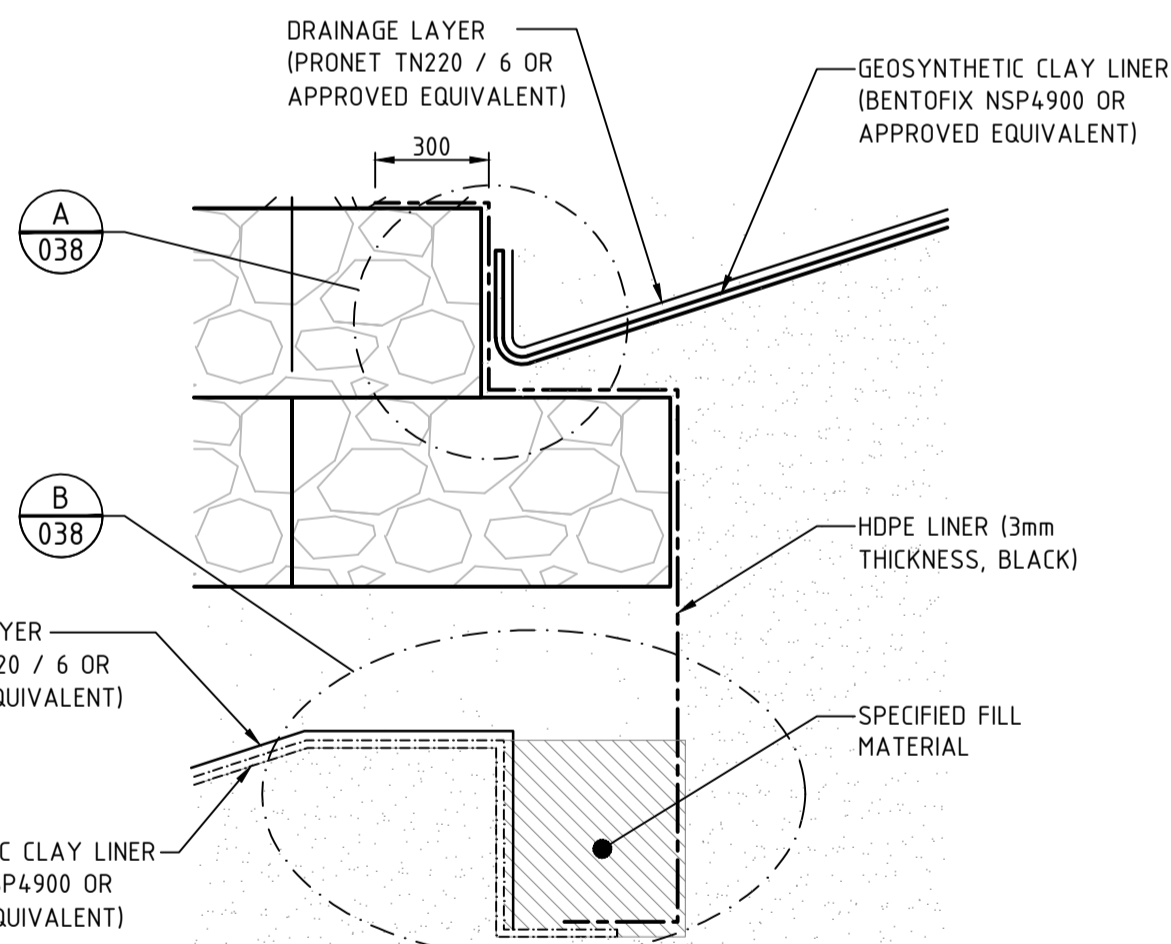
**DETAIL**  
SCALE 1:10

**ANCHORING TRENCH FOR GEOSYNTHETIC CLAY LINER**



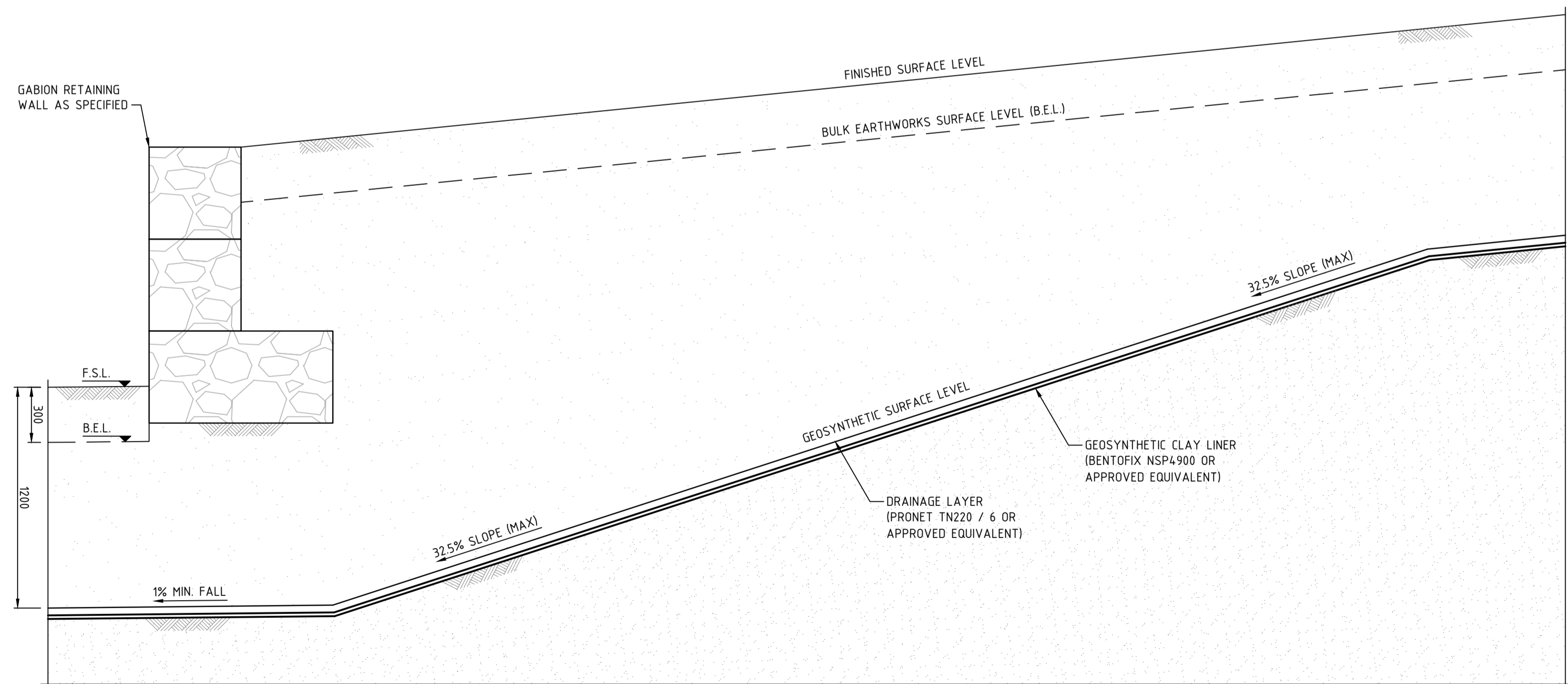
**DETAIL**  
SCALE 1:10

**ANCHORING TRENCH FOR GEOSYNTHETIC CLAY LINER**

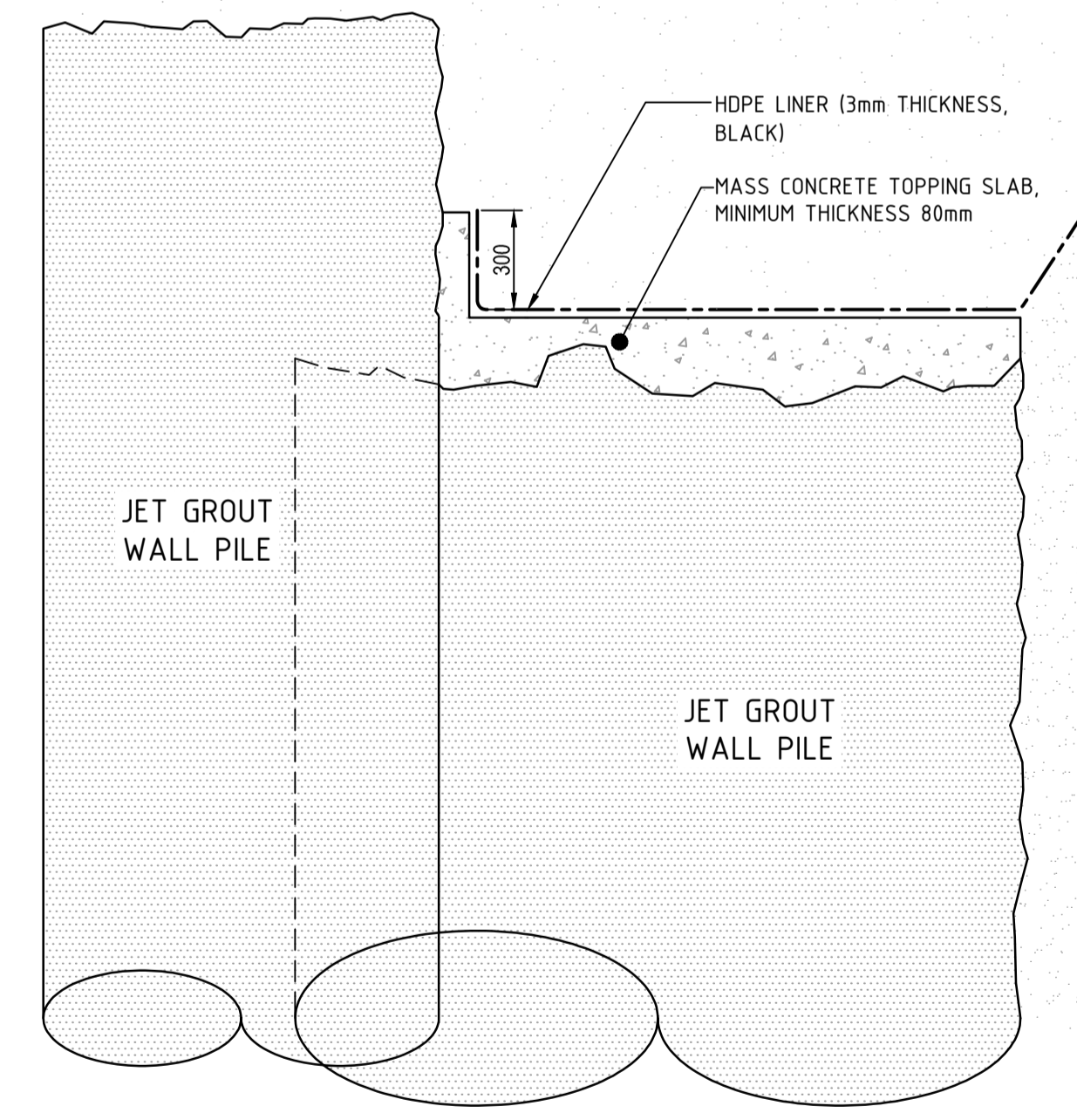


**DETAIL**  
SCALE 1:20

**GEOSYNTHETIC CLAY LINER AT GW4 GABION WALLS**

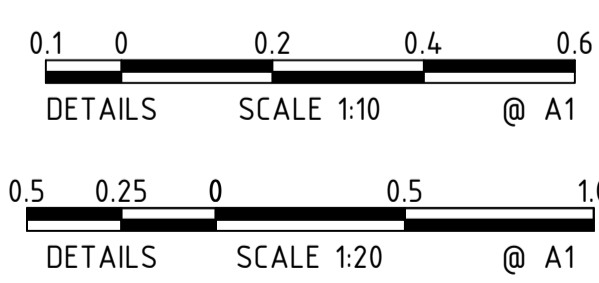


**GEOSYNTHETIC CLAY LINER UNDER RETAINING WALL - TYPICAL DETAIL**  
SCALE 1:20



**DETAIL**  
SCALE 1:20

**SEALING HDPE LINER TO GROUT WALL**



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DESIGN	PREPARED	CHECKED	DESIGN CONSULTANT APPROVED
DC	DC	RPH	
DRAWN	DC	RBD	DATE 05.07.2013



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HMAS PLATYPUS STAGE 2 REMEDIATION WORKS

DRAWING TITLE  
**GEOSYNTHETIC DRAINAGE LAYER DETAILS**

WAE	DATE	WORK AS EXECUTED	ORC	RPH	RBD
20.02.15		WORK AS EXECUTED			

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REF:  
MMD-298850-C-DR-CC01-GEOSYNTHETIC DRAINAGE DETAILS.dwg

SCALE	ORG NO	REV
A1 1:20	050010-CAP-CIVIL-038	WAE

## **APPENDIX F: SPECIFICATIONS FOR LINERS USED IN CAP**

# bidim<sup>®</sup>

## Nonwoven Geotextiles

### Technical Data Sheet



QUALITY - SUPPORT - EXPERTISE



## Specifications

### bidim® Geotextiles – Typical and MARV Values

bidim® geotextiles are manufactured in accordance to ISO 9001:2008, Cert No: QEC1773.

All bidim® “A” range nonwoven, needle punched geotextiles are made in Australia.

Test	Standard	Units	A12	A14	A19	A24	A29	A34	A39	A44	A49	A64	
Mechanical Properties	Wide Strip Tensile Strength (MD/XMD)	Typical	9.4/8.0	11.0/9.5	14.0/12.8	16.0/14.2	19.0/17.0	21.5/21.0	26.5/25.5	29.5/28.0	37.0/34.0	41.5/38.0	
		MARV	7.5/6.6	9.0/7.7	12.0/10.0	14.0/12.0	15.5/14.5	18.5/17.5	22.0/21.0	24.5/24.0	29.5/28.0	31.5/30.5	35.8/33.0
	Grab Tensile Strength (MD/XMD)	Typical	620/570	720/650	950/860	1,130/1,060	1,280/1,200	1,430/1,350	1,900/1,670	1,900/1,670	2,100/1,910	2,850/2,570	3,010/2,850
		MARV	510/430	600/530	795/730	850/800	1,100/1,000	1,270/1,210	1,590/1,490	1,590/1,490	1,800/1,680	2,490/2,200	2,620/2,460
Trapezoidal Tear Strength (MD/XMD)	AS3706.3-12	Typical	240/230	300/270	350/330	430/400	490/450	540/510	630/610	753/700	915/910	1,060/1,010	
		MARV	205/180	240/220	295/280	320/310	380/360	440/410	530/510	575/550	750/740	800/770	
CBR Burst Strength	AS3706.4-12	Typical	1,550	1,720	2,250	2,700	3,200	3,600	4,400	4,800	6,400	6,850	
		MARV	1,275	1,500	1,925	2,450	2,800	3,300	3,950	4,450	5,850	6,300	
G Rating	Austroads	Typical	1,150	1,500	1,950	2,230	2,480	2,800	3,450	3,900	5,150	5,400	
		MARV	900	1,250	1,550	1,800	2,160	2,510	3,100	3,450	4,600	5,000	

(MD) = Machine Direction Strength  
(XMD) = Cross Machine Direction Strength

Hydraulic Properties	Pore Size	AS3706.7-03	120	110	110	100	90	90	80	80	80	80
	Permittivity	AS3706.9-12	2.50	2.35	2.20	2.00	1.85	1.65	1.25	1.10	0.90	0.80
	Coefficient of Permeability	AS3706.9-12	33	33	33	33	33	33	33	33	33	33
	Flow Rate @ 100mm Head	AS3706.9-12	250	235	220	200	185	165	125	110	90	80

The data and specifications contained in this table are obtained from the manufacturer's laboratory testing. To ensure this information is current please contact your local branch of Geofabrics Australasia.

The product properties listed on this sheet include both **Typical** and **Minimum Average Roll Values (MARV)** for machine and cross machine directions (MD/XMD).

Definitions of these terms are included on the reverse side of this data sheet. All testing has been carried out by a NATA accredited laboratory and copies of test certificates are available on request.



# Definition of Terms

## ISO Accreditation

ISO9001 is a manufacturing quality assurance system under which **bidim®** is manufactured. Please refer to the **bidim®** Quality Assurance & Control Manual for testing frequencies.

**Note;** not all manufacturers test to the same frequency.

## Machine Direction (MD)

The direction in a machine-made fabric, parallel to the direction of motion of the material through the processing machine (i.e. along the length of the roll).

## Cross Machine Direction (XMD)

The direction in a machine made fabric, perpendicular to the direction of motion of the material through the processing machine (i.e. across the width of the roll).

## Typical Value

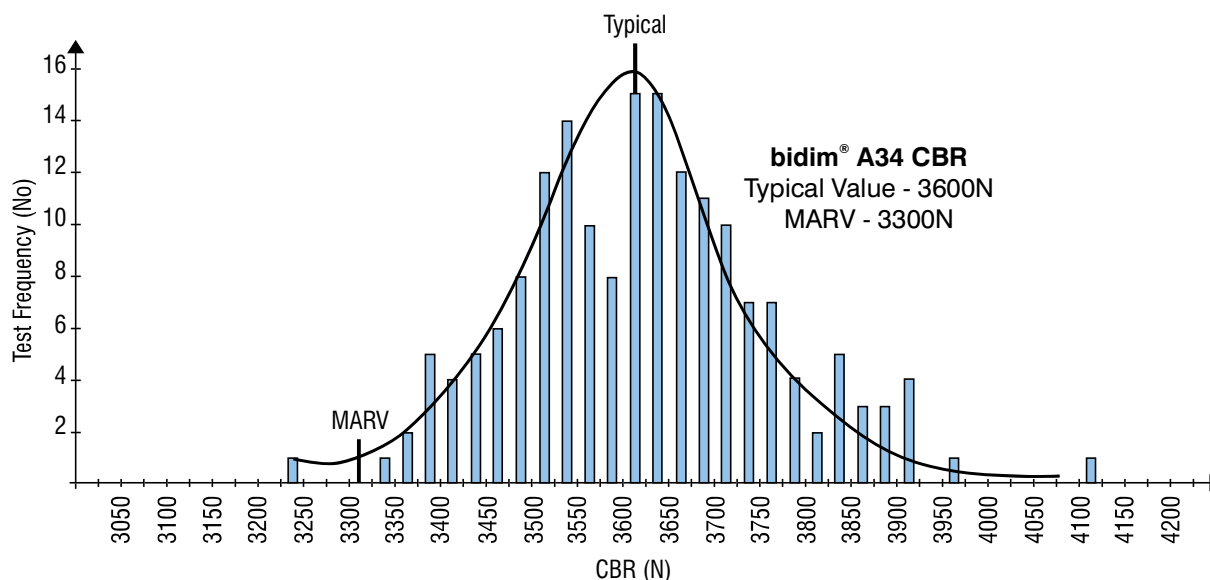
A typical value is the arithmetic mean of a set of results (refer to diagram below). This implies that 50% of the tested specimens will typically exceed this value and 50% will typically not meet this value.

## Minimum Average Roll Value (MARV)

MARV is a statistical derivation for any distribution of data. It is defined as the mean or typical value less 2 standard deviations (refer to diagram below). Mathematically it is implied that 97.5% of the tested specimens will exceed the MARV.

## Indicative Results Spread

(for a given test method for a given period of time)



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M018-05/12

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AUSTRALASIA PTY LTD





# ELCOSEAL<sup>®</sup>

## Geosynthetic Clay Liners

### Technical Data Sheet



QUALITY - SUPPORT - EXPERTISE



# ELCOSEAL® Bentonite Specification

ELCOSEAL® Geosynthetic Clay Liners contain a sodium bentonite processed to exceed the relevant requirements of API Spec 13A, for which the bentonite supplier is a licensed manufacturer. The unique swelling properties and low permeability performance of ELCOSEAL®'s sodium bentonite can be attributed to the following properties.

PROPERTY	TEST METHOD	UNITS	VALUE
Bentonite Particle Size	Dry Screen	% passing 75µm	≥ 75
	AS 1289-3.6.2 <sup>1</sup>	% ≤ 0.5µm	≥ 55
Swell Index	ASTM D 5890 <sup>2</sup>	mL/2g	≥ 24
Fluid Loss	ASTM D 5891 <sup>3</sup>	mL	≤ 15
Montmorillonite Content	XRD Quantitative Mineralogy Analysis <sup>4</sup>	% of Bulk Sample	≥ 70
Montmorillonite Content of Bentonite Particles ≤ 0.5µm	XRD Quantitative Mineralogy Analysis <sup>4</sup>	% ≤ 0.5µm	≥ 90
Calcium Carbonate Content (CaCO <sub>3</sub> )	XRD Quantitative Mineralogy Analysis <sup>5</sup>	% of Bulk Sample	≤ 2
Layer Charge and Layer Charge Distribution	Chemical analysis and structural formula calculation <sup>6</sup>	e <sup>-</sup> per unit cell (O <sub>20</sub> (OH) <sub>4</sub> )	0.75 - 0.90
		% in tetrahedral sheet	< 35
Cation Exchange Capacity (CEC)	NH <sub>4</sub> displacement <sup>7</sup>	cmol/kg of Bulk Sample	70 - 110
	Barium Saturation Method - (e.g. Battaglia et al., 2006) <sup>7</sup>		
	Methylene Blue <sup>7</sup>		

## EXPLANATION OF TEST METHODS

- BENTONITE PARTICLE SIZE – AS 1289-3.6.2 – ‘Methods of testing soils for engineering purposes - Soil classification tests - Determination of the particle size distribution of a soil - Analysis by sieving in combination with hydrometer analysis (subsidiary method)’** – Particle size provides an indication of the reactive surfaces. Smaller particle sizes generally react more efficiently and effectively with water to result in better swelling, lower fluid loss, higher swelling pressure, greater gel strength and lower permeability.
- SWELL INDEX - ASTM D5890 – ‘Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners’** – This is an index test that evaluates the swelling potential of the bentonite component of a GCL. The index relates to bulk swelling under minimal confinement. The swell index is generally inversely related to GCL permeability, i.e. the higher the swell index, the lower the GCL permeability.
- FLUID LOSS - ASTM D5891 – ‘Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners’** – This is an index test that evaluates the fluid loss properties of the bentonite component of a GCL, under 100psi (690 MPa) pressure, over a specified period of time. A low Fluid Loss value is indicative of the ability of the bentonite to restrict movement of liquid under load. Fluid Loss is directly related to GCL permeability, i.e. the lower the fluid loss, the lower the GCL permeability.
- MONTMORILLONITE CONTENT – XRD Quantitative Mineralogy Analysis** – The method enables quantification of the mineralogy of a bentonite by powder X-ray diffraction and Reitveldt refinement. The XRD method can be performed on bulk bentonite, showing montmorillonite content as a % of bulk; or on size-fractionated materials, showing montmorillonite content as a % of size fraction (i.e. ≤0.5µm).

### REFERENCE

Taylor, J.C., Hinczak, (2004). Reitveldt Made Easy. Sietronics, Pty Ltd, Belconnen Australia, 201p.

- CALCIUM CARBONATE CONTENT – ‘XRD Quantitative Mineralogy Analysis’** – As for Montmorillonite content, quantitative mineralogy analysis enables quantification of carbonate minerals present in bentonite.
- LAYER CHARGE AND LAYER CHARGE DISTRIBUTION – ‘Chemical analysis and structural formula calculation’** – This method enables calculation, from chemical analysis, of layer charge characteristics of the <0.2 micron smectite clay component of a GCL. Chemical analysis is quantified by XRF on calcium saturated purified smectite samples. Smectite layer charge is responsible for the cation exchange capacity of bentonite, but also influences swelling, sealing and gel formation. Layer charge values <0.90e<sup>-</sup> per unit cell in combination with a tetrahedral layer charge <35%, indicates a good swelling bentonite.

### REFERENCES

1. Norrish, K., Hutton, J.T. (1969). "An accurate X-ray spectroscopic method for the analysis of a wide range of geologic samples", *Geochemical Cosmochimical Acta*, 33, 431-453.

2. Bodine, M.W.Jr. (1987). "CLAYFORM: A FORTRAN 77 computer program apportioning the constituents in the chemical analysis of a clay or other silicate mineral in a structural formula", *Computers and Geosciences*, 13:77-88.

- CATION EXCHANGE CAPACITY – ‘NH<sub>4</sub> Displacement Method’** – This method has traditionally been used to determine CEC in SOILS. The NH<sub>4</sub> displacement method can be modified to enable direct determination of the cation exchange capacity of the bentonite component of a GCL. The amount of NH<sub>4</sub> retained by the clay is quantified by Inductively Coupled Plasma Atomic Absorption Spectrometry (ICP-AAS). This method can be performed on the bulk bentonite, in which case "Bentonite CEC" is recorded; or on the monomineralic smectite (<2.0 micron) isolated from the bentonite, in which case the "Smectite CEC" is recorded. The ranges in CEC values specified provide the best combination of good swelling and cation retention capabilities – see Note 6 - **LAYER CHARGE AND LAYER CHARGE DISTRIBUTION**.

or **‘Barium Saturation Method’** – The barium (Ba) displacement method enables direct determination of the cation exchange capacity of the carbonate free fractions of the bentonite component of a GCL. The amount of Ba retained by the clay is quantified by X-ray Fluorescence (XRF). This method can be performed on the carbonate free bulk bentonite, in which case "Bentonite CEC" is recorded; or on the carbonate free monomineralic smectite isolated from the bentonite, in which case the "Smectite CEC" is recorded. The ranges in CEC values specified provide the best combination of good swelling and cation retention capabilities – see Note 6 - **LAYER CHARGE AND LAYER CHARGE DISTRIBUTION**.

### REFERENCES

Wang, M.K., Wang, S.L., Wang W.M. 1996. Rapid Estimation of Cation-exchange Capacities of Soils and Clays with Methylene Blue Exchange. *Soil Science Society of America J.* 60:138-141.

# ELCOSEAL® GCL Specification

ELCOSEAL® is a New Generation Geosynthetic Clay Liner (GCL) made from quality polypropylene geotextiles and premium grade sodium bentonite powder mined in Australia. ELCOSEAL® GCL's are fibre-reinforced by needle-punching the composite across the entire surface area of the product. Unique to this product, the high tenacity fibres are then thermally-locked to ensure high long-term shear strength.

PROPERTY		TEST METHOD	MQC <sup>1</sup> FREQUENCY	UNITS	ELCOSEAL® GRADE			
					X800	X1000	X2000	X3000
GCL Hydraulic Properties								
Hydraulic Conductivity, k	MaxArv <sup>2</sup>	ASTM D 5887	40,000m <sup>2</sup>	m/s	3.5 x 10 <sup>-11</sup>	2.8 x 10 <sup>-11</sup>	3 x 10 <sup>-11</sup>	2 x 10 <sup>-11</sup>
	Typical <sup>3</sup>				2 x 10 <sup>-11</sup>	1.6 x 10 <sup>-11</sup>	1.6 x 10 <sup>-11</sup>	1.5 x 10 <sup>-11</sup>
GCL Components - Mass								
Cover Nonwoven Geotextile Mass per Unit Area	MARV <sup>4</sup>	AS 3706.1	10,000m <sup>2</sup>	g/m <sup>2</sup>	220	270	270	290
	Typical				280	300	300	330
Bentonite Mass per Unit Area @ 0% moisture content	MARV	ASTM D 5993	2,500m <sup>2</sup>	g/m <sup>2</sup>	3,600	4,000	3,700	4,250
	Typical				4,100	4,500	4,250	4,700
Carrier / Composite Geotextile Mass per Unit Area	MARV	AS 3706.1	70,000m <sup>2</sup>	g/m <sup>2</sup>	110	110	380	380
	Typical				110	110	410	410
Geotextile Configuration (Carrier / Cover)					W / NW <sup>5</sup>	W / NW	W+NW / NW	W+NW / NW
GCL - Mass								
GCL Total Mass per Unit Area @ 0% moisture content	MARV	ASTM D 5993	2,500m <sup>2</sup>	g/m <sup>2</sup>	3,930	4,380	4,350	4,920
	Typical				4,490	4,910	4,960	5,440
GCL - Strength Properties								
Strip Tensile Strength (MD) <sup>6</sup>	MARV	ASTM D 6768	10,000m <sup>2</sup>	kN/m	7	8	12	12
	Typical				10	11	15	16
CBR Strength	MARV	AS 3706.4	25,000m <sup>2</sup>	N	1,400	1,600	3,900	4,100
	Typical				2,000	2,100	4,900	5,300
CBR Elongation	MARV	AS 3706.4	25,000m <sup>2</sup>	%	10	15	30	30
	Typical				30	40	80	80
GCL - Shear Strength Properties								
Hydrated Peak Internal Shear Strength @ 10kPa Normal Stress	Typical <sup>7</sup>	ASTM D 6243	Periodic	kPa	30	30	35	40
Hydrated Peak Internal Shear Strength @ 30kPa Normal Stress	Typical	ASTM D 6243	Periodic	kPa	50	50	60	70
GCL Longitudinal Edge Treatment								
Bentonite Impregnation - Width ≥ 300mm - Typical				-	√	√	√	√
Edge Sealing				-	√	√	√	√
GCL Roll Dimensions								
Roll Dimensions (Width x Length)				m	4.7 x 45	4.7 x 35	4.7 x 30	4.7 x 30
Maximum Roll Mass			(Weighed every roll)	kg	1,200	1,000	875	950
GCL Spreader Bar Requirement				-	Heavy-Duty <sup>8</sup>	Heavy-Duty <sup>8</sup>	Standard <sup>9</sup>	Standard <sup>9</sup>

## NOTES

- MQC** = Manufacturing Quality Control – an ongoing system that monitors and tests materials during manufacture to ensure compliance with certification documents and contract specifications.
- MaxARV** = Maximum Average Roll Value – a MaxARV is defined as the Mean or Typical values plus 2 standard deviations. Mathematically, it is implied that 97.5% of the results of the tested specimens will be less than the MaxARV. A MaxARV provides a confidence level of 97.5%. **NOTE** – in reference to GCL Permeability, **LOWER IS BETTER**.
- Typical** = A typical value is the arithmetic mean of a set of results. This implies that 50% of the tested specimens will typically exceed this value and 50% will typically not meet this value.
- MARV** = Minimum Average Roll Value – a MARV is defined as the Mean or Typical values less 2 standard deviations. Mathematically, it is implied that 97.5% of the results of the tested specimens will exceed the MARV. A MARV provides a confidence level of 97.5%.
- W** = Woven, **NW** = Nonwoven.
- MD** = Roll Machine Direction.
- Peak value** reported at 10kPa or 30kPa normal stress. [The reported values are not intended to replace site specific internal shear or interface friction testing required for design].
- Heavy-Duty WLL** (Working Load Limit) = 1400kg.
- Standard WLL** = 1000kg.

# ELCOSEAL® Technical Data Sheet

Contact your nearest Geofabrics Australasia office for any further information on:



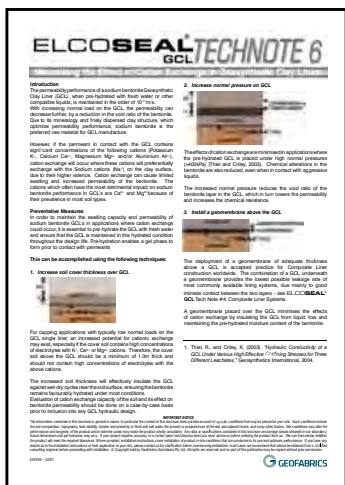
## General Information



## ELCOSEAL® Installation Guidelines



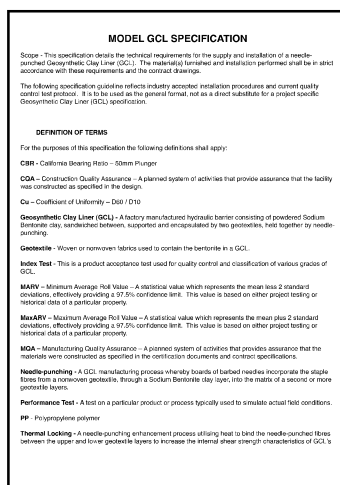
## Manufacturers Quality Assurance & Control Manual



## GCL Technical Notes



## Bentonite Technical Notes



## GCL Model Specification

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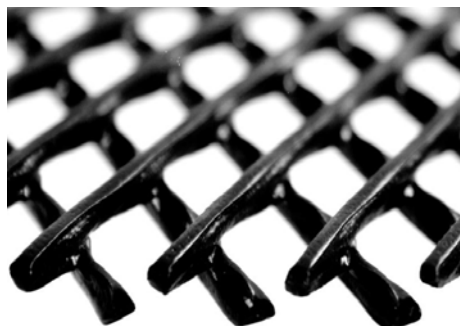
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M123 - 04/12





**PRODUCT DESCRIPTION:**

**INTERDRAIN M5** is a high-density polyethylene (HDPE) geonet. The geonet is made with 2 overcrossed strands at 60°, whose geometry create channels with a high flow capacity, also under pressure and at very low gradients.

**FUNCTION:**  
DRAINAGE.

**MAIN USES:**

Landfill capping, new landfills, water reservoirs, horizontal drainage in embankments and platforms of roads, railways, trams and other trafficked areas, retaining structures, bridges, foundations, basements, canals, cut and cover tunnels, tunnels and other underground structures, gardens and sport fields.

Characteristics	Value	Unit	Standard
<b>Drainage geonet</b>			
Polymer	High-density polyethylene ( HDPE )		
Carbon black	1,2 - 2,5	%	ASTM D 1603
Density	> 0,94	g / cm <sup>3</sup>	ASTM D1505
Thickness at 2 kPa / 200 kPa	5,2 / 4,8	mm	ISO 9863-1
Mass per unit area	650	g / m <sup>2</sup>	ISO 9864
Peak tensile strength MD / CD	7,0 / 2,5	kN / m	ISO 10319
Elongation at peak, MD / CD	20 / 90	%	ISO 10319
CBR	0,6	kN	ISO 12236
Flow capacity in their plane, MD		l / m·s	ISO 12958 <sup>(1)</sup>
i = 1,0	σ = 20 kPa	2,00	
	σ = 50 kPa	1,82	
	σ = 200 kPa	1,44	
	σ = 400 kPa	1,00	

**INTERDRAIN** standard roll format is **2 or 4 meters-wide**.

<sup>(1)</sup> ISO 12958-1999 with 380\*300 mm specimens and rigid plates (hard-hard).The tolerance is ±30%.

i : Hydraulic gradient

MD : Machine direction (longitudinal)

CD : Cross machine direction (transversal)

σ: Normal stress

This information are typical values based on our present state of knowledge and is intended to provide general notes on our products and their uses.



# Megaflo<sup>®</sup>

## Panel Drain System

General Brochure



QUALITY - SUPPORT - EXPERTISE



Please read the important notice at the end of this brochure

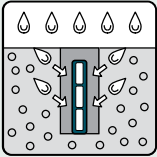
**Megaflo**® panel drain provides the dimensional stability and field-proven structural strength for quick, effective subsurface drainage. **Megaflo**® consists of a perforated HDPE core wrapped with **bidim**® nonwoven geotextile to prevent soil ingress into the drainage system.

Performance is the distinguishing feature of the panel drain due to its ability to rapidly collect and remove water. Compared to 100mm diameter round pipe, **Megaflo**® has twice the inflow capacity for an equivalent length and will drain water in less than 60% of the response time. Its slim 40mm wide profile permits faster and more cost effective installation in a narrower trench.

The design of the **Megaflo**® panel drain permits significantly higher flow velocity at lower head.

## FUNCTIONS

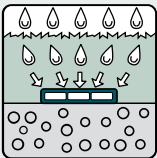
### Drainage



Removal of excess water from a structure whether it be a road, retaining wall or sports field is key to long term performance of the structure. **Megaflo**® is a unique composite drainage system with an unsurpassed infiltration rate and rigid flow path which ensures effective drainage under the most challenging conditions.



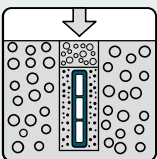
### Rapid Response Time



Rapid removal of excess water is a key consideration in roads and sports fields where excess water can result in significant damage to the pavement or limit the playability of the sports surface. The long flat shape of **Megaflo**® incorporates a high open area for inflow of water - allowing rapid response time well in excess of conventional drainage systems.



### Strength



Vertically installing the **Megaflo**® drainage panel utilises the ribbed structure to provide higher strength under traffic loads. The properties of high compressive modulus, longitudinal stiffness and structural rigidity aids the mechanical performance of **Megaflo**®, ensuring the long term hydraulic flow capacity of the drain. High structural strength allows for a minimum cover depth of 100mm, recommended for **Megaflo**® in most applications. **Megaflo**® typically requires less backfill in comparison to a traditional trench which results in cost savings and faster installation.



## APPLICATIONS

### ROADSIDE EDGE DRAINS

**Megaflor**® provides faster and higher inflow capacity due to its high trench installation profile and earlier interception of pavement infiltration. **Megaflor**® has a high compressive modulus and structural rigidity (preventing deflection under normal service loads), due to its elongated ribbed profile incorporating internal support.

Simple installation techniques provide installation savings compared to a traditional round pipe drainage system.



### SPORTS FIELDS

Sports field surfaces endure high traffic, which if not drained adequately, results in costly and time consuming maintenance. Adequate drainage requires the fast and effective removal of water after a storm.

The use of narrow width **Megaflor**® flat panel drain ensures minimal disruption of the existing sports surface with a simple, cost effective installation process.



### RETAINING WALLS

**Megaflor**® provides reliable drainage in specialist construction applications such as retaining walls, shotcrete walls and tunnels.

The **Megaflor**® drainage system can be utilised vertically or horizontally to remove excess water, preventing the build up of water pressures induced on the structure.



### LANDFILL

Landfill leachate and gas collection systems are an integral part of landfill design for lining and capping systems.

The high compressive strength of **Megaflor**® under normal and inclined loads makes it the ideal product for a range of landfill drainage applications.



### MINING

**Megaflor**® is ideally suited for use as collector drains in mining applications. Its high compressive modulus and structural rigidity prevents deflection and the loss of flow capacity under high load or localised settlement.

**Megaflor**® Ultra is available for the rapid drainage of tailing dams.



### GOLF COURSES

The trenchless option of **Megaflor**® laid directly onto the subgrade results in significant savings in man-hours and material compared to traditional round pipe.

Regardless of the subgrade soil type, all golf courses can benefit from improved drainage using **Megaflor**®.





## ADVANTAGES OF MEGAFLO® DRAINAGE SYSTEMS

<b>High Crush Strength</b>	The high vertical crush strength means <b>Megaflo®</b> can be installed closer to the surface reducing the cost of excavation.
<b>Enhanced Performance</b>	The increased height and rapid response times associated with <b>Megaflo®</b> ensures the system outperforms traditional drainage options. The flat pipe construction prevents intrusion of the cover geotextile allowing flow rates to be maintained despite soil confinement pressure.
<b>Cost Effective</b>	The narrow trench width requirement combines rapid installation of the geotextile encapsulated <b>Megaflo®</b> to provide significant cost savings when compared to traditional French drain systems.
<b>Environmentally Friendly</b>	<b>Megaflo®</b> is manufactured from recycled HDPE, minimising the carbon footprint of the project.

## MEGAFLO® DIMENSIONS

Megaflo® Products:		
Product Description	Height	Roll Length
<b>Megaflo® 170</b>	170mm	50m or 100m
<b>Megaflo® 300</b>	315mm	50m or 100m
<b>Megaflo® 450</b>	450mm	50m or 100m
<b>Megaflo® 900</b>	900mm	50m

## FITTINGS

A range of standard **Megaflo®** fittings are available:

- **Megaflo®** couplers are a high strength, secure means to join continuous sections of **Megaflo®**, inserted beneath the geotextile.
- Connecting to 100mm diameter round pipe is easily achieved using either the **Megaflo®** side outlet or **Megaflo®** end outlet where required.
- **Megaflo®** end caps can be fitted to terminations to prevent backfill ingress into the system. Other fittings are available for connecting **Megaflo®** in various arrangements depending on the application.



Fittings are available to suit all Megaflo® sizes:

A	Joiner Coupling	C	Side Outlet
B	End Outlet	D	End Cap

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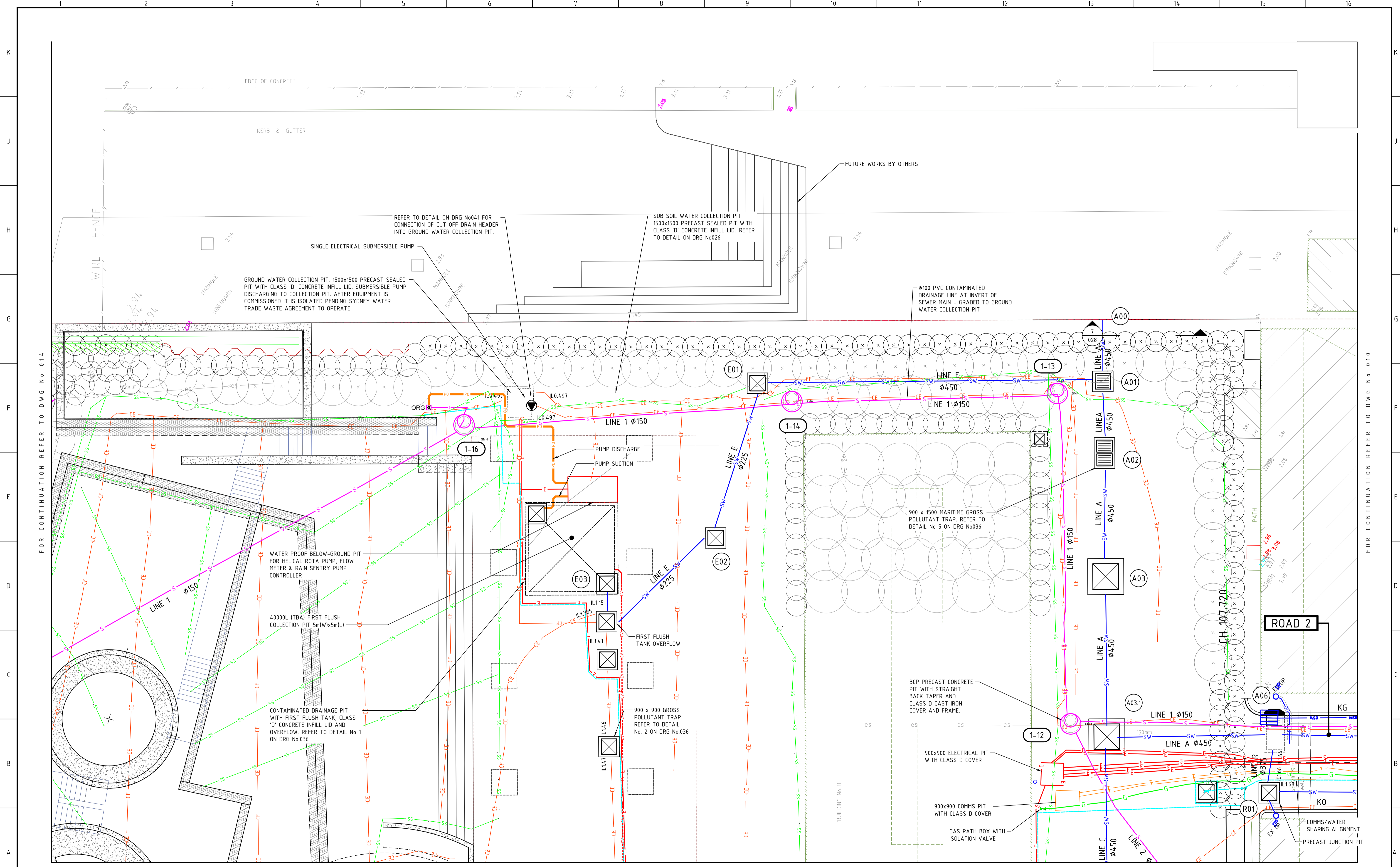
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## **APPENDIX G: DRAINAGE SYSTEM AS- BUILTS IN NORTHERN REMEDICATION CONTAINMENT AREA**



FOR CONTINUATION REFER TO DWG No 014

FOR CONTINUATION REFER TO DWG No 010

FOR CONTINUATION REFER TO DWG No 013

WAE	DATE	DESCRIPTION	BY	APP'D	REVIEWED
03.03.15		WORK AS EXECUTED	DRG	RPH	RBD
REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED

**Mott MacDonald**  
Hughes Trueman

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Level 2, 60 Pacific Hwy, PO Box 151, ST LEONARDS NSW 2065  
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DESIGN	DC	CHECKED	RPH	DESIGN CONSULTANT APPROVED
DRAWN	DC		RBD	DATE 13.08.14

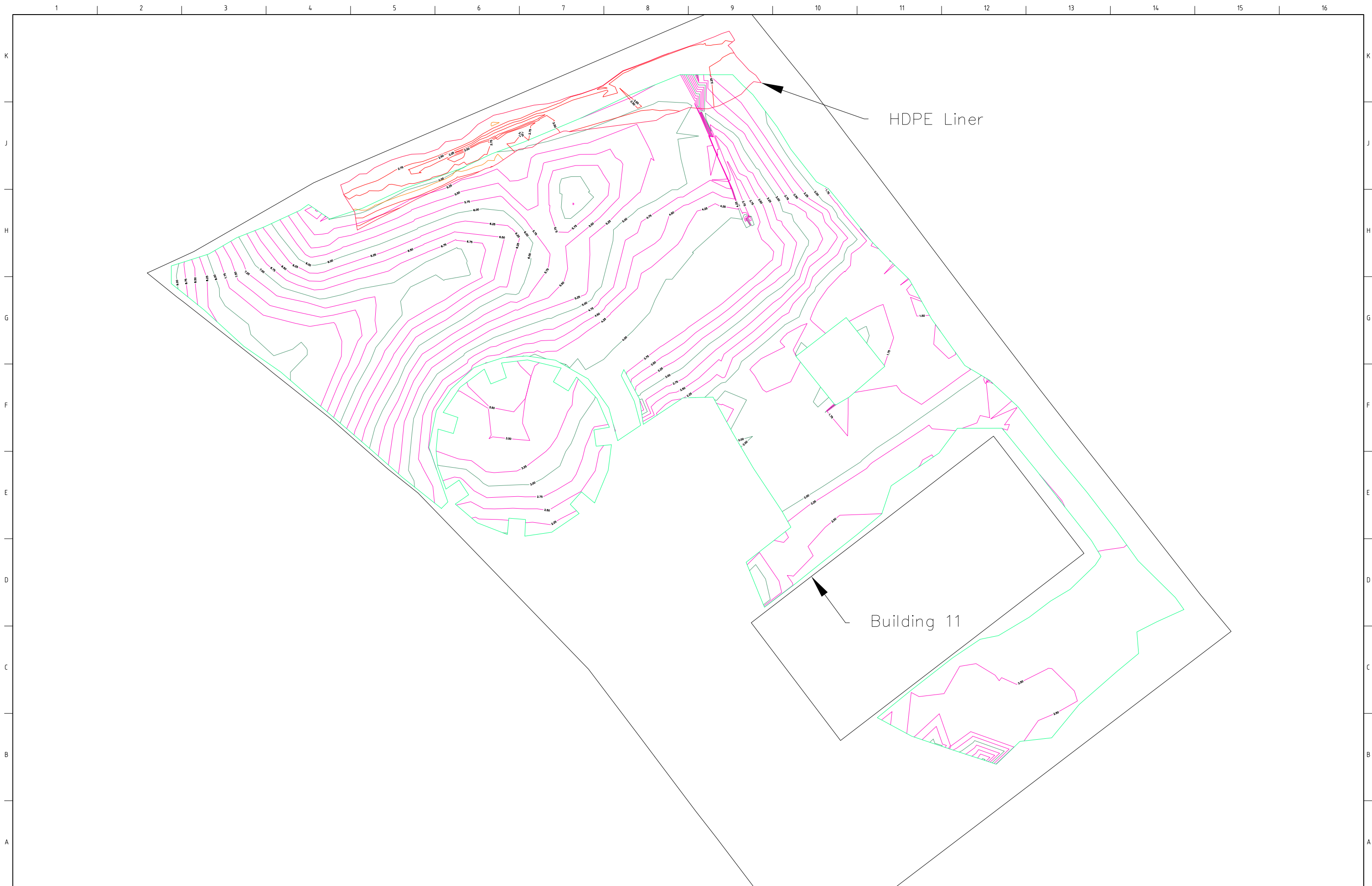
REF: MMD-298850-C-DR-CC01-SITWORKS PLANS.dwg

Australian Government  
Sydney Harbour Federation Trust

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FAX (02) 8892 5901

HMAS PLATYPUS STAGE 2 REMEDIATION WORKS		
DRAWING TITLE		
SITWORKS PLAN		
SHEET 4 OF 7		
SCALE	DRG NO.	REV
A1 1:100	050010-CAP-CIVIL-011	WAE



REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED
B	4.11.2014	HDPE LINER SURFACE ADDED	SHB	SHB	BW
A	20.10.2014	ISSUED FOR REVIEW	SHB	SHB	BW

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	PREPARED	CHECKED	DESIGN CONSULTANT APPROVED
DESIGN	SHB	BW	S Barthelme
DRAWN	SHB	BW	DATE 20.10.2014

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HMAS PLATYPUS STAGE 2 REMEDIATION WORKS		
DRAWING TITLE		
GEOSYNTHETIC CLAY LINER		
AS BUILT		
SCALE	DRG NO.	REV
A1 1:150	050010-CAP-WAE-010	B



RW3 retaining wall

Gabion wall

Building 11

REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED
A	20.10.2014	ISSUED FOR REVIEW	SHB	SHB	BW

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DESIGN	SHB	BW	S Bartheleme
DRAWN	SHB	BW	DATE 20.10.2014

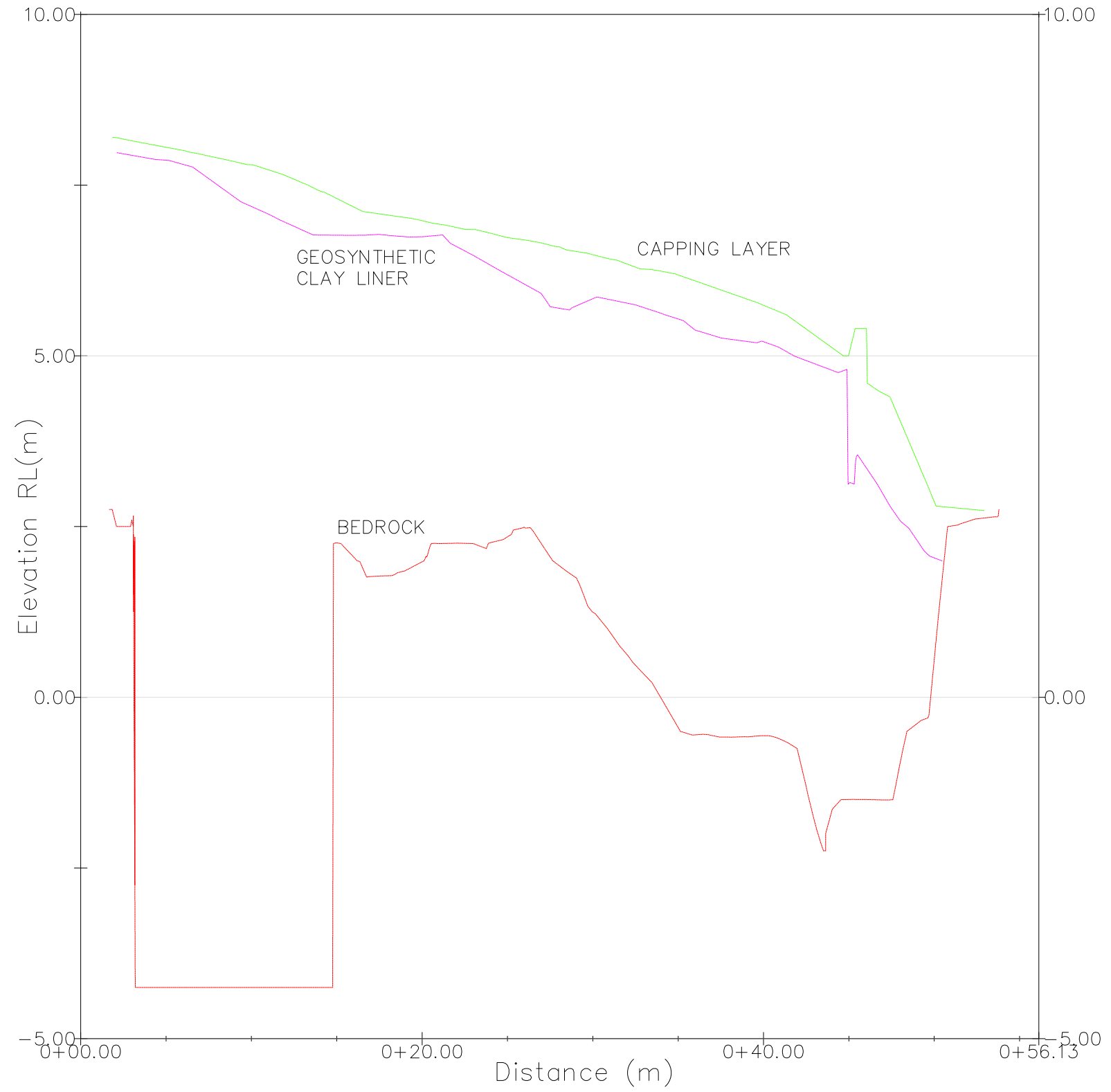


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HMAS PLATYPUS STAGE 2 REMEDIATION WORKS		
DRAWING TITLE		
FINAL CAPPING SURFACE		
AS BUILT		
SCALE	DRG NO.	REV
A1 1:150	050010-CAP-WAE-011	A

# Typical Cross Section



REV	DATE	DESCRIPTION	BY	APP'D	REVIEWED
A	20.10.2014	ISSUED FOR REVIEW	SHB	SHB	BW


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DESIGN	SHB	BW	DATE	20.10.2014
DRAWN	SHB	BW		

DESIGN CONSULTANT APPROVED  
S Bartheleme



<b>HMAS PLATYPUS STAGE 2 REMEDIATION WORKS</b> DRAWING TITLE <b>CONTAINMENT CELL TYPICAL CROSS SECTION AS BUILT</b>		
SCALE	DRG NO.	REV
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