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Engineering | Environmental | Testing

Report Type:
Remedial Action Plan

Project Address:
Charles Street Square, Parramatta, NSW
Portions of Lot 1 in DP506760, Lot 2 in DP532539, Lot 2 in DP869816, Lot 2 in DP532539 and Lot 1 in DP1172250

Client Name:
Northrop Consulting Engineers P/L

1 September 2020
Report No: 7957-ER-3-1_Rev02

We give you the right information to make the right decisions

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DOCUMENT CONTROL

Revision Status	Date	Author	Reviewer	Comments
Preliminary Draft	6 March 2020	Jacob Walker	Steven Wallace	Issued for Council comments
Rev01 - Draft	22 June 2020	Mehran Asadabadi	Aidan Rooney	Issued for Council Review
Rev02	1 September 2020	Mehran Asadabadi	Aidan Rooney	-

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Title	Senior Environmental Scientist	**Title**	Principal Environmental Scientist

EXECUTIVE SUMMARY

Alliance Geotechnical Pty Ltd (AG) was engaged by Northrop Consulting Engineers P/L on behalf of City of Parramatta, to prepare a remedial action plan (RAP) for Charles Street Square, Parramatta, NSW (refer **Figure 1** with the 'site' boundaries outlined in **Figure 2**).

AG has the following project appreciation:

- The site is proposed for redevelopment, demolition, utility adjustments, civil infrastructure, planting and urban amenities;
- Contamination assessments have been undertaken for the site by EIS in 2014 and AG in 2019;
- A remedial action plan (RAP) is required to address unacceptable land contamination exposure risks identified for the site in previous contamination assessments; and
- The client's preferred remedial strategy has not yet been decided. However, it is understood that capping and containment of the contaminated materials is an option being discussed currently. If such option is not feasible, then offsite removal of contaminated fill material may be considered.

The objectives of this project were to:

- Prepare a remedial action plan to address potentially unacceptable contamination exposure risks on the site identified in the Stage 1 PSI and Stage 2 DSI in the context of the proposed land use setting.

The scope of works undertaken to address the project objectives, included:

- A desktop review; and
- Data assessment and reporting.

The remedial goal for this site is to remediate potential soil contamination (where identified) to a level that does not present an unacceptable human health and ecological exposure risk, based on the proposed land use setting. AG notes that the client would prefer that the remedial works be undertaken in a manner that does not result in the need for:

- Notation on a planning certificate for the site;
- A covenant registered on the title to the land; or
- A long-term environmental management plan (EMP).

The known lateral extent of remediation on the site is considered to be as a minimum, the following:

- AEC01 – fill soils across the site.

It is noted that the lateral extent of remediation may be altered, during remedial works based on site observations and validation soil sample analytical laboratory results.

AG notes that AEC02 to AEC04 will inform the current data gaps and the extent of contamination in these areas, if identified is not fully understood. Based on the extent of the remediation and the proposed site redevelopment works, remedial options considered appropriate for this site include:

- In-situ containment by capping;
- Ex-situ containment by capping; and
- Excavation and offsite disposal.

Based on the known extent of the remediation identified in **Section 8.2**, and the proposed site redevelopment works, remedial options considered appropriate for this site include:

- In-situ containment by capping;
- Excavation and containment by capping;
- Excavation and removal off site;
- Excavate and spread for raking/picking; and
- In-situ raking and picking/on-site treatment.

Taking into consideration the client's objectives for the site, and the nature and extent of the proposed site redevelopment works, the preferred remedial option for the site is:

- AEC01 – containment onsite by method of capping or excavation and offsite disposal.

AG notes that in the event of substantial unexpected finds encountered during remediation / bulk earthworks, the preferred remedial option may be altered to include the treatment of soil materials for beneficial re-use on site (where applicable), including:

- Excavate and spread for raking/picking; and
- In-situ raking and picking/screening.

Based on the information presented in historical contamination assessment reports, and AG's observations made by on site, AG concludes that the remedial goal can be achieved and the site made suitable for the proposed land use setting, subject to:

- Implementation of the strategies, methodologies and measures set out in this remedial action plan;
- Should newly identified unacceptable land contamination risks be identified during supplementary assessment works, an addendum to this RAP may be required. The addendum should be prepared by a suitably experienced environmental consultant;
- Prior to any removal of soils from site for offsite disposal during remedial works, a waste classification for soils to be disposed of should be prepared by a suitably experienced environmental consultant;
- Future remedial works should be monitored and validated by a suitably experienced environmental consultant; and
- A long-term EMP that documents all areas where residual contamination is still present on the site and all capping and isolation measures will be required. Any provisions contained in the long-term EMP will be legally enforceable and will be publicly notified.

AG recommends that remediation monitoring and validation works should be undertaken by a suitably experienced environmental consultant.

This report must be read in conjunction with the limitations set out in **Section 13**.

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LIST OF ABBREVIATIONS

A list of the common abbreviations used throughout this report is provided below:

ACM	Asbestos Containing Material
AEC	Area of Environmental Concern
AG	Alliance Geotechnical Pty Ltd
AHD	Australian Height Datum
BTEX	Benzene, toluene, ethyl benzene, xylenes
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DP	Deposited Plan
DSI	Detailed Site Investigation
EPA	Environment Protection Authority
LOR	Limit of reporting
m	metres
m^2	square metres
m bgs	metres below ground surface
mg/kg	milligrams per kilogram
NSW	New South Wales
OCP	Organochlorine pesticides
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
RPD	Relative percentage difference
TRH	Total recoverable hydrocarbons
UCL	Upper Confidence Limit

1. INTRODUCTION

1.1. Background

Alliance Geotechnical Pty Ltd (AG) was engaged by Northrop Consulting Engineers P/L on behalf of City of Parramatta, to prepare a remedial action plan (RAP) for Charles Street Square, Parramatta, NSW (refer **Figure 1** with the 'site' boundaries outlined in **Figure 2**).

AG has the following project appreciation:

- The site is proposed for redevelopment, demolition, utility adjustments, civil infrastructure, planting and urban amenities;
- Contamination assessments have been undertaken on/ adjacent to the site by EIS in 2014 and AG in 2019;
- A remedial action plan (RAP), including a Data Gap Assessment, is required to address unacceptable land contamination exposure risks identified for the site in previous contamination assessments; and
- It is understood that the clients preferred option is a combination of onsite capping/ containment and offsite removal of the contaminated materials. However, supplementary information, including further site investigations and detailed design will inform the final remedial method.

1.2. Objectives

The objective of this project is to:

- Prepare a remedial action plan to address unacceptable contamination exposure risks on the site identified in previous contamination reports, in the context of the proposed land use setting.

1.3. Scope of Work

Alliance Geotechnical undertook the following scope of works to address the project objective:

- A desktop review; and
- Data assessment and reporting.

2. SITE IDENTIFICATION

The site is identified as Portions of Lot 1 in DP506760, Lot 2 in DP532539, Lot 2 in DP869816, Lot 2 in DP532539 and Lot 1 in DP1172250.

The approximate geographic coordinates of the middle of the site, inferred from Google Earth were 33º40'19" S and 151º52'40" E.

The locality of the site is set out in **Figure 1**.

The general layout and boundary of the site is set out in **Figure 2**.

The site covers an area of 3,665m^2.

A copy of the proposed development plans are presented in **Appendix A**.

3. GEOLOGY, ACID SULFATE SOILS, TOPOGRAPHY AND HYDROGEOLOGY

3.1. Geology

AG (2019a) reported that the Geological Survey of NSW /Department of Mineral Resources Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1) 1983, indicated that the site is likely to be underlain by Wianamatta Group (Rwa) Ashfield Shale, defined as black to dark grey shale and laminite.

3.2. Acid Sulfate Soils

AG (2019a) reported that a review of the Department of Land and Water Conservation NSW Acid Sulfate Soil Risk Map for Prospect / Parramatta (1:25,000 scale) indicated that the site lies within two different areas mapped as:

1. **Disturbed Terrain** (Section 2) which may include filled areas, which often occur during reclamation of low-lying swamps for urban development. Other disturbed terrain includes areas which have been mined or dredged, or have undergone heavy ground disturbance through general urban development or construction of dams or levees. Soil investigations are required to assess these areas for acid sulfate potential.

2. **No Known Occurrence** (Section 5 and 7) for which Acid sulfate soils are not known or expected to occur in these environments. Land management activities are not likely to be affected by acid sulfate soil materials. The typical landform types include bedrock slopes, elevated Pleistocene and Holocene dunes, and elevated alluvial plains.

The Parramatta City Council LEP 2011 Acid Sulfate Soils Map Sheet ASS_010 has the site listed as:

Class 4: Development consent is required for the carrying out of works more than 2 metres below the natural ground surface; and works by which the water table is likely to be lowered more than 2 metres below the natural ground surface.

As potential acid sulfate soils were encountered at BH03 within AG (2019b), AG considers a further, standalone assessment of acid sulfate soils in the context of this investigation is warranted, in the form of an Acid Sulfate Soils Assessment.

3.3. Topography

The site topography slopes from the southwest (RL7.9m) to the northeast (RL2m).

3.4. Hydrology & Hydrogeology

AG (2019a) reported that surface water courses proximal to the site included the Parramatta River immediately adjacent to the site along the northern boundary.

Based on the vicinity of this surface water course and the site topography, groundwater flow in the vicinity of the site is inferred likely to be in a northerly direction.

4. PREVIOUS CONTAMINATION ASSESSMENTS

The following reports were considered during the undertaking of this project:

- Environmental Investigation Services (EIS) 2014, 'Asbestos Management Plan' , dated August 2014, ref: E27279Krpt2-AMP;
- AG (2019a), 'Preliminary Site Investigation, Charles Street Square, Parramatta NSW', dated August 2019, ref: 7957-ER-1-1 Rev01; and
- AG (2019b), 'Stage 2 Detailed Site Investigation, Charles Street Square, Parramatta NSW', dated June 2020, ref: 7957-ER-2-1_Rev01;

A summary of these reports is presented in **Section 4.1 to 4.3**.

4.1. EIS 2014

EIS were commissioned by City of Parramatta to prepare an asbestos management plan (AMP) for a proposed boardwalk and landscaping project along two sections of Parramatta River foreshore.

The two sections of land of which the AMP was subject to, were summarised in the AMP, and the extract is shown below:

***"East Section**: The proposed development for the east section of the site includes two main parts:*

- *An elevated boardwalk approximately 260m in length from the Charles Street weir heading east; and*
- *A track along the floodplain of the river on either side of the Gasworks Bridge, approximately 130m in length, in which ground levels are to be reduced to form a salt marsh environment.*

***West Section:** The proposed development for the west section of the site involves naturalising the banks of the Parramatta River between the Charles Street weir and the Elizabeth Street footbridge by removing the existing concrete canal and terracing the banks. Additionally, it is proposed to replace the existing stairwell on the northern embankment slightly to the west of the Elizabeth Street footbridge and to construct a new stairway from the river walk up to the bridge on the southern side of the embankment, on the eastern side of the Elizabeth Street Footbridge."*

AG notes that above sections that the AMP was subjected to are mostly outside of AG's site boundary and do not impact, in the context of land contamination, this DSI. However, boreholes BH24 and BH25 of the west section fall on the western boundary of the AG subject site.

Based on the above and review of EIS 2014, AG notes that EIS 2014 boreholes BH24 and BH25 were not reported to contain contamination. In relation to asbestos contamination, EIS 2014 made the following recommendation for locations that were not impacted by asbestos:

"For all remaining site areas of the site not impacted by asbestos we recommend a program that monitors the condition of the site soil for the potential presence of asbestos. We recommend that the monitoring program is undertaken for the duration of the site works involving excavation and disturbance of in-situ soil.

We recommend that the following monitoring program is undertaken:

- *Intermittent air monitoring during large scale earthworks. This may include one round of monitoring at the commencement of significant earthworks in a selected area. Provided the results are negative for the first round of monitoring, other monitoring events could be undertaken once a week;*
- *Site inspections should be undertaken by the licenced asbestos assessor once significant earthworks have been undertaken at a selected area and the surface soils have been*

exposed and are easily inspected. Inspections should also be undertaken where required, for instance if the earthworks contractor encounters potential asbestos material; and

- *We recommend that soil sampling is undertaken at the time of the site inspection following significant earthworks in order to screen the soil for any microscopic or trace amounts of asbestos material within the soil matrix. The soil sampling density would be judgemental and dependent on-site conditions and the nature of proposed landscape works in the given area.*

In the event any asbestos is identified by soil or air analysis the area would be subject to conditions associated with asbestos removal. Management options would be provided on an on-going basis by the licenced asbestos assessor.

The exact nature of the monitoring program should be clarified with Council prior to site works commencing.

For the areas of the site not impacted by asbestos we recommend that dust levels are suppressed, the site surface is kept damp and personal hygiene is kept to a high standard."

4.2. AG (2019a)

The main objective of this investigation was to assess the potential for soil and groundwater contamination on the site, based on a review of site setting and past land uses (i.e. site history). The scope of works comprised reviews of available desktop information (refer to **Sections 2.3 to 2.6**) and a site walkover inspection, designed to observe landscape characteristics and check for indicators of actual/potential contamination and preparation of a final report.

Table 4.1: AEC & COPC

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
AEC01	Imported fill materials	Uncontrolled filling	Metals, PAH, TRH/BTEX, OCP, PCB, acid sulfate soils (ASS) and asbestos

Based on AG's assessment of the desktop review information and fieldwork data, in the context of the proposed development works, AG makes the following conclusions:

- One area of environmental concern (AEC01) has been identified for the site; and
- The site could be made suitable (from a land contamination perspective) for the proposed development works, subject to the further assessment of potential unacceptable contamination risks identified in AEC01.

Based on these conclusions, AG makes the following recommendations:

- Consideration should be given to the preparation of a Stage 2 Detailed Site Investigation (DSI). The Stage 2 DSI should be prepared by a suitably qualified environmental consultant;
- All fill soils proposed for excavation and offsite disposal, should be appropriately classified in accordance with relevant NSW EPA waste guidance; and
- Records of the transport and disposal of waste materials should be maintained.

4.3. AG (2019b)

The objectives of this project were to:

- Assess the potential for contamination to be present on the site as a result of past and current land use activities;

- Provide advice on whether the site would be suitable (in the context of land contamination) for the proposed land use setting; and
- Provide recommendations for further investigation, management and/or remediation (if warranted).

AG undertook the following scope of works to address the project objective:

- A desktop review of relevant information pertaining to the site;
- A site walkover to understand current site conditions;
- The preparation of a Sampling and Analysis Quality Plan (SAQP);
- Conduct an intrusive site investigation to establish ground conditions and to facilitate the collection of representative soil samples;
- Laboratory analysis of selected samples collected during the field investigation; and
- An assessment of the contamination status of the site and the recommendation of any further remedial requirements associated with the redevelopment of the site (if necessary).

The site history data collected and site walkover observations made were assessed within the objectives of this investigation and in the context of the proposed development works. The assessment identified areas of environmental concern (AEC) and contaminants of potential concern (COPC) which have the potential to be present on site. The AEC identified and associated COPC are presented in **Table 4.3**.

Table 4.3: AEC and COPC

ID	Area of Environmental Concern	Land Use Activity	Contaminants of Potential Concern
AEC01	Imported fill	Uncontrolled filling	Metals, PAH, TRH/BTEX, OCP, PCB, acid sulfate soils (ASS) and asbestos

Based on the proposed development works and guidance provided in Section 2.2 of NEPM (2013), AG considered it reasonable to adopt the 'HIL C – public open space and parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths', land use setting, for the purpose of assessing land contamination exposure risks.

Conclusions and recommendations

Based on AG's assessment of the desktop review information, fieldwork data and laboratory analytical data, in the context of the proposed redevelopment scenario, AG makes the following conclusions:

- The detected concentrations of identified contaminants of potential concern in the soils assessed are considered unlikely to present:
    - An unacceptable inhalation / vapour intrusion human health exposure risk; or
    - An unacceptable petroleum management limit risk.
- The detected concentrations of benzo(a)pyrene TEQ in the soils assessed present a direct contact human health exposure risk, at sampling locations BH3-0.1, BH4-0.1, BH5-0.1, BH5-1.0 and BH5-2.0;

- Asbestos was detected within four (4) of the eight (8) locations sampled (BH02, BH06, BH07 and BH08), and is considered to present an unacceptable human health exposure risk during the future intrusive/redevelopment works, in these locations;

- Ecological Investigation Levels were exceeded for Copper at sampling location BH7 and Zinc at sampling locations BH2, BH3 and BH7. As such, may present an unacceptable ecological exposure risk during the future intrusive/redevelopment works, in these locations;

- As the majority of the site is covered by hardstand materials and landscaped areas, and that the detected contaminants in soil were located at depth and will not be disturbed until commencement of redevelopment works, AG considers that there is no immediate human health risk to occupants of surrounding areas, as well as nearby pedestrians; and

- Based on the assessments undertaken as part of this investigation, AG has concluded that the site can be made suitable for the proposed redevelopment pending supplementary contamination assessment and subsequent remediation of the aforementioned exceedances of the adopted site assessment criteria.

Based on these conclusions, AG makes the following recommendations:

- A supplementary contamination assessment should be carried out to determine the extent of contamination within areas of detected contamination, with regard to the asbestos and PAH contamination. The PAH concentrations exceeding the adopted criteria are likely associated with black/ brown coal and coke and may pose an unacceptable exposure risk via direct contact, ingestion and inhalation. Considerations should be given to further assessment of soils for the leachability characteristics of the PAH soil contamination and assessment of groundwater that may have been potentially impacted by the overlying fill materials. An appropriate asbestos assessment should be completed in accordance with WA DOH 2009 with considerations should be made to allow for test pit exploration excavations, in order to adequately quantify the asbestos exposure risk;

- Remediation will require the completion of a Remedial Action Plan (RAP) detailing the works required to adequately delineate, remediate and validate the areas of identified contamination;

- Following remediation of the identified contamination, validation sampling and a site validation report will be required to confirm the effectiveness of the remedial works;

- Investigation of Acid Sulfate Soils (ASS) for any soil proposed for excavation / disposal at or below 2.0 metres bgl; and

- Any soil proposed for disposal should be classified and disposed of as per the NSW EPA *Waste Classification Guidelines 2014.*

5. ADDITIONAL ASSESSMENT PRIOR TO REMEDIATION

5.1. Detailed Gravimetric Assessment (AEC02)

Site conditions and restrictions encountered in the previous investigations limited AG to borehole drilling at the site and therefore appropriate gravimetric assessment, in accordance with ASC NEPM (2013), could not be conducted.

In lieu of the above, and subsequent review of the proposed development, the cut and fill earthworks plan and the potential for a proposed capping strategy, the underlying fill materials at the site are assessed to require gravimetric assessment.

Based on the above and in accordance with ASC NEPM (2013) and Western Australia, Department of Health *'Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites'* May 2009 (WA DOH 2009), AG proposes the following additional assessment/ sampling plan for the site:

- The collection of 10L samples, which is required every 1m from surface (commencing with the top 100mm of soil) to the base of the fill materials in nominated areas. At every sampling point the materials will be spread/ screened onsite to observe ACM. The fragments observed will be collected and weighed onsite and subsequently sent to the laboratory for weight confirmation and asbestos content. A 500mL sub-sample will be collected from the 10L bucket and weighed (prior to screening/ spreading) for asbestos quantification testing (AF/FA);
- Based on Appendix A of WA DOH, 2009, a minimum of eleven (11) sampling points is required for assessment of asbestos contamination based on an area of approximately 3,665m^2. However, based on Table 1 of WA DOH 2009 (Triggers and Types of Asbestos Investigations), if there is known asbestos at the site, the sampling density is then doubled to account for confirmation and delineation of the asbestos concern;
- Intrusive investigation to the base of the fill layer in twenty-two (22) sampling points using an appropriately sized (5-tonne) excavator with 600mm diameter bucket attachment; and
- The findings of the assessment will address the data gaps and inform an addendum to the RAP prior to commencement of remediation works.

5.2. Contamination Assessment of Carcinogenic PAHs, B(a)P TEQ Impacted Soils (AEC03)

Based on the findings of AG 2019b, in the context of benzo(a)pyrene (B(a)P) TEQ contamination at the site, the following comments are made:

- Boreholes BH03, BH04 and BH05 recorded concentrations of B(a)P TEQ exceeding the adopted HIL-C criteria;
- B(a)P TEQ contamination recorded in borehole BH03 and BH05 were not vertically delineated; and
- The leachability characteristics of the identified contaminant are unknown.

Based on the above, AG recommends further delineation (vertically and laterally) assessment, be conducted at the locations which recorded B(a)P TEQ exceedances. The leachability characteristics of the soil materials impacted by PAH should also be assessed to inform the addendum to the RAP in relation to proposed remedial strategy.

5.3. Groundwater Assessment (AEC04)

Based on the known PAH contamination within the fill materials at the subject described in the above **Section 5.2**, and recommendations made in revision 1 of AG 2019b, an assessment of groundwater is required to assess the potential impact to groundwater. The following sections details the groundwater methods and COPC. Groundwater results will be compared to the relevant fresh water quality guidelines in ANZG 2018 trigger values (95% species protection level).

5.3.1. Groundwater Monitoring Well Installation Methodology

Three (3) groundwater monitoring wells (MW01 to MW03) will be installed on the site to target these off-site locations. It is proposed that two (2) of the monitoring wells will be installed along the northern boundary with the third monitoring well installed along the southern western boundary. The wells will be extended to a target depth of 6m below ground surface or 2m below inferred standing water level, using the soil borehole drilling rig fitted with solid stem augers.

Each monitoring well will be constructed using 50mm Class 18 PVC machine slotted screen (likely screened from 2.5m to 6.0m bgl) and casing, gravel pack from the base to approximately 0.5m above the top of the screen, followed by approximately 0.5m of hydrated bentonite, grout to the surface and a lockable cast iron road box or lockable monument.

5.3.2. Sampling Method – Groundwater

The sampling methods set out in **Table 5.3.2** will be used on this project. These methods are based on a number of factors that are relevant to this project, based on site history, and include:

- The identified COPC;
- The assessed laydown mechanisms for COPC in groundwater;
- The assessed likely lateral and vertical extent of potential contamination in groundwater; and
- Constraints on site which may restrict the use of certain sampling techniques.

Based on the above, it is considered reasonable to adopt a sampling plan comprising of 3 groundwater wells drilled as per **Table 5.3.2** overleaf:

Table 5.3.2. Groundwater Sampling Plan

ID	Location	Sampling Point ID	Method of Well Construction	Method of Sampling	Target Depth (m bgl)
AEC04 (included in revised CSM)	Along the northern boundary of the site and south western boundaries of the site	MW01 to MW03	Mechanical drilling using a drill rig fitted with solid stem auger, 50mm uPVC class 18 screen and casing, gravel pack, hydrated bentonite seal, concrete and standpipe sticking above ground. The screens will be placed across permeable horizon and appropriately gravel-packed and sealed.	Low flow sampling – groundwater is extracted from the well at a rate <500mL/min, so that drawdown of water is minimised. Water quality meters will be used for stability to indicate the change from stagnant well water to representative formation water. The depth of sampling will be the mid-way point of the water column. Field filtering will	Target depth of 6m or 2m below inferred standing water level or practical refusal, whichever occurs first

			be undertaken using WAT45 filters for metals analysis.

Should this assessment determine that groundwater is impacted by contamination, it is recognised that additional groundwater monitoring wells may be required in order to fully delineate potential contamination impacts across the site.

5.3.3. Laboratory Analytical Schedule

Samples scheduled for laboratory analysis will be selected based on the following:

- TRH/BTEX/ PAH, and metals analysis – samples will be collected from all groundwater wells.

The proposed laboratory analytical schedule (including upper limiting sample quantities) for the project is set out in **Table 5.3.3.**

Table 5.3.3. Laboratory analytical schedule

Analyte	Holding Time	Method	LOR (ug/L)
BTEX and TRH C6-C10	14 days	USEPA 5030, 8260B and 8020	1-2
TRH C10-C40	14 days	USEPA 8015B & C	50-200
PAH	30 days	USEPA 8270	0.1
Metals	6 months	USEPA 8015B & C	0.1-5.0

6. REVISED CONCEPTUAL SITE MODEL

6.1. Areas of Environmental Concern and Contaminants of Potential Concern

Previous contamination investigations were assessed within the objectives of this project and in the context of the proposed development works. That assessment identified the following areas of environmental concern (AEC) and contaminants of potential concern (COPC) which either require assessment, further assessment, and/or remediation.

The AECs have been updated to reflect a consolidated summary of known site contamination identified to date and is presented in **Figure 4** and associated COPC are presented in **Table 6.1**.

Table 6.1. AEC and COPC

Area of Environmental Concern	Contaminant of Potential concern	Media	Receptor	Potential Exposure Pathway
AEC01	TRH, BTEX, PAH, OCP. PCB, Acid sulfate soils and asbestos	Soil	Site Users and Visitors. Future Construction and maintenance personal.	Direct contact and/or ingestion, Inhalation and terrestrial – ecological
AEC02	Asbestos	Soil	Site Users and Visitors. Future Construction and maintenance personal.	Inhalation
AEC03	PAH (BaP TEQ) and associated leachability characteristics	Soil	Site Users and Visitors. Future Construction and maintenance personal.	Direct contact and/or ingestion
AEC04	TRH/BTEX/PAH, and metals	Groundwater	Future site occupants	Inhalation and/ or aquatic ecosystem

7. INTERIM SITE MANAGEMENT PLAN

Based on the findings of the previous contamination assessments and in order to manage risk to human health prior to commencement of remedial works, AG recommends the following interim site management requirements with regards to known asbestos contamination at the site:

- Access to known asbestos impacted soils near surface (i.e. BH06) should be restricted; and
- Steps should be taken to ensure that the maintenance of grass in such areas is limited to the extent as possible. This may include spraying the asbestos impacted areas (near surface) with herbicides so that further mowing of grass and weed control is not required; and
- No intrusive works or disturbance to in-situ soils within the known areas of contamination to be conducted prior to work associated with remediation of the site.

8. REMEDIAL ACTION PLAN

8.1. Remedial Goal

The remedial goal for this site is to remediate potential soil contamination (where identified) to a level that does not present an unacceptable human health exposure risk, based on the proposed land use setting. AG notes that the client would prefer that the remedial works be undertaken in a manner that does not result in the need for:

- Notation on a planning certificate for the site;
- A covenant registered on the title to the land; or
- A long-term environmental management plan (EMP).

8.2. Remediation Extent

The known extent of remediation on the site is considered to be the following:

- AEC01 – fill materials within the site footprint

8.3. Remediation Options

Based on the extent of the remediation identified in Section 8.2, and the proposed site redevelopment works, remedial options considered appropriate for this site include:

- In-situ containment by capping;
- Excavation and containment by capping;
- Excavation and removal off site;
- Excavate and spread for raking/picking; and
- In-situ raking and picking/on-site treatment.

8.4. Preferred Remediation Option

Taking into consideration the client's objectives for the site, and the nature and extent of the proposed site redevelopment works, the preferred remedial option for the site is:

- AEC01 – containment by capping/ containment or excavation and offsite disposal.

8.5. Sequence of Works for Remediation

8.5.1. Remediation Schedule

It is anticipated that remediation works will likely be completed in 1-2 months. It is expected that remediation timeframes will be further refined following the supplementary investigation. the appointment of the remediation contractor, and the staging of the remediation tasks in the contractor's works program.

8.5.2. Notifications and Approvals

As per clause 16 of SEPP 55, notification of an intention to undertake remediation works on the site, will be submitted by the remediation contractor to the City of Parramatta, 30 days prior to remediation works commencing. The proposed remediation works would likely be classed as Category 2 under SEPP55, which do not require consent from the local authority.

The following information will also be provided to the City of Parramatta, 14 days prior to the commencement of remediation works:

- Copies of the contamination assessment reports and the approved RAP;
- Contact details of the contractor appointed to undertake the remediation works; and
- Contact details of the parties responsible (if not the remediation contractor) for ensuring remediation works comply with relevant regulatory requirements.

A notification will be submitted to SafeWork NSW prior to undertaking asbestos removal works (where applicable). The removal works will be undertaken by a suitably licensed contractor.

It is noted that:

- As remedial works will likely require demolition, excavation or shoring, development consent or a construction certificate will be required from the Local Authority/ Private Certifier; and
- As remedial works are proposed to occur adjacent to Transport for New South Wales (TfNSW) controlled asset, further consultation and approval may be needed to address TfNSW requirements. It is expected that any such requirements would be identified by Council during the 30-day notification period.

Within one month of completion of remediation and validation works, a notification will be submitted to the planning consent authority.

8.5.3. Structural Stability

The structural stability of walls, footings and other structures, which may be affected by the remedial works, will be assessed by a suitably experienced consultant, prior to remedial works commencing, and the structural consultant's recommendations considered during execution of remedial works.

8.5.4. Demolition

A hazardous building materials survey will be undertaken of the structures on site, to identify the potential for hazardous materials (e.g. asbestos, lead paint, PCBs) to be present in those structures. If found, hazardous materials will be stabilised and/or removed from site, and a clearance certificate obtained from a suitably experienced occupational hygienist, prior to demolition works of the structures commencing. The remediation contractor will retain transport and disposal records for all hazardous materials removed off site.

Above ground structures and hardstand pavements will be demolished by a suitably licensed contractor, and associated wastes removed from site for recycling and/or disposal. The remediation contractor will retain transport and disposal records for all demolition wastes removed off site.

8.5.5. Remediation Works

8.5.5.1. AEC01 – Fill materials across the site.

Following completion of demolition works of above-ground structures and pavements, the lateral extents of the AEC will be set out by an appropriately experienced environmental consultant. Fill soils across the AEC will be either excavated and removed from site, for offsite disposal, pending waste classifications being carried out, or contained onsite by method of capping. The depth of potential excavation, based on previous contamination assessments is likely to range between nominal depths of 2.0 and 2.5m below ground surface level (BGSL).

The remediation contractor will retain transport and disposal records for all wastes removed off site, if necessary.

As potential acid sulfate soils were encountered at BH03 within AG (2019b), AG considers a further, standalone assessment of acid sulfate soils in the context of this investigation is as warranted, in the form of an Acid Sulfate Soils Assessment.

The validation strategy for the residual soils is set out in **Section 9.7**.

8.5.6. Backfilling

Should remedial excavations require backfilling (including capping material), then backfill soils will be limited to:

- Virgin excavated natural material (VENM);
- Excavated natural material (ENM); or
- Other material that is the subject of a resource recovery exemption and the placement of that material is within the lawful constraints of the resource recovery exemption (and does not present an unacceptable exposure risk to human health or the environment, within the context of the proposed land use setting).

Consideration will be given to geotechnical engineering requirements associated with backfilling; however, those requirements will be specified by others elsewhere.

8.5.7. Remediation Contingency Plan

Remediation works have an inherent degree of uncertainty. Based on the site history information made available, and AG's experience with comparable projects, AG considers the situations set out in **Table 8.5.7** may be encountered during remediation works. Contingency plans for those situations are also presented in **Table 8.5.7.**

Table 8.5.7 Remediation Contingency Plan

Situation	Continency Plan
Groundwater	**Primary Treatment** - If required, a groundwater treatment system will be installed to provide primary treatment of the extracted groundwater and the system must provide the following capabilities: • A baffled treatment tank (6kL minimum capacity); • Automated inline chemical dosing systems for the addition of pH buffering solutions, coagulants and flocculants; • Data logging capabilities for recording pH levels; • Flow meter capable of real-time flow and total flow rates; and • Emergency response alarms for non-routine situations. The primary treatment system should be sized to provide a minimum of ten minutes contact for the initial chemical dosing, prior to secondary treatment using a sedimentation tank. Calibration of pH loggers fitted in the groundwater treatment system must be undertaken at least weekly whilst the system is operational. **Secondary Treatment** - If required, a sedimentation tank will be utilised to provide additional residence time allowing deposition of the coagulated materials. The sedimentation tanks should provide a minimum of 30 minutes residence time to assist with the reduction of sediment and dissolved metals. **Hydrocarbon Treatment** - If hydrocarbon concentrations are detected in the assessment and during pre-discharge monitoring, a sedi-sparge treatment system will be installed, in order to provide final treatment of the extracted groundwater. This system should be designed to: • The removal of solids via sedimentation; • The separation of light non-aqueous phase liquids (LNAPL); • The skimming of separated LNAPLs from the top of the water surface via gravity or pumping into appropriately rated storage vessels; and • The stripping of VOCs from contaminated groundwater. The above system injects pressurised air into the bottom of the tank causing VOCs in the liquid phase to be transferred to the vapour phase. VOC bubbles are then separated from the water and vapours are treated using carbon adsorption. This process can be repeated, if required, resulting a significant reduction in volatile contaminants in the water. **Activated Carbon Filtration** - Activated carbon filtration may be adopted if detectable organic contaminants concentrations are identified during pre-discharge monitoring. Activated carbon filtration operates by the adsorption of organic compounds onto the surface of the filter media, with a broad-spectrum adsorptive capacity which is capable of retaining most organic molecules. **Discharge of Extracted Groundwater** - If required, the extracted groundwater will be pumped via the adopted groundwater treatment system to the existing stormwater network which discharges to Parramatta River. Each point of discharge must be approved by City of Parramatta and Sydney Water prior to commencement of dewatering.

Unexpected potential contamination or underground structures encountered during remediation (e.g. underground storage tank, underground pit).	Consider excavation of test pits / trenches to assess potential for contamination to be present. Remove underground structures (if required) and associated soil contamination (if required). Consider groundwater assessment, subject to nature and extent of identified soil contamination. Amendment to the preferred remedial strategy (if required), pending the outcomes of the assessment of the unidentified contamination.
Unexpected finds/potential asbestos containing materials (ACM) observed in soil materials.	Stop work. Analyse sample/s of potential ACM. Subject to results, commence relevant SafeWork NSW notifications, engage an occupational hygienist, proceed to screen the soil materials with reference to Table 4 in *WA DOH* 2009 depending on the nature/extent of the asbestos find and implement asbestos validation for retained fill material as per **Table 9.7.1**.

9. VALIDATION DATA QUALITY OBJECTIVES

Appendix B of NEPM ASC (2013) provides guidance on the development of data quality objectives (DQO) using a seven-step process.

The DQO for this project are set out in **Sections 9.1** to **9.7** of this report.

9.1. Step 1: State the problem

The first step involves summarising the contamination problem that will require new data and identifying the resources available to resolve the problem.

The objective of this project is to assess whether the remedial goal has been achieved, and whether the site presents an unacceptable human health exposure risk, for the proposed land use setting.

This project is being undertaken because:

- The site is the subject of redevelopment works; and
- Historically identified areas of environmental concern on the site, have the potential to present an unacceptable human health exposure risk in the context of the proposed land use setting.

The project team identified for this project includes Alliance Geotechnical Pty Ltd, the designers, the nominated remediation contractor and the landowner.

The regulatory authorities identified for this investigation include NSW EPA and the City of Parramatta.

9.2. Step 2: Identify the decision/goal of the study

The second step involves identifying decisions that need to be made about the contamination problem and the new environmental data required to make them.

The decisions that need to be made during this investigation include:

- Is the environmental data collected for the project, suitable for assessing relevant land contamination exposure risks?
- Do the concentrations of identified contaminants of potential concern (COPC) present an unacceptable exposure risk to identified receptors, for the proposed land use setting?
- Is the site suitable for the proposed land use setting, in the context of land contamination?

9.3. Step 3: Identify the information inputs

The third step involves identifying the information needed to support decisions and whether new environmental data will be needed.

The inputs required to make the decisions set out in **Section 9.2** for this investigation, will include:

- Data obtained during searches of the site's history;
- The nature and extent of sampling at the site, including both density and distribution;
- Samples of relevant site media;
- The measured physical and/or chemical parameters of the site media samples (including field screening and laboratory analysis, where relevant); and
- Assessment criteria adopted for each of the media sampled.

Taking into consideration the objectives of this investigation, and the conceptual site model and land use setting presented in **Section 6** of this report, the assessment criteria relevant to the proposed land use setting have been adopted for this investigation:

- Human health direct contact – HILs in Table 1A (1) in NEPM ASC (2013);
- Human health (asbestos) – absence / presence for preliminary screening, and no visible ACM on surface;
- Ecological Investigation and Screening Levels as calculated per NEPM ASC 2013 Table 1 (B) 1-6;
- CRC CARE 2017, *Risk-based management and remediation guidance for benzo(a)pyrene*, CRC CARE Technical Report No.39, CRC for Contamination Assessment and Remediation of the Environment, Newcastle Australia; and

- Aesthetics – no highly malodorous site media (e.g. strong residual petroleum hydrocarbon odours, hydrogen sulphide in site media, organosulfur compounds), no hydrocarbon sheen on surface water, no discoloured chemical deposits or soil staining with chemical waste other than of a very minor nature, no large monolithic deposits of otherwise low risk material (e.g. gypsum as powder or plasterboard, cement kiln dust), no presence of putrescible refuse including material that may generate hazardous levels of methane such as a deep-fill profile of green waste or large quantities of timber waste, and no soils containing residue from animal burial (e.g. former abattoir sites).

9.4. Step 4: Define the boundaries of the study

The fourth step involves specifying the spatial and temporal aspects of the environmental media that the data must represent to support decisions.

The spatial extent of the project will be limited to the site as defined by its boundaries.

The temporal boundaries of the project include:

- The project timeframes presented in the AG proposal for this project, and subsequent remediation contractor works program;
- Unacceptable weather conditions at the time of undertaking fieldwork, including rainfall, cold and/or heat;
- Access availability of the site (to be defined by the site owner/representative); and
- Availability of AG field staff (typically normal daylight working hours, Monday to Friday).

The lateral extent that contamination is expected to be distributed across, based on the conceptual site model, is defined by the inferred boundaries of the areas of environmental concern (AEC).

The vertical extent that contamination is expected to be distributed across, based on the conceptual site model and the project scope, is limited to base of fill material.

The scale of the decisions required will be based on the entire site.

Constraints which may affect the carrying out of this investigation may include access limitations, presence of above and below ground infrastructure, and hazards creating health and safety risks.

9.5. Step 5: Develop the analytical approach (or decision rule)

The fifth step involves defining the parameter of interest, specifying the action level, and integrating information from Steps 1 to 4 into a single statement that gives a logical basis for choosing between alternative actions.

9.5.1. Rinsate Blanks

One rinsate blank will be collected and scheduled for analysis, for each day of sampling undertaken, if non-disposable sampling equipment was used on that day. The rinsate blank will be analysed for at least one of the analytes the sample/s collected that day are being scheduled for analysis for (with the exception of asbestos).

9.5.2. Trip Spikes and Trip Blank Samples

One trip spike and trip blank sample will be used and scheduled for analysis, for each day of sampling undertaken, if site samples being collected that day are being analysed for volatile contaminants of concern (typically BTEX and/or TRH C_6-C_{10}).

9.5.3. Field Duplicates and Field Triplicates

Field duplicate and Field triplicates will be collected at a rate of one per twenty (5%) site samples collected. The duplicates and triplicates collected will be analysed for at least one of the analytes that the parent sample of the duplicate/triplicate is being scheduled for analysis for (with the exception of asbestos).

The relevant percent difference (RPD) of concentrations of relevant analytes, between the parent sample and the duplicate/triplicate will be calculated.

9.5.4. Laboratory Analysis Quality Assurance / Quality Control

The analytical laboratory QA/QC program will typically include laboratory method blank samples, matrix spike samples, surrogate spike samples, laboratory control samples, and laboratory duplicate samples.

9.5.5. If/Then Decision Rules

AG has adopted the following ‘if/then’ decision rules for this investigation:

- If the result of the assessment of field data and laboratory analytical data is considered acceptable, then that field data and laboratory analytical data is suitable for interpretation within the scope of this investigation; and
- If the field data and laboratory analytical data is within the constraints of the assessment criteria adopted for this investigation (refer Section 9.3), then the contamination exposure risks to identified receptors, are considered acceptable.

In the event the assessment of field data and/or laboratory analytical data results in the data being not suitable for interpretation, then AG will determine if additional data is required to allow interpretation to be undertaken.

In the event that field data and/or laboratory analytical data exceeds the assessment criteria adopted for this investigation (refer **Section 9.3**), AG will undertake an assessment of the exceedance in the context of the project objectives to determine if additional data is required and whether management and/or remediation is required.

9.6. Step 6: Specify the performance or acceptance criteria

The sixth step involves specifying the decision maker’s acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainties in the data. When assessing contaminated land, there are generally two types of errors in decision making:

- Contamination exposure risks for a specific land use setting are acceptable, when they are not; and
- Contamination exposure risks for a specific land use setting are not acceptable, when they are.
- AG will mitigate the risk of decision error by:
- Calculation of the 95% upper confidence limit (UCL) statistic to assess the mean concentration of relevant contaminants of potential concern;
- Assignment of fieldwork tasks to suitably experienced AG consulting staff, and suitably experienced contractors;
- Assignment of laboratory analytical tasks to reputable NATA accredited laboratories;
- Assignment of data interpretation tasks to suitably experienced AG consulting staff, and outsourcing to technical experts where required.

AG will also adopt a range of data quality indicators (DQI) to facilitate assessment of the completeness, comparability, representativeness, precision and accuracy (bias).

Table 9.6.1 – Data Quality Indicators

Completeness

Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Critical locations sampled	Refer **Section 9.7.1**	Critical samples analysed according to DQO	Refer **Section 9.7.6**
Critical samples collected	Refer **Section 9.7.1**	Analytes analysed according to DQO	Refer **Section 9.7.6**
SOPs appropriate and complied with	100%	Appropriate laboratory analytical methods and LORs	Refer **Section 9.7.6**
Field documentation complete	All sampling point logs, calibration logs and chain of custody forms	Sample documentation complete	All sample receipt advices, all certificates of analysis
		Sample extraction and holding times complied with	Refer **Section 9.7.7**

Comparability

Field Considerations	Assessment Criterion	Laboratory Considerations	Assessment Criterion
Same SOPs used on each occasion	100%	Same analytical methods used by primary laboratory	Refer **Section 9.7.7**
Climatic conditions	Samples stored in insulated containers with ice, immediately after collection	Same LORs at primary laboratory	Refer **Section 9.7.7**

Same types of samples collected, and handled/preserved in same manner	All soil samples same size, all stored in insulated containers with ice	Same laboratory for primary sample analysis	All primary samples to SGS Environmental
		Same analytical measurement units	Refer **Section 9.7.7**

Representativeness

Field Considerations	**Assessment Criterion**	**Laboratory Considerations**	**Assessment Criterion**
Appropriate media sampled according to SAQP	Refer **Section 9.4**	Samples analysed according to SAQP	Refer **Section 9.7.6**
Media identified in SAQP sampled	Refer **Section 9.4**		

Precision

Field Considerations	**Assessment Criterion**	**Laboratory Considerations**	**Assessment Criterion**
Field duplicate / triplicate RPD	Minimum 5% duplicates and triplicates No limit for analytical results <10 times LOR 50% for analytical results 10-20 times LOR 30% for analytical results >10 times LOR	Laboratory duplicates	No exceedances of laboratory acceptance criteria
SOPs appropriate and complied with	100%		

Accuracy (bias)

Field Considerations	**Assessment Criterion**	**Laboratory Considerations**	**Assessment Criterion**
Rinsate blanks	Less than laboratory limit of reporting	Laboratory method blank	No exceedances of laboratory acceptance criteria
Field trip spikes	Recoveries between 60% and 140%	Matrix spike recovery	No exceedances of laboratory acceptance criteria

Field trip blanks	Analyte concentration <LOR	Surrogate spike recovery	No exceedances of laboratory acceptance criteria
		Laboratory control sample recovery	No exceedances of laboratory acceptance criteria

9.7. Step 7: Develop the plan for obtaining data

The seventh step involves identifying the most resource effective sampling and analysis design for generating the data that is required to satisfy the DQOs.

9.7.1. Validation Sampling

Table A in NSW EPA (1995) provides guidance on minimum sampling point densities required for site characterisation, based on detecting circular hot spots by using a systematic sampling pattern. This guidance assumes the investigator has little knowledge about the probable locations of the contamination, the distribution of the contamination is expected to be random (e.g. land fill sites) or the distribution of the contamination is expected to be fairly homogenous (e.g. agricultural lands).

However, Section 3.1 of NSW EPA (1995) states that a judgemental sampling pattern can be used where there is enough information on the probable locations of contamination. Further to this, Section 6.2.1 of NEPM ASC (2013) states that the number and location or sampling points is based on knowledge of the site and professional judgement. Sampling should be localised to known or potentially contaminated areas identified from knowledge of the site either from site history or an earlier phase of site investigation. Judgemental sampling can be used to investigation sub-surface contamination issues in site assessment.

As this investigation has included gathering data which provides a reasonable understanding of site history (in the context of potential areas of environmental concern on the site), and taking into consideration Table 1 in WA DOH (2009), as well as the conclusions outlined with AG(2019b), it is considered reasonable to adopt a judgemental sampling pattern, where necessary, for each AEC.

The validation sampling arrangements for this project are presented in **Table 9.7.1**.

Table 9.7.1 Validation Sampling Methodology

Area of Environmental Concern	Validation Methodology
AEC01	**Onsite Capping -** Excavation and removal of contaminated fill material; Lateral and vertical survey pre and post cap installation to confirm the extent of each cell and the installation thickness for the overlying cap; Inspection of geotextile marker layer to confirm its adequacy as a high viz layer, and its placement; and Assessment of imported fill (VENM/ENM) prior to placement. **Offsite Removal -** Visual inspection of the surface soils, and visual assessment of whether fill soils have been removed to the appropriate extent laterally and vertically (outlined within AG (2019b)).

Area of Environmental Concern	Validation Methodology
Unexpected Finds (On-site treatment of Non-friable Asbestos)	Visual inspection of at least two manual rake passes in perpendicular direction of treated material, using a manual rake with teeth spaced <7mm apart and >10cm long, will be carried out by a licensed asbestos assessor or competent person (as per definition in SafeWork NSW 2019). Photographic record of treated soils. If any fragments of non-friable ACM are identified within the remediated material during the validation process, remedial contractor will restart remedial strategy**.** This process is to continue until remedial goal is achieved. One 10L sample collected and assessed for fragments of ACM >7mm. One (1) 500mL NEPM asbestos quantification (0.001%) (zip-lock bag) sample per 25m^3 of treated material or at least one (1) per stockpile. Soil samples will be analysed for friable asbestos (FA) / asbestos fines (AF).
Unexpected Finds (Off-site disposal of Friable Asbestos)	Visual inspection of stockpile footprint to confirm removal. One (1) 500mL NEPM asbestos quantification (0.001%) (zip-lock bag) sample per 25m^2 of footprint (minimum 3 samples). Soil samples will be analysed for friable asbestos (FA) / asbestos fines (AF). Photographic record of removal.
Waste Classification	Quantity dependent – refer to Section 7.5.2 in Schedule B2 of NEPM ASC 2013
Imported Fill – VENM	1 per 100m^3 or 3 samples per stockpile / site
Imported Fill - ENM	Quantity dependent – refer to The Excavated Natural Material (ENM) exemption for further details.
Landscaped materials	Minimum 3 samples per source analysed for metals, TRH, BTEXN, PAHs, OCPs. OPPs, PCBs and asbestos. Documentation required to confirm material has been classified with reference to a relevant exemption and is fit for purpose on site.

Classification of soils for offsite disposal is not technically a validation task for assessing site suitability. However, for the purpose of planning, fill soil waste classification sampling is quantity dependent, and reference should be made to Section 7.5.2 in Schedule B2 of NEPM ASC (2013).

If visual or olfactory observations indicated a potential for soil contamination to be present, then collection of additional validation samples will be considered.

The location of each sampling point will be marked on a site plan.

9.7.2. Identification, Storage and Handling of Samples

Sample identifiers will be used for each sample collected, based on the sampling point number and the depth/interval the sample was collected from, e.g. a sample collected from test pit TP03 at a depth of 0.2m to 0.4m below ground level, would be identified as TP03/0.2-0.4.

Project samples will be stored in laboratory prepared glass jars (and zip lock bags if collected for asbestos or acid sulfate soil assessment).

Soil samples in glass jars (and acid sulfate soil samples) will be placed in insulated container/s with ice.

Samples will be transported to the relevant analytical laboratory, with chain of custody (COC) documentation that includes the following information:

- AG project identification number;
- Each sample identifier;
- Date each sample was collected;
- Sample type (e.g. soil or water);
- Container type/s for each sample collected;
- Preservation method used for each sample (e.g. ice);
- Analytical requirements for each sample and turnaround times; and
- Date and time of dispatch and receipt of samples (including signatures).

9.7.3. Headspace Screening

Where the contaminants of potential concern include volatiles (e.g. TRH, BTEX), project soil samples will be subjected to field screening for ionisable volatile organic compounds (VOC), using a photo-ionisation detector (PID). The results of field screening will be recorded on sampling point log.

9.7.4. Decontamination

In the event that non-disposable sampling equipment is used, that equipment will be decontaminated before and in between sampling events, to mitigate potential for cross contamination between samples collected. The decontamination methodology to be adopted for this project will include:

- Washing relevant sampling equipment using potable water with a phosphate free detergent (i.e. Decon 90 or similar) mixed into the water;
- Rinsing the washed non-disposable sampling equipment with distilled or de-ionised water; and
- Air drying as required.

9.7.5. Laboratory Selection

The analytical laboratories used for this project will be NATA accredited for the analysis undertaken.

9.7.6. Laboratory Analytical Schedule

Project samples will be scheduled for NATA accredited laboratory analysis, using a combination of:

- Observations made in the field of the media sampled;
- Headspace screening results (where available); and
- The contaminants of potential concern (COPC) identified for the area of environmental concern that the sample was collected from.

Based on site history, AG has adopted the laboratory analytical schedule presented in **Table 9.7.6** for this project.

Table 9.7.6 Laboratory Analytical Schedule

AEC	Analytical Quantity
AEC01	Asbestos, Copper, Zinc, Benzo(a)pyrene, Benzo(a)pyrene (TEQ)

9.7.7. Laboratory Holding Times, Analytical Methods and Limits of Reporting

The laboratory holding times, analytical methods and limits of reporting (LOR) being used for this project, are presented in **Table 9.7.7**

Table 9.7.7 Laboratory Holding Times, Analytical Methods and Limits of Reporting

Analyte	Holding Time	Analytical Method	Limit of Reporting (mg/kg)
BTEX and TRH C_6-C_{10}	14 days	USEPA 5030, 8260B and 8020	0.2-0.5
TRH >C_{10}-C_{40}	14 days	USEPA 8015B & C	20-100
PAH	14 days	USEPA 8270	0.1-0.5
VOC	14 days	USEPA 8260	0.1-0.5
Metals	6 months	USEPA 8015B & C	0.05 – 2
Asbestos	No limit	AS4964:2004	Absence / presence
Asbestos	No limit	Inhouse Method	0.001% w/w

10. SITE VALIDATION REPORTING

At the completion of remediation works, a site validation report will be prepared with reference to the relevant sections of NSW EPA 2020. The site validation report will include:

- Document status;
- Executive summary;
- Objectives;
- Scope of work;
- Site identification;
- Site history;
- Site condition and surrounding environment;
- Previous results;
- Conceptual site model;
- Implementation of remedial action plan;
- Sampling and analysis plan and sampling methodology;
- Field quality assurance/ quality control;
- Laboratory quality assurance/ quality control;
- Quality assurance/ quality control data evaluation;
- Basis for remediation criteria;
- Validation;
- Waste management; and
- Conclusions and recommendations.

11. SITE MANAGEMENT PLAN

The following site management plan will apply during undertaking of the remediation tasks.

11.1. Soil and Stormwater Management

11.1.1. Site Access/Egress

Vehicle access and egress to the site will be stabilised to prevent tracking of sediment onto roads and footpaths. Soil, mud and other similar materials will be removed from the roadway adjacent the access/egress point by sweeping, shovelling or a means other than washing, on a daily basis, or as required.

Trucks will be loaded adjacent to the remediation excavation (where practical). Spills of excavated soil will be scraped / swept up and combined with the soil being disposed offsite.

Soil and sediment will be broomed or washed off vehicle/plant tyres and tracks, prior to vehicles/plant leaving the remediation works zone. This soil and sediment will be scraped / swept up and managed onsite or disposed of, depending on its contamination status.

A site-specific sediment and erosion control plan has been prepared by Northrop Consulting Engineers as part of the Review of Environmental Factors which includes the erosion and sediment control measures to be maintained in a functional condition. Sediment laden stormwater runoff will be controlled using measures outlined in Landcom 2004, 'Managing Urban Stormwater - Soils and Construction' (the Blue Book).

11.1.2. Stockpiles

Stockpiles of soil or other materials:

- Will not be placed on footpaths or nature strips, unless approved by Council;
- Will be placed away from gutters, stormwater pits and other drainage lines;
- Will be stored in a secure area and be covered if remaining on site for more than 24 hours; and
- Will generally be constructed as low elongated mounds on level surfaces.

11.1.3. Excavation Pump Out

Should excavations require pumping out, water will be analysed for total suspended solids, pH, metals and petroleum hydrocarbons. Should analytical results be less than relevant marine ecosystem groundwater investigation levels in ANZECC (2000), excavation water may be discharged to stormwater.

Should analytical results exceed ANZECC (2000) criteria, other options for disposal will be considered, including:

- Discharge to sewer (with prior approval from Sydney Water with a Trade Waste Agreement); and
- Removal and offsite disposal by a liquid waste contractor.

11.1.4. Rehabilitation and Landscaping

Stabilisation of exposed areas on the site, where required, will be undertaken in a progressive manner, as stages of remediation works are completed. Stabilisation will be maintained until such time as site redevelopment works commence.

As site redevelopment works are expected to be undertaken in conjunction with remediation works, revegetation of the site is considered unlikely to be required.

11.2. Waste Management

Removal of materials from site for recycling and/or disposal, will be undertaken with reference to the relevant provisions of the Protection of the Environment Operations Act (1997) and NSW EPA (2014).

The remediation contractor will maintain detailed records of materials removed from the site, including date/time of removal, quantities of materials, transport company details and vehicle registration details.

The remediation contractor will retain records verifying lawful disposal of the materials, including weighbridge / tipping dockets from the waste receiver.

11.3. Groundwater Management

Should dewatering of the site be required, development consent may be required from the planning consent authority. Dewatering may also require approvals from the NSW Department of Planning, Industry and Environment.

11.4. Noise Control

Noise levels from the site during the project will not exceed the limits indicated in AS2436-1981.

No ‘offensive noise’ as defined under the Protection of the Environment Operations Act 1997 will be created during remediation works/activities.

Plant and equipment will be fitted with noise attenuation devices (e.g. mufflers on exhausts). Consideration will be given to use of reversing alarms other than the standard pulsed tonal alarms.

Vehicle access roads will be designed in such a way to minimise the need for plant and vehicles to reverse (e.g. provision of a turning circle adjacent to the remediation works zone).

11.5. Dust Control

Dust may be generated during remediation works and associated tasks. To mitigate risk of dust emissions migrating beyond the site boundary, consideration will be given to implementing the following procedures:

- Erection of dust screens around the perimeter of the site (e.g. fencing with shade cloth attached);
- Securely covering all loads entering or exiting the site;
- Use of water sprays across the site to suppress dust;
- Covering stockpiles of contaminated soil remaining on site for more than 24 hours;
- Keeping excavation surfaces moist;
- Wetting down of placed fill material during spreading;
- Sweeping of hardstand surfaces;
- Minimising soil disturbance works during windy days; and
- Retaining stabilised site access/egress points for vehicles.

11.6. Odour Control

Generation of significant odours during the remediation works is considered to be unlikely.

If odours are generated, odours will be monitored at the site boundary. Should unacceptable odours be detected at the site boundary, consideration will be given to implementing the following procedures.

- Use of appropriate covering techniques such as plastic sheeting to cover excavation faces or stockpiles;
- Use of fine mist sprays (which may incorporate deodorizing agents);
- Use of hydrocarbon mitigating agents on impacted areas/materials; and
- Adequate maintenance of equipment and machinery to minimise exhaust emissions.

A record of unacceptable odours and corrective/preventative action taken, will be maintained by the remediation contractor.

11.7. Traffic Management

Haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site will be selected by the remediation contractor and will be meet the following objectives:

- Compliance with all traffic road rules;
- Minimisation of noise, vibration and odour to adjacent premises; and
- Utilisation of state roads and minimisation of use of local roads.

The remediation contractor will ensure that site vehicles:

- Conduct deliveries of soil, materials, equipment or machinery during the hours of remediation work identified in Section 11.13;
- Securely cover all loads to prevent dust or odour emissions during transportation;
- Exit the site in a forward direction; and
- Do not track soil, mud or sediment onto the road.

11.8. Vibration Management

Vibration emissions during remediation works will be controlled to mitigate risk of potential damage to assets on adjacent properties, and to mitigate unreasonable loss of amenity to nearby residents.

11.9. Fill Importation

Material proposed to be imported to site as engineered fill, will be limited to materials certified as:

- Virgin Excavated Natural Material (VENM); or
- Excavated Natural Material (ENM).

VENM certification will be undertaken with reference to NSW EPA (1995). ENM certification will be undertaken with reference to NSW EPA Excavated Natural Material Exemption.

The concentrations of potential contaminants in VENM and ENM proposed to be imported to site, will be less than the human health assessment criteria adopted for the site.

Imported fill will be compatible with existing soil characteristics for site drainage purposes.

The remediation contractor will maintain detailed records of all fill imported to the site, including details of the supplier, the source of the fill, the quantities of the fill, vehicle registration numbers and the dates/times the fill was received on site.

11.10. Work Health and Safety

11.10.1. Safe Work Method Statement

Each contractor and sub-contractor undertaking remediation works, or working within a remediation works zone, will prepare a project specific safe work method statement (SWMS), which will include, but not be limited to:

- The tasks to be undertaken;
- Hazards identified for each of the tasks to be undertaken;
- An assessment of risk for each hazard, considering likelihood and consequence; and
- Control measures to eliminate or mitigate risks associated with each identified hazard.

11.10.2. Personal Protective Equipment

The following minimum personal protective equipment (PPE) should be worn by all persons working in or visiting the remediation works zone:

- Long sleeves and long pants
- High visibility vests (or clothing);
- Safety boots;
- Hard hats
- Gloves; and
- Eye protection (e.g. safety glasses).

Additional PPE may be required in accordance with task specific control measures in SWMS (refer Section 11.10.1).

11.10.3. Decontamination of Personnel

Personnel undertaking remediation tasks, or entering the remediation works zone, be required to decontaminate upon exiting the remediation works zone. Decontamination procedures will include:

- Cleaning down of protective footwear (including removal of soil from the soles); and
- Washing of hands.

The following minimum personal protective equipment (PPE) should be worn by any persons the remediation works zone:

- Gloves;
- Safety boots;
- Hard hats;
- High visibility vests or clothing; and
- Safety glasses.

11.11. Site Signage

A sign will be posted on the boundary of the site, adjacent to the site access point, which will include 24-hour contact details of the remediation contractor. This sign will be maintained onsite until all remediation works are complete.

11.12. Site Security

Site security will be maintained throughout the duration of the remediation works, with appropriate boundary fencing and gate locks. Other security measures may be implemented, if the need arises.

11.13. Site Hours of Operation

It is anticipated that remediation works will be undertaken on Monday to Friday between the hours of 7:00am to 5:00pm, and Saturday between the hours of 8:00am and 1:00pm.

Remediation works are not anticipated to be undertaken outside the hours stated above, or on Sundays or public holidays. However, given the location of the site, in some instances, remediation works may be necessary outside of these working hours. Where this is anticipated, the measures outlined in Section 8.14 will be enacted.

11.14. Community Relations and Complaints

Owners, occupants and tenants of properties adjacent the site, will be provided with notification of remediation works, prior to those works commencing.

Personnel undertaking remediation works on the site, will direct all third-party communications and/or complaints to the Project Manager. The Project Manager will arrange for the communication/complaint to be assessed, a response prepared, corrective/preventative actions implemented (if necessary).

A register will be maintained on site for the recording of communications / complaints from third parties, including but not limited to, local residents and local businesses.

11.15. Emergency Preparedness

An emergency assembly point will be established at the site egress point. This point will be communicated to all site workers and visitors, during relevant site induction processes.

In the event of an emergency, site workers and visitors will assemble here and await further instructions from the site supervisor, project manager or emergency services.

Spill control kits and fire extinguishers will be located on site, as and where required.

Contact details to be used in the event of an emergency, are presented in **Section 11.16**.

11.16. Register of Contacts

A register of contacts for the project is presented in **Table 8.1**

Table 8.16 Register of Contacts

Project Role	Person	Organisation	Contact
Emergency Services	-	Fire / Police / Ambulance	000
Site Controller	-	Appointed Principal Contractor	

Project Role	Person	Organisation	Contact
Planning Consent Authority	-	City of Parramatta Council	(02) 98065524
WHS Regulatory Authority	-	SafeWork NSW	131 050
Environmental Regulatory Authority	-	NSW EPA	131 500
Remediation Contractor	-	To be advised	To be advised
Environmental Consultant	-	Alliance Geotechnical	0434 215 998

12. CONCLUSIONS

Based on the information presented in historical contamination assessment reports, and AG's observations made by on site, AG concludes that the remedial goal can be achieved and the site made suitable for the proposed land use setting, subject to:

- Implementation of the strategies, methodologies and measures set out in this remedial action plan;
- Should newly identified unacceptable land contamination risks be identified during supplementary assessment works, an addendum to this RAP may be required. The addendum should be prepared by a suitably experienced environmental consultant;
- Prior to any removal of soils from site for offsite disposal during remedial works, a waste classification for soils to be disposed of should be prepared by a suitably experienced environmental consultant;
- Future remedial works should be monitored and validated by a suitably experienced environmental consultant; and
- A long-term EMP that documents all areas where residual contamination is still present on the site and all capping and isolation measures will be required. Any provisions contained in the long-term EMP will be legally enforceable and will be publicly notified.

AG recommends that any waste classification, remediation monitoring and validation works be undertaken by a suitably experienced environmental consultant.

This report must be read in conjunction with the limitations set out in **Section 13**.

13. STATEMENT OF LIMITATIONS

The findings presented in this report are based on specific searches of relevant, government historical databases and anecdotal information that were made available during the course of this investigation. To the best of our knowledge, these observations represent a reasonable interpretation of the general condition of the site at the time of report completion.

This report has been prepared solely for the use of the client to whom it is addressed and no other party is entitled to rely on its findings.

No warranties are made as to the information provided in this report. All conclusions and recommendations made in this report are of the professional opinions of personnel involved with the project and while normal checking of the accuracy of data has been conducted, any circumstances outside the scope of this report or which are not made known to personnel and which may impact on those opinions is not the responsibility of Alliance Geotechnical Pty Ltd. Should information become available regarding conditions at the site including previously unknown sources of contamination, AG reserves the right to review the report in the context of the additional information.

This report must be reviewed in its entirety and in conjunction with the objectives, scope and terms applicable to AG's engagement. The report must not be used for any purpose other than the purpose specified at the time AG was engaged to prepare the report.

Logs, figures, and drawings are generated for this report based on individual AG consultant interpretations of nominated data, as well as observations made at the time site walkover/s were completed.

Data and/or information presented in this report must not be redrawn for its inclusion in other reports, plans or documents, nor should that data and/or information be separated from this report in any way.

Should additional information that may impact on the findings of this report be encountered or site conditions change, AG reserves the right to review and amend this report.

14. REFERENCES

AG (2019a), 'Preliminary Site Investigation, Charles Street Square, Parramatta NSW', dated 22 August 2019, ref: 7957-ER-1-1 REV01;

AG (2019b), 'Stage 2 Detailed Site Assessment, Charles Street Square, Parramatta NSW', dated 21 June 2019, ref: 7957-ER-2-1;

National Environment Protection Council (NEPC) 1999a, 'Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013';

National Environment Protection Council (NEPC) 1999b, 'Schedule B(2) Guideline on Site Characterisation, National Environment Protection (Assessment of Site Contamination) Measure (NEPM) as amended in May 2013';

NSW DEC 2006, 'Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd edition)'.

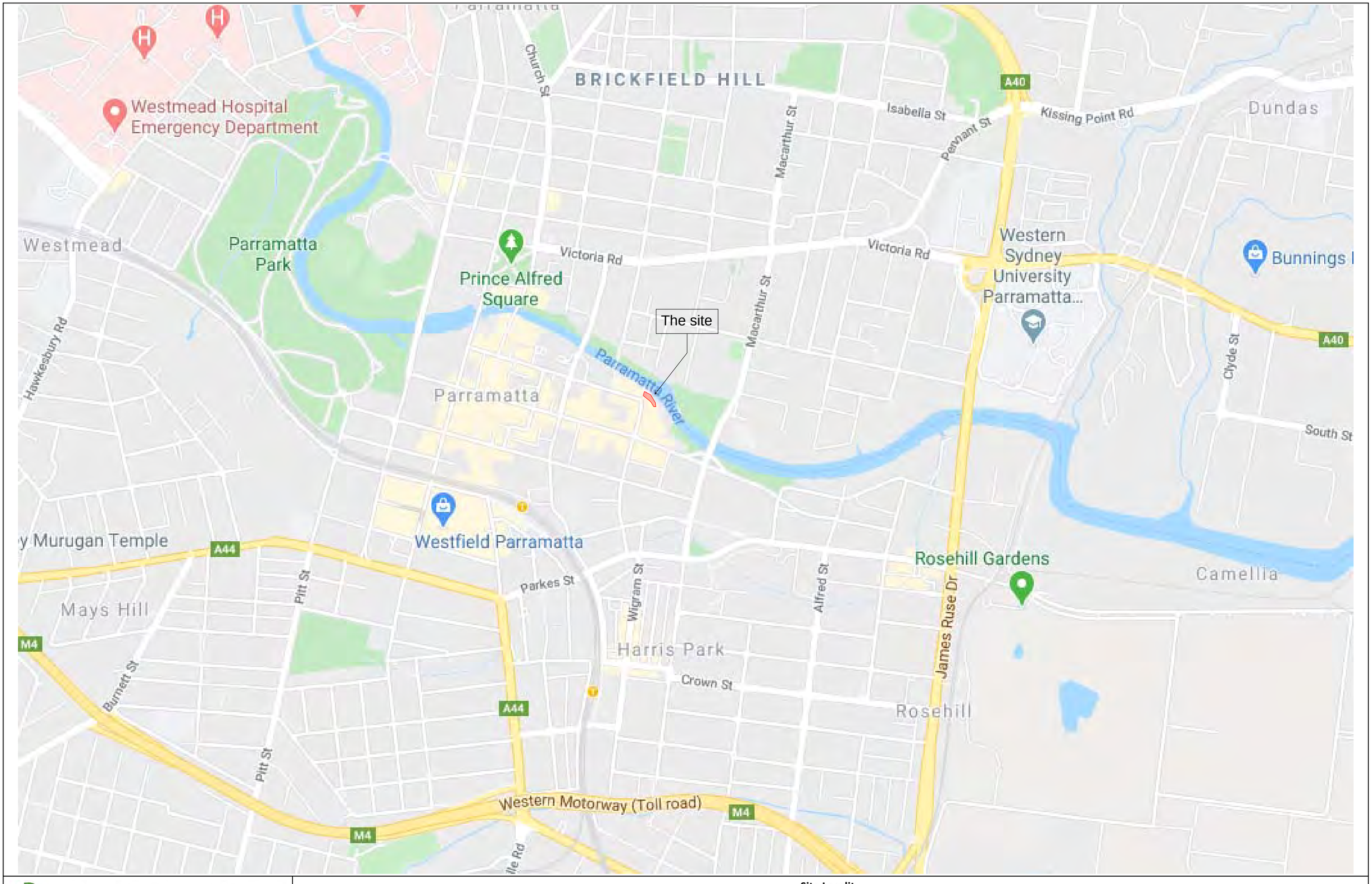
NSW EPA 1995, 'Contaminated Sites: Sampling Design Guidelines';

NSW OEH 2020, 'Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites';

CRC CARE 2017, *Risk-based management and remediation guidance for benzo(a)pyrene*, CRC CARE Technical Report No.39, CRC for Contamination Assessment and Remediation of the Environment, Newcastle Australia; and

WA DOH 2009, 'Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia' dated May 2009.

FIGURES



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Site Locality

Client Name:	Northrop Consulting Engineers P/L	N	Figure Number:	1
Project Name:	Remedial Action Plan		Figure Date:	18 June 2020
Project Location:	Charles Street Square, Parramatta NSW		Report Number:	7957ER-3-1

Source: NearMap (Nearmap.com)

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Site Layout

Client Name:	Northrop Consulting Engineers P/L	Figure Number:	2
Project Name:	Remedial Action Plan	Figure Date:	18 June 2020
Project Location:	Charles Street Square, Parramatta NSW	Report Number:	7957ER-3-1

N

Source: NearMap (Nearmap.com)

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Extent of Remediation

Client Name:	Northrop Consulting Engineers P/L	Figure Number:	3
Project Name:	Remedial Action Plan	Figure Date:	18 June 2020
Project Location:	Charles Street Square, Parramatta NSW	Report Number:	7957ER-3-1

N

Source: NearMap (Nearmap.com)

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Revised AEC's

Client Name:	Northrop Consulting Engineers P/L	Figure Number:	4
Project Name:	Remedial Action Plan	Figure Date:	22 June 2020
Project Location:	Charles Street Square, Parramatta NSW	Report Number:	7957ER-3-1

N

APPENDIX A

PROPOSED DEVELOPMENT PLANS

CHARLES STREET SQUARE

DESIGN DEVELOPMENT ISSUED FOR QS REVIEW
CIVIL ENGINEERING WORKS PACKAGE

SOURCE : NEARMAP.COM.AU (©2018)

DRAWING SCHEDULE	
DRG No.	DRAWING TITLE
C1.01	COVERSHEET, DRAWING SCHEDULE AND LOCALITY PLAN
C2.01	CONCEPT SEDIMENT AND EROSION CONTROL PLAN
C2.11	SEDIMENT AND EROSION CONTROL DETAILS
C3.01	BULK EARTHWORKS PLAN
C4.01	SITEWORKS AND STORMWATER MANAGEMENT PLAN
C5.01	UTILITY SERVICES IMPACT PLAN
C5.11	UTILITY SERVICES SECTION - SHEET 1
C5.12	UTILITY SERVICES SECTION - SHEET 2
C5.13	UTILITY SERVICES SECTION - SHEET 3

DRAWN: J.PHILLIPS DESIGNED: T.HOWE JOB MANAGER: T.HOWE VERIFIER:

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1	DESIGN DEVELOPMENT ISSUED FOR QS REVIEW	J.P		T.H	24.04.20
2	ISSUED FOR REF	D.T		T.H	22.05.20

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P.O. Box 863, Wollongong, NSW 2500
Email southcoast@northrop.com.au ABN 81 094 433 100

PROJECT: CHARLES STREET SQUARE

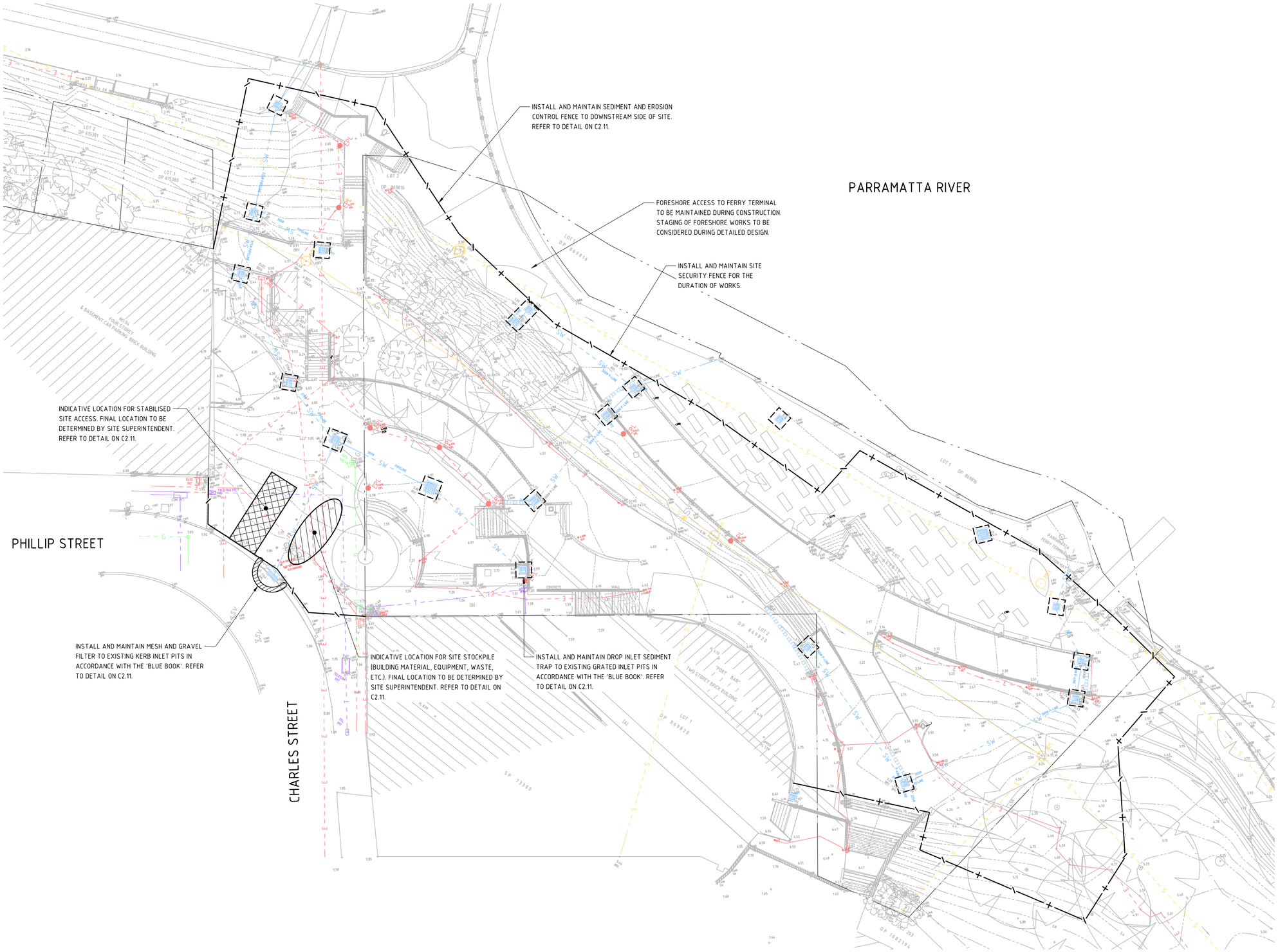
DRAWING TITLE: COVERSHEET, DRAWING SCHEDULE AND LOCALITY PLAN

JOB NUMBER: 182116

DRAWING NUMBER: C1.01 REVISION: 2

DRAWING SHEET SIZE = A1

Plotted By: dtenhave Date: 22-5-20 11:17am Found: W:\Mjobs\20th\182116 - Charles Street Square\3D-Drawings\3D-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_C101_COVERSHEET, DRAWING SCHEDULE AND LOCALITY PLAN.dwg



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PROJECT: CHARLES STREET SQUARE

DRAWING TITLE: CONCEPT SEDIMENT AND EROSION CONTROL PLAN

JOB NUMBER: 182116

DRAWING NUMBER: C2.01

REVISION: 2

DRAWING SHEET SIZE = A1

DRAWN: J.PHILLIPS
DESIGNED: T.HOWE
JOB MANAGER: T.HOWE
VERIFIER:

Found: W:\#jobs\2018\182116 - Charles Street Square\3D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_C2.01_CONCEPT SEDIMENT AND EROSION CONTROL PLAN.dwg
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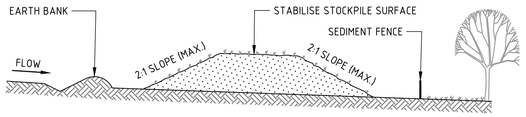
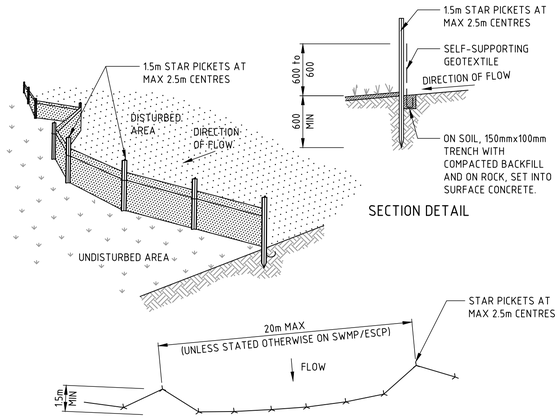


CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2m (PREFERABLY 5m) FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE.

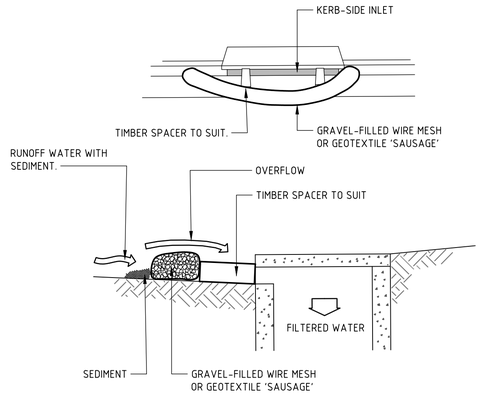
STOCKPILE
SD4.1



CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN IN THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50 LITRES PER SECOND IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. DRIVE 1.5 METRE LONG STAR PICKETS INTO GROUND AT 2.5 METRE INTERVALS (MAX) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.

SEDIMENT FENCE - LANDSCAPED AREAS
SD6.8

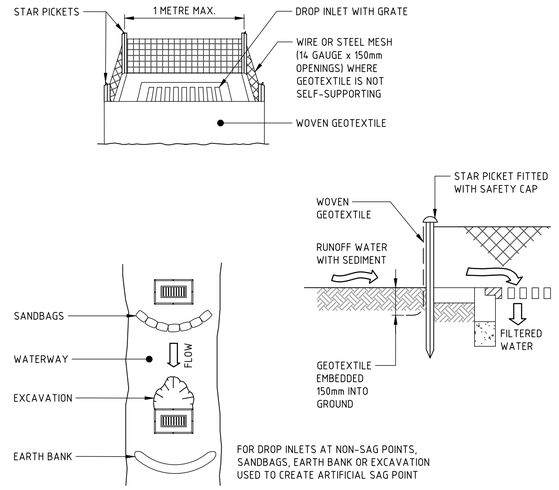


NOTE:THIS PRACTICE ONLY TO BE USED WHERE SPECIFIED IN APPROVED SWMP/ESCP.

CONSTRUCTION NOTES

1. INSTALL FILTERS TO KERB INLETS ONLY AT SAG POINTS.
2. FABRICATE A SLEEVE MADE FROM GEOTEXTILE OR WIRE MESH LONGER THAN THE LENGTH OF THE INLET PIT AND FILL IT WITH 25mm TO 50mm GRAVEL.
3. FORM AN ELLIPTICAL CROSS-SECTION ABOUT 150mm HIGH x 400mm WIDE.
4. PLACE THE FILTER AT THE OPENING LEAVING AT LEAST A 100mm SPACE BETWEEN IT AND THE KERB INLET. MAINTAIN THE OPENING WITH SPACER BLOCKS.
5. FORM A SEAL WITH THE KERB TO PREVENT SEDIMENT BYPASSING THE FILTER.
6. SANDBAGS FILLED WITH GRAVEL CAN SUBSTITUTE FOR THE MESH OR GEOTEXTILE PROVIDING THEY ARE PLACED SO THAT THEY FIRMLY ABUT EACH OTHER AND SEDIMENT-LADEN WATERS CANNOT PASS BETWEEN.

WIRE MESH AND GRAVEL SEDIMENT FILTER
SD6.11

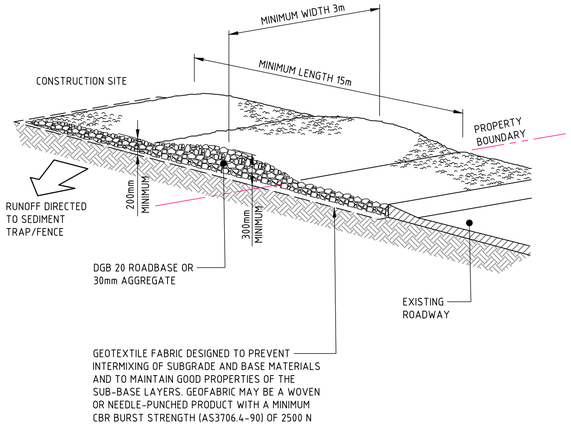


FOR DROP INLETS AT NON-SAG POINTS, SANDBAGS, EARTH BANK OR EXCAVATION USED TO CREATE ARTIFICIAL SAG POINT

CONSTRUCTION NOTES

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. FOLLOW STANDARD DRAWING 6-7 AND STANDARD DRAWING 6-8 FOR INSTALLATION PROCEDURES FOR THE STRAW BALES OR GEOFABRIC. REDUCE THE PICKET SPACING TO 1 METRE CENTRES.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DO NOT COVER THE INLET WITH GEOTEXTILE UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

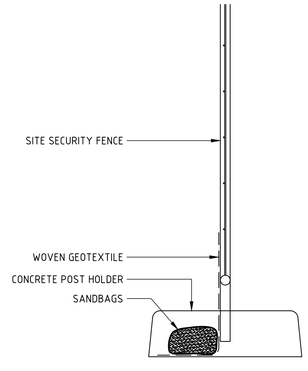
GEOTEXTILE INLET FILTER TRAPS
SD6.12



CONSTRUCTION NOTES

1. STRIP THE TOPSOIL, LEVEL THE SITE AND COMPACT THE SUBGRADE.
2. COVER THE AREA WITH NEEDLE-PUNCHED GEOTEXTILE.
3. CONSTRUCT A 200mm THICK PAD OVER THE GEOTEXTILE USING ROAD BASE OR 30mm AGGREGATE.
4. ENSURE THE STRUCTURE IS AT LEAST 15 METRES LONG OR TO BUILDING ALIGNMENT AND AT LEAST 3 METRES WIDE.
5. WHERE A SEDIMENT FENCE JOINS ONTO THE STABILISED ACCESS, CONSTRUCT A HUMP IN THE STABILISED ACCESS TO DIVERT WATER TO THE SEDIMENT FENCE.

STABILISED SITE ACCESS
SD6.14



CONSTRUCTION NOTES

1. PLACE SANDBAGS ALONG BASE OF FENCE ON TOP OF GEOTEXTILE.
2. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE SECURITY FENCE. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
3. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.

SECURITY AND SEDIMENT FENCE - HARDSTAND AREAS

VERIFIER:
JOB MANAGER: T.HOWE
DESIGNED: T.HOWE
DRAWN: J.PHILLIPS

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PROJECT: CHARLES STREET SQUARE

DRAWING TITLE: SEDIMENT AND EROSION CONTROL DETAILS

JOB NUMBER: 182116
DRAWING NUMBER: C2.11
REVISION: 2
DRAWING SHEET SIZE = A1

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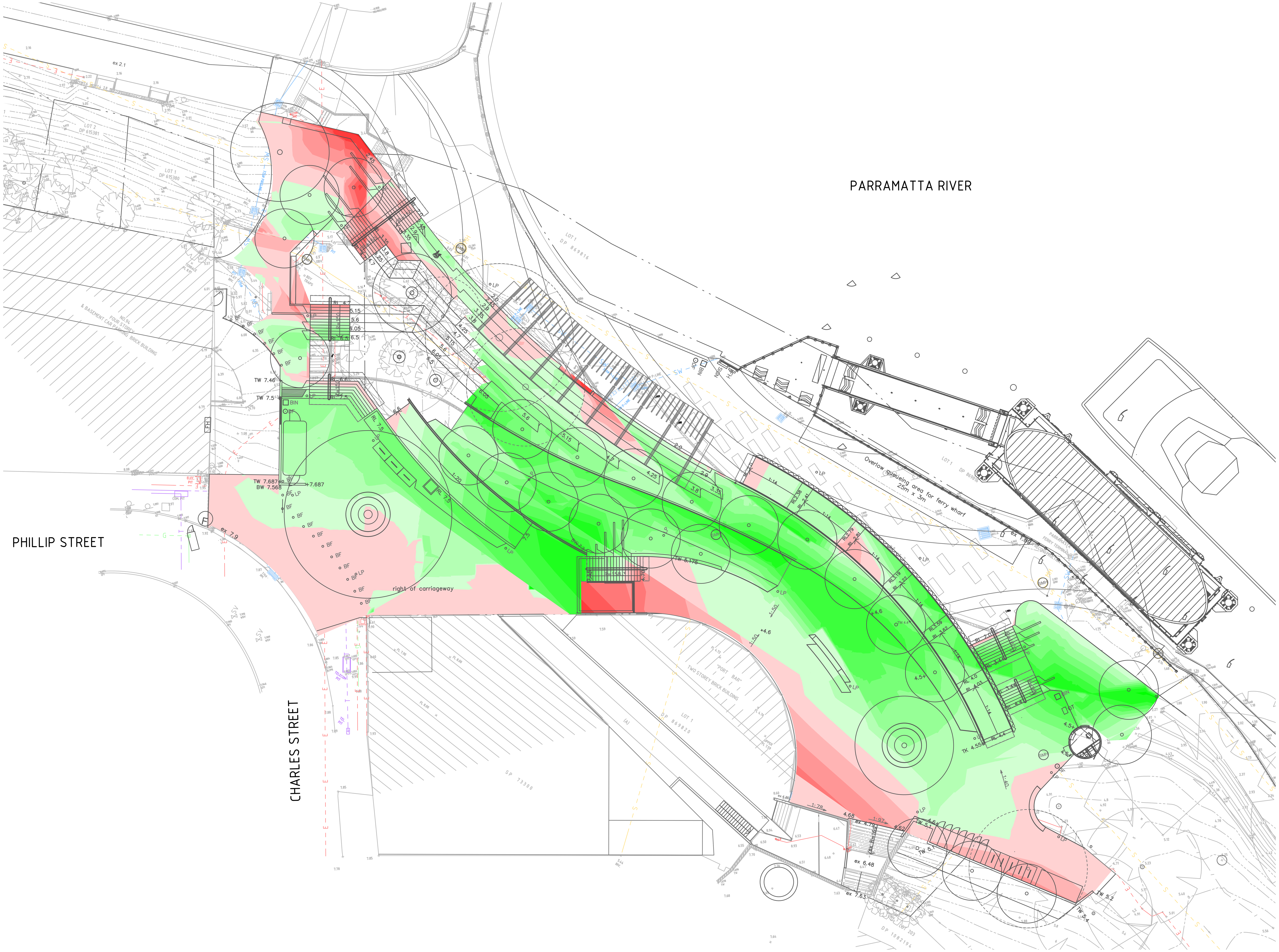

LEGEND

BOUNDARY LINE

DEPTH OF CUT

- -1.5m TO -1.25m
- -1.25m TO -1.0m
- -1.0m TO -0.75m
- -0.75m TO -0.5m
- -0.5m TO -0.25m
- -0.25m TO -0.0m

DEPTH OF FILL

- 0.0m TO 0.25m
- 0.25m TO 0.5m
- 0.5m TO 0.75m
- 0.75m TO 1.0m
- 1.0m TO 1.25m
- 1.25m TO 1.5m
- 1.5m TO 2.0m

GENERAL NOTES:

1. REFER SPECIFICATIONS NOTES FOR EARTHWORKS GENERAL REQUIREMENTS.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL / RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
3. CAD FILES / DTM FILES TO BE SUPPLIED IN AUTOCAD FORMAT FOR SETOUT PURPOSES (UPON REQUEST).
4. NO ALLOWANCE HAS BEEN MADE FOR BULKING FACTORS. NOTE ALL VOLUMES DEPICTED ARE SOLID VOLUMES ONLY AND MAY NOT REFLECT DETAILED EARTHWORKS.
5. NO ALLOWANCE HAS BEEN MADE FOR DETAILED EARTHWORKS; ie SERVICE TRENCHING, DETAILED EXCAVATION, FOOTINGS, RETAINING WALLS AND THE LIKE. CONTRACTOR IS TO ALLOW FOR REMOVAL OF ALL EXCESS MATERIAL GENERATED BY THE WORKS.
6. THE CONTRACTOR SHALL USE FINAL SURFACE LEVELS AND TYPICAL PAVEMENT DETAILS FOR ACTUAL EARTHWORKS LEVELS.
7. BULK EARTHWORKS ARE BASED ON THE FOLLOWING DEPTHS FROM FINISHED SURFACE LEVELS;
   - 7.1. CONCRETE / FOOTPATH / UNIT PAVERS 310mm
   - 7.2. LANDSCAPE AREAS 200mm
8. APPROXIMATE BULK EARTHWORK VALUES AS FOLLOWS;
   - 8.1. HARDSTAND REMOVAL (ASSUMED 200mm ACROSS SITE) 174 cu.m
   - 8.2. EXPORT MATERIAL (AFTER HARDSTAND REMOVAL) 172 cu.m
   - 8.3. IMPORT MATERIAL (TO BULK LEVEL) 992 cu.m

DRAWN: J.PHILLIPS
DESIGNED: T.HOWE
JOB MANAGER: T.HOWE
VERIFIER:

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PROJECT: CHARLES STREET SQUARE

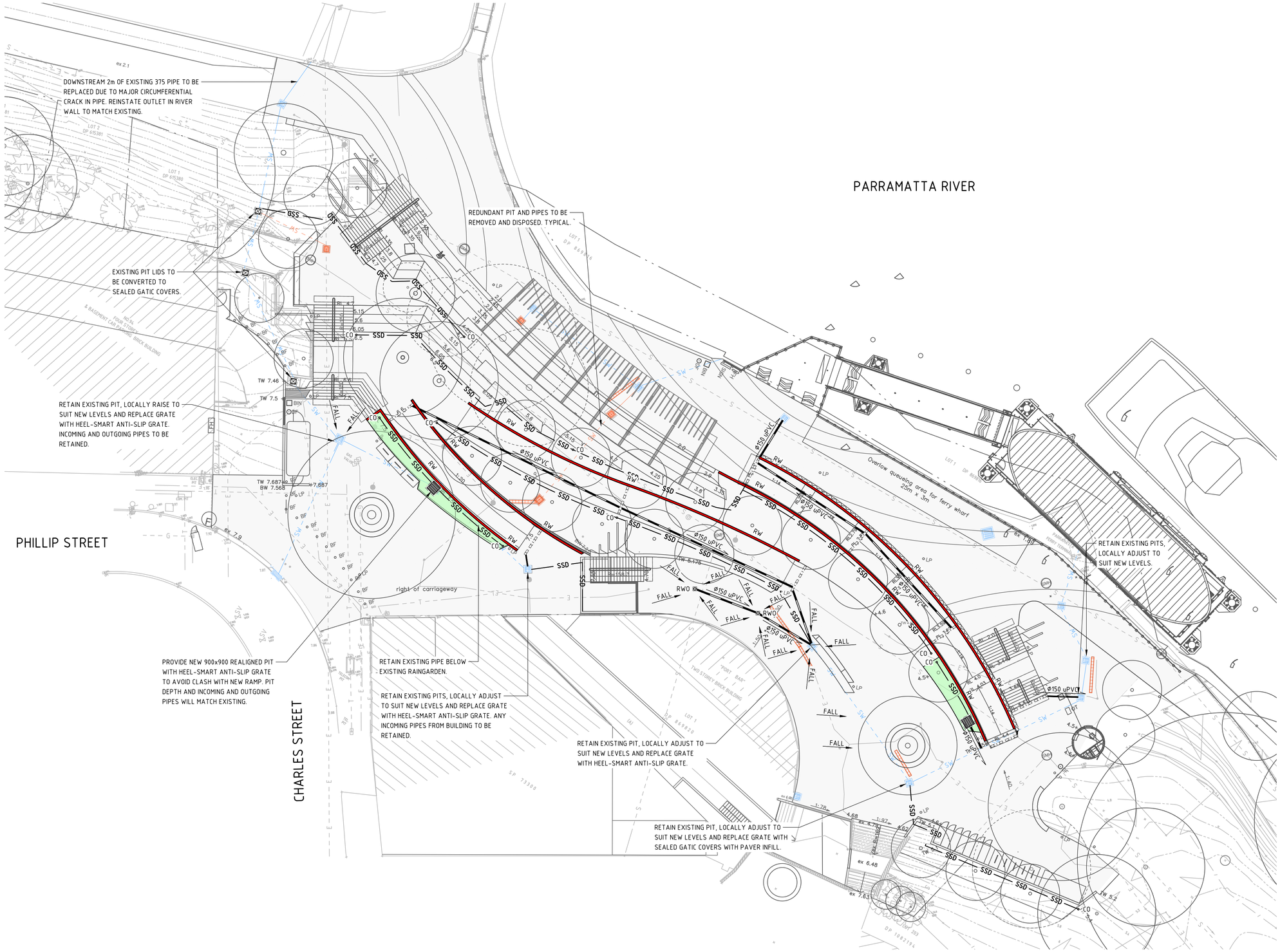
DRAWING TITLE: BULK EARTHWORKS PLAN

JOB NUMBER: 182116

DRAWING NUMBER: C3.01 — REVISION: 2

DRAWING SHEET SIZE = A1

Plotted By: dtenhave Date: 22-5-20 11:18am



LEGEND

- BOUNDARY LINE
- EXISTING CONTOURS
- SW — EXISTING STORMWATER PIPE
- EXISTING GRATED TRENCH DRAIN
- EXISTING STORMWATER PIT
- Ø150 uPVC — PROPOSED STORMWATER PIPE
- SW — REDUNDANT STORMWATER PIPE
- PROPOSED GRATED INLET PIT
- REDUNDANT STORMWATER PIT
- GTD — PROPOSED GRATED TRENCH DRAIN
- REDUNDANT GRATED TRENCH DRAIN
- RWO — RAINWATER OUTLET
- SSD — SSD — SUBSOIL DRAINAGE LINE
- CO — SUBSOIL DRAINAGE CLEAROUT
- RW — RETAINING WALL
- PROPOSED RAINGARDEN

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	DESIGN DEVELOPMENT ISSUED FOR QS REVIEW	J.P		T.H	24.04.20
2	ISSUED FOR REF	D.T		T.H	22.05.20

CLIENT: Welcome to City of Parramatta

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SCALE 1:200@ A1 (0 2 4 6 8 10m)

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Email southcoast@northrop.com.au ABN 81 094 433 100

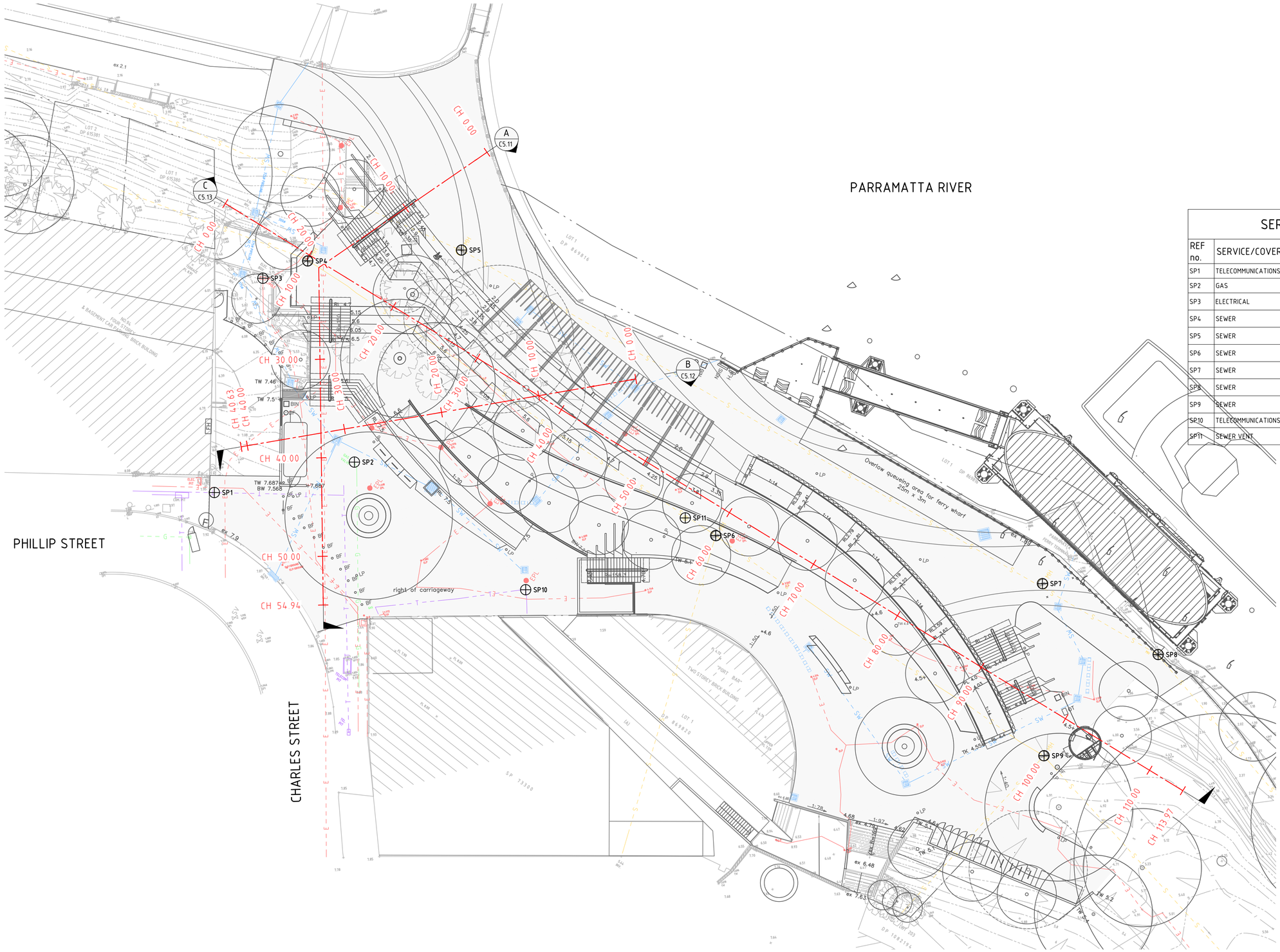
PROJECT: CHARLES STREET SQUARE

DRAWING TITLE: SITEWORKS AND STORMWATER MANAGEMENT PLAN

JOB NUMBER: 182116
DRAWING NUMBER: C4.01
REVISION: 2
DRAWING SHEET SIZE = A1

DRAWN: J.PHILLIPS
DESIGNED: T.HOWE
JOB MANAGER: T.HOWE
VERIFIER:

Plotted By: dtehsave
Date: 22-5-20 2:38pm
Found: W:\Jobs\20th\182116 - Charles Street Square\3D-Drawings\3D-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_C4.01_SITEWORKS AND STORMWATER MANAGEMENT PLAN.dwg



LEGEND

- BOUNDARY LINE
- EXISTING CONTOURS
- E — EXISTING ELECTRICITY
- G — EXISTING GAS
- T — EXISTING TELSTRA
- SW — EXISTING STORMWATER
- S — EXISTING SEWER
- CONTROL LINE
- CH 0.00 — CHAINAGE
- SP1 — SERVICE PIT TAG

SERVICES ADJUSTMENT SCHEDULE

REF no.	SERVICE/COVER	EXISTING RL	PROPOSED RL	COVER ADJUST	COMMENTS
SP1	TELECOMMUNICATIONS	7.893	7.910	0.017	
SP2	GAS	7.070	7.580	0.510	
SP3	ELECTRICAL	5.440	5.330	-0.110	REDUNDANT PIT TO BE REMOVED - REFER ELECTRICAL DRAWINGS
SP4	SEWER	5.212	4.700	-0.512	TO BE COORDINATED BY WATER SERVICE COORDINATOR
SP5	SEWER	2.360	1.977	-0.383	TO BE COORDINATED BY WATER SERVICE COORDINATOR
SP6	SEWER	4.235	5.100	0.865	TO BE COORDINATED BY WATER SERVICE COORDINATOR
SP7	SEWER	1.945	-	-	ADJUSTMENT BY OTHERS
SP8	SEWER	1.977	-	-	ADJUSTMENT BY OTHERS
SP9	SEWER	4.350	4.510	0.160	TO BE COORDINATED BY WATER SERVICE COORDINATOR
SP10	TELECOMMUNICATIONS	7.030	7.570	0.540	
SP11	SEWER VENT	3.897	-	-	VENT TO BE RELOCATED

GENERAL NOTES

1. SERVICE ADJUSTMENT PLAN AND SCHEDULE HAS BEEN PROVIDED FOR DESIGN TEAM COORDINATION ONLY.
2. PROPOSED RL'S ARE BASED ON PREFERRED LANDSCAPE CONCEPT BY SMM DATED 16.04.20.
3. SOME SERVICES MAY BE BEYOND PROJECT SCOPE/EXTENT AND/OR ARE SUBJECT TO CHANGE BY OTHERS.
4. SERVICES SURFACE AND EXISTING UNDERGROUND LEVELS ARE BASED ON SURVEY INFORMATION PROVIDED BY YSCO GEOMATICS LAND RESOURCE CONSULTANTS.

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DRAWN: J.PHILLIPS
DESIGNED: T.HOWE
JOB MANAGER: T.HOWE
VERIFIER:

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	DESIGN DEVELOPMENT ISSUED FOR QS REVIEW	J.P		T.H	24.04.20
2	ISSUED FOR REF	D.T		T.H	22.05.20

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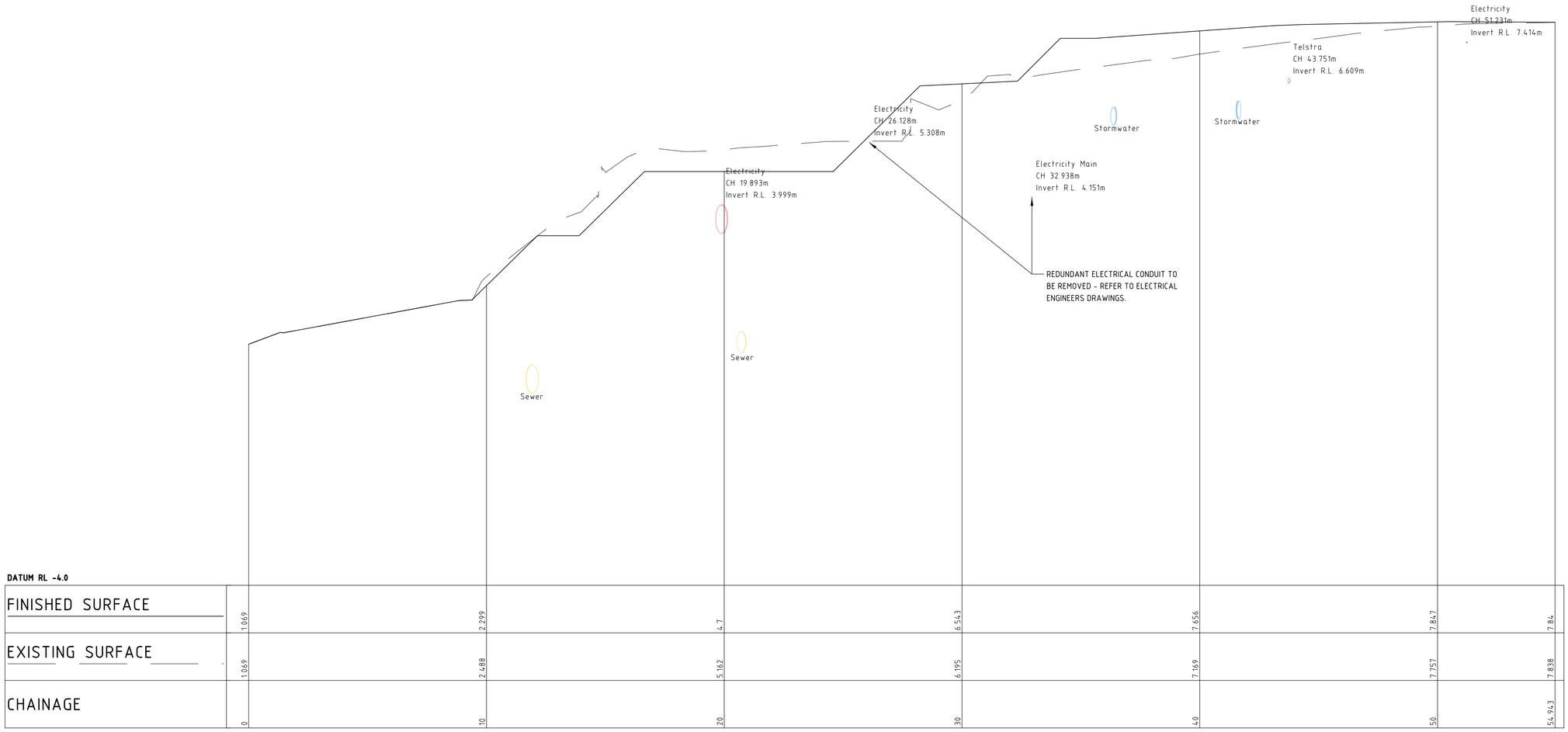
Email southcoast@northrop.com.au ABN 81 094 433 100

PROJECT: CHARLES STREET SQUARE

DRAWING TITLE: UTILITY SERVICES IMPACT PLAN

JOB NUMBER: 182116
DRAWING NUMBER: C5.01
REVISION: 2
DRAWING SHEET SIZE = A1

Date: 22-5-20 11:18am Plotted By: dtemhave Found: W:\#jobs\2018\182116 - Charles Street Square\3D-Drawings\3D-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_C5.01_UTILITY SERVICES IMPACT PLAN.dwg



LONGITUDINAL SECTION ALONG SECTION A

HORIZONTAL SCALE 1:100@A1
VERTICAL SCALE 1:50@A1

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	DESIGN DEVELOPMENT ISSUED FOR QS REVIEW	J.P		T.H	24.04.20
2	ISSUED FOR REF	D.T		T.H	22.05.20

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SCALE 1:50@A1 0.0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:100@A1 0 1 2 3 4 5m

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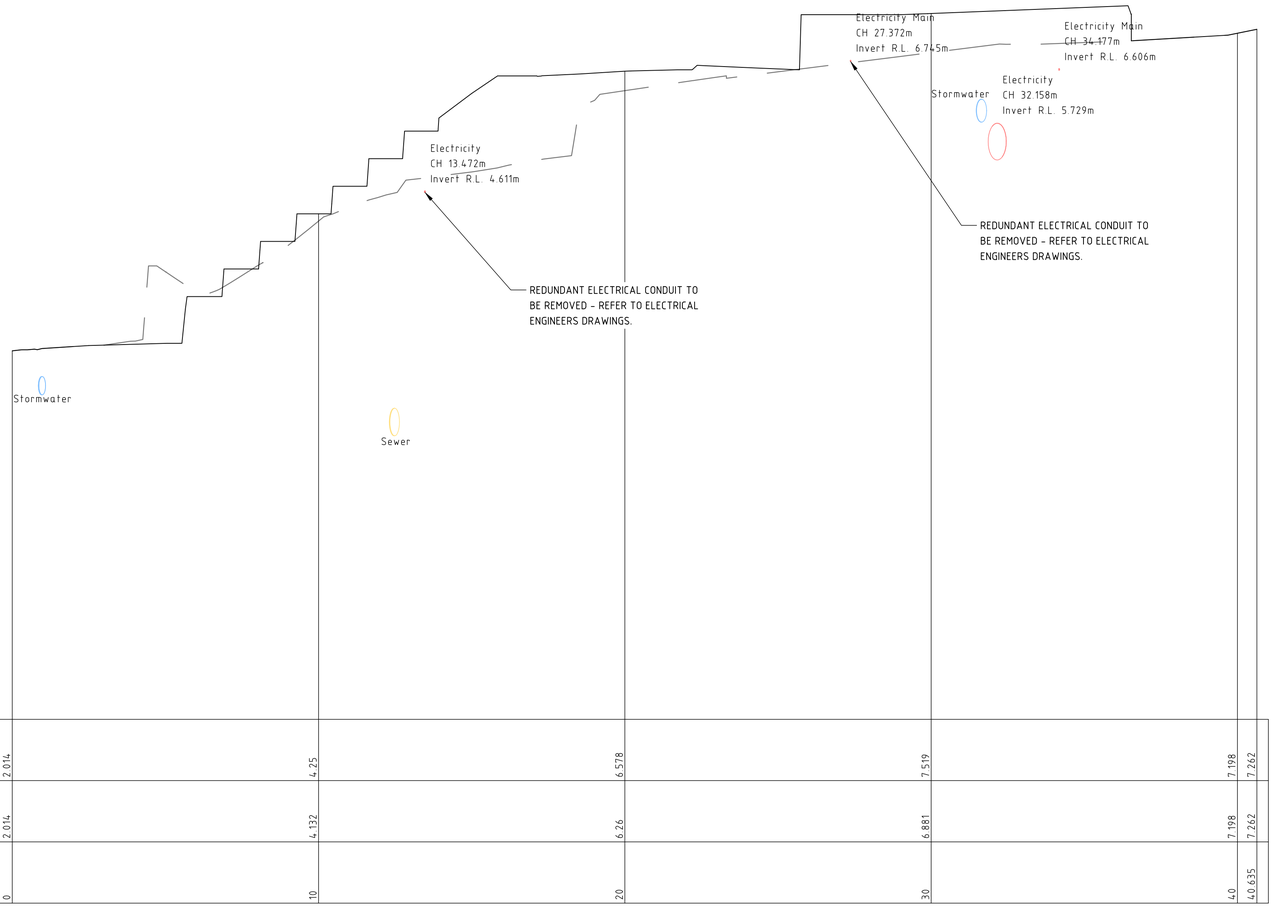
PROJECT
CHARLES STREET SQUARE

DRAWING TITLE
UTILITY SERVICES SECTION - SHEET 1

JOB NUMBER **182116**
DRAWING NUMBER **C5.11**
REVISION **2**
DRAWING SHEET SIZE = A1

DRAWN: J.PHILLIPS
DESIGNED: T.HOWE
JOB MANAGER: T.HOWE
VERIFIER:

Date: 22-5-20 11:19am Plotted By: dtehsave Found: W:\Mjobs\20th\182116 - Charles Street Square\0-Drawings\0-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_C5.11_UTILITY SERVICES SECTION - SHEET 1.dwg



LONGITUDINAL SECTION ALONG SECTION B

HORIZONTAL SCALE 1:100@A1
VERTICAL SCALE 1:50@A1

NOT FOR CONSTRUCTION

DRAWN: J.PHILLIPS
DESIGNED: T.HOWE
JOB MANAGER: T.HOWE
VERIFIER:

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	DESIGN DEVELOPMENT ISSUED FOR QS REVIEW	J.P		T.H	24.04.20
2	ISSUED FOR REF	D.T		T.H	22.05.20

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SCALE 1:50@A1 0.0 0.5 1.0 1.5 2.0 2.5m
SCALE 1:100@A1 0 1 2 3 4 5m

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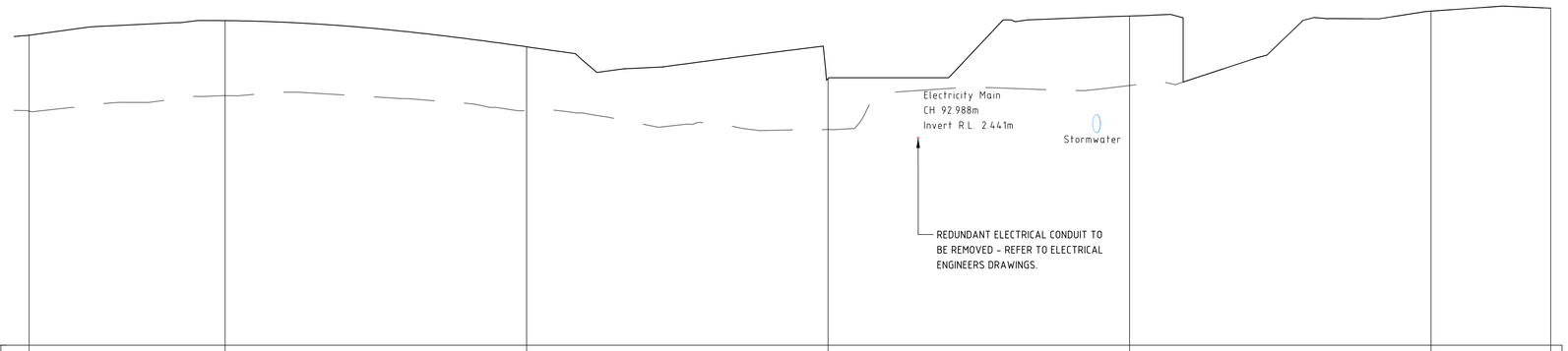
PROJECT
CHARLES STREET SQUARE

DRAWING TITLE
UTILITY SERVICES SECTION - SHEET 2

JOB NUMBER **182116**
DRAWING NUMBER **C5.12**
REVISION **2**
DRAWING SHEET SIZE = A1

Date - 22-5-20 11:19am Plotted By - dtenhave Found - W:\#Jobs\2018\182116 - Charles Street Square\D-Drawings\D-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_CS12_UTILITY SERVICES SECTION - SHEET 2.dwg

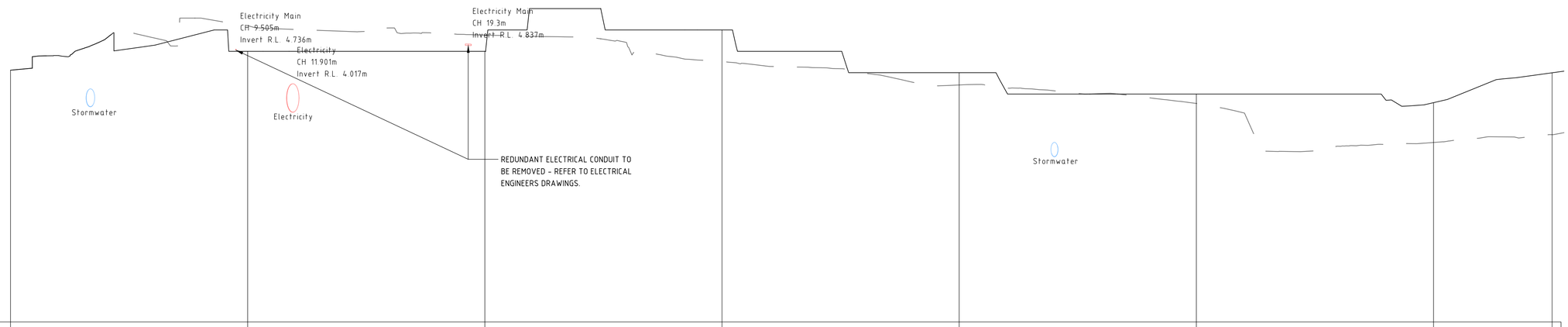


DATUM RL -1.0

FINISHED SURFACE	4.145	4.388	3.955	3.426	4.465	4.546	4.595
EXISTING SURFACE	2.885	3.143	2.895	2.582	3.311	4.546	4.595
CHAINAGE	63.5	70	80	90	100	110	113.971

LONGITUDINAL SECTION ALONG SECTION C

HORIZONTAL SCALE 1:100@A1
VERTICAL SCALE 1:50@A1



DATUM RL -1.0

FINISHED SURFACE	4.303	4.7	4.7	5.15	4.25	3.8	3.619	4.248
EXISTING SURFACE	4.303	5.242	5.04	4.485	3.991	3.603	2.78	2.945
CHAINAGE	0	10	20	30	40	50	60	65

LONGITUDINAL SECTION ALONG SECTION C

HORIZONTAL SCALE 1:100@A1
VERTICAL SCALE 1:50@A1

NOT FOR CONSTRUCTION

DESIGNED: T.HOWE
DRAWN: J.PHILLIPS
JOB MANAGER: T.HOWE
VERIFIER:

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
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SCALE 1:50@ A1
SCALE 1:100 @ A1
0.0 0.5 1.0 1.5 2.0 2.5m
0 1 2 3 4 5m

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PROJECT
CHARLES STREET SQUARE

DRAWING TITLE
UTILITY SERVICES SECTION - SHEET 3

JOB NUMBER 182116
DRAWING NUMBER C5.13
REVISION 2
DRAWING SHEET SIZE = A1

Date: 22-5-20 11:19am Plotted By: dtenhave Found: W:\Mjobs\2018\182116 - Charles Street Square\1D-Northrop\C-CIVIL\2-CURRENT CAD FILES\182116_C5.13_UTILITY SERVICES SECTIONS - SHEET 3.dwg

LEGEND

PAVING FINISH
- P1 Exposed aggregate concrete
- P2 Not used
- P3 Granite pavers

STAIRS
- S1 Solid precast concrete steps
- S2 Solid granite steps
- HR Stainless steel double handrail
- TI Tactile ground surface indicators
- Note: All steps to include 50mm insert safety stair bar

RAMPS
- R1 1:14 ramp (to DSAPT/AS1428.2 standard) Exposed aggregate concrete finish Stainless steel handrails both sides
- R2 1:20 walkway (to DSAPT/AS1428.2 standard) Exposed aggregate concrete finish Stainless steel handrail one side
- R3 1:20 walkway (to DSAPT/AS1428.2 standard) Granite pavers Stainless steel handrail one side

TERRACES
- T1 Precast concrete terraces
- T2 Timber terraces Recycled class 1 Australian hardwood
- T3 Concrete deck Exposed aggregate concrete finish
- TG Tree grate

STRUCTURES
- EO Exeloo 'Orbit' relocated existing automated toilets with new graphic 'skin'
- FO Ferry site office and artwork projectors to architect's detail
- SS Shade structure to architect's detail includes CCTV and PA system (relocated)

BALUSTRADES
- B1 Weathering steel pleated balustrade with integrated SS handrail
- B2 Flat steel balustrade, painted finish with integrated stainless steel handrails
- B3 Flat steel balustrade, painted finish

WALLS
- W1 Cast in situ concrete retaining wall
- W2 Cast in situ concrete retaining/seat wall
- W3 Cast in situ concrete terrace walls
- W4 Reinforced blockwork wall, stone clad
- W5 Reinforced blockwork wall, granite clad
- WE Precast concrete wedge block

SEATING
- SE1 Timber seat insert to precast terrace Recycled class 1 Australian hardwood
- SE2 Timber seat on steel frame Recycled class 1 Australian hardwood
- SE3 Precast concrete seat/low wall with timber seat insert Recycled class 1 Australian hardwood
- SE4 Precast concrete seat/low wall

ARTWORK
- PA New public artwork (by others) Static sculptural component (not part of current REF)

BIKE PARKING
- BE Bike rack - existing relocated Stainless steel bike hoops
- BH Bike hire (by others)
- BL Bike lockers (single, front opening) Powder coated finish
- BN Bike rack - new Stainless steel bike hoops

FURNITURE & FIXTURES
- BIN Rubbish bin
- BO Bollard
- DF Drinking fountain
- ELP Existing light pole
- FH Fire hydrant
- LP Light Pole – proposed
- OT Opal Top Up machine
- SIGN Plan Your Trip sign
- SMH Sewer manhole levels to be adjusted

PLANTING
- GB Garden bed with mass planting

TREES
- New tree
- Existing tree retained
- Existing tree removed

CONTOURS
- Existing contours @200mm
- Proposed contours @500mm
- Proposed contours @100mm

BOUNDARIES
- Project boundary
- Property boundary

NOTES
1. Sewer vent pipe to be relocated
2. Existing fire hydrant relocated

NOT FOR CONSTRUCTION

ORIGINAL IN COLOUR

Filename: Charles St Sq - DD-REF PLAN.vwx

REV	DESCRIPTION	DATE	APPROVED
1	REF PACKAGE	18/8/20	MS

REVISION HISTORY

GENERAL NOTES
1. Do not scale from this drawing. Use figured dimensions only.
2. Verify all dimensions on site. Refer any discrepencies to the Principal's Representative for resolution before proceeding.
3. If this drawing is unclear, ask for direction from the Principal's Representative.
4. Site check the location of utilities and services prior to the commencement of works. Refer any discrepencies to the Principal's Representative for resolution.

SURVEY
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Artarmon NSW 2064
www.yscogeomatics.com.au
T 9419 8222

Survey drawing date	Grid	Datum
07/05/2019	MGA	AHD

DIMENSION STANDARD
Unless noted otherwise:
- All levels are shown in metres
- All dimensions are computer generated to 1mm

DESIGN TEAM
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PO Box 3
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LANDSCAPE ARCHITECT | HEAD CONSULTANT
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www.sm2group.com.au
info@sm2group.com.au | T 02 9361 4549

SMM Project no: 18074

Approval	Director	Date
Tender		xx/xx/xx
Construction		xx/xx/xx

DRAWING STATUS
PART 5 ASSESSMENT

Designed	Drawing date	North
CD	August 2020	
Drawn	Plot date	
CD	18/8/20	
Checked		Scale
MS		1:200 @ A1

Sheet size: A1
Size on original: 0 10 20 30 40 50mm

PROJECT
CHARLES STREET SQUARE
CHARLES STREET, PARRAMATTA

Drawing name
GENERAL ARRANGEMENT PLAN

Drawing number: **L-REF-102**
Rev: **1**