MARRICKVILLE council

Camdenville Park

PLAN OF MANAGEMENT

July 2014

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INTRODUCTION

1.1 What is a Plan of Management?

A Plan of Management (PoM) is a strategic document providing a planning and management framework for the future use, development and maintenance of multiple or individual areas of community land in accordance with the Local Government Act 1993. While a PoM is a requirement for all community land owned by Council, it also presents an opportunity to engage with the community and create a vision and values that are consistent with the needs of the current population and establishes how the park can be used in the future.

PoMs may also include other land and open space under Council's management, care and control such as Crown Land.

There are 106 parks and reserves including 55 playgrounds and 10 sportsgrounds in the Marrickville Local Government Area (LGA) and plans of management are required that apply to all community land. In 2012, Council completed the *Recreation Needs Research – Strategic Directions for Marrickville* (RNR), which identifies that the majority of plans of management are in need of review to reflect the current recreation needs of the Marrickville community and to ensure consistency with the Marrickville LEP 2011 and other Council plans, and policies. The RNR recommends the review and revision of Community and Crown Land Plans of Management including Camdenville Park.

1.2 Marrickville Community Strategic Plan

Parks service multiple community needs as demonstrated by the extensive list of relevant outcomes stated in the Marrickville Community Strategic Plan 2023 that are consistent with the role of Camdenville Park:

- The community is active and healthy;
- The community has improved access to a range of local services for all ages and abilities;
- The community has increased opportunities for participation and enjoyment;
- The community feels safe, connected and has accessible infrastructure;
- Marrickville is a creative community participating in arts and cultural activities at all stages of life;
- The community understands and has a strong sense of history;
- Increased awareness and appreciation of Aboriginal art, culture and history in Marrickville;
- The community walks, rides bikes and uses public transport;
- Marrickville's parks grounds and open spaces provide diverse opportunities for recreation and enjoyment and are designed with community input;
- Marrickville is a water sensitive community that supplies from within its catchment, provides green infrastructure to support ecosystem services add collaborates to make plans, designs and decisions that are water sensitive;
- Marrickville has thriving natural habitats;
- Marrickville's built environment demonstrates good urban design and the conservation of heritage, as well as social and environmental sustainability;
- Council is innovative in its delivery of services and projects;
- Council operations are high quality, sustainable, ethical and efficient;
- Council is financially viable and provides value for money in the delivery of its services; and
- Council consults, engages and communicates with the community effectively.

The ongoing management of Camdenville Park is consistent with this plan which provides a high level vision shared by Council and the wider community and provides a focus for all plans and actions.

1.3 Land covered under this Plan of Management

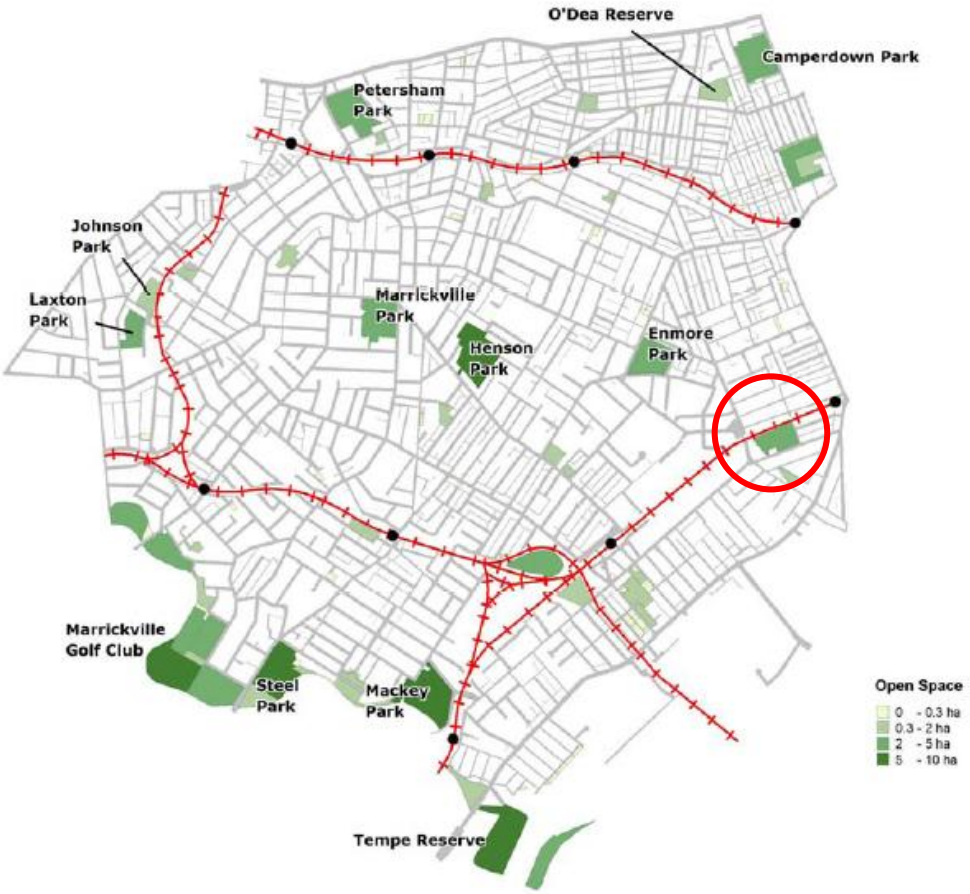
Camdenville Park is located in the suburb of St Peters, in the east of the Marrickville Local Government Area (see Figure 1). The Park is bound by:

- Illawarra Railway to the north;
- Council St to the east;
- May St to the south; and
- Bedwin Rd to the west.

The Park is zoned RE1 Public Recreation in Marrickville Council LEP 2011 and a small parcel in the north-western corner within the fence line of the park is owned by RailCorp and zoned SP2 – Infrastructure. The Park is classified as community land.

The Park is located adjacent to St Peters Railway Station and close to the suburb of St Peters. Camdenville and St Peters Public Schools and St Pius School are located a short walk from the Park.

Location of Camdenville Park



The area covered by this Plan of Management

2. DESCRIPTION OF THE PARK

2.1 History

Throughout the 19th and early 20th centuries St Peters and adjoining Tempe were important brick making centres, while the area was an important supplier of raw materials for the building and development industry. Marrickville Local Government Area's southern regions were abundant in suitable clay soils, as well as the timber needed to fuel the kilns, and swamps and river lands provided the necessary water supplies. As a result, the park was used as a clay quarry and brick works with a large clay pit developing over much of the site. Waste incineration and filling of the pit with municipal waste occurred from the early 1920's until development of the park. Today the area around Camdenville Park comprises a mix of residential and industrial buildings reflective of its historical development.

A more comprehensive history of Camdenville Park is included at Appendix 1.

2.2 Legal Description

Land title and Ownership

Land	**Camdenville Park**
Title Information	Lot 9 in DP 879483
Ownership	Marrickville Council and Railcorp
Location	Camdenville Park is located in the suburb of St Peters, in the east of the Marrickville Local Government Area (see Figure 1). The Park is bound by: ▪ Illawarra Railway to the north; ▪ Council St to the east; ▪ May St to the south; and ▪ Bedwin Rd to the west.
Total area	34,367m^2
Zoning	RE1 Public Recreation and SP2 Infrastructure
Classification	Community Land and unclassified

There is a Roads and Maritime Services (RMS) reservation for acquisition across the western portion of the park. While RMS does not own any part of Camdenville Park, this land is noted on Council's LEP as land reserved for acquisition.

RMS reservation for acquisition across Camdenville Park

2.3 Physical description

The following table provides a description of the elements of Camdenville Park, their current condition and use in accordance with the requirements of clause 36 (3A) (a) (i) and 36 (3A) (a) (ii) of the Local Government Act.

Item	Description	Condition	Current Use
	Amenities Building	Fair / Poor	Canteen facility, change rooms, storage and public toilets.
	Fencing	Fair	Encloses sports field

			
	Light poles located throughout the park	Good / Fair	Pedestrian – general purpose lighting
	Park furniture	Poor	Passive recreation
	Pathway	Fair / Poor	Active recreation / transport
	Playground	Fair / Poor	Children's play
	Retaining Walls	Good	Protection of adjacent heritage residences

			
	Sports Lighting	Fair	Sports training
	Stormwater Pumping Facility	Good	Flood mitigation
	Taps and bubblers	Poor	Access to drinking water
	Trees	Fair / Poor	Biodiversity and landscaping values

2.4 Access

Camdenville Park is served by Sydney Buses service St Peters with the Tempe-bound 422 from Circular Quay. There is also the 370 route (which travels from Leichhardt to Coogee) and allows pedestrians to access the nearby St Peters train station. The nearest existing bus stops are located along the Princes Highway (north of the Concord Street intersection) and towards the east of Sydney Park Road.

The park itself is currently accessed from the frontage along May St and Council St. The park has a path that forms a key pedestrian / bike link to St Peters train station via Goodsell Street and is included in Council's Bicycle Strategy 2006.

There are three vehicular access points, one adjacent to the terraced residences along May St and two others adjacent to the amenities building on Council St.

Consistent with many other district size park facilities there are a limited number of 90^{o} angle parking spaces provision within the park adjacent to the amenities block and consequently parking is mainly constrained to on street availability in adjacent streets.

2.5 Buildings

2.5.1 Amenities Building

This building is located at the eastern end of the park adjacent to Council St. The building contains a canteen, change rooms, public toilets and storage facilities. The public toilets are currently open from sun up to sun down. The structure is an example of 1950/60s architecture and is used by sporting organisations in conjunction with the sports field for midweek training and weekend match play and the public toilets are used throughout the week. The structure forms a visual end to Goodsell Street to the west. The building has some architectural merit, and is in moderate condition. The toilets are operational, however they inconsistent with current CPTED (Crime Prevention Through Environmental Design) and DDA (Disability Discrimination Act) principles.

2.6 Culture and Heritage

2.6.1 Heritage

Marrickville Council's Development Control Plan for the St Peters Triangle 2011 notes Camdenville Park and adjacent residences as a Heritage Conservation Area:

> *"The Goodsell Estate HCA is historically significant for demonstrating the principles and patterns of the LGA's development from colonial to contemporary eras.*
>
> *The Marrickville LGA contained many brick and pottery works including Frederick Goodsell's Steam Brick Factory (1869 onwards). The footprint of Camdenville Park overlays the site of the brickworks and the surviving terraces facing May Street were built by Goodsell and occupied by brickmakers.*
>
> *The HCA is historically significant for the pattern of the built forms that has responded to the progressive release of land for development. The terrace groups in the area were built as a result of successive land releases and demonstrate the patterns of subdivision and development in Marrickville LGA.*
>
> *The HCA is aesthetically significant for its narrow and dense streetscape development of 19th and early 20th century terraces, cottages and houses (detached and semi-detached) including several highly cohesive groups. These establish a tightly described street wall that creates a sense of intimacy and privacy, emphasised by the mature fig trees at the eastern end of the streetscape that contribute positively to the aesthetic values of the area.*
>
> *The HCA demonstrates the range of modest housing available to the Victorian worker and contributes to the evidence of the evolution of the terrace typology in Marrickville LGA throughout the second half of the 19th century to its final form before being superseded by the suburban cultural landscape.*
>
> *The key period of significance for the Goodsell Estate HCA is 1869-1957."*

The terraces from 105 to 119 May Street are also noted as Heritage items on the Marrickville LEP 2011.

A comprehensive history of Camdenville Park is included as an appendix to this plan.

2.7 Maintenance

Marrickville Council currently undertakes the regular maintenance of the park including:

- Grass maintenance – (mowing, edge trimming etc.)
- Inspection and repairs to fixtures and furniture
- Pathways inspections and repairs
- Signage
- Park furniture and retaining walls
- Pump station
- Tree maintenance

2.8 Natural

2.8.1 Biodiversity

Camdenville Park is part of the Urban Habitat Mosaic Priority Biodiversity Area (UHMPBA) as identified in Council's Biodiversity Strategy 2011-21. The UHMPBA comprises all the parks, reserves, streets, road verges, schools, church grounds and back yards and is important for providing local and regional connectivity and habitat. A mixture of native and exotic vegetation gives structural habitat for a range of identified biodiversity values including Long-nosed Bandicoots, Grey-headed Flying Fox, frogs, rock/crevice dependant reptiles, moisture dependent reptiles, nocturnal birds, small granivorous birds, small nectarivorous and insectivorous birds, mega bats and micro bats.

2.8.2 Trees

The park has three main groupings of trees as follows:

- The railway line - A mix of mature Brush box; Swamp She-Oak; and Poplar, are scattered along the interface with the railway line.
- Detention Basin - a mix of mature Swamp She-Oak and Weeping Willow. These plantings are scattered in an informal nature around the detention basin.
- Major Park Pathway - The major park pathway is shaded by an irregular grouping of advanced Southern Blue Gum. These trees are located in the most heavily used part of the park and have a strong contribution to the existing park character.

An Arboricultural Audit and Assessment of the trees within Camdenville Park was prepared by Urban Forestry Australia in February / March 2014 and includes assessment of tree health, significance, retention value and critical tree protection and root zones. The assessment recommends removal and replacement of a number of trees across the park due to structural defects and poor health. Mulching of park trees to protect root zones is also recommended and is consistent with the recommendations of the Remediation and Construction Environmental Management Action Plan (see 2.10). The report identifies structural root zones and tree protection zones for consideration in the detailed design and implementation of the park Master Plan.

2.8.3 Water Management

Council is encouraging everyone in the community to get involved in creating a water-sensitive community by managing water sustainably. To achieve this, Council is making long-term subcatchment management plans for each of the subcatchments (local watersheds) in Marrickville where all the rain falling into a specific local area flows to the same waterway, namely the Cooks River at the Camdenville Park location. The plans are designed to target the particular needs of each community with its unique land use, demographic and environmental issues. The process

identifies options for water sensitive urban design (WSUD) including stormwater management, flooding and harvesting. Camdenville Park is located in the Eastern Channel East Subcatchment, the subcatchment management plan for which has been completed. The Subcatchment Plan identifies actions relating to Camdenville Park including options for the treatment and harvesting of stormwater and flood mitigation through the use of the existing detention basin in the Park to treat run off from the nearby junction of Bedwin Road, Unwins Bridge Road and Campbell Street which is an identified location for stormwater ponding. The detention basin and pump facility was created as part of the park development in the 1950's to capture run off from the local catchment. The basin currently captures low flows from May Street as well as overflows from the 20 hectare catchment South of May Street and Unwins Bridge Road. The basin serves an important purpose by limiting the depth of flooding at the intersection of May and Campbell Streets due to the limited capacity of the piped system which drains the intersection.

2.9 Recreation

As the demographic make up of the local population changes, there is increasing demand placed on public open space for recreation purposes in terms of both the quantity and diversity of recreation activities. The community engagement undertaken to inform the development of the plan of management indicated that Camdenville Park is popular with the local community for a range of active and passive activities. Relaxation was the most popular reason for visiting Camdenville Park followed by access through the park on the way to the station or another destination. Other popular uses were walking the dog and children's play.

Activity	Per cent
Relaxation	24
Cut through the park / access St Peters Station	24
Walking the dog	14
Use children's playground	11
Play sport	8
Personal Train	7
Picnic / have lunch	5
Watch Sport	4
Walk or run	3

2.10 Remediation

The site's history as a fill site has resulted in a number of issues including exposed bricks and other rough fill at the park surface, subsurface contamination and generation of subsurface landfill gas. Detailed site investigations have been undertaken in recent years in accordance with the Contaminated Land Management Act 1997 and a Remediation and Construction Environmental Management Action Plan (RCEMAP) was completed in 2013. The RCEMAP provides strategies to remediate the site through upgrading and ongoing management.

3. Categorisation and Planning Context

3.1 Categorisation

This plan of management is prepared in accordance with the requirements of the Local Government Act 1993. It provides a strategic framework for the future management and use of Camdenville Park.

Public Land under the control of Council must be classified as either “community” or “operational” land. Land classified as “community” reflects the importance to the community in that the land is for use by the general public. All community land requires a plan of management to govern and manage the use of the land. The plan of management must include the following:

- the category of the land
- objectives and performance targets of the plan with respect to the land
- the means by which Council proposed to achieve the plan’s objectives and performance targets
- the manner in which council proposes to assess its performance with respect to the plan’s objectives and performance targets
- the condition of the land and of any buildings or other improvements on the land
- the use of the land and of any buildings or improvements as at the date of adoption
- specify the purposes for which the land and any buildings or improvements will be permitted to be used; and
- specify the purposes for which any further development of the land will be permitted, whether under lease or licence of otherwise
- describe the scale and intensity of any such permitted use or development

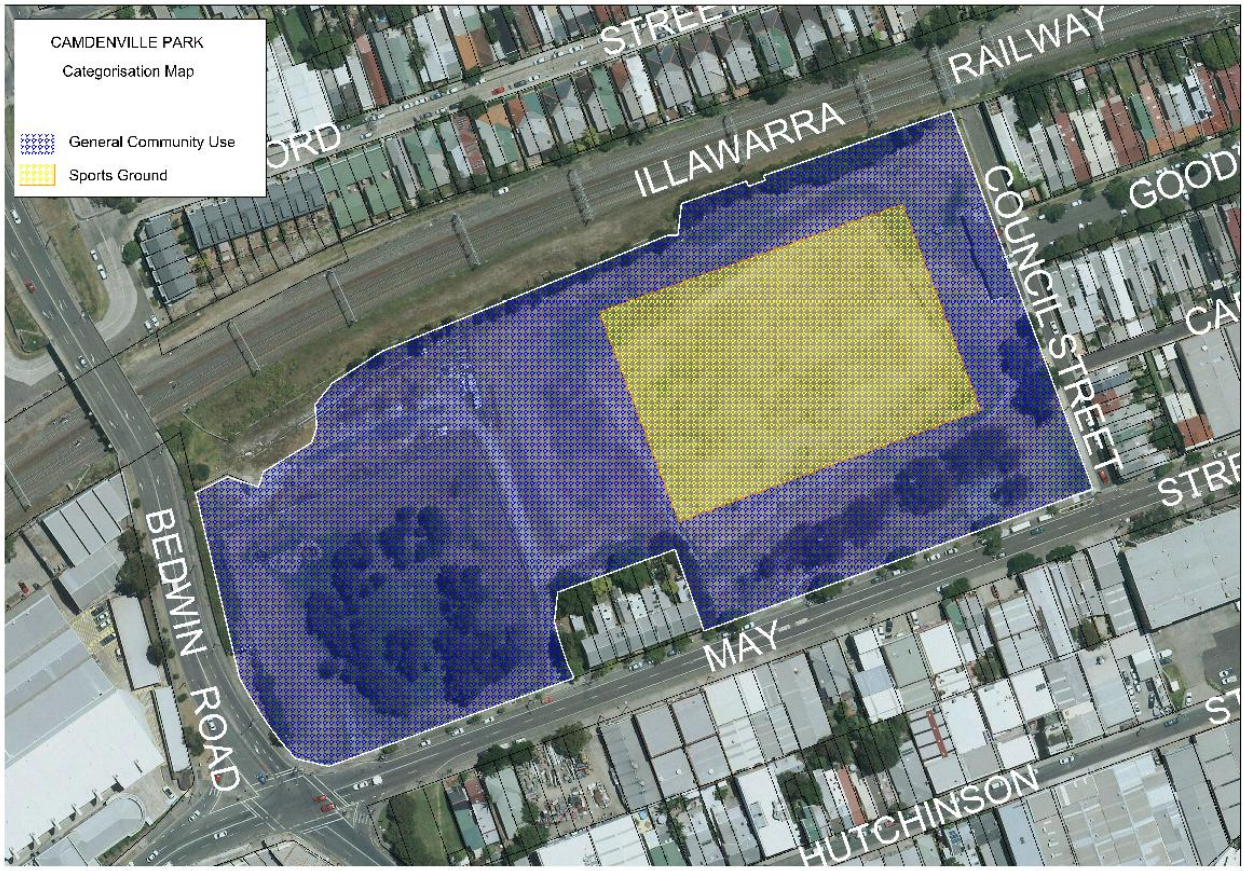
The land must be categorised as one of more of the following:

- a natural area
- a sportsground
- a park
- an area of cultural significance
- general community use

This Plan of Management categorises the community land in Camdenville Park as follows:

Land Category	Core Objectives
Sportsground (LGA 1993, Section 36F)	▪ To encourage, promote and facilitate recreational pursuits in the community involving organised and informal sporting activities and games, and ▪ To ensure that such activities are managed having regard to any adverse impact on nearby residences.
General Community Use	▪ The core objectives for management of community land categorised as general community use are to promote, encourage and provide for the use of the land. and to provide facilities on the land, to meet the current and future needs of the local community and of the wider public: (a) in relation to public recreation and the physical, cultural, social and intellectual welfare or development of individual members of the public, and (b) in relation to purposes for which a lease, licence or other estate may be granted in respect of the land (other than the provision of public utilities and works associated with or ancillary to public utilities).

Camdenville Park - Categorisation Map



Note the Plan of Management proposes the realignment of the playing field as shown above. Use of the facility in the current configuration will continue until the proposed works are completed.

3.2 Other relevant legislation

- Companion Animals Act
- Disability Discrimination Act 1992
- Threatened Species Conservation Act 1995

3.3 Local planning context

Relevant Marrickville Council strategies and policies are:

- Asset Management Strategy and Asset Management Plans
- Biodiversity Strategy (2011-21 and Biodiversity Action Plan (2011-15)
- Community Strategic Plan
- Companion Animals Management Plan
- DDA Access Policy and Access Action Plan 2004
- Marrickville LEP 2011
- Recreation Needs Research – Strategic Directions for Marrickville 2012
- Recreation Strategy and Policy 2013
- Remediation and Construction Management and Action Plan (RCEMAP) 2013
- Strategy for a Water Sensitive Community
- Subcatchment Management Plan 2011 for Eastern Channel East
- Urban Forest Strategy

4.0 Values, Roles and Objectives

4.1 Values and Role of the Park

Council's commitment to recreation facilities and services is articulated through the Recreation Policy and Strategy 2013:

- **Lifelong Recreation** – inclusive access to best practice and innovative recreation opportunities for the Marrickville community;
- **Active In Marrickville** – enrichment of the health and well-being of the Marrickville community through participation in a diverse range of recreational activities; and
- **The Recreation Economy** – support for local recreation businesses and organisations that facilitate recreation in Marrickville and add economic value to the community.

Consistent with the Recreation Policy and Strategy, the desired roles of Camdenville Park are defined in the table below:

VALUE	ROLE
Lifelong Recreation	▪ Provide an accessible park for people of all abilities ▪ Provide a place for children and young people to play ▪ Provide a place for informal recreation including safe walking paths and ancillary facilities such as shade and seating for all ages ▪ To maintain the culture and character or the park and surrounding area through acknowledgement and expression of local heritage.
Active in Marrickville	▪ A park that is well connected to the surrounding urban environment ▪ An opportunity to engage in informal active recreation activities ▪ An opportunity for leisure ▪ Protection and preservation of plantings within the Park ▪ Sustainable management of recreation and community facilities ▪ Enhancement of biodiversity within the Urban Habitat Mosaic ▪ Water is sourced from within the subcatchment and is fit-for-purpose ▪ Flood mitigation
The Recreation Economy	▪ Provide appropriate recreation facilities for future incoming populations. ▪ Maintain and actively seek new partnerships. ▪ Recreation facilities are safe, equitable, inclusive and affordable

4.2 Management Objectives

Lifelong Recreation Objectives

1. Provide opportunities for people of all ages and abilities to participate in recreation activities.
2. Acknowledge and conserve the local heritage of Camdenville Park.
3. Provide a range of engaging and safe play opportunities for children.
4. Provide a range of engaging and safe play opportunities for young people.
5. Provide safe walking paths and ancillary facilities including shade, amenities and seating for all ages.

6. Provide safe and shared use of parks and open space for people with pets

Active In Marrickville

1. Enhance connectivity to surrounding residential areas, transport nodes, schools and community hubs adjacent to Camdenville Park.

2. Encourage a range of informal and organised active recreation activities through the provision of high quality open space and recreation facilities.

3. Provide opportunities for passive recreation – a place for contemplation, to escape the urban environment or social gatherings such as a picnics or bbq.

4. Provide a park and open space with well maintained recreation and community facilities.

5. Ensure the sustainable management of Camdenville Park as a valued recreational and community asset.

6. Protect and enhance the biodiversity of Camdenville Park.

7. Effective management of stormwater and reduction of reliance on potable water.

The Recreation Economy

1. Cater for incoming populations through the development of key plans to guide Council in the provision of recreation facilities.

2. Maintain and actively seek new partnerships to support the effective management and delivery of recreation facilities and services.

3. Provide safe, equitable and affordable access to recreation facilities and programs.

5.0 Management of the Park

Camdenville Park provides the community with a variety of active and passive recreation opportunities. The Park is well used by the community nonetheless there are a number of functional issues which have been highlighted. This section of the Plan of Management outlines the challenges and design issues within the Park as well as the opportunities and constraints which have informed the development of a Master Plan. The Master Plan reviews the existing structure of the Park including the current location and provision of facilities. The Master Plan also considers future opportunities and provides a vision for the implementation of the development of the park. The Master Plan is a concept plan and elements are subject to change to accommodate detailed design constraints and other unforeseen changes provided the overall objectives of the PoM remain unchanged.

5.1 Lifelong Recreation

5.1.1 Access

Improve the accessibility of Camdenville Park as follows:

- Plan the ongoing maintenance of all pathways;
- Plan infrastructure upgrades that maximise accessibility to accommodate shared use by multiple users;
- Develop a circulation path that minimises impact on parks users and local residences and facilitates connectivity to St Peters Station;
- Remove the fencing around the playing field;
- Remove the fencing around the detention basin and create a pathway network to incorporate the area as part of the park using vegetation as a deterrent to access; and
- Remove / change the fencing along Bedwin Rd to significantly improve access to the western end of the park and passive surveillance of the area proposed for the BMX pump track.

5.1.2 Culture and Heritage

This Plan of Management is consistent with Marrickville Council's Local Environment Plan and Development Control Plan for the St Peters Triangle 2011 in noting the following:

- Camdenville Park and adjacent residences as a Heritage Conservation Area; and
- The terraces from 105 to 119 May Street as Heritage items.

5.1.3 People with Pets in Parks

Manage the use of pets in parks in conjunction with other park users and consistent with the Companion Animals Act, the Companion Animals Management Plan and the Marrickville Recreation Policy and Strategy.

- Upgrade and maintain facilities used for on-leash access, including major public thoroughfares and shared pedestrian / cycle paths.
- Plan for all on-leash areas to have appropriate signage to inform pet owners, including main access paths, major public thoroughfares and shared pedestrian / cycle paths; garden display areas and informal recreation areas.

5.1.4 Play Facilities

Improve and maintain existing equipment and provide additional play opportunities to better engage with young children and to cater for the needs of older children and youth.

- Upgrade the play facilities to better engage with young children;
- Develop play opportunities for older children and youth including but not limited to the development of a BMX / Pump cycle track; and
- Engage with the local population in the development of all youth play facilities.

5.1.5 Signage

A review of all signage in Camdenville Park should be conducted to ensure:

- Consistency of signage with Council's corporate branding;
- Relevant regulatory signage is in place and appropriately located; and
- Sufficient way finding signage is in place.

5.2 Active In Marrickville

5.2.1 Amenities

Ensure the needs of people are considered in the provision and management of park amenities, including public toilet facilities.

- Provide sufficient public toilets in an activated location in the Park;
- Be consistent with Crime Prevention through Environmental Design (CPTED) principles; and
- Incorporate sustainable design features (water sensitive urban design, renewable energy, renewable and recyclable materials, stormwater detention etc.) into all infrastructure upgrades

5.2.2 Biodiversity

Ensure the proposed actions in the PoM and Master Plan are consistent with Council's Biodiversity Strategy.

- Investigate opportunities to provide increased habitat throughout the park using local provenance plants; and
- Investigate opportunities for installing created habitat solutions that will protect and enhance biodiversity within the park.

5.2.3 Lighting

- Lighting upgrades to primary pathways to facilitate improved connectivity, usability and safety should consider minimising impacts on biodiversity values.
- Upgrade existing sports lighting to meet relevant compliance standards for the proposed sports use.

5.2.4 Maintenance

- Maintain Camdenville Park to provide a safe and clean park for the community;
- All maintenance activities should be programmed to minimise impacts on users of the facilities; and
- Maintenance staff should be consulted to ensure recurrent maintenance costs are considered in the design of all future facilities.

5.2.5 Recreation

- Increase the capacity of the sports field through an upgrade considering as a minimum the reconstruction of the playing surface, drainage and returfing;
- Ensure the provision of sufficient shade opportunities;
- Provide adequate accessible and appropriately located furniture and seating throughout the park; and
- Provide appropriate facilities to facilitate active informal recreation.

5.2.6 Remediation

Camdenville Park is a former brick works and a garbage incinerator (see the history of the park at Appendix 2 of the draft Plan of Management) and consequently the site has some major constraints due to this history of use. A consultant was commissioned to prepare a Remedial Action Plan and this investigative research was submitted to the NSW Environment Protection Authority who confirmed in a letter (April 2013) that 'there is no reason to believe that contamination at the site is significant enough to warrant regulation under the *Contaminated Land Management Act 1997'*. Nonetheless there are significant constraints on any development works such as cut and fill activities and which can only take place in specific areas within the park that

have been identified as not having contamination issues. The report also proposes the remediation of the detention basin area through the use of photo-remediation which involves the planting of vegetation in the basin which effectively treats the water by taking up any contaminants present.

- Plan all upgrades and works at Camdenville Park in accordance with the recommendations of the Remedial and Construction Environmental Management Action Plan 2013 (RCEMAP); and
- Integrate implementation of park remediation as outlined in the RCEMAP with the actions and works identified in the Master Plan.

5.2.7 Trees

The Master Plan includes an inventory of trees in the park as an Appendix.

- Implement the recommendations of the tree assessment including the following key features
  - Maintain and reinforce existing trees adjoining May Street
  - Consolidate tree planting along the boundary to the railway
  - Increase tree planting across the park to provide shade, enhance landscape character and improve biodiversity

5.2.8 Waste Management

- Investigate the development and operation of a storage facility at the eastern end of Camdenville Park for the garbage and recycling bins for the residences on Council St.
- Work with all park users to increase the recovery of recyclable materials and reduce waste leaving the site.

5.2.9 Water Management

- Integrate capital works identified in the Eastern Channel East Subcatchment Management Plan 2011 and Sustainable Irrigation Plan with the actions in this Plan of Management and Master Plan; and
- Ensure the effective maintenance of stormwater and WSUD infrastructure.

5.3 The Recreation Economy

5.3.1 User agreements

- Continue to licence the sports field to seasonal and casual sports users
- Investigate the possibility of leasing Transport for NSW land in the north-western corner of the park for the purposes of public recreation.

5.3.2 Equitable and Affordable Access

- Apply fees and charges consistent with Council's adopted Pricing Policy and Fees and Charges as applicable for the use of park facilities.
- Ensure consistency with relevant Council Policy governing the leasing of community facilities.
- Ensure consistency with other relevant policies governing the use of parks and open space facilities.

5.3.3 Planning

- Conduct a review of this PoM after 5 years.

6.0 Leases and Licences

6.1 Existing Leases and Licences

There are no long-term (12 months or longer) leases and licences in place over Camdenville Park at the time of developing this plan.

6.2 Future Leases and Licences

Future lease and licences will be allowable for any part of the Park for uses consistent with this Plan of Management, the Marrickville Local Environment Plan and any other applicable legislation.

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7.0 Master Plan

CAMDENVILLE PARK
MASTER PLAN

FOR **MARRICKVILLE COUNCIL**

16 JULY 2014

PREPARED FOR MARRICKVILLE COUNCIL

PREPARED BY GROUPGSA AND STORM CONSULTING

ISSUE	TITLE	DATE
1	DRAFT	07.03.2014
2	FINAL DRAFT	28.03.2014
3	DRAFT FOR APPROVAL	12.06.2014
4	FINAL REPORT	16.07.2014

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01. INTRODUCTION

1.1 PROJECT VISION

Camdenville Park is a significant area of open space, approximately 3.5 hectares in size, located in St Peters. This master plan outlines a future vision and working plan for the park to establish it as a unique and important recreation destination for the local area.

The vision is to create a dynamic and engaging park that optimises the potential of its rich layers of history, its unique setting, and its intriguing topography, as well as satisfying a wide variety of social and recreational opportunities.

The sporting and recreation uses will be embedded into the park and provide a diverse range of structured and informal recreation opportunities, catering for increasing recreation demand.

The park will continue to develop a strong ecological framework contributing to the regional ecological values. Improvements to the water management systems will benefit water quality leaving the site and facilitate reuse.

1.2 CONTEXT

As surrounding land use intensifies, Camdenville Park will become an increasingly important social and environmental asset.

Due to its size, Camdenville Park will become a valuable recreational alternative to both large and small parks in the area. The park will develop as part of a wider recreation network, by creating clear links and developing facilities in tandem with surrounding parks.

Unwins Bridge Road / May St, on the south side of the park, is an important regional recreational and ecological link between the Cooks River and Sydney Park, via several smaller parks. This 'green link' will be developed as part of a greater green streets strategy of street tree planting, WSUD treatments and traffic calming.

Camdenville Park has a growing user catchment due to the densification of surrounding land uses. These uses consist of commercial areas, light industry, medium density residential (terrace housing) and an increasing amount of high density residential. Two local primary schools, St Peters railway station and Marrickville Metro are also significant contributors to the park's user catchment.

1943 aerial photo showing disused brickworks in Camdenville Park. (Marrickville Council)

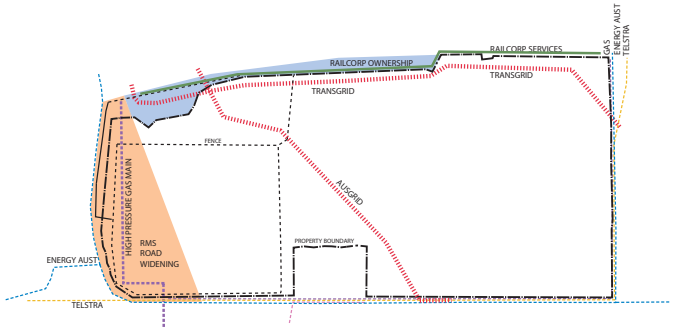


Diagram of land ownership and services

1.3 HISTORY

The name Camdenville originated from the large two-storeyed Georgian villa, named Camden Villa, which was built by Robert Bourne during the 1840s.(1) Although Camden Villa was built on the northern side of Camden Street, the name Camdenville came to represent the area southwards between Edgeware Road and King Street up to the Cooks River.

BRICKWORKS

The first known development of present day Camdenville Park occurred in 1848, when John Goodsell Co. purchased the existing brickworks on the property. At this time the property was bounded by Edgeware Road, Cooks River Road, May Street and present day Lord Street. In 1884 the St Peters Railway Station was constructed on the eastern side of the site, with the operations of the Goodsell Brickworks reduced to the site's western side up to the current John Street. In 1891 the business was sold, becoming Speare's Brickworks. Speare's Brickworks continued operation on the site up until 1921 when the viability of the clay reserves was exhausted.

WASTE DISPOSAL

In 1922 Newtown Council unveiled a Council run garbage incinerator on the old Speare's brickworks site. Using the chimney from the Speare's Brickworks factory, the Council spent £12,000 on the site. At the time it represented best practice in sanitary disposal of household waste. Fill from the process was disposed of in the hollowed out brick pit, progressively levelling out the site. The incinerator operated on the site up until the 1950s.

CREATION OF PARK

At their meeting 29 July, 1949 the City of Sydney Council carried a motion declaring the land be used as a recreation area.(3) In the 1950s a playing field was installed on the site, which interfered with the storm water run-off in the area.(4) In 1957 the City of Sydney Council installed a holding basin and pump facility to hold storm water run-off. The area was formally named Camdenville Park in 1960.

Flooding continued to be an issue in the area; the holding basin overfilled in May 1975, with water entering houses in Hutchinson Street. This flooding occurred during the worst downpour the area had received in 43 years, and coincided with a shaft breaking on the single detention basin pump.

(1) Rural Outpost to Inner City. p. 114.

(2) "Garbage Destruction: Newtown's Incinerator" Sydney Morning Herald. 16 September, 1922 p. 4.

(3) 0034/04073-52 Land, Council Street, May St & Edgeware Road, Newtown acquired for recreation purposes. City of Sydney Archives

(4) C Meader, R Cashman & A Carolan. Marrickville People and Places: A social history of Marrickville, Newtown, Camperdown, Petersham, Stanmore, St Peters, Tempe and Dulwich Hill. p. 167.

1.4 PLANNING CONSIDERATIONS

RAILCORP OWNERSHIP

A portion of the park is owned by Railcorp. Railcorp have given in-principal support to the land use proposed in the masterplan, though further liason may be required prior to implementation in this area. No change to the boundary fence is proposed.

ROAD WIDENING ZONING

A portion of the park, on the western edge, is zoned for Arterial Road Widening. Uses proposed in the masterplan are allowable under this zoning. Liaison may need to be undertaken with the RMS prior to implementation in this area. No change between the effective park boundary and existing roadway is proposed.

SERVICES

Underground services within the park boundary include; a transgrid cable along the north edge, high presure gas along the west edge, and an Ausgrid cable through the middle. Refer LANDFORM section for underground service cover requirements.


RAILWAY
BEDWIN ROAD
GOODSELL STREET
COUNCIL STREET
CAROLINE LANE
MAY STREET
1
2
3
4
5
6A
6B
7
8
9
10
11
12

02. MASTERPLAN

2.1 SUMMARY

01. FIELD UPGRADE
Improve park circulation by reorientating the field and removing perimeter fencing. Increase field quality with a new playing surface and lighting. Improve spectator experience with regrading and picnic shelters.

02. CIRCUIT PATHS
Establish new pathways to link park activities and encourage recreation use by walkers and joggers.

03. BEDWIN ROAD EDGE
Remove fencing along park boundary and create three new park entries to improve access and views into the park, including passive surveillance of the proposed BMX facility.

04. WETLANDS
Establish constructed and ephemeral wetlands in the detention basin, with planting and a semi-permanent water body, to treat stormwater and bioremediate site soil. Construct a small weir around the pump outlet.

05. DETENTION BASIN EDGE
Upgrade fencing and regrade edges to 1:6 slope, or mass plant with shrubs, to integrate basin into park and maintain user safety

06. PUMP TRACK + BMX TRACK
Integrate the proposed proposed pump track (6A) and BMX track (6B) into the park with shade tree planting and multiple access paths. Regrade surrounding landform to increase passive surveillance and discourage anti-social behaviour.

07. MAY STREET EDGE
Define edge and buffer park from street with tree and low shrub planting . Trees will be in accordance with street tree masterplan and shrub planting will be low to retain passive surveillance into park. Widen footpath to 5m, between Bedwin Road and terraces, to separate park visitors from street.

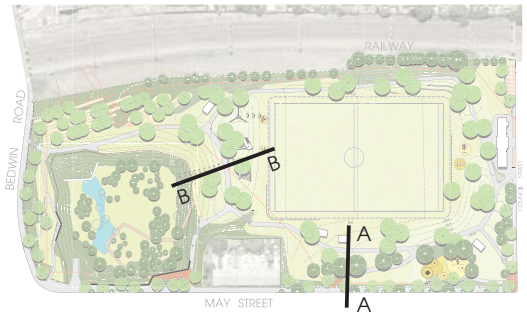
08. ACTIVITY SPACE
Create an adventure-play zone and picnic area in raised central location with views over field, BMX facility and wetland.

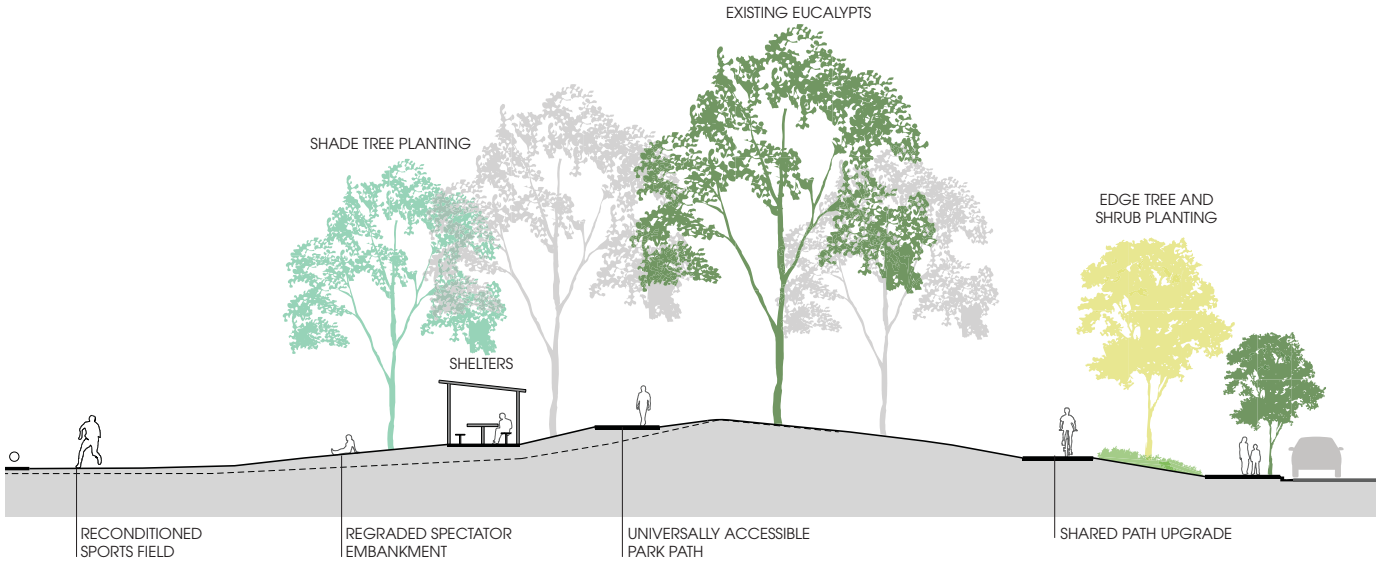
09. PLAYGROUND UPGRADE
Renew playground equipment, furniture and planting to provide an inclusive and engaging play experience. Separate children from traffic with integrated planting and fencing on the May Street side of playground.

10. EXERCISE EQUIPMENT
Provide exercise equipment stations to enhance the informal active recreation use of the park.

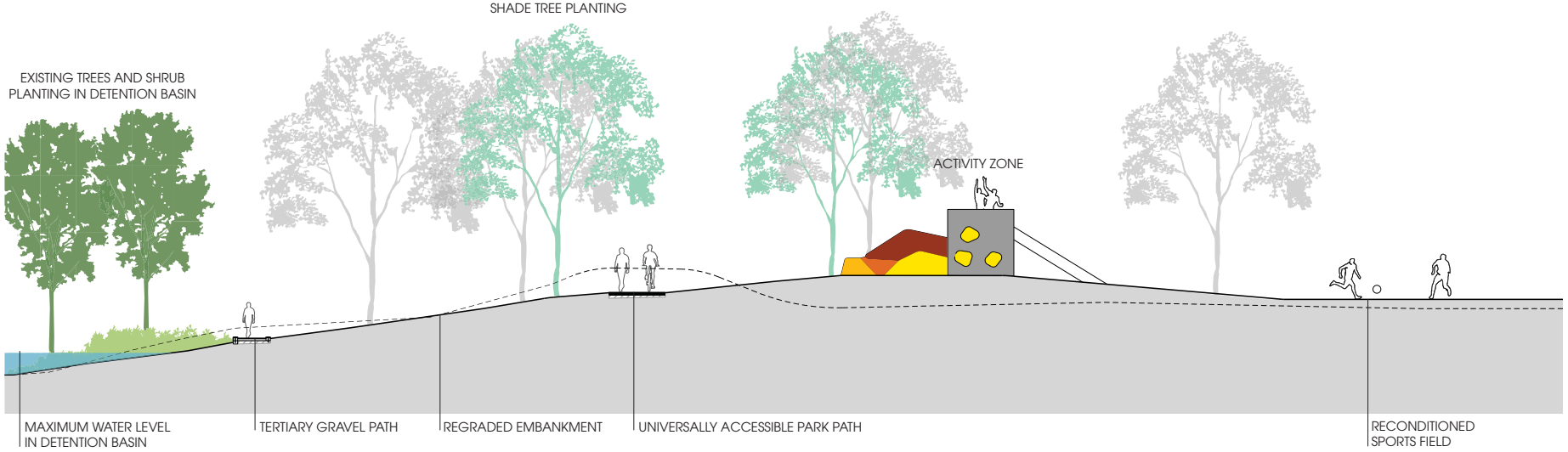
11. AMENITIES BUILDING UPGRADE
Renovate amenities building to meet contemporary design, CPTED and DDA principles. Investigate removal of central kiosk to facilitate views from Goodsell Street into park.

12. MAY STREET CROSSING
Investigate priority pedestrian crossing on May St to increase access into, and use of the park.





SECTION AA



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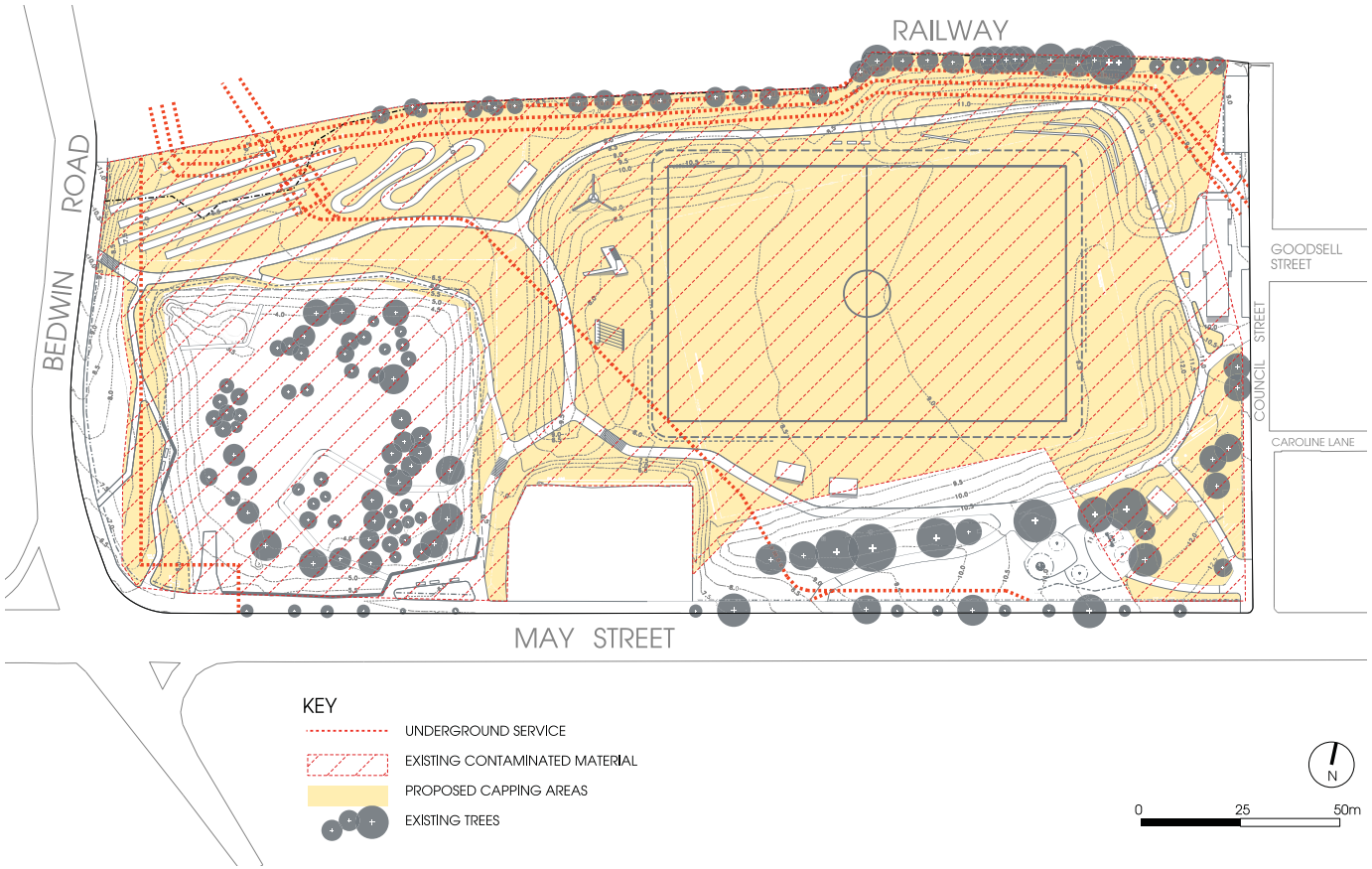
03. LANDFORM



3.1 CONTAMINATION

EXISTING CONDITION

Contaminated materials are present across much of the site. (1) Contaminantion in these areas is both chemical (lead, total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbon (PAH) compounds) and physical contaminants (broken glass, brick and metal wire). Site soils in the contaminated areas generally have a high clay content and little organic matter - which has made planting in these areas difficult.

GROUNDWATER

Groundwater under the detention basin contains contaminants (amonia) and there are indications that these contaminants are leaching into surface water and could recontaminate capping remediation measures unless the basin is fully lined. (2)

PROPOSED UPGRADES

As recomended in the RCEMAP, the risk of exposure to contaminants will be mitigated through application of:

> 200mm of capping with 'clean' soils in park recreation areas

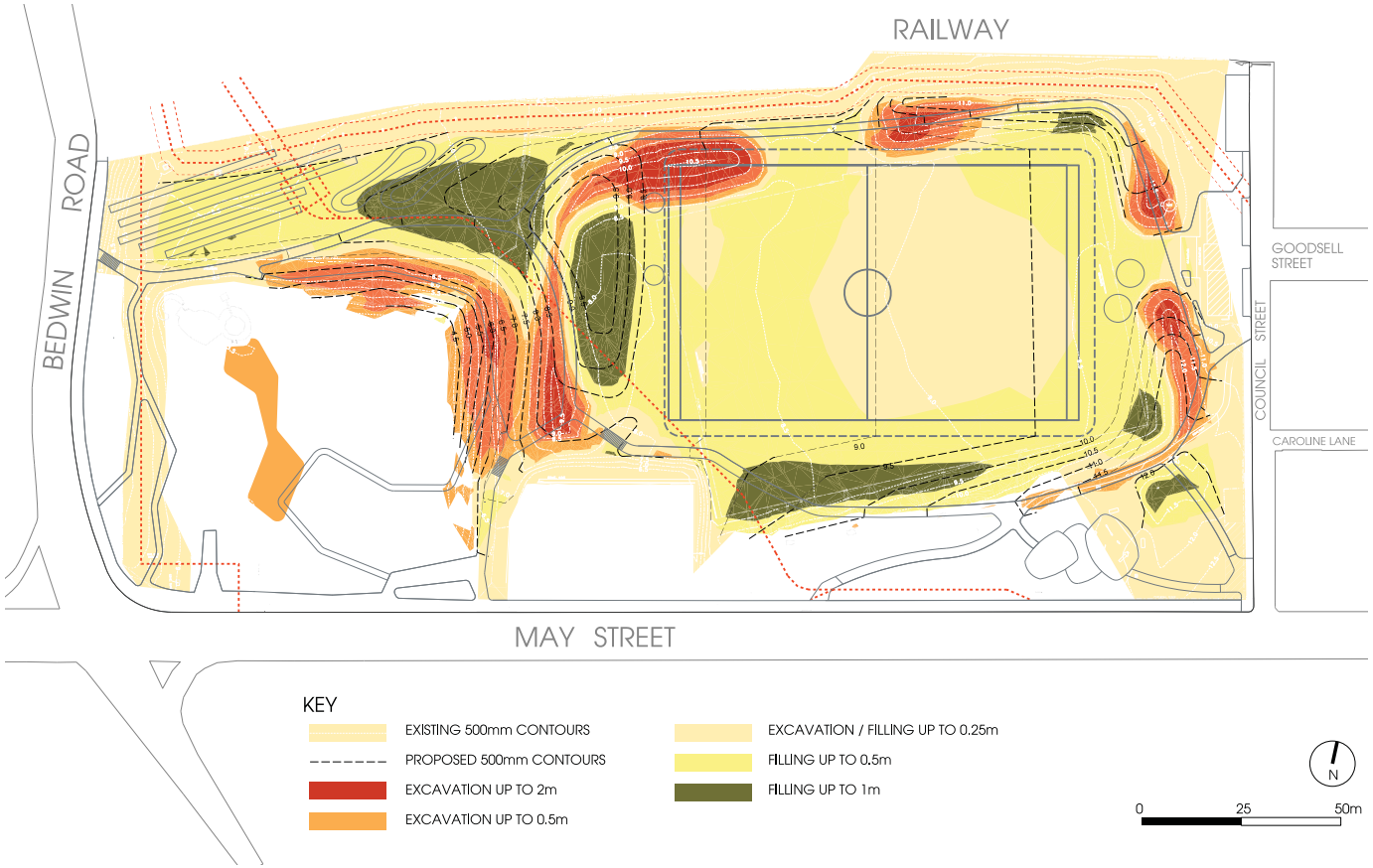
> 200mm of capping with 'clean' soils and an approved geotextile where intensive use is planned, eg. proposed BMX facility

> 150mm depth of mulch within a 4m radius of existing trees

Capping will not be applied to the detention basin due to the risk of recontamination by groundwater outlined above. It should be noted that the soil in contaminated areas should be tested further prior to reuse in regrading works outline below. (3)

Capping is not required where new paths are to be installed over contaminated areas, provided paths are 150mm thick.

> Approximately 4700 cubic metres of clean soil is required for capping



3.2 REGRADING

Regrading is proposed across the much of the site, in conjunction with the remediation measure identified above, to improve access, sports usage, and overland water flows in the park. Existing mounds around the sports field will be regraded to 1:6 slopes, to improve spectator seating and maintenance, and 1: 21 to allow construction of DDA compliant pathways.

> Approximately 4500 cubic metres of site soil will be redistibuted around the site as part of the regrading .

> Further investigation on potential noise issues is to be undertaken prior to final detail design to determine noise impacts on residents and inform the design of mounding which may assist in deflecting noise.

3.3 IN-GROUND SERVICES

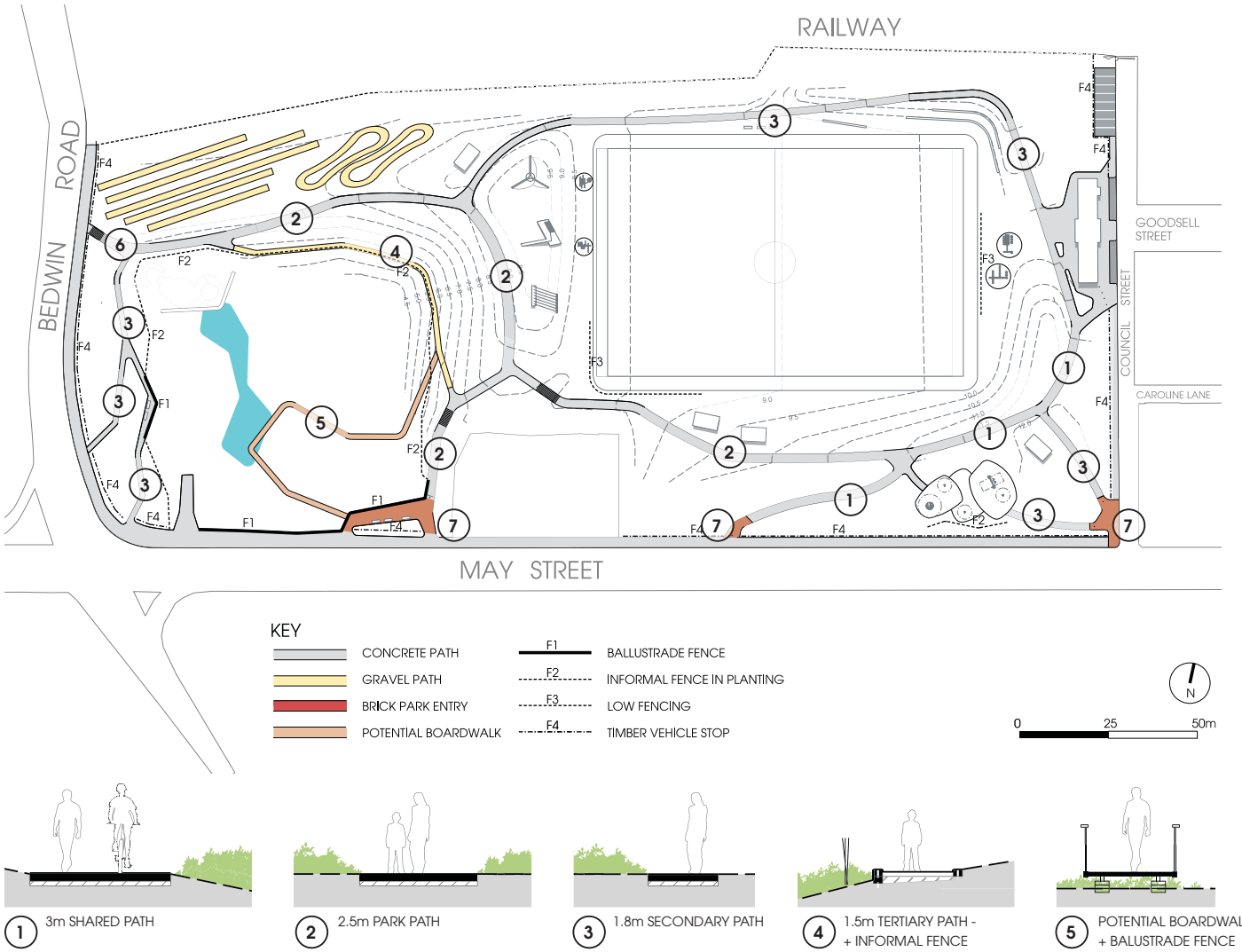
Existing in ground services restrict earthworks that can occur in the park. Existing levels cannot be altered above the TransGrid cable and associated easement, which runs along the north edge of the park, or above the high pressure gas main, which runs parallel to Bedwin Rd. Levels cannot be altered by more than 1m above the Ausgrid cable which bisects the site in an east-west direction.

(1) "Remedial and Construction Environmental Management Action Plan (RCEMAP)" GHD. August 2013 p. 38

(2) "Stormwater Monitoring Report" GHD. June 2012 p. 6

(3) "Remedial and Construction Environmental Management Action Plan (RCEMAP)" GHD. August 2013 p. 36

04. ACCESS



4.1 PATH NETWORK

ACCESS OPPORTUNITIES

The existing paths in the park are focussed in the south-east corner, linking May Street to Goodsell Street. To increase activity and permeability in the park, the new path network will focus on:

> Linking to new activity areas in the park.

> Encouraging through links.

> Facilitating the cycle route (Route L8) through the park.

> Creating recreational path loops.

> Enhancing diversity and experiences of pathways.

> Facilitating universally access through regrading.

PROPOSED UPGRADES

01. 3m wide concrete shared path upgrade of the existing path will safely accommodate cyclists and pedestrians.

02. 2.5m wide concrete park paths will facilitate universally accessible east-west movements through the park and maintenance access to the proposed BMX facility.

03. 1.8m wide concrete secondary paths will facilitate universally accessible recreational circuits around the sports field and detention basin.

04. 1.5 wide gravel tertiary paths will be constructed to encourage walking and jogging.

05. There is potential to expand the path network into the detention basin with boardwalks. Hazard signage is required on these paths to warn users of the risk of rising water and contamination.

06. Bike safe steps on the Bedwin Road edge provide direct park access for users north of the rail corridor.

07. Park entries, with brick paving, reflecting historic site use, formalise park arrival.

Precedent: Paths and steps in Old-Graveyard, Leinefelde, Landschaftsarchitektur gmbh

Precedent: Timber chain fence in planting at Sydney Park by JMD Design

4.2 FENCING

FENCING OPPORTUNITIES

Parts of the existing park, such as the detention basin, has large protective fencing. The existing sports field is contained by a low scale chain-mesh fence.

To enhance access and visual permeability through the site, the approach to fencing will be to:

- Apply fencing at heights and locations only as needed to address safety concerns.
- Integrate fencing within planting areas where possible to reduce visual impact.
- Provide separation through soft treatments such as planting and landform where possible.

PROPOSED UPGRADES

The existing detention basin fencing will be replaced with a combination of fence types designed to protect users from flood waters and contaminants while enhancing views and park experience;

- 1m high balustrade, topped with lean rail, adjacent to paths
- 1m high timber and chain fence integrated into planting and set back from paths

The existing sports field fencing will be replaced will small sections of fence designed to prevent balls from running away and people taking short-cuts across the field.

A section of informal fencing will be installed between the playground and May Street to increase child safety. This fencing will be 1m high timber and chain fence integrated into planting. Fencing will not be continuous around playground.

Fencing along Bedwin Road will be removed (subject to RMS review) to improve park access and increase passive surveillance and park safety.

The fencing along the railway corridor will be reviewed with Railcorp to ensure an adequate height as a safety barrier is provided.

4.3 PARKING

PARKING OPPORTUNITIES

The park has limited opportunity for on-site parking without impacting the quality of the park. The parking area on Council Street will be adjusted to enhance visual quality of the entry area, as well as access to the building and into the park.

It is not anticipated that large volumes of people will drive to Camdenville Park to use the proposed BMX facility. Council's Investigation and Design team will be conducting a Parking Study in 2017 (which will coincide with the recommended completion of the BMX track). This will provide information to base for further action.

PROPOSED UPGRADES

Parking outside the amenities building on Council Street will be relocated, but the overall number of spaces will be retained. Perpendicular parking outside the building will be replaced by 4 parallel parking spaces to improve access into the park and around the building. The remaining 8 perpendicular parking spaces will be relocated to the north end of Council Street.

4.4 VEHICLE ACCESS

There are three vehicles access points; two on Council Street, and one on May Street, between the residential properties and the detention basin. All other vehicle access is restricted by raised timber barriers, combined with the fencing identified previously. Existing vehicle access point will be upgraded with new removable bollards.

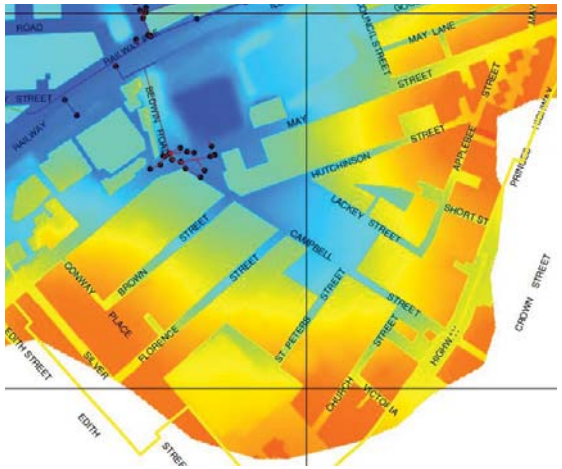
4.5 MAY STREET CROSSING

A priority pedestrian crossing of May Street, located midway between Bedwin Road and Council St, would improve access to the park and should be reviewed with the RMS.

4.6 COUNCIL STREET REFUSE BINS

Residential refuse bins are frequently stored on the east edge of the park, blocking access and reducing aesthetic quality of the park. This is addressed in the Marrickville Council 'Bins Off Streets' strategy.

05. HYDROLOGY



Local area catchment grading plan, Goulder Associates

Detention Basin catchment diagram, Storm Consulting

5.1 CATCHMENT AND DRAINAGE

The detention basin receives stormwater via formal drainage from the adjacent field and housing lots as well as road runoff from the north lane of May Street (between Bedwin road and Council Street).

The 23Ha urban catchment to the south and south-east of the park bypasses the basin, via formal drainage, in small storm events. In large storm events stormwater from this large catchment spills into the basin via a spillway on May Street. The detention basin doesn't alleviate nuisance flooding experienced at the intersection of May and Campbell Streets during small frequent storms.

The main land use within the southern sub-catchment is residential. Development in the residential area is characterised by highly impervious terrace housing lots which drain to the street. The south-eastern sub-catchment includes a mix of residential and commercial land uses. The southern and south-eastern sub-catchments have a high runoff potential, with approximately 70-75% of the surfaces comprising the catchment characterised as impervious.

5.2 DETENTION BASIN

There is no permanent water stored in the basin. The basin relies on pumping to drain stored water to the 1200mm diameter stormwater main under the railway line. This pipe connects to a Sydney Water channel north side of railway line (Lucas Cons Eng 1998). The basin takes approx 1 day to empty when completely filled.

In the case of pump failure, there is a pit located on the north side of the basin which gravity feeds to formal draiange downstream. There is a spillway on the north side of the basin which directs flood water to a an overland flow path north across the railway line towards Murray St and the Sydney Water drainage channel.

Detention Basin Volume (approx)	>	Caters for up to 1:20 event.
	>	No freeboard = 7.9ML (to RL 5.6m)
	>	300mm freeboard = 6.3ML (to RL 5.6m)
	>	500mm freeboard = 5.3ML (to RL 5.1m)
Pump Capability	>	Combined capability of all pumps = 200 L/s. (Marrickville Council information)
Catchment	>	Approx 30 ha (estimate)

PROPOSED UPGRADES

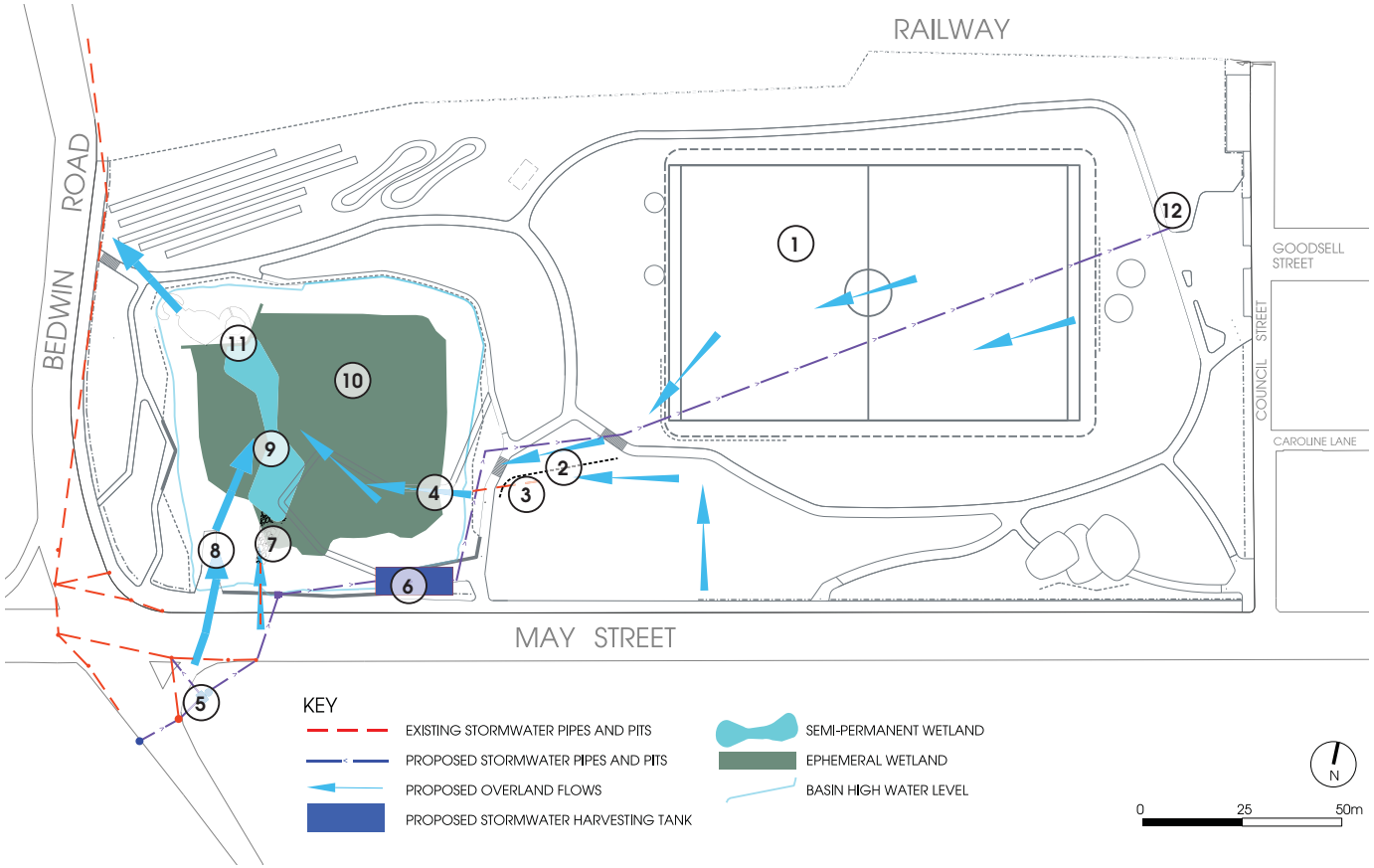
The proposal for the detention basin focuses on treatment of stormwater runoff that currently discharges directly into the basin. These measures include;

> Wetlands, including ephemeral and semi-permanent water areas, to polish and filter stormwater prior to discharging into downstream waterways.

> Gross pollutant traps as a primary treatment measure to capture stormwater pollution washed off the adjacent urban catchment.

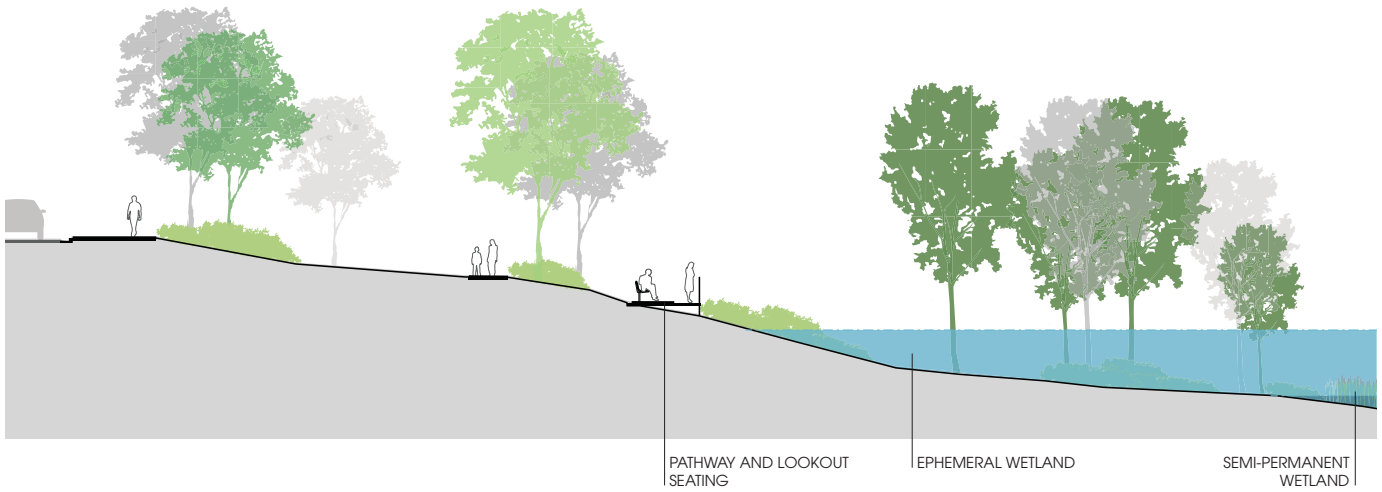
HYDROLOGY OPTIONS

Options for extensive drainage diversion into the basin from the adjacent stormwater network are reviewed in the HYDROLOGY OPTIONS APPENDIX.



5.3 HYDROLOGY PLAN

01. Install sub-surface drainage to sports field as part of oval upgrade.
02. New bund at the top of the embankment and drainage to convey flow towards basin and reduce nuisance flooding
03. Remove debris and blockages from stormwater channel and pipe inlet to reduce incidence of nuisance flooding
04. Construct level spreader and vegetated filter strip at the existing stormwater outlet to the basin to reduce scour and improve stormwater treatment
05. Construct new GPT and stormwater offtake for proposed harvesting scheme. High flow bypass to existing drainage.
06. 200kL stormwater tank and treatment location - harvested water to irrigate sports oval/park via rising main. Stormwater tank yield: 3.73 ML/yr (84.5%)
07. Construct sediment basin, level spreader, mini wetland, at the existing stormwater outlet to the basin
08. Extend driveway and maintenance access
09. Semi-permanent wetland (lined) with average water depth of 200mm
10. Ephemeral wetland planting on the floor and sides of the basin
11. Rock wier around existing pump station
12. Treated water rising main to existing header tank for reticulation



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5.4 WETLANDS

Wetlands are proposed in the detention basin to enhance park amenity, increase habitat, and improve the quality of stormwater that discharges from the basin in regular storm events. The wetlands include both an area of semi-permanent water, referred to here as a SEMI-PERMANENT WETLAND, and area of temporary inundation, referred to here as EPHEMERAL WETLANDS. Wetland planting will also assist in bioremediation of site contaminants.

SEMI-PERMANENT WETLAND

A shallow constructed wetland is proposed to provide passive treatment to runoff from the directly connected catchment, as it flows through the basin. Constructed wetlands rely on enhanced sedimentation, fine filtration and biological uptake processes to remove pollutants from stormwater. Water levels temporarily rise during rainfall events and outlets are configured to slowly release flows typically over 48 to 72 hours back to dry weather water levels. During dry weather ponded water will slowly infiltrate into the surrounding soils or be lost via evapotranspiration.

The wetland will perform a critical role in the 'treatment train' proposed for the basin, which comprises of the following elements to achieve best practice pollutant retention for the directly connected impervious catchments;

- 300m2 lined wetland with an average water depth of 200mm (requires excavation and remediation to a depth of 250mm).
- Sediment trap at the inlet from May street.
- Vegetated swale at the inlet from the adjacent lots and playing fields.

The design of the wetland will rely on the existing topography and ideally be located in the low point of the basin. As the proposed wetland system will be located at the base of the existing detention basin it will occasionally become inundated to greater depths than the ideal extended detention depth; however, the inundation duration is usually relatively short (<24 hours) and is unlikely to affect the wetland vegetation provided that scour velocities are managed

Precedent: Wetlands in Royal Park, Adelaide by Rushwright

Precedent: Wetland lookout at West Sydney Regional Park by Govt Arch Office

through the wetland. Approximately 80-100m3 of soil will need to be excavated and 8-10 trees will need to be removed to facilitate construction of the wetland without reducing the capacity of the detention basin. The excavated material will be reused elsewhere on site - REFER LANDFORM

A leaky rocky weir configuration (anchored down) is envisaged for the outlet of the wetland to control discharge during storm events and provide adequate detention of stormwater in the wetland.

EPHEMERAL WETLAND

Low planting is proposed on the floor and sides of the basin; areas of temporary water inundation. This planting will provide some treatment to floodwaters from the southern catchments in larger more infrequent storm events. This planting will also assist in bioremediation (or phyto-remediation of contaminated soils. Plant species will suit local site conditions, including infrequent deep inundation, and be under 1m high to ensure sightlines are retained in accordance with CPTED principals.

WETLAND MAINTENANCE

Active maintenance of the sediment traps, wetland, and vegetated features will be required and are important to ensure the functionality and benefits of the system into the long term.

5.5 GROSS POLLUTANT TRAPS

The installation of a GPT (Gross Pollutant Trap) as a primary treatment measure will capture stormwater pollution washed off the adjacent urban catchment. A CDS unit or equivalent GPT specification would be ideal due to its non-blinding screening capability and its proven pollutant removal performance. A trash screen consisting of galvanised steel exclusion bars would ideally be installed at the stormwater inlet to wetland, to trap litter and debris close to the maintenance access to the site.

5.6 STORMWATER HARVESTING

A stormwater harvesting system is proposed to irrigate the sports field and provide grey water for the amenities building. This system would include a new tank located on the May St side of the detention basin, feed by new pits in May St and connected to the existing header tank near the amenities building.

IRRIGATION DEMANDS

The mean historical irrigation demand for the sports field is 4.4ML/yr (Equatica, 2011). The annual irrigation application rate required to maintain sport fields in Sydney is 500-1500mm/yr. and the field area is approx 8000m2 - which corresponds to annual Irrigation requirements for ranging from 4.2ML - 8.3ML/yr.

TANK SPECIFICATION

A 200kL tank (gravity supply) and treatment plant, located to capture stormwater from the 23Ha catchment south of the park, can provide up to 85% of the annual irrigation demands of the sports field, or 3.7ML/yr. Locating stormwater diversion and storage infrastructure at the corner of Campbell and May Sts will also assist in alleviating the nuisance flooding issues experienced at this intersection.

GPT's are a critical component of a stormwater harvesting proposal refered to on the next page as they prevent the accumulation of litter, debris and sediment in the storage tank, and clogging of filters and pumping/distribution equipment.

STORMWATER HARVESTING OPTIONS

Alternative options for stormwater harvesting are reviewed in the HYDROLOGY OPTIONS APPENDIX.

06. RECREATION

Precedent: Adventure play at Plough and Harrow Reserve, Sydney by Group GSA

Precedent: Adventure play at Normand Park, UK by Kinnear Landscape Architects

6.1 PLAYGROUND

PLAY OPPORTUNITIES

A playground is located between the sports field and May Street, which suits both daily and sporting related use, and is partially shaded by adjacent trees.

The potential for the play facilities in the park are to:

- Retain the preschool / primary age play in the existing approximate existing location due to the visibility, accessibility and the existing shade.
- Upgrade facilities in the play area.
- Develop more challenging active play in other areas of the park. (Refer ACTIVITY SPACE).

PROPOSED UPGRADES

The playground will be expanded and upgraded, in approximately the same existing location, to provide a diverse and engaging play experience for children aged between 1-12. Universally accessible play will be encouraged. Upgrades will include new equipment, adventure play areas, sensory planting and furniture.

A section of fencing, integrated with planting, will be installed between the playground and May Street to provide protection from May Street. (REFER FENCING) Shrub planting will be installed between playground and shared path to reduce potential conflict with cyclists. (REFER VEGETATION)

6.2 ACTIVITY SPACE

An activity space is proposed on a high point in the centre of the park, close to the sports field, BMX track and detention basin. This space will cater to older children and young adults by providing challenging adventure play opportunities. Large scale equipment will contribute a sculptural aspect to the park, due to the prominence of the location.

Precedent: Pump track in Ventura Park, Oregon

Precedent: Pump track in Ventura Park, Oregon

Precedent: Macarthur BMX pump track, Narellan, Sydney

Precedent: Macarthur BMX pump track, Narellan, Sydney

6.3 PUMP TRACK + BMX TRACK

A BMX facility, including a junior 'pump' track and senior BMX track, is proposed in the north west section of the park. The track will be integrated into the park with shade tree planting, access paths and landform modification which increase passive surveillance. The intensive nature of BMX usage will require additional contamination remediation measures (REFER EARTHWORKS)

The track will be delivered in stages with the junior 'pump' track built within three years in conjunction with new paths, improved sight lines and access, and ancillary facilities.

The pump and BMX tracks caters to a wide range of riders who are learning and developing skills in off-road riding. The junior 'pump' track is a small scale facility designed as interconnected gravel loop paths integrated with small jumps and berms. The senior BMX track caters for more advanced rider skills. Together, the tracks provide a unique recreation facility catering to a wide age range from Primary school age through to experienced older riders. The BMX and pump tracks supplement the recreation activity precinct within the centre of the park.

6.4 SPORTS FIELD

SPORTS OPPORTUNITIES

The sports field is a major attractor for the park. The field is defined by fencing and is surrounded by steep grassed embankments. The mounds and embankments are well used by spectators watching sports games. Opportunities for the sports fields include:

- Upgrade grass surface.
- Remove surrounding fencing to integrate the field into the park.
- Include informal seating opportunities for spectator viewing.

Precedent: Amenities building at Elizabeth Bay, Sydney by Sam Crawford Architects

PROPOSED UPGRADES

The sports field will be reoriented and upgraded with new surfacing and drainage. The new orientation will allow regrading of surrounding mounds to improve spectator seating, as-well-as improving access within the park (REFER ACCESS). The improved durability of the upgraded playing surface will accommodate additional sports use, including increased informal recreation usage. Lighting of the sports field would further increase field usage (REFER LIGHTING). Fencing around the field will largely be removed to encourage informal recreation and discourage off-leash dog use (REFER FENCING).

6.5 AMENITIES BUILDING

AMENITIES BUILDING OPPORTUNITIES

An amenities building is located on the Council Street edge of the park. The building has some architectural merit and contains public toilets and several sports uses, including; changing rooms, storage and a central canteen. The toilets are operational, but do not comply with current CPTED and DDA standards. The toilets are open from sun up to sun down.

The opportunity is to upgrade the existing building to preserve the siting, character and scale of the building, whilst modifying with a contemporay design overlay.

PROPOSED UPGRADES

Upgrades to the existing structure could include:

- Internal upgrading of the facilities including reducing changing room size and increase toilet sizes to achieve DDA and CPTED compliance.
- Alterations of facade brickwork to allow more light and ventilation.
- Removal of internal kiosk to facilitate sight lines into the park from Goodsell Street.
- Design improvements; green walls / roof to insulate the building and integrate into the park.

6.6 PARK FURNITURE

FURNITURE OPPORTUNITIES

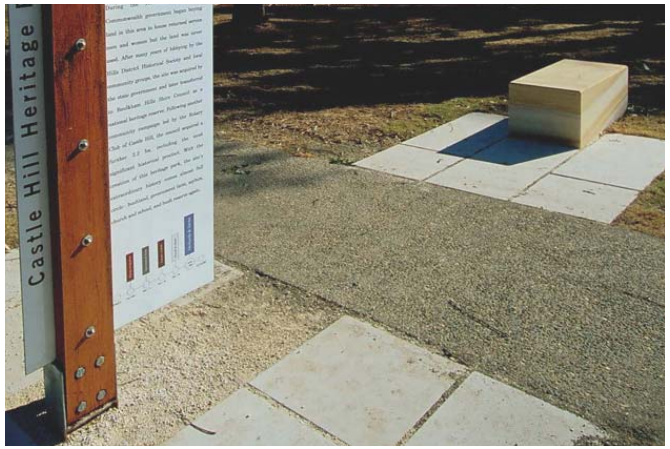
Existing park furniture consists of park benches and bins in the vicinity of the sports field. Opportunity for furniture in the park will be to provide:

- Seating in varied locations to encourage use of different areas of the park.
- Areas for groups to gather.
- Shelters for weather protection.
- Informal seating opportunities with walling and low scale elements.
- Exercise equipment stations located in the central area of the park to support the active recreation diversity offered.

PROPOSED UPGRADES

Additional seating will be provided throughout the park, and existing benches refurbished. Benches will be located adjacent to the new path network and orientated toward activities and open space. Seating terraces could be included around the sports field to improve spectator experience.

Shelters, some with BBQ facilities, will be provided to encourage picnicking. Shelters will be located adjacent to the sports field, BMX track and playground to maximize usage. The area closest to the corner of May Street and Council Street is the preferred location for BBQ facilities due to the proximity to the sports field, parking, and connecting to services.



Precedent: Castle Hill Heritage Park Interpretive signage with informal seating

Precedent: Waverley Coastal Walk wayfinding signage

6.7 DOGS

Dogs will continue to be allowed in the park, except on the sports field, provided they are on-leash. Access paths will improve dog walking in the park. No official off leash area is planned in the park.

6.8 LIGHTING

Lighting in the park will continue to focus on the sports field and the shared path connection. Existing light in these ares will be assessed for compliance with relevant standards and upgraded as required. Additional lighting of the sports field, through additional fittings on the north side, would improve night time sports usage and could be considered as part of field upgrades. Light will not be installed in other areas of the park due to potential safety issues resulting from inadequate passive surveillance.

6.9 ART

Interactive art panels are proposed in the north west section of the park to engage the active street art culture in the area. Panels should be visible from the train tracks and planned paths, to ensure art is highly visible and to discourage anti-social behaviour.

Existing slogans on the Bedwin Road fencing will be reinterpreted through new signage or artwork along the western park edge.

6.10 SIGNAGE

Wayfinding and interpretation signage will be developed for the park, in conjunction with LGA wide signage strategies. Wayfinding signage will be located at major park entries and will contain information to inform users of facilities in the park and destinations in the surrounding area. Interpretation signage will convey the park's history and ecological systems and will be located at strategic locations within the park.

07. VEGETATION

Site photo: trees screening rail corridor on north park edge

7.1 EXISTING VEGETATION

Planting has historically been restricted by poor quality soils over much of the park. Growing conditions will be significantly improved in these areas through the addition of imported soil, as outlined in the Earthworks section.

EXISTING TREES

The park's existing trees are being reviewed by an arborist and the finding of this review will be incorporated into the final masterplan.

Trees in the south-east corner are a mixture of mature native Eucalypts and exotic species. The most significant of these are a row of mature Eucalyptus that occupy the top of the southern mound, between the sports field and May St, providing shade to spectators, pathway users and the playground area. The location and stature of these Eucalypts are a significant part the park's aesthetic.

Trees along the north boundary are predominantly juvenile Casuarina. These trees partially screen the rail line and provide a small habitat corridor.

Trees in the detention basin are a mixture of juvenile and mature Casuarina. These trees provide a valuable small urban forest and contribute a sense of green to the park and passersby.

Street trees along May Street are generally small and poor quality. This is due to trimming required by overhead power lines.

Shrub planting is restricted to native and exotic regrowth along the northern and Bedwin Road boundaries. This planting is minimally managed and reaches height of up to 3m in height.

7.2 TREE PLANTING

Tree planting will develop the existing planting themes in the park. Trees will be clear trunked to maintain sightlines in accordance with CPTED principals. Three types of tree planting will be implemented as follows;

SHADE TREES

Building on the character established by the existing Eucalypts on the south mound, large Eucalypts will be planted individually and in small groups through the centre of the park. These trees will frame the sports field and provide extensive shade to spectator seating, pathways and activity areas.

PARK TREES

Existing street trees will be supplemented with medium sized evergreen species along the May Street and Bedwin Road park edges, within the park boundary. These trees will provide shade to passing pedestrians and visually define the park perimeter.

WOODLAND TREES

Existing stands of native trees in the detention and along the north boundary will be linked with native evergreen species, planted in bands to shade but not preclude proposed BMX. The tree planting will create a valuable large woodland habitat. Hardy species selection will be critical to ensuring success of planting in this difficult area.

MAY STREET TREES

New street tree planting along May Street will occur within the park boundary to ensure successful canopy development, unobstructed by power lines. Tree species will be in accordance with Marrickville Council's Street Tree Masterplan.

7.3 SHRUB AND GROUNDCOVER PLANTING

Shrub planting will contribute to the park's overall aesthetic, increase habitat value and reduce maintenance in the park. Shrub planting will provide some phytoremediation to the contaminated detention basign which is not being capped. Four types of shrub planting will be implemented as follows;

ORNAMENTAL SHRUBS AND GROUNDCOVERS

Low growing shrubs and groundcovers, up to 500mm high, will be planted along the May St and Bedwin Road edges of the park. The low growing planting provides separation whilst maintaining views through and into the park. This planting will buffer the park from the traffic, provide seasonal visual interest and integrate existing traffic control devices.

GRASSLAND

A native grassland is proposed along the northern boundary to reduce maintenance and increase habitat value around the existing trees.

EMBANKMENTS SHRUBS AND GROUNDCOVERS

Mass planting of low-growing native species is proposed on steep embankments to reduce maintenance and provide extensive terrestrial habitat. Species selected for the embankments surrounding basin will need to be able to withstand temporary inundation during storm events.

WETLAND GRASSES AND SHRUBS

Establishment of the wetland with macrophyte plants and surrounding native grasses and shrubs,

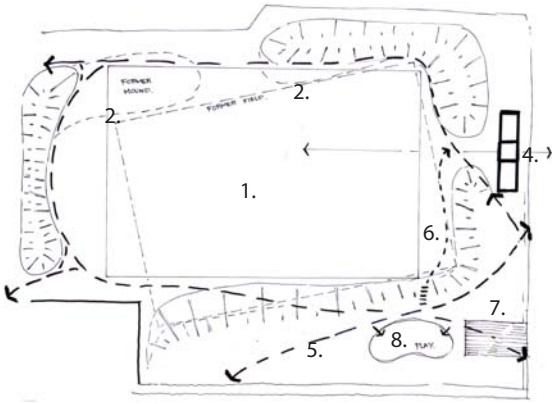
08. CONCLUSION

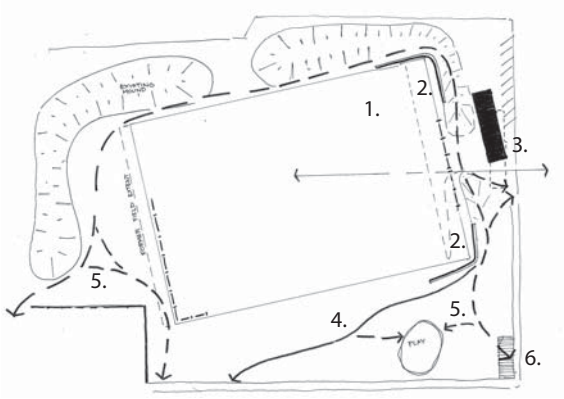
The Master Plan for Camdenville Park builds upon the intrinsic existing site character with the vision of the park as a unique and important recreation destination interwoven with a resilient and diverse ecology.

The sporting and recreation uses will be embedded into the park, providing a diverse range of structured and informal recreation opportunities, catering for increasing recreation demand. The park will also have a strong ecological framework contributing to the important local and regional ecological values.

This Master Plan document has been prepared with the aim of providing a robust plan to guide the future development and improvements of Camdenville Park.

01. DESIGN TESTING





OPION 1

01. Re size field for senior use) and reorientate to reduce `pinch-point at terraces
02. Reduce and regrade existing mounds in north-west to accommodate field.
03. Regrade slope on south side of field to improve connection from south-east corner of the park to the field and west side of park and improve spectator seating by reducing slope.
04. Improve sightlines into park by removing central kiosk section of amenities building.
05. Existing path replaced with wider path with simpler geometry.
06. Secondary path with gravel surface and steps to improve and diversify access.
07. Plaza area near park entrance with group seating and BBQs.
08. Large playground relocated away from May St .

OPION 2

01. Resize field for senior use) and move north-east to reduce `pinch-point at terraces
02. Reduce and regrade existing mounds in north-east to accommodate field and allow accessible path. Incorporate seating walls into mounds to improve spectator amenity and reduce earthworks.
03. Move and replace amenities building to create sight lines and better access into park.
04. Upgrade existing path to reduce hazards
05. Additional paths to improve access.
06. Small formal entry and seating area.
07. Playground upgraded in existing location

Camdenville Park - Draft Masterplan

Preliminary Opinion of Probable Costs

By Group GSA for Marrickville Council

Preliminary Opinion of Probable Costs

Camdenville Park - Draft Masterplan

REV. 1	30.01.2014
REV. 2	10.02.2014
REV. 3	07.03.2014

1.00	Demolition	Qty	Unit	Rate	Total
1.01	Demolition and removal of concrete pathway	252	SqM	$20	$5,040
1.02	Demolition and removal of fencing (dentention basin and Bedwin Rd)	1043	LM	$15	$15,645
1.03	Demolition of miscellaneous items, including playground equipment, softfall and furniture	1	Item	$10,000	$10,000
	Total				**$30,685**

2.00	Earthworks	Qty	Unit	Rate	Total
2.01	Capping of contaminated areas with 200mm of imported soil	4700	CuM	$40	$188,000
2.02	Allow to excavate and regrade existing site soil with low level contamination (all to soil to remain on site)	4500	CuM	$50	$225,000
2.03	High level contaminated materials				Excl
	Total				**$413,000**

`

3.00	Stormwater	Qty	Unit	Rate	Total
3.01	GPT + wetland construction + harvesting works, including tank, pump and pipework (with 30% contingency)	1	Item	$1,085,000	$1,085,000
	Total				**$1,085,000**

4.00	Pathways	Qty	Unit	Rate	Total
4.01	Concrete pathways: 2.5m wide (average) x 100mm deep with 25MPa concrete, SL62 reinforcing over 150mm deep compacted roadbase, on compacted subgrade.	1000	SqM	$120	$120,000
4.02	Brick paving at park entries: recycled bricks laid over 30mm sand/cement (10:1) mortar bedding with 100mm 25 Mpa concrete over 50mm compacted sand bedding and compacted subgrade.	100	SqM	$140	$14,000
4.03	Decomposed granite: 75mm compacted deco granite on 200mm compacted roadbase.	100	SqM	$65	$6,500
	Total				**$140,500**

5.00	Playground	Qty	Unit	Rate	Total
5.01	New playground equipment	5	Item	$40,000	$200,000
5.02	Softfall play surface	328	SqM	$200	$65,600
5.03	Sundry items, including signage and planting	1	Item	$70,000	$70,000
	Total				**$335,600**

6.00	Sports Field	Qty	Unit	Rate	Total
6.01	Sports field surface, including; drainage, soil media, irrigation and turfing	1	Item	$600,000	$600,000
6.02	Sports lighting	4	Item	$20,000	$80,000
	Total				**$680,000**

7.00	Planting	Qty	Unit	Rate	Total
7.01	Mulched planting, including installation of new plants (nom. 200mm pots at 500mm centres) and 75mm depth mulch	7100	SqM	$35	$248,500
7.02	Turf, including installation and application of fertilisers and wetting agent	16000	SqM	$15	$240,000
7.03	Trees, including excavation + installation of 100L trees, fertilisers, wetting agent and staking (as required).	158	Item	$80	$12,640
7.04	150mm mulch to 4m radius around existing trees in contaminated areas	300	CuM	$20	$6,000
7.05	Cultivation of site soil and and imported topsoil for all mulched planting, turf and trees is covered in Earthworks Section				Excl
	Total				**$507,140**

8.00	Furniture	Qty	Unit	Rate	Total
8.01	Park shelter with picninc table and benches, including installation on 4m x 4m concrete slab	4	Item	$25,000	$100,000
8.02	Park seats, including installation on concrete slab.	10	Item	$3,000	$30,000
8.03	Fencing to wetland, sports field and playground	400	LM	$200	$80,000
	Total				**$210,000**

9.00	Activity Zone	Qty	Unit	Rate	Total
9.01	Adventure play equipment	2	Item	$150,000	$300,000
	Total				**$300,000**
	Overall Total				**$3,701,925**

5 March 2014

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SUSTAINABLE WATER
STORMWATER & RUNOFF
STREAMS & WATERWAYS
CIVIL & INFRASTRUCTURE

Dear David

RE: Camdenville Park - MUSIC modelling and Wetland sizing

Storm consulting have developed a MUSIC model for Camdenville Park to support the Masterplan submission for the site. This document should be read in conjunction with the Masterplan document for Camdenville Park. The following report outlines the results from the assessment.

MUSIC MODELLING

MUSIC v6 (the Model for Urban Stormwater Improvement Conceptualisation) was adopted to model the water quality of runoff from the proposed development. The primary water quality constituents modelled in MUSIC and of relevance to this report include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) and Gross Pollution (GP). MUSIC modelling was undertaken in accordance with NSW DRAFT MUSIC Modelling Guidelines (SMCMA, 2010), and has considered treatment measures (GPT, Stormwater Harvesting and Wetland, etc...) as proposed by Storm Consulting and Group GSA. A concept plan has been developed for this project and is included as Appendix 1 to this document.

Catchments

Sub-catchments have been modelled separately for the basin and the stormwater harvesting reflecting the basic catchment hydrology. In reality floodwater from the large urban catchment (23Ha) spills into the basin which imparts some treatment on these flows prior to discharge downstream.

Refer to the masterplan document for a more detailed discussion of the catchments.

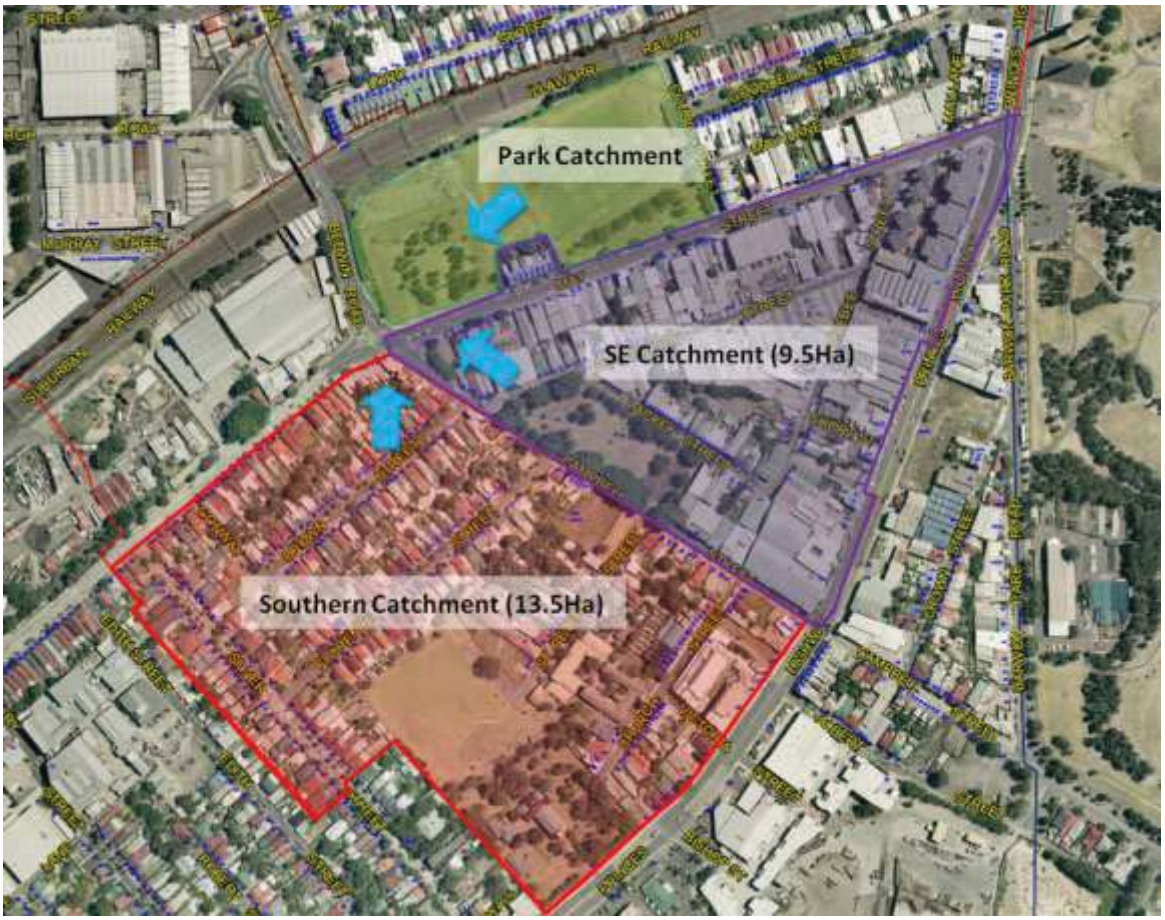

Figure 1: Catchment Plan

Table 1: Catchment Summary

Catchment ID	May St - Campbell St (9.5Ha)	Southern Catchment (13.5Ha)	Camdenville Oval + Units (1.54Ha)	May St – road catchment (0.7Ha)
Node Type	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode	UrbanSourceNode
Total Area (ha)	9.5	13.5	1.5	0.7
Area Impervious (ha)	7.1	8.8	0.1	0.6
Area Pervious (ha)	2.4	4.7	1.4	0.1

Figure 2: Model Layout

Model Assumptions

The following is a summary of MUSIC modelling assumptions;

- Climate Data – 066037 Sydney Observatory Hill [01/01/1990-31-12-1999]
- Catchment Characteristics – refer table 1
- Water supply catchment: 23 Ha Urban Catchment
- Soil Characteristics – as per NSW Draft MUSIC guidelines
- Pollutant Generation data – as per NSW Draft MUSIC guidelines
- Stormwater Harvesting Tank Size - 200kL
- Wetland Surface Area: 300m2
- Wetland Permanent Pool storage size 30m3
- Average Depth of Permanent Pool: 150mm
- Basin Extended Detention Depth - 2m
- Tank Demands – Irrigation Demands (4.4ML/yr) derived from Equatica Report for 07/08

Treatment Train

- A portion of May Street (0.7Ha) and the playing fields drain directly to the basin in Camdenville Oval via a concrete channel - and a vegetated swale is proposed as a primary treatment measure for this catchment.

- The larger urban catchment (23Ha) bypasses the basin in minor events. A primary treatment device (i.e. GPT) has been proposed to intercept runoff from this catchment prior to diversion into a harvesting tank for reuse.

STORMWATER HARVESTING TANK SIZING

The stormwater tank has been sized using the water balance function in MUSIC. A yield analysis has been undertaken to determine the optimal tank size to supply harvested stormwater for irrigation purposes. The optimal tank size is the point of whereby increasing the tank size will lead to a diminishing return in the % of irrigation demands met by harvested stormwater. This relationship can be seen in Figure 3 below, and the optimal tank size appears to be in the range of 200kL which can provide 85% yield (equivalent to 3.74ML of stormwater per year).

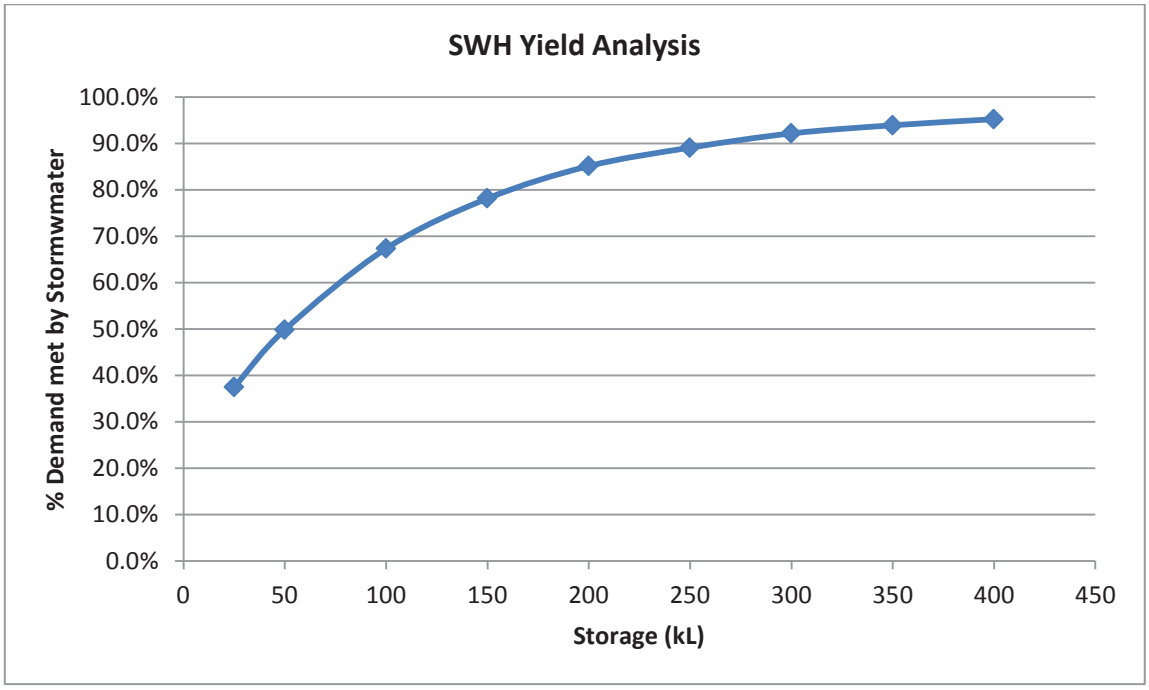

Figure 3: Stormwater Harvesting - Yield Analysis Results

MUSIC RESULTS

The following table provides performance results from MUSIC for the proposed treatment train in the basin (i.e. sediment basin, wetland, and swale) with respect to best practice stormwater pollution targets for NSW. The treatment train performs well for all target pollutants and achieves best practice pollution reduction for TP and Gross Pollution and comes close for TSS and TN. At concept design stage the wetland design can be further optimised to achieve best practice pollution reduction for all target pollutants.

Table 1: MUSIC Results for Basin Treatment Train

MUSIC Results	Sources	Residual Load	% Reduction	Best Practice Targets
Flow (ML/yr)	11.9	7.86	33.9	
Total Suspended Solids (kg/yr)	1650	297	82	85%
Total Phosphorus (kg/yr)	3.04	0.984	67.6	65%
Total Nitrogen (kg/yr)	23.2	13.8	40.7	45%
Gross Pollutants (kg/yr)	214	0	100	70%

The following table provides performance results from MUSIC for the proposed stormwater harvesting treatment train (i.e. GPT and stormwater harvesting scheme) with respect to best practice stormwater pollution targets for NSW. The treatment train performs well for Gross Pollution, and provides some treatment for other target pollutants (TSS, TP, and TN). The primary function of the stormwater harvesting scheme is to provide non-potable water for irrigation, rather than stormwater treatment.

Table 2: MUSIC Results for Stormwater Harvesting Scheme

MUSIC Results	Sources	Residual Load	% Reduction	Best Practice Targets
Flow (ML/yr)	165	161	2.3	
Total Suspended Solids (kg/yr)	27700	19000	31.5	85%
Total Phosphorus (kg/yr)	46.5	35.9	22.9	65%
Total Nitrogen (kg/yr)	346	337	2.6	45%
Gross Pollutants (kg/yr)	4400	540	87.7	70%

GENERAL DISCUSSION

The proposal achieves number of project objectives including reduction in nuisance flooding, stormwater treatment to the local catchment, provision of alternative water for irrigation, as well as improved park amenity.

A major impediment to a more extensive stormwater proposal within the basin is soil contamination. The basin has a lot of potential from a stormwater perspective but significant infrastructure upgrades and soil capping would be required to transform the basin into a functioning wetland for stormwater treatment and storage of stormwater for harvesting.

If the issues of contamination could be resolved via capping or remediation the stormwater harvesting and wetland systems could be merged within the basin mitigating the need for a separate tank, whilst providing much better treatment for the 23 ha urban catchment to the south.

Yours sincerely,

Dov Ben-Avraham
Environmental Engineer
Storm Consulting Pty Ltd

8.0 Action Plan

This section of the Plan of Management outlines the proposed actions to realise the desired outcomes as articulated in the Master Plan. The Master Plan is a concept aspiration and elements within this (and consequently the Action Plan) are subject to change to accommodate detailed design constraints and other unforeseen changes provided the overall objectives of the PoM remain unchanged.

Item	Action	Staging	Performance Measure	Value	Project Grouping	Estimated Cost ($)
Access	Remove / change the fencing along Bedwin Rd and create pathway access to the western end of the park and significantly improve passive surveillance of the area proposed for the BMX pump track. Include investigation of: **-** the associated noise impact of the fence removal; and **-** bringing forward BMX track from the 3 year completion target	1	Subject to satisfactory investigations, fencing removal and pathway completed.	Lifelong Recreation	1	86,600
Play Facilities	Develop play opportunities for older children and youth including the development of a BMX pump cycle track.	1	Provision of a pump track as per Master Plan	Lifelong Recreation	1	163,000
Play Facilities	Cut and fill earthworks to remove soil from mounding to improve sight lines and raise proposed BMX area.	1	Cut and fill works completed as per Master Plan	Lifelong Recreation	1	53,000
Play Facilities	Improve current and provide additional inclusive play opportunities to better engage with young children.	1	Upgrade to children's play facilities completed as per Master Plan	Lifelong Recreation	2	335,660
Recreation	Consider the installation of bbqs appropriately located to integrate with other passive recreation facilities.	1	Bbq facilities provided as per the Master Plan	Active in Marrickville	2	65,000

Access	Remove the fencing around the detention basin and create a pathway network to incorporate the area as part of the park using vegetation as a deterrent to access.	1	Development of detention basin area as per the Master Plan	Lifelong Recreation	3	298,000
Water Management	Integrate capital works identified in the Eastern Channel East Subcatchment Management Plan 2011 and the Sustainable Irrigation Plan with the actions in this Plan of Management and Master Plan.	1	No. of initiatives completed	Active in Marrickville	3	885,000
Access	Develop a shared pedestrian / cycle circulation path through the realignment of the playing field that clearly identifies park entry points, minimises impact on parks users and local residences and facilitates connectivity to St Peters Station. Ensure the realignment of the sports field minimises potential problems from overplay into adjacent residences.	1	Sports field realigned and path network developed as per Master Plan	Lifelong Recreation	4	268,499
Access	Remove the fencing around the playing field.	1	Fencing removed	Lifelong Recreation	4	14,940
Lighting	Consider lighting upgrades to primary pathways to facilitate improved connectivity, usability and safety. Upgrades should consider minimising impacts on biodiversity values.	1	Lighting of primary pathway completed as per Master Plan	Active in Marrickville	4	270,000
People with Pets in Parks	Install appropriate signage to assist pet owners, including main access paths, major public thoroughfares and shared pedestrian / cycle paths; garden display areas and informal recreation areas.	1	Signage in place	Lifelong Recreation	4	15,000
Recreation	Provide adequate accessible and appropriately located furniture and seating throughout the park.	1	Additional furniture and seating provided	Active in Marrickville	4	97,500

Signage	A review of the consistency of signage with Council's corporate branding.	1	Review completed	Lifelong Recreation	4	15,000
Signage	Ensure relevant regulatory signage is in place and appropriately located.	1	Review completed and appropriate signage in place	Lifelong Recreation	4	15,000
Signage	Ensure sufficient way finding signage is in place.	1	Signage in place	Lifelong Recreation	4	13,000
Recreation	Upgrade existing sports lighting to meet relevant compliance standards for the proposed sports use noting the specific design requirements within the Remedial and Construction Environmental Management Action Plan (2013).	2	Upgraded sports lighting installed	Active in Marrickville	5	220,000
Recreation	Increase the capacity of the sports field through an upgrade considering as a minimum the reconstruction of the playing surface, drainage and returfing.	2	Sports field upgrade completed	Active in Marrickville	5	600,000
Access	Provide adequate and appropriately located seating throughout the park.	2	Park furniture upgraded in appropriate locations	Active in Marrickville	6	50,000
Recreation	Ensure the provision of sufficient shade opportunities	2	No. of initiatives completed that will increase shade	Active in Marrickville	6	45,541
Biodiversity	Investigate opportunities for installing created habitat solutions.	2	Number of habitat solutions installed >5	Active in Marrickville	7	17,000
Biodiversity	Investigate opportunities and establish informal native garden beds with ground layer structures, around existing mature trees in appropriate and strategic locations within the park.	2	Number of areas established >2	Active in Marrickville	8	65,285

Amenities	Renovate the amenities block in accordance with Crime Prevention Through Environmental Design (CPTED) principles including the provision of accessible public toilets.	3	Renovate the amenities block as per the Park Building Condition Assessment.	Active in Marrickville	9	950,000
Play Facilities	Develop additional play opportunities for older children and youth.	3	Provision of play opportunities for older children and youth as per Master Plan	Lifelong Recreation	10	111,000
Access	Investigate the relocation of existing parking places opposite the end of Goodsell Street to the north to provide improved passive surveillance.	3	Item investigated and parking amended appropriately	Lifelong Recreation	11	120,000
Access	Investigate the installation of perpendicular parking into the park area on the southern end of Council Street which is currently used for bin storage, the same as that proposed for the northern or railway end of Council Street.	3	Investigations completed and parking amended appropriately.	Lifelong Recreation	11	120,000
Participation	Install outdoor exercise equipment in Camdenville Park	3	Installation of equipment completed	Active in Marrickville	12	$90,000
Access	Plan to maximise accessibility for all upgrades to buildings, park furniture and other infrastructure.	Ongoing	Council's Community Development section is consulted on all upgrades	Lifelong Recreation	N/A	N/A
Amenities	Incorporate sustainable design features (water sensitive urban design, renewable energy, renewable and recyclable materials, stormwater detention etc.) into all infrastructure upgrades.	Ongoing	Council's Environmental Services section is consulted on all upgrades	Active in Marrickville	N/A	N/A

Culture and Heritage	Continue to manage all heritage items identified in this PoM in accordance with the LEP 2011 and subsequent amendments.	Ongoing	All heritage items remain in good condition	Lifelong Recreation	N/A	N/A
Equitable and Affordable Access	Ensure consistency with Council's adopted Pricing Policy and Fees and Charges as applicable for the use of park facilities.	Ongoing	Compliance with relevant governance documents	The Recreation Economy	N/A	N/A
Equitable and Affordable Access	Ensure consistency with other relevant Council policies governing the use of parks and open space facilities.	Ongoing	Compliance with relevant governance documents	The Recreation Economy	N/A	N/A
Heritage and Planning	Ensure that any development in the park is consistent with Marrickville Council's Local Environment Plan and Development Control Plan for the St Peters Triangle 2011.	Ongoing	Council's Heritage Officer and urban Design Planner are consulted on all developments and upgrades	Lifelong Recreation	N/A	N/A
Maintenance	Ensure the maintenance of all pathways	Ongoing	Documented inspection of pathways	Lifelong Recreation	N/A	
Maintenance	Maintenance staff be engaged with to ensure recurrent maintenance costs are considered in the design of all future facilities.	Ongoing	Engagement undertaken	Active in Marrickville	N/A	N/A
Maintenance	Maintain Camdenville Park to provide a safe and clean park for the community.	Ongoing	Park facilities remain functional, clean and safe for intended use	Active in Marrickville	N/A	
Planning	Conduct a review of this PoM after 5 years.	2	PoM reviewed	The Recreation Economy	N/A	N/A
Recreation	All maintenance activities should be programmed to minimise impacts on users of the facilities.	Ongoing	Minimal disruption to user groups	Active in Marrickville	N/A	N/A

Remediation	Ensure that all upgrades and works at Camdenville Park are conducted in accordance with the recommendations of the Remedial and Construction Environmental Management Action Plan (2013).	Ongoing	Confirmation of consistency with RCEMAP for all upgrade works	Active in Marrickville	N/A	N/A
Remediation	The penetration of the surface (for example pegging for erection of a marquee) is prohibited in any area of the park.	1	Inclusion in terms and conditions of use for all licence agreements	Active in Marrickville	N/A	N/A
Trees	Prepare a tree audit and assessment plan for the site to help guide the tree management within the park.	1	Plan completed	Active in Marrickville	N/A	
Waste Management	Work with all park users to increase the recovery of recyclable materials and reduce waste leaving the site.	Ongoing	Increased recovery of recyclable waste	Active in Marrickville	N/A	N/A
Water Management	Ensure the effective maintenance of stormwater and WSUD infrastructure.	Ongoing	Adherence to maintenance schedule	Active in Marrickville	N/A	

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APPENDIX 1

Camdenville Park History

The 3.4 ha Camdenville Park is bounded by Council Street to the east, May Street to the south, Bedwin Road to the west and the Illawarra railway line to the north. Camdenville Park is also known as Camdenville Oval. The Camdenville Detention Basin, located at the western end of the park is designed to alleviate flooding in the May and Campbell Streets area.

The name Camdenville originated from the large two-storeyed Georgian villa, named Camden Villa, which was built by Robert Bourne during the 1840s.[1] Robert Bourne was a missionary who sailed to Sydney in 1836. Although Camden Villa was built on the northern side of Camden Street, the name Camdenville came to represent the area southwards between Edgeware Road and King Street up to the Cooks River. Thomas Holt obtained the property from Bourne before selling it to the Congregational Church in 1863. The building then operated as Camden College, a theological boarding college, up until 1888 when it was sold at public auction and subsequently demolished.

The first known development of present day Camdenville Park occurred in 1848, when John Goodsell Co. purchased existing brickworks on the property. At this time the property was bounded by Edgeware Road, Cooks River Road, May Street and present day Lord Street. Henry Wesley Goodsell had arrived in the colony in 1838 beginning brickworks manufacturing in Sydney before relocating to Newtown.

In 1884 the St Peters Railway Station was constructed on the eastern side of the site, with the operations of the Goodsell Brickworks reduced to the site's western side up to the current John Street. In 1891 the business was sold, becoming Speare's Brickworks. Speares Brickworks continued operation on the site up until 1921 when the viability of the clay reserves was exhausted.

In 1922 Newtown Council unveiled a Council run garbage incinerator on the old Speare's brickworks site. Using the chimney from the Speare's Brickworks factory, the Council spent £12,000 on the site. At the time it represented best practice in sanitary disposal of household waste. Newtown Council entered into an agreement with Redfern Council to incinerate garbage from that municipality.[2] Fill from the process was disposed of in the hollowed out brick pit, progressively levelling out the site. During this period the brick pit was altered to establish a storm water basin, holding run-off from the surrounding streets. The incinerator operated on the site up until the 1950s when the future use of the site was put under the consideration of the City of Sydney, which had incorporated Newtown Council as part of broader local government amalgamations in 1949.[3] At their meeting 29 July, 1949 the City of Sydney Council carried a motion declaring the land be used as a recreation area.[4] At this time the site was being used as a tip, but it is unclear whether the incinerator still operated.

By 1953 the site was being used, in conjunction with an Alexandria site, as one of the City of Sydney Council tips. At this time a playing field was installed on the site, which interfered with the

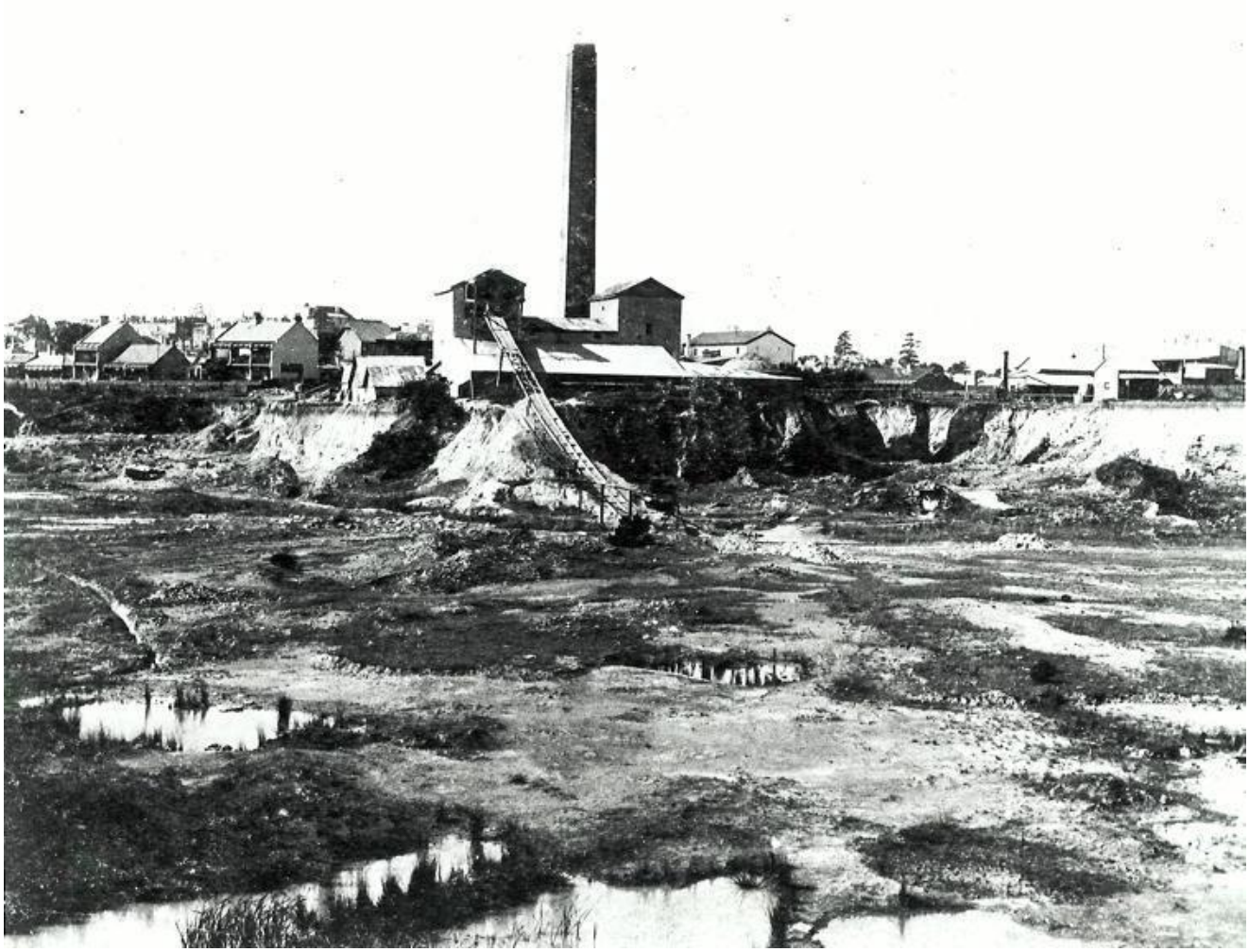
[1] *Rural Outpost to Inner City*. p. 114.
[2] "Garbage Destruction: Newtown's Incinerator" Sydney Morning Herald. 16 September, 1922 p. 4.
[3] Photograph of the incinerator is shown in a photograph dated 15 October, 1952. City of Sydney Archives 068\068199. The incinerator appears to be in a disused state.
[4] 0034/04073-52 Land, Council Street, May St & Edgeware Road, Newtown acquired for recreation purposes. City of Sydney Archives

storm water run off in the area.[5] After the filling of the brick-pit in 1957 the City of Sydney Council installed a holding basin and pump facility to hold storm water run off from a 30 acre catchment area. Finally, on the 29 February, 1960 the area was formally named Camdenville Park by the City of Sydney Council.[6]

This holding basin overfilled in May 1975, with water entering houses in Hutchinson Street. The surcharge occurred in the worst downfall the area had received in 43 years, following a shaft breaking on the single basin pump.

Goodsell's Brickyard, 1883

[5] C Meader, R Cashman & A Carolan. *Marrickville People and Places: A social history of Marrickville, Newtown, Camperdown, Petersham, Stanmore, St Peters, Tempe and Dulwich Hill.* p. 167.
[6] 0034/6418-59 Recreation Area, Council St., May St & Edgeware Rd., Newtown 1) Question of naming 2) Naming as "Camdenville Park". City of Sydney Archives.



Speare's Brickworks

APPENDIX 2

Marrickville Council

Camdenville Park, May Street, St Peters, NSW

Remedial and Construction Environmental Management Action Plan

September 2013

Abbreviations

Abbreviation	Details
ACM	Asbestos Containing Material
ANZECC	Australia and New Zealand Environment and Conservation Council
B(a)P	Benzo(a)pyrene
BTEX	Benzene, toluene, ethyl benzene and xylenes
CEMP	Construction environmental management plan
CoPC	Chemical of Potential Concern
CT	Contaminant Threshold
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved oxygen
DQO	Data quality objectives
DQI	Data quality indicators
HILs	Health-based soil investigation levels
HSLs	Health Screening Levels
LNAPL	Light non aqueous phase liquid
LOR	Limit of reporting
MLEP	Marrickville Local Environment Plan
mbgl	Metres below ground level
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
mm	Millimetres
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW EPA	New South Wales Environmental Protection Authority
NSW DEC	New South Wales Department of Environment and Conservation
NSW DECC	New South Wales Department of Environment and Climate Change
NSW OEH	New South Wales Office of Environment &Heritage

Abbreviation	Details
OCP	Organo-chlorine Pesticides
OH&S	Occupational health and safety
OPP	Organo-phosphate pesticides
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated Biphenyl's
PBIL	Phyto-toxicity based investigation levels
PID	Photo-ionisation detector
POEO	Protection of Environment Operations
ppm	Parts per million
PQL	Practical quantitation limit
QA/QC	Quality assurance/quality control
RAP	Remedial action plan
Redox	Reduction-oxidation potential
RPD	Relative percentage difference
SCC	Specific Contaminant Concentration
SCEW	Standing Council on Environment and Water
SEPP	State Environmental Planning Policy
SFOP	Standard field operating procedures
TCLP	Toxicity characteristic leaching potential
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
µg/L	Micrograms per litre
µ	Micron
µS/cm	Micro-Siemens per centimetre
UCL	Upper confidence limit
UST	Underground storage tank
VENM	Virgin Excavated Natural Materials
VOC	Volatile organic compounds

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1. Introduction

1.1 Background

GHD Pty Ltd (GHD) was commissioned by Marrickville Council (Council) to prepare a Remedial and Construction Environmental Management Action Plan (RCEMAP) for Camdenville Park (a former landfill), 63 May Street, St Peters, NSW 2044 (the site). A site location plan is provided as **Figure 1.**

A variety of contamination assessments and groundwater, surface water and landfill gas monitoring events have been undertaken at the site, and are reviewed in **Section 4** of this report. These works have identified that the site is contaminated by waste materials used to infill former clay pits on the site. These include surface and near surface soils at the site which have been impacted by both chemical (specifically lead, total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbon (PAH) compounds) and physical contaminants (specifically broken glass, brick and metal wire), which are the focus of the remedial works.

The site is currently used as a publicly accessible recreational facility. A detention basin is located in the western portion of the site; access by the public is prohibited. Council intends to upgrade the site via a programme of landscaping works, which will involve soil disturbance and re-grading. Due to the soil, groundwater, surface water and landfill gas issues identified at the site, remedial works are required to be undertaken at the site, prior to (or in conjunction with) Council's intended upgrade works.

In 2009, GHD was retained by Council to prepare a Remedial Action Plan (RAP) for the site. To facilitate the remedial options appraisal that forms part of the RAP, GHD prepared a preliminary remedial options appraisal during 2010 (based on data available at that time), to allow Council to consider the options and provide input into preparation of the RAP.

The additional investigative / assessment works completed between 2010 and 2012 have provided additional data on the site and allowed an improved level of understanding of the site (compared to when the preliminary remedial options assessment was written).

Council has engaged Andrew Lau (the Auditor) an accredited NSW Site Auditor to prepare a non-statutory Site Audit Report. The works undertaken by GHD have been reviewed by the Auditor, and these and the ongoing remedial, monitoring and management works will be reviewed and form the basis of the Site Audit Report.

Additionally, the works undertaken to date have been submitted to NSW Environment Protection Authority (EPA). The EPA confirmed in a letter (April 2013) that 'there is no reason to believe that contamination at the site is significant enough to warrant regulation under the *Contaminated Land Management Act 1997*'. Further details are provided in **Section 4**.

1.2 Redevelopment plans

GHD understands that Council are planning to refurbish the park to include the following works:

- cut and fill activities are being considered, subject to detailed design, to re-level the playing fields and/or modify the spectator mounds) to enlarge the playing field and increase usable recreation areas. No cut and fill activities are being considered in the detention basin and BMX area;
- upgrade drainage beneath the playing field as well as the playing surface in the east of the site;

- upgrade the management of surface water within the detention basin (dilution and wetland treatment (subject to feasibility assessment)), along with upgrading the fencing surrounding the basin;
- upgrade the stormwater system including:
  - drainage to the southwest corner of the site (corner of May and Campbell Street) which likely to involve new inlet pits in Campbell Street connected directly to the detention basin.
  - Stormwater harvesting scheme including installing a 200 kL tank in the northeastern corner of the site (near Goodsell Street).
- construction works may also include a new BMX track in the northwestern portion of the site (in the area of the council compound) as well as installing an in ground stormwater harvesting tank in the northeastern corner of the site;
- expected park improvements include sports field irrigation and drainage, sports lighting, new and upgraded paths, playground refurbishment, seating, tree planting and some ground cover planting.

Council have provided the following note regarding the status of the development plans:

A number of preliminary development plans have been prepared for the site since 2006. These include:

- *Camdenville Park Preliminary Masterplan*, POD Landscape Architects, 2006
- *EC East Subcatchment Management Plan Option R9*, Golder and Associates, 2010; and
- *Goodsell Street Bioretention and Stormwater Harvest Scheme*, Marrickville Council, December 2011.

The finalisation of a scope of works for improvement of the park will be undertaken in the near future through a community engagement and Plan of Management process along with detailed design and assessment of the site. This will take into consideration remedial requirements, site constraints, community priorities and cost. Draft development plans are provided in **Appendix A**.

1.3 Objectives

The objectives of the works are to rehabilitate the site so that:

- It is suitable for the current and proposed future land use scenarios (public open space);
- The rehabilitation, management and monitoring works are approved by the Site Auditor; and
- All identified hazards to human health and the environment are reduced to acceptable levels.

1.4 Scope of works

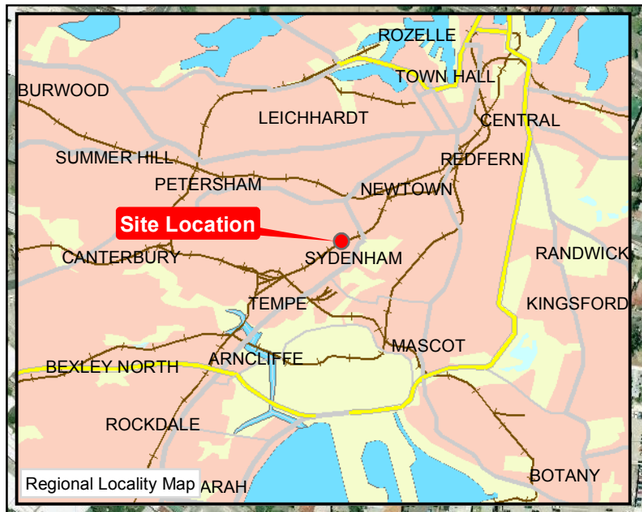
The scope of works completed by GHD in preparing this report comprised the following:

- collate and review existing data and identify the remediation area (**Section 4**);
- define the remediation strategy and the validation plan (**Section 7**);
- outline information to be documented in the Site Management and Safety plans during the works (**Section 8**);

1.5 Roles and responsibilities

The following roles and responsibilities have been identified:

Role		Responsibility
Council	Marrickville project manager or their nominee	The client and principal
Accredited site auditor	Andrew Lau of JBS	The auditor will prepare a Site Audit Report (SAR). The Site Auditor will undertake an independent review of the works in accordance with the *Contaminated Land Management Act*.
Contractor	To be confirmed	The contractor will be responsible for undertaking the remedial works and obtaining and complying with all relevant approvals such as those required to undertake these works.
Environmental Consultant	To be confirmed	Will be required to liaise with the Client, Site Auditor and Contractor, and provide an independent review and validation of the remedial works / management measures.



0 50 100 150 200
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

Site Boundary (Approximate)

Marrackville Council
Camdenville Park

Job Number	21-16600
Revision	A
Date	22 Jul 2013

Site Location Plan

Figure 1

G:\21\16600\GIS\Maps\MXD\21_16600_Z001_CAMDENVILLE_SiteLocationPlan.mxd

Data Source: Google Earth Pro 2012 - Imagery; Geoscience Australia: 250k Data - Jan 2011. Created by: tnham

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

2. Site and environmental setting

2.1 Site setting

Table 1 provides a summary of the sites setting.

Table 1 Site setting

Information	Details
Site address	63 May Street, St Peters, NSW (a site layout plan is provided below as **Figure 2**)
Site area	Approximately 3.5 hectares (35,000 m^2)
Lot and DP	Lot 9 DP 879483
Zoning	In accordance with the *Marrickville Local Environment Plan* (MLEP) 2011 the site is zoned as public recreation (RE1).
Local Government Area	Marrickville Council
Current Site Description	The site currently consists of: • a grassed playing field with surrounding bunds / spectator mounds, which occupies approximately two thirds of the eastern and central portions of the site; • a former storage yard recently restored to turf and gravel following works by Ausgrid, in the north-western corner of the site; • a children's playground in the south-eastern corner of the site; • a low lying fenced flood detention basin, which occupies the south-western portion of the site; • an amenities block along the eastern site boundary; and • construction works occurring in the north-west corner of the site.
Surrounding Land uses	The site is surrounded by the following land uses and land zoning (MLEP, 2011): • north: Illawarra Railway Line (SP2, infrastructure), with residential housing (R2, low density residential) beyond; • east: Council Street, with residential housing (R2, low density residential) beyond; • south: Terraced residential housing (R2, low density residential) which is bounded by the site with May Street to the south, with residential (R1, general residential) and commercial (B5, business development) properties beyond; and • west: Bedwin Road, with commercial/industrial properties (IN1, general industrial) beyond.

0 10 20 30 40 50
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

Site Boundary (Approximate)

Infrastructure (Approximate)

Marrackville Council
Camdenville Park

Job Number	21-16600
Revision	A
Date	23 Jul 2013

Site Layout Plan

Figure 2

G:\21\16600\GIS\Maps\MXD\21_16600_Z005_CAMDENVILLE_SiteLayout_2013.mxd

Data Source: Google Earth Pro 2012 - Imagery. Created by: tnham

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

2.2 Site history

Based on the limited information available, the site's history reportedly includes:

- from 1800s to 1930s, the site was used for clay / shale quarrying and production of bricks. The clay pit occupied a substantial portion of the site's central and western region;
- waste incineration operations with subsequent landfilling of residues commencing in circa 1922;
- completion of waste incineration and landfilling operations circa 1951 to 1955;
- the site opened to local community as a passive recreation area circa 1955 to 1957;
- a stormwater detention basin was reportedly constructed in the sites southwestern corner during 1964 to alleviate flood risks to homes in the surrounding area; and
- ongoing use of Camdenville Park as a public recreation area from circa 1955/1957 to present.

GHD has estimated that the maximum quantity of waste present at the site is likely to be around 300,000 tonnes (i.e. approximately 10,000 tonnes of waste may have been disposed at the landfill during each year of operation – assuming a uniform input rate). Based on the period of operation of the Site, it is unlikely that waste compaction equipment or significant quantities of daily or intermediate cover would have been used during waste disposal operations. No engineered final cover layer is present at the site (and would not have been a regulatory requirement at the time of the site's operation). No engineered basal / side wall containment system or leachate collection system is known to be present at the site (and would not have been a regulatory requirement during the period of operation).

2.3 Environmental setting

Table 2 provides a summary of the sites environmental setting.

Table 2 Site environmental setting

Setting	Details
Local climate / meteorology	GHD notes that the site is located approximately 3 kilometres north of the Commonwealth Bureau of Meteorology's Sydney Airport weather station, the following summary has been prepared by GHD: • mean monthly rainfall is variable throughout the year, with rainfall being highest during January to June and lowest during July to December; • mean daily evaporation is lowest during the months of March to August and highest during the months of September to February; • the annual mean daily evaporation (circa 1,676 mm) far exceeds the annual mean rainfall (circa 1,085 mm); • mean monthly evaporation exceeds mean monthly rainfall for all months with the exception of May and June; • mean maximum temperatures occur during the months of December to March (mean maximum 25.2 to 26.5 °C); and • cooler temperatures occur during the months of June to August (mean minimum < 9°C).
Topography	The site is generally elevated between approximately 3.6 and 11 m AHD. In general, the site slopes in a general westerly direction towards the detention basin from high points located on the eastern boundary. The detention basin is a square area dug into the western portion of the site typically two to three metres below the immediate

Setting	Details
	surrounding ground surface. The soccer field located in the central and eastern portion of the site is generally flat and surrounded by engineered spectator mounds on the northern and eastern flanks, typically one to two metres in height.
Hydrology	The nearest surface water body to the site (other than the onsite stormwater detention basin) is a stormwater channel, approximately 300 m to the west of the site. This flows to a further large stormwater detention basin which is assumed to outflow to an unnamed tributary of the Cooks River, approximately 1.25 km to the south west. Precipitation would typically infiltrate the site's unsealed (grassed) surface. Any waters forming as sheet flow would typically run-off in accordance with the localised topographic features, which generally trend either onto the main sporting field or into the detention basin the site's south-western region. Some street drainage enters the detention basin from May Street.
Geology	The NSW Department of Mineral Resources (now the Department of Primary Industries) 1:100,000 Sydney Geological Map Sheet 9130 indicates that the bedrock beneath the site consists of Ashfield Shale, of the Wianamatta Group. An area of Quaternary Alluvium described as gravel, sand, silt and clay sediment is mapped as being present near the north-western site boundary. The soil profile observed during the field investigations undertaken by GHD have confirmed that the site had been subject to historical quarrying and subsequent filling across most of the site; hence the soil profile is Fill, overlying Quaternary deposits generally clays and/or Shale. • The investigations suggests that the final cover materials present at the site vary in thickness between absent and 0.3 m and generally comprise brown silty topsoils, with occasional glass, ash, brick, metal wire and slag inclusions. • Fill underlying the topsoil in the landfilled areas has been recorded to extend up to circa 19 m bgl (BH15A) in the landfilled areas and comprised dark grey to black sand, gravel and clays with substantial anthropogenic inclusions (timber, ash, metal, slag, bitumen, building rubble). Ash and hydrocarbon like odours as well as dark shiny staining were also noted. • Within the sites detention basin the topsoil was underlain by fill apparently originating from an industrial source. The fill was encountered to a depth greater than 8 m bgl in the centre of the detention basin (due to auger refusal and hole collapse, the maximum depth of drilling was 7.9 m in BH14A, hence the full depth of fill was not determined). The depth of fill around the perimeter of the detention basin (adjacent to the site boundary) was typically less than three metres. The fill encountered generally comprised dark grey to black sand gravel and clays with large amounts of rubble including concrete, bricks, ash, slag, glass, timber and metals, and typically exhibited ash and hydrocarbon like odours. The fill material was poorly compacted and typically had large voids and pore spaces present. • The soil profile observed during the investigations to the north of the landfilled area (within the railway corridor) identified as Fill of crushed sandstone and ballast to 0.4 m bgl, underlain by Quaternary deposits (red/brown clays) to depths of 7-9 m bgl, which was in turn underlain by Shale.
Hydrogeology	Groundwater within the Ashfield Shale is generally considered to be saline and therefore unlikely to be used as a potable resource. Furthermore, yields are typically low, which, in conjunction with the high salinity, generally makes those waters undesirable for domestic,

Setting	Details
	agricultural or industrial use. Groundwater beneath the site is believed to flow in a north westerly direction (based on groundwater levels taken during GHD's investigations). This follows the general topography in the vicinity of the Site. Groundwater within the Ashfield Shales is generally considered to be saline and therefore unlikely to be used as a potable resource. Groundwater levels were recorded in the following strata by GHD as follows in April 2012: • Fill: 0.5 (BH1) to 4.3 (BH19) m bgl. • Fill and Quaternary deposits: 2.3 (BH10) to 4.93 (BH23) m bgl. • Quaternary deposits: 2.5 (BH29) to 7.4 (BH31) m bgl. • Quaternary deposits and Shale: 4.5 (BH26) to 7.4 (BH25A & BH28) m bgl. • Shale: 3.9 (BH28) to 15.0 (BH25) m bgl.

3. Basis of the assessment

3.1 Relevant guidelines

GHD notes that previous investigations (as discussed in **Section 4**) were undertaken in accordance with the National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure (NEPM)* (December 1999). GHD notes that these measures were amended on 11 April 2013 and registered on 15 May 2013. In accordance with the Standing Council on Environment and Water (SCEW), regulators in the states and territories of Australia have agreed, in principle, to a transition period of up to 12 months for full implementation of the amended NEPM. Given that the proposed remedial works have not commenced, the validation criteria shall be adjusted in accordance with the amended (April 2013) NEPM guidelines.

The framework for this RCEMAP has been developed in accordance with guidelines "made or approved" by the NSW EPA under *Section 105* of the *Contaminated Land Management Act, 1997*.

These guidelines include the following:

- National Environment Protection Council (NEPC) 2013, *National Environment Protection (Assessment of Site Contamination) Measure (NEPM) Amendment Measure (No.1)..*
- NSW Office of Environment & Heritage (OEH) 2011, *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*
- NSW Department of Environment & Climate Change (DECC) 2009, *Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*.
- DECCW 2009, *Waste Classification Guidelines, Part 1: Classifying Waste*.
- NSW DEC 2006, *Contaminated Sites: Guidelines for NSW Site Auditor Scheme (2nd Edition)*.
- NSW EPA 1995, *Contaminated Sites: Sampling Design Guidelines*.

Additional guidelines referred to in this RCEMAP are:

- CRC Care 2011, Technical Report No. 10: *Health screening levels for petroleum hydrocarbons in soil and groundwater.*

3.2 Human health criteria

Remediation criteria have been adopted from assessment criteria presented in NEPM (2013) as discussed below: Given the current and proposed future land use of the site is public open space, health screening levels (HSL) and health investigation levels (HIL) for; HIL / HSL C – public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths have been selected as the remediation validation criteria, and are discussed in the following sections:

3.2.1 Overview

The reference sources from which the criteria have been adopted are as follows:

Petroleum Hydrocarbons (TRH, BTEX and naphthalene)

The NEPM (2013) presents Health Screening Levels (HSLs) for fuel derived petroleum hydrocarbons, which are generic criteria based on a series of reasonably conservative assumptions in order to be protective of human health for a variety of land use types. For the purposes of selecting health based investigation levels for the remediation works at this site, a 'HSL C' is considered to be appropriate. Note that the NEPM (2013) presents HSLs for vapour intrusion only. For the direct contact pathway, reference has been made to Friebel and Nadebaum (2011) Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater CRC Technical Report No 10. The NEPM HSLs are based on the work by Friebel and Nadebaum, however the direct contact pathway was not included into the NEPM (2013).

The assumptions inherent in the derivation of the HSLs listed in **Table 3** will need to be confirmed in respect of moisture content, soil texture and total organic carbon as well application of the HSL checklist. Further as the HSLs assume a fresh typical diesel/petrol source at 80:20 aliphatic/aromatic split and the source of hydrocarbons on the site may not match this profile, confirmation of aliphatic/aromatic speciation will also be required.

Metals, OCP/OPP, PCB, Total PAH and benzo(a)pyrene

For non-petroleum hydrocarbons, the NEPM 2013 HIL C have been adopted. The HILs take into account direct contact pathways, including incidental ingestion and dermal contact. A summary of the HILs used to evaluate measured chemical concentrations in soil samples are presented in **Tables 4**.

Asbestos

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

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

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

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

Bonded asbestos ACM in sound condition represents a low human health risk. However, both FA and AF materials have a significantly higher potential to generate, or be associated with, free

asbestos fibres and may represent a significant human health risk if disturbed and fibres are made airborne.

Table 4 below summarises the land use setting and health screening levels for asbestos in soil that are considered the most appropriate for the site.

Appendix B (*Management of Small-Scale Low-Risk Soil Asbestos Contamination*) of the WA DoH Guidelines describes a simplified action level based on visual inspection of surface contamination. A total ACM sheet area <10 cm^2 (e.g. 3 x 3 cm) per m^2 of soil surface area and with little associated past soil disturbance is considered very low risk. This is approximately equivalent to about 0.01% w/w. It should be noted that this process is intended for single residential blocks where the asbestos is bonded, present at the surface only, and there is little free fibre present – hence this is not considered directly applicable to the site, but may be a useful "rule of thumb" for approximating the significance of observed surface contamination.

3.2.2 Selected soil criteria

A summary of the soil criteria used to evaluate measured chemical concentrations in soil samples is presented in **Tables 3** and **4.**

Table 3 Soil HSLs (mg/kg)

HSL-C, recreational / open space	Vapour intrusion pathway[1]				Direct contact pathway
	0 - <1 m	1 m – <2 m	2 m - <4 m	4 m – <8 m	
Benzene	NL	NL	NL	NL	120
Toluene	NL	NL	NL	NL	18,000
Ethylbenzene	NL	NL	NL	NL	5,300
Xylenes	NL	NL	NL	NL	15,000
Naphthalene	NL	NL	NL	NL	1,900
TRH - F1	NL	NL	NL	NL	5,100
TRH – F2	NL	NL	NL	NL	3,800
TRH >C16-C34	-	-	-	-	5,300
TRH >C34-C40	-	-	-	-	7,400

1. Assuming soil type as SAND (which includes sandy clay) and will alter if ground conditions differ.

NL (Not Limiting) denotes that the calculated HSL exceeds the solubility limit for the chemical of concern. To reach the maximum allowed breathable air concentrations, a soil vapour source would be required that is greater than is possible for a petroleum mixture.

To obtain F1 subtract the sum of BTEX concentrations from the C_6-C_{10} fraction.

To obtain F2 subtract naphthalene from the >C_{10}-C_{16} fraction.

Table 4 Soil HILs and asbestos (mg/kg)

Parameter	Recreational / open space (HIL-C)
Arsenic (total)	300
Cadmium	90
Chromium (VI)	300
Copper	17,000
Lead	600
Mercury (inorganic)	80
Nickel	1,200
Zinc	30,000
Total PAH	300

Parameter	Recreational / open space (HIL-C)
Carcinogenic PAHs (as Benzo(a)pyrene TEQ)	3
Aldrin + Dieldrin	10
DDT + DDD + DDE	400
Heptachlor	10
Chlordane	70
PCB (total)	1
Asbestos	No visual asbestos in surface soils 0.02 % - bonded ACM 0.001% friable asbestos

TEQ – toxicity equivalent

3.2.3 Calculated 95% UCL_{avg} concentration for comparison to the soil criteria

When comparing specific layers or bodies of material against the HIL criteria, the data set is separated to ensure that only materials of similar composition are included for comparison. For example, when calculating the 95%UCL_{avg} (Upper Confidence Limit of the arithmetic average contaminant concentration) for a particular contaminant concentration in a given volume of material for the purposes of comparison against the relevant site criteria, only the data for the samples collected for that particular material is used in the calculation. This is known as a homogenous sample population.

The guidelines indicate that the calculated 95% UCL_{avg} concentrations for each parameter can be compared to the HIL criteria and represent acceptable concentrations of parameter assuming the following:

- The calculated 95% UCL_{avg} concentration does not exceed the respective criteria;
- No single concentration within the data set exceeds 250% of the respective criteria for each parameter; and
- The standard deviation of the data set must not to exceed 50% of the respective criteria for each parameter.

Tables 3 and **4** provides a summary of the adopted criteria used to assess soil contamination levels at the site.

3.3 Ecological

Ecological receptors are not considered to be sensitive at the site and the importation of clean capping material will break the pathway between the impacted soils and terrestrial ecosystems. Further it is noted that Council plans to import an appropriate growing medium for establishment of vegetation such as grasses and trees, which will be implemented as per **Section 7.**

3.4 Waste classification

Waste classification Criteria were obtained from Table 2 of the NSW DECCW (2009) *Environmental Guidelines: Assessment Classification & Management of Liquid & Non-Liquid Wastes (the guidelines).* The guidelines provide criteria for assessing the appropriate waste classification and subsequent disposal location for solid and liquid wastes. The classification process for non–liquid wastes focuses on the potential for the waste to release chemical contaminants into the environment through contact with liquids (leachates).

The first test used to chemically assess waste is the Specific Contaminant Concentration (SCC) test, which determines the total concentration of each contaminant in the waste sample. The

guidelines set different maximum levels for the total concentration of each contaminant in order for waste to be classified as either general solid waste or restricted solid waste.

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

The screening criteria for waste classification is outlined in **Table 5**. This is a summary of the criteria relevant to site specific contaminants of concern and does not include all contaminants.

Table 5 Waste classification guidelines

Analyte	General Solid Waste			Restricted Solid Waste		
	CT1 [a] (mg/kg)	SCC [b] (mg/kg)	TCLP [c] (mg/L)	CT2 [a] (mg/kg)	SCC [b] (mg/kg)	TCLP [c] (mg/L)
Arsenic	100	500	5	400	2000	20
Cadmium	20	100	1	80	400	4
Chromium (VI)	100	1900	5	400	7600	20
Lead	100	1500	5	400	6000	20
Mercury (inorganic)	4	50	0.2	16	200	0.8
Nickel	40	1050	2	160	4200	8
Total PAH	200	N/A	N/A	800	N/A	N/A
Benzo(a)pyrene	0.8	10	0.04	3.2	23	0.16
TPH C_6-C_9	650	N/A	N/A	2600	N/A	N/A
TPH C_{10}-C_{36}	10000	N/A	N/A-	40000	N/A	N/A-

a) Maximum values of specific contaminant concentrations (SCC) for classification without TCLP. Contaminant Threshold (CT) values presented in Table 1 of *NSW DECCW (2009) Waste Classification Guidelines*.
b) Maximum values of leachable concentrations and SCC for classification when used together. Specific contaminant concentration as presented in Table 2 of the *NSW DECCW (2009) Waste Classification Guidelines.*
c) Maximum values of leachable concentrations and SCC for classification when used together. Leachable concentration (TCLP) as presented in Table 2 of the *NSW DECCW (20098) Waste Classification Guidelines*.

3.5 Aesthetic considerations

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

General assessment considerations include:

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

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

The planned remedial works should not expose any landfill material which could trigger the aesthetic issues detailed above. Should any of the above aesthetic triggers be identified during the remedial works, these should be either removed off site or appropriately capped (in accordance with the capping strategy for the site (**Section 7**)).

3.6 Landfill gas

The New South Wales Environmental Protection Authority (NSW EPA) Guideline *Environmental Guidelines: Solid Waste Landfills (January 1996)* indicates the following landfill gas environmental benchmarks:

- The release of methane should not exceed 500 ppm at any point above final or intermediate cover areas;
- Methane concentrations must not exceed 1.25% v/v at any buildings / structures which are located within 250 metres of deposited waste; and
- Methane concentrations must not exceed 1.25% v/v within sub-surface landfill gas monitoring bores (boundary of the Site).

4. Contamination status

4.1 Previous reports

The following site investigation and monitoring reports have been prepared for the site:

- Environmental & Earth Sciences (E&ES) 2006 a, *Preliminary Contamination & Geotechnical Investigation*.
- E&ES 2006 b, *Interim Gas, Soil, Stormwater & Asbestos Investigation*.
- E&ES 2007 a, *Interim Management Plan*.
- E&ES 2007 b, Asbestos and Gas Monitoring Survey.
- GHD Pty Ltd July 2008, *Detailed Site Investigation* (21/16600/140944).
- GHD Pty Ltd August 2009, *Supplementary Groundwater and Landfill Gas Investigation* (21/16600/151104)
- GHD Pty Ltd March 2010, *Remedial Options Appraisal* (21/16600/157969).
- GHD Pty Ltd, June 2012 a, *Surface Water Sampling* (21/16600/178871).
- GHD Pty Ltd July 2012 b, *Groundwater Monitoring Event* (21/16600/179856).
- GHD Pty Ltd December 2012 c, *Landfill Gas Risk Assessment and Hazardous Ground Gases Assessment (Combined*) (21/16600/186482).

Additionally, the EPA prepared a letter (DOC12/50391#FIL08/10057) dated 4 April 2013, detailing the conclusions of its review of the GHD investigations and monitoring in relation to whether the site required regulation under *Section 60* of the *Contaminated Land Management Act* (1997).

4.2 Summary of reports

The following sections provide a summary of the contamination recorded at the site.

4.2.1 Preliminary Contamination & Geotechnical Investigation (2006 a)

Sampling and analytical works undertaken as part of the initial study included:

- drilling nine boreholes (BH1-BH9) (please refer to **Figure 3** below), three of which (BH1, BH2 and BH9) were converted into permanent groundwater monitoring wells in or around the detention basin;
- sampling soil from all boreholes;
- sampling groundwater from all monitoring wells;
- sampling surface water from within a pump pit within the detention pond;
- laboratory analysis of collected soil, groundwater and surface water samples; and
- measurement of gas composition within each borehole during drilling and sampling.

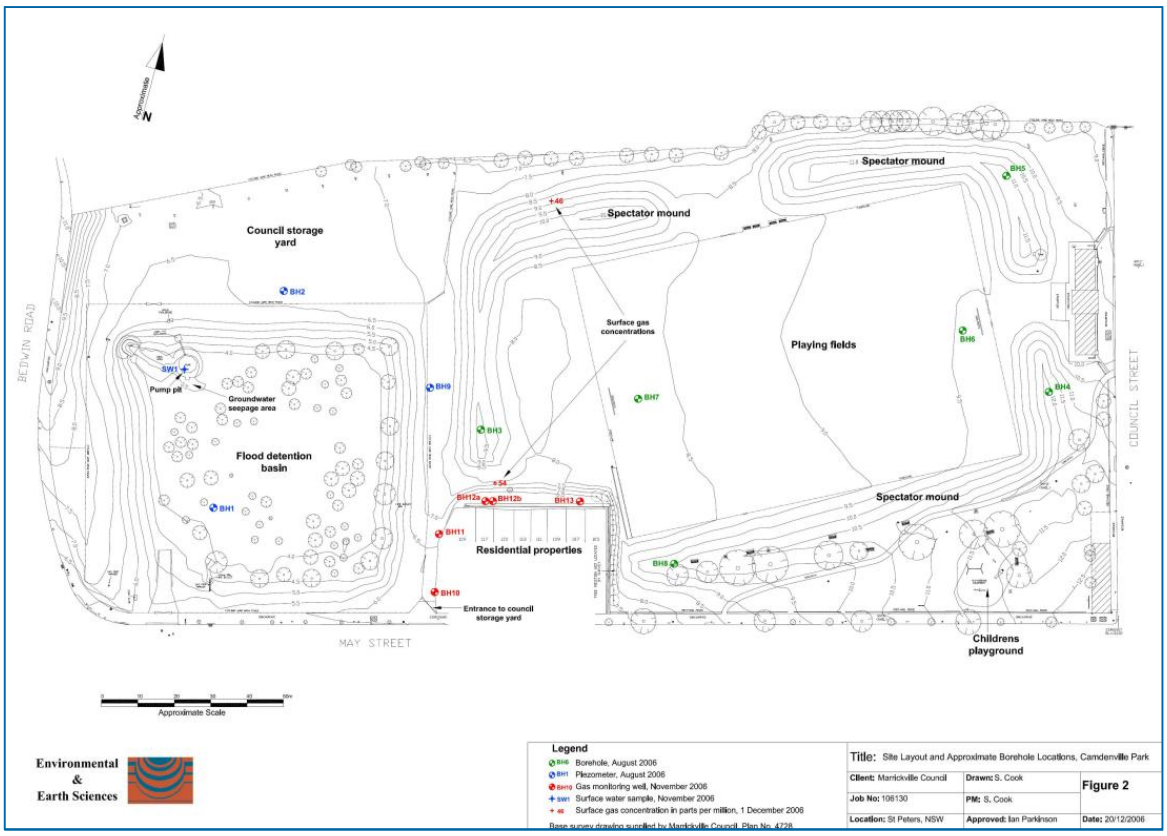
Key results of the sampling and analytical works were as follows:

- the site was underlain by fill of highly variable composition, consistent with uncontrolled filling. Typically, the fill beneath the site's central and western regions comprised a heterogeneous mixture of sand and clay soil, with various inclusions such as bricks, gravels, asphalt, wood, metal scraps and some vegetative matter. Fill over the site's

eastern region was, however, less heterogeneous, and appeared to comprise mainly sand and clay, with some sandstone gravels and only minor anthropogenic inclusions.

- the depth of fill was generally not defined (as boreholes were generally terminated in fill), however natural soil was logged at a depth of less than two metres in one borehole drilled within the site's eastern region. Fill extended beyond 10 m in the site's western region (within the apparent boundaries of the former clay pit).
- a number of fill samples contained contaminants (organics and metals) at concentrations above the health-investigation levels applicable to parks and open space. Primary soil-borne contaminants included PAH, TPH, asbestos and lead.
- groundwater within the former clay pit was reported to contain elevated concentrations of ammonia, naphthalene and zinc.
- groundwater discharging to the surface (via a pump pit in the north-west of the detention basin) reportedly exhibited a hydrocarbon type odour.
- detectable levels of methane were reported across parts of the site.

Figure 3 E&ES borehole location plans



4.2.2 Interim Gas, Soil, Stormwater & Asbestos Investigation (2006 b)

In response to the identification of various contaminants during the initial study, E&ES was commissioned to:

- install five gas monitoring wells (BH10-BH12a, BH12b and BH13, on **Figure 3**) in the surrounds of the residential properties adjoining the Site (on the northern side of May Street);
- monitor landfill gas concentrations within those wells;
- survey landfill gas concentrations at various points across the surface of the site;

- analyse soil samples collected during the gas monitoring well installation;
- analyse a sample of surface water collected from the pump pit within the detention basin; and
- manage the appointment of an AS1 licensed contractor to inspect the site and remove all visible fibre cement sheeting from across the site surface and provide a 'clearance certificate' upon completion of those works.

Monitoring of gas within the five newly installed wells, plus across the surface of the site reportedly did not identify methane at concentrations above the NSW EPA (1999) 'thresholds' of 1.25 % vol/vol (v.v) for subsurface or 500 ppm for surface.

Samples of fill collected during installation of the gas monitoring wells were reported to contain elevated concentrations of lead, TPH and PAH compounds. Asbestos (bonded) was also identified in one borehole (BH13).

No organic contaminants were reported within the surface water sample analysed from within the pump pit, although the reported ammonia concentration was high.

A number of fibre cement fragments were removed from the site in December 2006, with a clearance certificate issued on 19 December 2006.

4.2.3 Interim Management Plan (2007 a)

In January 2007, E&ES prepared an Interim Site Management Plan, documenting interim procedures to be adopted in order to manage and monitor the following issues:

- surface gas emissions and subsurface gas migration;
- potential asbestos within fill;
- contaminated fill materials; and
- quality of water being pumped to the stormwater system.

Each of the measures documented was stressed to be an interim measure only, until such time as further (detailed) investigations could be undertaken and an appropriate remedial strategy developed.

4.2.4 Asbestos and Gas Monitoring Survey (2007 b)

As part of the Interim Management Plan, it was a requirement that the following works be undertaken on a periodic basis:

- a gas survey of the site surface and the five gas monitoring wells installed by E&ES; and
- an inspection of the site surface, to identify any visible fibre cement sheeting (or other potential asbestos-bearing materials).

Two rounds of monitoring / inspection works were undertaken by E&ES (in March and June 2007). No gas concentrations were reported that would warrant notification to the DECC.

A small number of fibre cement fragments were identified and removed during the March 2007 site inspection.

It was noted that one groundwater monitoring well (BH2) could not be located, as it was located in the storage yard in the site's north-eastern region and appeared to have been covered with concrete pipes and wooden telegraph poles.

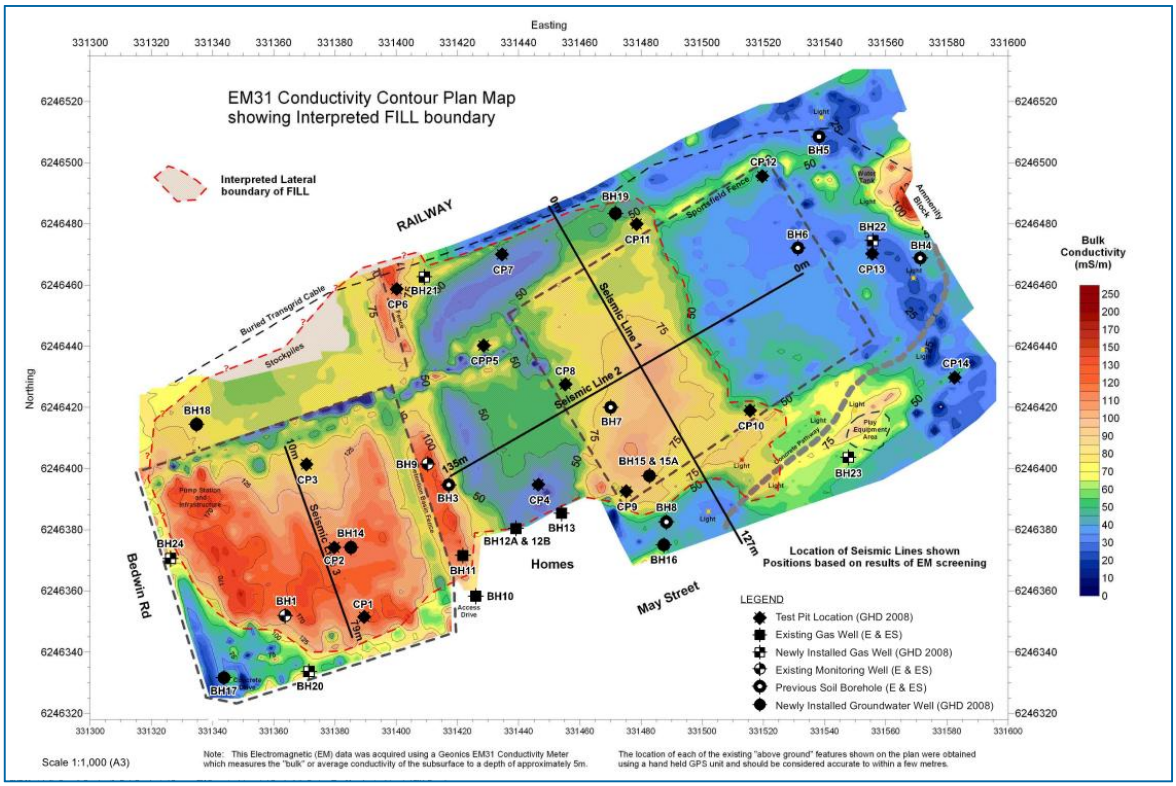
4.2.5 Detailed Site Investigation (2008)

The works undertaken by GHD included the following:

- a geophysical survey to gain a preliminary understanding of the sites subsurface soil conditions and boundaries of the former clay pit;
- sampling and analysis of near-surface soil (CP1 to CP14) on a grid based pattern to assess the soil's physical properties and chemical contamination status;
- groundwater well installation and monitoring (BH14, BH15, BH15a, BH16 to BH19)to determine the chemical contamination status of the site's underlying groundwater;
- installation of additional landfill gas monitoring wells (BH20-BH24) to assess whether landfill gases were being generated within the filled material at the site;
- a surface landfill gas assessment to determine if landfill gas present beneath the site (if any) was migrating vertically through the ground surface; and
- collection and analysis of surface water ponded in the detention basin and pump station to assess the potential for impacted water to be migrating off-site.

The following figure provides an overview of the geophysics and investigation locations undertaken.

Figure 4 GHD investigation location plan (2008)



The following results were recorded:

Soil

- the vast majority of the site had been subject to filling to varying depths (greater than 18 m within the bounds of a former clay pit in the site's central and western regions);
- the majority of the site's near surface soils (less than 0.3 m below the ground surface) comprised brown silty sand topsoils, with occasional glass, ash, brick, metal wire and slag inclusions;

- fill underlying the topsoil horizon comprised a variety of soil types with substantial anthropogenic inclusions (ash, metal, slag, bitumen, building rubble);
- both the shallow (topsoil) and deeper fill horizons were shown to be impacted, most notably by lead, petroleum hydrocarbons and PAH compounds. No asbestos was recorded during sampling; and
- the existing near surface soil matrix may pose potential health risks under the current land use scenario, due to both physical contaminants (namely broken glass, brick and metal wire) and chemical contaminants (lead, petroleum hydrocarbons and PAH compounds).

Groundwater

- the hydraulic gradient varies across the site:
  - in the eastern and central region of the site it appeared to flow in a westerly direction towards the sites detention basin;
  - in the north western section of the site it appeared to flow southwards towards the detention basin;
  - a high point existed in the south western portion of the site in the vicinity of perimeter monitoring well BH17; and
  - a low point was present within the sites detention basin in the vicinity of monitoring well BH1.
- the site's groundwater was contaminated most notably by metals (arsenic, copper and zinc), petroleum hydrocarbons, PAH compounds and ammonia, seemingly derived from the landfilled material across the majority of site;
- petroleum hydrocarbons were recorded in BH1, BH9 and B14 (in or adjacent to the detention basin), along with light non aqueous phase liquid (LNAPL) was present in the east of the detention basin (BH9);
- it was considered that the metals were consistent with regional background levels; and
- groundwater contamination was reported in several of the sites perimeter monitoring wells however, groundwater at the site was inferred to be migrating towards a low point, situated in the detention basin, indicating that contaminated fill-zone groundwater is generally unlikely to be migrating off-site. It must be noted that no detailed evaluation of any groundwater migration via deeper bedrock aquifer (if any) was undertaken.

Surface Water

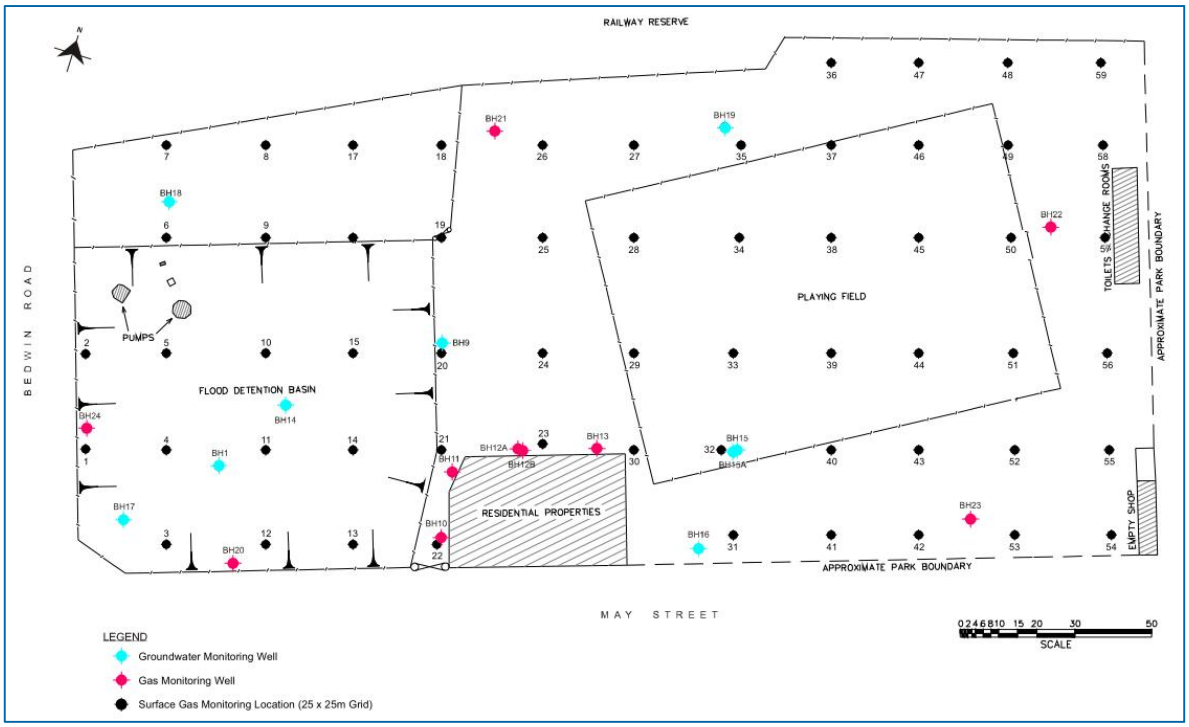
- surface waters present in the detention basin and one of the stormwater pumping stations were contaminated (ammonia, arsenic, copper, lead, total petroleum hydrocarbons and zinc);
- physical observations made of the water in the pumping station plus analytical results suggested there was a degree of connectivity between the sites groundwater and surface water; and
- during periods of significant rainfall, the detention basin is dewatered via a pumping system. Engineering drawings provided by Council, indicated that the water is pumped into stormwater infrastructure which discharges to the open stormwater channel located to the north of the site along the Illawarra rail line.

Landfill Gases

- high levels of methane were being produced within the landfilled material present at the site; and
- landfill gases were seemingly migrating laterally in the soil subsurface towards the sites boundaries in a northerly and easterly direction.

Landfill gas surface sampling was undertaken at the locations shown in **Figure 5**:

Figure 5 GHD surface gas sampling locations (2008)



Surface landfill gas monitoring undertaken across the site showed that landfill gases were typically not venting to atmosphere through the sites surface soils at measurable levels. Only three low level methane concentrations were detected across the site (at location 10, 11 and 12, all of which were in the detention basin) and ranged from 10 to 55 ppm, which were well below the benchmark threshold of 500 ppm.

No detectable levels of hydrogen sulphide or carbon monoxide were detected and the PID only recorded low-level volatile hydrocarbon concentrations in atmosphere of between 0.1 and 0.8 ppm, most likely due to background levels and inherent 'sway' within the monitoring device.

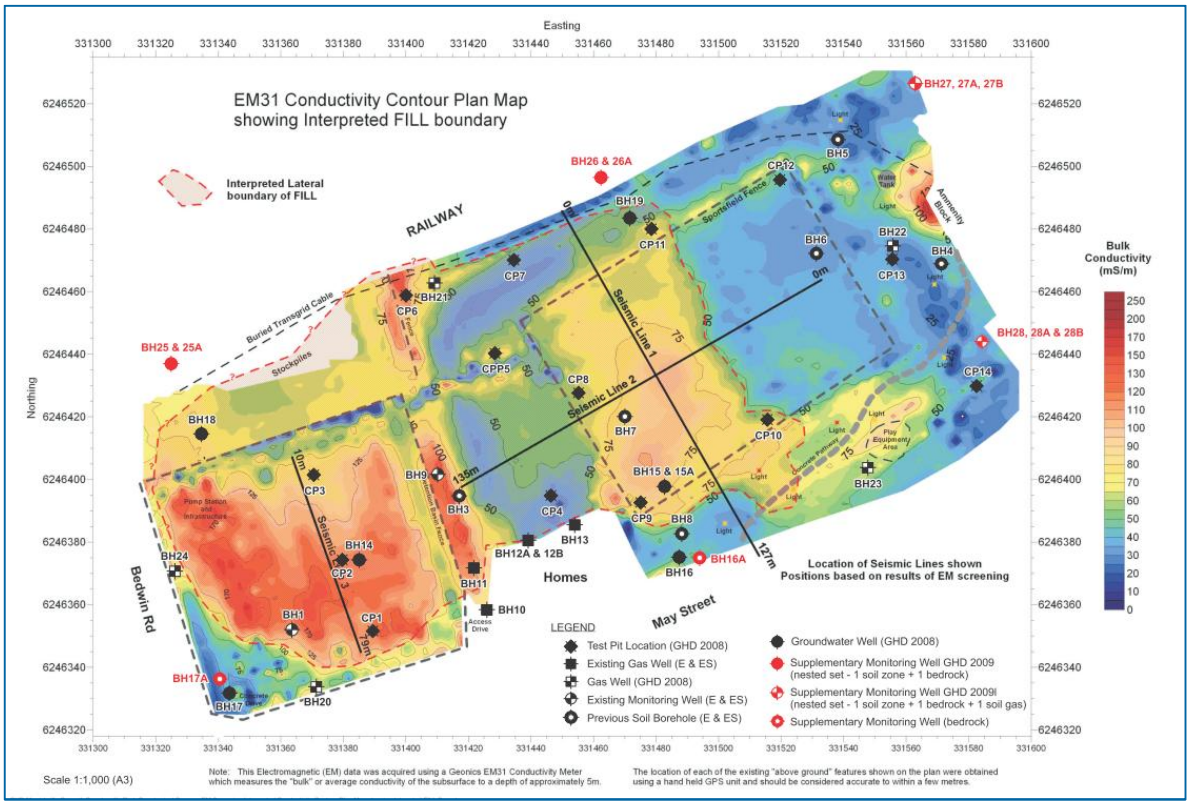
4.2.6 Supplementary Groundwater and Landfill Gas Investigation (2009)

GHD completed the following works:

- collection and analysis of surface water samples from the two pump stations located within the site's detention basin following a significant rainfall event, to assess what impact (if any) dilution may be having on previously observed surface water contaminant concentrations;
- installation and subsequent monitoring of additional perimeter groundwater wells (BH16A, BH17A, BH25, BH25A, BH26, BH26A, BH27, BH27A, BH27B, BH28, BH28A, BH28B) targeting both the shallow 'perched' and deeper bedrock aquifers;
- installation and monitoring of additional perimeter landfill gas monitoring wells to assess whether landfill gases were migrating laterally off-site; and

- monitoring for accumulated landfill gases within buildings located on the eastern portion of the site and service pits / trenches adjacent to the eastern boundary of the site.

Figure 6 GHD investigation location plan (2009)



The following results were recorded:

Surface Water

- surface waters present in the detention basin stormwater pumping stations were impacted by TPH and ammonia;
- concentrations of TPH and ammonia were not significantly reduced following a heavy rainfall event when compared to the results obtained during the GHD (2008) investigation;
- physical observations made of the water in the pumping station plus analytical results obtained suggested there was a degree of connectivity between the sites groundwater and surface water; and
- during periods of significant rainfall, the detention basin is dewatered via a pumping system. Engineering drawings provided by Council, indicated that the water is pumped into stormwater infrastructure which discharges to the open stormwater channel located to the north of the site along the Illawarra rail line.

Groundwater

- while the shallow "perched" groundwater within the bounds of the previous clay pits and landfilled areas at the site had elevated petroleum hydrocarbons, PAH compounds and ammonia, seemingly derived from the landfilled material, generally there is no evidence to suggest the impacted groundwater has migrated beyond the bounds of the former clay pits;
- the bedrock aquifer groundwater did not appear to be grossly impacted by shallow "perched" groundwater present within the bounds of the former clay pits at the site;

- whilst concentrations of TPH above the laboratory PQL were detected in groundwater from deep aquifer wells BH17A and BH28B, it is not considered to be indicative of possible off-site migration of impacted groundwater from the filled clay pits as groundwater contour flow patterns produced indicate that the two wells are in inferred up-gradient locations from the clay pits and land fill material; and
- a thin layer of LNAPL was present atop the groundwater column within monitoring well BH9 located adjacent to the site's detention basin. It was considered that the LNAPL was relatively localised as it was not encountered in any other monitoring wells at the site. Gauging and purging of LNAPL in BH9 indicated recharge rates were low (little to no LNAPL rebound observed three days after initial purging).

Landfill Gases

- high methane concentrations were apparently being produced within the landfilled material present at the site;
- methane concentrations detected in several monitoring wells exceeded the NSW EPA threshold concentration of 1.25% v/v;
- landfill gases were seemingly migrating laterally in the soil subsurface predominately towards the sites northern boundary (BH18 and BH21). Occasional and localised migration was also reported in an easterly direction in the vicinity of monitoring well BH22. There was considered to be a potential risk to human health / safety particularly in respect of occupational activities within the rail corridor along the northern boundary of the site; and
- monitoring of landfill gases in buildings and structures on and along the site's eastern boundary did not identify any evidence of elevated landfill gases (methane and carbon dioxide). Conditions within the buildings and infrastructure were generally consistent with atmospheric conditions (i.e., oxygen concentrations were 20.9% vol/vol) and hence the risk to human health / safety was considered to be low.

4.2.7 Surface Water Sampling (2012 a)

The works undertaken by GHD included:

- collection of two surface water samples (SW_PP1 and SW_DB) from the western pump and the detention basin respectively at a time of heavy rainfall at the site of the pumps and the detention basin (locations are provided on **Figure 7** below);
- samples were analysed for a range of analytes including metals, TPH, BTEX, total kjeldahl nitrogen, nitrite, nitrate and ammonia; and
- comparison of data to recognised regulatory investigation levels and data from a previous sampling programme completed in 2009.

The surface water was observed at the pumps and flood detention basin on 8 March 2012 after a period of very high rainfall across the Sydney Basin which caused wide spread flash flooding around the Sydney Metropolitan area. A total of 75.4 mm of rain fell in the 24 hours before the sampling event. The flood detention basin contained a large volume of water in it. The depth could not be estimated. The water in the basin was turbid and a brownish grey colour. As one of the eastern pump, was completely submerged at the time of sampling; therefore the western pump was sampled as well as the detention basin.

The following results were recorded:

- results for TPH, BTEX, and some heavy metals (mercury, nickel (SW_DB), cadmium, and chromium) were at concentrations below the laboratory's method detection limits.
- other results, copper and zinc were above the screening criteria.
- for most chemicals tested, the 2012 results were less than those recorded in 2009 with the exception of zinc at SW_PP1. The lower concentrations of contaminants after the 2012 rain event could be a product of higher rainfall causing a dilution effect (25 mm in 2009 compared to 75.4 mm in 2012). Ammonia in the 2012 sampling was two orders of magnitude lower than results from 2009.
- at times when the detention basin is saturated, these contaminants pose a potential risk to site users. However, in period of dry conditions and the absence surface water, there is no potential risk from surface waters to site users, as no water is present.

Figure 7 GHD sampling location plan (2012)

4.2.8 Groundwater Monitoring Event (2012 b)

In 2012, GHD completed the following works (**Figure 7** provides details of the monitoring locations)

- installation of three shallow combined groundwater / landfill gas monitoring wells (BH29 to BH31) within the rail corridor (at the northern boundary of the site). Each well was drilled to depths between 5 and 9 metres below ground level (m bgl) and screened only over the residual soil profile.
- the existing wells sampled during the GME comprised:
  - E&ES borehole: BH1; and
  - GHD boreholes: BH14, BH16A, BH17, BH17A, BH25, BH25A, BH26, and BH26A.

The following results were recorded:

- BH9 was not located during this sampling round and a sample could not be collected. This has most likely been lost or damaged as a result of construction works that were taking place in the Council storage yard at the time of sampling. The absence of BH9 provides a data gap, as it was the only well previously reported to contain LNAPL.
- hydraulic gradients were calculated between wells screened within the Shale as 0.003, and for wells screened within the Quaternary deposits as 0.004. Groundwater flow direction appears to be in a northerly direction. Both are consistent with the 2009 data.
- hydrocarbon odours were detected during the groundwater sampling fieldworks in both wells (BH1 and BH14) screened within the Fill.
- the analytical results showed similar results for groundwater located within the Quaternary Deposits and Shale in comparison to that in the Fill material. This was considered to be a result of confinement and low permeability of the clay and shale strata, limiting downward migration.
- groundwater within the Fill material (located in the flood detention basin) showed elevated levels of TPH fractions C_{6-9} and C_{10-14} and ammonia. BH14 also recorded elevated levels of BTEX and elevated concentrations of zinc exceeding the screening criteria.
- groundwater within the Quaternary and Shale deposits recorded exceedence for copper, nickel and zinc, as well as marginally elevated concentrations of arsenic. BH26 also contained low levels of ammonia and TPH.
- GHD considered that the elevated metals are related to background concentrations, as the Shale deposits are of marine origin and have naturally high metal loads.
- the results indicates that the observed contaminant concentrations are generally at a higher in the shallow perched aquifer when compared to the deeper aquifer.
- based on the groundwater data, contaminant groundwater migration did not appear to be occurring down hydraulic gradient and towards the residential housing north of the railway line.

4.2.9 Landfill Gas Risk Assessment and Hazardous Ground Gases Assessment (Combined) (2012 c)

The report provided a detailed review of five landfill gas monitoring rounds undertaken between January 2011 and May 2012. The following pertinent information was reported:

- the monitoring was undertaken on 23 boreholes located across the site as well as off site. These included: BH10, BH11, BH12A, BH12B, BH13, BH16A, BH17, BH17A, BH19-BH25, BH25A, BH26, BH26A, BH27-BH33 (locations are detailed on **Figure 7**).
- No exceedances of the nominated actions levels for methane and / or carbon dioxide were observed during the period in monitored sub-surface services, across the site's surface or within the on-site building. These results suggest that significant emissions of landfill gas are not occurring from the site.
- the landfill continues to generate landfill gas containing methane and carbon dioxide in excess of 1% by volume (v.v.) and 5%v.v.
- GHD notes that several of the boreholes were saturated during monitoring which may affect the data.
- five perimeter boreholes (BH22, BH24, BH26, BH26A and BH28) have recorded methane concentrations in excess of 1% v.v. on at least one occasion during the period. Three of the five boreholes are installed into waste (Fill) materials. As such, it is considered that

the presence of methane at these three boreholes is likely to be indicative of local landfill gas generation within the waste materials.

- two perimeter boreholes that are installed into the natural strata adjacent to the site (BH26A and BH28) recorded a methane concentration that exceeded 1%v.v. on one occasion, with concentrations of 2.5 and 1.4 %v.v. respectively.
- 20 boreholes have recorded maximum carbon dioxide concentrations that exceeded 5 %v.v. on at least one occasion during the monitoring period. Seven boreholes are installed into waste materials and the remaining in the clay, weathered shale or shale deposits. Those boreholes installed outside of the landfill (BH25, BH25A, BH29, BH30, BH31) have recorded maximum carbon dioxide concentrations between 4.7 and 15.7 %v.v. which is suggestive that elevated carbon dioxide concentrations are naturally occurring in the clay, weathered shale and shale deposits.
- low flow rates were recorded on two occasions (April and May 2012) ranging between <0.1 to 0.4 L/hr.
- the results indicate that the ground gas regime beneath the site (within the specific geological horizons monitored) is representative of a Characteristic Situation 2 (low risk). However, utilising the approach detailed in NSW EPA guidelines, as methane concentrations have been recorded above 20 %v.v. in parts of the site, Characteristic Situation 3 (moderate risk) should be considered.
- additionally, the report detailed a number of unacceptable, acceptable and insignificant risks associated with pathways for landfill gas migration at the site. An unacceptable risk was recorded for landfill gas emissions through the sites surface and associated penetrations impacting on sub surface services at the site.

4.2.10 EPA letter (2013)

The works undertaken to date have been submitted to NSW Environment Protection Authority (EPA). The EPA confirmed in the letter issued on 4 April 2013 that 'there is no reason to believe that contamination at the site is significant enough to warrant regulation under the *Contaminated Land Management Act 1997'*, for the following reasons:

- groundwater is impacted by petroleum hydrocarbons, metals and ammonia in concentrations that exceed the ANZECC guidelines. However, groundwater is not used at the site and there is no evidence that significant concentrations of the contaminants have migrated (or are migrating off site).
- soil is impacted by petroleum hydrocarbons and metals exceeding the health based investigation levels for public open space. However, the site is well grassed and maintained indicating that exposure to the contaminants is unlikely.
- landfill gas concentrations in monitoring boreholes sampled within the landfill and outside the landfill exceeded the NSW EPA threshold for methane (1.5 %v/v). It was reported that landfill gases were migrating laterally in the surface soils towards the site boundaries in a northerly and easterly direction. However, the results in the railway corridor (BH29, BH30 and BH31) and beyond the corridor (BH25 and BH25A) did not show the presence of methane.
- the landfill gas monitoring in the stormwater drains, service pits and inside the amenities building did not identify any concentrations of landfill gases. No vapour accumulation due to landfill gases had been identified. However, there is an explosion hazard for subsurface maintenance works such as welding.

- the landfill gas report (2012) details actions to address the risks including continuing of landfill gas monitoring and implementing a communication strategy. The EPA recommended that Council implements the actions listed in the report to ensure that any potential risks due to landfill gas emissions are adequately addressed.

4.3 Summary of contamination

GHD has reviewed the data provided in the reports discussed in **Section 4.2**. The review has identified the following contamination issues at the site (**Sections 4.3.1** to **4.3.4**).

4.3.1 Soil

Table 6 provides a summary of the soil contamination (analytes with concentrations above the nominated screening criteria) present in the samples collected and analysed as part of the investigations (2006 to 2008). The table excludes the analytes with concentrations less than the screening criteria.

Table 6 Summary of soil contamination (chemical)

Sample ID (depth m bgl)	Copper	Lead	Total Petroleum Hydrocarbons (TPH)		B[a]P	Total PAH
			C6 - C9	C10-C36		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
HILE*	2,000	600	65	1,000	2	40
CP1 (0-0.1)	491	**2520**	ND	**1110**	**4.5**	**55.5**
CP1 (0.9)	370	**9990**	ND	**8420**	**59.0**	**1411.2**
CP2 (0-0.1)	306	366	ND	550	**8.5**	**100.6**
CP2 (1.3)	80	131	ND	**5190**	**40.6**	**859.3**
CP3 (0-0.1)	164	495	ND	430	**2.7**	29.3
CP3 (0.3)	271	141	15	**1170**	**6.1**	**71.7**
CP4 (0-0.1)	124	266	ND	330	**2.3**	23.8
CP4 (0.3)	-	-	-	-	-	-
CP4 (0.9)	381	**821**	ND	**1250**	**10.5**	**92.1**
CP4 (1.9)	1750	**999**	ND	**3000**	**5.0**	**56.9**
CP5 (0-0.1)	29	86	ND	ND	ND	2.8
CP5 (1.0)	126	210	ND	440	**3.2**	**32.3**
CP6 (0-0.1)	364	375	ND	260	**4.4**	**46.5**
CP6 (0.3)	720	233	ND	350	1.7	19.7
CP6 (2.3)	583	288	47	**10280**	0.8	10.1
CP7 (0-0.1)	ND	8	ND	ND	ND	ND
CP7 (0.3)	51	84	ND	ND	1.2	10.8
CP7 (1.3)	26	314	ND	ND	1.2	11.1
CP8 (0-0.1)	31	97	ND	ND	0.8	8.6
CP8 (1.4)	112	223	16	**1160**	**2.7**	31.5
CP9 (0-0.1)	61	172	ND	260	1.7	17.4
CP9 (1.1)	60	117	ND	ND	1.5	16.3
CP9 (2.2)	**6840**	**5380**	ND	**8620**	**3.1**	**56.6**
CP10 (0-0.1)	20	53	ND	ND	ND	0
CP10 (0.5)	441	**1630**	ND	420	**3.8**	**41**
CP10 (1.3)	2540	**5800**	ND	**1730**	ND	3.6
CP11 (0-0.1)	91	**706**	ND	100	1.7	17.6
CP11 (0.3)	-	-	-	-	-	-
CP11 (1.0)	232	251	ND	**1020**	**7.8**	74.7
CP12 (0-0.1)	61	239	ND	ND	1.3	11.7

Sample ID (depth m bgl)	Copper	Lead	Total Petroleum Hydrocarbons (TPH)		B[a]P	Total PAH
			C6 - C9	C10-C36		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
HILE*	2,000	600	65	1,000	2	40
CP12 (1.2)	940	**1900**	ND	**1080**	**12.0**	**133.9**
CP13 (0-0.1)	37	69	ND	ND	ND	3.5
CP13 (0.8)	56	219	ND	ND	**2.4**	32.8
CP13 (1.8)	37	72	ND	580	**2.3**	26.2
CP14 (0-0.1)	41	**826**	ND	ND	ND	1.8
CP14 (0.5)	ND	20	ND	ND	ND	0
BH1 (0.2-0.4)	660	**1020**	-	-	1.9	31.3
BH1 (2.0-2.2)	72	560	<25	**1690**	**5.8**	**103.6**
BH1 (4.6-4.8)	-	-	**97**	**7200**	**6.6**	**226.9**
BH1 (5.8-6.0)	105	**5250**	-	-	-	-
BH2 (0-0.2)	420	190	-	-	<1	7.8
BH2 (0.8-1.0)	28	200	-	-	-	-
BH2 (2.0-2.2)	68	110	<25	**8200**	**11**	**958.6**
BH2 (2.6-2.8)	320	**1550**	-	-	<1	8.8
BH3 (0-0.15)	130	400	-	-	-	-
BH3 (0.8-1.0)	290	570	-	-	**2**	32.5
BH3 (1.7-1.9)	280	350	-	-	1.5	23
BH4 (0.3-0.5)	38	130	-	-	<1	4.2
BH4 (1.8-2.0)	30	130	-	-	-	-
BH4 (3.0-3.2)	300	290	<25	**1120**	**8.5**	**187**
BH5 (1.8-2.0)	470	320	-	-	<1	ND
BH5 (3.3-3.5)	230	260	<25	160	<1	1.1
BH6 (1.3-1.5)	17	17	-	-	<1	ND
BH6 (2-2.2)	3	29	-	-	<1	ND
BH7 (0-0.2)	11	19	-	-	-	-
BH7 (0.3-0.4)	-	-	-	-	<1	ND
BH7 (1.8-2.0)	460	170	-	-	**3.1**	**56.6**
BH8 (2.0-2.2)	3	15	-	-	<1	ND
BH9 (0.7-0.9)	260	350	<25	**2530**	**8.6**	**169.1**
BH9 (2.6-2.8)	115	320	<25	**4900**	**22**	**503.4**
BH10(0.2-0.3)	**2420**	**1660**	-	-	**26**	**267.4**
BH10 (0.8-1.0)	68	140	<25	580	**2.4**	30.5
BH10 (1.8-2.0)	10	23	-	-	<1	<2
BH11 (0.2-0.3)	160	**720**	-	-	**4**	24.4
BH11 (0.4-0.6)	120	500	-	-	**2.7**	26.3
BH11 (0.8-1.0)	230	**720**	<25	460	**2.6**	26.8
BH12A (0.2-0.3)	310	**960**	-	-	**4**	39.5
BH12A (0.9-1.0)	310	**1110**	<25	450	1.4	8.8
BH13 (0.2-0.3)	1520	**660**	-	-	<1	3.5
BH13 (0.4-0.6)	17	21	<25	<100	<1	<2
BH13 (1.9-2.1)	13	36	-	-	<1	<2

** NSW DEC 2006, Contaminated Sites: Guidelines for NSW Site Auditor Scheme (2nd Edition).*

ND – Non detection **Bold** – Guideline exceedence - not analysed

The chemicals of potential concern (COPC) are copper, lead, TPH C10-C36, benzo(a)pyrene and total PAHs.

GHD has prepared a plan (**Figure 8**) of the distribution of the shallow recorded contamination (top 0.5 m). GHD noted that there are impacts in the deeper Fill, for the purposes of this

RCEMAP, the material greater than 0.5 m bgl is unlikely to be disturbed, and is provided for information purposes only.

Generally the top 0.5 m of soil across the site contains physical anthropogenic materials (specifically broken glass, brick and metal wire).

Asbestos containing materials have previously been observed at surface, and have historically been managed by emu picking. One subsurface sample from BH13 (1.5-1.7) has recorded asbestos containing materials. Asbestos containing materials cannot be discounted elsewhere at the site.

The soils have been identified as potential risk to site users as well as construction/maintenance workers, and remedial and management measures are warranted.

Table 7 provides comparison of the soil samples within the top 0.5 m which have exceeded the screening criteria of the NSW DECC (2009) *Waste Classification Guidelines Part 1: Classifying Waste*.

Table 7 Summary of soil contamination (preliminary waste classification)

Sample ID	Copper	Lead	Total Petroleum Hydrocarbons (TPH)		B[a]P	Total PAH
			C6 - C9	C10-C36		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
HILE*	**2,000**	**600**	**65(2)**	**1,000 (2)**	**2**	**40**
CT1*	**-**	***100***	***650***	***10,000***	***0.8***	***200***
CT2***	**-**	**400**	**2600**	**40,000**	**3.2**	**800**
CP1 (0-0.1)	491	***2520***	ND	1110	***4.5***	55.5
CP2 (0-0.1)	306	*366*	ND	550	***8.5***	100.6
CP3 (0-0.1)	164	***495***	ND	430	***2.7***	29.3
CP3 (0.3)	271	*141*	15	1170	***6.1***	71.7
CP4 (0-0.1)	124	*266*	ND	330	***2.3***	23.8
CP6 (0-0.1)	364	*375*	ND	260	***4.4***	46.5
CP10 (0.5)	441	***1630***	ND	420	***3.8***	41
CP11 (0-0.1)	91	***706***	ND	100	*1.7*	17.6
CP14 (0-0.1)	41	***826***	ND	ND	ND	1.8
BH1 (0.2-0.4)	660	***1020***	-	-	*1.9*	31.3
BH10(0.2-0.3)	**2420**	***1660***	-	-	***26***	***267.4***
BH10 (0.8-1.0)	68	140	<25	580	***2.4***	30.5
BH11 (0.2-0.3)	160	***720***	-	-	***4***	24.4
BH11 (0.4-0.6)	120	500	-	-	***2.7***	26.3
BH11 (0.8-1.0)	230	***720***	<25	460	***2.6***	26.8
BH12A (0.2-0.3)	310	***960***	-	-	***4***	39.5
BH12A (0.9-1.0)	310	***1110***	<25	450	*1.4*	8.8
BH13 (0.2-0.3)	1520	***660***	-	-	<1	3.5

** NSW DEC 2006, Contaminated Sites: Guidelines for NSW Site Auditor Scheme (2nd Edition).*

*** General Solid Waste criteria under the Waste Classification Guidelines (2009)*

**** Restricted Solid Waste criteria under the Waste Classification Guidelines (2009)*

Italic – exceeds the general solid waste guideline

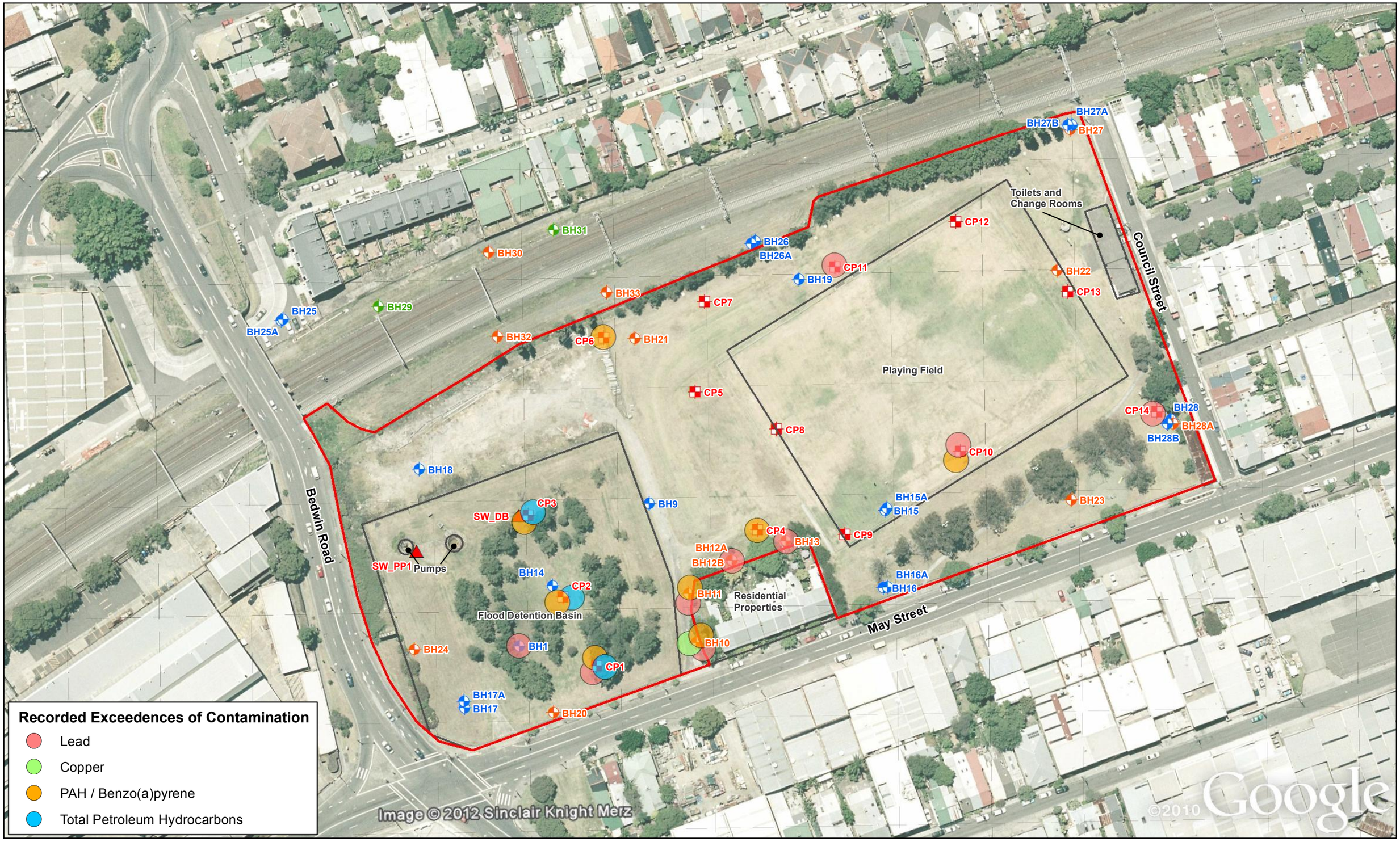
Bold – exceeds the restricted solid waste guideline

Italic and bold – exceeds both the general and restricted solid waste guideline

- not analysed

Based on the proposed construction of drainage within the top 500 mm, may require disposal at an appropriately licenced facility as either restricted solid waste or hazardous waste.

Hazardous wastes may require pre-treatment prior to any off site disposal. Further assessment is recommended as well as an assessment for asbestos.



Recorded Exceedences of Contamination

- Lead
- Copper
- PAH / Benzo(a)pyrene
- Total Petroleum Hydrocarbons

0 10 20 30 40 50
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Site Boundary (Approximate)
- Infrastructure (Approximate)
- Surface Water Sampling Location
- Test Pit Location
- Landfill Gas Monitoring Well
- Groundwater Monitoring Well
- Combined Groundwater and Gas Well

Marrackville Council
Camdenville Park

Job Number	21-16600
Revision	A
Date	23 Jul 2013

Recorded Exceedences

Figure 8

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Data Source: Google Earth Pro 2012 - Imagery. Created by: tnham

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4.3.2 Groundwater

Table 8 provides a summary of the 2012 groundwater data collected by GHD.

Table 8 Summary of groundwater contamination (mg/L)

Strata	Borehole	Standing water level (m below top of casing)	Standing water level (m AHD)	Arsenic	Copper	Zinc	Ammonia
				0.007*	0.0013*	0.015*	0.748*
Fill	BH1	0.79	3.69	0.003	0.001	0.008	**50**
	BH14	0.75	3.71	0.003	<PQL	**0.066**	**38**
Shale	BH16A	4.20	4.04	<PQL	**0.007**	**0.17**	0.14
	BH17A	2.14	4.01	0.003	<PQL	<PQL	0.65
	BH25	15.85	-10.57	<PQL	**0.003**	**0.049**	0.08
	BH26A	3.44	3.66	**0.008**	0.001	**0.16**	0.25
Quaternary Deposits / Shale	BH17	2.03	4.12	<PQL	**0.03**	**0.12**	0.25
	BH25A	3.53	1.73	0.004	0.001	**0.05**	0.03
	BH26	2.98	4.07	0.003	**0.005**	0.006	**4.5**
Quaternary Deposits	BH29	1.94	3.58	<PQL	**0.008**	**0.097**	<PQL
	BH30	4.36	1.44	<PQL	**0.015**	**0.25**	<PQL
	BH31	2.50	3.44	<PQL	<PQL	0.009	0.05

PQL – Practical Quantification Limit **Bold** – Guideline exceedence *ANZECC criteria (marine)

Based on the current groundwater data, contaminant migration does not appear to be occurring down hydraulic gradient and towards the residential housing north of the railway line. Based on the current and historical data, and lack of significant contamination down gradient and within deeper geological units, GHD do not consider that there is a risk posed to offsite receptors.

4.3.3 Surface Water

Table 9 provides a summary of the 2012 surface water monitoring completed by GHD.

Sample results for TPH, BTEX, and some Heavy Metals (mercury, nickel (SW_DB), cadmium, and chromium) were at concentrations below the laboratory's method detection limits.

Other results, exceeded the relevant guidelines: these included copper and zinc. The table also provides a comparison with the 2009 GHD data set.

Table 9 Summary of surface water contamination (µg/L)

Analyte	Units	Screening criteria*	Previous Data (2009) SP1 16-Feb-09	Previous Data (2009) SP2 16-Feb-09	Current Data (2012) SW_PP1 8-Mar-12	Current Data (2012) SW_DB 8-Mar-12
TPH C10-C36 (Total)	µg/L	-	76	180	ND	ND
Total BTEX	µg/L	-	ND	ND	ND	ND
Ammonia	µg/L	910	**13,000**	**33,000**	120	150
Nitrate	µg/L	-	300	500	370	130
Nitrite	µg/L	-	130	70	10	10
Total Kjeldahl Nitrogen	µg/L	-	14,000	36,000	1,000	400
Lead	µg/L	4.4	**6.5**	3.7	2	2
Mercury	µg/L	4	ND	ND	ND	ND
Nickel	µg/L	7	6.6	6.7	1	ND
Arsenic	µg/L	2.3	**2.4**	**2.9**	1	1
Cadmium	µg/L	5.5	0.2	0.1	0.1	ND

Analyte	Units	Screening criteria*	Previous Data (2009) SP1 16-Feb-09	SP2 16-Feb-09	Current Data (2012) SW_PP1 8-Mar-12	SW_DB 8-Mar-12
Chromium	µg/L	4.4(2)	1.6	1.3	ND	ND
Copper	µg/L	1.3	**30**	**9.8**	**8**	**5**
Zinc	µg/L	15	**190**	**83**	**710**	**28**

ND – non-detect ***Bold*** *– guideline exceedance* ** ANZECC (2000) Marine 95% Protection Trigger Value.*

Based on the results of laboratory analyses, copper and zinc were found to be above the 95% marine protection trigger value. GHD notes that these analytes are commonly recorded at similar concentrations in the Sydney area.

At times where the detention basin is saturated, these contaminants pose a potential risk to site users. However, in period of dry conditions and the absence surface water, there is no potential risk from surface waters to site users.

Based on the results and discussions with Council, there is a requirement to upgrade the detention basin at the site.

4.3.4 Ground/Landfill Gas

Gas monitoring was carried out by GHD on five occasions in January and February 2011 and April and May 2012. **Table 10** provides an overview of the maximum concentrations (methane and carbon dioxide) and flow rates recorded during these five monitoring events.

Table 10 Summary of gas monitoring data

Geological Stratum Screened Horizon	Borehole	Max. CH4 (%)	Max. CO2 (%)	Min. O2 (%)	Max. Flow (l/hr)	Gas Screening Value*	Characteristic Situation**
Fill (Waste)	BH19	**36.1**	**35.3**	<0.1	0.1	0.036	2 (CH4>1% & CO2>5%)
Fill (Waste)	BH21	**73.1**	**17.1**	0.2	0.1	0.073	2 (CH4>1% & CO2>5%)
Fill (Waste)	BH22	**10.1**	**10.1**	<0.1	0.1	0.010	2 (CH4>1% & CO2>5%)
Fill (Waste)	BH23	0.1	**10.5**	7.5	0.2	0.02	2 (CO2>5%)
Fill (Waste)	BH24	**2.0**	**9.6**	0.9	0.1	0.01	2 (CH4>1% & CO2>5%)
Fill (Waste)	BH26	**15.3**	**15.7**	<0.1	0.1	0.016	2 (CH4>1% & CO2>5%)
Fill (Waste)	BH33	0.1	**10.5**	2.6	0.1	0.01	2 (CO2>5%)
Fill (Waste) / Clay	BH27	0.1	**4.0**	17.2	0.1	0.004	1
Clay	BH20	0.2	**14.1**	6.6	<0.1	0.014	2 (CO2>5%)
Clay	BH29	<0.1	**15.7**	3.4	0.1	0.016	2 (CO2>5%)
Clay	BH30	1.0	**6.5**	10.9	0.1	0.007	2 (CO2>5%)
Clay	BH31	0.1	4.7	16.0	<0.1	0.005	1
Clay	BH32	0.1	**12.8**	6.2	0.2	0.03	2 (CO2>5%)
Clay / Weathered Shale	BH17	0.1	**16.5**	10.5	0.2	0.033	2 (CO2>5%)
Clay / Weathered Shale	BH28	**1.4**	**12.8**	6.9	0.2	0.026	2 (CH4>1% & CO2>5%)
Weathered Shale /	BH25A	0.7	**12.4**	10.1	0.1	0.012	2 (CO2>5%)

Geological Stratum Screened Horizon	Borehole	Max. CH4 (%)	Max. CO2 (%)	Min. O2 (%)	Max. Flow (l/hr)	Gas Screening Value*	Characteristic Situation**
Shale							
Shale	BH16A	0.1	**69.8**	6.0	<0.1	0.07	2 (CO2>5%)
Shale	BH17A	<0.1	**12.0**	10.9	0.4	0.048	2 (CO2>5%)
Shale	BH25	0.1	4.9	11.1	0.1	0.005	1
Shale	BH26A	**2.5**	**5.4**	15.0	0.29	0.016	2 (CH4>1% & CO2>5%)
-	BH10	<0.1	3.9	13.6	<0.1	0.004	1
-	BH11	0.1	2.6	14.5	<0.1	0.003	1
-	BH12A	0.5	**7.5**	4.4	0.2	0.015	2 (CO2>5%)
-	BH12B	<0.1	**7.8**	17.3	<0.1	0.008	2 (CO2>5%)
-	BH13	<0.1	**12.5**	0.3	0.1	0.013	2 (CO2>5%)

*utilising the instruments detection limit of 0.1% v/v or 0.1 l/hr flow rate if less than <0.1, and the maximum concentration of either methane or carbon dioxide.
**based on the modified Wilson and card methodology detailed in the NSW EPA guidelines 2012
- geology and screened strata unknown as borehole logs not available as work was undertaken by others.
Bold – above 1% methane / above 5% carbon dioxide

The results indicate that the ground gas regime beneath the site (within the specific geological horizons monitored) is representative of a Characteristic Situation 2 (low risk). However, utilising the approach detailed in NSW EPA guidelines (2012), as methane concentrations have been recorded above 20% v.v. in parts of the site, Characteristic Situation 3 (moderate risk) should be considered.

Based on the current data and the classification discussed above, gas protection measures will be required in any future building construction at the site. Based on the guidelines, given a moderate potential for generation (old landfill) and likely low sensitivity development (if undertaken), to fully characterise the gas regime at the site a minimum of six rounds over three months is recommended. GHD note that five rounds over twelve months have been completed, however, these have been between the months of January to May. Further monitoring is recommended between June to December to provide a better seasonal distribution of the data. Further monitoring should also include collection of flow rates, to provide a more robust data set. This however has been excluded at this stage as it is understood that there are no proposals to construct additional buildings at the site.

Based on the results and the letter from the EPA (2013) reviewed in **Section 4.2.10**, further gas monitoring is required to manage and monitor any changes to the gas regime at the site, this should be completed in monitoring boreholes as well as service pits and amenities buildings as well as during any works likely to generate sparks. Monitoring requirements are detailed in **Section 7.4.** and **8.2.1.**.

Figure 9 provides an overview of the gas monitoring data.

0 10 20 30 40 50
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Site Boundary (Approximate)
- Infrastructure (Approximate)
- Surface Water Sampling Location
- Test Pit Location
- Landfill Gas Monitoring Well
- Groundwater Monitoring Well
- Combined Groundwater and Gas Well

Marrackville Council
Camdenville Park

Job Number	21-16600
Revision	A
Date	23 Jul 2013

Distribution of Landfill Gases (Maximum Concentrations)

Figure 9

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Data Source: Google Earth Pro 2012 - Imagery. Created by: tnham

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4.4 Conceptual site model

Based on the recorded contamination at the site, remedial measures are required for the following source – pathway –receptor linkages:

Table 11 Conceptual site model

Contaminants	Potential Pathway	Potential Receptor	Potential S-P-R Linkage
Fill soils – copper, lead, TPH (C10-C36), B[a]P, Total PAH and asbestos	• Ingestion of soils. • Dermal contact with soil. • Inhalation of dust.	• Site users (parks, open spaces and playing fields). • Construction and maintenance workers (on site).	Yes, management measures to protect potential risks to human health
	• Direct contact	• Ecological receptors	Not considered due to importation of chemically suitable capping material
Groundwater – arsenic, copper, zinc , ammonia (and possible LNAPL beneath detention basin). Metals are considered to be background.	• Ingestion / dermal contact with groundwater during intrusive works. • Potential for mixing with surface waters (on site).	• Construction and maintenance workers (on site). • Surface water in detention basin	No remedial or management measures are required to protect off site receptors. Direct contact by construction maintenance workers should be managed by use of PPE.
Surface water – arsenic, copper, lead, zinc and ammonia. Metals are considered to be background. At times where the detention basin is saturated, these contaminants pose a potential risk to site users. However, in period of dry conditions and the absence surface water, there is no potential risk from surface waters to site users.	• Ingestion / dermal contact with surface water. • Surface water run off.	• Site users (parks, open spaces and playing fields). • Construction and maintenance workers (on site). • Surface water	Yes, manage through bio-remediation (surface water) and management measures (human health) to protect potential risks to human health and environment.
Ground/Landfill Gas – methane and carbon dioxide (enclosed spaces)	• Asphyxiation and explosion risk	• Site users (parks, open spaces and playing fields). • Construction and maintenance workers (on site). • Buildings / services	Yes, manage through management measures.

Intentionally blank

5. Extent of site requiring remediation / management

Based on the information detailed in **Section 4**, the media requiring remediation / management are:

- soils across the site (from chemical and physical contaminants).
- Surface water that accumulates in the detention basin.
- ground/landfill gas.

Figure 10 has been prepared and outlines the six key areas of the development that warrant remedial / management measures.

5.1.1 Area A: Spectator Mounds

There has been limited sampling completed on the spectator mounds. The surface samples (top 0.5 m) have recorded one exceedance of the screening criteria at CP11 for lead and benzo(a)pyrene. Further, asbestos containing materials have historically been emu picked from the surface of these mounds.

It is understood Council is looking to reuse these mounds to land raise the areas (e.g. a low area to the west of the existing playing field).

To undertake the assessment of the suitability of reuse of these soils further classification (chemical and physical) of these soils necessary along with appropriate cut and fill calculations (**Section 6**).

Dependent on the results of the assessment, there may be a requirement to either cap the area where the material has been removed from as well as capping the material reused during the filling works. Maintenance of the capping will be managed under an Environmental Management Plan (EMP) (**Section 7.4**).

Should the material be either unsuitable for reuse as part of the cut and fill works, the material will be disposed of offsite at an appropriate facility.

5.1.2 Area B: Playing Fields

There has been limited soil sampling across the area of the playing field. The surface samples (top 0.5 m) have recorded one location (CP10) with elevated lead and PAHs. Council is looking to upgrade the playing field and as part of these works it proposes to install drainage channels and sprinkler system across this area of the site.

It is understood that these items will be installed at approximately 500 mm below current ground surface and will form a grid based system (similar to the pattern shown on **Figure 10**). The drainage will comprise gravels, sands and an agricultural pipe. New irrigation pipework and sprinkler system will be installed and integrated within the drainage trenches to reduce the material requiring excavation. The drainage system will be capped (**Section 7**).

The sports lighting may be upgraded as part of the works, and is likely to include the installation of additional lighting columns. New columns would require appropriate footings. Sealing of joints of electricity conduits and lighting columns will avoid the ground gas entering the lighting column. In addition, ventilations such as small holes on the lighting columns will avoid the accumulation of ground gas inside the lighting columns. Sports lighting design plans should be prepared to meet the above requirements and will need to be agreed with the Site Auditor prior

to construction (**Section 6.4**). The details of gas protection measures should be included within the validation report (**Section 7.3.5**).

Excavated soils should be appropriately managed under the materials management plan (**Section 8.2.6**), which should include appropriate testing for reuse of material / waste classification (**Section 6.2**) and disposal of soils as well as all other construction site management considerations detailed in **Section 8**.

Excavated materials will need to be stockpiled and tested for re-use or off site disposal

Maintenance of the capping will be managed under an EMP (**Section 7.4**).

0 10 20 30 40 50
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Site Boundary (Approximate)
- Infrastructure (Approximate)
- Field Drainage Grid (Approx. 5m x 3m)
- Surface Water Sampling Location
- Test Pit Location
- Landfill Gas Monitoring Well
- Groundwater Monitoring Well
- Combined Groundwater and Gas Well

Marrackville Council
Camdenville Park

Job Number	21-16600
Revision	A
Date	23 Jul 2013

Remediation Works and Management Areas

Figure 10

G:\21\16600\GIS\Maps\MXD\21_16600_Z012_CAMDENVILLE_Remediation_Areas.mxd

Data Source: Google Earth Pro 2012 - Imagery. Created by: tnham

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

5.1.3 Area C: Proposed water treatment / storage structure

Council proposes to install a water treatment / storage structure in the northeast corner of the site. The construction of this subsurface structure will require testing of the soil suitability for the purpose of construction design as well as waste classification of the soils for any potential offsite disposal of soils associated with the construction (**Section 6**).

5.1.4 Area D: General capping areas

Based on the limited soil sampling across areas outside of Areas A, C, B, E and F, there is a requirement to provide capping across the ground surface to reduce exposure to site users from the contamination recorded in these areas (**Section 7**).

Several locations (CP4, CP14, BH10, BH11, BH12a, BH12B and BH12) have recorded elevated copper, lead and hydrocarbons (TPH and PAH) in the surface 0.5 m. Deeper contamination has also been recorded during sampling and analysis for a similar suite of chemicals of concern.

Maintenance of the capping will be managed under an EMP (**Section 7.4**).

5.1.5 Area E: Proposed BMX track

Council proposes to develop a BMX track in the area of the former depot in the west of the site.

There is limited soil sampling data from this area. One surface sample (top 0.5 m) at CP6 had recorded elevated PAHs. Based on this information, there is a requirement to cap the surface of this area to reduce exposure to site users from the contamination recorded in these areas. The capping will also need to be of sufficient thickness and quality to use as a BMX track (**Section 7**).

Maintenance of the capping will be managed under an EMP (**Section 7.4**).

5.1.6 Area G: Upgrade to detention basin and stormwater system

Based on the potential risks from contamination at the detention basin from lead and hydrocarbons (TPH and PAH) in shallow soils as well as the periodic risk from contaminants in surface waters there is a requirement to manage and upgrade the detention basin.

The Council is aiming to renew the fencing in this part of the site, as well as upgrade the detention basin using a phyto-remediation system in the form of reed beds or similar (**Section 6**). This approach is subject to feasibility assessment and the approach described herein is indicative in nature and any detailed design will require input from a drainage engineer.

The design requirements for the fencing will be subject to the results of the feasibility assessment.

Proposed upgrades to the stormwater system include installation of inlet pits in Campbell Street connecting directly into the detention basin and a stormwater harvesting tank with associated pipe work in the northeast corner of the site (near Goodsell Street). These works will include excavation of soils as well as a tank pit which is likely to comprise an area of 3 metres deep by 10 metres diameter. Excavated soils should be appropriately managed under the materials management plan (**Section 8.2.6**), which should include appropriate testing for reuse of material / waste classification (**Section 6.2**) as well as all other construction site management considerations detailed in **Section 8**.

Maintenance of the detention basin as well as the fencing will be managed under an EMP (**Section 7.4**).

5.1.7 Site wide: Ground/landfill gas monitoring

As part of the ongoing management of the site there is a requirement to undertake ongoing gas monitoring from both monitoring boreholes as well as lighting columns (existing and proposed), service pits (existing and proposed), and amenities buildings and during any works likely to generate sparks. The aim of the gas monitoring is to manage and monitor any changes to the gas regime at the site.

Gas monitoring will be managed under an EMP (**Section 7.4**) and managing gas/vapours during subsurface works or works likely to generate sparks will be managed under a gas management plan (**Section 8.2.1**).

5.1.8 Site wide: Development of an Environmental Management Plan

This document does not include the sites long term EMP, as this will need to be prepared upon completion of the works detailed within this document. The EMP will be required to support the remedial and management strategies detailed in this document. The long term EMP should detail the controls installed as part of the remedial and management works to control potential exposure to contamination, and provide a system to ensure the maintenance of the controls and prevent future exposure to contamination.

It should be noted that the EMP would not intended to replace or supersede health and safety plans for the site. This EMP would be a supplement to these documents. The EMP would need to be made reasonably legally enforceable. It is understood it is Council's intention to achieve this through incorporation of the EMP into the Plan of Management for the park.

Further details are provided in **Section 7.4**.

6. Preliminary Works

Based on the information detailed in **Section 5**, there are a couple of phases of works that are required prior to the implementation of the remedial or management measures detailed in **Section 7**.

6.1 Cut and fill assessment

A cut and fill assessment should be undertaken by an appropriately qualified person to assess whether the materials present in the spectator mounds can be placed elsewhere in lower areas of the site (such as the area to the west of the playing field).

6.2 Investigation for reuse as filling

Investigations are required for the mounds in Area A as well as for the proposed construction of this subsurface structure in Area C.

A suitably qualified Environmental Consultant should carry out an investigation of the soils to assess the suitability of the material for re-use. The investigation and resultant report will need to be reviewed by the Site Auditor prior to undertaking the cut and fill works. Advice regarding geotechnical suitability should be sought from a geotechnical engineer.

The material should be investigated at a minimum frequency of one sample per 70 m^3. Samples should be collected by excavator. All samples collected should be tested for the following suite of contaminants at a NATA accredited laboratory:

- Heavy metals (As, Cd, Cr, Cu, Ni, Hg, Pb, Zn);
- Asbestos (in accordance Schedule B1 (NEPM, 2013));
- Total petroleum hydrocarbons (TPH);
- Benzene, toluene, ethyl benzene and xylene (BTEX); and
- Polycyclic aromatic hydrocarbons (PAH).

All samples should pass the validation criteria detailed in **Section 3**.

If materials are classified as not suitable, waste classification will be required and the soils should be disposed of at an appropriately licenced facility.

If the material is assessed as suitable for placement as part of the cut and fill works or requires offsite disposal tracking details will need to be provided in a Materials Tracking Plan.

All investigation data related to the reuse of soil for filling should be submitted to the Site Auditor for review prior to placement of material.

6.3 Feasibility assessment for detention basin

A feasibility assessment should be undertaken to assess the viability of upgrading the detention basin (Area F) into a phyto-remediation system in the form of reed beds or similar; with the aim to meet the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines for Fresh and Marine Water Quality (2000)* at discharge from the detention basin. The approach should include the following phases:

- A water and contaminant mass balance assessment for the retention pond to characterise:
  - the range of contaminant mass and water inflows to the retention pond over time;

  - the range of contaminant mass and water outflows from the retention pond over time; and
  - the range of contaminant mass and water stored in the retention pond over time.
- An assessment of the viability of phyto-remediation based on the water and mass balance assessment results.

The results of the assessment should be submitted to the Site Auditor for review prior to the scheme being finalised and implemented.

6.4 Gas protection measures

Gas protection measures proposed in new sports lighting should be documented in plans which should be prepared in consultation with the Environmental Consultant and submitted to the Site Auditor for review.

The lighting should be designed to inhibit a preferential pathway of landfill gases into the conduits and lighting columns, as well as preventing accumulation of gases that may present both an explosion and asphyxiation risk.

6.5 Final park upgrade development plans

Full details of the proposed upgrade works should be prepared and issued to both the Site Auditor and Environmental Consultant. This RCEMP should be reviewed and any addendums to this plan should be prepared by the Environmental Consultant and agreed by the Site Auditor.

7. Remedial & validation strategy

7.1 Overview

The information presented in this section presents the remediation strategy and the procedures to address the presence of soil contamination at the site. The strategy is based on the outline development plans provided by Council.

A review of the existing site investigation data (as summarised in **Section 4**) has indicated that remedial works include capping in areas; A, B, D and E.

7.1 Regulatory Compliance

7.1.1 State Environmental Planning Policy (SEPP)

SEPP 55 provides state wide planning controls for the remediation of contaminated land. Under the provisions of SEPP 55, *"land must not be developed if it is suitable for a proposed use owning to contamination and must be remediated prior to development".*

Under the requirements of SEPP 55, remediation work is classified as either:

- Category 1: remediation work for which development consent is required; or
- Category 2: remediation work not requiring development consent.

Category 1 remediation work, for which development consent is required includes:

Work which is designated development under Schedule 3 of the Environmental Planning and Assessment (EP & A) Regulation or under a planning instrument;

- Work proposed on land identified as critical habitat under the Threatened Species Conservation Act 1995;
- Works where consideration of Section 5A of the EP&A Act indicates that remediation work is likely to have a significant effect on threatened species, populations, ecological communities or their habitats;
- Works proposed in an area or zone identified in a planning instrument as being an area of environmental significance; and
- Remediation works involving on-site treatment and of groundwater and / or soil.

Section 3.5.4 of SEPP 55 states that *remediation of contaminated land is considered to be development and may require planning approval even if the proposed land use does not require approval*.

SEPP 55 outlines matters that indicate Category 1 remediation work. GHD has reviewed these matters and consider the work does not indicate Category 1 with the exception of the requirement for compliance with Council policy for contaminated land. Council will assess and confirm if the remediation work complies with Council's development control plan (DCP) and the resulting indication of Category 1 or 2 as part of the detailed design process.

Council will need to determine consent requirements well before construction and tendering, once a revised design is determined for the site.

7.1.2 Council development control plan

Marrickville Council's *Development Control plan (2011) Section 2.24 Contaminated Land* provided the following information pertinent to the sites remediation and validation:

2.24.5.5 Validation and monitoring reports (Stage 5)

A validation report demonstrates that the objectives stated in the RAP have been achieved and relevant conditions of development consent (where applicable) have been complied with.

Council will require a validation report to be submitted after remediation works have been completed. The validation report must confirm statistically that the remediated site complies with the clean-up criteria set for the site.

Further the Development Control plan states that the Council may require an independent audit by a Site Auditor.

2.24.10.3 Notification requirements for Category 2 remediation works

Prior notice

C14. Notice of remediation work *must be given to Council at least 30 days before commencement of works or as otherwise provided for in SEPP 55. The notification for the Category 2 remediation works must:*

i. Provide the name, address and telephone number of the person who has the duty of ensuring that the notice is given;

ii. Provide details of the remediation work (including a RAP, where appropriate, and a soil and water management plan);

iii. Explain why the work is Category 2 remediation work by reference to SEPP 55 and this DCP;

iv. Specify the land on which the work is to be carried out and provide a map of the location of the land; and

v. Estimate the dates for the commencement and completion of the work.

Notice of completion

C15. Notice of the completion *of Category 2 remediation work must be given to Council within 30 days after the completion of the work. The notification must:*

i. Be in writing and be signed by the person who carried out the work;

ii. Provide the person's name, address and business telephone number;

iii. Provide details of the person's qualifications to carry out the work;

iv. Specify the land on which the work was undertaken and provide a map of the land and the location of the work;

v. State when the work was completed;

vi. Specify the uses of the land, and the substances that contaminated it in such a way as to present a risk of harm to human health or some other aspect of the environment;

vii. Specify the use(s) of the land immediately before the work started;

viii. Describe the method of remediation used in the work and the guidelines that were complied with in the work; and

ix. Specify the standard of remediation achieved.

x. State what actions must be maintained in relation to the land after the completion of the remediation work if the standard of remediation achieved is to be maintained.

***NB** Council will need to be satisfied that the site is suitable for the proposed use when considering any subsequent development applications for the subject site. Accordingly, it is recommended that comprehensive records are maintained during the remediation works including any RAPs or validation reports.*

C38 Tree preservation

Remediation work must not be carried out within 4 m of the base of a tree or adversely affect the appearance, health or stability of a tree where works affecting the tree require Council's approval.

7.2 Remedial strategy

7.2.1 Stage 1 - Preliminaries and approvals

Prior to commencing remedial works, all relevant licences and approvals must be obtained by the Principal and/or Contractor from the relevant authorities and stakeholders.

Prior to the establishment at the site, the Contractor must possess plans, programmes, licences, certificates and other documents necessary for the commencement of the work. All such plans must be completed and approved by the relevant consent authority and stakeholders (where required). These documents are anticipated to include, but not be limited by, the following:

- A detailed work programme;
- Insurance certificates;
- WorkCover authority notifications;
- A management and procedures covering all aspects of the work, including:
  - Project management
  - Environmental management plan
  - Materials management plan
  - Emergency plan
  - Occupational health and safety plan, including safe work method statements.
  - Community relations plans

Following provision and approval of these documents, the Contractor will mobilise all necessary plant, equipment and amenities as required to complete the project in accordance with these requirements.

7.2.2 Stage 2 - Site establishment

Prior to site establishment, all staff involved in the remedial works must be aware of, and provided with all relevant documents necessary for the commencement of work as outlined in **Section 7.2.1.**

Prior to any work commencing, the Contractor shall delineate the work area. A temporary fence should be erected around the work area where appropriate. Survey markers can be used to identify the extent of the remediation areas and should be verified with the Environmental Consultant.

Access to the work area will be determined by the Contractor. The site shall be accessible only to personnel inducted for work within the work area.

7.2.3 Stage 3 - Capping

Installation of a minimum of 200 mm capping layer has been proposed across Areas A, B and D. Area E will require a minimum of 500 mm as there will be heavy traffic over these areas.

Grassed Areas

The 200 mm capping layer shall comprise a minimum of 100 mm of chemically suitable topsoil (growing medium) in areas being covered by grass. The growing medium must be capable of supporting vegetation growth.

All imported growing medium shall comprise a free-draining soil material with sufficient nutrients for the establishment and continued growth of vegetation. The imported growing medium shall comply with *AS 4419 Soils for landscaping and garden use, 2003* for 'organic soil' and be free from clay lumps, stones over 0.25 m diameter, weeds, tree roots, sticks, rubbish, material toxic to plants and fire ant infestation.

All other soil imported to site for capping must be meet the requirements of Virgin excavated natural material (VENM) or Excavated natural material (ENM) under the NSW EPA Waste Classification Guidelines:

All imported material delivered to the site must be validated and inspected by an Environmental Consultant prior to placement.

The importation of this material requires validation by an Environmental Consultant, with details outlined in **Section 7.3.**

Following the installation of the capping layer, the area will be planted with couch grass turf (in the playing field) or other turf grasses or native grass in other areas.

In order to validate the successful completion of the site capping layer, a visual assessment, field investigations and site topographic survey will be required. These details are outlined in **Section 7.3.**

Trees and shrubs

In line with the Councils DCP (2011) for a 4 m radius around existing trees, the capping layer around the trees and shrubs shall comprise a minimum of 150 mm of mulch.

New trees and shrubs shall be planted within subsurface root pits comprising the excavation and appropriate disposal / reuse of material (beneath capping) of approximately 1 m^3 of soils. The tree pits will be backfilled with appropriately validated soils suitable for sustaining plant growth. All imported growing medium shall comprise a free-draining soil material with sufficient nutrients for the establishment and continued growth of vegetation. The imported growing medium shall comply with *AS 4419 Soils for landscaping and garden use, 2003* for 'organic soil' and be free from clay lumps, stones over 0.25 m diameter, weeds, tree roots, sticks, rubbish, material toxic to plants and Fire Ant infestation. The top 150 mm will be topped with mulch.

All mulch shall be sourced from an accredited supplier and will be free from clay lumps, stones over 0.25 m diameter, weeds, tree roots, sticks, rubbish, material toxic to plants and fire ant infestation.

The importation of this material requires validation by an Environmental Consultant, with details outlined in **Section 7.3.2.**

In order to validate the successful completion of the site capping layer, a visual assessment, field investigations and site topographic survey will be required. These details are outlined in **Section 7.**

Foot paths

Where footpaths are installed in capping areas, the thickness of the hardstanding and subgrade materials should be a minimum of 150 mm thick.

In order to validate the successful completion of the site capping layer, a visual assessment, and site topographic survey will be required. These details are outlined in **Section 7.**

Playground

The playground area should be covered by a minimum of either:

- 200 mm of chemically suitable imported soil to be turfed or mulched and planted upon; or
- 150 mm of hardstanding and subgrade material; or
- 100 mm of rubber soft fall and subgrade material; or
- 300 mm of mulch soft fall with a geotextile marker layer;or
- 200 mm of mulch cover to existing tree zones; or
- Other surface approved by the Site Auditor.

All soil imported to site for capping must be meet the requirements of VENM or ENM under the NSW EPA Waste Classification Guidelines. All imported material delivered to the site must be validated and inspected by an Environmental Consultant prior to placement.

The importation of soil requires validation by an Environmental Consultant, with details outlined in **Section 7.3.**

In order to validate the successful completion of the site capping layer, a visual assessment, field investigations and site topographic survey will be required. These details are outlined in **Section 7.**

Proposed BMX track

The BMX track should be covered by either:

- a minimum of 500 mm of chemically suitable imported soil; or
- 200 mm of chemically suitable soil with a geotextile liner, with a base course of chemically suitable stabilised soil.

The purpose of this capping is to address the risk that earthworks and heavy wear will breach the capping.

All soil imported to site for capping must be meet the requirements of VENM or ENM under the NSW EPA Waste Classification Guidelines. All imported material delivered to the site must be validated and inspected by an Environmental Consultant prior to placement.

The importation of soil requires validation by an Environmental Consultant, with details outlined in **Section 7.3.**

In order to validate the successful completion of the site capping layer, a visual assessment, field investigations and site topographic survey will be required. These details are outlined in **Section 7.**

7.2.4 Stage 4 - Demobilisation

Following completion of remediation works, the Contractor shall be responsible for removing all plant equipment and general rubbish generated through the remediation process.

7.2.5 Stage 5 - Reporting

An appropriately qualified Environmental Consultant should prepare a validation report detailing the completion of the remediation works.

The report should be completed in accordance with the NSW EPA *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites,* 2011.

7.3 Validation strategy

7.3.1 Data quality objectives

Overview

Data quality objectives as outlined in the NSW DEC *Guidelines for the NSW Site Auditor Scheme (2nd edition,* 2006) are required for all remediation programs. The Data Quality Objective (DQO) process will be applied to the validation programme, as described below, to ensure that data collection activities are appropriate and achieved the project objectives. The DQO process involves seven steps as follows:

Step 1: The problem;

Step 2: Identify the decision;

Step 3: Identify inputs to the decision;

Step 4: Define the study boundaries;

Step 5: Develop a decision rule;

Step 6: Specify limits on decision errors; and

Step 7: Optimise the design for obtaining data.

The seven DQO steps for this project are defined as follows:

Step 1: The problem

As stated in the objectives in **Sections 1.3**, the remediation goal is to address the presence of soil and gas contamination so the site is made suitable from a contamination perspective for public open space / recreation.

The problem as it stands is that the site needs to be remediated to ensure it is suitable for use.

Contamination of surface water detention basin by landfill leachate seepage.

Step 2: Identify the decisions

The aim of the validation programme is to collect sufficient data to verify that the remediation has been carried out satisfactorily.

The decision to be made is whether the remediation has made the site suitable for its intended use. These questions to be answered are the following:

- Has the extent of the identified impacts been adequately removed or the affected area(s) appropriately capped?
- Is imported material acceptable for use on the site?
- Are there any aesthetic triggers?
- In the event that unforseen impacts are identified (i.e. unidentified contamination), is the proposed remedial plan adequate to manage this contamination?

- Discharge from the surface water treatment system is at an acceptable level?

Step 3: Identify inputs to the decision

The validation programme has been designed to provide sufficient information to allow a sound scientific and statistical evaluation of the questions set out above**.** This will be achieved by:

- Visual inspection of site areas, soils, and ground works on a regular basis, and ensure that there are no triggers regarding aesthetic considerations as detailed in **Section 3.5**; There are no clear guidelines on what constitutes "aesthetic action levels" or similar. Nonetheless, soils once remediated, will be inspected to establish that the material will not generate long term offensive odours and that there is little evidence of large pieces of anthropogenic material (e.g. bricks, concrete, plastic or pipework – excluding asbestos).

In addition, where soil validation sampling is required:

- Comparing the soil analytical data to applicable investigation level (as defined in **Section 3**) to evaluate the potential for contamination to adversely impact upon human health receptors.

Comparing the concentrations of the surface water at the discharge point to the ANZECC water quality criteria (both fresh and marine systems).

Step 4: Define the study boundaries

The physical boundaries are the lateral boundaries of the proposed remediation zones as nominated in **Figure 10**.

The vertical boundary for the remediation zone is nominated as 200 mm, which is considered to be the minimum capping necessary.

The site and the wider surface water catchment area contributing water to the detention basin.

Step 5: Develop a decision rule

The decisions associated with accepting data in relation to soil and groundwater sampling will be assessed with reference to the chosen guidelines (**Section 3**), which were established within the framework of guidelines made or approved by the NSW EPA.

- If the validation data are above the nominated guidelines, then additional remediation or risk assessment may be required.
- If the validation data indicates that the analysis is less than the nominated guidelines, then no further remediation or risk assessment is required.
- If aesthetic issues are triggered additional remediation may be required.

If criteria are not met, further assessment or engineered mitigation measures may be required.

Step 6: Specify limits on decision errors

The two primary decision error-types may occur due to uncertainties or limitations in the project data set:

- A sample/area may be deemed to pass the nominated criteria, when in fact it does not. This may occur if contamination is 'missed' due to limitations in the sampling plan, or if the project analytical data set is unreliable.
- A sample/area may be deemed to fail the nominated criteria, when in fact it does not. This may occur if the project analytical data set is unreliable, due to inappropriate sampling, sample handling, or analytical procedures.

In order to address the potential for decision errors 95% UCL (average) will be used, where applicable, in order to assess the quality of the data; and to minimise the potential for decision errors (if applicable).

Incorporating uncertainty in input parameters into the surface water assessment model. This will incorporate high / low end model runs.

Step 7: Optimise the design for obtaining data

Data quality indicators (DQIs) for completeness, comparability, representativeness, precision and accuracy will be used to optimise the design for obtaining data.

The DQIs for sampling techniques and laboratory analysis of collected samples identifies the acceptable level of error for the validation. An adopted nominal acceptance criterion of +/- 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of +/- 50% RPD for field duplicates and splits for organics has been selected. However, it is noted that this may not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations.

7.3.2 Validation criteria

Section 3 details the relevant guidelines utilised in the development and selection of the validation criteria. All validation sampling and assessment shall comply with the data quality objectives detailed in **Section 7.3.1.**

7.3.3 Validation plan

All material imported to the site as part of the remediation shall be from a verified source.

The Environmental Consultant will carry out an inspection and a review of site history for each identified source of topsoil. The nature of the imported material will be recorded (including photographs) at the source so it can be verified on site. The Contractor will need to provide tracking details of imported material in accordance with the Materials Tracking Plan.

If necessary, the imported material should be chemically validated and undertaken at a minimum frequency of one sample per 200 m^3.

All samples should pass the validation criteria detailed in **Section 3**.

In addition, the imported soil must be inspected (including photographs) and verified as being free from deleterious materials, for example, rubbish and other man made materials by the Environmental Consultant.

All samples collected should be tested for the following suite of contaminants at a NATA accredited laboratory:

- Heavy metals (As, Cd, Cr, Cu, Ni, Hg, Pb, Zn);
- Asbestos;
- Total petroleum hydrocarbons (TPH);
- Benzene, toluene, ethylbenzene and xylene (BTEX);
- Organochlorine pesticides (OCP);
- Polychlorinated biphenyls (PCBs); and
- Polycyclic aromatic hydrocarbons (PAH).

Validation of capping following completion of the works will be undertaken through the following:

- Visual indicators;
- Visual depth inspections; and
- Site topographical survey (pre and post importation and deposition of the topsoil) including boundaries of the imported soils.

The Environmental Consultant will undertake an independent visual assessment of the construction of the capping layer, and provide an accurate log/description of its condition and document a photographic record of the final capping surfaces, and ensure that records documenting the volume of capping placed above the fill are provided.

Copies of documentation (including details of source, quality and records of material movement) for the importation of material will be required to support the Environmental Consultant's assessment.

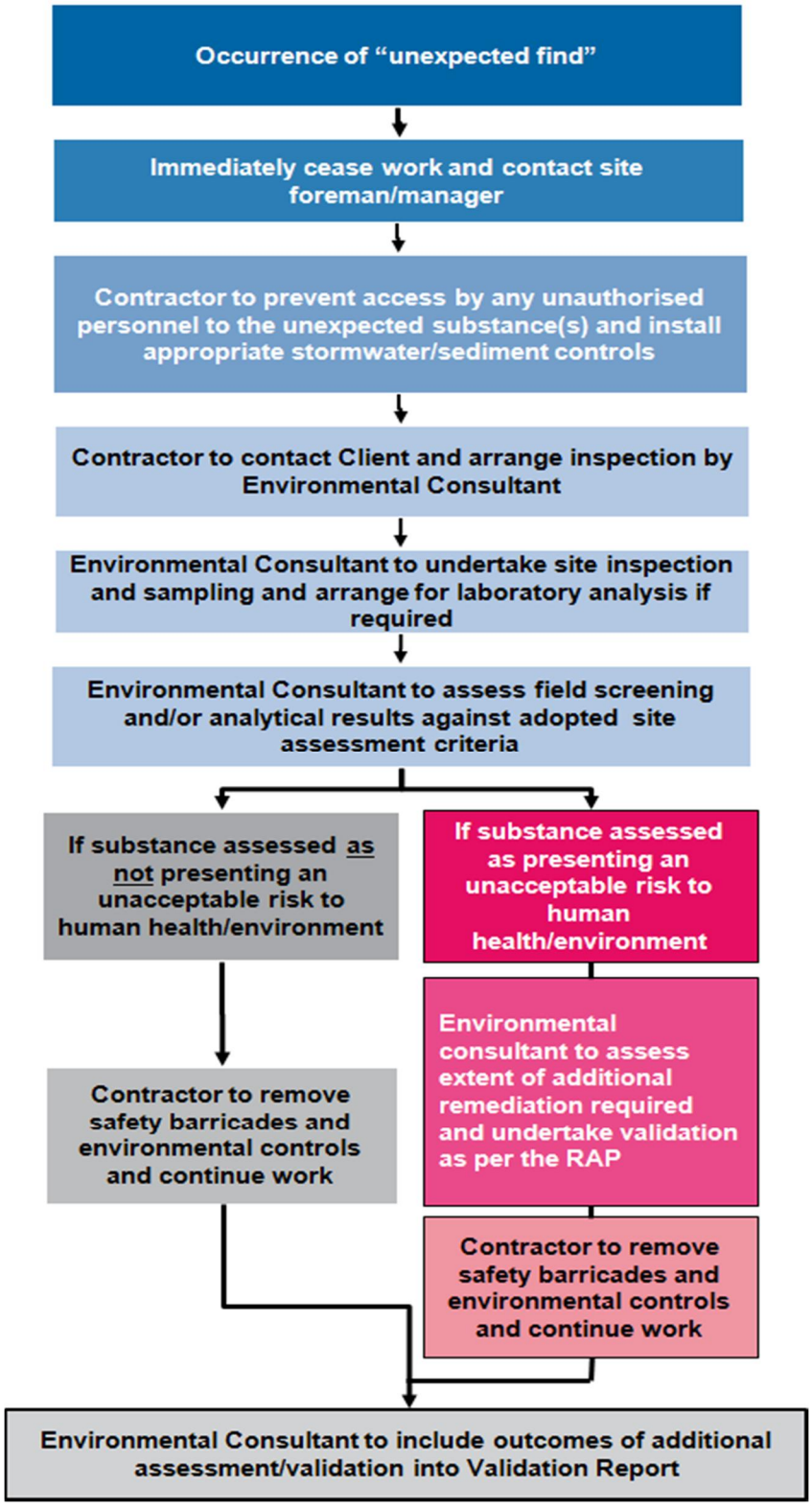
For the purposes of the validation works, a site topographic survey will need to be conducted prior to and post validation capping. This would establish the final depths of the proposed capping and validate that the criterion of 200 mm of capping has been fulfilled.

To assess the aesthetics of the remediation works, at the completion the surface of the remedial areas shall be inspected to confirm the absence or little evidence of large pieces of anthropogenic material (e.g. bricks, concrete, plastic or pipework – excluding asbestos).

7.3.4 Contingency plan

In the event that greater volumes of impacted fill material or friable asbestos be uncovered during excavation works or the remedial excavations are extended as a result of 'failures' of the validation criteria, or unknown / unexpected materials are identified during remedial works, the procedures detailed in the following figure should be followed.

Figure 11 Unexpected finds protocol



7.3.5 Validation report

A validation report shall be prepared following successful remediation and validation of the site. This report shall contain all relevant information and shall conform to:

- NSW EPA (2011) *Contaminated sites: guidelines for consultants reporting on contaminated sites*; and

- Department of Environment and Conservation NSW (2006) – *Contaminated sites: Guidelines for the NSW site auditor scheme (2nd edition*).

The validation report should include:

- a photographic record of the remedial works;
- a summary of the remedial works;
- results of the validations sampling and waste classification testing;
- validation including topographical plan to verify the thickness and extent of capping;
- as built drawings of the lighting columns and conduits detailing the gas protection measures and validation of joint seals as well as installation in accordance with the designs;
- evidence of waste disposal records including confirmation from haulage contractor and disposal facilities;
- records of environmental monitoring including dust, vapours, gas and groundwater data (if available).

The report shall be submitted to the Site Auditor. The site will not be signed off as suitable until the report has been reviewed and the EMP implemented.

7.4 Long term environmental management plan

A long term environmental management plan will be prepared to manage the presence of contaminated residual soils and soil gases upon the completion of the remedial works.

The long term environmental management plan (if required) should be prepared in accordance with the NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme (2nd Edition*). In particular, the following information should be included:

- the objectives of the plan;
- a description of the nature and location of the contaminated material remaining in situ on the site;
- how contaminants are to be managed under potential exposure scenarios, i.e. major maintenance work and/ or the installation of additional underground infrastructure;
- state who will be responsible for implementation of the plan;
- outline the timeframe over which actions specified in the plan, such as periodic reviews, will be implemented; and
- include a surveyed plan identifying the areas of concern.

Additionally, the long term environmental management plan should include regular gas monitoring to meet both the requirements for management and EPA obligations. Ongoing monitoring should be completed from both monitoring boreholes as well as sports light poles, service pits and amenities buildings as well as during any works likely to generate sparks. The aim of the gas monitoring is to manage and monitor any changes to the gas regime at the site. The key objectives of the monitoring works should be designed to:

- Provide additional data to further confirm the findings of the Hazardous Ground Gas Assessment (GHD, 2012c) i.e. completion of six rounds over six months between June and December to assess existing data gaps if buildings that are to be constructed;

- Obtain landfill gas monitoring data from potential landfill gas accumulation points not previously monitored (including amenities building electrical room and existing sports light poles as), newly installed service and sports lighting poles and conduits and service pits near the site (in particular Council Street) as recommended in the Landfill Gas Risk Assessment (GHD, 2012c). This should be undertaken for a period of six months. The data should be reviewed and rationalised; and
- Confirm (on an on-going basis) that landfill gas emissions / accumulation do not present unacceptable risks to human health or the environment at previously monitored borehole locations as recommended in the Landfill Gas Risk Assessment (GHD, 2012c). Gas monitoring should be undertaken on a quarterly basis and formally reviewed annually. Annual reviews should include consideration of rationalisation of monitoring frequency, with consultation with Council and the Site Auditor.

8. Construction site management

The following provides a guide to the minimum site management controls that should be implemented for the construction works. The selected Contractor should however prepare its own site management and occupational health and safety protocols that are based on these controls and any other regulatory requirements.

8.1 Site establishment

8.1.1 Site access and security

The site is currently accessible by the public; however, during construction and remediation the site will be secured to prevent the public from entering the site.

8.1.2 Site signage and contact information

As a minimum, security fencing and appropriate signage associated with the remedial works must be maintained at all times and the Contractor will be responsible for ensuring all persons on site are authorised personnel (i.e. persons not employed by the Contractor, Principal, the Environmental Consultant, or their agents will not be permitted on-site unless authorised by the Contractor, Principal and/ or Environmental Consultants).

A sign displaying the contact details of the Contractor (and site facilitator if different to the Contractor) shall be displayed on the site adjacent to the site access. This sign shall be displayed for the duration of the remediation works.

8.1.3 Hours of operation

All remediation work shall be conducted in accordance with the standard Marrickville Council hours of construction work.

8.2 Environmental management plans

The Contractor shall prepare environmental management plans including but not limited to the following plans. It is noted that it will be the responsibility of the Contractor to provide, install, monitor and maintain the environmental control measures taken on site.

8.2.1 Gas management plan

Gas will be monitored continuously during any works that have the potential to generate sparks or are below surface. Monitoring should be completed using a gas measuring device such as the multi-gas monitor (or similar) and a photo-ionisation detector (PID). The multi-gas monitor will be used to monitor oxygen, methane, carbon dioxide, carbon monoxide and the lower explosive level (LEL) and the PID will be used to monitor volatile organic compound vapours in the work area.

Alarm levels adopted from the Australian Standards shall be as follows:

- Oxygen – 19% v.v. ;
- Hydrogen sulphide – 0.01 % v.v.;
- Methane – 1 % v.v.
- Carbon dioxide –1.5 % v.v.;
- LEL – 5% v.v.; and

- VOC – 10 ppm.

If the gas monitors exceed the above levels, an alarm will be raised and the following procedure applies:

- All work will stop;
- Staff are to apply half face respirators with associated filters for organic chemicals;
- Should the vapours pose a potential human health risk to site users, site visitors and neighbouring residents, the contractor will immediately inform Council and all other appropriate authorities;
- If the LEL is reached, no work is to recommence until an investigation has been completed and steps have been made to ensure a safe work area by the Contractor and Environmental Consultant; and
- If the LEL is not reached, cover the excavation and/or stockpiled material with plastic to prevent exposure.

8.2.2 Erosion and Sediment control management plan

Prior to the commencement of the remedial works, an Erosion and Sediment Control Plan must be prepared and approved by the Principal or its representative.

The plan must comply with the specifications and standards endorsed by Council, NSW EPA and the Principal requirements, including the Southern Sydney Regional Organisation of Councils publication and fact sheets '*Do it right On-Site Soil and Water Management for the Construction Industry'*.

8.2.3 Noise control plan

The remedial works shall comply with Australian Standard 2436-1981 *Guide to Noise Control on Construction, Maintenance Demolition Sites* and the Environment Protection Authority *Environmental Noise Manual for the control of construction site noise 1994 (*as applicable to the relevant site).

No "offensive noise" as defined under the *Protection of the Environment Operations Act*, 1997 shall be created during remediation works/activities.

All associated mechanical plant, equipment and the like used during remediation works/ activities shall use all practical and reasonable noise attenuating devices and measures to minimise noise being transmitted from the site.

8.2.4 Dust control plan

Dust emissions shall be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement:

- erection of dust screens around the perimeter of the site;
- securely covering all loads entering or exiting the site;
- use of water sprays across the site to suppress dust;
- covering of all stockpiles of contaminated soil remaining on site more than 24 hours; and
- keeping excavation surfaces moist.

Dust emissions shall also be controlled by ensuring vehicles leave via stabilised site access.

Dust will be suppressed at all times. Dusty areas or areas where there is a potential dust emission shall be wet down using fine mist sprays. The excavated material shall be lightly sprayed prior to leaving the site.

8.2.5 Odour control plan

Odour shall be controlled so that no odours shall be detected at any boundary of the site during remediation works. The following procedures may be employed to comply with this requirement: use of appropriate covering techniques such as the

- use of plastic sheeting to cover excavation faces or stockpiles;
- use of fine mist sprays;
- use of a hydrocarbon mitigating agent on the impacted areas/materials; and
- adequate maintenance of equipment and machinery to minimise exhaust emissions.

The characteristics of the site contamination present are not considered to present an offensive odour risk.

8.2.6 Materials management plan

All waste generated as part of remedial works will be stored in appropriate container or controlled stockpiles, prior to offsite disposal.

Waste will be disposed of by approved waste handlers, in accordance with NSW EPA guidelines. These records will be included into the Validation Report.

8.2.7 Community relations plans

Prior to the commencement of the remedial works, a Community Relations Plan must be prepared and approved by the Principal or their representative. The plan must comply with the specifications and standards endorsed by Council, NSW EPA and the Principal requirements.

It is understood that Council requires that owners and/or occupants of adjoining properties must be notified in writing at least seven days prior to the commencement of remediation works.

8.3 Occupational health and safety & asbestos management plans

8.3.1 Health and safety plan

An occupational health and safety (OH&S) plan is an essential part of all remediation projects to manage the health and safety of all personnel working on or visiting the site. A detailed Occupational Health and Safety (OHS) plan will be prepared by the Contractor for the works prior to the commencement of any site activity, and will be approved by the Principal.

The purpose of the plan is to provide all relevant health and safety information for all personnel undertaking work at the site and to provide and maintain safety standards and practices which offer the highest practical degree of personal protection to the on-site workers, based on current knowledge.

The plan will recognise the legislative obligations of the Contractor and of the Principal and will in particular:

a) Recognise that the work to be undertaken as part of the RCEMAP may involve a “construction project” (as defined in the relevant legislation) in respect of which the Principal

has obligations as Principal Contractor. These obligations will be expressly dealt with in the plan; and

b) Recognise that the work to be undertaken as part of the RCEMAP includes "high risk construction work" (as defined in the relevant legislation) in respect of which both the Contractor and the Principal have obligations. These obligations will be expressly dealt with in the plan.

All personnel must read the plan and confirm acceptance of its requirements prior to commencing work at the site. The information provided by the plan shall include:

- Induction requirements;
- Assignment of responsibilities;
- A discussion of site conditions;
- Details of the work;
- Identification of on-site and off-site hazards;
- Assessment of the potential risks associated with identified hazards;
- Procedures to eliminate, or if not possible, control the potential risks;
- Establishment of personnel protection standards and mandatory safety practices and procedures;
- Establishment of OH&S monitoring protocols;
- Training and responsibilities of emergency team members;
- Evacuation procedures and emergency drills;
- Emergency information;
- Incident reporting;
- Provision for contingencies that may arise while operations are being conducted during the project; and
- Procedures to ensure that the Contractor consults with, co-operates with, and co-ordinates its activities with the Principal (and with any other person or entity having concurrent health and safety duties arising out of the remediation works).

The works should comply (at a minimum) with all legislation, regulations and standards. At a minimum the legislation related to activities that may take place during the remedial works will include:

- NSW 2003, *OH&S Amended (Dangerous Goods) Act;*
- AS 2436 1981, *Guide to Noise Control on Construction, Maintenance and Demolition Sites*;
- AS 1470 1986, *Health and Safety at Work - Principles and Practices*;
- AS 1319 1994*, Safety Signs for the Occupational Environment;*
- Safe Work Australia 2011, *Code of Practice - Excavation Work*;
- *Workplace Health and Safety Act* 2011; and
- *Workplace Health and Safety Regulation* 2011.

The Contractor will be required to assess the level of personal protective equipment (PPE) for personnel working at the site. This may include:

- P2 mask or equivalent respirator;
- Tyvek suit;
- Steel capped boots;
- Hard hat;
- Safety vest; and
- Safety glasses (when in an active work zone).

The OH&S plan should also include an asbestos management plan (refer to Section 8.3.2).

8.3.2 Asbestos management plan

An Asbestos Management Plan shall be prepared by the Contractor for the site documenting the procedures to be followed during disturbance of site soils, and should be prepared in accordance with NSW EPA guidelines as well as the Principals requirements.

Under the *Work Health and Safety Regulation 2011* laws asbestos removal work is licensed. A licence for friable asbestos removal work is a 'Class A' asbestos removal licence and a licence for bonded asbestos removal work is a 'Class B' asbestos removal work licence under the *Work Health and Safety Regulation 2011*.

Based on the known presence of bonded asbestos fragments reported in previous investigations (**Sections 4.2.1, 4.2.2.** and **4.2.4**) and the absence of asbestos in soil samples collected during previous investigations (**Sections 4.2.1, 4.2.2** and **4.2.5**) the works will require a Class B licenced contractor. Should friable asbestos be identified a Class A licenced contractor will be required.

A competent person is defined in Safe Work Australia (2011a) as a person who has acquired through training, qualification or experience, the knowledge and skills to carry out the task. A competent person in the context of asbestos is a person who has acquired through training, qualification or experience, the knowledge and skills to identify, investigate and assess asbestos in the context of an environmental site assessment.

The Asbestos Management Plan will document specific health and safety requirements associated with the management of asbestos containing material. Procedures shall include, but not be limited to:

- Documenting the results of the visual and sample assessment and the safe system of management throughout the remediation;
- Wearing appropriate PPE;
- Work area and boundary air monitoring using air-sampling equipment to monitor airborne asbestos in accordance with NOHSC:3003, Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres, 2nd Edition, 2005. At a minimum, boundary air monitoring for asbestos fibres will be initially performed daily. This may be subject to review following receipt of test results after an initial period, such as one week. The primary objective of the air monitoring programme is to assess the effectiveness of the control measures used and provide data on asbestos exposure (if reported); and
- Appropriate decontamination of trucks that are used to transport contaminated soil before leaving the work site and after disposing of the contaminated soil at the disposal facility.

Specific health and safety requirements, including appropriate PPE requirements for asbestos sampling, should be documented in the OHSP and Asbestos Management Plan.

Information relating to asbestos contamination in soils and safe disposal and transport of asbestos is presented in WorkCover NSW (2008). Reference should be made to WorkCover NSW (2008) during the preparation of the OHS plan and Asbestos Management Plan. The Contractor should also make reference to the following guidelines:

- Safe Work Australia 2011, *How to manage and control asbestos in the workplace Code of Practice.*
- Safe Work Australia 2011, *How to safely remove asbestos Code of Practice.*
- NOHSC: 2018 (2005), *Code of Practice for the Management and Control of Asbestos in Workplaces*.
- NOHSC: 2002 (2005), *Code of Practice for the Safe Removal of Asbestos 2nd edn.*

In the event that friable asbestos is identified during remediation, works will cease and the procedures should be documented in the contingency and emergency plan (**Sections 7.3.4** and **8.4**).

8.4 Contingency and emergency plan

A Contingency and Emergency Response Plan should be prepared by the Contractor. The purpose of the contingency plan is to comply with relevant legal requirements. Additionally, identify unexpected situations that could occur during the project, and to specify procedures that can be implemented to manage such situations and prevent adverse impacts to the environment and human health. The information that will be contained herein will include, but is not necessarily limited to:

- Uncovering greater amounts of contamination than previously estimated;
- Uncovering friable asbestos;
- Assignment of responsibilities to nominated key personnel;
- Hazard assessment of potential off-site impacts;
- Contingency responses;
- Reporting to regulatory authorities; and
- Unexpected situations such as:
  - Generation of unacceptable dust or vapour;
  - Generation of unacceptable noise; and
  - Uncovering significant quantities of friable asbestos contaminating material.

9. Limitations

*This Remedial Action Plan (“*RCEMAP*”):*

1. *has been prepared by GHD Pty Ltd (“GHD”) for Marrickville Council*
2. *may only be used and relied on by Marrickville Council*
3. *the report may be used for the purposes of Marrickville Councils construction tendering, contracts and site management for the works outlined in the RCEMAP*
4. *may only be used for the purpose as stated in Section 1 of the* RCEMAP *(and must not be used for any other purpose).*

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Marrickville Council arising from or in connection with this RCEMAP*.*

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the RCEMAP *are excluded unless they are expressly stated to apply in this* RCEMAP*.*

The services undertaken by GHD in connection with preparing this RCEMAP*:*

- *were limited to those specifically detailed in section 1 of this* RCEMAP *and GHD proposal dated 15 April 2011, document number 21/16600/168758; and*
- *were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this* RCEMAP *and any previous site investigation and assessment* RCEMAP *s referred to in the* RCEMAP*.*

The opinions, conclusions and any recommendations in this RCEMAP *are based on assumptions made by GHD when undertaking services and preparing the* RCEMAP *(“Assumptions”), as specified throughout this* RCEMAP*.*

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the RCEMAP*, the opinions, conclusions and any recommendations in this* RCEMAP *are based on conditions encountered and information reviewed at the time of preparation of this* RCEMAP *and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this* RCEMAP *arising from or in connection with those opinions, conclusions and any recommendations.”*

This RCEMAP *is based solely on the investigations and findings contained in the reports attached to the* RCEMAP *(Section 4) and on the conditions encountered and information reviewed at the time of each report. This* RCEMAP *should be read in conjunction with the reports. It is also subject to all the limitations and recommendations in the reports.*

GHD has prepared this RCEMAP *utilising investigations (Section 4) provided by Marrickville Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked (“Unverified Information”) beyond the agreed scope of work.*

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the RCEMAP*, which were caused or contributed to by errors in, or omissions from, the Unverified Information.*

GHD has considered and/or tested for only those chemicals specifically referred to in this RAP and makes no statement or representation as to the existence (or otherwise) of any other chemicals.

Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigations carried out prior to this RCEMAP*. As a result, it is unlikely that the results and estimations expressed or used to compile this* RCEMAP *will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the reports attached to this* RCEMAP *may later, due to natural causes or human intervention, become contaminated.*

Except as otherwise expressly stated in this RCEMAP*, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.*

These Disclaimers should be read in conjunction with the entire RCEMAP*. This* RCEMAP *must be read in full and no excerpts are taken to be representative of the findings of this* RCEMAP*.*

Appendix A – Proposed Development plans

Section A-A 1:500

Section B-B 1:200

Section C-C 1:200

CAMDENVILLE PARK, ST PETERS preliminary feasibility and master plan

0 5 10 20 30 40 50m

Date: 31 March 2006
Plan Scale: 1:500 at A1 / 1:1000 at A3
Project: 05015 / H

prepared by
Pod Landscape Architecture
for
Marrickville Council

9.9 Option R9 – Optimization of Drainage at corner of Campbell St and May St

The corner of Campbell St and May St has regular drainage issues because it is a local trapped low-point and the existing pit/pipe infrastructure at this location feeds into a 1200 mm pipe that underlies Bedwin Road which is subject to outlet control.

The objective of this management option therefore is to attempt to divert excess stormwater that ponds at this intersection into Camdenville Oval prior to it becoming a nuisance during more frequent storm events. It is not anticipated that this management solution will provide significant benefit during rare events such as the 10 yr or 100 yr events.

It is noted that this option is similar to the Stage 1 of Option R3 with the difference that Stage 1 of Option R3 would divert all stormwater at the corner of May and Campbell St into Camdenville Oval.

It is noted that this option is contingent on approval to discharge additional stormwater into Camdenville Oval due to current site contamination constraints at the detention basin.

The approach consists:

- Installation of row of grated inlets (3.6 m by 0.45 m) on either side of Campbell St, oriented parallel to Campbell St; and
- Installation of a new pipeline (2 x 900 mmØ) from western grated inlets through eastern grated inlets into open space and then diverted northward into Camdenville Oval.

It is noted that the location of the grated inlets inlets is to be within the roadway itself, rather than in the gutter, such that only excess stormwater is diverted to Camdenville Oval rather than runoff from every storm event.

The layout of this management option is presented in APPENDIX G (Figure G27). It is also noted that utilisation of Camdenville Oval as a detention basin has an operational cost associated with pumping out of detained runoff into the stormwater system following rainfall events. Detailed long-sections of this option are presented in APPENDIX F (Figure F14). Proposed pit inlet details are also presented in APPENDIX E.

9.9.1 Impact of Option R9

This management option consists of installation of new infrastructure to divert excess stormwater ponding at the corner of Campbell St and May St into Camdenville Oval. Figure G28 presents the predicted change in modelled flood depth and Figure G29 presents the predicted change in hazard class.

As shown in Figure G28, this management option results in a reduction of predicted flood depth of 10 cm at the low point at this intersection in the 2 yr event and a reduction of only 1 cm in modelled flood depth in the 100 yr event. The predicted increase in flood depth within Camdenville Oval is about 4 cm in the 2 yr event and less than 1 cm in the 100 yr event. The predicted increase in flood depth with the Camdenville Oval detention basin during the 2 yr event does not result in over-topping of the basin.

As seen in Figure G29, there is a minor reduction in flood hazard of overland flow at the entrance to Camdenville Oval during the 2 yr event. There is no change in flood hazard associated with the 100 yr event.

9.10 Option R10 – Expansion of Camdenville Oval Detention Basin

The southern subcatchment of EC East is subject to regular drainage issues, mostly related to the fact that there is no stormwater infrastructure up-gradient of the intersection of

This option is expensive to implement as compared to the irrigation option using street runoff. Other issues such as pipe laying across the Bedwin Rd or along the rail corridor and negotiations with the factory owners makes it less suitable for implementation.

SWQ9 + WR – Sealed Wetland in Camdenville Oval

Provision of a wetland in Camdenville Oval provides significant benefit in terms of stormwater quality improvement. It also provides a very cost-effective means of providing irrigation water for the Oval. However, Camdenville Oval is an old landfill site and currently under investigation for impacts on surrounding environment including landfill gas migration away from the site. Construction of a wetland, although sealed, would still be a major threat to enhancing the environmental impacts of the old landfill. Implementation of this option is therefore not recommended.

R2 – Drainage Upgrade at Alice St and Edgeware Rd Intersection

This involves street drainage upgrade at the intersection of Alice St and Edgeware Rd. The Quadruple Bottom Line analysis suggests that it is the second highest ranked option outside of non-structural flood measures. Given that the option has a reasonable benefit cost ratio and has reasonable scores in the Quadruple Bottom Line analysis, it is suitable for implementation.

R1 – Drainage Upgrade for Improvement of Railway Parade

This option involves extensive street drainage upgrade upstream of the Railway Parade including provision of a culvert along Murray St to the Eastern Channel. This option is ranked 15 out of the 24. The benefit cost ratio is low due to high capital cost. The option scores reasonably well for other criteria in the Quadruple Bottom Line analysis, however, due to high capital cost it will be difficult to implement.

This option can be suitable for implementation due to its widespread benefit within the subcatchment, however, may need to be implemented in stages. The cost to partially implement this option has been provided in APPENDIX D.

R9 – Drainage Upgrade at Corner of Campbell St and May St

This option involves diversion of ponded stormwater into Camdenville Oval during frequent rainfall events. Modelling indicates a reduction in ponded stormwater of more than 5 cm in the 2 yr event. However, this reduction is not sufficient to reduce flood damage of the effected property, Town and Country Hotel. The option, therefore, has no monetary benefit.

Although this option does not have a monetary benefit, a reduction in nuisance flooding due to ponded stormwater during events up to the 2 year event leads to this option having the highest rank for flood management purposes. This option may be considered for implementation, however, it is noted that there are currently environmental constraints on the detention basin in Camdenville Oval due to site contamination issues. It is noted, however, that utilisation of Camdenville Oval as a detention basin has an operational cost associated with pumping out of detained runoff into the stormwater system following rainfall events.

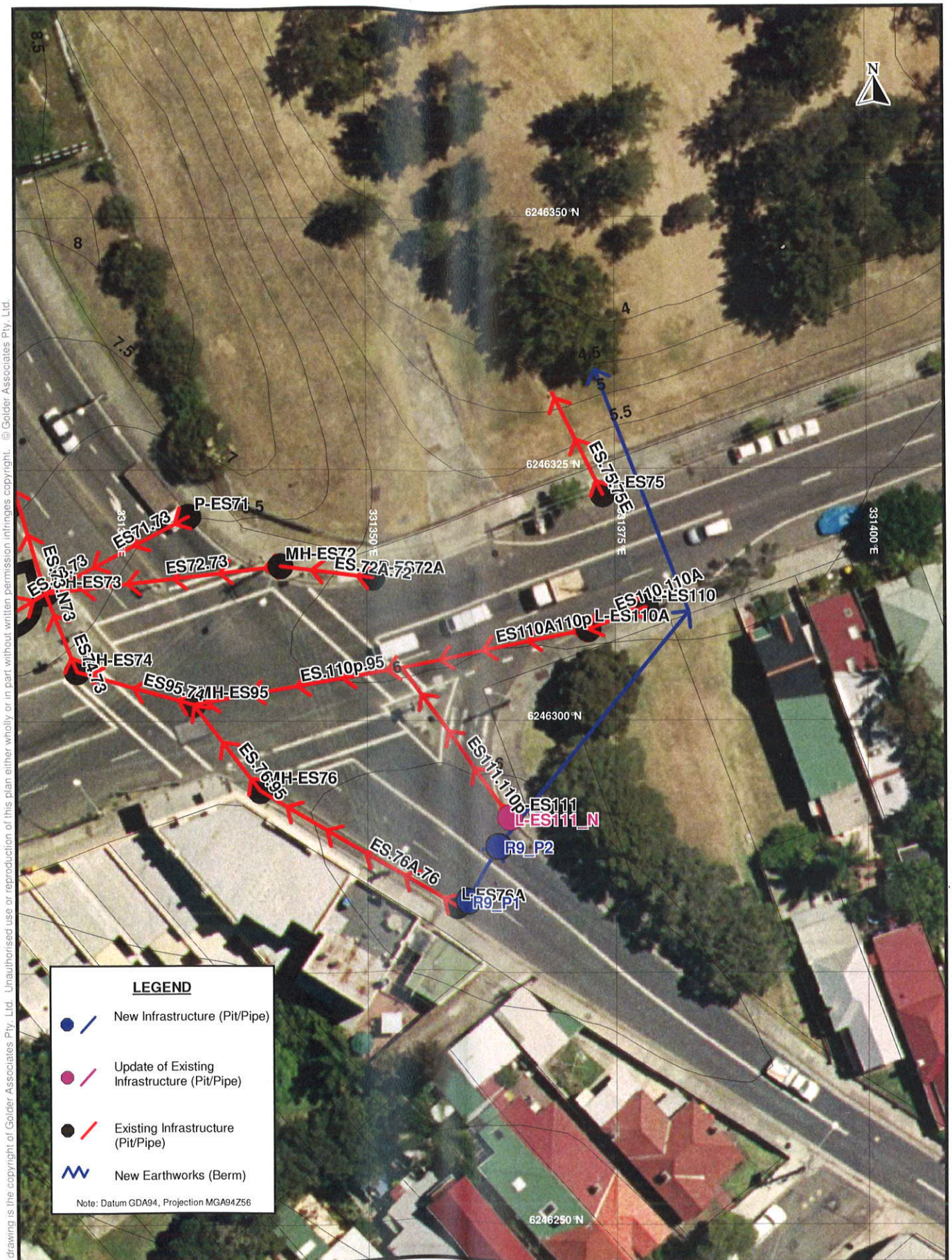
R10 – Drainage Upgrade of Southern Subcatchment and Expansion of Camdenville Oval

This option is based on Option R3, including Simpson Park detention basin, but also involves increased utilisation of Camdenville Oval by amplification of proposed trunk drainage system with the Southern Subcatchment, as well as expansion of Camdenville Oval itself. This option has a cost benefit ratio equivalent to option R3. This is because the benefit from the reduction in flood depth in the 100 yr event by expansion of Camdenville Oval detention basin is offset by increased capital cost.

This option remains suitable for implementation due to the potential of implementing a water quality improvement option in Simpson Park (SWQ3).

Property Modification and Emergency Response Modification Options

The Quadruple Bottom Line assessment of various property modification and response modification options highlights the high value of these options in managing the flood risk in the EC East Subcatchment. These



Golder Associates	CLIENT: Marrickville Council	PROJECT: ECE Subcatchment Management Plan	
	DRAWN: JRB — DATE: 09-08-10	TITLE: **OPTION R9 - CORNER OF CAMPBELL AND MAY ST**	
	CHECKED: HR — DATE: 09-08-10		
	SCALE: 1:500	PROJECT No: 097626003-014 — FIGURE No: 27 — REV No: 2	A4

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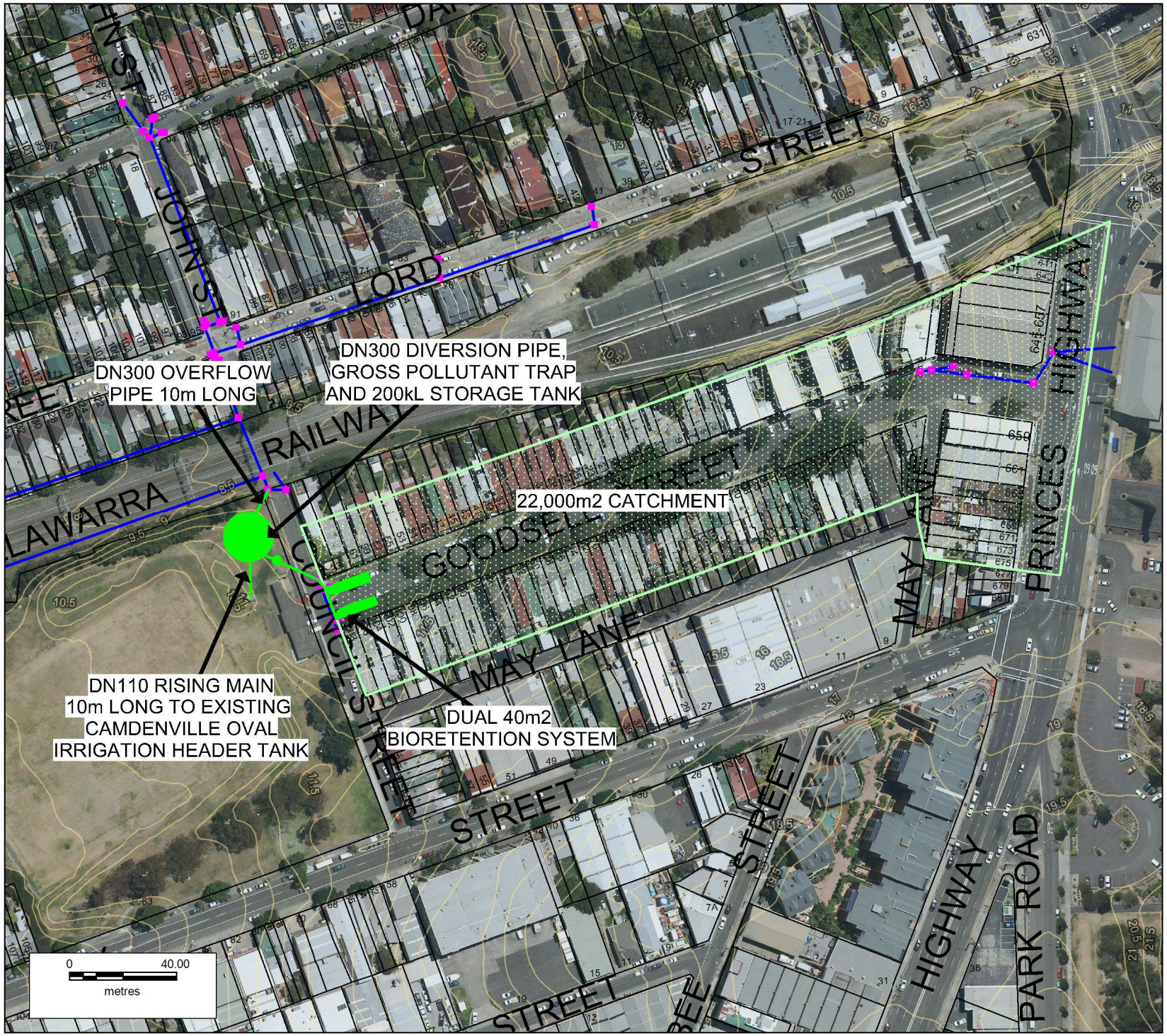

MARRICKVILLE council

Priority 3 (Option SWQ5a): Goodsell Street Bioretention System and Stormwater Harvesting Scheme

Legend

- MCC Stormwater Structure
- MCC Stormwater Conduit
- SWC Stormwater Conduit
- Proposed Conduit
- Proposed Catchment Area
- Proposed Treatment or Storage Structure

Created by enuw
on Friday, 22 December 2011

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Document Status

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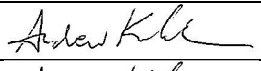
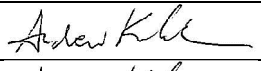
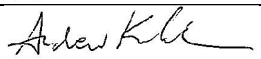
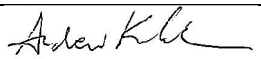
Final	H Milne	A Kohlrusch		A Kohlrusch		16/08/13
V2	H Milne	A Kohlrusch		A Kohlrusch		05/09/13

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