



Final Environmental Management Plan

Warringah Council

John Fisher Park, North Curl Curl, NSW

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Figure 1 – Site Location

Figure 2 – Site Layout and Monitoring Well Locations

List of Abbreviations

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

- ACM Asbestos Containing Material
- As Arsenic
- Cd Cadmium
- Cr Chromium
- Cu Copper
- BTEX Benzene, Toluene, Ethylbenzene and Xylenes
- B(a)P Benzo (a) pyrene
- DQO Data Quality Objectives
- DP Deposited Plan
- EPA New South Wales Environment Protection Authority
- Hg Mercury
- HIL Health Based Investigation Level
- LFG Landfill Gas
- LOR Limit of Reporting
- MAH Monocyclic Aromatic Hydrocarbon
- Ni Nickel
- OCP Organochlorine Pesticide
- SAR Site Audit Report
- SAS Site Audit Statement
- PAH Polycyclic Aromatic Hydrocarbons
- Pb Lead
- PIL Phytotoxicity Based Investigation Level
- PCB Polychlorinated Biphenyls
- PQL Practical Quantitation Limit
- QA/QC Quality Assurance/Quality Control
- RPD Relative Percentage Difference
- TPH Total Petroleum Hydrocarbons (C₆-C₉ and C₁₀-C₃₆)
- Zn Zinc

1 Introduction

1.1 Background

This Environmental Management Plan (EMP) documents the principles for environmental management of John Fisher Park (the site), located across the boundary between the suburbs of Curl Curl and North Curl Curl, NSW. The location of the site is shown in **Figure 1** and layout of the site in **Figure 2**.

The area occupied by John Fisher Park (including Greendale Creek, Curl Curl Lagoon and surrounding parkland) and Abbot Road Land is a mixture of Council, Crown and Department of Education & Communities owned land, being managed by Warringah Council (Council).

The site is currently used for open space / recreational purposes, and this land use is proposed to continue. Facilities within the park include the Curl Curl Sports Centre, the Curl Curl Youth and Community Centre, one Scout Hall, four amenities buildings, a temporary toilet/ canteen facility on the Abbott Road Land, benches, picnic tables and barbecue facilities.

The site was historically poorly drained estuarine flats. In the early 20th century, the land was cleared and drained for the creation of market gardens. The site was subject to significant reclamation works between the 1950s to the late 1970s. The reclamation was achieved by uncontrolled filling with both domestic and commercial waste which comprised a mixture of putrescible and non-putrescible waste. The site was rehabilitated for open space land use following a series of civil works in the late 1970s.

Previous investigations conducted across the site have identified landfill materials buried at the site which require management to minimise the potential risks posed to site users, workers and the surrounding environment.

Two areas of the site have been assessed, remediated and signed off as suitable for open space use subject to the implementation of existing EMPs. The requirements of those EMPs (as listed in **Section 1.3**) apply to those specific areas (Weldon Oval and Adams St Reserve). This EMP provides controls for 'the site' particularly where no existing EMPs apply. The portions of the site managed under existing EMPs are shown on **Figure 2**.

1.2 Objectives

The purpose of this EMP is to ensure continued suitability of the site for recreational open space use. Specifically, the objectives of the EMP are to:

- summarise the identified environmental issues at the site requiring management, in order to ensure the adequate protection of site users, the surrounding community and the environment;
- identify entities responsible for the implementation of the EMP and for managing the identified environmental issues at the site in accordance with the EMP;
- provide a framework for the review and revision of the EMP as necessary to ensure the appropriateness of the plan should further investigation/regulatory information become available;
- document management measures to be implemented to address the identified issues at the subject site; and
- document environmental monitoring and reporting requirements.

1.3 Existing Management Plans

EMPs which are already being implemented at the site include:

- *Playing Field – Adams Street Oval, Curl Curl, NSW, Environmental Management Plan*. Sinclair Knight Mertz, Final V1, July 2012 (SKM 2012)
- *Weldon Oval Environmental Management Plan* (WSP 2012) although it is noted that the Weldon Oval EMP was not provided for review as part of the preparation of this document.

2 Application of the EMP and Responsibilities

2.1 Application

This EMP will apply into the foreseeable future, or until such time as the landfill and other contaminated materials are removed from the site.

The requirements of this EMP are intended to apply during activities which may potentially expose people to contaminants at the site, which is generally restricted to maintenance and subsurface workers.

Activities that may potentially result in exposure of users to potentially impacted material and therefore require management include:

- General park maintenance including grass cutting;
- Building maintenance in subfloor or confined areas;
- Minor soil disturbance (restricted to soils less than 0.5 m deep) anticipated to be required for planting or laying of turf or pavement; and
- Larger scale soil disturbance (for soils greater than 0.5 m deep) during excavation works for service trenches or similar.

It is noted that assessment, remediation and validation works have been conducted at Weldon Oval and Adams St Reserve to make them suitable for use as playing fields, as long as they are managed in accordance with the existing EMPs (WSP 2012 and SKM 2012). The works at Weldon Oval and Adams St Reserve have been signed off by EPA-accredited auditors. The controls in the EMPs prepared for these areas apply for these specific areas (as shown in **Figure 2**).

This EMP is in no way intended to replace or supersede existing EMPs and / or Health and Safety Plans provided for the site. Instead this EMP should be considered an overarching document targeted towards potential contamination issues across the entire site, particularly in areas which have not been subject to substantial previous investigation.

2.2 Responsibilities

2.2.1 Council

It is the responsibility of Council to ensure that a person in a management position is appointed as the nominated Site Manager and given the responsibility for ensuring implementation of the provisions of the EMP including:

- implementation of the requirements of the EMP;
- distribution of a copy of this EMP to the Site Manager and Building Managers, and communications as required to ensure understanding of, and agreement with, the requirements of the EMP by the Site Manager and Building Managers;
- actions as necessary to ensure the ongoing monitoring of groundwater and landfill gases, and monitoring of the ground cover as outlined in this EMP;
- the health and safety and environmental requirements specific to the contamination issues on the site, as outlined in this EMP, are complied with; and
- that any non-conformances are recorded and addressed in a timely manner.

2.2.2 Council Site Manager

Specifically, the nominated Council Site Manager will be responsible for:

- liaison with the Building Managers and ongoing communication as required to ensure compliance with the EMP;
- actions as necessary to ensure the ongoing monitoring of groundwater and landfill gases, and monitoring of the ground cover as outlined in this EMP;
- liaison with Building Managers in the event the occupants propose disturbance of the ground surface or subsurface soils to ensure management requirements are appropriately implemented;
- ensuring compliance with all environmental/health based requirements outlined in this EMP and statutory requirements;
- liaison with the regulatory authorities in relation to environmental matters;
- where necessary reviewing reports and inspections and initiating any actions to rectify; and
- ensuring that site workers or sub-contractors, who are engaged to conduct works with potential to disturb or be exposed to identified contamination are inducted into the EMP and are aware of their environmental responsibilities in relation to the presence of the materials which may present a human health risk.

2.2.3 Building Managers

The Building Managers are those that manage facilities within the park including the Curl Curl Sports Centre, the Curl Curl Youth and Community Centre, the Scout Hall and the temporary toilet/ canteen facility on the Abbott Road Land. The Council is the Building Manager for the four amenities blocks and any remaining facilities.

The Building Managers are required to:

- maintain the integrity of the ground cover and conduct any works likely to disturb the ground or subsurface soils in accordance with this EMP;
- liaise with Council and the appointed Council Site Manager as required to ensure compliance with the EMP;
- liaise with Council and the appointed Council Site Manager in the event of proposed ground disturbance or subsurface works; and
- report any breaches of the ground surface in a prompt manner and participate in any reporting/actions associated with rectifying the ground surface maintenance measures.

2.2.4 Site Workers including Contractors

Site workers with responsibilities relating to the implementation of this EMP include any worker involved with the maintenance of the ground surface, working in subsurface areas or with potential to disturb the ground surface or subsurface soils.

The site workers are required to:

- maintain the integrity of the ground cover and conduct any works likely to disturb the ground or subsurface soils in accordance with this EMP;

- liaise with Council and the appointed Council Site Manager as required to ensure compliance with the EMP;
- liaise with Council and the appointed Council Site Manager in the event of proposed ground disturbance or subsurface works;
- report to Council's Site Manager the identification of any unexpected finds encountered during works; and
- report any breaches of the ground surface in a prompt manner and participate in any reporting/actions associated with rectifying the ground surface maintenance measures.

3 Environmental Status

3.1 Summary of Identified Contamination Issues

Numerous assessments have been undertaken across various portions of the site, followed by remedial works and the implementation of management plans in two areas (Weldon Oval and Adams St Reserve). Some areas of the site have not been subject to assessment. However, the history of the site would indicate that contaminants associated with the former landfill and cover material can be expected to extend across the majority of the site area.

This EMP has been developed with consideration to the results of previous assessments (as listed in **Section 9**), and documents procedures which are considered to be appropriately protective of human health and the environment across the entire site.

Contamination issues identified during previous investigations which require management are summarised below:

- Fragments of non-friable asbestos containing material (ACM) on the ground surface where no surface cover (grass) was present;
- Fragments of ACM identified within the landfill cover materials;
- Landfill gases (including methane, carbon dioxide and volatile vapours) associated with degrading organic material such as food or green waste;
- Asbestos and chemical contaminants (including total petroleum hydrocarbon (TPH), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), heavy metals and pesticides within the landfill materials;
- Groundwater contaminants including ammonia, TPH, volatile organic compounds (VOCs) such as chlorobenzene and trichloroethene, and heavy metals;
- Contaminated groundwater discharges into Greendale Creek and Curl Curl Lagoon which impact the surface water quality; and
- Potential acid sulfate soils (ASS) identified in natural soils beneath landfill material at the site.

3.2 Potential Exposure Pathways

A summary of contaminants identified and their potential health affects and exposure pathways are summarised below.

3.2.1 ACM Fragments

Fragments of non-friable (bonded) ACM have been identified on the ground surface in isolated areas where no surface cover (such as grass) was present. Fragments of bonded ACM have also been identified within material historically used to cover the landfill material, which is thought to have been imported to the site as a growing medium. Asbestos fibres have not been identified in soils or in general air monitoring conducted previously around the site.

The main health risks associated with asbestos include asbestosis, lung cancer and mesothelioma, which are associated with the inhalation of respirable fibres and their subsequent deposition in the lung. The potential for airborne fibres to be released into the respiratory environment depends on the type of ACM, its location and condition. Fibre

release is also dependent on the material being significantly compromised or disturbed to enable release (enHealth 2005¹).

Bonded ACM are where the fibres are locked into a matrix (eg asbestos-cement, vinyl tiles). The fibres are contained within the matrix by use of such materials as resins and cement. If ACM is left in situ and in good condition then there is no risk to health (AIOH 2008²).

For bonded products, where fibres are contained within a matrix, it is more difficult to release any measurable respirable fibres into the air. There is much less risk of airborne respirable fibres being liberated from bonded ACM unless it is being worked (eg drilled, sawn). Given the nature of the asbestos material generally encountered, it is most unlikely that the general public would be exposed to levels much higher than background, except in a few isolated instances, for example, during poorly managed demolition or renovation activities in homes (enHealth 2005).

The potential risks associated with the identified non-friable ACM at the site can be managed simply by minimising the potential for weathering or abrading, which includes maintaining a cover over the material and implementing management protocols when disturbing potentially ACM impacted material.

The risk posed to park users by fragments of bonded ACM on the ground surface but covered by grass or other covering is negligible provided the ground cover is maintained. There is no risk to occupants of onsite buildings or building maintenance workers given the bonded ACM fragments are located in isolated areas external to the buildings. The potential risk posed to park maintenance and excavation workers can be controlled by way of procedures documented in **Section 4**.

The risk posed to park users by ACM within the cover material is negligible given the material is buried within the material. There is no risk to occupants of onsite buildings or building maintenance workers given the ACM is buried within cover material. The potential risk posed to park maintenance and excavation workers can be controlled by way of procedures documented in **Section 4**.

3.2.2 Landfill Gas

Landfills primarily produce methane and carbon dioxide gases, as well as other constituents, and may potentially contain a wide variety of corrosive, toxic or malodorous components. Landfill gas is produced by the decay of putrescible material as well as decay of timber and green waste associated with non-putrescible landfill material (although to a lesser extent).

Landfill gas can migrate vertically and laterally, depending on subsurface conditions and other conditions including atmospheric pressure changes. Migrating gases can impact service trenches and pits, and excavations. Migration into slab-on-ground structures through cracks and joints in slabs can occur, as well as into other indoor structures via service pipes.

Methane represents an explosion risk which may occur on-site or off-site depending on subsurface conditions and migration. Ground gases can cause a range of health effects depending on the constituents present, their concentrations and the physical conditions (e.g. confined space, ventilation, etc).

¹ *Management of asbestos in the non-occupational environment*, enHealth 2005 (enHealth 2005)

² *AIOH Position Paper, Asbestos*. Australian Institute of Occupational Hygienists Inc. August 2008 (AIOH 2008)

The landfill at the site is estimated to be more than 30 years old, given that initial remedial works were conducted in the late 1970s. EPA (2012) '*Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*' document that the generation of methane decreases over time, with little gas produced after around 30 years (dependant on favourable decay conditions). However, it argues also that the Australian Greenhouse Office (2008) estimated that 23% of degradable waste remains after 30 years and 11% after 50 years. Thus, it should not be assumed that a landfill will not produce methane, just because it is old.

Limited subsurface gas monitoring undertaken across the site has identified the presence of methane at some locations in concentrations exceeding 1.25% (v/v), which is the concentration that requires EPA notification in operational landfill monitoring. Elevated methane concentrations have been identified near the site boundary. Localised elevated concentrations of hydrogen sulphide has have been identified within the former landfill material. Elevated carbon dioxide, which is likely to be both naturally occurring and sourced from the waste beneath the site, was also identified.

Gas sampling has not identified significant gas flux or formation pressure at the monitored locations, which decreases the potential for lateral migration of gas. Off-site lateral migration of landfill gas could have the potential to impact adjoining residential areas. On-site vertical migration of landfill gas has the potential to impact on-site buildings. Gas migration is dependent on a range of factors including, among others, atmospheric pressure, the presence of preferential migration pathways, cover/cap conditions and building construction.

It is noted that a landfill gas assessment is currently being prepared for the site. The data from this assessment will be used to refine the procedures required to be implemented by site workers.

Based on the currently available data, the potential risk posed to park users by landfill gas emissions in open space is negligible given the absence of places for gas to accumulate. The potential risk posed to occupants of onsite buildings is likely to be low but is to be monitored as part of this EMP. The potential risk posed to building maintenance workers, park maintenance and excavation workers by landfill gas emissions can be controlled by way of procedures documented in **Section 4**.

3.2.3 Landfill Contents

The former landfill may contain a variety of substances that can be potentially classified as corrosive, toxic or malodorous. These can pose a risk to human and ecological health depending on the contaminant type, its form (i.e. solid, liquid, gas) and concentration, and the method of exposure (i.e. dermal contact, ingestion, inhalation). Landfills can contain ACM in various forms some of which can pose a risk to human health if respirable asbestos fibres are present.

Previous investigations have identified concentrations of TPH, PCBs, PAHs and metals exceeding the health-based investigation levels for parks/ open space (DEC 2006³). Contaminant impacts to soil have mainly been subsurface as cover material appears to have been imported to the site as a growing medium.

The landfill cover material identified at Adams St Reserve prior to remedial works comprised sand between 0.5 and 1.0 m thick. Landfill material within the Reserve was

³ *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 2nd Edition*. NSW EPA, 2006 (DEC 2006)

identified to 3.0 m below ground surface and consisted of predominantly demolition waste including ACM, concrete, brick pieces, plastic, metal, broken glass, car parts, car tyres, timber, vegetation and sandstone (SKM 2011). During remedial works, over 1000 m³ of excavated natural material (ENM) was imported to resurface the entire Reserve. The type of ENM and the resultant change to the existing ground level was not reported in the Audit Report (PJR&A 2012). The cover over the landfill at Adams St Reserve now comprises imported ENM over the sand layer between 0.5 and 1.0 m thick.

Prior to remedial works at Weldon Oval, the landfill cover material was sand between 0.2 and 0.65 m deep (WSP 2012). The landfill material comprised brick pieces, ACM sheeting, plastic sheeting, broken glass, mattress springs, carpet, car tyres and timber fragments. The landfill material extended to between 3.0 and 3.5 m below the ground surface. During remedial works, fill was imported and used to form a cover over the site comprising 0.3 m growing medium over 0.1 m sand. The resultant change to the ground level was not reported in WSP (2012) and it is presumed the cover over the landfill at Weldon Oval now comprises imported growing medium and sand 0.4 m thick over the original cover layer between 0.2 and 0.65 m thick.

The shallow fill encountered across the remainder of the site during previous investigations appears to be sand or clayey sand with occasional fragments of ACM. The thickness of cover material over other landfill areas across the site is not known. Given that sand fill material was historically imported to the site specifically to cover the landfill, it is assumed that at least 0.2 m of cover material will be present over any areas of landfill material at the site.

The potential risk posed to park users by the landfill contents is negligible given the material is buried. Similarly, there is no potential risk to occupants of onsite buildings or building maintenance workers. The potential risk posed to park maintenance and excavation workers can be controlled by way of procedures documented in **Section 4**.

3.2.4 Groundwater and Surface Water

Ground and surface waters can be contaminated by untreated leachate from landfill sites. Leachate is the liquid that percolates through landfills as a result of infiltration and/or decomposition of the wastes. It may cause water pollution if not properly managed, and could be detrimental to human and ecological health if extracted for use at the surface or contact otherwise occurs.

Previous investigations of groundwater and surface water have been undertaken that broadly assess the groundwater and surface water quality across the site. Elevated ammonia, TPH, VOCs and metals have been identified in groundwater.

A preliminary review of the surface water data indicates that concentrations of ammonia, nitrate, metals and TPH are less than the primary contact, recreational use criteria provided in ANZECC/ARMCANZ (2000) *Water Quality Guidelines*.

From a human health perspective, potential receptors of surface water are expected to be limited to site users coming into contact with the lagoon water. From the available data there appears to be low risk to human receptors of the surface water due to chemical contamination.

The potential risk posed to park users by the groundwater contents is negligible given the groundwater is present at depth. Similarly, there is no potential risk to occupants of onsite buildings or building maintenance workers. The potential risk posed to park

maintenance and excavation workers can be controlled by way of procedures documented in **Section 4**.

3.2.5 Acid Sulfate Soils

Previous investigations have identified the potential for ASS to be present underlying landfill material at the site. Potential ASS that are disturbed and/or exposed to the atmosphere become acidic (low pH) and can be corrosive to concrete and building materials and may cause acidic run off resulting unacceptable impacts to the environment.

Potential ASS does not pose a health risk, rather a risk to the surrounding environment if it is not managed appropriately, as documented in **Section 4.11**.

4 Environmental Management

4.1 Basic Personal Protective Equipment and Hygiene

Notwithstanding the outcomes of the job risk analysis to be completed as part of a safety plan for any works at the site, workers who may potentially come into contact with contaminated soils are anticipated to wear, as a minimum, the following personal protective equipment (PPE):

- overalls or long sleeved shirt and long pants;
- heavy duty outer gloves (e.g. leather) where there is a risk of cuts or abrasions, otherwise latex outer gloves if in direct contact with contaminated soil;
- steel capped boots; and
- safety glasses.

Additional PPE is required as described below when working with potentially impacted material.

Basic rules of hygiene should apply with no eating, drinking or smoking during the works. Wash hands following the works and before eating or drinking.

4.2 Ground Surface Maintenance

Works conducted above the ground surface which do not disturb the surface soils may be conducted with the normal level of PPE for that task. This includes works such as mowing of grass, laying of mulch or gravel pavement and collection of general litter on the ground.

The ground surface should be inspected prior to activities such as mowing as described in **Section 5.1**.

Where bare soil is present, the ground surface shall be covered by grass or other vegetation, gravel or mulch. Where fragments of ACM are identified on areas of bare soils, they shall be collected and disposed as described in **Section 4.3**.

4.3 Asbestos removal

If isolated fragments of ACM are present on the ground surface, they shall be collected in accordance with WorkCover NSW (2011) *Guide to the Safe Removal of Asbestos* and disposed of at an appropriately licensed waste facility.

PPE to be worn during the collection and removal of ACM fragments, additional to the PPE described in **Section 4.1**, includes:

- disposable coveralls; and
- a P2 disposable respirator or half faced respirator fitted with a particulate cartridge.

4.4 Building Maintenance

Maintenance works conducted on the ground floor or above in buildings across the site may be conducted with the normal level of PPE for that task.

Additional procedures are required where maintenance works are conducted in pits or subfloor or confined areas where landfill gas has the potential to accumulate. Where

building maintenance works are to be conducted subfloor or confined areas, the following procedures are to be implemented:

- All subfloor or confined areas shall be treated as confined spaces. All confined spaces shall be tested and cleared for the accumulation of methane and landfill gases with a calibrated meter capable of measuring lower explosive limit based on methane concentrations, and concentrations of oxygen, hydrogen sulphide, carbon monoxide and carbon dioxide. All works in confined spaces shall be undertaken in accordance with clauses 65 to 77 and other relevant sections of the Work Health and Safety Regulation 2011.
- As long as monitoring continues to indicate a normal atmosphere with no elevated landfill or volatile gases, PPE to be worn during works are as described in **Section 4.1**.
- If monitoring is not conducted continuously throughout the works, PPE to be worn during works, additional to the PPE described in **Section 4.1** includes:
 - a half faced respirator fitted with an organic vapour cartridge.

4.5 Disturbance of Surface or Shallow Soils (<0.2 m)

4.5.1 Hand Excavations

Works conducted where the surface or shallow soils (up to 0.2 m deep) may be disturbed via hand excavation are required to be undertaken in accordance with the following procedure:

- Works may be conducted with the normal level of PPE for that task.
- Fragments of ACM have been identified in the landfill cover material at isolated locations. If a few fragments are identified during the minor works, they do not pose a potential health risk provided they remain bonded and are not abraded or worked in any way. The fragments are not required to be removed.
- When reinstating the soil, ensure all potentially contaminated fill materials are placed in excavation pit prior to reinstatement of the clean surface cover. Fragments of ACM should be placed at least 0.1 m below the ground surface.
- Once the works are complete, the works area shall be inspected in accordance with **Section 5.1**.
- Council Site Manager should be advised of the locations where ACM fragments were observed.
- If large quantities of ACM or potentially friable ACM (crushable by hand pressure) are identified, replace any excavated soils and reinstate the ground surface. Notify the Council Site Manager with the location and a description of the material encountered. The Council Site Manager will implement inspection of the material by a trained hygienist, remedial works as required and clearances, as per the Unexpected Finds Protocol in **Section 4.14**.

4.5.2 Mechanical Excavations

Works conducted where the surface or shallow soils (up to 0.2 m deep) may be disturbed via mechanical excavation are required to be undertaken in accordance with the following procedure:

- Approval for the works must be sought from the Council Site Manager(**Section 2.2.2**) who will review and approve the job specific risk

assessment (JSRA) and safe work method statements (SWMS) for the works and ensure that Site personnel and/or contractors who will undertake the works are inducted into the EMP;

- The works should be undertaken under the supervision of a trained hygienist, who will assess the materials being excavated and provide direction on whether the level of PPE needs to be upgraded based on their observations.
- Otherwise, works may be conducted as per **Section 4.5.1**.

4.6 Disturbance of Soils at Depth

4.6.1 Works between 0.2 m and 0.5 m

Works conducted between 0.2 m and 0.5 m (whether excavated by hand or mechanical means) are presumed to be conducted within the landfill cover material, however, additional procedures have been included to protect the safety of workers in the instance that landfill material is encountered within these depths.

- Approval for the works must be sought from the Council Site Manager (**Section 2.2.2**) who will review and approve the JSRA and SWMS for the works and ensure that Site personnel and/or contractors who will undertake the works are inducted into the EMP;
- The works should be undertaken under the supervision of a trained hygienist, who will assess the materials being excavated and provide direction on whether the level of PPE needs to be upgraded based on their observations. It is noted that ACM has been identified within cover material, and the depth to landfill material is not known.
- Where landfill material is identified, works are to be conducted in accordance with **Section 4.6.2**.
- Otherwise, works may be conducted as per **Section 4.5.1**.

4.6.2 Works deeper than 0.5 m

Works conducted in soils deeper than 0.5 m are presumed to be conducted within the landfill material, and with the potential to encounter groundwater.

Landfill gases have been identified within the former landfill beneath the site. ACM has been identified within landfill material. Groundwater is contaminated with ammonia, hydrocarbons and metals. Measures are required to be implemented to limit exposure for works where landfill material is disturbed. The following measures apply:

- Approval for the works must be sought from the Council Site Manager (**Section 2.2.2**) who will assess whether the works are necessary; evaluate whether there is an alternative that will not result in exposure of potentially impacted landfill material and groundwater; and whether the works are required to be carried out by a specialist contractor. The Manager must also review and approve the JSRA and SWMS for the works and ensure that Site personnel and/or contractors who will undertake the works are inducted into the EMP;
- All service providers on the site shall be advised of the potential sub-surface risks associated with the former landfill underlying the site;
- the works area must be isolated from casual entry using temporary barriers and only personnel inducted in the requirements of the EMP will be permitted to enter the works area;

- All excavations greater than 0.5 m in depth shall be treated as confined spaces. All confined spaces shall be tested and cleared for the accumulation of methane and landfill gases with a calibrated meter capable of measuring lower explosive limit based on methane concentrations, and concentrations of oxygen, hydrogen sulphide, carbon monoxide and carbon dioxide. All works in confined spaces shall be undertaken in accordance with clauses 65 to 77 and other relevant sections of the Work Health and Safety Regulation 2011.
- sufficient room must be provided within the works area to allow stockpiling of spoil from excavations, if required, in accordance with **Section 4.7**.
- If soil / fill materials are required to be excavated, excavate cover material separately, cover excavated materials with plastic, then place it back into original position prior to reinstating cover layer. Ensure all potentially contaminated fill materials are placed in excavation pit prior to reinstatement of clean cover layer.
- PPE to be worn during works, additional to the PPE described in **Section 4.1** includes:
 - disposable coveralls; and
 - a P2 disposable respirator or half faced respirator fitted with cartridges for organic vapour and particulates.
- The potential for dust generation must be managed in accordance with the requirements outlined in **Section 4.8**;
- The potential for odours must be managed in accordance with the requirements outlined in **Section 4.9**;
- All excess excavated material must be removed from Site in accordance with the requirements outlined in **Section 4.10**;
- Potential groundwater flowing into any excavations must be treated as contaminated and, if necessary, must be removed from the Site in accordance with the requirements outlined in **Section 4.12**;
- Once the works are complete, the works area shall be inspected in accordance with **Section 5.1**.

4.7 Soil Management

Any soil or fill excavated during on-site works, such as maintenance of underground services, must be securely stockpiled separately. Where possible, stockpiles should be placed on a sealed surface or on plastic sheeting to prevent cross contamination of unsealed surfaces.

If it is not possible to stockpile on a sealed or plastic covered surface, following the removal of the stockpile, the unsealed surface within the footprint of the stockpiles must be inspected by a person who is appropriately qualified, and samples collected and analysed to confirm that cross contamination has not occurred.

Stockpiles must be placed in a secure location onsite and covered if they are to remain for more than 24 hours.

The potential for dust generation must be managed in accordance with the requirements outlined in **Section 4.8**. All excess excavated material must be removed from Site in accordance with the requirements outlined in **Section 4.10**.

4.8 Dust Management

During works within landfill material, exposed fill in the walls and floors of excavations and stockpiles of spoil should be kept moist to prevent the generation of dust and odours from these sources. Care should be taken to not over-wet excavations and/or stockpiles such that excess runoff is generated.

4.9 Odour

During works within landfill material, consideration will be given to the management of odour via:

- Installation of an odour screening / masking system at the boundaries of the work area;
- Disturbance of soils during meteorologically favourable periods only; and/or
- Covering of impacted soils.

Additional odour suppression actions will be taken to reduce the odours as necessary, which may include: increasing the amount of covering of excavations / stockpiles; mist sprays; odour suppressants; or maintenance of equipment.

4.10 Waste Management

Any material to be disposed off-site should be classified in accordance with NSW DECCW (2009) *Waste Classification Guidelines* for disposal to an appropriately licensed facility.

4.11 Acid Sulfate Soils

If acid sulfate soils are disturbed during any construction they will require management in accordance with the *Acid Sulfate Soil Manual*, NSW Acid Sulfate Soil Management Advisory Committee, August 1998, (ASSMAC 1998).

4.12 Groundwater

Due to the presence of elevated ammonia, hydrocarbons and metals in the groundwater, the groundwater is considered to be a contaminated media. Consequently, there will be no unlicensed abstraction of groundwater, and no abstraction of groundwater which is potentially contaminated such that it is unsuitable for the proposed use.

Groundwater encountered during excavation works which requires removal from the site will be removed so by a licensed contractor and disposed of off-site as "liquid waste" in accordance with DECCW (2009).

4.13 Imported Fill

If any materials are required to be imported on Site then only Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) or material otherwise approved by a specific exemption by the NSW EPA will be accepted onto the Site.

4.14 Unexpected Finds Protocol

The possibility exists for hazards other than those identified and expected based on previous investigations, to be present at the site.

The nature of any additional hazards which may be present at the site are generally detectable through visual or olfactory means, for example:

- Friable ACM;
- Drums or underground tanks; and
- Odourous or unusual coloured soils.

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances be identified (or any other unexpected potentially hazardous substance), the procedure to be followed is:

- Notify the Council Site Manager with the location and a description of the material encountered.
- The Council Site Manager will ensure the work area where the unexpected find was identified is made safe by the installation of barricades, temporary fencing and/or signage preventing access to the area.
- The Council Site Manager shall engage a trained hygienist to inspect the identified find, and make an assessment regarding the potential risk posed by the material, plus works to be undertaken to remove or manage the potential risk.
- The Council Site Manager shall implement the recommendations of the trained hygienist prior to re-commencement of works within the vicinity of the unexpected find.

5 Environmental Monitoring

5.1 Existing EMPs

EMPs are already in place for the management of Adams St Reserve and Weldon Oval, as listed in **Section 1.3**. The portions of the site managed under existing EMPs are shown on **Figure 2**.

The requirements of those EMPs apply to those specific areas (Weldon Oval and Adams St Reserve).

This EMP is in no way intended to replace or supersede existing EMPs and / or Health and Safety Plans provided for the site. Instead this EMP should be considered an overarching document targeted towards potential contamination issues across the entire site, particularly in areas which have not been subject to substantial previous investigation.

5.2 Ground surface inspections

Ground surface inspections are to be conducted annually or following ground disturbance works or heavy storms, or prior to works on the ground surface such as mowing.

The objective is to ensure the ground surface is maintained to limit exposure to potentially contaminated material underlying the ground surface.

The ground surface across the site shall be inspected to identify areas of bare soil. If areas of bare soil are identified, the ground cover shall be maintained as per **Section 4.1**.

If fragments of ACM are observed on the ground surface, the Site Manager should be advised and ACM removed in accordance with the procedure outlined in **Section 4.3**.

5.3 Landfill Gas Monitoring

Landfill gas monitoring shall be conducted annually in conjunction with the groundwater monitoring event (**Section 5.4**). Landfill gas monitoring will be undertaken by a contaminated land consultant in accordance with relevant guidelines.

Landfill gas monitoring will be conducted across different areas of the site as described below.

5.3.1 Outdoor Areas

The site atmosphere shall be tested using a landfill gas meter at a height of 5 cm above the ground surface. Testing shall be undertaken by walking transects of the entire width of the site at 25 m spacings. Any depressions in the site surface shall be individually assessed, including sub-surface depressions such as service pits.

Maximum readings of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and the lowest reading of oxygen shall be recorded for each transect.

The wind speed at the time of undertaking monitoring shall not exceed 10 km/h.

5.3.2 Building Monitoring

The internal areas of all buildings on the site shall be assessed using a landfill gas meter. This shall include the measurement of levels of landfill gas in targeted areas including poorly ventilated and ground level areas, including the corners of large rooms and small storage areas (ie closets). Monitoring shall be undertaken for a sufficient period to

determine the maximum readings of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and the lowest reading of oxygen.

5.3.3 Monitoring Wells

Prior to opening the wells for the groundwater monitoring procedure, landfill gas monitoring will also be undertaken at monitoring wells MW01-MW07, MW09S-MW14S as shown on **Figure 2**.

5.4 Groundwater Monitoring

A groundwater monitoring event shall be conducted annually in conjunction with the landfill gas monitoring event. Groundwater monitoring will be undertaken by a contaminated land consultant in accordance with relevant guidelines.

Groundwater samples shall be collected from monitoring wells MW01-MW07 and MW09S-MW14S, as shown on **Figure 2**.

Groundwater samples shall be analysed for heavy metals (As, Cd, Cr, Cu, Pb, , Hg, Ni and Zn), major cations (Ca^{2+} , K^+ , Mg^{2+} and Na^+), major anions (CO_3^{2-} , HCO_3^- , SO_4^{2-} and Cl^-), ammonia (as N), BOD, TPH, VOCs, phenols and PAHs by a NATA accredited laboratory. Appropriate chain of custody documentation shall be generated by the consultant and shall accompany all samples submitted for analysis.

6 Non-Compliances and Record Keeping

Where a non-compliance is identified, the non-complying party will be required to rectify the non-conformity as soon as possible, as per the requirements of the relevant procedure(s) where non-compliance has occurred. Detail of the action taken to rectify the non-compliance shall be provided to Council's Site Manager in writing.

Where a non-compliance cannot be rectified, the EMP will require to be reviewed as described in **Section 8**.

Council shall be responsible for the maintenance of all documents relating to the implementation of this EMP. This shall include monitoring reports, any additional assessment undertaken and any relevant correspondence between the Council, Building Managers and Site Workers including Contractors.

7 EMP Notification

The EMP shall be maintained by Council and distributed to:

- Building Managers; and
- Site workers.

Where required to facilitate implementation of specific management actions, the EMP shall also be distributed to sub-contractors engaged by Council. Regulatory authorities may also be provided with a copy of this EMP by Council as part of regulatory obligations.

8 Revision of the EMP

Revisions should be undertaken annually, or when otherwise required, by an appropriately qualified and experienced environmental scientist/engineer. Copies of the revised EMP should be distributed to the site owner, Site Manager and Building Managers for on-going implementation.

Any revision of the EMP must take into consideration the notification requirements recommended in **Section 7**.

9 References

Documents considered as part of the preparation of this EMP include:

- *Report for Reub Hudson Oval, Groundwater and Landfill Gas Monitoring Summary Report.* GHD, File Reference: 21/16354/139628, May 2008 (GHD 2008)
- *Rehabilitation Environmental Monitoring, Weldon Oval, Curl Curl.* Coffey Environments, 6 August 2009 (Coffey 2009a)
- *Rehabilitation Environmental Monitoring, Weldon Oval, Curl Curl.* Coffey Environments, 11 September 2009 (Coffey 2009b)
- *Rehabilitation Environmental Monitoring, Weldon Oval, Curl Curl.* Coffey Environments, 11 June 2010 (Coffey 2010a)
- *Rehabilitation Environmental Monitoring, Weldon Oval, Curl Curl.* Coffey Environments, 14 July 2010 (Coffey 2010b)
- *Rehabilitation Environmental Monitoring, Weldon Oval, Curl Curl.* Coffey Environments, 29 September 2010 (Coffey 2010c)
- *Curl Curl Lagoon Groundwater Assessment, August 2010, Final Draft, File Reference 1089RP01FD, WSP Environment and Energy 2010 (WSP 2010)*
- *Adams Street Oval Rectification Works, Remediation Action Plan.* Sinclair Knight Mertz, Final V2, December 2011 (SKM 2011)
- *Validation Report, Weldon Oval, Curl Curl, NSW.* WSP Environment & Energy, File Reference: 00002339.01, July 2012 (WSP 2012a)
- *Landfill Gas Monitoring Summary Report, Weldon Oval, Curl Curl, NSW.* WSP Environment & Energy, File Reference: 00002339.04, July 2012 (WSP 2012b)
- *Stormwater and Estuary Modelling for Curl Curl Lagoon, 30 May 2012, Revision 1, Document R.N2126.001.01.docx, BMT WBM Pty Ltd, 2012 (BMT 2012)*
- *Playing Field – Adams Street Oval, Curl Curl, NSW, Environmental Management Plan.* Sinclair Knight Mertz, Final V1, July 2012 (SKM 2012)
- *Site Audit Report, Adams Street Oval, Lalchere Street, Curl Curl, NSW.* Peter J Ramset & Associates, October 2012 (PJR&A 2012)
- *John Fisher Park, North Curl Curl, NSW – Overview of Contamination Issues.* JBS Environmental, JBS 42494-52767 (Rev 0), 17 December 2012 (JBS 2012a)
- *John Fisher Park, Curl Curl, NSW – Groundwater Assessment and Estuary Modelling Review.* JBS Environmental, JBS 42494-52765, 14 December 2012 (JBS 2012b)
- *John Fisher Park, North Curl Curl, NSW – Asbestos Assessment.* JBS Environmental, JBS 42540-53128, 21 February 2013 (JBS 2013)

10 Limitations

This report has been prepared for use by the client who commissioned the works in accordance with the project brief only and has been based in part on information obtained from other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

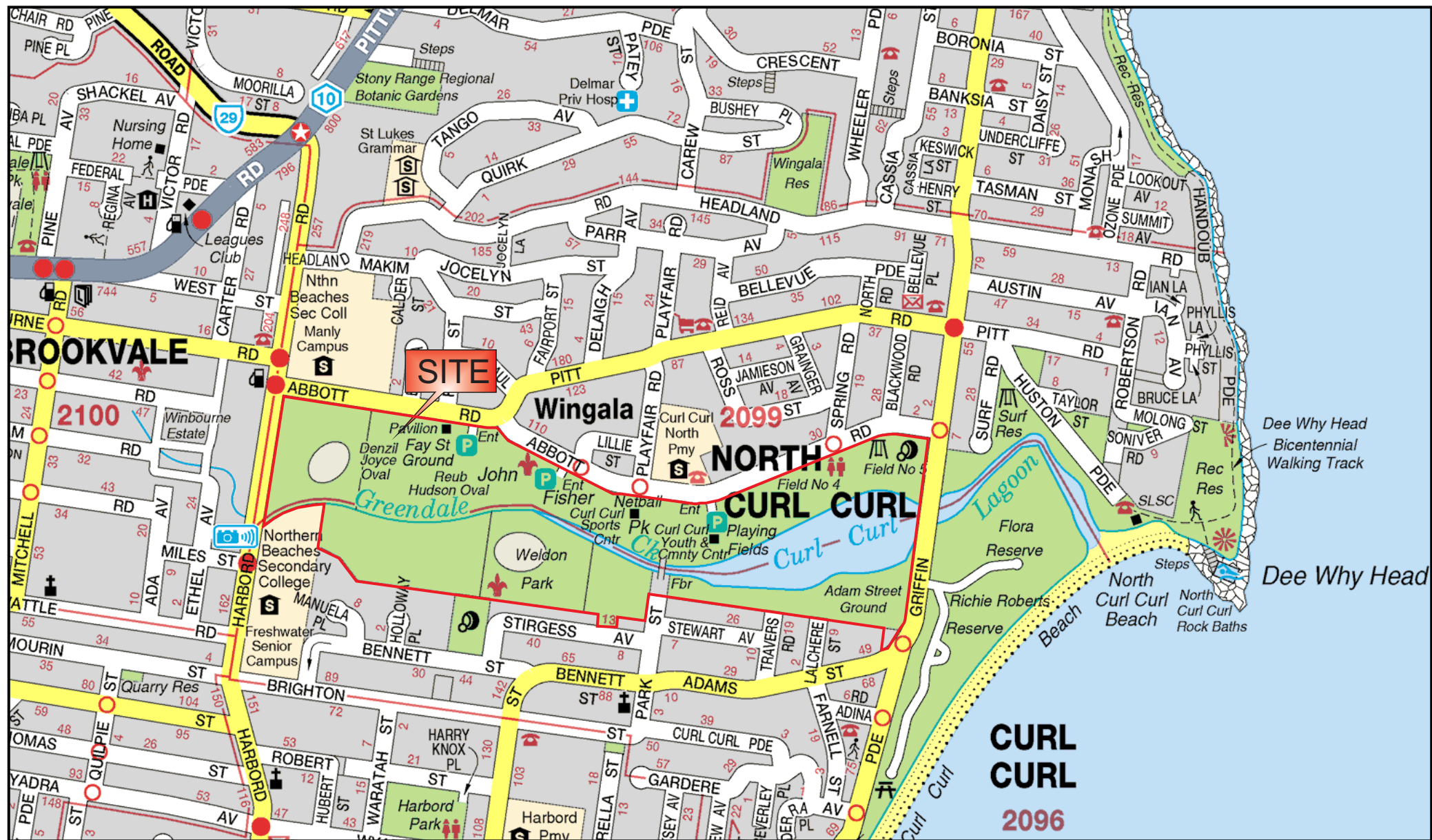
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Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information.

Figures



Source: Base Image - Universal Publishers 2008

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0 150 300 m		
Scale: Approximate		
Datum: MGA94 Zone 56 - AHD		
A4		
A	Original Issue - R01	SE 27-03-2013
Rev	Description	Drn. Date

Legend:
 — Approximate Site Boundary

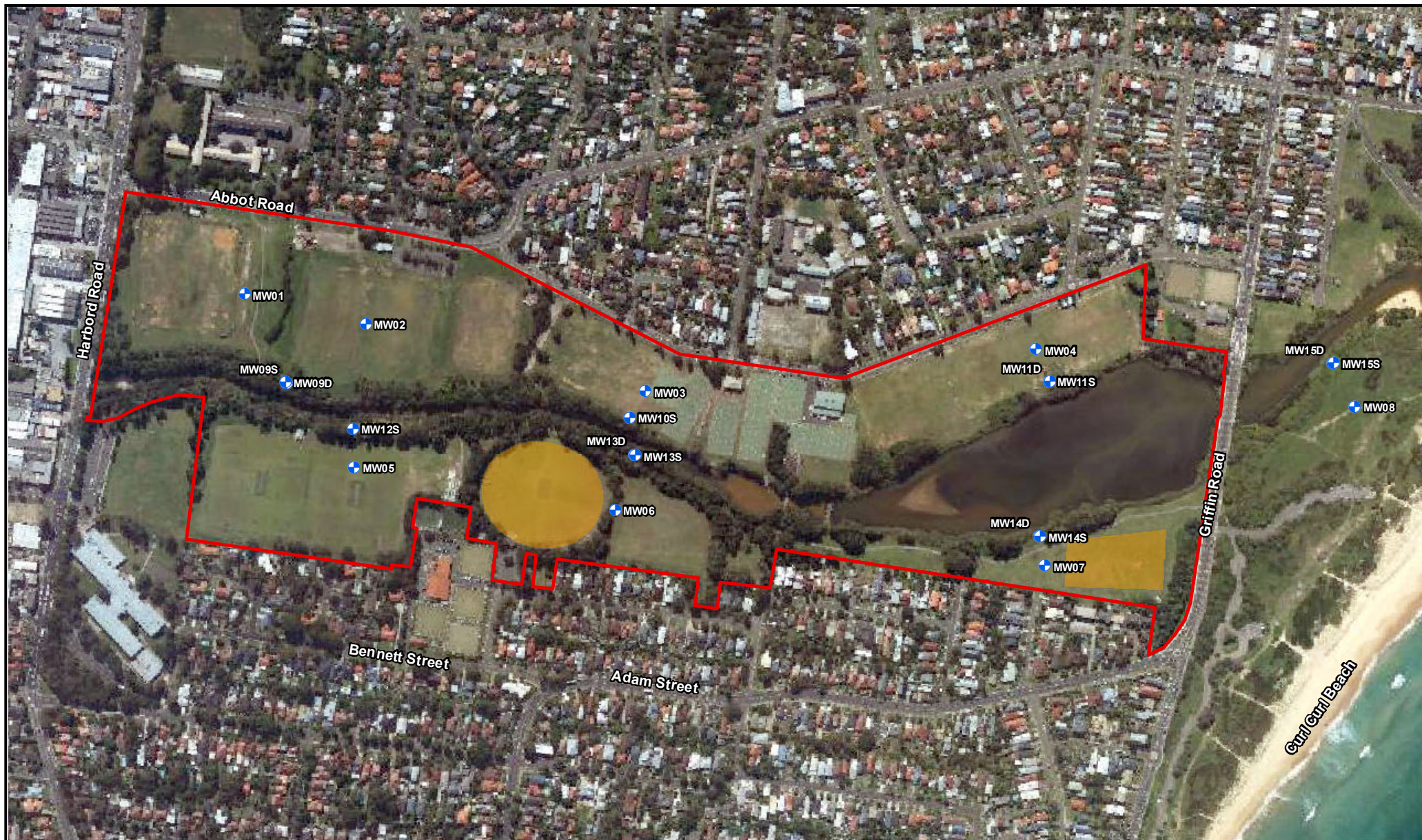
JBS ENVIRONMENTAL Figure 1: Site Location

Client: Warringah Council

Project: John Fisher Park, Wingala, NSW - EMP

Job No: 42669

File Name: 42669_01



Source: Base Image - © SIX Maps www.maps.six.nsw.gov.au, imagery date 01-01-2011, accessed 27-03-2013

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0 70 140 280 m			
Scale: 1:6,500			
Datum: GDA 1994 MGA Zone 56 - AHD			
A4			
A	Original Issue - R01	SE	12-04-2013
Rev	Description	Dm.	Date:

Legend:

- Approximate Site Boundary
- Approximate Areas Managed Under Existing EMPs (as described in Section 1.3)
- Monitoring Well Location



Figure 2: Site Layout

Client: Warringah Council

Project: John Fisher Park, Wingala, NSW - EMP

Job No: 42669


File Name: 42669_02



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Document Status

Rev No.	Author	Reviewer	Approved for Issue		
		Name	Name	Signature	Date
A	Cathy Roberts	Matthew Bennett	Draft for client comment	-	12/04/2013
B	Cathy Roberts	Matthew Bennett	Matthew Bennett		19/04/2013

