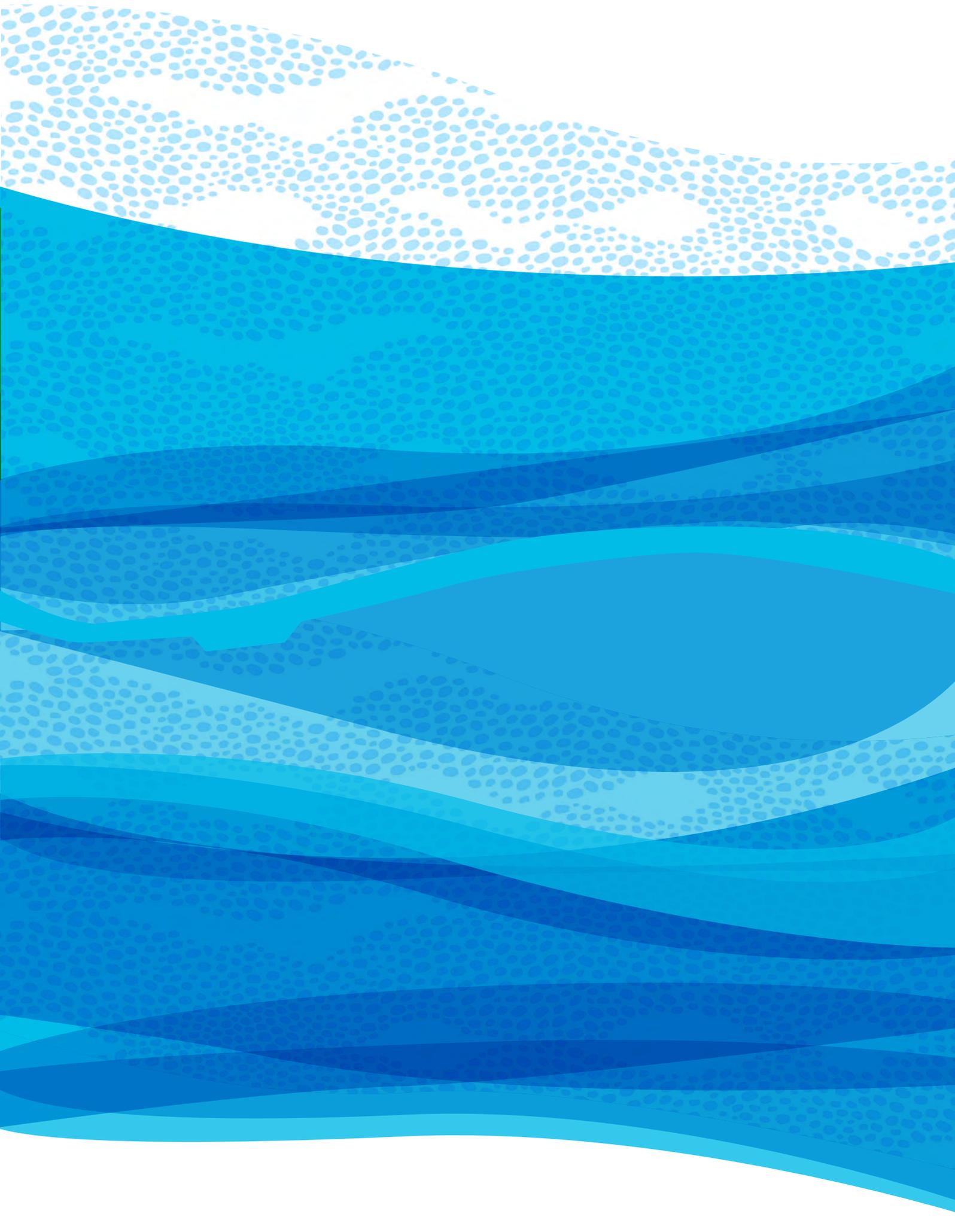


**FINAL DESKTOP STUDY
AND PRELIMINARY
REGIONAL CONCEPTUAL
SITE MODEL**

**FISHERMANS BEND
EMPLOYMENT
PRECINCT**



Final Desktop Study and Preliminary Regional Conceptual Site Model

Fishermans Bend Employment Precinct

Client: Environment Protection Authority Victoria

Prepared by

AECOM Australia Pty Ltd

Level 10, Tower Two, 727 Collins Street, Melbourne VIC 3008, Australia
T +61 3 9653 1234 F +61 3 9654 7117 www.aecom.com
ABN 20 093 846 925

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Reviewed by Gavin Scherer

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Executive Summary

AECOM Australia Pty Ltd (AECOM) was requested by the Environment Protection Authority Victoria (EPA) to prepare this Desktop Study and Preliminary Regional Conceptual Site Model (PRCSM) for the Fishermans Bend Employment Precinct (the precinct).

The precinct is one of five precincts within Fishermans Bend. AECOM successfully completed the initial regional baseline groundwater assessment in the other four precincts (Wirraway, Sandridge, Lorimer and Montague) in 2015/2016. The combined area of the four precincts was 240 hectares (ha). The employment precinct that now requires assessment is approximately 245 ha as seen in **Figure 1**.

The Desktop Study aimed to review existing publically available data to determine key factors that may be influencing shallow groundwater within the precinct on a regional scale. For the purpose of assessing baseline groundwater quality from a regional perspective, AECOM has reviewed significant environmental conditions in broad terms as either being related to natural or anthropogenic (ambient) sources. This included consideration of the following sources of information, as they have the potential to have significant influence on the overall groundwater migration and quality:

- Inorganic substances that are naturally present in the environment.
- Organic substances that may be present in the environment as a result of organic matter decomposition or as the products of incomplete combustion.
- Tidal influences.
- Former swamp and wetlands.
- Geological Features.
- The sewer, drainage and stormwater networks across the precinct.
- Uncontrolled filling (including filling of former quarries/landfills).

Point sources of contamination have also been considered (and identified where possible) during this Desktop Study to ensure that any future groundwater sampling plan aims to avoid sampling groundwater that may be influenced by point sources of contamination, or so that point sources of contamination can be considered further if required.

Point sources of contamination may be associated with the following historical land uses:

- Automotive production and supporting automotive materials supply industries.
- Private aerospace development and mass production of war goods, with the purpose of building military aircraft.
- An airfield and supporting factories.
- Production of consumer goods including, but not limited to, cars, gypsum, farming machinery, refrigeration units, timber yards and metal products.
- Significant engine manufacturing plants, storage and testing facilities.
- Municipal tip operations.
- Melbourne International Shooting Club.

It is intended that the information obtained as part of the Desktop Study and PRCSM will be used during the development of a Groundwater Sampling and Analysis Quality Plan (SAQP) for a regional groundwater investigation at the precinct. The outcomes of that investigation will be considered in relation to the findings of the Desktop Study and the PRCSM to assist in further conceptualising the precinct. Based on our review, AECOM makes the following recommendations:

- A SAQP should be developed in consideration of the natural and anthropogenic influences on regional groundwater conditions.

- A groundwater investigation should be conducted on a regional scale to gain a holistic understanding of groundwater flow and possible contaminant movement via groundwater. This investigation should be used to obtain site specific data to further inform and refine the PRCSM.
- The best approach to characterising and assessing the regional groundwater quality of the precinct is to adopt a grid based approach to obtaining groundwater data and avoid the point sources identified to date. This will allow assessment of contaminant concentrations in terms of consistency with background concentrations or influence by known former and current industry practices, including known point sources, reclaimed land and landfills.
- Sewers and drains should be investigated further if discrepancies in groundwater elevation are apparent in the vicinity of the sewer and drainage locations during sampling works for this assessment, and any in the future.
- Further consideration of tidal influence on the regional groundwater quality including the impacts of regular flushing of water, salinity and migration pathways needs to be further assessed as part of future investigations. This will be best addressed by collection of site specific gauging and survey data.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was requested by the Environment Protection Authority Victoria (EPA) to prepare this Desktop Study and Preliminary Regional Conceptual Site Model (PRCSM) for the Fishermans Bend Employment Precinct (the precinct).

The precinct is located to the south-west of Melbourne's central business district (CBD) and covers an area of approximately 245 hectares (**Figure F1**). The Employment Precinct is bound by the Yarra River to the north and west of the precinct, the Westgate Freeway to the south and Todd Road to the east. The precinct itself is mixed use between heavy and light industrial and commercial landholdings, as well as public parks. Notable land holders in the area include Boeing, Holden, Defence Science and Technology Organisation (DSTO) and Parks Victoria.

The precinct is one of five precincts within Fishermans Bend. AECOM completed the initial regional baseline groundwater assessment in the other four precincts (Wirraway, Sandridge, Lorimer and Montague) in 2015/2016.

This Desktop Study and PRCSM is part of a broader project that aims to determine the regional groundwater quality across the Fishermans Bend area to assist in the development of a potential regional Groundwater Quality Restricted Use Zone (Regional GQRUZ), which may be identified together with the previously investigated area.

2.0 Objective and Scope of Works

2.1 Objective

The objective of the Desktop Study is to gather and assimilate information on the site setting to inform the PRCSM for the project.

The information obtained as part of the Desktop Study and PRCSM will assist in the development of a Groundwater Sampling and Analysis Quality Plan (SAQP) for a regional groundwater assessment at the precinct.

2.2 Scope of Works

The scope of works undertaken to achieve the objective included reviews of the following information sources:

- Topography, geology and hydrogeology maps.
- Historical aerial photographs.
- Twelve (12) Environmental Audit (Audit) reports within proximity to the Employment precinct.
- Priority Sites Register (PSR).
- Visualising Victoria's Groundwater.
- Historic and current tidal trends.
- Melbourne Metropolitan Board of Works (MMBW) historical maps.
- City of Port Phillip records.
- City of Melbourne records (note – currently awaiting stormwater and sewer plans).
- Public Records Office of Victoria (PROV).
- Preliminary Land Contamination Study, Employment Precinct, Fishermans Bend (Golder Associates, 7 September 2016).
- Fishermans Bend Heritage Study (Biosis, 11 June 2013).

Information from the above sources was used to:

- Supplement existing knowledge relating to regional contamination issues and support the planning of the groundwater investigation.
- Identify and develop an initial understanding of potential pathways of contaminant migration across the site from identified sources and receptors on a regional scale.

Further definition and understanding of these pathways will be developed as site specific data and additional historical information becomes available. This may result in more localised interpretation for specific pathways where necessary.

3.0 Regulatory Setting

3.1 EPA and the Environment Protection Act

In Victoria, protection of the environment is regulated by the Environment Protection Authority (EPA) which is established via the *Environment Protection Act 1970* (the Act). EPA's role is to be an effective environmental regulator and an influential authority on environmental impacts. EPA is responsible for the regulation of pollution and administration of the Act via its compliance and enforcement actions. EPA recommends and assists in the development of environment policy and prepares guidelines to further guide stakeholders in compliance with the Act.

3.2 State Environmental Policy

State Environment Protection Policy (SEPP) is subordinate legislation and provides further detail on interpretation and expectations for compliance with the Act. A number of policies have been published and include:

- State Environment Protection Policy - *Prevention and Management of Contamination of Land*;
- State Environment Protection Policy - *Groundwaters of Victoria*;
- State Environment Protection Policy - *Waters of Victoria*,
- State Environment Protection Policy – *Ambient Air Quality*;
- State Environment Protection Policy – *Air Quality Management*,
- State Environment Protection Policy - *Control of Noise from Industry, Commerce and Trade*; and
- State Environment Protection Policy - *Control of Music Noise from Public Premises*.

Some of these policies have been amended or varied and there is currently a review being undertaken to contemplate the amalgamation of the Waters of Victoria and Groundwaters of Victoria SEPPs.

For the purpose of this project the SEPPs for Groundwaters of Victoria and Waters of Victoria (as this relates to the point of discharge for groundwater) are most relevant.

Whilst the soil assessment is not the primary assessment of this project, the *State Environment Protection Policy - Prevention and Management of Contamination of Land* [SEPP (PMCL)] should also be noted, as it provides the framework for the protection of land and associated beneficial uses throughout Victoria.

These SEPPs are discussed in the following sections.

3.2.1 SEPP Groundwaters of Victoria

The *State Environment Protection Policy (Groundwaters of Victoria) 1997* (SEPP GoV) applies to the management of groundwater quality in Victoria. The purpose of the policy is:

“to maintain and where necessary improve groundwater quality sufficient to protect existing and potential beneficial uses of groundwaters throughout Victoria”

Beneficial use means a use of the environment or any element or segment of the environment which is:

- Conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or deposits or of the emission of noise; or
- Declared by State Environment Protection Policy (SEPP) to be a beneficial use.

The SEPP (GoV) defines beneficial uses of groundwater on the basis of background salinity, measured as total dissolved solids (TDS). Groundwater is considered to be polluted where current and / or future protected beneficial uses for the relevant segment are precluded. Beneficial uses of groundwater are considered precluded when relevant groundwater quality objectives have been exceeded, or where non-aqueous phase liquid is present.

The SEPP GoV allows for the EPA to establish Groundwater Quality Restricted Use Zones (GQRUZ) where one or more beneficial uses are precluded due to contamination or pollution. It also indicates that if such a zone is established then the groundwater within the zone must be managed to enable the groundwater to be contained within the restricted use zone. Where pollution of groundwater has been established it must be cleaned up otherwise, in accordance with clause 19(2)(b), groundwater must be cleaned up to the extent practicable (CUTEP).

3.2.2 SEPP Waters of Victoria

The State Environment Protection Policy (Waters of Victoria) (SEPP WoV) was originally Gazetted in 1988. Since then a number of variations have been published. These include:

- Variation to the State Environment Protection Policy (Waters of Victoria) – Insertion of Schedule F6. Waters of Port Phillip Bay [27 August 1997]
- Variation to the State Environment Protection Policy (Waters of Victoria) – Insertion of Schedule F7. Waters of the Yarra Catchment [22 June 1999]
- Variation to the State Environment Protection Policy (Waters of Victoria) [4 June 2003]

The purpose of the SEPP (WoV) [clause 5] *is to help achieve sustainable surface waters by setting out the environmental values and beneficial uses of water that Victorians want, and the environmental quality required to protect them.*

The SEPP (WoV) is an important policy document for this project where the point of discharge for groundwater is the surface waters of the Yarra Port or Hobsons Bay.

3.2.3 SEPP Prevention and Management of Contaminated Land (SEPP PMCL)

The Victorian Government (June 2002) *State Environment Protection Policy - Prevention and Management of Contamination of Land* [SEPP (PMCL)] (varied in 2013) provides the framework for the protection of land and associated beneficial uses throughout Victoria. This policy allows for a consistent approach to the prevention of contamination of land, and clean-up of pollution of land in Victoria, and sets environmental quality indicators and objectives for each beneficial use. The SEPP (PMCL) defines certain land use categories and associated beneficial uses of land to be protected.

It should be noted that regardless of the proposed or potential future site use, in order to issue a Certificate of Environmental Audit (CoEA) for a site, an assessment of all beneficial uses of land is required. These land use scenarios defined in SEPP (PMCL) are as follows:

- Parks and reserves
- Agricultural
- Sensitive use (high density)
- Sensitive use (other)
- Recreation/open space
- Commercial
- Industrial

The beneficial uses that are protected for a site where any land use is being assessed are as follows:

- Maintenance of ecosystems
- Human health
- Buildings and structures
- Aesthetics
- Production of food, flora and fibre

3.3 National Environment Protection Measure

The National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM) is the premier guidance document in Australia for the assessment of site contamination. The NEPM is made under the *National Environment Protection Council Act 1994* and is given effect by individual legislation and guidelines in each state and territory. In Victoria, these include the regulatory frameworks established in the relevant State environment protection policies.

The NEPM guidance document was subject to a review process that commenced in 2004 and concluded with the NEPC approving an amending instrument to the 1999 NEPM in April 2013 (NEPC, 2013, *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*). The amended 2013 NEPM guidance came into effect on 16 May 2013. The amendment includes repealing all the original schedules to the 1999 NEPM guidance and the substitution of new schedules. Implementation of the amended 2013 NEPM is the responsibility of each state jurisdiction.

It is noted that the SEPP (PMCL) was varied on 24 September 2013 to capture modifications to the schedules within the NEPM.

3.4 EPA Guidelines

As noted above, EPA is responsible for the publication of guidelines to further assist stakeholders to understand their environmental obligations and provide advice relating to compliance.

EPA guidelines which are most relevant to this project and which describe the procedural elements for establishing whether groundwater has been cleaned up to the extent practicable are discussed in the following sections.

3.4.1 EPA Publication 759.3

EPA Publication 759.3 *Environmental auditor (contaminated land): Guidelines for issue of certificates and statements of environmental audit* (December 2015) is relevant to this project as it includes guidance to auditors regarding expectations and interpretation of CUTEP process. This project is not subject to a statutory environmental audit, however, certain elements of the project reference the procedural steps in establishing groundwater pollution, the clean up of groundwater pollution and groundwater quality restricted use zones.

3.4.2 EPA Publication 840.2

EPA Publication 840.2 *The Clean Up and Management of Polluted Groundwater* (April 2016) provides details on EPA's requirements and expectations for developing and implementing the clean up and management of polluted groundwater to ensure the protection of human health and the environment. Where polluted groundwater has been identified, EPA's role is to require clean up of the pollutants. If it is impracticable to clean up groundwater to the level needed to restore beneficial uses, EPA may accept that clean up to the extent practicable has occurred and that, subject to appropriate ongoing management, further clean up is not required.

When clean up to protect beneficial uses is not practicable (or where clean up has not yet occurred or is currently occurring), polluted groundwater should be managed to ensure the protection of human health and the environment.

3.4.3 EPA Publication 862

As noted above, the SEPP (GoV) allows for the establishment of groundwater quality restricted use zones (GQRUZ) as a tracking and information tool to be applied when the beneficial uses of groundwater are precluded due to pollution. EPA Publication 862 *Groundwater Quality Restricted Use Zone* (July 2002) discusses the various aspects and impacts of GQRUZ for Victorians.

3.4.4 Other Relevant Publications

Other relevant EPA Publications include, but are not necessarily limited to, the following:

- Environment Protection Authority (EPA) Victoria, 2009. *Industrial Waste Resource Guidelines 621 (IWRG621) – Soil Hazard Categorisation and Management*.

- EPA Victoria, 2009b. IWGR701 – *Sampling and Analysis of Waters, Waste Waters, Soils and Waste*.
- EPA Victoria, 2009c. IWGR702– *Soil Sampling*.
- EPA Victoria, 2006. EPA Publication 668 – *Hydrogeological Assessment (Groundwater Quality) Guidelines*.
- EPA Victoria, 2000. EPA Publication 669 – *Groundwater Sampling Guidelines*.

4.0 Site Setting

The precinct is located in the south-west of Melbourne and is bound by Lorimer Street to the north, Westgate Freeway to the west and south, and Citylink/Bolte Bridge to the east. The Yarra River is beyond Lorimer Street at the northern boundary of the precinct.

The precinct is generally used for heavy and light commercial and industrial processes which are described further in **Section 4.1**. The following table summarises the relevant precinct details. Please refer to **Figure F2** for the current zoning and **Figure F3a** and **F3b** for overlay conditions across the precinct.

Table 1 Site Information

Precinct	Area (ha)	Municipality	Current Zoning	Current Overlays
Employment	245	City of Melbourne	IN1Z C2Z PPRZ SUZ3 PUZ1 Road Zone	ESO

Notes:

Overlays: ESO = Environmental Significance Overlay,

Zoning: IN1Z = Industrial Zones, PPRZ = Public Park and Recreation Zones, PUZ1, PUZ2, PUZ4, PUZ6 = Public Use Zones, Road Zone = Road Zone Category 1, C2Z = Commercial 2 Zone, SUZ3 = Special Use 3 Zone.

4.1 Overview of Current and Historical Land Uses

Golder (September, 2016) lists former and current land uses for the Employment Precinct. Rather than repeat this work and re-list all of these former and current land uses, AECOM has reviewed them when assimilating our regional historical information to ensure there are no significant differences. Please refer to **Appendix A** for the original table prepared by Golder.

We note that, whilst it is important to understand where the possible point sources of contamination exist across the sub-precincts on an individual 'site by site' basis, this Desktop Study is regionally focused. As such, a holistic approach to assessing current and historic land uses is required.

Current and historical uses across the precinct are also summarised on **Figures F4** and **F5** and further described in the following sections. The sources of information used to develop these figures include Melways maps, Council records, MMBW maps, information from the Public Records Office of Victoria, aerial photographs, information obtained from surrounding audit reports and Golder (September, 2016).

4.1.1 Historical Land Use Overview

As described in AECOM (August, 2015) and Biosis (June, 2013), Aboriginal occupants of the Fishermans Bend area may have travelled regularly across the precinct prior to mid-1800s, however, travel along the south side of the Yarra River would have been difficult due to swamps and thick tree scrub. This is supported by our observations made in **Section 5.3** regarding the presence of swamp land in 1864. Biosis (June, 2013) further refers to a series of shallow swamps and wetlands along the line of the present Westgate Freeway, which may have provided good camp sites. The observation of low lying swamps and proximity to Melbourne is important, as the precinct was seen as a convenient dumping ground for fill and rubbish. It also later attracted industries that were generally shunned from the commercial and residential parts of Melbourne, as described below.

4.1.1.1 Manufacturing Land Use

The historical land use of the precinct indicates that it was broadly developed during the gold rush period prior to the 1900s, and established as an industrial precinct in the 1930s (Golder, September, 2016).

The precinct was originally used for advanced manufacturing with early industry led by GM Holden (GMH) automotive production that prompted the development of supporting automotive materials supply industries. The beginning of World War 2 (WW2) drove private aerospace development and the mass production of war goods in the precinct, with the purpose of building military aircraft. By 1938, an airfield in the western half of the precinct and supporting factories were established, with the Government Aircraft Factory built in 1939 to share the airfield facilities (Golder, September 2016).

The 1950s saw the mass production of consumer goods including, but not limited to, personal GMH and AutoCraft cars, Kraft consumer items, gypsum, farming machinery, refrigeration units, timber yards and metal products (Golder, September 2016). Significant engine manufacturing plants, storage and testing facility expansion was experienced during this development phase. This period saw the diversification of the precinct, with the Port Melbourne municipal tip operating during the 1960s and 1970s in the southern areas, along with other businesses including the Melbourne International Shooting Club.

4.1.1.2 Post 1990s Industrial Activities

Industrial change has seen the renewal of historical industry, business park development and incorporation of new industry in the precinct following the inception of the Environmental Audit System in Victoria (1990). The 1990s saw a change in the Aeronautical Research Laboratory to the Department of Science and Technology, and a shift to the services sector has resulted in the development of numerous business parks across the precinct with warehouse storage facilities, the BMW workshop, logistics, technology and light manufacturing, and cement and plaster production identified.

Golder (September, 2016) have identified various records of both historical and current fuel storage tanks, of which many above ground and underground storage tanks have been noted as removed or present on the precinct. Uses include diesel, petroleum, waste oil, kerosene, jet fuel and unknown purposes.

4.1.2 Current Land Use Overview

As seen on **Figures F4**, notable current land uses across the precinct includes:

- Automotive industries including vehicle manufacturing plants, car dealerships, auto mechanics and other vehicle services.
- Manufacturing industries such as timber yards, printing works plastic and packaging manufacturing, cement and concrete works.
- Transport and logistics industries including container and freight services, distribution centres storage and warehousing.
- Various other industrial and commercial uses such as Kraft, Petrol Stations
- Public infrastructure and facilities including Westgate parklands and reserves and Melbourne International Karting Complex, Melbourne International Shooting Club and roads.
- Heavy industrial land use at Boeing Aerostructures Australia (Boeing), as described below.
- Heavy industrial land use at the Defence Science and Technology Organisation (DSTO) site, as described below, including aeronautical and chemical research.
- Pockets of vacant land also exist across the precinct.

4.2 Key Land Holdings

The Employment Precinct covers an area of approximately 245 hectares. The precinct itself generally comprises of a mixed use between heavy and light industrial and commercial landholdings, as well as public parks, however there are currently significant land holdings occupied by Boeing, DSTO, General Motors Holden and Parks Victoria.

Boeing Aerostructures Australia (Boeing)

Representing approximately 9% of the total area of the Employment Precinct, Boeing is Australia's only designer and manufacturer of structural composite components for Boeing's commercial airplanes. The unit's capabilities include design and analysis, materials and process technology, testing, structural bonding, resin infusion, non-destructive testing, automated assembly and paint. Boeing Aerostructures Australia's capabilities at Fishermans Bend are complemented by the on-site support of Boeing Research and Technology-Australia, engaging in advanced composite and automation programs.

As the Boeing site occupies approximately 21 hectares of the Employment Precinct and noting its former and current heavy industrial use, the site has potential to influence and impact groundwater flow and contamination through previous and existing infrastructure, as well as past and recent uses that may have resulted in soil and groundwater impact.

Noting that the objective of this assessment is to gain a greater understanding of regional groundwater quality throughout the Employment Precinct, due to the size of the Boeing site and the influence that this may have on groundwater quality within the Employment Precinct, this will need to be considered in preparation of the Sampling and Analysis Quality Plan (SAQP).

Defence Science and Technology Organisation (DSTO)

DSTO is located within the Employment Precinct and was previously undeveloped swamp land. DSTO represents approximately 13 hectares of the overall employment precinct. The DSTO facility was first developed as an aeronautical and chemical research facility in 1939. Activities carried out at the site include general chemical use in workshops, bulk chemical storage in aboveground and below ground storage tanks and the use of radioactivity in laboratories. The site also contained a former solvent disposal facility which ceased operation in 1980.

As the DSTO site occupies approximately 6% of the Employment Precinct and noting its former heavy industrial use and experimental facilities, the site has potential to influence and impact groundwater flow and contamination through previous and existing infrastructure, as well as past and recent uses that may have resulted in soil and groundwater impact.

Noting that the objective of this assessment is to gain a greater understanding of regional groundwater quality throughout the Employment Precinct, due to the size of the DSTO site and the influence that this may have on groundwater quality within the Employment Precinct, this will need to be considered in planning and understanding future assessments.

General Motors Holden (GMH)

GMH is an Australian automobile manufacturer that operates in Australia and is headquartered in Fishermans Bend within the Employment Precinct. Holden represents approximately 43 hectares of the overall Employment Precinct. The Holden facility in Fishermans Bend has a varied history over 80 years, since operations commenced in 1936, although it was not until 1948 that full scale engine building commenced across the site.

As the Holden site occupies approximately 18% of the Employment Precinct and noting its former heavy industrial use, the site has potential to influence and impact groundwater flow and contamination through previous and existing infrastructure, as well as past and recent uses that may have resulted in soil and groundwater impact.

Noting that the objective of this assessment is to gain a greater understanding of regional groundwater quality throughout the Employment Precinct, due to the size of the Holden site and the influence that this may have on groundwater quality within the Employment Precinct, this will need to be considered in planning and understanding future assessments.

Westgate Park (Parks Victoria)

The site of the current Westgate Park represents approximately 25 hectares of the Employment Precinct. Prior to its commissioning of a State Park in 1985, the site had multiple uses including a race track, sand mine, aerodrome and rubbish dump.

As the Westgate Park occupies over 10% of the Employment Precinct and noting its varied uses, particularly as a quarry and landfill, the influence that this may have on groundwater quality within the

Employment Precinct, this will need to be considered in planning and understanding future assessments.

4.3 Existing Sewer and Drainage Infrastructure

The Employment Precinct has the potential to be influenced by numerous sewers and drainage infrastructure, particularly noting the shallow depth of groundwater within the precinct.

Based on our review of information obtained by the City of Melbourne, the depth of the local drainage network appears to be variable across the precinct. These drainage systems should be investigated further if discrepancies in groundwater elevation are apparent along potential drainage lines (such as roads) during sampling works.

From further review of existing reports (including Environmental Audit reports), no reliable information could be determined in relation to whether or not such assets are having a significant regional influence on the flow of shallow groundwater within the precinct, however, this should be further considered following the outcome of intrusive investigations and sampling.

The Hobsons Bay Main, which falls westward under the Yarra River and defines the southern boundary of Westgate Park, was constructed at approximately -10 Australian Height Datum (mAHD) (i.e. approximately 6-7 m below the shallow groundwater table).

According to the Melbourne Water Community Bulletin (24 May 2013), the original Melbourne Main Sewer (first built between 1894 and 1897) was constructed from a variety of materials ranging from bluestone, brick, cast iron and Portland cement and concrete sourced from local suppliers. Given the date of construction of the Hobsons Bay Main (commenced late 1893), it is likely that it too was constructed of similar materials. Therefore, due to the age and likely construction methodology, it is possible that the Hobsons Bay Main has integrity issues, which may result in an influence to the flow of groundwater at the precinct and movement of chemicals of potential concern (CoPC) via groundwater.

The location of the Hobsons Bay Main is provided on **Figure F6**.

4.4 Topography

AECOM has reviewed topography maps on Land Channel from a regional perspective. The topography across the entire precinct is generally relatively flat with a gradual decline in elevation towards the Yarra River to the east and north, and to Hobsons Bay located to the south of the precinct.

The elevation of the precinct was found to range from 0 - >4 mAHD. This is likely to result in a slightly variable depth to the underlying groundwater table.

The main topographic observations made across the entire precinct include:

- The area immediately south of the precinct has been built up for construction of the freeway.
- The gradient of the precinct continues to drop consistently towards the level of the Yarra River, which is located to the east and north of the precinct.
- There is a slight plateau at the southern end of the precinct at Westgate Park and the Melbourne International Karting Complex.

AECOM has also made the observations below when comparing the topography maps with the preliminary estimates of fill thickness provided in Golder (September, 2016). Note that the fill thickness estimates provided were developed using a high resolution LiDAR (Light Detection and Ranging) survey, and the observations made below are provided to assist in interpretation of groundwater flow across the precinct following groundwater gauging/sampling works.

- The precinct has been extensively influenced by historical filling across the entire precinct, with fill thickness estimated at 1 – 2 meters below ground level (mBGL) in the area bordering the Yarra River, and increasing to thicknesses in excess of 4 mBGL at the inland southern extent of the precinct.

- The topography of the precinct appears to have been significantly influenced by historical fill activities. This fill thickness appears to follow a typically natural gradient towards the banks of the Yarra River.
- The topography to the south of the precinct appears to have large fill thicknesses (up to 4-5 m in thickness) influenced by historical filling activities along the freeway and in areas where quarrying and excavations for construction have historically occurred. Historical operating landfills would have a range of fill material including, but not limited to putrescible and industrial waste (Golder, September 2016).
- The topography of the former Commonwealth Aircraft Corporation (CAC) Airfield and Runways indicates that low lying areas of the runway were elevated with fill material (including along Todd Road), and further areas in the central precinct were also infilled up to 4m to support industrial expansion (Golder, September 2016). The source of the fill material in these locations is not known.

4.5 Geological Conditions

The precinct is located in the Yarra Delta, which is comprised of a number of flat lying sedimentary deposits. Together these deposits are known as the Yarra Delta group.

The Yarra Delta Group is described as dipping in a south-westerly direction due to an erosion surface which has been cut into the Tertiary and Silurian aged formations underlying the Yarra Delta Group (Nelson, 1996).

As described below, the precinct is located above the Yarra Delta Group on Recent Quaternary aged sediments likely to have been deposited by the Yarra River within the past 2 million years.

According to the Melbourne 1:63,360 Geology Map and the Melbourne 1: 250,000 Geology Map, the majority of the precinct is underlain by Quaternary aged Port Melbourne Sands consisting of raised beach ridges, bedded and cross-bedded well sorted sand, shelly sand and minor silty or clayey sand. The Melbourne and Suburbs 1:31,680 Geology Map also indicate the presence of alluvial fields, mud flats, beach and estuarine deposits.

Based on our reviews of Audit reports across the precinct (**Section 5.5**, limited reviews of groundwater bores across the precinct (**Section 4.8**), and the information obtained in Golder (2016), the fill thickness overlying the Port Melbourne Sands across the precinct is expected to be highly variable but generally between up to 2 meters (m) to greater than 4m thickness. AECOM note that fill is likely to be considerably thicker in areas where old landfills or quarries were present (as described in **Section 4.2**).

The fill on the precinct is likely to overlie the Quaternary aged Port Melbourne sand (Qrp) This has been described as raised beach ridges; bedded and cross-bedded well sorted sand, shelly sand, minor silty or clayey sand. The following geological units underlie the Port Melbourne Sand (from youngest to oldest):

- Coode Island Silt (Qri) which is described as silt, silty clay, sandy clay dark grey with minor peat and shell beds.
- The pleistocene aged Fishermans Bend Silt (Qpf) described as silty clay, pale grey to pale brown, with some minor sandy clay and silt the upper part of the formation is mottled and fissured.
- The pleistocene aged Moray Street Gravel (Qpg) described as quartz gravel and sand, with minor silt, clay and carbonaceous clay.
- The tertiary aged Newport Formation (Tmn) described as silt, grey and green, with calcareous silt, silty clay and minor limestone.
- Miocene aged Older Volcanics (Tvo) described as dense blue / black basalt.
- The Eocene aged Werribee Sand (Tew) described as sand, sandy and silty clay, with pyritic and lignitic quartz sand.

The bedrock below the precinct and the surrounding area is the Upper Sulurian aged Dargile formation which is described as sandstone, siltstone, minor shaley siltstone which is thinly and regularly bedded. Please refer to **Figure F7**.

During our geological review, we attempted to identify any potential ancient river channels or waterways at the precinct that could potentially influence preferential pathways. As described above, and as seen on **Figure F7**, these features are not apparent in the study area. However, additional features may (such as re-alignment of the Yarra River to the north-west of the precinct, deep sewer lines and filled quarries) influence preferential pathways.

4.6 Hydrogeological Conditions

According to the 12 Audit reports reviewed within 1 km of the precinct (**Section 5.5**), the average depth to groundwater in the Port Melbourne Sands is approximately 2 meters below ground level (mBGL). Based on the topography of the precinct, regional groundwater within the local aquifer system is expected to flow to the north towards the Yarra River or west towards Port Phillip Bay.

As detailed in **Section 4.7**, and according to the *Victorian Groundwater Beneficial Use Map Series: South Western Victoria, Water Table Aquifers* (DCNR, 1995), the concentration of total dissolved solids (TDS) in groundwater in the upper aquifer in the study area is expected to range between 1,001 mg/L and 3,500 mg/L which falls within “Segment B” according to the SEPP (GoV). The following protected beneficial uses are considered relevant under this segment:

- Maintenance of Ecosystems
- Potable mineral water supply
- Agriculture, parks and gardens
- Stock watering
- Industrial water use
- Primary contact recreation
- Buildings and structures

Section 6.4 provides a discussion on the TDS values reported during Audits undertaken within 1 km of the precinct.

Based on the 12 Audit reports reviewed as part of this Desktop Study (**Section 5.5** groundwater within the precinct has a high potential to be influenced by natural and anthropogenic preferential pathways (e.g. deep sewer lines, filled quarries, former swamps and low lying wetlands that have since been filled).

Brief hydrogeological descriptions for each of the geological units discussed above are listed in **Table 2** below. Classification and hydraulic conductivities have been sourced from Leonard (1992).

Table 2 Hydrogeological Descriptions for each Geological Unit

Geological Unit (Youngest to Oldest)	Brief Hydrogeological Description
Port Melbourne sand (Qrp)	Unconfined aquifer. Medium porosity. $K = 10^{-6}$ to 10^{-4} m/s.
Coode island silt (Qri)	Aquitard. Medium porosity. As there are sand layers and lenses, the horizontal hydraulic conductivity ($K_h = 10^{-8}$ to 10^{-7} m/s) is generally greater than the vertical hydraulic conductivity ($K_v = 10^{-9}$ to 10^{-8} m/s).

Geological Unit (Youngest to Oldest)	Brief Hydrogeological Description
Fishermans Bend silt (Qpf)	Aquitard. Medium porosity. As there is fissuring, the vertical hydraulic conductivity ($K_v = 10^{-8}$ m/s) may be greater than horizontal hydraulic conductivity ($K_h = 10^{-9}$ to 10^{-8} m/s).
Moray Street Gravel (Qpg)	High yielding confined aquifer. Medium porosity. Hydraulic conductivity is likely to range between 10^{-5} and 10^{-4} m/s.
Newport formation (Tmn)	Aquitard. Medium porosity. Hydraulic conductivity is likely to range between 10^{-9} to 10^{-7} m/s.
Older Volcanics (Tvo)	Confined aquifer. Low to high hydraulic conductivity depending on the extent of weathering ($K = 10^{-7}$ to 10^{-5} m/s).
Werribee sand (Tew)	Potentially high yielding aquifer. Medium porosity. Hydraulic conductivity is likely to range between ($K = 10^{-8}$ to 10^{-5} m/s).

4.7 Tidal Information

The following section refers to tidal information that is reported by the Bureau of Meteorology (BOM) in meters above sea level (MASL).

Note that in 1971 the mean sea level for 1966-1968 was assigned the value of 0.0 m on the Australian Height Datum (AHD). The resulting datum surface, with minor modifications in two metropolitan areas, has been termed the AHD.

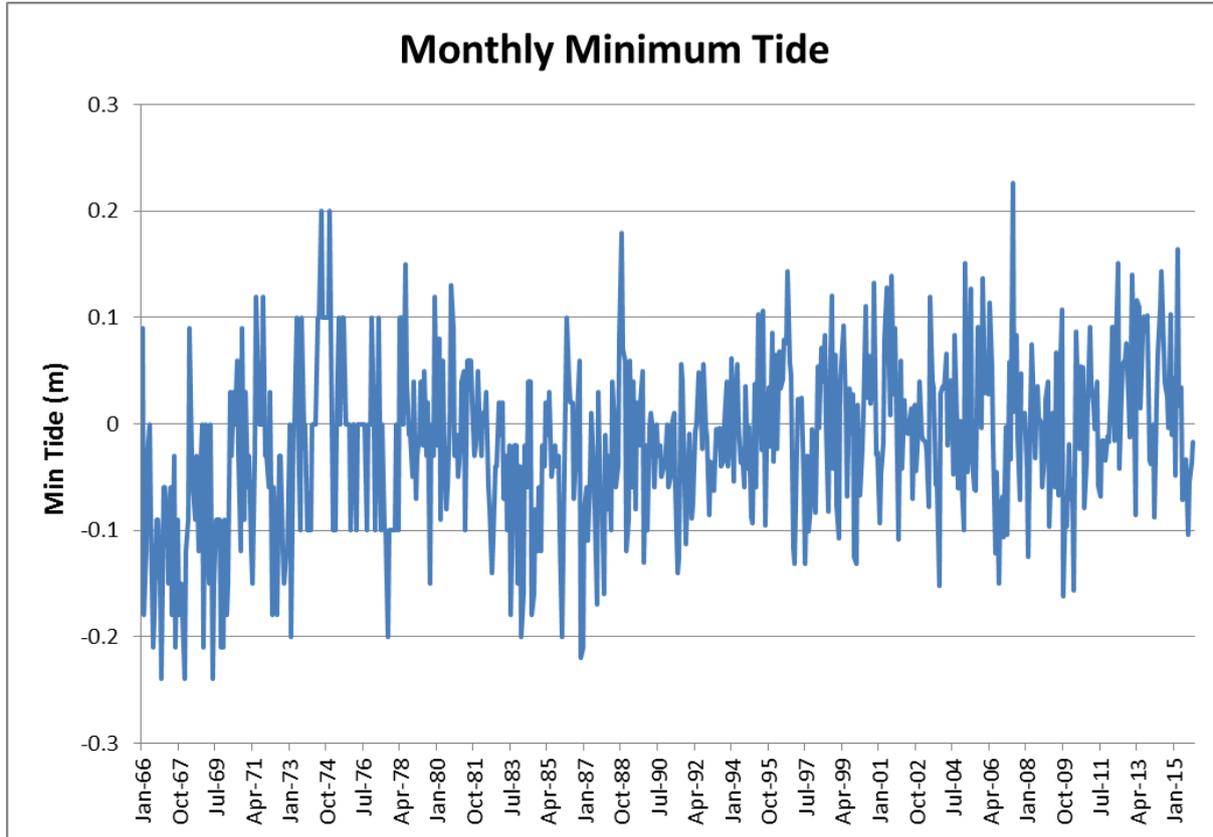
Groundwater depth and elevation reported in future groundwater investigations should be reported in both meters below ground level (mBGL) and mAHD. In order to assess tidal influence, the magnitude of, and trends in, fluctuations of tidal data (reported by BOM in MASL) during future gauging/sampling events should be compared to the magnitude of, and trends in, groundwater depth and elevation data (in mBGL and mAHD) obtained during that time, as AHD is roughly equivalent to mean sea level.

AECOM has reviewed the BOM *Monthly sea levels for Williamstown - 1966 to 2015* and makes the following observations:

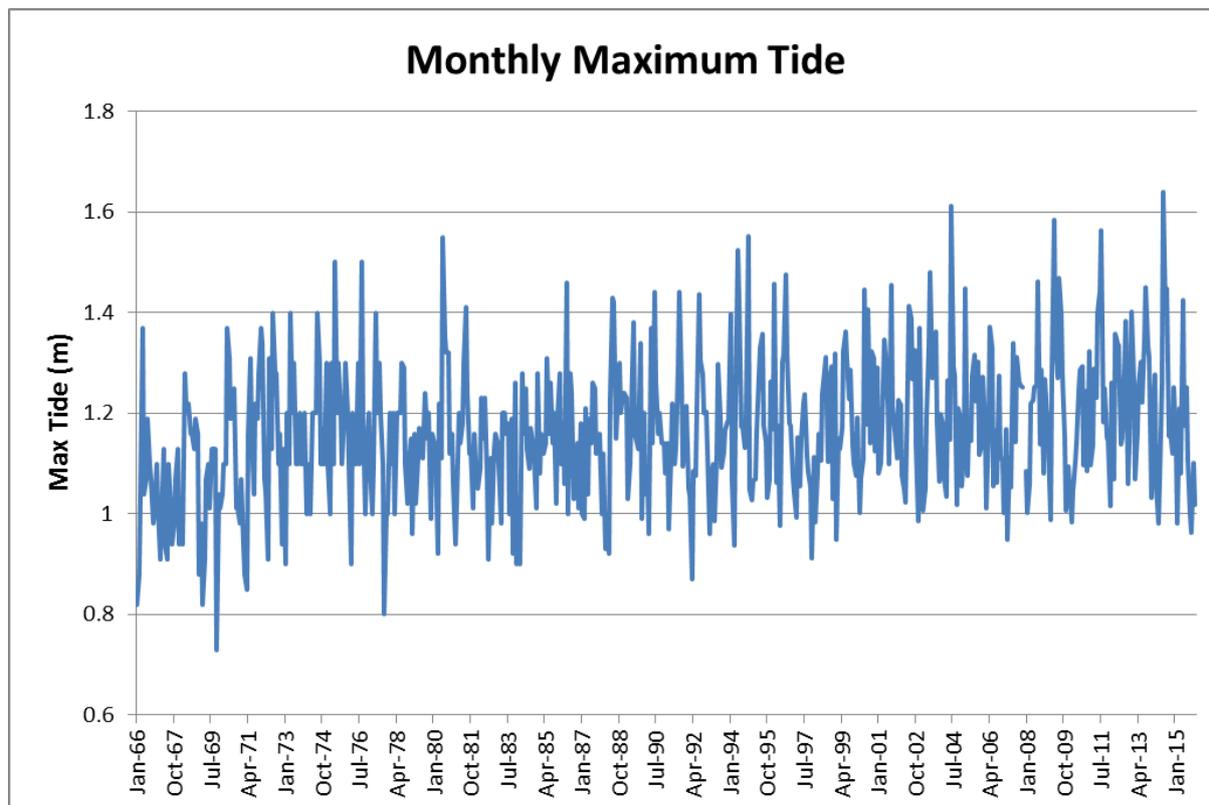
- The mean, maximum and minimum tide heights near the study area have been fluctuating throughout the review period (1966 to 2015), however, there also appears to be general increasing trend in tide heights over this time.
- The lowest of the minimum tide heights was -0.24 MASL, which occurred at 1300 hours (1pm) on 2 December 1966.
- The highest of the maximum tides was 1.639 MASL, which occurred at 0400 hours (4am) 24 June 2014.
- The highest of the mean tides was 0.759 MASL, which occurred in December 2005.
- The lowest of the maximum tides was 0.73 MASL, which occurred in October 1969.

- The highest of the minimum tide heights was 0.227 MASL, which occurred in May 2007.
- The average monthly sea level is 0.554 m.

Graphs 1 to 2 below depict the Monthly Minimum Tides and Monthly Maximum Tides between 1966 and 2015.



Graph 1 Monthly Minimum Tide between 1966 and 2015



Graph 2 Monthly Maximum Tide between 1966 and 2015

Based on the data presented above in relation to tidal variation (up to 0.759 MASL), the elevation of the precinct (0 - >4 mAHD) and the anticipated average depth of groundwater (approximately 3 mBGL, based on the results of groundwater sampling across the other four precincts), we would expect that tides would increase and decrease the groundwater elevation at the precinct.

We note that the tidal response observed during Stage 1 of this project was found to be very minimal within the well locations along the transects investigated. However:

- Based on the data presented above in relation to tidal variation (up to 0.759 MASL), the elevation of the precinct (0 - >4 mAHD) and the average depth of groundwater (approximately 3 mBGL), groundwater elevation is expected to fluctuate at the precinct due to rising and lowering tides in the Yarra River.
- The tidal influence is expected to be greater in the Employment Precinct (compared to the other four precincts), as it is closer to the Yarra River to the north of the precinct.

Further consideration of tidal influence on the regional groundwater quality including the impacts of regular flushing of water, salinity and migration pathways needs to be further assessed as part of future investigations.

4.8 Existing Groundwater Bores

A search of the Visualising Victoria's Groundwater (VVG) website (www.vvg.org.au) was conducted for registered bores within a 300m radius of the precinct. The search found 127 groundwater bores registered on the VVG website. Of these:

- 55 are reported to have a total groundwater well depth < 6 mBGL.
- 53 are registered as use for groundwater investigation purposes (ranging between 3 and 33.3 m – assumed to be 'below top of casing').
- 1 is registered as use for domestic and stock purposes (at 4 m).

- 3 are registered as use for industrial disposal purposes (ranging between 5 and 6.5 m).
- 49 are registered as use for observation purposes (ranging between 3 and 17 m).
- 17 are registered as use for 'non groundwater' purposes (ranging between 3 and 11.9 m).
- 2 are registered as 'unidentified use'.
- 2 registered bores have no comment in relation to use.

AECOM has not been able to obtain any information from Melbourne Water relating to any additional wells that they may own across the precinct.

The results of our search are presented in **Appendix B**.

As detailed above, AECOM has undertaken a preliminary review of the groundwater bore data to gain an overview of the spread of groundwater bores across the study area, and to ascertain which bores are potentially installed in shallow groundwater. This information was further used to identify existing / known groundwater bores on-site which are considered to be potentially useful to the sampling and analysis program that is to be conducted as part of the project. Furthermore, the information obtained on the registered groundwater bores across the precinct provides an understanding of the potential users of groundwater, which need to be considered in the conceptual understanding of the precinct and the assessment of possible receptors.

Our approach to determining potentially suitable groundwater bores was driven by four key elements including:

- Maximising precinct coverage.
- Likely screen interval (i.e. within the shallow groundwater table).
- Proximity to possible point source/s of contamination.
- Publically accessible.

AECOM identified 63 groundwater wells within a 300 m radius of the precinct to be potentially suitable for the groundwater investigation. We attempted to locate these existing groundwater wells across the precinct on 8 and 10 March 2016 in order to inspect each of them, and confirm whether or not they are in a condition that would enable groundwater sampling. During this process, AECOM identified 3 existing groundwater wells that are potentially suitable for the groundwater investigation.

It is recommended that the information obtained from the VVG website be reviewed prior to undertaking any groundwater drilling works at the precinct to obtain an appreciation of the expected stratigraphy in the immediate area of identified drilling locations, to assist in understanding expected conditions which will be valuable during installation and well construction.

5.0 Historical Review

5.1 Priority Sites Register (PSR)

Priority sites are sites for which the EPA has issued a Clean-up Notice pursuant to Section 62A, or a Pollution Abatement Notice pursuant to Section 31A or 31B (relevant to land and / or groundwater) of the *Environment Protection Act 1970*. These are generally sites where pollution of land and / or groundwater presents a potential risk to human health or to the environment. The condition of these sites is not compatible with the current or approved use of the land without active management to reduce the risk to human health and the environment.

A review of the PSR on 8 March 2017 showed that there is one property inside the Precinct, a current service station located at 1 West Gate Freeway, Port Melbourne which requires assessment and/or clean up. There are eight properties located within 1 km of the precinct boundaries which are listed on the PSR. A brief summary of the relevant PSR sites is given below in Table 3

Table 3 Summary of sites on PSR

Notice no	Address	Council	Location from Precinct	Issue
90006917	1 West Gate Fwy, Port Melbourne	Melbourne City Council	On-site	Current Service Station
9006663	2 West Gate Fwy, Port Melbourne	Melbourne City Council	50 m south	Current Service Station
90006320	2A Francis St, Yarraville	Maribyrnong City Council	500 m north west	Former Industrial Site
90006713	29 Francis St, Spotswood	Hobsons Bay City Council	700 m north west	Current chemical storage facility
90004781	325 Whitehall St, Yarraville	Maribyrnong City Council	900 m north west	Former Industrial Site
90006664	325 Whitehall St, Yarraville	Maribyrnong City Council	900 m north west	Former Industrial Site
90001325	Burleigh St, Newport	Hobsons Bay City Council	700 m west	Current Petroleum Storage Site
90006881	411 Douglas Pde, Newport	Hobsons Bay City Council	800 m west	Current Petroleum Storage Site
90007126	18-24 Drake St, Spotswood	Hobsons Bay City Council	850 m west	Former Petroleum storage site

5.2 Historical Aerial Photographs

AECOM has reviewed historical aerial photographs that range between 1951 and 1988. Please refer to **Figures F8 –F12** for a copy of these aerial photographs, and **Table 4** for a summary of our key observations of the photographs. Particular interest has been paid to any apparent reclaimed land, quarries, landfills, runways and former water bodies.

Table 4 Summary of Observations from Review of Aerial Photographs

Year	Key Observations
1951	<ul style="list-style-type: none"> The most prominent infrastructure is the runway in the central eastern side of the precinct, surrounded by vacant land. The area south of the runway in the east appears to be occupied by undeveloped lake/swampland areas. Industrial development is fairly well established along Lorimer Street and the eastern side of the precinct.
1962	<ul style="list-style-type: none"> The runway in the eastern side of the precinct is still visible, although it seems it was not in use. The density of industrial development in the eastern side of the precinct seems to be increased. The lake/swampland in the southwest of the runway is also visible.
1970	<ul style="list-style-type: none"> The runway in the western side of the precinct appears to be transformed into roads, with construction of buildings in the western and eastern side. There is some vacant land in the central of the precinct (on both sides of the roads/historical runway). The industrial development in the eastern side of the precinct appears to be unchanged. Visible signs of construction around the wetland/lake in the southwest corner of the precinct.
1982	<ul style="list-style-type: none"> Visible signs of construction around the roads in the central and south western side of the precinct. The south western corner is changing to become the current Westgate Park. The industrial development in the eastern side of the precinct appears to be unchanged. The West Gate Freeway south of the precinct is visible with the Lorimer Street exit ramp in place.
1988	<ul style="list-style-type: none"> Majority of the precinct remains unchanged. It is noted that the available aerial photograph was incomplete and does not show some parts in the eastern side.

5.3 Council Records

As detailed in **Table 1**, the precinct lies within the City of Melbourne.

AECOM has contacted the City of Melbourne and attempted to gather as much information from the Council in relation to the development of the precinct, underground services, drainage works and reclaimed land. The City of Melbourne has indicated that they do not have a Historian and there appears to be limited historical information available from the City of Melbourne in relation to the precinct. We have been provided with two survey images from 1864 and 1948 (**Figures F13** and **F14** respectively). The results of this investigative work are summarised in the following sections.

The 1864 image shows some apparent swamp land within the following areas of the precinct:

- A comparatively larger swamp in the south west extending beyond the precinct boundary.
- Group of 3-4 small swamps in near north east and south east boundaries.
- A single elongated swamp near the northern boundary.

In addition, the image identifies the Yarra River to the west, north and north-east of the precinct. Further north again is an area of land that appears to have been cleared.

The 1948 image indicates that the Yarra River has been diverted to the north of the precinct since 1864. It is understood that this is due to the creation of Coode Island as a result of the excavation of the Coode Canal in 1886 between a point on the Yarra River just below the Victoria Dock to just above the Stony Creek Backwash. This work cut off a bend of the Yarra previously known as Fishermans Bend, and a stretch known as Humbug Reach and reduced the trip from the bay to the Melbourne docks by about two miles (Biosis, 2013).

We can therefore infer that a significant amount of dredging was required to complete this work. According to writing on the image, material was dredged to a depth ranging between approximately 20 and 31 feet (or 6.09 and 9.45 m). Dredging also occurred in Hobsons Bay to depths between approximately 34 and 36 feet (10.37 and 10.98 m).

The area of potentially cleared land to the north of the Yarra River that was identified in the 1864 image appears to have been infilled. One possibility is that the material dredged from the Yarra River was used to fill this area. However, it is also not unreasonable to assume that some of the dredged material was used across Fishermans Bend, particularly as the previously identified swamp areas are no longer present in the 1948 image. Neither of these activities can be confirmed based on the evidence available.

Additional observations of the 1948 image include:

- Development of some industrial buildings/warehouses near the northern boundary of the precinct.
- Presence of the Golf Course in the eastern side of the precinct.
- Development of roads, approximately 200m east of the eastern boundary of the precinct.

5.4 Public Records Office of Victoria (PROV)

The PROV was used for sourcing Melbourne Metropolitan Board of Works (MMBW) Detailed Base Plans for the Employment Precinct. This information is discussed below.

Other resources sometimes available at the PROV includes Local Parish Plans that record details about the usage of Crown Land properties and historical survey field books that show historical levels throughout the precinct.

AECOM undertook a search for this material, however, there was little available with relevance to the precinct and / or the Desktop Study.

5.4.1 Melbourne Metropolitan Board of Works Plans

The MMBW detailed base plans dated 1896 – 1933 were reviewed for the entire precinct in order to identify significant historical point source facilities, significant conduits for groundwater / contaminant movement, and historical sewer lines that could contribute to regional contamination or locally influence groundwater flow conditions.

The following noteworthy observations can be made:

- The information obtained from the MMBW maps appears to be fairly consistent with historical aerial photographs, the wetlands map and the current understanding of the placement of sewer/stormwater lines. Note that the shape of the former landfills/quarries on these figures are approximate (only) as they are based on historical aerial photographs. It is likely that some of these landfill/quarry areas were once joined in places.
- A 24" WAG Shell fuel pipeline is seen to located in close proximity of south west corner of the precinct parallel to a gas transmission pipeline and Hobsons Bay Main Sewer.
- It is clear on these figures that the areas of former swamp land and former landfills/quarries make up a large portion of land across the precinct.
- The aerodromes were once present on the precinct, as seen on **Figure F6**.

5.5 Review of Certificates and Statements of Environmental Audit

The EPA publishes a list of properties for which a Certificate or Statement of Environmental Audit (CoEA or SoEA) has been issued under Part IXD of the *Environment Protection Act 1970*. These Audits are referred to as 53X Audits, which are required when land proposed for a new use is potentially contaminated or already covered by an environmental audit overlay (EAO) within a planning scheme.

In addition, Environmental Auditors also conduct 53V Audits, which are a 'risk of harm' Audit, which is most commonly used by EPA to understand the risk to the environment posed by an industrial activity or to validate that cleanup of contaminated land or groundwater occurred.

A review of the list of environmental audits within 1 km of the precinct was undertaken on 8 March 2017. **Figure F15** shows the Audit reports identified as part of this Desktop Study, as well as the existing Groundwater Quality Restricted Use Zones across the study area.

A brief summary of each of these Audit reports is presented in **Appendix C**. In accordance with our proposed scope of works, a detailed review of 12 of the Audit reports was undertaken to gain a greater understanding of environmental conditions and issues typically encountered across the precinct.

The following initial detail was considered when selected the 12 Audit reports for review:

- Location and proximity to the precinct. Note that only five Audit reports have been prepared across the precinct area.
- Extent and quality of a groundwater assessment.
- Presence of a discussion on background and ambient groundwater conditions.
- Historical land uses and reference to possible point sources of contamination.
- Coverage of Audit reports across the precinct.

5.5.1 Summary of Audit Review Findings

Whilst there are some specific point source facilities across the precinct, there is a common theme in running through the Audit report findings, and that is that contamination exists on a regional scale from sources including natural geological breakdown, regional fill material and compromised sewers.

Some of the noteworthy points that are commonly made in the 12 environmental Audit report findings include the following:

- Groundwater aquifer yields are generally too low across the precinct to provide viable and sustained extraction for industrial uses, and the current number of extraction wells near the precinct is low.
- Significant tidal influences and influence by man-made features like sewer drains are seen, as demonstrated by groundwater levels and TDS concentrations.
- Most beneficial uses of groundwater within the precinct are not likely to be realised due to proposed high density land uses and the urban setting, thus groundwater clean-up is not always required for the issue of a Statement of Environmental Audit.
- Ecological receptors across the precinct are generally the Yarra River and Hobsons Bay, which are deemed unlikely to be significantly impacted by the amount of contaminant discharge.
- Reducing exposure pathways between contaminated fill material and future occupants is often recommended to be implemented via the importation of new fill or a sealed surface prior to occupation.
- The local groundwater table is generally similar to 0 m AHD, and as a result, local groundwater flow is highly influenced by sewers, the Yarra River and Hobsons Bay.

5.5.2 CARMS No. 73239-1

Table 5 CARMS 73239 Key Audit Information

Site Information	Detail
Precinct/Location	Employment - Onsite
Audit Site Address	224-260 Lorimer Street, Port Melbourne
Audit Date	30/6/2015
Previous Land Uses	Aeronautical manufacturing and maintenance
CoPCs	Chlorinated volatile organic compounds primarily Trichloroethylene (TCE), 1,1,1-Trichloroethane (1,1,1-TCA), Tetrachloroethene (PCE) and their degradation products, metals and metalloids, petroleum hydrocarbons, specific hydrocarbon compounds such as 1,4 dioxane, methyl ethyl; ketone and other contaminants such as acids, cyanide, dyes and resins
Audit Outcome	53V Recommendations –Commercial and Industrial
Average TDS reported	Range from 3,800 mg/L to 34,000 mg/L
Approximate depth to groundwater	1 to 8 MBGL
Hydraulic head influence from sewer or tides	Yes. Sewer likely acting as a drain.

Summary

The site was primarily used as an aeronautical manufacturing and maintenance facility from 1939 and prior to that was salt marsh and swamp land. At the time of the audit, the site was operated by Boeing Aerostructures Australia Pty Ltd as a design, testing and manufacturing facility for component parts used in aircraft.

Potential source areas associated with historical activities undertaken at the Site include clean lines, vapour degreasers, dichromate baths and metal plating activities, underground and above ground storage tanks, wastewater treatment and chemical use and storage.

Groundwater Conditions – Audit site

Groundwater flow on-site is roughly radial with a high point on the Site. Flow is interpreted to be towards the Yarra River in the north, and Westgate Park in the south. Groundwater levels were identified ranging from 1 mBGL to 8 mBGL in the Port Melbourne Sands aquifer. Sewer lines lower than groundwater levels were identified and as such may be draining shallow groundwater in places.

Groundwater Conditions – Background and Ambient

Expected TDS conditions based on published references were 1,000 – 3,500 mg/L. However average TDS values measured from sampled groundwater bores range from 3,800 mg/L to 34,000 mg/L depending on the PMS or CIS aquifer.

The contaminants showing exceedances included chlorinated volatile organic compounds (CVOCs), primarily TCE, 1,1,1-TCA, PCE and their degradation products, metals and metalloids, petroleum hydrocarbons, specific hydrocarbons compounds such as 1,4 dioxane and methyl ethyl ketone plus a number of other contaminants such as acids, cyanide, dyes and resins.

Conclusions

The audit concluded that there is no unacceptable risk posed by contaminants transported by or in groundwater or soil vapour to the following human receptors:

- Off-site aquatic food consumers
- Recreation users of the Yarra River bank and Westgate Park.
- On and off-site intrusive workers via inhalation or direct contact with groundwater.
- On and off-site commercial and manufacturing workers.

Site-derived groundwater contamination is not assessed as posing an unacceptable risk to the groundwater beneficial uses: Maintenance of Ecosystems - Highly Modified (i.e. the ecosystems of the adjacent Yarra River and the lakes in Westgate Park), agriculture, parks and gardens (i.e. Irrigation), and Buildings and Structures.

The Site conditions and the pattern of land use at and adjacent to the Site made the use of groundwater for 'Industrial purposes' on and adjacent to the Site unlikely.

Some uncertainties were identified during the conduct of the audit. These uncertainties were proposed to be addressed through completion of additional assessment work, modelling or interpretation. A Groundwater Monitoring Plan (GWMP) was developed to address remaining uncertainties: i.e.: in contaminant trends, where additional soil vapour assessment is warranted at locations where peak groundwater concentrations occur, where groundwater flow directions and pathways need to be refined, where unidentified contaminants may be present in soil vapour at low concentrations, and identification of total petroleum hydrocarbon (TPH) composition. The GWMP also identified proposed remedial actions to cut pathways between sources and receptors, and/or lessen the mass of contaminants being transported via groundwater or soil vapour.

5.5.3 CARMS No. 32409-1

Table 6 CARMS 32409-1 Key Audit Information

Site Information	Detail
Precinct	Employment - Onsite
Audit Site Address	Lot 1, ASTA Facility Lorimer Street, Fishermans Bend
Audit Date	25 March 1998
Previous Land Uses	Aeronautical manufacturing and maintenance
CoPCs	Chlorinated volatile organic compounds primarily TCE, 1,1,1-TCA, PCE and their degradation products, metals and metalloids, petroleum hydrocarbons
Audit Outcome	53 X Statement – High density Commercial and Industrial
Average TDS reported	No quantitative Information, referred as highly saline
Approximate depth to groundwater	1 – 1.5 mBGL
Hydraulic head influence from sewer or tides	Yes. Sewer likely acting as a drain.

Summary

The site has been used for the building of aircraft and related activities since 1939 followed by "restructuring", and subdivided into three lots, in 1995. The surrounding area is long-established industrial land, dominated by the aeronautics / aerospace precinct which has been present since at least 1939. There also appears to be considerable historical fill over much of the site.

Potential source areas associated with historical activities undertaken at the site include clean lines, vapour degreasers, dichromate baths and metal plating activities, underground and above ground storage tanks, wastewater treatment and chemical use and storage.

Groundwater Conditions – Audit site

The groundwater table was measured at approximately 1-1.5 m BGL across the site. Although regional groundwater flow under the site was known to be towards the Yarra River, i.e. to the west and north-west, elevations of groundwater on this site suggested that flow directions are primarily radial.

Conclusions

The audit concluded that there was evidence of contamination due to arsenic and other heavy metals at several locations in the surface fill. There was indication of lesser contamination with the solvent TCE and its degradation products, and minor hydrocarbon and heavy metal contamination in the groundwater beneath the site. However, all the concentrations were below the adopted criteria for Commercial and industrial use. Hence the Auditor opined that although contamination is present on the site, it remains suitable for commercial or industrial use, provided the contaminated soil remains covered and/or managed as described in the Statement of Environmental Audit.

5.5.4 CARMS No. 32409-2

Table 7 CARMS 32409-2 Key Audit Information

Site Information	Detail
Precinct	Employment - Onsite
Audit Site Address	Test Cells 1 and 2 of the ASTA Facility, Lorimer Street, Fishermans Bend, Port Melbourne
Audit Date	27 March 1998
Previous Land Uses	Aeronautical manufacturing and maintenance
CoPCs	Total Petroleum Hydrocarbons, Volatile Organic compounds, Polycyclic Aromatic Hydrocarbons, Metals like (arsenic, Cadmium, Nickel and chromium, and possible Tetrachloroethylene (TCE) derivatives
Audit Outcome	53X Statement –High density Commercial / Industrial
Average TDS reported	250 to 700 mg/L
Approximate depth to groundwater	1 – 1.5 mBGL
Hydraulic head influence from sewer or tides	Not reported.

Summary

The site has been used for the testing of aircraft engines since 1950s followed by "restructuring", and subdivided into three lots, in 1995. The surrounding area is long-established industrial land, dominated by the aeronautics / aerospace precinct, a car yard and an alloy foundry. There is also evidence of historic filling of the swampy terrain commonly in the form of building rubble, inert industrial and municipal refuse, clean soil and crushed rock.

Potential sources of contamination identified at the Audit site include spills and leaks from fuel test rigs, underground storage tanks, above ground storage tanks, underground fuel lines, triple interceptor traps, drum storage and transformers; potential migration of contamination from up-gradient surrounding areas and potential historic filling of low lying areas.

Groundwater Conditions – Audit site

The average depth of groundwater in the Port Melbourne Sands aquifer encountered at the Audit site was 1-1.5 mBGL, and direction of groundwater flow was generally north-northwest towards the Yarra River, which is approximately 100 m north of the Audit site over Lorimer Street.

Measured TDS ranged from 250 to 700 mg/L.

Groundwater Conditions – Background and Ambient

Groundwater underlying the site has been reported contaminated by arsenic, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds. The identified contamination of the groundwater is likely to be sourced from several locations mainly associated with the storage of Jet A1 fuel. However, arsenic and chlorinated hydrocarbons including chloroform and cis- 1,2-dichloroethene were also detected and are not associated with the storage of Jet A1 fuel. The source of these compounds is unknown.

No background groundwater samples were assessed in this study.

Conclusions

The Audit concluded that there was evidence of contamination due to arsenic and other heavy metals at several locations in the surface fill. There was indication of lesser contamination with the solvent TCE and its degradation products, and minor hydrocarbon and heavy metal contamination in the groundwater beneath the site. However, all the concentrations were below the adopted criteria for commercial and industrial use. Hence the Auditor opined that although contamination is present on the site, it remains suitable for commercial or industrial use, provided the contaminated soil remains covered and/or managed as described in the Statement of Environmental Audit.

5.5.5 CARMS No. 42748-2

Table 8 CARMS 42748-2 Key Audit Information

Site Information	Detail
Precinct/Location	Employment - Onsite
Audit Site Address	770 Lorimer Street, Port Melbourne
Audit Date	28 November 2003
Previous Land Uses	Carpark, foundry operations, historic filling
CoPCs	Metals, Hydrocarbons including PAHs
Audit Outcome	53 X Statement
Average TDS reported	200 – 3,800 mg/L
Approximate depth to groundwater	1.7 to 2.4m BGL
Hydraulic head influence from sewer or tides	Not reported.

Summary

The Audit site was originally developed for industrial use in the early 1900s however, the exact use of the site during the early 1900s is not known. Aerial photographs indicate that filling had occurred on the Audit site by 1945 and a number of small buildings were located on the Audit site at this time. The site appeared to be vacant between 1968 and 1987 when it was used as a car park. Sometime after

1987 the site formed part of a foundry operation (Myttons Rodd Pty Ltd) until 1996. In 1996, Australand purchased the site and it was once again used for car parking until 2000 when construction of the new BMW Workshop commenced. At the time of the Audit, the site was not subject to any overlays related to contaminated land, was not on the EPA Priority Sites Register and was not subject to an EPA clean-up or pollution abatement notice.

Contamination present in the fill and the groundwater at the Audit site was not expected to adversely affect the use of the site for its commercial or industrial use. The concentrations of contaminants were well below the criteria for commercial/industrial use, and considered to not adversely affect the health of persons working at the site. The groundwater was not expected to adversely affect the ecosystem of receiving waters of Yarra River. Some excavation works occurred to remove contaminated soils that exceeded adopted criteria for benzo-a-pyrene and some metals, and the remaining soil was not considered to pose an ongoing contamination risk. The Auditor confirmed that clean up to the extent practicable has been carried out and there is no requirement for further groundwater monitoring or for a Groundwater Quality Restricted Use Zone.

Groundwater Conditions – Audit site

The sampled groundwater at the Audit site was measured to have TDS ranging from approximately 200 to 3800 mg/L, and the groundwater table was encountered between 1.7 to 2.4 mBGL. One of the bores was noted to record significantly reduced TDS (200-320 mg/L). If this bore was excluded, the TDS ranged from 910 to 3800 mg/L. The Auditor noted that the general groundwater flow direction in the area was likely to be north towards the Yarra River.

Groundwater Conditions – Background and Ambient

A range of metals including chromium (VI), copper, nickel, and zinc were reported at concentrations exceeding adopted assessment criteria. These were concluded by the Assessor to be consistent with regional conditions that likely result from fill material and other anthropogenic influences. The Auditor also noted that the uniformity of copper, nickel and zinc concentrations in natural soils across the site indicated that these are likely to be associated with the Port Melbourne Sands formation, leading to elevated concentrations of these metals in groundwater. The leaching tests carried out by Auditor showed that the concentrations of copper and zinc in more highly contaminated fill samples can exceed the adopted guideline values. However, as the groundwater is at a greater depth than the fill and does not intersect the fill, and because most of the site has been developed and capped with buildings, car parking or concrete paving, infiltration of rainwater through the fill will no longer occur, thus preventing further impacts to groundwater.

Conclusions

The Audit report for the site concluded that the site is suitable for the existing commercial and industrial use of the land. The Statement of Audit was issued in accordance with EPA including conditions for other commercial and industrial use. The conditions include replacing the fill with clean soil up to 0.5 m below ground in areas where garden beds are proposed, and site coverage similar to the present development should be maintained.

5.5.6 CARMS No. 33298-9

Table 9 CARMS 33298-9 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site adjacent eastern boundary
Audit Site Address	Melbourne Citylink Lorimer Off Ramp
Audit Date	22 March 1999
Previous Land Uses	Various industrial
CoPCs	PAHs, TPHs, metals, VOCs, phenols, polychlorinated biphenyls (PCBs)

Site Information	Detail
Audit Outcome	Statement –Road Reserve, Industrial and Public Open Space Use
Average TDS reported	1,000 – 22,000 mg/L
Approximate depth to groundwater	2.2 and 2.8 m BGL
Hydraulic head influence from sewer or tides	Not reported.

Summary

The Audit site is the area under the existing Lorimer Street exit ramp from the Westgate Freeway, at the interception of the Lorimer, Wirraway and Sandridge precincts. The area was originally low lying swamp land, however, at the time of the Audit, the Audit site comprised very little natural vegetation and was primarily covered by paved surface and industrial buildings.

Part of the Audit site (near Graham Street) was once an operating sand quarry, and heterogeneous fill material comprising various soils and bricks, glass, concrete, rubber and domestic waste was encountered up to 7 m BGL.

Groundwater Conditions

Groundwater was encountered at depths between 2.2 and 2.8 m BGL and was expected to flow north-northwest from the Audit site towards the Yarra River. Due to sealed surfaces across the majority of the site, recharge from infiltration at the Audit site was not thought to be a major contributor to groundwater locally, impeding the pathway of surface contaminants to groundwater. TDS of groundwater was measured to be in the range 1,000 and 22,000 mg/L, which was consistent with expectations from nearby groundwater monitoring results, and the saline background conditions of groundwater in the Docklands vicinity.

Conclusions

The construction works for the Citylink ramp, carparks and landscaped areas have resulted in a substantially reduced area for potential exposure of occupiers of the Audit site to be exposed to contaminated soil. Most of the fill material existing on-site prior to Citylink works would have been classified as Fill Material or Category C Contaminated Soil.

The mobility of the CoPC was found to be low, and there were no groundwater supply bores within 1 km of the Audit site. Groundwater quality at a previously audited site down-gradient of the Audit site also suggested that there was no significant migration of contaminants from the Audit site, and hence clean-up was not required at the Audit site.

5.5.7 CARMS No. 49997-1

Table 10 Carms 49997-1 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site, approx. 100 m east of site
Audit Site Address	844 Lorimer Street, Port Melbourne
Audit Date	11 July 2006
Previous Land Uses	Service Station
CoPCs	Petroleum hydrocarbons, BTEX, heavy metals, VHCs
Audit Outcome	Statement

Site Information	Detail
Average TDS reported	224 - 519 mg/L
Approximate depth to groundwater	2 – 3 mBGL
Hydraulic head influence from sewer or tides	Not reported.

Summary

The Audit site is a former service station. An EPA clean up notice was issued to remove risks associated with stockpiled contaminated spoil material excavated during removal of four on-site underground storage tanks (USTs). One UST remained in place and contaminated soil remained stockpiled on-site thereby posing a secondary contamination source risk.

Background and Ambient Groundwater Conditions

Samples collected from groundwater bores up-gradient of the Audit site were used to evaluate background groundwater conditions. The expected TDS conditions based on published references were 2,400 – 11,000 mg/L, however, the average measured TDS during the sampling program was 224 - 519 mg/L.

Contaminant concentrations specific to the Audit site were found to be in low concentrations in down-gradient groundwater bores, and groundwater quality was considered to be consistent with regional conditions when compared with up gradient bores.

Conclusions

Groundwater from all five groundwater monitoring bores was found to have high turbidity, however, this is said to be representative of the regional groundwater conditions and no significant source for groundwater impact was found to be present on-site.

It is likely that contaminants in soil at the excavation locations have leached into groundwater, however, this was considered to be localised and unlikely to compromise beneficial uses at the site. Elevated concentrations of VHC's were found near the primary point sources.

Considering the low concentration of residual contaminants at the site and the difficulty in further excavation works due to the proximity of electrical cables and building footings, no further remediation was necessary at the site. It was also noted that new fill material and /or paving will be laid down on-site to cover existing exposed ground, thus the exposure pathway to future users was to be removed.

5.5.8 CARMS No. 26919-1

Table 11 CARMS 26919-1 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site, approximately 900 m south east
Audit Site Address	Corner Williamstown Rd and Derham Street
Audit Date	22 December 1995
Previous Land Uses	Service station
CoPCs	TPH, Metals, BTEX, PAH
Audit Outcome	Certificate
Average TDS reported	880 – 1,200 mg/L
Approximate depth to groundwater	2.2 – 2.5 mBGL

Site Information	Detail
Hydraulic head influence from sewer or tides	Not reported.

Summary

This Audit site was previously used as a fuel service station with six USTs that were considered the highest risk of the contamination sources at the Audit site. A remediation program was carried out prior to the completion of this audit, which involved the removal of the six USTs, excavation of the surrounding fill from the pit floor and walls, backfilling the excavation with crushed concrete, and sparging of contaminated groundwater.

Groundwater samples were analysed for TPH, BTEX and lead (only), thus a comparative indication of typical regional contaminants such as metals and PAHs was not possible.

Groundwater Conditions – Audit site

The groundwater table at the Audit site was found to be 2.2 - 2.5 m BGL. Groundwater flow is south towards Hobsons Bay, although it is thought that some mounding of groundwater occurs at the UST pits due to increased infiltration through the porous material. The TDS at the Audit site was found to be approximately 880 – 1,200 mg/L, which indicates that groundwater under the site is in good condition when compared with general aquifer conditions.

There are a number of registered groundwater bores used for domestic and irrigation purposes in the vicinity of the Audit site.

Conclusions

The sparging remediation system was installed at the Audit site, pumping fresh air into the soil at a 4.5 m depth to mobilise volatile compounds. This resulted in benzene concentration in the most impacted groundwater bore to be reduced to below guideline levels for raw water for drinking water supply. All other BTEX and TPH analytes were also reduced to concentrations below the laboratory limit of reporting (LOR) in groundwater wells MW2 – MW7.

5.5.9 CARMS No. 45435-1

Table 12 CARMS 45435-1 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site, approximately 500 m east
Audit Site Address	349 Ingles Street, Port Melbourne
Audit Date	9 March 2001
Previous Land Uses	Storage warehouses, commercial offices
CoPCs	Metals, TPH, MAH, Phenols, VHCs, Cyanide, Pesticides
Audit Outcome	Statement –Commercial / Industrial
Average TDS reported	1,200 mg/L
Approximate depth to groundwater	2.5 mBGL
Hydraulic head influence from sewer or tides	Not reported.

Summary

The Audit site has previously been home to warehouses used for storage of chemicals, oil and textiles. The main sources of contamination relate to fill material, pesticides used for maintenance around warehouses and small fuel leaks from parked vehicles.

Exceedances of PAHs and heavy metals were found within the fill material at the Audit site.

Groundwater Conditions

Groundwater flow at the Audit site was assumed to be generally north towards the Yarra River, although it was acknowledged that there may be some other localised influences on the Audit site. Evaluation of the flow direction was not possible in this study because well heads were not surveyed. Groundwater was found at approximately 2.5 m BGL and TDS was measured at approximately 1,200 mg/L. There were no reported domestic groundwater bores within 1 km of the Audit site.

Concentrations of all analysed contaminants in groundwater at the Audit site were found to be below either laboratory levels of reporting (LOR), ANZECC groundwater quality guidelines (1992) for irrigation or NHMRC drinking water guidelines.

Conclusions

Groundwater sampling results indicated that there have been no impacts on groundwater at the Audit site. The most concerning source of contamination on the Audit site was the fill material. The Auditor considered the Audit site to be suitable for commercial and industrial uses provided the future users do not come into direct contact with contaminated fill material.

5.5.10 CARMS No. 37104-1

Table 13 CARMS 37104-1 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site, approximately 100 south west
Audit Site Address	Corner Todd Rd and Williamstown Rd
Audit Date	5 November 1999
Previous Land Uses	Landfill
CoPCs	Heavy metals, PAH
Audit Outcome	Statement
Average TDS reported	2,700 – 5,800 mg/L
Approximate depth to groundwater	2 – 3 mBGL
Hydraulic head influence from sewer or tides	Yes. Possible tidal influence.

Summary

Sand was mined at the Audit site to a depth of 8m, before filling with domestic and industrial rubbish, which continued until 1991. Geological conditions and contaminant concentrations were found to be highly heterogeneous at the Audit site, however, exceedances of some heavy metals and PAH were noted at the site in both soil and groundwater. Most of the Audit site was capped with 0.3-0.5 m of cover material, however, there were some areas where rubbish was still visible. Some methane was also being emitted through the ground surface, however, this was considered and seen to be occurring at a diminishing rate.

Groundwater Conditions – Audit site

Groundwater was measured at 2 – 3 m BGL, and monitoring data indicated that groundwater was flowing to the south-southwest towards Hobsons Bay and the Yarra River. It was noted that there may

be a separation of flow between Hobsons Bay and the Yarra River. Groundwater at the site was found to be contaminated with heavy metals and PAHs.

Groundwater sampling was conducted on two separate occasions, several days apart. There were significant differences in groundwater levels between these events (approximately 300 mm between these two occasions), suggesting that tidal influence on groundwater is significant in this section of the site.

Groundwater Conditions – Background and Ambient

Whilst a detailed discussion of background or ambient groundwater quality was not available, it was noted that adjacent waste disposal and industrial facilities were likely to have contributed to the measured contamination as well as the activities on the site itself. The Auditor stated that *"groundwater contamination is extensive in the area and contributed to by a number of sources"*. Regional contaminants of concern included heavy metals (arsenic, lead, copper, mercury), phenolics, ammonia, volatile chlorinated organics and hydrocarbons.

Conclusions

The site was found to be suitable for use as a secondary school playing field, provided that direct contact between future users and contaminated fill material is avoided by capping the contaminated material with new imported fill.

Leachate testing indicated low mobility of contaminants in the fill material.

5.5.11 CARMS No. 38456-3

Table 14 CARMS 38456-3 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site, approximately 100 south
Audit Site Address	Lot 1B, 69-119 Salmon Street, Port Melbourne
Audit Date	10 November 1999
Previous Land Uses	Landfill, public works depot, storage warehouses, fuel storage
CoPCs	Metals, asbestos, TPH, lead, BTEX
Audit Outcome	Statement – Commercial / Industrial purposes
Average TDS reported	931 – 4,440 mg/L
Approximate depth to groundwater	3 mBGL
Hydraulic head influence from sewer or tides	Not reported.

Summary

The Audit site comprised a former landfill and storage warehouses including fuel storage facilities. Contaminants associated with these facilities presented a contamination risk to the Audit site, as well as a fuel station to the north-west of the Audit site, outside the boundaries of the Wirraway Precinct.

There was a low risk posed by methane emissions at the Audit site, however, industry standards for building on sites with landfill gas were to be followed to minimise associated human health and environmental health risks.

Groundwater Conditions – Audit site

Groundwater at the Audit site was at approximately 3 m BGL, within the fill material. Diverse wastes in the fill material were likely to have contributed to contaminant loading in the groundwater, in particular

PAHs. Groundwater contours indicated that groundwater tends to mound at the landfill area of the Audit site due to infiltration and flows outwards from that area. There was also some increased flow at the north-western part of the Audit site due to remedial extraction works at a nearby service station.

Conclusions

There was minimal groundwater contamination present at the Audit site, and it was noted that the existing contamination was present in insufficient concentrations to pose any threat to human or ecological receptors considering the likely future uses. The soil contamination in areas adjacent to the landfill was considered to be due to original fill material that was not associated with landfill operations or other activities on the Audit site.

Contaminant concentrations in soil generally were within the allowable range for industrial / commercial purposes, although replacement soil was to be imported for areas where planting of gardens is intended. Soil in some other areas was classified as low level contaminated fill material due to the presence of metals, PAHs and rubble such as coke, ash, glass and bricks. As such, this was to be managed as low level contaminated soil in accordance with EPA requirements if excavated and removed from the site.

5.5.12 CARMS No. 68702-1

Table 15 CARMS 68702-1 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site approximately 950 m south east
Audit Site Address	14 Woodruff Street, Port Melbourne
Audit Date	7 January 2014
Previous Land Uses	Chemical manufacturing facility
CoPCs	TPH, BTEX, Phenols, Metals, PCBs, TRH, PAHs
Audit Outcome	53V Recommendations –Commercial and Industrial
Average TDS reported	420 – 10,000 mg/L
Approximate depth to groundwater	1.2 - 2.7 m BGL
Hydraulic head influence from sewer or tides	Yes. Sewer likely to be acting as a drain.

Summary

The Audit site housed a chemical manufacturing facility from 1896 – 2013, which primarily produced soaps, cleaning products and oleo products. The EPA issued a Pollution Abatement Notice for the Audit site in order to determine the potential for soil and groundwater contaminants to have migrated from the Audit site. There were at least four petrol underground storage tanks (USTs) at the Audit site as well as a number of above ground chemical storage tanks that were considered likely to have caused contamination. The Audit site is currently almost entirely sealed with bitumen or concrete where buildings are not present.

Soil pH varied across the site due to potential spills of acidic and neutralising chemicals to treat by products, and the influence of alkaline products in the production of soaps and cleaners.

Groundwater Conditions – Audit site

The groundwater table at the Audit site was encountered at 1.2 - 2.7 m BGL, and the flow direction was inferred from measured groundwater levels to be flowing south-west towards a sewer running along Ingles Street, via which it will eventually reach Port Phillip Bay. Drawdown of the groundwater table was also noted in the vicinity of the sewer, confirming its action as a local groundwater drain.

TDS at the Audit site was measured between 420 and 10,000 mg/L, which was consistent with expected conditions in the region.

Groundwater Conditions – Background and Ambient

The regional groundwater flow was expected to be north towards the Yarra River; however, this was altered locally at the Audit site to flow south-west towards the Ingles Street sewer.

Conclusions

There were some minor exceedances of heavy metals in groundwater sampled at the Audit site, however, these were deemed not to have migrated off the Audit site and the Auditor noted that the groundwater was unlikely to be used for domestic or irrigation purposes in the vicinity of the site.

There are some remaining secondary sources in the soils at the Audit site, however, exposure pathways to this material were likely to be eliminated during development, and future users were to be made aware of this.

5.5.13 CARMS No. 35419-5

Table 16 CARMS 35419-5 Key Audit Information

Site Information	Detail
Precinct/Location	Off-site approximately 500 m east
Audit Site Address	Yarra's Edge, Lorimer Street, Docklands, Victoria
Audit Date	15 February 2005
Previous Land Uses	Shipping wharf, asphalt works, tanneries, boat building and maintenance, blacksmith, wool scouring and foundries, a railway line on the southern boundary
CoPCs	Heavy metals (mercury, lead, copper, arsenic and zinc), PAHs from gasworks waste and asphalt, TPHs, aromatic and heavier hydrocarbons, PCBs associated with the electricity sub-stations
Audit Outcome	53 X Statement
Average TDS reported	860 to 1,700 mg/L in Fill 708 to 4,100 mg/L in Port Melbourne Sand and 1,800 to 18,000 mg/L in Coode Island Silts
Approximate depth to groundwater	0.22 to 1.18mBGL
Hydraulic head influence from sewer or tides	Tidal Influence

Summary

The Audit site was a former wharf from the late 1800s to the 1990s, with industries including asphalt works, fellmongers (tanneries), boat building and maintenance, blacksmith, wool scouring and foundries. The audit site has been surrounded by industrial sites including abattoir, foundry, chemical works and a railway line was formerly located on the southern boundary of the Audit site. More recent uses since 2001 include storage of cars, car parking, car detailing etc.

The main sources of contamination included gasworks waste which was used as fill, above ground fuel tanks, transformers, railway line waste,

Groundwater Conditions – Audit site

The groundwater table at the Audit site was encountered at 0.22 – 1.18m BGL, and the groundwater flow direction was inferred to be variable and was not determined due to uncertainty resulting from the tidal fluctuations and the narrow shape of the site. Historic groundwater flow was inferred to be generally southwards or into the site from the Yarra.

TDS at the Audit site was measured as:

- 860 to 1,700 mg/L in Fill.
- 708 to 4,100 mg/L in Port Melbourne Sand.
- 1,800 to 18,000 mg/L in Coode Island Silts.

Groundwater Conditions – Background and Ambient

Given the presence on site of metals and PAHs in the site soils, and the presence of metals in groundwater bores the Auditor considered that there was a potential for pollution of the groundwater to have occurred beneath the site. Lead and PAHs were considered by the Auditor as potentially the main contaminants of concern for groundwater beneath the Audit site. Also, metals and ammonia were detected in groundwater at concentrations above ecosystem guidelines; however, these were consistent with background levels for Yarra River.

A groundwater restricted use zone was also recommended for the site with restricted use for drinking water, livestock water supply, irrigation of crops (including domestic gardens) and parks, and water used for recreational purposes (e.g. swimming)

Conclusions

There were some minor exceedances of heavy metals (lead, copper, nickel and barium) and PAHs above ecosystem protection levels and NEPM Standard Residential Guidelines in soil sampled at the Audit site, however, it was considered that the Audit site is suitable for sensitive uses, including residential within certain conditions. The Auditor also concluded that the level and extent of contamination is unlikely to represent an environmental risk or a health risk to neighbouring sites.

Metals and ammonia were detected in groundwater at concentrations above ecosystem guidelines. The levels were consistent with background levels for the nearest receptor, the Yarra River immediately adjacent to the site and so were considered acceptable. Given the distance of over 2 km to Port Phillip Bay these levels were not considered a risk to the marine environment.

The site was considered acceptable for Sensitive Uses including Residential Use, and Childcare Recreation/Open Space and Commercial Use and/or Industrial.

6.0 Preliminary Regional Conceptual Site Model

Fundamental to identifying risk assessment issues is the development of a Conceptual Site Model (CSM). A CSM is a site-specific qualitative description of the source(s) of contamination, the pathway(s) by which contaminants may migrate through the environmental media, and the receptors (human or ecological) that may potentially be exposed. This relationship is commonly known as a Source-Pathway-Receptor linkage. Where one or more elements of a linkage are missing, the exposure pathway is considered incomplete and no further assessment is required.

In the context of this assessment, the PRCSM aims to describe source-pathway-receptor linkages that are ubiquitous across the study area. Therefore, it is focussed on linkages associated with diffuse sources of pollution that may influence the potential beneficial uses of groundwater in the study area. Point sources of contamination are therefore not discussed herein as it is considered they will be assessed on a site-specific basis rather than on a regional basis. Similarly, beneficial uses of land are not discussed herein because the primary focus is groundwater and only limited soil data will be obtained through the project.

6.1 Identification of Regional Sources of Impact to Groundwater

Regionally significant environmental conditions can be described in broad terms as either being related to natural or anthropogenic (ambient) sources. These are discussed separately below.

6.1.1 Background Conditions

Inorganic substances are naturally present in the environment. Background concentrations of metals in soil and groundwater depend on the geological parent material and can be highly variable (ASC NEPM 2013).

Organic substances may be present in the environment as a result of organic matter decomposition (e.g. hydrocarbons) or as the products of incomplete combustion (e.g. polycyclic aromatic hydrocarbons and dioxins).

The preferred approach to determining the background concentration of a particular analyte is via direct measurement at a known unpolluted reference site. However, this is often challenging in an urban setting due to the added influence of diffuse anthropogenic impacts.

6.1.2 Anthropogenic (Ambient) Conditions

A wide range of anthropogenic activities may contribute to the ambient background concentration of both inorganics and organic compounds. These are typically activities that occur as diffuse (non-point) sources not attributable to any particular site or operation.

In an urban setting these may include:

- Deposition of atmospheric pollution.
- Leakage and other emissions from motor vehicles on public roads.
- Leakage from waste water utilities (stormwater and sewer).
- The use of pesticide and fertiliser on public land.
- Backfilling with uncontrolled fill during early land reclamation activities.

6.2 Regional Chemicals of Potential Concern

A number of the Audit reports reviewed in **Section 5.5** have indicated the presence of both naturally occurring and anthropogenic background impacts in groundwater not attributed to the site being audited. These groundwater chemicals of potential concern (CoPC) for the PRCSM are summarised in **Table 17**.

Table 17 Background Concentrations Reported in Previous Audits Relevant to the Study Area

CoPC Identified Exceeding Beneficial Use Criteria	Concentration Range (µg/L)	CARMS No.	Inferred Source Description
1,1-Dichloroethane	4,300 – 5,400	73239-1	Highest concentrations found in 'Area 1' within 'Clean Lines', vapour degreasers, chemical milling, AG and UG chemical storage tanks.
1,2-Dichloroethane	1,200 – 1,660	73239-1	Highest concentrations found in 'Area 1' within 'Clean Lines', vapour degreasers, chemical milling, AG and UG chemical storage tanks.
1,4 dioxane	<0.5 - 330	73239-1	Highest concentrations found in 'Area 1' within 'Clean Lines' and vapour degreasers.
Ammonia	3-10	73239-1	Highest concentrations were encountered beneath building 1, but was spatially distributed i.e. concentrations decreased with distance from Building 1.
Ammonia	7,700 - 170,000	61183-2	Audit report states that the elevated ammonia is likely to be primarily due to gasworks wastes and to a lesser extent natural conditions.
Ammonia	800 – 39,000	35419-5	Historical use as gasworks site and regional fill.
Arsenic	2 -247	32409-1	High arsenic was detected in GW in the 'electroplating shop', 'decanting room' and 'outside the storage area' and waste water treatment areas.
Arsenic	11 - 140	33298-9	Industrial facilities, regional fill material and landfill.
Arsenic	82	38456-3	Industrial facilities, regional fill material and landfill
Arsenic	1 - 86	35419-5	Historical use as gasworks site and regional fill.
Boron	30 - 390	35419-5	Historical use as gasworks site and regional fill.
Cadmium	1 - 5	33298-9	Industrial facilities, regional fill material and landfill.
Chromium	2 - 6	49997-1	Regional fill material. Audit report states that similar concentrations were found in up-gradient background wells.
Chromium	10-40	73239-1	High Concentrations encountered in shallow GW at Building 41, potentially due to former use of chromic acid in the vicinity.
Chromium	140	38456-3	Industrial facilities, regional fill material.

CoPC Identified Exceeding Beneficial Use Criteria	Concentration Range (µg/L)	CARMS No.	Inferred Source Description
Chromium	18 - 120	33298-9	Industrial facilities, regional fill material and landfill.
Chromium	13-14	42748-2	Regional fill material.
Copper	1 - 2	49997-1	Audit report states that similar concentrations were found in up-gradient background wells.
Copper	7-17	42748-2	Regional fill material
Copper	200 - 280	37104-1	Exceedances were reported at up-gradient locations and sources are considered to be surrounding industry as well as the Audit Site
Copper	9	38456-3	Industrial facilities, regional fill material and landfill
Copper	40	33298-9	Industrial facilities, regional fill material and landfill
Copper	1-40	35419-5	Historical use as gasworks site and regional fill
Fluoride	1700	73239-1	Regional fill material, and former use of hydrofluoric acid
Lead	15	38456-3	Industrial facilities, regional fill material and landfill
Lead	10 - 990	37104-1	Exceedances were reported at up-gradient locations and sources are considered to be surrounding industry as well as the Audit Site
Lead	77 - 3,600	33298-9	Industrial facilities, regional fill material and landfill
Manganese	1.5	73239-1	Regional fill material
Manganese	1 - 76		Historical use as gasworks site and regional fill
Molybdenum	51	38456-3	Industrial facilities, regional fill material and landfill
Nickel	4 - 470	49997-1	Audit report states that similar concentrations were found in up-gradient background wells
Nickel	13-89	42748-2	Regional fill material
Nickel	78 - 100	37104-1	Exceedances were reported at up-gradient locations and sources are considered to be surrounding industry as well as the Audit Site

CoPC Identified Exceeding Beneficial Use Criteria	Concentration Range (µg/L)	CARMS No.	Inferred Source Description
Nickel	76	38456-3	Industrial facilities, regional fill material and landfill
PAH	118 - 477	37104-1	Exceedances were seen at up-gradient locations and sources are considered to be surrounding industry as well as the Audit Site.
Selenium	0.1 – 1.1	35419-5	Historical use as gasworks site and regional fill
TCE	420 – 1,280 mg/L	73239-1	The source areas were identified in 'Area 2' near 'Clean Line Area' in Building 41
Tin	50	38456-3	Industrial facilities, regional fill material and landfill
TPH	18 - 65	42748-2	Underground storage tanks
TPH	< LOR - 2370	32409-2	High concentrations were due to the leaking UG storage tanks
TPH	11,000 to 100,000	73239-1	The exceedances were attributed to chlorinated hydrocarbons as all detections were in the F1 fraction. Other sources may include regional fill
Zinc	4 - 77	49997-1	Audit report states that similar concentrations were found in up-gradient background wells
Zinc	0.026	73239-1	Regional fill material
Zinc	50 – 1,300	37104-1	Exceedances were reported at up-gradient locations and sources are considered to be surrounding industry as well as the Audit Site
Zinc	31-92	42748-2	Regional fill material
Zinc	420 - 8,100	33298-9	Industrial facilities, regional fill material and landfill

6.3 Regional Groundwater Exposure Pathways

Receptors in the study area may interact with groundwater in several ways as follows:

- Groundwater may discharge to surface water receptors and influence water conditions affecting ecological receptors. Groundwater flow direction and rate may also be influenced by natural and anthropogenic preferential pathways (e.g. historic stream channels or deep sewer lines).
- Groundwater may be abstracted for either domestic or non-domestic uses (e.g. potable water supply, irrigation or industrial use).
- Groundwater may be in direct contact with infrastructure (e.g. utilities or building foundations). Under such conditions, chemicals present in groundwater may permeate these structures or human receptors may come into contact with groundwater during maintenance works.

- Vapours derived from groundwater may migrate through the subsurface and into overlying buildings.

6.4 Beneficial Uses of Groundwater

According to the *Victorian Groundwater Beneficial Use Map Series: South Western Victoria, Water Table Aquifers* (DCNR, 1995), the concentration of total dissolved solids (TDS) in groundwater in the upper aquifer in the study area is expected to range between 1,001 mg/L and 3,500 mg/L which falls within “Segment B” according to the SEPP (GoV).

Given that groundwater at the precinct has been assessed as Segment B, the following protected beneficial uses are considered relevant:

- Maintenance of Ecosystems
- Potable mineral water supply
- Agriculture, parks and gardens
- Stock watering
- Industrial water use
- Primary contact recreation
- Buildings and structures

A wide range of TDS values have been recorded in the Audit reports reviewed in **Section 5.50**, as summarised in **Table 18**. The lower end of the range of reported TDS values may indicate a potential for use of the groundwater for potable water supply purposes, in addition to the beneficial uses listed above. The upper end of the range of reported TDS values may indicate that in areas the groundwater is not suitable for use for potable water supply or irrigation purposes. Note, not all of the audit reports reviewed provided a clear TDS concentrations or range. We have summarised those that have been defined (only).

Table 18 TDS Ranges Reported in Previous Audits Relevant to the Study Area

Audit Report CARMS No.	TDS Range (mg/L)
49997-1	224 - 519
68702-1	420 - 10,000
44896-1	800
73437-1	12,000 – 22,000
72541-1	3,530 – 13,000
45435-1	1,200

6.5 Future Land Use Scenarios and Potential Receptors

Fishermans Bend has an anticipated future use as a mixed-use precinct with some medium to high density residential areas. The potential receptors to groundwater contamination are discussed below in the context of the protected beneficial uses of groundwater.

Table 19 Potential Receptors

Beneficial Use of Groundwater	Identified Receptors
Maintenance of Ecosystems	Based on the site setting, topography and findings of previous assessments, groundwater is considered likely to flow in a south to south west direction. Groundwater may therefore discharge to the Yarra River and Hobsons Bay and influence aquatic ecosystems in this water body.
Potable water supply	The precinct is located in an area of reticulated water supply which reduces the likelihood of extraction for potable use. However, owing to the low TDS reported in some areas, this beneficial use of groundwater cannot be excluded. It should be noted that some groundwater bores installed throughout the precinct may not be registered, and bores such as these may be used for potable water supply.
Potable mineral water supply	The precinct is not located within a designated mineral water zone therefore this groundwater beneficial use is considered unlikely to be realised.
Agriculture, parks and gardens	The precinct is located in an area of reticulated water supply which reduces the likelihood of extraction for irrigation use. However, owing to the low TDS reported in some areas, this beneficial use of groundwater cannot be excluded, particularly as we have obtained anecdotal evidence from local residents that indicates that groundwater is used for irrigation purposes on sporting fields.
Stock watering	The precinct is located in an area of reticulated water supply which reduces the likelihood of extraction for stock watering use. Such a use is also considered unlikely to be realised under the anticipated future land use and urban setting. However, owing to the low TDS reported in some areas, this beneficial use of groundwater cannot be excluded.
Industrial water use	It is considered unlikely that following redevelopment industrial land uses will continue in the area and therefore this groundwater beneficial use is considered unlikely to be realised. Furthermore it is considered likely that any groundwater extracted for industrial purposes would require treatment prior to use owing to the variable salinity.
Primary contact recreation	Based on the site setting, topography and findings of previous assessments, groundwater is considered likely to flow in a south to south west direction. Groundwater may therefore discharge to the Yarra River and Hobsons Bay and be contacted by recreational users of these waterways. Additional and potential recreational users include people who install swimming pools within residential properties.

Beneficial Use of Groundwater	Identified Receptors
Buildings and structures	Groundwater is relatively shallow across the study area and has the potential to come into contact with building foundations, basement structures and subsurface utilities. Vapours derived from groundwater may migrate through the subsurface and into buildings.

6.6 Potentially Complete Source-Pathway-Receptor Linkages

Potentially complete regional source-pathway-receptor linkages based on the above information are summarised in the PRCSM (**Appendix D**).

7.0 Data Gap Assessment

Some data gaps which may impact the assessment have been identified based on review of the data from previous investigations. These are summarised in **Table 20** below. The manner in which data gaps have been addressed in the assessment is also summarised.

Table 20 Summary of Data Gaps

Data Gaps	Potential Significance	Manner in Which Addressed in the Assessment
There are few EPA Audit sites within the boundaries of the precinct.	The low density of EPA Audit reports reduces certainty of precinct wide contamination profiling as it becomes more likely that sampling has encountered hotspots.	12 Audit reports for properties within 1 km of precinct boundaries and with diverse historical land uses have undergone detailed reviews to ensure that a range of sampling programs are validated against one another in order to accurately characterise background conditions.
There are no sources providing reliably complete lists of point sources and boundaries of historic landfills.	Significant point sources need to be identified and delineated to ensure sampling plan avoids targeting these locations.	A variety of sources have been reviewed to identify significant point sources (Section 5.0). These have been validated against the Golder (2016) report.
Some EPA Audit reports reviewed neglect inclusion of background sampling in site analysis.	Increases risk that contamination profile indicated by review of EPA Audit reports is influenced by point sources and does not reflect Precinct wide conditions.	EPA Audit reviews have put particular emphasis on discussion of background conditions findings that are relevant to the precinct as a whole.

8.0 Conclusions and Recommendations

The Desktop Study aimed to review existing publically available data to determine key factors that may be influencing shallow groundwater within the precinct on a regional scale. For the purposes of assessing baseline groundwater quality from a regional perspective, AECOM has reviewed significant environmental conditions in broad terms as either being related to natural or anthropogenic (ambient) sources. This included particular consideration of the following sources of information, as they have the potential to have influence on the overall groundwater migration and quality:

- Inorganic substances that are naturally present in the environment.
- Organic substances that may be present in the environment as a result of organic matter decomposition or as the products of incomplete combustion.
- Tidal influences.
- Former swamp and wetlands.
- Geological Features.
- The sewer, drainage and stormwater networks across the precinct.
- Uncontrolled filling (including filling of former quarries/landfills).

Point sources of contamination have also been considered (and identified where possible) during this Desktop Study to ensure that any future SAQP aims to avoid sampling groundwater that may be influenced by point sources of contamination.

The results of this study have been incorporated into a Preliminary Regional Conceptual Site Model (PRCSM), which is presented in this document. It is intended that the information obtained as part of the Desktop Study and PRCSM will be used during the development of a Groundwater Sampling and Analysis Quality Plan (SAQP) for a baseline regional groundwater investigation at the precinct. The outcomes of that investigation will be considered in relation to the findings of the Desktop Study and the PRCSM to assist in further conceptualising the precinct.

8.1 Conclusions

The finding of this work identified the following aspects in relation to the regional groundwater quality and influencing factors across the precinct.

Conclusions resulting from the Desktop Study and PRCSM are as follows:

- The precinct is located to the south-west of Melbourne's CBD and covers an area of approximately 245 hectares. The Employment Precinct is bound by the Yarra River to the north and west of the precinct, the Westgate Freeway to the south and Todd Road to the east. The precinct itself generally comprises of a mixed use between heavy and light industrial and commercial landholdings, as well as public parks. Notable occupants in the area include Boeing, Holden, Defence Science and Technology Organisation (DSTO) and Parks Victoria.
- Prior to European settlement the precinct was generally low lying swamp/wetlands. Post European settlement the precinct has been highly modified including sections filled through land reclamation, quarried and used for a variety of industrial and agricultural purposes.
- Post European settlement land use of the precinct indicates that it was broadly developed during the gold rush period prior to the 1900s which included quarrying activities and land reclamation. It was later established as a heavy industrial precinct in the 1930s, including automotive production, research and aerospace development. Later development post the 1950s included various light industrial uses and commercial business parks.
- The precinct is underlain by flat lying sedimentary deposits of the Quaternary aged Yarra Delta group and the topography of the precinct is generally flat with an elevation ranging between 0->4 mAHD.
- The average depth of the shallow groundwater in the precinct is approximately 3 mBGL and is expected to flow to the north towards the Yarra River, or west towards Port Phillip Bay.

- Factors influencing regional groundwater flow identified as part of this review include the following:
 - Tidal influence. Based on the tidal variation (up to 0.759 MASL), the elevation of the precinct (0 - >4mAHD) and the average depth of groundwater (approximately 3 mBGL), there is expected to be significant tidal influence on the shallow groundwater. This tidal influence is expected to be greater particularly closer to the Yarra River to the north of the precinct and is likely to become damped towards the south. Further consideration of this on the regional groundwater quality including the impacts of regular flushing of water, salinity and migration pathways needs to be further assessed as part of the next groundwater sampling event.
 - Existing stormwater and drainage infrastructure. Both deep and shallow stormwater and sewerage infrastructure exist throughout the precinct. This includes the Hobson Bay Main which was constructed in the late 1800's, as well as stormwater infrastructure including the Melbourne Water Drainage System. The integrity of these assets was unable to be determined, however, due to the age, construction methodology and depth of some of these assets, they can potentially have influence on groundwater flow. From review of existing reports, no reliable information could be determined in relation to if these assets are having a significant influence on the flow of shallow groundwater within the precinct, however, this should be further considered following the outcome of intrusive investigations and sampling.
 - Former landfills and quarries. Former quarry locations and landfills were identified within the precinct and have the potential to have significant influence on regional groundwater flow direction, as they have been excavated to depths greater than the shallow aquifer. This influence of former landfills and quarries should be further considered following the outcome of intrusive investigations and sampling.

Large landholdings including Boeing (9% of Employment Precinct Area), DSTO (6% of Employment Precinct Area), Holden (18% of Employment Precinct Area) and Parks Victoria (10% of Employment Precinct Area) have the potential to influence groundwater quality within the Employment Precinct, including flow direction and large scale contamination status.

Further factors in addition to those factors mentioned above were also reviewed. This included consideration of geological influence such as the presence of ancient river channels and drainage pathways, as well as the influence of land reclamation and other historical practices including diverting and dredging the Yarra River (up to depths between 6.09 and 10.98 m). The results of this review did not identify definitive factors in respect to these activities that could be considered as influencing regional groundwater flow, however, it is possible that dredged material was used to fill areas of the precinct and therefore affect movement of groundwater. These factors will continue to be considered in relation to the findings of the next groundwater sampling event and in the further development of the CSM.

- Based on published literature, the concentration of total dissolved solids (TDS) in groundwater in the upper aquifer in the study area is expected to range between 1,001 mg/L and 3,500 mg/L which falls within "Segment B" according to the SEPP (GoV). However, in terms of site specific data, a wide range of TDS values have been recorded in the 12 Audit reports reviewed within 1km of the precinct, which show that the lower end of the TDS range may indicate a potential for use of the groundwater for potable water supply purposes.
- From the review of available information including the Audit reports, regional groundwater quality (natural and ambient) may comprise of metals, petroleum hydrocarbons, dioxins, nitrates, sulphates and pesticides. In addition new and emerging contaminants such as Poly-fluoroalkyl substances (PFAS) may need to be considered, particularly noting the former heavy industrial, airstrips and experimental uses that were undertaken in the Employment Precinct.

The information obtained from this review is considered critical to the development of a SAQP and the conceptual understanding of regional groundwater conditions across the precinct; there are a number of natural and anthropogenic influences (detailed above) that have the potential to influence groundwater flow direction and movement of contamination via groundwater.

8.2 Recommendations

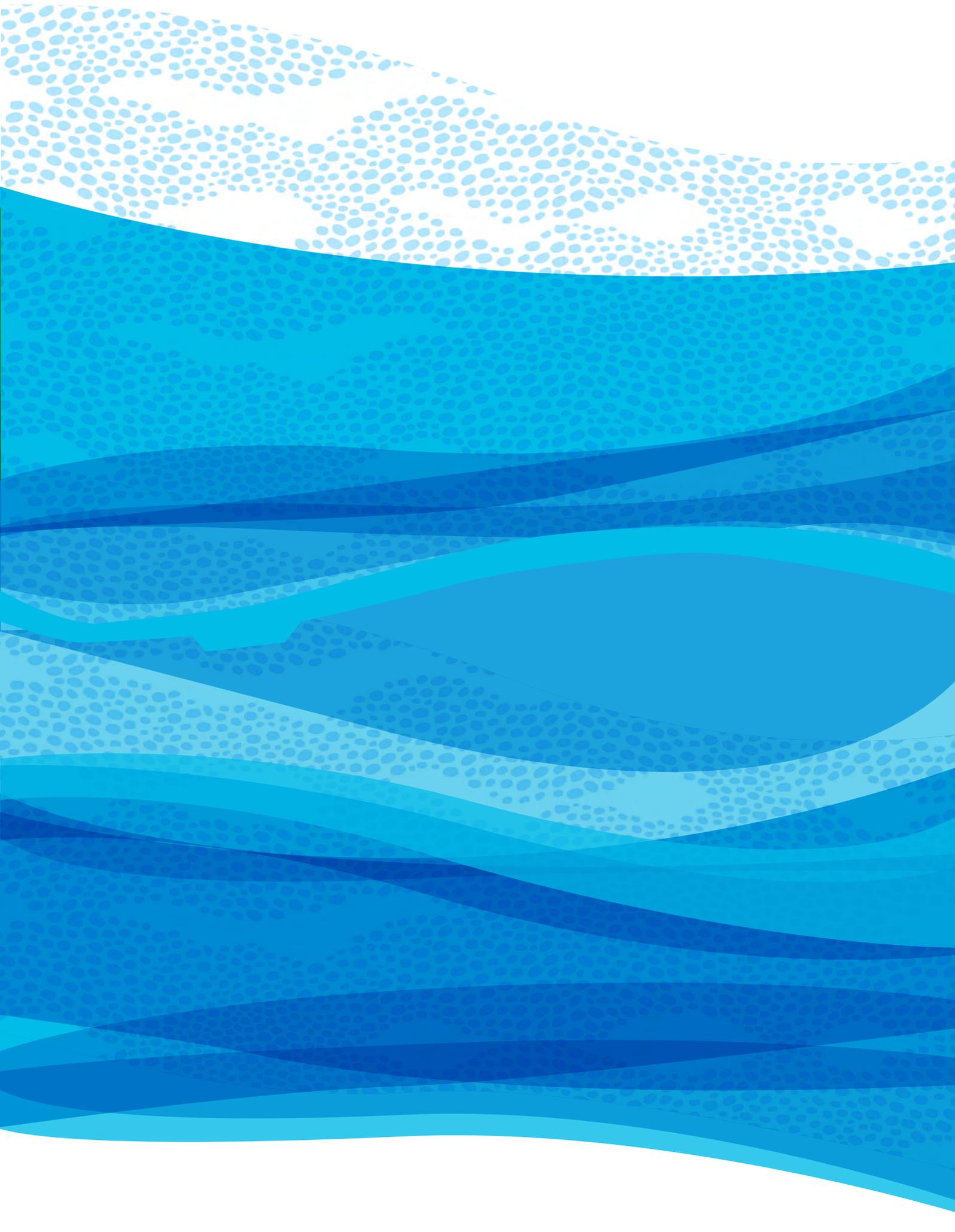
Based on our review, AECOM makes the following recommendations:

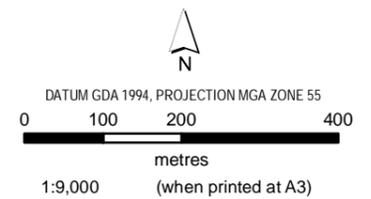
- A SAQP should be developed in consideration of the natural and anthropogenic influences on regional groundwater conditions.
- A groundwater investigation be conducted on a regional scale to gain a holistic understanding of groundwater flow and possible contaminant movement via groundwater. This investigation will be used to obtain site specific data to further inform and refine the PRCSM.
- The best approach to characterising and assessing the regional groundwater quality of the precinct is to adopt a grid based approach to obtaining groundwater data and avoid the point sources identified to date. This will allow assessment of contaminant concentrations in terms of consistency with background concentrations or influence by known former and current industry practices, including known point sources reclaimed land and landfills.
- Sewers and drains should be investigated further if discrepancies in groundwater elevation are apparent near the sewer and drainage locations during future sampling works.
- The influence that large landholdings have on the potential status of groundwater, including flow direction and contamination status, should be further considered in a regional context following results of the next groundwater sampling program.
- Further consideration of tidal influence on the regional groundwater quality including the impacts of regular flushing of water, salinity and migration pathways needs to be further assessed as part of future investigations. This will be best addressed by collection of site specific gauging and survey data.

9.0 References

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- Victorian Government (June 2002) *State Environment Protection Policy - Prevention and Management of Contamination of Land*
- Victorian Government (August 1997) *State Environment Protection Policy – Schedule F6 Waters of Port Phillip Bay (as varied in 2003)*

FIGURES





- LEGEND**
- Employment Precinct
 - Lorimer Precinct
 - Sandridge Precinct
 - Wirraway Precinct



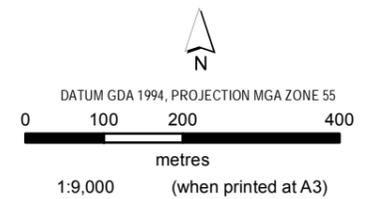
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EMPLOYMENT PRECINCT LOCATION

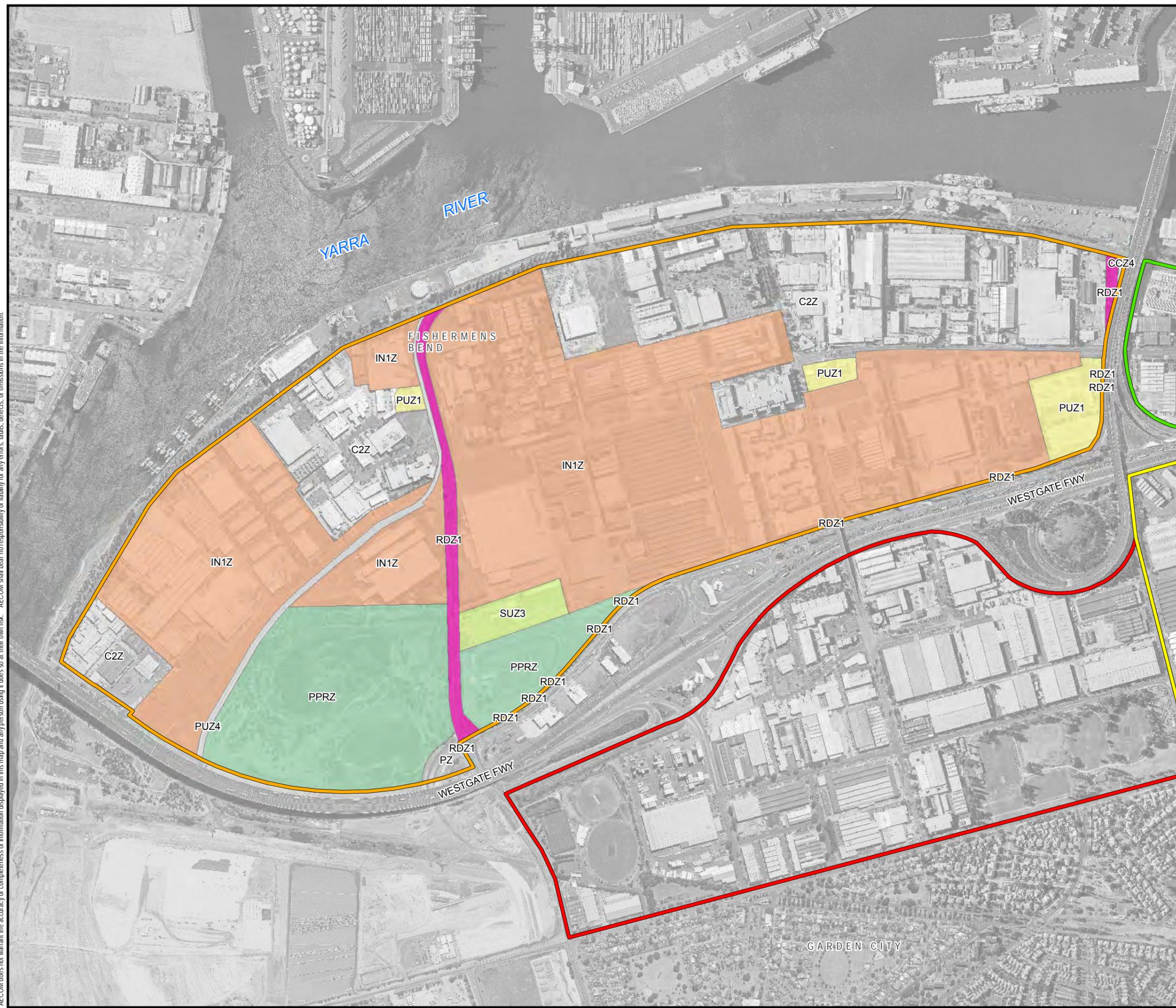
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 Fisherman's Bend, Melbourne, VIC

Figure
F1

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- LEGEND**
- Employment Precinct
 - Lorimer Precinct
 - Sandridge Precinct
 - Wirraway Precinct
 - Industrial 1 Zone
 - Special Use 3 Zone
 - Public Use 1 Zone - Service & Utility
 - Public Use 4 Zone - Transport
 - Public Park and Recreation Zone
 - Road Zone - Category 1

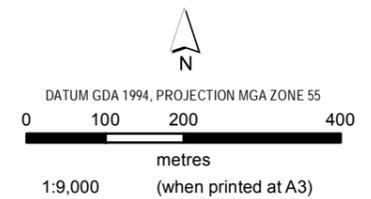
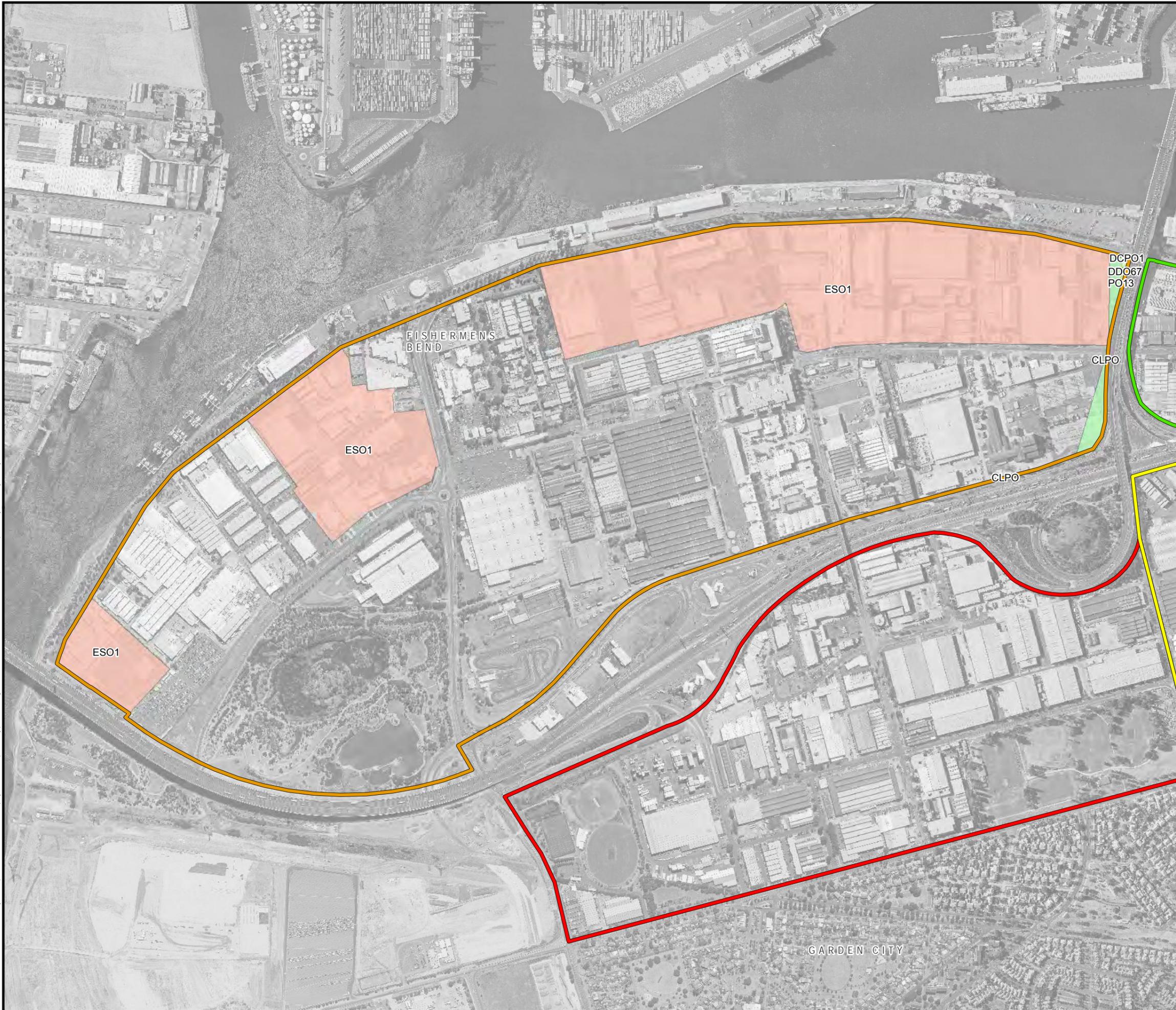


CURRENT PLANNING ZONES

<p>EPA 2017 Employment Desktop Study Fisherman's Bend, Port Melbourne, VIC</p>	<p>Figure F2</p>
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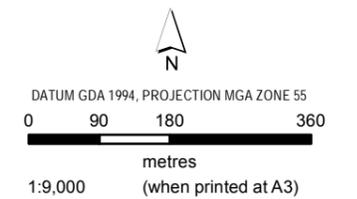


- LEGEND**
- Employment Precinct
 - Lorimer Precinct
 - Montague Precinct
 - Sandridge Precinct
 - Wirraway Precinct
- Planning Overlay**
- CLPO, CITY LINK PROJECT OVERLAY
 - DCPO1, DEVELOPMENT CONTRIBUTIONS PLAN OVERLAY - SCHEDULE 1
 - DDO67, DESIGN AND DEVELOPMENT OVERLAY - SCHEDULE 67
 - ESO1, ENVIRONMENTAL SIGNIFICANCE OVERLAY - SCHEDULE 1
 - PO13, PARKING OVERLAY - PRECINCT 13

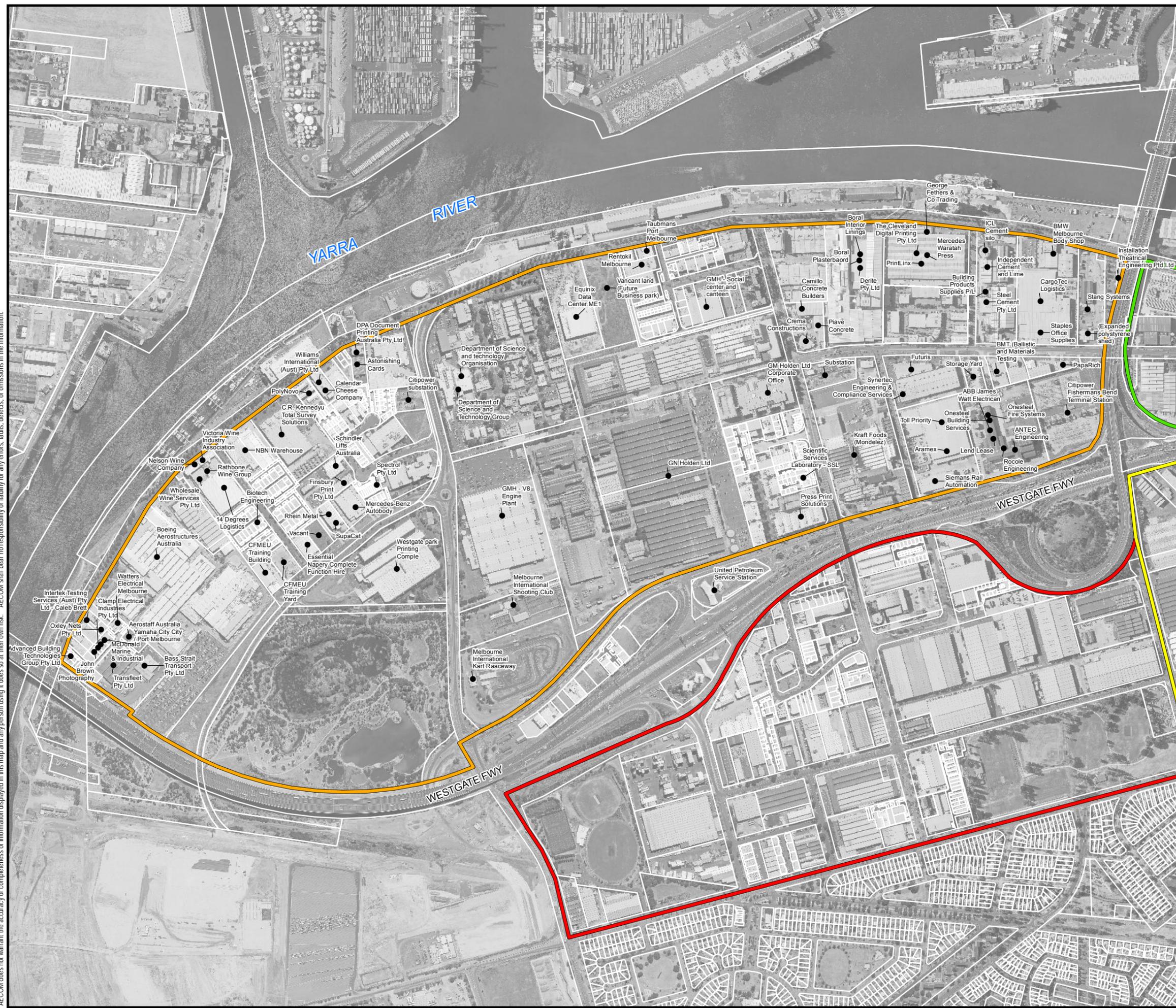
CURRENT PLANNING OVERLAYS

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Fisherman's Bend, Port Melbourne,
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Figure
F3



- LEGEND**
- Current Land Uses
 - ▭ Employment Precinct
 - ▭ Lorimer Precinct
 - ▭ Sandridge Precinct
 - ▭ Wirraway Precinct



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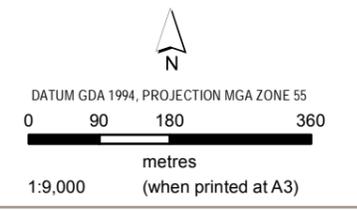
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**CURRENT LAND USES -
 EMPLOYMENT PRECINCT**

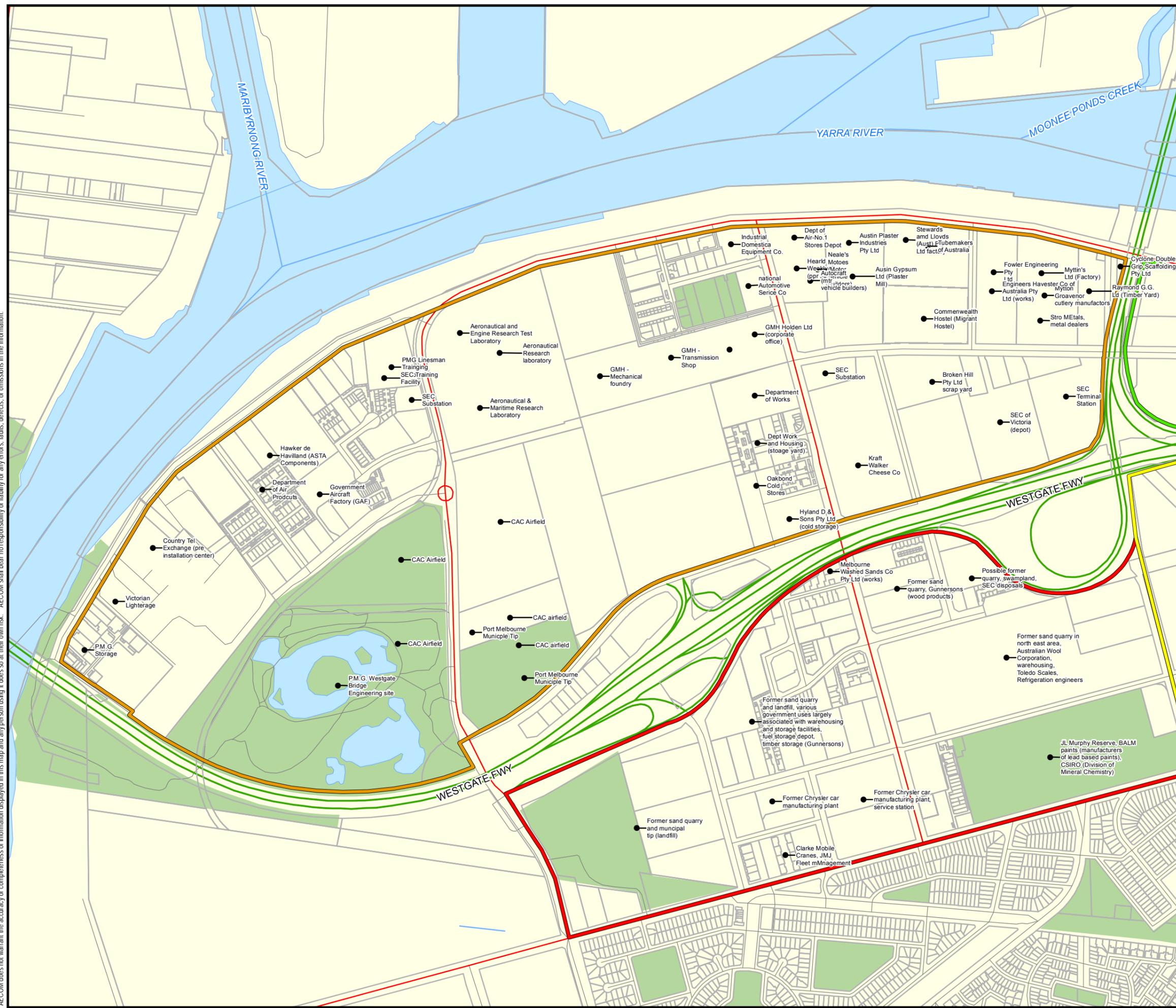
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Figure
F4

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- LEGEND**
- Historical Land Uses
 - Employment Precinct
 - Lorimer Precinct
 - Sandridge Precinct
 - Wirraway Precinct



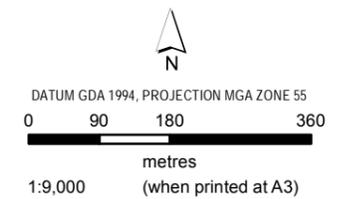
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HISTORICAL LAND USE

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F5

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LEGEND

- Historic Utilities**
- 24" Shell Fuel Pipeline
 - Water
 - Gas
 - Sewerage/ Stormwater
 - ▨ Wetlands (1788)
 - ▭ Employment Precinct
 - ▭ Lorimer Precinct
 - ▭ Sandridge Precinct
 - ▭ Wirraway Precinct
 - ▭ 1954
 - ▭ 1968
 - ▭ Historical Aerodrome
 - ▭ Historic Landfill Location
 - ▭ Historical Quarry / Landfill
 - ▭ Historical Runway footprint
 - Hobson's Bay Main
 - Transmission Line

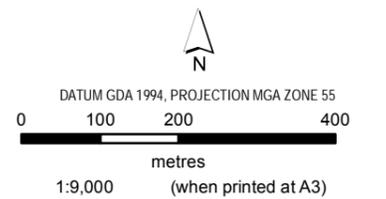
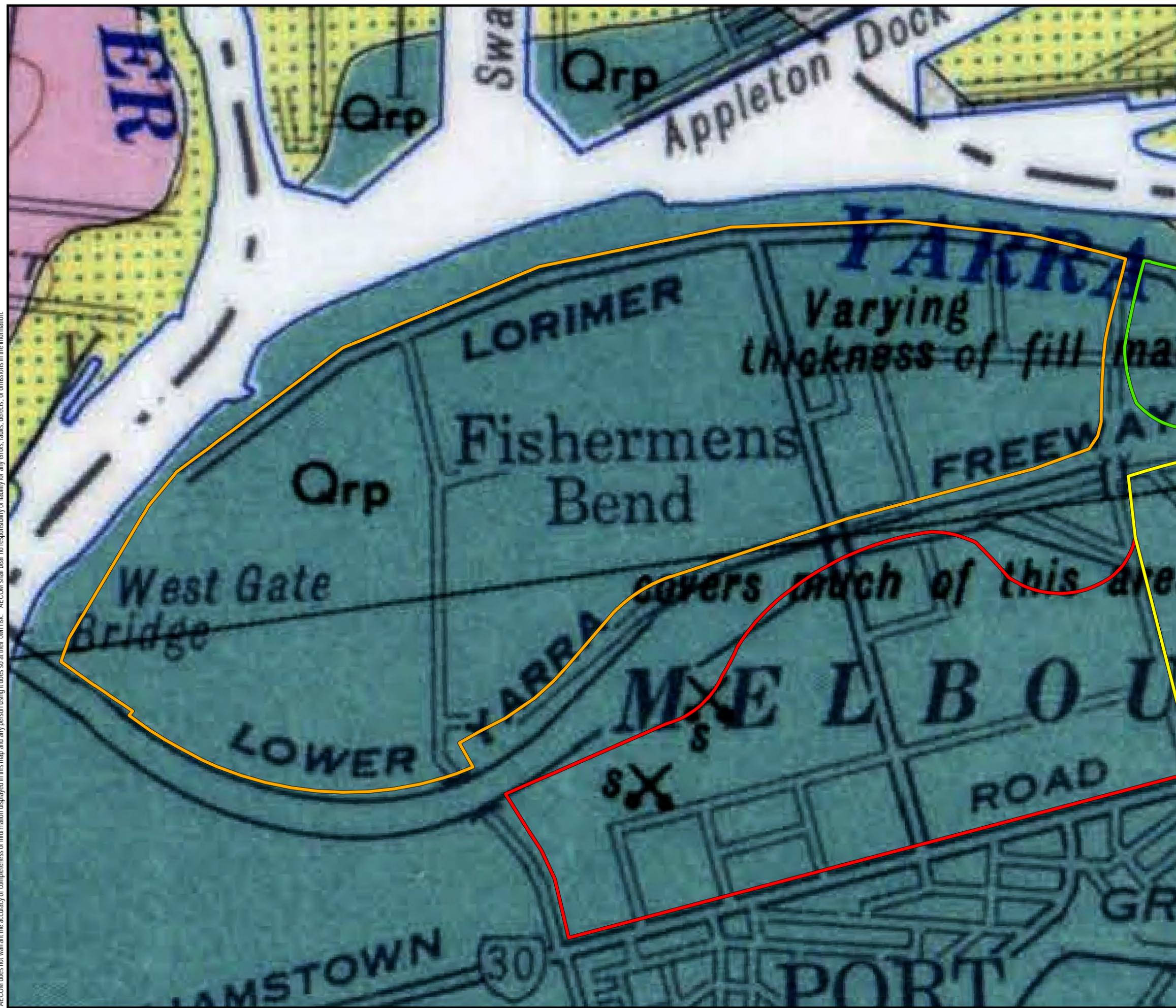
Data sources:
Base Data: (c) 2012 StreetPro
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**KEY HISTORICAL FEATURES-
EMPLOYMENT PRECINCT**

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Figure
F6

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- LEGEND**
- Employment Precinct
 - Lorimer Precinct
 - Sandridge Precinct
 - Wirraway Precinct

- NEWER VOLCANICS**
- Qrp** Raised beach ridges: bedded and cross bedded well sorted sand, shelly sand, minor silty or clayey sand
 - Qrs** Coastal swamp deposits: fine sand, silt, silty clay often with shell beds
 - Qri** Silt, silty clay, sandy clay, dark grey, minor peat and shell beds

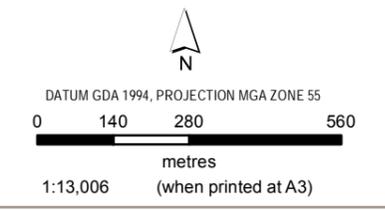
- BRIGHTON GROUP**
- Tpr** Sand, red-brown, yellow, and white, well bedded to cross bedded; silty sand, minor gravel, sometimes includes clay balls

Data sources:
 Base Data: (c) 20XX (data source)
 (additional data)

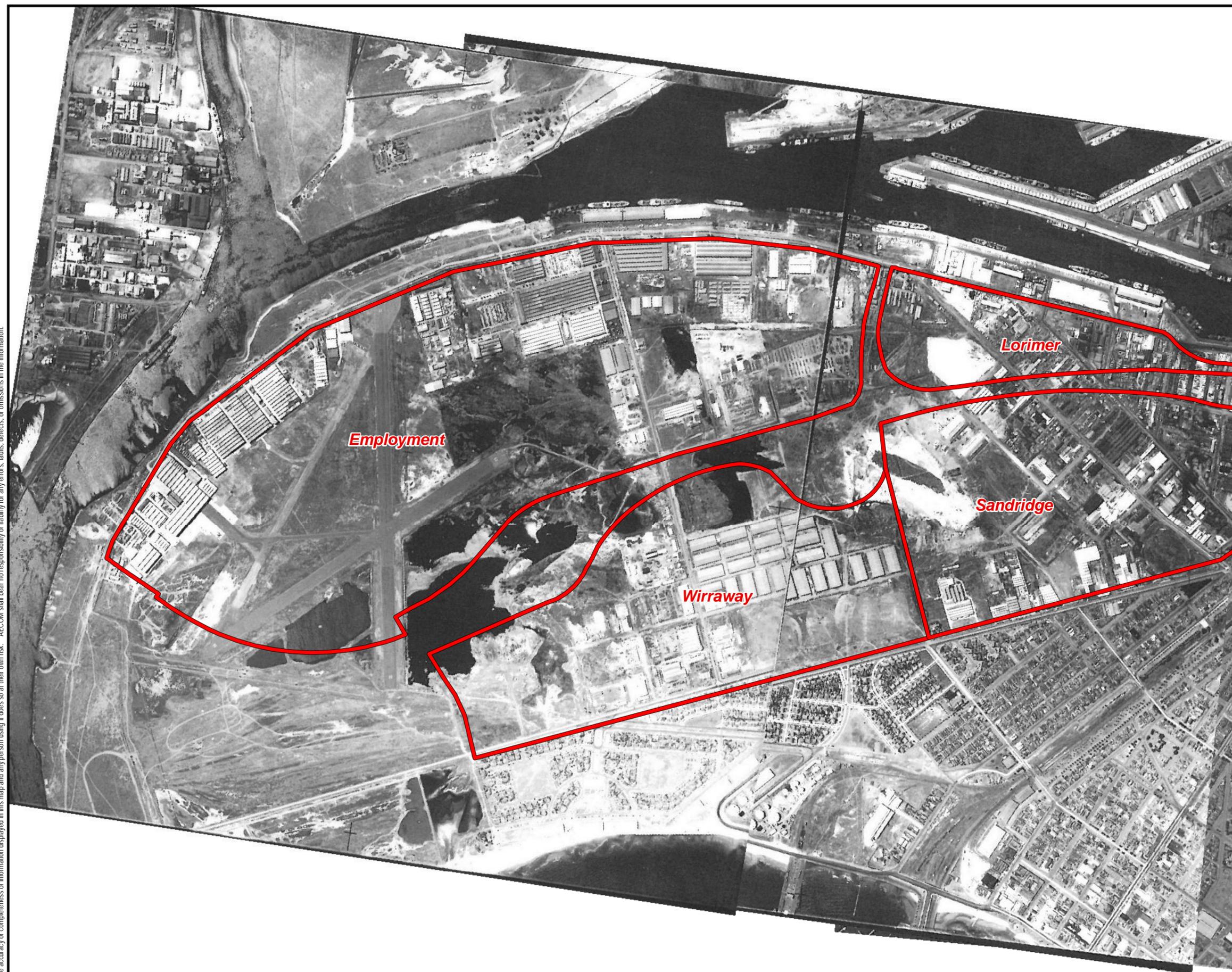
GEOLOGICAL CONDITIONS

<p>EPA 2017 Employment Desktop Study Fisherman's Bend, Port Melbourne, VIC</p>	<p>Figure F7</p>
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LEGEND
[Red outline symbol] Precinct Boundary

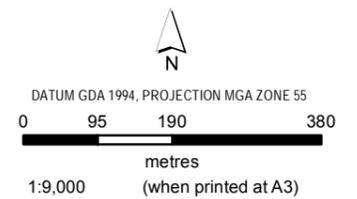


Data sources:
Photographs from Land Victoria Aerial Photography storage facility

**HISTORICAL AERIAL
PHOTOGRAPHY - 1951**

EPA
FBURA Desktop Study
Fisherman's Bend, Port Melbourne,
VIC

Figure
F8



LEGEND
 Precinct Boundary



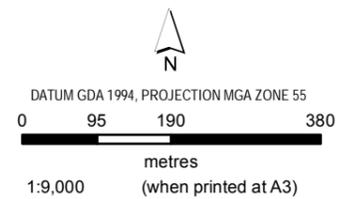
Data sources:
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HISTORICAL AERIAL PHOTOGRAPHY - 1970

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 2017 Employment Desktop Study
 Fisherman's Bend, Port Melbourne, VIC

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LEGEND
 Precinct Boundary

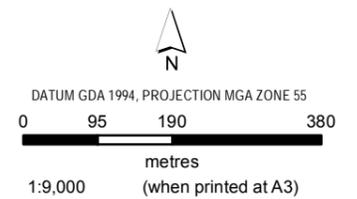
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Data sources:
 Photographs from Land Victoria Aerial Photography storage facility

HISTORICAL AERIAL PHOTOGRAPHY - 1951

EPA
 2017 Employment Desktop Study
 Fisherman's Bend, Port Melbourne, VIC

Figure
F10



LEGEND

 Precinct Boundary



Data sources:
Photographs from Land Victoria Aerial Photography storage facility

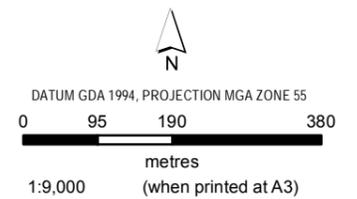
HISTORICAL AERIAL PHOTOGRAPHY - 1970

EPA
FBURA Desktop Study
Fisherman's Bend, Port Melbourne, VIC

Figure
F10

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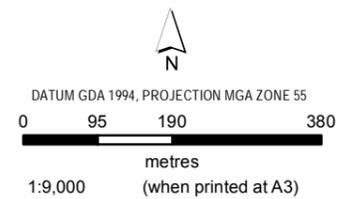
LEGEND
[Red outline symbol] Precinct Boundary

Data sources:
Photographs from Land Victoria Aerial Photography storage facility

**HISTORICAL AERIAL
PHOTOGRAPHY - 1982**

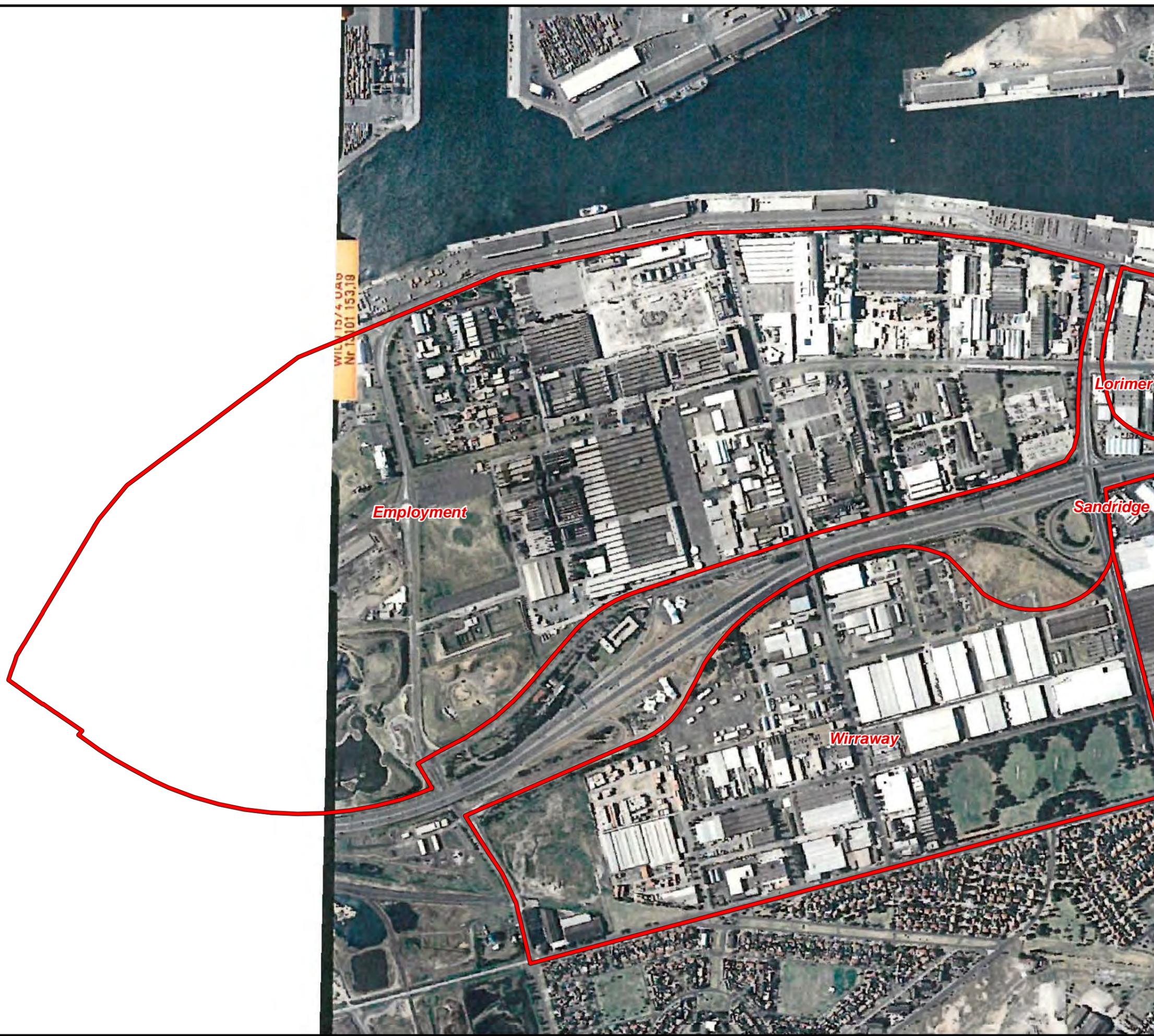
EPA
FBURA Desktop Study
Fisherman's Bend, Port Melbourne,
VIC

Figure
F11



LEGEND

 Precinct Boundary



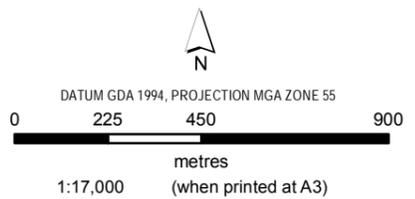
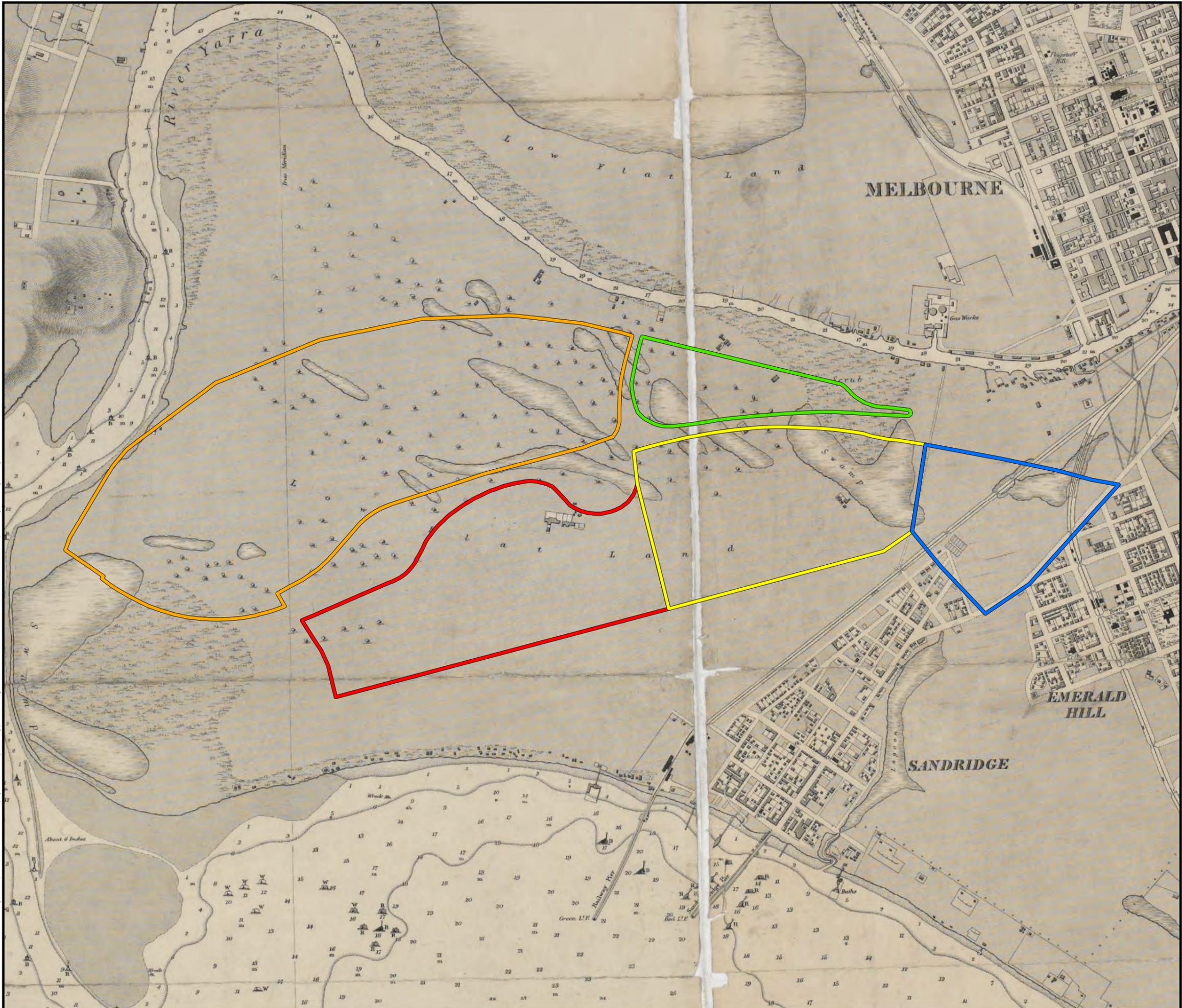
Data sources:
Photographs from Land Victoria Aerial Photography storage facility

**HISTORICAL AERIAL
PHOTOGRAPHY - 1988**

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VIC

Figure
F12

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- LEGEND**
- Employment Precinct
 - Lorimer Precinct
 - Montague Precinct
 - Sandridge Precinct
 - Wirraway Precinct

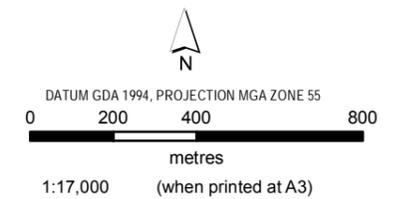
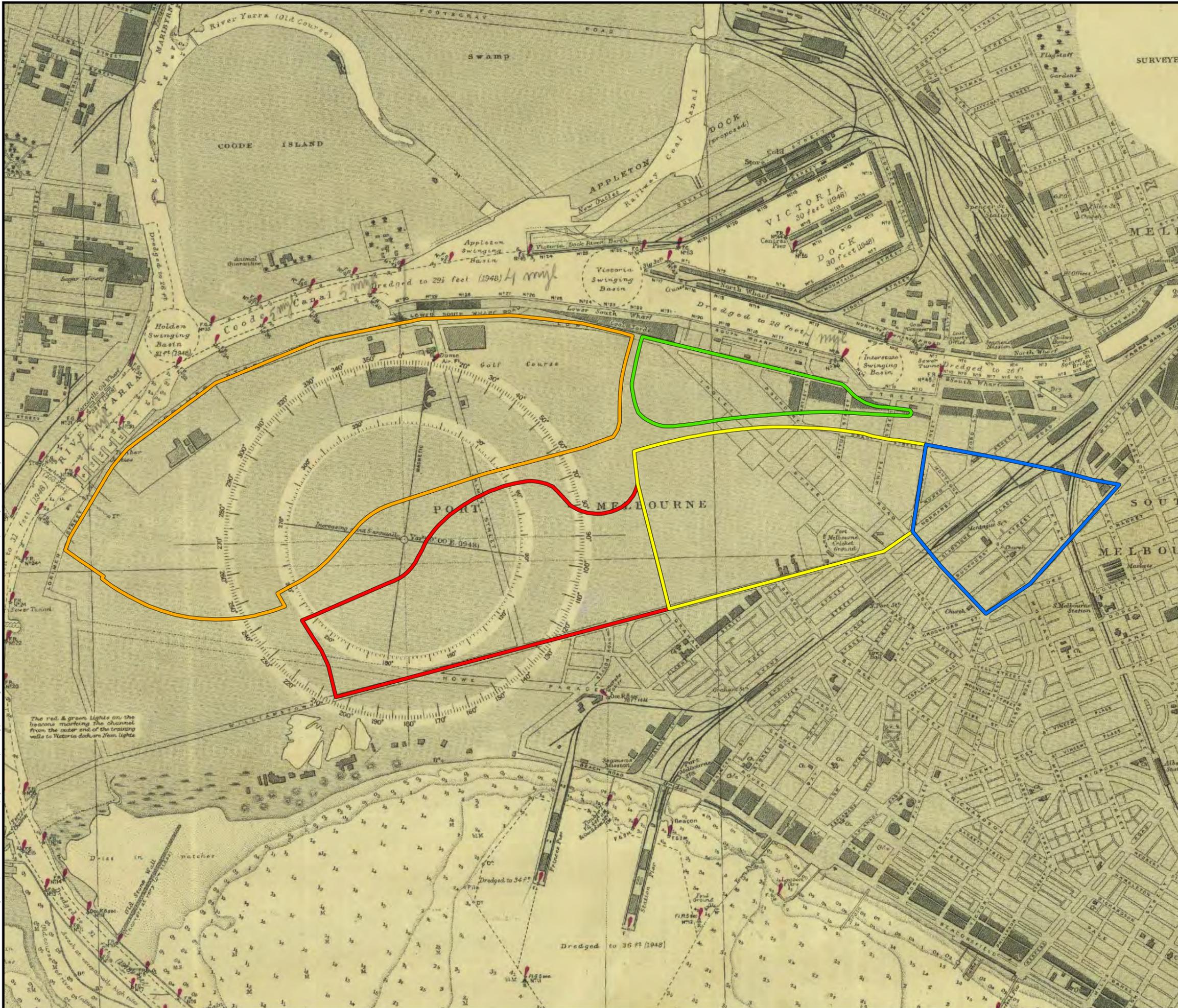
Data sources:
 Base Data: (c) 2012 StreetPro
 Aerial photography service layer credits:

CITY OF MELBOURNE MAP 1864

EPA
 2017 Employment Desktop Study
 Fisherman's Bend, Port Melbourne,
 VIC

Figure
F13

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- LEGEND**
- Employment Precinct
 - Lorimer Precinct
 - Montague Precinct
 - Sandridge Precinct
 - Wirraway Precinct

Data sources:
 Base Data: (c) 2012 StreetPro
 Aerial photography service layer credits:

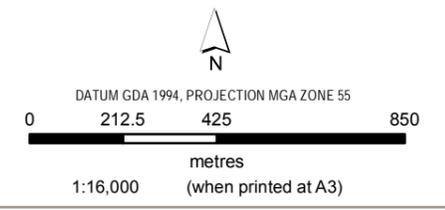
CITY OF MELBOURNE MAP 1948

EPA
 FBURA Desktop Study
 Fisherman's Bend, Port Melbourne,
 VIC

Figure
F14

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- LEGEND**
- GQRUZ_Sites
 - PSR_Sites
 - Site_Audit_Summary
 - 1km Buffer
 - LGA Boundary
 - Employment Precinct
 - Lorimer Precinct
 - Montague Precinct
 - Sandridge Precinct
 - Wirraway Precinct

Data sources:
 Base Data: (c) 20XX (data source)
 (additional data)

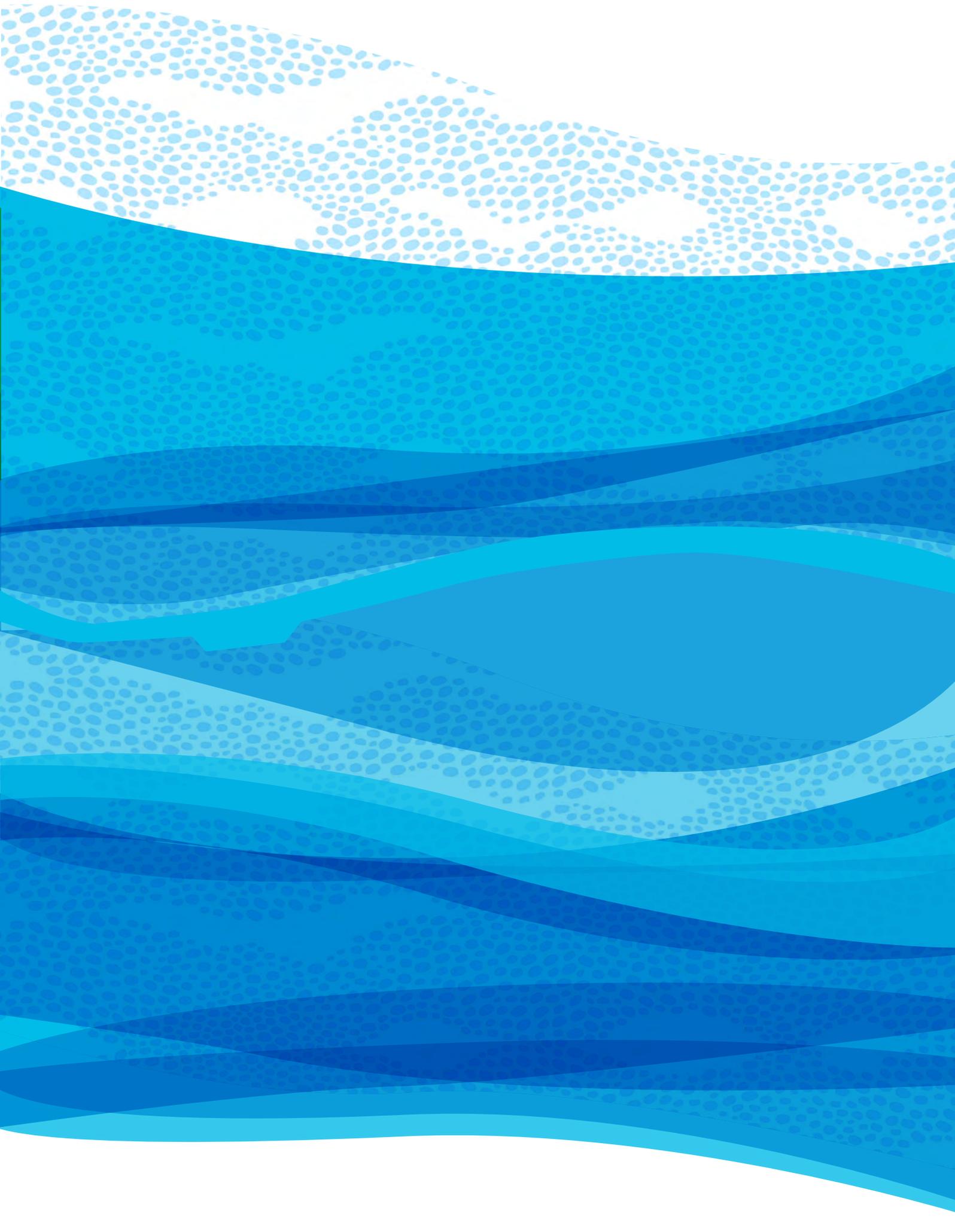
EPA AUDIT, PSR, GQRUZ SITES

EPA
 2017 Employment Desktop Study
 Fisherman's Bend, Port Melbourne,
 VIC

Figure
F15

Historical and Current Land Uses (Golder, 2016)

APPENDIX A





3.2 Summary: Industry Land Use Model

3.2.1 Past and Present Land Use by Industry Sector

A broad range of land uses have been identified in the Employment Precinct. Land use can be grouped to develop an understanding the general extent and periods of industrial land use in the Employment Precinct. The National Environment Protection (Assessment of Site Contamination) Measure 1999 (amended in 2013) provides guidance on how to categorise land use based on industry sector and sub sector. Land use has been assigned by industry sector and sub-sector to group similar land use, industrial processes and contaminants of interest. The industry land use model is important to inform the ranking of potential land use contamination.

Land use has been categorised into two periods: past (before 1990) and present (after 1990). The year 1990 has been used as it represents when the Environmental Audit system began in Victoria. The introduction of this system represents a shift in the assessment of contaminated land to support renewal of industrial land for sensitive uses in Victoria. Sites which were redeveloped after 1990 were listed as both past and present. Land use related to landfills and mining is covered within the fill model section of the report (Section 4.3).

Past and present land-use has been summarised a using current approach to screen land use to aid comparison (Table 1).

Table 1: Industrial Land Uses Identified within the Study Area

Industry Sector	Industry Sub-Sector and Land Use
Advanced Manufacturing: Aerospace	Aerospace
	Airfield / Racecourse
	Industrial Laboratory / Research Centre
Advanced Manufacturing: Automotive	Automotive
	Machinery
	Metal Fabrication
Advanced Manufacturing: Hi Tech	Print and Paint
	Electronics
	Medical
	Laboratories
Light Manufacturing and Engineering	Depots and Workshops
	Food Production
	Utilities and Energy Services
	Mechanics and Mechanical Good
	Timber
	Salvage Yards
Cement, Lime, Plaster and Concrete Products	Recreational Boating and Motorised Sports
	Cement Products
	Plaster Products
Shipping / Logistics / Distribution	Precast Concrete Products
	Logistics
	Warehousing and Distribution
Commerce / Business Services / Wholesaling	Shipping / Container Yard
	Commerce
	Office and Warehouse
	Wholesale / Retail Space
Open Space and Recreation	Accommodation
	Parks
	Sport Facilities



PRELIMINARY LAND CONTAMINATION STUDY, EMPLOYMENT PRECINCT FISHERMANS BEND

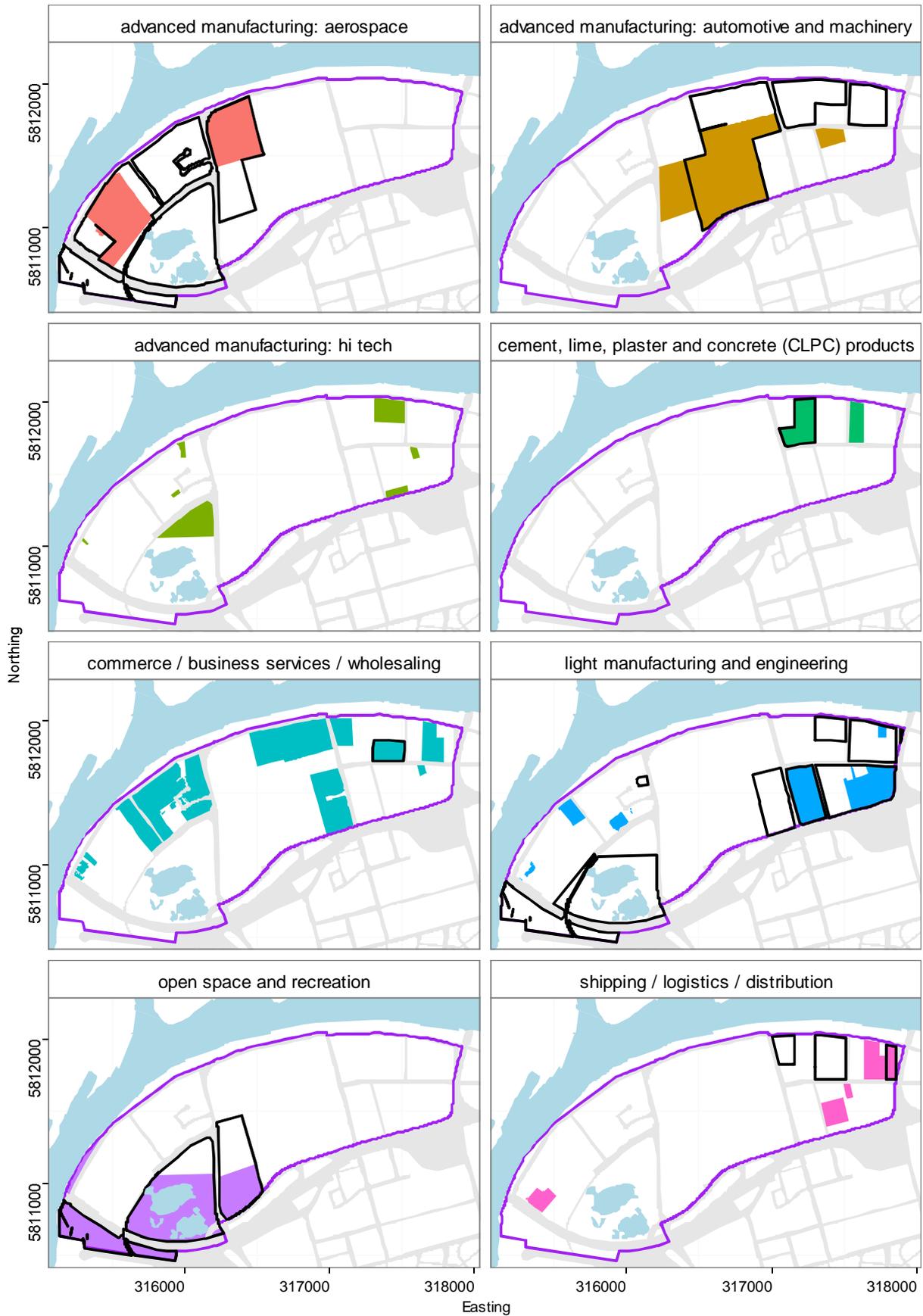


Figure 37: Location of industry footprint in Fisherman's Bend Precinct showing a) past land use (black border) and b) present land use (filled area). Study Area boundary shown with Employment Precinct in purple.



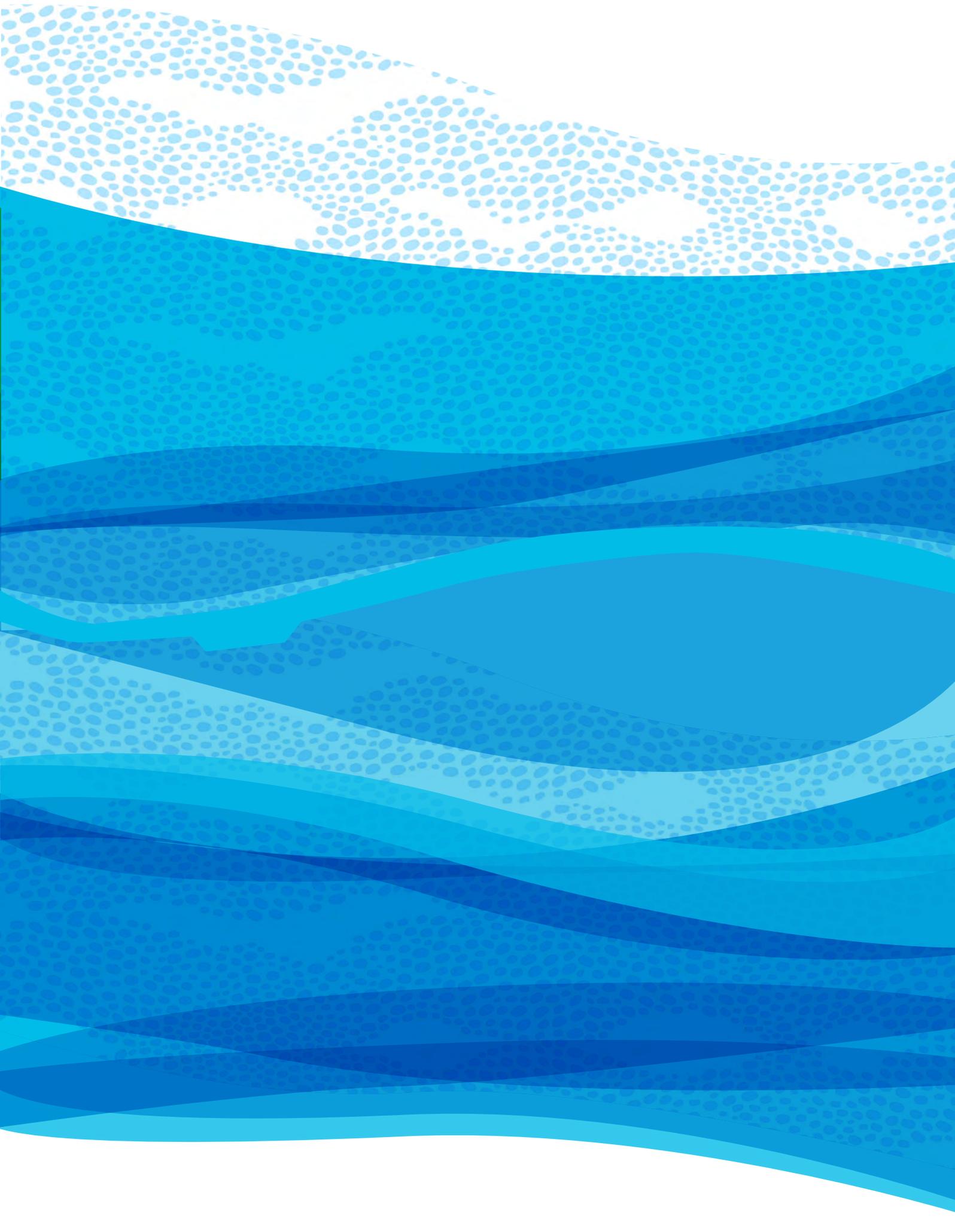
- Sub-precinct E09 – former Port Melbourne Municipal Tip
- Sub-precinct E10 – current Herald and Weekly Times print facility
- Sub-precinct E11 – current Boeing Aerostructures Australia and former Government Aircraft Factory
- Sub-precinct E12 – former Commonwealth Aircraft Corporation
- Sub-precinct E13 – current Westgate Park

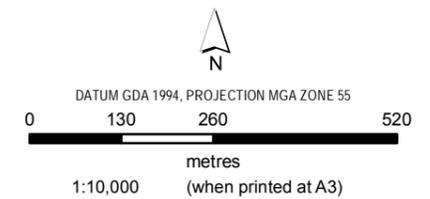
The following sub-precincts are noted for their mixed land use and ownership. This approach is similar to that adopted in the Golder (2012) study:

- Sub-precinct E01 – current mixed industry and distribution land use
- Sub-precinct E02 - current mixed industry and business park land use
- Sub-precinct E07 – current business parks

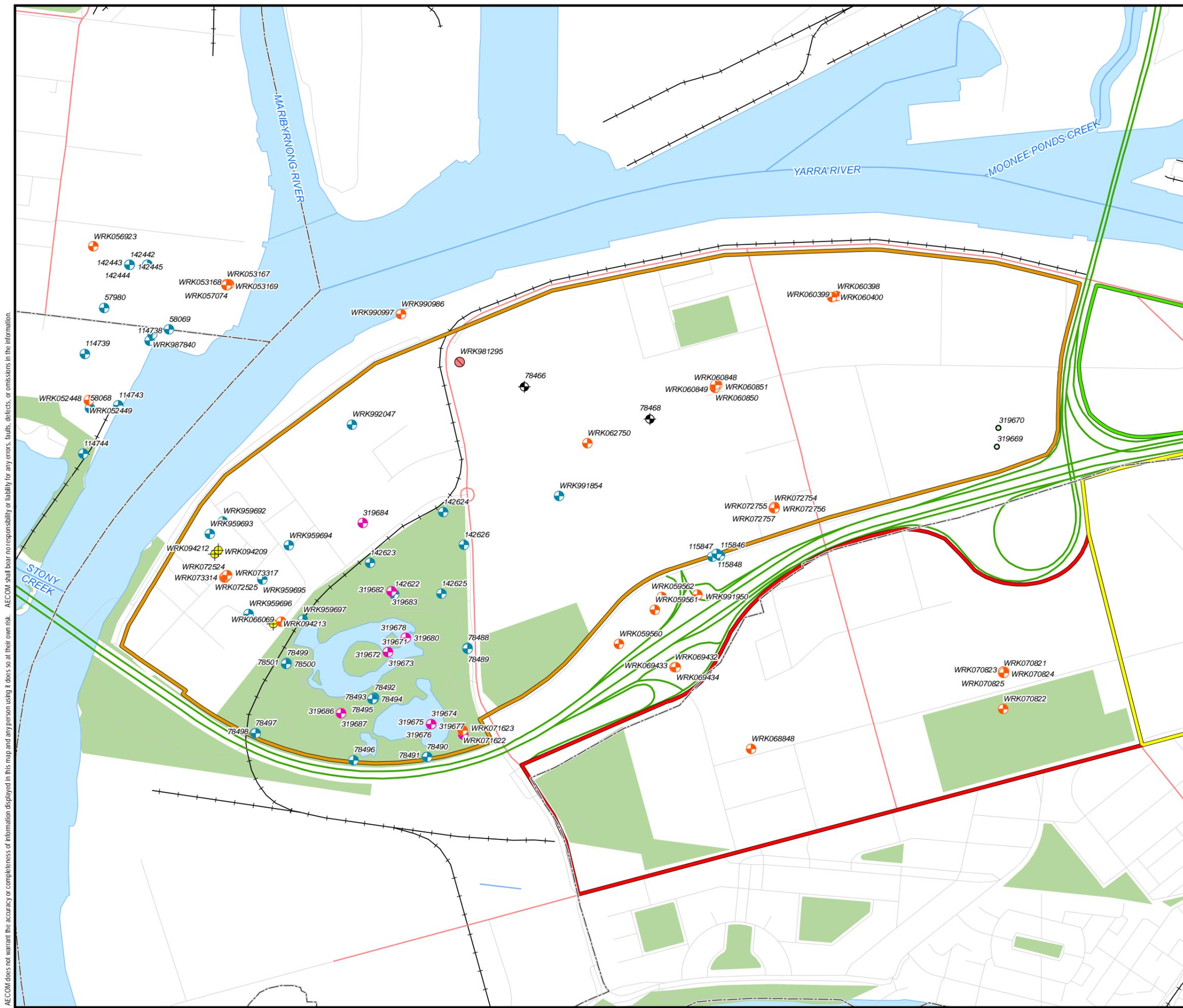
Groundwater Bore Search Results

APPENDIX B





- LEGEND**
-  DOMESTIC AND STOCK
 -  GROUNDWATER INVESTIGATION
 -  INDUSTRIAL, DISPOSAL
 -  NON GROUNDWATER
 -  NOT KNOWN
 -  OBSERVATION
 -  SEC BORES (USE UNIDENTIFIED)
 -  LGA Boundary
 -  Employment Precinct
 -  Lorimer Precinct
 -  Montague Precinct
 -  Sandridge Precinct
 -  Wirraway Precinct



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Data sources:
 Base Data: (c) 20XX (data source)
 (additional data)

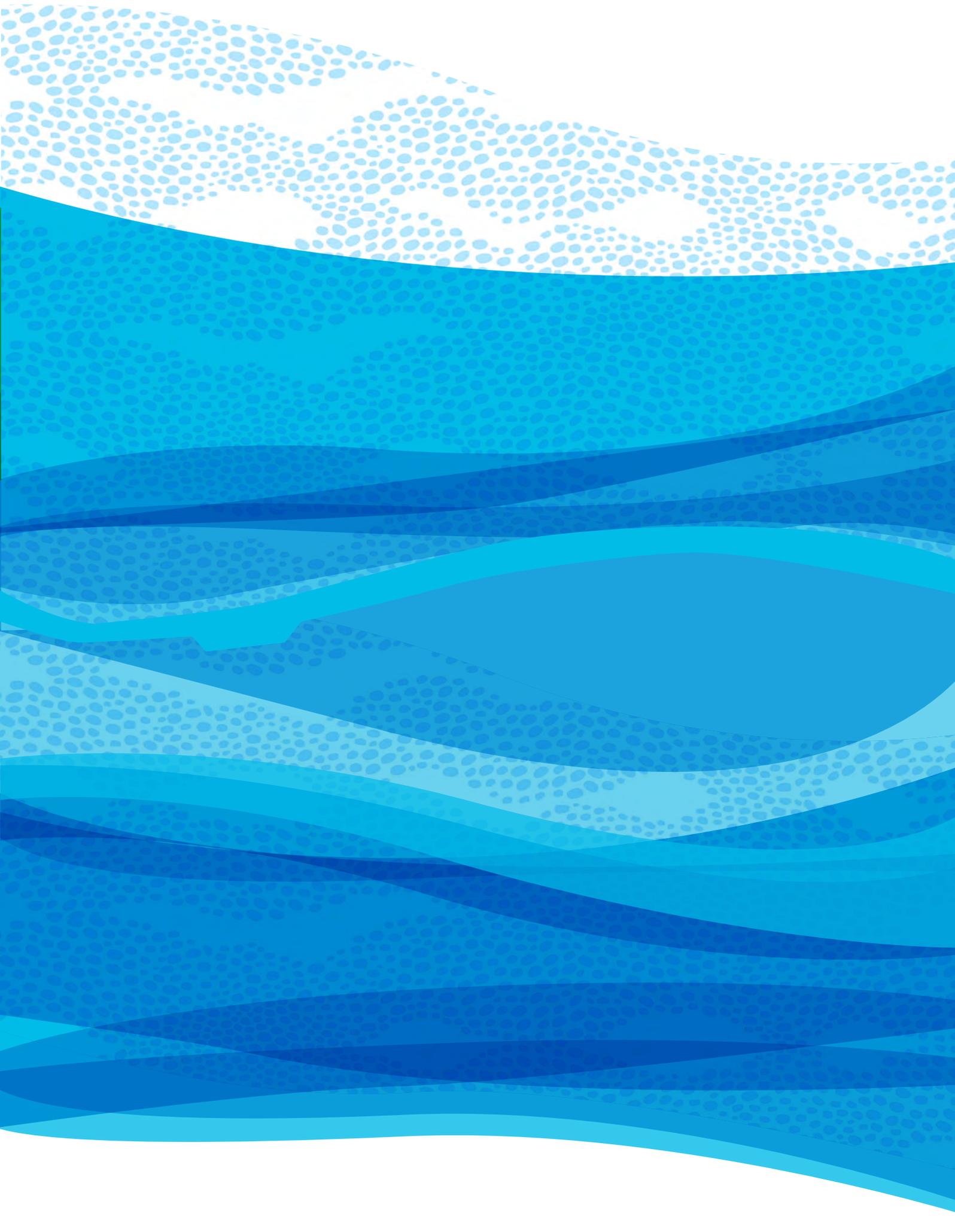
**VISUALISING VICTORIA'S
 GROUNDWATER BORE NETWORK
 WITHIN 1KM OF THE SITE**

<p>EPA 2017 Employment Desktop Study Fisherman's Bend, Port Melbourne, VIC</p>	<p>Figure</p>
---	---------------

Bore ID	Type	Status	Latitude	Longitude	Location m	Easting	Northing	Zone	Distance to Area	Alias ID	Date comm	Date complet	Use	Date retired (Total depth Drilled bore	Max diame	Elevation t	Elevation g	Date surge	Survey des	Surveyor n	Survey loc	Screen top	Screen bot	Condition c	Date effect	Artesian y/	Screened lithology	
WRK07082	DRILLED	E Used	-37.8316	144.9284	NOT KNOV	317697	5810850	55	RWC=SOL	Victorian W	29/08/2012	29/08/2012	OBSERVATION		5												N		
WRK07082	DRILLED	E Used	-37.8316	144.9285	NOT KNOV	317699	5810846	55	RWC=SOL	Victorian W	30/08/2012	30/08/2012	OBSERVATION		4.5													N	
WRK07162	DRILLED	E Used	-37.8327	144.9113	NOT KNOV	316192	5810687	55	RWC=SOL	Victorian W	1/11/2012	1/11/2012	OBSERVATION		15													N	
WRK07162	DRILLED	E Used	-37.8327	144.9113	NOT KNOV	316192	5810687	55	RWC=SOL	Victorian W	1/11/2012	1/11/2012	OBSERVATION		15													N	
WRK07162	DRILLED	E Used	-37.8327	144.9113	NOT KNOV	316192	5810687	55	RWC=SOL	Victorian W	1/11/2012	1/11/2012	OBSERVATION		15													N	
WRK07252	DRILLED	E Used	-37.8288	144.9039	NOT KNOV	315528	5811113	55	RWC=SOL	Victorian W	2/01/2013	2/01/2013	OBSERVATION		8.3	220							6.8	8.3				N	
WRK07252	DRILLED	E Used	-37.8288	144.9039	NOT KNOV	315530	5811115	55	RWC=SOL	Victorian W	2/01/2013	2/01/2013	OBSERVATION		6.8													N	
WRK07272	DRILLED	E Used	-37.8272	144.9213	NOT KNOV	317058	5811305	55	RWC=SOUTHERN	RL	23/04/2013	23/04/2013	OBSERVATION		3.8	150							0.8	3				N	
WRK07272	DRILLED	E Used	-37.8272	144.9213	NOT KNOV	317060	5811306	55	RWC=SOUTHERN	RL	23/04/2013	23/04/2013	OBSERVATION		3.8	150							0.8	3				N	
WRK07272	DRILLED	E Used	-37.8272	144.9213	NOT KNOV	317060	5811310	55	RWC=SOUTHERN	RL	23/04/2013	23/04/2013	OBSERVATION		3.8	150							0.8	3				N	
WRK07272	DRILLED	E Used	-37.8272	144.9213	NOT KNOV	317060	5811305	55	RWC=SOUTHERN	RL	23/04/2013	23/04/2013	OBSERVATION		3.8	150							0.8	3				N	
WRK07331	DRILLED	E Used	-37.8286	144.9039	NOT KNOV	315528	5811113	55	RWC=SOUTHERN	RL	25/02/2013	25/02/2013	OBSERVATION		6.8	200							5.3	6.8				N	
WRK07331	DRILLED	E Used	-37.8288	144.9039	NOT KNOV	315529	5811113	55	RWC=SOL	Victorian W	25/02/2013	25/02/2013	OBSERVATION		5.8													N	
WRK07331	DRILLED	E Used	-37.8288	144.9039	NOT KNOV	315530	5811115	55	RWC=SOL	Victorian W	25/02/2013	25/02/2013	OBSERVATION		5.7													N	
WRK07331	DRILLED	E Used	-37.8287	144.904	NOT KNOV	315535	5811120	55	RWC=SOL	Victorian W	26/02/2013	26/02/2013	OBSERVATION		6.1													N	
WRK09420	DRILLED	E Used	-37.828	144.9036	NOT KNOV	315501	5811179	55	RWC=(Not set),GMA=	4/06/2016	4/06/2016	INDUSTRIAL,DISPOSAI		6.5									2.5	6.5				N	
WRK09421	DRILLED	E Used	-37.828	144.9037	NOT KNOV	315511	5811189	55	RWC=(Not set),GMA=	4/06/2016	4/06/2016	INDUSTRIAL,DISPOSAI		6.5									2.5	6.5				N	
WRK09421	DRILLED	E Used	-37.8298	144.9054	NOT KNOV	315664	5810984	55	RWC=(Not set),GMA=	5/06/2016	5/06/2016	INDUSTRIAL,DISPOSAI		5									2	3				N	
WRK95962	NOT KNOV	Used	-37.8274	144.9039	GLOBAL P	315523.3	5811269	55	Historic	Gv	29/08/2003	29/08/2003	GROUNDWATER INVE:		5.5		2.82	2.82	9/11/2011	DEM20	DSE-C/O SKM TATUR		0.8	5.5				N	
WRK95962	NOT KNOV	Used	-37.8277	144.9034	GLOBAL P	315486.7	5811234	55	Historic	Gv	29/08/2003	29/08/2003	GROUNDWATER INVE:		7		2.71	2.71	9/11/2011	DEM20	DSE-C/O SKM TATUR		0.7	7				N	
WRK95962	NOT KNOV	Used	-37.828	144.9059	GLOBAL P	315707.2	5811202	55	Historic	Gv	29/08/2003	29/08/2003	GROUNDWATER INVE:		8.5		2.48	2.48	9/11/2011	DEM20	DSE-C/O SKM TATUR		0.3	8.5				N	
WRK95962	NOT KNOV	Used	-37.8288	144.9051	GLOBAL P	315633.3	5811107	55	Historic	Gv	29/08/2003	29/08/2003	GROUNDWATER INVE:		8.5		2.36	2.36	9/11/2011	DEM20	DSE-C/O SKM TATUR		0.7	8.5				N	
WRK95962	NOT KNOV	Used	-37.8297	144.9046	GLOBAL P	315595.2	5811012	55	Historic	Gv	29/08/2003	29/08/2003	GROUNDWATER INVE:		8		2.23	2.23	9/11/2011	DEM20	DSE-C/O SKM TATUR		0.5	8				N	
WRK95962	NOT KNOV	Used	-37.8299	144.9063	GLOBAL P	315746.3	5810995	55	Historic	Gv	29/08/2003	29/08/2003	GROUNDWATER INVE:		12.7		2.11	2.11	9/11/2011	DEM20	DSE-C/O SKM TATUR		0.7	12.7				N	
WRK98122	DRILLED	E Used	-37.8235	144.9115	NOT KNOV	316183	5811713	55	RWC=SOL	Historic Gv	16/05/2007	18/05/2007	DOMESTIC AND STOC		4	200	2.58	2.58	9/11/2011	DSELI	DSE-C/O SKM TATUR		1	3				N	
WRK98782	DRILLED	E Used	-37.8226	144.9018	NOT KNOV	315327	5811791	55	RWC=SOL	Historic Gv	4/09/2008	5/09/2008	GROUNDWATER INVE:		5	300	2.61	2.61	9/11/2011	DSELI	DSE-C/O SKM TATUR		1	5				N	
WRK99092	DRILLED	E Used	-37.8223	144.9096	NOT KNOV	316020	5811846	55	RWC=SOL	Historic Gv	25/05/2009	1/06/2009	GROUNDWATER INVE:		3.5	200	2.11	2.11	9/11/2011	DSELI	DSE-C/O SKM TATUR		2	3.5				N	
WRK99092	DRILLED	E Used	-37.8223	144.9096	NOT KNOV	316020	5811846	55	RWC=SOL	Historic Gv	22/10/2009	22/10/2009	OBSERVATION		3	200	2.11	2.11	9/11/2011	DSELI	DSE-C/O SKM TATUR		1.5	3				N	
WRK99182	DRILLED	E Used	-37.8269	144.9145	NOT KNOV	316460	5811340	55	RWC=SOL	Historic Gv	2/07/2009	9/07/2009	GROUNDWATER		6	150	3.36	3.36	9/11/2011	DSELI	DSE-C/O SKM TATURA							N	
WRK99192	DRILLED	E Used	-37.8295	144.9188	NOT KNOV	316845	5811065	55	RWC=SOL	Historic Gv	4/12/2009	4/12/2009	OBSERVATION		6	125	4.97	4.97	9/11/2011	DSELI	DSE-C/O SKM TATURA							N	
WRK99202	DRILLED	E Used	-37.825	144.908	NOT KNOV	315883	5811539	55	RWC=SOL	Historic Gv	14/07/2009	14/07/2009	GROUNDWATER INVE:		5	225	2.37	2.37	9/11/2011	DSELI	DSE-C/O SKM TATUR		2	5				N	

Summary of Audit Reports within 1km of the Site

APPENDIX C



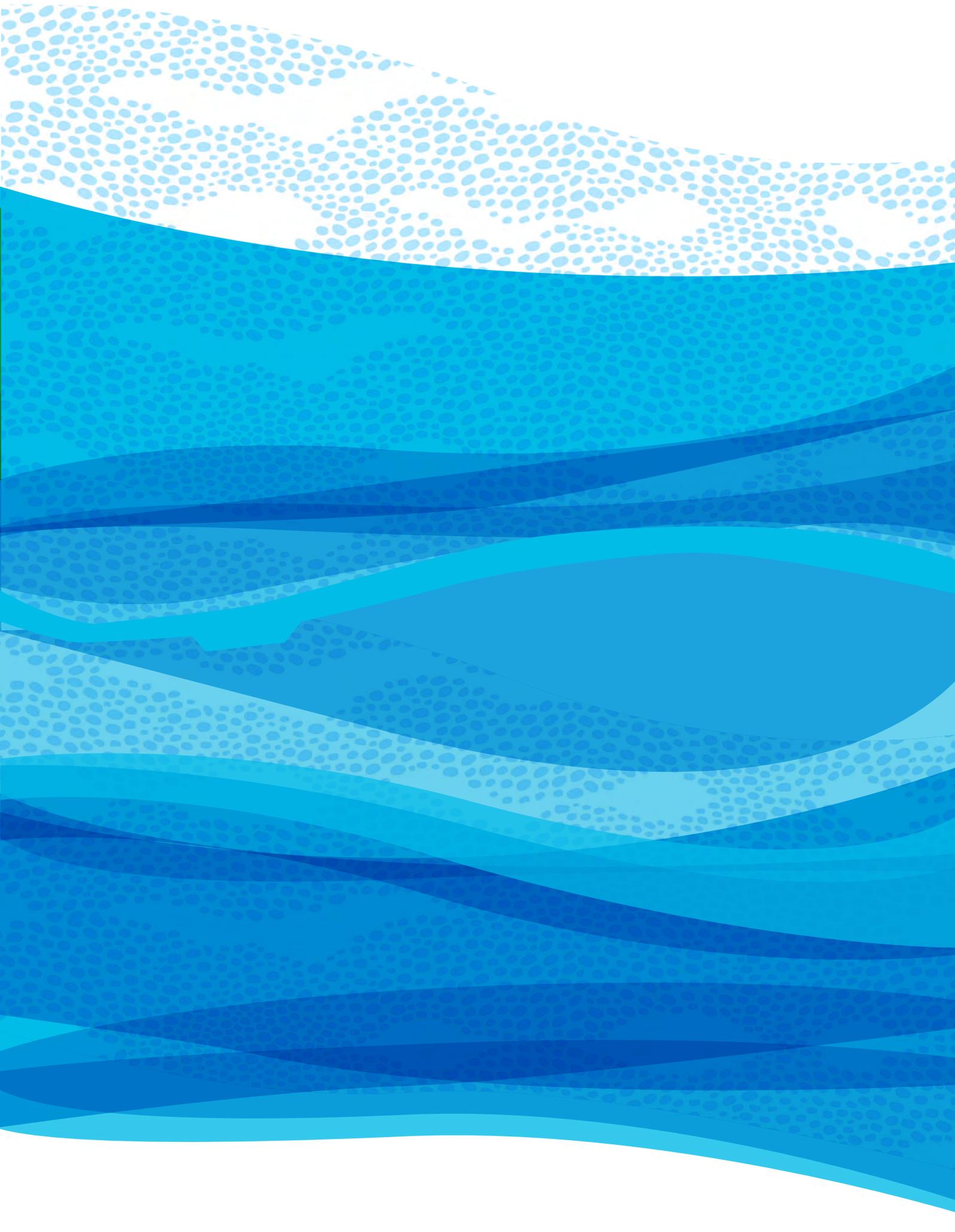
SON / CARMs No.	Type	Reason for Audit	Latitude	Longitude	Address	Date	GW investigation (Y/N)	Average Depth to GW (mbg)	Groundwater flow direction	TDS (mg/L)	CUTEP (Y/N)	Site Area (m ²)	No. of Wells	Current / Historical Use	Primary Source	Further Review Required (Y/N)	Onsite or Offsite
73239-1	53 V Recommendations	Voluntary	-37.494532	144.541484	224-260 Lorimer Street, Boeing Aerostructures Australia	30/06/2015	Y	1-8 mbg	north and South	NA	NA	12.9 Ha	NA	Aeronautical Manufacturing and Maintenance	Solvents from former degreasing activities, storage locations and clean lines. Former hydrocarbon fuel storage and use locations. Metals sources such as former electroplating shops. Other chemicals associated with various industrial processes including cyanides, dyes, epoxies, acids and alkalis	Y	On-site
32409-1	53 X Statement	NA	-37.829166	144.904368	Asta Facility, Lorimer Street, Fishermans Bend	25/03/1998	NA	NA	NA	NA	NA	NA	NA	Aircraft manufacturing	Fill material, fuel storage tanks	N	On-site
32409-2	53 X Statement	NA	-37.830084	144.902765	Test Cells 1&2 ASTA facility, Lorimer Street	25/03/1998	N	1-1.5 mbg	north to Yarra	High Salinity	NA	NA	NA	Aircraft engine testing facility	Metals Contained in Fill, TPH (Jet A1) and possibly TCE derivatives in soil and Groundwater	N	On-site
42748-2	53 X Statement	Voluntary	-37.821462	144.928486	770 Lorimer St, Port Melbourne	28/11/2003	Y	2.2 to 2.5	north to north west	NA	Y	4565	5 onsite, 2 off-site	Car park, foundry, BMW workshop	Fill, historical underground Storage tanks	N	On-site
33298-9	53 X Statement	EPA issued clean up notice	-37.827911	144.929682	Melbourne Citylink Lorimer Off Ramp, Area 9	22/03/1999	Y	1.9-2.7 m	north to north west	NA	NA	NA	NA	Abattoir, chemical works, soap factory, Kraft factory, quarry	Fill, various chemicals as per historical and current use including abattoir, manufacturing etc	N	On-site
Off-site																	
26919-1	53 X certificate		-37.832171	144.940601	Corner Durnam Street and Williamstown Rd	22/12/1995											Off-site
49997-1	53 X Statement	EPA issued clean up notice	-37.822582	144.93231	844 Lorimer Street, Port Melbourne	11/07/2006	Y	2.5	N	400	N	1700	9	Golf course, Service station	Fuel UST's on site	N	Off-site
45435-1	53 X Statement	Due diligence	-37.824345	144.933872	349 Ingles Street, Port Melbourne	9/03/2001	Y	2.5	N	1200	N	33000	4	Chemical manufacture, oil storage, joinery	Fill material, warehouse operations, car park	N	Off-site
48180-1	53 X Statement	Request for audit (CoEA) by EPA	-37.814939	144.90887	717 Footscray Rd, West Melbourne	28/08/2006	Y				Y	34520		Chemical Manufacturing/Storage/blending			Off-site
37104-1	53 X Statement		-37.836081	144.915611	Corner Todd Rd and Williamstown Rd	5/11/1999								Municipal Landfill			Off-site
38456-1	53 X Statement		-37.831986	144.923705	Lot 1, 69-119 Salmon Street, Port Melbourne	21/09/1999	Y		south to south west	NA	NA			Non Landfill Portion	Fill, Landfill		Off-site
38456-2	53 X Statement		-37.831986	144.923705	Lot 1, 69-119 Salmon Street, Port Melbourne	29/07/1999	Y		south to south west	NA	NA	12,650		Public works depot			Off-site
38456-3	53 X Statement		-37.831986	144.923705	69-119 Salmon Street, Port Melbourne	10/11/1999	Y		south to south west	NA	NA			Quarry, municipal landfill			Off-site
68702-1		Pollution Abatement Notice	-37.82865	144.941978	14 Woodruff Street, Port Melbourne	7/01/2014	Y	2	SW	420-10000	N	39000	11	Chemical factory and storage facility	Chemical storage tanks (above and below ground), chemical spills, fill material		Off-site
68702-2	53 V Recommendations	Pollution Abatement Notice	-37.82865	144.941978	14 Woodruff Street, Port Melbourne	7/01/2014								Chemical factory and storage facility	Chemical storage tanks (above and below ground), chemical spills, fill material		Off-site
68702-3	53 X Statement	Pollution Abatement Notice	-37.82865	144.941978	164 Ingles St, Port Melbourne	17/07/2015								Chemical factory and storage facility	Chemical storage tanks (above and below ground), chemical spills, fill material		Off-site
44896-1	53 X certificate		-37.832348	144.94019	518 Williamstown Road, Port Melbourne	28/09/2001	Y	3	SW	800	Planning permit requirement	439	3	Storage of building materials	Fill material, neighbouring foundry and service station		Off-site
35419-1	52 X Statement	Voluntary	-37.82417	144.94318	Yarra Waters Precinct, Docklands	5/01/2000	Y	0.5 to 1.5	Southerly					Shipping Wharf, gasworks, chemical manufacturing, automobile storage and detailing	Fill, chemicals used in gasworks, manufacturing, USTs		Off-site
35419-5	53 X Statement	Voluntary	-37.82234	144.93709	Yarra Waters Precinct, Docklands	15/02/2005	Y	0.22 to 1.18	Southerly		Y			Shipping Wharf, gasworks, chemical manufacturing, automobile storage and detailing	Fill, chemicals used in gasworks, manufacturing, USTs		Off-site
73437-1	53X Statement/GQRUZ	Voluntary	-37.82408	144.94132	85-93 Lorimer St, Docklands	24/08/2015	Y	0.66 - 1.55	north and northwest	12,000 to 22,000	N	8849	920	Timber storage, Timber drying and transport industry use, Coal yard	Fill, Timber saw mill operation, USTs,		Off-site
71083-1	53X Statement	Voluntary	-37.82459	144.93753	222 Ingles St, Port Melbourne	8/12/2015	Y	1-2 m	SW			4800		Boral manufacturing			Off-site
48518-4	53X Statement	Voluntary	-37.82015	144.94046	Victoria Dock, Bourke st, Docklands	22/01/2010	Y	1 -2 m	Radial			1600		warehouse, maritime cargo and vehical storage	Fill, USTs and manufacturing operations		Off-site
48518-6	53X Statement	Voluntary	-37.81954	144.93651	Victoria Harbour, Collins st, Docklands	11/05/2012	Y	1 -2 m	Radial			3000		Marshland, reclaimed land, stevedoring, warehouse, marine maintenance, coal handling	Fill, USTs, gasworks		Off-site
33298-8	53 X Statement	Voluntary	-37.81768	144.93271	Melbourne City Link, west melbourne	18/03/1999	Y	2 -4 m	south					Flood plain, Dockyard, railway alignment, storage and manufacturing	Fill, USTs and manufacturing operations		Off-site
26997-1	53 X Statement	NA	-37.83988	144.89471	Newport, Hobsons Bay City Council	4/06/1996	NA	NA	NA	NA	NA	NA	NA	Newport Power Station	Fill, chemicals associated with Power Station		Off-site
72541-1	53 X Statement	Client wishes to adopt best practices	-37.816943	144.934202	473-534 Docklands Dr, Docklands	31/07/2014	Y		primarily west	3530 to 13,000	NA	23,000		Ship maintenance, Railway sidings, Timber and coal storage and transportation, workshop, waste equipment dumping	Fill, USTs, railway use, workshop chemicals, coal storage etc		

Notice No	Latitude	Longitude	Council	Address	Approximate DistanceFrom Site	Issue	Recommendation
90006917	-37.82902	144.91898	Melbourne City Council	1 West Gate Fwy, Port Melbourne		Current Service Station	Requires assessment and/or clean up
Off-site							
9006663	-37.83092	144.91864	Melbourne City Council	2 West Gate Fwy, Port Melbourne	50 m south	Current Service Station	Requires assessment and/or clean up
90006320	-37.82170	144.90148	Maribyrnong City Council	2A Francis St, Yarraville	500 m north west	Former Industrial Site	Requires assessment and/or clean up
90006713	-37.82360	144.89839	Hobsons Bay City Council	29 Francis St, Spotswood	700 m north west	Current chemical storage facility	Requires assessment and/or clean up
90004781	-37.82129	144.89847	Maribyrnong City Council	325 Whitehall St, Yarraville	900 m north west	Former Industrial Site	Requires assessment and/or clean up
90006664	-37.82061	144.89856	Maribyrnong City Council	325 Whitehall St, Yarraville	900 m north west	Former Industrial Site	Requires assessment and/or clean up
90001325	-37.83566	144.89083	Hobsons Bay City Council	Burleigh St, Newport	700 m west	Current Petroleum Storage Site	Requires assessment and/or clean up
90006881	-37.83580	144.88946	Hobsons Bay City Council	411 Douglas Pde, Newport	800 m west	Current Petroleum Storage Site	Requires assessment and/or clean up
90007126	-37.83526	144.88877	Hobsons Bay City Council	18-24 Drake St, Spotswood	850 m west	Former Petroleum storage site	Requires assessment and/or clean up

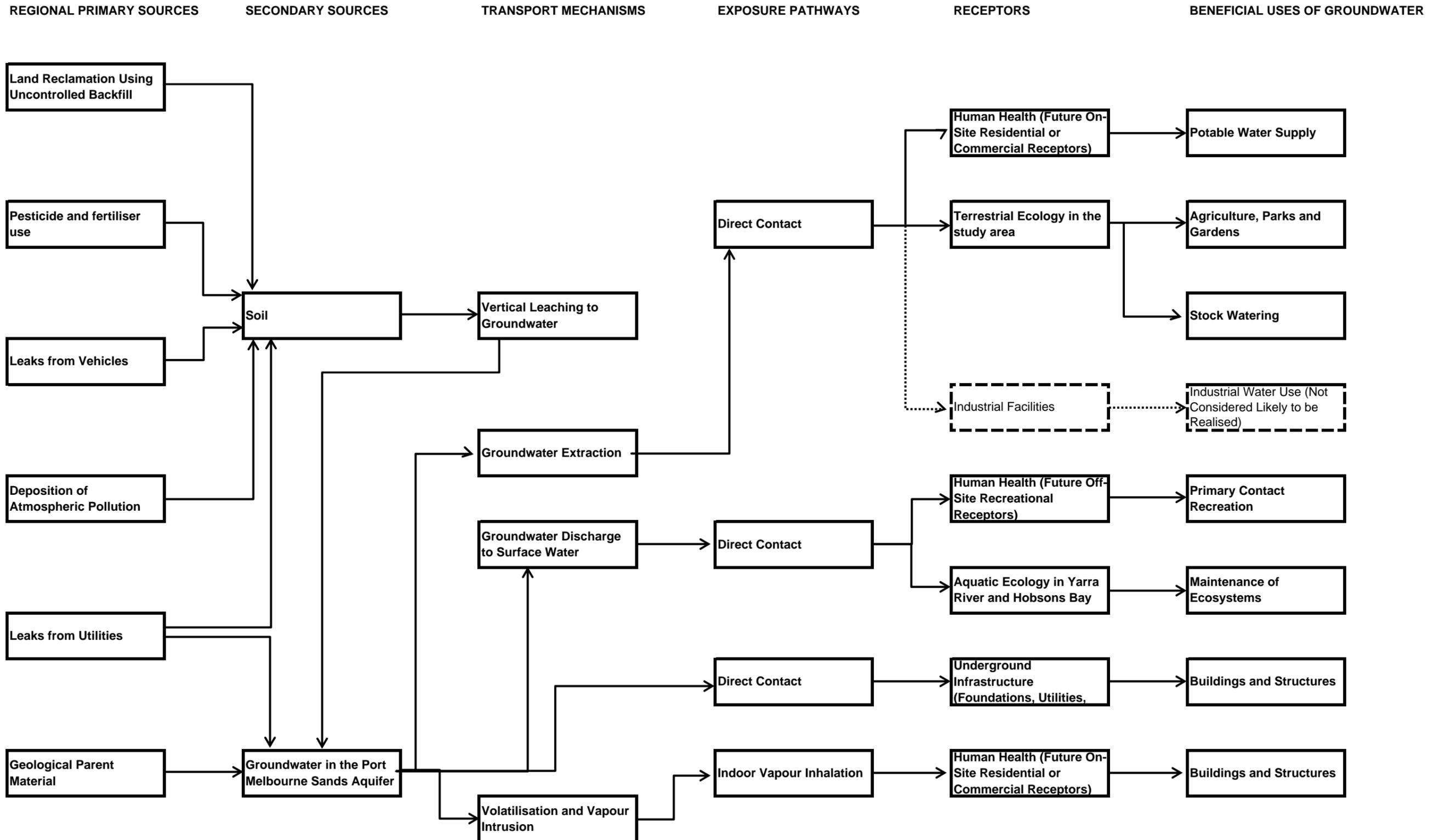
EPA CARMs No.	Latitude	Longitude	Address	Date	GW investigation (Y/N)	Site History	Restriction
35419-5	-37.82234	144.93709	Yarra Waters Precinct, Lorrimer St, Docklands	15/02/2005	Y	Shipping Wharf, gasworks, chemical manufacturing, automobile storage and detailing	Drinking water, Livestock water supply, irrigation of crops (including domestic gardens) and parks, water used for recreational purposes (e.g. swimming)
71083-1	-37.82459	144.93753	222 Ingles St, Port Melbourne	8/12/2015	Y	Boral manufacturing	Drinking water, Livestock water supply, irrigation of crops (including domestic gardens) and parks, water used for recreational purposes (e.g. swimming)
68702-3	-37.82865	144.941978	164 Ingles St, Port Melbourne	17/07/2015	Y	Chemical factory and storage facility	Drinking water, Livestock water supply, irrigation of crops (including domestic gardens) and parks, water used for recreational purposes (e.g. swimming)
73437-1	-37.82408	144.94132	85-93 Lorimer St, Docklands	24/08/2015	Y	Timber torage, Timber drying and trnsport industry use, Coal yard	Drinking water, Livestock water supply, water used for recreational purposes (e.g. swimming), water used for industrial purposes
72541-1	-37.816943	144.934202	509-529 Docklands Dr, Docklands	31/07/2014	Y	Ship maintenance, Railway sidings, Timber and coal storage and transportation, workshop, waste eqipment dumping	Drinking water, water used for industrial purposes
48180-1	-37.814939	144.90887	717 Footscray Rd, West Melbourne	28/08/2006	Y	Chemical Manufacturing/Storage/blending	Drinking water, Livestock water supply, irrigation of crops (including domestic gardens) and parks, water used for recreational purposes (e.g. swimming)

Potentially Complete Regional Source- Pathway-Receptor Linkages

APPENDIX D



Preliminary Regional Conceptual Site Model



Note: Site Specific Sources are excluded.



