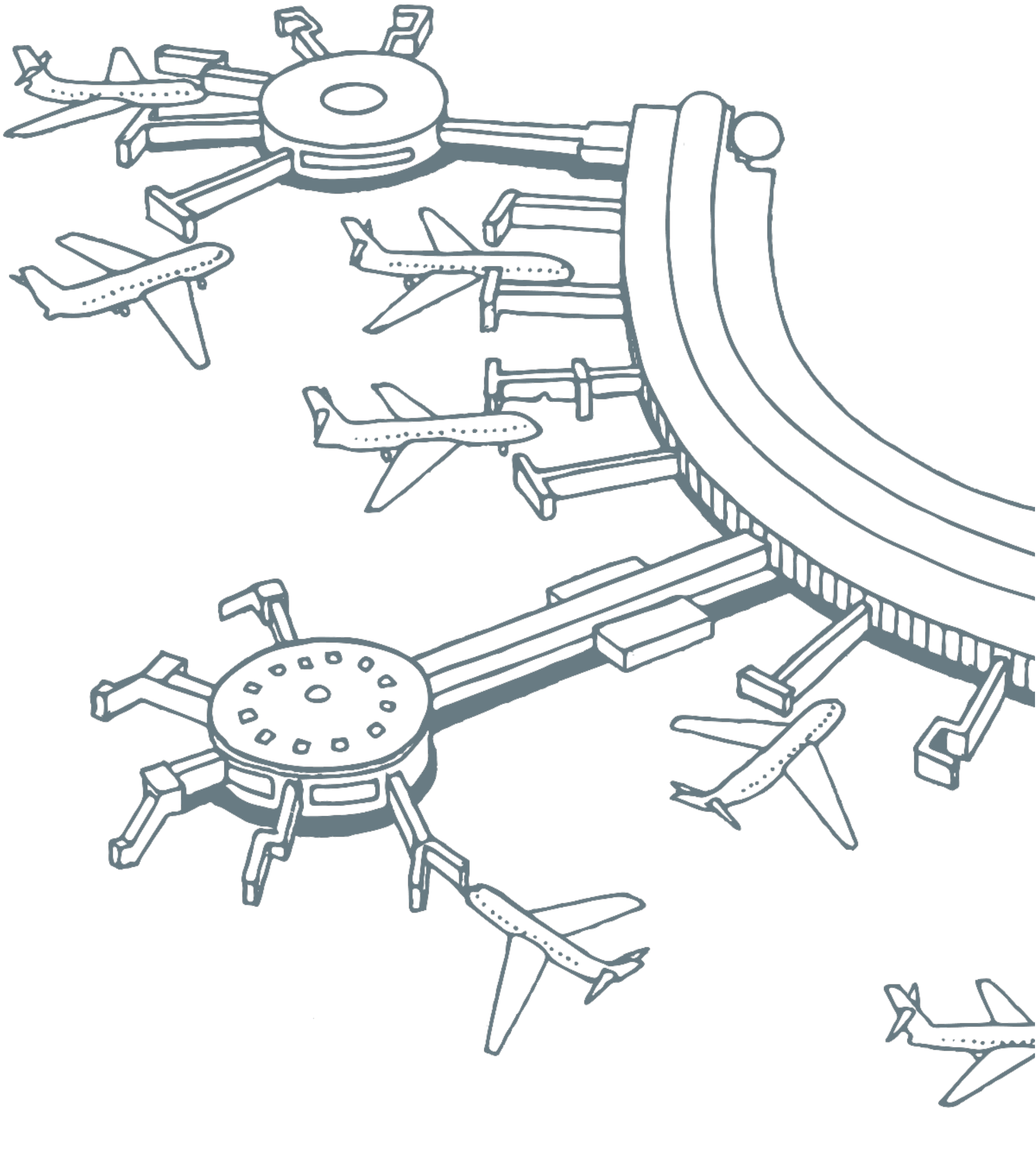
# APPENDIX G
# CONTAMINATION SUMMARY – TECHNICAL MEMORANDUM



GOLDER

# TECHNICAL MEMORANDUM

**DATE** 26 March 2019 18107809-001-TM-Rev0

**TO** Paul Lutz, Brisbane Airport Corporation Pty Limited

**CC** Greg Whitmore

**FROM** Andrew Howes **EMAIL** ahowes@golder.com.au

**CONTAMINATION SUMMARY – TECHNICAL MEMORANDUM**
**PROPOSED AUTO MALL DEVELOPMENT, BRISBANE AIRPORT**

## 1.0 INTRODUCTION

Brisbane Airport Corporation Pty Ltd (BAC) commissioned Golder Associates Pty Ltd (Golder) to complete a soil and water quality summary report for the proposed Auto Mall at Brisbane Airport. The proposed Auto Mall Precinct development is situated on an area between Moreton Drive, Nancy Bird Way and Airport Drive at the Brisbane Airport in Queensland (site, **Figure 1**).

The aim of the technical memorandum is to provide a summary of results from previous contamination investigations and construction monitoring. This includes a review of results against the Heads of EPAs (HEPA) per- and polyfluoroalkyl substances National Environmental Management Plan (PFAS NEMP) that was released in January 2018 since previous contamination investigations were reported. It also includes an update of the conceptual site model (CSM) and recent surface water data relevant to the construction phase at the site.

## 2.0 PROJECT DETAILS

The proposed project site covers an area of approximately 51.3 hectares, previously a low-lying area heavily vegetated with casuarina forest and mangroves. The original surface level was at approximately RL 2.4-2.5 m AD[1]. Large areas of the site were influenced by tidal waters and seasonal groundwater was shallow, interacting with the surface soils. An unlined drain cut through the north-eastern corner of the site. An Energex electrical substation and associated cables easement cuts the site in two, as illustrated in **Figure 1**.

This first phase of the project is currently being undertaken in accordance with the Environmental Assessment Report (EAR) which identified the potential environmental risks, and associated management and monitoring measures to be implemented for the disturbance activities. It included vegetation clearing, ground improvement works, filling and surcharge to develop the land. The next phase of works will be subject to a Major Development Plan with the scope to include the construction of the performance track, roads and services, and dealerships.

[1] Aerodrome Datum

Three land development stages were proposed as described below:

- Development Stage 1: Track, roads and selected development lots; lots north of the Energex easement between the track and Moreton Drive, and the Track and Nancy Bird Way.
- Development Stage 2: Development lots south of the Energex easement.
- Development Stage 3: Development lots north of the Energex easement between the track and Airport Drive.

The excavation of the perimeter drains and flood storage areas has been undertaken in stages with tidal waters prevented from entering the perimeter drains by temporary bunding. It is anticipated that tidal flaps will be installed during operation of the development (see also Section 6.5).

The designed construction works had the following ground disturbances:

- Excavation of perimeter drains, with invert levels (IL) ranging from 0.2 m AD to 2.4 m AD.
- Surcharge with imported material, to an assumed maximum of 9.5 m AD used to consolidate soft soils underlying this site and was designed to result in settlement of existing ground surface by up to 1.5 m.

Final site levels after settlement are designed to range from about 3.75 to 4.25 m AD.

Acid sulfate soils (ASS) have been addressed under a separate cover and an ASS Management Plan has been prepared for the site (both documents are referenced in Section 3.1). In addition, a Construction Environmental Management Plan (CEMP) has been prepared for the site to manage risks to workers and off-site human and ecological receptors. A Project Environmental Management Plan (Aurecon, 2017) has also been prepared, which is relevant to monitoring and managing of environmental values in this document, such as surface water and groundwater. The site's ASS MP and CEMP details monitoring to be undertaken during construction across a broad range of media but includes groundwater and surface water in accordance with the PFAS NEMP and the National Environmental Protection (Assessment of Site Contamination) Measure, 1999 (as amended in 2013). These documents address changes to the construction process and can be amended if unforeseen events occur.

# 3.0 BACKGROUND

## 3.1 Previous Investigations

Previous investigations undertaken at the site are listed below:

- Golder Associates, Acid Sulphate Soil and Contamination Desktop Review, Proposed Auto Precinct Brisbane Airport, February 2015, reference 1460490-002-R-Rev0 (Golder 2015).
- Golder Associates, Contamination Assessment, Proposed Auto Mall Precinct Stage 1, 5 June 2017, reference 1538021-013-R-Rev2 (Golder 2017b).
- Golder Associates, Contamination Assessment, Proposed Auto Mall Precinct Stage 2, 1 June 2017, reference 1538021-011-R-Rev2 (Golder 2017a).
- Golder Associates, Acid Sulphate Soil Assessment, Proposed Auto Mall Precinct Stage 1, 5 June 2017, reference 1538021-014-R-Rev2 (Golder 2017c).
- Golder Associates, Acid Sulphate Soil Assessment, Proposed Auto Mall Precinct Stage 2, 5 June 2017, reference 1538021-012-R-Rev1 (Golder 2017d).
- Golder Associates, Proposed Auto Mall Precinct, Acid Sulphate Soil Management Plan, February 2019, reference 1664971-001-R-Rev5 (Golder 2019).

- Golder Associates, Mineral Sands at Stage 2 of the Auto Mall Development – Results of the Assessment, 10 October 2018, 1664971-045-TM-Rev0 (Golder 2018)
- PSK, Site Monitoring Future Auto Mall Precinct – Stages 1, 2 and 3, Brisbane Airport, November 2018, 12 December 2018, 0517-005-020
- ALS Environmental, Surface Water Monitoring Results, sampled 7 February 2019, reference EB1902986 and PSK figure of sampling locations from tidal areas outside of the AutoMall site
- PSK Report, Site Monitoring Future Auto Mall Precinct – Stages 1, 2 and 3, Brisbane Airport, January 2019, 27 February 2019, 0517-005-022.
- PSK Technical Memorandum, PFAS Site Monitoring Future Auto Mall Precinct – Stages 1, 2 and 3, Brisbane Airport, January 2019, 27 February 2019, J0517-005-022.

In summary, Golder completed a desktop assessment of contamination in 2015 (Golder 2015), followed by detailed contamination investigations of soil and groundwater in 2015 and 2016 (Golder 2017a and Golder 2017b). The investigations by Golder considered the site as two portions being Stage 1 and Stage 2 as advised by BAC at the time of works being commissioned. This staging has been amended to be consistent with the latest staging in Section 2.0. Golder has also completed assessment of acid sulphate soils (ASS) in parallel with contamination investigations in addition for ASS management plans (Golder 2017c, Golder 2017d and Golder 2019).

The results are discussed in the respective reports. However, a summary of outcomes of those reports is as follows:

- Groundwater on site was shallow, measured to be as little as 710 mm from the surface. Groundwater is likely to be shallower at times of severe rain events.
- The key chemical of concern was PFAS, however, some metal concentrations (nickel and zinc) were also present above guidelines in groundwater.
- No known or potential PFAS contaminating activities were identified occurring (presently or in the past) on or in the immediate vicinity of the site.
- Concentrations of PFAS in soils and groundwater were below levels protective of human health and ecological receptors (besides guidelines available at the time, which related to consumption of fish).
- Diffuse levels of PFAS were present at low levels in soil and groundwater, generally at concentrations lower than areas of the airport closer to the known sources. On that basis, a qualitative risk assessment for the PFAS concentrations in groundwater beneath this site, suggests a low risk outcome associated with groundwater migration to the nearby and downstream surface water bodies.
- A qualitative risk assessment of expected PFAS impacted groundwater seepage entering the proposed site drain also suggested a low risk outcome for exposure downstream tidal drains and waterways.

Golder reported in 2018 an assessment summary of material suspected to be mineral sands (Golder 2018) – see Section 6.6. Most recently PSK undertook construction monitoring for the site of groundwater, surface water, dust, noise and vibration monitoring between December 2017 and November 2018 (PSK 2018). Construction monitoring of COPC was undertaken in groundwater for metals and PFAS. Whilst monitoring of surface water was undertaken for metals this was in relation to assessment of ASS.

Since the findings of the Golder contamination investigations being reported in 2017, the PFAS NEMP was released in January 2018. This technical memo provides a summary of the existing contamination investigation results and construction monitoring results against the PFAS NEPM.

## 3.2 Contaminants of Potential Concern

The contaminants of potential concern (COPC) from the following potential contamination sources were previously investigated by Golder at the site:

- PFAS in soil and groundwater associated with historical use in AFFF used for firefighting elsewhere at the airport.
- Heavy metals, mineral sands and radioactivity associated with BAC's activities listed as site 28 on its Contaminated Site Register (CSR). The location of BAC CSR site 28 is provided on **Figure 1**. It is understood that mineral sands may have been placed with other imported fill materials on site in the past. The mineral sands are likely to be sourced from the mining activities on North Stradbroke Island where rutile, zircon and ilmenite were mined (and continue to be mined). These minerals contain titanium and zirconium metals as well as associated naturally occurring radioactive materials (NORMs).
- Hydrocarbons, heavy metals and organochlorine pesticides in soil associated with the former constructions yard at the southern end of the site. This former activity was identified from review of historical aerial photographs to be present in 2009 and was likely associated with the works for the construction of Moreton Drive at that time. Hydrocarbons include total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAH).

# 4.0 SITE SETTING

## 4.1 Topography

The proposed site was historically a low lying plain drained by several channels. At the time of the investigations by Golder in 2015 and 2016, portions of the site had been filled with dredged sand, though with a limited thickness of 0.05 to 0.7 m. The predevelopment surface levels were in the 2.4-2.5 m AD range. Surcharging activities are currently being undertaken and final site levels after settlement are designed to range from about 3.75 to 4.25 m AD.

## 4.2 Hydrogeology

Previous investigations at the site have indicated that unconfined groundwater is typically present within about 0.6 m to 2 m below the original ground surface. Groundwater levels at the site are influenced by tidal fluctuations and seasonal rain events and expected to be generally at their highest at the end of the wet season in late summer. There is likely to be significant vertical movement of groundwater through the original shallow lithology with unrestricted discharge into the existing unnamed drains prior to earthworks commencing. More site-specific detail of groundwater movement and activity is provided in the Stage 1 and Stage 2 reports (Golder 2017b and Golder 2017a) and which is summarised in Section 6.2).

## 4.3 Hydrology

Prior to development, an open drain cut through the north-eastern corner of the site, allowing surface water and elevated groundwater to have flowed off site. Surrounding the site is Landers Pocket drain, which is the closest surface water body feature, located about 100 m west of the project area beyond Moreton Drive. Surface water in Landers Pocket drain flows north east for about 1 km from the site before discharging into Kedron Brook Floodway Drain, eventually discharging into Kedron Brook (also see EPP EV and WQO reference in Section 5.0). The ultimate receiving environment of surface water from Kedron Brook is Moreton Bay. Upon completion, the proposed perimeter drains will flow towards either end of the site and will result in discharges into Landers Pocket drain and subsequently Kedron Brook. Tidal flaps will reduce the risk of tidal water flowing backwards into the perimeter drains. During the current construction phase, these perimeter drains are isolated from external tidal drains by temporary bunding.

Additional site-specific information relating to historic surface water and its current interaction with the surrounding receiving environment is provided in Sections 6.5 and 6.6 of this document.

## 4.4 Soil Landscape

The Soil Landscapes of Brisbane and South-Eastern Environs, Queensland, CSIRO 1:100,000 scale Map Sheet (1985), indicates that the site is situated within alluvial landscapes likely to comprise the Woongoolba - WO soil group comprising the following:

- Dominant Soil Group – ‘Humic gleys, peaty gleys’ and ‘solonchaks’
- Landscape and Parent Geology – Low (coastal) plains of alluvium and narrow depressions.

This soil profile is young alluvium and frequently contains moderate to high concentrations of pyritic material and fine organic matter. This soil unit is generally associated with ASS.

## 4.5 Geology

The 1:100,000 scale Brisbane Geological map (1990) indicates that the site contains recent alluvial deposits of Holocene age of ‘undifferentiated coastal plains’, comprising mud and sand deposits. Local experience indicates that the site is underlain by Upper Holocene-age alluvia overlying Lower Holocene-age alluvia, with a relict Pleistocene alluvial land surface below. Residual soils and rock are present below the alluvia. Holocene alluvial deposits are typically associated with ASS formation.

# 5.0 ASSESSMENT GUIDELINES

The following key regulatory drivers and guidance documents have been considered in selecting assessment guidelines.

## *PFAS*

- *HEPA PFAS NEMP,* January 2018 (NEMP 2018).
- Australian Government – Department of Health *Guidance Health Based Guidance Values for PFAS for use in Site Investigations in Australia*, 2017 (Health 2017).
- Queensland DES, Model Operating Conditions – ERA 60 – Waste Disposal, Version 3.02, June 2018.

## *Other contaminants*

- Office of Legislative Drafting Attorney-General's Department, *Airports (Environment Protection) Regulations 1997* (AEPR 1997 guidelines).
- *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended in 2013 (NEPM). The NEPM has been recognised as the primary national guidance document for the assessment of site contamination in Australia.
- *Queensland Water Quality Guidelines* 2009, as amended in 2013 (QWQG 2009), which provides an overarching framework for the management of waters (including groundwater) under the Environmental Protection Act 1994.
- Department of Environment and Resource Management*, Environmental Protection (Water) Policy 2009, Brisbane Creeks – Bramble Bay environmental values and water quality objectives, Basin No. 142 (part), including Bald Hills, Cabbage Tree, Downfall, Kedron Brook, Nudgee and Nundah creeks*, July 2010. EVs define the uses of the water by aquatic ecosystems and for human uses (e.g. drinking water, irrigation, aquaculture, recreation). WQOs define objectives for the physical, chemical and biological characteristics of the water (e.g. nitrogen content, dissolved oxygen, turbidity, toxicants, fish).

Analytical results will be compared against relevant risk-based guideline criteria as detailed below for each matrix.

## 5.1 Soil Assessment Guidelines

### 5.1.1 PFAS

The AEPR 1997 guidelines apply to airports in Australia and to all BAC land. However, AEPR 1997 do not include screening or acceptable levels for PFAS in soil.

The *Soil Criteria for Investigation* from the NEMP 2018 for PFAS in soil presented in **Table 1** below have been adopted for the initial assessment of risk for human health and direct and indirect ecological receptors exposure scenarios.

In light of the land use, the guidelines for industrial/commercial settings have been selected.

**Table 1 Soil Guidelines for Investigation (NEMP 2018)**

| Exposure Scenario | PFOS+PFHxS | PFOA | Land use | Comment |
|---|---|---|---|---|
| ***Soil*** | | | | |
| Human Health | 20 mg/kg | 50 mg/kg | Industrial/ commercial | The degree of conservatism in the soil criteria for investigation – human health-based guidance values (80% attributed to other exposure pathways) means that exceeding these values does not constitute a risk if other pathways are controlled. |
| Ecological Receptors – Interim soil – ecological indirect exposure | 0.140 mg/kg (PFOS only) | - | Industrial/ commercial | Concentration in soil that is expected to protect against potential impacts on freshwater life from PFOS originating in soil that may enter the groundwater and subsequently discharge to a surface water body. |
| Ecological Receptors - soil direct toxicity | 20 mg/kg | 50 mg/kg | Industrial/ commercial | Direct exposure applies specifically to protection of organisms that live within, or are closely associated with, the soil, such as earthworms and plants. The direct exposure guidelines can be used to assess the possibility of harm to these organisms. In the absence of acceptable published guideline values for direct exposure, the Soil Criteria – Human Health are recommended as an interim position. |

### 5.1.2 Other Contaminants Assessment Guidelines

AEPR 1997 apply to federal airports in Australia and therefore to BAC land. The site is not listed as an Area of Environmental Significance at Brisbane Airport, as such soil results were compared with the *Acceptable Limits for general areas* (Schedule 1, Table 2 of AEPR).

In addition, the following guidelines derived from NEPM 2013, Schedule B1 were also referenced as a general environmental screening tool for soil:

- *Health Screening Levels* (HSLs) for the protection of human health from exposure to vapour intrusion from volatile hydrocarbon impacts in soil. HSLs have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation pathway. The HSLs depend on specific soil physicochemical properties, land use scenarios, and the characteristics of building structures. They apply to different soil types, and depths below surface to greater than 4 m. For the program of works, the analytical data has been initially screened against the most conservative criteria for sand soils under an HSL-D commercial/industrial setting, for the protection of future site commercial users.
- *Health investigation Levels* (HILs) for the protection of human health under a HIL-D commercial/industrial setting, for the protection of future site commercial users from exposure to a wide range of contaminants.
- *Ecological Screening Levels* (ESLs) (coarse textured soil) for a commercial/industrial setting, for the protection of ecological receptors from petroleum hydrocarbons contamination.
- *Ecological investigation levels* (EILs) for a commercial/industrial setting, for the protection of ecological receptors from exposure to a wide range of contaminants.

## 5.2 Groundwater Assessment Guidelines

### 5.2.1 PFAS

The following water guideline values from NEMP 2018 have been adopted as initial assessment guidelines for human health and aquatic ecosystems' exposure to PFAS in groundwater.

The human health recreational guidelines have been included in the assessment, as drains in and surrounding the site discharge into larger surface water bodies (Kedron Brook then Moreton Bay) that may be accessed by the general public. Whilst there is negligible likelihood for groundwater/surface water to be used for drinking purposes within the Airport precinct, drinking water guidelines have been included for preliminary assessment of risk to workers resulting from accidental ingestion.

Though Brisbane Airport is a highly disturbed environment, relevant ecological receptors (Ramsar wetland) are present in its proximity; as such the guidelines for the protection of 95% of the species have been selected for the assessment.

Groundwater and surface water across Brisbane Airport can be fresh or marine, depending on the tide effects, whereas the receiving environment is marine; however, as per NEMP 2018, freshwater guidelines are to be used as interim marine guidelines in the absence of specific marine guidelines, and are applicable across the whole Airport area for PFAS. The assessment criteria adopted from PFAS NEMP 2018 are summarised in **Table 2**.

**Table 2: Water guideline values (NEMP 2018)**

| Exposure scenario | PFOS/PFHxS[2] | PFOA | Comment |
|---|---|---|---|
| Human health – drinking water | 0.07 µg/L | 0.56 µg/L | Based on *Health 2017* |
| Human health – recreational water | 0.7 µg/L | 5.6 µg/L | Based on *Health 2017* |
| Aquatic Ecology - Freshwater/interim marine water | 0.13 µg/L | 220 µg/L | 95% species protection – highly disturbed ecosystems |

No water guidelines are currently cited in the NEMP to address impacts to human health resulting from ongoing consumption of fish/other aquatic species impacted by PFAS. The NEMP provides guidance on PFAS concentrations in the flesh of aquatic organisms. Biota sampling and analysis was beyond the scope of previous investigations.

### 5.2.2 Other Contaminants Assessment Guidelines

To assess groundwater quality, the results will be compared against AEPR 1997 *Accepted Limits of Contamination* for marine waters (Table in Schedule 2).

In addition, the following guidelines derived from NEPM 2013, Schedule B1 were also referenced as a general environmental screening tool for groundwater:

- *Groundwater Investigation Levels* for the protection of the marine aquatic ecosystems (Marine Water GILs).
- *Drinking Water Investigation Levels* for the protection of human receptor from direct ingestion of contaminated water (Drinking Water GILs).

[2] Sum of PFOS and PFHxS

- *Recreational Water Investigation Levels* for the protection of human receptor from direct contact with contaminated water (Recreational GILs).

Drinking water guidelines have been included for preliminary assessment of risk to workers resulting from accidental ingestion.

# 6.0 SUMMARY OF FINDINGS

The previous contamination investigation locations undertaken by Golder for soil and groundwater are indicated on Figure 1. Construction monitoring locations by PSK are included in **Attachment A**.

## 6.1 Sub-surface conditions

A summary of typical subsurface conditions encountered by Golder is as follows (Golder 2017a and Golder 2017b):

- **Topsoil** - Generally comprising loose silty sand and sandy clay, found at most locations to depths between 0.1 to 0.3 m bgl, overlying
- **Recent Alluvium (Holocene)** – Compressible, inter-bedded sandy clays and clayey sands (Upper Holocene) from approximately 0 to 3 m bgl (target depth).

Thicker layers of fill comprising gravelly material, with various percentages of fines, were encountered at several locations (AM-BH13, AM-BH14, AM-BH18, AM-BH24, AM-BH26), to a maximum depth of 1.65 m bgl.

Layers of material possibly associated with mineral sand deposition, known to have been historically present in the site surroundings, were noted at the following locations:

- AM-BH26 at 1.75-2.0 m (black mottling in clay)
- AM-BH25 at 0.5-0.6 m bgl (black fine to coarse sand in clay)
- AM-BH15 at 0.0-0.1 m bgl (dark brown silty sand)
- AM-BH16 at 0.0-0.1 m bgl (black sand in silty clay)
- AM-BH29 at 0.0-0.1 m bgl (dark brown silty sand).

## 6.2 Groundwater Quality and Levels

Groundwater quality sampling has been conducted by Golder in 2016 at fifteen monitoring well locations previously installed across the site (**Figure 1**) to provide a ‘snapshot’ of the baseline groundwater conditions) (Golder 2017a and Golder 2017b). PSK has also assessed the groundwater quality and levels (PSK, 2018).

The following ground water conditions were indicated:

- Stabilised groundwater levels were measured in the completed monitoring wells ranging from 0.87 to 3.08 m AD. The general groundwater flow direction is west to north-west towards Landers Pocket Drain.
- The field pH results (pH 4.1 to pH 7.2) indicated that the groundwater was acidic to near neutral. The lowest pH levels occurred in wells along the western site boundary.
- Electrical conductivity (EC) values were recorded ranging from 1 mS/cm to 60.9 mS/cm indicating brackish to saline water conditions;

## 6.3 Soil Analysis

Soil contamination assessments at the site have been undertaken by Golder in 2015 and 2016 (Golder 2017a and Golder 2017b). At the time of investigations being undertaken most of the site was covered with casuarina forest and several creeks/drains intersected the site. Thus, the investigation locations were subject to site access and existing fire-ant trails were utilised where possible. Boreholes were positioned at 100 m intervals along the proposed drain alignments. Investigation in the remaining area were undertaken on a 250 m triangular grid in areas not previously investigated for acid sulphate soils with contamination sampling combined with these.

There were 29 boreholes locations in Stage 1 and Stage 2 (and accessible [dry] areas of Stage 3) for soil sampling that were drilled to 3 m below ground (bgl). Ground disturbance below 3 m bgl were not expected for the site development. COPC were analysed at a rate of one to two samples per borehole including assessment of different strata within the borehole.

Although the density of sampling locations is low compared to AS4482.1, it is considered that there was broad scale site coverage for residues associated with historical importation of fill and use of AFFF at the airport. The site appears not to be a local source of PFAS, with activities involving AFFF being off-site and at a significant distance away. Also, there was targeted sampling of potential contaminations sources of BAC CSR site 28 and the former construction yard activities located in the southern area of the site (not shown on Figure 1). The dataset used to assess the contamination status of the site indicated low concentrations of most contaminants compared to guidelines, as well as low standard deviations compared to the mean of the data for COPCs. This indicates consistent results over the site with limited evidence of ‘hotspots’, or limited areas where higher contamination from historical activities may exist.

Therefore, the quantum of sampling was likely suitable to provide an indication of broadscale contamination on site.

The soil analytical results, including comparisons with the relevant assessment guidelines are presented as follows:

- Table 3: Soil laboratory analysis PFAS.
- Table 4: Soil laboratory analysis heavy metals and pesticides
- Table 5: Soil laboratory analysis TRH, BTEX and PAH

The PFAS assessment guidelines adopted are those updated in the NEMP 2018. Key analytical results from the investigation are as follows:

- PFAS was present at concentrations above the laboratory limit of reporting (LOR) in four locations (AM-BH31 0.25-0.5m, AM-BH32 2.75-3 m, AM-BH14 0.25-0.5 m and AM-BH25 0.25-0.5) of the 52 samples tested. PFAS compounds above the LOR were limited to PFOS, PFHxS and PFTeDA present at low concentrations. PFAS concentrations in all sample analysed were below the adopted human health and environmental guidelines for commercial/industrial site settings.
- PFAS leachability was not undertaken in 2016. The PFAS NEMP (2018) now recommends leachability testing on soils to assess potential impacts of PFAS to groundwater and from run-off to surface water. Golder considers that retrospective testing for leachable PFAS in a new site assessment is not necessary for the following reasons:
  - only PFOS in three samples out of 52 samples from 25 sampling locations contained PFAS concentrations higher than LOR
  - the concentrations of PFAS in soil was considered low compared to the adopted soil guidelines

- trends in PFOS in soil were as follows:
  - PFOS was present in borehole AM-BH14 (Stage 2, west) at a concentration of 0.0003 mg/kg (LOR = 0.0002 mg/kg) in the shallow soil sample, which was converted to groundwater monitoring well AM-MW14, however the deeper sample has no PFOS above LOR
  - PFOS was present in borehole AM-BH25 (Stage 2, north) at a concentration of 0.002 mg/kg (LOR=0.0002 mg/kg) in the shallow soil sample, however the deeper sample has no PFOS above LOR
  - PFOS was present in borehole AM-BH32 (Stage 1, control) at a concentration equal to the LOR of 0.0002 mg/kg) in a deep soil sample.
- exceedances of PFOS in groundwater for drinking water (not a likely use for water) were as follows:
  - in well AM-MW14 (the same location as soil bore AM-BH14)
  - in well AM-MW16 (Stage 2, SE corner).
- it is possible that the PFOS near borehole AM-BH14 is responsible for the PFOS in groundwater within the same area, however it appears that attenuation through the soil was partially effective and, in any case, the amount of PFOS in groundwater met the criteria for the key human health exposure (recreational) and for the protection of ecological receptors with 95% species protection
- similarly, the concentrations in well AM-BH16 was below key criteria and the soil in which the PFOS was present (AM-BH25 and BH32) did not influence this groundwater quality.

- With reference to heavy metals, no exceedances of the AEPR guidelines are noted in the samples for the compounds tested. With reference to NEPM guidelines, exceedances of the EILs[3] are noted:
  - for nickel in 2 samples (AM-BH24 at 0.25-0.5 m and AM-BH26 at 0.25-0.5 m) in the western portion of the site
  - for zinc in 2 samples (AM-BH10 at 0.25-0.5 m and AM-BH15 0.25-0.5, in duplicate QAQC005), in the western and eastern portions of the site respectively
  - however, the 95% upper confidence limit of the mean concentration (UCL) calculated for nickel and zinc for the 14 samples of shallow soils collected at the Stage 2 of the site is equal to 34.64 mg/kg and 62.36 mg/kg respectively, with the standard deviations at 23.07 mg/kg and 54.14 mg/kg respectively. No individual result exceeded 250% of the assessment guidelines, therefore no ‘hot spots’, as defined in the NEPM 2013, have been identified, and standard deviations are lower than 50% of the respective guidelines. Therefore, based on this statistical approach, the overall soil quality is considered to meet the EILs for heavy metals for the site. The 95% UCL calculations sheets are presented in Table 6 and Table 7.
- Titanium and zirconium were tested in 3 shallow soil samples (0-0.1m bgl) where suspected black sands/ mineral sands were noted: the results indicate that titanium concentrations are generally elevated (>250 mg/kg) in shallow soils of AM-BH15, AM-BH16 and AM-BH29 along the east portion of the time, while zirconium is reported at low levels at the locations (<3 mg/kg). This suggests that residual amounts of either rutile or ilmenite (or both) may be present and mixed in with the surface soil. There are no assessment criteria for these analytes (see also Section 6.6).

[3] EILs have been calculated using conservative values for CEC, as no analysis for site specific parameters were completed, and a pH of 4, as per the most conservative result of ASS analysis for shallow soils.

- Concentrations of TRH, BTEX, PAH and OCP were below the respective LORs in the samples (except for TRH F3 in AM-BH20 at 0.25-0.5 m, reported at 120 mg/kg). Concentrations in the samples were below the adopted guidelines for human health and environment assessment.

### Table 3: Soil laboratory analysis PFAS

| | | | Per- and polyfluoroalkyl substances (PFAS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Perfluorodecane sulfonic acid (PFDS) | N-Methyl PFO sulfonamidoethanol (MeFOSE) | N-methyl-PFO sulfonamidoacetic acid (MeFOSAA) | Perfluorooctanoic Acid (PFOA) | Perfluorooctane sulfonic acid (PFOS) | Perfluorohexane sulfonic acid (PFHxS) | Sum of PFHxS and PFOS (lab reported) | PFAS (Sum of total - Lab Reported) | Sum of PFAS (Swedish 11 + 8:2FTSA, lab reported) | Perfluorobutanoic acid (PFBA) | Perfluorohexanoic acid (PFHxA) | Perfluoroheptanoic acid (PFHpA) | Perfluorodecanoic acid (PFDA) | Perfluoropentanoic acid (PFPeA) | Perfluorononanoic acid (PFNA) | Perfluorotetradecanoic acid (PFTeDA) | Perfluorotridecanoic acid (PFTrDA) | Perfluorododecanoic acid (PFDoDA) | Perfluoroundecanoic acid (PFUnDA) | Perfluoroheptane sulfonic acid (PFHpS) | Perfluoropentane sulfonic acid (PFPeS) | Perfluorobutane sulfonic acid (PFBS) | Ammonium perfluorodecane sulfonate (NH4-PFDS) | 4:2 Fluorotelomer sulfonic acid (4:2 FTSA) | 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | 10:2 Fluorotelomer sulfonic acid (10:2 FTSA) | N-Ethyl PFO sulfonamide (EtFOSA) | N-Ethyl PFO sulfonamidoethanol (EtFOSE) | N-Methyl PFO sulfonamide (MeFOSA) | Perfluorooctane sulfonamide (FOSA) | N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA) |
| | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | 0.0002 | 0.0005 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.001 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0005 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0002 | 0.0002 |
| **NEMP [1] 2018 Ecological-Interim sol-ecological indirect exposure-Ind/comm** | | | | | | **0.14** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NEMP 2018 Human Health (Commercial/Industrial) | | | | | | 50 | | | 20 | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Sampled Date** | **Lab Report Number** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AM-BH01 0.00-0.50 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH01 2.50-3.00 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH02 0.00-0.50 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH02 1.00-1.50 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH03 0.00-0.50 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH03 1.00-1.50 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH04 0.00-0.50 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH04 0.50-1.00 | 16-Dec-15 | EB1538408 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH05 0.50-1.00 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH05 2.50-3.00 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH06 0.50-1.00 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH06 2.50-3.00 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH07 0.00-0.50 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH07 1.50-2.00 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH08 0.00-0.50 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH08 1.00-1.50 | 16-Dec-15 | EB1538415 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH09 0.00-0.50 | 17-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH09 0.50-1.00 | 17-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH10 0.25-0.5 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH10 1.75-2 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH13 0.25-0.5 | 06-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH13 2.75-3 | 06-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH14 0.25-0.5 | 06-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | 0.0003 | <0.0002 | 0.0003 | 0.0003 | 0.0003 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH14 0.75-1 | 06-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH15 0.25-0.5 | 07-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH15 1.75-2 | 07-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH16 0.25-0.5 | 07-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH16 2.75-3 | 07-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH17 0.00-0.50 | 18-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH17 1.00-1.50 | 18-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH18 0.25-0.5 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH18 1.75-2 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH19 0.00-0.50 | 17-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH19 1.50-2.00 | 17-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH24 0.25-0.5 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH24 2.75-3 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH25 0.25-0.5 | 07-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | 0.002 | 0.0005 | 0.0025 | 0.0025 | 0.0025 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH25 2.75-3 | 07-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH26 0.25-0.5 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH26 2.75-3 | 06-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH28 0.00-0.50 | 18-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH28 2.50-3.00 | 18-Dec-15 | EB1538419 | <0.0002 | <0.001 | - | <0.0005 | <0.0005 | <0.0002 | <0.0005 | - | - | - | <0.0002 | <0.0002 | <0.0002 | - | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | - | - | <0.0002 | - | - | <0.005 | <0.001 | - | <0.001 | <0.001 | <0.001 | <0.0002 | - |
| AM-BH29 0.25-0.5 | 07-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH29 1.75-2 | 07-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH30 0.25-0.5 | 10-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH30 0.75-1 | 10-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH31 0.25-0.5 | 10-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | 0.0005 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | 0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH31 1.75-2 | 10-Oct-16 | EB1624749 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH32 0.25-0.5 | 10-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |
| AM-BH32 2.75-3 | 10-Oct-16 | EB1624693 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | 0.0002 | <0.0002 | 0.0002 | 0.0002 | 0.0002 | <0.001 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0005 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | <0.0002 | - | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0005 | <0.0002 | <0.0002 |

Notes:
[1] NEMP = PFAS National Environmental Management Plan January 2018

**Table 4: Soil laboratory analysis heavy metals and pesticides**

| | | | | | | | Location Code | AM-BH10 | AM-BH13 | AM-BH14 | AM-BH15 | AM-BH15 | AM-BH16 | AM-BH16 | AM-BH18 | AM-BH21 0.50-1.00 | AM-BH22 1.00-1.50 | AM-BH23 0.50-1.00 | AM-BH24 | AM-BH25 | AM-BH25 | AM-BH26 | AM-BH29 | AM-BH29 | AM-BH30 | AM-BH31 | AM-BH32 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Depth | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.0-0.1 | 0.25-0.5 | 0.0-0.1 | 0.25-0.5 | 0.25-0.5 | 0.5-1.0 | 1.0-1.5 | 0.5-1.0 | 0.25-0.5 | 0.25-0.5 | 0.5-0.6 | 0.25-0.5 | 0.25-0.5 | 0.0-0.1 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 |
| | | | | | | | Sampled Date | 6/10/2016 | 6/10/2016 | 6/10/2016 | 7/10/2016 | 7/10/2016 | 7/10/2016 | 7/10/2016 | 6/10/2016 | 17/12/2015 | 17/12/2015 | 17/12/2015 | 6/10/2016 | 7/10/2016 | 7/10/2016 | 6/10/2016 | 7/10/2016 | 7/10/2016 | 10/10/2016 | 10/10/2016 | 10/10/2016 |
| **Chem Group** | **ChemName** | **output unit** | **EQL** | **NEPM [1] 2013 EILS-Commercial and industrial** | **NEPM 2013 HIL-Commercial/ Industrial D Soil** | **AEPR [2] 1997 - General Areas of Airports** | **Lab Report Number** | EB1624693 | EB1624749 | EB1624749 | EB1624749 | EB1624749 | EB1624749 | EB1624749 | EB1624693 | EB1538419 | EB1538419 | EB1538419 | EB1624693 | EB1624749 | EB1624749 | EB1624693 | EB1624693 | EB1624693 | EB1624749 | EB1624749 | EB1624693 |
| Heavy Metals | Arsenic | mg/kg | 5 | **160** | **3000** | **500** | | 33 | 7 | 8 | 8 | 14 | 11 | <5 | 14 | 11 | 20 | 14 | <5 | 10 | - | <5 | 8 | 7 | 8 | 19 | 14 |
| | Cadmium | mg/kg | 1 | | **900** | **100** | | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 | <1 |
| | Chromium | mg/kg | 2 | **310** | | **60,000** | | 49 | 9 | 21 | 46 | 41 | 37 | 55 | 65 | 54 | 58 | 30 | 214 | 54 | - | 211 | 51 | 42 | 39 | 41 | 65 |
| | Copper | mg/kg | 5 | **85** | **240000** | **5000** | | 31 | 23 | 24 | 34 | 22 | 25 | 20 | 15 | 12 | 19 | 8 | 80 | 41 | - | 70 | 19 | 17 | 16 | 20 | 18 |
| | Lead | mg/kg | 5 | **1800** | **1500** | **1500** | | 60 | 14 | 13 | 10 | 10 | 17 | 6 | 10 | 7 | 42 | 13 | <5 | 15 | - | <5 | 9 | 9 | 12 | 13 | 12 |
| | Mercury | mg/kg | 0.1 | | **730** | **75** | | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | - | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Nickel | mg/kg | 2 | **55** | **6000** | **3000** | | 33 | 9 | 14 | 52 | 39 | 18 | 18 | 18 | 7 | 14 | 6 | **82** | 31 | - | **82** | 38 | 27 | 24 | 41 | 16 |
| | Titanium | mg/kg | 10 | | | | | - | - | - | 360 | - | 340 | - | - | - | - | - | - | - | - | - | - | 250 | - | - | - |
| | Zinc | mg/kg | 5 | **110** | **400000** | **35,000** | | 242 | 30 | 40 | 56 | 90 | 65 | 33 | 61 | 25 | 35 | 24 | 38 | 44 | - | 32 | 47 | 41 | 54 | 63 | 44 |
| | Zirconium | mg/kg | 0.5 | | | | | - | - | - | 1.4 | - | 3 | - | - | - | - | - | - | - | - | - | - | 1.8 | - | - | - |
| OCP | a-BHC | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Aldrin | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Aldrin & Dieldrin (Sum of total) (Lab Reported) | mg/kg | 0.05 | | **45** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | - | - | - | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | b-BHC | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Chlordane (Sum of total) | mg/kg | 0.05 | | **530** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | - | - | - | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | cis-Chlordane | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | trans-Chlordane | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | d-BHC | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | DDD | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | DDE | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | DDT | mg/kg | 0.2 | **640** | | | | <0.2 | <0.2 | <0.2 | - | <0.2 | - | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | - | <0.2 | <0.2 | - | <0.2 | <0.2 | <0.2 |
| | DDT+DDE+DDD (Sum of total) (Lab Reported) | mg/kg | 0.05 | | **3600** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | - | - | - | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Dieldrin | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endosulfan | mg/kg | 0.05 | | **2000** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | - | - | - | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endosulfan I | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endosulfan II | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endosulfan sulphate | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endrin | mg/kg | 0.05 | | **100** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endrin aldehyde | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Endrin ketone | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | g-BHC | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Heptachlor | mg/kg | 0.05 | | **50** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Heptachlor epoxide | mg/kg | 0.05 | | | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| | Methoxychlor | mg/kg | 0.2 | | **2500** | | | <0.2 | <0.2 | <0.2 | - | <0.2 | - | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | - | <0.2 | <0.2 | - | <0.2 | <0.2 | <0.2 |
| Halogenated Benzenes | Hexachlorobenzene | mg/kg | 0.05 | | **80** | | | <0.05 | <0.05 | <0.05 | - | <0.05 | - | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | - | <0.05 | <0.05 | - | <0.05 | <0.05 | <0.05 |
| OPP | Azinphos-methyl | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Bromophos-ethyl | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Carbophenothion | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Chlorfenvinphos | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Chlorpyriphos | mg/kg | 0.05 | | **2000** | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Chlorpyriphos-methyl | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Diazinon | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Dichlorvos | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Dimethoate | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Ethion | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Fenamiphos | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Fenthion | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Malathion | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Parathion-methyl | mg/kg | 0.2 | | | | | - | - | - | - | <0.2 | - | <0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Monocrotophos | mg/kg | 0.2 | | | | | - | - | - | - | <0.2 | - | <0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Parathion | mg/kg | 0.2 | | | | | - | - | - | - | <0.2 | - | <0.2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Pirimphos-ethyl | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | Prothiofos | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pesticides-Others | Demeton-s-methyl | mg/kg | 0.05 | | | | | - | - | - | - | <0.05 | - | <0.05 | - | - | - | - | - | - | - | - | - | - | - | - | - |

1 National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013 (NEPM).
2 AEPR is defined as Airports (Environmental Protection) Regulations
***EILs criteria for aged contaminants in soil have been selected based on the soil physical properties of pH 4 as per the most conservative result of ASS analysis of shallow soils. In addition the EILs have been calculated using conservative values for soil physical properties of CEC and TOC.

**Table 5: Soil laboratory analysis TRH, BTEX and PAH**

| Chem Group | ChemName | output unit | EQL | NEPM 2013 Commercial/ Industrial D, Sand Soil HSL for Vapour Intrusion 0-1m | NEPM 2013 Commercial/ Industrial D, Sand Soil HSL for Vapour Intrusion 1-2m | NEPM 2013 EILS- Commercial and industrial | NEPM 2013 ESLs- Commercial and industrial, Coarse Soil | NEPM 2013 HIL- Commercial/ Industrial D Soil | AEPR [2] 1997 - General Areas of Airports |
|---|---|---|---|---|---|---|---|---|---|
| BTEX | Benzene | mg/kg | 0.2 | 3 | 3 | | 75 | | |
| | Toluene | mg/kg | 0.5 | NL | NL | | 135 | | |
| | Ethylbenzene | mg/kg | 0.5 | NL | NL | | 165 | | |
| | Xylenes (m & p) | mg/kg | 0.5 | | | | | | |
| | Xylene (o) | mg/kg | 0.5 | | | | | | |
| | Xylenes (Sum of total) (Lab Reported) | mg/kg | 0.5 | 260 | 370 | | 180 | | |
| | Total BTEX | mg/kg | 0.2 | | | | | | |
| PAH | Acenaphthene | mg/kg | 0.5 | | | | | | |
| | Acenaphthylene | mg/kg | 0.5 | | | | | | |
| | Anthracene | mg/kg | 0.5 | | | | | | |
| | Benz(a)anthracene | mg/kg | 0.5 | | | | | | |
| | Benzo(a)pyrene | mg/kg | 0.5 | | | | 1.4 | | 5 |
| | Benzo(a)pyrene TEQ (lower bound)* | mg/kg | 0.5 | | | | | 40 | |
| | Benzo(a)pyrene TEQ (medium bound)* | mg/kg | 0.5 | | | | | 40 | |
| | Benzo(a)pyrene TEQ (upper bound)* | mg/kg | 0.5 | | | | | 40 | |
| | Benzo(b)&(j)fluoranthene | mg/kg | 0.5 | | | | | | |
| | Benzo(g,h,i)perylene | mg/kg | 0.5 | | | | | | |
| | Benzo(k)fluoranthene | mg/kg | 0.5 | | | | | | |
| | Chrysene | mg/kg | 0.5 | | | | | | |
| | Dibenz(a,h)anthracene | mg/kg | 0.5 | | | | | | |
| | Fluoranthene | mg/kg | 0.5 | | | | | | |
| | Fluorene | mg/kg | 0.5 | | | | | | |
| | Indeno(1,2,3-c,d)pyrene | mg/kg | 0.5 | | | | | | |
| | Naphthalene | mg/kg | 0.5 | NL | NL | 370 | | | |
| | Phenanthrene | mg/kg | 0.5 | | | | | | |
| | Pyrene | mg/kg | 0.5 | | | | | | |
| | PAH (Sum of Common 16 PAHs - Lab Reported) | mg/kg | 0.5 | | | | | 4000 | 100 |
| TRH | TRH C6 - C10 Fraction F1 | mg/kg | 10 | | | | | | |
| | TRH C6 - C10 Fraction Less BTEX F1 | mg/kg | 10 | 260 | 370 | | 215 | | 800 |
| | TRH >C10 - C16 Fraction F2 | mg/kg | 50 | | | | | | |
| | TRH >C10 - C12 Fraction Less Naphthalene F2 | mg/kg | 50 | | | | 170 | | 500 |
| | TRH >C16 - C34 Fraction F3 | mg/kg | 100 | | | | 1700 | | 500 |
| | TRH >C34 - C40 Fraction F4 | mg/kg | 100 | | | | 3300 | | |

| Location Code | AM-BH30 | AM-BH31 | AM-BH32 | AM-BH10 | AM-BH13 | AM-BH14 | AM-BH15 | AM-BH16 | AM-BH18 | AM-BH21 0.50-1.00 | AM-BH22 1.00-1.50 | AM-BH23 0.50-1.00 | AM-BH24 | AM-BH25 | AM-BH25 | AM-BH26 | AM-BH29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.25-0.5 | 0.5-1.0 | 1.0-1.5 | 0.5-1.0 | 0.25-0.5 | 0.25-0.5 | 0.5-0.6 | 0.25-0.5 | 0.25-0.5 |
| Sampled Date | 10/10/2016 | 10/10/2016 | 10/10/2016 | 6/10/2016 | 6/10/2016 | 6/10/2016 | 7/10/2016 | 7/10/2016 | 6/10/2016 | 17/12/2015 | 17/12/2015 | 17/12/2015 | 6/10/2016 | 7/10/2016 | 7/10/2016 | 6/10/2016 | 7/10/2016 |
| Lab Report Number | EB1624749 | EB1624749 | EB1624693 | EB1624693 | EB1624749 | EB1624749 | EB1624749 | EB1624749 | EB1624693 | EB1538419 | EB1538419 | EB1538419 | EB1624693 | EB1624749 | EB1624749 | EB1624693 | EB1624693 |
| Benzene | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | - | <0.2 | <0.2 |
| Toluene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | <0.5 | <0.5 |
| Ethylbenzene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | <0.5 | <0.5 |
| Xylenes (m & p) | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | <0.5 | <0.5 |
| Xylene (o) | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | <0.5 | <0.5 |
| Xylenes (Sum of total) (Lab Reported) | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | <0.5 | <0.5 |
| Total BTEX | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | - | <0.2 | <0.2 |
| Acenaphthene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Acenaphthylene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Anthracene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Benz(a)anthracene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Benzo(a)pyrene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Benzo(a)pyrene TEQ (lower bound)* | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Benzo(a)pyrene TEQ (medium bound)* | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| Benzo(a)pyrene TEQ (upper bound)* | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| Benzo(b)&(j)fluoranthene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Benzo(g,h,i)perylene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Benzo(k)fluoranthene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Chrysene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Dibenz(a,h)anthracene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Fluoranthene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Fluorene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Indeno(1,2,3-c,d)pyrene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Naphthalene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Phenanthrene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Pyrene | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| PAH (Sum of Common 16 PAHs - Lab Reported) | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| TRH C6 - C10 Fraction F1 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | - | <10 | <10 |
| TRH C6 - C10 Fraction Less BTEX F1 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | - | <10 | <10 |
| TRH >C10 - C16 Fraction F2 | - | - | - | - | - | - | <50 | <50 | - | - | - | - | - | - | - | - | - |
| TRH >C10 - C12 Fraction Less Naphthalene F2 | - | - | - | - | - | - | <50 | <50 | - | - | - | - | - | - | - | - | - |
| TRH >C16 - C34 Fraction F3 | - | - | - | - | - | - | <100 | <100 | - | - | - | - | - | - | - | - | - |
| TRH >C34 - C40 Fraction F4 | - | - | - | - | - | - | <100 | <100 | - | - | - | - | - | - | - | - | - |

1 National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013 (NEPM).

2 AEPR is defined as Airports (Environmental Protection) Regulations

**Table 6: 95% Upper Confidence Level Average Calculation for Zinc**

| *Parameter* | *Normal Distribution* | *Lognormal Distribution* | *Recommended Distribution* | *Units* |
|---|---|---|---|---|
| Analyte threshold | 45 | 45 | **45** | mg/kg |
| UCL $_{average}$ | 87.98 | 82.66 | **87.98** | mg/kg |
| No. of samples | 14 | 14 | **14** | |
| Mean | 62.36 | 52.03 | **62.36** | mg/kg |
| Estimated Mean | 62.36 | 60.83 | **62.36** | mg/kg |
| Standard deviation | 54.14 | 1.71 | **54.14** | mg/kg |
| Distribution | - | - | **normal** | |

**Distribution Test Summary Using Coeffiecient Of Variation**
Distribution test result - normal

The statistical analysis indicates that there is a 95% probability that the arithmetic average concentration of the contamination will not exceed 87.9825 mg/kg

Data Entered By: Serena Curti

Date: 14/11/2016

Checked By: Andrew Howes

Date: 15/11/2016

**References:** VIC EPA, *Industrial Waste Resource Guidelines - Soil Sampling, June 2009*
Gilbert, R.O., 1987, *Statistical Methods For Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York

**Note:** Where the laboratory reported a result below the method detection limit, a value equal to half the detection limit was substituted for the purposes of statistical calculation.
Gilbert (1987) also indicates that this is common practice on pages 177 to 178 of the text.

**Table 7: 95% Upper Confidence Level Average Calculation for Nickel**

| *Parameter* | *Normal Distribution* | *Lognormal Distribution* | *Recommended Distribution* | *Units* |
|---|---|---|---|---|
| Analyte threshold | 45 | 45 | **45** | mg/kg |
| $UCL_{average}$ | 45.56 | 52.47 | **45.56** | mg/kg |
| No. of samples | 14 | 14 | **14** | |
| Mean | 34.64 | 28.66 | **34.64** | mg/kg |
| Estimated Mean | 34.64 | 35.37 | **34.64** | mg/kg |
| Standard deviation | 23.07 | 1.89 | **23.07** | mg/kg |
| Distribution | - | - | **normal** | |

**Distribution Test Summary Using Coeffiecient Of Variation**

Distribution test result - normal

The statistical analysis indicates that there is a 95% probability that the arithmetic average concentration of the contamination will not exceed 45.5622 mg/kg

Data Entered By: Serena Curti

Date: 14/11/2016

Checked By: Andrew Howes

Date: 15/11/2016

**References:** VIC EPA, *Industrial Waste Resource Guidelines - Soil Sampling, June 2009*
Gilbert, R.O., 1987, *Statistical Methods For Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York

**Note:** Where the laboratory reported a result below the method detection limit, a value equal to half the detection limit was substituted for the purposes of statistical calculation.
Gilbert (1987) also indicates that this is common practice on pages 177 to 178 of the text.

## 6.4 Groundwater Analysis

### 6.4.1 Contamination Investigation

Assessment of groundwater contamination was undertaken by Golder for PFAS and metals by Golder in January 2016 (Golder 2017a and Golder 2017b). Some additional monitoring was undertaken in October 2016. Sampling was undertaken from 10 installed wells and 5 existing groundwater monitoring wells. The vertical extent of the groundwater monitoring wells was generally 3 m bgl and were considered suitable for targeting the shallow unconfined aquifer that is within 0.6 to 2 m of the ground surface. The groundwater wells were suitably located across the site and at the perimeter to access the potential contamination sources.

The groundwater analytical results, including comparisons with the relevant assessment guidelines are presented in **Table 8**: PFAS and **Table 9**: Heavy metals below. The PFAS assessment guidelines have been updated to NEMP 2018. Key analytical results from the investigation are as follows:

- PFAS was reported above the laboratory LOR at three of the ten monitoring wells sampled in January 2016. In the October 2016 monitoring event 8 of the 9 groundwater monitoring wells were sampled. PFAS concentrations were below the adopted assessment guidelines for freshwater/interim marine water 95% species protection and human health recreational water. Concentrations of PFOS+ PFHxS have been reported above the assessment guidelines for human health drinking water at groundwater monitoring wells AM-MW14 and AM-MW16 sampled in October 2016.
- Heavy metals exceedances of the AEPR Marine Waters guideline and NEPM 2013 Marine Waters GILs are noted for nickel and zinc in five monitoring wells sampled at the site (AM-MW10, AM-MW14, AM-MW15, AM-MW16 and MW-31).
- Nickel concentrations exceeded the NEPM 2013 Drinking Water GILs in three groundwater monitoring wells (AM-14, AM-MW16 and MW-31).

**Table 8: Groundwater laboratory analysis PFAS**

| | | | Per- and polyfluoroalkyl substances (PFAS) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Perfluorodecane sulfonic acid (PFDS) | N-Methyl PFO sulfonamidoethanol (MeFOSE) | N-methyl-PFO sulfonamidoacetic acid (MeFOSAA) | Perfluorooctanoic Acid (PFOA) | Perfluorooctane sulfonic acid (PFOS) | Perfluorohexane sulfonic acid (PFHxS) | Sum of PFHxS and PFOS (lab reported) | PFAS (Sum of total - Lab Reported) | Perfluorobutanoic acid (PFBA) | Perfluorohexanoic acid (PFHxA) | Perfluoroheptanoic acid (PFHpA) | Perfluorodecanoic acid (PFDA) | Perfluoropentanoic acid (PFPeA) | Perfluorononanoic acid (PFNA) | Perfluorotetradecanoic acid (PFTeDA) | Perfluorotridecanoic acid (PFTrDA) | Perfluorododecanoic acid (PFDoDA) | Perfluoroundecanoic acid (PFUnDA) | Perfluoroheptane sulfonic acid (PFHpS) | Perfluoropentane sulfonic acid (PFPeS) | Perfluorobutane sulfonic acid (PFBS) | 4:2 Fluorotelomer sulfonic acid (4:2 FTSA) | 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | 10:2 Fluorotelomer sulfonic acid (10:2 FTSA) | N-Ethyl PFO sulfonamide (EtFOSA) | N-Ethyl PFO sulfonamidoethanol (EtFOSE) | N-Methyl PFO sulfonamide (MeFOSA) | Perfluorooctane sulfonamide (FOSA) | N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA) |
| | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | 0.002 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.01 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.002 | 0.002 |
| ***NEMP[1] 2018 Health-based guidance values drinking water*** | | | | | | ***0.56*** | | | ***0.07*** | | | | | | | | | | | | | | | | | | | | | | | |
| NEMP[1] 2018 Health-based guidance values recreational water | | | | | | 5.6 | | | 0.7 | | | | | | | | | | | | | | | | | | | | | | | |
| NEMP 2018 Marine 95% Protection | | | | | | 220 | 0.13 | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **DATE** | **Lab Report Number** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AM-BH01 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | <0.002 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| AM-BH04 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | <0.002 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| AM-BH08 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | 0.009 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | 0.004 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| AM-BH08 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | 0.007 | 0.007 | 0.022 | <0.01 | 0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | 0.005 | 0.008 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| AM-BH19 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | 0.003 | 0.003 | - | - | 0.005 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | 0.004 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| AM-BH19 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | 0.012 | 0.012 | 0.02 | <0.01 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | 0.003 | 0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| AM-BH28 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | <0.002 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| AM-MW10 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | 0.004 | 0.004 | 0.062 | 0.066 | 0.087 | <0.01 | 0.003 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | 0.008 | 0.006 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| AM-MW14 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | 0.003 | 0.011 | 0.394 | ***0.405*** | 0.686 | <0.01 | 0.019 | <0.002 | <0.002 | 0.004 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | 0.084 | 0.171 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| AM-MW15 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | 0.054 | 0.054 | 0.071 | <0.01 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | 0.006 | 0.011 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| AM-MW16 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | 0.016 | 0.021 | 0.293 | ***0.314*** | 0.431 | <0.01 | 0.023 | 0.005 | <0.002 | 0.005 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | 0.002 | 0.029 | 0.037 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| AM-MW31 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.01 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| BAC-MW07 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | <0.002 | - | 0.03 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| BAC-MW24 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | <0.002 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| BIP/MW1 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | 0.007 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | 0.006 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| BIP-MW1 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | 0.011 | 0.011 | 0.033 | <0.01 | 0.006 | <0.002 | <0.002 | 0.004 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | 0.004 | 0.008 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| BIP/MW2 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | 0.002 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |
| BIP-MW2 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.002 | <0.01 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.002 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| BIP-MW07 | 2016-10-25 | EB1625464 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.01 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.002 |
| BP/MW6 | 2016-01-04 | EB1600085 | <0.005 | <0.1 | - | <0.002 | <0.002 | <0.002 | <0.002 | - | - | <0.002 | <0.002 | <0.002 | - | <0.002 | <0.05 | <0.005 | <0.005 | <0.005 | - | - | <0.002 | - | <0.01 | <0.01 | - | <0.005 | <0.1 | <0.05 | <0.002 | - |

Notes:

[1] NEMP is defined as the PFAS National Environmental Management Plan 2018

**Table 9: Groundwater laboratory analysis for heavy metals**

| | | | Heavy Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic (Filtered) | Cadmium (Filtered) | Chromium (Filtered) | Copper (Filtered) | Lead (Filtered) | Mercury (Filtered) | Nickel (Filtered) | Zinc (Filtered) |
| | | | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L | ug/L |
| EQL | | | 1 | 0.1 | 1 | 1 | 1 | 0.1 | 1 | 5 |
| **NEPM[1] 2013 GILs[2], Recreational** | | | **100** | **20** | **500*** | **20,000** | **100** | **10** | **200** | |
| ***NEPM 2013 GILs, Drinking Water*** | | | ***10*** | ***2*** | ***50**** | ***2,000*** | ***10*** | ***1*** | ***20*** | |
| *NEPM 2013 GILs, Marine Waters* | | | | *0.7* | *27* | *1.3* | *4.4* | *0.1* | *7* | *15* |
| AEPR 1997 - Marine Waters | | | 50 | 2 | 50 | 5 | 5 | 0.1 | 15 | 50 |
| **Field_ID** | **Sampled Date** | **Lab Report Number** | | | | | | | | |
| AM-MW10 | 25/10/2016 | EB1625464 | <5 | <0.5 | <5 | <5 | <5 | <0.1 | *18* | *134* |
| AM-MW14 | 25/10/2016 | EB1625464 | <5 | <0.5 | <5 | <5 | <5 | <0.1 | ***74*** | *194* |
| AM-MW15 | 25/10/2016 | EB1625464 | 1 | <0.1 | <1 | <1 | <1 | <0.1 | *18* | *76* |
| AM-MW16 | 25/10/2016 | EB1625464 | 4 | <0.1 | <1 | <1 | <1 | <0.1 | ***32*** | *118* |
| AM-MW31 | 25/10/2016 | EB1625464 | <5 | <0.5 | <5 | <5 | <5 | <0.1 | ***24*** | *118* |

Notes:

1. NEPM is defined as National Environmental Protection (Assessment of Site Contamination) Measure
2. GIL is defined as Groundwater Investigation Levels
3. AEPR is defined as Airports (Environmental Protection) Regulations

* Guideline for Chromium VI adopted for GILs

### 6.4.2 Construction Monitoring

PSK has undertaken groundwater monitoring for PFAS (the Total Oxidisable Precursor Assay (TOPA) method) and metals monthly from December 2017 to November 2018, although results have not been reproduced in this document. The groundwater monitoring was undertaken from 15 monitoring wells spaced generally evenly around the site perimeter. Review of these monitoring results indicated the following:

- PFAS concentrations were reported above the laboratory LOR in the 15 monitoring wells sampled over the monitoring period. The PFAS concentrations were below the adopted assessment guidelines for freshwater/interim marine water 95% species protection and human health recreational water. Groundwater monitoring well MW1B located at the northern end of the site sampled in June 2018 had concentrations of PFOS+ PFHxS reported above the assessment guidelines for human health drinking water (workers exposure). For the remaining samples of groundwater, the concentrations of PFAS were below the assessment guidelines for human health drinking water. Further discussion on PFAS in receiving waters is provided in Section 6.5.
- Heavy metal exceedance were as follows:
  - Repeated exceedances of the AEPR Marine Waters guideline and NEPM 2013 Marine Waters GILs were encountered for nickel and zinc across the 15 groundwater monitoring wells.
  - Exceedances of AEPR Marine Waters guideline for chromium at MW1F and MW1B.
  - Cadmium concentrations exceeded NEPM 2013 Marine Waters GILs at 3 wells (MW1B, MW1E and MW1G). Cadmium concentrations at MW1E also exceeded the AEPR Marine Waters guideline.
  - Copper concentrations exceeded NEPM 2013 Marine Waters GILs at 6 monitoring wells (MW1A, MW1B, MW1D, MW1E, MW1F and MW1G). Copper concentrations at 3 monitoring wells (MW1E, MW1F and MW1G) also exceeded the AEPR Marine Waters guideline.
  - Nickel concentrations exceeded NEPM 2013 Drinking Waters GILs for some monitoring events for 11 wells (MW1A, MW1B, MW1E, MW1F, MW1G, MW1H, MW2A, MW1C, MW3D and MW2B, MW2C).

Despite some exceedances of metals in the groundwater, the criteria are relevant to the point of discharge. Further discussion of metals in receiving surface waters is provided in Section 6.6.

## 6.5 Receiving Surface Water Monitoring for PFAS

PSK collected surface water samples from areas outside of the drains (ie, in the receiving water disconnected from, and outside of, the water collected from site. These locations are subject to tidal influences and are considered to be representative of surface water which will reach Kedron Brook. Results are summarised in Table 10 and the locations are provided in the site plan in **Attachment A**.

Several PFAS chemicals, such as PFOS, PFHxS and PFOA are present at concentrations above the laboratory LOR. It is considered that the PFAS present in these locations (being disconnected from the water from the site drains), represents diffuse ambient concentrations in the surrounding waterways. Conversely, the PFAS concentrations are relatively low compared to water guidelines presented in the PFAS NEMP which is consistent with the primary sources of PFAS from firefighting facilities at significant distances from the Auto Mall site. The closest known source of PFAS within the airport is the Joint User Hydrant Installation (JUHI) at Hakea Street (620 m away) and which is in a separate stormwater and drainage catchment, and which flows into Boggy Creek then the Brisbane River.

The source areas on the CSR are lower in the catchment than the Auto Mall site and for this reason they are unlikely to be directly affecting the PFAS levels in the surrounding surface water channels, except possibly from significant tidal events. The airport precinct is surrounded by upstream industrial process and wastewater discharges, providing numerous external sources which may be contributing to the background concentrations of PFAS observed within the tidal channels.

**Table 10: Receiving Surface Water Monitoring Results for PFAS**

| | | | Per- and polyfluoroalkyl substances (PFAS) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Perfluorodecane sulfonic acid (PFDS) | N-Methyl PFO sulfonamidoethanol (MeFOSE) | N-methyl-PFO sulfonamidoacetic acid (MeFOSAA) | Perfluorooctanoic Acid (PFOA) | Perfluorooctane sulfonic acid (PFOS) | Perfluorohexane sulfonic acid (PFHxS) | Sum of PFHxS and PFOS (lab reported) | PFAS (Sum of total - Lab Reported) | Perfluorobutanoic acid (PFBA) | Perfluorohexanoic acid (PFHxA) | Perfluoroheptanoic acid (PFHpA) | Perfluorodecanoic acid (PFDA) | Perfluoropentanoic acid (PFPeA) | Perfluorononanoic acid (PFNA) | Perfluorotetradecanoic acid (PFTeDA) |
| | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | 0.002 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.01 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 |
| ***NEMP[1] 2018 Health-based guidance values drinking water*** | | | | | | ***0.56*** | | | ***0.07*** | | | | | | | | |
| NEMP[1] 2018 Health-based guidance values recreational water | | | | | | 5.6 | | | 0.7 | | | | | | | | |
| NEMP 2018 Marine 95% Protection | | | | | | 220 | 0.13 | | | | | | | | | | |
| **Field_ID** | **DATEONLY** | **Lab_Report_Number** | | | | | | | | | | | | | | | |
| SW7 | 6/02/2019 | EB1902986 | <0.002 | <0.005 | <0.002 | 0.004 | 0.004 | 0.003 | 0.007 | 0.027 | <0.01 | 0.008 | 0.003 | <0.002 | 0.005 | <0.002 | <0.005 |
| SW12 | 6/02/2019 | EB1902986 | <0.002 | <0.005 | <0.002 | 0.005 | 0.011 | 0.006 | 0.017 | 0.081 | 0.03 | 0.011 | 0.004 | <0.002 | 0.012 | <0.002 | <0.005 |
| SW14 | 6/02/2019 | EB1902986 | <0.002 | <0.005 | <0.002 | 0.004 | 0.004 | 0.009 | 0.013 | 0.116 | 0.06 | 0.014 | 0.005 | <0.002 | 0.017 | <0.002 | <0.005 |

| | | | Per- and polyfluoroalkyl substances (PFAS) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Perfluorotridecanoic acid (PFTrDA) | Perfluorododecanoic acid (PFDoDA) | Perfluoroundecanoic acid (PFUnDA) | Perfluoroheptane sulfonic acid (PFHpS) | Perfluoropentane sulfonic acid (PFPeS) | Perfluorobutane sulfonic acid (PFBS) | 4:2 Fluorotelomer sulfonic acid (4:2 FTSA) | 6:2 Fluorotelomer sulfonic acid (6:2 FTSA) | 8:2 Fluorotelomer sulfonic acid (8:2 FTSA) | 10:2 Fluorotelomer sulfonic acid (10:2 FTSA) | N-Ethyl PFO sulfonamide (EtFOSA) | N-Ethyl PFO sulfonamidoethanol (EtFOSE) | N-Methyl PFO sulfonamide (MeFOSA) | Perfluorooctane sulfonamide (FOSA) | N-ethyl-PFO sulfonamidoacetic acid (EtFOSAA) |
| | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.002 | 0.002 |
| ***NEMP[1] 2018 Health-based guidance values drinking water*** | | | | | | | | | | | | | | | | | |
| NEMP[1] 2018 Health-based guidance values recreational water | | | | | | | | | | | | | | | | | |
| NEMP 2018 Marine 95% Protection | | | | | | | | | | | | | | | | | |
| **Field_ID** | **DATEONLY** | **Lab_Report_Number** | | | | | | | | | | | | | | | |
| SW7 | 6/02/2019 | EB1902986 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.005 | <0.005 | <0.002 | <0.002 |
| SW12 | 6/02/2019 | EB1902986 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.002 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.005 | <0.005 | <0.002 | <0.002 |
| SW14 | 6/02/2019 | EB1902986 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.003 | <0.005 | <0.005 | <0.005 | <0.005 | <0.002 | <0.005 | <0.005 | <0.002 | <0.002 |

Notes:

[1] NEMP is defined as the PFAS National Environmental Management Plan 2018

## 6.6 Receiving Surface Water Monitoring for Metals

PSK collected surface water samples from the drains and the areas outside of the drains (ie, in the receiving water bodies disconnected from, and outside of, the water collected from site. These locations are subject to tidal influences and are considered to be representative of surface water which will reach Kedron Brook. Results of receiving water quality before significant rain (January 2019) and after significant rain (February 2019) are summarised in **Attachment B** along with Tables A1 and A2 from PSK report providing the remaining drain data. The sampling locations are provided in **Attachment A**.

It is noted that in some areas of the internal drains (sample locations SW9 and SW10) concentrations of 6 out of 8 (total) metals exceeded the WQOs based on the published guidelines or deviations from baseline concentrations. This appears to be associated with low pH. A procedure for increasing the pH with lime treatment is available in the ASS MP. The purpose is to adjust pH and also precipitate metals. The procedure is followed prior to release of waters from those portions of the drain. In the remaining drains, the data indicates that only iron exceeds background concentrations in some drains and copper at SW13.

Sample locations SW7 and SW12 represent receiving waters up until January 2019 and, from February 2019, SW14 in the south has been included. During a recent scheduled monitoring event (23 January 2019), after a period of unseasonably low rainfall, water quality was acceptable in SW7 and SW12, except that iron concentrations were higher than the WQOs. In contrast, during the day of significant rainfall on 6 February 2019, a special round of sampling was completed. Only iron in SW7 exceeded WQOs at a similar concentration to the January round. Iron concentrations in SW12 decreased and iron in SW14 was similar to SW.

The concentrations of iron and other metals are at higher concentrations in the on-site drains. Despite some impacts contained within these drains and their isolation from drains outside of the site, the trends indicate that the site is not impacting the receiving water.

## 6.7 Mineral Sands

It is understood that mineral sands may have been placed on site in the past. Anomalous material has been observed at the site that was consistent with mineral sands during previous site activities. This is documented as BAC CSR Site 28. The soil investigation of the site by Golder in 2016 analysed three shallow soils along the eastern portion of the site which contained elevated concentrations of titanium. The concentrations are related to the historical placement of mineral sands and suggests that residual amounts of either rutile or ilmenite (or both) may be present and mixed in with the surface soil. Further chemical analysis of surface samples in 2017 and 2018 confirmed that the material suspected to be minerals sands is ilmenite.

In 2018 Golder reported an assessment summary of this material. It was concluded that the material is a mineral sand and is ilmenite. The exposure levels (in µSv/hr) measured by Radiation & Nuclear Sciences in the area shown on Plate 1 are consistent with typical background levels. The mineral sand content and emission dosage are significantly below published NORMs guidelines. Titanium and zirconium which are heavy metals associated with mineral sand, as well as the radiological products are less likely to be leachable (mobile) as they are part of the crystalline structure of the minerals. Leaching of radioisotope from the material to groundwater will be consistent with typical background soils of which the NORMs are comparable. Based on this information, the mineral sand material (and its entrained radio-isotopic components) will not cause harm to aquatic ecological receptors, to site workers or the future site users of the Auto Mall, from radioactivity.

**Plate 1: Location of mineral sands and monitoring locations (Radiation and Nuclear Sciences, October 2018)**

## 6.8 Discussion

As discussed in Section 6.3, the spatial density of soil investigations was considered sufficient given site access was limited and there was coverage of potential contamination sources. Groundwater investigations were considered appropriate. No additional contaminations assessments of soil and groundwater is considered to be required.

Review of previous assessments for contamination provides the following information:

- Low levels of PFAS were reported at three near-surface locations and one location at depth of 3 m bgl. The concentrations were below the human health and ecological assessment guidelines adopted for this site.
- Concentrations of other potential contaminants of concern in soil samples analysed were below the human health and ecological assessment guidelines adopted for this site.
- Low levels of PFAS were also reported in groundwater samples. The concentrations were below the recreational human health and ecological assessment guidelines adopted for this site. There has been three monitoring well results where PFOS+ PFHxS concentrations were above the assessment guidelines for human health drinking water.
- Although leachability testing was not undertaken in soil samples at the time, only 3 soil samples out of 52 had PFAS concentrations above LOR. In two cases, deeper samples had concentrations less than LOR indicating a propensity for low leachability and hence a low risk to groundwater. However, two wells were impacted with (only) PFOS, one of which was in the soil bore containing PFAS that was converted to a well. In both wells, the concentrations in the groundwater were below the key criteria for protection of recreational users and ecological receptors, indicating that the groundwater is not significantly impacted, even if as a result of the limited levels of leaching which may be occurring. This is consistent with the 1 year period of PFAS testing of wells surrounding the site by PSK. PSK's testing showed only well, MW1B (Stage 1, north - and not near where the areas with PFAS in soil), had concentrations exceeding the drinking water guidelines, and the groundwater quality in the 15 wells present on site (including MW1B) was suitable for recreational use and exposure by ecological receptors (95% species protection).
- Titanium concentrations appear elevated in shallow soil along the eastern portion of the site (CSR site 28), possibly relating to the historical placement of mineral sands. Assessment of the material for NORMs were considered be consistent with typical background levels and would not result in additional impact to groundwater underlying the site for either titanium or radioisotope levels.
- Heavy metal concentrations in groundwater have exceeded the human health guidelines for drinking water and ecological receptor guidelines adopted for this site.
- Concentrations of PFAS in surface water bodies outside of the site, disconnected from the internal drains, were above LOR. These concentrations are considered to potentially represent the surrounding ambient concentration in water influenced by tidal effects.

# 7.0 CONCEPTUAL SITE MODEL

## 7.1 Developing the Conceptual Site Model (CSM)

In accordance with Schedule B1 of the NEPM 2013, a CSM has been developed for the site to assess identified contamination in relation to the current condition and possible disturbances of soil and groundwater during construction works and possible reuse of excavated materials. The essential elements of the CSM have been identified in the guidelines as the following:

- Known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination, as a result of future disturbance works (i.e. nature of the source release into the environment).
- Potentially affected media: this project focuses on soil and groundwater as the affected media; other media were not tested as part of this investigation.
- Human and ecological receptors.
- Potential and complete exposure pathways.

The above elements have been addressed in the following sections.

## 7.2 Sources of Contamination

Active or historical primary sources of PFAS were not identified at the site. Low level and diffuse PFAS impacts were present in soils (below assessment guidelines for the human health and ecological receptor protection) and groundwater (above drinking water and interim marine water guidelines for 95% species protection). These may be related to historical use of AFFF elsewhere at the main airport precinct, although known sources of PFAS relative to the Auto Mall site are within separate catchment and generally drain east to Boggy Creek. Other sources of PFAS within the tidal channels will include upstream industrial process and wastewater discharges.

The source of heavy metal concentrations in groundwater which are above NEPM 2013 Drinking Water GILs (nickel), AEPR Marine Waters guideline (nickel, zinc, cadmium and copper) and NEPM 2013 Marine Waters GILs (nickel, zinc, cadmium, copper and chromium) may be related to leaching from historically placed fills or reflect natural levels in this area.

Titanium concentrations also appear elevated in shallow soil along the eastern portion of the site, possibly relating to the historical placement of inert mineral sands. Titanium in the mineral sands has low mobility and is considered not to pose a risk to terrestrial or aquatic ecosystems. NORMs associated with these minerals were at concentrations consistent with background and therefore were not considered further.

## 7.3 Contaminants of Interest

The results of the investigation (Section 3.0) identified the following key COPCs:

- Low level PFAS in disturbed soils
- Heavy metals and PFAS in groundwater

## 7.4 Receptors and Pathways for Exposure

A CSM has been developed for the identified contaminants of interest for specific sources/pathways/ receptors. The CSM has been developed for the proposed construction works including filling and surcharge on the existing soils and influence on groundwater, for soil movement around the site (such as drain excavation), and post-construction development. The scenarios are based on a commercial/industrial land use.

**Table 11: Receptors and Pathways for Exposure**

| Activity | Sources | Receptors | Exposure pathways |
|---|---|---|---|
| **Construction Works** | Low level PFAS in soils | Construction Workers | Ingestion/contact/inhalation with soil/dust |
| | | Aquatic Ecosystems | Migration of disturbed soils into surface waters by erosion. |
| | | General Public | Migration of disturbed soils into surface waters and then:<br>• Contact by recreational users of surface waters<br>• Consumption of contaminated fish/aquatic species |
| | Heavy metals in groundwater | Construction Workers | Accidental ingestion/contact with (nickel impacted) groundwater. |
| | | Aquatic Ecosystems | Discharge of nickel, zinc, cadmium, copper and chromium-impacted groundwater into surface waters. |
| | PFAS in groundwater | Surface Water | As the drains' bases in some areas are deeper than groundwater levels, groundwater can passively fill the drains when low. |
| | | Construction Workers | Accidental ingestion/contact with extracted groundwater or once in surface water. |
| | | Aquatic Ecosystems | Discharge of extracted groundwater directly into surface waters or via the drains. |
| | | General Public | Discharge of groundwater into surface waters and then:<br>• Contact by recreational users of surface waters<br>• Consumption of contaminated fish/aquatic species |

# 8.0 ENVIRONMENTAL RISK ASSESSMENT

## 8.1 Qualitative Assessment

Risk is measured as a function of the likelihood and consequence of an event occurring. This risk assessment has been completed with the consideration of source - pathway - receptors, as described in the conceptual site model above and is in general accordance with the NEPM 2013.

The qualitative risk assessment was undertaken in general accordance with AS/NZS ISO 31000:2009 Risk management - Principles and guidelines and adopting the likelihood, consequence rankings summarised below.

**Table 12: Qualitative Risk Assessment Rankings**

| Likelihood (L) | Description | Consequences (C) | Description |
|---|---|---|---|
| 1) Rare | Impact is unlikely to occur within lifetime of project operations. No further management or engineering controls are required to minimise potential for occurrence | 1) Low | Negligible or acceptable impact. No further management or engineering controls are required assuming no change to current conditions. |
| 2) Low | Minor management control may need to be considered to reduce likelihood of occurrence. | 2) Low to Moderate | Impact may be acceptable. Further monitoring is required to establish potential significance. Implementation of simple management controls. |
| 3) Moderate | Impact has moderate likelihood of occurrence. Appropriate management control can result in low likelihood of occurrence. | 3) Moderate | Moderate impact. Potentially acceptable if appropriate management controls are implemented. |
| 4) High | Appropriate management control may not be sufficient to minimise likelihood and thus engineering or design solution may need to be considered. | 4) Moderate to High | Impact has the potential to be unacceptable. Further monitoring may be required to establish potential significance. Implementation of appropriate management controls is required. |
| 5) Almost Certain | Impact is believed to be inevitable or has already occurred. Management controls cannot practically minimise likelihood of occurrence to acceptable levels. Engineering or design solutions are required, if possible. | 5) High | Unacceptable impact. The potential impact has a high severity and cannot necessarily be managed, should it occur. |

The resulting qualitative risk ranking matrix adopted for the assessment is presented below.

**Table 13: Qualitative Risk Assessment Ranking Matrix**

| Risk Ranking (RR) | Consequences (C) | | | | |
|---|---|---|---|---|---|
| **Likelihood (L)** | **1) Low** | **2) Low to Moderate** | **3) Moderate** | **4) Moderate to High** | **5) High** |
| **1) Rare** | 1 (Low) | 2 (Low) | 3 (Low) | 4 (Low) | 5 (Moderate) |
| **2) Low** | 2 (Low) | 4 (Low) | 6 (Moderate) | 8 (Moderate) | 10 (Moderate) |
| **3) Moderate** | 3 (Low) | 6 (Moderate) | 9 (Moderate) | 12 (Moderate) | 15 (High) |
| **4) High** | 4 (Low) | 8 (Moderate) | 12 (Moderate) | 16 (High) | 20 (High) |
| **5) Certain** | 5 (Moderate) | 10 (Moderate) | 15 (High) | 20 (High) | 25 (High) |

Where:

- Low Risk Ranking: Score 0 to 4. Acceptable, no specific management and/or engineering controls typically necessary.
- Moderate Risk Ranking: Score 5 to 15. Potentially acceptable subject to appropriate management and/or engineering controls.
- High Risk Ranking: Score 15 and above. Not acceptable. Engineering controls generally required, possibly in conjunction with management controls.

Ranking for the source-pathway-receptor identified in the CSM are summarised below.

**Table 14: Risk Rankings – Disturbance During Construction**

| Receptors | Pathways | Assessment Factors | L | C | RR | Summary Item/ Mitigation Measure |
|---|---|---|---|---|---|---|
| Construction Workers | Ingestion/contact/inhalation with soil/dust | PFAS concentrations below human health criteria.<br>Low likelihood of ingestion and low volumes ingested. | 1 | 1 | 1 | Negligible or acceptable impact. No mitigation required. |
| | Accidental ingestion/contact with groundwater. | PFAS and nickel concentrations exceeds human health (drinking water) criteria, in a limited number of wells, but not primary contact criteria.<br>Low likelihood of ingestion and low volumes ingested.<br>Minor groundwater disturbance only expected during services and infrastructure footings. | 3 | 1 | 3 | Low risk, acceptable impact. Control measures to be put in place and PPE to be used to prevent accidental ingestion. |
| Aquatic Ecosystems | Migration of disturbed soils into surface waters. | Site perimeter drains capture run-off prior to testing and release during high rainfall events. There is strong evidence that leachable levels of PFAS are low. | 1 | 1 | 1 | Negligible or acceptable impact. Adopt sediment and erosion control measures during construction works site to mitigate migration. |

| Receptors | Pathways | Assessment Factors | L | C | RR | Summary Item/ Mitigation Measure |
|---|---|---|---|---|---|---|
| | Discharge of extracted groundwater into surface waters. | PFAS concentrations in groundwater are below the criteria for the protection of aquatic ecosystems.<br>PFAS is present in surrounding waters which will be the receiving waters if accidental or active discharge occurs.<br>Some heavy metals exceed the marine water aquatic guidelines, but active pumping of groundwater will occur only onto the ground or temporary seepage ponds.<br>Groundwater on site is captured via the drains or monitored at the point of discharge off-site. | 3 | 1 | 3 | Moderate Risk. Active discharge to surface waters should be prevented. Remediation or management of extracted groundwater required to reduce the risk. Groundwater entering passively into the drains is managed by monitoring prior to release in accordance with the NEMP while taking into account existing baseline concentrations, and attenuation from rain events and tidal influences. |
| General Public | Direct contact by recreational users of surface water impacted by soil migration. | Leachable levels of PFAS from site soils had concentrations below human health criteria. | 1 | 1 | 1 | Negligible or acceptable impact |
| | Consumption of Fish/Aquatic species from surface water impacted by soil migration. | PFAS levels in Fish/Aquatic Species not known. PFAS leachability concentrations do not suggest disturbed soil will result in significant PFAS release. | 1 | 2 | 2 | Low risk, acceptable impact.<br>Adopt sediment and erosion control measures during construction works site to mitigate soil migration. |
| | Direct contact by recreational users with surface waters impacted by discharge of extracted groundwater. | PFAS concentrations in groundwater below health recreational criteria. | 1 | 1 | 1 | Low risk, acceptable impact. |
| | Consumption of Fish/Aquatic species from surface water impacted by discharge of extracted groundwater. | PFAS levels in Fish/Aquatic Species not known. PFAS concentrations in groundwater are below marine water criteria. | 1 | 1 | 1 | Low risk, acceptable impact. |

## 9.0 CONCLUSIONS

Based on the results of this assessment, the following conclusions are drawn for the site.

- Groundwater was encountered at levels between about 1.3m AD and 2.3m AD across the site and inferred to be flowing toward the north east, i.e. generally towards Kedron Brook (approximately 1.5 km north east of site).
- Low levels of total PFAS were present in soils at concentrations representing a negligible to low risk to human health and aquatic ecosystems.
- PFAS and nickel were present in some groundwater samples at concentrations above human health criteria. The concentrations in groundwater represent a low risk to construction workers and a low risk to recreational surface water users.
- PFAS and heavy metals (nickel, zinc, cadmium, copper and chromium) were present in some groundwater samples at concentrations exceeding the criteria for the protection of marine aquatic ecosystems. The concentrations represent a low risk to marine aquatic ecosystems if discharged to surface waters.

## 10.0 RECOMMENDATIONS

Based on the findings of this preliminary investigation it is recommended that:

- Erosion and control measures implemented during construction should be maintained to prevent migration of soils into surrounding drains and waterways.
- Direct discharge of any groundwater (extracted during construction) into surrounding drains should be prevented. Active discharge should be onto site soils or into temporary seepage ponds, other control measures and use of PPE should be adopted to prevent accidental ingestion by construction workers. Passive groundwater movement generally enters the perimeter drains and therefore should be managed through the ASS MP or scheduled monitoring program.
- Perimeter drain levels are to be maintained at levels consistent with seasonal groundwater levels, in order to reduce groundwater influx into the drain or excessive water leaving site, as detailed in the ASS Management Plan.

## 11.0 CONSULTATION

This document has been provided to the following stakeholders and comments have been received from the listed parties:

- The wider Brisbane Airport Corporation Pty Limited
- The Consultant preparing the Exposure Draft Major Development Plan (edMDP)
- Commonwealth Department of Infrastructure, Regional Development and Cities
- Commonwealth Department of the Environment and Energy

## 12.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in **Attachment C** of this technical memorandum. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used.  It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

## 13.0 REFERENCES

Golder 2015. Golder Associates, Acid Sulphate Soil and Contamination Desktop Review, Proposed Auto Precinct Brisbane Airport, February 2015

Golder 2017 a. Golder Associates, Contamination Assessment, Proposed Auto Mall Precinct Stage 2, 1 June 2017, reference 1538021-011-R-Rev2

Golder 2017b. Golder Associates, Contamination Assessment, Proposed Auto Mall Precinct Stage 1, 5 June 2017, reference 1538021-013-R-Rev2

Golder 2017c. Golder Associates, Acid Sulphate Soil Assessment, Proposed Auto Mall Precinct Stage 1, 5 June 2017, reference 1538021-014-R-Rev2

Golder 2017d. Golder Associates, Acid Sulphate Soil Assessment, Proposed Auto Mall Precinct Stage 2, 5 June 2017, reference 1538021-012-R-Rev1

Golder 2018. Golder Associates, Mineral Sands at Stage 2 of the Auto Mall Development – Results of the Assessment, 10 October 2018, 1664971-045-TM-Rev0

PSK 2018. PSK, Site Monitoring Future Auto Mall Precinct– Stages 1, 2 and 3, Brisbane Airport, November 2018, 12 December 2018, 0517-005-020

Golder 2019. Golder Associates, Proposed Auto Mall Precinct, Acid Sulphate Soil Management Plan, reference 1664971-001-R-Rev4, update in progress.

Aurecon August 2017, Proposed Brisbane Airport Auto Mall- Environmental Management Plan. Revision 3. Prepared for Brisbane Airport Corporation.

Andrew Howes
*Principal Environmental Scientist*

ERC/AWH/xx

**Attachments:**

**Figure 1**: Proposed Development with Contamination Investigation Locations

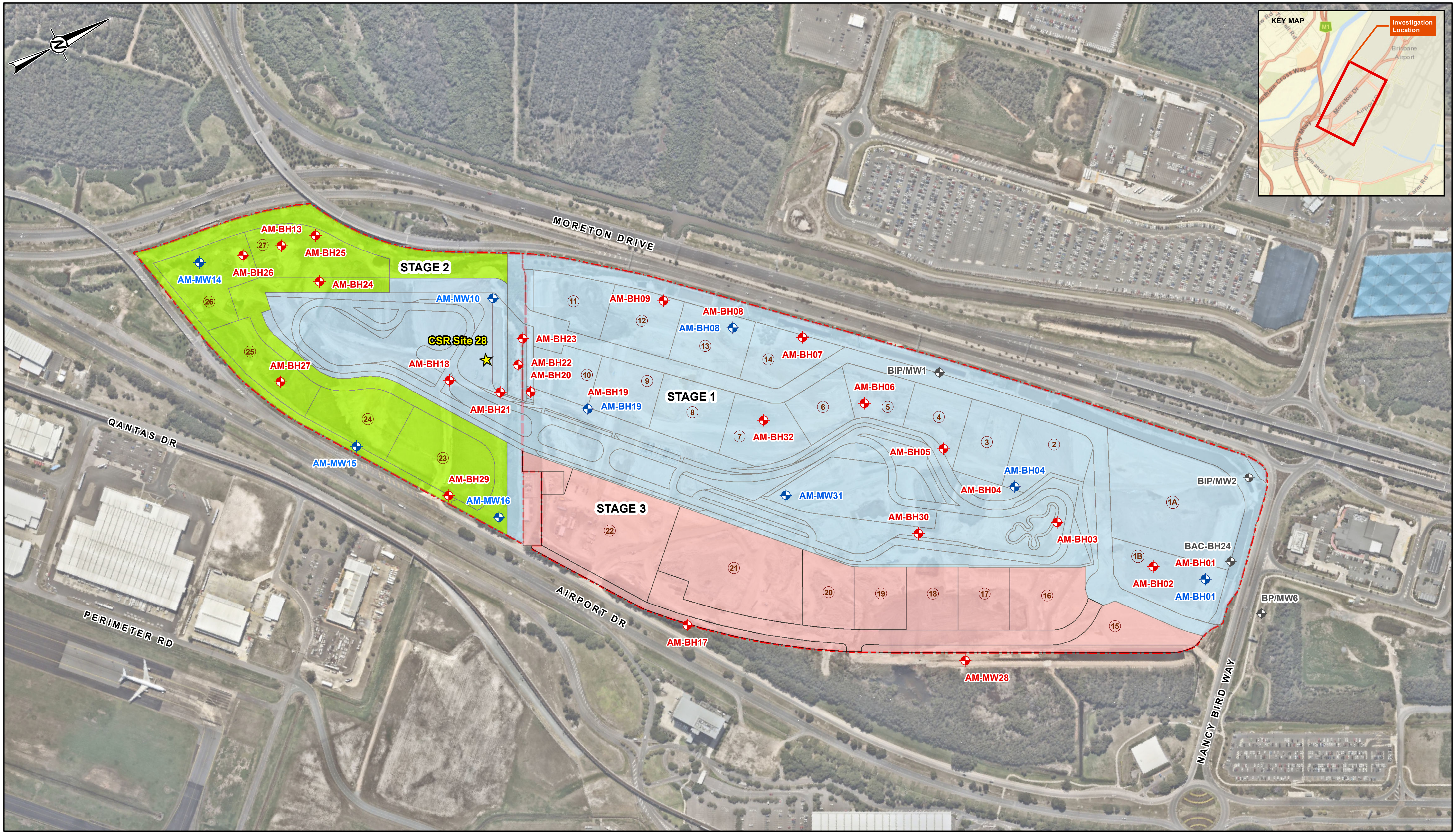
**Attachment A** – Surface Water Sampling Locations (from PSK)

**Attachment B** – Surface Water Metal Sampling Results (from PSK)

**Attachment C** – Important Information

https://golderassociates.sharepoint.com/sites/31996g/correspondence/deliverables/18107809-001-tm-rev0 auto mall contamination summary report.docx

# Figure 1 - Proposed Development with Contamination Investigation Locations




**LEGEND**

BAC CSR (2008)

**Current Investigation**

Well

Borehole

**Previous Investigation**

Monitoring Well

**BRIS0012 SK-025 (24/08/2016)**

BAC Auto Precinct Layout

Indicative Stage 1

Indicative Stage 2

Indicative Stage 3

Site Boundary

Coordinate System: GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994

0 50 100 150 200
1:5,000 @ A3 METRES

**NOTE(S)**
**Service Layer Credits:** Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

**REFERENCE(S)**
1. Investigation Locations Supplied by Golder 2018
2. Development Yield Plan layout supplied by BAC as CAD file 'BRIS0012 SK-004[E] DEVELOPMENT YIELD PLAN.pdf.dwg'

CLIENT
BRISBANE AIRPORT CORPORATION

PROJECT
AUTO MALL

CONSULTANT
GOLDER

| | |
|---|---|
| DD/MM/YYYY | 2/22/2019 |
| DESIGNED | DP |
| PREPARED | DC |
| REVIEWED | DP |
| APPROVED | EC |

TITLE
**PROPOSED DEVELOPMENT WITH PREVIOUS AND CURRENT CONTAMINATION INVESTIGATION LOCATIONS**

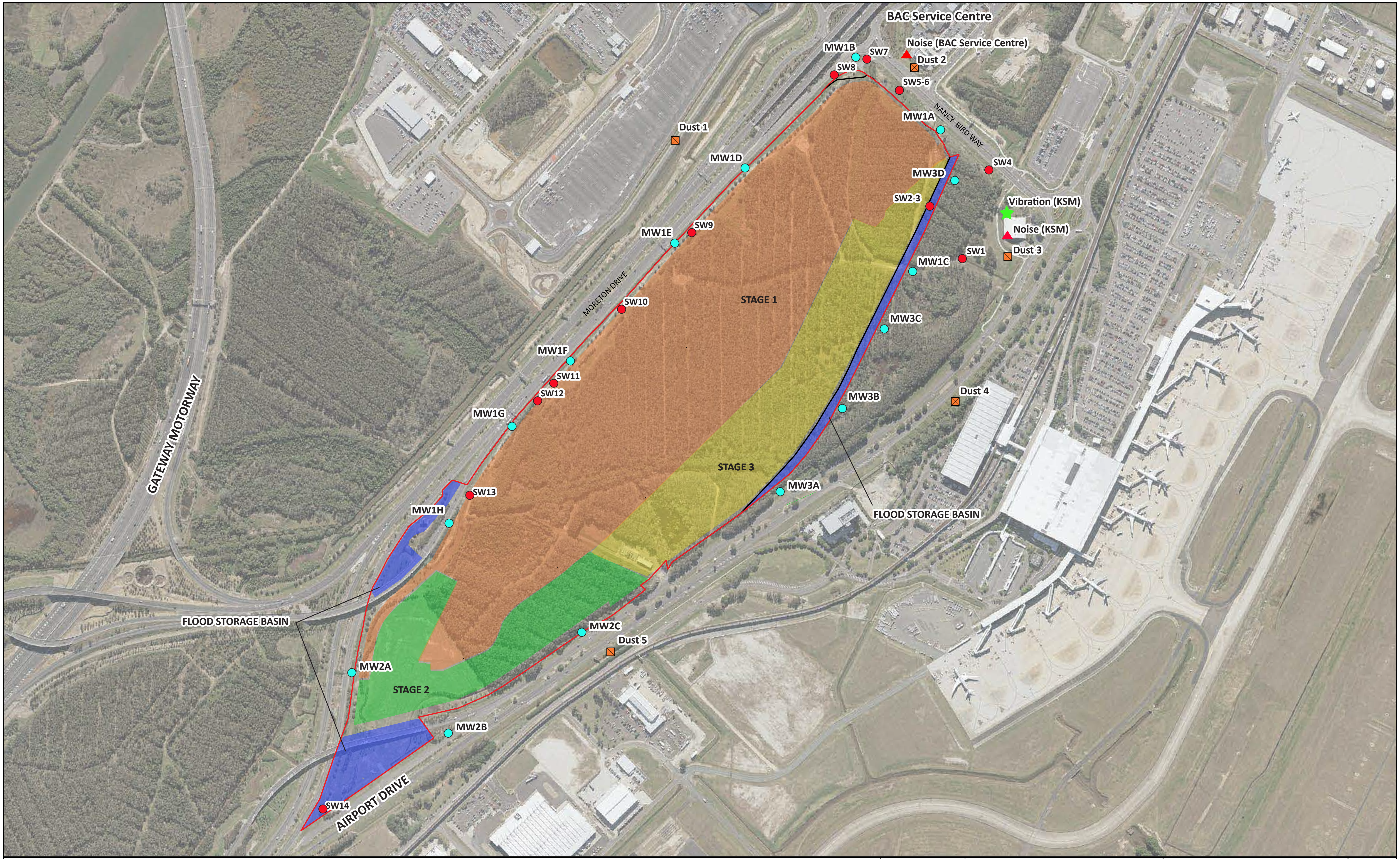
| PROJECT NO. | CONTROL | REV. | FIGURE |
|---|---|---|---|
| 18107809 | 001 | C | 1 |

PATH: R:\01 Client\BAC\18107809\99_PROJECTS\18107809-001-R-RevC-F001-Proposed-Development-Prev-Current-Contam-Investigation-Location.mxd PRINTED ON: 2019-02-22 AT: 5:24:48 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25mm

**APPENDIX A**

# Surface Water Sampling Locations (from PSK)




## LEGEND

- Groundwater Monitoring Well
- Vibration Monitoring location
- Dust Monitoring location
- Noise Monitoring location
- Surface Water Monitoring location

Notes:
- Baseplan extracted from ImageGlobe 2016. Extracted 06/11/2017
- Stages of development extracted from Brisbane Airport Auto Mall EMP Rev3, Figure 2. Stages of Development, Version 3, Job No: 255492-002

PSK Environmental

| | | |
|---|---|---|
| Client: | Brisbane Airport Corporation | |
| Drawn: | AS/RM | Date: 26/02/2019 |
| Checked: | SLS | Date: 26/02/2019 |
| Scale: | 0m – 175m | |
| Project: | Monthly Monitoring Future Auto Mall Precinct Brisbane Airport | |
| Title: | SITE PLAN AND SAMPLING LOCATIONS | |
| Job No.: J0517-005-022 | Fig. No.: 1 | Rev: |

N

A3

**APPENDIX B**

# Water Sampling Results (from PSK)

**SUMMARY OF SURFACE WATER MONITORING RESULTS (Monthly Monitoring_23 January & 6 February 2019)**

**Future Auto Mall Precinct**

**Brisbane Airport Corporation, Brisbane Airport J0517-005**

| Sample ID | Sample date | Sample Time | ALS Batch Number | Field Parameters | | | | | Acidity/Alkalinity | | Dissolved Metals | | | | | | | | Total Metals | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH | EC | DO | | Turbidity | Total Alkalinity as CaCO3 | Acidity as CaCO3 | Aluminium | Arsenic | Cadmium | Copper | Lead | Nickel | Zinc | Iron | Aluminium | Arsenic | Cadmium | Copper | Lead | Nickel | Zinc | Iron |
| **Unit** | | | | pH unit | mS/cm | ppm | Saturation (%) | NTU | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| **Limit of Reporting** | | | | 0.01 | 0.1 | 0.1 | | 0.1 | 1 | 1 | 0.01 | 0.001 | 0.0001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.05 | 0.01 | 0.001 | 0.0001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.05 |
| SW7 | 23/01/2019 | 12:10 | EB1901744 | 7.4 | 89.4 | 5.7 | 82 | 9.7 | 176 | 22 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.025 | <0.05 | 0.14 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 1.17 |
| SW7 | 6/02/2019 | 13:25 | EB1902990 | 7.9 | 40.4 | 2.8 | 40 | 42.3 | 176 | 22 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.025 | 0.07 | 0.36 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 1.30 |
| SW12 | 23/01/2019 | 9:45 | EB1901744 | 6.9 | 58.6 | 2.8 | 40 | 22.5 | 198 | 50 | <0.05 | <0.005 | <0.0005 | 0.01 | <0.005 | 0.01 | 0.043 | 0.07 | 0.2 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 2.34 |
| SW12 | 6/02/2019 | 13:05 | EB1902990 | 8.1 | 30.9 | 4.4 | 60 | 11.1 | 198 | 50 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.025 | <0.05 | 0.34 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 0.65 |
| SW14 | 6/02/2019 | 14:35 | EB1902990 | 8.9 | 40.3 | 7.0 | 89 | 23.4 | 597 | 109 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | 0.006 | <0.025 | 0.06 | 0.3 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 0.59 |
| **Water Quality Objectives - Kedron Brook Floodway Drain^** | | | | **6.5-8.5** | - | - | **80-100** | **20** | - | - | - | - | - | - | - | - | - | - | **0.65*** | **0.050** | **0.002** | **0.005** | **0.005** | **0.015** | **0.050** | **1.01**** |
| **ASS Performance Criteria - (Aurecon 2017)** | | | | **>6.0** | - | - | - | - | - | **<40** | **<1.0** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

from PSK

**TABLE A1: SUMMARY OF SURFACE WATER MONITORING RESULTS (Monthly Monitoring_23 January 2019)**
**Future Auto Mall Precinct**
**Brisbane Airport Corporation, Brisbane Airport**
**J0517-005**

| Sample ID | Sample date | Sample Time | ALS Batch Number | Field Parameters | | | | | Acidity/Alkalinity | | Dissolved Metals | | | | | | | | Total Metals | | | | | | | | Nutrients | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH | EC | DO | | Turbidity | Total Alkalinity as CaCO3 | Acidity as CaCO3 | Aluminium | Arsenic | Cadmium | Copper | Lead | Nickel | Zinc | Iron | Aluminium | Arsenic | Cadmium | Copper | Lead | Nickel | Zinc | Iron | Total Nitrogen as N | Total Kjeldahl Nitrogen as N | Total Phosphorus as P | Nitrite + Nitrate as N | Dissolved TKN as N | Filtered Total Nitrogen as N | Filtered Total Phosphorus as P |
| **Unit** | | | | pH unit | mS/cm | ppm | Saturation (%) | NTU | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| **Limit of Reporting** | | | | 0.01 | 0.1 | 0.1 | | 0.1 | 1 | 1 | 0.01 | 0.001 | 0.0001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.05 | 0.01 | 0.001 | 0.0001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.05 | 0.1 | 0.1 | 0.01 | 0.01 | 0.1 | 0.1 | 0.01 |
| SW1 | 23/01/2019 | 12:30 | EB1901744 | 8.2 | 3.1 | 9.7 | 138 | 8.7 | 102 | 1 | 0.01 | 0.002 | <0.0001 | 0.002 | <0.001 | 0.002 | 0.006 | 0.16 | 0.46 | 0.003 | <0.0001 | <0.001 | <0.001 | 0.001 | 0.007 | 2.64 | 1.8 | 1.8 | 0.23 | 0.02 | 0.6 | 0.6 | 0.14 |
| SW2-3 | 23/01/2019 | 12:20 | EB1901744 | 8.6 | 14.9 | 12.5 | 175 | 11.3 | 254 | <1 | 0.01 | 0.009 | <0.0001 | 0.003 | <0.001 | 0.001 | <0.005 | 0.1 | 0.06 | 0.01 | <0.0001 | 0.002 | <0.001 | 0.002 | <0.005 | 0.66 | 4.8 | 4.8 | 0.35 | <0.01 | 2.6 | 2.6 | 0.12 |
| SW4 | 23/01/2019 | 12:15 | EB1901744 | 8.1 | 7.9 | 7.6 | 105 | 6.2 | 191 | <1 | 0.01 | 0.003 | <0.0001 | 0.001 | <0.001 | <0.001 | 0.006 | 0.25 | 0.07 | 0.003 | <0.0001 | <0.001 | <0.001 | 0.001 | <0.005 | 0.7 | 2.8 | 1.8 | 0.29 | 0.99 | 1.4 | 2.4 | 0.19 |
| SW5-6 | 23/01/2019 | 11:20 | EB1901744 | 8.6 | 17.2 | 7.8 | 110 | 6.3 | 229 | <1 | 0.02 | 0.005 | <0.0001 | 0.004 | <0.001 | 0.01 | 0.006 | 0.09 | 0.03 | 0.006 | <0.0001 | <0.001 | <0.001 | 0.001 | <0.005 | 0.36 | 2.7 | 2.7 | 0.14 | 0.04 | 2.1 | 2.1 | 0.06 |
| SW7 | 23/01/2019 | 12:10 | EB1901744 | 7.4 | 89.4 | 5.7 | 82 | 9.7 | 176 | 22 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.025 | <0.05 | 0.14 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 1.17 | 1.2 | 1.1 | 0.12 | 0.1 | 1.3 | 1.4 | 0.14 |
| SW8 | 23/01/2019 | 11:10 | EB1901744 | 7.5 | 56.3 | 8.2 | 110 | 4.1 | 101 | 6 | 0.11 | <0.005 | <0.0005 | 0.009 | <0.005 | 0.054 | <0.025 | 0.25 | 0.12 | <0.005 | <0.0005 | <0.005 | <0.005 | 0.009 | <0.026 | 0.8 | 1.8 | 1.8 | <0.05 | <0.01 | 1.7 | 1.7 | <0.05 |
| SW9 | 23/01/2019 | 10:50 | EB1901744 | 2.7 | 58.0 | 6.4 | 86 | 1.9 | <1 | 556 | 15.4 | 0.007 | 0.0013 | 0.025 | 0.01 | 0.527 | 0.709 | 91.4 | 16.2 | 0.007 | 0.0014 | 0.01 | 0.006 | 0.505 | 0.681 | 89.8 | 8.8 | 8.8 | <0.05 | <0.01 | 8.7 | 8.7 | <0.05 |
| SW10 | 23/01/2019 | 10:40 | EB1901744 | 2.6 | 67.6 | 7.1 | 99 | 2.7 | <1 | 1320 | 1.84 | 0.01 | 0.0006 | 0.13 | 0.03 | 0.158 | 0.315 | 400 | 1.9 | 0.011 | <0.0005 | 0.011 | 0.008 | 0.114 | 0.147 | 433 | 27 | 27 | <0.05 | <0.01 | 28 | 28 | <0.05 |
| SW11 | 23/01/2019 | 10:20 | EB1901744 | 7.8 | 44.2 | 10.3 | 140 | 20.4 | 197 | 28 | <0.05 | <0.005 | <0.0005 | 0.005 | <0.005 | 0.005 | <0.025 | 0.09 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 2.51 | 2.2 | 2.2 | <0.05 | 0.02 | 1.8 | 1.8 | <0.05 |
| SW12 | 23/01/2019 | 9:45 | EB1901744 | 6.9 | 58.6 | 2.8 | 40 | 22.5 | 198 | 50 | <0.05 | <0.005 | <0.0005 | 0.01 | <0.005 | 0.01 | 0.043 | 0.07 | 0.2 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 2.34 | 1.1 | 1 | 0.08 | 0.06 | 0.9 | 1 | 0.08 |
| SW13 | 23/01/2019 | 9:30 | EB1901744 | 7.3 | 54.4 | 1.7 | 25 | 8.5 | 597 | 109 | <0.05 | 0.008 | <0.0005 | 0.026 | <0.005 | 0.029 | 0.046 | 0.1 | <0.05 | 0.008 | <0.0005 | 0.008 | <0.005 | 0.007 | <0.026 | 0.74 | 3.2 | 3.2 | 0.41 | 0.02 | 3.2 | 3.2 | 0.42 |
| **Water Quality Objectives - Kedron Brook Floodway Drain^** | | | | 6.5-8.5 | - | - | 80-100 | 20 | - | - | - | - | - | - | - | - | - | - | 0.65* | 0.050 | 0.002 | 0.005 | 0.005 | 0.015 | 0.050 | 1.01** | 0.45 | - | 0.06 | - | - | - | - |
| **ASS Performance Criteria - (Aurecon 2017)** | | | | >6.0 | - | - | - | - | - | <40 | <1.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Notes:**

^Water Quality Objectives (WQO) as per Table 3.14 of the Project EMP (Aurecon 2017)

*Aluminium WQO has been calculated based on background concentrations detected at KB5 + 10%

**Iron WQO has been calculated based on background concentrations detected at KB5 + 10%

The sampling locations as per Golder Associates TM (Doc Ref. 1664791 -041-TM-Rev1)

EC = Electrical Conductivity, DO = Dissolved Oxygen

"-" Denotes no WQO

Values shaded exceed the WQOs for Kedron Brook Dloodway Drain or ASS Performance Criteria

PSK Environmental

**TABLE A2: SUMMARY OF SURFACE WATER MONITORING RESULTS (Interim site visit_ 06 February 2019)**
**Future Auto Mall Precinct**
**Brisbane Airport Corporation, Brisbane Airport**
**J0517-005**

| Sample ID | Sample date | Sample Time | ALS Batch Number | Field Parameters | | | | | Acidity/Alkalinity | | Dissolved Metals | | | | | | | | Total Metals | | | | | | | | Nutrients | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | pH | EC | DO | | Turbidity | Total Alkalinity as CaCO3 | Acidity as CaCO3 | Aluminium | Arsenic | Cadmium | Copper | Lead | Nickel | Zinc | Iron | Aluminium | Arsenic | Cadmium | Copper | Lead | Nickel | Zinc | Iron | Total Nitrogen as N | Total Kjeldahl Nitrogen as N | Total Phosphorus as P | Nitrite + Nitrate as N | Dissolved TKN as N | Filtered Total Nitrogen as N | Filtered Total Phosphorus as P |
| **Unit** | | | | pH unit | mS/cm | ppm | Saturation (%) | NTU | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| **Limit of Reporting** | | | | 0.01 | 0.1 | 0.1 | | 0.1 | 1 | 1 | 0.01 | 0.001 | 0.0001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.05 | 0.01 | 0.001 | 0.0001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.05 | 0.1 | 0.1 | 0.01 | 0.01 | 0.1 | 0.1 | 0.01 |
| SW7 | 6/02/2019 | 13:25 | EB1902990 | 7.9 | 40.4 | 2.8 | 40 | 42.3 | 176 | 22 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.025 | 0.07 | 0.36 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 1.3 | 1.6 | 1.3 | 0.1 | 0.35 | 1.2 | 1.6 | 0.06 |
| SW12 | 6/02/2019 | 13:05 | EB1902990 | 8.1 | 30.9 | 4.4 | 60 | 11.1 | 198 | 50 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.025 | <0.05 | 0.34 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 0.65 | 1.2 | 1 | 0.07 | 0.23 | 0.9 | 1.1 | 0.05 |
| SW14 | 6/02/2019 | 14:35 | EB1902990 | 8.9 | 40.3 | 7.0 | 89 | 23.4 | 597 | 109 | <0.05 | <0.005 | <0.0005 | <0.005 | <0.005 | 0.006 | <0.025 | 0.06 | 0.3 | <0.005 | <0.0005 | <0.005 | <0.005 | <0.005 | <0.026 | 0.59 | 1.8 | 1.8 | 0.19 | 0.01 | 1.2 | 1.2 | 0.13 |
| **Water Quality Objectives - Kedron Brook Floodway Drain^** | | | | 6.5-8.5 | - | - | 80-100 | 20 | - | - | - | - | - | - | - | - | - | - | - | 0.050 | 0.002 | 0.005 | 0.005 | 0.015 | 0.050 | - | 0.45 | - | 0.06 | - | - | - | - |
| **ASS Performance Criteria - (Aurecon 2017)** | | | | >6.0 | - | - | - | - | - | <40 | <1.0 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

**Notes:**

^Water Quality Objectives (WQO) as per Table 3.14 of the Project EMP (Aurecon 2017)

The sampling locations as per Golder Associates TM (Doc Ref. 1664791 -041-TM-Rev1)

EC = Electrical Conductivity, DO = Dissolved Oxygen

"-" Denotes no WQO

Values shaded exceed the WQOs for Kedron Brook Dloodway Drain or ASS Performance Criteria

PSK Environmental

**APPENDIX C**

# Important Information

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

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**Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification**