

# DAM DECOMMISSIONING STRATEGY – REV 2

Aspect Industrial Estate, Mamre Road, Kemps Creek, NSW

Prepared for Mirvac Office and Industrial Pty Ltd

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# DAM DECOMMISSIONING STRATEGY

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This report has been prepared for Mirvac Office and Industrial Pty Ltd in accordance with the terms and conditions of appointment in the Consultant Agreement for Lots 54-58 (DP 259135) Mamre Road, Kemps Creek – Phase 2 DSI, FIP, UFP, Dam Decommissioning Strategy, Groundwater Management Plan dated 24th September 2019. Arcadis Australia Pacific Pty Limited (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

## REVISIONS

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# 1 INTRODUCTION

Arcadis Australia Pacific (Arcadis) was engaged by Mirvac Office and Industrial (Mircvac) to prepare a Dam Decommissioning Strategy (DDS) to support the proposed Aspect Industrial Estate development located at Lots 54-58 DP259135 Mamre Road, Kemps Creek, NSW 2178 (the site). The location of the site is illustrated in Figure 1, **Appendix A**.

The site comprises an approximate area of 56.3 ha and is located within the Penrith City Council Local Government Area (LGA). The site is currently zoned as IN1 General Industrial land within the Broader Western Sydney Employment Area stipulated within State Environmental Planning Policy (Western Sydney Employment Area) 2009 (SEPP WSEA), updated 11 June 2020.

Mircvac require the following documentation to support a State Significant Development (SSD) application relevant to the site:

- Phase 2 Detailed Site Investigation (DSI).
- Fill Importation Protocol (FIP).
- Unexpected Finds Protocol (UFP).
- Dam Decommissioning Strategy (DDS).
- Groundwater Management Plan (GMP).

This DDS is one of five reports that Arcadis has prepared for submission to Mircvac to support the industrial redevelopment.

A Remediation Action Plan (RAP) may also be required under the Secretary's Environmental Assessment Requirements (SEARs).

## 1.1 Background

The site has approximately 950 m of frontage to Mamre Road, with a proposed signalised intersection providing vehicular access via Mamre Road to the M4 Motorway and the Great Western Highway to the north and Elizabeth Drive to the south. Known historical land uses at the site include rural residential, grazing, dairy farming, poultry farming and horticulture.

Ministerial Local Planning Direction 3.5 precludes future residential development of the site due to its proximity to the Western Sydney Airport ANEF 20 noise contour. However, future land uses relevant to employment generating purposes are consistent with the approved 2020 amendment to the SEPP WSEA and the 2018 Western Sydney Aerotropolis Land Use and Infrastructure Implementation Plan (LUIIP) Stage 1: Initial Precincts.

The proposed redevelopment of the site will facilitate land uses consistent with commercial and industrial use, as prescribed in the National Environmental Protection Measure as amended in 2013 (NEPC, 2013) and will involve the following activities:

- Demolition and removal of existing rural structures.
- Heritage salvage works (if applicable).
- Clearing of existing vegetation on the subject site and associated dam dewatering and decommissioning.
- Realignment of existing creek.
- On-site bulk earthworks including any required ground dewatering.
- Importation, placement and compaction of soil material, consisting of;
  - Virgin Excavated Natural Material (VENM) within the meaning of the POEO Act; and/or
  - Excavated Natural Material (ENM) within the meaning of the NSW Environmental Protection Agency's (EPA) Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the POEO (Waste) Regulation 2014 – The Excavated Natural Material Order 2014; and/or
  - Materials covered by a specific NSW EPA Resource Recovery Order and Exemption which are suitable for their proposed use.
- Construction of boundary retaining walls.

- Catchment level stormwater infrastructure, trunk services connections, utility infrastructure, roads and access infrastructure (signalised intersection with Mamre Road) associated with Stage 1.
- Construction fit out and 24 hours a day / 7 day per week use of industrial warehouse and distribution buildings within Stage 1.
- Detailed earthworks, stormwater, services and utility infrastructure associated with the construction of industrial logistics and warehouse buildings within Stage 1.
- Boundary stormwater management, fencing and landscaping.
- Staged subdivision of Stage 1.

Arcadis understands that earthworks undertaken as part of site redevelopment works will not require importation of significant volumes of fill material, as the bulk earthworks plan has been designed to achieve an overall cut/fill net balance for the development.

## 1.2 Purpose of this Document

The purpose of this DDS is to outline the requirements to dewater and decommission the dams located at the site which is proposed to undergo development for industrial and/or commercial land uses. It is expected that this DDS will form part of an overarching Construction Environmental Management Plan (CEMP) that will manage environmental considerations during the construction phase.

This DDS has been prepared with due consideration of the results from an intrusive site investigation undertaken at the site in October 2019 (Arcadis, 2019).

This document has been developed for the initial assessment and dewatering of the on-site dams prior to construction activities. These works relate to the assessment and remediation of on-site water as a result of historical farmland use and associated potential contaminants. Following dam dewatering and decommissioning works, regular on-site construction water management procedures will need to be detailed in a project specific Construction Environmental Management Plan (CEMP) and implemented by the appointed civil contractor for bulk earthworks at the Site - Western Earthmoving Pty Ltd (WEM).

This document has been developed for the initial assessment and dewatering of the onsite dams prior to construction activities. These works relate to the assessment and remediation of onsite water as a result of historical farmland use and associated potential contaminants. Following dam decommissioning works, regular onsite construction water management procedures as outlined in the site developed construction environmental management plan should be implemented.

## 1.3 Objectives

The objective of this DDS is to provide a viable strategy to dewater and decommission the five dams located across the site. Dam decommissioning will involve the removal of water and sediments from the dams, removal of the dam embankments and infilling of the void. The objectives of this report are to provide a strategy to:

- Assess the water quality within each dam;
- Provide water re-use options;
- Outline a methodology for removing the dam structure;
- Outline a methodology to remove sediments from the base of the dam;
- Assess and classify the sediments and dam wall soils with a view of no-site re-use;
- Provide void infill options; and
- Consider surface water flow during and after dam removal.

## 1.4 Scope of Works

To complete the DDS, Arcadis undertook the following scope of work:

- Developed the DDS objectives and methodology;
- Reviewed the dam water analytical results (Arcadis, 2019);
- Compiled water re-use options;
- Considered water treatment options;
- Outlined a methodology to estimate the volume of water to be removed from the dams;
- Developed project specific water quality objectives in general accordance with the ANZECC 2000/ANZG 2018 criteria; and
- Developed a proposed dam dewatering strategy.



## 2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

### 2.1 Site Identification

The site location and five on-site dams are shown in Figures 1 and 2, **Appendix A**. The site details are summarised in Table 2-1 and described in the following sections.

*Table 2-1 Site Detail Summary*

Site Characteristic	Detail
Street Address	804-882 Mamre Road, Kemps Creek, NSW, 2178
Deposited Plan	Lots 54-58 DP259135
Closest Cross Road(s)	Mamre Rd and Bakers Ln
Local Government Area	Penrith City Council
Land Use Zoning Information	IN2 General Industrial
Site Coordinates to the approximate centre of the site (Geographic)	Latitude: -33.842987 Longitude: 150.784934
Current Land Use	Rural residential properties
Proposed Future Land Use (Assumed)	Employment purposes (industrial and/or commercial land use)
Approximate Site Area	Approximately 563,000 m <sup>2</sup>

### 2.2 Topography

The site is located within a generally flat alluvial plain with localised undulating rises/falls and generally slopes toward Kemps Creek/South Creek to the west. The site slopes to the south west and has an elevation of approximately 40 to 50 m relative to the Australian Height Datum (AHD). A generally north south oriented drainage line bisects the site along which the five dams have been constructed.

### 2.3 Hydrology

Observations were made during field work conducted in October 2019. The five dams were being used for stock watering and irrigation of crops and a chicken coup. The site is primarily covered by grass with some bare patches observed due to the drought. Rainfall infiltration is expected to be limited due to the low permeability, clayey nature of the topsoil with rainfall runoff directed towards the dams.

The nearest surface water bodies include several small dams on neighbouring properties and Kemps Creek, which is located approximately 600 m to the west of the site. Kemps Creek drains into South Creek approximately 900 m west of the site, before ultimately discharging into the Hawksbury River located approximately 26 km north of the site.

### 2.4 Geology

The Sydney 1:100,000 Geological Survey of NSW map indicates that the site is underlain by the Triassic aged Bringelly Shale of the Wianamatta Group. This is described as comprising shales, carbonaceous clay, laminate and coal.

The eSPADE NSW Soil and Land Information database indicates that the site is underlain by Blacktown and Luddenham Soil Landscapes.

The soils encountered during fieldwork conducted by Arcadis in October 2019 aligned with the above descriptions and were described as:

- Fill material generally comprising topsoil and brown silty clay to a typical depth of 0.2 m below ground level (m bgl) and a maximum depth of 1.2 m bgl (in TP110 and MW01); and
- Natural material generally comprising slightly stiff, orange to brown clay with grey mottling turning into grey to brown weathered shale.

## 2.5 Hydrogeology

Groundwater is present within the Bringelly Shale. Typically, the Bringelly Shale yields low volumes of saline groundwater. The shale generally has low water transmitting properties, displaying a very low primary porosity with the majority of flow being via saturated structural features such as fractures, joints and laminations. Groundwater can be perched at the base of the weathered soil profile along the interface with fresh bedrock. The regional aquifer within the shale is often confined or partially confined and rises once intersected in a borehole.

A review of NSW Department of Primary Industries and Environment – Water (DPIE-Water) database of registered groundwater bores indicates there are no boreholes present within a 2000 m radius of the site. This is consistent with groundwater in the Kemps Creek area having low beneficial use due to poor groundwater quality and the presence of surface water.

Groundwater standing water levels were measured in newly installed wells (monitoring wells MW01 to MW06) constructed across the site (Arcadis, 2019). Groundwater levels measured in October 2019 ranged between 2.52 and 8.31 metres below ground level. Review of this data indicates that the standing water levels are shallowest along the central drainage line and as expected become deeper higher in the catchment to the east and west. During the drilling program groundwater was intersected at depths deeper than the measured standing water levels (ranging between 2.3 and 6.8 metres). The difference between the standing water level and water strike indicates the groundwater within the shale is partially confined. Consequently, excavations across the site are likely to intersect groundwater at depths deeper than the measured standing water levels.

Reduced standing water levels ranged from 37.98 and 57.18 mAHD. These groundwater elevations indicate groundwater flow is towards the northwest, in the direction of Kemps Creek.

## 2.6 Acid Sulfate Soil and Salinity

Acid sulfate soils (ASS) are generally associated with low-lying coastal areas, including estuarine flood plains, rivers and creeks. JBS&G, 2019 state that since the site is not located near the coast and the elevation is in excess of 40 m AHD the likelihood of ASS within the study area is low.

Salts are naturally present in soil, bedrock and groundwater. In western Sydney salts naturally occur within the Bringelly Shale and are mobilised in the subsurface by the movement of groundwater. When saline groundwater is present close to the surface the salts can precipitate on the ground as the saline groundwater is drawn to the surface by fluctuating water tables combined with capillary action. Seepage of saline groundwater can cause corrosion of building materials, prevent growth of all but highly salt tolerant vegetation contributing to increased soil erosion. Salinity hazard mapping (DIPNR, 2012) indicates the site is of moderate salinity potential due to the site being located on Bringelly Shale. Off-site adjacent to drainage lines near Kemps Creek the salinity potential is considered high as the saline groundwater becomes shallower near natural surface water features where there is an increased potential of groundwater reaching the ground surface.

## 2.7 Summary of Previous Investigations

### 2.7.1 Preliminary Site Investigation (JBS&G 2019)

In January 2019, JBS&G conducted a Preliminary Site Investigations (PSI) with limited soil sampling at the site.

JBS&G's review of the site history indicated that the site appeared to be utilised for light agricultural purposes (i.e. grazing, historical dairy farming, poultry farming and horticulture). Based on the findings of the desktop study and followed by detailed site inspections by JBS&G on 30 November 2018 and 16 January 2019, potential sources of on-site contamination, both historical and current, were considered likely to be from surficial sources associated with:

- Pesticides/herbicides used in former and current market gardens;
- Potential biological impacts from livestock/poultry farming;
- Potential use of hazardous building materials (asbestos, lead based paints, PCBs) in historic and current site structures resulting in localised impacts to soils in proximity to the location of site structures;
- Potential hydrocarbon and pesticide contamination from the storage of materials and consumables at various locations across the site area (former and current sheds);
- Fill materials of unknown origin; and
- Potential asbestos containing materials (ACM) in irrigation lines (conduits).

JBS&G collected soil samples from a total of 38 locations across the site (29 soil boreholes, two test pits and seven stockpile). JBS&G also collected one surface water sample (labelled 'Pond') from Dam01. These sampling locations are provided in Figure 3, **Appendix A**.

When assessed against the ANZG (2018) Freshwater 95% toxicant DGVs Guidelines, the surface water sample did not present any exceedances.

The soil investigation identified minor exceedances including:

- One trace of friable asbestos at one location adjacent to historic structures;
- Elevated TRH at one location where localised surface staining was visible around a drum; and
- Minor exceedances of heavy metals.

### 2.7.2 Detailed Site Investigation (Arcadis 2019)

During October 2019, Arcadis undertook a Detailed Site Investigation (DSI) which involved intrusive works to assess soil, groundwater and surface water on site for contaminants of potential concern (CoPC) identified in the PSI.

Review of previous site reports, observations from site walk overs on 8<sup>th</sup>, 9<sup>th</sup>, 16<sup>th</sup> and 23<sup>rd</sup> October 2019 and analytical results from soil, surface water, groundwater and potentially asbestos containing material (PACM) indicated that impact at the site is unlikely to be wide-spread. Observations were consistent with the JBS&G findings.

The results from the samples collected by Arcadis have been summarised below:

- Soil samples were taken from fifteen (15) test pits and six (6) monitoring wells. One sample reported an outlier exceedance of benzo(a)pyrene at MW02\_2.0, however this exceedance was considered an anomaly and does not represent the concentration of benzo(a)pyrene in natural soil materials, nor does it present a risk when compared to ecological screening levels.
- Three (3) soil samples collected from areas adjacent to treated timber posts were assessed, with one sample (SO01) which exceed the NSW EPA General Solid Waste CT1 criteria for nickel.
- All surface waters reported analytes below the adopted criteria.

- Surface waters reported elevated pH and electrical conductivity when compared to the adopted criteria.
- A small number of heavy metal impacts to groundwater were observed and these were attributed to the elevated background concentrations of metals in on-site clay soils.
- Potential asbestos containing material (PACM) reported positive identification of asbestos at three out of four samples locations. No PACM was observed on roads or access tracks, with identified material adjacent current or former structures.

Based on the findings of the DSI, the site was deemed suitable from a contamination perspective for the proposed development as an industrial estate, pending the removal of identified asbestos containing material and the issuing of a clearance certificate to soil surfaces. Arcadis recommended that a HAZMAT survey and an asbestos register should be developed for the site prior to demolition works, asbestos removal works should be undertaken and a clearance certificate issued post demolition and that a site unexpected finds protocol should be implemented prior to any intrusive works. Arcadis also recommended that on-site surface water should be measured after a significant rainfall event and compared to previously recorded the observations to observed water quality prior to dam de-watering. Accordingly, there is potential for unexpected finds, including contamination or waste, which may be encountered during demolition or earthworks at the site.

## 2.8 Dam Descriptions

Five farm dams labelled Dam01 (northern) to Dam05 (southern) are to be decommissioned as shown in Figure 2, **Appendix A**. Photographs of the dams taken in October 2019 are provided in **Appendix D**.

The dams are located along a north-west trending creek line that discharges into Kemps Creek. The dams have been formed by constructing earthen embankments across the creek line creating voids in the lowest part of the catchment. Off-site to the south-west there are two dams that have been constructed in a similar manner.

The source of water that infills the dams is rainfall runoff-rather than the dams intersecting groundwater. This is supported by electrical conductivity (EC) measurements of the dam water measured in October 2019 ranging between 1,300 and 2,600  $\mu\text{S}/\text{cm}$  which is fresh to brackish and indicative of rainfall runoff. In contrast the EC measured in October 2019 in monitoring wells screened in the shale ranged from 14,000 to 20,000  $\mu\text{S}/\text{cm}$  which is saline. In addition, the standing water level within the shale is lower than the elevation of the dams. Soil observed at the site was a hard-silty clay which is conducive to rainfall runoff flowing towards the dams rather than infiltrating to groundwater.

Although the dams are constructed along the creek line it appears that the majority of rainfall runoff enters the dams from the east rather than from along the creek line to the south east.

Descriptions of each of the five dams observed during the Arcadis fieldwork to support the Detailed Site Investigation in October 2019 are summarised in Table 2-2. The surface area and volume of each dam has been approximated and is discussed in Section 2.8.1.

Table 2-2 Dam Descriptions

Dam	Description
Dam01	<p>Dam01 is the largest dam on the site and spans across the central to southern portion of the two northern-most properties (Lots 58 and 57 DP259135). The dam appeared to be at less than half capacity.</p> <p>The construction material of the dam embankment appeared to comprise of local natural reworked soils. The western embankment of Dam01 was observed to be raised approximately 3m above the ground surface.</p> <p>A dry watercourse connecting Dam01 to the other dams on-site appears on its south-eastern most point. Another watercourse connecting the dam to Kemps Creek (located to the west of</p>

Dam	Description
	the site) was also apparent on the north-western point of Dam01. The dam appears to be infilled by rainfall runoff from the east.
Dam02	<p>Dam02 is situated at the central to southern portion of Lot 56 DP259135. At the time of inspection, the water level in the dam was noted to be very low. It was also noted that at full capacity, Dam02 and Dam03 (to the south) would join together to become a single larger dam. This is also evident in the historical photographs provided in JBS&amp;G's report (2019).</p> <p>The construction material of the dam embankment appeared to comprise of local natural reworked soils. The northern embankment was observed to be raised approximately 3m above the ground surface.</p> <p>A dry watercourse connecting Dam02 to Dam01 appears on its northern most point. The dam appears to be infilled from rainfall runoff from the east and south-east.</p>
Dam03	<p>Dam03 is located at a central to northern portion of Lot 55 DP259135. At full capacity, Dam03 and Dam02 (to the north) join together to become a single larger dam.</p> <p>The construction material of the dam embankment appeared to comprise of local natural reworked soils with the embankments raised approximately 3m above the ground surface.</p> <p>A dry watercourse connecting Dam03 to Dam04 appears to exist on its southern most point. The dam appears to be infilled from rainfall runoff from the south-west.</p>
Dam04	<p>Dam04 is located at a central to southern portion of Lot 55 DP259135.</p> <p>The construction material of the dam embankment appeared to comprise of local natural reworked soils with the embankments raised approximately 3m above the ground surface.</p> <p>A dry watercourse connecting Dam04 to Dam03 is apparent on its north-western point. Another dry watercourse connecting Dam04 to Dam05 appears on its south-eastern point. The dam appears to be infilled from rainfall runoff from the south and south-west.</p>
Dam05	<p>Dam05 is located towards the eastern end of Lot 54 DP259135. At the time of inspection, the water level of the dam was low enough that a soil barrier could be seen separating the water within the dam. This separation barrier ran approximately west to east across the dam. The southern separated portion of water was observed to be elevated slightly higher than the northern separated portion of water.</p> <p>The construction material of the dam embankment appears to comprise of local natural reworked soils with the embankments raised approximately 3m above the ground surface.</p> <p>A dry watercourse connecting Dam05 to Dam04 is apparent on its north-western point. Another dry watercourse connecting Dam04 to a dam on the neighbouring property is apparent to the east.</p>

### 2.8.1 Current Dam Volume Estimations

The volume of each dam will be required at the time of dewatering to ensure there is sufficient storage in other dams to contain the dam water and there is sufficient material to infill the dam void. An approximate estimate of the current (October 2019) surface area and volume of each of the dams is provided in

Table 2-3. The estimates are calculated for the current volume in the dams using a recent aerial photograph.

A methodology for more accurately calculating the volume of each dam is provided in Section 4.2.2.

Table 2-3 Estimations of Current (October 2019) Dam Capacity Areas and Volumes

Dam	Area (m <sup>2</sup> )	Estimated average depth (m)	Water Volume (m <sup>3</sup> ) *	Water Volume (ML)
Dam01	16,000	0.6	3,840	3.84
Dam02	1,000	0.5	200	0.2
Dam03	1,150	0.6	276	0.276
Dam04	360	0.5	72	0.072
Dam05	5,300	0.6	1,272	1.272

*\*This approximate volume has been calculated using the formula presented in Section 4.2.2.1.*

*Note: These calculated values are rough estimates only.*

It is noted that the water volume of the dams is subject to change depending on rainfall conditions and water usage. At the time of dewatering each dam it is recommended a more up to date volume and accurate water volume is estimated.

## 3 LEGISLATION AND POLICY

### 3.1 Legislative Requirements

Surface water and groundwater resources in NSW are managed by the NSW Department of Primary Industry and Environment (Water) (DPIE-Water) under the Water Act 1912 and the Water Management Act 2000.

The NSW Dam Safety Committee (DSC) are responsible managing the safety of prescribed dams which are defined as extreme, high and significant category dams along with low consequence category dams over 15 metres high. Since the farm dams are less than 15 metres high, they are not managed under the DSC although the general principles of public and ecological safety apply. Dam safety is regulated under the Dams Safety Act 2015 which has replaced the Dams Safety Act 1978.

Water NSW is responsible for managing dam safety for all dams across NSW including the decommissioning of farm dams.

### 3.2 Assessment Criteria

Surface water quality is screened against the following guidelines:

- Australian and New Zealand Governments, *Australian and New Zealand Guidelines (ANZG), Direct Guideline Values (DGV) for Toxicants in Freshwater*, 2021 (ANZG 2021) – 95% Species Protection; and
- National Health and Medical Research Council (NHMRC), *National Water Quality Management Strategy, Australian Drinking Water Guidelines (ADWG)*, 2020 (NHMRC 2020).
- NHMRC, *Guidelines for Managing Risks in Recreational Water, with Non-volatile Contaminants*, 2018 (NHMRC 2018) – Contaminants from ADWG corrected by a factor of 10 for primary contact recreation (PCR).

Sediment and dam embankment soil is screened against the following guidelines prior to assist in the re-use or off-site disposal process:

- National Environmental Protection Council, *National Environmental Protection (assessment of Site Contamination) Measure*, 2019 (as amended 2013) (NEPM 2013) – Health Investigation Levels and Health Screening Levels for soil contaminants on Commercial/Industrial sites (HIL/HSL-D).



## 4 DECOMMISSIONING CONSIDERATIONS

### 4.1 Dam Decommissioning Strategy

It is recommended the decommissioning of all five on-site dams is undertaken in sequence with water transferred between the dams for storage. The ultimate decommissioning sequence will be in part dictated by the water management requirements of the site and the re-development plan of works schedule. Currently (October 2019) water levels in the dams are relatively low due to the extended period of low rainfall. Should these drought conditions be broken prior to the commencement of site earthworks there may be a surplus of water at the site. Alternatively, if high rainfall conditions are experienced during site works, on-site storage will be required to manage surface water to minimise the risk of water discharging off-site. Assessment of water conditions will be required prior to discharge as per Section 3.2 of this report.

Based on consultation with WEM (the appointed civil contractor for bulk earthworks at the Site), it is proposed that Dam01 be dewatered and decommissioned first, with Dam02 to be utilised during subsequent construction works as the on-site sediment basin. Since the dams are constructed on a natural watercourse it is recommended that the current creek line is diverted from upgradient of Dam02, around Dam02 and Dam01 to the existing point of discharge from the Site, adjacent to Mamre Road, with all site derived surface water runoff directed into this new artificial water course to minimise any inflow into the remaining dams on-site. Once the surface water flow upgradient of Dam02 has been diverted around Dam02 and Dam01 the dewatering and decommissioning of Dam03, Dam 04 and Dam05 can then occur.

Removal of the dams will reduce water storage capacity across the site, although the additional storage provided by these dams will not be required as rainfall runoff is directed to Kemps Creek via the realigned creek. In the unlikely event that during the redevelopment program the dams reach full capacity, excess water could be discharged to Kemps Creek from the sediment basin following assessment and flocculation as required.

Towards the end of redevelopment when the sedimentation basin is no longer required, dam levels can be lowered by on-going water use from the dam and redirecting rainfall runoff into the realigned creek. Once empty and bunding is in place the on-site sediment basin may be decommissioned.

As per the DSI, prior to initiating this DDS on-site surface water should be measured after a significant rainfall event and compared to the observations in the DSI. This should be done in order to assess the potential contributions (surface material leaching, groundwater impact, evaporation) to observed water quality for dam de-watering purposes

### 4.2 Dam Water

Removal of the dam water will require an understanding of the water quality and an estimate of the dam volume to assess re-use or disposal options. On-site re-use is the preferred disposal option. However, due to the volume of water retained in the Dams, off-site discharge via the diversion to the existing point of discharge from the Site is likely to be required.

#### 4.2.1 Dam Water Quality

A surface water sample was collected in October 2019 from each of the five dams to assess the dam water quality. The dam water generally contained low suspended solids, was clear and no sheen or odour was observed. However, within the water polystyrene and plastic (plastic bags, polypipe off-cuts) debris was observed. The locations of the dam and the sampling points are shown in Figure 2, **Appendix A**. A more detailed discussion of dam water quality results is provided in the DSI prepared by Arcadis (2019).

#### 4.2.1.1 Physico-Chemical Parameters

Water quality parameters were recorded for each of the surface water samples collected from the five dams and are presented in Table 4-1.

Based on the physico-chemical data collected during surface water sampling, the following conclusions are made:

- pH values indicate that the surface water is neutral to alkaline;
- The electrical conductivity values indicate that the water is fresh to brackish;
- The dissolved oxygen indicates anaerobic conditions within Dam05, and aerobic conditions in Dams 01-04; and
- Oxygen reduction potential (ORP) indicate a moderate to high (positive) ORP, suggesting an oxidative environment.

#### 4.2.1.2 Analytical Results

The dam surface water samples collected in October 2019 (Arcadis, 2019) were analysed and assessed against the water quality guidelines outlined in Section 3.2. No exceedances were observed against the adopted guidelines. Some detections above the laboratory limits of reporting were observed for Arsenic (Filtered) and Nickel (Filtered), however these were minor and did not exceed the adopted guidelines.

A summary of the analytical results from the collected dam surface water samples is presented in **Appendix B** and the laboratory reports of the analysed samples are presented in **Appendix C**.

#### 4.2.1.3 Dam Water Quality Discussion

The preliminary water quality results collected for the dam waters indicate the water is of low to moderate salinity and the pH is neutral to alkaline. In addition, the analytical results did not identify any contamination within the dam waters. These results indicate the water would be suitable for on-site usage as recommended in Table 4-2, subject to the turbidity which is expected to vary depending on site conditions. Some treatment may be required to lower the pH although the pH may be lowered naturally by mixing the waters and aerating the water by pumping it around the site.

During the dewatering process, it is recommended the pumped water is filtered through a gross pollutant trap or similar, to remove solids and plastic debris.

Table 4-1 Physico-Chemical Parameters of sampled dam water

Dam	pH	Temperature °C	Electrical Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)*	Flow Conditions	Comments
Dam01	8.34	20.8	1,785	6.31	301.9	Stagnant	Low water volume in dam
Dam02	9.19	24.3	1,498	13.56	287.3	Stagnant	Algae present
Dam03	9.41	24.6	1,544	18.09	283	Stagnant	Algal growth, barrels in water + bag, saline odour
Dam04	8.13	22.3	1,313	7.03	301.6	Stagnant	Emergents, no algae
Dam05	7.14	24.8	2,656	0.94	320.3	Stagnant	No emergents, blood worms, excavated soil.

\* 199mV has been added to all redox field measurements to convert to standard hydrogen electrode (SHE)

## 4.2.2 Calculating Volume of Dam Water

An estimate of the volume of water within each dam is required to approximate the storage capacity to collect the pumped water from each dam.

An estimate of dam volumes (based on aerial photography in October 2018) has been provided in Section 2.8.1 of this report based on the methodology outlined in Section 4.2.2.1. It is noted that dam levels in October 2019 are low due to drought conditions across NSW. A conservative calculation should be made based on the volume of water that will collect in the dams after a heavy rainfall event. A methodology of calculating more accurately the volume of water in the dams when they are at full capacity is outlined below.

### 4.2.2.1 Methodology of Calculating Volume of Dam Water

The NSW Office of Water has provided a methodology of estimating dam capacity (NSW Office of Water, 2010). The following formula will allow the capacity of each dam to be calculated:

$$Volume (m^3) = 0.4 \times Surface Area (m^2) \times Maximum Depth (m)$$

*Note: 0.4 is a conversion factor that takes into account the slope of the sides of the dam.*

The recommended method to measure the maximum depth of each of the dam is to paddle a kayak or canoe into the centre of each dam and measure the depth with a graduated staff or by lowering a weighted rope to the base. In the case of Dam 01 it is recommended the depth measurements are taken from multiple positions as this dam is relatively large compared to the other four dams. Once the depth from the surface of the water to the base has been obtained it should be added to the length of exposed embankment above the water surface, if any is present. By adding these two lengths, the 'maximum depth' in the above formula can be found, which will allow an estimate of the full capacity of each dam to be calculated.

The surface area of each of the dams can be determined using aerial photography or an area calculation tool on a platform such as SIX Maps (<https://maps.six.nsw.gov.au/>).

## 4.3 Dam Water Discharge

Given the volume of water retained on-site, it is expected that dewatering of the dams via off-site discharge will be required. This can be undertaken in conjunction with on-site reuse. Prior to any off-site discharge to the downgradient creek system, approval from the appropriate regulatory authority should be granted.

Initial dam dewatering activities will be required to address remedial actions for on-site dam waters. This will require assessment of the waters in all dams against the assessment criteria provided in Section 3.2 of this report. Only water compliant with these criteria would be suitable for discharge to the downgradient creek system. Remediation action may be required prior to dewatering if concentrations are found to exceed the criteria.

Water should not be discharged at a rate that would cause harm to the environment (downgradient surface water channel or Kemps Creek as the receiving body) or downstream properties (which include off-site private dams). An assessment should be undertaken prior to any dewatering and discharge to the downgradient creek system, to determine appropriate maximum discharge rates to prevent localised or widespread downstream flooding, scouring or ecological shock to the receiving waters.

## 4.4 Surface Water Re-Use Options

The Department of Natural Resources, Mines and Energy has specified that no off-site discharge of stormwater will be allowed during or after the redevelopment of the site. It is expected that once the natural creek line is re-established natural rainfall runoff from across the catchment will flow into the creek and discharge into Kemps Creek. Stormwater and sewer services have yet to be installed on-

site. Consequently, discharge of surface water during development via these options is not possible. It is proposed to re-use the surface water on-site primarily for site management purposes. If there is water in excess of site management requirements, discharging water to neighbouring dams may be considered. Surface water re-use options are outlined in Table 4-2.

Table 4-2 Surface Water Re-Use Options

	Option	Option Description
1	Dust suppression	The surface water pumped from the dams can be used to spray water across the site for dust suppression during the earthworks and construction phases.
2	On-site irrigation	The surface water can be sprayed around the site for irrigation purposes.
3	Wheel washing	The surface water can be utilised to spray trucks down before they leave the site to reduce tracking of mud and dirt off-site.
4	Topping up neighbouring dams	The surface water can be pumped into off-site neighbouring dams, subject to the dam owner's approval.
5	Discharge to the on-site sediment basin	As a contingency, if there is excess surface water, an option is to discharge to the on-site sediment basin. The water will have to be flocculated and the water quality monitored. If the water is in accordance with the Australian and New Zealand Guidelines for Fresh Water Quality 95% species protection (ANZG 2018), then the water can be discharged to South Creek via Kemps Creek.

## 4.5 Removal of Dam Structure

After dewatering each dam, bunds should be emplaced around the dam void to direct rainfall run-off away from the void and into a drainage line directing surface water towards Kemps Creek. Bunding should be constructed in accordance with the NSW hydrology “Blue Book” (Landcom, 2004).

The dam structure will be removed by excavating the earthen dam embankments and the sediments at the base of the dam. Both the soil and sediments would need to be sampled and analysed to assess disposal options to assess if the soils are suitable for on-site reuse. The preferred option would be to use the embankment soils and sediments to partially infill the dam voids. The soil assessment and field investigation would be undertaken in accordance with a site-specific Sampling Analysis and Quality Plan (SAQP).

### 4.5.1 Dam Embankment Soils

Field observations suggest the embankment soils have been locally sourced and thus would be compatible with other soil at the site. The embankment soils are likely be re-used on-site as fill to either infill the dam void, provided the soils meet the guidelines as outlined in Section 3.2.

Should the soil fail to meet the guideline criteria it would be classified under the NSW EPA Waste Classification Guidelines (2014) to assess off-site disposal options.

### 4.5.2 Dam Sediments

It is anticipated that the saturated sediments would be excavated from the dam, and “land farmed” to remove excess water. Water is removed from the sediments to reduce the risk of settlement following

compaction. As for the dam embankment soils, the sediments are likely to be re-used on-site as fill to either infill the dam void provided the soils meet the adopted guidelines.

Should the dried sediments fail to meet the guideline criteria it would be classified under the NSW EPA Waste Classification Guidelines (2014) to assess off-site disposal options.

## 4.6 Infill of Dam Voids

The dam voids will be infilled after the removal of surface water, embankments and sediments as per the options outlined in Table 4-3.

*Table 4-3 Options for the Infill of the Dam Voids*

	Option	Option Description
1	Use the dam embankment soils and sediments	<p>If the dam embankment soils and/or the dam sediments meet the required criteria as per outlined in Section 3.3, they can be re-used within the dam voids as fill material.</p> <p>Sediments will need to be dried out prior to re-use as fill.</p>
2	Import fill (Virgin Excavated Natural Material (VENM) and/or Excavated Natural Material (ENM)).	<p>Mirvac has indicated that approximately 200,000 m<sup>3</sup> of VENM and/or ENM will be imported onto the site to support earthworks undertaken as part of the Stage 1 site redevelopment works. Some of this imported fill can be used to infill the dam voids.</p>

The voids should be infilled to restore the site to the same conditions before the dam's construction. Infilled voids should then be compacted so surface water will not pond on the former void. Bunding and a construction of a permanent drainage line as outlined in Section 4.5 will direct rainfall runoff away from the infilled voids.

There will be a deficit of fill during redevelopment to infill the dam voids and provide foundations for buildings. Material to be used on-site including VENM and ENM will have to be sampled in accordance with a SAQP to ensure the material is suitable.

## 5 CONCLUSIONS

A strategy has been outlined to decommission the five farm dams to be undertaken during the redevelopment. The ultimate decommissioning sequence will be in part dictated by the water management requirements of the site and the re-development plan of works schedule.

Since the dams are constructed on a natural watercourse it is recommended that the current creek line is realigned, and surface water runoff is directed into this artificial water course to reduce inflow to the dams. Once the dams are removed surface water runoff would naturally discharge into Kemps Creek which is consistent with pre dam conditions. Bunding would also be installed around the dams during decommissioning in accordance with constructed in accordance with the NSW hydrology “Blue Book” (Landcom, 2004).

Preliminary water quality testing of the dam water indicates the water would be suitable for a number of on-site re-use options such as wheel washing, on-site irrigation dust suppression, topping up neighbouring dams or discharge into the sedimentation basin. Some minor water treatment may be required to reduce the turbidity or pH, although once the water is aerated by pumping the pH may naturally decline. No water contamination was identified within the dam waters other than some plastic debris. Given the time passed from initial assessment (2019) and significant wet weather experienced in NSW and the area of the Site from February 2022 to present, resampling and assessment of surface water quality in the on-site dams prior to discharge should be undertaken, with the results of analysis screened using the Assessment Criteria outlined in Section 3.2 of this report.

Once the dams are dewatered the voids will be infilled. Initial observations made of the dam earthen embankments indicate this material should be suitable for partially infilling the voids, subject to appropriate analytical soil testing. Similarly, it is expected that the sediments to be excavated from the base of the dams are likely to be suitable to fill the void once excess water is removed and appropriate analytical testing has been completed. Since there is a deficit of on-site fill VENM and ENM will be imported to site, subject to appropriate sampling.

As per the DSI, prior to initiating this DDS on-site surface water should be measured after a significant rainfall event and compared to the observations in the DSI. This should be done in order to assess the potential contributions (surface material leaching, groundwater impact, evaporation) to observed water quality for dam de-watering purposes.

## 6 LIMITATIONS

The findings of this report are based on the Scope of Work described in this report. Arcadis performed the services in a manner consistent with the level of care and expertise exercised by members of the environmental profession. That standard of care may change and new methods and practices of exploration, testing and analysis may develop in the future, which might produce different results.

No warranties, express or implied, are made. Subject to the Scope of Work, Arcadis' assessment is limited strictly to identifying typical environmental conditions associated with the subject property.

While normal assessments of data reliability have been made, Arcadis assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Arcadis, or developments resulting from situations outside the scope of this project.

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Information from samples collected by Arcadis or historical data reviewed relating to soil, groundwater, waste, air or other matrix conditions in this document is considered to be accurate at the date of issue. Surface, subsurface and atmospheric conditions can vary across a particular site or region, which cannot be wholly defined by investigation. As a result, it is unlikely that the results and estimations presented in this report will represent the extremes of conditions within the site that may exist. Subsurface conditions including contaminant concentrations can change in a limited period of time and typically have a high level of spatial heterogeneity.

From a technical perspective, there is a high degree of uncertainty associated with the assessment of subsurface, aquatic and atmospheric environments. They are prone to be heterogeneous, complex environments, in which small subsurface features or changes in geologic conditions or other environmental anomalies can have substantial impact on water, air and chemical movement.

Arcadis' professional opinions are based upon its professional judgment, experience, and training. These opinions are also based upon data derived from the limited testing and analysis described in this report. It is possible that additional testing and analysis might produce different results and/or different opinions. Arcadis has limited its investigation(s) to the scope agreed upon with its client.



## 7 REFERENCES

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NSW EPA (2014); *Waste Classification Guidelines*.

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## **APPENDIX A FIGURES**

10035157 - Aspect Industrial Estate - Dam Decommissioning Strategy



10035157 - Aspect Industrial Estate - Dam Decommissioning Strategy

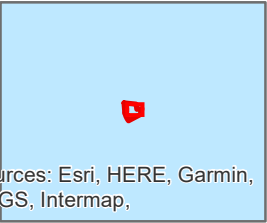


Legend

- Surface Water Samples
- Dams
- Site Boundary
- Lot Boundaries

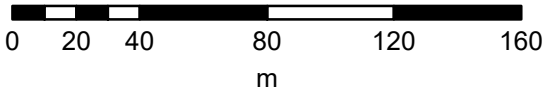
1:2,377 at A3

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Date issued: October 24, 2019



Sources: Esri, HERE, Garmin,  
GS, Intermap,

Figure 2 - Dam locations and Surface Water Samples





0 40 80 160 240 320  
m



## **APPENDIX B TABLES**

Summary of Analytical Results -  
Dam Surface Water

ARCADIS	Design & Consultancy for natural and built assets	Metals															TPH					TRH							
		Arsenic	Arsenic (Filtered)	Cadmium	Cadmium (Filtered)	Chromium (III+VI)	Chromium (III+VI) (Filtered)	Copper	Copper (Filtered)	Lead	Lead (Filtered)	Mercury	Mercury (Filtered)	Nickel	Nickel (Filtered)	Zinc	Zinc (Filtered)	C6-C9	C10-C14	C15-C28	C29-C36	C10-C36 (Sum of total)	C6-C10	>C6-C10 less BTEX (F1)	C10-C16	>C10-C16 less Naphthalene (F2)	C16-C34	C34-C40	>C10 - C40 (Sum of total)
		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	1	1	0.2	0.2	1	1	1	1	1	1	0.1	0.1	1	1	5	5	20	50	100	100	100	20	20	50	50	100	100	100	
ANZG (2018) Freshwater 95% toxicant DGVs			0.2 <sup>#1</sup>	0.2 <sup>#1</sup>			1.4 <sup>#1</sup>	1.4 <sup>#1</sup>	3.4 <sup>#2</sup>	3.4 <sup>#2</sup>	0.6 <sup>#3</sup>	0.06 <sup>#3 #7</sup>	11 <sup>#3</sup>	11 <sup>#3</sup>	8 <sup>#4</sup>	8 <sup>#4</sup>													
NHMRC 2008 Primary Contact Recreation	100 <sup>#5</sup>	100 <sup>#5</sup>	20 <sup>#5</sup>	20 <sup>#5</sup>	500 <sup>#6</sup>	500 <sup>#6</sup>	20000 <sup>#5</sup>	20000 <sup>#5</sup>	100 <sup>#5</sup>	100 <sup>#5</sup>	10 <sup>#5</sup>	10 <sup>#5</sup>	200 <sup>#5</sup>	200 <sup>#5</sup>															

Field_ID	Sampled_Date_Time																												
DW01	16-Oct-19	-	1	-	<0.2	-	<1	-	<1	-	<1	-	<0.1	-	<1	-	<5	<20	<50	<100	<100	<100	<20	<20	<50	<50	<100	<100	<100
DW02	16-Oct-19	-	2	-	<0.2	-	<1	-	<1	-	<1	-	<0.1	-	2	-	<5	<20	<50	<100	<100	<100	<20	<20	<50	<50	<100	<100	<100
DW03	16-Oct-19	-	2	-	<0.2	-	<1	-	<1	-	<1	-	<0.1	-	2	-	<5	<20	<50	<100	<100	<100	<20	<20	<50	<50	<100	<100	<100
DW04	16-Oct-19	-	1	-	<0.2	-	<1	-	<1	-	<1	-	<0.1	-	1	-	<5	<20	<50	<100	<100	<100	<20	<20	<50	<50	<100	<100	<100
DW05	16-Oct-19	-	2	-	<0.2	-	<1	-	<1	-	<1	-	<0.1	-	2	-	<5	<20	<50	<100	<100	<100	<20	<20	<50	<50	<100	<100	<100

Statistical Summary		2	5	2	5	2	5	2	5	2	5	2	5	2	5	2	5	8	6	6	6	6	8	7	6	6	6	6	6	
Number of Results		1	5	0	0	0	0	0	0	0	0	0	1	4	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	
Number of Detects		<1	1	<0.2	<0.2	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<1	<1	<5	<5	<20	<50	<100	<100	<100	<20	<20	<50	<50	<100	<100	<100	
Minimum Concentration		4	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	1	32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Minimum Detect		4	2	<0.2	<0.2	<1	<1	<1	<1	<1	<1	<0.1	<0.1	4	2	32	<5	ND	ND	<50	<100	<100	<100	ND	<20	<50	<50	<100	<100	<100
Maximum Concentration		4	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	2	32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Maximum Detect			1.6		0.1		0.5		0.5		0.5		0.05		1.5		2.5	10	25	50	50	50	10	10	25	25	50	50	50	
Average Concentration		2.25	2	0.1	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.05	0.05	2.25	2	17.25	2.5	10	25	50	50	50	10	10	25	25	50	50	50	
Median Concentration			0.55		0		0		0		0		0		0.71		0	0	0	0	0	0	0	0	0	0	0	0	0	
Standard Deviation		0	0	2	5	0	0	0	0	0	0	2	5	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	
Number of Guideline Exceedances		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Number of Guideline Exceedances(Detects Only)																														

Env Stds Description

NEPM 2013 Table 1C GILs, Fresh Waters:A Apply to typical slightly-moderately disturbed systems

B From ADWG

C May not protect key species from chronic toxicity

Env Stds Comments

#1:Very high reliability

#2:Moderate reliability

#3:Low reliability

#4:High reliability

#5:ADWG 2015 Health

#6:NHMRC 2008 Risk in Recreational Water

#7: ANZG (2018) Freshwater 99% toxicant DGVs

#8:Values calculated using hardness of 30 mg/L CaCO3. Refer ANZECC & ARMCANZ (2000) for site specific hardness guidance

#9:Chemical for which possible bioaccumulation and secondary poisoning effects should be considered, refer to ANZECC & ARMCANZ (2000) for further guidance.

#10:Figure may not protect key species from chronic toxicity, refer to ANZECC & ARMCANZ (2000) for further guidance.

Summary of Analytical Results -  
Dam Surface Water

ARCADIS Design & Consultancy for natural and built assets	BTEX						PAH																		Phenols
	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b,h,i)perylene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of total)	Phenolics Total	
	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	1	1	1	2	1	3	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	50	
ANZG (2018) Freshwater 95% toxicant DGVs	950 <sup>#2</sup>				350 <sup>#3</sup>															16 <sup>#3</sup>					
NHMRC 2008 Primary Contact Recreation	10 <sup>#5</sup>	8000 <sup>#5</sup>	3000 <sup>#5</sup>			6000 <sup>#5</sup>				0.12 <sup>#7</sup>	0.1 <sup>#6</sup>														

Field_ID	Sampled_Date_Time																							
DW01	16-Oct-19	<1	<1	<1	<2	<1	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<50
DW02	16-Oct-19	<1	<1	<1	<2	<1	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<50
DW03	16-Oct-19	<1	<1	<1	<2	<1	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<50
DW04	16-Oct-19	<1	<1	<1	<2	<1	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<50
DW05	16-Oct-19	<1	<1	<1	<2	<1	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<50

Statistical Summary																								
Number of Results	8	8	8	8	8	8	6	6	6	6	6	6	6	6	6	6	6	6	6	8	6	6	6	5
Number of Detects	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Minimum Concentration	<1	<1	<1	<2	<1	<3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<50
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration	ND	ND	ND	ND	ND	ND	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	<0.01	<0.01	<0.01	<50
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration	0.5	0.5	0.5	1	0.5	1.5	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	11001	0.005	0.005	0.005	25
Median Concentration	0.5	0.5	0.5	1	0.5	1.5	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	25
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31112	0	0	0	0
Number of Guideline Exceedances	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Number of Guideline Exceedances(Detects Only)	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

Env Stds Description  
NEPM 2013 Table 1C GILs, Fresh Waters:A Apply to typ  
B From ADWG  
C May not protect key species from chronic toxicity

Env Stds Comments  
#1:Very high reliability  
#2:Moderate reliability  
#3:Low reliability  
#4:High reliability  
#5:ADWG 2015 Health  
#6:NHMRC 2008 Risk in Recreational Water  
#7: ANZG (2018) Freshwater 99% toxicant DGVs  
#8:Values calculated using hardness of 30 mg/L CaCO3.  
#9:Chemical for which possible bioaccumulation and se  
#10:Figure may not protect key species from chronic tc



Summary of Analytical Results -  
Dam Surface Water

ARCADIS Design & Consultancy for natural and built assets	PCBs								Organochlorine Pesticides																									
	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260	PCBs (Sum of total)	a-BHC	Aldrin	Dieldrin	Aldrin + Dieldrin	b-BHC	chlordan	d-BHC	DDD	4,4-DDE	DDT	DDT+DDE+DDD	Endrin ketone	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Toxaphene	Organochlorine pesticides EPAVic	Other organochlorine pesticides EPAVic		
	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	ug/L	ug/L	ug/L		
EQL	1	1	1	1	1	1	1	1	0.1	0.1	0.1	0.1	0.1	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	10	1	1		
ANZG (2018) Freshwater 95% toxicant DGVs				0.6 <sup>#3</sup>		0.03 <sup>#2</sup>								0.06 <sup>#2</sup>				0.01 <sup>#2</sup>						0.02 <sup>#2</sup>		0.2 <sup>#2</sup>	0.09 <sup>#2</sup>				0.2 <sup>#2</sup>			
NHMRC 2008 Primary Contact Recreation												3 <sup>#5</sup>		20 <sup>#5</sup>				90 <sup>#5</sup>								100 <sup>#5</sup>	3 <sup>#5</sup>							

Field_ID	Sampled_Date_Time																														
DW01	16-Oct-19	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1	
DW02	16-Oct-19	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1
DW03	16-Oct-19	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1
DW04	16-Oct-19	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1
DW05	16-Oct-19	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1

Statistical Summary																																
Number of Results	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1	
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration	<1	<1	<1	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<10	<1	<1	
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.05	0.05	0.05	0.05	0.05	0.5	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	5	0.5	0.5	
Median Concentration	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.05	0.05	0.05	0.05	0.05	0.5	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	5	0.5	0.5	
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Number of Guideline Exceedances	0	5	5	5	5	5	5	5	5	5	5	0	0	5	0	0	0	5	0	0	0	0	0	5	0	5	5	5	0	5	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

**Env Stds Description**  
NEPM 2013 Table 1C GILs, Fresh Waters:A Apply to typ  
B From ADWG  
C May not protect key species from chronic toxicity

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#9:Chemical for which possible bioaccumulation and se  
#10:Figure may not protect key species from chronic to

Summary of Analytical Results -  
Dam Surface Water

	Organophosphorous Pesticides																												Pesticides	Herbicides	Halogenated Benzenes				
	Azinophos methyl	Boistar (Sulprofos)	Chlorfenvinphos	Chlorpyrifos	Chlorpyrifos-methyl	Coumaphos	Demeton-O	Demeton-S	Diazinon	Dichlorvos	Dimethoate	Disulfoton	Ethoprop	Ethion	Fensulfothion	Fenitrothion	Fenthion	EPN	Malathion	Merphos	Methyl parathion	Mevinphos (Phosdrin)	Naled (Dibrom)	Monocrotophos	Omethoate	Parathion	Phorate	Pyrazophos	Ronnel	Terbufos	Trichloronate	Tetrachlorvinphos	Prirniphos-methyl	Tokuthion	Hexachlorobenzene
	µg/L	µg/L	µg/L	µg/L	ug/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	ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	ug/L	ug/L	mg/L	µg/L	
EQL	2	2	2	20	2	20	2	20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	20	0.002	0.1	
ANZG (2018) Freshwater 95% toxicant DGVs	0.02 <sup>#2</sup>			0.01 <sup>#3</sup>					0.01 <sup>#2</sup>		0.15 <sup>#3</sup>					0.2 <sup>#2</sup>			0.05 <sup>#2</sup>						0.004 <sup>#2</sup>										
NHMRC 2008 Primary Contact Recreation	300 <sup>#5</sup>	100 <sup>#5</sup>	20 <sup>#5</sup>	100 <sup>#5</sup>					40 <sup>#5</sup>	50 <sup>#5</sup>	70 <sup>#5</sup>	40 <sup>#5</sup>	10 <sup>#5</sup>	40 <sup>#5</sup>	100 <sup>#5</sup>	70 <sup>#5</sup>	70 <sup>#5</sup>		700 <sup>#5</sup>		7 <sup>#5</sup>	50 <sup>#5</sup>		20 <sup>#5</sup>	10 <sup>#5</sup>	200 <sup>#5</sup>		200 <sup>#5</sup>		9 <sup>#5</sup>	1000 <sup>#5</sup>	900 <sup>#5</sup>			

Field_ID	Sampled_Date_Time																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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Statistical Summary																																				
Number of Results	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5		
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Minimum Concentration	<2	<2	<2	<20	<2	<20	<2	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<20	<0.002	<0.1		
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Maximum Concentration	<2	<2	<2	<20	<2	<20	<2	<20	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<20	<0.002	<0.1			
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Average Concentration	1	1	1	10	1	10	1	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	0.001	0.05			
Median Concentration	1	1	1	10	1	10	1	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	0.001	0.05			
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Number of Guideline Exceedances	5	0	0	5	0	0	0	0	5	0	5	0	5	0	0	5	0	5	5	0	5	0	0	5	5	0	0	0	5	0	0	0	0	5		
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			

**Env Stds Description**  
NEPM 2013 Table 1C GILs, Fresh Waters:A Apply to typ  
B From ADWG  
C May not protect key species from chronic toxicity

**Env Stds Comments**  
#1:Very high reliability  
#2:Moderate reliability  
#3:Low reliability  
#4:High reliability  
#5:ADWG 2015 Health  
#6:NHMRC 2008 Risk in Recreational Water  
#7: ANZG (2018) Freshwater 99% toxicant DGVs  
#8:Values calculated using hardness of 30 mg/L CaCO3.  
#9:Chemical for which possible bioaccumulation and se  
#10:Figure may not protect key species from chronic to

## **APPENDIX C LABORATORY REPORTS**

Arcadis Australia  
Lvl 16/580 George Street  
Sydney  
NSW 2000



NATA Accredited  
Accreditation Number 1261  
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing  
The results of the tests, calibrations and/or  
measurements included in this document are traceable  
to Australian/national standards.

Attention: **Jack Palma**

Report **683212-W**  
Project name **MIRVAC - KEMPS CREEK**  
Project ID **10035157**  
Received Date **Oct 17, 2019**

Client Sample ID			MW01 Water	MW02 Water	MW04 Water	MW05 Water
Sample Matrix			S19-Oc26968	S19-Oc26969	S19-Oc26970	S19-Oc26971
Eurofins Sample No.			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Date Sampled						
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
<b>BTEX</b>						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	82	87	89	89
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(g,h,i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Dibenz(a,h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Client Sample ID			MW01 Water	MW02 Water	MW04 Water	MW05 Water
Sample Matrix			S19-Oc26968	S19-Oc26969	S19-Oc26970	S19-Oc26971
Eurofins Sample No.			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Date Sampled						
Test/Reference	LOR	Unit				
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>						
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	63	63	68	67
p-Terphenyl-d14 (surr.)	1	%	75	54	86	60
<b>Heavy Metals</b>						
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	0.0003	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	0.009	0.003	< 0.001
Zinc (filtered)	0.005	mg/L	< 0.005	0.010	0.009	< 0.005

Client Sample ID			MW06 Water	DW01 Water	DW02 Water	DW03 Water
Sample Matrix			S19-Oc26972	S19-Oc26973	S19-Oc26974	S19-Oc26975
Eurofins Sample No.			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Date Sampled						
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
<b>BTEX</b>						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	97	94	93	96

Client Sample ID			MW06 Water S19-Oc26972 Oct 16, 2019	DW01 Water S19-Oc26973 Oct 16, 2019	DW02 Water S19-Oc26974 Oct 16, 2019	DW03 Water S19-Oc26975 Oct 16, 2019
Sample Matrix						
Eurofins Sample No.						
Date Sampled						
Test/Reference	LOR	Unit				
<b>Organochlorine Pesticides</b>						
Chlordanes - Total	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
4,4'-DDD	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
4,4'-DDE	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
4,4'-DDT	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
a-BHC	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Aldrin	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
b-BHC	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
d-BHC	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Dieldrin	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Endosulfan I	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Endosulfan II	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Endosulfan sulphate	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Endrin	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Endrin aldehyde	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Endrin ketone	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
g-BHC (Lindane)	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Heptachlor	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Heptachlor epoxide	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Hexachlorobenzene	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Methoxychlor	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Toxaphene	0.01	mg/L	-	< 0.01	< 0.01	< 0.01
Aldrin and Dieldrin (Total)*	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
DDT + DDE + DDD (Total)*	0.0001	mg/L	-	< 0.0001	< 0.0001	< 0.0001
Vic EPA IWRG 621 OCP (Total)*	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Vic EPA IWRG 621 Other OCP (Total)*	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Dibutylchloredate (surr.)	1	%	-	83	67	54
Tetrachloro-m-xylene (surr.)	1	%	-	58	94	82
<b>Organophosphorus Pesticides</b>						
Azinphos-methyl	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Bolstar	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Chlorfenvinphos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Chlorpyrifos	0.02	mg/L	-	< 0.02	< 0.02	< 0.02
Chlorpyrifos-methyl	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Coumaphos	0.02	mg/L	-	< 0.02	< 0.02	< 0.02
Demeton-S	0.02	mg/L	-	< 0.02	< 0.02	< 0.02
Demeton-O	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Diazinon	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Dichlorvos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Dimethoate	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Disulfoton	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
EPN	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Ethion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Ethoprop	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Ethyl parathion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Fenitrothion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Fensulfothion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Fenthion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Malathion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Merphos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002

Client Sample ID			MW06 Water S19-Oc26972 Oct 16, 2019	DW01 Water S19-Oc26973 Oct 16, 2019	DW02 Water S19-Oc26974 Oct 16, 2019	DW03 Water S19-Oc26975 Oct 16, 2019
Sample Matrix						
Eurofins Sample No.						
Date Sampled						
Test/Reference	LOR	Unit				
<b>Organophosphorus Pesticides</b>						
Methyl parathion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Mevinphos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Monocrotophos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Naled	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Omethoate	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Phorate	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Pirimiphos-methyl	0.02	mg/L	-	< 0.02	< 0.02	< 0.02
Pyrazophos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Ronnel	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Terbufos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Tetrachlorvinphos	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Tokuthion	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Trichloronate	0.002	mg/L	-	< 0.002	< 0.002	< 0.002
Triphenylphosphate (surr.)	1	%	-	69	77	81
<b>Polychlorinated Biphenyls</b>						
Aroclor-1016	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Aroclor-1221	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Aroclor-1232	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Aroclor-1242	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Aroclor-1248	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Aroclor-1254	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Aroclor-1260	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Total PCB*	0.001	mg/L	-	< 0.001	< 0.001	< 0.001
Dibutylchlorendate (surr.)	1	%	-	83	67	54
Tetrachloro-m-xylene (surr.)	1	%	-	58	94	82
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(g,h,i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Dibenz(a,h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Indeno(1,2,3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
2-Fluorobiphenyl (surr.)	1	%	78	93	78	66
p-Terphenyl-d14 (surr.)	1	%	64	90	73	74
Phenolics (total)	0.05	mg/L	-	< 0.05	< 0.05	< 0.05



Client Sample ID			MW06 Water S19-Oc26972 Oct 16, 2019	DW01 Water S19-Oc26973 Oct 16, 2019	DW02 Water S19-Oc26974 Oct 16, 2019	DW03 Water S19-Oc26975 Oct 16, 2019
Sample Matrix						
Eurofins Sample No.						
Date Sampled						
Test/Reference	LOR	Unit				
<b>Heavy Metals</b>						
Arsenic (filtered)	0.001	mg/L	0.003	0.001	0.002	0.002
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.002	< 0.001	0.002	0.002
Zinc (filtered)	0.005	mg/L	0.047	< 0.005	< 0.005	< 0.005

Client Sample ID			DW04 Water S19-Oc26976 Oct 16, 2019	DW05 Water S19-Oc26977 Oct 16, 2019	QA1 Water S19-Oc26978 Oct 16, 2019	RINSATE Water S19-Oc26979 Oct 16, 2019
Sample Matrix						
Eurofins Sample No.						
Date Sampled						
Test/Reference	LOR	Unit				
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>						
Naphthalene <sup>N02</sup>	0.01	mg/L	< 0.01	< 0.01	< 0.01	-
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	< 0.02	-
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	0.02	mg/L	< 0.02	< 0.02	< 0.02	-
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	< 0.05	-
TRH >C10-C16 less Naphthalene (F2) <sup>N01</sup>	0.05	mg/L	< 0.05	< 0.05	< 0.05	-
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH >C10-C40 (total)*	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	-
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	< 0.05	-
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH C10-C36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
<b>BTEX</b>						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	-
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	< 0.003	-
4-Bromofluorobenzene (surr.)	1	%	95	81	87	-
<b>Organochlorine Pesticides</b>						
Chlordanes - Total	0.001	mg/L	< 0.001	< 0.001	-	-
4,4'-DDD	0.0001	mg/L	< 0.0001	< 0.0001	-	-
4,4'-DDE	0.0001	mg/L	< 0.0001	< 0.0001	-	-
4,4'-DDT	0.0001	mg/L	< 0.0001	< 0.0001	-	-
a-BHC	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Aldrin	0.0001	mg/L	< 0.0001	< 0.0001	-	-
b-BHC	0.0001	mg/L	< 0.0001	< 0.0001	-	-
d-BHC	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Dieldrin	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Endosulfan I	0.0001	mg/L	< 0.0001	< 0.0001	-	-



Client Sample ID			DW04 Water S19-Oc26976 Oct 16, 2019	DW05 Water S19-Oc26977 Oct 16, 2019	QA1 Water S19-Oc26978 Oct 16, 2019	RINSATE Water S19-Oc26979 Oct 16, 2019
Sample Matrix						
Eurofins Sample No.						
Date Sampled						
Test/Reference	LOR	Unit				
<b>Organochlorine Pesticides</b>						
Endosulfan II	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Endosulfan sulphate	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Endrin	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Endrin aldehyde	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Endrin ketone	0.0001	mg/L	< 0.0001	< 0.0001	-	-
g-BHC (Lindane)	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Heptachlor	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Heptachlor epoxide	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Hexachlorobenzene	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Methoxychlor	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Toxaphene	0.01	mg/L	< 0.01	< 0.01	-	-
Aldrin and Dieldrin (Total)*	0.0001	mg/L	< 0.0001	< 0.0001	-	-
DDT + DDE + DDD (Total)*	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Vic EPA IWRG 621 OCP (Total)*	0.001	mg/L	< 0.001	< 0.001	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.001	mg/L	< 0.001	< 0.001	-	-
Dibutylchloroendate (surr.)	1	%	114	58	-	-
Tetrachloro-m-xylene (surr.)	1	%	78	82	-	-
<b>Organophosphorus Pesticides</b>						
Azinphos-methyl	0.002	mg/L	< 0.002	< 0.002	-	-
Bolstar	0.002	mg/L	< 0.002	< 0.002	-	-
Chlorfenvinphos	0.002	mg/L	< 0.002	< 0.002	-	-
Chlorpyrifos	0.02	mg/L	< 0.02	< 0.02	-	-
Chlorpyrifos-methyl	0.002	mg/L	< 0.002	< 0.002	-	-
Coumaphos	0.02	mg/L	< 0.02	< 0.02	-	-
Demeton-S	0.02	mg/L	< 0.02	< 0.02	-	-
Demeton-O	0.002	mg/L	< 0.002	< 0.002	-	-
Diazinon	0.002	mg/L	< 0.002	< 0.002	-	-
Dichlorvos	0.002	mg/L	< 0.002	< 0.002	-	-
Dimethoate	0.002	mg/L	< 0.002	< 0.002	-	-
Disulfoton	0.002	mg/L	< 0.002	< 0.002	-	-
EPN	0.002	mg/L	< 0.002	< 0.002	-	-
Ethion	0.002	mg/L	< 0.002	< 0.002	-	-
Ethoprop	0.002	mg/L	< 0.002	< 0.002	-	-
Ethyl parathion	0.002	mg/L	< 0.002	< 0.002	-	-
Fenitrothion	0.002	mg/L	< 0.002	< 0.002	-	-
Fensulfothion	0.002	mg/L	< 0.002	< 0.002	-	-
Fenthion	0.002	mg/L	< 0.002	< 0.002	-	-
Malathion	0.002	mg/L	< 0.002	< 0.002	-	-
Merphos	0.002	mg/L	< 0.002	< 0.002	-	-
Methyl parathion	0.002	mg/L	< 0.002	< 0.002	-	-
Mevinphos	0.002	mg/L	< 0.002	< 0.002	-	-
Monocrotophos	0.002	mg/L	< 0.002	< 0.002	-	-
Naled	0.002	mg/L	< 0.002	< 0.002	-	-
Omethoate	0.002	mg/L	< 0.002	< 0.002	-	-
Phorate	0.002	mg/L	< 0.002	< 0.002	-	-
Pirimiphos-methyl	0.02	mg/L	< 0.02	< 0.02	-	-
Pyrazophos	0.002	mg/L	< 0.002	< 0.002	-	-
Ronnel	0.002	mg/L	< 0.002	< 0.002	-	-
Terbufos	0.002	mg/L	< 0.002	< 0.002	-	-

Client Sample ID			DW04 Water	DW05 Water	QA1 Water	RINSATE Water
Sample Matrix			S19-Oc26976	S19-Oc26977	S19-Oc26978	S19-Oc26979
Eurofins Sample No.			Oct 16, 2019	Oct 16, 2019	Oct 16, 2019	Oct 16, 2019
Date Sampled						
Test/Reference	LOR	Unit				
<b>Organophosphorus Pesticides</b>						
Tetrachlorvinphos	0.002	mg/L	< 0.002	< 0.002	-	-
Tokuthion	0.002	mg/L	< 0.002	< 0.002	-	-
Trichloronate	0.002	mg/L	< 0.002	< 0.002	-	-
Triphenylphosphate (surr.)	1	%	88	60	-	-
<b>Polychlorinated Biphenyls</b>						
Aroclor-1016	0.001	mg/L	< 0.001	< 0.001	-	-
Aroclor-1221	0.001	mg/L	< 0.001	< 0.001	-	-
Aroclor-1232	0.001	mg/L	< 0.001	< 0.001	-	-
Aroclor-1242	0.001	mg/L	< 0.001	< 0.001	-	-
Aroclor-1248	0.001	mg/L	< 0.001	< 0.001	-	-
Aroclor-1254	0.001	mg/L	< 0.001	< 0.001	-	-
Aroclor-1260	0.001	mg/L	< 0.001	< 0.001	-	-
Total PCB*	0.001	mg/L	< 0.001	< 0.001	-	-
Dibutylchloroendate (surr.)	1	%	114	58	-	-
Tetrachloro-m-xylene (surr.)	1	%	78	82	-	-
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>						
Acenaphthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Acenaphthylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Benz(a)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Benzo(a)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Benzo(g,h,i)perylene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Chrysene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Dibenz(a,h)anthracene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Fluoranthene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Fluorene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Indeno(1,2,3-cd)pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Naphthalene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Phenanthrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Pyrene	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
Total PAH*	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	-
2-Fluorobiphenyl (surr.)	1	%	67	66	89	-
p-Terphenyl-d14 (surr.)	1	%	56	61	70	-
Phenolics (total)	0.05	mg/L	< 0.05	< 0.05	-	-
<b>Heavy Metals</b>						
Arsenic	0.001	mg/L	-	-	0.004	< 0.001
Arsenic (filtered)	0.001	mg/L	0.001	0.002	-	-
Cadmium	0.0002	mg/L	-	-	< 0.0002	< 0.0002
Cadmium (filtered)	0.0002	mg/L	< 0.0002	< 0.0002	-	-
Chromium	0.001	mg/L	-	-	< 0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	-	-
Copper	0.001	mg/L	-	-	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	-	-
Lead	0.001	mg/L	-	-	< 0.001	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	-	-
Mercury	0.0001	mg/L	-	-	< 0.0001	< 0.0001

<b>Client Sample ID</b>			<b>DW04</b>	<b>DW05</b>	<b>QA1</b>	<b>RINSATE</b>
<b>Sample Matrix</b>			<b>Water</b>	<b>Water</b>	<b>Water</b>	<b>Water</b>
<b>Eurofins Sample No.</b>			<b>S19-Oc26976</b>	<b>S19-Oc26977</b>	<b>S19-Oc26978</b>	<b>S19-Oc26979</b>
<b>Date Sampled</b>			<b>Oct 16, 2019</b>	<b>Oct 16, 2019</b>	<b>Oct 16, 2019</b>	<b>Oct 16, 2019</b>
Test/Reference	LOR	Unit				
<b>Heavy Metals</b>						
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	-	-
Nickel	0.001	mg/L	-	-	0.004	< 0.001
Nickel (filtered)	0.001	mg/L	0.001	0.002	-	-
Zinc	0.005	mg/L	-	-	0.032	< 0.005
Zinc (filtered)	0.005	mg/L	< 0.005	< 0.005	-	-

<b>Client Sample ID</b>			<b>R20TS</b>	<b>TB</b>
<b>Sample Matrix</b>			<b>Water</b>	<b>Water</b>
<b>Eurofins Sample No.</b>			<b>S19-Oc26980</b>	<b>S19-Oc26981</b>
<b>Date Sampled</b>			<b>Oct 16, 2019</b>	<b>Oct 16, 2019</b>
Test/Reference	LOR	Unit		
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>				
Naphthalene <sup>N02</sup>	0.01	mg/L	88	< 0.01
TRH C6-C10	0.02	mg/L	72	< 0.02
TRH C6-C10 less BTEX (F1) <sup>N04</sup>	0.02	mg/L	-	< 0.02
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>				
TRH C6-C9	0.02	mg/L	71	< 0.02
<b>BTEX</b>				
Benzene	0.001	mg/L	93	< 0.001
Toluene	0.001	mg/L	95	< 0.001
Ethylbenzene	0.001	mg/L	91	< 0.001
m&p-Xylenes	0.002	mg/L	88	< 0.002
o-Xylene	0.001	mg/L	95	< 0.001
Xylenes - Total	0.003	mg/L	90	< 0.003
4-Bromofluorobenzene (surr.)	1	%	98	87

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.  
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 21, 2019	7 Days
<b>Eurofins   mgt Suite B7 (filtered metals/PAH trace level)</b>			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 21, 2019	7 Days
Total Recoverable Hydrocarbons - 2013 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 21, 2019	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 21, 2019	7 Days
BTEX - Method: LTM-ORG-2010 TRH C6-C40	Melbourne	Oct 21, 2019	14 Days
Polycyclic Aromatic Hydrocarbons (Trace level) - Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)	Melbourne	Oct 21, 2019	7 Days
Metals M8 filtered - Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS	Melbourne	Oct 21, 2019	28 Days
<b>Eurofins   mgt Suite B15</b>			
Organochlorine Pesticides - Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8270)	Melbourne	Oct 21, 2019	7 Days
Organophosphorus Pesticides - Method: LTM-ORG-2200 Organophosphorus Pesticides by GC-MS (USEPA 8081)	Melbourne	Oct 21, 2019	7 Days
Polychlorinated Biphenyls - Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8082)	Melbourne	Oct 21, 2019	7 Days
Phenolics (total) - Method: LTM-INO-4050 Total Phenolics in Waters and solids by CFA	Melbourne	Oct 21, 2019	7 Days
<b>Eurofins   mgt Suite B7 (PAH trace level)</b>			
Metals M8 - Method:	Melbourne	Oct 21, 2019	180 Days

**Company Name:** Arcadis Australia  
**Address:** Lvl 16/580 George Street  
Sydney  
NSW 2000  
  
**Project Name:** MIRVAC - KEMPS CREEK  
**Project ID:** 10035157

**Order No.:**  
**Report #:** 683212  
**Phone:** 02 8907 9000  
**Fax:**

**Received:** Oct 17, 2019 4:33 PM  
**Due:** Oct 24, 2019  
**Priority:** 5 Day  
**Contact Name:** Jack Palma

**Eurofins Analytical Services Manager : Ursula Long**

Sample Detail						Asbestos Absence / Presence	HOLD	Phenolics (total)	Metals M7	Metals M8	Eurofins   mgt Suite B15	Moisture Set	BTEXN and Volatile TRH	Eurofins   mgt Suite B7 (PAH trace level)	Eurofins   mgt Suite B7 (filtered metals/PAH trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X									
Brisbane Laboratory - NATA Site # 20794															
Perth Laboratory - NATA Site # 23736															
External Laboratory															
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID										
1	MW01	Oct 16, 2019		Water	S19-Oc26968										X
2	MW02	Oct 16, 2019		Water	S19-Oc26969										X
3	MW04	Oct 16, 2019		Water	S19-Oc26970										X
4	MW05	Oct 16, 2019		Water	S19-Oc26971										X
5	MW06	Oct 16, 2019		Water	S19-Oc26972										X
6	DW01	Oct 16, 2019		Water	S19-Oc26973			X			X				X
7	DW02	Oct 16, 2019		Water	S19-Oc26974			X			X				X
8	DW03	Oct 16, 2019		Water	S19-Oc26975			X			X				X
9	DW04	Oct 16, 2019		Water	S19-Oc26976			X			X				X

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Sample Detail						Asbestos Absence / Presence	HOLD	Phenolics (total)	Metals M7	Metals M8	Eurofins   mgt Suite B15	Moisture Set	BTEXN and Volatile TRH	Eurofins   mgt Suite B7 (PAH trace level)	Eurofins   mgt Suite B7 (filtered metals/PAH trace level)
<b>Melbourne Laboratory - NATA Site # 1254 &amp; 14271</b>							X	X	X	X	X	X	X	X	X
<b>Sydney Laboratory - NATA Site # 18217</b>						X									
<b>Brisbane Laboratory - NATA Site # 20794</b>															
<b>Perth Laboratory - NATA Site # 23736</b>															
10	DW05	Oct 16, 2019		Water	S19-Oc26977			X			X				X
11	QA1	Oct 16, 2019		Water	S19-Oc26978									X	
12	RINSATE	Oct 16, 2019		Water	S19-Oc26979					X					
13	TS	Oct 16, 2019		Water	S19-Oc26980								X		
14	TB	Oct 16, 2019		Water	S19-Oc26981								X		
15	SO01	Oct 16, 2019		Soil	S19-Oc26982				X			X			
16	SO02	Oct 16, 2019		Soil	S19-Oc26983		X								
17	SO03	Oct 16, 2019		Soil	S19-Oc26984				X			X			
18	SO04	Oct 16, 2019		Soil	S19-Oc26985				X			X			
19	SO05	Oct 16, 2019		Soil	S19-Oc26986		X								
20	ASB01	Oct 16, 2019		Building Materials	S19-Oc26987	X									

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Sample Detail						Asbestos Absence / Presence	HOLD	Phenolics (total)	Metals M7	Metals M8	Eurofins   mgt Suite B15	Moisture Set	BTEXN and Volatile TRH	Eurofins   mgt Suite B7 (PAH trace level)	Eurofins   mgt Suite B7 (filtered metals/PAH trace level)
Melbourne Laboratory - NATA Site # 1254 & 14271							X	X	X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217						X									
Brisbane Laboratory - NATA Site # 20794															
Perth Laboratory - NATA Site # 23736															
21	ASB02	Oct 16, 2019		Building Materials	S19-Oc26988	X									
22	ASB03	Oct 16, 2019		Building Materials	S19-Oc26989	X									
23	ASB04	Oct 16, 2019		Building Materials	S19-Oc26990	X									
Test Counts						4	2	5	3	1	5	3	2	1	10

## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

### Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/L:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100mL:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### Terms

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	US Department of Defense Quality Systems Manual Version 5.3
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NC</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

### QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.



**Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Method Blank</b>							
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
<b>Method Blank</b>							
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
<b>Method Blank</b>							
<b>BTEX</b>							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
<b>Method Blank</b>							
<b>Organochlorine Pesticides</b>							
Chlordanes - Total	mg/L	< 0.001			0.001	Pass	
4,4'-DDD	mg/L	< 0.0001			0.0001	Pass	
4,4'-DDE	mg/L	< 0.0001			0.0001	Pass	
4,4'-DDT	mg/L	< 0.0001			0.0001	Pass	
a-BHC	mg/L	< 0.0001			0.0001	Pass	
Aldrin	mg/L	< 0.0001			0.0001	Pass	
b-BHC	mg/L	< 0.0001			0.0001	Pass	
d-BHC	mg/L	< 0.0001			0.0001	Pass	
Dieldrin	mg/L	< 0.0001			0.0001	Pass	
Endosulfan I	mg/L	< 0.0001			0.0001	Pass	
Endosulfan II	mg/L	< 0.0001			0.0001	Pass	
Endosulfan sulphate	mg/L	< 0.0001			0.0001	Pass	
Endrin	mg/L	< 0.0001			0.0001	Pass	
Endrin aldehyde	mg/L	< 0.0001			0.0001	Pass	
Endrin ketone	mg/L	< 0.0001			0.0001	Pass	
g-BHC (Lindane)	mg/L	< 0.0001			0.0001	Pass	
Heptachlor	mg/L	< 0.0001			0.0001	Pass	
Heptachlor epoxide	mg/L	< 0.0001			0.0001	Pass	
Hexachlorobenzene	mg/L	< 0.0001			0.0001	Pass	
Methoxychlor	mg/L	< 0.0001			0.0001	Pass	
Toxaphene	mg/L	< 0.01			0.01	Pass	
<b>Method Blank</b>							
<b>Organophosphorus Pesticides</b>							
Azinphos-methyl	mg/L	< 0.002			0.002	Pass	
Bolstar	mg/L	< 0.002			0.002	Pass	
Chlorfenvinphos	mg/L	< 0.002			0.002	Pass	
Chlorpyrifos	mg/L	< 0.02			0.02	Pass	
Chlorpyrifos-methyl	mg/L	< 0.002			0.002	Pass	
Coumaphos	mg/L	< 0.02			0.02	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Demeton-S	mg/L	< 0.02			0.02	Pass	
Demeton-O	mg/L	< 0.002			0.002	Pass	
Diazinon	mg/L	< 0.002			0.002	Pass	
Dichlorvos	mg/L	< 0.002			0.002	Pass	
Dimethoate	mg/L	< 0.002			0.002	Pass	
Disulfoton	mg/L	< 0.002			0.002	Pass	
EPN	mg/L	< 0.002			0.002	Pass	
Ethion	mg/L	< 0.002			0.002	Pass	
Ethoprop	mg/L	< 0.002			0.002	Pass	
Ethyl parathion	mg/L	< 0.002			0.002	Pass	
Fenitrothion	mg/L	< 0.002			0.002	Pass	
Fensulfothion	mg/L	< 0.002			0.002	Pass	
Fenthion	mg/L	< 0.002			0.002	Pass	
Malathion	mg/L	< 0.002			0.002	Pass	
Merphos	mg/L	< 0.002			0.002	Pass	
Methyl parathion	mg/L	< 0.002			0.002	Pass	
Mevinphos	mg/L	< 0.002			0.002	Pass	
Monocrotophos	mg/L	< 0.002			0.002	Pass	
Naled	mg/L	< 0.002			0.002	Pass	
Omethoate	mg/L	< 0.002			0.002	Pass	
Phorate	mg/L	< 0.002			0.002	Pass	
Pirimiphos-methyl	mg/L	< 0.02			0.02	Pass	
Pyrazophos	mg/L	< 0.002			0.002	Pass	
Ronnel	mg/L	< 0.002			0.002	Pass	
Terbufos	mg/L	< 0.002			0.002	Pass	
Tetrachlorvinphos	mg/L	< 0.002			0.002	Pass	
Tokuthion	mg/L	< 0.002			0.002	Pass	
Trichloronate	mg/L	< 0.002			0.002	Pass	
<b>Method Blank</b>							
<b>Polychlorinated Biphenyls</b>							
Aroclor-1016	mg/L	< 0.001			0.001	Pass	
Aroclor-1221	mg/L	< 0.001			0.001	Pass	
Aroclor-1232	mg/L	< 0.001			0.001	Pass	
Aroclor-1242	mg/L	< 0.001			0.001	Pass	
Aroclor-1248	mg/L	< 0.001			0.001	Pass	
Aroclor-1254	mg/L	< 0.001			0.001	Pass	
Aroclor-1260	mg/L	< 0.001			0.001	Pass	
Total PCB*	mg/L	< 0.001			0.001	Pass	
<b>Method Blank</b>							
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Total PAH*	mg/L	< 0			0.00001	Pass	
<b>Method Blank</b>							
Phenolics (total)	mg/L	< 0.05			0.05	Pass	
<b>Method Blank</b>							
<b>Heavy Metals</b>							
Arsenic	mg/L	< 0.001			0.001	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Cadmium (filtered)	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
<b>LCS - % Recovery</b>							
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>							
Naphthalene	%	85			70-130	Pass	
TRH C6-C10	%	98			70-130	Pass	
TRH >C10-C16	%	76			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>							
TRH C6-C9	%	95			70-130	Pass	
TRH C10-C14	%	79			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>BTEX</b>							
Benzene	%	92			70-130	Pass	
Toluene	%	89			70-130	Pass	
Ethylbenzene	%	82			70-130	Pass	
m&p-Xylenes	%	81			70-130	Pass	
Xylenes - Total	%	82			70-130	Pass	
<b>LCS - % Recovery</b>							
<b>Organochlorine Pesticides</b>							
Chlordanes - Total	%	114			70-130	Pass	
4,4'-DDD	%	104			70-130	Pass	
4,4'-DDE	%	105			70-130	Pass	
4,4'-DDT	%	97			70-130	Pass	
a-BHC	%	113			70-130	Pass	
Aldrin	%	94			70-130	Pass	
b-BHC	%	110			70-130	Pass	
d-BHC	%	112			70-130	Pass	
Dieldrin	%	90			70-130	Pass	
Endosulfan I	%	93			70-130	Pass	
Endosulfan II	%	104			70-130	Pass	
Endosulfan sulphate	%	94			70-130	Pass	
Endrin	%	94			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endrin aldehyde			%	126			70-130	Pass	
Endrin ketone			%	104			70-130	Pass	
g-BHC (Lindane)			%	124			70-130	Pass	
Heptachlor			%	95			70-130	Pass	
Heptachlor epoxide			%	97			70-130	Pass	
Hexachlorobenzene			%	114			70-130	Pass	
Methoxychlor			%	86			70-130	Pass	
LCS - % Recovery									
Organophosphorus Pesticides									
Diazinon		%	115				70-130	Pass	
Dimethoate		%	80				70-130	Pass	
Ethion		%	110				70-130	Pass	
Fenitrothion		%	103				70-130	Pass	
Methyl parathion		%	102				70-130	Pass	
Mevinphos		%	98				70-130	Pass	
LCS - % Recovery									
Polychlorinated Biphenyls									
Aroclor-1260		%	120				70-130	Pass	
LCS - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)									
Acenaphthene		%	79				70-130	Pass	
Acenaphthylene		%	77				70-130	Pass	
Anthracene		%	72				70-130	Pass	
Benz(a)anthracene		%	99				70-130	Pass	
Benzo(a)pyrene		%	101				70-130	Pass	
Benzo(b&j)fluoranthene		%	77				70-130	Pass	
Benzo(g,h,i)perylene		%	78				70-130	Pass	
Benzo(k)fluoranthene		%	89				70-130	Pass	
Chrysene		%	82				70-130	Pass	
Dibenz(a,h)anthracene		%	93				70-130	Pass	
Fluoranthene		%	77				70-130	Pass	
Fluorene		%	83				70-130	Pass	
Indeno(1.2.3-cd)pyrene		%	72				70-130	Pass	
Naphthalene		%	86				70-130	Pass	
Phenanthrene		%	83				70-130	Pass	
Pyrene		%	82				70-130	Pass	
LCS - % Recovery									
Phenolics (total)		%	100				70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic		%	95				80-120	Pass	
Cadmium		%	97				80-120	Pass	
Chromium		%	97				80-120	Pass	
Copper		%	96				80-120	Pass	
Lead		%	95				80-120	Pass	
Mercury		%	95				75-125	Pass	
Nickel		%	95				80-120	Pass	
Zinc		%	97				80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16		W19-Oc25712	NCP	%	90		70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					

Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
TRH C10-C14	W19-Oc25712	NCP	%	95		70-130	Pass	
<b>Spike - % Recovery</b>								
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>				Result 1				
Naphthalene	S19-Oc26969	CP	%	72		70-130	Pass	
TRH C6-C10	S19-Oc26969	CP	%	94		70-130	Pass	
<b>Spike - % Recovery</b>								
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>				Result 1				
TRH C6-C9	S19-Oc26969	CP	%	95		70-130	Pass	
<b>Spike - % Recovery</b>								
<b>BTEX</b>				Result 1				
Benzene	S19-Oc26969	CP	%	98		70-130	Pass	
Toluene	S19-Oc26969	CP	%	97		70-130	Pass	
Ethylbenzene	S19-Oc26969	CP	%	94		70-130	Pass	
m&p-Xylenes	S19-Oc26969	CP	%	90		70-130	Pass	
o-Xylene	S19-Oc26969	CP	%	92		70-130	Pass	
Xylenes - Total	S19-Oc26969	CP	%	91		70-130	Pass	
<b>Spike - % Recovery</b>								
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>				Result 1				
Acenaphthene	B19-Oc28739	NCP	%	85		70-130	Pass	
Acenaphthylene	B19-Oc28739	NCP	%	91		70-130	Pass	
Anthracene	B19-Oc28739	NCP	%	81		70-130	Pass	
Benz(a)anthracene	B19-Oc28739	NCP	%	77		70-130	Pass	
Benzo(a)pyrene	B19-Oc28739	NCP	%	84		70-130	Pass	
Benzo(b&j)fluoranthene	B19-Oc28739	NCP	%	76		70-130	Pass	
Benzo(g,h,i)perylene	B19-Oc28739	NCP	%	87		70-130	Pass	
Benzo(k)fluoranthene	B19-Oc28739	NCP	%	106		70-130	Pass	
Chrysene	B19-Oc28739	NCP	%	100		70-130	Pass	
Dibenz(a,h)anthracene	B19-Oc28739	NCP	%	73		70-130	Pass	
Fluoranthene	B19-Oc28739	NCP	%	92		70-130	Pass	
Fluorene	B19-Oc28739	NCP	%	98		70-130	Pass	
Indeno(1,2,3-cd)pyrene	B19-Oc28739	NCP	%	121		70-130	Pass	
Naphthalene	B19-Oc28739	NCP	%	73		70-130	Pass	
Phenanthrene	B19-Oc28739	NCP	%	84		70-130	Pass	
Pyrene	B19-Oc28739	NCP	%	87		70-130	Pass	
<b>Spike - % Recovery</b>								
<b>Organochlorine Pesticides</b>				Result 1				
4,4'-DDE	M19-Oc18417	NCP	%	90		70-130	Pass	
a-BHC	M19-Oc18417	NCP	%	111		70-130	Pass	
Aldrin	M19-Oc18417	NCP	%	75		70-130	Pass	
b-BHC	M19-Oc18417	NCP	%	94		70-130	Pass	
d-BHC	M19-Oc18417	NCP	%	99		70-130	Pass	
Dieldrin	M19-Oc18417	NCP	%	85		70-130	Pass	
Endosulfan I	M19-Oc18417	NCP	%	83		70-130	Pass	
Endosulfan II	M19-Oc18417	NCP	%	88		70-130	Pass	
Endrin	M19-Oc18417	NCP	%	87		70-130	Pass	
Endrin aldehyde	M19-Oc18417	NCP	%	82		70-130	Pass	
g-BHC (Lindane)	M19-Oc18417	NCP	%	122		70-130	Pass	
Heptachlor	M19-Oc18417	NCP	%	71		70-130	Pass	
Heptachlor epoxide	M19-Oc18417	NCP	%	74		70-130	Pass	
Hexachlorobenzene	M19-Oc18417	NCP	%	124		70-130	Pass	
<b>Spike - % Recovery</b>								
<b>Organophosphorus Pesticides</b>				Result 1				
Diazinon	B19-Oc28018	NCP	%	99		70-130	Pass	
Dimethoate	B19-Oc28018	NCP	%	75		70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ethion	B19-Oc28018	NCP	%	90			70-130	Pass	
Fenitrothion	B19-Oc28018	NCP	%	108			70-130	Pass	
Methyl parathion	B19-Oc28018	NCP	%	91			70-130	Pass	
Mevinphos	B19-Oc28018	NCP	%	103			70-130	Pass	
<b>Spike - % Recovery</b>									
				Result 1					
Phenolics (total)	S19-Oc26973	CP	%	106			70-130	Pass	
<b>Spike - % Recovery</b>									
				Result 1					
<b>Heavy Metals</b>									
Arsenic (filtered)	S19-Oc26975	CP	%	92			70-130	Pass	
Cadmium (filtered)	S19-Oc26975	CP	%	88			70-130	Pass	
Chromium (filtered)	S19-Oc26975	CP	%	93			70-130	Pass	
Copper (filtered)	S19-Oc26975	CP	%	90			70-130	Pass	
Lead (filtered)	S19-Oc26975	CP	%	88			70-130	Pass	
Mercury (filtered)	S19-Oc26975	CP	%	80			70-130	Pass	
Nickel (filtered)	S19-Oc26975	CP	%	88			70-130	Pass	
Zinc (filtered)	S19-Oc26975	CP	%	90			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
<b>Total Recoverable Hydrocarbons - 2013 NEPM Fractions</b>				Result 1	Result 2	RPD			
Naphthalene	S19-Oc26968	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	S19-Oc26968	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C10-C16	S19-Oc28806	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
<b>Duplicate</b>									
<b>Total Recoverable Hydrocarbons - 1999 NEPM Fractions</b>				Result 1	Result 2	RPD			
TRH C6-C9	S19-Oc26968	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	S19-Oc28806	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S19-Oc28806	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S19-Oc28806	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
<b>Duplicate</b>									
<b>BTEX</b>				Result 1	Result 2	RPD			
Benzene	S19-Oc26968	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S19-Oc26968	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S19-Oc26968	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S19-Oc26968	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	S19-Oc26968	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	S19-Oc26968	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
<b>Duplicate</b>									
<b>Polycyclic Aromatic Hydrocarbons (Trace level)</b>				Result 1	Result 2	RPD			
Acenaphthene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Acenaphthylene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Anthracene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(a)pyrene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(b&j)fluoranthene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(g,h,i)perylene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(k)fluoranthene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Chrysene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Dibenz(a,h)anthracene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluoranthene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluorene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1,2,3-cd)pyrene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Naphthalene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Phenanthrene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Pyrene	B19-Oc28738	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	

Duplicate								
Organochlorine Pesticides				Result 1	Result 2	RPD		
Chlordanes - Total	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
4,4'-DDD	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
4,4'-DDE	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
4,4'-DDT	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
a-BHC	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Aldrin	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
b-BHC	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
d-BHC	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Dieldrin	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Endosulfan I	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Endosulfan II	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Endosulfan sulphate	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Endrin	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Endrin aldehyde	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Endrin ketone	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
g-BHC (Lindane)	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Heptachlor	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Heptachlor epoxide	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Hexachlorobenzene	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Methoxychlor	M19-Oc24938	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Duplicate								
Organophosphorus Pesticides				Result 1	Result 2	RPD		
Azinphos-methyl	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Bolstar	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Chlorfenvinphos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Chlorpyrifos	M19-Oc24938	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Chlorpyrifos-methyl	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Coumaphos	M19-Oc24938	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Demeton-S	M19-Oc24938	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Demeton-O	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Diazinon	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Dichlorvos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Dimethoate	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Disulfoton	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
EPN	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ethion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ethoprop	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ethyl parathion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Fenitrothion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Fensulfthion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Fenthion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Malathion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Merphos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Methyl parathion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Mevinphos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Monocrotophos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Naled	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Omethoate	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Phorate	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Pirimiphos-methyl	M19-Oc24938	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Pyrazophos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Ronnel	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Terbufos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Tetrachlorvinphos	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass



Duplicate								
Organophosphorus Pesticides				Result 1	Result 2	RPD		
Tokuthion	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Trichloronate	M19-Oc24938	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Duplicate								
Polychlorinated Biphenyls				Result 1	Result 2	RPD		
Aroclor-1016	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Aroclor-1221	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Aroclor-1232	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Aroclor-1242	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Aroclor-1248	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Aroclor-1254	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Aroclor-1260	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Total PCB*	M19-Oc24938	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Phenolics (total)	S19-Oc26973	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Arsenic (filtered)	S19-Oc26975	CP	mg/L	0.002	0.002	1.0	30%	Pass
Cadmium (filtered)	S19-Oc26975	CP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass
Chromium (filtered)	S19-Oc26975	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Copper (filtered)	S19-Oc26975	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Lead (filtered)	S19-Oc26975	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Mercury (filtered)	S19-Oc26975	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Nickel (filtered)	S19-Oc26975	CP	mg/L	0.002	0.002	4.0	30%	Pass
Zinc (filtered)	S19-Oc26975	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass



## Comments

### Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

### Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
R20	This sample is a Trip Spike and therefore all results are reported as a percentage

## Authorised By

Ursula Long	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Julie Kay	Senior Analyst-Inorganic (VIC)



### Glenn Jackson General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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## **APPENDIX D PHOTOBORD**

## SITE PHOTOGRAPHS

Project: Dam Decommissioning Strategy

Client: Mirvac

Project Number: 10035157

Location: Lots 54-58 DP259135, Mamre Road, Kems Creek



**Photo 1**

**Date: 16/10/2019**

Dam01



**Photo 2**

**Date: 16/10/2019**

Dam02



## SITE PHOTOGRAPHS

Project: Dam Decommissioning Strategy

Client: Mirvac

Project Number: 10035157

Location: Lots 54-58 DP259135, Mamre Road, Kems Creek



**Photo 3**

**Date: 16/10/2019**

Dam03



**Photo 4**

**Date: 16/10/2019**

Dam03

## SITE PHOTOGRAPHS

Project: Dam Decommissioning Strategy

Client: Mirvac

Project Number: 10035157

Location: Lots 54-58 DP259135, Mamre Road, Kems Creek



**Photo 5**

**Date: 16/10/2019**

Dam05

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