Appendix R

Nearshore Marine Characterisation

DISCLAIMER

This disclaimer applies to and governs the disclosure and use of this Environmental Impact Statement ("EIS"), and by reading, using or relying on any part(s) of the EIS you accept this disclaimer in full.

This Environmental Impact Statement, including the Executive Summary, and all chapters of and attachments and appendices to it and all drawings, plans, models, designs, specifications, reports, photographs, surveys, calculations and other data and information in any format contained and/or referenced in it, is together with this disclaimer referred to as the "**EIS**".

Purpose of EIS

The EIS has been prepared by, for and on behalf of Wafi Mining Limited and Newcrest PNG 2 Limited (together the "**WGJV Participants**"), being the participants in the Wafi-Golpu Joint Venture ("**WGJV**") and the registered holders of exploration licences EL 440 and EL1105, for the sole purpose of an application (the "**Permit Application**") by them for environmental approval under the Environment Act 2000 (the "**Act**") for the proposed construction, operation and (ultimately) closure of an underground copper-gold mine and associated ore processing, concentrate transport and handling, power generation, water and tailings management, and related support facilities and services (the "**Project**") in Morobe Province, Independent State of Papua New Guinea. The EIS was prepared with input from consultants engaged by the WGJV Participants and/or their related bodies corporate ("**Consultants**").

The Permit Application is to be lodged with the Conservation and Environment Protection Authority ("**CEPA**"), Independent State of Papua New Guinea.

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The EIS is intended and will be made available to CEPA, for review by CEPA and other applicable agencies of the Government of the Independent State of Papua New Guinea ("**Authorised Agencies**"), for the purpose of considering and assessing the Permit Application in accordance with the Act ("**Authorised Purpose**"), and for no other purpose whatsoever.

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Limits on investigation and information

The EIS is based in part on information not within the control of either the WGJV Participants or the Consultants. While the WGJV Participants and Consultants believe that the information contained in the EIS should be reliable under the conditions and subject to the limitations set forth in the EIS, they do not guarantee the accuracy of that information.

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While the WGJV Participants, their Related Bodies Corporate and Consultants believe that the information (including any opinions, forecasts or projections) contained in the EIS should be reliable under the conditions and subject to the limitations set out therein, and provide such information in good faith, they make no warranty, guarantee or promise, express or implied, that any of the information will be correct, accurate, complete or up to date, nor that such information will remain unchanged after the date of issue of the EIS to CEPA, nor that any forecasts or projections will be realised. Actual outcomes may vary materially and adversely from projected outcomes.

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The basis of the Consultants' engagement is that the Consultants' liability, whether under the law of contract, tort, statute, equity or otherwise, is limited as set out in the terms of their engagement with the WGJV Participants and/or their related bodies corporate.

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The WGJV Participants acknowledge and agree that, for the Authorised Purpose, the EIS may be:

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Development of Project subject to Approvals, Further Studies and Market and Operating Conditions

Any future development of the Project is subject to further studies, completion of statutory processes, receipt of all necessary or desirable Papua New Guinea Government and WGJV Participant approvals, and market and operating conditions.

Engineering design and other studies are continuing and aspects of the proposed Project design and timetable may change.

NEWCREST MINING LIMITED DISCLAIMER

Newcrest Mining Limited ("**Newcrest**") is the ultimate holding company of Newcrest PNG 2 Limited and any reference below to "Newcrest" or the "Company" includes both Newcrest Mining Limited and Newcrest PNG 2 Limited.

Forward Looking Statements

The EIS includes forward looking statements. Forward looking statements can generally be identified by the use of words such as "may", "will", "expect", "intend", "plan", "estimate", "anticipate", "continue", "outlook" and "guidance", or other similar words and may include, without limitation, statements regarding plans, strategies and objectives of management, anticipated production or construction commencement dates and expected costs or production outputs. The Company continues to distinguish between outlook and guidance. Guidance statements relate to the current financial year. Outlook statements relate to years subsequent to the current financial year.

Forward looking statements inherently involve known and unknown risks, uncertainties and other factors that may cause the Company's actual results, performance and achievements to differ materially from statements in this EIS. Relevant factors may include, but are not limited to, changes in commodity prices, foreign exchange fluctuations and general economic conditions, increased costs and demand for production inputs, the speculative nature of exploration and project development, including the risks of obtaining necessary licences and permits and diminishing quantities or grades of reserves, political and social risks, changes to the regulatory framework within which the Company operates or may in the future operate, environmental conditions including extreme weather conditions, recruitment and retention of personnel, industrial relations issues and litigation.

Forward looking statements are based on the Company's good faith assumptions as to the financial, market, regulatory and other relevant environments that will exist and affect the Company's business and operations in the future.

The Company does not give any assurance that the assumptions will prove to be correct. There may be other factors that could cause actual results or events not to be as anticipated, and many events are beyond the reasonable control of the Company. Readers are cautioned not to place undue reliance on forward looking statements. Forward looking statements in the EIS speak only at the date of issue. Except as required by applicable laws or regulations, the Company does not undertake any obligation to publicly update or revise any of the forward looking statements or to advise of any change in assumptions on which any such statement is based.

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Newcrest results are reported under International Financial Reporting Standards (IFRS) including EBIT and EBITDA. The EIS also includes non-IFRS information including Underlying profit (profit after tax before significant items attributable to owners of the parent company), All-In Sustaining Cost (determined in accordance with the World Gold Council Guidance Note on Non-GAAP Metrics released June 2013), AISC Margin (realised gold price less AISC per ounce sold (where expressed as USD), or realised gold price less AISC per ounce sold divided by realised gold price (where expressed as a %), Interest Coverage Ratio (EBITDA/Interest payable for the relevant period), Free cash flow (cash flow from operating activities less cash flow related to investing activities), EBITDA margin (EBITDA expressed as a percentage of revenue) and EBIT margin (EBIT expressed as a percentage of revenue). These measures are used internally by Management to assess the performance of the business and make decisions on the allocation of resources and are included in the EIS to provide greater understanding of the underlying performance of Newcrest's operations. The non-IFRS information has not been subject to audit or review by Newcrest's external auditor and should be used in addition to IFRS information.

Ore Reserves and Mineral Resources Reporting Requirements

As an Australian Company with securities listed on the Australian Securities Exchange (ASX), Newcrest is subject to Australian disclosure requirements and standards, including the requirements of the Corporations Act 2001 and the ASX. Investors should note that it is a requirement of the ASX listing rules that the reporting of Ore Reserves and Mineral Resources in Australia comply with the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the JORC Code) and that Newcrest's Ore Reserve and Mineral Resource estimates comply with the JORC Code.

Competent Person's Statement

The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

HARMONY GOLD MINING COMPANY LIMITED DISCLAIMER

Harmony Gold Mining Company Limited ("**Harmony**") is the ultimate holding company of Wafi Mining Limited and any reference below to "Harmony" or the "Company" includes both Harmony Gold Mining Company Limited and Wafi Mining Limited.

Forward Looking Statements

These materials contain forward-looking statements within the meaning of the safe harbor provided by Section 21E of the Securities Exchange Act of 1934, as amended, and Section 27A of the Securities Act of 1933, as amended, with respect to our financial condition, results of operations, business strategies, operating efficiencies, competitive positions, growth opportunities for existing services, plans and objectives of management, markets for stock and other matters. These include all statements other than statements of historical fact, including, without limitation, any statements preceded by, followed by, or that include the words "targets", "believes", "expects", "aims", "intends", "will", "may", "anticipates", "would", "should", "could", "estimates", "forecast", "predict", "continue" or similar expressions or the negative thereof.

These forward-looking statements, including, among others, those relating to our future business prospects, revenues and income, wherever they may occur in this EIS and the exhibits to this EIS, are essentially estimates reflecting the best judgment of our senior management and involve a number of risks and uncertainties that could cause actual results to differ materially from those suggested by the forward-looking statements. As a consequence, these forward-looking statements should be considered in light of various important factors, including those set forth in these materials. Important factors that could cause actual results to differ materially from estimates or projections contained in the forward-looking statements include, without limitation: overall economic and business conditions in South Africa, Papua New Guinea, Australia and elsewhere, estimates of future earnings, and the sensitivity of earnings to the gold and other metals prices, estimates of future gold and other metals production and sales, estimates of future cash costs, estimates of future cash flows, and the sensitivity of cash flows to the gold and other metals prices, statements regarding future debt repayments, estimates of future capital expenditures, the success of our business strategy, development activities and other initiatives, estimates of reserves statements regarding future exploration results and the replacement of reserves, the ability to achieve anticipated efficiencies and other cost savings in connection with past and future acquisitions, fluctuations in the market price of gold, the occurrence of hazards associated with underground and surface gold mining, the occurrence of labour disruptions, power cost increases as well as power stoppages, fluctuations and usage constraints, supply chain shortages and increases in the prices of production imports, availability, terms and deployment of capital, changes in government regulation, particularly mining rights and environmental regulation, fluctuations in exchange rates, the adequacy of the Group's insurance coverage and socio-economic or political instability in South Africa and Papua New Guinea and other countries in which we operate.

For a more detailed discussion of such risks and other factors (such as availability of credit or other sources of financing), see the Company's latest Integrated Annual Report and Form 20-F which is on file with the Securities and Exchange Commission, as well as the Company's other Securities and Exchange Commission filings. The Company undertakes no obligation to update publicly or release any revisions to these forward-looking statements to reflect events or circumstances after the date of this EIS or to reflect the occurrence of unanticipated events, except as required by law.

Competent Person's Statement

The Wafi-Golpu Joint Venture is an unincorporated joint venture between a wholly-owned subsidiary of Harmony Gold Mining Company Limited and a wholly-owned subsidiary of Newcrest Mining Limited.

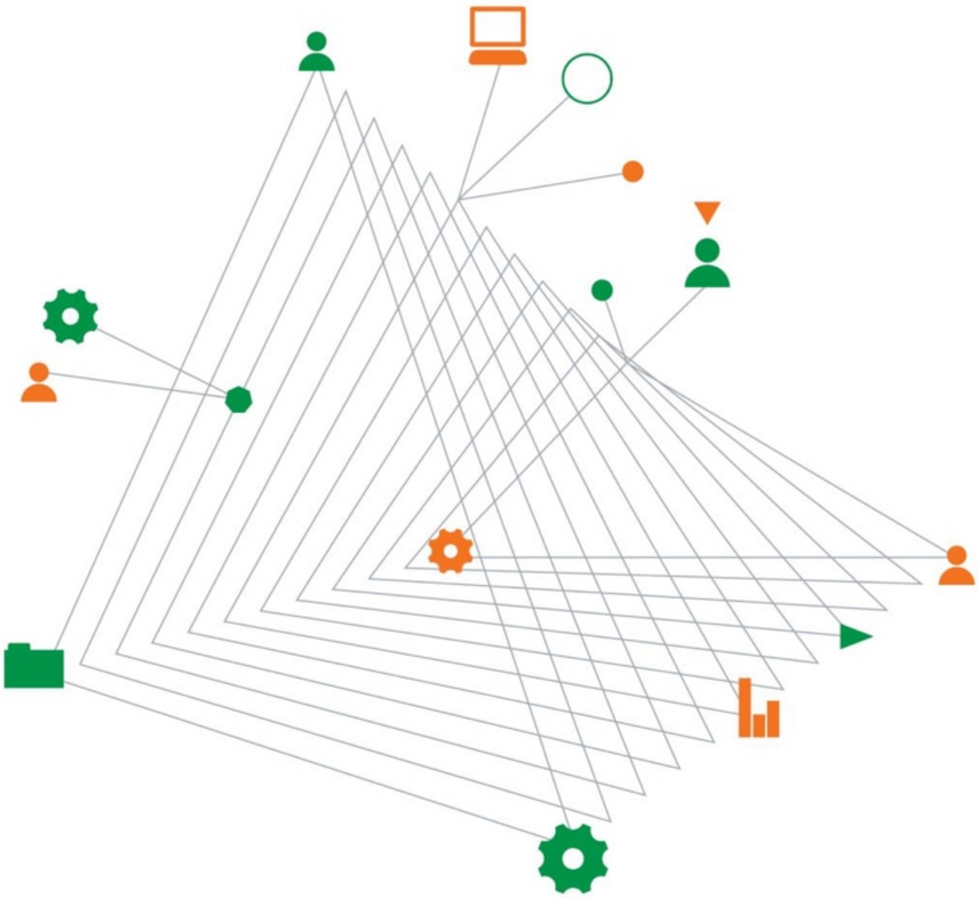
The information in the EIS that relates to Golpu Ore Reserves is based on information compiled by the Competent Person, Mr Pasqualino Manca, who is a member of The Australasian Institute of Mining and Metallurgy. Mr Pasqualino Manca, is a full-time employee of Newcrest Mining Limited or its relevant subsidiaries, holds options and/ or shares in Newcrest Mining Limited and is entitled to participate in Newcrest's executive equity long term incentive plan, details of which are included in Newcrest's 2017 Remuneration Report. Ore Reserve growth is one of the performance measures under recent long term incentive plans. Mr Pasqualino Manca has sufficient experience which is relevant to the styles of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the JORC Code 2012. Mr Pasqualino Manca consents to the inclusion of material of the matters based on his information in the form and context in which it appears.

Wafi-Golpu Joint Venture

Wafi-Golpu Project

Nearshore marine characterisation

25 June 2018



Experience
comes to life
when it is
powered by
expertise

Wafi-Golpu Project

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Rev B	Final	25 June 2018	Ivan Steward Travis Wood	Daniel Moriarty	Daniel Moriarty

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Executive summary

Background

Wafi Mining Limited and Newcrest PNG 2 Limited (WGJV Participants) are equal participants in the Wafi-Golpu Joint Venture (the WGJV) and propose to construct, operate and (ultimately) close an underground copper-gold mine and associated ore processing, concentrate transport and handling, power generation, water and tailings management and related support facilities and services (hereafter the “Wafi-Golpu Project” or the “Project”) in the Morobe Province of Papua New Guinea (PNG). The Project is located approximately 300 kilometres (km) north-northwest of Port Moresby and 65km southwest of Lae.

The Project includes ore processing, concentrate transport and handling, power generation, water management, a deep sea tailings placement (DSTP) system for tailings management, access roads to the mine and related support facilities.

The WGJV has commissioned a range of studies to inform the Project’s Feasibility Study Update and to prepare an Environmental Impact Statement (EIS).

This report describes the findings of the nearshore marine characterisation study. This study is based on investigations undertaken in the Coastal Area and reference locations in the Huon Gulf in November 2016, February 2017 and May 2017.

Objectives

The overall objective of the study was to characterise the nearshore marine environment near the Coastal Area.

The characterisation comprised a combination of visual appraisal and targeted sampling, focussing on marine water and sediment quality, shallow benthic habitats, mangrove habitats, seagrass communities, reefs, fishing areas, turtle nesting areas, species of conservation significance, and included a description of anthropogenic influences.

Study area

The spatial extent of the study area spanned the nearshore areas of the Huon Gulf from Salamaua in the south to approximately 6 km east of Singaua in the northeast. The study focussed on shallow coastal waters up to a maximum of about 100 metres (m) offshore (up to about 20 m depth) and on the littoral zones (i.e., the area that is exposed at low tide and submerged at high tide, also known as the intertidal zone) and foreshore. These areas included the proposed location of the mix/de-aeration tank, shore terrestrial tailings pipeline crossing and filtration plant discharge near the Port of Lae. This collective of Project infrastructure is termed the Coastal Area.

Locations beyond the proposed Outfall Area, including those near Labu, Salamaua and Singaua, were included as reference sites. The investigations at reference sites allowed characterisation of different ‘zones’ within the study area – i.e., sites near river mouths, sites affected by river turbidity plumes, marine waters largely free of riverine influence and sites adjacent to town and village areas. These different reference locations were included in the study to provide broader contextual information for the Huon Gulf and to help the assessment of impacts to the nearshore marine environment in the vicinity of the Outfall Area.

Key findings

This section provides a summary of the key findings from the nearshore marine characterisation study.

Areas near the Coastal Area (Lae to Busu River)

The key findings specifically relating to those areas near the Project – i.e., near the Coastal Area – are summarised as follows:

- Water was turbid in November 2016, mainly due to riverine influence. Turbidity was lower in February 2017, likely reflecting lower rainfall during and prior to that period.
- Water and sediment quality parameters were mostly below PNG standards and ANZECC guidelines. The few exceptions were a slight exceedance of copper (ANZECC 95% species protection guideline of 1.3 micrograms per litre (µg/L) at Voco Point (site V1) and an exceedance of sediment quality guidelines (interim sediment quality guidelines) for bioavailable nickel at the outfall site. Boron exceeded the PNG criteria of 2,000 µg/L in these areas; however, this value is lower than that observed typically in seawater.
- Faecal coliforms were detected in the waters at locations V1, W1, W2 and B1, between Lae and the Busu River.
- No seagrass or coral reefs were observed or are likely to be present.
- Benthic habitats at all sites investigated around Lae appear to be low in structural complexity and structural diversity, and generally highly influenced by terrigenous sediments. The potential exception to this was at V1 and LA1 where benthic fauna (shrimp, macroalgae) was opportunistically observed during sediment sampling.
- Wagang villagers described the presence of a small 'rocky reef' adjacent to the Outfall Area, situated approximately 30 m offshore and in approximately 5 to 10 m of water. This feature may be a section of outcropping rock or a gravel splay that has been colonised by various organisms potentially including sponges, soft corals, macroalgae and coralline algae. Villagers explained that this reef is visible from sea when conditions are calm and water is sufficiently clear. Fishing was observed to take place from the shore and from canoes in this area, with local people stating that red emperor, trevally, grouper and snapper species are targeted. Bathymetric data collected in other studies shows this feature may be part of a ridge feature that extends some 750 m along the coast.
- Macrofauna and meiofauna samples taken around Lae and the Outfall Area (at sites W2, W1, V1, LA1, LA3) displayed high spatial variability in diversity and abundance. Infauna communities were less abundant and diverse than is typically expected for shallow tropical subtidal benthic environments, particularly when compared to a site near Salamaua (S2) well removed from riverine influence.
- There are no coastal mangroves between Lae and the Busu River, with the exception of an area immediately west of Wagang (some 2 km west of the Outfall Area) within the un-named tributaries of the Nungwa River. These are referred to by local people as the Butudendeng and Nungawahac mangrove areas.
- No turtle nests were observed around the Outfall Area. Local interviews and historical data indicated that West Pacific Leatherback sea turtles nest in the area. According to some Wagang villagers, three or fewer west Pacific leatherback turtles are claimed to be caught when nesting between Wagang and the Busu River by local people each year, during November to February. These turtles are listed as critically endangered on the IUCN Red List. No turtle nesting was observed to occur around the urban areas of Lae.

- Hawksbill turtles (critically endangered) and green turtles (endangered) are known to inhabit the waters near the outfall site, though no evidence of nesting was observed on the surrounding beaches.
- The nearshore environment around Lae is highly modified, with buildings and infrastructure, rubbish, shipwrecks, stockpiled timber, port facilities and docked boats all present in the area. There was much scattered plastic and other rubbish that had been washed up along the beach at the proposed outfall site during the period of the survey.
- Resource use around Lae includes swimming, fishing and stockpiling of driftwood on the shoreline. Resource use observed around the outfall site includes fishing from the shoreline and driftwood collection.

Broader Huon Gulf region

The key findings for the Huon Gulf region more broadly are summarised as follows:

- The broader Huon Gulf study area is influenced by highly turbid freshwater discharges, mainly from the Markham and Busu rivers and to a lesser extent by smaller rivers such as the Bumbu, Bupu and Bunga rivers. Turbid plumes frequently extend at least 5 km offshore from the Markham and Busu River mouths and this causes the nearshore marine waters in the vicinity of the Outfall Area and City of Lae to be turbid most of the time. However, the extent of the influence of these turbid plumes shows temporal variation in terms of their thickness within the water column, which is likely to relate to rainfall (and therefore river discharge) and distance offshore. In situ readings and samples showed that, in general, turbidity and TSS were much lower in February 2017 than in November 2016.
- The marine environment in the study area has varying degrees of riverine freshwater influence both spatially and temporally. In November 2016 pH, conductivity and salinity results were lower than those of typical marine waters. Based on salinity readings, the waters at all sites monitored in 2016 were estuarine in nature according to definitions in literature (ANZECC/ARMCANZ, 2000). However, when re-measured at the same 1.5 m depth in February 2017 the pH, conductivity and salinity were typical of marine waters. This indicates the riverine plumes were thinner in February 2017.
- The majority of the in situ water chemistry results from February 2017 showed little difference between measurements taken at 1.5 m depth compared with those taken at 10 m depth. However, there was high variability in some turbidity and faecal coliform levels between the two depths. There was a clear increase in salinity and conductivity with depth at most sites, which is characteristic of a freshwater lens above the denser salt water.
- Water quality parameters were mostly below PNG water quality criteria and ANZECC/ARMCANZ (2000) guidelines for slightly-to-moderately disturbed aquatic ecosystems. The exceptions were:
  - Boron, which exceeded the PNG criterion of 2,000 µg/L at most sites (R1, R2, L1, M1, M2, V1, LA1, W1, W2, B1 and S1) in both November 2016 and February 2017. However, the concentrations detected are lower than the concentrations acknowledged in the literature such as ANZECC/ARMCANZ (2000) as being typical of seawater.
  - Oil and grease, which exceeded the PNG criterion (none to be present) at sites L1, L3, L4 and B1 in November 2016. These concentrations (between 6 to 8 mg/L) were just above the detection limit of less than 5 mg/L. The source of these slightly elevated concentrations is not clear and no oil and grease was observed at the other sampling sites. The only oil sheens were observed within Lae Yacht Club marina and the small harbour at Voco Point. Oil and grease concentrations at all sites sampled in 2017 were below detection limits.
  - Dissolved copper, which exceeded the ANZECC/ARMCANZ 95% protection guideline (1.3 µg/L) at two sites, (2 µg/L at V1 in 2016 and 1.9 µg/L at M1 in 2017). The source of the slightly elevated copper is unknown; however, given that site V1 is adjacent to Voco Point,

which has numerous shipwrecks, boat traffic and rubbish floating in the water and scattering the shoreline, it is not unexpected in this area.

- The presence of faecal coliforms in waters was widespread. Faecal coliforms were detected around Labu, in the Markham River plume, at sites near Lae, at Wagang and in the Busu River plume. Faecal coliforms were not detected at sites well removed from town or village areas (S1 and S2 near Salamaua, R1 south of Labu Lakes, and R2 west of Singaua).
- Bed sediment was a dark-coloured sand at most sites. The exceptions were in the Markham River mouth (site M1), near the Lae Tidal Basin (sites LA5, LA4, LA3, LA2 and LA1) and within the Labu Lakes (site L3) where the sediment was a brown or greyish-brown muddy silt; in the Labu Lakes mouth (site L4) and a reference site near Singaua (site R2) where sediment was dominated by gravel; and in the Salamaua area (site S2) where sediment was a coarser light-coloured coral sand. This coral sand contained readily observable infauna and macrophytes, which were rarely observed in sediment samples at any other study sites, with the exception of some benthic invertebrates present in sediment samples at sites V1 and LA1.
- Sediment bioavailable metals concentrations were mostly below internationally adopted sediment quality guidelines (ANZECC/ARMCANZ, 2000) suggesting that effects to benthic biota are rarely observed. The one exception was nickel at site W2 (24.5 mg/kg) adjacent to the Outfall Area in November 2016, which exceeded the Effects-Range Low (ERL) guideline of 21 mg/kg. Given there are no obvious anthropogenic sources of elevated nickel in the sediment at this location, it is likely that the in-fauna present would be adapted to such concentrations in the sediment.
- Macrobenthos and meiobenthos samples typically lacked the high diversity that is expected in shallow tropical subtidal benthic environments, and the infauna assemblages represent typically stressed environmental conditions, with the exception of site S2. Variable abundance and diversity was apparent, particularly for meiobenthos communities, and is most likely related to the proximity of the sampling locations to riverine sediment influence. Sites with greater gravel content and lower levels of organic matter (S2, W1, V1) exhibited higher meiofaunal abundance and diversity.
- For most of the study area, water turbidity was too high to obtain useful imagery of the seafloor habitat from the underwater video tows. This included all areas near Lae, at the Outfall Area and the entire coastline up to about 20 km to the east and also much of the coastline to the south of Lae.
- The only locations where water visibility was sufficiently clear to obtain useful underwater video imagery of the seafloor were 25 km south of Lae at Busama and some 10 km further southeast at Salamaua, where nearshore fringing reefs and seagrass were observed. Some imagery, although cloudy due to turbidity, was obtained at sites from Labu Miti (site L1) to along the coast to about 12 km south of Labu Lakes (sites DV1, DV2, DV3, DV4 and DV5).
- Within much of the western Huon Gulf investigated during this study, the high terrestrial sediment input, combined with a steeply sloping seafloor, appears to preclude the growth of typical Indo-Pacific hard reef-building corals, and creates unfavourable conditions for the establishment and perpetuation of coral reefs. The benthic habitats consisted of steeply sloping sand and gravel beds, and absence of physically more complex benthic habitats such as reefs or exposed rocks along much of the coastline (including at the Coastal Area). For similar reasons, seagrasses are expected to be absent from the typically steep, turbid nearshore environment present in the study area. Healthy coral reefs are present along the coasts of Busama and Salamaua more than 25 km south of Lae, with those near Salamaua appearing to experience a lower level of sedimentation than those further north. These were the closest nearshore coral reefs to the Outfall Area identified during the survey.
- The beach and foreshore environments around Lae (i.e., east of Lae from Voco Point towards Busu River) contain extensive accumulations of rubbish, typically comprising plastic bags, plastic and glass bottles, polystyrene, timber, building waste and discarded clothing/footwear. This rubbish degrades the visual amenity of the coast near Lae, and is transported into the ocean and along the coast, potentially impeding or preventing turtle nesting activities. Rubbish was observed along the coastline further east toward the Busu River, although in lower amounts than closer to

Lae. Little rubbish was observed on the coast around Labu, Labu Miti and further south. Floating plastic debris was also observed in nearshore waters around Lae and Wagang. Several corroding shipwrecks were present along the coast adjacent to Lae and Wagang and to a lesser extent along the southern coast south of the Labu Lakes.

- There are no mangroves at the Outfall Area; however, mangroves are dense and extensive in the Labu Lakes area and are dominated by *Rhizophora apiculata* and *Bruguiera* spp., with *Aegiceras corniculatum*, *Avicennia marina*, *Heritiera littoralis*, *Sonneratia caseolaris* and *Xylocarpus granatum* also present. There are two small areas of mangrove vegetation in un-named creeks within the un-named tributaries of the Nungwa River, immediately west of Wagang.
- Nearshore marine resource uses identified during the survey included shore fishing (Wagang and further east toward Singaua); gathering of floating driftwood adjacent to the shore by people wading in the water (entire south coast from Labu to Busama); stockpiling of driftwood timber on the shoreline for firewood (Wagang area and further east to the Busu River area); recreational swimming; trap net fishing near Labu Miti, fishing from outrigger canoes and boats along the coast from Labu Miti to Salamaua, and shellfish collection near Labu. No boat fishing or net fishing was observed along the coast from Wagang to the Busu River (including the Outfall Area); however, local people advised that they fish the rocky reef adjacent to the Outfall Area from the shoreline from boats. Local people stated that more fish are caught at the Busu River mouth than the rocky reef. Most of the shore fishing observed during the surveys was around the Busu River mouth.
- Turtle nests were observed south of Labu Miti near Labu Butu and Labu Tale (some 7 km south of Labu Lakes) in November 2016. Local people indicated that leatherback sea turtles nest between Wagang and the Busu River (including the proposed Outfall Area) and along the southern coast of the Huon Gulf from Labu Butu toward Salamaua. Local people indicated that turtle nesting in the area between Wagang and Busu River is much less common than it was many years ago (i.e., in the 1970s). According to some Wagang people interviewed, between Wagang and the Busu River, three leatherback turtles (or fewer) were claimed to be caught and consumed by local people each year between November and February, with approximately 150 to 200 eggs harvested per nest when found. Local people from Wagang stated that hawksbill and green turtles are occasionally seen in the waters coming up for air along the coast from Wagang to Busu River. No turtles, turtle nests or old nesting pits were observed around the proposed Outfall Area at the time of the surveys during November 2016 and February 2017 (which is during the nesting period for these turtles) or during May 2017.
- Dolphins were seen daily during the survey in the Lae Port zone within 100 m from shore during both the November 2016 and February 2017 surveys. It was not possible to identify the species of dolphins. It was stated by local people in the Labu area that dugong were occasionally present and hunted in the Salamaua area.

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Figures

Tables

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Glossary

Abbreviations

°C	degrees Celsius
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
cfu	colony-forming units
DSTP	deep sea tailings placement
DO	dissolved oxygen
EIS	environmental impact statement
ERL	effects range low
ERM	effects range median
HCl	hydrochloric acid
IUCN	International Union for Conservation of Nature
ISQG	interim sediment quality guidelines
mg/kg	milligrams per kilogram
MPN	most probable number
mS/cm	milliSiemens per centimetre
Mtpa	million tonnes per annum
NTU	Nephelometric Turbidity Unit
PNG	Independent state of Papua New Guinea
ppt	parts per thousand
SQG	sediment quality guidelines
TOC	total organic carbon
TSS	total suspended solids
WGJV	Wafi-Golpu Joint Venture

Terms

Coastal Area	Includes the proposed Port Facilities Area and the proposed Outfall Area.
infauna	Benthic fauna living in the substrate or sediment, especially in a soft seafloor.
littoral zone	The area that is exposed at low tide and submerged at high tide.
macrofauna	Multicellular animals that are retained on a 500 μm sieve.
meiofauna	Multicellular animals that include those retained on 63 μm mesh and pass through 500 μm mesh.
nearshore	The region of the sea or seabed relatively close to the shore.
Outfall Area	The area encompassing the Outfall System, pipeline laydown area, choke station, access track and parking and turnaround area.
Outfall System	Includes mix/de-aeration tank, seawater intake pipelines and DSTP outfall pipelines. Located in the Outfall Area.
pelagic	The part of the water column that is neither close to the bottom nor near the shore.
Port Facilities Area	The area encompassing the proposed facilities located at the Port Area, including the concentrate filtration plant and materials handling, storage and ship loading facilities and filtrate discharge pipeline. This area may in the future need to include oil handling and storage facilities.
study area	The nearshore area of the Huon Gulf from Salamaua in the southwest to approximately 6 km east of Singaua in the northeast. The nearshore area includes shallow pelagic waters up to a maximum of about 100 m offshore (up to about 20 m depth) and on the littoral zones and foreshore.

1. Introduction

1.1. Background

Wafi Mining Limited and Newcrest PNG 2 Limited (WGJV Participants) are equal participants in the Wafi-Golpu Joint Venture (the WGJV) and propose to construct, operate and (ultimately) close an underground copper-gold mine and associated ore processing, concentrate transport and handling, power generation, water and tailings management and related support facilities and services (hereafter the “Wafi-Golpu Project” or the “Project”) in the Morobe Province of Papua New Guinea (PNG). The Project is located approximately 300 kilometres (km) north-northwest of Port Moresby and 65km southwest of Lae.

The Project includes ore processing, concentrate transport and handling, power generation, water management, a deep sea tailings placement (DSTP) system for tailings management, access roads to the mine and related support facilities.

Geographically, the Project occupies a mine to port footprint that extends from the Mine Area to the Coastal Area with an Infrastructure Corridor that links the two areas. Together these discrete areas make up the proposed Project Area:

- **Mine Area.** The area encompassing the proposed block cave mine, underground access declines and nearby infrastructure, including a portal terrace and waste rock dump supporting each of the Watut and Nambonga declines, the Watut Process Plant, power generation facilities, laydown areas, water treatment facilities, quarries, wastewater discharge and raw water make-up pipelines, raw water dam, sediment control structures, roads and accommodation facilities for the construction and operations workforces.
- **Infrastructure Corridor.** The area encompassing the proposed Project infrastructure linking the Mine Area and the Coastal Area, being corridors for pipelines and roads and associated laydown areas. The proposed concentrate pipeline, terrestrial tailings pipeline and fuel pipeline will connect the Mine Area to the Coastal Area. A proposed Mine Access Road and Northern Access Road will connect the Mine Area to the Highlands Highway. New single-lane bridges are proposed over the Markham, Watut and Bavaga rivers. Laydown areas will be located at key staging areas.
- **Coastal Area.** The Coastal Area includes the proposed Port Facilities Area and the proposed Outfall Area:
  - Port Facilities Area. Located at, or in proximity to, the Port of Lae, with a site adjacent to Berth 6 (also known as Tanker Berth) nominated as the preferred option. The proposed facilities will include the concentrate filtration plant and materials handling, storage, ship loading facilities and filtrate discharge pipeline.
  - Outfall Area. Located approximately six kilometres east of the port. The proposed facilities will include the Outfall System comprising the mix/de-aeration tank and associated facilities, seawater intake pipelines and DSTP outfall pipelines, pipeline laydown area, choke station, access track and parking turnaround area.

The WGJV has commissioned a range of studies to inform the Project’s Feasibility Study Update and to prepare an Environmental Impact Statement (EIS).

This report describes the findings of the nearshore marine characterisation study. The study area for this report is the nearshore area of the Huon Gulf from Salamaua in the southwest to approximately 6 km east of Singaua in the northeast. The nearshore area includes shallow pelagic waters up to a maximum of about 100 metres (m) offshore (up to about 20 m depth) and on the littoral zones and foreshore. The study area addresses the Coastal Area.

Future development of the Project remains subject to ongoing deep orebody drilling and definition (after underground access has been achieved), technical studies, completion of statutory permitting processes and securing Government and WGJV Participants' approvals.

Engineering design and other studies, including environmental studies, are continuing and there is potential that aspects of the proposed Project design, layout and timetable may change.

1.2. Objectives

The overall objective of the study was to characterise the nearshore marine environment near the Outfall Area (approximately 1.5 km east of Wagang) and the Port Facilities Area where discharge may occur. These two areas are collectively known as the Coastal Area. The study objective also included investigating reference locations away from potential Project influence. The study focussed on providing a level of detail sufficient to inform the DSTP impact assessment component of the EIS, and to contribute to a subsequent baseline dataset.

The characterisation focussed on marine water and sediment quality; potential environmental sensitivities such as shallow benthic habitats, mangrove habitats, seagrass communities, reefs, fishing areas, sea turtle nesting areas, species of conservation significance; and a description of anthropogenic influences.

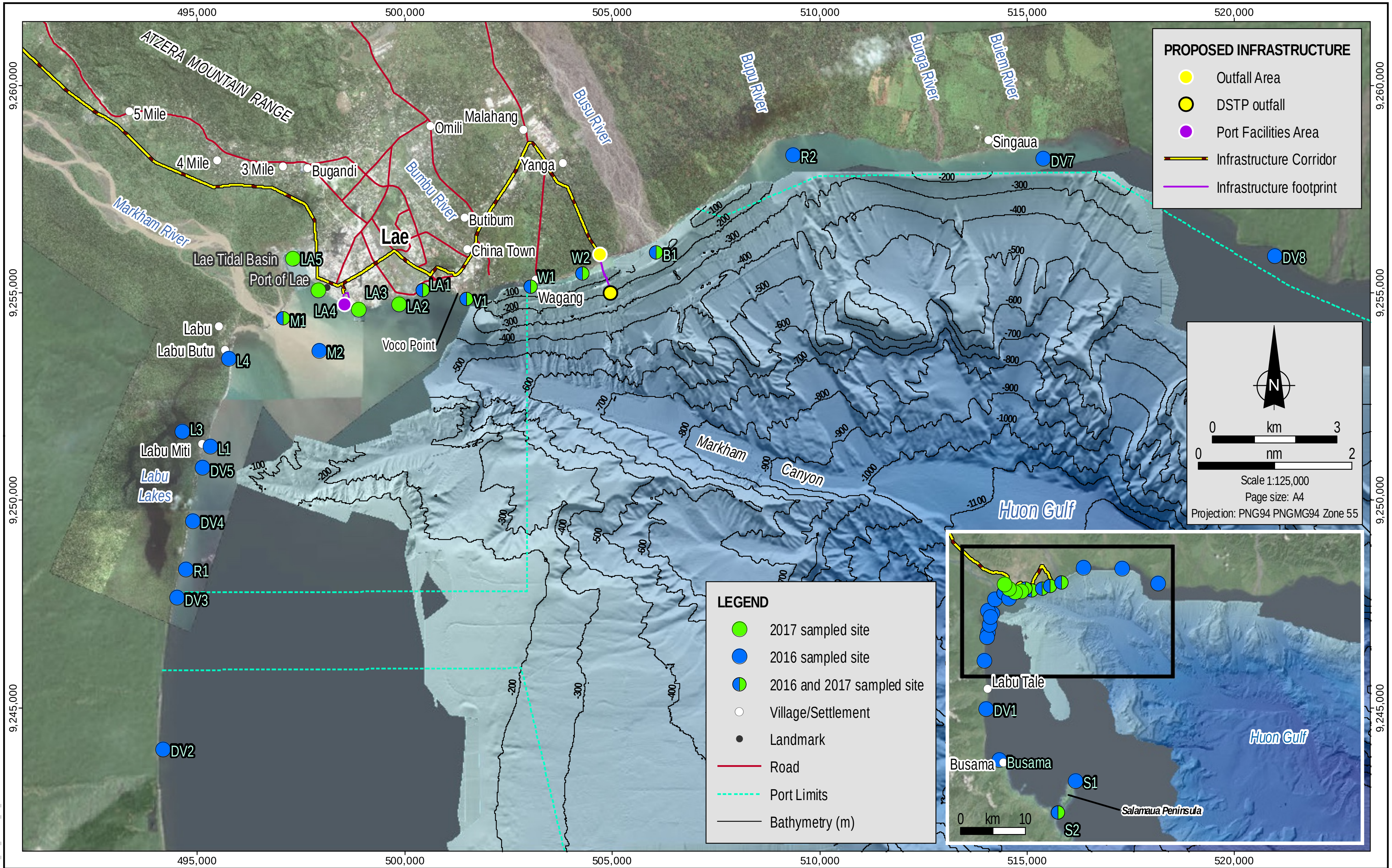
1.3. Study area

In November 2016 and February 2017, Coffey conducted nearshore marine field characterisation surveys in the Huon Gulf. In May 2017, a follow up interview was conducted at Wagang village regarding nearshore marine resources.

Figure 1.1 shows the study area, including the locations for water and sediment sampling, and underwater video analysis. The spatial extents of the study area spanned the nearshore areas of the Huon Gulf from Salamaua in the southwest to approximately 6 km east of Singaua in the northeast. The study focussed on shallow pelagic waters up to a maximum of about 100 m offshore (up to about 20 m depth) and on the littoral[1] zones and foreshore. The study area included the location of the proposed mix/deaeration tank, shore terrestrial tailings pipeline crossing and DSTP outfall pipelines, as well as sites in the vicinity of existing port facilities and other development around Lae. This area collectively is known as the Coastal Area.

Locations outside the anticipated area of potential Project influence, such as those in the vicinity of Lae, Labu, Salamaua and Singaua, were also sampled as reference sites. These reference sites were investigated so as to provide context of the nearshore marine environment in the Huon Gulf more broadly.

[1] The littoral or 'intertidal' zone is the area that is exposed at low tide and submerged at high tide.



Source:
Nearshore sites, roads and Port Limits from Coffey (Port Limits indicative only).
Villages/Settlements, landmarks and infrastructure from WGJV and Coffey.
Bathymetry from WGJV survey.
Imagery from WGJV (capture date 2016) and ArcGIS Online (capture date unknown).

coffey
A TETRA TECH COMPANY

Date: 23.03.2018
Project: 754-ENAUABTF100520DD
File Name: 0520DD_09_F01.01_GIS

WAFI-GOLPU JOINT VENTURE

Wafi-Golpu Project

Nearshore marine survey sites

Figure No: 1.1

MXD Reference: 0520CC_NR_GIS002_v0_4

2. Methods

2.1. Study team

Field work was conducted in November 2016 and in February 2017 by Senior Environmental Consultants from Coffey.

Logistics assistance was also provided by crew of the Collins Shipping vessel 'Kuring', chartered for both surveys. Community Affairs assistance was provided by WGJV.

2.2. Sites characterised

Sites investigated included the potential nearshore impact area (vicinity of the Outfall and Port Facility Areas) and reference locations (away from areas of potential Project impact). Additional sites were chosen to characterise different zones within the study area – i.e., sites near river mouths, sites affected by river plumes, marine waters free of riverine influence and also shorelines adjacent to urban and industrial areas. These different 'zones' were characterised in order to provide contextual information for the subsequent assessment of impacts to the nearshore environment in the vicinity of the Coastal Area. Field investigations conducted in February 2017 involved repeat sampling of seven of the fifteen November 2016 sampling sites to characterise potential seasonal variation and to collect water samples at depths to compare quality within and below the influence of river plumes. The survey also included additional sites near the Lae port to further characterise the existing nearshore marine environment in that area.

Table 2.1 outlines the sampling locations and the parameters monitored at each site. It also outlines which sites were sampled for seasonal variation (i.e., in both November 2016 and February 2017).

Photographs and observations were made at each sampling site. These observations included:

- Name and identification number of site.
- Coordinates of sampling site.
- Date and time of sampling.
- Weather conditions.
- Estimation of depth at site (using a depth finder on-board the study vessel).
- Environmental sensitivities.
- Safety observations.

Table 2.1: Monitoring locations and parameters measured

Site	Coordinates (mE; mN)[a]	Date	Time	Water	Sediment	Underwater video tow	Site description
R1	494717; 9248341	16/11/2016	12:50	Yes	Yes	No[b]	Reference location adjacent to the southern tip of the Labu Lakes.
R2	509353; 9258335	17/11/2016	09:30	Yes	Yes	No[b]	Reference location at Singaua.
L1	495306; 9251294	16/11/2016	11:00	Yes	Yes	No[b]	Adjacent to Labu Miti.
L3	494612; 9251659	16/11/2016	10:36	Yes	Yes	No[b]	In the Labu Lakes adjacent to Labu Miti.
L4	495746; 9253411	16/11/2016	07:45	Yes	Yes	No[b]	At the mouth of Labu Lakes near Labu village.
M1	497062, 9254385	18/11/2016 28/02/2017	07:30 12:30	Yes[e]	Yes[f]	No[b]	Within the Markham River plume adjacent to the river mouth (just outside the most turbid plume).
M2	497928; 9253608	18/11/2016	08:00	Yes	No[d]	No[b]	Within the Markham River plume (most turbid plume) approximately 1.5 km from the river mouth.
V1	501471; 9254850	19/11/2016 28/02/2017	07:20 11:30	Yes[e]	Yes[f]	No[b]	Offshore near Voco Point, Lae.
LA1	500428; 9255062	19/11/2016 28/02/2017	08:20 11:50	Yes[e]	Yes[f]	No[b]	Adjacent to the old airstrip at Lae. The main Lae sewage outfall is in this area.
LA2	499851; 9254723	26/02/2017	14:10	Yes[e]	Yes	No	Near Lae port facilities.
LA3	498874; 9254603	26/02/2017	13:00	Yes[e]	Yes[f]	No	Near Lae port facilities.
LA4	497900; 9255066	26/02/2017	10:30	Yes[e]	Yes	No	Between Lae tidal basin and Lae port facilities.
LA5	497294; 9255821	26/02/2017	08:30	Yes[e]	Yes	No	Closest site to shore in Lae tidal basin.
W1	503029; 9255141	17/11/2016 28/02/2017	06:50 10:15	Yes[e]	Yes[f]	No[b]	Adjacent to Wagang village.
W2	504275; 9255470	17/11/2016 28/02/2017	07:20 10:00	Yes[e]	Yes[f]	No[b]	At the Outfall Area.
B1	506050; 9255971	17/11/2016 28/02/2017	08:20 09:00	Yes[e]	Yes[f]	No[b]	Within the Busu River plume 100 m from the river mouth.
S1	508227; 9225492	18/11/2016	09:40	Yes	No	Yes	Reference location at coral reef off Salamaua Peninsula.

Site	Coordinates (mE; mN)[a]	Date	Time	Water	Sediment	Underwater video tow	Site description
S2	505482; 9220601	18/11/2016 27/02/2017	10:50 09:30	2016 No 2017 Yes[e]	Yes[f]	Yes – 2016 only	Reference location near Salamaua Peninsula.
Busama	496394; 9228649	18/11/2016	11:35	Yes[c]	No	Yes	Reference location at coral reef at Busama village.
DV1	494356; 9236595	25/11/2016	10:30	No	No	No[b]	Reference location 12 km south of Labu Lakes.
DV2	494153; 9244006	25/11/2016	10:14	No	No	No[b]	Reference location 4 km south of Labu Lakes.
DV3	494488; 9247654	25/11/2016	10:03	No	No	No[b]	Reference location 0.5 km south of Labu Lakes.
DV4	494868; 9249504	25/11/2016	09:58	No	No	No[b]	Reference location 1.8 km south of Labu Miti. Adjacent to Labu Lakes.
DV5	495110; 9250788	25/11/2016	09:53	No	No	No[b]	Reference location 0.6 km south of Labu Miti. Adjacent to Labu Lakes.
DV7	515379; 9258237	25/11/2016	13:32	No	No	No[b]	Reference location at Singaua 5.5 km east of site R2.
DV8	520965; 9255901	25/11/2016	14:05	No	No	No[b]	Reference location 6 km southeast of site DV7.

a Coordinates given in PNG94 PNGMG94 Zone 55.
b Underwater video tow attempted, however visibility at these sites too low to obtain footage of the benthic environment.
c In situ water quality measurements only taken at this site. No samples for lab analysis were taken.
d Site too deep for sediment sample collection.
e November 2016 water quality samples for laboratory analysis collected at 1.5 m water depth. February 2017 water quality samples collected at 1.5 m and 10 m water depth.
f Infauna sample also collected in 2017.

2.3. Water quality

2.3.1. Sampling procedures

Water samples were collected using a Niskin bottle attached to a rope and messenger (Plate 2.1). The sampling process involved lowering the Niskin bottle from the boat and deploying a messenger (a small weight that slides along the rope to trigger the closure of the Niskin bottle) that triggered the bottle to close tightly, capturing the water sample. Prior to collecting the water sample, the Niskin bottle was thoroughly rinsed with the water to be sampled.

In November 2016, the samples were taken from 1.5 m below the surface at all sites. In 2017 samples were taken at 1.5 m and 10 m, in order to investigate water quality below the influence of riverine freshwater surface plumes. All water sampling and bottle handling was performed while wearing powder-free nitrile gloves to avoid sample contamination. Samples were taken upwind, and upstream and toward the prevailing current to minimise contamination from fuel vapour, bilge discharges and engine exhaust gases from the survey vessel. Water samples were collected before sediment sampling to avoid disturbance of sediment and resuspension of materials into the water column.

The water sample from the Niskin bottle was then used to pre-rinse each of the laboratory-supplied sample bottles prior to filling them with sample. Three rinses were performed for each bottle with the rinsate being discarded. The exceptions were the bottles that included preservative, which were not pre-rinsed.

Table 2.2 outlines the bottle types, including preservatives, for the water sampling.

Appendix A outlines the laboratory analysis methods.

Table 2.2: Sample bottles used for water sampling

Bottle	Label	Preservative	Analysis
250 millilitres (mL) plastic	Green	None	TSS, alkalinity, major ions, nitrite, nitrate, reactive phosphorus
500 mL plastic	Green	None	Low level TSS
60 mL plastic	Purple	Sulfuric acid	Nitrite, nitrate, ammonia, total Kjeldahl nitrogen, total nitrogen, total phosphorus
250 mL glass	Purple	Sulfuric acid	Oil and grease
60 mL plastic	Red and green	None	Total metals
60 mL plastic	Red and green	None	Dissolved metals (field filtered)
250 mL jar	Grey	Sodium thiosulfate	Faecal coliforms

Note: These sampling bottles were supplied by ALS Laboratories Brisbane.

Field filtering was performed to obtain samples for dissolved metals analysis. This was achieved by passing the sample through a syringe fitted with a 0.45 micrometre (μm) plastic membrane filter. Filtrate was used to pre-rinse the sample bottle prior to sample collection. Field filtering was conducted at each of the sampling sites.

2.3.2. In situ measurements

A pre-calibrated water quality meter (YSI Instruments; model: DSS) was used to undertake the following in-situ measurements of water quality concurrently with water sampling:

- Temperature (°C).
- pH.
- Conductivity (mS/cm).
- Salinity (ppt).
- Dissolved oxygen (mg/L and % saturation).
- Turbidity (NTU).

The probes were lowered to 1.5 m below the surface and left for several minutes until the parameter readings stabilised. The readings were recorded in a waterproof notebook.

2.4. Sediment quality and infauna sampling

2.4.1. Sediment sampling procedures

Sediment samples were taken from the sea floor using a Petite Ponar grab sampler (Plate 2.2 and Plate 2.3).

The depth of each sampling site was determined using the boat’s depth sounder.

The sediment was then tipped from the grab sampler into a large stainless steel bowl. Several replicate samples were obtained and mixed in the bowl, using a stainless steel spoon, to create a composite site sample. This was conducted in order to obtain a representative sample that accounts for any localised site variability in the sediment material. All sediment sampling and sample bag handling was performed while wearing nitrile powder-free gloves to avoid sample contamination.

The grab sampler was scrubbed with a plastic brush and rinsed with seawater after each sampling event and thoroughly cleaned daily with a plastic brush, ‘Decon 90’ dilute decontamination solution and freshwater.

Photographs were taken of each sediment sample and observations made on its appearance.

Subsamples were then placed in laboratory-supplied plastic zip-lock bags and a glass jar. The samples in zip-lock bags were triple-bagged in order to minimise the risk of sample leakage. Table 2.3 outlines the types of sample bag and jar used and the associated laboratory analyses.

Table 2.3: Sample bags and jar used for sediment sampling

Container	Preservative	Analysis
150 mL glass jar	None	Nutrients, carbon content.
500 mL plastic ziplock bag	None	Particle size distribution.
500 mL plastic ziplock bag	Sulfuric acid	Sieving. Metals (total and bioavailable) analysis.

Photo credit: Coffey

Plate 2.1
Filling a laboratory-supplied water sample bottle from a Niskin bottle

Photo credit: Coffey

Plate 2.2
Retrieving the Petit Ponar Grab Sampler

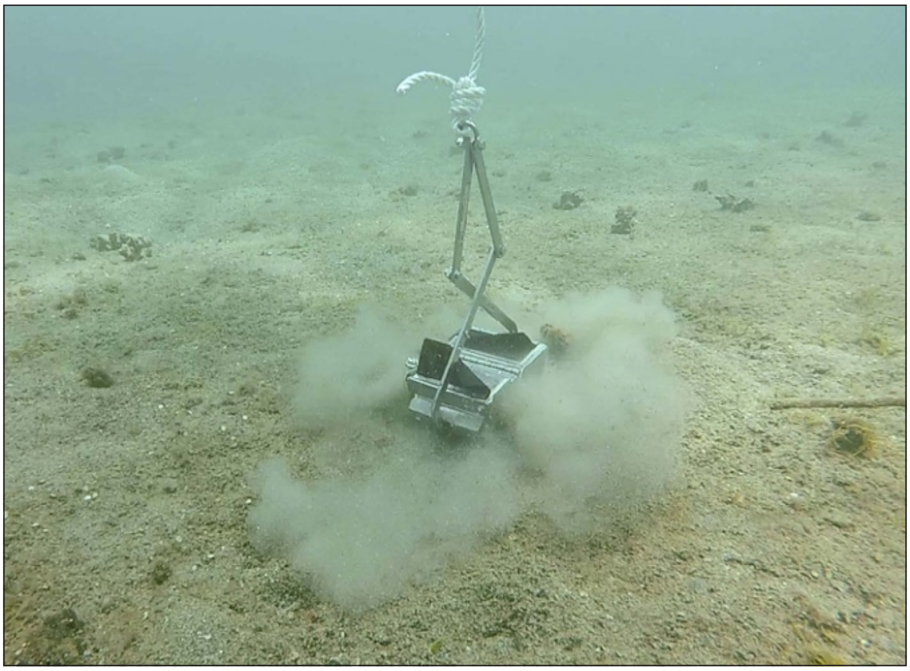


Photo credit: Coffey

Plate 2.3
Petit Ponar Grab Sampler capturing sample at site S2 near Salamaua

2.4.2. Infauna sampling and analysis procedures

Samples of meiobenthos and macrobenthos were collected from sediments on 26 and 27 February 2017 from eight sites (see Table 2.1), in addition to the sediment sampling. Meiofauna are multicellular animals that include those retained on 63 µm mesh and pass through 500 µm mesh. However, traditionally all nematodes and harpacticoid copepods in meiofauna samples are also counted and these can be greater than 500 µm. Macrofauna is defined as multicellular animals that are retained on a 500 µm sieve.

The Petite Ponar grab sampler was used to obtain the sediment samples. The meiobenthos subsamples were taken directly from the sediment sample using a 50 mL syringe with the tapered tip removed, to enable the entire diameter of barrel (approximately 2.5 cm) to be inserted into the flocculent layer[2]. The plunger was drawn back progressively during insertion into the (usually about 2 cm thick) layer of overlying seawater to collect a sample from within the top 3 cm of the sediment. Due to the highly liquid content of the samples, the open end of the barrel was briskly stoppered using a strip of plastic as the syringe was removed from the sediment to minimise loss of sample. Three subsamples were combined as a composite in a ziplock bag and preserved with 10% formaldehyde.

Macrobenthos samples were collected by transferring the sediment sample into a 0.5 mm, or less frequently a 1 mm, sieve. Sieve size was chosen depending on the sediment type, with the 1 mm sieve only used for samples with larger sediments such as site V1. The samples were not sieved extensively in the field, and in practice this process primarily served to remove only the liquid or suspended silty component of the sample. Only conspicuous or large pieces of organic matter or debris were removed from the samples in order to minimise the loss of benthos. Even for samples taken at sites with an observably high fine sediment / silt content (such as M1) a very small amount of sediment was observed to pass through the sieve, due to the particle size, organic matter and viscosity of the sampled benthic material. This typically resulted in much of each macrobenthos sample being retained for preservation and analysis. Samples were transferred into a ziplock bag and preserved with 10% formaldehyde.

Infauna samples were analysed for abundance and diversity by Dr John Moverley (see Appendix D for further detail on laboratory methods for infauna analysis). All samples were initially washed with water and sieved using a 0.5 mm sieve. Macrofauna samples were processed following methods outlined by the UK Centre for Environment Fisheries and Aquaculture Science, Clean Seas Environment Monitoring Programme Green Book (CEFAS, 2010). Larger animals were picked out by eye and smaller animals were sorted under a dissecting microscope. Meiofauna were extracted using the flotation techniques described in Somerfield and Warwick (1996). Meiofauna samples were analysed under a microscope after being transferred onto microscopic slides. The animals were counted with the assistance of scanning by a compound microscope.

2.5. Sample storage and transportation

Water and sediment samples were immediately stored in eskies with freezer bricks while on the vessel. At the end of each day the samples were transferred to a refrigerator. All sample bottles and sample bags were stored upright (without any stacking) in a plastic bag for each suite of bottles for each site. For transport to the laboratory the samples were placed in eskies with freezer bricks.

Water and sediment samples collected in November 2016 were dispatched to the analytical laboratory (ALS Laboratories, Brisbane) in two batches, in order to reduce holding times. The batches were sent on 17 and 19 November 2016 and received by the laboratory on 21 and 23 November 2016, respectively. Water and sediment samples collected in February 2017 were sent from Lae on

[2] The flocculent layer represents material collected on and within the seafloor closest to the sediment-water interface.

1 March 2017 and received by the laboratory on 6 March 2017. Following collection and preservation in formalin, meiobenthos and macrobenthos samples were stored in eskies in the cold storage at the 11 Mile WGJV camp, and shipped on 13 April 2017 to the laboratory of Dr John Moverley in Victoria Australia for taxonomic analysis. The infauna samples arrived at the laboratory on 2 May 2017.

2.6. Laboratory analysis

ALS Laboratories, Brisbane, conducted the analysis of water and sediment samples. The exception was the faecal coliforms bacteria analysis that was subcontracted to DTS Food Laboratories, Brisbane (November 2016 samples only; the February 2017 faecal coliforms were analysed by ALS Laboratories).

Both of these laboratories are accredited by NATA (National Association of Testing Authorities, Australia).

Appendix B outlines each of the laboratory analytical procedures.

The parameters analysed for water quality were:

- Total and dissolved metals (ultra trace level).
- Major ions.
- Faecal coliforms.
- Total suspended solids.
- Nutrients (including ammonia, nitrate, nitrite, phosphorus and nitrogen).
- Oil and grease.

The parameters analysed for sediment quality were:

- Particle size distribution.
- Total and weak acid (1 M HCl) dissociable metals (by standardised particle size fractions: less than 2,000 µm and less than 63 µm size fractions).
- Nutrients (including total nitrogen and total phosphorus).
- Carbon content (organic, inorganic and total).

Taxonomic identification of infauna was conducted. Methods employed for the extraction and processing of the macrobenthos and meiobenthos samples are described in Appendix D.

2.7. Quality control

Quality control measures were implemented in the field and in the laboratory. These measures included:

- Field duplicate sample collection – where a sample was taken at the same site in succession of the original sample. This was performed to check the precision of both the sampling technique and lab analysis technique. Field duplicate sample collection was performed for water and sediment at one site in 2016 (site V1) and at two sites in 2017 (site V1 for water and site S2 for sediment).
- Field blank sample collection – where a suite of sample bottles replicating the different analyses was filled with de-ionised water under sampling conditions. This was performed to check for the presence of contamination. Field blank sample collection was performed at site V1 in November 2016 and B1 in February 2017. This included filling the bottles directly with blank water and in the case of dissolved metals, involved filtering the blank water into the bottle – in the same way dissolved metals samples are collected.

- Laboratory duplicates – where analysis of a sample was repeated to check for analytical precision.
- Laboratory spikes – where analysis of a sample was conducted with a known concentration of analyte added. This is performed in order to check the effect of sample matrix interference on the analysis result (matrix spike). This is also performed for diluted samples with no matrix interference where the sample is spiked with known amounts of certified reference materials to check for analytical accuracy and precision (laboratory control spike).
- Laboratory blanks – where de-ionised water was analysed to check for the presence of laboratory contamination.

Appendix B provides further detail on the laboratory quality control methods.

The water quality meter was calibrated prior to use. Spot checks of the water quality calibration were then performed on a daily basis. On 17 November 2016, a pH calibration was performed. No other parameters required calibration during the surveys. During the February 2017 survey, meter calibration was checked daily but no calibration was needed.

2.8. Visual assessment

2.8.1. Visual assessment of foreshore and shallow pelagic environment

A qualitative description was made of the features observed in the study area in November 2016, with photographs and videos taken for visual characterisation and record keeping. The visual assessment was conducted mainly from the vessel but also while onshore at Labu and Wagang villages.

No video footage was collected during the February 2017 survey; however photographs were taken from the vessel at most sites.

2.8.2. Visual assessment of benthic features

Video tows were conducted in November 2016 using a GoPro camera in an underwater housing (rated to 60 m) and colour CCD camera with white LED lights, mounted on a steel frame (Plate 2.4). The camera was lowered using a rope to within approximately one metre of the seabed and the vessel then moved in a straight line, typically parallel to the shoreline, while the camera was recording. A live feed of the footage was observed using an LCD monitor onboard the boat (Plate 2.5) so that the orientation of the camera and depth above the seabed could be manually adjusted if necessary. The intent of the study was to identify and describe the types and extent of broad habitat zones in the study area, and record the general features and representativeness of the benthic habitats in those zones. It did not represent a standardised sampling program involving collection of imagery suitable to provide quantitative data, i.e., from transects at pre-determined locations and of pre-determined size, suitable for repeat monitoring using established benthic classification categories such as per cent cover of different habitat types.

Video footage was reviewed and stored on a hard-drive along with the time, date and site reference information. The GPS tracks of video tows were recorded using a hand-held GIS loaded with Avenza Maps software. Due to the low water visibility near Lae and near the Outfall Area, the survey team was not able to obtain useful footage in these areas (primarily highly turbid water was discernible from video records) and no benthic features were able to be identified. For this reason, the team added an extra day (25 November 2016) to conduct underwater video deployments further afield (sites DV1, DV2, DV3, DV4, DV5, DV7 and DV8 in Figure 1.1) in an attempt to determine where water clarity was sufficient for adequately viewing the benthic environment.

2.8.3. Stakeholder Consultation

During November 2016, Coffey interviewed local stakeholders regarding marine resource use (as part of a separate fisheries and marine resource use study). These interviews were conducted in collaboration with the WGJV Community Affairs team. They included discussion of resources used by local people in the nearshore marine environment.

The interviews were conducted on an opportunistic basis and included questionnaires with local fishers at the DCA Point fish market in Lae (Plate 2.6 and Plate 2.7), and with village councillors or individuals identified as representative of the local community during meetings at Labu and Wagang. Interviews were also conducted with the Lae Game Fishing Club and members of Morobe Fisheries Management Authority and the National Fisheries Authority based in Lae.

This consultation is further described in EnviroGulf (2017).

2.9. Desktop review

To support the study, a desktop review of existing information was conducted. The key sources of information include:

- WorleyParsons (2016) Wafi-Golpu Project Nearshore Marine Ecology Assessment.
- PNG Ports Corporation (2007) Summary Environmental Impact Assessment - Papua New Guinea: Lae Port Development Project.
- Kinch (2006) Socio-economic Assessment Study for the Huon Coast.

Photo credit: Coffey

Plate 2.4
The underwater video system

Photo credit: Coffey

Plate 2.5
LCD monitor used for real-time observation of underwater camera footage

Photo credit: Coffey

Plate 2.6
Boat access to DCA point where fishers offload catch

Photo credit: Coffey

Plate 2.7
Fish being sold at DCA Point

3. Results

3.1. Water quality

This section presents the water quality results from the in situ measurements and laboratory analysis of nearshore waters within the Huon Gulf.

3.1.1. In-situ parameters and suspended solids

Table 3.1 presents the results of the in situ measurements from November 2016. Table 3.2 and Table 3.3 present the in situ measurements from February 2017, in which measurements were taken at 1.5 m and 10 m depths, respectively. For comparative purposes, laboratory measured total suspended solids (TSS) are presented alongside turbidity results in the tables.

Water quality results are compared to the PNG Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 – Water Quality Criteria for Aquatic Life Protection (Seawater). The criteria, under the PNG *Environment Act 2000*, are legally enforceable water quality criteria in Papua New Guinea.

To support the characterisation, water quality results are also compared, where relevant, to guidelines recommended in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000). These guidelines are the default trigger values outlined for marine ecosystem protection (slightly-to-moderately disturbed aquatic ecosystems). Comparison to these guidelines allows further understanding of the existing water quality of nearshore waters within the Huon Gulf given that some PNG criteria for aquatic ecosystem protection are less stringent than the guidelines in ANZECC/ARMCANZ (2000).

Table 3.1: In situ measurements results from November 2016 (at 1.5 m depth)

	PNG Criteria[a]	R1	R2	L1	L3	L4	M1	M2	V1	LA1	W1	W2	B1	S1	Busama
Temp (ºC)	no change > 2°C	32.5	30.8	31.8	29.9	30.6	28.8	28.5	30.1	30.1	29.8	29.8	29.2	29.7	30.4
pH	no change	8.1	8.1	8.1	7.4	8.1	7.9	7.9	7.9	7.9	8.1	8.1	8.1	8.1	8
Cond. (mS/cm)	-	47.8	41	42.9	13.2	40.5	39.1	35.3	47.7	39	35	35.6	28.2	48.6	44.8
Salinity (ppt)	-	26.8	23.2	24.8	6.7	23	22.7	20.4	27.9	22.5	19.6	20.5	16.7	28.4	28.9
DO (mg/L)	>5	6.6	7	6.9	5.1	6.6	6.7	7	6.7	6.7	7.1	7.1	7.3	6.7	6.8
DO (% sat)[b]	-	105	106	105	71	99	97	100	103	99	105	105	108	103	106
Turb. (NTU)	no change > 25 NTU	1.2	9.6	25.6	3.5	45.1	10	525	10.1	11.7	6.4	10.6	305	<1	<1
TSS (mg/L)	-	5	14	15	4	36	157	1,300	<5	<5	6	9	546	<5	n/a

- denotes no applicable criteria. n/a denotes not analysed.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection (PNG, 2002).
b Note that dissolved oxygen readings of more than 100% saturation are not necessarily erroneous. This is likely because the oxygen saturation calibration is done in moist air (which contains 21% oxygen) and in waters this concentration can be exceeded due to both air bubbles and dissolved oxygen produced from sources such as photosynthesis. It could also be explained by waters which are supersaturated in oxygen with respect to their temperature.

Table 3.2: In situ measurements results from February 2017 (at 1.5 m depth)

	PNG Criteria	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Temp (ºC)	no change > 2°C	30.8	31.7	31.2	31.4	31.5	29.7	30.9	30.7	30.8	30.7	31
pH	no change	8.5	8.4	8.4	8.4	8.45	8.3	8.5	8.5	8.5	8.4	8.5
Cond. (mS/cm)	-	44.9	51.2	50.9	50.3	49.2	39.9	50.5	50	50.1	49.8	51.1
Salinity (ppt)	-	28.9	29.4	29.2	25.4	28.0	6.0	29.2	29.0	29.0	28.7	29.8
DO (mg/L)	>5	6.6	6.5	6.5	6.3	6.5	6.9	6.6	6.6	6.6	6.6	6.5
DO (% sat)[b]	-	103	104	103	100	103	99	103	103	104	103	103
Turb. (NTU)	no change > 25 NTU	1.1	3.2	11.2	2.7	2.2	420	1.4	0.1	0.1	1.9	0.2
TSS (mg/L)	-	6	5	15	9	8	2,620	7	7	7	66	2

- denotes no applicable criteria. n/a denotes not analysed.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection (PNG, 2002).
b Note that dissolved oxygen readings of more than 100% saturation are not necessarily erroneous. This is likely because the oxygen saturation calibration is done in moist air (which contains 21% oxygen) and in waters this concentration can be exceeded due to both air bubbles and dissolved oxygen produced from sources such as photosynthesis. It could also be explained by waters which are supersaturated in oxygen with respect to their temperature.

Table 3.3: In situ measurements results from February 2017 (at 10 m depth)

	PNG Criteria	LA1-10	LA2-10	LA3-10	LA4-10	LA5-10	M1-10	V1-10	W1-10	W2-10	B1-10
Temp (ºC)	no change > 2°C	30.9	31.2	31	30.9	30.8	30.9	30.8	30.9	31.1	31.1
pH	no change	8.5	8.4	8.4	8.4	8.5	8.4	8.5	8.5	8.5	8.5
Cond. (mS/cm)	-	53.7	51.7	52.9	53.2	52.9	50.1	54.4	53.8	52.7	51.6
Salinity (ppt)	-	30.2	29.5	30.7	31.0	30.7	29.5	31.9	31.4	30.5	29.0
DO (mg/L)	>5	6.4	6.4	6.6	6.2	6.3	6.4	6.5	6.6	6.6	6.6
DO (% sat)[b]	-	102	102	105	99	100	102	104	105	104	105
Turb. (NTU)	no change > 25 NTU	0.6	3.8	2.7	2.3	1	322	0.6	0.2	0.1	2.2
TSS (mg/L)	-	6	10	21	5	4	541	<1	4	2	8

- denotes no applicable criteria. n/a denotes not analysed.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection (PNG, 2002).
b Note that dissolved oxygen readings of more than 100% saturation are not necessarily erroneous. This is likely because the oxygen saturation calibration is done in moist air (which contains 21% oxygen) and in waters this concentration can be exceeded due to both air bubbles and dissolved oxygen produced from sources such as photosynthesis. It could also be explained by waters which are supersaturated in oxygen with respect to their temperature.

November 2016 results

Table 3.1 shows that in November 2016 the sites within the main plumes of the Markham and Busu rivers, M2 and B1, were unsurprisingly the most turbid (525 and 305 NTU, respectively). Correspondingly, these two sites had the greatest total suspended solids (TSS) concentrations (1,300 and 546 mg/L, respectively). Site M1 was situated just outside the main turbidity plume of the Markham River and had the third highest TSS concentration of 157 mg/L. Sites well removed from riverine sediment influence (R1, S1 and Busama) had turbidity of less than 2 NTU and TSS at or below the detection limit.

Sites within the Markham River freshwater plume around Lae (sites M1, M2, V1 and LA1) had slightly lower pH (between 0.1 to 0.2 units lower) compared to seawater control sites (R1, R2, S1 and Busama) suggesting the influence of freshwater from the Markham River. In fact, all sites showed varying degrees of freshwater influence having salinities below 30 ppt, which is below the range of 30 to 40 ppt expected for typical marine waters (ANZECC/ARMCANZ, 2000). With the exception of site V1, the sites within the Markham River influence also had lower conductivity and salinity than the seawater control sites and this is also indicative of freshwater influence. The site within the Labu Lakes (L3) was brackish with a pH of 7.4, salinity of 6.7 ppt and conductivity of 13.2 mS/cm.

Dissolved oxygen concentrations were consistent across all sites being between 6.6 to 7.3 mg/L and being either close to complete saturation or supersaturated (>100% saturated). The exception was the site in Labu Lakes (L3), which had dissolved oxygen concentration of 5.1 mg/L (71% saturation). All dissolved oxygen concentrations were above the minimum of 5 mg/L outlined in the PNG Environment (Water Quality Criteria) Regulation 2002 – Schedule 1.

Temperature was similar between all sites, ranging from 28.5°C to 32.5°C.

February 2017 results

Table 3.2 shows turbidity in February 2017 to be generally lower than that observed in November 2016. The maximum turbidity was 420 NTU at site M1 (within the Markham River turbidity plume) with the next highest being 11.2 NTU at site LA3 near the Lae Port. However, these two sites had the greatest TSS concentrations (2,620 mg/L and 15 mg/L for M1 and LA3, respectively). In November 2016, turbidity was 10 NTU or greater at eight sites and TSS was greater than 10 mg/L at six sites. However, in February 2017 only two sites had turbidity greater than 10 NTU and three sites had turbidity greater than 10 mg/L.

The greatest variation between 2016 and 2017 was the turbidity and TSS at site B1 adjacent to the Busu River mouth. In November 2016, this site had turbidity of 305 NTU and TSS of 546 mg/L; whereas in February 2017 turbidity was 1.9 NTU and TSS concentration was 66 mg/L. Site M1 also showed high variability between sampling events having turbidity and TSS (10 NTU and 420 mg/L TSS) much lower in November 2016 than in February 2017 (157 NTU and 2,260 mg/L).

The pH at all sites in February 2017 ranged from 8.3 to 8.5, which is in contrast to the lower pH observed in November 2016. The pH in 2016 ranged from 7.9 to 8.1 (excluding L3 in the Labu Lakes, which is not a marine water site).

Salinity and conductivity reflect freshwater influence and were also higher in February 2017 than in November 2016. With the exception of site M1 within the Markham River plume and near the river mouth (which had a salinity of 6 ppt and conductivity of 39 mS/cm), salinity ranged from 25.4 ppt to 29.8 ppt and conductivity from 44.9 mS/cm to 51.2 mS/cm. In November 2016, salinity ranged from 16.7 to 28.9 ppt (with most readings being below 23 ppt) and conductivity ranged from 28.2 mS/cm to 48.6 mS/cm (with most sites being below 43 mS/cm).

Temperature and dissolved oxygen were generally consistent between 2016 and 2017.

Comparison of different depths, 1.5 m and 10 m

The results from in situ readings taken at two different depths in the water column during February 2017: 1.5 m and 10 m (i.e., a comparison of Table 3.2 and Table 3.3) indicate some differences between the surface plumes and the underlying, more saline marine waters.

The results show that for sites where surface turbidity was low (less than 4 NTU; sites LA1, LA2, LA4, LA5, B1, W1, W2 and V1) there was little variation in turbidity (i.e., within about 1 NTU) between 1.5 and 10 m. For the more turbid sites, LA3 and M1, there was a distinct decrease in turbidity at 10 m depth. At site LA3, turbidity was 11.2 NTU at 1.5 m and 2.7 NTU at 10 m. At site M1, turbidity was 420 NTU at 1.5 m and 322 NTU at 10 m. The same trend was apparent for TSS results, where only the most turbid sites, M1 and B1, showed a notable difference between 1.5 m and 10 m depth. The TSS concentrations at M1 were 2,620 mg/L at 1.5 m and 541 mg/L at 10 m depth. The TSS concentrations at B1 were 66 mg/L at 1.5 m and 8 mg/L.

An increase in conductivity and salinity from 1.5 m to 10 m depth was observed at all sites. Conductivity typically increased by 1 to 3 mS/cm at 10 m depth. Salinity typically increased by 1 to 2 ppt at 10 m depth. Site LA4 showed an increase in salinity of 5.5 ppt over this depth range. Site M1 showed the greatest increase in conductivity and salinity over the depth range with conductivity of 35.8 mS/cm measured at 1.5 m and 45.8 mS/cm at 10 m; and salinity of 6.0 ppt at 1.5 m and 29.5 ppt at 10 m. These results suggest that the depth of the surface plume of freshwater at site M1 near the Markham River mouth varied between 1.5 and 10 m, with seawater always below 1.5 m depth.

Temperature, dissolved oxygen and pH were consistent across the two depths at each of the sites.

3.1.2. Nutrients, faecal coliforms and oil and grease

November 2016 results

Table 3.4 presents the November 2016 nutrients, faecal coliforms and oil and grease results.

Table 3.4 shows that concentrations of nutrients (ammonia, nitrate, nitrite, nitrogen and phosphorus) were generally low and close to or below detection limits. Total phosphorus was highest at the most turbid sites in the Markham River plume (M2) and Busu River plume (B1). Concentrations of ammonia at all sites were below the ANZECC/ARMCANZ (2000) guideline of 0.91 mg/L. Concentrations of inorganic nitrogen (nitrite plus nitrate) were well below the PNG criterion of 45 mg/L at all sites.

Faecal coliforms were detected at most sites. The exceptions were the sites furthest from Lae (R1, R2 and S1), where faecal coliforms were not detected. There are no PNG criteria or ANZECC/ARMCANZ guidelines for faecal coliforms in marine waters. As the laboratory used two methods for faecal coliforms analysis it is difficult to make meaningful comparisons across sites. However, it does show that the presence of faecal coliforms is widespread with the nearshore marine waters around Labu, Lae, Wagang and Busu containing faecal coliform bacteria. The highest counts were recorded at sites M1, V1 and LA1.

Oil and grease was below detection limits at most sites. The exceptions were at the sites around Labu (L1, L3 and L4) and at the Busu River mouth (B1) where low concentrations of 7 mg/L, 6 mg/L, 8 mg/L and 8 mg/L respectively, were measured. These concentrations for these four samples were marginally over the detection limit of 5 mg/L. The PNG criteria for aquatic life protection stipulates no oil and grease to be present in marine waters.

February 2017 results

Table 3.5 shows that concentrations of nutrients (ammonia, nitrate, nitrite, nitrogen and phosphorus), were generally close to or below detection limits, as they were in November 2016. The exceptions were the ammonia concentrations at site W1 (0.47 mg/L) and S2 (0.45 mg/L), which were noticeably higher than in November 2017; although still below the ANZECC/ARMCANZ (2000) guideline.

Faecal coliforms were detected at all sites around Lae (LA1, LA2, LA3, LA4, LA5, M1 and V1) and Wagang (W1, W2 and B1) in February 2017. Faecal coliforms were also detected at the sites near Lae and Wagang in November 2016.

While low concentrations of oil and grease were detected at L1, L3, L4 and B1 in 2016, oil and grease concentrations were below detection limits at all sites in 2017. Sites L1, L3 and L4 were not sampled in 2017 so temporal comparisons cannot be made for those sites.

Comparison of 1.5 m and 10 m depth samples

Between 1.5 m (Table 3.5) and 10 m depth (Table 3.6) there was little variation in nutrients concentrations. The notable exception to this was the elevated ammonia concentration observed at W1 (0.47 mg/L) at 1.5 m depth, which was higher than the concentration at 10 m depth (0.09 mg/L). Site S2 could not be sampled to 10 m depth as the seafloor is shallower than 10 m at this site.

Faecal coliforms concentrations were highly variable between the two depths, with concentrations decreasing with depth at sites LA1, M1, V1, W1, W2 and B1 and increasing with depth at sites LA2, LA3, LA4 and LA5. Site M1 had by far the greatest faecal coliforms concentrations at 1.5 m (4,000 colony forming units (cfu)/100 mL) and at 10 m (1,200 cfu/100 mL).

There was no change in oil and grease concentrations with depth.

Table 3.4: Nutrients, faecal coliforms and oil and grease (November 2016 at 1.5 m depth)

Analyte	**PNG criteria[a]**	**ANZECC 2000[b]**	**R1**	**R2**	**L1**	**L3**	**L4**	**M1**	**M2**	**V1**	**LA1[e]**	**W1**	**W2**	**B1**	**S1**
Ammonia	-	0.91	0.06	0.05	0.06	0.06	<0.01	0.05	0.05	0.06	0.03	0.03	0.03	0.08	0.09
Nitrite	-	-	<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
Nitrate	-	-	<0.01	0.02	<0.01	<0.01	<0.01	0.02	0.03	0.02	<0.01	0.01	0.01	<0.01	<0.01
Nitrate + nitrite	45	-	<0.01	0.02	0.04	<0.01	<0.01	0.02	0.03	0.02	<0.01	0.01	0.01	<0.01	<0.01
Total nitrogen	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total phosphorus	-	-	0.10	0.13	<0.05	<0.05	0.08	0.10	0.74	<0.05	<0.05	0.07	0.13	0.45	<0.05
Reactive phosphorus	-	-	<0.01	<0.01	0.02	0.03	0.02	0.03	0.02	0.02	<0.01	0.02	0.01	0.10	<0.01
Faecal coliforms (MPN/100 mL)[c] (cfu/100 mL)[d]	-	-	<1[d]	<1[d]	>80[d]	11[d]	>80[d]	920[c]	79[c]	920[c]	540[c]	23[d]	>80[d]	>80[d]	<2[c]
Oil and grease	None to be present	-	<5	<5	**7**	**6**	**8**	<5	<5	<5	<5	<5	<5	**8**	<5

All units are in mg/L unless otherwise noted.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection (PNG, 2002).
b Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).
c Result is for faecal coliforms measured as most probable number (MPN) per 100 mL. This a statistical estimate of the number of faecal coliform bacteria organisms in 100 mL of sample. The lab erroneously measured the faecal coliforms in this unit for the second batch of samples.
d Result is for faecal coliforms measured as cfu per 100 mL. This method involves counting the colonies (groups of cells growing together) of faecal coliform bacteria.
e Site LA1 is labelled 'L1' in the raw laboratory results (dated 19/11/16) in Appendix A- Laboratory Analytical Results.

Table 3.5: Nutrients, faecal coliforms and oil and grease (February 2017 at 1.5 m depth)

Analyte	PNG criteria[a]	ANZECC 2000[b]	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Ammonia	-	0.91	0.07	0.03	0.06	0.10	0.06	0.05	0.15	0.47	0.05	0.05	0.45
Nitrite	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.08
Nitrate + nitrite	45	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.08
Total nitrogen	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	<0.5	<0.5
Total phosphorus	-	-	0.12	0.08	0.06	<0.05	<0.05	1.37	<0.05	0.08	<0.05	0.06	<0.05
Reactive phosphorus	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01
Faecal coliforms (cfu/100 mL)	-	-	110	7	35	20	21	4,000	120	120	120	20	0
Oil and grease	None to be present	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

All units are in mg/L unless otherwise noted.
- denotes no applicable guideline.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection (PNG, 2002).
b Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).

Table 3.6: Nutrients, faecal coliforms and oil and grease (February 2017 at 10 m depth)

Analyte	PNG criteria[a]	ANZECC 2000[b]	LA1-10	LA2-10	LA3-10	LA4-10	LA5-10	M1-10	V1-10	W1-10	W2-10	B1-10
Ammonia	-	0.91	0.11	0.15	0.11	0.13	0.06	0.09	0.11	0.09	0.12	0.12
Nitrite	-	-	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate	-	-	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate + nitrite	45	-	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total nitrogen	-	-	<0.5	<0.5	0.03	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
Total phosphorus	-	-	0.06	0.12	0.11	<0.05	0.06	0.74	<0.05	<0.05	0.08	<0.05
Reactive phosphorus	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
Faecal coliforms (cfu/100 mL)	-	-	43	22	75	95	46	1,200	55	20	24	7
Oil and grease	None to be present	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

All units are in mg/L unless otherwise noted.
- denotes no applicable guideline.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection (PNG, 2002).
b Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).

3.1.3. Dissolved metals

Table 3.7 presents the November 2016 dissolved metals results. Table 3.8 and Table 3.9 present the February 2017 dissolved metals results from 1.5 m and 10 m depths respectively. For simplicity, the metalloids arsenic and boron are included with the metals results.

Where results exceed PNG water quality criteria they are shown in bold. Where results exceed ANZECC/ARMCANZ (2000) guidelines they are shown in grey highlight.

Table 3.7: Dissolved metals results (November 2016 at 1.5 m depth)

Metal	PNG criteria[a]	ANZECC 2000[b]	R1	R2	L1	L3	L4	M1	M2	V1	LA1[d]	W1	W2	B1	S1
Aluminium	-	-	<5	<5	<5	<5	<5	16	21	71	18	5	5	14	10
Arsenic	50	-	1.2	1.2	2.2	0.8	1.2	1.8	2.4	1.5	1.4	1.2	1.3	1.4	1.2
Barium	1,000	-	12	25	28	19	20	31	43	25	17	31	31	28	9
Boron	2,000	-	**3,580**	**3,030**	**2,160**	1,310	1,660	**2,230**	**2,560**	**2,540**	**3,380**	**2,500**	**2,600**	**3,380**	**3,850**
Cadmium	1	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1
Chromium	10	27.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	LOD[c]	1	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2
Copper	30	1.3	<1	<1	1	<1	<1	1	1	2	<1	1	<1	1	<1
Iron	1,000	-	<5	<5	<5	42	49	<5	<5	21	<5	<5	<5	<5	<5
Lead	4	4.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	2,000	-	4	8.5	10.2	40.9	53.2	1.5	7.0	10.8	4.8	13.2	11.8	16.4	1.3
Mercury	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1,000	7	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	0.7	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	10	-	<2	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2	<2
Silver	5	1.4	<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
Tin	500	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Zinc	5,000	15	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Note: All units are in µg/L.
Note: Exceedance of PNG criteria is shown in bold. Exceedance of ANZECC/ARMCANZ (2000) guidelines are shown in grey highlight.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection.
b Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).
c PNG criterion for cobalt is the laboratory limit of detectability (LOD).
d Site LA1 is labelled 'L1' in the raw laboratory results (dated 19/11/16) in Appendix A - Laboratory Analytical Results.

Table 3.8: Dissolved metals results (February 2017 at 1.5 m depth)

Metal	PNG criteria[a]	ANZECC 2000[b]	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Aluminium	-	-	8	9	12	16	14	10	14	11	13	9	<5
Arsenic	50	-	1.3	1.4	1.6	1.4	1.5	4.1	1.4	1.4	1.4	1.3	1.5
Barium	1,000	-	8	8	8	11	10	26.1	9	11	12	7	4
Boron	2,000	-	**3,930**	**3,970**	**3,940**	**3,730**	**3,860**	276	**3,910**	**3,830**	**3,920**	**3,850**	**4,150**
Cadmium	1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	10	27.4	<0.5	<0.5	<0.5	<0.5	<0.5	0.2	<0.5	<0.5	<0.5	0.6	<0.5
Cobalt	LOD[c]	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	30	1.3	<1	<1	<1	<1	<1	1.9	<1	<1	<1	<1	<1
Iron	1,000	-	23	<5	<5	<5	<5	10	<5	<5	<5	<5	<5
Lead	4	4.4	<0.2	<0.2	<0.2	<0.2	0.4	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	2,000	-	5.5	3.3	2.8	7.0	3.1	0.8	7.6	6.6	7.2	21.2	<0.5
Mercury	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1,000	7	<0.5	1.6	2.3	1.4	0.5	0.8	0.6	<0.5	<0.5	<0.5	<0.5
Selenium	10	-	4	4	5	5	7	0.9	5	4	4	5	7
Silver	5	1.4	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	500	-	<5	<5	<5	<5	<5	<0.2	<5	<5	<5	<5	<5
Zinc	5,000	15	<5	<5	<5	<5	<5	<1	<5	<5	<5	<5	<5

Note: All units are in µg/L.
Note: Exceedance of PNG criteria is shown in bold. Exceedance of ANZECC/ARMCANZ (2000) guidelines are shown in grey highlight.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection.
b Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).
c PNG criterion for cobalt is the laboratory limit of detectability (LOD).

Table 3.9: Dissolved metals results (February 2017 at 10 m depth)

Metal	PNG criteria[a]	ANZECC 2000[b]	LA1-10	LA2-10	LA3-10	LA4-10	LA5-10	M1-10	V1-10	W1-10	W2-10	B1-10
Aluminium	-	-	12	10	8	17	17	29	13	6	7	<5
Arsenic	50	-	1.5	1.4	1.4	1.3	1.4	2.0	1.6	1.5	1.5	1.4
Barium	1,000	-	8	7	6	15	13	36	9	5	6	6
Boron	2,000	-	**4,360**	**4,220**	**4,220**	**4,330**	**4,270**	**4,090**	**4,410**	**4,330**	**4,320**	**4,340**
Cadmium	1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	10	27.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	LOD[c]	1	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2
Copper	30	1.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Iron	1,000	-	<5	<5	<5	<5	<5	5	<5	<5	<5	<5
Lead	4	4.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	2,000	-	2.7	3.9	1.7	1.7	9.9	14.3	2.3	0.6	0.9	<0.5
Mercury	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	1,000	7	<0.5	0.5	<0.5	0.6	0.6	0.8	<0.5	<0.5	<0.5	<0.5
Selenium	10	-	7	7	7	8	8	7	6	7	7	7
Silver	5	1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	500	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Zinc	5,000	15	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5

Note: All units are in µg/L.
Note: Exceedance of PNG criteria is shown in bold. Exceedance of ANZECC/ARMCANZ (2000) guidelines are shown in grey highlight.
a Source: Environment (Water Quality Criteria) Regulation 2002 – Schedule 1 Water Quality Criteria for Aquatic Life Protection.
b Source: Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000).
c PNG criterion for cobalt is the laboratory limit of detectability (LOD).

November 2016 results

Table 3.7 shows that all dissolved metals concentrations were below PNG water quality criteria except boron, which exceeded the criterion of 2,000 µg/L at all sites except L3 and L4. However, these concentrations are lower than typical boron seawater concentrations (between 4,500 to 5,100 µg/L) described in the literature (Emsley, 1991 and ANZECC/ARMANZ, 2000). All dissolved metals concentrations were also below ANZECC/ARMCANZ (2000) guidelines with the exception of a slight exceedance for copper at site V1, where 2 µg/L of copper was detected compared to the ANZECC/ARMCANZ guideline of 1.3 µg/L. Most metals (cadmium, chromium, cobalt, lead, mercury, selenium, silver, tin and zinc) concentrations were at or below laboratory limits of detection.

February 2017 results

Table 3.8 shows that all dissolved metals concentrations were below PNG water quality criteria other than boron, which exceeded the criterion of 2,000 µg/L at all sites except M1. These results were greater than the boron concentrations recorded in November 2016, again with the exception of M1, though remained lower than typical boron concentrations in seawater. All dissolved metals concentrations were also below ANZECC/ARMCANZ (2000) guidelines with the exception of a slight exceedance for copper at site M1, where 1.9 µg/L of copper was detected compared to the ANZECC/ARMCANZ guideline of 1.3 µg/L. As was the case in 2016, most dissolved metals (cadmium, chromium, cobalt, lead, mercury, silver, tin and zinc) concentrations were at, or below, laboratory limits of detection.

There were few notable differences in dissolved metals concentrations at those sites sampled in both November 2016 and February 2017. Only selenium and boron concentrations were consistently higher at sites sampled in 2017 than in 2016.

Comparison between 1.5 m and 10 m depth samples

Concentrations were generally similar between depths, with cadmium, chromium, cobalt, copper, iron, lead, mercury, silver, tin, and zinc concentrations all typically being at or below detection limits.

Differences between dissolved metals concentrations include iron at site LA1 where the 1.5 m depth sample (23 µg/L) was higher than the 10 m sample (less than 5 µg/L). Selenium concentrations were generally two to three micrograms per litre higher in 10 m samples at all sites, except for M1, where the 1.5 m sample was 0.9 µg/L compared with 7 µg/L recorded for the 10 m sample. Barium and boron concentrations were also generally higher in all 10 m samples compared with those taken at 1.5 m, while the opposite was true for concentrations of manganese. Boron concentrations in samples taken at 10 m were closer to those typical of seawater than those taken at 1.5 m.

3.2. Sediment quality

This section presents the sediment quality results in terms of physical appearance, particle size distribution, metals concentrations, and nutrients and carbon concentrations.

Plate 3.1 to Plate 3.16 show the sediments sampled from each of the sites, while Plate 3.17 and Plate 3.18 show shrimp (unidentified species) and macroalgae (*Halimeda* sp.) collected opportunistically during sediment sampling at site V1 in February 2017.

3.2.1. Particle size distribution

Table 3.10 presents the November 2016 particle size distribution results. Table 3.11 shows the February 2017 particle size distribution results. Appendix C presents the complete particle size distribution data (including graphs).

Table 3.10: Sediment classification based on particle size (data in % of total) (November 2016)

Sediment classification	Site											
	R1	**R2**	**L1**	**L3**	**L4**	**M1**	**V1**	**LA1**	**W1**	**W2**	**B1**	**S2**
Clay (<2 µm)	<1	2	<1	29	<1	23	10	1	2	18	4	1
Silt (2–60 µm)	1	3	1	64	<1	76	28	<1	3	42	5	<1
Sand (0.06-2.00 mm)	99	42	98	7	29	1	36	99	77	40	45	79
Gravel (>2 mm)	<1	53	1	<1	71	<1	26	<1	18	<1	46	20
Cobbles (> 6 cm)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 3.11: Sediment classification based on particle size (data in % of total) (February 2017)

Sediment classification	Site										
	LA1	**LA2**	**LA3**	**LA4**	**LA5**	**M1**	**V1**	**W1**	**W2**	**B1**	**S2**
Clay (<2 µm)	4	30	28	31	36	19	13	4	9	1	<1
Silt (2–60 µm)	3	57	70	67	50	51	35	3	17	3	2
Sand (0.06-2.0 mm)	93	13	2	2	14	30	28	92	69	43	79
Gravel (>2 mm)	<1	<1	<1	<1	<1	<1	24	1	5	53	19
Cobbles (> 6 cm)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 3.10 shows that most sediments were comprised predominantly of sand and silt sized particles. A high proportion of gravel was present at site L4 (Labu Lakes mouth) and at R2 (reference location at Singaua). The site near the Markham River mouth (M1) and the site within the Labu Lakes (L3) contained the greatest proportion of silts and clays. The two reference sites and the two Busu sites were characterised by a greater proportion of coarser (sand/gravel) sediment.

Table 3.11 shows that, like in November 2016, the sediments sampled in February 2017 were also generally dominated by sand and silt sized particles. The sites around Lae Port (LA3, LA4 and LA5) were dominated by clay and silts with a relatively low sand content. Of the repeated sites (i.e., M1, V1, W1, W2, B1 and S2), the particle size distributions were generally similar between the two surveys. The exceptions were: the greater sand content of 30% at M1 in 2017 compared to 1% in 2016; and the greater gravel content of 69% at W2 in 2017 compared to 40% in 2016.

3.2.2. Metals in sediments

As there are no PNG sediment quality guidelines the results are compared to international sediment quality guidelines (SQGs) (Long et al., 1995). These guidelines were developed from a North American biological effects database for sediments and are frequently used in the USA, Australia, PNG and elsewhere. These guidelines are those adopted by ANZECC/ARMCANZ (2000), which are the ‘interim sediment quality guidelines’ (ISQGs) for sediment assessment in Australia and New Zealand. The guidelines used here also incorporate the more recent revision to the guideline for silver (Simpson et al., 2013).

Photo credit: Coffey

Plate 3.1
Sediment collected from R1

Photo credit: Coffey

Plate 3.2
Sediment collected from R2

Photo credit: Coffey

Plate 3.3
Sediment collected from L1

Photo credit: Coffey

Plate 3.4
Sediment collected from L3

Photo credit: Coffey

Plate 3.5
Sediment collected from L4

Photo credit: Coffey

Plate 3.6
Sediment collected from M1


Photo credit: Coffey

Plate 3.7
Sediment collected from V1


Photo credit: Coffey

Plate 3.8
Sediment collected from LA1


Photo credit: Coffey

Plate 3.9
Sediment collected from W1

Plate 3.10
Sediment collected from W2

Plate 3.11
Sediment collected from B1

Plate 3.12
Sediment collected from S2

Photo credit: Coffey

Plate 3.13
Sediment collected from LA2

Photo credit: Coffey

Plate 3.14
Sediment collected from LA3

Photo credit: Coffey

Plate 3.15
Sediment collected from LA4

Photo credit: Coffey

Plate 3.16
Sediment collected from LA5

Photo credit: Coffey

Plate 3.17
Shrimp (species unknown) collected during sediment sampling at V1

Photo credit: Coffey

Plate 3.18
Halimeda sp. collected during sediment sampling at V1

The SQGs provide ranges of metal concentrations in sediments likely to cause adverse biological effects to benthic biota. Two values are presented — Effects Range-Low (ERL) and Effects Range-Median (ERM) — which delineate three effects ranges:

- Concentrations below the ERL represent a range where adverse biological effects are rarely observed. The ERL guideline is referred to 'ISQG-low' in the ANZECC/ARMANZ (2000) guidelines.
- Concentrations equal to or above the ERL but below the ERM represent a range where adverse biological effects are occasionally observed. The ERM guideline is referred to 'ISQG-high' in the ANZECC/ARMANZ (2000) guidelines.
- Concentrations equal to or above the ERM represent a range where adverse biological effects are frequently observed.

Data is presented for two standardised particle size fractions: a) less than 2,000 μm, which represents the whole sediment (i.e., with larger objects such as plant matter and shells removed) and b) less than 63 μm, which represents the silt content of the sediment. The results for the less than 63 μm fraction allow for a more direct comparison of metals concentrations between sites because the variability in particle size has been removed. The metals concentrations are normally highest for the silt fraction given the greater surface area for metals to bind to per unit mass of sediment.

Results for two acid digests are also presented. These are a) strong, concentrated acid digest representing the total metals concentration (Table 3.12 and Table 3.15) and b) weak acid (1 molar hydrochloric acid: '1M HCl') digest (Table 3.13 and Table 3.16). The weak acid digest more closely represents the bioavailable fraction of metals in sediment. ANZECC/ARMCANZ (2000) sediment quality guidelines recommend the weak acid digest technique as a surrogate for metal bioavailability.

All concentrations presented are in mg/kg dry weight. Exceedance of the ERL is shown in bold and exceedance of the ERM is bold and highlighted grey.

Table 3.14 and Table 3.17 present the data for the less than 63 μm fraction and include a comparison of metals concentrations between the present study and at Astrolabe Bay and Basamuk in a previous sediment sampling study (NSR, 1998). This allows for a comparison of the results of the current study in the context of findings from a similar setting in PNG, as Astrolabe Bay and Basamuk also receive drainage from the Finisterre Range. It should be noted that the sediment quality guidelines are not applicable to the <63 μm size fraction.

Table 3.12: Sediment metals concentrations (mg/kg, dry weight) – total metals in <2,000 μm fraction (November 2016)

Metal	SQGs	R1	R2	L1	L3	L4	M1	V1	LA1	W1	W2	B1	S2
Aluminium	-	16,200	36,200	13,200	31,900	25,000	37,500	38,900	29,900	34,800	40,400	34,600	6,270
Arsenic	20[a]; 70[b]	4.3	2.9	4.1	12.6	2.7	12.3	2.2	3.9	2.2	2.3	2.0	2.8
Barium	-	63.4	136	31.7	37.0	72.4	63.9	58.9	19.9	38.7	39.5	47.4	32.9
Cadmium	1.5[a]; 10[b]	<0.1	<0.1	<0.1	0.2	0.2	0.1	<0.1	0.1	<0.1	<0.1	0.2	<0.1
Chromium	80[a]; 370[b]	**114**	62.7	49.8	51.3	**95.5**	48.4	47.2	21.8	79.5	54.1	28.9	10.3
Cobalt	-	8.2	13.8	6.9	23.1	9.9	25.1	24.9	17.4	18.2	24.6	19.1	3.3
Copper	65[a]; 270[b]	17.5	52.6	16.8	**105**	40.2	**82.3**	**71.4**	56.4	59.9	**87.5**	**74.9**	6.0
Iron	-	30,000	42,500	26,500	54,300	32,200	52,700	44,100	39,100	46,100	52,300	40,200	10,100
Lead	50[a]; 220[b]	4.8	4.4	3.8	11.4	2.8	11.2	5.9	24.6	2.3	2.7	2.2	1.3
Manganese	-	357	587	321	968	622	1,180	871	910	786	920	732	141
Mercury	0.15[a]; 1[b]	<0.01	<0.01	<0.01	0.06	<0.01	0.04	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Nickel	21[a]; 52[b]	16	**24.6**	15	**48.7**	17.4	**52.9**	**50.2**	**31**	**41.6**	**57.2**	**44.4**	4.8
Zinc	200[a]; 410[b]	50.2	60.7	43	86.6	51.4	90.4	79.1	116	60.1	69.5	59.1	25.2

Note: exceedance of the ERL is shown in bold and exceedance of the ERM is shown in grey highlight.
a Effects Range-Low (ERL) sediment quality guideline: concentrations below the ERL represent a range where adverse biological effects are rarely observed.
b Effects Range-Median (ERM) sediment quality guideline: concentrations equal to or above the ERM represent a range where adverse biological effects are frequently observed.

Table 3.13: Sediment metals concentrations (mg/kg, dry weight) – bioavailable metals (1 M HCl weak acid digest) in <2,000 µm fraction (November 2016)

Metal	SQGs	R1	R2	L1	L3	L4	M1	V1	LA1	W1	W2	B1	S2
Aluminium	-	3,700	18,000	3,090	15,600	14,000	15,200	17,600	10,200	17,600	23,800	19,200	1,390
Arsenic	20[a]; 70[b]	1.24	0.83	1.65	2.21	1.07	3.30	0.82	1.32	0.7	0.8	0.68	0.8
Barium	-	27.3	64.3	13.5	26.1	44.2	26.2	24.2	5.35	19.5	24	23.9	2.31
Cadmium	1.5[a]; 10[b]	<0.05	<0.05	<0.05	0.13	0.14	0.08	0.05	0.07	<0.05	0.07	0.17	<0.05
Chromium	80[a]; 370[b]	70.6	38.5	18.5	33.7	64	6.33	8.47	2.94	35.6	17.3	14.9	2.56
Cobalt	-	3.03	6.94	2.20	10.3	4.84	8.62	10.7	3.64	6.72	11.6	7.52	0.38
Copper	65[a]; 270[b]	5.54	27.2	5.54	47.4	20.6	33.6	34.6	19.4	23.1	37.6	25.7	1.6
Iron	-	5,950	14,000	4,410	20,000	10,800	13,500	13,200	5,490	11,900	18,700	13,200	993
Lead	50[a]; 220[b]	3.76	3.16	2.76	9.48	1.97	5.66	4.97	20.4	1.41	1.79	1.27	0.90
Manganese	-	103	244	86.3	393	267	496	414	271	265	385	267	12.6
Mercury	0.15[a]; 1[b]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	21[a]; 52[b]	3.93	11.2	3.44	15.9	7.33	11.8	17	5.57	14.7	**24.5**	16.1	1.36
Zinc	200[a]; 410[b]	10.7	22.6	8.11	32.2	19	20.8	31.2	31.4	18.2	27.1	20.9	5.78

Note: exceedance of the ERL is shown in bold.
a Effects Range-Low (ERL) sediment quality guideline: concentrations below the ERL represent a range where adverse biological effects are rarely observed.
b Effects Range-Median (ERM) sediment quality guideline: concentrations equal to or above the ERM represent a range where adverse biological effects are frequently observed.

Table 3.14: Sediment metals concentrations (mg/kg, dry weight) – total metals in <63 µm fraction (November 2016)

Metal	NSR, 1998[a]	R1	R2	L1	L3	L4[b]	M1	V1	LA1[b]	W1	W2	B1	S2
Aluminium	39,000-55,000	23,400	39,200	22,200	35,400	-	37,800	43,000	-	34,400	45,100	39,800	31,600
Arsenic	6.5-7	7.6	2.9	8.2	11.1	-	12.7	2.4	-	3.6	2.8	2.4	20.2
Barium	-	47.3	173	39.6	39.8	-	66.6	65.2	-	53.8	42.4	54.4	76.1
Cadmium	0.07-0.1	1.1	0.2	<1.1	0.2	-	0.1	0.1	-	0.1	0.2	0.2	0.6
Chromium	22-100	49.1	45.2	95.7	51.8	-	52.3	66.2	-	66.2	54	45.9	68.1
Cobalt	20-26	15	24.1	15.6	22.7	-	27.3	29.7	-	27	33.8	22.3	12.8
Copper	92-129	79.7	126	81.4	101	-	86.5	95.2	-	104	111	101	194
Iron	34000-67000	45,100	52,500	67,600	62,600	-	53,500	52,800	-	59,300	60,700	56,400	36,300
Lead	<0.5-8.3	9.5	5.3	16.2	14.5	-	12	9.3	-	4.4	3	3.4	19.5
Manganese	690-770	779	1,140	704	963	-	1,230	1,020	-	1,150	1,180	809	421
Mercury	<0.05-0.04	<0.02	0.02	<0.05	0.06	-	0.04	0.02	-	0.02	0.01	0.02	0.08
Nickel	30-70	29.4	45.5	35.9	50.3	-	56.7	59.4	-	58.6	75.5	55.0	36.3
Zinc	85-110	130	162	770	88.6	-	96.1	100	-	91.4	85.4	78.8	148

Note: the sediment quality guidelines are not applicable to the <63 µm size fraction.
a Concentrations in sediments from Astrolabe Bay and near Basamuk on the north coast of the Finisterre Range in waters 70 to 200 m deep (NSR, 1998).
b Analysis of the <63 µm particle size fraction was not possible on these samples due to insufficient material of this particle size in the sample.

Table 3.15: Sediment metals concentrations (mg/kg, dry weight) – total metals in <2,000 µm fraction (February 2017)

Metal	SQGs	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Aluminium	-	29,800	39,600	38,100	39,200	40,600	5,910	39,500	41,200	32,400	33,000	35,100
Arsenic	20[a]; 70[b]	<5	9	11	10	6	<5	<5	<5	<5	<5	9
Barium	-	30	70	70	60	80	30	70	50	30	50	80
Cadmium	1.5[a]; 10[b]	<1	<1	1	1	1	<1	<1	<1	<1	<1	<1
Chromium	80[a]; 370[b]	28	50	53	58	60	16	47	24	43	15	41
Cobalt	-	18	25	26	27	26	4	24	18	21	16	22
Copper	65[a]; 270[b]	56	**95**	**95**	**99**	**105**	5	**79**	**64**	**72**	**72**	**81**
Iron	-	42,400	55,600	59,400	59,600	60,300	10,000	48,600	39,000	48,900	37,000	47,400
Lead	50[a]; 220[b]	24	22	12	12	13	<5	10	<5	<5	<5	8
Manganese	-	935	996	1,160	1,110	996	118	767	825	812	711	1,030
Mercury	0.15[a]; 1[b]	0.01	0.05	0.04	0.05	0.04	<0.01	0.02	<0.01	<0.01	<0.01	0.03
Nickel	21[a]; 52[b]	**35**	**56**	**58**	**65**	**55**	**55**	**49**	**39**	**45**	**28**	**50**
Zinc	200[a]; 410[b]	121	132	93	101	115	18	86	52	61	59	79

Note: exceedance of the ERL is shown in bold and exceedance of the ERM is shown in grey highlight.
a Effects Range-Low (ERL) sediment quality guideline: concentrations below the ERL represent a range where adverse biological effects are rarely observed.
b Effects Range-Median (ERM) sediment quality guideline: concentrations equal to or above the ERM represent a range where adverse biological effects are frequently observed.

Table 3.16: Sediment metals concentrations (mg/kg, dry weight) – bioavailable metals (1 M HCl weak acid digest) in <2,000 µm fraction (February 2017)

Metal	SQGs	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Aluminium	-	11,200	16,200	14,800	14,600	15,700	1,540	15,700	22,400	16,400	17,200	16,200
Arsenic	20[a]; 70[b]	1.6	2.8	3.2	2.2	2.0	<1.0	1.0	2.1	1.1	1.8	1.9
Barium	-	8.0	25	29	25.4	31.1	2.9	24.3	14.0	10.4	17.6	34.2
Cadmium	1.5[a]; 10[b]	<0.1	0.2	0.2	0.2	0.2	<0.1	0.2	<0.1	0.1	<0.1	0.2
Chromium	80[a]; 370[b]	3.0	7.1	6.8	6.8	9.2	3.4	6.8	3.4	4.6	2.8	5.7
Cobalt	-	3.7	8.3	8.2	8.6	8.5	<0.5	8.1	4.9	5.6	4.2	7.3
Copper	65[a]; 270[b]	16.2	38.4	35.4	43.8	49.2	1.6	31.5	19.6	20.9	18.9	32.0
Iron	-	5,560	12,300	12,100	12,300	14,000	900	10,800	7,690	8,620	6,920	10,300
Lead	50[a]; 220[b]	19.2	16.3	5.8	7.5	9.3	1.2	7.8	1.0	1.3	<1.0	4.0
Manganese	-	291	341	423	424	347	<10	267	287	252	154	408
Mercury	0.15[a]; 1[b]	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	21[a]; 52[b]	5.4	11.7	11.6	12.6	12.4	2.0	12.4	9.5	11.2	8.4	11.4
Zinc	200[a]; 410[b]	39.5	42.6	20.5	23.2	38.7	2.5	29.2	11.0	12.0	9.8	17.8

Note: exceedance of the ERL is shown in bold.
a Effects Range-Low (ERL) sediment quality guideline: concentrations below the ERL represent a range where adverse biological effects are rarely observed.
b Effects Range-Median (ERM) sediment quality guideline: concentrations equal to or above the ERM represent a range where adverse biological effects are frequently observed.

Table 3.17: Sediment metals concentrations (mg/kg, dry weight) – total metals in <63 µm fraction (February 2017)

Metal	NSR, 1998[a]	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Aluminium	39000-55000	48,700	37,100	36,300	37,900	42,600	38,400	41,200	41,900	27,100	39,400	35,600
Arsenic	6.5-7	6	9	11	9	6	15	<5	<5	<5	<5	10
Barium	-	60	70	70	60	80	80	50	50	30	60	80
Cadmium	0.07-0.1	1	1	1	1	1	1	1	1	2	1	1
Chromium	22-100	58	51	51	57	66	65	61	55	85	50	49
Cobalt	20-26	31	24	25	27	27	21	27	28	27	27	25
Copper	92-129	145	92	91	95	106	94	97	114	92	109	91
Iron	34000-67000	64,900	55,900	59,000	60,300	63,400	65,500	57,500	60,700	75,800	57,400	54,300
Lead	<0.5-8.3	38	21	10	12	14	16	15	7	<5	<5	9
Manganese	690-770	1,360	970	1,100	1,100	1,070	953	865	1,280	1,020	893	1,070
Mercury	<0.05-0.04	0.09	0.04	0.04	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.04
Nickel	30-70	76	54	56	64	61	54	58	66	53	74	56
Zinc	85-110	352	127	89	99	125	113	108	98	96	83	87

Note: the sediment quality guidelines are not applicable to the <63 µm size fraction.
a Concentrations in sediments from Astrolabe Bay and near Basamuk off the north coast of the Finisterre Range in waters 70 to 200 m deep (NSR, 1998).
b Analysis of the <63 µm particle size fraction was not possible on these samples due to insufficient material of this particle size in the sample.

November 2016 results

Table 3.12 shows that at most sites at least one metal exceeded sediment quality guidelines in the total (<2,000 µm) fraction. These were:

- R1 – chromium (114 mg/kg) exceeded the ERL.
- R2 – nickel (24.6 mg/kg) exceeded the ERL.
- L3 – copper (105 mg/kg) and nickel (48.7 mg/kg) exceeded the ERL.
- L4 – chromium (95.5 mg/kg) exceeded the ERL.
- M1 – copper (82.3 mg/kg) exceeded the ERL and nickel (52.9 mg/kg) exceeded the ERM.
- LA1 – nickel (31 mg/kg) exceeded the ERL.
- W1 – nickel (41.6 mg/kg) exceeded the ERL.
- W2 – copper (87.5 mg/kg) exceeded the ERL and nickel (57.2 mg/kg) exceeded the ERM.
- B1 – copper (74.9 mg/kg) exceeded the ERL and nickel (44.4 mg/kg) exceeded the ERM.

Table 3.13 shows that the bioavailable concentrations were low in comparison to the sediment quality guidelines, with only nickel at one site, W2 (24.5 mg/kg), exceeding the ERL.

Table 3.14 allows for direct comparison of results between sites based on a standardised particle fraction (<63 µm fraction). No distinct trends are evident between the sites, with many of the metals concentrations being similar across all sites. The greatest variations in concentration were arsenic (20.2 mg/kg at S2 and 2.4 mg/kg at V1 and B1), barium (173 mg/kg at R2 and between 39 and 77 mg/kg at the remaining sites), lead (3 mg/kg at W2 and 19.5 mg/kg at S2), and manganese (421 mg/kg at S2 and 1,230 mg/kg at M1). The sediment quality guidelines are not applicable to the <63 µm fraction; however, Table 3.14 compares the results in the present study to a range measured (also <63 µm fraction) at Astrolabe Bay and Basamuk in a previous sediment sampling study (NSR, 1998). These sites are on the other side of the Finisterre Range from the Huon Gulf. The metals content in the sediments analysed in the current study are similar to the range reported by NSR (1998), with the exception of zinc at one site, L1, which was about seven times higher than the range in the NSR (1998) study. While these values are directly comparable between locations, it should be noted from Table 3.10 that 98% of the particle size distribution at site L1 in 2016 was sand (60 µm to 2 mm), so the <63 µm fraction represents a very small proportion of the sediment as a whole. The total and bioavailable zinc concentrations in the <2,000 µm fraction at L1 (see Table 3.12 and Table 3.13) were low. Manganese concentrations in the <63 µm fraction were also higher than the NSR (1998) ranges in eight out of the ten sites sampled in 2016.

February 2017 results

Table 3.15 shows that the following February 2017 samples exceeded sediment quality guidelines in the total (<2,000 µm) fraction:

- LA1 – nickel (35 mg/kg) exceeded the ERL.
- LA2 – copper (95 mg/kg) exceeded the ERL and nickel (56 mg/kg) exceeded the ERM.
- LA3 – copper (95 mg/kg) exceeded the ERL and nickel (58 mg/kg) exceeded the ERM.
- LA4 – copper (99 mg/kg) exceeded the ERL and nickel (65 mg/kg) exceeded the ERM.
- LA5 – copper (105 mg/kg) exceeded the ERL and nickel (55 mg/kg) exceeded the ERM.
- M1 – nickel (55 mg/kg) exceeded the ERL.
- V1 – copper (79 mg/kg) and nickel (49 mg/kg) exceeded the ERLs.
- W1 – copper (64 mg/kg) and nickel (39 mg/kg) exceeded the ERLs.

- W2 – copper (72 mg/kg) and nickel (45 mg/kg) exceeded the ERLs.
- B1 – copper (72 mg/kg) and nickel (28 mg/kg) exceeded the ERLs.
- S2 – copper (81 mg/kg) and nickel (50 mg/kg) exceeded the ERLs.

Elevated copper and nickel was also observed in the November 2016 samples, exceeding the ERL at most sites. Of the sites that were repeated (LA1, M1, V1, W1, W2 and B1) there was little variation in the copper and nickel concentrations. In the 2017 sample results, the highest total concentrations of nickel were observed around the Markham River mouth and Lae Port area (M1, L2, LA3, LA4, LA5), exceeding the ERM at these sites but at no other sites. These sites, apart from M1, were not sampled in November 2016.

As was the case in November 2016, metal bioavailability was low (see Table 3.16). No bioavailable metals concentrations exceeded sediment quality guidelines in 2017 whereas one exceedance occurred in November 2016 (W2, 24.5 mg/kg nickel; exceeded the ERL).

A comparison of the less than 63 µm fraction results between November 2016 (Table 3.14) and February 2017 (Table 3.17) shows that most metals concentrations were similar between sampling events. Some variation (particularly for copper) was seen for sites near Wagang/Busu River area (W1, W2 and B1) and at Salamaua (S2). At W1 copper was 27 mg/kg in 2016 and 114 mg/kg in 2017; at W2 copper was 33.8 mg/kg in 2016 and 92 mg/kg in 2017; at B1 copper was 22.3 mg/kg in 2016 and 109 mg/kg in 2017; at S2 copper was 12.8 mg/kg in 2016 and 91 mg/kg in 2016. Aluminium was variable at W2 between sampling events (45,100 mg/kg in 2016 and 27,100 mg/kg in 2017). Iron (36,300 mg/kg and 54,300 mg/kg), manganese (421 mg/kg and 1,070 mg/kg), nickel (36.3 mg/kg and 56 mg/kg) and zinc (148 mg/kg and 87 mg/kg) were highly variable at S2 between 2016 and 2017. The metals content in the sediments are all similar to the ranges reported by NSR (1998), with the exception of manganese, which were slightly higher than the NSR (1998) ranges at all sites sampled in 2017.

3.2.3. Nutrients and carbon in sediments

Table 3.18 and Table 3.19 present the 2016 and 2017 results for sediment nutrients (total nitrogen and total phosphorus) and carbon (total organic and total inorganic).

Table 3.18: Results for sediment nutrients, total carbon and total inorganic carbon (November 2016)

	R1	R2	L1	L3	L4	M1	V1	LA1	W1	W2	B1	S2
Total nitrogen as N (mg/kg)	130	50	110	1230	30	480	330	70	<20	100	30	90
Total phosphorus as P (mg/kg)	387	530	404	759	320	772	594	573	430	662	607	366
Total organic carbon (%)	0.21	0.09	0.22	2.16	0.09	0.32	0.28	0.03	0.04	0.11	0.05	<0.02
Total inorganic carbon (%)	0.05	<0.02	0.04	0.16	0.31	0.47	0.40	0.33	0.30	0.39	0.5	0.64

Note: Total organic carbon and total inorganic carbon results are for the <2,000 µm fraction and total nitrogen and total phosphorus results are for the whole sediment (i.e., prior to sieving to <2,000 µm fraction).

Table 3.19: Results for sediment nutrients, total carbon and total inorganic carbon (February 2017)

	LA1	LA2	LA3	LA4	LA5	M1	V1	W1	W2	B1	S2
Total nitrogen as N (mg/kg)	190	700	650	670	970	90	640	150	140	30	480
Total phosphorus as P (mg/kg)	584	743	729	736	907	336	550	570	599	506	586
Total organic carbon (%)	0.14	0.63	0.46	0.55	1.02	0.08	0.58	0.36	0.20	0.65	0.41
Total inorganic carbon (%)	0.37	0.51	0.47	0.55	0.47	0.52	0.22	0.35	0.34	0.61	0.45

Note: Total organic carbon and total inorganic carbon results are for the <2,000 μm fraction and total nitrogen and total phosphorus results are for the whole sediment (i.e., prior to sieving to <2,000 μm fraction).

November 2016 results

Table 3.18 shows total nitrogen and total phosphorus to be highly variable across sites, with total nitrogen ranging from less than 20 mg/kg (site W1) to 1,230 mg/kg (site L3) and total phosphorus ranging from 320 mg/kg (site L4) to 772 mg/kg (site M1). There is no evident trend with the total nitrogen and phosphorus concentrations over the different locations.

Sites R1, R2, L1 and L3 had greater proportions of total organic carbon than total inorganic carbon, with L3 having the highest total organic carbon content. Sites L4, M1, V1, LA1, W1, W2, B1 and S2 had greater proportions of total inorganic carbon than total organic carbon, with site S2 having the greatest inorganic carbon content. There is no evident trend with the total organic and inorganic carbon concentrations over the different locations.

February 2017 results

Table 3.19 shows that total nitrogen, total phosphorus, total organic carbon and total inorganic carbon are within the same ranges across all sites. However, large temporal variability was seen for most of the sites sampled in both November 2016 and February 2017 (LA1, M1, V1, W1, B1 and S2) – the exception being W2 where results were similar between the two sampling events. Site LA1 showed high variability of total nitrogen (70 mg/kg in 2016 and 190 mg/kg in 2017); site M1 showed high variability of total nitrogen (480 mg/kg in 2016 and 90 mg/kg in 2017), total phosphorus (772 mg/kg in 2016 and 336 mg/kg in 2017) and total organic carbon (0.32% in 2016 and 0.08% in 2017); V1 showed high variability of total nitrogen (330 mg/kg in 2016 and 640 mg/kg in 2017); W1 showed high variability of total nitrogen (<20 mg/kg in 2016 and 150 mg/kg in 2017) and total organic carbon (0.04% in 2016 and 0.36% in 2017); B1 showed high variability of total organic carbon (0.05% in 2016 and 0.65% in 2017); S2 showed high variability of total nitrogen (90 mg/kg in 2016 and 480 mg/kg in 2017), total phosphorus (366 mg/kg in 2016 and 586 mg/kg in 2017) and total organic carbon (<0.02% in 2016 and 0.41% in 2017).

3.3. Sediment infauna

Sediment infauna abundance and diversity results from sampling conducted in February 2017 were determined by Dr. John Moverley. The full inshore benthos report detailing macrofauna and meiofauna from the eight sampling sites is provided in Appendix D.

Table 3.20 presents the macrobenthos and meiobenthos abundance in each sample.

Table 3.20: Abundance of macrobenthos and meiobenthos in nearshore sediments

	Sampling site							
	B1	W2	W1	V1	LA1	LA3	M1	S2
Macrobenthos	1	42	96	230	24	4	1	322
Meiobenthos	27	4,449	927	962	693	278	28	1,811

While most macrofauna taxa had fewer than five representatives, a limited number of taxa had high relative abundance, including 165 Cylindroleberidae at site W1, 92 Sphaeromatidae isopods at site V1 and 85 Anomiidae at site LA3. Molluscs comprised 2% of the total number of macrobenthos, and certain polychaete groups such as Sedentaria were observed in lower numbers than are typically expected for nearshore marine waters. Certain amphipod and tanaid families were also present in low abundance. At S2 amphioxus were also present (10 individuals). Site W2 near the Outfall System had very low macrofauna abundance (a single Anthuridae), and the macrofauna assemblage was similar to that found at sites near the mouths of the Busu (B1) and Markham (M1) Rivers.

Meiobenthos abundance and taxonomic composition was highly variable between sites, primarily evidenced by the comparative abundance and diversity of nematode and harpacticoid assemblages. As with macrofauna, abundance was only similar at the sites near the mouths of the Busu (B1) and Markham (M1) Rivers, with these sites displaying the lowest abundance of all sites (fewer than 30 meiofauna, compared to the hundreds or thousands of individuals at other sites). High amounts of terrestrial organic material were also observed at these sites. Meiofauna abundance and diversity at site W1 near Wagang more closely resembled site S2, than sites M1 and B1. Site W2 near the Outfall System had relatively high meifoaunal abundance (and the highest abundance of harpacticoids and nematodes) with limited diversity, while site S2 had a large proportion of nematode genera that were not present in other samples.

Although harpacticoids were present at all sites and in relatively high abundance at some sites (1,443 individuals at W2, 367 at W1, 334 at S2, 188 at LA1 and 124 at V1), gravid females (i.e., egg sacs evident) and early development stage specimens (nauplii) were either relatively uncommon or absent at all sites aside from site S2. S2 contained a high proportion of gravid females and nauplii, with approximately 17% of the total Harpacticoida abundance represented by nauplii, compared to less than 1% at all other sites.

3.4. Quality control

Appendix A includes the 2016 and 2017 results for field blank and field duplicates submitted with the samples. Quality control results for water and sediment analyses are provided in Appendix B. This includes the interpretative quality control reports provided by the laboratory.

2016 Quality control results

Results for 2016 laboratory duplicates, blanks, laboratory control samples and matrix spikes were mostly within the quality assurance limits defined by the laboratory. There were several exceptions as follows:

- Matrix spike recoveries were outside laboratory limits for weak acid extractable mercury and total Kjeldahl nitrogen analyses for sample V1D and for dissolved and total aluminium analyses for an anonymous intra-laboratory QC sample.

- Some matrix spike recoveries could not be determined as the spike concentration was less than four times the background concentration of the analyte. This was the case for manganese, total phosphorus, and total and weak acid extractable manganese for sediment sample V1D; sulfate and chloride for site water sample L1; total and weak acid extractable manganese for sediment sample R2; and total phosphorus and chloride for R2 water sample.
- One laboratory duplicate sample was an outlier. This was total phosphorus for sample L1 sediment. This was slightly outside the lab permitted value of 20% relative percent difference, where a difference of 22.1% was recorded between the duplicates.
- One method blank for sediment metals analysis showed copper and manganese concentrations to be slightly above the laboratory limits of 0.1 mg/kg.

Some analysis holding time exceedances occurred for some parameters (nitrite, reactive phosphorus and faecal coliforms). However, this was the result of the location of the survey area and the requirement to transport samples to Australia for analysis. This is common to all baseline water quality studies where samples have to be transported from PNG to Australian laboratories for analysis at a NATA-accredited facility.

Results from the 2016 field blank (FB1) showed all parameters to be at or below detection limits indicating the sampling was conducted free of contamination.

Results from the 2016 field duplicates (V1 and V1D) showed that there was mostly good agreement between the results for the sediment duplicates. The results for the water duplicates show some noticeable variation with major ions and some dissolved (aluminium, boron, iron and manganese) and total (aluminium, boron, iron, molybdenum and nickel) metals between the duplicates. As these results were confirmed by re-analysis, this suggests some localised variation in the water quality at the site V1. This could be explained by the fact that vessel drift occurred during the time of sampling and that the site is close to the outflow of the Bumbu River. It is possible that the duplicate sample included a greater proportion of freshwater from that river.

The 2016 quality control results indicate that the analytical data is of good quality. Of the 291 laboratory spikes performed, only thirteen spikes analyses (4% of all spikes) were outside laboratory quality control limits or could not be determined. Of the 269 laboratory duplicate analyses only one outlier occurred (0.4% of all duplicates). Of the 213 laboratory method blanks analysed, only one blank analysis (0.5% of all method blanks) was slightly outside the laboratory quality control limit.

2017 Quality Control Results

Results for 2017 laboratory duplicates, blanks, laboratory control samples and matrix spikes were mostly within the quality assurance limits defined by the laboratory. No method blank, duplicate or laboratory control outliers occurred.

Some matrix spike recoveries could not be determined as the spike concentration was less than four times the background concentration of the analyte. This was the case for total phosphorus, and total and weak acid extractable manganese for sediment sample W2; total extractable manganese for sediment sample S2; and sulfate and chloride for water samples W2 and M1-10.

As with 2016, some analysis holding time exceedances occurred for some parameters (nitrite, reactive phosphorus and faecal coliforms). Again, this was a result of the location of the survey area and the requirement to transport samples to Australia for analysis at a NATA-accredited facility.

Results from the 2017 field blank (FB1) showed most parameters to be at or below detection limits indicating the sampling was conducted free of contamination. Low concentrations of magnesium (1 mg/L), iron (2 mg/L) and sodium (4 mg/L) were detected in the blank.

Results from the 2017 sediment field duplicate samples (S2 and S2-D) showed some noticeable differences in several total metal (aluminium, boron, chromium, iron, manganese, zinc) and weak acid extractable metal (aluminium, barium, iron, manganese) concentrations. The laboratory analysis of these parameters was repeated with the same differences observed. It is not clear why the results differed for these samples but it perhaps suggests high sediment heterogeneity at this site. The results for the water sample duplicates (V1 and V1D) showed good agreement between samples.

Overall, the 2017 quality control results indicate that the analytical data is of acceptable quality. Of the 381 laboratory spikes performed, only eight spikes analyses (2% of all spikes) could not be determined. None of the 364 laboratory duplicate analyses were outside the laboratory quality control limits. None of the 263 laboratory method blanks were outside the laboratory quality control limits.

3.5. Visual assessment

3.5.1. Visual assessment of benthic nearshore marine environment

Lae

For the majority of the study area (including around Lae), water turbidity was too high and visibility too low to obtain video footage that was clear enough to facilitate useful observations of the benthic features in the study area, aside from very brief glimpses of primarily bare, sandy substrate with occasional detritus.

It is evident that high turbidity as a result of an ongoing high terrestrial sediment load from riverine sources is a characteristic feature of the Huon Gulf nearshore environment. As a result, fish, invertebrate, benthic and other aquatic communities (where present) are likely to be adapted to the prevailing conditions or only present periodically (i.e., seasonally, to migrate, or feed). Earlier studies (IHAConsult, 2012, PNG Ports Corporation, 2007; WorleyParsons, 2016) corroborate that the seabed near Lae, particularly in the immediate areas of riverine influence, is typically muddy and comprised of sands, clays, silts, and stones. The substrate is colonised by a relatively low abundance and diversity of meiofauna and macrofauna due to the high sediment deposition rate (see Section 3.3).

The study found no visual evidence of seagrass in the area around Lae.

While a comprehensive visual assessment of ecological communities was not completed due to poor visibility, sediment sampling opportunistically resulted in various benthos being observed in the samples taken in approximately 2 to 5 m of water in the vicinity of Lae. This included encrusting coralline algae, macroalgae, invertebrate and sponge growth (*Porifera* sp.). Photos of these organisms are shown in Plate 3.17 and Plate 3.18 (site V1) and Plate 3.19 and Plate 3.20 (site LA1). It is not known what substrate this benthos was attached to or associated with, and it is possible that these organisms have colonised artificial hard materials (such as scrap materials and dumped rock) and otherwise avoided the most intensive smothering effects and impacts of terrigenous sediment or other discharges. These opportunistic visual assessments were made in addition to the samples submitted for identification by Dr John Moverley.

Outfall Area, Wagang and Busu River

A visual assessment of the seafloor in this part of the study area was precluded by the high turbidity due to the suspended sediments discharged from the Busu River in this area (Plate 3.21 and Plate 3.22). As expected, a low diversity of benthos was observed in the sediment samples taken around the Outfall Area to Wagang. Coral reef habitat was not observed in this area. Local people indicated that coral reefs are not present in the area.

Photo credit: Coffey

Plate 3.19
Plating coralline algae, branch algae and sponge growth retrieved from site LA1

Photo credit: Coffey

Plate 3.20
Green macroalgae retrieved with sediment sampler at site LA1

Photo credit: Coffey

Plate 3.21
Plume from Busu River as viewed from surface of ocean

While not observed during the survey, Wagang villagers reported the presence of a rocky reef adjacent to the Outfall Area, situated about 30 m offshore and in about 10 m of water. This is likely a section of outcropping rock that has been colonised by various benthic organisms including sponges, soft corals, macroalgae and coralline algae. Local people explained that this reef is visible from canoes when the water is calm and sufficiently clear. People fish from the bank and from boat at this reef structure and reported that they target red emperor, trevally, cod, grouper and snapper species.

Labu Lakes

High turbidity precluded the collection of useful benthic imagery in the Labu Lakes area. However, sediment samples were a uniformly greyish-brown, thick sludge/mud (see Plate 3.4) and no flora, infauna or epifauna were observed in the sediment. Seagrass communities are absent from the waters of the Labu Lakes and surrounds due to suspended sediments acting to attenuate the light required by photosynthetic biota such as seagrass. The lakes are relied upon by local village residents for harvesting fish such as mangrove jack, mullet, trevally, and crabs, lobster, shrimp, and snails including members of family Thiaridae (Plate 3.23). Other molluscs present in the brackish waters of the Labu Lakes include *Telescopium telescopium*, *Geloina coaxans*, various species of genus Onchidium, cerithids and neritids (WorleyParsons, 2016). The majority of the fishing activities take place to support subsistence requirements, although some catch is sold at the markets in Lae, along with shells that are reduced to a powder via sun-drying, burning and pulverising, intended to accompany consumption of betel nut. Although not observed during the field surveys, WorleyParsons (2016) reports that Labu Lakes are commonly fished at night owing to the lakes being relatively protected from adverse weather conditions that otherwise pose difficulties for local people fishing in coastal or open seas during the night.

Southern Reference Sites

The only survey locations where underwater visibility was consistently sufficiently high to obtain clear photographs and video footage of the seafloor were beyond approximately 25 km south of Lae at Busama, and some 10 km further southeast at Salamaua (sites S1 and S2), where fringing reefs were observed. North of Busama or thereabouts, visibility tended to decrease, apparently due to frequent incursions of the Markham River plume and outflows from the Labu Lakes. The seabed was sporadically visible (although cloudy vision due to turbidity) in approximately 10 to 30 m of water depth at sites along the upper western Huon Gulf coast, between Labu Miti to 12 km south of the Labu Lakes. Benthic habitat observed in these locations was gently sloping and comprised grey sands (Plate 3.24 and Plate 3.25), and no complex rock or reef structure was present. By-products of detritivore activity were also observed (Plate 3.25). Opportunistic video camera deployments recorded fringing reefs in approximately 5 to 20 m of water depth, with corals present to within a few metres of the shoreline in some areas. These coral reefs were at Busama and near the Salamaua Peninsula (see Figure 1.1).

The coral reefs near Salamaua (Plate 3.26) were generally contiguous, in good condition with no obvious bleaching or other degradation, and of variable structural complexity and coral diversity. Reef-associated fish species including fusiliers (Caesionidae) damselfish (Pomacentridae) surgeonfish (Acanthuridae) and others were commonly observed.

Near Busama, coral reefs in good condition were observed in the 2016 and 2017 surveys, although occasional evidence of coral damage and sedimentation was present in 2016 (Plate 3.27 and Plate 3.28). Intact, complex reef near Busama appeared to be restricted to shallower depths, with patchy growth and sea whips observed on sandy sediments beyond 15 m depth.

Plate 3.22
Busu River mouth, Site B1


Photo credit: Coffey

Plate 3.23
Gastropod molluscs (Family: Thiaridae)
collected from the Labu Lakes by local villagers


Photo credit: Coffey

Plate 3.24
Sands at site DV 3, typical of those observed
at DV sites between Labu miti and Busama

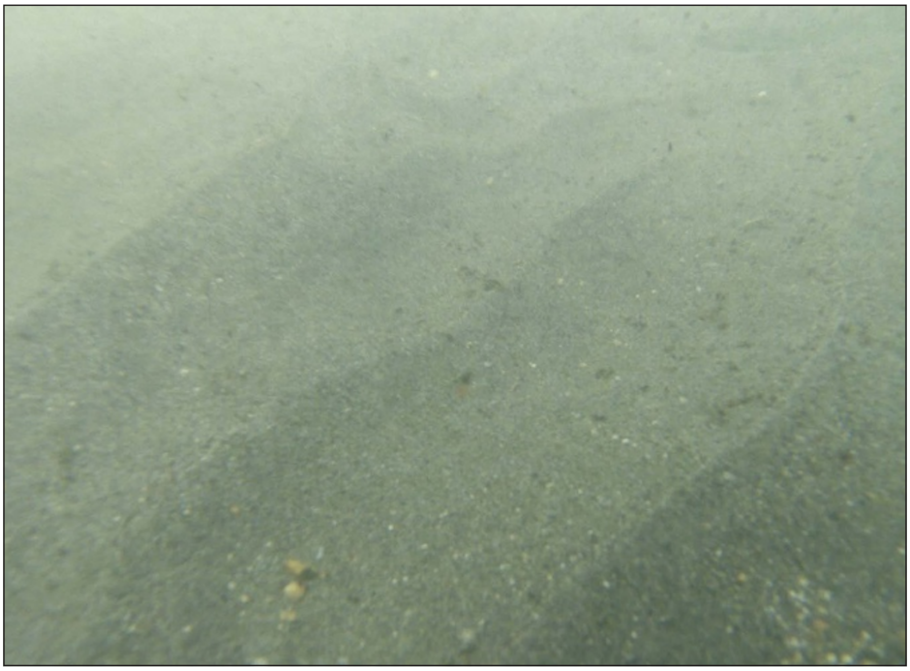


Photo credit: Coffey

Photo credit: Coffey

Plate 3.25
Evidence of detritivore activity at D3

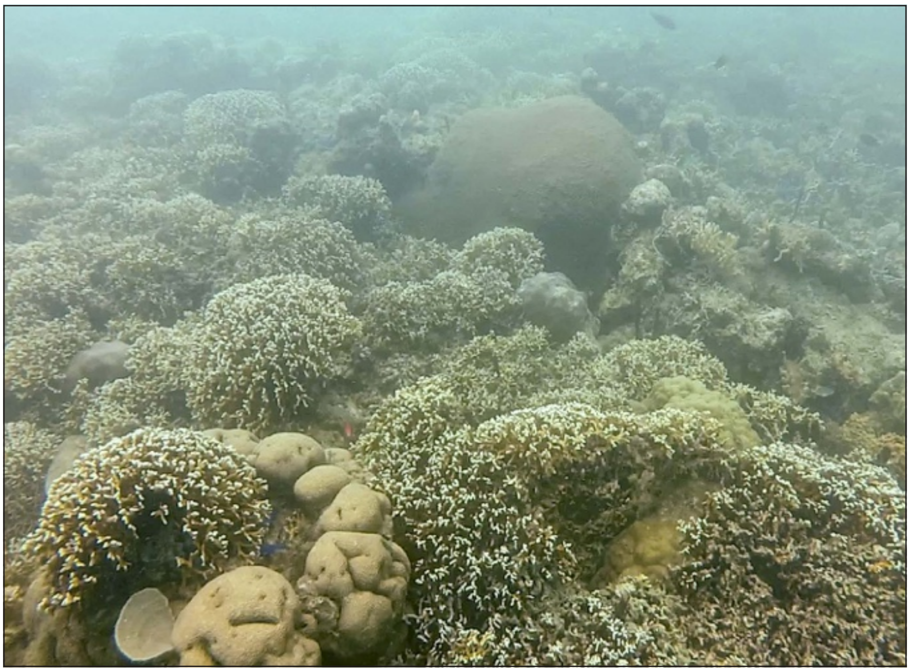


Photo credit: Coffey

Plate 3.26
Coral reef at S1

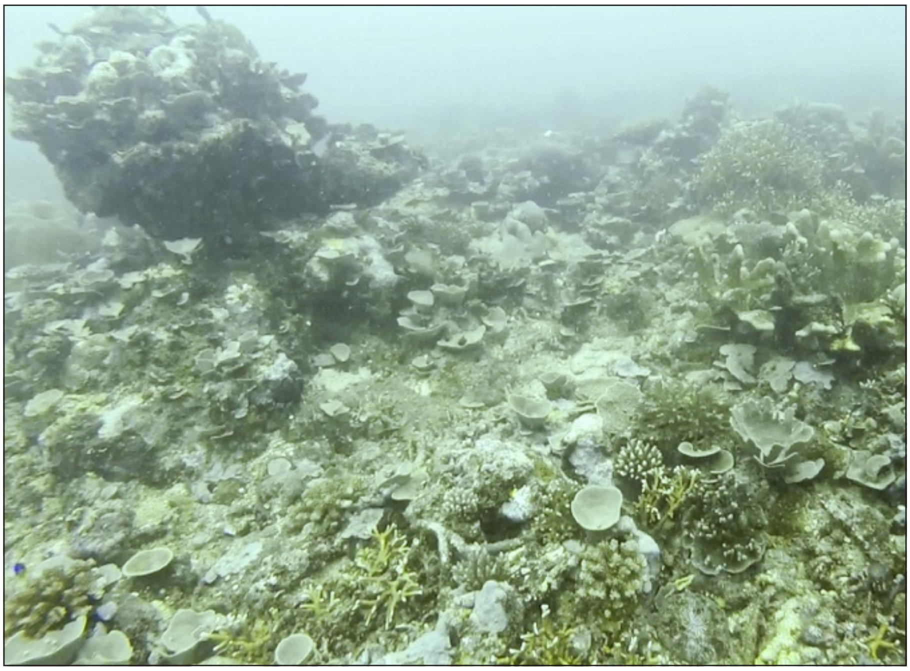


Photo credit: Coffey

Plate 3.27
Coral reef at Busama

Closer proximity to both the shoreline (and therefore to sediment resuspension resulting from wave action) and riverine sediments being transported south via longshore drift, are likely to contribute to the lower visibility observed near Busama. At both Busama and Salamaua, fine sands, microphytobenthos (algae), bioturbation (mounds and burrows), coral fragments and isolated live coral bommies were commonly observed on the seabed in areas where intact reef was absent.

Seagrass (Plate 3.29, Plate 3.30, and Plate 3.31) was present but sparse around Salamaua and no dense meadows were encountered during the 2016 survey. In 2017, opportunistic observations of benthic habitats closer to shore near site S2 (approximately 5 to 10 m from the shoreline, an area not investigated during the 2016 survey) indicated the presence of dense, contiguous meadows (Plate 3.32). Seagrass was only observed in the photic zone, in typically shallow, clear water on flat seabed.

3.5.2. Visual assessment of foreshore and shallow pelagic environment

The features of the terrestrial nearshore marine environment and the adjacent marine waters within the study area vary, typically due to various historical and ongoing anthropogenic activities, and the effects of inputs to the shoreline of the Huon Gulf coast from the surrounding catchments. These features, activities and developments include:

- The Markham, Bumbu and Busu Rivers.
- Labu Lakes.
- Lae Port.
- Lae Port Development Project Tidal Basin.
- Lae Yacht Club.
- Additional commercial, industrial and urban discharges and developments in and around Lae.

The combined influence of these are discussed below.

Lae

Infrastructure development, the placement of rock to inhibit coastal erosion, and the dumping or accumulation of various debris (Plate 3.33) have substantially modified the foreshore environment near Lae. As a result, ecological features are typically highly modified in the vicinity of anthropogenic influences. It is likely that the natural course of littoral drift, shoreline evolution and sedimentation patterns have been altered by these activities.

The coastline between Lae and Wagang village, particularly near Voco Point, is also inundated with litter pollution generally comprised of various forms of plastic materials including bags and bottles (Plate 3.34). This litter also extends from Wagang to the mouth of the Busu River, although to a lesser extent than between Lae and Wagang. Point source discharge from road runoff is known to occur around Voco Point, and it was stated by a local villager at Wagang that they believed wastewater from the tuna canneries is also discharged into the Bumbu River. Local fishers also noted that floating plastic, which was observed floating at various locations along the coast near Lae, occasionally becomes entangled in boat propellers, causing damage and hampering fishing activities.

Photo credit: Coffey

Plate 3.28
Area of damaged reef at Busama displaying signs of sedimentation

Photo credit: Coffey

Plate 3.29
Seagrass (likely *Halodule* sp.) collected in sediment at S1

Photo credit: Coffey

Plate 3.30
Seagrass (*Halophila* sp.) collected in sediment at S1

Photo credit: Coffey

Plate 3.31
Seagrass (*Syringodium* sp.) collected in sediment at S1

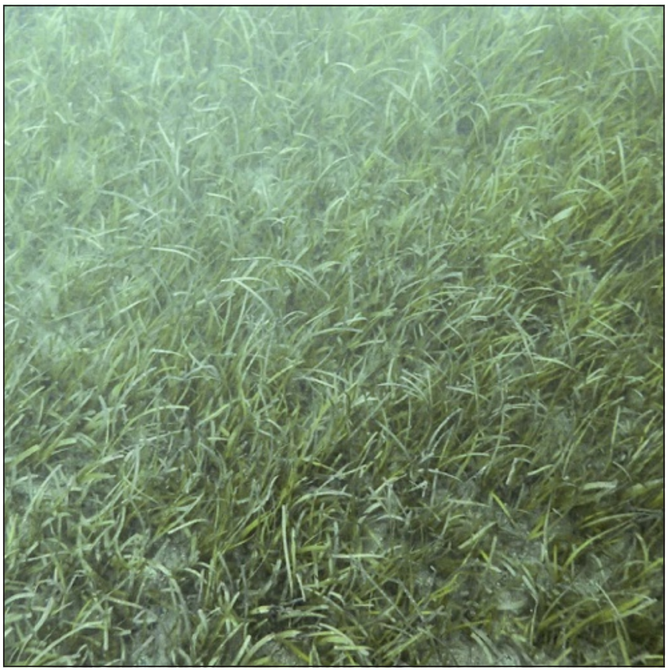


Photo credit: Coffey

Plate 3.32
Seagrass at S2

Photo credit: Coffey

Plate 3.33
Various debris and concrete either placed or accumulated on the beach near LA1

Driftwood is also present along the beaches near Lae, and some is collected by local people to be sold or retained for personal use. The coast around Voco Point is a heavily utilised thoroughfare for local dinghies, and is also a favoured location for recreational swimming (Plate 3.35) despite the apparent poor water quality (see Section 3.2.3).

Present near Lae were several large (approximately 20 m in length or greater) shipwrecks in varying states of degradation, and ships anchored nearshore and not apparently operated for extended periods of time (due to the degree of corrosion and biofouling observed). Approximately 10 were seen along the coast between the Markham River mouth and Wagang, mainly near Lae Port, DCA Point and east of Voco Point. These were generally fishing vessels or cargo ships, and may provide some degree of artificial habitat for fish and a viable structure for invertebrates to colonise in the absence of suitable natural materials (Plate 3.36).

Southwest and east of Lae (excluding Labu Lakes)

Vegetation, often including large trees, was commonly observed floating in the nearshore area (Plate 3.37) and deposited as driftwood along beaches in the Huon Gulf beyond Lae (Plate 3.38). This driftwood is carried into the Huon Gulf from the rivers in the area. The driftwood is harvested by local people, with collection particularly prevalent in the Wagang to Busu River area (see Plate 3.39). This driftwood is used or sold as firewood and timber at Lae. Local people were observed transporting large logs by hand in the water close to shore, particularly along the southern coast from Labu Miti further south (Plate 3.40).

Local people were observed fishing from the beach between Wagang and Singaua. During interviews, residents of Wagang stated that they commonly fish from the shore in various areas along this stretch of coast, including at the mouth of the Busu River. This was also observed during the field survey. According to local people, some shoreline and boat fishing is conducted at the rocky reef adjacent to the Outfall Area; however, no fishing was observed in this area during the November 2016 and February 2017 surveys. Weather conditions were fine during these surveys and did not appear to influence the absence of fishing observed in this area. However, signs of fishing (marker sticks or fishing rods fixed in the sand) were observed in this area during interviews conducted in May 2017, although no fishing was observed directly. Conditions were very rough at this time in May 2017, potentially influencing fishing activities.

A large fish trap net operation that was established as an economic development project in association with the PNG National Fisheries Authority and Japanese Trust Fund, is located adjacent to Labu Miti. The trap net targets various fish including mackerel, rainbow runner (*Elagatis bipinnulata*) and mahi-mahi (*Coryphaena* spp.). Outrigger canoes and small motorised boats were observed fishing along the coast from Labu Miti to Salamaua. No fishing nets or boat fishing were observed during the field survey between Wagang and Busu River. Some small fish nets close to the shoreline were observed further east near Singaua.

Along the southwest coast of the Huon Gulf, beaches and nearshore habitats exhibit fewer signs of human influence compared with those near Lae. As might be expected, visible signs of habitat disturbance increase with greater proximity to coastal villages including Labu Butu, Labu Tale, Labu Miti and Busama. A similar correlation between proximity to human settlement and an observable degree of nearshore habitat alteration exists along the northern Huon Coast near Wagang village. A number of shipwrecks were also observed along the southern Huon Coast (Plate 3.41). No mangrove habitat was observed along the northern areas of coast (i.e., from the Markham River mouth to east of the Busu River) during the nearshore marine surveys. However, Coffey (2018) identified two small areas of mangrove vegetation immediately west of Wagang (some 2 km west of the Outfall Area) within the un-named tributaries of the Nungwa River. These are referred to by local people as the Butudendeng and Nungawahac mangrove areas.

Photo credit: Coffey

Plate 3.34
Plastic and other anthropogenic debris accumulated on the beach near Voco Point

Photo credit: Coffey

Plate 3.35
Recreational swimming and shipwreck near Voco Point

Photo credit: Coffey

Plate 3.36
Shipwreck along coast near LA1

Photo credit: Coffey

Plate 3.37
Floating wood and other mobilised terrestrial vegetation agglomerating near Voco Point

Photo credit: Coffey

Plate 3.38
Shoreline at the outfall site. Note the woody debris and plastic litter along the shoreline.

Photo credit: Coffey

Plate 3.39
Tree limbs and other driftwood or debris deposited on the beach at Wagang and collected by villagers. Residents and visitors regularly swim at this beach.

Although not observed during the 2016 and 2017 field surveys, WorleyParsons (2016) reports that the estaurine mud flats of the Markham River provide habitat for a wide variety of shorebirds, including the far eastern curlew (listed as vulnerable under IUCN). The other bird species identified by WorleyParsons (2016) as being present in the area are listed as least concern or near threatened.

No crocodiles were observed during the field surveys; however, WorleyParsons (2016) reports that the saltwater crocodile, *Crocodylus porosus*, is found in all rivers of the Huon coast. A crocodile was caught at Lae Yacht Club in June 2017 (Wissink, 2017 pers. com.). There is a commercial crocodile farm near ‘9 mile’ suburb in Lae. BAAM (2016) recorded the presence of a saltwater crocodile (*Crocodylus porosus*) skull at Chiatz village.

Labu Lakes

The Labu Lakes estuarine system is situated 2 km from Lae and 1 km to the south of the west of bank of the Markham River. The lakes meet the Huon Gulf via an opening approximately 50 m wide, near the village of Labu. The lakes are shallow, with typical water depth approximately 2 m. The transition between mangrove forest and other types of coastal vegetation near to and beyond the sand barrier that separates the lakes from the mouth of the Markham River and the open sea is readily identifiable. Where present, mangroves are dense and extensive (Plate 3.42 and Plate 3.43). Womersley, (1984) noted that the vegetation assemblage was dominated by *Rhizophora apiculata* and Bruguiera spp., with *Aegiceras corniculatum*, *Avicennia marina*, *Heritiera littoralis*, *Sonneratia caseolaris* and *Xylocarpus granatum* also present. More detailed mangrove species composition was not assessed during the current study.

With the exception of human settlement at the entrance to the lakes (Labu village), villages adjacent to the lakes on the coast (Labu Butu and Labu Miti) and shipwrecks present within the area, the Labu Lakes support an extensive area of intact and largely undisturbed mangrove-dominated ecosystem that appears to sustain many of the well-recognised functions of productive mangrove nursery habitats.

The brackish waters of the Labu Lakes are used by villagers for recreational purposes such as swimming, but to a lesser extent than the accessible waters of the Huon Coast and mouth of the Markham River. The Labu Lakes provide for shellfisheries, such as fishing and trapping prawns, crabs and lobsters and surplus catch is sometimes sold at the fish markets in Lae. The local people here also use shallow-water seine netting to catch fish for eating and for bait.

3.6. Nearshore fauna

Fauna species in the study area were either observed during the field survey or their presence was investigated during interviews with local people.

During the field survey, dolphins (species unknown, Plate 3.44) were observed on a number of occasions at different locations within the Huon Gulf near Lae and Salamaua, in pods numbering approximately three to eight individuals. No other marine mega fauna such as whales, dugongs or turtles were observed during the survey. Local residents stated that dugong are occasionally hunted near Salamaua, which is likely to be one of the only viable dugong habitat areas in the region, due to the absence of seagrass near Lae. Interview respondents from the Lae Game Fishing Club stated that pilot whales and blue whales were occasionally seen in the Huon Gulf near Lababia some 60 km south of Lae.

Five sea turtle species are known to have distributions that include the Huon Gulf; the west Pacific leatherback turtle (*Dermochelys coriacea*, listed as critically endangered under the IUCN Red List), hawksbill turtle (*Eretmochelys imbricata*, listed as critically endangered under the IUCN Red List),

Photo credit: Coffey

Plate 3.40
Local man transporting log in shallow waters near Labu Miti

Photo credit: Coffey

Plate 3.41
Shipwreck on beach near Labu Tale

Photo credit: Coffey

Plate 3.42
Mangroves of Labu Lakes, including unsubmerged portion of shipwreck

green turtle (*Chelonia mydas*, listed as endangered under the IUCN Red List), olive ridley turtle (*Lepidochelys olivacea,* listed as vulnerable under the IUCN Red List), and the South Pacific subpopulation of the loggerhead turtle (*Caretta caretta*, listed as critically endangered under the IUCN Red List).

Along the shore between Lae and the Busu River, including around the Outfall Area, no turtles, turtle nests or old nesting pits were observed during the November 2016 or February 2017 surveys. These surveys coincided with the nesting period for these turtles in the Huon Gulf, although peak nesting occurs during December and January (Kinch, 2006). No visual evidence of turtles was observed during a follow up visit to Wagang in May 2017. West Pacific leatherback turtle nests (Plate 3.45) were observed south of Labu Miti near Labu Butu and Labu Tale (some 7 km south of Labu Lakes) in November 2016.

The largest PNG nesting population of the west Pacific leatherback (*Dermochelys coriacea*), which is listed as Critically Endangered on the IUCN Red List (Tiwari et al., 2013), occurs primarily along the south coast of the Huon Gulf. This comprises a metapopulation of a single genetic stock distinct from the east Pacific leatherback population, and the almost extinct Malaysian population (Gaspar et al., 2012). Interviews with local people from Wagang indicated that the west Pacific leatherback sea turtle nests between Wagang and the Busu River (EnviroGulf, 2017) and established records support this assertion (Benson et al, 2007). Local people from Wagang indicated that turtle nesting in the area between Wagang and Busu River is presently less common than it was historically (i.e., in the 1970s). According to some Wagang residents, three or fewer west Pacific leatherback turtles are claimed to be caught between Wagang and the Busu River by local people each year, during November to February. The meat is consumed and approximately 150 to 200 eggs are harvested per nest when found.

In February 2017, a local informant from the Labu Butu region stated that 150 west Pacific leatherback turtles were nesting between Labu Lakes and Busama during the 2016 Christmas period. The informant stated that some of these turtles were killed and eaten and their eggs harvested, while others were left to return to the sea. No active nests or turtles were known to be present in the area between Labu Butu and Labu Tale after January 2017, according to another informant from Labu Butu.

WorleyParsons (2016) indicates that the hawksbill turtle and green turtle were previously recorded as being present in the Huon Gulf nearshore environment. The source of this information did not state more specific location data, however it is likely that any observations that may have taken place in association with preferred feeding and/or breeding habitats such as reefs, seagrass meadows and favourable nesting beaches. Interviews with residents from Labu village noted the presence of either or both of the hawksbill turtle and green turtle (the visual similarities between the two species generally precluded being able to distinguish with certainty which species local people were referring to) around Labu Butu and in the mouth of the Markham River during the dry season. Wagang residents also noted the presence of turtles resembling the hawksbill turtle and green turtle along the coast near Wagang. They stated that these turtles were occasionally visible in the water when surfacing for air, and indicated that local fishers had inadvertently caught and subsequently eaten, one of these turtles in approximately March 2017. No evidence of this was observed.

No observations or other evidence regarding the presence of olive ridley or loggerhead turtles was observed during the study.

Along the southwestern Huon Coast nesting area near Labu Butu, Labu Tale, Busama, Salamaua and further south, various turtle recovery projects have been established; given this region represents the largest turtle nesting population in PNG (Kinch, 2006; PNG Ports Corporation, 2007). Local people from Labu Miti, Labu Butu, Labu Tale and Busama stated they previously conserved west Pacific leatherback turtles on behalf of various conservation programs (starting in 2003) including those established by the Western Pacific Regional Fishery Management Council and the WWF Bismarck Solomon Seas Ecoregion non-legal binding tri-national partnership Memorandum of Understanding. These were devised to explore methods for governments, communities and institutions to manage and conserve nesting sites, feeding areas and turtle migration routes (Kinch, 2006). Other agencies support, or have previously supported, west Pacific leatherback turtle conservation initiatives in the area. Since the cessation of conservation program funding, or lack of tangible economic benefit from doing so (Kinch, 2006), local people along the southwestern coast of the Huon Gulf around Busama, Labu Miti and Labu Tale stated that they no longer protect turtles and instead consume west Pacific leatherback turtle eggs and green turtle meat. It appears that with the apparent reduction or cessation of conservation funding, a major threat to west Pacific leatherback turtles nesting in the area around Labu Butu, Labu Tale and Labu Miti is the depredation of nests for local consumption of eggs, and the periodic capture and consuming of adult nesting females. This general threat also applies to other species of sea turtle in the Huon Gulf, given that turtle predation by local people is opportunistic and does not appear to discriminate according to species. No conservation projects are known to occur in the Wagang area.

Photo credit: Coffey

Plate 3.43
Fisherman in Labu Lakes. Extensive mangrove forest present in background

Photo credit: Coffey

Plate 3.44
Dolphins near site S1

Photo credit: Coffey

Plate 3.45
Leatherback sea turtle nesting site near Labu Tale (depression in the sand in the centre of the picture)

4. Discussion

This section discusses and expands upon the results presented in Section 3 for water quality, sediment quality and the visual assessments of nearshore marine features.

4.1. Water quality

The nearshore waters of the Huon Gulf within most of the study area when sampled in November 2016 were turbid, with pH, conductivity and salinity measurements being lower than typical for seawater (see Table 3.1), indicating the influence of river input. Seawater typically has a pH of around 8.1 to 8.3, conductivity of about 50 mS/cm and salinity between 30 to 40 ppt. Based on the water salinity results the waters were typical of estuarine water and not marine water in November 2016 (based on salinity ranges outlined in ANZECC/ARMCANZ (2000)[3]). Sites M1, M2, V1 and LA1 had a pH of 7.9, while sites L4, M1, M2, LA1, W1, W2 and B1 had conductivity of between 28.2 to 40.1 mS/cm and salinity of between 16.7 to 23 ppt. This salinity range is consistent with the range of 20 ppt to 22 ppt reported by a previous sampling program near the mouth of the Markham River (WorleyParsons, 2016). These salinity ranges demonstrate the variable freshwater influence on the nearshore marine water from the Markham, Busu and Bumbu rivers as well as outflows from the Labu Lakes.

The dominant turbid plume in the region is from the Markham River (see Figure 1.1) and the Busu River, with numerous additional plumes from smaller rivers along the coastline to past Singaua in the east, and down to Labu Tale in the south. In November 2016, a TSS concentration of 1,300 mg/L and turbidity of 525 NTU was measured in the main Markham River plume (site M2), which is consistent with a previous study, which reported TSS of 970 mg/L within this plume (Willy, 2012). The site within the Busu River main turbidity plume had a TSS concentration of 546 mg/L and corresponding turbidity of 305 NTU. Nearshore waters south of Labu Tale were relatively clear (<1 NTU and <5 mg/L TSS), where the waters contained less riverine suspended sediment. The waters south of the Markham River plume at R1, Busama and S1 had a lower freshwater influence as evidenced by their physicochemistry with pH of 8 to 8.1, conductivity of 44.8 to 48.6 mS/cm and salinity between 26.8 to 28.9 ppt. However, these conductivity and salinity readings are still lower than expected for seawater. These results are consistent with measurements taken for another study at Busama and Salamaua in 2007 where salinity of 30 ppt was recorded (PNG Ports Corporation, 2007).

When sampling was conducted again in February 2017, the water was more characteristic of seawater with higher pH (ranging from 8.3 to 8.5), conductivity (ranging from 39.9 mS/cm to 51.2 mS/cm) and salinity (ranging from 25.4 ppt to 29.8 ppt). Turbidity and TSS were also lower in the February 2017 sampling, the main exception being at site M1, at the Markham River mouth, where turbidity was 420 NTU and TSS 2,620 mg/L. Site M1 was the only site with obvious freshwater influence during the 2017 sampling. As the in situ measurements were taken at 1.5 m below the surface during both surveys, these results suggest that the surface freshwater plumes fluctuate in thickness over time, being deeper than 1.5 m in November 2016 but shallower than 1.5 m in February 2017. It was noted from discussions with local people and WGJV personnel during the February 2017 sampling that rainfall had been relatively sparse in the weeks prior to the survey. The major rivers (Markham and Busu) were also observed to have lower flow than in November 2016. This reduced riverine input in February 2017 could explain the chemistry of the upper water column being more typical of seawater than it was in November 2016. WorleyParsons (2016) reports that a halocline (a rapid change of salinity with depth in the water column) typically exists in the Markham River plume at

[3] ANZECC/ARMCANZ(2000) describes estuarine waters as having salinity in the range 0.5 to 30 ppt and marine waters having salinity in the range 30 to 40 ppt.

a depth of between 1 to 1.5 m in the water column. During times of flooding a halocline of 4.5 m depth is more common.

Between the different sampling depths (1.5 m and 10 m), in situ results displayed low variability, with the exception of salinity, with values generally higher at 10 m depth. This demonstrates the freshwater influence in the upper 1.5 m of the water column. Site M1 in the Markham plume showed an obvious freshwater surface influence, with very low salinity of 6.0 ppt at 1.5 m, and 29.5 ppt salinity at 10 m.

Nutrients concentrations were low at all sites in both November 2016 and most sites in February 2017, typically being close to or below detection limits (see Table 3.4). Total phosphorus concentrations were greatest within the turbid river plumes from the Markham (site M2: 0.74 mg/L in 2016 and 1.37 mg/L in 2017) and Busu (site B1: 0.45 mg/L in 2016) indicating that these rivers are a source of phosphorus runoff. Ammonia concentrations were below ANZECC/ARMCANZ (2000) guidelines at all sites. Inorganic nitrogen (nitrite + nitrate) concentrations were below PNG water quality criteria at all sites. As nutrients concentrations were low at the reference locations away from towns or villages and the concentrations were similarly low at the sites around Lae (i.e., LA1 and V1), this suggests that the low levels of nutrients in the waters are naturally occurring.

Faecal coliform concentrations in November 2016 were below detection limits at the reference sites remote from town or village areas (i.e., at R1, R2 and S1) (see Table 3.4). Faecal coliforms were detected at sites near Labu (L1, L3 and L4), sites within the Markham River plume near Lae (M1 and M2), sites adjacent to Lae (V1, LA1), the sites at Wagang and the Outfall Area (W1 and W2) and the site within the Busu River plume (B1). Site LA1 is in the vicinity of Lae's main sewage outfall. At this site, 540 most probable number (MPN)/100 mL of faecal coliform bacteria was detected. However, 920 MPN was detected further afield at both M1 (in the Markham River plume) and V1 (at Voco Point) suggesting that the presence of faecal coliform bacteria in the nearshore waters around Lae is widespread and also influenced by riverine sources and runoff from urban areas. The laboratory erroneously analysed the second batch of samples for most probable number MPN/100 mL compared to the first batch, which was analysed for colony forming units, cfu/100 mL. The MPN method is a statistical estimate of the number of faecal coliform bacteria organisms in 100 mL of sample. The cfu method involves counting the colonies (groups of cells growing together) of faecal coliform bacteria. This means that the results are not directly comparable between the first and second batches of samples analysed by these two different methods; however, both methods provide scales of faecal coliform abundance. In 2017, faecal coliforms were detected in various concentrations at all sites around Lae (LA1, LA2, LA3, LA4, LA5, M1 and V1) and Wagang (W1, W2 and B1) in both 1.5 and 10 m depth samples. Faecal coliforms were also detected at the sites near Lae and Wagang in November 2016. The only sample with no faecal coliform detected was at the S2 reference location, more than 20 km south-southeast of Lae.

Faecal coliform results in 2017 displayed a high degree of variability both between sites and between depths, with no obvious trend apparent. There are no PNG criteria or ANZECC/ARMCANZ guidelines for faecal coliforms in marine waters.

Low concentrations of oil and grease were detected at sites L1, L3, L4 and B1 in 2016, while none was detected in 2017. These concentrations of 7 mg/L, 6 mg/L, 8 mg/L and 8 mg/L, respectively were slightly above the detection limit of 5 mg/L. The source of the oil and grease is not clear and no oil or grease residue was noticed at the sites at the time of sampling. The only locations where surface oil sheens were visible were within the Lae Yacht Club marina and within the small boat harbour at Voco Point. The PNG marine water quality criteria for aquatic ecosystem protection stipulates that there is to be no detectable oil and grease in marine waters. WorleyParsons, (2016) detected oil and grease in baseline water quality monitoring for the Lae Port Tidal Basin Development Project, with concentrations of up to 96 mg/L reported. However, the report does not elaborate on the potential sources of the oil and grease and the actual locations of these high concentrations were not identified.

Dissolved metals concentrations were typically low in both November 2016 and February 2017, being generally well below PNG water quality criteria and ANZECC/ARMCANZ guidelines (see Table 3.7, Table 3.8 and

Table 3.9). The exceptions were boron, which exceeded the PNG criteria of 2,000 µg/L at all sites, except L3 and L4 in 2016, and copper which marginally exceeded the ANZECC/ARMCANZ guideline of 1.3 µg/L at site V1 (2 µg/L) in 2016 and M1 (1.9 µg/L) in 2017. The concentrations of boron, while exceeding PNG water quality criteria at all but two sites, are not considered to be problematic as they are lower than the background range of 4,500 to 5,100 µg/L described in literature as being typical of seawater (ANZECC/ARMCANZ, 2000). WorleyParsons (2016) also reported boron to be within a similar range to the current study, with concentrations up to 3,900 µg/L reported. The source of the slightly elevated copper at M1 and V1 is unknown; however, given these sites are adjacent to the Lae urban area, which has numerous shipwrecks, boat traffic and rubbish floating in the water and scattering the shoreline, the concentrations are not unexpected. Dissolved copper was below detection limits in a previous water quality study near Lae Port and the Markham River mouth (WorleyParsons, 2016).

The majority of dissolved metals concentrations were also similar between samples from 1.5 m and 10 m depths. The exception was boron which was significantly greater at 10 m depth at all sites. The concentrations of dissolved boron at 10 m depth were typical of concentrations reported for seawater in the literature (ANZECC/ARMCANZ (2000) and Emsley (1991). This stratification of boron is particularly evident at site M1 where the dissolved boron concentration was 276 µg/L at 1.5 m compared to 4,090 µg/L at 10 m, clearly highlighting the influence of freshwater in the upper layer of the water column.

Another finding from the study is the development of a new distributary of the lower Markham River adjacent to Labu and the resulting turbid discharge from the Markham River to mouth of the Labu Lakes. Figure 4.1 presents a sequence of aerial images from between 2002 and 2016 and shows the formation of a new channel of the Markham River, which discharges into the Huon Gulf near Labu. This new channel also appears to have drained the lagoon that was previously present (as shown in the imagery from 2002 in the top left of Figure 4.1). It is not clear how the new channel formed, but it appears from the imagery that the river broke through during high flow to follow a small track. The imagery shows that this channel joined the Huon Gulf at some stage between December 2010 and June 2013.

This recently formed outflow indicates that the marine waters around Labu are likely to be more turbid more of the time, compared to about five years ago. During the field surveys it could not be determined whether the plume extended into the mouth of the Labu Lakes. However, recent aerial imagery from 2017 shows the Markham River turbid plume entering the mouth of the Labu Lakes (Plate 4.1). During the November 2016 survey the water inside the mouth of the lakes (site L4) was reasonably turbid with a turbidity of 45.1 NTU and TSS concentration of 36 mg/L. In contrast, turbidity was 3.5 NTU and TSS was 4 mg/L further within the lakes at site L3.

4.2. Sediment quality

Most sediments were comprised predominantly of dark coloured sand and silt sized particles. However, site L3 in the Labu Lakes, sites LA2, LA3, LA4 and LA5 near the Lae Tidal Basin, and site and M1 adjacent to the Markham River mouth were dominated by silts and clays with little sand present. The sites L4 (Labu Lake mouth) and R2 (reference location at Singaua) comprised mostly gravels and sands. The sediment at site S2 near Salamaua was noticeably lighter in colour than the other sediments within the Huon Gulf. This is likely due to the different mineralogy of the riverine silts and sands deposited closer to Lae compared to the sandy material remote from riverine influence. These findings are consistent with those reported in WorleyParsons (2016). That study also reported the sediments to be soft, sandy silts near the Lae Port/tidal basin area.

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WAFI-GOLPU JOINT VENTURE

Wafi-Golpu DSTP Project

Imagery showing the formation of a new channel of the lower Markham River

Figure No: 4.1

Plate 4.1
Aerial imagery showing the turbid Markham River plume entering the mouth of the Labu Lakes

Sediment metals concentrations were compared to sediment quality guidelines in order to understand whether any existing concentrations are likely to be adversely affecting benthic biota. International SQGs (Long et al., 1995; as adopted by ANZECC/ARMCANZ) were adopted as there are no PNG sediment quality guidelines. These guidelines were developed from a North American biological effects database for sediments and are frequently used in the USA, Australia, PNG and elsewhere. Concentrations of sediment metals were compared to the ERL guidelines (where concentrations are below the ERL, adverse biological effects are rarely observed) and ERM guidelines (where concentrations exceed the ERM, adverse biological effects are frequently observed). Between the ERL and ERM indicates a range where adverse biological effects are occasionally observed.

Most of the sites had at least one metal that exceeded either the ERL or ERM guidelines (see Table 3.12 and Table 3.15) in the less than 2,000 µm particle size fraction. Nickel exceed the ERM at sites M1 and W2 in 2016, and at sites LA2, LA3, LA4, LA5 and M1 in 2017. Nickel exceeded the ERL at R2, L3, V1, LA1, W1 and B1 in 2016 and at all sites in 2017. Chromium exceeded the ERL at R1 and L4 in 2016 and at no sites in 2017. Copper exceeded the ERL at L3, M1, V1, W2 and B1 in 2016, and at all sites except LA1 and M1 in 2017. These elevated concentrations are likely to originate from terrestrial geologic sources. Previous sediment sampling for the Lae Port Tidal Basin Development Project also reported that nickel and copper concentrations in sediments to commonly exceed the ERL over five years of monitoring (WorleyParsons, 2016). However, it was not reported whether those results are for the total metals or bioavailable metals concentrations.

The measured concentrations of chromium (between 45.2 to 95.7 mg/kg), copper (79.7 to 194 mg/kg) and nickel (29.4 to 76.0 mg/kg) in Huon Gulf nearshore sediments (<63 µm size fraction) are similar to those in nearshore sediments in previous sediment baseline investigations in Astrolabe Bay and near Basamuk on the north coast of the Finisterre Range in waters 70 to 200 m deep (NSR, 1998). Those investigations determined metals content of the less than 63 µm fraction and reported sediment total chromium concentrations of between 22 to 100 mg/kg, total copper concentrations of between 92 to 129 mg/kg; and total nickel concentrations of between 30 to 70 mg/kg. This suggests that outcropping geologic mineralisation may be present in catchments draining into the Huon Gulf and as well as Astrolabe Bay, which is not unexpected given they drain the same mountain range.

Ultimately, it is the bioavailable concentration that has greater relevance to sediment quality guidelines for the protection of aquatic biota. Measurement of metal bioavailability showed that the bioavailable portions were low. In November 2016, bioavailable chromium was below 50% of the total chromium concentration at 7 of the 12 sites and below 67% at the remaining sites, and below 22% at all sites in 2017. In 2016, bioavailable copper concentrations were below 52% of the total copper concentration at all sites; while in 2017 all sites were below 45% of the total copper concentration. Bioavailable nickel concentrations in 2016 were between less than 50% of the total nickel concentration at 10 of the 12 sites and below 67% for the remaining sites, and at or below 30% at all sites in 2017. Only bioavailable nickel (24.2 mg/kg) at W2 (the Outfall Area) in November 2016 exceeded the ERL of 21 mg/kg (see Table 3.13 and Table 3.16). These results suggest that, apart from site W2 where adverse effects to biota may be occasionally observed due to nickel concentration, all sites have bioavailable metal concentrations below sediment quality guidelines indicating that any adverse biological effects (due to metals concentrations) are likely to be rarely observed.

Metal concentrations are typically higher in silts and clays due to the increased surface areas available for binding of metals. The comparison of metals concentrations from different sampling sites is therefore based on equivalent sediment grain sizes (i.e., the effect of variable particle size distributions in samples is minimised). Comparison of the standardised particle fraction (less than 63 µm fraction) (see Table 3.14 and Table 3.17), which represents the silt fraction, showed there to be no distinct trends in metals concentrations across the sites, with many of the metals concentrations being similar across all sites. Data from this size fraction will be the most appropriate to compare to any future sampling, if conducted, as the variability in particle size distribution is eliminated.

Total nitrogen and total phosphorus were highly variable across all sites, with total nitrogen ranging from less than 20 mg/kg (site W1) to 1,230 mg/kg (site L3) in 2016 and 30 mg/kg (site B1) to 970 mg/kg (site LA5) in 2017 and total phosphorus ranging from 320 mg/kg (site L4) to 772 mg/kg (site M1) in 2016 and 336 mg/kg (site B1) to 736 mg/kg (site LA4) in 2017 (see Table 3.18 and Table 3.19). There is no evident trend with the total nitrogen and phosphorus concentrations over the different locations. There are currently no sediment quality guidelines for phosphorus and nitrogen.

There was no evident trend in total organic and inorganic carbon concentrations over the different locations (see Table 3.18 and Table 3.19). In 2016, sites R1, R2, L1 and L3 had greater proportions of total organic carbon than total inorganic carbon, while sites L4, M1, V1, LA1, W1, W2, B1 and S2 had greater proportions of total inorganic carbon than total organic carbon. In 2017, sites LA2, LA5, V1, W1 and B1 had greater proportions of total organic carbon than total inorganic carbon, while sites LA1, LA3, M1, W2 and S2 had greater proportions of total inorganic carbon than total organic carbon. Organic carbon comes from sources such as decayed plant matter, while inorganic carbon consists of carbonates and bicarbonates and other ionic forms of carbon. The highest organic carbon concentration at L3 (within the Labu Lakes) is expected, given that organic material is more likely to accumulate on the lake bed in the relatively quiescent waters compared to the dynamic environment in the Huon Gulf. Total organic carbon content of more than 1% can provide additional adsorptive surfaces for metals to bind to, thereby decreasing metal bioavailability in the sediment (ANZECC/ARMCANZ, 2000). Only two sites, L3 (2.16% total organic carbon in 2016) and LA5 (1.02% total organic carbon in 2017), had total organic carbon of greater than 1%.

4.3. Sediment infauna

The macrofauna and meiofauna communities observed from the eight analysed samples are largely characteristic of stressed environments, with the exception of site S2 at Salamaua, which is located 25 km south of Lae and well removed from the riverine sediment influence. The stressed nature of most sites near Lae is evidenced by under-representation of groups such as Sedentaria, amphipods and tanaids and an overall low diversity, when compared to typical tropical subtidal infauna assemblages. Sediments were also observed to appear estuarine rather than marine (i.e., contained muds and gravels), and some contained anthropogenic debris. This is expected given the proximity of the sampling locations (aside from S2) to major rivers and the city of Lae. While macrofauna abundance was low at most sites, it is not clear why relatively high numbers of individual taxa are apparent at sites W1 and LA3, and not others.

Site S2 was the only sample to contain amphioxi, which, while being globally distributed, are rarely seen, and generally of biological interest due to their linkages between invertebrates and vertebrates. The status of amphioxi in PNG is not well understood.

Meiofaunal communities typically displayed high variability in abundance and diversity between sites. Sites with greater proportions of gravel content in sediments and less riverine influence such as S2, W1, W2 and V1, had higher meiobenthic complexity overall. Sites characterised by substantial riverine influence and with large quantities of terrestrial organic material (such as M1 and B1) had low meiofauna abundance. While abundant organic content is typically associated with high meiofauna numbers due its serving as a food source, the dynamic and stressed environmental conditions associated with these sites (i.e., high concentrations of suspended solids and high current flow) is likely to be the main cause of the impoverished infauna communities.

Site S2 was the only sample to include a high proportion of gravid females and nauplii within the harpacticoid (copepod) group. This suggests that harpacticoid reproduction was not occurring at other sites at the time of sample collection, however the reason for this is not evident. The sediment characteristics at site S2 also differ from the other sites in that they comprised mainly sands as opposed to silts, and had no terrestrial organic matter. Harpacticoid abundance is known to be inversely correlated with current velocity and suspended solids (Casanova and Henry, 2004), and this may explain the very low abundance of this group at sites B1 (two individuals) and M1 (five individuals).

Given the variable proximity of the sampling sites to the high sedimentation load discharged from the Markham and Busu rivers, and varying exposure to industrial influences such as those associated with the Port of Lae and coastal infrastructure development, the localised differences in infauna communities are to be expected.

4.4. Visual assessment

4.4.1. Nearshore benthic environment

Consistently high terrestrial sediment inputs have apparently resulted in generally low structural diversity benthic habitats across much of the study area. The ability to describe benthic features was limited by the prevailing high turbidity, which typically encompassed much of the nearshore environment at the sites investigated during the study. The observable differences between the high-turbidity habitats near Lae that are characterised by a predominantly muddy seabed, and the intact coral reef ecosystems near Busama and further south, illustrate the manner by which terrigenous sediment deposits have shaped much of the nearshore marine receiving environment. In the areas where high sediment input and low light penetration are combined with a steeply sloping seafloor, these conditions are unfavourable for the establishment and growth of reef-building corals (Anthony and Connolly, 2004; Draut et al., 2009; Gilmour, 1999; Nugues and Roberts, 2003; Storlazzi et al., 2009; Storlazzi et al., 2015). Consequently, complex benthic habitats are absent along much of the coastline near Lae, and only appear in the clearer waters some 25 km to the south of Lae. For similar reasons, seagrass habitat is also absent near Lae and the turbid region of influence of the Markham and Busu rivers.

However, while benthic communities near Lae generally appear to be of low diversity, the presence of coralline algae, macroalgae, porifera (sponge) growth and invertebrates (shrimp) indicates that the influence of sediment-laden riverine and other inputs does not entirely impede the establishment of nearshore benthic biota. These organisms were not observed in any other sediments in the turbid region around Lae, Labu, Wagang and Busu River.

According to local people at Wagang, a small rocky reef is situated adjacent to the Outfall Area in 5 to 10 m of water. The existence of this reef structure is consistent with bathymetry data from the area, which shows a linear ridge feature that extends some 750 m along the coast (IHAConsult, 2018a). Local people stated that this reef structure is visible from canoes when the water is sufficiently clear and calm. It is likely that this is a section of outcropping rock that has been colonised by various benthic organisms, potentially including sponges, corals, macroalgae and coralline algae. Given the heavy wave action, freshwater influence and high sediment load from the Busu River, a fairly tolerant suite of organisms may use the reef as habitat. Due to the prevailing environmental factors in this area, the extant species may differ from those found further offshore or at reefs in clear, oligotrophic water. Local people fish in this area from boats and from the shore.

Of the rivers discharging along the northern shoreline of the Huon Gulf coast, those closest to Lae (the Markham River, Bumbu River and Busu River) exhibited the most obvious influence on nearshore marine conditions within the study area. Renagi et al. (2010) estimated the Markham River sediment load to the head of the Markham Canyon to be 12 Mtpa. However, more recent sediment supply investigations by IHAConsult have estimated the annual average sediment load from the Markham River to be 33 Mtpa (IHAConsult, 2018b). The combined sediment load from the Markham River and the catchments along the Huon Gulf north coast are estimated to be 60 Mtpa (IHAConsult, 2018b).

Sediment plumes generally extend several kilometres from their discharge locations into the Huon Gulf and are a major factor limiting the growth of seagrass and the development of coral reefs. The Lae Port Development Project (PNG Ports Corporation, 2007) indicated that sedimentation rates at a previous monitoring site at Busama were approximately ten times higher than a corresponding site at Salamaua. Local sedimentation conditions are likely to display variability on account of weather and seasonality. It is most likely that corals will also be present around Salamaua and to the south, where light penetration and physicochemical parameters are conducive to coral growth.

4.4.2. Foreshore and shallow pelagic environment

Extensive plastic litter pollution (typically plastic bags and bottles) has accumulated on beaches near Lae and was observed floating on the water in the nearshore zone. Plastic within the water column is a known source of harm leading to mortality in sea turtles as a result of ingestion or entanglement (Nelms et al, 2015), and local people cited it as a cause of damage to boat propellers. The highest density of rubbish on the shoreline was observed between Voco Point and Wagang village. Rubbish was observed along the coastline further east toward the Busu River although in lower amounts than closer to Lae. Little rubbish was observed on the southwestern coast around Labu, Labumiti and further south.

Other forms of debris, including metals, glass, polystyrene, timber, concrete, building waste and discarded clothing/footwear are also present along the coast near Lae, particularly between the port zone and Voco Point.

The presence of dolphins, occasionally seen within 100 m of the shore and frequently observed beyond this, is an apparently contradictory finding to that presented in *Wafi-Golpu Nearshore Ecology Assessment* (WorleyParsons, 2016), which claimed that no marine mammals are known to occur in the estuarine or nearshore waters within the vicinity of the Port of Lae. Twenty species of cetacean have been recorded from PNG; all are widely dispersed, many are migratory, and several are rare and endangered (UNEP, 2012). It is possible that some of these species would pass through the Project Area.

West Pacific Leatherback sea turtles (listed as critically endangered under the IUCN Red List) nest on the beaches southwest of Lae and between Wagang and Busu River. According to local people the nesting of this sea turtle between Wagang and Busu River (including the Outfall Area) is less common than historically (i.e., in the 1970s). The Huon Gulf coast is one of the few remaining nesting grounds for this species in PNG (Haywood et al, 2012; Tiwari et al, 2013). It appears that with the apparent reduction or cessation of conservation funding, a major threat to turtles nesting in this area is the depredation of nests for local consumption of eggs, and the periodic slaughter of adult nesting females.

Hawksbill and green turtles are occasionally seen by local people in the waters along the coast from Wagang to the Busu River. Under the IUCN Red List, the hawksbill turtle is listed as critically endangered while the green turtle is listed as endangered.

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Appendix A – Water and Sediment Analyses Laboratory Analytical Results

Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1627576**	Page	: 1 of 23
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR TRAVIS WOOD	Contact	: Bronwyn Sheen
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-3-8549 9636
Project	: 520	Date Samples Received	: 21-Nov-2016 13:05
Order number	: ----	Date Analysis Commenced	: 21-Nov-2016
C-O-C number	: ----	Issue Date	: 15-Dec-2016 12:44
Sampler	: TRAVIS WOOD		
Site	: ----		
Quote number	: EN/007/14		
No. of samples received	: 32		
No. of samples analysed	: 32		

NATA

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane External Subcontracting, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
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Tom Maloney	Nutrients Section Supervisor	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- It is recognised that EG093-T (Total Metals in Saline Water by ORC-ICP-MS) is less than EG093-F (Dissolved Metals in Saline Water by ORC-ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- EG020T (Total Metals): Some Method Blanks are above LOR but are not considered significant compared to analyte levels in the samples.
- Insufficient sieve fraction was recoverable to perform analysis on sample EB1627576-029 (L4 <63µm).
- Insufficient sieve fraction was recoverable to perform 1M HCl Extractable (EG035SDH, EG005E, EG020E) analysis on samples EB1627576-025 (R1 <63µm), 026 (R2 <63µm) & 030 (L1 <63µm).
- It is recognised that EG020-SD (Total Metals in Sediments by ICP-MS) is less than EG020-E (1 M HCl Extractable Metals by ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- EK061G (Total Kjeldahl Nitorgen as N) / EK067G(Total Phosphorus as P) : Samples were diluted due to matrix interference. LOR adjusted accordingly.

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	R1	R2	W1	W2	L4
			Client sampling date / time	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 10:50	17-Nov-2016 08:00	16-Nov-2016 08:00
Compound	CAS Number	LOR	Unit	EB1627576-009	EB1627576-010	EB1627576-011	EB1627576-012	EB1627576-013
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.9	9.1	9.8	9.1	9.6
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	24.4	17.6	9.2	32.1	16.6
EA150: Particle Sizing								
+75µm	----	1	%	98	94	94	26	100
+150µm	----	1	%	72	91	52	4	100
+300µm	----	1	%	7	89	25	2	100
+425µm	----	1	%	2	87	23	1	100
+600µm	----	1	%	1	85	22	1	99
+1180µm	----	1	%	<1	69	20	<1	88
+2.36mm	----	1	%	<1	46	17	<1	64
+4.75mm	----	1	%	<1	31	11	<1	40
+9.5mm	----	1	%	<1	12	6	<1	22
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	<1	2	2	18	<1
Silt (2-60 µm)	----	1	%	1	3	3	42	<1
Sand (0.06-2.00 mm)	----	1	%	99	42	77	40	29
Gravel (>2mm)	----	1	%	<1	53	18	<1	71
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.75	2.66	2.81	2.79	2.70
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1630	17500	13500	24200	8520
Boron	7440-42-8	1	mg/kg	2	<1	4	6	<1
Iron	7439-89-6	1	mg/kg	3040	13600	7960	19800	5070
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	16400	34800	30500	43900	18400
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	29100	37400	38800	54900	20800
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	1.52	0.67	0.58	0.90	0.94

Analytical Results

Sub-Matrix: **MARINE SEDIMENT** (Matrix: **SOIL**)			Client sample ID	R1	R2	W1	W2	L4
			Client sampling date / time	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 10:50	17-Nov-2016 08:00	16-Nov-2016 08:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1627576-009**	**EB1627576-010**	**EB1627576-011**	**EB1627576-012**	**EB1627576-013**
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Barium	7440-39-3	0.05	mg/kg	**9.30**	**29.3**	**9.41**	**20.9**	**18.2**
Cadmium	7440-43-9	0.05	mg/kg	<0.05	<0.05	<0.05	**0.05**	<0.05
Chromium	7440-47-3	0.05	mg/kg	**2.48**	**7.35**	**4.50**	**12.2**	**2.27**
Cobalt	7440-48-4	0.05	mg/kg	**2.28**	**7.36**	**5.32**	**12.1**	**3.17**
Copper	7440-50-8	0.05	mg/kg	**4.55**	**30.9**	**20.5**	**41.3**	**11.0**
Lead	7439-92-1	0.05	mg/kg	**2.90**	**2.01**	**0.82**	**1.83**	**2.37**
Manganese	7439-96-5	0.05	mg/kg	**75.0**	**256**	**224**	**393**	**162**
Nickel	7440-02-0	0.05	mg/kg	**2.27**	**11.8**	**11.9**	**25.4**	**4.62**
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Tin	7440-31-5	0.05	mg/kg	**0.06**	**0.05**	<0.05	**0.07**	<0.05
Vanadium	7440-62-2	0.5	mg/kg	**7.1**	**33.0**	**14.7**	**33.6**	**7.9**
Zinc	7440-66-6	0.05	mg/kg	**6.49**	**21.4**	**12.7**	**28.3**	**9.04**
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	**4.7**	**1.4**	**1.7**	**2.6**	**1.9**
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	**0.3**	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/kg	**44.4**	**98.8**	**26.0**	**42.2**	**68.6**
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/kg	**8.3**	**13.9**	**14.9**	**26.8**	**6.8**
Chromium	7440-47-3	0.1	mg/kg	**28.2**	**19.9**	**24.9**	**51.8**	**9.3**
Copper	7440-50-8	0.1	mg/kg	**19.3**	**64.1**	**62.7**	**94.3**	**24.3**
Manganese	7439-96-5	0.1	mg/kg	**347**	**605**	**658**	**952**	**455**
Nickel	7440-02-0	0.1	mg/kg	**16.9**	**24.0**	**32.0**	**64.2**	**9.8**
Lead	7439-92-1	0.1	mg/kg	**4.0**	**3.0**	**1.7**	**2.8**	**2.6**
Zinc	7440-66-6	0.5	mg/kg	**52.3**	**53.6**	**48.6**	**73.4**	**34.2**
Vanadium	7440-62-2	1	mg/kg	**46**	**105**	**166**	**229**	**60**
Tin	7440-31-5	0.1	mg/kg	**0.7**	**0.8**	**0.8**	**1.1**	**0.6**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	<0.01	**0.01**	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20

Analytical Results

Sub-Matrix: **MARINE SEDIMENT** (Matrix: **SOIL**)			Client sample ID	**R1**	**R2**	**W1**	**W2**	**L4**
			Client sampling date / time	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 10:50	17-Nov-2016 08:00	16-Nov-2016 08:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1627576-009**	**EB1627576-010**	**EB1627576-011**	**EB1627576-012**	**EB1627576-013**
				Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	**0.2**	**0.2**	**0.2**	<0.1	**0.2**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	**0.2**	**0.2**	**0.2**	<0.1	**0.2**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**130**	**50**	<20	**100**	**30**
EK062: Total Nitrogen as N (TKN + NOx)								
^ **Total Nitrogen as N**	----	20	mg/kg	**130**	**50**	<20	**100**	**30**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	**387**	**530**	**430**	**662**	**320**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	**0.6**	**0.1**	**0.3**	**0.2**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.34**	**0.41**	**0.08**	**0.28**	**0.07**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**0.41**	**0.66**	**0.44**	**0.67**	**0.48**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	**0.07**	**0.25**	**0.36**	**0.39**	**0.41**
GEO26: Sieving								
-2000µm	----	0.01	%	----	----	----	----	----
-63µm	----	0.01	%	----	----	----	----	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)	Client sample ID			L1	L3	B1	R1 <2000µm	R2 <2000µm
	Client sampling date / time			16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	16-Nov-2016 13:00	17-Nov-2016 09:30
Compound	CAS Number	LOR	Unit	EB1627576-014	EB1627576-015	EB1627576-016	EB1627576-017	EB1627576-018
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.6	8.6	9.2	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	20.8	61.2	16.6	----	----
EA150: Particle Sizing								
+75µm	----	1	%	98	5	90	----	----
+150µm	----	1	%	74	4	77	----	----
+300µm	----	1	%	22	2	64	----	----
+425µm	----	1	%	9	1	60	----	----
+600µm	----	1	%	5	<1	57	----	----
+1180µm	----	1	%	2	<1	51	----	----
+2.36mm	----	1	%	<1	<1	43	----	----
+4.75mm	----	1	%	<1	<1	34	----	----
+9.5mm	----	1	%	<1	<1	23	----	----
+19.0mm	----	1	%	<1	<1	<1	----	----
+37.5mm	----	1	%	<1	<1	<1	----	----
+75.0mm	----	1	%	<1	<1	<1	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	<1	29	4	----	----
Silt (2-60 µm)	----	1	%	1	64	5	----	----
Sand (0.06-2.00 mm)	----	1	%	98	7	45	----	----
Gravel (>2mm)	----	1	%	1	<1	46	----	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.79	2.51	2.80	----	----
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1280	15600	21000	3700	18000
Boron	7440-42-8	1	mg/kg	2	14	3	<1	<1
Iron	7439-89-6	1	mg/kg	2520	21500	11900	5950	14000
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	11300	39800	42000	16200	36200
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	23000	62800	45400	30000	42500
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	1.55	2.71	0.60	1.24	0.83

Analytical Results

Sub-Matrix: MARINE SEDIMENT
(Matrix: SOIL)

Client sample ID				L1	L3	B1	R1 <2000µm	R2 <2000µm
Client sampling date / time				16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	16-Nov-2016 13:00	17-Nov-2016 09:30
Compound	CAS Number	LOR	Unit	EB1627576-014	EB1627576-015	EB1627576-016	EB1627576-017	EB1627576-018
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Barium	7440-39-3	0.05	mg/kg	6.60	16.5	21.3	27.3	64.3
Cadmium	7440-43-9	0.05	mg/kg	<0.05	0.10	<0.05	<0.05	<0.05
Chromium	7440-47-3	0.05	mg/kg	1.82	11.4	5.92	70.6	38.5
Cobalt	7440-48-4	0.05	mg/kg	1.61	11.5	7.13	3.03	6.94
Copper	7440-50-8	0.05	mg/kg	3.34	54.3	25.8	5.54	27.2
Lead	7439-92-1	0.05	mg/kg	2.36	11.0	0.92	3.76	3.16
Manganese	7439-96-5	0.05	mg/kg	60.5	477	236	103	244
Nickel	7440-02-0	0.05	mg/kg	1.81	18.4	16.3	3.93	11.2
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Tin	7440-31-5	0.05	mg/kg	<0.05	0.12	<0.05	0.14	0.13
Vanadium	7440-62-2	0.5	mg/kg	5.7	38.5	19.0	9.7	30.7
Zinc	7440-66-6	0.05	mg/kg	4.99	36.2	16.6	10.7	22.6
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	4.6	12.4	1.8	4.3	2.9
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/kg	27.0	38.5	45.4	63.4	136
Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/kg	5.9	23.2	18.1	8.2	13.8
Chromium	7440-47-3	0.1	mg/kg	25.1	53.9	23.0	114	62.7
Copper	7440-50-8	0.1	mg/kg	13.9	104	71.5	17.5	52.6
Manganese	7439-96-5	0.1	mg/kg	272	1010	726	357	587
Nickel	7440-02-0	0.1	mg/kg	12.7	53.4	39.8	16.0	24.6
Lead	7439-92-1	0.1	mg/kg	2.9	12.1	1.9	4.8	4.4
Zinc	7440-66-6	0.5	mg/kg	39.0	90.4	51.4	50.2	60.7
Vanadium	7440-62-2	1	mg/kg	40	130	153	52	121
Tin	7440-31-5	0.1	mg/kg	0.6	1.5	0.8	0.9	1.0
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	0.06	0.01	<0.01	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	----	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	L1	L3	B1	R1 <2000µm	R2 <2000µm
			Client sampling date / time	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	16-Nov-2016 13:00	17-Nov-2016 09:30
Compound	CAS Number	LOR	Unit	EB1627576-014	EB1627576-015	EB1627576-016	EB1627576-017	EB1627576-018
				Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	**0.2**	<0.1	<0.1	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	**0.2**	<0.1	<0.1	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**110**	**1230**	**30**	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	**110**	**1230**	**30**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	**404**	**759**	**607**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	**5.8**	**0.1**	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.25**	**2.44**	**0.04**	**0.21**	**0.09**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**0.31**	**2.54**	**0.54**	**0.26**	**0.09**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	**0.06**	**0.10**	**0.50**	**0.05**	<0.02
GEO26: Sieving								
-2000µm	----	0.01	%	----	----	----	**91.8**	**42.2**
-63µm	----	0.01	%	----	----	----	----	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	W1 <2000µm	W2 <2000µm	L4 <2000µm	L1 <2000µm	L3 <2000µm
			Client sampling date / time	17-Nov-2016 10:50	17-Nov-2016 08:00	16-Nov-2016 08:00	16-Nov-2016 11:00	16-Nov-2016 10:00
Compound	CAS Number	LOR	Unit	EB1627576-019	EB1627576-020	EB1627576-021	EB1627576-022	EB1627576-023
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	----	----
+150µm	----	1	%	----	----	----	----	----
+300µm	----	1	%	----	----	----	----	----
+425µm	----	1	%	----	----	----	----	----
+600µm	----	1	%	----	----	----	----	----
+1180µm	----	1	%	----	----	----	----	----
+2.36mm	----	1	%	----	----	----	----	----
+4.75mm	----	1	%	----	----	----	----	----
+9.5mm	----	1	%	----	----	----	----	----
+19.0mm	----	1	%	----	----	----	----	----
+37.5mm	----	1	%	----	----	----	----	----
+75.0mm	----	1	%	----	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	----	----
Silt (2-60 µm)	----	1	%	----	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	----	----	----	----	----
Gravel (>2mm)	----	1	%	----	----	----	----	----
Cobbles (>6cm)	----	1	%	----	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	----	----	----
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	17600	23800	14000	3090	15600
Boron	7440-42-8	1	mg/kg	6	4	<1	<1	8
Iron	7439-89-6	1	mg/kg	11900	18700	10800	4410	20000
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	34800	40400	25000	13200	31900
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	46100	52300	32200	26500	54300
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	0.70	0.80	1.07	1.65	2.21

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	W1 <2000µm	W2 <2000µm	L4 <2000µm	L1 <2000µm	L3 <2000µm
			Client sampling date / time	17-Nov-2016 10:50	17-Nov-2016 08:00	16-Nov-2016 08:00	16-Nov-2016 11:00	16-Nov-2016 10:00
Compound	CAS Number	LOR	Unit	EB1627576-019	EB1627576-020	EB1627576-021	EB1627576-022	EB1627576-023
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Barium	7440-39-3	0.05	mg/kg	19.5	24.0	44.2	13.5	26.1
Cadmium	7440-43-9	0.05	mg/kg	<0.05	0.07	0.14	<0.05	0.13
Chromium	7440-47-3	0.05	mg/kg	35.6	17.3	64.0	18.5	33.7
Cobalt	7440-48-4	0.05	mg/kg	6.72	11.6	4.84	2.20	10.3
Copper	7440-50-8	0.05	mg/kg	23.1	37.6	20.6	5.54	47.4
Lead	7439-92-1	0.05	mg/kg	1.41	1.79	1.97	2.76	9.48
Manganese	7439-96-5	0.05	mg/kg	265	385	267	86.3	393
Nickel	7440-02-0	0.05	mg/kg	14.7	24.5	7.33	3.44	15.9
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Tin	7440-31-5	0.05	mg/kg	0.50	0.10	0.10	0.08	0.18
Vanadium	7440-62-2	0.5	mg/kg	19.3	31.3	15.1	8.2	33.0
Zinc	7440-66-6	0.05	mg/kg	18.2	27.1	19.0	8.11	32.2
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	2.2	2.3	2.7	4.1	12.6
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.3
Barium	7440-39-3	0.1	mg/kg	38.7	39.5	72.4	31.7	37.0
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.2	<0.1	0.2
Cobalt	7440-48-4	0.1	mg/kg	18.2	24.6	9.9	6.9	23.1
Chromium	7440-47-3	0.1	mg/kg	79.5	54.1	95.5	49.8	51.3
Copper	7440-50-8	0.1	mg/kg	59.9	87.5	40.2	16.8	105
Manganese	7439-96-5	0.1	mg/kg	786	920	622	321	968
Nickel	7440-02-0	0.1	mg/kg	41.6	57.2	17.4	15.0	48.7
Lead	7439-92-1	0.1	mg/kg	2.3	2.7	2.8	3.8	11.4
Zinc	7440-66-6	0.5	mg/kg	60.1	69.5	51.4	43.0	86.6
Vanadium	7440-62-2	1	mg/kg	213	223	103	54	122
Tin	7440-31-5	0.1	mg/kg	1.2	0.9	0.5	0.6	1.0
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	0.01	<0.01	<0.01	0.06
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	----	----	----	----	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	W1 <2000µm	W2 <2000µm	L4 <2000µm	L1 <2000µm	L3 <2000µm
Client sampling date / time				17-Nov-2016 10:50	17-Nov-2016 08:00	16-Nov-2016 08:00	16-Nov-2016 11:00	16-Nov-2016 10:00
				EB1627576-019	EB1627576-020	EB1627576-021	EB1627576-022	EB1627576-023
				Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	----	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	----	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.04	0.11	0.09	0.22	2.16
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	0.34	0.50	0.40	0.26	2.32
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	0.30	0.39	0.31	0.04	0.16
GEO26: Sieving								
-2000µm	----	0.01	%	70.9	79.9	27.5	86.7	57.4
-63µm	----	0.01	%	----	----	----	----	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	B1 <2000µm	R1 <63µm	R2 <63µm	W1 <63µm	W2 <63µm
Client sampling date / time				17-Nov-2016 08:30	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 10:50	17-Nov-2016 08:00
				EB1627576-024	EB1627576-025	EB1627576-026	EB1627576-027	EB1627576-028
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	----	----
+150µm	----	1	%	----	----	----	----	----
+300µm	----	1	%	----	----	----	----	----
+425µm	----	1	%	----	----	----	----	----
+600µm	----	1	%	----	----	----	----	----
+1180µm	----	1	%	----	----	----	----	----
+2.36mm	----	1	%	----	----	----	----	----
+4.75mm	----	1	%	----	----	----	----	----
+9.5mm	----	1	%	----	----	----	----	----
+19.0mm	----	1	%	----	----	----	----	----
+37.5mm	----	1	%	----	----	----	----	----
+75.0mm	----	1	%	----	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	----	----
Silt (2-60 µm)	----	1	%	----	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	----	----	----	----	----
Gravel (>2mm)	----	1	%	----	----	----	----	----
Cobbles (>6cm)	----	1	%	----	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	----	----	----
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**19200**	----	----	**20800**	**22700**
Boron	7440-42-8	1	mg/kg	**3**	----	----	**5**	**8**
Iron	7439-89-6	1	mg/kg	**13200**	----	----	**18000**	**19200**
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**34600**	**23400**	**39200**	**34400**	**45100**
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	**40200**	**45100**	**52500**	**59300**	**60700**
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	**0.68**	----	----	**1.09**	**0.80**

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	B1 <2000µm	R1 <63µm	R2 <63µm	W1 <63µm	W2 <63µm
Client sampling date / time				17-Nov-2016 08:30	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 10:50	17-Nov-2016 08:00
				EB1627576-024	EB1627576-025	EB1627576-026	EB1627576-027	EB1627576-028
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Barium	7440-39-3	0.05	mg/kg	23.9	----	----	26.8	19.3
Cadmium	7440-43-9	0.05	mg/kg	0.17	----	----	0.07	0.08
Chromium	7440-47-3	0.05	mg/kg	14.9	----	----	11.2	11.2
Cobalt	7440-48-4	0.05	mg/kg	7.52	----	----	10.8	12.1
Copper	7440-50-8	0.05	mg/kg	25.7	----	----	44.3	44.0
Lead	7439-92-1	0.05	mg/kg	1.27	----	----	3.11	2.03
Manganese	7439-96-5	0.05	mg/kg	267	----	----	500	391
Nickel	7440-02-0	0.05	mg/kg	16.1	----	----	21.0	24.3
Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	<0.1	<0.1
Silver	7440-22-4	0.05	mg/kg	<0.05	----	----	<0.05	<0.05
Tin	7440-31-5	0.05	mg/kg	0.07	----	----	0.21	0.09
Vanadium	7440-62-2	0.5	mg/kg	20.9	----	----	31.0	29.1
Zinc	7440-66-6	0.05	mg/kg	20.9	----	----	29.8	27.6
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	2.0	7.6	2.9	3.6	2.8
Selenium	7782-49-2	1	mg/kg	<1	<4	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	<0.1	0.2	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/kg	47.4	47.3	173	53.8	42.4
Cadmium	7440-43-9	0.1	mg/kg	0.2	1.1	0.2	0.1	0.2
Cobalt	7440-48-4	0.1	mg/kg	19.1	15.0	24.1	27.0	33.8
Chromium	7440-47-3	0.1	mg/kg	28.9	49.1	45.2	66.2	54.0
Copper	7440-50-8	0.1	mg/kg	74.9	79.7	126	104	111
Manganese	7439-96-5	0.1	mg/kg	732	779	1140	1150	1180
Nickel	7440-02-0	0.1	mg/kg	44.4	29.4	45.5	58.6	75.5
Lead	7439-92-1	0.1	mg/kg	2.2	9.5	5.3	4.4	3.0
Zinc	7440-66-6	0.5	mg/kg	59.1	130	162	91.4	85.4
Vanadium	7440-62-2	1	mg/kg	177	67	170	292	239
Tin	7440-31-5	0.1	mg/kg	0.9	14.4	1.8	1.0	0.9
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	----	----	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.02	0.02	0.02	0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	----	----	----	----	----

Analytical Results

Sub-Matrix: **MARINE SEDIMENT**
(Matrix: **SOIL**)

			Client sample ID	B1 <2000µm	R1 <63µm	R2 <63µm	W1 <63µm	W2 <63µm
			Client sampling date / time	17-Nov-2016 08:30	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 10:50	17-Nov-2016 08:00
Compound	CAS Number	LOR	Unit	EB1627576-024	EB1627576-025	EB1627576-026	EB1627576-027	EB1627576-028
				Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	----	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	----	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.05	0.51	0.91	0.48	0.22
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	0.49	0.62	1.25	1.00	0.64
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	0.44	0.11	0.34	0.52	0.42
GEO26: Sieving								
-2000µm	----	0.01	%	63.4	----	----	----	----
-63µm	----	0.01	%	----	0.68	0.54	3.28	56.7

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)

Compound	CAS Number	LOR	Unit	L4 <63µm	L1 <63µm	L3 <63µm	B1 <63µm	----
Client sampling date / time				17-Nov-2016 08:00	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	----
				EB1627576-029	EB1627576-030	EB1627576-031	EB1627576-032	--------
				Result	Result	Result	Result	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	----	----
+150µm	----	1	%	----	----	----	----	----
+300µm	----	1	%	----	----	----	----	----
+425µm	----	1	%	----	----	----	----	----
+600µm	----	1	%	----	----	----	----	----
+1180µm	----	1	%	----	----	----	----	----
+2.36mm	----	1	%	----	----	----	----	----
+4.75mm	----	1	%	----	----	----	----	----
+9.5mm	----	1	%	----	----	----	----	----
+19.0mm	----	1	%	----	----	----	----	----
+37.5mm	----	1	%	----	----	----	----	----
+75.0mm	----	1	%	----	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	----	----
Silt (2-60 µm)	----	1	%	----	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	----	----	----	----	----
Gravel (>2mm)	----	1	%	----	----	----	----	----
Cobbles (>6cm)	----	1	%	----	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	----	----	----
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	----	----	15700	20200	----
Boron	7440-42-8	1	mg/kg	----	----	10	6	----
Iron	7439-89-6	1	mg/kg	----	----	21600	16000	----
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	----	22200	35400	39800	----
Boron	7440-42-8	50	mg/kg	----	<110	<50	<50	----
Iron	7439-89-6	50	mg/kg	----	67600	62600	56400	----
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	----	----	2.03	0.68	----

Analytical Results

Sub-Matrix: **MARINE SEDIMENT** (Matrix: **SOIL**)			Client sample ID	L4 <63µm	L1 <63µm	L3 <63µm	B1 <63µm	----
			Client sampling date / time	17-Nov-2016 08:00	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	----
Compound	CAS Number	LOR	Unit	EB1627576-029	EB1627576-030	EB1627576-031	EB1627576-032	--------
				Result	Result	Result	Result	----
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Barium	7440-39-3	0.05	mg/kg	----	----	19.2	34.5	----
Cadmium	7440-43-9	0.05	mg/kg	----	----	0.12	0.57	----
Chromium	7440-47-3	0.05	mg/kg	----	----	11.0	9.60	----
Cobalt	7440-48-4	0.05	mg/kg	----	----	12.2	9.77	----
Copper	7440-50-8	0.05	mg/kg	----	----	60.0	39.7	----
Lead	7439-92-1	0.05	mg/kg	----	----	12.8	2.46	----
Manganese	7439-96-5	0.05	mg/kg	----	----	470	310	----
Nickel	7440-02-0	0.05	mg/kg	----	----	18.8	21.4	----
Selenium	7782-49-2	0.1	mg/kg	----	----	<0.1	<0.1	----
Silver	7440-22-4	0.05	mg/kg	----	----	<0.05	<0.05	----
Tin	7440-31-5	0.05	mg/kg	----	----	0.50	0.30	----
Vanadium	7440-62-2	0.5	mg/kg	----	----	37.0	27.8	----
Zinc	7440-66-6	0.05	mg/kg	----	----	39.0	32.6	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	----	8.2	11.1	2.4	----
Selenium	7782-49-2	1	mg/kg	----	<11	<1	<1	----
Silver	7440-22-4	0.1	mg/kg	----	<1.1	0.3	<0.1	----
Barium	7440-39-3	0.1	mg/kg	----	39.6	39.8	54.4	----
Cadmium	7440-43-9	0.1	mg/kg	----	<1.1	0.2	0.2	----
Cobalt	7440-48-4	0.1	mg/kg	----	15.6	22.7	22.3	----
Chromium	7440-47-3	0.1	mg/kg	----	95.7	51.8	45.9	----
Copper	7440-50-8	0.1	mg/kg	----	81.4	101	101	----
Manganese	7439-96-5	0.1	mg/kg	----	704	963	809	----
Nickel	7440-02-0	0.1	mg/kg	----	35.9	50.3	55.0	----
Lead	7439-92-1	0.1	mg/kg	----	16.2	14.5	3.4	----
Zinc	7440-66-6	0.5	mg/kg	----	770	88.6	78.8	----
Vanadium	7440-62-2	1	mg/kg	----	143	117	215	----
Tin	7440-31-5	0.1	mg/kg	----	324	1.2	0.9	----
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	<0.10	<0.10	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	----	<0.05	0.06	0.02	----
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	----	----	----	----	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT
(Matrix: SOIL)

			Client sample ID	L4 <63µm	L1 <63µm	L3 <63µm	B1 <63µm	----
			Client sampling date / time	17-Nov-2016 08:00	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	----
Compound	CAS Number	LOR	Unit	EB1627576-029	EB1627576-030	EB1627576-031	EB1627576-032	--------
				Result	Result	Result	Result	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	----	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	----	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	1.46	1.45	2.17	0.25	----
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	----	1.72	2.51	0.70	----
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	----	0.27	0.34	0.45	----
GEO26: Sieving								
-2000µm	----	0.01	%	----	----	----	----	----
-63µm	----	0.01	%	0.05	0.19	48.2	5.33	----

Analytical Results

Sub-Matrix: MARINE WATER
(Matrix: WATER)

Compound	CAS Number	LOR	Unit	R1	R2	W1	W2	L4
Client sampling date / time				16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 06:55	17-Nov-2016 07:30	16-Nov-2016 07:30
				EB1627576-001	EB1627576-002	EB1627576-003	EB1627576-004	EB1627576-005
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	5	14	6	9	36
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	108	109	108	108	97
Total Alkalinity as CaCO3	----	1	mg/L	108	109	108	108	97
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2160	1870	1540	1580	1470
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	13200	11700	10100	10200	9690
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	329	301	259	270	247
Magnesium	7439-95-4	1	mg/L	1020	902	761	796	722
Sodium	7440-23-5	1	mg/L	8260	7300	6180	6440	5900
Potassium	7440-09-7	1	mg/L	305	272	227	236	225
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	<5	5	5	<5
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	0.7	<0.5
Arsenic	7440-38-2	0.5	µg/L	1.2	1.2	1.2	1.3	1.2
Barium	7440-39-3	1	µg/L	12	25	31	31	20
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	3580	3030	2500	2600	1660
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.2	<0.2	<0.2
Copper	7440-50-8	1	µg/L	<1	<1	1	<1	<1
Iron	7439-89-6	5	µg/L	<5	<5	<5	<5	49
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	4.0	8.5	13.2	11.8	53.2
Molybdenum	7439-98-7	0.1	µg/L	8.0	6.6	5.4	5.8	3.3

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	R1	R2	W1	W2	L4
			Client sampling date / time	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 06:55	17-Nov-2016 07:30	16-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627576-001	EB1627576-002	EB1627576-003	EB1627576-004	EB1627576-005
				Result	Result	Result	Result	Result
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	7782-49-2	2	µg/L	<2	**2**	<2	<2	<2
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Vanadium	7440-62-2	0.5	µg/L	**2.0**	**4.5**	**5.4**	**5.1**	**2.0**
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**135**	**682**	**322**	**550**	**621**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.3**	**1.3**	**1.5**	**1.4**	**1.8**
Barium	7440-39-3	1	µg/L	**12**	**28**	**38**	**35**	**19**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**3560**	**3160**	**2670**	**2820**	**1500**
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	7440-47-3	0.5	µg/L	<0.5	**1.0**	<0.5	**0.7**	**0.9**
Cobalt	7440-48-4	0.2	µg/L	<0.2	**0.6**	**0.4**	**0.5**	**0.6**
Copper	7440-50-8	1	µg/L	**1**	**2**	**2**	**3**	**2**
Iron	7439-89-6	5	µg/L	**245**	**907**	**411**	**700**	**1270**
Lead	7439-92-1	0.2	µg/L	**0.3**	<0.2	<0.2	<0.2	**1.4**
Manganese	7439-96-5	0.5	µg/L	**12.1**	**29.3**	**25.4**	**29.6**	**84.2**
Molybdenum	7439-98-7	0.1	µg/L	**8.9**	**8.1**	**6.3**	**6.9**	**3.5**
Nickel	7440-02-0	0.5	µg/L	<0.5	**1.1**	<0.5	**0.9**	**1.0**
Selenium	7782-49-2	2	µg/L	**2**	**2**	<2	<2	<2
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Vanadium	7440-62-2	0.5	µg/L	**2.5**	**6.3**	**7.4**	**7.6**	**4.0**
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	**6**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.06**	**0.05**	**0.03**	**0.03**	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	**0.02**	**0.01**	**0.01**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	R1	R2	W1	W2	L4
			Client sampling date / time	16-Nov-2016 13:00	17-Nov-2016 09:30	17-Nov-2016 06:55	17-Nov-2016 07:30	16-Nov-2016 07:30
Compound	*CAS Number*	*LOR*	*Unit*	**EB1627576-001**	**EB1627576-002**	**EB1627576-003**	**EB1627576-004**	**EB1627576-005**
				Result	Result	Result	Result	Result
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	**0.02**	**0.01**	**0.01**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.10**	**0.13**	**0.07**	**0.13**	**0.08**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	**0.02**	**0.01**	**0.02**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**419**	**371**	**319**	**323**	**306**
Total Cations	----	0.01	meq/L	**467**	**414**	**350**	**365**	**334**
Ionic Balance	----	0.01	%	**5.41**	**5.43**	**4.64**	**6.16**	**4.41**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	**8**

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	L1	L3	B1	----	----
			Client sampling date / time	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	----	----
Compound	CAS Number	LOR	Unit	EB1627576-006	EB1627576-007	EB1627576-008	--------	--------
				Result	Result	Result	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	15	4	546	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	102	69	112	----	----
Total Alkalinity as CaCO3	----	1	mg/L	102	69	112	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1430	751	2200	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	9420	5540	13300	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	219	124	349	----	----
Magnesium	7439-95-4	1	mg/L	650	370	1070	----	----
Sodium	7440-23-5	1	mg/L	5480	2900	8620	----	----
Potassium	7440-09-7	1	mg/L	197	110	318	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	<5	14	----	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Arsenic	7440-38-2	0.5	µg/L	2.2	0.8	1.4	----	----
Barium	7440-39-3	1	µg/L	28	19	28	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Boron	7440-42-8	100	µg/L	2160	1310	3380	----	----
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	----	----
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	<0.2	----	----
Copper	7440-50-8	1	µg/L	1	<1	1	----	----
Iron	7439-89-6	5	µg/L	<5	42	<5	----	----
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	----	----
Manganese	7439-96-5	0.5	µg/L	10.2	40.9	16.4	----	----
Molybdenum	7439-98-7	0.1	µg/L	4.7	2.4	8.0	----	----

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	L1	L3	B1	----	----
			Client sampling date / time	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	----	----
Compound	CAS Number	LOR	Unit	EB1627576-006	EB1627576-007	EB1627576-008	--------	--------
				Result	Result	Result	----	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Selenium	7782-49-2	2	µg/L	<2	<2	**2**	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Tin	7440-31-5	5	µg/L	<5	<5	<5	----	----
Vanadium	7440-62-2	0.5	µg/L	**3.4**	**1.6**	**4.0**	----	----
Zinc	7440-66-6	5	µg/L	<5	<5	<5	----	----
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**644**	**97**	**24800**	----	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Arsenic	7440-38-2	0.5	µg/L	**2.6**	**0.7**	**2.3**	----	----
Barium	7440-39-3	1	µg/L	**33**	**18**	**60**	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	**0.2**	----	----
Boron	7440-42-8	100	µg/L	**2290**	**1130**	**3320**	----	----
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	----	----
Chromium	7440-47-3	0.5	µg/L	**1.1**	**1.9**	**18.5**	----	----
Cobalt	7440-48-4	0.2	µg/L	**0.5**	**0.2**	**14.7**	----	----
Copper	7440-50-8	1	µg/L	**3**	**4**	**53**	----	----
Iron	7439-89-6	5	µg/L	**916**	**264**	**27000**	----	----
Lead	7439-92-1	0.2	µg/L	**0.6**	**0.7**	**1.9**	----	----
Manganese	7439-96-5	0.5	µg/L	**29.9**	**50.7**	**546**	----	----
Molybdenum	7439-98-7	0.1	µg/L	**5.5**	**2.3**	**8.8**	----	----
Nickel	7440-02-0	0.5	µg/L	**1.1**	**0.8**	**38.0**	----	----
Selenium	7782-49-2	2	µg/L	<2	<2	**3**	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Tin	7440-31-5	5	µg/L	<5	<5	<5	----	----
Vanadium	7440-62-2	0.5	µg/L	**6.4**	**1.4**	**79.1**	----	----
Zinc	7440-66-6	5	µg/L	<5	**11**	**41**	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.06**	**0.06**	**0.08**	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.04**	<0.01	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	L1	L3	B1	----	----
			Client sampling date / time	16-Nov-2016 11:00	16-Nov-2016 10:00	17-Nov-2016 08:30	----	----
Compound	CAS Number	LOR	Unit	EB1627576-006	EB1627576-007	EB1627576-008	--------	--------
				Result	Result	Result	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser - Continued								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.04**	<0.01	<0.01	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	**0.45**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.02**	**0.03**	**0.10**	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**298**	**173**	**423**	----	----
Total Cations	----	0.01	meq/L	**308**	**166**	**488**	----	----
Ionic Balance	----	0.01	%	**1.70**	**2.27**	**7.17**	----	----
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	**7**	**6**	**8**	----	----

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AUSTRALIAN LABORATORY SERVICES

2 Byth Street
Stafford QLD 4053

Sarah Ashworth

CERTIFICATE OF ANALYSIS

DTS Ref: DTSQ16020460
Report Date: 28 November 2016

Report No: 2008105

Sample description: **EB1627576 WATER SAMPLES 16/11/16-17/11/16**

Sample received: November 22, 2016 11:02 am

Testing commenced: November 22, 2016 11:18 am

Samples tested as received into the laboratory.

Temperature on receipt: 10°C

Laboratory Number	Sample Description	Results and Units	DTS Method reference
22NOV16/9301490	**001 R1 16/11/16 W 1**		
Faecal Coliforms		<1 cfu/100mL	3-3-4-3
E.coli		<1 cfu/100mL	3-3-4-3
22NOV16/9301491	**002 R2 17/11/16 W 1**		
Faecal Coliforms		<1 cfu/100mL	3-3-4-3
E.coli		<1 cfu/100mL	3-3-4-3
22NOV16/9301492	**003 W1 17/11/16 W 1**		
Faecal Coliforms		23 cfu/100mL	3-3-4-3
E.coli		23 cfu/100mL	3-3-4-3
22NOV16/9301493	**004 W2 17/11/16 W 1**		
Faecal Coliforms		>80 cfu/100mL	3-3-4-3
E.coli		>80 cfu/100mL	3-3-4-3
22NOV16/9301494	**005 L4 16/11/16 W 1**		
Faecal Coliforms		>80 cfu/100mL	3-3-4-3
E.coli		>80 cfu/100mL	3-3-4-3
22NOV16/9301495	**006 L1 16/11/16 W 1**		
Faecal Coliforms		>80 cfu/100mL	3-3-4-3
E.coli		>80 cfu/100mL	3-3-4-3
22NOV16/9301496	**007 L3 16/11/16 W 1**		
Faecal Coliforms		11 cfu/100mL	3-3-4-3
E.coli		11 cfu/100mL	3-3-4-3

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AUSTRALIAN LABORATORY SERVICES

2 Byth Street
Stafford QLD 4053

Sarah Ashworth

CERTIFICATE OF ANALYSIS

DTS Ref: DTSQ16020460
Report Date: 28 November 2016

Report No: 2008105

Sample description: **EB1627576 WATER SAMPLES 16/11/16-17/11/16**

Sample received: November 22, 2016 11:02 am

Testing commenced: November 22, 2016 11:18 am

Samples tested as received into the laboratory.

Temperature on receipt: 10°C

Laboratory Number	Sample Description	Results and Units	DTS Method reference
22NOV16/9301497	**008 B1 17/11/16 W 1**		
Faecal Coliforms		>80 cfu/100mL	3-3-4-3
E.coli		>80 cfu/100mL	3-3-4-3

< = Less than > = Greater than Est = Estimated spp = Species Y = Yeasts M = Moulds N/D = Not Detected -- = Not tested

SAMPLES RECEIVED OUTSIDE OF RECOMMENDED HOLDING TIME.

S. Lawrence

Sharon Lawrence
Microbiologist

Testing services are subject to DTS terms and conditions.

NATA ACCREDITED LABORATORY Number - 345

Sample(s) tested as received

Accredited for compliance with ISO/IEC 17025 - Testing
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Measurement Uncertainty (MU) data can be found on DTSLIVE at www.dtsfoodlabs.com.au.
Please note that the MU provided is indicative for general matrices and analytes only.

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AUSTRALIAN LABORATORY SERVICES

2 Byth Street
Stafford QLD 4053

Sarah Ashworth

CERTIFICATE OF ANALYSIS

DTS Ref: DTSQ16020714
Report Date: 28 November 2016

Report No: 2008982

Sample description: **EB1627798 WATER SAMPLES 18/11/16-19/11/16**

Sample received: November 24, 2016 4:28 pm

Testing commenced: November 25, 2016 12:42 pm

Samples tested as received into the laboratory.

Temperature on receipt: 8°C

Laboratory Number	Sample Description	Results and Units	DTS Method reference
24NOV16/9312321	**EB1627798-001**		
Thermotolerant coliforms		<2 MPN/100mL	ECWT 04 12.08
24NOV16/9312322	**EB1627798-002**		
Thermotolerant coliforms		540 MPN/100mL	ECWT 04 12.08
24NOV16/9312323	**EB1627798-003**		
Thermotolerant coliforms		540 MPN/100mL	ECWT 04 12.08
24NOV16/9312324	**EB1627798-004**		
Thermotolerant coliforms		920 MPN/100mL	ECWT 04 12.08
24NOV16/9312325	**EB1627798-005**		
Thermotolerant coliforms		79 MPN/100mL	ECWT 04 12.08
24NOV16/9312326	**EB1627798-006**		
Thermotolerant coliforms		<2 MPN/100mL	ECWT 04 12.08
24NOV16/9312327	**EB1627798-007**		
Thermotolerant coliforms		920 MPN/100mL	ECWT 04 12.08

< = Less than > = Greater than Est = Estimated spp = Species Y = Yeasts M = Moulds N/D = Not Detected -- = Not tested

SAMPLES RECEIVED OUTSIDE OF RECOMMENDED HOLDING TIME.

V.Morris

Vanessa Morris
Microbiologist

Testing services are subject to DTS terms and conditions.

CERTIFICATE OF ANALYSIS

Work Order	: **EB1627798**	Page	: 1 of 10
Amendment	: **1**		
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 23-Nov-2016 11:30
Order number	: ----	Date Analysis Commenced	: 23-Nov-2016
C-O-C number	: ----	Issue Date	: 15-Dec-2016 16:24
Sampler	: IVAN STEWARD, TRAVIS WOOD		
Site	: ----		
Quote number	: BN/288/16		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EK061G (Total Kjeldahl Nitrogen as N) / EK067G (Total Phosphorus as P): Samples were diluted due to matrix interference. LOR adjusted accordingly.
- Amendment (15/12/2016): This report has been amended and re-released to allow the reporting of additional analytical data.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	FB1	L1	V1D	V1	M2
			Client sampling date / time	19-Nov-2016 09:50	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 08:00
Compound	CAS Number	LOR	Unit	EB1627798-001	EB1627798-002	EB1627798-003	EB1627798-004	EB1627798-005
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	**1300**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**1**	**103**	**112**	**107**	**103**
Total Alkalinity as CaCO3	----	1	mg/L	**1**	**103**	**112**	**107**	**103**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**2120**	**2100**	**1320**	**1530**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	**13800**	**13500**	**9350**	**10400**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	**355**	**363**	**255**	**274**
Magnesium	7439-95-4	1	mg/L	<1	**1060**	**1100**	**718**	**772**
Sodium	7440-23-5	1	mg/L	<1	**8940**	**9210**	**6010**	**6520**
Potassium	7440-09-7	1	mg/L	<1	**320**	**329**	**212**	**232**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	**18**	**20**	**71**	**21**
Antimony	7440-36-0	0.5	µg/L	----	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	----	**1.4**	**1.7**	**1.5**	**2.4**
Barium	7440-39-3	1	µg/L	----	**17**	**16**	**25**	**43**
Beryllium	7440-41-7	0.1	µg/L	----	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	----	**3380**	**3540**	**2540**	**2560**
Cadmium	7440-43-9	0.1	µg/L	----	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.5	µg/L	----	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	----	<0.2	<0.2	<0.2	<0.2
Copper	7440-50-8	1	µg/L	----	<1	<1	**2**	**1**
Iron	7439-89-6	5	µg/L	----	<5	<5	**21**	<5
Lead	7439-92-1	0.2	µg/L	----	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	----	**4.8**	**5.8**	**10.8**	**7.0**
Molybdenum	7439-98-7	0.1	µg/L	----	**7.8**	**8.0**	**5.4**	**6.0**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	FB1	L1	V1D	V1	M2
			Client sampling date / time	19-Nov-2016 09:50	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 08:00
Compound	CAS Number	LOR	Unit	EB1627798-001	EB1627798-002	EB1627798-003	EB1627798-004	EB1627798-005
				Result	Result	Result	Result	Result
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	----	<0.5	<0.5	0.7	0.6
Selenium	7782-49-2	2	µg/L	----	<2	<2	<2	<2
Silver	7440-22-4	0.1	µg/L	----	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	----	<5	<5	<5	<5
Vanadium	7440-62-2	0.5	µg/L	----	3.2	3.1	6.5	5.8
Zinc	7440-66-6	5	µg/L	----	<5	<5	<5	<5
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	643	572	654	40900
Antimony	7440-36-0	0.5	µg/L	----	<0.5	<0.5	<0.5	<0.5
Iron	7439-89-6	5	µg/L	----	728	657	731	63200
Arsenic	7440-38-2	0.5	µg/L	----	1.7	1.8	1.5	20.1
Barium	7440-39-3	1	µg/L	----	22	21	27	115
Beryllium	7440-41-7	0.1	µg/L	----	<0.1	<0.1	<0.1	0.6
Boron	7440-42-8	100	µg/L	----	3200	3270	2250	2670
Cadmium	7440-43-9	0.2	µg/L	----	<0.2	<0.2	<0.2	0.2
Chromium	7440-47-3	0.5	µg/L	----	0.9	3.0	1.6	55.2
Cobalt	7440-48-4	0.2	µg/L	----	0.5	0.5	0.6	30.4
Copper	7440-50-8	1	µg/L	----	2	2	3	104
Lead	7439-92-1	0.2	µg/L	----	0.3	<0.2	<0.2	15.1
Manganese	7439-96-5	0.5	µg/L	----	28.4	25.3	32.7	1460
Molybdenum	7439-98-7	0.1	µg/L	----	7.9	10.2	6.1	6.7
Nickel	7440-02-0	0.5	µg/L	----	1.5	10.4	4.8	63.0
Selenium	7782-49-2	2	µg/L	----	<2	<2	<2	<2
Silver	7440-22-4	0.1	µg/L	----	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	----	<5	<5	<5	<5
Vanadium	7440-62-2	0.5	µg/L	----	6.7	5.9	9.5	149
Zinc	7440-66-6	5	µg/L	----	<5	<5	<5	117
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	----	----	----	----
Antimony	7440-36-0	0.2	µg/L	<0.2	----	----	----	----
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Barium	7440-39-3	0.5	µg/L	<0.5	----	----	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	----	----	----	----
Boron	7440-42-8	5	µg/L	<5	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	FB1	L1	V1D	V1	M2
			Client sampling date / time	19-Nov-2016 09:50	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 08:00
Compound	CAS Number	LOR	Unit	EB1627798-001	EB1627798-002	EB1627798-003	EB1627798-004	EB1627798-005
				Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued								
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L	<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L	<0.1	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	<0.1	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	<0.5	----	----	----	----
Selenium	7782-49-2	0.2	µg/L	<0.2	----	----	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	----	----	----	----
Tin	7440-31-5	0.2	µg/L	<0.2	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L	<0.2	----	----	----	----
Zinc	7440-66-6	1	µg/L	<1	----	----	----	----
EG094T: Total metals in Fresh water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	----	----	----	----
Antimony	7440-36-0	0.2	µg/L	<0.2	----	----	----	----
Arsenic	7440-38-2	0.2	µg/L	<0.2	----	----	----	----
Barium	7440-39-3	0.5	µg/L	<0.5	----	----	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	----	----	----	----
Boron	7440-42-8	5	µg/L	<5	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	<0.05	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	<0.2	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	<0.1	----	----	----	----
Copper	7440-50-8	0.5	µg/L	<0.5	----	----	----	----
Iron	7439-89-6	2	µg/L	<2	----	----	----	----
Lead	7439-92-1	0.1	µg/L	<0.1	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	<0.5	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	<0.1	----	----	----	----
Selenium	7782-49-2	0.2	µg/L	<0.2	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	<0.5	----	----	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	----	----	----	----
Tin	7440-31-5	0.2	µg/L	<0.2	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L	<0.2	----	----	----	----
Zinc	7440-66-6	1	µg/L	<1	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	FB1	L1	V1D	V1	M2
			Client sampling date / time	19-Nov-2016 09:50	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 08:00
Compound	CAS Number	LOR	Unit	EB1627798-001	EB1627798-002	EB1627798-003	EB1627798-004	EB1627798-005
				Result	Result	Result	Result	Result
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	**0.03**	**0.05**	**0.06**	**0.05**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	**0.03**	**0.02**	**0.03**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	**0.03**	**0.02**	**0.03**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.5	<0.5	<0.5	<0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.1	<0.5	<0.5	<0.5	<0.5
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.05	<0.05	<0.05	**0.74**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	**0.02**	**0.02**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**0.02**	**435**	**427**	**293**	**327**
Total Cations	----	0.01	meq/L	<0.01	**502**	**518**	**339**	**367**
Ionic Balance	----	0.01	%	**----**	**7.10**	**9.62**	**7.16**	**5.69**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	S1	M1	----	----	----
			Client sampling date / time	18-Nov-2016 09:40	18-Nov-2016 07:10	----	----	----
Compound	CAS Number	LOR	Unit	EB1627798-006	EB1627798-007	--------	--------	--------
				Result	Result	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	<5	**157**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**104**	**116**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**104**	**116**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2350**	**1250**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**15400**	**9240**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**387**	**252**	----	----	----
Magnesium	7439-95-4	1	mg/L	**1180**	**688**	----	----	----
Sodium	7440-23-5	1	mg/L	**9970**	**5720**	----	----	----
Potassium	7440-09-7	1	mg/L	**358**	**206**	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**10**	**16**	----	----	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	----	----	----
Arsenic	7440-38-2	0.5	µg/L	**1.2**	**1.8**	----	----	----
Barium	7440-39-3	1	µg/L	**9**	**31**	----	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	----	----	----
Boron	7440-42-8	100	µg/L	**3850**	**2230**	----	----	----
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	----	----	----
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	----	----	----
Cobalt	7440-48-4	0.2	µg/L	<0.2	**0.2**	----	----	----
Copper	7440-50-8	1	µg/L	<1	**1**	----	----	----
Iron	7439-89-6	5	µg/L	<5	<5	----	----	----
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	----	----	----
Manganese	7439-96-5	0.5	µg/L	**1.3**	**1.5**	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	**8.6**	**5.0**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	S1	M1	----	----	----
			Client sampling date / time	18-Nov-2016 09:40	18-Nov-2016 07:10	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1627798-006**	**EB1627798-007**	--------	--------	--------
				Result	Result	----	----	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	**0.6**	----	----	----
Selenium	7782-49-2	2	µg/L	<2	<2	----	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	----	----	----
Tin	7440-31-5	5	µg/L	<5	<5	----	----	----
Vanadium	7440-62-2	0.5	µg/L	**1.7**	**6.2**	----	----	----
Zinc	7440-66-6	5	µg/L	<5	<5	----	----	----
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**110**	**730**	----	----	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	----	----	----
Iron	7439-89-6	5	µg/L	**129**	**814**	----	----	----
Arsenic	7440-38-2	0.5	µg/L	**1.7**	**2.1**	----	----	----
Barium	7440-39-3	1	µg/L	**11**	**33**	----	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	----	----	----
Boron	7440-42-8	100	µg/L	**4300**	**2310**	----	----	----
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	----	----	----
Chromium	7440-47-3	0.5	µg/L	<0.5	**0.9**	----	----	----
Cobalt	7440-48-4	0.2	µg/L	<0.2	**0.5**	----	----	----
Copper	7440-50-8	1	µg/L	<1	**4**	----	----	----
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	----	----	----
Manganese	7439-96-5	0.5	µg/L	**5.5**	**47.6**	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	**10.8**	**5.4**	----	----	----
Nickel	7440-02-0	0.5	µg/L	**0.6**	**1.5**	----	----	----
Selenium	7782-49-2	2	µg/L	**2**	<2	----	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	----	----	----
Tin	7440-31-5	5	µg/L	<5	<5	----	----	----
Vanadium	7440-62-2	0.5	µg/L	**2.4**	**8.0**	----	----	----
Zinc	7440-66-6	5	µg/L	<5	<5	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	----	----	----	----
Antimony	7440-36-0	0.2	µg/L	----	----	----	----	----
Arsenic	7440-38-2	0.2	µg/L	----	----	----	----	----
Barium	7440-39-3	0.5	µg/L	----	----	----	----	----
Beryllium	7440-41-7	0.1	µg/L	----	----	----	----	----
Boron	7440-42-8	5	µg/L	----	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	S1	M1	----	----	----
			Client sampling date / time	18-Nov-2016 09:40	18-Nov-2016 07:10	----	----	----
Compound	CAS Number	LOR	Unit	EB1627798-006	EB1627798-007	--------	--------	--------
				Result	Result	----	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued								
Cadmium	7440-43-9	0.05	µg/L	----	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	----	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	----	----	----	----	----
Copper	7440-50-8	0.5	µg/L	----	----	----	----	----
Iron	7439-89-6	2	µg/L	----	----	----	----	----
Lead	7439-92-1	0.1	µg/L	----	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	----	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	----	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	----	----	----	----	----
Selenium	7782-49-2	0.2	µg/L	----	----	----	----	----
Silver	7440-22-4	0.1	µg/L	----	----	----	----	----
Tin	7440-31-5	0.2	µg/L	----	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L	----	----	----	----	----
Zinc	7440-66-6	1	µg/L	----	----	----	----	----
EG094T: Total metals in Fresh water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	----	----	----	----
Antimony	7440-36-0	0.2	µg/L	----	----	----	----	----
Arsenic	7440-38-2	0.2	µg/L	----	----	----	----	----
Barium	7440-39-3	0.5	µg/L	----	----	----	----	----
Beryllium	7440-41-7	0.1	µg/L	----	----	----	----	----
Boron	7440-42-8	5	µg/L	----	----	----	----	----
Cadmium	7440-43-9	0.05	µg/L	----	----	----	----	----
Chromium	7440-47-3	0.2	µg/L	----	----	----	----	----
Cobalt	7440-48-4	0.1	µg/L	----	----	----	----	----
Copper	7440-50-8	0.5	µg/L	----	----	----	----	----
Iron	7439-89-6	2	µg/L	----	----	----	----	----
Lead	7439-92-1	0.1	µg/L	----	----	----	----	----
Manganese	7439-96-5	0.5	µg/L	----	----	----	----	----
Molybdenum	7439-98-7	0.1	µg/L	----	----	----	----	----
Selenium	7782-49-2	0.2	µg/L	----	----	----	----	----
Nickel	7440-02-0	0.5	µg/L	----	----	----	----	----
Silver	7440-22-4	0.1	µg/L	----	----	----	----	----
Tin	7440-31-5	0.2	µg/L	----	----	----	----	----
Vanadium	7440-62-2	0.2	µg/L	----	----	----	----	----
Zinc	7440-66-6	1	µg/L	----	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	S1	M1	----	----	----
			Client sampling date / time	18-Nov-2016 09:40	18-Nov-2016 07:10	----	----	----
Compound	CAS Number	LOR	Unit	EB1627798-006	EB1627798-007	--------	--------	--------
				Result	Result	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.09**	**0.05**	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	**0.02**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	**0.02**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.05	**0.10**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	**0.03**	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**485**	**289**	----	----	----
Total Cations	----	0.01	meq/L	**559**	**323**	----	----	----
Ionic Balance	----	0.01	%	**7.07**	**5.60**	----	----	----
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB1627811**	Page	: 1 of 11
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 23-Nov-2016 11:30
Order number	: ----	Date Analysis Commenced	: 24-Nov-2016
C-O-C number	: ----	Issue Date	: 22-Dec-2016 17:04
Sampler	: IVAN STEWARD, TRAVIS WOOD		
Site	: ----		
Quote number	: BN/288/16		
No. of samples received	: 15		
No. of samples analysed	: 15		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EK061G (Total Kjeldahl Nitrogen as N): Sample EB1627811_002 shows poor spike recovery due to sample heterogeneity. This has been confirmed by visual inspection.
- EK067G (Total Phosphorous as P): Sample EB1627811_001 shows poor duplicate results due to sample heterogeneity. This has been confirmed by visual inspection.
- EG035-SDH (1M HCl Extractable Mercury by FIMS): Insufficient residue was recovered for metals analysis to proceed on samples EB1627811-011 (L1) and -014 (S2).
- EG005E (1M HCl Extractable metals by ICP-AES): Insufficient residue was recovered for metals analysis to proceed on samples EB1627811-011 (L1) and -014 (S2).
- EG020E (1M HCl Extractable metals by ICP-MS): Insufficient residue was recovered for metals analysis to proceed on samples EB1627811-011 (L1) and -014 (S2).
- EG035-SDH (1M HCl Extractable Mercury) Sample EB1627811-002 shows poor matrix spike recovery due to sample heterogeneity. Confirmed by re-extraction and re-analysis.
- EG005T (Total Metals by ICP-AES): Insufficient residue was recovered for metals analysis to proceed on samples EB1627811-011 (L1).
- It is recognised that EG020-T (Total Metals by ICP-MS) is less than EG020-E (1 M HCl Extractable Metals by ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- EG020-T (Total Metals by ICP-MS): Insufficient residue was recovered for metals analysis to proceed on samples EB1627811-011 (L1).
- EG035T-LL (Total Mercury by FIMS [Low Level]): Insufficient residue was recovered for metals analysis to proceed on samples EB1627811-011 (L1).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1	V1D	V1	S2	M1
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 07:30	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-001	EB1627811-002	EB1627811-003	EB1627811-004	EB1627811-005
				Result	Result	Result	Result	Result
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	26.7	47.4	38.3	26.1	48.9
EA150: Particle Sizing								
+75µm	----	1	%	99	45	57	98	<1
+150µm	----	1	%	96	27	32	98	<1
+300µm	----	1	%	60	26	30	95	<1
+425µm	----	1	%	24	25	30	92	<1
+600µm	----	1	%	2	25	30	83	<1
+1180µm	----	1	%	<1	24	29	40	<1
+2.36mm	----	1	%	<1	22	25	10	<1
+4.75mm	----	1	%	<1	19	21	2	<1
+9.5mm	----	1	%	<1	11	15	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	1	18	10	1	23
Silt (2-60 µm)	----	1	%	<1	35	28	<1	76
Sand (0.06-2.00 mm)	----	1	%	99	24	36	79	1
Gravel (>2mm)	----	1	%	<1	23	26	20	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.88	2.77	2.75	2.68	2.79
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	10900	20900	18200	1500	17000
Boron	7440-42-8	1	mg/kg	12	24	19	6	21
Iron	7439-89-6	1	mg/kg	6040	21600	17400	1050	16700
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	34200	50600	48800	7220	44400
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	44400	56800	53500	11600	62100
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	1.59	1.11	0.95	0.72	4.49
Barium	7440-39-3	0.05	mg/kg	6.40	32.2	28.5	1.56	30.3
Cadmium	7440-43-9	0.05	mg/kg	0.06	0.06	0.06	<0.05	0.08

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1	V1D	V1	S2	M1
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 07:30	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-001	EB1627811-002	EB1627811-003	EB1627811-004	EB1627811-005
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Chromium	7440-47-3	0.05	mg/kg	**3.34**	**14.2**	**11.8**	**2.59**	**8.47**
Cobalt	7440-48-4	0.05	mg/kg	**4.47**	**15.6**	**13.9**	**0.36**	**11.2**
Copper	7440-50-8	0.05	mg/kg	**22.9**	**51.6**	**45.2**	**0.77**	**39.8**
Lead	7439-92-1	0.05	mg/kg	**22.1**	**5.93**	**5.82**	**0.67**	**6.78**
Manganese	7439-96-5	0.05	mg/kg	**304**	**521**	**530**	**10.6**	**557**
Nickel	7440-02-0	0.05	mg/kg	**6.69**	**27.4**	**23.6**	**1.51**	**15.8**
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	**0.15**
Tin	7440-31-5	0.05	mg/kg	**0.48**	**0.30**	**0.31**	<0.05	**0.06**
Vanadium	7440-62-2	0.5	mg/kg	**10.4**	**44.6**	**38.4**	**4.4**	**28.1**
Zinc	7440-66-6	0.05	mg/kg	**43.4**	**47.6**	**42.0**	**1.80**	**28.2**
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	**4.3**	**3.1**	**2.6**	**3.2**	**16.1**
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/kg	**21.1**	**71.2**	**78.3**	**36.7**	**71.5**
Cadmium	7440-43-9	0.1	mg/kg	**0.1**	**0.2**	**0.1**	<0.1	**0.1**
Cobalt	7440-48-4	0.1	mg/kg	**19.4**	**30.2**	**28.5**	**3.0**	**27.9**
Chromium	7440-47-3	0.1	mg/kg	**27.6**	**66.0**	**60.2**	**12.3**	**53.4**
Copper	7440-50-8	0.1	mg/kg	**60.9**	**100**	**87.0**	**4.7**	**93.7**
Manganese	7439-96-5	0.1	mg/kg	**1000**	**1050**	**1060**	**111**	**1370**
Nickel	7440-02-0	0.1	mg/kg	**35.5**	**66.0**	**62.3**	**6.2**	**61.6**
Lead	7439-92-1	0.1	mg/kg	**26.3**	**8.5**	**7.6**	**1.2**	**14.3**
Zinc	7440-66-6	0.5	mg/kg	**126**	**98.1**	**91.5**	**18.9**	**107**
Vanadium	7440-62-2	1	mg/kg	**158**	**178**	**179**	**36**	**154**
Tin	7440-31-5	0.1	mg/kg	**4.0**	**1.8**	**1.3**	**0.7**	**1.4**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	**0.02**	**0.01**	<0.01	**0.05**
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1	V1D	V1	S2	M1
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 07:30	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-001	EB1627811-002	EB1627811-003	EB1627811-004	EB1627811-005
				Result	Result	Result	Result	Result
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	0.2	0.2	0.2	0.2	0.2
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.2	0.2	0.2	0.2
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	70	800	330	90	480
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	70	800	330	90	480
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	573	854	594	366	772
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.1	0.9	0.9	0.4	0.2
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	0.04	0.62	0.15	0.08	0.29
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	0.40	0.86	0.55	0.72	0.76
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	0.36	0.24	0.40	0.64	0.47
GEO26: Sieving								
-2000µm	----	0.01	%	----	----	----	----	----
-63µm	----	0.01	%	----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1 <2000µm Sieve	V1D <2000µm Sieve	V1 <2000µm Sieve	S2 <2000µm Sieve	M1 <2000µm Sieve
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 10:50	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-006	EB1627811-007	EB1627811-008	EB1627811-009	EB1627811-010
				Result	Result	Result	Result	Result
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	----	----
+150µm	----	1	%	----	----	----	----	----
+300µm	----	1	%	----	----	----	----	----
+425µm	----	1	%	----	----	----	----	----
+600µm	----	1	%	----	----	----	----	----
+1180µm	----	1	%	----	----	----	----	----
+2.36mm	----	1	%	----	----	----	----	----
+4.75mm	----	1	%	----	----	----	----	----
+9.5mm	----	1	%	----	----	----	----	----
+19.0mm	----	1	%	----	----	----	----	----
+37.5mm	----	1	%	----	----	----	----	----
+75.0mm	----	1	%	----	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	----	----
Silt (2-60 µm)	----	1	%	----	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	----	----	----	----	----
Gravel (>2mm)	----	1	%	----	----	----	----	----
Cobbles (>6cm)	----	1	%	----	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	----	----	----
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	10200	17600	17100	1390	15200
Boron	7440-42-8	1	mg/kg	8	12	10	4	14
Iron	7439-89-6	1	mg/kg	5490	15500	13200	993	13500
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	29900	44900	38900	6270	37500
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	39100	50800	44100	10100	52700
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	1.32	1.02	0.82	0.80	3.30
Barium	7440-39-3	0.05	mg/kg	5.35	28.6	24.2	2.31	26.2
Cadmium	7440-43-9	0.05	mg/kg	0.07	0.08	0.05	<0.05	0.08

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	L1 <2000µm Sieve	V1D <2000µm Sieve	V1 <2000µm Sieve	S2 <2000µm Sieve	M1 <2000µm Sieve
Client sampling date / time				19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 10:50	18-Nov-2016 07:30
				EB1627811-006	**EB1627811-007**	**EB1627811-008**	**EB1627811-009**	**EB1627811-010**
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Chromium	7440-47-3	0.05	mg/kg	**2.94**	**10.6**	**8.47**	**2.56**	**6.33**
Cobalt	7440-48-4	0.05	mg/kg	**3.64**	**13.7**	**10.7**	**0.38**	**8.62**
Copper	7440-50-8	0.05	mg/kg	**19.4**	**44.4**	**34.6**	**1.60**	**33.6**
Lead	7439-92-1	0.05	mg/kg	**20.4**	**5.38**	**4.97**	**0.90**	**5.66**
Manganese	7439-96-5	0.05	mg/kg	**271**	**428**	**414**	**12.6**	**496**
Nickel	7440-02-0	0.05	mg/kg	**5.57**	**20.2**	**17.0**	**1.36**	**11.8**
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	**0.12**
Tin	7440-31-5	0.05	mg/kg	**0.36**	**0.26**	**0.27**	**1.00**	**0.06**
Vanadium	7440-62-2	0.5	mg/kg	**8.6**	**35.1**	**28.3**	**4.0**	**22.7**
Zinc	7440-66-6	0.05	mg/kg	**31.4**	**38.1**	**31.2**	**5.78**	**20.8**
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	**3.9**	**3.0**	**2.2**	**2.8**	**12.3**
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/kg	**19.9**	**74.8**	**58.9**	**32.9**	**63.9**
Cadmium	7440-43-9	0.1	mg/kg	**0.1**	**0.1**	<0.1	<0.1	**0.1**
Cobalt	7440-48-4	0.1	mg/kg	**17.4**	**31.3**	**24.9**	**3.3**	**25.1**
Chromium	7440-47-3	0.1	mg/kg	**21.8**	**60.4**	**47.2**	**10.3**	**48.4**
Copper	7440-50-8	0.1	mg/kg	**56.4**	**92.5**	**71.4**	**6.0**	**82.3**
Manganese	7439-96-5	0.1	mg/kg	**910**	**943**	**871**	**141**	**1180**
Nickel	7440-02-0	0.1	mg/kg	**31.0**	**62.7**	**50.2**	**4.8**	**52.9**
Lead	7439-92-1	0.1	mg/kg	**24.6**	**7.8**	**5.9**	**1.3**	**11.2**
Zinc	7440-66-6	0.5	mg/kg	**116**	**93.7**	**79.1**	**25.2**	**90.4**
Vanadium	7440-62-2	1	mg/kg	**132**	**174**	**158**	**31**	**131**
Tin	7440-31-5	0.1	mg/kg	**2.8**	**1.1**	**1.0**	**0.6**	**0.9**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	**0.02**	**0.01**	<0.01	**0.04**
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	----	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	----	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

			Client sample ID	L1 <2000µm Sieve	V1D <2000µm Sieve	V1 <2000µm Sieve	S2 <2000µm Sieve	M1 <2000µm Sieve
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 10:50	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-006	EB1627811-007	EB1627811-008	EB1627811-009	EB1627811-010
				Result	Result	Result	Result	Result
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	----	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.03**	**0.48**	**0.28**	<0.02	**0.32**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**0.36**	**0.80**	**0.52**	**0.50**	**0.81**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	**0.33**	**0.32**	**0.24**	**0.50**	**0.49**
GEO26: Sieving								
-2000µm	----	0.01	%	**98.6**	**95.3**	**57.4**	**85.6**	**63.1**
-63µm	----	0.01	%	----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1 <63µm Sieve	V1D <63µm Sieve	V1 <63µm Sieve	S2 <63µm Sieve	M1 <63µm Sieve
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 10:50	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-011	EB1627811-012	EB1627811-013	EB1627811-014	EB1627811-015
				Result	Result	Result	Result	Result
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	----	----	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	----	----	----	----	----
+150µm	----	1	%	----	----	----	----	----
+300µm	----	1	%	----	----	----	----	----
+425µm	----	1	%	----	----	----	----	----
+600µm	----	1	%	----	----	----	----	----
+1180µm	----	1	%	----	----	----	----	----
+2.36mm	----	1	%	----	----	----	----	----
+4.75mm	----	1	%	----	----	----	----	----
+9.5mm	----	1	%	----	----	----	----	----
+19.0mm	----	1	%	----	----	----	----	----
+37.5mm	----	1	%	----	----	----	----	----
+75.0mm	----	1	%	----	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	----	----	----
Silt (2-60 µm)	----	1	%	----	----	----	----	----
Sand (0.06-2.00 mm)	----	1	%	----	----	----	----	----
Gravel (>2mm)	----	1	%	----	----	----	----	----
Cobbles (>6cm)	----	1	%	----	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	----	----	----
EG005E: 1M HCl extractable metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	----	**17100**	**16100**	----	**15500**
Boron	7440-42-8	1	mg/kg	----	**15**	**14**	----	**14**
Iron	7439-89-6	1	mg/kg	----	**17700**	**15800**	----	**14200**
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	----	**44500**	**43000**	**31600**	**37800**
Boron	7440-42-8	50	mg/kg	----	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg	----	**53700**	**52800**	**36300**	**53500**
EG020E: 1M HCl Extractable metals by ICPMS								
Arsenic	7440-38-2	0.05	mg/kg	----	**1.00**	**0.83**	----	**3.43**
Barium	7440-39-3	0.05	mg/kg	----	**29.5**	**26.3**	----	**28.5**
Cadmium	7440-43-9	0.05	mg/kg	----	**0.10**	**0.08**	----	**0.08**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1 <63µm Sieve	V1D <63µm Sieve	V1 <63µm Sieve	S2 <63µm Sieve	M1 <63µm Sieve
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 10:50	18-Nov-2016 07:30
Compound	*CAS Number*	*LOR*	*Unit*	EB1627811-011	EB1627811-012	EB1627811-013	EB1627811-014	EB1627811-015
				Result	Result	Result	Result	Result
EG020E: 1M HCl Extractable metals by ICPMS - Continued								
Chromium	7440-47-3	0.05	mg/kg	----	12.8	11.6	----	7.29
Cobalt	7440-48-4	0.05	mg/kg	----	15.0	14.0	----	9.86
Copper	7440-50-8	0.05	mg/kg	----	70.2	50.9	----	37.0
Lead	7439-92-1	0.05	mg/kg	----	8.30	7.85	----	6.08
Manganese	7439-96-5	0.05	mg/kg	----	540	548	----	528
Nickel	7440-02-0	0.05	mg/kg	----	22.2	20.3	----	14.0
Selenium	7782-49-2	0.1	mg/kg	----	<0.1	<0.1	----	<0.1
Silver	7440-22-4	0.05	mg/kg	----	0.05	<0.05	----	0.14
Tin	7440-31-5	0.05	mg/kg	----	0.36	0.40	----	0.08
Vanadium	7440-62-2	0.5	mg/kg	----	41.2	38.3	----	25.8
Zinc	7440-66-6	0.05	mg/kg	----	49.5	44.6	----	24.0
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.1	mg/kg	----	3.0	2.4	20.2	12.7
Selenium	7782-49-2	1	mg/kg	----	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	----	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.1	mg/kg	----	70.3	65.2	76.1	66.6
Cadmium	7440-43-9	0.1	mg/kg	----	0.1	0.1	0.6	0.1
Cobalt	7440-48-4	0.1	mg/kg	----	31.3	29.7	12.8	27.3
Chromium	7440-47-3	0.1	mg/kg	----	66.9	66.2	68.1	52.3
Copper	7440-50-8	0.1	mg/kg	----	122	95.2	194	86.5
Manganese	7439-96-5	0.1	mg/kg	----	1030	1020	421	1230
Nickel	7440-02-0	0.1	mg/kg	----	62.4	59.4	36.3	56.7
Lead	7439-92-1	0.1	mg/kg	----	10.0	9.3	19.5	12.0
Zinc	7440-66-6	0.5	mg/kg	----	107	100	148	96.1
Vanadium	7440-62-2	1	mg/kg	----	170	182	112	142
Tin	7440-31-5	0.1	mg/kg	----	1.2	1.2	7.2	1.0
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	<0.10	<0.10	----	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	----	0.02	0.02	0.08	0.04
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	----	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	L1 <63µm Sieve	V1D <63µm Sieve	V1 <63µm Sieve	S2 <63µm Sieve	M1 <63µm Sieve
			Client sampling date / time	19-Nov-2016 08:20	19-Nov-2016 07:10	19-Nov-2016 07:00	18-Nov-2016 10:50	18-Nov-2016 07:30
Compound	CAS Number	LOR	Unit	EB1627811-011	EB1627811-012	EB1627811-013	EB1627811-014	EB1627811-015
				Result	Result	Result	Result	Result
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	----	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	----	**0.63**	**0.48**	----	**0.30**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	----	**1.02**	**0.77**	----	**0.70**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	----	**0.39**	**0.29**	----	**0.40**
GEO26: Sieving								
-2000µm	----	0.01	%	----	----	----	----	----
-63µm	----	0.01	%	**1.20**	**34.1**	**41.3**	**1.45**	**85.0**

CERTIFICATE OF ANALYSIS

Work Order	: **EB1704258**		
Amendment	: **1**		
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 03-Mar-2017 16:00
Order number	: ----	Date Analysis Commenced	: 06-Mar-2017
C-O-C number	: ----	Issue Date	: 18-Apr-2017 15:15
Sampler	: GREG HEATH		
Site	: ----		
Quote number	: BN/288/16 V6		
No. of samples received	: 60		
No. of samples analysed	: 48		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EK061G (Total Kjeldahl Nitrogen as N)/ EK067G (Total Phosphorous as P): Some samples were diluted due to matrix interference. LOR adjusted accordingly.
- It is recognised that EG093-T (Total Metals in Saline Water by ORC-ICP-MS) is less than EG093-F (Dissolved Metals in Saline Water by ORC-ICP-MS) for some samples. However, the difference is within experimental variation of the methods.
- EG094F (Dissolved Metals) were found to be higher than EG094T (Total Metals) for EB1704258-010 (M1). This was confirmed by re-digestion and re-analysis.
- Amendment (4/4/2017): This report has been amended to flag on Al. Ba and Fe as per the quote and to adjust >63 to <63 as per the COC.
- E.coli & Faecal Coliforms MF (MM518) is conducted by ALS Scoresby NATA accreditation no. 992, site no. 989.

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	B1 <2000µm Fraction	W2 <2000µm Fraction	W1 <2000µm Fraction	V1 <2000µm Fraction	LA1 <2000µm Fraction
			Client sampling date / time	27-Feb-2017 16:30	27-Feb-2017 16:00	27-Feb-2017 15:00	27-Feb-2017 14:30	27-Feb-2017 13:30
Compound	CAS Number	LOR	Unit	EB1704258-037	EB1704258-038	EB1704258-039	EB1704258-040	EB1704258-041
				Result	Result	Result	Result	Result
EG005-SDH: 1M HCl-Extractable Metals by ICPAES								
Aluminium	7429-90-5	50	mg/kg	**17200**	**16400**	**22400**	**15700**	**11200**
Arsenic	7440-38-2	1	mg/kg	**1.8**	**1.1**	**2.1**	**1.0**	**1.6**
Barium	7440-39-3	1	mg/kg	**17.6**	**10.4**	**14.0**	**24.3**	**8.0**
Cadmium	7440-43-9	0.1	mg/kg	<0.1	**0.1**	<0.1	**0.2**	<0.1
Cobalt	7440-48-4	0.5	mg/kg	**4.2**	**5.6**	**4.9**	**8.1**	**3.7**
Chromium	7440-47-3	1	mg/kg	**2.8**	**4.6**	**3.4**	**6.8**	**3.0**
Copper	7440-50-8	1	mg/kg	**18.9**	**20.9**	**19.6**	**31.5**	**16.2**
Iron	7439-89-6	50	mg/kg	**6920**	**8620**	**7690**	**10800**	**5560**
Lead	7439-92-1	1	mg/kg	<1.0	**1.3**	**1.0**	**7.8**	**19.2**
Manganese	7439-96-5	10	mg/kg	**154**	**252**	**287**	**267**	**291**
Nickel	7440-02-0	1	mg/kg	**8.4**	**11.2**	**9.5**	**12.4**	**5.4**
Silver	7440-22-4	1	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium	7440-62-2	2	mg/kg	**10.4**	**12.6**	**12.2**	**25.1**	**10.3**
Zinc	7440-66-6	1	mg/kg	**9.8**	**12.0**	**11.0**	**29.2**	**39.5**
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**33000**	**32400**	**41200**	**39500**	**29800**
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	<5
Barium	7440-39-3	10	mg/kg	**50**	**30**	**50**	**70**	**30**
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**15**	**43**	**24**	**47**	**28**
Cobalt	7440-48-4	2	mg/kg	**16**	**21**	**18**	**24**	**18**
Copper	7440-50-8	5	mg/kg	**72**	**72**	**64**	**79**	**56**
Iron	7439-89-6	50	mg/kg	**37000**	**48900**	**39000**	**48600**	**42400**
Lead	7439-92-1	5	mg/kg	<5	<5	<5	**10**	**24**
Manganese	7439-96-5	5	mg/kg	**711**	**812**	**825**	**767**	**935**
Nickel	7440-02-0	2	mg/kg	**28**	**45**	**39**	**49**	**35**
Zinc	7440-66-6	5	mg/kg	**59**	**61**	**52**	**86**	**121**
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Tin	7440-31-5	2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
EG020T: Total Metals by ICP-MS								
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	B1 <2000µm Fraction	W2 <2000µm Fraction	W1 <2000µm Fraction	V1 <2000µm Fraction	LA1 <2000µm Fraction
			Client sampling date / time	27-Feb-2017 16:30	27-Feb-2017 16:00	27-Feb-2017 15:00	27-Feb-2017 14:30	27-Feb-2017 13:30
Compound	CAS Number	LOR	Unit	EB1704258-037	EB1704258-038	EB1704258-039	EB1704258-040	EB1704258-041
				Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued								
Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**0.1**
Tin	7440-31-5	0.1	mg/kg	**0.5**	**0.7**	**0.5**	**1.0**	**1.9**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	<0.01	**0.02**	**0.01**
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	<20	**20**	**40**	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	<0.1	**0.1**	<0.1	<0.1	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	**0.1**	<0.1	<0.1	<0.1
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**30**	**140**	**150**	**640**	**190**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	**30**	**140**	**150**	**640**	**190**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	**506**	**599**	**570**	**550**	**584**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	**0.2**	**0.3**	**0.6**	**4.9**	**2.1**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.65**	**0.20**	**0.36**	**0.58**	**0.14**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**1.26**	**0.54**	**0.71**	**0.80**	**0.51**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	**0.61**	**0.34**	**0.35**	**0.22**	**0.37**
GEO26: Sieving								
-2000µm	----	0.01	%	**72.4**	**86.5**	**92.4**	**93.3**	**84.4**

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	LA2 <2000µm Fraction	LA3 <2000µm Fraction	LA4 <2000µm Fraction	LA5 <2000µm Fraction	M1 <2000µm Fraction
			Client sampling date / time	27-Feb-2017 14:50	26-Feb-2017 13:30	26-Feb-2017 11:00	26-Feb-2017 08:30	27-Feb-2017 12:00
Compound	CAS Number	LOR	Unit	EB1704258-042	EB1704258-043	EB1704258-044	EB1704258-045	EB1704258-046
				Result	Result	Result	Result	Result
EG005-SDH: 1M HCl-Extractable Metals by ICPAES								
Aluminium	7429-90-5	50	mg/kg	16200	14800	14600	15700	1540
Arsenic	7440-38-2	1	mg/kg	2.8	3.2	2.2	2.0	<1.0
Barium	7440-39-3	1	mg/kg	25.0	29.0	25.4	31.1	2.9
Cadmium	7440-43-9	0.1	mg/kg	0.2	0.2	0.2	0.2	<0.1
Cobalt	7440-48-4	0.5	mg/kg	8.3	8.2	8.6	8.5	<0.5
Chromium	7440-47-3	1	mg/kg	7.1	6.8	6.8	9.2	3.4
Copper	7440-50-8	1	mg/kg	38.4	35.4	43.8	49.2	1.6
Iron	7439-89-6	50	mg/kg	12300	12100	12300	14000	900
Lead	7439-92-1	1	mg/kg	16.3	5.8	7.5	9.3	1.2
Manganese	7439-96-5	10	mg/kg	341	423	424	347	<10
Nickel	7440-02-0	1	mg/kg	11.7	11.6	12.6	12.4	2.0
Silver	7440-22-4	1	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium	7440-62-2	2	mg/kg	23.0	24.8	25.7	30.0	4.2
Zinc	7440-66-6	1	mg/kg	42.6	20.5	23.2	38.7	2.5
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	39600	38100	39200	40600	5910
Arsenic	7440-38-2	5	mg/kg	9	11	10	6	<5
Barium	7440-39-3	10	mg/kg	70	70	60	80	30
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	1	1	1	<1
Chromium	7440-47-3	2	mg/kg	50	53	58	60	16
Cobalt	7440-48-4	2	mg/kg	25	26	27	26	4
Copper	7440-50-8	5	mg/kg	95	95	99	105	5
Iron	7439-89-6	50	mg/kg	55600	59400	59600	60300	10000
Lead	7439-92-1	5	mg/kg	22	12	12	13	<5
Manganese	7439-96-5	5	mg/kg	996	1160	1110	996	118
Nickel	7440-02-0	2	mg/kg	56	58	65	55	5
Zinc	7440-66-6	5	mg/kg	132	93	101	115	18
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Tin	7440-31-5	2	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0
EG020T: Total Metals by ICP-MS								
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	LA2 <2000µm Fraction	LA3 <2000µm Fraction	LA4 <2000µm Fraction	LA5 <2000µm Fraction	M1 <2000µm Fraction
			Client sampling date / time	27-Feb-2017 14:50	26-Feb-2017 13:30	26-Feb-2017 11:00	26-Feb-2017 08:30	27-Feb-2017 12:00
Compound	CAS Number	LOR	Unit	EB1704258-042	EB1704258-043	EB1704258-044	EB1704258-045	EB1704258-046
				Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued								
Silver	7440-22-4	0.1	mg/kg	**0.2**	**0.2**	**0.2**	**0.2**	<0.1
Antimony	7440-36-0	0.1	mg/kg	**0.1**	**0.1**	**0.1**	<0.1	<0.1
Tin	7440-31-5	0.1	mg/kg	**1.9**	**0.7**	**0.8**	**1.0**	**0.3**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.05**	**0.04**	**0.05**	**0.04**	<0.01
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	**30**	<20	<20	<20	<20
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**0.2**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	**0.2**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**700**	**650**	**670**	**970**	**90**
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	**700**	**650**	**670**	**970**	**90**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	**743**	**729**	**736**	**907**	**336**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	**2.8**	**1.2**	**3.6**	**5.0**	**0.1**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.63**	**0.46**	**0.55**	**1.02**	**0.08**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**1.14**	**0.93**	**1.10**	**1.49**	**0.60**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	**0.51**	**0.47**	**0.55**	**0.47**	**0.52**
GEO26: Sieving								
-2000µm	----	0.01	%	**95.7**	**91.6**	**44.7**	**88.4**	**80.6**

Analytical Results

Sub-Matrix: MARINE SEDIMENT
(Matrix: SOIL)

			Client sample ID	S2 <2000µm Fraction	B1 >63µm	W2 <63µm	W1 <63µm	V1 <63µm
			Client sampling date / time	27-Feb-2017 09:45	27-Feb-2017 16:30	27-Feb-2017 16:00	27-Feb-2017 15:00	27-Feb-2017 14:30
Compound	CAS Number	LOR	Unit	EB1704258-047	EB1704258-048	EB1704258-049	EB1704258-050	EB1704258-051
				Result	Result	Result	Result	Result
EG005-SDH: 1M HCl-Extractable Metals by ICPAES								
Aluminium	7429-90-5	50	mg/kg	**16200**	----	----	----	----
Arsenic	7440-38-2	1	mg/kg	**1.9**	----	----	----	----
Barium	7440-39-3	1	mg/kg	**34.2**	----	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	**0.2**	----	----	----	----
Cobalt	7440-48-4	0.5	mg/kg	**7.3**	----	----	----	----
Chromium	7440-47-3	1	mg/kg	**5.7**	----	----	----	----
Copper	7440-50-8	1	mg/kg	**32.0**	----	----	----	----
Iron	7439-89-6	50	mg/kg	**10300**	----	----	----	----
Lead	7439-92-1	1	mg/kg	**4.0**	----	----	----	----
Manganese	7439-96-5	10	mg/kg	**408**	----	----	----	----
Nickel	7440-02-0	1	mg/kg	**11.4**	----	----	----	----
Silver	7440-22-4	1	mg/kg	<1.0	----	----	----	----
Vanadium	7440-62-2	2	mg/kg	**20.7**	----	----	----	----
Zinc	7440-66-6	1	mg/kg	**17.8**	----	----	----	----
Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**35100**	**39400**	**27100**	**41900**	**41200**
Arsenic	7440-38-2	5	mg/kg	**9**	<5	<5	<5	<5
Barium	7440-39-3	10	mg/kg	**80**	**60**	**30**	**50**	**80**
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	**1**	**2**	**1**	**1**
Chromium	7440-47-3	2	mg/kg	**41**	**50**	**85**	**55**	**61**
Cobalt	7440-48-4	2	mg/kg	**22**	**27**	**27**	**28**	**27**
Copper	7440-50-8	5	mg/kg	**81**	**109**	**92**	**114**	**97**
Iron	7439-89-6	50	mg/kg	**47400**	**57400**	**75800**	**60700**	**57500**
Lead	7439-92-1	5	mg/kg	**8**	<5	<5	**7**	**15**
Manganese	7439-96-5	5	mg/kg	**1030**	**893**	**1020**	**1280**	**865**
Nickel	7440-02-0	2	mg/kg	**50**	**74**	**53**	**66**	**58**
Zinc	7440-66-6	5	mg/kg	**79**	**83**	**96**	**98**	**108**
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Selenium	7782-49-2	0.5	mg/kg	<0.5	----	----	----	----
Tin	7440-31-5	2	mg/kg	<2.0	----	----	----	----
EG020T: Total Metals by ICP-MS								
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	S2 <2000µm Fraction	B1 >63µm	W2 <63µm	W1 <63µm	V1 <63µm
			Client sampling date / time	27-Feb-2017 09:45	27-Feb-2017 16:30	27-Feb-2017 16:00	27-Feb-2017 15:00	27-Feb-2017 14:30
Compound	CAS Number	LOR	Unit	EB1704258-047	EB1704258-048	EB1704258-049	EB1704258-050	EB1704258-051
				Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued								
Silver	7440-22-4	0.1	mg/kg	**0.2**	**0.1**	<0.1	**0.1**	**0.1**
Antimony	7440-36-0	0.1	mg/kg	**0.1**	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	0.1	mg/kg	**0.6**	**0.9**	**0.7**	**0.8**	**1.2**
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.10	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.03**	**0.02**	**0.02**	**0.03**	**0.03**
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	<20	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	<0.1	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	**480**	----	----	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	**480**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	**586**	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	**0.8**	----	----	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.41**	----	----	----	----
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**0.86**	----	----	----	----
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	**0.45**	----	----	----	----
GEO26: Sieving								
-2000µm	----	0.01	%	**90.6**	----	----	----	----
-63µm	----	0.01	%	----	**3.31**	**15.1**	**10.0**	**33.7**

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	LA1 <63µm	LA2 <63µm	LA3 <63µm	LA4 <63µm	LA5 <63µm
			Client sampling date / time	27-Feb-2017 13:30	27-Feb-2017 14:50	26-Feb-2017 13:30	26-Feb-2017 11:00	26-Feb-2017 08:30
Compound	CAS Number	LOR	Unit	EB1704258-052	EB1704258-053	EB1704258-054	EB1704258-055	EB1704258-056
				Result	Result	Result	Result	Result
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**48700**	**37100**	**36300**	**37900**	**42600**
Arsenic	7440-38-2	5	mg/kg	**6**	**9**	**11**	**9**	**6**
Barium	7440-39-3	10	mg/kg	**60**	**70**	**70**	**60**	**80**
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	**1**	**1**	**1**	**1**	**1**
Chromium	7440-47-3	2	mg/kg	**58**	**51**	**51**	**57**	**66**
Cobalt	7440-48-4	2	mg/kg	**31**	**24**	**25**	**27**	**27**
Copper	7440-50-8	5	mg/kg	**145**	**92**	**91**	**95**	**106**
Iron	7439-89-6	50	mg/kg	**64900**	**55900**	**59000**	**60300**	**63400**
Lead	7439-92-1	5	mg/kg	**38**	**21**	**10**	**12**	**14**
Manganese	7439-96-5	5	mg/kg	**1360**	**970**	**1100**	**1100**	**1070**
Nickel	7440-02-0	2	mg/kg	**76**	**54**	**56**	**64**	**61**
Zinc	7440-66-6	5	mg/kg	**352**	**127**	**89**	**99**	**125**
EG020T: Total Metals by ICP-MS								
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	<1
Silver	7440-22-4	0.1	mg/kg	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
Antimony	7440-36-0	0.1	mg/kg	**0.1**	**0.1**	**0.1**	<0.1	<0.1
Tin	7440-31-5	0.1	mg/kg	**2.3**	**1.7**	**0.7**	**0.8**	**1.0**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	**0.09**	**0.04**	**0.04**	**0.05**	**0.04**
GEO26: Sieving								
-63µm	----	0.01	%	**9.39**	**60.2**	**44.5**	**70.6**	**74.1**

Analytical Results

Sub-Matrix: **MARINE SEDIMENT** (Matrix: **SOIL**)			*Client sample ID*	**M1 <63µm**	**S2 <63µm**	**S2-D <2000µm**	**S2-D <63µm**	**----**
			Client sampling date / time	27-Feb-2017 12:00	27-Feb-2017 09:45	27-Feb-2017 09:45	27-Feb-2017 09:45	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1704258-057**	**EB1704258-058**	**EB1704258-059**	**EB1704258-060**	**--------**
				Result	Result	Result	Result	----
EG005-SDH: 1M HCl-Extractable Metals by ICPAES								
Aluminium	7429-90-5	50	mg/kg	----	----	**1240**	----	----
Arsenic	7440-38-2	1	mg/kg	----	----	<1.0	----	----
Barium	7440-39-3	1	mg/kg	----	----	**1.9**	----	----
Cadmium	7440-43-9	0.1	mg/kg	----	----	<0.1	----	----
Cobalt	7440-48-4	0.5	mg/kg	----	----	<0.5	----	----
Chromium	7440-47-3	1	mg/kg	----	----	**2.7**	----	----
Copper	7440-50-8	1	mg/kg	----	----	<1.0	----	----
Iron	7439-89-6	50	mg/kg	----	----	**770**	----	----
Lead	7439-92-1	1	mg/kg	----	----	<1.0	----	----
Manganese	7439-96-5	10	mg/kg	----	----	<10	----	----
Nickel	7440-02-0	1	mg/kg	----	----	**1.1**	----	----
Silver	7440-22-4	1	mg/kg	----	----	<1.0	----	----
Vanadium	7440-62-2	2	mg/kg	----	----	**3.8**	----	----
Zinc	7440-66-6	1	mg/kg	----	----	**2.9**	----	----
Boron	7440-42-8	50	mg/kg	----	----	<50	----	----
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**34800**	**35600**	**6020**	**13500**	----
Arsenic	7440-38-2	5	mg/kg	**15**	**10**	<5	**12**	----
Barium	7440-39-3	10	mg/kg	**80**	**80**	**40**	**50**	----
Boron	7440-42-8	50	mg/kg	<50	<50	<50	**90**	----
Cadmium	7440-43-9	1	mg/kg	**1**	**1**	<1	<1	----
Chromium	7440-47-3	2	mg/kg	**65**	**49**	**11**	**71**	----
Cobalt	7440-48-4	2	mg/kg	**21**	**25**	**3**	**11**	----
Copper	7440-50-8	5	mg/kg	**94**	**91**	**5**	**100**	----
Iron	7439-89-6	50	mg/kg	**65500**	**54300**	**10600**	**106000**	----
Lead	7439-92-1	5	mg/kg	**16**	**9**	<5	**13**	----
Manganese	7439-96-5	5	mg/kg	**953**	**1070**	**126**	**484**	----
Nickel	7440-02-0	2	mg/kg	**54**	**56**	**6**	**39**	----
Zinc	7440-66-6	5	mg/kg	**113**	**87**	**19**	**152**	----
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Selenium	7782-49-2	0.5	mg/kg	----	----	<0.5	----	----
Tin	7440-31-5	2	mg/kg	----	----	<2.0	----	----
EG020T: Total Metals by ICP-MS								
Selenium	7782-49-2	1	mg/kg	<1	<1	<1	<1	----

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	M1 <63µm	S2 <63µm	S2-D <2000µm	S2-D <63µm	----
			Client sampling date / time	27-Feb-2017 12:00	27-Feb-2017 09:45	27-Feb-2017 09:45	27-Feb-2017 09:45	----
Compound	CAS Number	LOR	Unit	EB1704258-057	EB1704258-058	EB1704258-059	EB1704258-060	--------
				Result	Result	Result	Result	----
EG020T: Total Metals by ICP-MS - Continued								
Silver	7440-22-4	0.1	mg/kg	0.2	0.2	<0.1	0.2	----
Antimony	7440-36-0	0.1	mg/kg	0.4	<0.1	<0.1	1.8	----
Tin	7440-31-5	0.1	mg/kg	3.1	0.6	0.5	13.5	----
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	<0.10	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.01	mg/kg	0.04	0.04	<0.01	0.03	----
EK055: Ammonia as N								
Ammonia as N	7664-41-7	20	mg/kg	----	----	<20	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	----	----	0.2	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N (Sol.)	14797-55-8	0.1	mg/kg	----	----	0.1	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	----	----	0.3	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	20	mg/kg	----	----	90	----	----
EK062: Total Nitrogen as N (TKN + NOx)								
^ Total Nitrogen as N	----	20	mg/kg	----	----	90	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	2	mg/kg	----	----	298	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	----	----	0.2	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	----	----	0.06	----	----
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	----	----	0.46	----	----
EP003TIC: Total inorganic Carbon (TIC) in Soil								
Total Inorganic Carbon	----	0.02	%	----	----	0.40	----	----
GEO26: Sieving								
-2000µm	----	0.01	%	----	----	90.8	----	----
-63µm	----	0.01	%	4.57	42.1	----	2.49	----

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	B1	W2	W1	V1	LA1
			Client sampling date / time	28-Feb-2017 09:00	28-Feb-2017 10:00	28-Feb-2017 10:15	28-Feb-2017 10:45	28-Feb-2017 12:00
Compound	CAS Number	LOR	Unit	EB1704258-001	EB1704258-002	EB1704258-003	EB1704258-004	EB1704258-005
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**66**	**7**	**7**	**7**	**6**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**109**	**113**	**112**	**113**	**112**
Total Alkalinity as CaCO3	----	1	mg/L	**109**	**113**	**112**	**113**	**112**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2310**	**2450**	**2340**	**2390**	**2410**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**13500**	**13700**	**15900**	**16200**	**15500**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**350**	**349**	**346**	**361**	**354**
Magnesium	7439-95-4	1	mg/L	**1120**	**1090**	**1100**	**1140**	**1110**
Sodium	7440-23-5	1	mg/L	**9100**	**8900**	**8950**	**9240**	**9080**
Potassium	7440-09-7	1	mg/L	**348**	**344**	**342**	**358**	**353**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**9**	**13**	**11**	**14**	**8**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.3**	**1.4**	**1.4**	**1.4**	**1.3**
Barium	7440-39-3	1	µg/L	**7**	**12**	**11**	**9**	**8**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**3850**	**3920**	**3830**	**3910**	**3930**
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
Iron	7439-89-6	5	µg/L	<5	<5	<5	<5	**23**
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	**1.4**	**3.6**	**3.1**	**3.0**	**2.2**
Molybdenum	7439-98-7	0.1	µg/L	**10.0**	**10.2**	**10.3**	**10.1**	**10.2**

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	B1	W2	W1	V1	LA1
			Client sampling date / time	28-Feb-2017 09:00	28-Feb-2017 10:00	28-Feb-2017 10:15	28-Feb-2017 10:45	28-Feb-2017 12:00
Compound	CAS Number	LOR	Unit	EB1704258-001	EB1704258-002	EB1704258-003	EB1704258-004	EB1704258-005
				Result	Result	Result	Result	Result
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	<0.5	**0.6**	<0.5
Selenium	7782-49-2	2	µg/L	**6**	**6**	**6**	**7**	**6**
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**817**	**94**	**86**	**145**	**87**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.6**	**1.6**	**1.5**	**1.3**	**1.5**
Barium	7440-39-3	1	µg/L	**8**	**13**	**11**	**9**	**8**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**4110**	**4100**	**3990**	**4140**	**4070**
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	7440-47-3	0.5	µg/L	**0.6**	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	**0.8**	**0.3**	**0.3**	**0.4**	**0.3**
Copper	7440-50-8	1	µg/L	**1**	**1**	<1	<1	<1
Iron	7439-89-6	5	µg/L	**983**	**103**	**95**	**165**	**98**
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	**21.2**	**7.2**	**6.6**	**7.6**	**5.5**
Molybdenum	7439-98-7	0.1	µg/L	**9.6**	**10.1**	**10.0**	**9.9**	**9.8**
Nickel	7440-02-0	0.5	µg/L	**2.0**	**1.9**	**1.6**	**1.9**	**1.4**
Selenium	7782-49-2	2	µg/L	**5**	**4**	**4**	**5**	**4**
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.05**	**0.05**	**0.47**	**0.15**	**0.07**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	**B1**	**W2**	**W1**	**V1**	**LA1**
			Client sampling date / time	28-Feb-2017 09:00	28-Feb-2017 10:00	28-Feb-2017 10:15	28-Feb-2017 10:45	28-Feb-2017 12:00
Compound	CAS Number	LOR	Unit	**EB1704258-001**	**EB1704258-002**	**EB1704258-003**	**EB1704258-004**	**EB1704258-005**
				Result	Result	Result	Result	Result
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.06**	<0.05	**0.08**	<0.05	**0.12**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**431**	**440**	**499**	**509**	**490**
Total Cations	----	0.01	meq/L	**514**	**503**	**506**	**523**	**513**
Ionic Balance	----	0.01	%	**8.81**	**6.72**	**0.63**	**1.35**	**2.33**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **MARINE WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	LA2	LA3	LA4	LA5	M1
			Client sampling date / time	26-Feb-2017 14:30	26-Feb-2017 13:20	26-Feb-2017 11:00	26-Feb-2017 08:30	28-Feb-2017 12:30
				EB1704258-006	EB1704258-007	EB1704258-008	EB1704258-009	EB1704258-010
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**5**	**15**	**9**	**8**	**2620**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**113**	**115**	**114**	**114**	**116**
Total Alkalinity as CaCO3	----	1	mg/L	**113**	**115**	**114**	**114**	**116**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2430**	**2380**	**2400**	**2310**	**226**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**15800**	**16000**	**16000**	**15800**	**1490**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**352**	**343**	**330**	**350**	**78**
Magnesium	7439-95-4	1	mg/L	**1110**	**1080**	**1020**	**1100**	**111**
Sodium	7440-23-5	1	mg/L	**9090**	**8830**	**8430**	**8900**	**887**
Potassium	7440-09-7	1	mg/L	**348**	**342**	**324**	**346**	**31**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**9**	**12**	**16**	**14**	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
Arsenic	7440-38-2	0.5	µg/L	**1.4**	**1.6**	**1.4**	**1.5**	----
Barium	7440-39-3	1	µg/L	**8**	**8**	**11**	**10**	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Boron	7440-42-8	100	µg/L	**3970**	**3940**	**3730**	**3860**	----
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	----
Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	----
Iron	7439-89-6	5	µg/L	<5	<5	<5	<5	----
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	**0.4**	----
Manganese	7439-96-5	0.5	µg/L	**3.3**	**2.8**	**7.0**	**3.1**	----
Molybdenum	7439-98-7	0.1	µg/L	**9.8**	**10.2**	**9.6**	**9.8**	----

Analytical Results

Sub-Matrix: MARINE WATER
(Matrix: WATER)

Compound	CAS Number	LOR	Unit	LA2	LA3	LA4	LA5	M1
Client sampling date / time				26-Feb-2017 14:30	26-Feb-2017 13:20	26-Feb-2017 11:00	26-Feb-2017 08:30	28-Feb-2017 12:30
				EB1704258-006	EB1704258-007	EB1704258-008	EB1704258-009	EB1704258-010
				Result	Result	Result	Result	Result
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	**0.5**	<0.5	**0.5**	----
Selenium	7782-49-2	2	µg/L	**6**	**6**	**6**	**7**	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	----
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	----
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**128**	**692**	**239**	**149**	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	----
Arsenic	7440-38-2	0.5	µg/L	**1.6**	**1.6**	**1.5**	**1.5**	----
Barium	7440-39-3	1	µg/L	**8**	**9**	**11**	**10**	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Boron	7440-42-8	100	µg/L	**4150**	**4010**	**3860**	**3980**	----
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	----
Chromium	7440-47-3	0.5	µg/L	<0.5	**0.5**	<0.5	<0.5	----
Cobalt	7440-48-4	0.2	µg/L	**0.3**	**0.8**	**0.4**	**0.3**	----
Copper	7440-50-8	1	µg/L	<1	**2**	**1**	<1	----
Iron	7439-89-6	5	µg/L	**160**	**941**	**305**	**186**	----
Lead	7439-92-1	0.2	µg/L	**0.4**	<0.2	<0.2	**2.3**	----
Manganese	7439-96-5	0.5	µg/L	**7.0**	**25.0**	**13.1**	**8.5**	----
Molybdenum	7439-98-7	0.1	µg/L	**10.2**	**10.1**	**9.3**	**10.0**	----
Nickel	7440-02-0	0.5	µg/L	**1.6**	**2.3**	**1.4**	**1.1**	----
Selenium	7782-49-2	2	µg/L	**4**	**5**	**5**	**5**	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	----
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	----	----	----	**10**
Antimony	7440-36-0	0.2	µg/L	----	----	----	----	<0.2
Arsenic	7440-38-2	0.2	µg/L	----	----	----	----	**4.1**
Barium	7440-39-3	0.5	µg/L	----	----	----	----	**26.1**
Beryllium	7440-41-7	0.1	µg/L	----	----	----	----	<0.1
Boron	7440-42-8	5	µg/L	----	----	----	----	**276**
Cadmium	7440-43-9	0.05	µg/L	----	----	----	----	<0.05
Chromium	7440-47-3	0.2	µg/L	----	----	----	----	**0.2**

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	**LA2**	**LA3**	**LA4**	**LA5**	**M1**
			Client sampling date / time	26-Feb-2017 14:30	26-Feb-2017 13:20	26-Feb-2017 11:00	26-Feb-2017 08:30	28-Feb-2017 12:30
Compound	CAS Number	LOR	Unit	**EB1704258-006**	**EB1704258-007**	**EB1704258-008**	**EB1704258-009**	**EB1704258-010**
				Result	Result	Result	Result	Result
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued								
Cobalt	7440-48-4	0.1	µg/L	----	----	----	----	<0.1
Copper	7440-50-8	0.5	µg/L	----	----	----	----	**1.9**
Iron	7439-89-6	2	µg/L	----	----	----	----	**10**
Lead	7439-92-1	0.1	µg/L	----	----	----	----	<0.1
Manganese	7439-96-5	0.5	µg/L	----	----	----	----	**0.8**
Molybdenum	7439-98-7	0.1	µg/L	----	----	----	----	**1.6**
Nickel	7440-02-0	0.5	µg/L	----	----	----	----	**0.8**
Selenium	7782-49-2	0.2	µg/L	----	----	----	----	**0.9**
Silver	7440-22-4	0.1	µg/L	----	----	----	----	**0.4**
Tin	7440-31-5	0.2	µg/L	----	----	----	----	<0.2
Zinc	7440-66-6	1	µg/L	----	----	----	----	<1
EG094T: Total metals in Fresh water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	----	----	----	**30400**
Antimony	7440-36-0	0.2	µg/L	----	----	----	----	**0.6**
Arsenic	7440-38-2	0.2	µg/L	----	----	----	----	**39.9**
Barium	7440-39-3	0.5	µg/L	----	----	----	----	**192**
Beryllium	7440-41-7	0.1	µg/L	----	----	----	----	**0.3**
Boron	7440-42-8	5	µg/L	----	----	----	----	**175**
Cadmium	7440-43-9	0.05	µg/L	----	----	----	----	**0.36**
Chromium	7440-47-3	0.2	µg/L	----	----	----	----	**69.8**
Cobalt	7440-48-4	0.1	µg/L	----	----	----	----	**39.3**
Copper	7440-50-8	0.5	µg/L	----	----	----	----	**131**
Iron	7439-89-6	2	µg/L	----	----	----	----	**79700**
Lead	7439-92-1	0.1	µg/L	----	----	----	----	**58.8**
Manganese	7439-96-5	0.5	µg/L	----	----	----	----	**1930**
Molybdenum	7439-98-7	0.1	µg/L	----	----	----	----	**3.4**
Selenium	7782-49-2	0.2	µg/L	----	----	----	----	**2.9**
Nickel	7440-02-0	0.5	µg/L	----	----	----	----	**75.1**
Silver	7440-22-4	0.1	µg/L	----	----	----	----	**0.4**
Tin	7440-31-5	0.2	µg/L	----	----	----	----	**0.8**
Zinc	7440-66-6	1	µg/L	----	----	----	----	**161**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.03**	**0.06**	**0.10**	**0.06**	**0.05**
EK057G: Nitrite as N by Discrete Analyser								

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	**LA2**	**LA3**	**LA4**	**LA5**	**M1**
			Client sampling date / time	26-Feb-2017 14:30	26-Feb-2017 13:20	26-Feb-2017 11:00	26-Feb-2017 08:30	28-Feb-2017 12:30
Compound	CAS Number	LOR	Unit	**EB1704258-006**	**EB1704258-007**	**EB1704258-008**	**EB1704258-009**	**EB1704258-010**
				Result	Result	Result	Result	Result
EK057G: Nitrite as N by Discrete Analyser - Continued								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.02**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.02**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	**1.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	**1.2**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.08**	**0.06**	<0.05	<0.05	**1.37**
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.04**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**498**	**503**	**504**	**496**	**49.0**
Total Cations	----	0.01	meq/L	**513**	**499**	**475**	**504**	**52.4**
Ionic Balance	----	0.01	%	**1.45**	**0.43**	**2.88**	**0.79**	**3.30**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	**S2**	**V1D**	**B1-10**	**W2-10**	**W1-10**
			Client sampling date / time	27-Feb-2017 09:15	28-Feb-2017 11:00	28-Feb-2017 09:15	28-Feb-2017 09:45	28-Feb-2017 10:30
Compound	*CAS Number*	*LOR*	*Unit*	**EB1704258-011**	**EB1704258-012**	**EB1704258-013**	**EB1704258-014**	**EB1704258-015**
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**2**	**3**	**8**	**2**	**4**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**112**	**111**	**116**	**113**	**115**
Total Alkalinity as CaCO3	----	1	mg/L	**112**	**111**	**116**	**113**	**115**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2470**	**2410**	**2600**	**2580**	**2600**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**16500**	**13600**	**14600**	**14500**	**15000**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**355**	**349**	**382**	**370**	**378**
Magnesium	7439-95-4	1	mg/L	**1130**	**1100**	**1200**	**1160**	**1180**
Sodium	7440-23-5	1	mg/L	**9180**	**8990**	**9850**	**9480**	**9690**
Potassium	7440-09-7	1	mg/L	**355**	**351**	**382**	**371**	**376**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	<5	**10**	<5	**7**	**6**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.5**	**1.5**	**1.4**	**1.5**	**1.4**
Barium	7440-39-3	1	µg/L	**4**	**8**	**6**	**6**	**5**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**4150**	**4020**	**4340**	**4320**	**4330**
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
Iron	7439-89-6	5	µg/L	<5	<5	<5	<5	<5
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	<0.5	**1.9**	<0.5	**0.9**	**0.6**
Molybdenum	7439-98-7	0.1	µg/L	**10.5**	**10.0**	**11.1**	**11.2**	**11.2**

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			*Client sample ID*	**S2**	**V1D**	**B1-10**	**W2-10**	**W1-10**
			Client sampling date / time	27-Feb-2017 09:15	28-Feb-2017 11:00	28-Feb-2017 09:15	28-Feb-2017 09:45	28-Feb-2017 10:30
Compound	*CAS Number*	*LOR*	*Unit*	**EB1704258-011**	**EB1704258-012**	**EB1704258-013**	**EB1704258-014**	**EB1704258-015**
				Result	Result	Result	Result	Result
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Selenium	7782-49-2	2	µg/L	**7**	**7**	**7**	**7**	**7**
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**14**	**86**	**164**	**56**	**49**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.5**	**1.6**	**1.4**	**1.4**	**1.5**
Barium	7440-39-3	1	µg/L	**5**	**8**	**6**	**6**	**6**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**4170**	**4020**	**4290**	**4260**	**4350**
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	<0.2	**0.3**	**0.3**	<0.2	**0.2**
Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	**4**
Iron	7439-89-6	5	µg/L	**14**	**100**	**208**	**66**	**49**
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	**1.6**	**4.9**	**5.9**	**3.0**	**3.2**
Molybdenum	7439-98-7	0.1	µg/L	**10.5**	**10.1**	**10.7**	**11.0**	**11.0**
Nickel	7440-02-0	0.5	µg/L	**1.0**	**0.8**	**0.9**	**0.7**	**0.6**
Selenium	7782-49-2	2	µg/L	**4**	**4**	**5**	**4**	**5**
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.45**	**0.12**	**0.12**	**0.12**	**0.09**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.08**	<0.01	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.08**	<0.01	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	S2	V1D	B1-10	W2-10	W1-10
			Client sampling date / time	27-Feb-2017 09:15	28-Feb-2017 11:00	28-Feb-2017 09:15	28-Feb-2017 09:45	28-Feb-2017 10:30
Compound	CAS Number	LOR	Unit	EB1704258-011	EB1704258-012	EB1704258-013	EB1704258-014	EB1704258-015
				Result	Result	Result	Result	Result
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	<0.05	**0.08**	<0.05
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**519**	**436**	**468**	**465**	**480**
Total Cations	----	0.01	meq/L	**519**	**508**	**556**	**536**	**547**
Ionic Balance	----	0.01	%	<0.01	**7.62**	**8.57**	**7.07**	**6.58**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	V1-10	LA1-10	LA2-10	LA3-10	LA4-10
			Client sampling date / time	28-Feb-2017 11:15	28-Feb-2017 12:15	26-Feb-2017 14:40	26-Feb-2017 13:20	26-Feb-2017 11:00
Compound	CAS Number	LOR	Unit	EB1704258-016	EB1704258-017	EB1704258-018	EB1704258-019	EB1704258-020
				Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	<1	**6**	**10**	**21**	**5**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**117**	**117**	**115**	**113**	**115**
Total Alkalinity as CaCO3	----	1	mg/L	**117**	**117**	**115**	**113**	**115**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2600**	**2620**	**2490**	**2510**	**2590**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**15000**	**14700**	**14000**	**14200**	**14700**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**381**	**381**	**354**	**360**	**369**
Magnesium	7439-95-4	1	mg/L	**1200**	**1190**	**1120**	**1130**	**1150**
Sodium	7440-23-5	1	mg/L	**9860**	**9710**	**9000**	**9230**	**9480**
Potassium	7440-09-7	1	mg/L	**383**	**382**	**353**	**361**	**367**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**13**	**12**	**10**	**8**	**17**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.6**	**1.5**	**1.4**	**1.4**	**1.3**
Barium	7440-39-3	1	µg/L	**9**	**8**	**7**	**6**	**15**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**4410**	**4360**	**4220**	**4220**	**4330**
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	**0.2**
Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
Iron	7439-89-6	5	µg/L	<5	<5	<5	<5	<5
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	**2.3**	**2.7**	**3.9**	**1.7**	**9.8**
Molybdenum	7439-98-7	0.1	µg/L	**11.2**	**11.2**	**10.8**	**10.7**	**11.2**

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	**V1-10**	**LA1-10**	**LA2-10**	**LA3-10**	**LA4-10**
			Client sampling date / time	28-Feb-2017 11:15	28-Feb-2017 12:15	26-Feb-2017 14:40	26-Feb-2017 13:20	26-Feb-2017 11:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1704258-016**	**EB1704258-017**	**EB1704258-018**	**EB1704258-019**	**EB1704258-020**
				Result	Result	Result	Result	Result
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	**0.5**	<0.5	**0.6**
Selenium	7782-49-2	2	µg/L	**6**	**7**	**7**	**7**	**8**
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**72**	**75**	**333**	**705**	**160**
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Arsenic	7440-38-2	0.5	µg/L	**1.3**	**1.6**	**1.4**	**1.7**	**1.4**
Barium	7440-39-3	1	µg/L	**8**	**8**	**8**	**7**	**14**
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	7440-42-8	100	µg/L	**4320**	**4350**	**4150**	**4070**	**4200**
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	**0.6**	<0.5
Cobalt	7440-48-4	0.2	µg/L	**0.2**	**0.2**	**0.4**	**0.6**	**0.4**
Copper	7440-50-8	1	µg/L	<1	<1	<1	**3**	<1
Iron	7439-89-6	5	µg/L	**80**	**96**	**428**	**970**	**191**
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	7439-96-5	0.5	µg/L	**4.8**	**5.6**	**15.0**	**23.3**	**14.1**
Molybdenum	7439-98-7	0.1	µg/L	**11.3**	**11.0**	**10.6**	**10.2**	**10.8**
Nickel	7440-02-0	0.5	µg/L	**0.8**	<0.5	**1.0**	**1.8**	**0.8**
Selenium	7782-49-2	2	µg/L	**4**	**5**	**5**	**4**	**4**
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	7440-31-5	5	µg/L	<5	<5	<5	<5	<5
Zinc	7440-66-6	5	µg/L	<5	<5	<5	<5	<5
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.11**	**0.11**	**0.15**	**0.11**	**0.13**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.01**
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.02**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.03**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	V1-10	LA1-10	LA2-10	LA3-10	LA4-10
			Client sampling date / time	28-Feb-2017 11:15	28-Feb-2017 12:15	26-Feb-2017 14:40	26-Feb-2017 13:20	26-Feb-2017 11:00
Compound	CAS Number	LOR	Unit	EB1704258-016	EB1704258-017	EB1704258-018	EB1704258-019	EB1704258-020
				Result	Result	Result	Result	Result
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	**0.6**	<0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<0.5	**0.6**	<0.5
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.05	**0.06**	**0.12**	**0.11**	<0.05
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**480**	**472**	**449**	**455**	**471**
Total Cations	----	0.01	meq/L	**556**	**549**	**510**	**522**	**535**
Ionic Balance	----	0.01	%	**7.42**	**7.60**	**6.39**	**6.82**	**6.36**
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	<5

Analytical Results

Sub-Matrix: **MARINE WATER** (Matrix: **WATER**)			Client sample ID	LA5-10	M1-10	V1-10-D	FB1	----
			Client sampling date / time	26-Feb-2017 08:40	28-Feb-2017 12:45	28-Feb-2017 11:30	28-Feb-2017 15:20	----
Compound	CAS Number	LOR	Unit	EB1704258-021	EB1704258-022	EB1704258-023	EB1704258-024	--------
				Result	Result	Result	Result	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	1	mg/L	**4**	**541**	**12**	<1	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**112**	**110**	**117**	**4**	----
Total Alkalinity as CaCO3	----	1	mg/L	**112**	**110**	**117**	**4**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2590**	**2460**	**2660**	**1**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**14600**	**16500**	**17600**	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**366**	**365**	**383**	<1	----
Magnesium	7439-95-4	1	mg/L	**1160**	**1120**	**1190**	**1**	----
Sodium	7440-23-5	1	mg/L	**9320**	**9170**	**9680**	**4**	----
Potassium	7440-09-7	1	mg/L	**366**	**357**	**381**	<1	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**17**	**29**	**9**	----	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Arsenic	7440-38-2	0.5	µg/L	**1.4**	**2.0**	**1.5**	----	----
Barium	7440-39-3	1	µg/L	**13**	**36**	**7**	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Boron	7440-42-8	100	µg/L	**4270**	**4090**	**4440**	----	----
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Cobalt	7440-48-4	0.2	µg/L	<0.2	**0.2**	<0.2	----	----
Copper	7440-50-8	1	µg/L	<1	<1	<1	----	----
Iron	7439-89-6	5	µg/L	<5	**5**	<5	----	----
Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	<0.2	----	----
Manganese	7439-96-5	0.5	µg/L	**9.9**	**14.3**	**0.8**	----	----
Molybdenum	7439-98-7	0.1	µg/L	**10.8**	**10.3**	**11.2**	----	----

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	LA5-10	M1-10	V1-10-D	FB1	----
			Client sampling date / time	26-Feb-2017 08:40	28-Feb-2017 12:45	28-Feb-2017 11:30	28-Feb-2017 15:20	----
Compound	CAS Number	LOR	Unit	EB1704258-021	EB1704258-022	EB1704258-023	EB1704258-024	--------
				Result	Result	Result	Result	----
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS - Continued								
Nickel	7440-02-0	0.5	µg/L	**0.6**	**0.8**	<0.5	----	----
Selenium	7782-49-2	2	µg/L	**8**	**7**	**8**	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Tin	7440-31-5	5	µg/L	<5	<5	<5	----	----
Zinc	7440-66-6	5	µg/L	<5	<5	<5	----	----
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	**120**	**17900**	**103**	----	----
Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Arsenic	7440-38-2	0.5	µg/L	**1.6**	**15.7**	**1.7**	----	----
Barium	7440-39-3	1	µg/L	**14**	**65**	**10**	----	----
Beryllium	7440-41-7	0.1	µg/L	<0.1	**0.3**	<0.1	----	----
Boron	7440-42-8	100	µg/L	**4250**	**4370**	**4200**	----	----
Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	<0.2	----	----
Chromium	7440-47-3	0.5	µg/L	<0.5	**27.0**	<0.5	----	----
Cobalt	7440-48-4	0.2	µg/L	**0.3**	**13.8**	**0.3**	----	----
Copper	7440-50-8	1	µg/L	<1	**45**	<1	----	----
Iron	7439-89-6	5	µg/L	**142**	**27800**	**94**	----	----
Lead	7439-92-1	0.2	µg/L	<0.2	**11.0**	<0.2	----	----
Manganese	7439-96-5	0.5	µg/L	**13.4**	**649**	**7.8**	----	----
Molybdenum	7439-98-7	0.1	µg/L	**10.6**	**9.5**	**10.5**	----	----
Nickel	7440-02-0	0.5	µg/L	**0.7**	**27.2**	**0.8**	----	----
Selenium	7782-49-2	2	µg/L	**4**	**5**	**5**	----	----
Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	<0.1	----	----
Tin	7440-31-5	5	µg/L	<5	<5	<5	----	----
Zinc	7440-66-6	5	µg/L	<5	**53**	<5	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	----	----	<5	----
Antimony	7440-36-0	0.2	µg/L	----	----	----	<0.2	----
Arsenic	7440-38-2	0.2	µg/L	----	----	----	<0.2	----
Barium	7440-39-3	0.5	µg/L	----	----	----	<0.5	----
Beryllium	7440-41-7	0.1	µg/L	----	----	----	<0.1	----
Boron	7440-42-8	5	µg/L	----	----	----	<5	----
Cadmium	7440-43-9	0.05	µg/L	----	----	----	<0.05	----
Chromium	7440-47-3	0.2	µg/L	----	----	----	<0.2	----

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	LA5-10	M1-10	V1-10-D	FB1	----
			Client sampling date / time	26-Feb-2017 08:40	28-Feb-2017 12:45	28-Feb-2017 11:30	28-Feb-2017 15:20	----
Compound	CAS Number	LOR	Unit	EB1704258-021	EB1704258-022	EB1704258-023	EB1704258-024	--------
				Result	Result	Result	Result	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS - Continued								
Cobalt	7440-48-4	0.1	µg/L	----	----	----	<0.1	----
Copper	7440-50-8	0.5	µg/L	----	----	----	<0.5	----
Iron	7439-89-6	2	µg/L	----	----	----	<2	----
Lead	7439-92-1	0.1	µg/L	----	----	----	<0.1	----
Manganese	7439-96-5	0.5	µg/L	----	----	----	<0.5	----
Molybdenum	7439-98-7	0.1	µg/L	----	----	----	<0.1	----
Nickel	7440-02-0	0.5	µg/L	----	----	----	<0.5	----
Selenium	7782-49-2	0.2	µg/L	----	----	----	<0.2	----
Silver	7440-22-4	0.1	µg/L	----	----	----	<0.1	----
Tin	7440-31-5	0.2	µg/L	----	----	----	<0.2	----
Zinc	7440-66-6	1	µg/L	----	----	----	<1	----
EG094T: Total metals in Fresh water by ORC-ICPMS								
Aluminium	7429-90-5	5	µg/L	----	----	----	<5	----
Antimony	7440-36-0	0.2	µg/L	----	----	----	<0.2	----
Arsenic	7440-38-2	0.2	µg/L	----	----	----	<0.2	----
Barium	7440-39-3	0.5	µg/L	----	----	----	<0.5	----
Beryllium	7440-41-7	0.1	µg/L	----	----	----	<0.1	----
Boron	7440-42-8	5	µg/L	----	----	----	<5	----
Cadmium	7440-43-9	0.05	µg/L	----	----	----	<0.05	----
Chromium	7440-47-3	0.2	µg/L	----	----	----	<0.2	----
Cobalt	7440-48-4	0.1	µg/L	----	----	----	<0.1	----
Copper	7440-50-8	0.5	µg/L	----	----	----	<0.5	----
Iron	7439-89-6	2	µg/L	----	----	----	**2**	----
Lead	7439-92-1	0.1	µg/L	----	----	----	<0.1	----
Manganese	7439-96-5	0.5	µg/L	----	----	----	<0.5	----
Molybdenum	7439-98-7	0.1	µg/L	----	----	----	<0.1	----
Selenium	7782-49-2	0.2	µg/L	----	----	----	<0.2	----
Nickel	7440-02-0	0.5	µg/L	----	----	----	<0.5	----
Silver	7440-22-4	0.1	µg/L	----	----	----	<0.1	----
Tin	7440-31-5	0.2	µg/L	----	----	----	<0.2	----
Zinc	7440-66-6	1	µg/L	----	----	----	<1	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.06**	**0.09**	**0.11**	<0.01	----
EK057G: Nitrite as N by Discrete Analyser								

Analytical Results

Sub-Matrix: MARINE WATER (Matrix: WATER)			Client sample ID	LA5-10	M1-10	V1-10-D	FB1	----
			Client sampling date / time	26-Feb-2017 08:40	28-Feb-2017 12:45	28-Feb-2017 11:30	28-Feb-2017 15:20	----
Compound	CAS Number	LOR	Unit	EB1704258-021	EB1704258-022	EB1704258-023	EB1704258-024	--------
				Result	Result	Result	Result	----
EK057G: Nitrite as N by Discrete Analyser - Continued								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	**0.6**	<0.5	<0.1	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	<0.5	**0.6**	<0.5	<0.1	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.06**	**0.74**	**0.10**	<0.01	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	**0.02**	<0.01	<0.01	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**468**	**519**	**554**	**0.10**	----
Total Cations	----	0.01	meq/L	**528**	**518**	**548**	**0.26**	----
Ionic Balance	----	0.01	%	**6.07**	**0.04**	**0.58**	----	----
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	<5	<5	<5	----

CERTIFICATE OF ANALYSIS

Batch No:	**17-12346**	*Page*	Page 1 of 3
Final Report	613786	*Laboratory*	Scoresby Laboratory
		Address	Caribbean Business Park, 22 Dalmore Drive, Scoresby, VIC 3179
		Phone	03 8756 8000
Client:	**Australian Laboratory Services Pty Ltd**	*Fax*	03 9763 1862
Contact:	**Greg Vogel**	Contact:	Ximena Iglesias Client Manager Ximena.Iglesias@alsglobal.com
Address:	2 Blyth Street STAFFORD QLD 4053		
Client Program Ref:	**EB1704258**	Date Sampled:	26-Feb-2017 - 28-Feb-2017
ALS Program Ref:	**ALSBRIS**	Date Samples Received:	07-Mar-2017
PO No:	**523750**	*Date Issued:*	**10-Mar-2017**

The sample(s) referred to in this report were analysed by the following method(s) under NATA Accreditation No. 992.

The hash (#) below indicates methods not covered by NATA accreditation in the performance of this service .

Analysis	*Method*	*Laboratory*	*Analysis*	*Method*	*Laboratory*	*Analysis*	*Method*	*Laboratory*
E. coli	MM540	Scoresby	**F. coliforms**	MM540	Scoresby			

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Analysis conducted outside holding time due to late arrival or delayed extraction/analysis. Based on APHA, VICEPA, AS & NEPM

Late Sample Arrival - E. coli[5124065,5124066,5124067,5124068,5124069,5124070,5124071,5124072,5124073,5124074,5124075,5124076,5124077,5124078,5124079,5124080,5124081,5124082,5124083,5124084,5124085,5124086,5124087 ...

Samples outside of holding time for microbiological analysis.

Signatories

These results have been electronically signed by the authorised signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11

Name	*Title*	*Name*	*Title*
Natacha Begue	**Deputy Team Leader Microbiology**		

LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5124065	5124066	5124067	5124068	5124069	5124070
				Client Sample ID	001	002	003	004	005	006
				Sample Date	28/02/17	28/02/17	28/02/17	28/02/17	28/02/17	26/02/17
				Sample Type	WATER	WATER	WATER	WATER	WATER	WATER
Analysis	**Analyte**	**CAS #**	**LOR**							
F. coliforms	Faecal Coliforms	Coliform	0	orgs/100mL	20 HTEX	120 HTEX	120 HTEX	120 HTEX	110 HTEX	7 HTEX
E. coli	E. coli	E.Coli	0	orgs/100mL	20 HTEX	110 HTEX	120 HTEX	120 HTEX	100 HTEX	3 HTEX

HTEX Holding time was not met. Therefore result may be indicative.

LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5124071	5124072	5124073	5124074	5124075	5124076
				Client Sample ID	007	008	009	010	011	012
				Sample Date	26/02/17	26/02/17	26/02/17	28/02/17	27/02/17	28/02/17
				Sample Type	WATER	WATER	WATER	WATER	WATER	WATER
Analysis	**Analyte**	**CAS #**	**LOR**							
F. coliforms	Faecal Coliforms	Coliform	0	orgs/100mL	35 HTEX	20 HTEX	21 HTEX	4000 HTEX	0 HTEX	150 HTEX
E. coli	E. coli	E.Coli	0	orgs/100mL	28 HTEX	12 HTEX	21 HTEX	4000 HTEX	0 HTEX	150 HTEX

HTEX Holding time was not met. Therefore result may be indicative.

Samples not collected by ALS and are tested as received.

A blank space indicates no test performed. Soil results expressed in mg/kg dry weight unless specified otherwise. Microbiological testing was commenced on the day of receival and within 24 hours of sampling unless otherwise stated. MM524: Plate count results <10 per mL and >300 per mL are deemed as approximate. MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate. Calculated results are based on raw data.

Batch No: 17-12346
Report Number: 613786
Client: Australian Laboratory Services Pty Ltd
Client Program Ref: EB1704258

LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5124077	5124078	5124079	5124080	5124081	5124082
				Client Sample ID	013	014	015	016	017	018
				Sample Date	28/02/17	28/02/17	28/02/17	28/02/17	28/02/17	26/02/17
				Sample Type	WATER	WATER	WATER	WATER	WATER	WATER
Analysis	**Analyte**	**CAS #**	**LOR**							
F. coliforms	Faecal Coliforms	Coliform	0	orgs/100mL	7 HTEX	24 HTEX	20 HTEX	55 HTEX	43 HTEX	22 HTEX
E. coli	E. coli	E.Coli	0	orgs/100mL	3 HTEX	24 HTEX	20 HTEX	51 HTEX	40 HTEX	17 HTEX

HTEX Holding time was not met. Therefore result may be indicative.

LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5124083	5124084	5124085	5124086	5124087	5124088
				Client Sample ID	019	020	021	022	023	024
				Sample Date	26/02/17	26/02/17	26/02/17	28/02/17	28/02/17	28/02/17
				Sample Type	WATER	WATER	WATER	WATER	WATER	WATER
Analysis	**Analyte**	**CAS #**	**LOR**							
F. coliforms	Faecal Coliforms	Coliform	0	orgs/100mL	75 HTEX	95 HTEX	46 HTEX	1200 HTEX	100 HTEX	0 HTEX
E. coli	E. coli	E.Coli	0	orgs/100mL	75 HTEX	95 HTEX	29 HTEX	480 HTEX	100 HTEX	0 HTEX

HTEX Holding time was not met. Therefore result may be indicative.

Samples not collected by ALS and are tested as received.

A blank space indicates no test performed. Soil results expressed in mg/kg dry weight unless specified otherwise. Microbiological testing was commenced on the day of receival and within 24 hours of sampling unless otherwise stated. MM524: Plate count results <10 per mL and >300 per mL are deemed as approximate. MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate. Calculated results are based on raw data.

CERTIFICATE OF ANALYSIS

Work Order	: **EB1707858**	Page	: 1 of 5
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TRAVIS WOOD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 19-Apr-2017 11:37
Order number	: ----	Date Analysis Commenced	: 28-Apr-2017
C-O-C number	: ----	Issue Date	: 28-Apr-2017 18:29
Sampler	: GREG HEATH		
Site	: ----		
Quote number	: BN/288/16 V6		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	B1	W2	W1	V1	LA1
			Client sampling date / time	27-Feb-2017 16:30	27-Feb-2017 16:00	27-Feb-2017 15:00	27-Feb-2017 14:30	27-Feb-2017 13:30
Compound	CAS Number	LOR	Unit	EB1707858-001	EB1707858-002	EB1707858-003	EB1707858-004	EB1707858-005
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
+75µm	----	1	%	96	70	92	48	91
+150µm	----	1	%	93	9	52	31	81
+300µm	----	1	%	82	5	18	30	25
+425µm	----	1	%	76	5	10	30	5
+600µm	----	1	%	70	5	5	29	<1
+1180µm	----	1	%	59	5	2	28	<1
+2.36mm	----	1	%	50	5	<1	22	<1
+4.75mm	----	1	%	41	4	<1	13	<1
+9.5mm	----	1	%	29	<1	<1	5	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	1	9	4	13	4
Silt (2-60 µm)	----	1	%	3	17	3	35	3
Sand (0.06-2.00 mm)	----	1	%	43	69	92	28	93
Gravel (>2mm)	----	1	%	53	5	1	24	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.66	2.79	2.63	2.56	2.70

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	LA2	LA3	LA4	LA5	M1
			Client sampling date / time	27-Feb-2017 14:50	26-Feb-2017 13:30	26-Feb-2017 11:00	26-Feb-2017 08:30	27-Feb-2017 12:00
Compound	CAS Number	LOR	Unit	EB1707858-006	EB1707858-007	EB1707858-008	EB1707858-009	EB1707858-010
				Result	Result	Result	Result	Result
EA150: Particle Sizing								
+75µm	----	1	%	7	<1	<1	13	24
+150µm	----	1	%	1	<1	<1	9	3
+300µm	----	1	%	<1	<1	<1	3	1
+425µm	----	1	%	<1	<1	<1	1	<1
+600µm	----	1	%	<1	<1	<1	<1	<1
+1180µm	----	1	%	<1	<1	<1	<1	<1
+2.36mm	----	1	%	<1	<1	<1	<1	<1
+4.75mm	----	1	%	<1	<1	<1	<1	<1
+9.5mm	----	1	%	<1	<1	<1	<1	<1
+19.0mm	----	1	%	<1	<1	<1	<1	<1
+37.5mm	----	1	%	<1	<1	<1	<1	<1
+75.0mm	----	1	%	<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	30	28	31	36	19
Silt (2-60 µm)	----	1	%	57	70	67	50	51
Sand (0.06-2.00 mm)	----	1	%	13	2	2	14	30
Gravel (>2mm)	----	1	%	<1	<1	<1	<1	<1
Cobbles (>6cm)	----	1	%	<1	<1	<1	<1	<1
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.68	2.56	2.54	2.58	2.49

Analytical Results

Sub-Matrix: MARINE SEDIMENT (Matrix: SOIL)			Client sample ID	S2	S2-D	----	----	----
			Client sampling date / time	27-Feb-2017 09:45	27-Feb-2017 09:45	----	----	----
Compound	CAS Number	LOR	Unit	EB1707858-011	EB1707858-012	--------	--------	--------
				Result	Result	----	----	----
EA150: Particle Sizing								
+75µm	----	1	%	98	98	----	----	----
+150µm	----	1	%	97	97	----	----	----
+300µm	----	1	%	89	89	----	----	----
+425µm	----	1	%	81	82	----	----	----
+600µm	----	1	%	71	71	----	----	----
+1180µm	----	1	%	37	36	----	----	----
+2.36mm	----	1	%	12	10	----	----	----
+4.75mm	----	1	%	2	2	----	----	----
+9.5mm	----	1	%	<1	<1	----	----	----
+19.0mm	----	1	%	<1	<1	----	----	----
+37.5mm	----	1	%	<1	<1	----	----	----
+75.0mm	----	1	%	<1	<1	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	<1	<1	----	----	----
Silt (2-60 µm)	----	1	%	2	2	----	----	----
Sand (0.06-2.00 mm)	----	1	%	79	80	----	----	----
Gravel (>2mm)	----	1	%	19	18	----	----	----
Cobbles (>6cm)	----	1	%	<1	<1	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.62	2.61	----	----	----

Appendix B – Water and Sediment Analyses Quality Control results

QUALITY CONTROL REPORT

Work Order	: **EB1627576**	Page	: 1 of 17
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR TRAVIS WOOD	Contact	: Bronwyn Sheen
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-3-8549 9636
Project	: 520	Date Samples Received	: 21-Nov-2016
Order number	: ----	Date Analysis Commenced	: 21-Nov-2016
C-O-C number	: ----	Issue Date	: 15-Dec-2016
Sampler	: TRAVIS WOOD		
Site	: ----		
Quote number	: EN/007/14		
No. of samples received	: 32		
No. of samples analysed	: 32		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane External Subcontracting, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Inorganics, Stafford, QLD
Tom Maloney	Nutrients Section Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD
Tom Maloney	Nutrients Section Supervisor	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002 : pH (Soils) (QC Lot: 664900)									
EB1627576-009	R1	EA002: pH Value	----	0.1	pH Unit	7.9	8.5	6.81	0% - 20%
EB1627684-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.4	6.4	0.00	0% - 20%
EA055: Moisture Content (QC Lot: 664910)									
EB1627576-009	R1	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	24.4	24.8	1.71	0% - 20%
EB1627684-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	46.4	43.8	5.90	0% - 20%
EG005E: 1M HCl extractable metals by ICP-AES (QC Lot: 684726)									
EB1627576-009	R1	EG005E: Boron	7440-42-8	1	mg/kg	2	1	0.00	No Limit
		EG005E: Iron	7439-89-6	1	mg/kg	3040	3100	1.84	0% - 20%
		EG005E: Aluminium	7429-90-5	50	mg/kg	1630	1640	0.688	0% - 20%
EB1627576-019	W1 <2000µm	EG005E: Boron	7440-42-8	1	mg/kg	6	5	0.00	No Limit
		EG005E: Iron	7439-89-6	1	mg/kg	11900	12700	6.40	0% - 20%
		EG005E: Aluminium	7429-90-5	50	mg/kg	17600	18100	2.44	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 684714)									
EB1627576-009	R1	EG005T: Aluminium	7429-90-5	50	mg/kg	16400	15100	8.10	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	29100	26800	8.42	0% - 20%
EB1627576-019	W1 <2000µm	EG005T: Aluminium	7429-90-5	50	mg/kg	34800	34400	1.12	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	46100	44800	2.72	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 684719)									
EB1627576-031	L3 <63µm	EG005T: Aluminium	7429-90-5	50	mg/kg	35400	35000	1.10	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	62600	59300	5.49	0% - 20%
EG020E: 1M HCl Extractable metals by ICPMS (QC Lot: 684725)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG020E: 1M HCl Extractable metals by ICPMS (QC Lot: 684725) - continued									
EB1627576-009	R1	EG020E: Arsenic	7440-38-2	0.05	mg/kg	1.52	1.55	2.08	0% - 20%
		EG020E: Barium	7440-39-3	0.05	mg/kg	9.30	8.77	5.86	0% - 20%
		EG020E: Cadmium	7440-43-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EG020E: Chromium	7440-47-3	0.05	mg/kg	2.48	2.55	2.56	0% - 20%
		EG020E: Cobalt	7440-48-4	0.05	mg/kg	2.28	2.32	1.48	0% - 20%
		EG020E: Copper	7440-50-8	0.05	mg/kg	4.55	4.50	1.07	0% - 20%
		EG020E: Lead	7439-92-1	0.05	mg/kg	2.90	2.84	2.29	0% - 20%
		EG020E: Manganese	7439-96-5	0.05	mg/kg	75.0	74.4	0.904	0% - 20%
		EG020E: Nickel	7440-02-0	0.05	mg/kg	2.27	2.37	4.15	0% - 20%
		EG020E: Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EG020E: Tin	7440-31-5	0.05	mg/kg	0.06	0.09	44.0	No Limit
		EG020E: Zinc	7440-66-6	0.05	mg/kg	6.49	6.69	3.10	0% - 20%
		EG020E: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020E: Vanadium	7440-62-2	0.5	mg/kg	7.1	7.0	1.79	0% - 50%
EB1627576-019	W1 <2000µm	EG020E: Arsenic	7440-38-2	0.05	mg/kg	0.70	0.70	0.00	0% - 50%
		EG020E: Barium	7440-39-3	0.05	mg/kg	19.5	20.0	2.20	0% - 20%
		EG020E: Cadmium	7440-43-9	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EG020E: Chromium	7440-47-3	0.05	mg/kg	35.6	36.7	3.07	0% - 20%
		EG020E: Cobalt	7440-48-4	0.05	mg/kg	6.72	7.07	5.07	0% - 20%
		EG020E: Copper	7440-50-8	0.05	mg/kg	23.1	24.2	4.77	0% - 20%
		EG020E: Lead	7439-92-1	0.05	mg/kg	1.41	1.40	0.00	0% - 20%
		EG020E: Manganese	7439-96-5	0.05	mg/kg	265	285	7.40	0% - 20%
		EG020E: Nickel	7440-02-0	0.05	mg/kg	14.7	15.9	8.05	0% - 20%
		EG020E: Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EG020E: Tin	7440-31-5	0.05	mg/kg	0.50	0.40	23.5	0% - 50%
		EG020E: Zinc	7440-66-6	0.05	mg/kg	18.2	19.0	4.56	0% - 20%
		EG020E: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020E: Vanadium	7440-62-2	0.5	mg/kg	19.3	21.5	10.9	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 684710)									
EB1627576-009	R1	EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EB1627576-019	W1 <2000µm	EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 684711)									
EB1627576-009	R1	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	0.3	<0.1	100	No Limit
EB1627576-019	W1 <2000µm	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 684712)									
EB1627576-009	R1	EG020X-T: Lead	7439-92-1	0.1	mg/kg	4.0	4.2	4.73	0% - 20%
		EG020X-T: Tin	7440-31-5	0.1	mg/kg	0.7	0.7	0.00	No Limit
EB1627576-019	W1 <2000µm	EG020X-T: Lead	7439-92-1	0.1	mg/kg	2.3	2.4	4.83	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG020T: Total Metals by ICP-MS (QC Lot: 684712) - continued									
EB1627576-019	W1 <2000µm	EG020X-T: Tin	7440-31-5	0.1	mg/kg	1.2	1.2	0.00	0% - 50%
EB1627576-009	R1	EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	4.7	4.4	5.78	0% - 20%
		EG020X-T: Barium	7440-39-3	0.1	mg/kg	44.4	41.0	8.10	0% - 20%
		EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	8.3	8.2	0.00	0% - 20%
		EG020X-T: Chromium	7440-47-3	0.1	mg/kg	28.2	27.1	3.84	0% - 20%
		EG020X-T: Copper	7440-50-8	0.1	mg/kg	19.3	19.1	1.41	0% - 20%
		EG020X-T: Manganese	7439-96-5	0.1	mg/kg	347	349	0.533	0% - 20%
		EG020X-T: Nickel	7440-02-0	0.1	mg/kg	16.9	16.4	3.21	0% - 20%
		EG020X-T: Zinc	7440-66-6	0.5	mg/kg	52.3	51.1	2.26	0% - 20%
		EG020X-T: Vanadium	7440-62-2	1	mg/kg	46	44	2.53	0% - 20%
EB1627576-019	W1 <2000µm	EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	2.2	2.1	5.57	0% - 20%
		EG020X-T: Barium	7440-39-3	0.1	mg/kg	38.7	37.1	4.24	0% - 20%
		EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	18.2	17.0	6.68	0% - 20%
		EG020X-T: Chromium	7440-47-3	0.1	mg/kg	79.5	72.4	9.29	0% - 20%
		EG020X-T: Copper	7440-50-8	0.1	mg/kg	59.9	56.7	5.45	0% - 20%
		EG020X-T: Manganese	7439-96-5	0.1	mg/kg	786	726	7.83	0% - 20%
		EG020X-T: Nickel	7440-02-0	0.1	mg/kg	41.6	40.6	2.46	0% - 20%
		EG020X-T: Zinc	7440-66-6	0.5	mg/kg	60.1	55.9	7.26	0% - 20%
		EG020X-T: Vanadium	7440-62-2	1	mg/kg	213	198	7.64	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 684715)									
EB1627576-031	L3 <63µm	EG020X-T: Barium	7440-39-3	0.1	mg/kg	39.8	39.1	1.97	0% - 20%
		EG020X-T: Lead	7439-92-1	0.1	mg/kg	14.5	14.9	2.46	0% - 20%
		EG020X-T: Tin	7440-31-5	0.1	mg/kg	1.2	1.2	0.00	0% - 50%
EB1627576-031	L3 <63µm	EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	11.1	12.4	10.8	0% - 20%
		EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	22.7	24.4	7.02	0% - 20%
		EG020X-T: Chromium	7440-47-3	0.1	mg/kg	51.8	58.9	12.8	0% - 20%
		EG020X-T: Copper	7440-50-8	0.1	mg/kg	101	112	10.2	0% - 20%
		EG020X-T: Manganese	7439-96-5	0.1	mg/kg	963	1060	10.0	0% - 20%
		EG020X-T: Nickel	7440-02-0	0.1	mg/kg	50.3	55.2	9.39	0% - 20%
		EG020X-T: Zinc	7440-66-6	0.5	mg/kg	88.6	100	12.4	0% - 20%
		EG020X-T: Vanadium	7440-62-2	1	mg/kg	117	133	13.0	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 684716)									
EB1627576-031	L3 <63µm	EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	0.2	0.1	0.00	No Limit
EB1627576-031	L3 <63µm	EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 684717)									
EB1627576-031	L3 <63µm	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	0.3	0.4	0.00	No Limit
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 684720)									
EB1627576-009	R1	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EB1627576-019	W1 <2000µm	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 684713)									
EB1627576-009	R1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EB1627576-019	W1 <2000µm	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 684718)									
EB1627576-031	L3 <63µm	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.06	0.05	0.00	0% - 20%
EK055: Ammonia as N (QC Lot: 664114)									
EB1627576-011	W1	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 664897)									
EB1627576-009	R1	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EB1627684-001	Anonymous	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 664898)									
EB1627576-009	R1	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.2	0.00	No Limit
EB1627684-001	Anonymous	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.1	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 684702)									
EB1627576-009	R1	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	130	130	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 684701)									
EB1627576-009	R1	EK067G: Total Phosphorus as P	----	2	mg/kg	387	348	10.8	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 664899)									
EB1627576-009	R1	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 683947)									
EB1627576-009	R1	EP003: Total Organic Carbon	----	0.02	%	0.34	0.32	4.90	0% - 50%
EB1627576-019	W1 <2000µm	EP003: Total Organic Carbon	----	0.02	%	0.04	0.05	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 685737)									
EB1627576-025	R1 <63µm	EP003: Total Organic Carbon	----	0.02	%	0.51	0.50	2.15	0% - 20%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 683948)									
EB1627576-009	R1	EP003TC: Total Carbon	TC	0.02	%	0.41	0.35	14.2	0% - 20%
EB1627576-019	W1 <2000µm	EP003TC: Total Carbon	TC	0.02	%	0.34	0.32	6.55	0% - 50%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 685738)									
EB1627576-025	R1 <63µm	EP003TC: Total Carbon	TC	0.02	%	0.62	0.58	7.06	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 662373)									
EB1627576-001	R1	EA025: Suspended Solids (SS)	----	1	mg/L	5	6	0.00	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 662398)									
EB1627576-004	W2	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	108	110	1.17	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	108	110	1.17	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED037P: Alkalinity by PC Titrator (QC Lot: 662398) - continued									
EB1627279-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	99	99	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	99	99	0.00	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 662137)									
EB1627576-001	R1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2160	2170	0.385	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 662136)									
EB1627576-001	R1	ED045G: Chloride	16887-00-6	1	mg/L	13200	13200	0.434	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 663876)									
EB1627552-004	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	26	26	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	20	20	0.00	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.00	No Limit
EB1627576-002	R2	ED093F: Calcium	7440-70-2	1	mg/L	301	312	3.62	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	902	956	5.83	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	7300	7700	5.35	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	272	285	4.66	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 663877)									
EB1627576-001	R1	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1627622-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 667674)									
EB1627576-001	R1	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1627798-002	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 686187)									
EB1627576-001	R1	EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	8.0	7.8	2.73	0% - 20%
		EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	1.2	1.2	0.00	No Limit
		EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	4.0	4.2	4.57	No Limit
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Vanadium	7440-62-2	0.5	µg/L	2.0	2.3	14.7	No Limit
		EG093A-F: Barium	7440-39-3	1	µg/L	12	13	0.00	0% - 50%
		EG093A-F: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
		EG093A-F: Boron	7440-42-8	100	µg/L	3580	3470	3.12	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 686187) - continued									
EB1627576-001	R1	EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	5	0.00	No Limit
		EG093A-F: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-F: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 686188)									
EB1627576-001	R1	EG093B-F: Selenium	7782-49-2	2	µg/L	<2	<2	0.00	No Limit
		EG093B-F: Iron	7439-89-6	5	µg/L	<5	<5	0.00	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 686189)									
EB1627576-001	R1	EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	8.9	8.4	5.81	0% - 20%
		EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Lead	7439-92-1	0.2	µg/L	0.3	0.2	0.00	No Limit
		EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Arsenic	7440-38-2	0.5	µg/L	1.3	1.4	9.52	No Limit
		EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Manganese	7439-96-5	0.5	µg/L	12.1	12.2	0.00	0% - 20%
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Vanadium	7440-62-2	0.5	µg/L	2.5	2.8	14.2	No Limit
		EG093A-T: Barium	7440-39-3	1	µg/L	12	13	0.00	0% - 50%
		EG093A-T: Copper	7440-50-8	1	µg/L	1	1	0.00	No Limit
		EG093A-T: Boron	7440-42-8	100	µg/L	3560	3050	15.6	0% - 20%
		EG093A-T: Aluminium	7429-90-5	5	µg/L	135	146	7.27	0% - 20%
		EG093A-T: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 686190)									
EB1627576-001	R1	EG093B-T: Selenium	7782-49-2	2	µg/L	2	2	0.00	No Limit
		EG093B-T: Iron	7439-89-6	5	µg/L	245	237	3.34	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 662140)									
EB1627576-001	R1	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.02	98.2	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 662138)									
EB1627576-001	R1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 662141)									
EB1627576-001	R1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 674408)									
EB1627576-001	R1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.00	No Limit
EB1628175-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.3	1.1	18.3	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 674407)									
EB1627576-001	R1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.10	0.19	62.3	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 674407) - continued									
EB1628175-002	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.00	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 662139)									
EB1627576-001	R1	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 664900)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	101	98	102
				----	7 pH Unit	99.8	98	102
EG005E: 1M HCl extractable metals by ICP-AES (QCLot: 684726)								
EG005E: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005E: Boron	7440-42-8	1	mg/kg	<1	----	----	----	----
EG005E: Iron	7439-89-6	1	mg/kg	2	----	----	----	----
EG005T: Total Metals by ICP-AES (QCLot: 684714)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Iron	7439-89-6	50	mg/kg	<50	34900 mg/kg	101	70	120
EG005T: Total Metals by ICP-AES (QCLot: 684719)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Iron	7439-89-6	50	mg/kg	<50	34900 mg/kg	95.5	70	120
EG020E: 1M HCl Extractable metals by ICPMS (QCLot: 684725)								
EG020E: Arsenic	7440-38-2	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Barium	7440-39-3	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Cadmium	7440-43-9	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Chromium	7440-47-3	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Cobalt	7440-48-4	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Copper	7440-50-8	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Lead	7439-92-1	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Manganese	7439-96-5	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Nickel	7440-02-0	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020E: Silver	7440-22-4	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Tin	7440-31-5	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Vanadium	7440-62-2	0.5	mg/kg	<0.5	----	----	----	----
EG020E: Zinc	7440-66-6	0.05	mg/kg	<0.05	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 684710)								
EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	----	----	----	----
EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.43 mg/kg	105	81	121
EG020T: Total Metals by ICP-MS (QCLot: 684711)								
EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	3.16 mg/kg	89.3	72	120

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EG020T: Total Metals by ICP-MS (QCLot: 684712)								
EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	<0.1	116.3 mg/kg	97.6	87	122
EG020X-T: Barium	7440-39-3	0.1	mg/kg	<0.1	82.2 mg/kg	109	86	123
EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	<0.1	11.6 mg/kg	89.6	88	129
EG020X-T: Chromium	7440-47-3	0.1	mg/kg	<0.1	22.9 mg/kg	101	75	130
EG020X-T: Copper	7440-50-8	0.1	mg/kg	# 0.1	52.9 mg/kg	96.2	84	120
EG020X-T: Manganese	7439-96-5	0.1	mg/kg	# 0.1	592 mg/kg	101	86	130
EG020X-T: Nickel	7440-02-0	0.1	mg/kg	<0.1	16.1 mg/kg	93.3	89	127
EG020X-T: Lead	7439-92-1	0.1	mg/kg	<0.1	66.3 mg/kg	117	85	117
EG020X-T: Zinc	7440-66-6	0.5	mg/kg	<0.5	187 mg/kg	98.5	71	130
EG020X-T: Vanadium	7440-62-2	1	mg/kg	<1	67.8 mg/kg	103	86	130
EG020X-T: Tin	7440-31-5	0.1	mg/kg	<0.1	4.48 mg/kg	124	79	130
EG020T: Total Metals by ICP-MS (QCLot: 684715)								
EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	<0.1	116.3 mg/kg	105	87	122
EG020X-T: Barium	7440-39-3	0.1	mg/kg	<0.1	82.2 mg/kg	117	86	123
EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	<0.1	11.6 mg/kg	91.6	88	129
EG020X-T: Chromium	7440-47-3	0.1	mg/kg	<0.1	22.9 mg/kg	98.7	75	130
EG020X-T: Copper	7440-50-8	0.1	mg/kg	<0.1	52.9 mg/kg	110	84	120
EG020X-T: Manganese	7439-96-5	0.1	mg/kg	# 0.2	592 mg/kg	104	86	130
EG020X-T: Nickel	7440-02-0	0.1	mg/kg	<0.1	16.1 mg/kg	101	89	127
EG020X-T: Lead	7439-92-1	0.1	mg/kg	<0.1	66.3 mg/kg	115	85	117
EG020X-T: Zinc	7440-66-6	0.5	mg/kg	<0.5	187 mg/kg	111	71	130
EG020X-T: Vanadium	7440-62-2	1	mg/kg	<1	67.8 mg/kg	105	86	130
EG020X-T: Tin	7440-31-5	0.1	mg/kg	<0.1	4.48 mg/kg	118	79	130
EG020T: Total Metals by ICP-MS (QCLot: 684716)								
EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	----	----	----	----
EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.43 mg/kg	114	81	121
EG020T: Total Metals by ICP-MS (QCLot: 684717)								
EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	3.16 mg/kg	89.8	72	120
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 684720)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	1.863 mg/kg	113	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 684713)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.111 mg/kg	80.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 684718)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.111 mg/kg	83.7	70	130
EK055: Ammonia as N (QCLot: 662846)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	25 mg/kg	99.1	80	110
EK055: Ammonia as N (QCLot: 664114)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EK055: Ammonia as N (QCLot: 664114) - continued								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	25 mg/kg	99.1	80	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 664897)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	96.0	83	111
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 664898)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	101	86	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 684702)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	877 mg/kg	93.5	70	110
				<20	3644 mg/kg	92.9	70	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 684701)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	766 mg/kg	97.0	70	110
				<2	1200 mg/kg	108	70	110
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 664899)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	102	89	115
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 683947)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	109	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 685737)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	100	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 683948)								
EP003TC: Total Carbon	TC	0.02	%	<0.02	100 %	109	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 685738)								
EP003TC: Total Carbon	TC	0.02	%	<0.02	100 %	101	70	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 662373)								
EA025: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	108	84	120
				<1	1000 mg/L	97.7	84	120
ED037P: Alkalinity by PC Titrator (QCLot: 662398)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.5	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 662137)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	107	85	118
				<1	100 mg/L	94.6	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 662136)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	96.2	90	115
				<1	1000 mg/L	93.3	90	115
ED093F: Dissolved Major Cations (QCLot: 663876)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
ED093F: Dissolved Major Cations (QCLot: 663876) - continued								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 663877)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.3	84	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 667674)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	88.9	80	100
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 686187)								
EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	# 66.6	85	118
EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	101	87	115
EG093A-F: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	96.3	87	116
EG093A-F: Barium	7440-39-3	1	µg/L	<1	50 µg/L	104	87	114
EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	94.7	80	120
EG093A-F: Boron	7440-42-8	100	µg/L	<100	500 µg/L	95.6	82	114
EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	100	88	114
EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	88.6	83	115
EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	97.0	86	116
EG093A-F: Copper	7440-50-8	1	µg/L	<1	20 µg/L	103	81	117
EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	86.9	80	117
EG093A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	96.6	80	119
EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	99.4	80	118
EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	102	87	117
EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	88.3	80	127
EG093A-F: Tin	7440-31-5	5	µg/L	<5	10 µg/L	97.2	82	118
EG093A-F: Vanadium	7440-62-2	0.5	µg/L	<0.5	10 µg/L	94.9	89	117
EG093A-F: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	102	81	120
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 686188)								
EG093B-F: Iron	7439-89-6	5	µg/L	<5	50 µg/L	89.2	78	123
EG093B-F: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	102	87	121
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 686189)								
EG093A-T: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	# 70.2	85	120
EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	112	83	116
EG093A-T: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	103	86	117
EG093A-T: Barium	7440-39-3	1	µg/L	<1	50 µg/L	109	84	118
EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	100	87	120
EG093A-T: Boron	7440-42-8	100	µg/L	<105	500 µg/L	89.7	83	123
EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	104	84	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 686189) - continued								
EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	91.0	84	120
EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	102	85	116
EG093A-T: Copper	7440-50-8	1	µg/L	<1	20 µg/L	106	84	119
EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	93.5	84	120
EG093A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	101	86	124
EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	0.4	10 µg/L	109	84	118
EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	115	80	120
EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	96.3	80	120
EG093A-T: Tin	7440-31-5	5	µg/L	<5	10 µg/L	98.4	83	114
EG093A-T: Vanadium	7440-62-2	0.5	µg/L	<0.5	10 µg/L	100	84	120
EG093A-T: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	111	81	124
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 686190)								
EG093B-T: Iron	7439-89-6	5	µg/L	<5	50 µg/L	96.8	80	128
EG093B-T: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	107	89	119
EK055G: Ammonia as N by Discrete Analyser (QCLot: 662140)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	100	86	112
EK057G: Nitrite as N by Discrete Analyser (QCLot: 662138)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.1	90	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 662141)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	100	89	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 674408)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	76.9	70	111
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 674407)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	87.2	77	109
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 662139)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	104	88	115
EP020: Oil and Grease (O&G) (QCLot: 675440)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	95.7	88	112

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EG020E: 1M HCl Extractable metals by ICPMS (QCLot: 684725)							

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG020E: 1M HCl Extractable metals by ICPMS (QCLot: 684725) - continued							
EB1627576-010	R2	EG020E: Arsenic	7440-38-2	25 mg/kg	94.7	70	130
		EG020E: Barium	7440-39-3	25 mg/kg	70.6	70	130
		EG020E: Cadmium	7440-43-9	12.5 mg/kg	98.3	70	130
		EG020E: Chromium	7440-47-3	25 mg/kg	91.0	70	130
		EG020E: Cobalt	7440-48-4	25 mg/kg	95.3	70	130
		EG020E: Copper	7440-50-8	25 mg/kg	75.3	70	130
		EG020E: Lead	7439-92-1	25 mg/kg	102	70	130
		EG020E: Manganese	7439-96-5	25 mg/kg	# Not Determined	70	130
		EG020E: Nickel	7440-02-0	25 mg/kg	86.1	70	130
		EG020E: Vanadium	7440-62-2	25 mg/kg	70.1	70	130
		EG020E: Zinc	7440-66-6	25 mg/kg	80.9	70	130
EG020T: Total Metals by ICP-MS (QCLot: 684710)							
EB1627576-010	R2	EG020Y-T: Cadmium	7440-43-9	25 mg/kg	106	70	130
EG020T: Total Metals by ICP-MS (QCLot: 684712)							
EB1627576-010	R2	EG020X-T: Lead	7439-92-1	50 mg/kg	97.0	70	130
EB1627576-010	R2	EG020X-T: Arsenic	7440-38-2	50 mg/kg	108	70	130
		EG020X-T: Barium	7440-39-3	50 mg/kg	114	70	130
		EG020X-T: Cobalt	7440-48-4	50 mg/kg	95.9	70	130
		EG020X-T: Chromium	7440-47-3	50 mg/kg	97.9	70	130
		EG020X-T: Copper	7440-50-8	50 mg/kg	85.6	70	130
		EG020X-T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70	130
		EG020X-T: Nickel	7440-02-0	50 mg/kg	91.6	70	130
		EG020X-T: Zinc	7440-66-6	50 mg/kg	91.0	70	130
		EG020X-T: Vanadium	7440-62-2	50 mg/kg	98.2	70	130
EG020T: Total Metals by ICP-MS (QCLot: 684715)							
EB1627576-031	L3 <63µm	EG020X-T: Barium	7440-39-3	50 mg/kg	104	70	130
		EG020X-T: Lead	7439-92-1	50 mg/kg	101	70	130
EB1627576-031	L3 <63µm	EG020X-T: Arsenic	7440-38-2	50 mg/kg	108	70	130
		EG020X-T: Cobalt	7440-48-4	50 mg/kg	99.1	70	130
		EG020X-T: Chromium	7440-47-3	50 mg/kg	111	70	130
		EG020X-T: Copper	7440-50-8	50 mg/kg	100	70	130
		EG020X-T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70	130
		EG020X-T: Nickel	7440-02-0	50 mg/kg	107	70	130
		EG020X-T: Zinc	7440-66-6	50 mg/kg	111	70	130
		EG020X-T: Vanadium	7440-62-2	50 mg/kg	129	70	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG020T: Total Metals by ICP-MS (QCLot: 684716)							
EB1627576-031	L3 <63µm	EG020Y-T: Cadmium	7440-43-9	25 mg/kg	107	70	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 684720)							
EB1627576-010	R2	EG035-SDH: Mercury	7439-97-6	1.25 mg/kg	98.2	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 684713)							
EB1627576-010	R2	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	70.7	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 684718)							
EB1627576-031	L3 <63µm	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	76.0	70	130
EK055: Ammonia as N (QCLot: 662846)							
EB1627576-009	R1	EK055: Ammonia as N	7664-41-7	100 mg/kg	95.2	70	130
EK055: Ammonia as N (QCLot: 664114)							
EB1627576-010	R2	EK055: Ammonia as N	7664-41-7	100 mg/kg	93.8	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 664897)							
EB1627576-010	R2	EK057G: Nitrite as N (Sol.)	14797-65-0	2 mg/kg	101	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 664898)							
EB1627576-010	R2	EK059G: Nitrite + Nitrate as N (Sol.)	----	2 mg/kg	105	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 684702)							
EB1627576-010	R2	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	92.4	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 684701)							
EB1627576-010	R2	EK067G: Total Phosphorus as P	----	100 mg/kg	# Not Determined	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 664899)							
EB1627576-010	R2	EK071G: Reactive Phosphorus as P	14265-44-2	2 mg/kg	107	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 662137)							
EB1627576-002	R2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 662136)							
EB1627576-002	R2	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 663877)							
EB1627576-002	R2	EG035F: Mercury	7439-97-6	0.01 mg/L	78.6	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 667674)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 667674) - continued							
EB1627576-002	R2	EG035T: Mercury	7439-97-6	0.01 mg/L	82.9	70	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 686187)							
EB1627576-002	R2	EG093A-F: Arsenic	7440-38-2	50 µg/L	94.3	70	130
		EG093A-F: Barium	7440-39-3	250 µg/L	97.6	70	130
		EG093A-F: Beryllium	7440-41-7	50 µg/L	92.2	70	130
		EG093A-F: Cadmium	7440-43-9	50 µg/L	92.2	70	130
		EG093A-F: Chromium	7440-47-3	50 µg/L	82.9	70	130
		EG093A-F: Cobalt	7440-48-4	50 µg/L	90.5	70	130
		EG093A-F: Copper	7440-50-8	100 µg/L	95.2	70	130
		EG093A-F: Lead	7439-92-1	50 µg/L	83.5	70	130
		EG093A-F: Manganese	7439-96-5	50 µg/L	91.1	70	130
		EG093A-F: Nickel	7440-02-0	50 µg/L	98.7	70	130
		EG093A-F: Vanadium	7440-62-2	50 µg/L	86.5	70	130
		EG093A-F: Zinc	7440-66-6	100 µg/L	99.7	70	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 686189)							
EB1627576-002	R2	EG093A-T: Arsenic	7440-38-2	50 µg/L	108	70	130
		EG093A-T: Barium	7440-39-3	250 µg/L	113	70	130
		EG093A-T: Beryllium	7440-41-7	50 µg/L	106	70	130
		EG093A-T: Cadmium	7440-43-9	50 µg/L	104	70	130
		EG093A-T: Chromium	7440-47-3	50 µg/L	93.3	70	130
		EG093A-T: Cobalt	7440-48-4	50 µg/L	102	70	130
		EG093A-T: Copper	7440-50-8	100 µg/L	109	70	130
		EG093A-T: Lead	7439-92-1	50 µg/L	92.2	70	130
		EG093A-T: Manganese	7439-96-5	50 µg/L	106	70	130
		EG093A-T: Nickel	7440-02-0	50 µg/L	110	70	130
		EG093A-T: Vanadium	7440-62-2	50 µg/L	104	70	130
		EG093A-T: Zinc	7440-66-6	100 µg/L	112	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 662140)							
EB1627576-002	R2	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	107	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 662138)							
EB1627576-002	R2	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	97.3	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 662141)							
EB1627576-002	R2	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	106	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 674408)							
EB1627576-002	R2	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	108	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 674407)							
EB1627576-002	R2	EK067G: Total Phosphorus as P	----	1 mg/L	119	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 662139)							
EB1627576-002	R2	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	109	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1627576**	Page	: 1 of 21
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR TRAVIS WOOD	Telephone	: +61-3-8549 9636
Project	: 520	Date Samples Received	: 21-Nov-2016
Site	: ----	Issue Date	: 15-Dec-2016
Sampler	: TRAVIS WOOD	No. of samples received	: 32
Order number	: ----	No. of samples analysed	: 32

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Duplicate outliers occur.**
- **Method Blank value outliers exist - please see following pages for full details.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Method Blank (MB) Values							
EG020T: Total Metals by ICP-MS	QC-MRG5-68471000	----	**Copper**	7440-50-8	0.1 mg/kg	0.1 mg/kg	**Blank result exceeds permitted value**
EG020T: Total Metals by ICP-MS	QC-MRG5-68471000	----	**Manganese**	7439-96-5	0.1 mg/kg	0.1 mg/kg	**Blank result exceeds permitted value**
EG020T: Total Metals by ICP-MS	QC-MRG5-68471600	----	**Manganese**	7439-96-5	0.2 mg/kg	0.1 mg/kg	**Blank result exceeds permitted value**
Matrix Spike (MS) Recoveries							
EG020E: 1M HCl Extractable metals by ICPMS	EB1627576--010	R2	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG020T: Total Metals by ICP-MS	EB1627576--010	R2	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG020T: Total Metals by ICP-MS	EB1627576--031	L3 <63µm	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK067G: Total Phosphorus as P by Discrete Analyser	EB1627576--010	R2	**Total Phosphorus as P**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EG093F: Dissolved Metals in Saline Water by ORC-ICP	QC-MRG2-68618700	----	**Aluminium**	7429-90-5	66.6 %	85-118%	**Recovery less than lower control limit**
EG093T: Total Metals in Saline Water by ORC-ICPMS	QC-MRG2-68618900	----	**Aluminium**	7429-90-5	70.2 %	85-120%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB1627576--002	R2	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED045G: Chloride by Discrete Analyser	EB1627576--002	R2	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA002 : pH (Soils)						
Soil Glass Jar - Unpreserved						
R1, L4, L1, L3	24-Nov-2016	23-Nov-2016	**1**	----	----	----

Matrix: **WATER**

Matrix: **WATER**

Method / **Container** / Client Sample ID(s)		*Extraction / Preparation* Date extracted	Due for extraction	Days overdue	*Analysis* Date analysed	Due for analysis	Days overdue
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural R1, L1,	L4, L3	----	----	----	21-Nov-2016	18-Nov-2016	**3**
Clear Plastic Bottle - Natural R2, W2,	W1, B1	----	----	----	21-Nov-2016	19-Nov-2016	**2**
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural R1, L1,	L4, L3	----	----	----	21-Nov-2016	18-Nov-2016	**3**
Clear Plastic Bottle - Natural R2, W2,	W1, B1	----	----	----	21-Nov-2016	19-Nov-2016	**2**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count QC	Regular	Rate (%) Actual	Expected	Quality Control Specification
Matrix Spikes (MS)					
1 M HCl Extractable metals by ICPAES	0	20	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	0	23	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	0	23	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)		Sample Date	*Extraction / Preparation* Date extracted	Due for extraction	Evaluation	*Analysis* Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils)								
Soil Glass Jar - Unpreserved (EA002) R1, L1,	L4, L3	**16-Nov-2016**	**24-Nov-2016**	23-Nov-2016	×	**24-Nov-2016**	24-Nov-2016	✓
Soil Glass Jar - Unpreserved (EA002) R2, W2,	W1, B1	**17-Nov-2016**	**24-Nov-2016**	24-Nov-2016	✓	**24-Nov-2016**	24-Nov-2016	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103) R1, L1,	L4, L3	**16-Nov-2016**	----	----	----	**23-Nov-2016**	30-Nov-2016	✓
Soil Glass Jar - Unpreserved (EA055-103) R2, W2,	W1, B1	**17-Nov-2016**	----	----	----	**23-Nov-2016**	01-Dec-2016	✓
EA150: Particle Sizing								
Snap Lock Bag (EA150H) R1, L1,	L4, L3	**16-Nov-2016**	----	----	----	**07-Dec-2016**	15-May-2017	✓
Snap Lock Bag (EA150H) R2, W2,	W1, B1	**17-Nov-2016**	----	----	----	**07-Dec-2016**	16-May-2017	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) R1, L1,	L4, L3	**16-Nov-2016**	----	----	----	**07-Dec-2016**	15-May-2017	✓
Snap Lock Bag (EA150H) R2, W2,	W1, B1	**17-Nov-2016**	----	----	----	**07-Dec-2016**	16-May-2017	✓
EA152: Soil Particle Density								
Snap Lock Bag (EA152) R1, L1,	L4, L3	**16-Nov-2016**	----	----	----	**07-Dec-2016**	15-May-2017	✓
Snap Lock Bag (EA152) R2, W2,	W1, B1	**17-Nov-2016**	----	----	----	**07-Dec-2016**	16-May-2017	✓
EG005E: 1M HCl extractable metals by ICP-AES								
Pulp Bag (-2000µm) (EG005E) R1 - <2000µm, W1 - <2000µm, L4 - <2000µm, L3 - <2000µm,	R2 - <2000µm, W2 - <2000µm, L1 - <2000µm, B1 - <2000µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Pulp Bag (-63µm) (EG005E) W1 - <63µm, L3 - <63µm,	W2 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG005E) R1, L1,	L4, L3	**16-Nov-2016**	**09-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EG005E) R2, W2,	W1, B1	**17-Nov-2016**	**09-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method **Container** / Client Sample ID(s)	**Sample Date**	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	**Date analysed**	Due for analysis	Evaluation
EG005T: Total Metals by ICP-AES							
Pulp Bag (-2000µm) (EG005T) R1 - <2000µm, R2 - <2000µm, W1 - <2000µm, W2 - <2000µm, L4 - <2000µm, L1 - <2000µm, L3 - <2000µm, B1 - <2000µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Pulp Bag (-63µm) (EG005T) R1 - <63µm, R2 - <63µm, W1 - <63µm, W2 - <63µm, L1 - <63µm, L3 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG005T) R1, L4, L1, L3	**16-Nov-2016**	**09-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EG005T) R2, W1, W2, B1	**17-Nov-2016**	**09-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓
EG020E: 1M HCl Extractable metals by ICPMS							
Pulp Bag (-2000µm) (EG020E) R1 - <2000µm, R2 - <2000µm, W1 - <2000µm, W2 - <2000µm, L4 - <2000µm, L1 - <2000µm, L3 - <2000µm, B1 - <2000µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Pulp Bag (-63µm) (EG020E) W1 - <63µm, W2 - <63µm, L3 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG020E) R1, L4, L1, L3	**16-Nov-2016**	**09-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EG020E) R2, W1, W2, B1	**17-Nov-2016**	**09-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020T: Total Metals by ICP-MS							
Pulp Bag (-2000µm) (EG020Z-T) R1 - <2000µm, R2 - <2000µm, W1 - <2000µm, W2 - <2000µm, L4 - <2000µm, L1 - <2000µm, L3 - <2000µm, B1 - <2000µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Pulp Bag (-63µm) (EG020Z-T) R1 - <63µm, R2 - <63µm, W1 - <63µm, W2 - <63µm, L1 - <63µm, L3 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	06-Jun-2017	✓	**09-Dec-2016**	06-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG020Z-T) R1, L4, L1, L3	**16-Nov-2016**	**09-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EG020Z-T) R2, W1, W2, B1	**17-Nov-2016**	**09-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓
EG035-SDH: 1M HCl extractable Mercury by FIMS							
Pulp Bag (-2000µm) (EG035-SDH) R1 - <2000µm, R2 - <2000µm, W1 - <2000µm, W2 - <2000µm, L4 - <2000µm, L1 - <2000µm, L3 - <2000µm, B1 - <2000µm	**08-Dec-2016**	**09-Dec-2016**	05-Jan-2017	✓	**12-Dec-2016**	05-Jan-2017	✓
Pulp Bag (-63µm) (EG035-SDH) W1 - <63µm, W2 - <63µm, L3 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	05-Jan-2017	✓	**12-Dec-2016**	05-Jan-2017	✓
Soil Glass Jar - Unpreserved (EG035-SDH) R1, L4, L1, L3	**16-Nov-2016**	**09-Dec-2016**	14-Dec-2016	✓	**12-Dec-2016**	14-Dec-2016	✓
Soil Glass Jar - Unpreserved (EG035-SDH) R2, W1, W2, B1	**17-Nov-2016**	**09-Dec-2016**	15-Dec-2016	✓	**12-Dec-2016**	15-Dec-2016	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS								
Pulp Bag (-2000µm) (EG035T-LL)								
R1 - <2000µm,	R2 - <2000µm,	**08-Dec-2016**	**09-Dec-2016**	05-Jan-2017	✓	**12-Dec-2016**	05-Jan-2017	✓
W1 - <2000µm,	W2 - <2000µm,							
L4 - <2000µm,	L1 - <2000µm,							
L3 - <2000µm,	B1 - <2000µm							
Pulp Bag (-63µm) (EG035T-LL)								
R1 - <63µm,	R2 - <63µm,	**08-Dec-2016**	**09-Dec-2016**	05-Jan-2017	✓	**12-Dec-2016**	05-Jan-2017	✓
W1 - <63µm,	W2 - <63µm,							
L1 - <63µm,	L3 - <63µm,							
B1 - <63µm								
Soil Glass Jar - Unpreserved (EG035T-LL)								
R1,	L4,	**16-Nov-2016**	**09-Dec-2016**	14-Dec-2016	✓	**12-Dec-2016**	14-Dec-2016	✓
L1,	L3							
Soil Glass Jar - Unpreserved (EG035T-LL)								
R2,	W1,	**17-Nov-2016**	**09-Dec-2016**	15-Dec-2016	✓	**12-Dec-2016**	15-Dec-2016	✓
W2,	B1							
EK055: Ammonia as N								
Soil Glass Jar - Unpreserved (EK055)								
R1		**16-Nov-2016**	**----**	----	----	**22-Nov-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EK055)								
L4,	L1,	**16-Nov-2016**	**----**	----	----	**23-Nov-2016**	15-May-2017	✓
L3								
Soil Glass Jar - Unpreserved (EK055)								
R2,	W1,	**17-Nov-2016**	**----**	----	----	**23-Nov-2016**	16-May-2017	✓
W2,	B1							
EK057G: Nitrite as N by Discrete Analyser								
Soil Glass Jar - Unpreserved (EK057G)								
R1,	L4,	**16-Nov-2016**	**24-Nov-2016**	15-May-2017	✓	**24-Nov-2016**	15-May-2017	✓
L1,	L3							
Soil Glass Jar - Unpreserved (EK057G)								
R2,	W1,	**17-Nov-2016**	**24-Nov-2016**	16-May-2017	✓	**24-Nov-2016**	16-May-2017	✓
W2,	B1							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Soil Glass Jar - Unpreserved (EK059G)								
R1,	L4,	**16-Nov-2016**	**24-Nov-2016**	15-May-2017	✓	**24-Nov-2016**	15-May-2017	✓
L1,	L3							
Soil Glass Jar - Unpreserved (EK059G)								
R2,	W1,	**17-Nov-2016**	**24-Nov-2016**	16-May-2017	✓	**24-Nov-2016**	16-May-2017	✓
W2,	B1							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Soil Glass Jar - Unpreserved (EK061G)								
R1, L1,	L4, L3	**16-Nov-2016**	**08-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EK061G)								
R2, W2,	W1, B1	**17-Nov-2016**	**08-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Soil Glass Jar - Unpreserved (EK067G)								
R1, L1,	L4, L3	**16-Nov-2016**	**08-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EK067G)								
R2, W2,	W1, B1	**17-Nov-2016**	**08-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓
EK071G: Reactive Phosphorus as P by discrete analyser								
Soil Glass Jar - Unpreserved (EK071G)								
R1, L1,	L4, L3	**16-Nov-2016**	**24-Nov-2016**	15-May-2017	✓	**24-Nov-2016**	15-May-2017	✓
Soil Glass Jar - Unpreserved (EK071G)								
R2, W2,	W1, B1	**17-Nov-2016**	**24-Nov-2016**	16-May-2017	✓	**24-Nov-2016**	16-May-2017	✓
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003)								
R1, L1, R1 - <2000µm, L1 - <2000µm,	L4, L3, L4 - <2000µm, L3 - <2000µm	**16-Nov-2016**	**08-Dec-2016**	14-Dec-2016	✓	**08-Dec-2016**	14-Dec-2016	✓
Pulp Bag (EP003)								
R2, W2, R2 - <2000µm, W2 - <2000µm,	W1, B1, W1 - <2000µm, B1 - <2000µm	**17-Nov-2016**	**08-Dec-2016**	15-Dec-2016	✓	**08-Dec-2016**	15-Dec-2016	✓
Pulp Bag (-63µm) (EP003)								
R1 - <63µm, W1 - <63µm, L4 - <63µm, L3 - <63µm,	R2 - <63µm, W2 - <63µm, L1 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	05-Jan-2017	✓	**09-Dec-2016**	05-Jan-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EP003TC: Total Carbon (TC) in Soil							
Pulp Bag (EP003TC) R1, L4, L1, L3, R1 - <2000µm, L4 - <2000µm, L1 - <2000µm, L3 - <2000µm	**16-Nov-2016**	**08-Dec-2016**	14-Dec-2016	✓	**08-Dec-2016**	14-Dec-2016	✓
Pulp Bag (EP003TC) R2, W1, W2, B1, R2 - <2000µm, W1 - <2000µm, W2 - <2000µm, B1 - <2000µm	**17-Nov-2016**	**08-Dec-2016**	15-Dec-2016	✓	**08-Dec-2016**	15-Dec-2016	✓
Pulp Bag (-63µm) (EP003TC) R1 - <63µm, R2 - <63µm, W1 - <63µm, W2 - <63µm, L1 - <63µm, L3 - <63µm, B1 - <63µm	**08-Dec-2016**	**09-Dec-2016**	05-Jan-2017	✓	**09-Dec-2016**	05-Jan-2017	✓
GEO26: Sieving							
Snap Lock Bag (GEO26C) R1 - <2000µm, L4 - <2000µm, L1 - <2000µm, L3 - <2000µm, R1 - <63µm, L1 - <63µm, L3 - <63µm	**16-Nov-2016**	**08-Dec-2016**	15-May-2017	✓	**----**	----	----
Snap Lock Bag (GEO26C) R2 - <2000µm, W1 - <2000µm, W2 - <2000µm, B1 - <2000µm, R2 - <63µm, W1 - <63µm, W2 - <63µm, L4 - <63µm, B1 - <63µm	**17-Nov-2016**	**08-Dec-2016**	16-May-2017	✓	**----**	----	----

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025) R1, L4, L1, L3	**16-Nov-2016**	**----**	----	----	**23-Nov-2016**	23-Nov-2016	✓
Clear Plastic Bottle - Natural (EA025) R2, W1, W2, B1	**17-Nov-2016**	**----**	----	----	**23-Nov-2016**	24-Nov-2016	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) R1, L4, L1, L3	**16-Nov-2016**	----	----	----	**22-Nov-2016**	30-Nov-2016	✓
Clear Plastic Bottle - Natural (ED037-P) R2, W1, W2, B1	**17-Nov-2016**	----	----	----	**22-Nov-2016**	01-Dec-2016	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) R1, L4, L1, L3	**16-Nov-2016**	----	----	----	**21-Nov-2016**	14-Dec-2016	✓
Clear Plastic Bottle - Natural (ED041G) R2, W1, W2, B1	**17-Nov-2016**	----	----	----	**21-Nov-2016**	15-Dec-2016	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G) R1, L4, L1, L3	**16-Nov-2016**	----	----	----	**21-Nov-2016**	14-Dec-2016	✓
Clear Plastic Bottle - Natural (ED045G) R2, W1, W2, B1	**17-Nov-2016**	----	----	----	**21-Nov-2016**	15-Dec-2016	✓
ED093F: Dissolved Major Cations							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) R1, L4, L1, L3	**16-Nov-2016**	----	----	----	**24-Nov-2016**	14-Dec-2016	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) R2, W1, W2, B1	**17-Nov-2016**	----	----	----	**24-Nov-2016**	15-Dec-2016	✓
EG035F: Dissolved Mercury by FIMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F) R1, L4, L1, L3	**16-Nov-2016**	----	----	----	**24-Nov-2016**	14-Dec-2016	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F) R2, W1, W2, B1	**17-Nov-2016**	----	----	----	**24-Nov-2016**	15-Dec-2016	✓
EG035T: Total Recoverable Mercury by FIMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T) R1, L4, L1, L3	**16-Nov-2016**	----	----	----	**28-Nov-2016**	14-Dec-2016	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T) R2, W1, W2, B1	**17-Nov-2016**	----	----	----	**28-Nov-2016**	15-Dec-2016	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093A-F) R1, L4, L1, L3	**16-Nov-2016**	**----**	----	----	**09-Dec-2016**	15-May-2017	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093A-F) R2, W1, W2, B1	**17-Nov-2016**	**----**	----	----	**09-Dec-2016**	16-May-2017	✓
EG093T: Total Metals in Saline Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093A-T) R1, L4, L1, L3	**16-Nov-2016**	**09-Dec-2016**	15-May-2017	✓	**09-Dec-2016**	15-May-2017	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093A-T) R2, W1, W2, B1	**17-Nov-2016**	**09-Dec-2016**	16-May-2017	✓	**09-Dec-2016**	16-May-2017	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G) R1, L4, L1, L3	**16-Nov-2016**	**----**	----	----	**21-Nov-2016**	14-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) R2, W1, W2, B1	**17-Nov-2016**	**----**	----	----	**21-Nov-2016**	15-Dec-2016	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) R1, L4, L1, L3	**16-Nov-2016**	**----**	----	----	**21-Nov-2016**	18-Nov-2016	×
Clear Plastic Bottle - Natural (EK057G) R2, W1, W2, B1	**17-Nov-2016**	**----**	----	----	**21-Nov-2016**	19-Nov-2016	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) R1, L4, L1, L3	**16-Nov-2016**	**----**	----	----	**21-Nov-2016**	14-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) R2, W1, W2, B1	**17-Nov-2016**	**----**	----	----	**21-Nov-2016**	15-Dec-2016	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) R1, L4, L1, L3	**16-Nov-2016**	**01-Dec-2016**	14-Dec-2016	✓	**01-Dec-2016**	14-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) R2, W1, W2, B1	**17-Nov-2016**	**01-Dec-2016**	15-Dec-2016	✓	**01-Dec-2016**	15-Dec-2016	✓

Matrix: **WATER**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) R1, L1,	L4, L3	**16-Nov-2016**	**01-Dec-2016**	14-Dec-2016	✓	**01-Dec-2016**	14-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) R2, W2,	W1, B1	**17-Nov-2016**	**01-Dec-2016**	15-Dec-2016	✓	**01-Dec-2016**	15-Dec-2016	✓
EK071G: Reactive Phosphorus as P by discrete analyser								
Clear Plastic Bottle - Natural (EK071G) R1, L1,	L4, L3	**16-Nov-2016**	**----**	----	----	**21-Nov-2016**	18-Nov-2016	✘
Clear Plastic Bottle - Natural (EK071G) R2, W2,	W1, B1	**17-Nov-2016**	**----**	----	----	**21-Nov-2016**	19-Nov-2016	✘
EP020: Oil and Grease (O&G)								
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020) R1, L1,	L4, L3	**16-Nov-2016**	**----**	----	----	**01-Dec-2016**	14-Dec-2016	✓
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020) R2, W2,	W1, B1	**17-Nov-2016**	**----**	----	----	**01-Dec-2016**	15-Dec-2016	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
1 M HCl Extractable metals by ICPAES	EG005E	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
1 M HCl Extractable metals by ICPMS	EG020E	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Mercury by FIMS	EG035-SDH	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055-103	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	3	23	**13.04**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	23	**13.04**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	23	**13.04**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	6	23	**26.09**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	4	23	**17.39**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	3	23	**13.04**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	8	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	4	23	**17.39**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	2	23	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type / *Analytical Methods*	*Method*	*Count QC*	*Count Regular*	*Rate (%) Actual*	*Rate (%) Expected*	*Evaluation*	*Quality Control Specification*
Method Blanks (MB)							
1 M HCl Extractable metals by ICPAES	EG005E	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1 M HCl Extractable metals by ICPMS	EG020E	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	8	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	4	23	17.39	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	3	23	13.04	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	25	8.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1 M HCl Extractable metals by ICPAES	EG005E	0	20	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
1 M HCl Extractable metals by ICPMS	EG020E	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	8	25.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	0	23	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	4	23	17.39	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	2	23	8.70	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	0	23	0.00	5.00	×	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	8	12.50	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type / *Analytical Methods*	*Method*	*Count QC*	*Count Regular*	*Rate (%) Actual*	*Rate (%) Expected*	*Evaluation*	*Quality Control Specification*
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	8	12.50	10.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP) - Continued							
Chloride by Discrete Analyser	ED045G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	8	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	2	8	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	8	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Moisture Content	EA055-103	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
1 M HCl Extractable metals by ICPAES	EG005E	SOIL	In house: Referenced to Allen HE 1993 - The significance of trace metal speciation for water, sediment and soil criteria and standards, Science of the Total Environment Supplement, 23-45.) (ICPAES) 1 M HCl extractable metals are determined following an extraction of the soil. The ICPAES technique ionises samples in a plasma, emitting characteristic spectrums based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards.
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
1 M HCl Extractable metals by ICPMS	EG020E	SOIL	In house: Referenced to Allen HE 1993 - The significance of trace metal speciation for water, sediment and soil criteria and standards, Science of the Total Environment Supplement, 23-45.) (ICPMS) Metals in solids are determined following an appropriate acid digestion. The ICPMS technique ionizes selected elements. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass / charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite X	EG020X-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite Y	EG020Y-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite Z	EG020Z-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Buchi Ammonia	EK055	SOIL	In house: Referenced to APHA 4500-NH3 B&G, H Samples are steam distilled (Buchi) prior to analysis and quantified using titration, FIA or Discrete Analyser.
Nitrite as N - Soluble by Discrete Analyser	EK057G	SOIL	In house: Referenced to APHA 4500-NO3- B. Nitrite in a water extract is determined by direct colourimetry by Discrete Analyser.
Nitrate as N - Soluble by Discrete Analyser	EK058G	SOIL	In house: Referenced to APHA 4500-NO3- F. Nitrate in the 1:5 soil:water extract is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results.
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Chemical Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	In house: Referenced to APHA 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	SOIL	In house: Referenced to APHA 4500 P-F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Total Carbon	EP003TC	SOIL	In house C-IR07. Dried and pulverised sample is combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved Carbon (as CO2) is measured by infra-red detector
Total Inorganic Carbon	EP003TIC	SOIL	In house C-CAL15. Determined as the difference between Total Carbon and Organic Carbon.
Suspended Solids	EA025	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Eschericia Coli (Water)	ECO-WAT	WATER	Eschericia Coli analysis of water matrices conducted by Subcontracting Laboratory

Analytical Methods	Method	Matrix	Method Descriptions
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg- D; APHA 4500 P - H. Macro Kjeldahl digestion.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
1M HCl Extraction for Metals in Sediments (1 hour)	EN71/1	SOIL	In house: Referenced to Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
Sieving (fine to -2mm)	GEO26	SOIL	In house: The dried sample is sieved to 2mm and the fines are then analysed per the client's request.
Sieving (fine to -63µm)	GEO26C	SOIL	In house: The sample is sieved to -63µm and the fines are then analysed per the client's request.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals - ORC	EN25-ORC	WATER	In house: Referenced to USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1627798**	Page	: 1 of 10
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 23-Nov-2016
Order number	: ----	Date Analysis Commenced	: 23-Nov-2016
C-O-C number	: ----	Issue Date	: 09-Dec-2016
Sampler	: IVAN STEWARD, TRAVIS WOOD		
Site	: ----		
Quote number	: ----		
No. of samples received	: 7		
No. of samples analysed	: 7		

ilac-MRA NATA

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 666471)									
EB1627645-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	176	188	6.87	0% - 20%
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 666519)									
EB1627714-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	132	131	0.00	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 668110)									
EB1627798-001	FB1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	1	<1	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	1	<1	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 665349)									
EB1627798-001	FB1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.00	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 665352)									
EB1627798-001	FB1	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.00	No Limit
ED093F: Dissolved Major Cations (QC Lot: 667599)									
EB1627798-001	FB1	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.00	No Limit
EB1627835-009	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	479	460	4.03	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	1390	1340	3.71	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	11600	11200	3.81	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	423	409	3.37	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 667597)									
EB1627623-011	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1627623-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 667674)									
EB1627576-001	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1627798-002	L1	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 665365)									
EB1627798-001	FB1	EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
		EG093A-F: Boron	7440-42-8	100	µg/L	<100	<100	0.00	No Limit
		EG093A-F: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-F: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 665366)									
EB1627798-001	FB1	EG093B-F: Selenium	7782-49-2	2	µg/L	<2	<2	0.00	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 665367)									
EB1627798-001	FB1	EG093B-T: Selenium	7782-49-2	2	µg/L	<2	<2	0.00	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 665368)									
EB1627798-001	FB1	EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Arsenic	7440-38-2	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
		EG093A-T: Boron	7440-42-8	100	µg/L	<105	<105	0.00	No Limit
		EG093A-T: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 673441)									

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 673441) - continued									
EB1627798-001	FB1	EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.2	<0.2	0.00	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 673442)									
EB1627798-001	FB1	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Antimony	7440-36-0	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG094A-F: Zinc	7440-66-6	1	µg/L	<1	<1	0.00	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	<5	<5	0.00	No Limit
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 673607)									
EB1627798-001	FB1	EG094B-T: Selenium	7782-49-2	0.2	µg/L	<0.2	<0.2	0.00	No Limit
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 673608)									
EB1627798-001	FB1	EG094A-T: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EG094A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-T: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-T: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-T: Antimony	7440-36-0	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-T: Arsenic	7440-38-2	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-T: Chromium	7440-47-3	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-T: Tin	7440-31-5	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-T: Copper	7440-50-8	0.5	µg/L	<0.5	0.5	0.00	No Limit
		EG094A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG094A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG094A-T: Zinc	7440-66-6	1	µg/L	<1	<1	0.00	No Limit
		EG094A-T: Boron	7440-42-8	5	µg/L	<5	<5	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 667077)									
EB1627798-001	FB1	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 665350)									
EB1627798-001	FB1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 667078)									
EB1627798-001	FB1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 669087)									
EB1627369-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.8	0.9	0.00	No Limit
EB1627798-006	S1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 669088)									
EB1627798-006	S1	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.00	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 665351)									
EB1627798-001	FB1	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 666471)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	102	88	112
				<5	1000 mg/L	95.4	88	112
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 666519)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	100	88	112
				<5	1000 mg/L	92.9	88	112
ED037P: Alkalinity by PC Titrator (QCLot: 668110)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	94.6	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 665349)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	110	85	118
				<1	100 mg/L	104	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 665352)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	96.3	90	115
				<1	1000 mg/L	99.5	90	115
ED093F: Dissolved Major Cations (QCLot: 667599)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 667597)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	88.4	84	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 667674)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	88.9	80	100
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 665365)								
EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	92.0	87	115
EG093A-F: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	96.0	87	116
EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	95.7	80	120
EG093A-F: Boron	7440-42-8	100	µg/L	<100	500 µg/L	97.5	82	114
EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	92.4	88	114
EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	92.5	83	115
EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	97.8	86	116
EG093A-F: Copper	7440-50-8	1	µg/L	<1	20 µg/L	95.9	81	117
EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	95.4	80	117
EG093A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	95.0	80	119

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 665365) - continued								
EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	100	80	118
EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	95.9	87	117
EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	87.9	80	127
EG093A-F: Tin	7440-31-5	5	µg/L	<5	10 µg/L	92.4	82	118
EG093A-F: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	92.6	81	120
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 665366)								
EG093B-F: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	94.5	87	121
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 665367)								
EG093B-T: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	110	89	119
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 665368)								
EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	93.7	83	116
EG093A-T: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	102	86	117
EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	104	87	120
EG093A-T: Boron	7440-42-8	100	µg/L	<105	500 µg/L	113	83	123
EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	93.8	84	115
EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	95.8	84	120
EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	101	85	116
EG093A-T: Copper	7440-50-8	1	µg/L	<1	20 µg/L	98.0	84	119
EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	98.3	84	120
EG093A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	103	86	124
EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	102	84	118
EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	105	80	120
EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	92.0	80	120
EG093A-T: Tin	7440-31-5	5	µg/L	<5	10 µg/L	108	83	114
EG093A-T: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	111	81	124
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 673441)								
EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.2	10 µg/L	102	80	120
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 673442)								
EG094A-F: Antimony	7440-36-0	0.2	µg/L	<0.2	10 µg/L	115	80	120
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	112	80	120
EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	98.4	80	120
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	108	80	120
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	103	80	120
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	105	80	120
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	106	80	120
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	20 µg/L	120	80	120
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	93.5	80	120
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	104	80	120

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 673442) - continued								
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	103	80	120
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	103	80	120
EG094A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	111	80	120
EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.2	10 µg/L	116	80	120
EG094A-F: Zinc	7440-66-6	1	µg/L	<1	20 µg/L	109	80	120
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 673607)								
EG094B-T: Selenium	7782-49-2	0.2	µg/L	<0.2	10 µg/L	93.6	80	120
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 673608)								
EG094A-T: Antimony	7440-36-0	0.2	µg/L	<0.2	10 µg/L	104	80	120
EG094A-T: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	106	80	120
EG094A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	95.2	80	120
EG094A-T: Boron	7440-42-8	5	µg/L	<5	50 µg/L	94.6	80	120
EG094A-T: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	99.4	80	120
EG094A-T: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	105	80	120
EG094A-T: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	104	80	120
EG094A-T: Copper	7440-50-8	0.5	µg/L	<0.5	20 µg/L	110	80	120
EG094A-T: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	91.9	80	120
EG094A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	104	80	120
EG094A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	103	80	120
EG094A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	103	80	120
EG094A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	106	80	120
EG094A-T: Tin	7440-31-5	0.2	µg/L	<0.2	10 µg/L	117	80	120
EG094A-T: Zinc	7440-66-6	1	µg/L	<1	20 µg/L	105	80	120
EK055G: Ammonia as N by Discrete Analyser (QCLot: 667077)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	107	86	112
EK057G: Nitrite as N by Discrete Analyser (QCLot: 665350)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	101	90	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 667078)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	98.1	89	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 669087)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	78.5	70	111
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 669088)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	98.9	77	109
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 665351)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	105	88	115
EP020: Oil and Grease (O&G) (QCLot: 667739)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	105	88	112

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 665349)							
EB1627798-002	L1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 665352)							
EB1627798-002	L1	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 667597)							
EB1627623-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	87.5	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 667674)							
EB1627576-002	Anonymous	EG035T: Mercury	7439-97-6	0.01 mg/L	82.9	70	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 665365)							
EB1627798-002	L1	EG093A-F: Arsenic	7440-38-2	50 µg/L	95.6	70	130
		EG093A-F: Beryllium	7440-41-7	50 µg/L	97.7	70	130
		EG093A-F: Cadmium	7440-43-9	50 µg/L	90.2	70	130
		EG093A-F: Chromium	7440-47-3	50 µg/L	95.7	70	130
		EG093A-F: Cobalt	7440-48-4	50 µg/L	97.1	70	130
		EG093A-F: Copper	7440-50-8	100 µg/L	93.7	70	130
		EG093A-F: Lead	7439-92-1	50 µg/L	93.7	70	130
		EG093A-F: Manganese	7439-96-5	50 µg/L	97.3	70	130
		EG093A-F: Nickel	7440-02-0	50 µg/L	96.8	70	130
		EG093A-F: Zinc	7440-66-6	100 µg/L	96.6	70	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 665368)							
EB1627798-002	L1	EG093A-T: Arsenic	7440-38-2	50 µg/L	103	70	130
		EG093A-T: Beryllium	7440-41-7	50 µg/L	94.6	70	130
		EG093A-T: Cadmium	7440-43-9	50 µg/L	93.3	70	130
		EG093A-T: Chromium	7440-47-3	50 µg/L	100	70	130
		EG093A-T: Cobalt	7440-48-4	50 µg/L	102	70	130
		EG093A-T: Copper	7440-50-8	100 µg/L	99.2	70	130
		EG093A-T: Lead	7439-92-1	50 µg/L	96.8	70	130
		EG093A-T: Manganese	7439-96-5	50 µg/L	102	70	130
		EG093A-T: Nickel	7440-02-0	50 µg/L	101	70	130
		EG093A-T: Zinc	7440-66-6	100 µg/L	101	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 667077)							
EB1627798-002	L1	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	125	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK057G: Nitrite as N by Discrete Analyser (QCLot: 665350)							
EB1627798-002	L1	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	101	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 667078)							
EB1627798-002	L1	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	95.9	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 669087)							
EB1627770-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	98.1	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 669088)							
EB1627770-001	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	120	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 665351)							
EB1627798-002	L1	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	108	70	130

Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1627798**	Page	: 1 of 12
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 23-Nov-2016
Site	: ----	Issue Date	: 09-Dec-2016
Sampler	: IVAN STEWARD, TRAVIS WOOD	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB1627798--002	L1	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED045G: Chloride by Discrete Analyser	EB1627798--002	L1	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
M2, M1	S1,	----	----	----	23-Nov-2016	20-Nov-2016	**3**
Clear Plastic Bottle - Natural							
FB1, V1D,	L1, V1	----	----	----	23-Nov-2016	21-Nov-2016	**2**
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural							
M2, M1	S1,	----	----	----	23-Nov-2016	20-Nov-2016	**3**
Clear Plastic Bottle - Natural							
FB1, V1D,	L1, V1	----	----	----	23-Nov-2016	21-Nov-2016	**2**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Total Phosphorus as P By Discrete Analyser	1	20	5.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H)								
M2,	S1,	**18-Nov-2016**	**----**	----	----	**25-Nov-2016**	25-Nov-2016	✓
M1								
Clear Plastic Bottle - Natural (EA025H)								
FB1,	L1,	**19-Nov-2016**	**----**	----	----	**25-Nov-2016**	26-Nov-2016	✓
V1D,	V1							
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
M2,	S1,	**18-Nov-2016**	**----**	----	----	**25-Nov-2016**	02-Dec-2016	✓
M1								
Clear Plastic Bottle - Natural (ED037-P)								
FB1,	L1,	**19-Nov-2016**	**----**	----	----	**25-Nov-2016**	03-Dec-2016	✓
V1D,	V1							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
M2,	S1,	**18-Nov-2016**	**----**	----	----	**23-Nov-2016**	16-Dec-2016	✓
M1								
Clear Plastic Bottle - Natural (ED041G)								
FB1,	L1,	**19-Nov-2016**	**----**	----	----	**23-Nov-2016**	17-Dec-2016	✓
V1D,	V1							
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
M2,	S1,	**18-Nov-2016**	**----**	----	----	**23-Nov-2016**	16-Dec-2016	✓
M1								
Clear Plastic Bottle - Natural (ED045G)								
FB1,	L1,	**19-Nov-2016**	**----**	----	----	**23-Nov-2016**	17-Dec-2016	✓
V1D,	V1							

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) M2, M1	S1,	**18-Nov-2016**	----	----	----	**25-Nov-2016**	16-Dec-2016	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F) FB1, V1D,	L1, V1	**19-Nov-2016**	----	----	----	**25-Nov-2016**	17-Dec-2016	✓
EG035F: Dissolved Mercury by FIMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F) M2, M1	S1,	**18-Nov-2016**	----	----	----	**26-Nov-2016**	16-Dec-2016	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F) FB1, V1D,	L1, V1	**19-Nov-2016**	----	----	----	**26-Nov-2016**	17-Dec-2016	✓
EG035T: Total Recoverable Mercury by FIMS								
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T) M2, M1	S1,	**18-Nov-2016**	----	----	----	**28-Nov-2016**	16-Dec-2016	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T) FB1, V1D,	L1, V1	**19-Nov-2016**	----	----	----	**28-Nov-2016**	17-Dec-2016	✓
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093B-F) M2, M1	S1,	**18-Nov-2016**	----	----	----	**25-Nov-2016**	17-May-2017	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093A-F) L1, V1	V1D,	**19-Nov-2016**	----	----	----	**25-Nov-2016**	18-May-2017	✓
EG093T: Total Metals in Saline Water by ORC-ICPMS								
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093A-T) M2, M1	S1,	**18-Nov-2016**	**26-Nov-2016**	17-May-2017	✓	**26-Nov-2016**	17-May-2017	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093B-T) L1, V1	V1D,	**19-Nov-2016**	**26-Nov-2016**	18-May-2017	✓	**26-Nov-2016**	18-May-2017	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG094B-F) FB1		**19-Nov-2016**	----	----	----	**30-Nov-2016**	18-May-2017	✓
EG094T: Total metals in Fresh water by ORC-ICPMS								
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094B-T) FB1		**19-Nov-2016**	**30-Nov-2016**	18-May-2017	✓	**30-Nov-2016**	18-May-2017	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) M2, M1	S1,	**18-Nov-2016**	**----**	----	----	**25-Nov-2016**	16-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) FB1, V1D,	L1, V1	**19-Nov-2016**	**----**	----	----	**25-Nov-2016**	17-Dec-2016	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) M2, M1	S1,	**18-Nov-2016**	**----**	----	----	**23-Nov-2016**	20-Nov-2016	×
Clear Plastic Bottle - Natural (EK057G) FB1, V1D,	L1, V1	**19-Nov-2016**	**----**	----	----	**23-Nov-2016**	21-Nov-2016	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) M2, M1	S1,	**18-Nov-2016**	**----**	----	----	**25-Nov-2016**	16-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) FB1, V1D,	L1, V1	**19-Nov-2016**	**----**	----	----	**25-Nov-2016**	17-Dec-2016	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) M2, M1	S1,	**18-Nov-2016**	**28-Nov-2016**	16-Dec-2016	✓	**28-Nov-2016**	16-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) FB1, V1D,	L1, V1	**19-Nov-2016**	**28-Nov-2016**	17-Dec-2016	✓	**28-Nov-2016**	17-Dec-2016	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G) M2, M1	S1,	**18-Nov-2016**	**28-Nov-2016**	16-Dec-2016	✓	**28-Nov-2016**	16-Dec-2016	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) FB1, V1D,	L1, V1	**19-Nov-2016**	**28-Nov-2016**	17-Dec-2016	✓	**28-Nov-2016**	17-Dec-2016	✓
EK071G: Reactive Phosphorus as P by discrete analyser								
Clear Plastic Bottle - Natural (EK071G) M2, M1	S1,	**18-Nov-2016**	**----**	----	----	**23-Nov-2016**	20-Nov-2016	×
Clear Plastic Bottle - Natural (EK071G) FB1, V1D,	L1, V1	**19-Nov-2016**	**----**	----	----	**23-Nov-2016**	21-Nov-2016	×

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020) M2, S1, M1	**18-Nov-2016**	**----**	----	----	**25-Nov-2016**	16-Dec-2016	✓
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020) FB1, L1, V1D, V1	**19-Nov-2016**	**----**	----	----	**25-Nov-2016**	17-Dec-2016	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✘ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type / Analytical Methods	Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Evaluation	Quality Control Specification
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**10.00**	✘	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	7	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	16	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type / *Analytical Methods*	*Method*	*Count* QC	*Count* Regular	*Rate (%)* Actual	*Rate (%)* Expected	*Evaluation*	*Quality Control Specification*
Laboratory Control Samples (LCS) - Continued							
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	16	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	0	1	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Total Mercury by FIMS	EG035T	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45μm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals - ORC	EN25-ORC	WATER	In house: Referenced to USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

QUALITY CONTROL REPORT

Work Order	: **EB1627811**	Page	: 1 of 8
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 23-Nov-2016
Order number	: ----	Date Analysis Commenced	: 24-Nov-2016
C-O-C number	: ----	Issue Date	: 22-Dec-2016
Sampler	: IVAN STEWARD, TRAVIS WOOD		
Site	: ----		
Quote number	: BN/288/16		
No. of samples received	: 15		
No. of samples analysed	: 15		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
- Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
- CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- RPD = Relative Percentage Difference
- # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 679680)									
EB1627811-001	L1	EA055-103: Moisture Content (dried @ 103°C)	----	1	%	26.7	25.7	3.83	0% - 20%
EG005E: 1M HCl extractable metals by ICP-AES (QC Lot: 687386)									
EB1627811-001	L1	EG005E: Boron	7440-42-8	1	mg/kg	12	12	0.00	0% - 50%
		EG005E: Iron	7439-89-6	1	mg/kg	6040	6090	0.873	0% - 20%
		EG005E: Aluminium	7429-90-5	50	mg/kg	10900	11000	0.725	0% - 20%
EB1627811-010	M1 <2000µm Sieve	EG005E: Boron	7440-42-8	1	mg/kg	14	14	0.00	0% - 50%
		EG005E: Iron	7439-89-6	1	mg/kg	13500	13500	0.00	0% - 20%
		EG005E: Aluminium	7429-90-5	50	mg/kg	15200	15100	0.673	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 687375)									
EB1627811-001	L1	EG005T: Aluminium	7429-90-5	50	mg/kg	34200	34400	0.588	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	44400	44200	0.333	0% - 20%
EB1627811-010	M1 <2000µm Sieve	EG005T: Aluminium	7429-90-5	50	mg/kg	37500	38400	2.27	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	52700	53800	2.21	0% - 20%
EG020E: 1M HCl Extractable metals by ICPMS (QC Lot: 687385)									
EB1627811-001	L1	EG020E: Arsenic	7440-38-2	0.05	mg/kg	1.59	1.56	1.46	0% - 20%
		EG020E: Barium	7440-39-3	0.05	mg/kg	6.40	6.32	1.30	0% - 20%
		EG020E: Cadmium	7440-43-9	0.05	mg/kg	0.06	0.06	0.00	No Limit
		EG020E: Chromium	7440-47-3	0.05	mg/kg	3.34	3.36	0.630	0% - 20%
		EG020E: Cobalt	7440-48-4	0.05	mg/kg	4.47	4.49	0.443	0% - 20%
		EG020E: Copper	7440-50-8	0.05	mg/kg	22.9	23.1	0.660	0% - 20%
		EG020E: Lead	7439-92-1	0.05	mg/kg	22.1	22.0	0.383	0% - 20%
		EG020E: Manganese	7439-96-5	0.05	mg/kg	304	305	0.240	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG020E: 1M HCl Extractable metals by ICPMS (QC Lot: 687385) - continued									
EB1627811-001	L1	EG020E: Nickel	7440-02-0	0.05	mg/kg	6.69	6.62	1.10	0% - 20%
		EG020E: Silver	7440-22-4	0.05	mg/kg	<0.05	<0.05	0.00	No Limit
		EG020E: Tin	7440-31-5	0.05	mg/kg	0.48	0.48	0.00	No Limit
		EG020E: Zinc	7440-66-6	0.05	mg/kg	43.4	43.7	0.622	0% - 20%
		EG020E: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020E: Vanadium	7440-62-2	0.5	mg/kg	10.4	10.5	0.00	0% - 20%
EB1627811-010	M1 <2000µm Sieve	EG020E: Arsenic	7440-38-2	0.05	mg/kg	3.30	3.32	0.609	0% - 20%
		EG020E: Barium	7440-39-3	0.05	mg/kg	26.2	25.9	1.14	0% - 20%
		EG020E: Cadmium	7440-43-9	0.05	mg/kg	0.08	0.08	0.00	No Limit
		EG020E: Chromium	7440-47-3	0.05	mg/kg	6.33	6.40	1.21	0% - 20%
		EG020E: Cobalt	7440-48-4	0.05	mg/kg	8.62	8.70	0.950	0% - 20%
		EG020E: Copper	7440-50-8	0.05	mg/kg	33.6	34.0	1.28	0% - 20%
		EG020E: Lead	7439-92-1	0.05	mg/kg	5.66	5.63	0.530	0% - 20%
		EG020E: Manganese	7439-96-5	0.05	mg/kg	496	495	0.00	0% - 20%
		EG020E: Nickel	7440-02-0	0.05	mg/kg	11.8	11.9	1.07	0% - 20%
		EG020E: Silver	7440-22-4	0.05	mg/kg	0.12	0.13	0.00	No Limit
		EG020E: Tin	7440-31-5	0.05	mg/kg	0.06	0.06	0.00	No Limit
		EG020E: Zinc	7440-66-6	0.05	mg/kg	20.8	21.2	1.81	0% - 20%
		EG020E: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020E: Vanadium	7440-62-2	0.5	mg/kg	22.7	23.0	1.26	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 687376)									
EB1627811-001	L1	EG020X-T: Tin	7440-31-5	0.1	mg/kg	4.0	4.1	0.00	0% - 50%
EB1627811-010	M1 <2000µm Sieve	EG020X-T: Tin	7440-31-5	0.1	mg/kg	0.9	0.9	0.00	No Limit
EB1627811-001	L1	EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	4.3	4.3	0.00	0% - 20%
		EG020X-T: Barium	7440-39-3	0.1	mg/kg	21.1	20.9	1.28	0% - 20%
		EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	19.4	19.4	0.00	0% - 20%
		EG020X-T: Chromium	7440-47-3	0.1	mg/kg	27.6	27.5	0.515	0% - 20%
		EG020X-T: Copper	7440-50-8	0.1	mg/kg	60.9	61.3	0.634	0% - 20%
		EG020X-T: Manganese	7439-96-5	0.1	mg/kg	1000	994	1.16	0% - 20%
		EG020X-T: Nickel	7440-02-0	0.1	mg/kg	35.5	35.4	0.317	0% - 20%
		EG020X-T: Lead	7439-92-1	0.1	mg/kg	26.3	26.3	0.00	0% - 20%
		EG020X-T: Zinc	7440-66-6	0.5	mg/kg	126	126	0.00	0% - 20%
		EG020X-T: Vanadium	7440-62-2	1	mg/kg	158	158	0.00	0% - 20%
EB1627811-010	M1 <2000µm Sieve	EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	12.3	12.2	0.00	0% - 20%
		EG020X-T: Barium	7440-39-3	0.1	mg/kg	63.9	63.5	0.729	0% - 20%
		EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	25.1	25.2	0.00	0% - 20%
		EG020X-T: Chromium	7440-47-3	0.1	mg/kg	48.4	48.0	0.856	0% - 20%
		EG020X-T: Copper	7440-50-8	0.1	mg/kg	82.3	82.2	0.00	0% - 20%
		EG020X-T: Manganese	7439-96-5	0.1	mg/kg	1180	1170	0.410	0% - 20%
		EG020X-T: Nickel	7440-02-0	0.1	mg/kg	52.9	53.1	0.491	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 687376) - continued									
EB1627811-010	M1 <2000µm Sieve	EG020X-T: Lead	7439-92-1	0.1	mg/kg	11.2	11.3	0.00	0% - 20%
		EG020X-T: Zinc	7440-66-6	0.5	mg/kg	90.4	90.6	0.263	0% - 20%
		EG020X-T: Vanadium	7440-62-2	1	mg/kg	131	131	0.00	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 687377)									
EB1627811-001	L1	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EB1627811-010	M1 <2000µm Sieve	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 687378)									
EB1627811-001	L1	EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	0.1	0.1	0.00	No Limit
		EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EB1627811-010	M1 <2000µm Sieve	EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	0.1	0.1	0.00	No Limit
		EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 689027)									
EB1627811-001	L1	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EB1627811-010	M1 <2000µm Sieve	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 687379)									
EB1627811-001	L1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EB1627811-010	M1 <2000µm Sieve	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.04	0.04	0.00	0% - 20%
EK055: Ammonia as N (QC Lot: 666690)									
EB1627811-002	V1D	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EB1627837-004	Anonymous	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 687381)									
EB1627811-001	L1	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 687380)									
EB1627811-001	L1	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.2	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 687384)									
EB1627811-001	L1	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	70	80	13.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 687383)									
EB1627811-001	L1	EK067G: Total Phosphorus as P	----	2	mg/kg	573	# 716	22.1	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 687382)									
EB1627811-001	L1	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.1	0.1	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 697204)									
EB1627811-001	L1	EP003: Total Organic Carbon	----	0.02	%	0.04	0.04	0.00	No Limit
EB1627811-010	M1 <2000µm Sieve	EP003: Total Organic Carbon	----	0.02	%	0.32	0.33	0.00	0% - 50%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 697205)									
EB1627811-001	L1	EP003TC: Total Carbon	TC	0.02	%	0.40	0.38	4.81	0% - 50%
EB1627811-010	M1 <2000µm Sieve	EP003TC: Total Carbon	TC	0.02	%	0.81	0.76	6.20	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005E: 1M HCl extractable metals by ICP-AES (QCLot: 687386)								
EG005E: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005E: Boron	7440-42-8	1	mg/kg	<1	----	----	----	----
EG005E: Iron	7439-89-6	1	mg/kg	10	----	----	----	----
EG005T: Total Metals by ICP-AES (QCLot: 687375)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Iron	7439-89-6	50	mg/kg	<50	34900 mg/kg	92.4	70	120
EG020E: 1M HCl Extractable metals by ICPMS (QCLot: 687385)								
EG020E: Arsenic	7440-38-2	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Barium	7440-39-3	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Cadmium	7440-43-9	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Chromium	7440-47-3	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Cobalt	7440-48-4	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Copper	7440-50-8	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Lead	7439-92-1	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Manganese	7439-96-5	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Nickel	7440-02-0	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Selenium	7782-49-2	0.1	mg/kg	<0.1	----	----	----	----
EG020E: Silver	7440-22-4	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Tin	7440-31-5	0.05	mg/kg	<0.05	----	----	----	----
EG020E: Vanadium	7440-62-2	0.5	mg/kg	<0.5	----	----	----	----
EG020E: Zinc	7440-66-6	0.05	mg/kg	<0.05	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 687376)								
EG020X-T: Arsenic	7440-38-2	0.1	mg/kg	<0.1	116.3 mg/kg	104	87	122
EG020X-T: Barium	7440-39-3	0.1	mg/kg	<0.1	82.2 mg/kg	99.1	86	123
EG020X-T: Cobalt	7440-48-4	0.1	mg/kg	<0.1	11.6 mg/kg	96.7	88	129
EG020X-T: Chromium	7440-47-3	0.1	mg/kg	<0.1	22.9 mg/kg	86.2	75	130
EG020X-T: Copper	7440-50-8	0.1	mg/kg	<0.1	52.9 mg/kg	96.3	84	120
EG020X-T: Manganese	7439-96-5	0.1	mg/kg	<0.1	592 mg/kg	99.1	86	130
EG020X-T: Nickel	7440-02-0	0.1	mg/kg	<0.1	16.1 mg/kg	91.1	89	127
EG020X-T: Lead	7439-92-1	0.1	mg/kg	<0.1	66.3 mg/kg	104	85	117
EG020X-T: Zinc	7440-66-6	0.5	mg/kg	<0.5	187 mg/kg	99.4	71	130
EG020X-T: Vanadium	7440-62-2	1	mg/kg	<1	67.8 mg/kg	91.1	86	130
EG020X-T: Tin	7440-31-5	0.1	mg/kg	<0.1	4.48 mg/kg	116	79	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020T: Total Metals by ICP-MS (QCLot: 687377)								
EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	3.16 mg/kg	91.4	72	120
EG020T: Total Metals by ICP-MS (QCLot: 687378)								
EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	----	----	----	----
EG020Y-T: Cadmium	7440-43-9	0.1	mg/kg	<0.1	1.43 mg/kg	94.4	81	121
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 689027)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	1.863 mg/kg	125	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 687379)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.111 mg/kg	79.8	70	130
EK055: Ammonia as N (QCLot: 666690)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	25 mg/kg	98.6	80	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 687381)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	104	83	111
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 687380)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	104	86	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 687384)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	877 mg/kg	102	70	110
				<20	3644 mg/kg	97.9	70	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 687383)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	766 mg/kg	91.6	70	110
				<2	1200 mg/kg	110	70	110
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 687382)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	105	89	115
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 697204)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	107	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 697205)								
EP003TC: Total Carbon	TC	0.02	%	<0.02	100 %	108	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020E: 1M HCl Extractable metals by ICPMS (QCLot: 687385)							
EB1627811-002	V1D	EG020E: Arsenic	7440-38-2	25 mg/kg	80.6	70	130
		EG020E: Barium	7440-39-3	25 mg/kg	88.8	70	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG020E: 1M HCl Extractable metals by ICPMS (QCLot: 687385) - continued							
EB1627811-002	V1D	EG020E: Cadmium	7440-43-9	12.5 mg/kg	90.9	70	130
		EG020E: Chromium	7440-47-3	25 mg/kg	99.8	70	130
		EG020E: Cobalt	7440-48-4	25 mg/kg	98.4	70	130
		EG020E: Copper	7440-50-8	25 mg/kg	87.0	70	130
		EG020E: Lead	7439-92-1	25 mg/kg	95.5	70	130
		EG020E: Manganese	7439-96-5	25 mg/kg	# Not Determined	70	130
		EG020E: Nickel	7440-02-0	25 mg/kg	93.5	70	130
		EG020E: Vanadium	7440-62-2	25 mg/kg	90.6	70	130
		EG020E: Zinc	7440-66-6	25 mg/kg	90.1	70	130
EG020T: Total Metals by ICP-MS (QCLot: 687376)							
EB1627811-002	V1D	EG020X-T: Arsenic	7440-38-2	50 mg/kg	106	70	130
		EG020X-T: Barium	7440-39-3	50 mg/kg	109	70	130
		EG020X-T: Cobalt	7440-48-4	50 mg/kg	113	70	130
		EG020X-T: Chromium	7440-47-3	50 mg/kg	114	70	130
		EG020X-T: Copper	7440-50-8	50 mg/kg	99.8	70	130
		EG020X-T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70	130
		EG020X-T: Nickel	7440-02-0	50 mg/kg	111	70	130
		EG020X-T: Lead	7439-92-1	50 mg/kg	102	70	130
		EG020X-T: Zinc	7440-66-6	50 mg/kg	109	70	130
		EG020X-T: Vanadium	7440-62-2	50 mg/kg	128	70	130
EG020T: Total Metals by ICP-MS (QCLot: 687378)							
EB1627811-002	V1D	EG020Y-T: Cadmium	7440-43-9	25 mg/kg	100	70	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 689027)							
EB1627811-002	V1D	EG035-SDH: Mercury	7439-97-6	1.25 mg/kg	# 0.800	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 687379)							
EB1627811-002	V1D	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	79.1	70	130
EK055: Ammonia as N (QCLot: 666690)							
EB1627811-001	L1	EK055: Ammonia as N	7664-41-7	100 mg/kg	98.0	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 687381)							
EB1627811-002	V1D	EK057G: Nitrite as N (Sol.)	14797-65-0	2 mg/kg	105	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 687380)							
EB1627811-002	V1D	EK059G: Nitrite + Nitrate as N (Sol.)	----	2 mg/kg	106	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 687384)							
EB1627811-002	V1D	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	# 59.3	70	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 687383)							
EB1627811-002	V1D	EK067G: Total Phosphorus as P	----	100 mg/kg	# Not Determined	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 687382)							
EB1627811-002	V1D	EK071G: Reactive Phosphorus as P	14265-44-2	2 mg/kg	118	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1627811**	Page	: 1 of 12
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 23-Nov-2016
Site	: ----	Issue Date	: 22-Dec-2016
Sampler	: IVAN STEWARD, TRAVIS WOOD	No. of samples received	: 15
Order number	: ----	No. of samples analysed	: 15

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Duplicate outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EK067G: Total Phosphorus as P by Discrete Analyser	EB1627811--001	L1	**Total Phosphorus as P**	----	22.1 %	0% - 20%	**RPD exceeds LOR based limits**
Matrix Spike (MS) Recoveries							
EG020E: 1M HCl Extractable metals by ICPMS	EB1627811--002	V1D	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG020T: Total Metals by ICP-MS	EB1627811--002	V1D	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG035-SDH: 1M HCl extractable Mercury by FIMS	EB1627811--002	V1D	**Mercury**	7439-97-6	0.800 %	70-130%	**Recovery less than lower data quality objective**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser	EB1627811--002	V1D	**Total Kjeldahl Nitrogen as N**	----	59.3 %	70-130%	**Recovery less than lower data quality objective**
EK067G: Total Phosphorus as P by Discrete Analyser	EB1627811--002	V1D	**Total Phosphorus as P**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method		*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA055: Moisture Content							
Soil Glass Jar - Unpreserved S2,	M1	----	----	----	05-Dec-2016	02-Dec-2016	**3**
Soil Glass Jar - Unpreserved L1, V1	V1D,	----	----	----	05-Dec-2016	03-Dec-2016	**2**
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag S2, S2 - <2000µm Sieve,	M1, M1 - <2000µm Sieve	19-Dec-2016	16-Dec-2016	**3**	19-Dec-2016	16-Dec-2016	**3**
Pulp Bag L1, V1, V1D - <2000µm Sieve,	V1D, L1 - <2000µm Sieve, V1 - <2000µm Sieve	19-Dec-2016	17-Dec-2016	**2**	19-Dec-2016	17-Dec-2016	**2**
EP003TC: Total Carbon (TC) in Soil							
Pulp Bag S2, S2 - <2000µm Sieve,	M1, M1 - <2000µm Sieve	19-Dec-2016	16-Dec-2016	**3**	19-Dec-2016	16-Dec-2016	**3**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EP003TC: Total Carbon (TC) in Soil - Analysis Holding Time Compliance							
Pulp Bag							
L1,	V1D,	19-Dec-2016	17-Dec-2016	**2**	19-Dec-2016	17-Dec-2016	**2**
V1,	L1 - <2000µm Sieve,						
V1D - <2000µm Sieve,	V1 - <2000µm Sieve						

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count: QC	Count: Regular	Rate (%): Actual	Rate (%): Expected	Quality Control Specification
Matrix Spikes (MS)					
1 M HCl Extractable metals by ICPAES	0	13	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	0	14	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	0	14	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103)								
S2,	M1	**18-Nov-2016**	**----**	----	----	**05-Dec-2016**	02-Dec-2016	✗
Soil Glass Jar - Unpreserved (EA055-103)								
L1,	V1D,	**19-Nov-2016**	**----**	----	----	**05-Dec-2016**	03-Dec-2016	✗
V1								
EA150: Particle Sizing								
Snap Lock Bag (EA150H)								
S2,	M1	**18-Nov-2016**	**----**	----	----	**16-Dec-2016**	17-May-2017	✓
Snap Lock Bag (EA150H)								
L1,	V1D,	**19-Nov-2016**	**----**	----	----	**16-Dec-2016**	18-May-2017	✓
V1								

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*		*Sample Date*	*Extraction / Preparation* Date extracted	Due for extraction	Evaluation	*Analysis* Date analysed	Due for analysis	Evaluation
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) S2,	M1	**18-Nov-2016**	**----**	----	----	**16-Dec-2016**	17-May-2017	✓
Snap Lock Bag (EA150H) L1, V1	V1D,	**19-Nov-2016**	**----**	----	----	**16-Dec-2016**	18-May-2017	✓
EA152: Soil Particle Density								
Snap Lock Bag (EA152) S2,	M1	**18-Nov-2016**	**----**	----	----	**16-Dec-2016**	17-May-2017	✓
Snap Lock Bag (EA152) L1, V1	V1D,	**19-Nov-2016**	**----**	----	----	**16-Dec-2016**	18-May-2017	✓
EG005E: 1M HCl extractable metals by ICP-AES								
Pulp Bag (EG005E) S2 - <2000µm Sieve,	M1 - <2000µm Sieve	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Pulp Bag (EG005E) L1 - <2000µm Sieve, V1 - <2000µm Sieve	V1D - <2000µm Sieve,	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
Pulp Bag (-63µm) (EG005E) V1D - <63µm Sieve, M1 - <63µm Sieve	V1 - <63µm Sieve,	**13-Dec-2016**	**13-Dec-2016**	11-Jun-2017	✓	**13-Dec-2016**	11-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG005E) S2,	M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EG005E) L1, V1	V1D,	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EG005T: Total Metals by ICP-AES								
Pulp Bag (EG005T) S2 - <2000µm Sieve,	M1 - <2000µm Sieve	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Pulp Bag (EG005T) L1 - <2000µm Sieve, V1 - <2000µm Sieve	V1D - <2000µm Sieve,	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
Pulp Bag (-63µm) (EG005T) V1D - <63µm Sieve, S2 - <63µm Sieve,	V1 - <63µm Sieve, M1 - <63µm Sieve	**13-Dec-2016**	**13-Dec-2016**	11-Jun-2017	✓	**13-Dec-2016**	11-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG005T) S2,	M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EG005T) L1, V1	V1D,	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020E: 1M HCl Extractable metals by ICPMS							
Pulp Bag (EG020E) S2 - <2000µm Sieve, M1 - <2000µm Sieve	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Pulp Bag (EG020E) L1 - <2000µm Sieve, V1D - <2000µm Sieve, V1 - <2000µm Sieve	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
Pulp Bag (-63µm) (EG020E) V1D - <63µm Sieve, V1 - <63µm Sieve, M1 - <63µm Sieve	**13-Dec-2016**	**13-Dec-2016**	11-Jun-2017	✓	**13-Dec-2016**	11-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG020E) S2, M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EG020E) L1, V1D, V1	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EG020T: Total Metals by ICP-MS							
Pulp Bag (EG020Z-T) S2 - <2000µm Sieve, M1 - <2000µm Sieve	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Pulp Bag (EG020Z-T) L1 - <2000µm Sieve, V1D - <2000µm Sieve, V1 - <2000µm Sieve	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
Pulp Bag (-63µm) (EG020Z-T) V1D - <63µm Sieve, V1 - <63µm Sieve, S2 - <63µm Sieve, M1 - <63µm Sieve	**13-Dec-2016**	**13-Dec-2016**	11-Jun-2017	✓	**13-Dec-2016**	11-Jun-2017	✓
Soil Glass Jar - Unpreserved (EG020Z-T) S2, M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EG020Z-T) L1, V1D, V1	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EG035-SDH: 1M HCl extractable Mercury by FIMS							
Pulp Bag (-2000µm) (EG035-SDH) L1 - <2000µm Sieve, V1D - <2000µm Sieve, V1 - <2000µm Sieve, S2 - <2000µm Sieve, M1 - <2000µm Sieve	**13-Dec-2016**	**13-Dec-2016**	10-Jan-2017	✓	**13-Dec-2016**	10-Jan-2017	✓
Pulp Bag (-63µm) (EG035-SDH) V1D - <63µm Sieve, V1 - <63µm Sieve, M1 - <63µm Sieve	**13-Dec-2016**	**13-Dec-2016**	10-Jan-2017	✓	**13-Dec-2016**	10-Jan-2017	✓
Soil Glass Jar - Unpreserved (EG035-SDH) S2, M1	**18-Nov-2016**	**13-Dec-2016**	16-Dec-2016	✓	**13-Dec-2016**	16-Dec-2016	✓
Soil Glass Jar - Unpreserved (EG035-SDH) L1, V1D, V1	**19-Nov-2016**	**13-Dec-2016**	17-Dec-2016	✓	**13-Dec-2016**	17-Dec-2016	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EG035T: Total Recoverable Mercury by FIMS							
Pulp Bag (EG035T-LL) S2 - <2000µm Sieve, M1 - <2000µm Sieve	**18-Nov-2016**	**13-Dec-2016**	16-Dec-2016	✓	**13-Dec-2016**	16-Dec-2016	✓
Pulp Bag (EG035T-LL) L1 - <2000µm Sieve, V1D - <2000µm Sieve, V1 - <2000µm Sieve	**19-Nov-2016**	**13-Dec-2016**	17-Dec-2016	✓	**13-Dec-2016**	17-Dec-2016	✓
Pulp Bag (-63µm) (EG035T-LL) V1D - <63µm Sieve, V1 - <63µm Sieve, S2 - <63µm Sieve, M1 - <63µm Sieve	**13-Dec-2016**	**13-Dec-2016**	10-Jan-2017	✓	**13-Dec-2016**	10-Jan-2017	✓
Soil Glass Jar - Unpreserved (EG035T-LL) S2, M1	**18-Nov-2016**	**13-Dec-2016**	16-Dec-2016	✓	**13-Dec-2016**	16-Dec-2016	✓
Soil Glass Jar - Unpreserved (EG035T-LL) L1, V1D, V1	**19-Nov-2016**	**13-Dec-2016**	17-Dec-2016	✓	**13-Dec-2016**	17-Dec-2016	✓
EK055: Ammonia as N							
Soil Glass Jar - Unpreserved (EK055) S2, M1	**18-Nov-2016**	**----**	----	----	**24-Nov-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EK055) L1, V1D, V1	**19-Nov-2016**	**----**	----	----	**24-Nov-2016**	18-May-2017	✓
EK057G: Nitrite as N by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK057G) S2, M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EK057G) L1, V1D, V1	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Soil Glass Jar - Unpreserved (EK059G) S2, M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EK059G) L1, V1D, V1	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Soil Glass Jar - Unpreserved (EK061G) S2, M1	**18-Nov-2016**	**12-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EK061G) L1, V1D, V1	**19-Nov-2016**	**12-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser								
Soil Glass Jar - Unpreserved (EK067G) S2,	M1	**18-Nov-2016**	**12-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EK067G) L1, V1	V1D,	**19-Nov-2016**	**12-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EK071G: Reactive Phosphorus as P by discrete analyser								
Soil Glass Jar - Unpreserved (EK071G) S2,	M1	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**13-Dec-2016**	17-May-2017	✓
Soil Glass Jar - Unpreserved (EK071G) L1, V1	V1D,	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**13-Dec-2016**	18-May-2017	✓
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003) S2, S2 - <2000µm Sieve,	M1, M1 - <2000µm Sieve	**18-Nov-2016**	**19-Dec-2016**	16-Dec-2016	✗	**19-Dec-2016**	16-Dec-2016	✗
Pulp Bag (EP003) L1, V1, V1D - <2000µm Sieve,	V1D, L1 - <2000µm Sieve, V1 - <2000µm Sieve	**19-Nov-2016**	**19-Dec-2016**	17-Dec-2016	✗	**19-Dec-2016**	17-Dec-2016	✗
Pulp Bag (-63µm) (EP003) V1D - <63µm Sieve, M1 - <63µm Sieve	V1 - <63µm Sieve,	**13-Dec-2016**	**19-Dec-2016**	10-Jan-2017	✓	**19-Dec-2016**	10-Jan-2017	✓
EP003TC: Total Carbon (TC) in Soil								
Pulp Bag (EP003TC) S2, S2 - <2000µm Sieve,	M1, M1 - <2000µm Sieve	**18-Nov-2016**	**19-Dec-2016**	16-Dec-2016	✗	**19-Dec-2016**	16-Dec-2016	✗
Pulp Bag (EP003TC) L1, V1, V1D - <2000µm Sieve,	V1D, L1 - <2000µm Sieve, V1 - <2000µm Sieve	**19-Nov-2016**	**19-Dec-2016**	17-Dec-2016	✗	**19-Dec-2016**	17-Dec-2016	✗
Pulp Bag (-63µm) (EP003TC) V1D - <63µm Sieve, M1 - <63µm Sieve	V1 - <63µm Sieve,	**13-Dec-2016**	**19-Dec-2016**	10-Jan-2017	✓	**19-Dec-2016**	10-Jan-2017	✓
GEO26: Sieving								
Snap Lock Bag (GEO26C) S2 - <2000µm Sieve, S2 - <63µm Sieve,	M1 - <2000µm Sieve, M1 - <63µm Sieve	**18-Nov-2016**	**13-Dec-2016**	17-May-2017	✓	**----**	----	----
Snap Lock Bag (GEO26C) L1 - <2000µm Sieve, V1 - <2000µm Sieve, V1D - <63µm Sieve,	V1D - <2000µm Sieve, L1 - <63µm Sieve, V1 - <63µm Sieve	**19-Nov-2016**	**13-Dec-2016**	18-May-2017	✓	**----**	----	----

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
1 M HCl Extractable metals by ICPAES	EG005E	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
1 M HCl Extractable metals by ICPMS	EG020E	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Mercury by FIMS	EG035-SDH	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055-103	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	4	14	**28.57**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	2	14	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
1 M HCl Extractable metals by ICPAES	EG005E	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type / Analytical Methods	Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Evaluation	Quality Control Specification
Method Blanks (MB) - Continued							
1 M HCl Extractable metals by ICPMS	EG020E	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	2	14	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1 M HCl Extractable metals by ICPAES	EG005E	0	13	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
1 M HCl Extractable metals by ICPMS	EG020E	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	0	14	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	0	14	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Moisture Content	EA055-103	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
1 M HCl Extractable metals by ICPAES	EG005E	SOIL	In house: Referenced to Allen HE 1993 - The significance of trace metal speciation for water, sediment and soil criteria and standards, Science of the Total Environment Supplement, 23-45.) (ICPAES) 1 M HCl extractable metals are determined following an extraction of the soil. The ICPAES technique ionises samples in a plasma, emitting characteristic spectrums based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards.
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
1 M HCl Extractable metals by ICPMS	EG020E	SOIL	In house: Referenced to Allen HE 1993 - The significance of trace metal speciation for water, sediment and soil criteria and standards, Science of the Total Environment Supplement, 23-45.) (ICPMS) Metals in solids are determined following an appropriate acid digestion. The ICPMS technique ionizes selected elements. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass / charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-MS - Suite X	EG020X-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite Y	EG020Y-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite Z	EG020Z-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Buchi Ammonia	EK055	SOIL	In house: Referenced to APHA 4500-NH3 B&G, H Samples are steam distilled (Buchi) prior to analysis and quantified using titration, FIA or Discrete Analyser.
Nitrite as N - Soluble by Discrete Analyser	EK057G	SOIL	In house: Referenced to APHA 4500-NO3- B. Nitrite in a water extract is determined by direct colourimetry by Discrete Analyser.
Nitrate as N - Soluble by Discrete Analyser	EK058G	SOIL	In house: Referenced to APHA 4500-NO3- F. Nitrate in the 1:5 soil:water extract is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results.
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Chemical Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	In house: Referenced to APHA 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	SOIL	In house: Referenced to APHA 4500 P-F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Total Carbon	EP003TC	SOIL	In house C-IR07. Dried and pulverised sample is combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved Carbon (as CO2) is measured by infra-red detector
Total Inorganic Carbon	EP003TIC	SOIL	In house C-CAL15. Determined as the difference between Total Carbon and Organic Carbon.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg- D; APHA 4500 P - H. Macro Kjeldahl digestion.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
1M HCl Extraction for Metals in Sediments (1 hour)	EN71/1	SOIL	In house: Referenced to Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
Sieving (fine to -2mm)	GEO26	SOIL	In house: The dried sample is sieved to 2mm and the fines are then analysed per the client's request.
Sieving (fine to -63µm)	GEO26C	SOIL	In house: The sample is sieved to -63µm and the fines are then analysed per the client's request.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

QUALITY CONTROL REPORT

Work Order	: **EB1704258**	Page	: 1 of 28
Amendment	: **1**		
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 03-Mar-2017
Order number	: ----	Date Analysis Commenced	: 06-Mar-2017
C-O-C number	: ----	Issue Date	: 18-Apr-2017
Sampler	: GREG HEATH		
Site	: ----		
Quote number	: BN/288/16 V6		
No. of samples received	: 60		
No. of samples analysed	: 48		

NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	WB Water Lab Brisbane, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 807904)									
EB1704258-037	B1 <2000µm Fraction	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.1	0.00	No Limit
		EG005-SDH: Cobalt	7440-48-4	0.5	mg/kg	4.2	4.1	0.00	No Limit
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	1.8	1.5	15.7	No Limit
		EG005-SDH: Barium	7440-39-3	1	mg/kg	17.6	17.4	1.53	0% - 50%
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	2.8	2.9	0.00	No Limit
		EG005-SDH: Copper	7440-50-8	1	mg/kg	18.9	18.6	1.70	0% - 50%
		EG005-SDH: Lead	7439-92-1	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	8.4	8.6	3.13	No Limit
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	9.8	9.7	0.00	No Limit
		EG005-SDH: Manganese	7439-96-5	10	mg/kg	154	154	0.00	0% - 50%
		EG005-SDH: Vanadium	7440-62-2	2	mg/kg	10.4	10.4	0.00	No Limit
		EG005-SDH: Aluminium	7429-90-5	50	mg/kg	17200	17100	0.478	0% - 20%
		EG005-SDH: Iron	7439-89-6	50	mg/kg	6920	6910	0.210	0% - 20%
EB1704258-047	S2 <2000µm Fraction	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	0.2	0.2	0.00	No Limit
		EG005-SDH: Cobalt	7440-48-4	0.5	mg/kg	7.3	7.2	1.74	0% - 50%
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	1.9	2.8	35.5	No Limit
		EG005-SDH: Barium	7440-39-3	1	mg/kg	34.2	33.5	2.09	0% - 20%
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	5.7	5.6	0.00	No Limit
		EG005-SDH: Copper	7440-50-8	1	mg/kg	32.0	31.8	0.600	0% - 20%
		EG005-SDH: Lead	7439-92-1	1	mg/kg	4.0	4.0	0.00	No Limit
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	11.4	11.4	0.00	0% - 50%
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	17.8	17.8	0.00	0% - 50%
		EG005-SDH: Manganese	7439-96-5	10	mg/kg	408	404	1.02	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG005-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 807904) - continued									
EB1704258-047	S2 <2000µm Fraction	EG005-SDH: Vanadium	7440-62-2	2	mg/kg	20.7	20.6	0.916	0% - 50%
		EG005-SDH: Aluminium	7429-90-5	50	mg/kg	16200	16200	0.300	0% - 20%
		EG005-SDH: Iron	7439-89-6	50	mg/kg	10300	10300	0.742	0% - 20%
EG005-SDH: 1M HCl-Extractable Metals by ICPAES (QC Lot: 836052)									
EB1704258-059	S2-D <2000µm	EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG005-SDH: Cobalt	7440-48-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EG005-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Barium	7440-39-3	1	mg/kg	1.9	1.9	0.00	No Limit
		EG005-SDH: Chromium	7440-47-3	1	mg/kg	2.7	2.7	0.00	No Limit
		EG005-SDH: Copper	7440-50-8	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Lead	7439-92-1	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Nickel	7440-02-0	1	mg/kg	1.1	<1.0	0.00	No Limit
		EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	<1.0	0.00	No Limit
		EG005-SDH: Zinc	7440-66-6	1	mg/kg	2.9	2.9	0.00	No Limit
		EG005-SDH: Manganese	7439-96-5	10	mg/kg	<10	<10	0.00	No Limit
		EG005-SDH: Vanadium	7440-62-2	2	mg/kg	3.8	3.7	0.00	No Limit
		EG005-SDH: Aluminium	7429-90-5	50	mg/kg	1240	1240	0.00	0% - 20%
		EG005-SDH: Iron	7439-89-6	50	mg/kg	770	750	2.44	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 807909)									
EB1704258-037	B1 <2000µm Fraction	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	50	50	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	15	15	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	16	16	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	28	28	0.00	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	72	73	0.00	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	711	718	0.989	0% - 20%
		EG005T: Zinc	7440-66-6	5	mg/kg	59	58	0.00	0% - 50%
		EG005T: Aluminium	7429-90-5	50	mg/kg	33000	33200	0.799	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	37000	37600	1.55	0% - 20%
EB1704258-047	S2 <2000µm Fraction	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	80	80	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	41	41	0.00	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	22	21	0.00	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	50	49	0.00	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	9	8	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	81	80	0.00	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	8	8	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG005T: Total Metals by ICP-AES (QC Lot: 807909) - continued									
EB1704258-047	S2 <2000µm Fraction	EG005T: Manganese	7439-96-5	5	mg/kg	1030	1010	1.48	0% - 20%
		EG005T: Zinc	7440-66-6	5	mg/kg	79	77	2.51	0% - 50%
		EG005T: Aluminium	7429-90-5	50	mg/kg	35100	34800	0.875	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	47400	46500	1.92	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 807916)									
EB1704258-057	M1 <63µm	EG005T: Cadmium	7440-43-9	1	mg/kg	1	1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	80	70	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	65	61	6.99	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	21	20	6.50	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	54	50	7.76	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	15	14	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	94	88	6.36	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	16	14	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	953	890	6.80	0% - 20%
		EG005T: Zinc	7440-66-6	5	mg/kg	113	106	6.00	0% - 20%
		EG005T: Aluminium	7429-90-5	50	mg/kg	34800	32600	6.38	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	65500	60000	8.78	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 836058)									
EB1704258-059	S2-D <2000µm	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	40	40	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	11	11	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	3	3	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	5	5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	126	126	0.00	0% - 20%
		EG005T: Zinc	7440-66-6	5	mg/kg	19	19	0.00	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	6020	6100	1.29	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	10600	10700	0.661	0% - 20%
EG020-SDH: 1M HCl Extractable metals by ICPMS (QC Lot: 807905)									
EB1704258-037	B1 <2000µm Fraction	EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EG020-SDH: Tin	7440-31-5	2	mg/kg	<2.0	<2.0	0.00	No Limit
EB1704258-047	S2 <2000µm Fraction	EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EG020-SDH: Tin	7440-31-5	2	mg/kg	<2.0	<2.0	0.00	No Limit
EG020-SDH: 1M HCl Extractable metals by ICPMS (QC Lot: 836053)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020-SDH: 1M HCl Extractable metals by ICPMS (QC Lot: 836053) - continued									
EB1704258-059	S2-D <2000µm	EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EG020-SDH: Tin	7440-31-5	2	mg/kg	<2.0	<2.0	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 807910)									
EB1704258-037	B1 <2000µm Fraction	EG020X-T: Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020X-T: Tin	7440-31-5	0.1	mg/kg	0.5	0.5	0.00	No Limit
EB1704258-047	S2 <2000µm Fraction	EG020X-T: Antimony	7440-36-0	0.1	mg/kg	0.1	0.1	0.00	No Limit
		EG020X-T: Tin	7440-31-5	0.1	mg/kg	0.6	0.6	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 807912)									
EB1704258-037	B1 <2000µm Fraction	EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EB1704258-047	S2 <2000µm Fraction	EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 807913)									
EB1704258-037	B1 <2000µm Fraction	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EB1704258-047	S2 <2000µm Fraction	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	0.2	0.2	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 807914)									
EB1704258-057	M1 <63µm	EG020X-T: Antimony	7440-36-0	0.1	mg/kg	0.4	0.4	0.00	No Limit
		EG020X-T: Tin	7440-31-5	0.1	mg/kg	3.1	2.9	6.34	0% - 20%
EG020T: Total Metals by ICP-MS (QC Lot: 807915)									
EB1704258-057	M1 <63µm	EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 807918)									
EB1704258-057	M1 <63µm	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	0.2	0.2	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 836056)									
EB1704258-059	S2-D <2000µm	EG020X-T: Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
		EG020X-T: Tin	7440-31-5	0.1	mg/kg	0.5	0.5	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 836057)									
EB1704258-059	S2-D <2000µm	EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	<1	0.00	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 836060)									
EB1704258-059	S2-D <2000µm	EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 807906)									
EB1704258-037	B1 <2000µm Fraction	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EB1704258-047	S2 <2000µm Fraction	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EG035-SDH: 1M HCl extractable Mercury by FIMS (QC Lot: 836051)									
EB1704258-059	S2-D <2000µm	EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	<0.10	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 807911)									
EB1704258-037	B1 <2000µm Fraction	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EB1704258-047	S2 <2000µm Fraction	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.03	0.03	0.00	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 807917)									
EB1704258-057	M1 <63µm	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.04	0.04	0.00	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 836059)									
EB1704258-059	S2-D <2000µm	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	<0.01	0.00	0% - 20%
EK055: Ammonia as N (QC Lot: 807246)									
EB1704258-038	W2 <2000µm Fraction	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EB1704258-046	M1 <2000µm Fraction	EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	<20	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 807902)									
EB1704258-040	V1 <2000µm Fraction	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EB1704258-046	M1 <2000µm Fraction	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 836050)									
EB1704258-059	S2-D <2000µm	EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	0.2	0.2	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 807903)									
EB1704258-040	V1 <2000µm Fraction	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EB1704258-046	M1 <2000µm Fraction	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.2	0.1	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 836049)									
EB1704258-059	S2-D <2000µm	EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	0.3	0.3	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 807908)									
EB1704258-037	B1 <2000µm Fraction	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	30	20	0.00	No Limit
EB1704258-047	S2 <2000µm Fraction	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	480	540	10.5	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 836054)									
EB1704258-059	S2-D <2000µm	EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	90	80	19.2	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 807907)									
EB1704258-037	B1 <2000µm Fraction	EK067G: Total Phosphorus as P	----	2	mg/kg	506	552	8.67	0% - 20%
EB1704258-047	S2 <2000µm Fraction	EK067G: Total Phosphorus as P	----	2	mg/kg	586	598	2.12	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 836055)									
EB1704258-059	S2-D <2000µm	EK067G: Total Phosphorus as P	----	2	mg/kg	298	362	19.5	0% - 20%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 807901)									
EB1704258-040	V1 <2000µm Fraction	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	4.9	4.9	0.00	0% - 20%
EB1704258-046	M1 <2000µm Fraction	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.1	0.1	0.00	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 836048)									
EB1704258-059	S2-D <2000µm	EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	0.2	0.2	0.00	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 817880)									
EB1704258-037	B1 <2000µm Fraction	EP003: Total Organic Carbon	----	0.02	%	0.65	0.62	4.36	0% - 20%
EB1704258-047	S2 <2000µm Fraction	EP003: Total Organic Carbon	----	0.02	%	0.41	0.41	0.00	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 836792)									
EB1704258-059	S2-D <2000µm	EP003: Total Organic Carbon	----	0.02	%	0.06	0.06	0.00	No Limit
EP003TC: Total Carbon (TC) in Soil (QC Lot: 817881)									
EB1704258-037	B1 <2000µm Fraction	EP003TC: Total Carbon	TC	0.02	%	1.26	1.46	14.4	0% - 20%
EB1704258-047	S2 <2000µm Fraction	EP003TC: Total Carbon	TC	0.02	%	0.86	0.83	3.35	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EP003TC: Total Carbon (TC) in Soil (QC Lot: 836793)									
EB1704258-059	S2-D <2000µm	EP003TC: Total Carbon	TC	0.02	%	0.46	0.48	4.02	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 779584)									
EB1704258-001	B1	EA025: Suspended Solids (SS)	----	1	mg/L	66	68	2.76	0% - 20%
EB1704258-014	W2-10	EA025: Suspended Solids (SS)	----	1	mg/L	2	3	0.00	No Limit
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 780202)									
EB1704258-005	LA1	EA025: Suspended Solids (SS)	----	1	mg/L	6	7	0.00	No Limit
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 781781)									
EB1704258-024	FB1	EA025: Suspended Solids (SS)	----	1	mg/L	<1	1	0.00	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 786790)									
EB1704258-001	B1	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	109	112	2.79	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	109	112	2.79	0% - 20%
EB1704258-011	S2	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	112	112	0.00	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	112	112	0.00	0% - 20%
ED037P: Alkalinity by PC Titrator (QC Lot: 786791)									
EB1704258-021	LA5-10	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	112	116	3.40	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	112	116	3.40	0% - 20%
EB1704474-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	1	<1	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	1	<1	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 779609)									
EB1704258-001	B1	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2310	2290	0.915	0% - 20%
EB1704258-011	S2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2470	2480	0.466	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 779611)									
EB1704258-021	LA5-10	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2590	2560	1.31	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 779606)									
EB1704258-001	B1	ED045G: Chloride	16887-00-6	1	mg/L	13500	13300	1.80	0% - 20%
EB1704258-011	S2	ED045G: Chloride	16887-00-6	1	mg/L	16500	14200	15.1	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 779610)									
EB1704258-021	LA5-10	ED045G: Chloride	16887-00-6	1	mg/L	14600	17200	16.3	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED093F: Dissolved Major Cations (QC Lot: 780176)									
EB1704258-010	M1	ED093F: Calcium	7440-70-2	1	mg/L	78	76	1.97	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	111	110	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	887	885	0.222	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	31	30	0.00	0% - 20%
EB1704258-001	B1	ED093F: Calcium	7440-70-2	1	mg/L	350	346	0.909	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	1120	1100	1.71	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	9100	8950	1.71	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	348	344	1.06	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 780177)									
EB1704291-006	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	28	28	0.00	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	2	2	0.00	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.00	No Limit
EB1704258-021	LA5-10	ED093F: Calcium	7440-70-2	1	mg/L	366	378	3.21	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	1160	1180	2.17	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	9320	9570	2.59	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	366	375	2.64	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 780175)									
EB1704258-011	S2	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1704258-001	B1	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 780178)									
EB1704258-021	LA5-10	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 785951)									
EB1704258-001	B1	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EB1704258-011	S2	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 785952)									
EB1704258-021	LA5-10	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 780162)									
EB1704258-001	B1	EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	10.0	10.2	1.68	0% - 20%
		EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	1.3	1.5	16.5	No Limit
		EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	1.4	1.5	0.00	No Limit
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 780162) - continued									
EB1704258-001	B1	EG093A-F: Barium	7440-39-3	1	µg/L	7	7	0.00	No Limit
		EG093A-F: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
		EG093A-F: Boron	7440-42-8	100	µg/L	3850	3940	2.36	0% - 20%
		EG093A-F: Aluminium	7429-90-5	5	µg/L	9	8	0.00	No Limit
		EG093A-F: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-F: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EB1704258-010	M1	EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	2.6	2.6	0.00	0% - 20%
		EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	3.2	3.1	4.24	No Limit
		EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	8.1	8.2	1.53	0% - 50%
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	0.5	0.5	0.00	No Limit
		EG093A-F: Barium	7440-39-3	1	µg/L	42	41	0.00	0% - 20%
		EG093A-F: Copper	7440-50-8	1	µg/L	2	2	0.00	No Limit
		EG093A-F: Boron	7440-42-8	100	µg/L	903	884	2.22	No Limit
		EG093A-F: Aluminium	7429-90-5	5	µg/L	20	17	16.1	No Limit
		EG093A-F: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-F: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 780163)									
EB1704258-001	B1	EG093B-F: Selenium	7782-49-2	2	µg/L	6	6	0.00	No Limit
		EG093B-F: Iron	7439-89-6	5	µg/L	<5	<5	0.00	No Limit
EB1704258-010	M1	EG093B-F: Selenium	7782-49-2	2	µg/L	<2	<2	0.00	No Limit
		EG093B-F: Iron	7439-89-6	5	µg/L	13	11	19.4	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 780164)									
EB1704258-021	LA5-10	EG093B-F: Selenium	7782-49-2	2	µg/L	8	7	0.00	No Limit
		EG093B-F: Iron	7439-89-6	5	µg/L	<5	<5	0.00	No Limit
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 780165)									
EB1704258-021	LA5-10	EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	10.8	10.8	0.00	0% - 20%
		EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Arsenic	7440-38-2	0.5	µg/L	1.4	1.3	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QC Lot: 780165) - continued									
EB1704258-021	LA5-10	EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-F: Manganese	7439-96-5	0.5	µg/L	9.9	9.4	5.65	0% - 50%
		EG093A-F: Nickel	7440-02-0	0.5	µg/L	0.6	<0.5	0.00	No Limit
		EG093A-F: Barium	7440-39-3	1	µg/L	13	13	0.00	0% - 50%
		EG093A-F: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
		EG093A-F: Boron	7440-42-8	100	µg/L	4270	4270	0.00	0% - 20%
		EG093A-F: Aluminium	7429-90-5	5	µg/L	17	17	0.00	No Limit
		EG093A-F: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-F: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 785942)									
EB1704258-001	B1	EG093B-T: Selenium	7782-49-2	2	µg/L	5	4	0.00	No Limit
		EG093B-T: Iron	7439-89-6	5	µg/L	983	982	0.00	0% - 20%
EB1704258-011	S2	EG093B-T: Selenium	7782-49-2	2	µg/L	4	5	0.00	No Limit
		EG093B-T: Iron	7439-89-6	5	µg/L	14	12	16.4	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 785943)									
EB1704258-001	B1	EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	9.6	9.8	1.90	0% - 20%
		EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Cobalt	7440-48-4	0.2	µg/L	0.8	0.9	0.00	No Limit
		EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Arsenic	7440-38-2	0.5	µg/L	1.6	1.6	0.00	No Limit
		EG093A-T: Chromium	7440-47-3	0.5	µg/L	0.6	1.0	47.6	No Limit
		EG093A-T: Manganese	7439-96-5	0.5	µg/L	21.2	21.4	0.685	0% - 20%
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	2.0	2.7	27.7	No Limit
		EG093A-T: Barium	7440-39-3	1	µg/L	8	8	0.00	No Limit
		EG093A-T: Copper	7440-50-8	1	µg/L	1	2	0.00	No Limit
		EG093A-T: Boron	7440-42-8	100	µg/L	4110	4120	0.124	0% - 20%
		EG093A-T: Aluminium	7429-90-5	5	µg/L	817	820	0.449	0% - 20%
		EG093A-T: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EB1704258-011	S2	EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	10.5	10.5	0.00	0% - 20%
		EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Arsenic	7440-38-2	0.5	µg/L	1.5	1.4	10.2	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 785943) - continued									
EB1704258-011	S2	EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	<0.5	0.00	No Limit
		EG093A-T: Manganese	7439-96-5	0.5	µg/L	1.6	1.5	9.25	No Limit
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	1.0	0.7	30.3	No Limit
		EG093A-T: Barium	7440-39-3	1	µg/L	5	5	0.00	No Limit
		EG093A-T: Copper	7440-50-8	1	µg/L	<1	<1	0.00	No Limit
		EG093A-T: Boron	7440-42-8	100	µg/L	4170	4150	0.360	0% - 20%
		EG093A-T: Aluminium	7429-90-5	5	µg/L	14	15	8.68	No Limit
		EG093A-T: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	<5	<5	0.00	No Limit
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 785944)									
EB1704436-001	Anonymous	EG093A-T: Beryllium	7440-41-7	0.1	µg/L	0.5	0.5	0.00	No Limit
		EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	3.0	3.2	6.56	0% - 20%
		EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG093A-T: Cadmium	7440-43-9	0.2	µg/L	0.3	0.3	0.00	No Limit
		EG093A-T: Cobalt	7440-48-4	0.2	µg/L	10.8	11.0	2.34	0% - 20%
		EG093A-T: Lead	7439-92-1	0.2	µg/L	16.6	16.7	0.00	0% - 20%
		EG093A-T: Antimony	7440-36-0	0.5	µg/L	2.7	2.9	9.39	No Limit
		EG093A-T: Arsenic	7440-38-2	0.5	µg/L	12.8	12.8	0.00	0% - 20%
		EG093A-T: Chromium	7440-47-3	0.5	µg/L	45.4	47.9	5.48	0% - 20%
		EG093A-T: Manganese	7439-96-5	0.5	µg/L	706	718	1.64	0% - 20%
		EG093A-T: Nickel	7440-02-0	0.5	µg/L	109	109	0.357	0% - 20%
		EG093A-T: Barium	7440-39-3	1	µg/L	335	337	0.428	0% - 20%
		EG093A-T: Copper	7440-50-8	1	µg/L	470	467	0.577	0% - 20%
		EG093A-T: Boron	7440-42-8	100	µg/L	169	165	2.60	No Limit
		EG093A-T: Aluminium	7429-90-5	5	µg/L	9340	9910	5.91	0% - 20%
		EG093A-T: Tin	7440-31-5	5	µg/L	<5	<5	0.00	No Limit
		EG093A-T: Zinc	7440-66-6	5	µg/L	56500	56100	0.736	0% - 20%
EG093T: Total Metals in Saline Water by ORC-ICPMS (QC Lot: 785945)									
EB1704436-001	Anonymous	EG093B-T: Selenium	7782-49-2	2	µg/L	<2	<2	0.00	No Limit
		EG093B-T: Iron	7439-89-6	5	µg/L	25500	26300	3.12	0% - 20%
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 781504)									
EB1704258-010	M1	EG094B-F: Selenium	7782-49-2	0.2	µg/L	0.9	1.0	0.00	No Limit
		EG094B-F: Iron	7439-89-6	2	µg/L	10	13	25.8	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 781505)									
EB1704258-010	M1	EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	<0.1	0.00	No Limit
		EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	1.6	1.6	0.00	0% - 50%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 781505) - continued									
EB1704258-010	M1	EG094A-F: Silver	7440-22-4	0.1	µg/L	0.4	<0.1	114	No Limit
		EG094A-F: Antimony	7440-36-0	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-F: Arsenic	7440-38-2	0.2	µg/L	4.1	4.2	0.00	0% - 20%
		EG094A-F: Chromium	7440-47-3	0.2	µg/L	0.2	0.2	0.00	No Limit
		EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.2	<0.2	0.00	No Limit
		EG094A-F: Barium	7440-39-3	0.5	µg/L	26.1	26.0	0.399	0% - 20%
		EG094A-F: Copper	7440-50-8	0.5	µg/L	1.9	1.9	0.00	No Limit
		EG094A-F: Manganese	7439-96-5	0.5	µg/L	0.8	0.9	12.0	No Limit
		EG094A-F: Nickel	7440-02-0	0.5	µg/L	0.8	0.9	12.6	No Limit
		EG094A-F: Zinc	7440-66-6	1	µg/L	<1	<1	0.00	No Limit
		EG094A-F: Aluminium	7429-90-5	5	µg/L	10	12	21.7	No Limit
		EG094A-F: Boron	7440-42-8	5	µg/L	276	281	1.80	0% - 20%
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 781508)									
EB1704258-010	M1	EG094A-T: Cadmium	7440-43-9	0.05	µg/L	0.36	0.34	6.53	No Limit
		EG094A-T: Beryllium	7440-41-7	0.1	µg/L	0.3	0.3	0.00	No Limit
		EG094A-T: Cobalt	7440-48-4	0.1	µg/L	39.3	39.5	0.503	0% - 20%
		EG094A-T: Lead	7439-92-1	0.1	µg/L	58.8	59.1	0.404	0% - 20%
		EG094A-T: Molybdenum	7439-98-7	0.1	µg/L	3.4	3.7	6.66	0% - 20%
		EG094A-T: Silver	7440-22-4	0.1	µg/L	0.4	<0.1	109	No Limit
		EG094A-T: Antimony	7440-36-0	0.2	µg/L	0.6	0.5	0.00	No Limit
		EG094A-T: Arsenic	7440-38-2	0.2	µg/L	39.9	39.7	0.673	0% - 20%
		EG094A-T: Chromium	7440-47-3	0.2	µg/L	69.8	69.1	1.10	0% - 20%
		EG094A-T: Tin	7440-31-5	0.2	µg/L	0.8	0.7	0.00	No Limit
		EG094A-T: Barium	7440-39-3	0.5	µg/L	192	194	0.776	0% - 20%
		EG094A-T: Copper	7440-50-8	0.5	µg/L	131	131	0.00	0% - 20%
		EG094A-T: Manganese	7439-96-5	0.5	µg/L	1930	1930	0.320	0% - 20%
		EG094A-T: Nickel	7440-02-0	0.5	µg/L	75.1	75.4	0.303	0% - 20%
		EG094A-T: Zinc	7440-66-6	1	µg/L	161	163	1.12	0% - 20%
		EG094A-T: Aluminium	7429-90-5	5	µg/L	30400	30200	0.817	0% - 20%
		EG094A-T: Boron	7440-42-8	5	µg/L	175	192	9.04	0% - 20%
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 781509)									
EB1704258-010	M1	EG094B-T: Selenium	7782-49-2	0.2	µg/L	2.9	3.3	12.9	0% - 50%
		EG094B-T: Iron	7439-89-6	2	µg/L	79700	79700	0.101	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 780376)									
EB1704228-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.68	0.66	3.51	0% - 20%
EB1704258-008	LA4	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.10	0.09	12.4	0% - 50%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 780378)									
EB1704258-018	LA2-10	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.15	0.13	11.4	0% - 50%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 779607)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 779607) - continued									
EB1704258-001	B1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1704258-011	S2	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 779612)									
EB1704258-021	LA5-10	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 780377)									
EB1704228-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1704258-008	LA4	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 780379)									
EB1704294-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.09	0.08	0.00	No Limit
EB1704258-018	LA2-10	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 791594)									
EB1704258-001	B1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.00	No Limit
EB1704258-011	S2	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 791595)									
EB1704258-021	LA5-10	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 791593)									
EB1704258-001	B1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.06	0.11	65.4	No Limit
EB1704258-011	S2	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 791596)									
EB1704258-021	LA5-10	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.06	0.06	0.00	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 779608)									
EB1704258-001	B1	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EB1704258-011	S2	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 779613)									
EB1704258-021	LA5-10	EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 807904)								
EG005-SDH: Aluminium	7429-90-5	50	mg/kg	<50	4579.7 mg/kg	116	86	130
EG005-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	9.2 mg/kg	106	73	116
EG005-SDH: Barium	7440-39-3	1	mg/kg	<1.0	71.9 mg/kg	95.3	70	130
EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.51234 mg/kg	104	70	130
EG005-SDH: Cobalt	7440-48-4	0.5	mg/kg	<0.5	2.6 mg/kg	120	70	130
EG005-SDH: Chromium	7440-47-3	1	mg/kg	<1.0	5 mg/kg	120	70	124
EG005-SDH: Copper	7440-50-8	1	mg/kg	<1.0	9.2 mg/kg	112	75	113
EG005-SDH: Iron	7439-89-6	50	mg/kg	<50	6700.5 mg/kg	122	71	123
EG005-SDH: Lead	7439-92-1	1	mg/kg	<1.0	28 mg/kg	113	87	130
EG005-SDH: Manganese	7439-96-5	10	mg/kg	<10	246.9 mg/kg	110	70	130
EG005-SDH: Nickel	7440-02-0	1	mg/kg	<1.0	3.8 mg/kg	114	70	128
EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	1.03852 mg/kg	94.6	89	117
EG005-SDH: Vanadium	7440-62-2	2	mg/kg	<2.0	11.1 mg/kg	113	70	130
EG005-SDH: Zinc	7440-66-6	1	mg/kg	<1.0	49.2 mg/kg	117	70	117
EG005-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 836052)								
EG005-SDH: Aluminium	7429-90-5	50	mg/kg	<50	4579.7 mg/kg	104	86	130
EG005-SDH: Arsenic	7440-38-2	1	mg/kg	<1.0	9.2 mg/kg	99.3	73	116
EG005-SDH: Barium	7440-39-3	1	mg/kg	<1.0	71.9 mg/kg	92.9	70	130
EG005-SDH: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.51234 mg/kg	96.8	70	130
EG005-SDH: Cobalt	7440-48-4	0.5	mg/kg	<0.5	2.6 mg/kg	108	70	130
EG005-SDH: Chromium	7440-47-3	1	mg/kg	<1.0	5 mg/kg	103	70	124
EG005-SDH: Copper	7440-50-8	1	mg/kg	<1.0	9.2 mg/kg	109	75	113
EG005-SDH: Iron	7439-89-6	50	mg/kg	<50	6700.5 mg/kg	109	71	123
EG005-SDH: Lead	7439-92-1	1	mg/kg	<1.0	28 mg/kg	105	87	130
EG005-SDH: Manganese	7439-96-5	10	mg/kg	<10	246.9 mg/kg	103	70	130
EG005-SDH: Nickel	7440-02-0	1	mg/kg	<1.0	3.8 mg/kg	109	70	128
EG005-SDH: Silver	7440-22-4	1	mg/kg	<1.0	1.03852 mg/kg	89.7	89	117
EG005-SDH: Vanadium	7440-62-2	2	mg/kg	<2.0	11.1 mg/kg	106	70	130
EG005-SDH: Zinc	7440-66-6	1	mg/kg	<1.0	49.2 mg/kg	116	70	117
EG005T: Total Metals by ICP-AES (QCLot: 807909)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	118.9 mg/kg	90.2	84	123
EG005T: Barium	7440-39-3	10	mg/kg	<10	105.1967 mg/kg	96.2	89	129
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EG005T: Total Metals by ICP-AES (QCLot: 807909) - continued								
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.87125 mg/kg	107	88	117
EG005T: Chromium	7440-47-3	2	mg/kg	<2	22.7 mg/kg	96.8	83	125
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	11.5 mg/kg	102	89	125
EG005T: Copper	7440-50-8	5	mg/kg	<5	55 mg/kg	102	86	122
EG005T: Iron	7439-89-6	50	mg/kg	<50	34900 mg/kg	97.6	70	120
EG005T: Lead	7439-92-1	5	mg/kg	<5	72.1 mg/kg	96.8	84	119
EG005T: Manganese	7439-96-5	5	mg/kg	<5	604.6 mg/kg	102	84	113
EG005T: Nickel	7440-02-0	2	mg/kg	<2	16.6 mg/kg	97.1	89	126
EG005T: Zinc	7440-66-6	5	mg/kg	<5	182.3 mg/kg	99.9	87	127
EG005T: Total Metals by ICP-AES (QCLot: 807916)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	118.9 mg/kg	98.4	84	123
EG005T: Barium	7440-39-3	10	mg/kg	<10	105.1967 mg/kg	94.9	89	129
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.87125 mg/kg	109	88	117
EG005T: Chromium	7440-47-3	2	mg/kg	<2	22.7 mg/kg	98.6	83	125
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	11.5 mg/kg	104	89	125
EG005T: Copper	7440-50-8	5	mg/kg	<5	55 mg/kg	104	86	122
EG005T: Iron	7439-89-6	50	mg/kg	<50	34900 mg/kg	98.0	70	120
EG005T: Lead	7439-92-1	5	mg/kg	<5	72.1 mg/kg	103	84	119
EG005T: Manganese	7439-96-5	5	mg/kg	<5	604.6 mg/kg	105	84	113
EG005T: Nickel	7440-02-0	2	mg/kg	<2	16.6 mg/kg	98.9	89	126
EG005T: Zinc	7440-66-6	5	mg/kg	<5	182.3 mg/kg	100	87	127
EG005T: Total Metals by ICP-AES (QCLot: 836058)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	118.9 mg/kg	109	84	123
EG005T: Barium	7440-39-3	10	mg/kg	<10	105.1967 mg/kg	96.7	89	129
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	1.87125 mg/kg	89.5	88	117
EG005T: Chromium	7440-47-3	2	mg/kg	<2	22.7 mg/kg	93.4	83	125
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	11.5 mg/kg	102	89	125
EG005T: Copper	7440-50-8	5	mg/kg	<5	55 mg/kg	103	86	122
EG005T: Iron	7439-89-6	50	mg/kg	<50	34900 mg/kg	102	70	120
EG005T: Lead	7439-92-1	5	mg/kg	<5	72.1 mg/kg	96.2	84	119
EG005T: Manganese	7439-96-5	5	mg/kg	<5	604.6 mg/kg	98.1	84	113
EG005T: Nickel	7440-02-0	2	mg/kg	<2	16.6 mg/kg	95.3	89	126
EG005T: Zinc	7440-66-6	5	mg/kg	<5	182.3 mg/kg	103	87	127
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 807905)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 807905) - continued								
EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	0.061 mg/kg	91.6	70	130
EG020-SDH: Tin	7440-31-5	2	mg/kg	<2.0	0.521 mg/kg	97.1	70	130
EG020-SDH: 1M HCl Extractable metals by ICPMS (QCLot: 836053)								
EG020-SDH: Selenium	7782-49-2	0.5	mg/kg	<0.5	0.061 mg/kg	98.6	70	130
EG020-SDH: Tin	7440-31-5	2	mg/kg	<2.0	0.521 mg/kg	119	70	130
EG020T: Total Metals by ICP-MS (QCLot: 807910)								
EG020X-T: Antimony	7440-36-0	0.1	mg/kg	<0.1	----	----	----	----
EG020X-T: Tin	7440-31-5	0.1	mg/kg	<0.1	4.48 mg/kg	109	79	130
EG020T: Total Metals by ICP-MS (QCLot: 807912)								
EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 807913)								
EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	3.16 mg/kg	91.0	72	120
EG020T: Total Metals by ICP-MS (QCLot: 807914)								
EG020X-T: Antimony	7440-36-0	0.1	mg/kg	<0.1	----	----	----	----
EG020X-T: Tin	7440-31-5	0.1	mg/kg	<0.1	4.48 mg/kg	111	79	130
EG020T: Total Metals by ICP-MS (QCLot: 807915)								
EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 807918)								
EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	3.16 mg/kg	107	72	120
EG020T: Total Metals by ICP-MS (QCLot: 836056)								
EG020X-T: Antimony	7440-36-0	0.1	mg/kg	<0.1	----	----	----	----
EG020X-T: Tin	7440-31-5	0.1	mg/kg	<0.1	4.48 mg/kg	116	79	130
EG020T: Total Metals by ICP-MS (QCLot: 836057)								
EG020Y-T: Selenium	7782-49-2	1	mg/kg	<1	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 836060)								
EG020Z-T: Silver	7440-22-4	0.1	mg/kg	<0.1	3.16 mg/kg	99.8	72	120
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 807906)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	1.863 mg/kg	127	70	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 836051)								
EG035-SDH: Mercury	7439-97-6	0.1	mg/kg	<0.10	1.863 mg/kg	107	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 807911)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.111 mg/kg	96.3	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 807917)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.111 mg/kg	103	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 836059)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.111 mg/kg	127	70	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EK055: Ammonia as N (QCLot: 807246)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	25 mg/kg	98.6	80	110
EK055: Ammonia as N (QCLot: 836154)								
EK055: Ammonia as N	7664-41-7	20	mg/kg	<20	25 mg/kg	100	80	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 807902)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	101	83	111
EK057G: Nitrite as N by Discrete Analyser (QCLot: 836050)								
EK057G: Nitrite as N (Sol.)	14797-65-0	0.1	mg/kg	<0.1	2.5 mg/kg	101	83	111
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 807903)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	95.2	86	115
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 836049)								
EK059G: Nitrite + Nitrate as N (Sol.)	----	0.1	mg/kg	<0.1	2.5 mg/kg	95.9	86	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 807908)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	877 mg/kg	96.9	70	110
				<20	3644 mg/kg	94.6	70	110
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 836054)								
EK061G: Total Kjeldahl Nitrogen as N	----	20	mg/kg	<20	877 mg/kg	90.5	70	110
				<20	3644 mg/kg	89.8	70	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 807907)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	766 mg/kg	92.9	70	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 836055)								
EK067G: Total Phosphorus as P	----	2	mg/kg	<2	766 mg/kg	74.7	70	110
				<2	1200 mg/kg	91.4	70	110
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 807901)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	103	89	115
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 836048)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.1	mg/kg	<0.1	2.5 mg/kg	100	89	115
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 817880)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	110	70	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 836792)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	113	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 817881)								
EP003TC: Total Carbon	TC	0.02	%	<0.02	100 %	109	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 836793)								
EP003TC: Total Carbon	TC	0.02	%	<0.02	100 %	110	70	130

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 779584)								
EA025: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	100	84	120
				<1	1000 mg/L	100	84	120
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 780202)								
EA025: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	101	84	120
				<1	1000 mg/L	96.2	84	120
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 781781)								
EA025: Suspended Solids (SS)	----	1	mg/L	<1	150 mg/L	105	84	120
				<1	1000 mg/L	101	84	120
ED037P: Alkalinity by PC Titrator (QCLot: 786790)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	98.7	80	120
ED037P: Alkalinity by PC Titrator (QCLot: 786791)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	99.6	80	120
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 779609)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	105	85	118
				<1	100 mg/L	99.9	85	118
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 779611)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	104	85	118
				<1	100 mg/L	100	85	118
ED045G: Chloride by Discrete Analyser (QCLot: 779606)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.7	90	115
				<1	1000 mg/L	99.7	90	115
ED045G: Chloride by Discrete Analyser (QCLot: 779610)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	96.2	90	115
				<1	1000 mg/L	100	90	115
ED093F: Dissolved Major Cations (QCLot: 780176)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations (QCLot: 780177)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 780175)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.9	84	118
EG035F: Dissolved Mercury by FIMS (QCLot: 780178)								

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	*CAS Number*	*LOR*	*Unit*	*Result*	*Concentration*	*LCS*	*Low*	*High*
EG035F: Dissolved Mercury by FIMS (QCLot: 780178) - continued								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	102	84	118
EG035T: Total Recoverable Mercury by FIMS (QCLot: 785951)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	92.5	80	100
EG035T: Total Recoverable Mercury by FIMS (QCLot: 785952)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	93.9	80	100
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780162)								
EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	94.7	85	118
EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	98.9	87	115
EG093A-F: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	96.5	87	116
EG093A-F: Barium	7440-39-3	1	µg/L	<1	50 µg/L	98.3	87	114
EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	108	80	120
EG093A-F: Boron	7440-42-8	100	µg/L	<100	500 µg/L	94.0	82	114
EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	95.2	88	114
EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	95.0	83	115
EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	96.5	86	116
EG093A-F: Copper	7440-50-8	1	µg/L	<1	20 µg/L	93.6	81	117
EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	96.2	80	117
EG093A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	102	80	119
EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	104	80	118
EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	95.0	87	117
EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	86.1	80	127
EG093A-F: Tin	7440-31-5	5	µg/L	<5	10 µg/L	103	82	118
EG093A-F: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	83.8	81	120
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780163)								
EG093B-F: Iron	7439-89-6	5	µg/L	<5	50 µg/L	95.7	78	123
EG093B-F: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	99.5	87	121
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780164)								
EG093B-F: Iron	7439-89-6	5	µg/L	<5	50 µg/L	107	78	123
EG093B-F: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	100	87	121
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780165)								
EG093A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	90.4	85	118
EG093A-F: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	97.1	87	115
EG093A-F: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	96.6	87	116
EG093A-F: Barium	7440-39-3	1	µg/L	<1	50 µg/L	98.2	87	114
EG093A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	106	80	120
EG093A-F: Boron	7440-42-8	100	µg/L	<100	500 µg/L	100	82	114
EG093A-F: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	91.7	88	114
EG093A-F: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	99.6	83	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780165) - continued								
EG093A-F: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	99.5	86	116
EG093A-F: Copper	7440-50-8	1	µg/L	<1	20 µg/L	102	81	117
EG093A-F: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	97.9	80	117
EG093A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	97.2	80	119
EG093A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	104	80	118
EG093A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	97.0	87	117
EG093A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	81.7	80	127
EG093A-F: Tin	7440-31-5	5	µg/L	<5	10 µg/L	96.7	82	118
EG093A-F: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	87.1	81	120
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785942)								
EG093B-T: Iron	7439-89-6	5	µg/L	<5	50 µg/L	101	80	128
EG093B-T: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	92.9	89	119
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785943)								
EG093A-T: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	98.1	85	120
EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	95.8	83	116
EG093A-T: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	96.3	86	117
EG093A-T: Barium	7440-39-3	1	µg/L	<1	50 µg/L	94.9	84	118
EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	105	87	120
EG093A-T: Boron	7440-42-8	100	µg/L	<105	500 µg/L	100	83	123
EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	89.8	84	115
EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	95.0	84	120
EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	97.8	85	116
EG093A-T: Copper	7440-50-8	1	µg/L	<1	20 µg/L	98.4	84	119
EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	92.2	84	120
EG093A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	99.4	86	124
EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	103	84	118
EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	106	80	120
EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	86.8	80	120
EG093A-T: Tin	7440-31-5	5	µg/L	<5	10 µg/L	95.0	83	114
EG093A-T: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	96.2	81	124
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785944)								
EG093A-T: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	96.0	85	120
EG093A-T: Antimony	7440-36-0	0.5	µg/L	<0.5	10 µg/L	96.9	83	116
EG093A-T: Arsenic	7440-38-2	0.5	µg/L	<0.5	10 µg/L	102	86	117
EG093A-T: Barium	7440-39-3	1	µg/L	<1	50 µg/L	91.2	84	118
EG093A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	92.7	87	120
EG093A-T: Boron	7440-42-8	100	µg/L	<105	500 µg/L	98.5	83	123
EG093A-T: Cadmium	7440-43-9	0.2	µg/L	<0.2	10 µg/L	86.9	84	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785944) - continued								
EG093A-T: Chromium	7440-47-3	0.5	µg/L	<0.5	10 µg/L	94.9	84	120
EG093A-T: Cobalt	7440-48-4	0.2	µg/L	<0.2	10 µg/L	99.9	85	116
EG093A-T: Copper	7440-50-8	1	µg/L	<1	20 µg/L	102	84	119
EG093A-T: Lead	7439-92-1	0.2	µg/L	<0.2	10 µg/L	91.9	84	120
EG093A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	87.1	86	124
EG093A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	100	84	118
EG093A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	98.9	80	120
EG093A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	85.7	80	120
EG093A-T: Tin	7440-31-5	5	µg/L	<5	10 µg/L	87.3	83	114
EG093A-T: Zinc	7440-66-6	5	µg/L	<5	20 µg/L	91.2	81	124
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785945)								
EG093B-T: Iron	7439-89-6	5	µg/L	<5	50 µg/L	98.8	80	128
EG093B-T: Selenium	7782-49-2	2	µg/L	<2	10 µg/L	103	89	119
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 781504)								
EG094B-F: Iron	7439-89-6	2	µg/L	<2	50 µg/L	93.5	80	120
EG094B-F: Selenium	7782-49-2	0.2	µg/L	<0.2	10 µg/L	103	80	120
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 781505)								
EG094A-F: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	115	80	120
EG094A-F: Antimony	7440-36-0	0.2	µg/L	<0.2	10 µg/L	103	80	120
EG094A-F: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	96.2	80	120
EG094A-F: Barium	7440-39-3	0.5	µg/L	<0.5	50 µg/L	95.5	80	120
EG094A-F: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	118	80	120
EG094A-F: Boron	7440-42-8	5	µg/L	<5	50 µg/L	94.6	80	120
EG094A-F: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	103	80	120
EG094A-F: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	95.6	80	120
EG094A-F: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	98.7	80	120
EG094A-F: Copper	7440-50-8	0.5	µg/L	<0.5	20 µg/L	99.3	80	120
EG094A-F: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	91.3	80	120
EG094A-F: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	117	80	120
EG094A-F: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	95.0	80	120
EG094A-F: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	93.1	80	120
EG094A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	99.5	80	120
EG094A-F: Tin	7440-31-5	0.2	µg/L	<0.2	10 µg/L	96.1	80	120
EG094A-F: Zinc	7440-66-6	1	µg/L	<1	20 µg/L	102	80	120
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 781508)								
EG094A-T: Aluminium	7429-90-5	5	µg/L	<5	50 µg/L	108	80	120
EG094A-T: Antimony	7440-36-0	0.2	µg/L	<0.2	10 µg/L	104	80	120
EG094A-T: Arsenic	7440-38-2	0.2	µg/L	<0.2	10 µg/L	96.3	80	120

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 781508) - continued								
EG094A-T: Barium	7440-39-3	0.5	µg/L	<0.5	50 µg/L	100	80	120
EG094A-T: Beryllium	7440-41-7	0.1	µg/L	<0.1	10 µg/L	116	80	120
EG094A-T: Boron	7440-42-8	5	µg/L	<5	50 µg/L	87.4	80	120
EG094A-T: Cadmium	7440-43-9	0.05	µg/L	<0.05	10 µg/L	98.8	80	120
EG094A-T: Chromium	7440-47-3	0.2	µg/L	<0.2	10 µg/L	100	80	120
EG094A-T: Cobalt	7440-48-4	0.1	µg/L	<0.1	10 µg/L	98.2	80	120
EG094A-T: Copper	7440-50-8	0.5	µg/L	<0.5	20 µg/L	101	80	120
EG094A-T: Lead	7439-92-1	0.1	µg/L	<0.1	10 µg/L	96.5	80	120
EG094A-T: Manganese	7439-96-5	0.5	µg/L	<0.5	10 µg/L	97.1	80	120
EG094A-T: Molybdenum	7439-98-7	0.1	µg/L	<0.1	10 µg/L	103	80	120
EG094A-T: Nickel	7440-02-0	0.5	µg/L	<0.5	10 µg/L	93.9	80	120
EG094A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	103	80	120
EG094A-T: Tin	7440-31-5	0.2	µg/L	<0.2	10 µg/L	102	80	120
EG094A-T: Zinc	7440-66-6	1	µg/L	<1	20 µg/L	91.5	80	120
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 781509)								
EG094B-T: Iron	7439-89-6	2	µg/L	<2	50 µg/L	96.1	80	120
EG094B-T: Selenium	7782-49-2	0.2	µg/L	<0.2	10 µg/L	94.0	80	120
EK055G: Ammonia as N by Discrete Analyser (QCLot: 780376)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	99.0	86	112
EK055G: Ammonia as N by Discrete Analyser (QCLot: 780378)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	99.0	86	112
EK057G: Nitrite as N by Discrete Analyser (QCLot: 779607)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	94.7	90	110
EK057G: Nitrite as N by Discrete Analyser (QCLot: 779612)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	92.0	90	110
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 780377)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	89	115
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 780379)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	89	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 791594)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	110	70	111
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 791595)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	82.3	70	111
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 791593)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	95.8	77	109
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 791596)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	97.5	77	109

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 779608)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	100	88	115
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 779613)								
EK071G: Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	0.5 mg/L	94.1	88	115
EP020: Oil and Grease (O&G) (QCLot: 784286)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	93.0	88	112
EP020: Oil and Grease (O&G) (QCLot: 784287)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	98.3	88	112

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG005-SDH: 1M HCl-Extractable Metals by ICPAES (QCLot: 807904)							
EB1704258-038	W2 <2000µm Fraction	EG005-SDH: Arsenic	7440-38-2	25 mg/kg	87.9	70	130
		EG005-SDH: Barium	7440-39-3	25 mg/kg	106	70	130
		EG005-SDH: Cadmium	7440-43-9	12.5 mg/kg	95.3	70	130
		EG005-SDH: Cobalt	7440-48-4	25 mg/kg	96.0	70	130
		EG005-SDH: Chromium	7440-47-3	25 mg/kg	94.4	70	130
		EG005-SDH: Copper	7440-50-8	25 mg/kg	86.0	70	130
		EG005-SDH: Lead	7439-92-1	25 mg/kg	95.6	70	130
		EG005-SDH: Manganese	7439-96-5	25 mg/kg	# Not Determined	70	130
		EG005-SDH: Nickel	7440-02-0	25 mg/kg	93.6	70	130
		EG005-SDH: Vanadium	7440-62-2	25 mg/kg	92.9	70	130
		EG005-SDH: Zinc	7440-66-6	25 mg/kg	85.8	70	130
EG005T: Total Metals by ICP-AES (QCLot: 807909)							
EB1704258-038	W2 <2000µm Fraction	EG005T: Arsenic	7440-38-2	50 mg/kg	93.4	70	130
		EG005T: Barium	7440-39-3	50 mg/kg	109	70	130
		EG005T: Cadmium	7440-43-9	25 mg/kg	94.5	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	90.1	70	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	94.0	70	130
		EG005T: Copper	7440-50-8	50 mg/kg	91.3	70	130
		EG005T: Lead	7439-92-1	50 mg/kg	90.7	70	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG005T: Total Metals by ICP-AES (QCLot: 807909) - continued							
EB1704258-038	W2 <2000µm Fraction	EG005T: Nickel	7440-02-0	50 mg/kg	90.2	70	130
		EG005T: Zinc	7440-66-6	50 mg/kg	83.6	70	130
EG005T: Total Metals by ICP-AES (QCLot: 807916)							
EB1704258-058	S2 <63µm	EG005T: Arsenic	7440-38-2	50 mg/kg	97.5	70	130
		EG005T: Barium	7440-39-3	50 mg/kg	120	70	130
		EG005T: Cadmium	7440-43-9	25 mg/kg	103	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	104	70	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	104	70	130
		EG005T: Copper	7440-50-8	50 mg/kg	105	70	130
		EG005T: Lead	7439-92-1	50 mg/kg	99.7	70	130
		EG005T: Manganese	7439-96-5	50 mg/kg	# Not Determined	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	97.6	70	130
		EG005T: Zinc	7440-66-6	50 mg/kg	98.8	70	130
EG005T: Total Metals by ICP-AES (QCLot: 836058)							
EB1704258-059	S2-D <2000µm	EG005T: Arsenic	7440-38-2	50 mg/kg	111	70	130
		EG005T: Barium	7440-39-3	50 mg/kg	118	70	130
		EG005T: Cadmium	7440-43-9	25 mg/kg	115	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	114	70	130
		EG005T: Cobalt	7440-48-4	50 mg/kg	111	70	130
		EG005T: Copper	7440-50-8	50 mg/kg	110	70	130
		EG005T: Lead	7439-92-1	50 mg/kg	109	70	130
		EG005T: Manganese	7439-96-5	50 mg/kg	111	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	112	70	130
		EG005T: Zinc	7440-66-6	50 mg/kg	111	70	130
EG035-SDH: 1M HCl extractable Mercury by FIMS (QCLot: 807906)							
EB1704258-038	W2 <2000µm Fraction	EG035-SDH: Mercury	7439-97-6	1.25 mg/kg	86.1	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 807911)							
EB1704258-038	W2 <2000µm Fraction	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	89.1	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 807917)							
EB1704258-058	S2 <63µm	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	90.7	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 836059)							
EB1704258-059	S2-D <2000µm	EG035T-LL: Mercury	7439-97-6	0.5 mg/kg	98.3	70	130
EK055: Ammonia as N (QCLot: 807246)							
EB1704258-037	B1 <2000µm Fraction	EK055: Ammonia as N	7664-41-7	100 mg/kg	99.4	70	130
EK055: Ammonia as N (QCLot: 836154)							

Work Order : EB1704258 Amendment 1
Client : COFFEY ENVIRONMENTS PTY LTD
Project : 520

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EK055: Ammonia as N (QCLot: 836154) - continued							
EB1704258-059	S2-D <2000µm	EK055: Ammonia as N	7664-41-7	100 mg/kg	96.6	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 807902)							
EB1704258-041	LA1 <2000µm Fraction	EK057G: Nitrite as N (Sol.)	14797-65-0	2 mg/kg	99.6	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 807903)							
EB1704258-041	LA1 <2000µm Fraction	EK059G: Nitrite + Nitrate as N (Sol.)	----	2 mg/kg	92.3	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 807908)							
EB1704258-038	W2 <2000µm Fraction	EK061G: Total Kjeldahl Nitrogen as N	----	500 mg/kg	120	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 807907)							
EB1704258-038	W2 <2000µm Fraction	EK067G: Total Phosphorus as P	----	100 mg/kg	# Not Determined	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 807901)							
EB1704258-041	LA1 <2000µm Fraction	EK071G: Reactive Phosphorus as P	14265-44-2	2 mg/kg	98.2	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 779609)							
EB1704258-002	W2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 779611)							
EB1704258-022	M1-10	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 779606)							
EB1704258-002	W2	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70	130
ED045G: Chloride by Discrete Analyser (QCLot: 779610)							
EB1704258-022	M1-10	ED045G: Chloride	16887-00-6	400 mg/L	# Not Determined	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 780175)							
EB1704258-002	W2	EG035F: Mercury	7439-97-6	0.01 mg/L	84.0	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 780178)							
EB1704258-022	M1-10	EG035F: Mercury	7439-97-6	0.01 mg/L	88.0	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 785951)							
EB1704258-002	W2	EG035T: Mercury	7439-97-6	0.01 mg/L	78.7	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 785952)							

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 785952) - continued							
EB1704258-022	M1-10	EG035T: Mercury	7439-97-6	0.01 mg/L	76.8	70	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780162)							
EB1704258-002	W2	EG093A-F: Arsenic	7440-38-2	50 µg/L	101	70	130
		EG093A-F: Barium	7440-39-3	250 µg/L	97.2	70	130
		EG093A-F: Beryllium	7440-41-7	50 µg/L	110	70	130
		EG093A-F: Cadmium	7440-43-9	50 µg/L	94.0	70	130
		EG093A-F: Chromium	7440-47-3	50 µg/L	95.8	70	130
		EG093A-F: Cobalt	7440-48-4	50 µg/L	97.2	70	130
		EG093A-F: Copper	7440-50-8	100 µg/L	96.9	70	130
		EG093A-F: Lead	7439-92-1	50 µg/L	96.9	70	130
		EG093A-F: Manganese	7439-96-5	50 µg/L	98.2	70	130
		EG093A-F: Nickel	7440-02-0	50 µg/L	98.8	70	130
		EG093A-F: Zinc	7440-66-6	100 µg/L	97.2	70	130
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS (QCLot: 780165)							
EB1704258-022	M1-10	EG093A-F: Arsenic	7440-38-2	50 µg/L	101	70	130
		EG093A-F: Barium	7440-39-3	250 µg/L	97.3	70	130
		EG093A-F: Beryllium	7440-41-7	50 µg/L	110	70	130
		EG093A-F: Cadmium	7440-43-9	50 µg/L	92.9	70	130
		EG093A-F: Chromium	7440-47-3	50 µg/L	95.8	70	130
		EG093A-F: Cobalt	7440-48-4	50 µg/L	98.0	70	130
		EG093A-F: Copper	7440-50-8	100 µg/L	95.5	70	130
		EG093A-F: Lead	7439-92-1	50 µg/L	95.5	70	130
		EG093A-F: Manganese	7439-96-5	50 µg/L	96.8	70	130
		EG093A-F: Nickel	7440-02-0	50 µg/L	97.2	70	130
		EG093A-F: Zinc	7440-66-6	100 µg/L	97.3	70	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785943)							
EB1704258-002	W2	EG093A-T: Arsenic	7440-38-2	50 µg/L	104	70	130
		EG093A-T: Barium	7440-39-3	250 µg/L	97.6	70	130
		EG093A-T: Beryllium	7440-41-7	50 µg/L	108	70	130
		EG093A-T: Cadmium	7440-43-9	50 µg/L	94.1	70	130
		EG093A-T: Chromium	7440-47-3	50 µg/L	105	70	130
		EG093A-T: Cobalt	7440-48-4	50 µg/L	107	70	130
		EG093A-T: Copper	7440-50-8	100 µg/L	108	70	130
		EG093A-T: Lead	7439-92-1	50 µg/L	103	70	130
		EG093A-T: Manganese	7439-96-5	50 µg/L	101	70	130
		EG093A-T: Nickel	7440-02-0	50 µg/L	105	70	130
		EG093A-T: Zinc	7440-66-6	100 µg/L	105	70	130
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785944)							

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG093T: Total Metals in Saline Water by ORC-ICPMS (QCLot: 785944) - continued							
EB1704258-023	V1-10-D	EG093A-T: Arsenic	7440-38-2	50 µg/L	102	70	130
		EG093A-T: Barium	7440-39-3	250 µg/L	97.4	70	130
		EG093A-T: Beryllium	7440-41-7	50 µg/L	95.7	70	130
		EG093A-T: Cadmium	7440-43-9	50 µg/L	92.8	70	130
		EG093A-T: Chromium	7440-47-3	50 µg/L	102	70	130
		EG093A-T: Cobalt	7440-48-4	50 µg/L	108	70	130
		EG093A-T: Copper	7440-50-8	100 µg/L	109	70	130
		EG093A-T: Lead	7439-92-1	50 µg/L	99.8	70	130
		EG093A-T: Manganese	7439-96-5	50 µg/L	98.9	70	130
		EG093A-T: Nickel	7440-02-0	50 µg/L	110	70	130
		EG093A-T: Zinc	7440-66-6	100 µg/L	104	70	130
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 781505)							
EB1704258-024	FB1	EG094A-F: Arsenic	7440-38-2	50 µg/L	102	70	130
		EG094A-F: Barium	7440-39-3	250 µg/L	96.6	70	130
		EG094A-F: Beryllium	7440-41-7	50 µg/L	115	70	130
		EG094A-F: Cadmium	7440-43-9	50 µg/L	99.4	70	130
		EG094A-F: Chromium	7440-47-3	50 µg/L	78.5	70	130
		EG094A-F: Cobalt	7440-48-4	50 µg/L	98.0	70	130
		EG094A-F: Copper	7440-50-8	100 µg/L	98.3	70	130
		EG094A-F: Lead	7439-92-1	50 µg/L	81.1	70	130
		EG094A-F: Manganese	7439-96-5	50 µg/L	91.6	70	130
		EG094A-F: Nickel	7440-02-0	50 µg/L	96.4	70	130
		EG094A-F: Zinc	7440-66-6	100 µg/L	107	70	130
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 781508)							
EB1704258-024	FB1	EG094A-T: Arsenic	7440-38-2	50 µg/L	103	70	130
		EG094A-T: Barium	7440-39-3	250 µg/L	105	70	130
		EG094A-T: Beryllium	7440-41-7	50 µg/L	117	70	130
		EG094A-T: Cadmium	7440-43-9	50 µg/L	98.8	70	130
		EG094A-T: Chromium	7440-47-3	50 µg/L	103	70	130
		EG094A-T: Cobalt	7440-48-4	50 µg/L	100	70	130
		EG094A-T: Copper	7440-50-8	100 µg/L	100	70	130
		EG094A-T: Lead	7439-92-1	50 µg/L	100	70	130
		EG094A-T: Manganese	7439-96-5	50 µg/L	99.0	70	130
		EG094A-T: Nickel	7440-02-0	50 µg/L	98.7	70	130
		EG094A-T: Zinc	7440-66-6	100 µg/L	97.2	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 780376)							
EB1704228-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	99.7	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 780378)							

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 780378) - continued							
EB1704258-019	LA3-10	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	130	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 779607)							
EB1704258-002	W2	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	108	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 779612)							
EB1704258-022	M1-10	EK057G: Nitrite as N	14797-65-0	0.4 mg/L	101	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 780377)							
EB1704228-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	87.8	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 780379)							
EB1704258-019	LA3-10	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	106	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 791594)							
EB1704258-002	W2	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	104	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 791595)							
EB1704258-022	M1-10	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	102	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 791593)							
EB1704258-002	W2	EK067G: Total Phosphorus as P	----	1 mg/L	105	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 791596)							
EB1704258-022	M1-10	EK067G: Total Phosphorus as P	----	1 mg/L	109	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 779608)							
EB1704258-002	W2	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	109	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 779613)							
EB1704258-022	M1-10	EK071G: Reactive Phosphorus as P	14265-44-2	0.4 mg/L	105	70	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1704258**	Page	: 1 of 27
Amendment	: **1**		
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: IVAN STEWARD	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 03-Mar-2017
Site	: ----	Issue Date	: 18-Apr-2017
Sampler	: GREG HEATH	No. of samples received	: 60
Order number	: ----	No. of samples analysed	: 48

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EG005-SDH: 1M HCl-Extractable Metals by ICPAES	EB1704258--038	W2 <2000µm Fraction	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005T: Total Metals by ICP-AES	EB1704258--038	W2 <2000µm Fraction	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EG005T: Total Metals by ICP-AES	EB1704258--058	S2 <63µm	**Manganese**	7439-96-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK067G: Total Phosphorus as P by Discrete Analyser	EB1704258--038	W2 <2000µm Fraction	**Total Phosphorus as P**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB1704258--002	W2	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB1704258--022	M1-10	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED045G: Chloride by Discrete Analyser	EB1704258--002	W2	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
ED045G: Chloride by Discrete Analyser	EB1704258--022	M1-10	**Chloride**	16887-00-6	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EG035T: Total Recoverable Mercury by FIMS						
Pulp Bag LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction	----	----	----	27-Mar-2017	26-Mar-2017	**1**
Pulp Bag S2-D - <2000µm	12-Apr-2017	27-Mar-2017	**16**	12-Apr-2017	27-Mar-2017	**16**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag							
LA3 - <2000µm Fraction,	LA4 - <2000µm Fraction,	31-Mar-2017	26-Mar-2017	**5**	31-Mar-2017	26-Mar-2017	**5**
LA5 - <2000µm Fraction							
Pulp Bag							
S2-D - <2000µm		12-Apr-2017	27-Mar-2017	**16**	12-Apr-2017	27-Mar-2017	**16**
Pulp Bag							
B1 - <2000µm Fraction,	W2 - <2000µm Fraction,	31-Mar-2017	27-Mar-2017	**4**	31-Mar-2017	27-Mar-2017	**4**
W1 - <2000µm Fraction,	V1 - <2000µm Fraction,						
LA1 - <2000µm Fraction,	LA2 - <2000µm Fraction,						
M1 - <2000µm Fraction,	S2 - <2000µm Fraction						
EP003TC: Total Carbon (TC) in Soil							
Pulp Bag							
LA3 - <2000µm Fraction,	LA4 - <2000µm Fraction,	31-Mar-2017	26-Mar-2017	**5**	31-Mar-2017	26-Mar-2017	**5**
LA5 - <2000µm Fraction							
Pulp Bag							
S2-D - <2000µm		12-Apr-2017	27-Mar-2017	**16**	12-Apr-2017	27-Mar-2017	**16**
Pulp Bag							
B1 - <2000µm Fraction,	W2 - <2000µm Fraction,	31-Mar-2017	27-Mar-2017	**4**	31-Mar-2017	27-Mar-2017	**4**
W1 - <2000µm Fraction,	V1 - <2000µm Fraction,						
LA1 - <2000µm Fraction,	LA2 - <2000µm Fraction,						
M1 - <2000µm Fraction,	S2 - <2000µm Fraction						

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural							
LA2,	LA3,	----	----	----	06-Mar-2017	05-Mar-2017	**1**
LA4,	LA5,						
LA2-10,	LA3-10,						
LA4-10,	LA5-10						
Clear Plastic Bottle - Natural							
LA1,	M1,	----	----	----	08-Mar-2017	07-Mar-2017	**1**
V1D,	V1-10,						
LA1-10,	M1-10,						
V1-10-D							
EK057G: Nitrite as N by Discrete Analyser							

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EK057G: Nitrite as N by Discrete Analyser - Analysis Holding Time Compliance							
Clear Plastic Bottle - Natural							
LA2,	LA3,	----	----	----	06-Mar-2017	28-Feb-2017	**6**
LA4,	LA5,						
LA2-10,	LA3-10,						
LA4-10,	LA5-10						
Clear Plastic Bottle - Natural							
S2		----	----	----	06-Mar-2017	01-Mar-2017	**5**
Clear Plastic Bottle - Natural							
B1,	W2,	----	----	----	06-Mar-2017	02-Mar-2017	**4**
W1,	V1,						
LA1,	M1,						
V1D,	B1-10,						
W2-10,	W1-10,						
V1-10,	LA1-10,						
M1-10,	V1-10-D,						
FB1							
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural							
LA2,	LA3,	----	----	----	06-Mar-2017	28-Feb-2017	**6**
LA4,	LA5,						
LA2-10,	LA3-10,						
LA4-10,	LA5-10						
Clear Plastic Bottle - Natural							
S2		----	----	----	06-Mar-2017	01-Mar-2017	**5**
Clear Plastic Bottle - Natural							
B1,	W2,	----	----	----	06-Mar-2017	02-Mar-2017	**4**
W1,	V1,						
LA1,	M1,						
V1D,	B1-10,						
W2-10,	W1-10,						
V1-10,	LA1-10,						
M1-10,	V1-10-D,						
FB1							

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count: QC	Regular	Rate (%): Actual	Expected	Quality Control Specification
Laboratory Control Samples (LCS)					
Total Metals by ICP-MS - Suite Y	0	24	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Matrix Spikes (MS) - Continued					
1M HCl Extractable Metals by ICPMS	0	12	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	0	24	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	0	24	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	0	24	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG005-SDH: 1M HCl-Extractable Metals by ICPAES							
Pulp Bag (-2000µm) (EG005-SDH) S2-D - <2000µm	**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EG005-SDH) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**24-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005T: Total Metals by ICP-AES								
Pulp Bag (EG005T) LA3 - <2000µm Fraction, LA5 - <2000µm Fraction	LA4 - <2000µm Fraction,	**26-Feb-2017**	**24-Mar-2017**	25-Aug-2017	✓	**27-Mar-2017**	25-Aug-2017	✓
Pulp Bag (EG005T) S2-D - <2000µm		**27-Feb-2017**	**12-Apr-2017**	26-Aug-2017	✓	**12-Apr-2017**	26-Aug-2017	✓
Pulp Bag (EG005T) B1 - <2000µm Fraction, W1 - <2000µm Fraction, LA1 - <2000µm Fraction, M1 - <2000µm Fraction,	W2 - <2000µm Fraction, V1 - <2000µm Fraction, LA2 - <2000µm Fraction, S2 - <2000µm Fraction	**27-Feb-2017**	**24-Mar-2017**	26-Aug-2017	✓	**27-Mar-2017**	26-Aug-2017	✓
Pulp Bag (-63µm) (EG005T) S2-D - <63µm		**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-63µm) (EG005T) B1 - >63µm, W1 - <63µm, LA1 - <63µm, LA3 - <63µm, LA5 - <63µm, S2 - <63µm	W2 - <63µm, V1 - <63µm, LA2 - <63µm, LA4 - <63µm, M1 - <63µm,	**24-Mar-2017**	**24-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓
EG020-SDH: 1M HCl Extractable metals by ICPMS								
Pulp Bag (-2000µm) (EG020-SDH) S2-D - <2000µm		**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EG020-SDH) B1 - <2000µm Fraction, W1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA3 - <2000µm Fraction, LA5 - <2000µm Fraction, S2 - <2000µm Fraction	W2 - <2000µm Fraction, V1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA4 - <2000µm Fraction, M1 - <2000µm Fraction,	**24-Mar-2017**	**24-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*		*Sample Date*	*Extraction / Preparation*			*Analysis*		
			Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG020T: Total Metals by ICP-MS								
Pulp Bag (EG020Z-T) LA3 - <2000µm Fraction, LA5 - <2000µm Fraction	LA4 - <2000µm Fraction,	**26-Feb-2017**	**24-Mar-2017**	25-Aug-2017	✓	**27-Mar-2017**	25-Aug-2017	✓
Pulp Bag (EG020Z-T) S2-D - <2000µm		**27-Feb-2017**	**12-Apr-2017**	26-Aug-2017	✓	**12-Apr-2017**	26-Aug-2017	✓
Pulp Bag (EG020Z-T) B1 - <2000µm Fraction, W1 - <2000µm Fraction, LA1 - <2000µm Fraction, M1 - <2000µm Fraction,	W2 - <2000µm Fraction, V1 - <2000µm Fraction, LA2 - <2000µm Fraction, S2 - <2000µm Fraction	**27-Feb-2017**	**24-Mar-2017**	26-Aug-2017	✓	**27-Mar-2017**	26-Aug-2017	✓
Pulp Bag (-63µm) (EG020Z-T) S2-D - <63µm		**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-63µm) (EG020Z-T) B1 - >63µm, W1 - <63µm, LA1 - <63µm, LA3 - <63µm, LA5 - <63µm, S2 - <63µm	W2 - <63µm, V1 - <63µm, LA2 - <63µm, LA4 - <63µm, M1 - <63µm,	**24-Mar-2017**	**24-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓
EG035-SDH: 1M HCl extractable Mercury by FIMS								
Pulp Bag (-2000µm) (EG035-SDH) S2-D - <2000µm		**12-Apr-2017**	**12-Apr-2017**	10-May-2017	✓	**12-Apr-2017**	10-May-2017	✓
Pulp Bag (-2000µm) (EG035-SDH) B1 - <2000µm Fraction, W1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA3 - <2000µm Fraction, LA5 - <2000µm Fraction, S2 - <2000µm Fraction	W2 - <2000µm Fraction, V1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA4 - <2000µm Fraction, M1 - <2000µm Fraction,	**24-Mar-2017**	**24-Mar-2017**	21-Apr-2017	✓	**27-Mar-2017**	21-Apr-2017	✓

Matrix: **SOIL**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EG035T: Total Recoverable Mercury by FIMS							
Pulp Bag (EG035T-LL) LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction	**26-Feb-2017**	**24-Mar-2017**	26-Mar-2017	✓	**27-Mar-2017**	26-Mar-2017	✘
Pulp Bag (EG035T-LL) S2-D - <2000µm	**27-Feb-2017**	**12-Apr-2017**	27-Mar-2017	✘	**12-Apr-2017**	27-Mar-2017	✘
Pulp Bag (EG035T-LL) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**27-Feb-2017**	**24-Mar-2017**	27-Mar-2017	✓	**27-Mar-2017**	27-Mar-2017	✓
Pulp Bag (-63µm) (EG035T-LL) S2-D - <63µm	**12-Apr-2017**	**12-Apr-2017**	10-May-2017	✓	**12-Apr-2017**	10-May-2017	✓
Pulp Bag (-63µm) (EG035T-LL) B1 - >63µm, W2 - <63µm, W1 - <63µm, V1 - <63µm, LA1 - <63µm, LA2 - <63µm, LA3 - <63µm, LA4 - <63µm, LA5 - <63µm, M1 - <63µm, S2 - <63µm	**24-Mar-2017**	**24-Mar-2017**	21-Apr-2017	✓	**27-Mar-2017**	21-Apr-2017	✓
EK055: Ammonia as N							
Pulp Bag (-2000µm) (EK055) S2-D - <2000µm	**12-Apr-2017**	**----**	----	----	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EK055) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**----**	----	----	**24-Mar-2017**	20-Sep-2017	✓
EK057G: Nitrite as N by Discrete Analyser							
Pulp Bag (-2000µm) (EK057G) S2-D - <2000µm	**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EK057G) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**27-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation Date extracted	Extraction / Preparation Due for extraction	Extraction / Preparation Evaluation	Analysis Date analysed	Analysis Due for analysis	Analysis Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Pulp Bag (-2000µm) (EK059G) S2-D - <2000µm	**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EK059G) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**27-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Pulp Bag (-2000µm) (EK061G) S2-D - <2000µm	**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EK061G) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**24-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Pulp Bag (-2000µm) (EK067G) S2-D - <2000µm	**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EK067G) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**24-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓
EK071G: Reactive Phosphorus as P by discrete analyser							
Pulp Bag (-2000µm) (EK071G) S2-D - <2000µm	**12-Apr-2017**	**12-Apr-2017**	09-Oct-2017	✓	**12-Apr-2017**	09-Oct-2017	✓
Pulp Bag (-2000µm) (EK071G) B1 - <2000µm Fraction, W2 - <2000µm Fraction, W1 - <2000µm Fraction, V1 - <2000µm Fraction, LA1 - <2000µm Fraction, LA2 - <2000µm Fraction, LA3 - <2000µm Fraction, LA4 - <2000µm Fraction, LA5 - <2000µm Fraction, M1 - <2000µm Fraction, S2 - <2000µm Fraction	**24-Mar-2017**	**27-Mar-2017**	20-Sep-2017	✓	**27-Mar-2017**	20-Sep-2017	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003)								
LA3 - <2000µm Fraction,	LA4 - <2000µm Fraction,	**26-Feb-2017**	**31-Mar-2017**	26-Mar-2017	×	**31-Mar-2017**	26-Mar-2017	×
LA5 - <2000µm Fraction								
Pulp Bag (EP003)								
S2-D - <2000µm		**27-Feb-2017**	**12-Apr-2017**	27-Mar-2017	×	**12-Apr-2017**	27-Mar-2017	×
Pulp Bag (EP003)								
B1 - <2000µm Fraction,	W2 - <2000µm Fraction,	**27-Feb-2017**	**31-Mar-2017**	27-Mar-2017	×	**31-Mar-2017**	27-Mar-2017	×
W1 - <2000µm Fraction,	V1 - <2000µm Fraction,							
LA1 - <2000µm Fraction,	LA2 - <2000µm Fraction,							
M1 - <2000µm Fraction,	S2 - <2000µm Fraction							
EP003TC: Total Carbon (TC) in Soil								
Pulp Bag (EP003TC)								
LA3 - <2000µm Fraction,	LA4 - <2000µm Fraction,	**26-Feb-2017**	**31-Mar-2017**	26-Mar-2017	×	**31-Mar-2017**	26-Mar-2017	×
LA5 - <2000µm Fraction								
Pulp Bag (EP003TC)								
S2-D - <2000µm		**27-Feb-2017**	**12-Apr-2017**	27-Mar-2017	×	**12-Apr-2017**	27-Mar-2017	×
Pulp Bag (EP003TC)								
B1 - <2000µm Fraction,	W2 - <2000µm Fraction,	**27-Feb-2017**	**31-Mar-2017**	27-Mar-2017	×	**31-Mar-2017**	27-Mar-2017	×
W1 - <2000µm Fraction,	V1 - <2000µm Fraction,							
LA1 - <2000µm Fraction,	LA2 - <2000µm Fraction,							
M1 - <2000µm Fraction,	S2 - <2000µm Fraction							
GEO26: Sieving								
Snap Lock Bag (GEO26C)								
LA3 - <2000µm Fraction,	LA4 - <2000µm Fraction,	**26-Feb-2017**	**24-Mar-2017**	25-Aug-2017	✓	**----**	----	----
LA5 - <2000µm Fraction,	LA3 - <63µm,							
LA4 - <63µm,	LA5 - <63µm							
Snap Lock Bag (GEO26C)								
S2-D - <2000µm,	S2-D - <63µm	**27-Feb-2017**	**12-Apr-2017**	26-Aug-2017	✓	**----**	----	----
Snap Lock Bag (GEO26C)								
B1 - <2000µm Fraction,	W2 - <2000µm Fraction,	**27-Feb-2017**	**24-Mar-2017**	26-Aug-2017	✓	**----**	----	----
W1 - <2000µm Fraction,	V1 - <2000µm Fraction,							
LA1 - <2000µm Fraction,	LA2 - <2000µm Fraction,							
M1 - <2000µm Fraction,	S2 - <2000µm Fraction,							
B1 - >63µm,	W2 - <63µm,							
W1 - <63µm,	V1 - <63µm,							
LA1 - <63µm,	LA2 - <63µm,							
M1 - <63µm,	S2 - <63µm							

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation

Matrix: **WATER**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation Date extracted	Due for extraction	Evaluation	Analysis Date analysed	Due for analysis	Evaluation
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025) LA2, LA3, LA4, LA5, LA2-10, LA3-10, LA4-10, LA5-10	**26-Feb-2017**	**----**	----	----	**06-Mar-2017**	05-Mar-2017	✘
Clear Plastic Bottle - Natural (EA025) S2	**27-Feb-2017**	**----**	----	----	**06-Mar-2017**	06-Mar-2017	✓
Clear Plastic Bottle - Natural (EA025) B1, W2, W1, V1	**28-Feb-2017**	**----**	----	----	**06-Mar-2017**	07-Mar-2017	✓
Clear Plastic Bottle - Natural (EA025) LA1, M1, V1D	**28-Feb-2017**	**----**	----	----	**08-Mar-2017**	07-Mar-2017	✘
Clear Plastic Bottle - Natural (EA025) B1-10, W2-10, W1-10	**28-Feb-2017**	**----**	----	----	**06-Mar-2017**	07-Mar-2017	✓
Clear Plastic Bottle - Natural (EA025) V1-10, LA1-10, M1-10, V1-10-D	**28-Feb-2017**	**----**	----	----	**08-Mar-2017**	07-Mar-2017	✘
Clear Plastic Bottle - Natural (EA025) FB1	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	07-Mar-2017	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) LA2, LA3, LA4, LA5, LA2-10, LA3-10, LA4-10, LA5-10	**26-Feb-2017**	**----**	----	----	**10-Mar-2017**	12-Mar-2017	✓
Clear Plastic Bottle - Natural (ED037-P) S2	**27-Feb-2017**	**----**	----	----	**10-Mar-2017**	13-Mar-2017	✓
Clear Plastic Bottle - Natural (ED037-P) B1, W2, W1, V1, LA1, M1, V1D, B1-10, W2-10, W1-10, V1-10, LA1-10, M1-10, V1-10-D, FB1	**28-Feb-2017**	**----**	----	----	**10-Mar-2017**	14-Mar-2017	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**06-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear Plastic Bottle - Natural (ED041G)								
S2		**27-Feb-2017**	**----**	----	----	**06-Mar-2017**	27-Mar-2017	✓
Clear Plastic Bottle - Natural (ED041G)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**06-Mar-2017**	28-Mar-2017	✓
W1,	V1,							
LA1,	M1,							
V1D,	B1-10,							
W2-10,	W1-10,							
V1-10,	LA1-10,							
M1-10,	V1-10-D,							
FB1								
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**06-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear Plastic Bottle - Natural (ED045G)								
S2		**27-Feb-2017**	**----**	----	----	**06-Mar-2017**	27-Mar-2017	✓
Clear Plastic Bottle - Natural (ED045G)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**06-Mar-2017**	28-Mar-2017	✓
W1,	V1,							
LA1,	M1,							
V1D,	B1-10,							
W2-10,	W1-10,							
V1-10,	LA1-10,							
M1-10,	V1-10-D,							
FB1								

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**07-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)								
S2		**27-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Mar-2017	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (ED093F)								
V1,	V1-10,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	28-Mar-2017	✓
V1-10-D								
Clear Plastic Bottle - Filtered; Lab-acidified (ED093F)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	28-Mar-2017	✓
W1,	LA1,							
M1,	V1D,							
B1-10,	W2-10,							
W1-10,	LA1-10,							
M1-10,	FB1							
EG035F: Dissolved Mercury by FIMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**07-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F)								
S2		**27-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Mar-2017	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG035F)								
V1,	V1-10,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	28-Mar-2017	✓
V1-10-D								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	28-Mar-2017	✓
W1,	LA1,							
M1,	V1D,							
B1-10,	W2-10,							
W1-10,	LA1-10,							
M1-10,	FB1							

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS								
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**13-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T)								
S2		**27-Feb-2017**	**----**	----	----	**13-Mar-2017**	27-Mar-2017	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG035T)								
B1,	V1,	**28-Feb-2017**	**----**	----	----	**13-Mar-2017**	28-Mar-2017	✓
LA1,	B1-10,							
LA1-10,	V1-10-D							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T)								
W2,	W1,	**28-Feb-2017**	**----**	----	----	**13-Mar-2017**	28-Mar-2017	✓
M1,	V1D,							
W2-10,	W1-10,							
V1-10,	M1-10,							
FB1								
EG093F: Dissolved Metals in Saline Water by ORC-ICPMS								
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093A-F)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**07-Mar-2017**	25-Aug-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093A-F)								
S2		**27-Feb-2017**	**----**	----	----	**07-Mar-2017**	26-Aug-2017	✓
Clear HDPE (U-T ORC) - Filtered; Lab-acidified (EG093A-F)								
V1,	V1-10,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Aug-2017	✓
V1-10-D								
Clear Plastic Bottle - Filtered; Lab-acidified (EG093A-F)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Aug-2017	✓
W1,	LA1,							
V1D,	B1-10,							
W2-10,	W1-10,							
LA1-10,	M1-10							

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG093T: Total Metals in Saline Water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093B-T) LA2, LA3, LA4, LA5, LA2-10, LA3-10, LA4-10, LA5-10	**26-Feb-2017**	**13-Mar-2017**	25-Aug-2017	✓	**13-Mar-2017**	25-Aug-2017	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093B-T) S2	**27-Feb-2017**	**13-Mar-2017**	26-Aug-2017	✓	**13-Mar-2017**	26-Aug-2017	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG093B-T) B1, V1, LA1, B1-10, LA1-10, V1-10-D	**28-Feb-2017**	**13-Mar-2017**	27-Aug-2017	✓	**13-Mar-2017**	27-Aug-2017	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG093B-T) W2, W1, V1D, W2-10, W1-10, V1-10, M1-10	**28-Feb-2017**	**13-Mar-2017**	27-Aug-2017	✓	**13-Mar-2017**	27-Aug-2017	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear Plastic Bottle - Natural (EG094B-F) M1, FB1	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Aug-2017	✓
EG094T: Total metals in Fresh water by ORC-ICPMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG094B-T) M1, FB1	**28-Feb-2017**	**07-Mar-2017**	27-Aug-2017	✓	**07-Mar-2017**	27-Aug-2017	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G) LA2, LA3, LA4, LA5, LA2-10, LA3-10, LA4-10, LA5-10	**26-Feb-2017**	**----**	----	----	**07-Mar-2017**	26-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) S2	**27-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) B1, W2, W1, V1, LA1, M1, V1D, B1-10, W2-10, W1-10, V1-10, LA1-10, M1-10, V1-10-D, FB1	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	28-Mar-2017	✓

Matrix: **WATER**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**06-Mar-2017**	28-Feb-2017	✘
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear Plastic Bottle - Natural (EK057G)								
S2		**27-Feb-2017**	**----**	----	----	**06-Mar-2017**	01-Mar-2017	✘
Clear Plastic Bottle - Natural (EK057G)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**06-Mar-2017**	02-Mar-2017	✘
W1,	V1,							
LA1,	M1,							
V1D,	B1-10,							
W2-10,	W1-10,							
V1-10,	LA1-10,							
M1-10,	V1-10-D,							
FB1								

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
LA2,	LA3,	**26-Feb-2017**	**----**	----	----	**07-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
S2		**27-Feb-2017**	**----**	----	----	**07-Mar-2017**	27-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
B1,	W2,	**28-Feb-2017**	**----**	----	----	**07-Mar-2017**	28-Mar-2017	✓
W1,	V1,							
LA1,	M1,							
V1D,	B1-10,							
W2-10,	W1-10,							
V1-10,	LA1-10,							
M1-10,	V1-10-D,							
FB1								

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) LA2, LA3, LA4, LA5, LA2-10, LA3-10, LA4-10, LA5-10	**26-Feb-2017**	**15-Mar-2017**	26-Mar-2017	✓	**15-Mar-2017**	26-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) S2	**27-Feb-2017**	**15-Mar-2017**	27-Mar-2017	✓	**15-Mar-2017**	27-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) B1, W2, W1, V1, LA1, M1, V1D, B1-10, W2-10, W1-10, V1-10, LA1-10, M1-10, V1-10-D, FB1	**28-Feb-2017**	**15-Mar-2017**	28-Mar-2017	✓	**15-Mar-2017**	28-Mar-2017	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) LA2, LA3, LA4, LA5, LA2-10, LA3-10, LA4-10, LA5-10	**26-Feb-2017**	**15-Mar-2017**	26-Mar-2017	✓	**15-Mar-2017**	26-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) S2	**27-Feb-2017**	**15-Mar-2017**	27-Mar-2017	✓	**15-Mar-2017**	27-Mar-2017	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) B1, W2, W1, V1, LA1, M1, V1D, B1-10, W2-10, W1-10, V1-10, LA1-10, M1-10, V1-10-D, FB1	**28-Feb-2017**	**15-Mar-2017**	28-Mar-2017	✓	**15-Mar-2017**	28-Mar-2017	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EK071G: Reactive Phosphorus as P by discrete analyser								
Clear Plastic Bottle - Natural (EK071G)								
LA2,	LA3,	**26-Feb-2017**	----	----	----	**06-Mar-2017**	28-Feb-2017	×
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Clear Plastic Bottle - Natural (EK071G)								
S2		**27-Feb-2017**	----	----	----	**06-Mar-2017**	01-Mar-2017	×
Clear Plastic Bottle - Natural (EK071G)								
B1,	W2,	**28-Feb-2017**	----	----	----	**06-Mar-2017**	02-Mar-2017	×
W1,	V1,							
LA1,	M1,							
V1D,	B1-10,							
W2-10,	W1-10,							
V1-10,	LA1-10,							
M1-10,	V1-10-D,							
FB1								
EP020: Oil and Grease (O&G)								
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)								
LA2,	LA3,	**26-Feb-2017**	----	----	----	**09-Mar-2017**	26-Mar-2017	✓
LA4,	LA5,							
LA2-10,	LA3-10,							
LA4-10,	LA5-10							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)								
S2		**27-Feb-2017**	----	----	----	**09-Mar-2017**	27-Mar-2017	✓
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)								
B1,	W2,	**28-Feb-2017**	----	----	----	**09-Mar-2017**	28-Mar-2017	✓
W1,	V1,							
LA1,	M1,							
V1D,	B1-10,							
W2-10,	W1-10,							
V1-10,	LA1-10,							
M1-10,	V1-10-D,							
FB1								

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✘ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	4	12	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	0	24	**0.00**	**5.00**	✘	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	3	12	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		*Count*		*Rate (%)*			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
1M HCl Extractable Mercury by FIMS	EG035-SDH	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
1M HCl Extractable Mercury by FIMS	EG035-SDH	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals	EG005-SDH	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
1M HCl Extractable Metals by ICPMS	EG020-SDH	0	12	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Buchi Ammonia	EK055	2	12	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N - Soluble by Discrete Analyser	EK057G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TKN as N By Discrete Analyser	EK061G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite X	EG020X-T	0	24	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Y	EG020Y-T	0	24	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-MS - Suite Z	EG020Z-T	0	24	**0.00**	**5.00**	✗	NEPM 2013 B3 & ALS QC Standard
Total Phosporus By Discrete Analyser	EK067G	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		*Count*		*Rate (%)*			*Quality Control Specification*
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	3	29	**10.34**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP) - Continued							
Chloride by Discrete Analyser	ED045G	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	4	33	**12.12**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	24	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	29	**6.90**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	24	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	6	24	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Control Samples (LCS) - Continued							
Total Phosphorus as P By Discrete Analyser	EK067G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	2	29	**6.90**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	33	**6.06**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids	EA025	3	24	**12.50**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	2	29	**6.90**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	24	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
1M HCl Extractable Metals	EG005-SDH	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined via ICPAES following weak acid extraction. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3). LORs per NAGD. ALS is not NATA accredited for the analysis of Barium, Boron, Molybdenum and Strontium by this method.
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
1M HCl Extractable Metals by ICPMS	EG020-SDH	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020. Metals are determined via ICPMS following weak acid extraction. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NAGD. ALS is not NATA accredited for the analysis of Tin, Uranium, Barium, Boron and Strontium by this method.
Total Metals by ICP-MS - Suite X	EG020X-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite Y	EG020Y-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite Z	EG020Z-T	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
1M HCl Extractable Mercury by FIMS	EG035-SDH	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B. Mercury is determined via FIMS following weak acid extraction. FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by $SnCl_2$ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection ($SnCl_2$)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by $SnCl_2$ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Buchi Ammonia	EK055	SOIL	In house: Referenced to APHA 4500-NH3 B&G, H Samples are steam distilled (Buchi) prior to analysis and quantified using titration, FIA or Discrete Analyser.
Nitrite as N - Soluble by Discrete Analyser	EK057G	SOIL	In house: Referenced to APHA 4500-NO3- B. Nitrite in a water extract is determined by direct colourimetry by Discrete Analyser.
Nitrate as N - Soluble by Discrete Analyser	EK058G	SOIL	In house: Referenced to APHA 4500-NO3- F. Nitrate in the 1:5 soil:water extract is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results.
Nitrite and Nitrate as N (NOx)- Soluble by Discrete Analyser	EK059G	SOIL	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) in a water extract is determined by Chemical Reduction, and direct colourimetry by Discrete Analyser.
TKN as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg-D Soil samples are digested using Kjeldahl digestion followed by determination by Discrete Analyser.
Total Nitrogen as N (TKN + NOx) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500 Norg/NO3- Total Nitrogen is determined as the sum of TKN and Oxidised Nitrrogen, each determined seperately as N.
Total Phosporus By Discrete Analyser	EK067G	SOIL	In house: Referenced to APHA 4500 P-B&F This procedure involves sulfuric acid digestion and quantification using Discrete Analyser.
Reactive Phosphorus as P-Soluble By Discrete Analyser	EK071G	SOIL	In house: Referenced to APHA 4500 P-F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3) (
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Total Carbon	EP003TC	SOIL	In house C-IR07. Dried and pulverised sample is combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved Carbon (as CO2) is measured by infra-red detector
Total Inorganic Carbon	EP003TIC	SOIL	In house C-CAL15. Determined as the difference between Total Carbon and Organic Carbon.
Suspended Solids	EA025	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of \`non-filterable\` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocyanate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003

Analytical Methods	Method	Matrix	Method Descriptions
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite A by ORC-ICPMS	EG093A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Saline Water Suite A by ORC-ICPMS	EG093A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Saline Water -Suite B by ORC-ICPMS	EG093B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020 Samples are 0.45µm filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals in Fresh Water -Suite B by ORC-ICPMS	EG094B-T	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	In house: Referenced to APHA 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg- D; APHA 4500 P - H. Macro Kjeldahl digestion.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
1M HCl Extraction for Metals in Sediments (1 hour)	EN71	SOIL	In house: Referenced to In house, Allen (1993). 1g of sample is leached at room temperature for 1 hour in 10% hydrochloric acid. The resultant extract is filtered and bulked for analysis of extracted metals.
Sieving (fine to -2mm)	GEO26	SOIL	In house: The dried sample is sieved to 2mm and the fines are then analysed per the client's request.
Sieving (fine to -63µm)	GEO26C	SOIL	In house: The sample is sieved to -63µm and the fines are then analysed per the client's request.
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Digestion for Total Recoverable Metals - ORC	EN25-ORC	WATER	In house: Referenced to USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM (2013) Schedule B(3)

QUALITY CONTROL REPORT

Work Order	: **EB1707858**	Page	: 1 of 3
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TRAVIS WOOD	Contact	: Jenny Bevan
Address	: LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 03 9290 7000	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 19-Apr-2017
Order number	: ----	Date Analysis Commenced	: 28-Apr-2017
C-O-C number	: ----	Issue Date	: 28-Apr-2017
Sampler	: GREG HEATH		
Site	: ----		
Quote number	: BN/288/16 V6		
No. of samples received	: 12		
No. of samples analysed	: 12		

Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1707858**	Page	: 1 of 4
Client	: **COFFEY ENVIRONMENTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: TRAVIS WOOD	Telephone	: +61-7-3243 7222
Project	: 520	Date Samples Received	: 19-Apr-2017
Site	: ----	Issue Date	: 28-Apr-2017
Sampler	: GREG HEATH	No. of samples received	: 12
Order number	: ----	No. of samples analysed	: 12

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA150: Particle Sizing								
Snap Lock Bag (EA150H) LA3, LA5	LA4,	**26-Feb-2017**	----	----	----	**28-Apr-2017**	25-Aug-2017	✓
Snap Lock Bag (EA150H) B1, W1, LA1, M1, S2-D	W2, V1, LA2, S2,	**27-Feb-2017**	----	----	----	**28-Apr-2017**	26-Aug-2017	✓
EA150: Soil Classification based on Particle Size								
Snap Lock Bag (EA150H) LA3, LA5	LA4,	**26-Feb-2017**	----	----	----	**28-Apr-2017**	25-Aug-2017	✓
Snap Lock Bag (EA150H) B1, W1, LA1, M1, S2-D	W2, V1, LA2, S2,	**27-Feb-2017**	----	----	----	**28-Apr-2017**	26-Aug-2017	✓
EA152: Soil Particle Density								
Snap Lock Bag (EA152) LA3, LA5	LA4,	**26-Feb-2017**	----	----	----	**28-Apr-2017**	25-Aug-2017	✓
Snap Lock Bag (EA152) B1, W1, LA1, M1, S2-D	W2, V1, LA2, S2,	**27-Feb-2017**	----	----	----	**28-Apr-2017**	26-Aug-2017	✓

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method

Appendix C – Particle Size Distribution Results

Certificate of Analysis

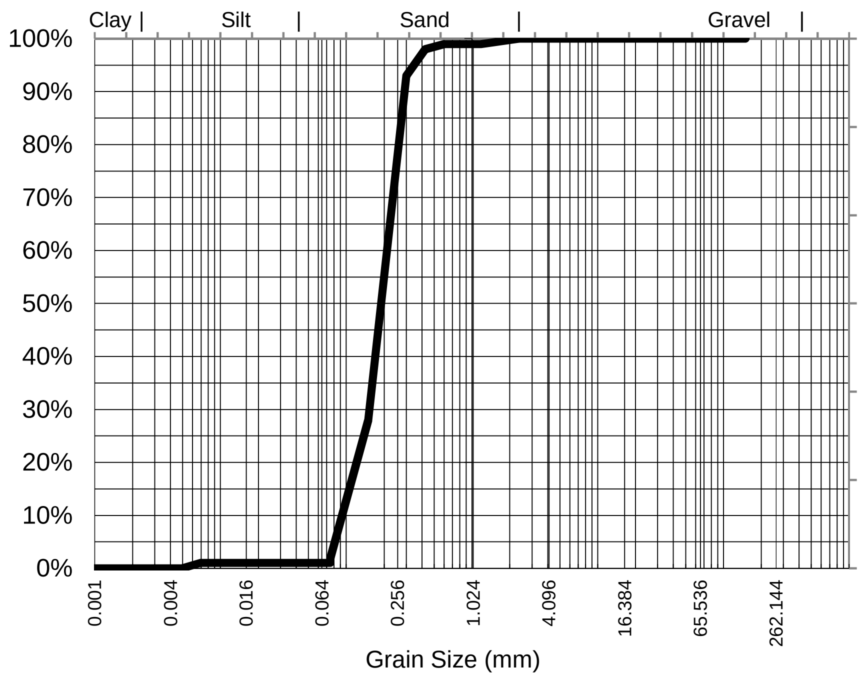
ALS Laboratory Group Pty Ltd
2 Byth Street, Stafford, QLD 4053
pH 07 3552 8678
fax 07 3352 3662
samples.brisbane@alsglobal.com

ALS Environmental

Brisbane, QLD

CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-009 / PSD
PROJECT:	520	**SAMPLE ID:**	R1

Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	93%
0.150	28%
0.075	2%
Particle Size (microns)	
75	1%
55	1%
39	1%
19	1%
10	1%
5	0%

Samples analysed as received.

Median Particle Size (mm)*	0.201

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 5-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.75 g/cm3

NATA Accreditation: 825 Site: Brisbane
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NATA
WORLD RECOGNISED ACCREDITATION

Satish Trivedi
Soil Chemist
Authorised Signatory

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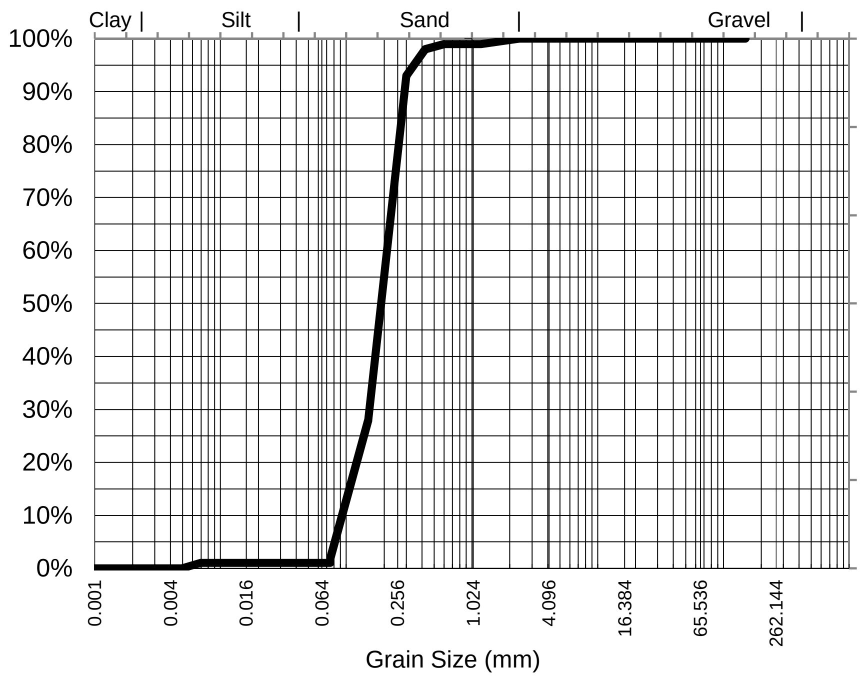
ALS Environmental

Brisbane, QLD

CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-009DUP / PSD
PROJECT:	520	**SAMPLE ID:**	R1

Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	99%
0.425	98%
0.300	93%
0.150	28%
0.075	2%
Particle Size (microns)	
75	1%
55	1%
39	1%
19	1%
10	1%
5	0%

Samples analysed as received.

Median Particle Size (mm)*	0.201

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 5-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.76 g/cm3

NATA Accreditation: 825 Site: Brisbane
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Certificate of Analysis

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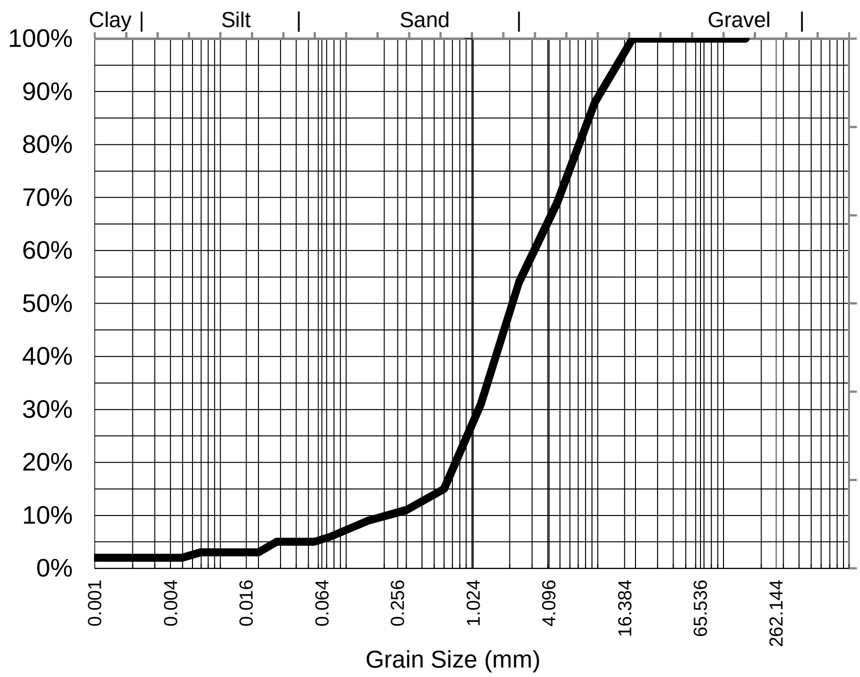
ALS Environmental

Brisbane, QLD

CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-010 / PSD
PROJECT:	520	**SAMPLE ID:**	R2

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	88%
4.75	69%
2.36	54%
1.18	31%
0.600	15%
0.425	13%
0.300	11%
0.150	9%
0.075	6%
Particle Size (microns)	
75	6%
56	5%
40	5%
20	3%
10	3%
5	2%
1	2%

Samples analysed as received.

Median Particle Size (mm)*	2.155

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	5-Dec-16
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.66 g/cm3

NATA Accreditation: 825 Site: Brisbane
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Satish Trivedi
Soil Chemist
Authorised Signatory

Certificate of Analysis

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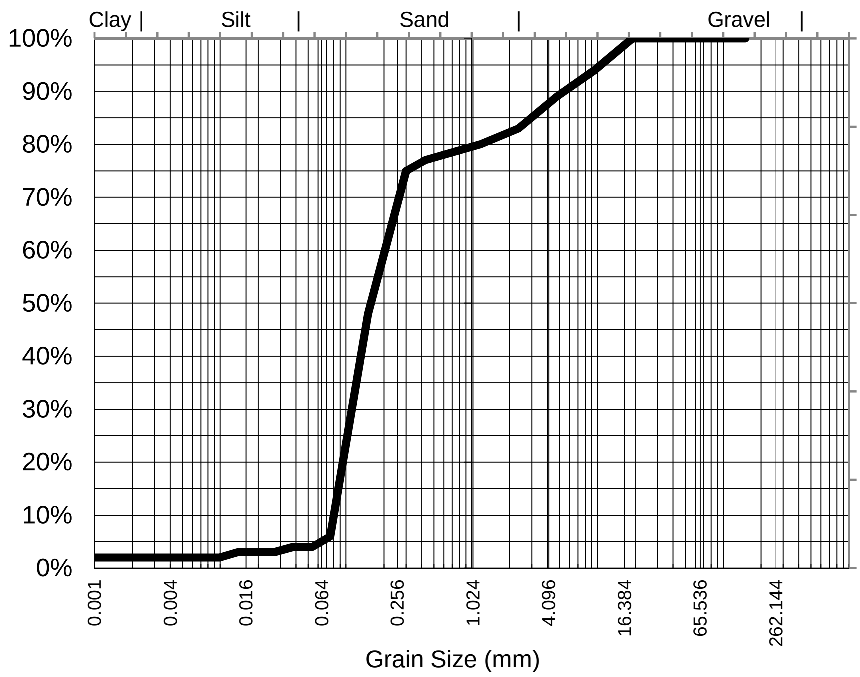
ALS Environmental

Brisbane, QLD

CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-011 / PSD
PROJECT:	520	**SAMPLE ID:**	W1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	94%
4.75	89%
2.36	83%
1.18	80%
0.600	78%
0.425	77%
0.300	75%
0.150	48%
0.075	6%
Particle Size (microns)	
75	6%
54	4%
38	4%
19	3%
10	2%
5	2%
1	2%

Samples analysed as received.

Median Particle Size (mm)*	0.161

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Loss on Pretreatment NA

Sample Description:

Test Method: AS1289.3.6.3 2003

Soil Particle Density (<2.36mm) 2.81 g/cm3

Analysed: 5-Dec-16

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

NATA Accreditation: 825 Site: Brisbane
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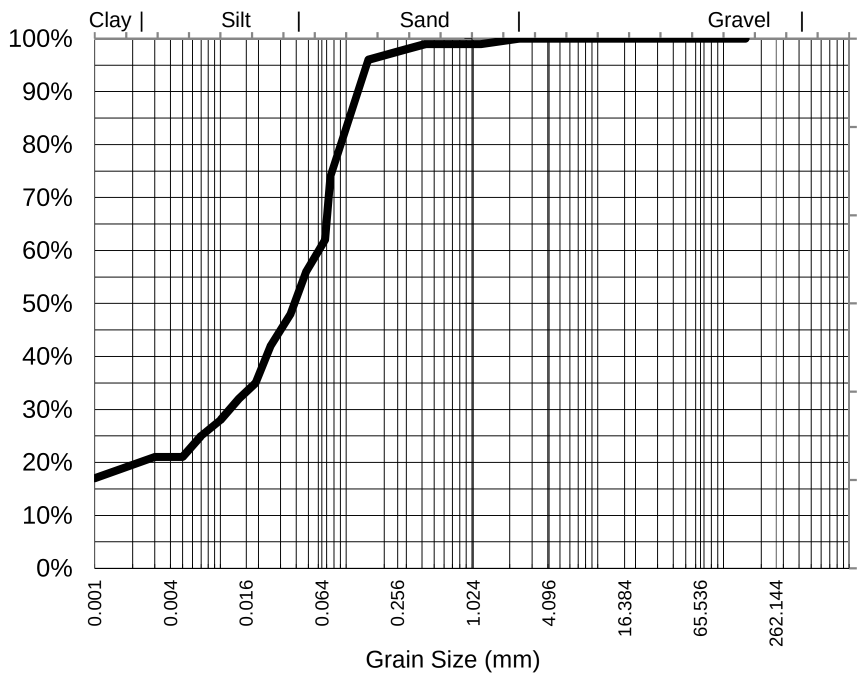
ALS Environmental

Brisbane, QLD

CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-012 / PSD
PROJECT:	520	**SAMPLE ID:**	W2

Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	99%
0.425	99%
0.300	98%
0.150	96%
0.075	74%
Particle Size (microns)	
68	62%
48	56%
36	48%
19	35%
10	28%
5	21%
1	17%

Median Particle Size (mm)*	0.039

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 5-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.79 g/cm3

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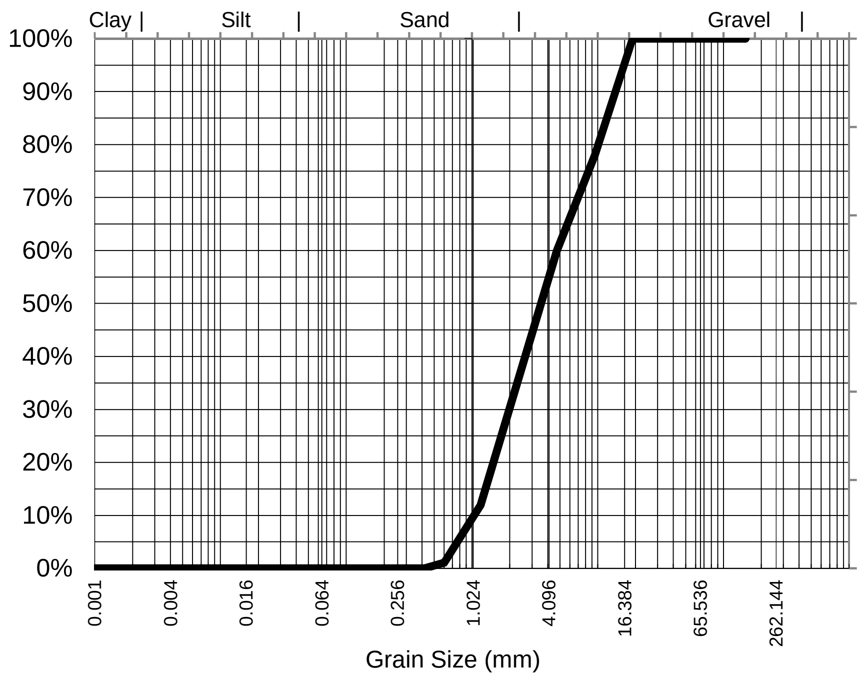
CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-013 / PSD
PROJECT:	520	**SAMPLE ID:**	L4

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	78%
4.75	60%
2.36	36%
1.18	12%
0.600	1%
0.425	0%
0.300	0%
0.150	0%
0.075	0%
Particle Size (microns)	

Median Particle Size (mm)*	3.754

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	5-Dec-16
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.7 g/cm3

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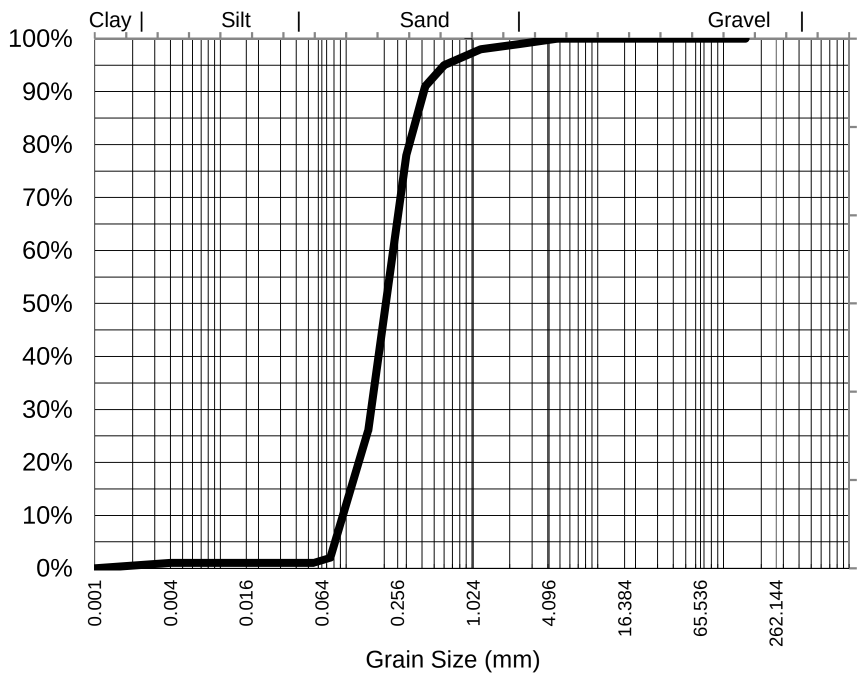
CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-014 / PSD
PROJECT:	520	**SAMPLE ID:**	L1

Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	91%
0.300	78%
0.150	26%
0.075	2%
Particle Size (microns)	
75	2%
55	1%
39	1%
19	1%
10	1%
5	1%
1	0%

Samples analysed as received.

Median Particle Size (mm)*	0.219

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 5-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.79 g/cm3

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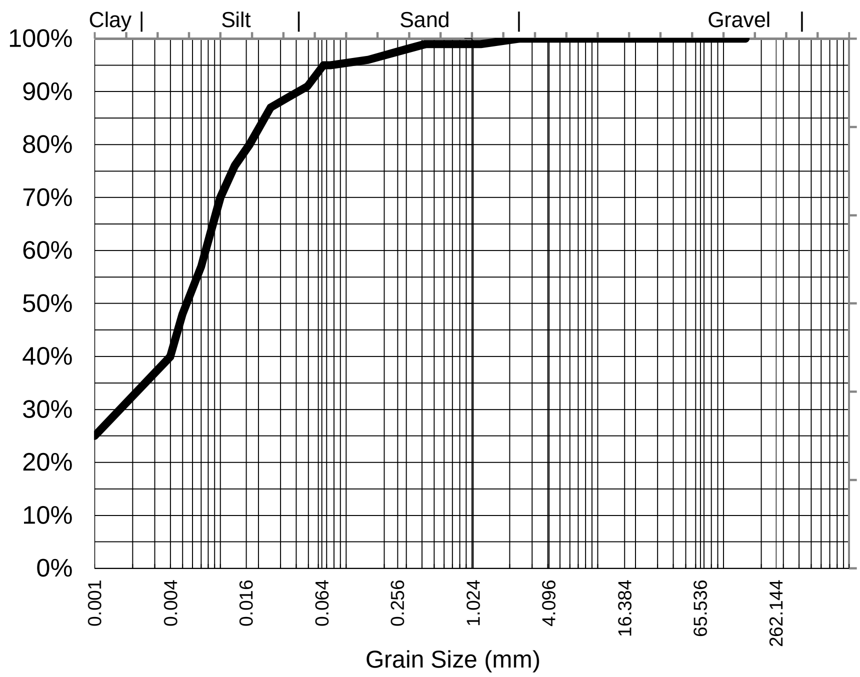
CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-015 / PSD
PROJECT:	520	**SAMPLE ID:**	L3

Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	99%
0.425	99%
0.300	98%
0.150	96%
0.075	95%
Particle Size (microns)	
66	95%
49	91%
35	89%
17	80%
10	70%
5	48%
1	25%

Median Particle Size (mm)*	0.005

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 5-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.51 g/cm3

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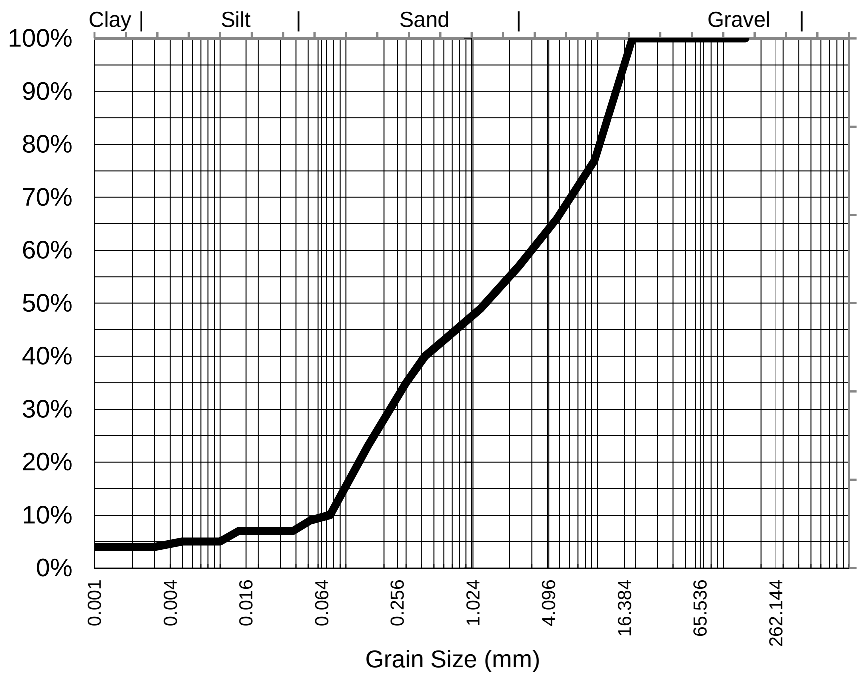
CLIENT:	Traviswood	**DATE REPORTED:**	8-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	21-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STREET ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627576-016 / PSD
PROJECT:	520	**SAMPLE ID:**	B1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	77%
4.75	66%
2.36	57%
1.18	49%
0.600	43%
0.425	40%
0.300	35%
0.150	23%
0.075	10%
Particle Size (microns)	
73	10%
52	9%
38	7%
19	7%
10	5%
5	5%
1	4%

Samples analysed as received.

Median Particle Size (mm)*	1.328

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 5-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.8 g/cm3

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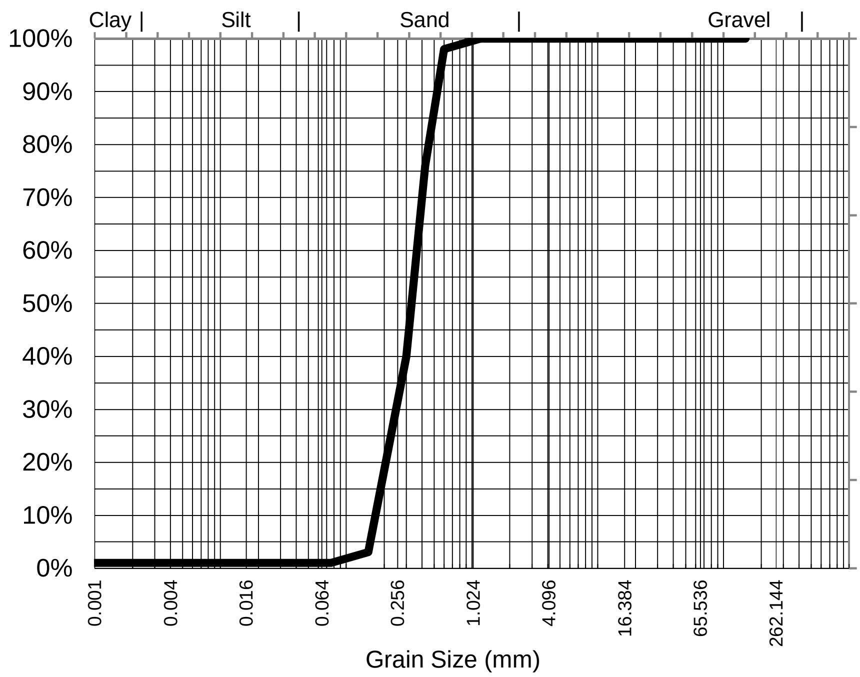
CLIENT:	Ivansteward	**DATE REPORTED:**	16-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	23-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STRE ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627811-001 / PSD
PROJECT:	520	**SAMPLE ID:**	L1

Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	98%
0.425	76%
0.300	40%
0.150	3%
0.075	1%
Particle Size (microns)	
75	1%
54	1%
38	1%
19	1%
10	1%
5	1%
1	1%

Median Particle Size (mm)*	0.335

Samples analysed as received.

** Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	14-Dec-16
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.88 (2.85)* g/cm3

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CLIENT: Ivansteward

DATE REPORTED: 16-Dec-2016

COMPANY: COFFEY ENVIRONMENTS PTY LTD

DATE RECEIVED: 23-Nov-2016

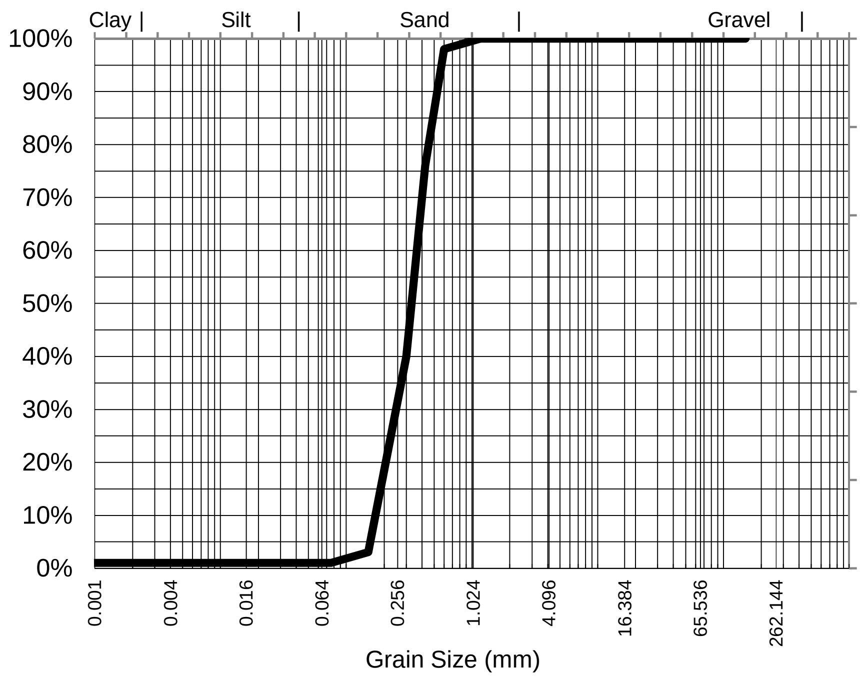
ADDRESS: LEVEL 1, 436 JOHNSTON STRE ABBOTSFORD VIC, AUSTRALIA 3067

REPORT NO: EB1627811-001DUP / PSD

PROJECT: 520

SAMPLE ID: L1

Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	98%
0.425	76%
0.300	40%
0.150	3%
0.075	1%
Particle Size (microns)	
75	1%
54	1%
38	1%
19	1%
10	1%
5	1%
1	1%

Median Particle Size (mm)*	0.335

Samples analysed as received.

** Soil Particle Density results fell outside the scope of AS 1289.3.6.3. Typical sediment SPD values used for calculations and consequently, NATA endorsement does not apply to hydrometer results*

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 14-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.88 (2.85)* g/cm3

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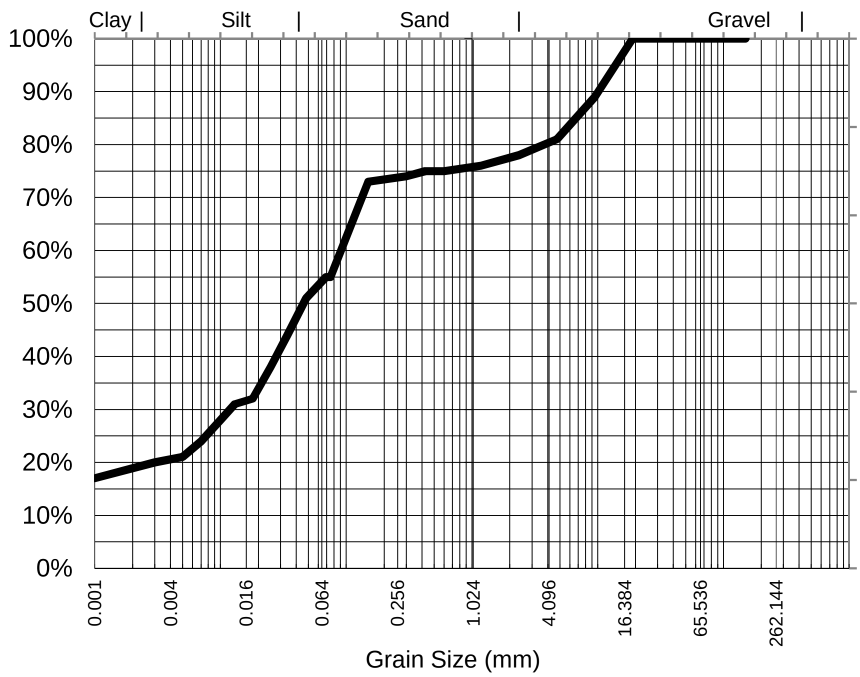
CLIENT:	Ivansteward	**DATE REPORTED:**	16-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	23-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STRE ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627811-002 / PSD
PROJECT:	520	**SAMPLE ID:**	V1D

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	89%
4.75	81%
2.36	78%
1.18	76%
0.600	75%
0.425	75%
0.300	74%
0.150	73%
0.075	55%
Particle Size (microns)	
69	55%
48	51%
34	44%
18	32%
10	28%
5	21%
1	17%

Samples analysed as received.

Median Particle Size (mm)*	0.046

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 14-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.77 g/cm3

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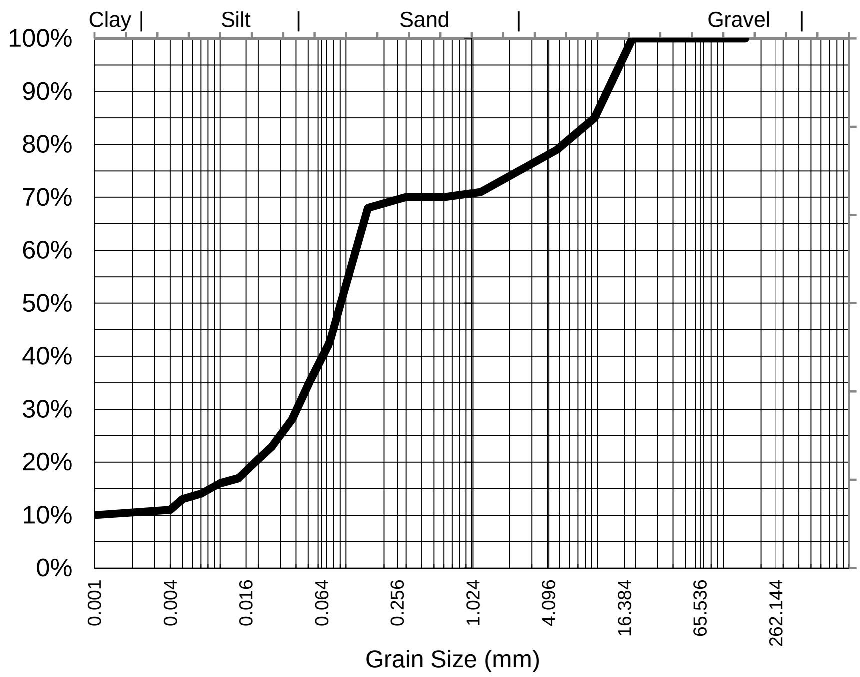
CLIENT:	Ivansteward	**DATE REPORTED:**	16-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	23-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STRE ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627811-003 / PSD
PROJECT:	520	**SAMPLE ID:**	V1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	85%
4.75	79%
2.36	75%
1.18	71%
0.600	70%
0.425	70%
0.300	70%
0.150	68%
0.075	43%
Particle Size (microns)	
72	42%
51	35%
37	28%
19	20%
10	16%
5	13%
1	10%

Median Particle Size (mm)*	0.096

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 14-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.75 g/cm3

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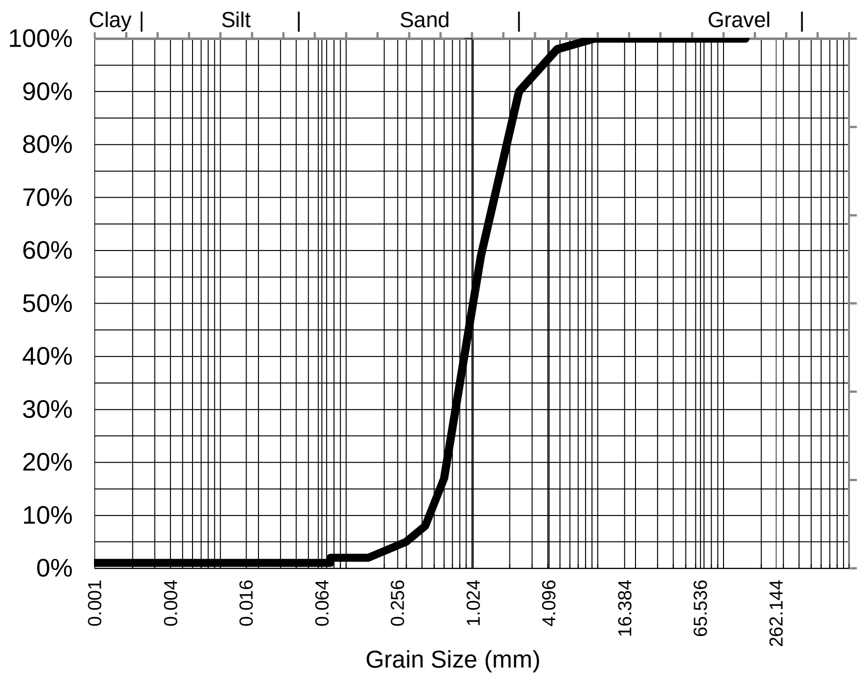
CLIENT:	Ivansteward	**DATE REPORTED:**	16-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	23-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STRE ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627811-004 / PSD
PROJECT:	520	**SAMPLE ID:**	S2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	98%
2.36	90%
1.18	59%
0.600	17%
0.425	8%
0.300	5%
0.150	2%
0.075	2%
Particle Size (microns)	
75	1%
57	1%
40	1%
20	1%
10	1%
5	1%
1	1%

Samples analysed as received.

Median Particle Size (mm)*	1.056

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 14-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.68 g/cm3

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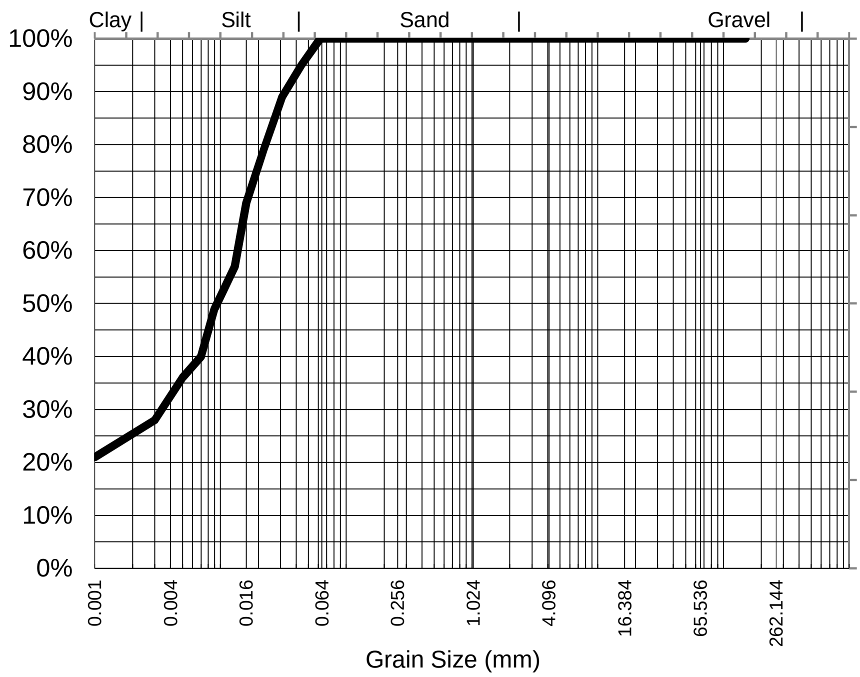
CLIENT:	Ivansteward	**DATE REPORTED:**	16-Dec-2016
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	23-Nov-2016
ADDRESS:	LEVEL 1, 436 JOHNSTON STRE ABBOTSFORD VIC, AUSTRALIA 3067	**REPORT NO:**	EB1627811-005 / PSD
PROJECT:	520	**SAMPLE ID:**	M1

Particle Size Distribution



Particle Size (mm)	Percent Passing
Particle Size (microns)	
62	100%
44	95%
31	89%
16	69%
9	49%
5	36%
1	21%

Median Particle Size (mm)*	0.010

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 14-Dec-16

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.79 g/cm3

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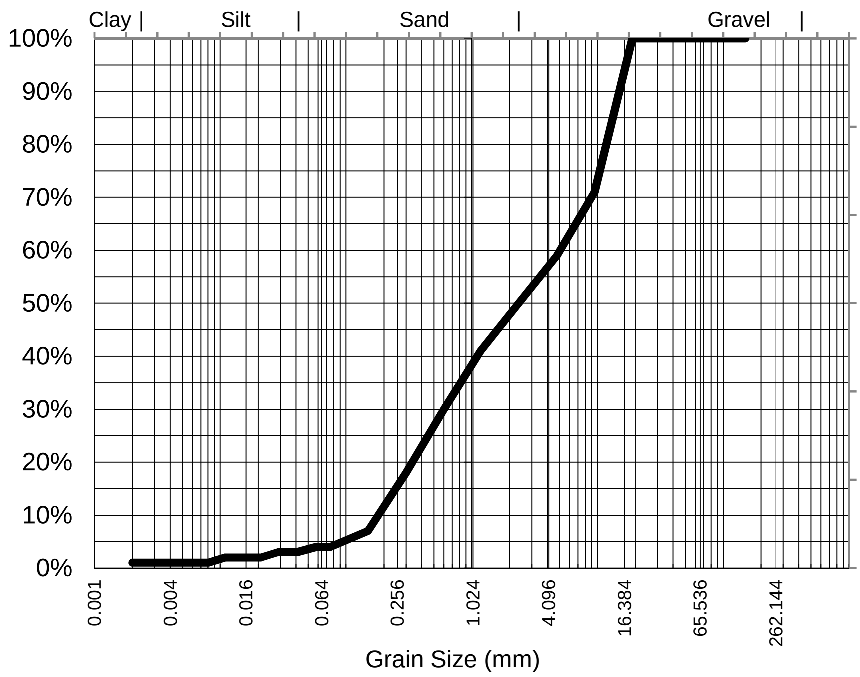
CLIENT:	TRAVIS WOOD	**DATE REPORTED:**	28-Apr-2017
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-001 / PSD
PROJECT:	520	**SAMPLE ID:**	B1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	71%
4.75	59%
2.36	50%
1.18	41%
0.600	30%
0.425	24%
0.300	18%
0.150	7%
0.075	4%
Particle Size (microns)	
75	4%
58	4%
41	3%
21	2%
11	2%
5	1%
2	1%

Samples analysed as received.

Median Particle Size (mm)*	2.360

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.66 g/cm3

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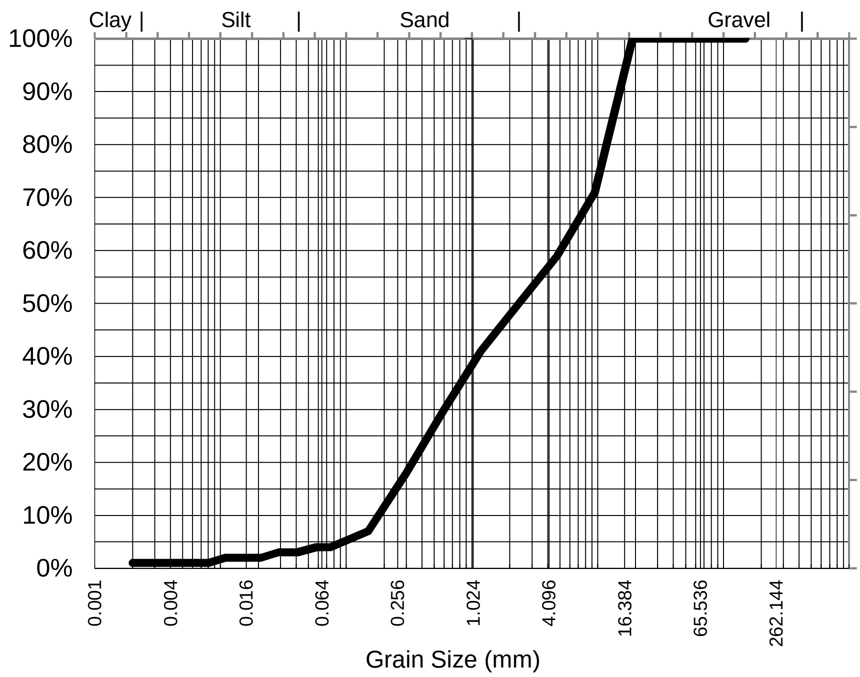
Brisbane, QLD

CLIENT:	TRAVIS WOOD	**DATE REPORTED:**	28-Apr-2017
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-001DUP / PSD
PROJECT:	520	**SAMPLE ID:**	B1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	71%
4.75	59%
2.36	50%
1.18	41%
0.600	30%
0.425	24%
0.300	18%
0.150	7%
0.075	4%
Particle Size (microns)	
75	4%
58	4%
41	3%
21	2%
11	2%
5	1%
2	1%

Median Particle Size (mm)*	2.360

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Loss on Pretreatment NA

Sample Description:

Test Method: AS1289.3.6.3 2003

Analysed: 25-Apr-17

Limit of Reporting: 1%

Dispersion Method Shaker

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.66 g/cm3

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CLIENT: TRAVIS WOOD

DATE REPORTED: 28-Apr-2017

COMPANY: COFFEY ENVIRONMENTS PTY LTD

DATE RECEIVED: 19-Apr-2017

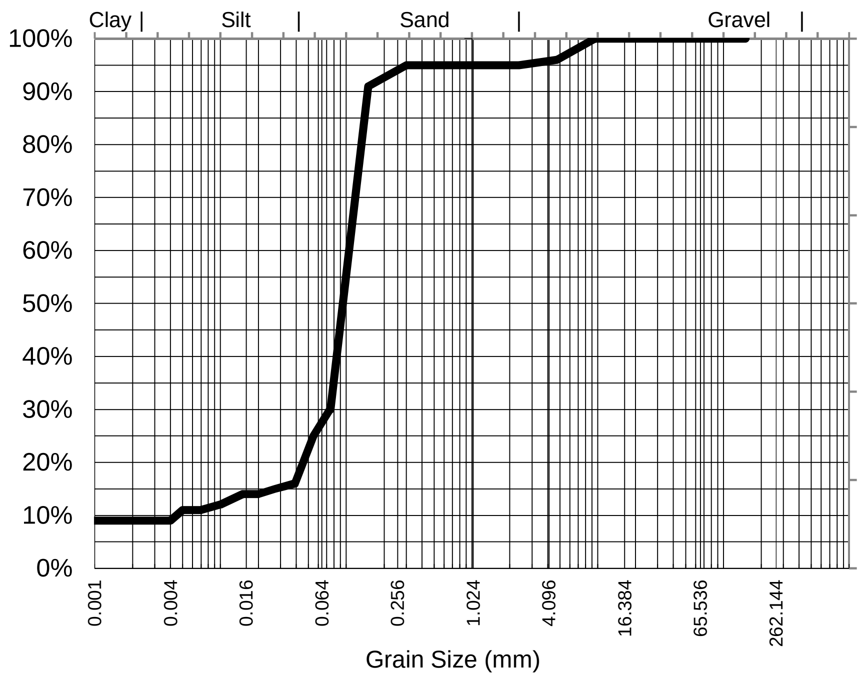
ADDRESS: LEVEL 1, 436 JOHNSTON ST
ABBOTSFORD VIC, 3067

REPORT NO: EB1707858-002 / PSD

PROJECT: 520

SAMPLE ID: W2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	96%
2.36	95%
1.18	95%
0.600	95%
0.425	95%
0.300	95%
0.150	91%
0.075	30%
Particle Size (microns)	
74	30%
55	25%
39	16%
20	14%
10	12%
5	11%
1	9%

Samples analysed as received.

Median Particle Size (mm)*	0.100

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.79 g/cm3

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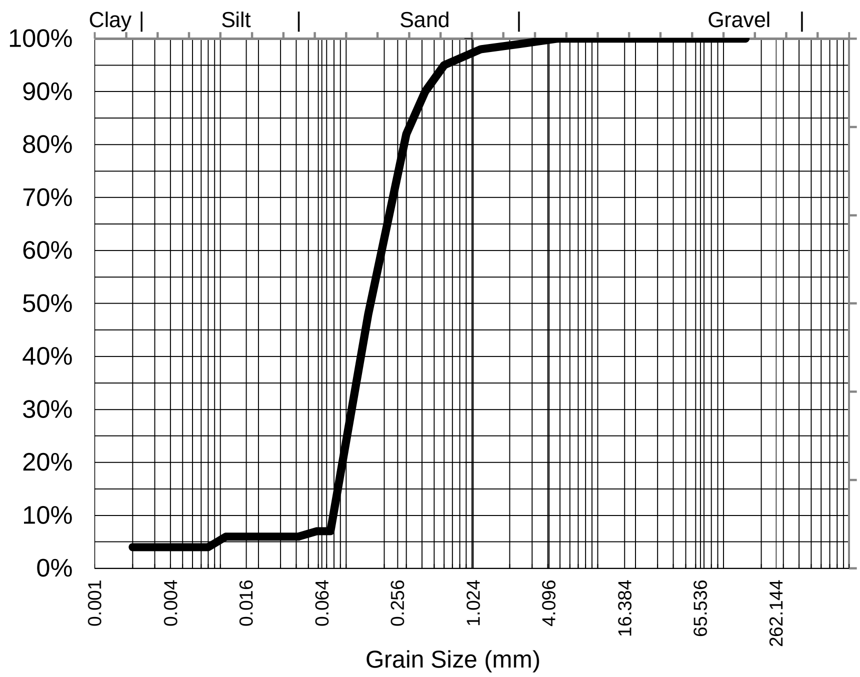
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-003 / PSD
PROJECT:	520	**SAMPLE ID:**	W1

Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	90%
0.300	82%
0.150	48%
0.075	7%
Particle Size (microns)	
75	7%
59	7%
42	6%
21	6%
11	6%
5	4%
2	4%

Samples analysed as received.

Median Particle Size (mm)*	0.159

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.63 g/cm3

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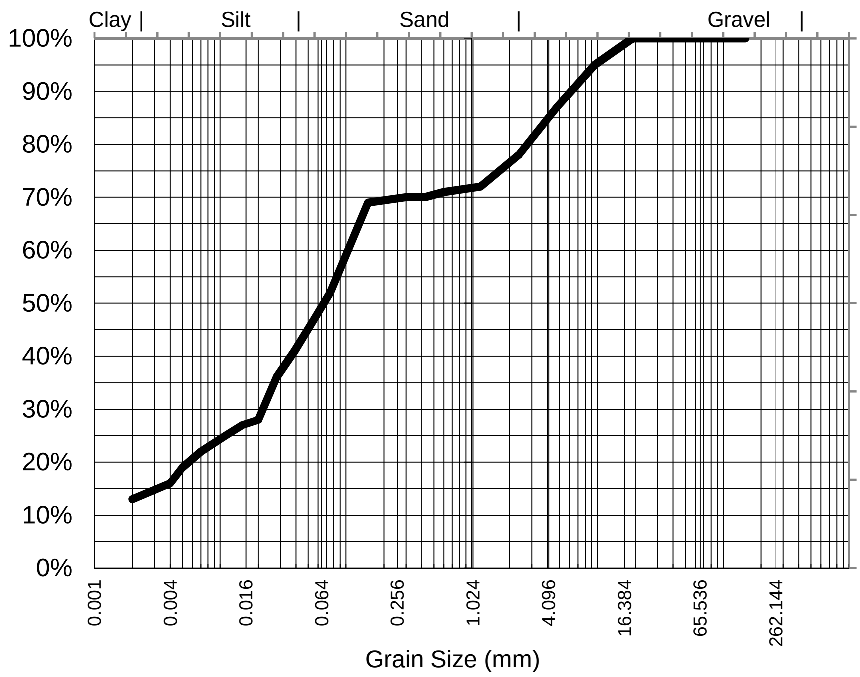
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-004 / PSD
PROJECT:	520	**SAMPLE ID:**	V1

Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	95%
4.75	87%
2.36	78%
1.18	72%
0.600	71%
0.425	70%
0.300	70%
0.150	69%
0.075	52%
Particle Size (microns)	
75	52%
56	47%
39	41%
20	28%
11	25%
5	19%
2	13%

Median Particle Size (mm)*	0.067

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:		**Analysed:**	25-Apr-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.56 g/cm3

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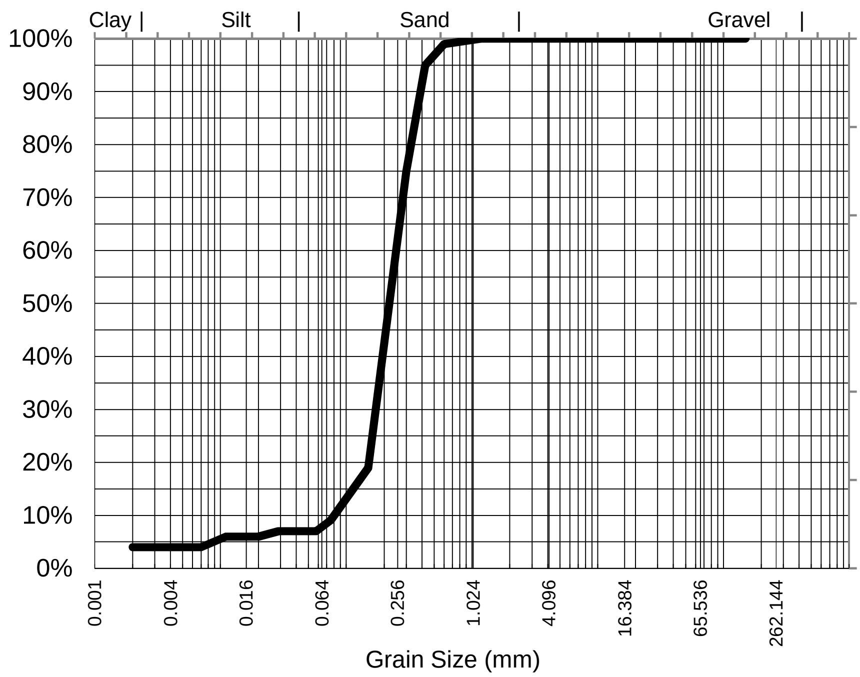
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-005 / PSD
PROJECT:	520	**SAMPLE ID:**	LA1

Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	95%
0.300	75%
0.150	19%
0.075	9%
Particle Size (microns)	
75	9%
58	7%
41	7%
20	6%
11	6%
5	4%
2	4%

Samples analysed as received.

Median Particle Size (mm)*	0.233

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	25-Apr-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.7 g/cm3

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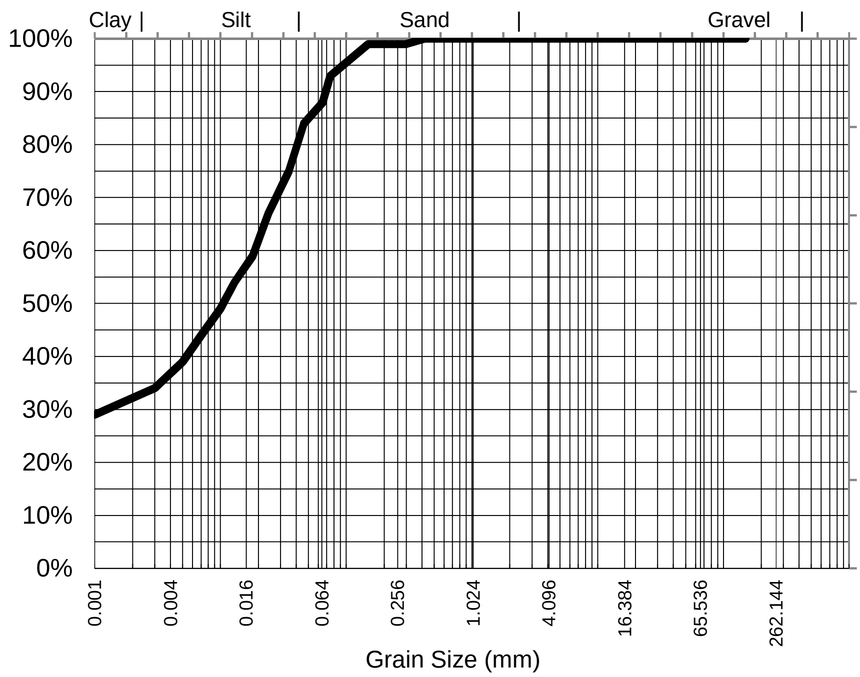
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-006 / PSD
PROJECT:	520	**SAMPLE ID:**	LA2

Particle Size Distribution



Particle Size (mm)	Percent Passing
0.425	100%
0.300	99%
0.150	99%
0.075	93%
Particle Size (microns)	
65	88%
46	84%
35	75%
18	59%
10	49%
5	39%
1	29%

Samples analysed as received.

Median Particle Size (mm)*	0.011

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.68 g/cm3

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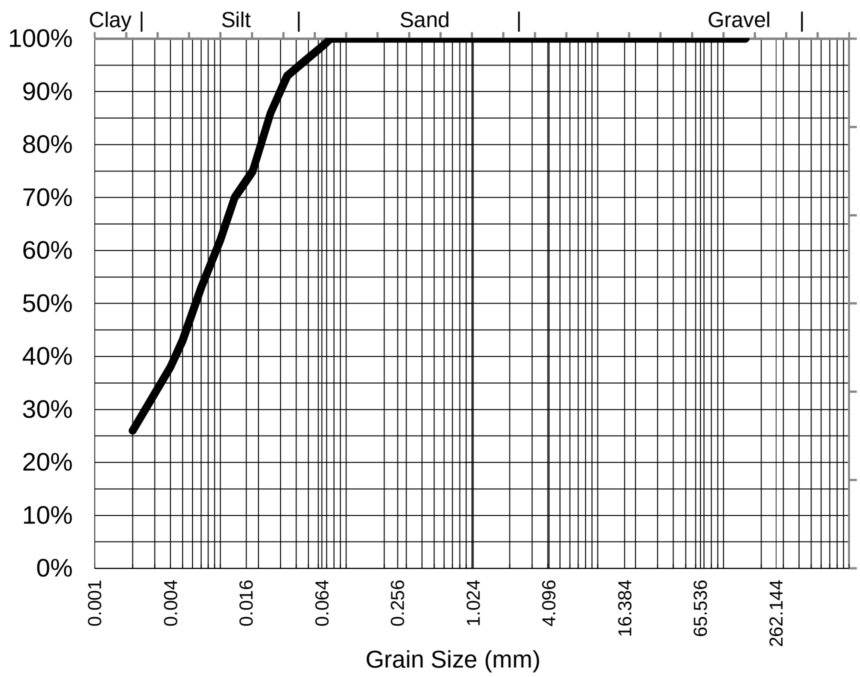
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-007 / PSD
PROJECT:	520	**SAMPLE ID:**	LA3

Particle Size Distribution



Particle Size (mm)	Percent Passing
Particle Size (microns)	
68	99%
48	96%
34	93%
18	75%
10	62%
5	43%
2	26%

Median Particle Size (mm)*	0.006

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.56 g/cm3

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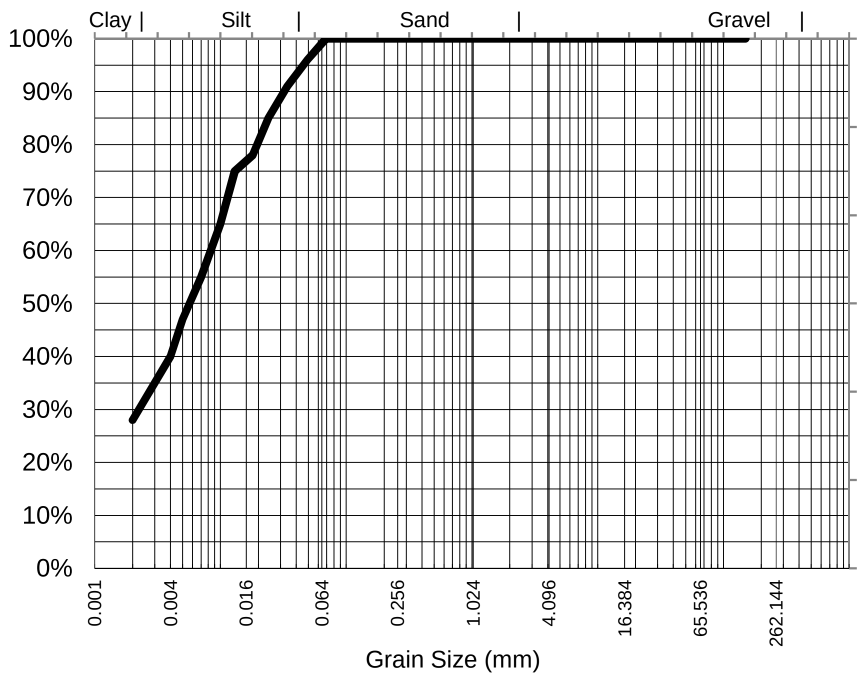
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-008 / PSD
PROJECT:	520	**SAMPLE ID:**	LA4

Particle Size Distribution



Particle Size (mm)	Percent Passing
Particle Size (microns)	
69	100%
49	96%
34	91%
18	78%
10	65%
5	47%
2	28%

Samples analysed as received.

Median Particle Size (mm)*	0.006

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.54 g/cm3

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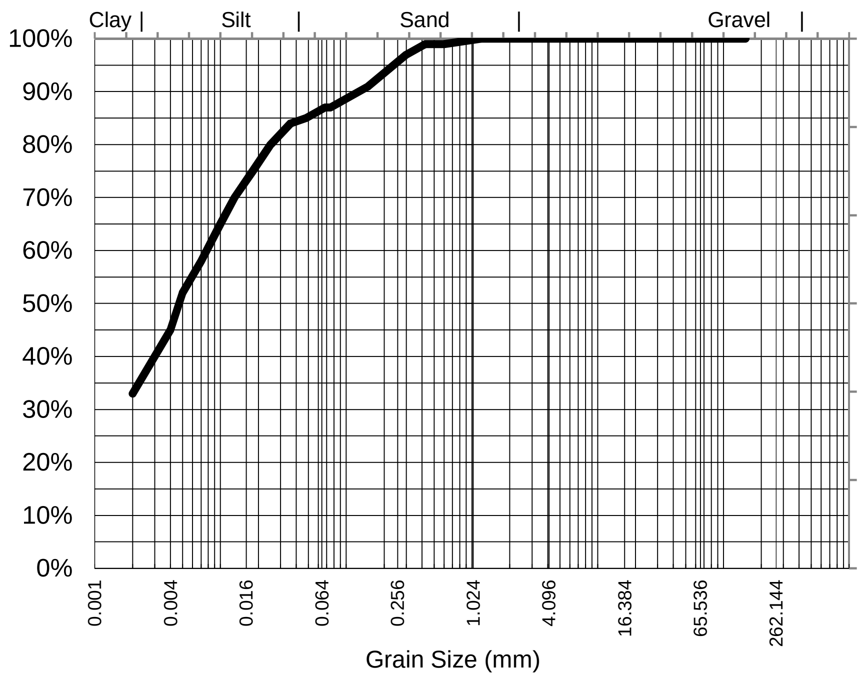
CLIENT:	TRAVIS WOOD	**DATE REPORTED:**	28-Apr-2017
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-009 / PSD
PROJECT:	520	**SAMPLE ID:**	LA5

Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	99%
0.300	97%
0.150	91%
0.075	87%
Particle Size (microns)	
68	87%
48	85%
36	84%
18	75%
10	65%
5	52%
2	33%

Median Particle Size (mm)*	0.005

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:		**Analysed:**	25-Apr-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.58 g/cm3

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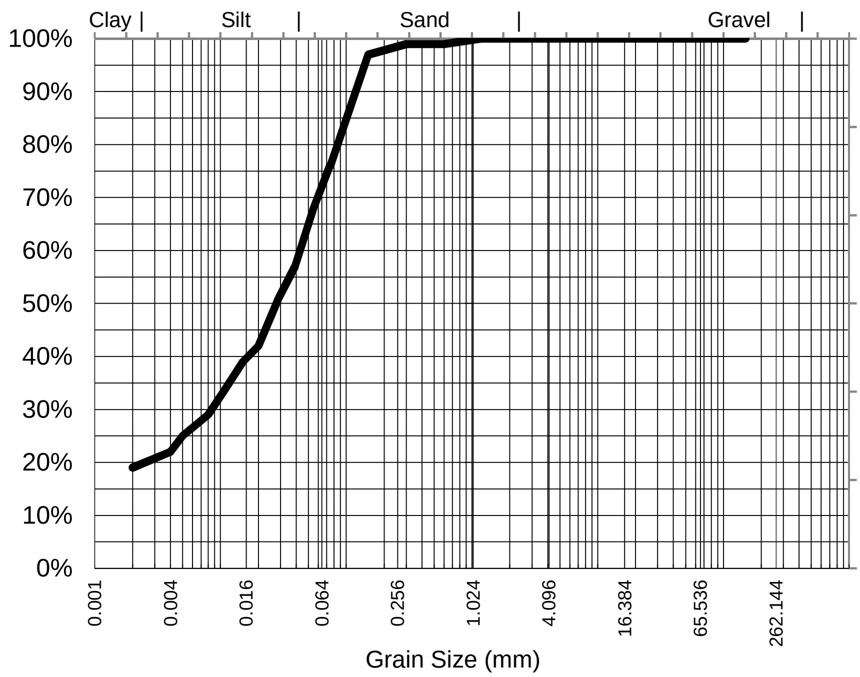
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-010 / PSD
PROJECT:	520	**SAMPLE ID:**	M1

Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	99%
0.300	99%
0.150	97%
0.075	76%
Particle Size (microns)	
74	76%
55	68%
39	57%
20	42%
11	34%
5	25%
2	19%

Median Particle Size (mm)*	0.028

Samples analysed as received.

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.49 g/cm3

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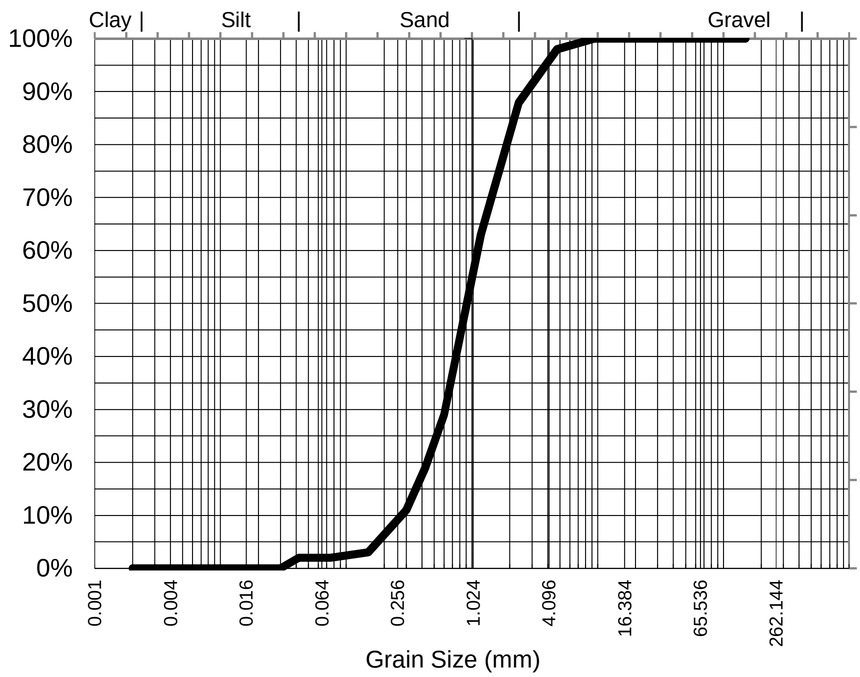
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-011 / PSD
PROJECT:	520	**SAMPLE ID:**	S2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	98%
2.36	88%
1.18	63%
0.600	29%
0.425	19%
0.300	11%
0.150	3%
0.075	2%
Particle Size (microns)	
75	2%
59	2%
42	2%
21	0%

Samples analysed as received.

Median Particle Size (mm)*	0.958

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.62 g/cm3

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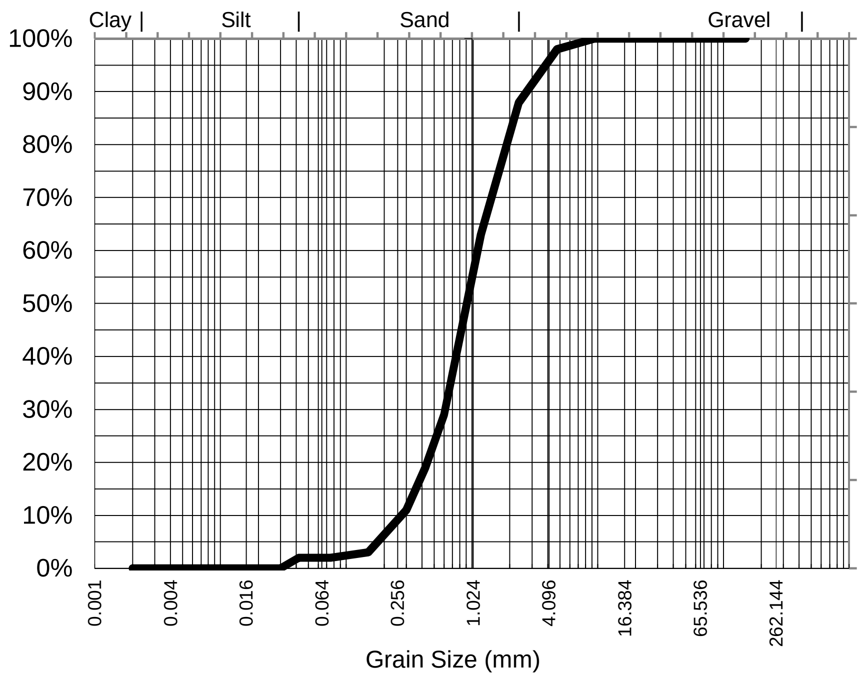
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-011DUP / PSD
PROJECT:	520	**SAMPLE ID:**	S2

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	98%
2.36	88%
1.18	63%
0.600	29%
0.425	19%
0.300	11%
0.150	3%
0.075	2%
Particle Size (microns)	
75	2%
59	2%
42	2%
21	0%

Samples analysed as received.

Median Particle Size (mm)*	0.958

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments: AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly

Analysed: 25-Apr-17

Loss on Pretreatment NA

Limit of Reporting: 1%

Sample Description:

Dispersion Method Shaker

Test Method: AS1289.3.6.3 2003

Hydrometer Type ASTM E100

Soil Particle Density (<2.36mm) 2.62 g/cm3

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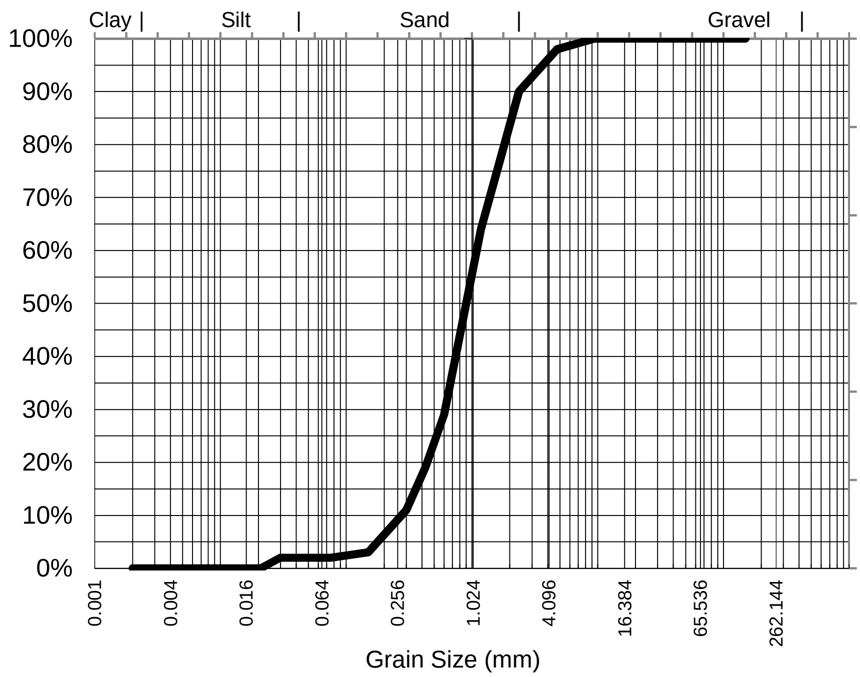
CLIENT:	TRAVIS WOOD	**DATE REPORTED:**	28-Apr-2017
COMPANY:	COFFEY ENVIRONMENTS PTY LTD	**DATE RECEIVED:**	19-Apr-2017
ADDRESS:	LEVEL 1, 436 JOHNSTON ST ABBOTSFORD VIC, 3067	**REPORT NO:**	EB1707858-012 / PSD
PROJECT:	520	**SAMPLE ID:**	S2-D

Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	98%
2.36	90%
1.18	64%
0.600	29%
0.425	19%
0.300	11%
0.150	3%
0.075	2%
Particle Size (microns)	
75	2%
59	2%
42	2%
21	0%

Samples analysed as received.

Median Particle Size (mm)*	0.948

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

Sample Comments:	AS1289.3.6.3 states that this method is not applicable for samples containing <10% fines (<75um). Results should be assessed accordingly	**Analysed:**	25-Apr-17
Loss on Pretreatment	NA	**Limit of Reporting:**	1%
Sample Description:		**Dispersion Method**	Shaker
Test Method:	AS1289.3.6.3 2003	**Hydrometer Type**	ASTM E100

Soil Particle Density (<2.36mm) 2.61 g/cm3

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Appendix D – Huon Gulf Inshore Benthos Report

HUON GULF INSHORE BENTHOS

SAMPLES SUBMITTED FOR MACROFAUNA AND MEIOFAUNA EXTRACTION AND IDENTIFICATION

Revision 1

Prepared for Wafi-Golpu Joint Venture

by:

DR JOHN H. MOVERLEY
7 Lansell Crescent
Camberwell 3124
Phone: 0398891475

June 21 2017

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ILLUSTRATIONS

LIST OF TABLES

LIST OF FIGURES

REVISION HISTORY

Version	Date	Notes on version
Original	9/6/17	First release
Revision 1		Changes to Sections 1.0, 2.0, 3.1, 3.4, 4.3 and header Appendix B made after review by Ivan Steward (Coffey / WGJV).

LIST OF ACRONYMS AND ABBREVIATIONS

CEFAS	Centre for Environment, Fisheries and Aquaculture Science
DSTP	Deep Sea Tailings Placement
PNG	Papua New Guinea
WGJV	Wafi-Golpu Joint Venture

1.0 INTRODUCTION

Eight macrofauna and eight meiofauna samples from the Huon Gulf, Morobe Province, Papua New Guinea were supplied. The samples were collected as part of a Wafi-Golpu Joint Venture feasibility study into using the area for deep sea tailings placement (DSTP). The samples were collected from depths less than 10 m.

The samples were prepared, fixed and preserved in the field and forwarded to Dr Moverley in Melbourne for extraction, identification and enumeration of the macrofauna and meiofauna.

Dr Moverley was instructed to use the same methods as for the 2017 Huon Gulf deep sea samples being processed for Ian Hargreaves and Associates.

1.1 Material Provided

Eight macrofauna samples were submitted for the extraction of the macrofauna and their identification to family taxonomic level, or, if the family could not be identified, to the lowest possible taxonomic level.

Eight meiofauna samples were submitted for the extraction of the meiofauna and their identification to major taxonomic groups.

Collection data including method, area sampled and locations, was not supplied. Many of the meiofauna animals live in the flocculent layer which collects at the sediment-water interface. Information was not supplied on whether or not the samples had been collected with this layer intact.

1.2 Report Objectives

This report:

- Documents the methods and procedures used for processing the samples.
- Records the results of the sorting, identification to the family taxonomic level and counting for the macrobenthos samples.
- Records the results of the sorting, identification to higher taxonomic levels (phylum or class) and counting for the meiobenthos samples.
- Documents the observations of the sediments that had been retained on the 0.5 mm sieve when collecting the macrofauna samples.
- Documents any interesting observations made on the macrofauna and meiofauna.

2.0 GENERAL OBSERVATIONS

The formalin preserved samples were stored between being collected in late February till they were processed in late May. Normally marine sediments are buffered from pH changes due to there being a large amount of calcium carbonate (shell fragments) in the sediments. This was not the case with these samples as they contained very small amounts of shell fragments. Formalin, which had been used for fixing and preserving the samples, is acidic. Also, the samples contained terrestrial organic matter, which breaks down to give acids. There was not enough buffering in these samples to prevent most of shells of the soft bottom benthic molluscs from completely or partially dissolving, over the storage time.

The samples appeared to have come from a wide range of sediment types with some containing a large quantity of terrestrial plant material while others contained virtually none. There was also a wide range in the amount and size of gravel in the samples.

The sand and gravel particles were mostly of angular and sub-angular shape with low sphericity. Sand particles were a wide range of colours from white to dark grey and black. The dark colours dominated giving the appearance of dark grey sand.

The overall impression was that these were not typical marine subtidal sediments. The presence of gravel, terrestrial plant material and the colour and shape of the sand particles made the sediments appear more like estuarine sediments than marine sediments.

Sample LA3 included some domestic rubbish.

Figure 2-1 Domestic rubbish in macrofauna sample LA3.

3.0 MACROFAUNA

3.1 Sediment Observations

Notes made on the macrofauna sample sediments are presented in Appendix A. The samples were photographed. Dr Moverley holds a copy of these photographs.

These notes were made on material that had been sieved in the field and thoroughly washed and sieved using a 0.5 mm sieve in the laboratory. These observations are of the sieved material and not the natural sediments.

3.2 Macrofauna Extraction Procedures

Macrofauna samples were processed based on the methods in U.K. Centre for Environment, Fisheries and Aquaculture Science, Clean Seas Environment Monitoring Programme Green Book V13 (CEFAS, 2010).

The samples were split into three size fractions using a series of 2 mm, 1 mm and 0.5 mm sieves. For each fraction, the lighter material in the sample was then separated from the sand, gravel and shell by placing the washed material in a sorting tray, covering the sample with water and suspending the lighter material by gently agitating the sample in a panning motion. The suspended material was then poured off into a 0.5 mm sieve. This process was repeated several times until no material was being washed out.

Figure 3-1 B1 macrofauna sample 2 mm fraction showing gravel and terrestrial organic matter.

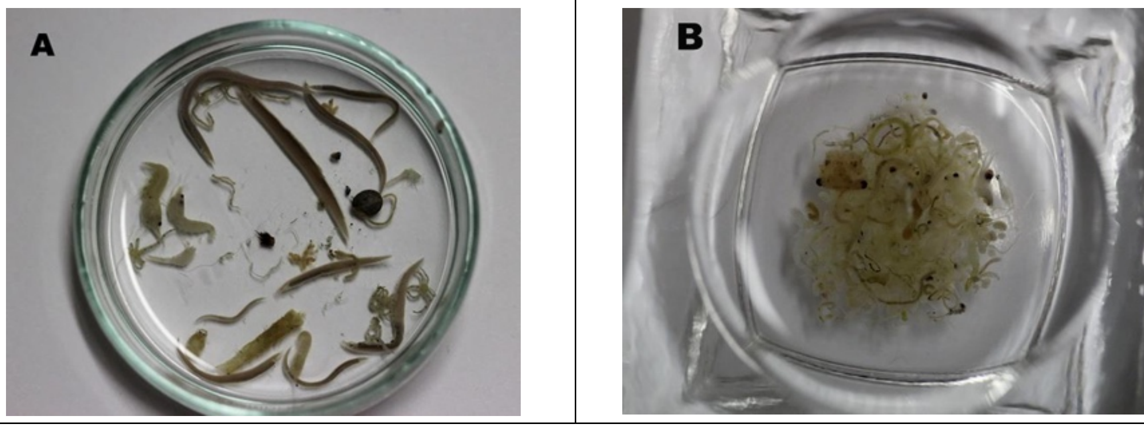

Figure 3-2 Sample S2 macrofauna.

A: Large animals picked out by eye. The large "worms" are amphioxus. B Approximately 300 small animals floated from the sample then picked out under the dissecting microscope.

The material collected in the sieve was sorted under a dissecting microscope (Figure 3-2). The denser material remaining in the tray for the fractions retained on the 2 mm and 1 mm sieves was sorted by eye. The fraction retained on the 0.5 mm sieve was initially sorted by eye. Then a portion of the sample was sorted under a dissecting microscope for 15 minutes. If no animals were found the remaining sample was then sorted by eye again. If no animals were found the sediment was discarded. If animals were found, then all the 0.5 mm fraction was sorted under the microscope.

3.3 Macrofauna Enumeration Procedures

All metazoan[1] benthic animals included in the sample are recorded. Only whole animals or fragments with heads were counted. This prevents multiple counting of specimens that are fragmented.

Some workers regard nematodes and harpacticoids as meiofauna, regardless of their size. Therefore, they do not include them in macrofauna data. This is not the case in this analysis. All benthic metazoan animals regardless of taxa were recorded. Planktonic animals can be introduced into the sample when it is being washed and sieved in the field or collected in the grab as it is being lowered. Under the protocols such animals are not counted. In this set of samples no planktonic animals were found.

[1] Multicellular animals with cells differentiated into tissues.

3.4 Macrofauna Observations

The taxonomic listing of macrofauna and the numbers collected in the samples is presented in Appendix B. These results are summarised in Table 3-1, where the total numbers of macrofauna per sample are presented.

Table 3-1 Numbers of macrobenthic animals collected in the Huon Gulf inshore samples

Sample	Number
W2	42
W1	96
V1	230
S2	322
LA3	4
M1	1
LA1	24
B1	1

The numbers collected from each site were highly variable and the taxonomic makeup was also very different for the different samples.

Sample S2 contained 10 amphioxi. Amphioxus are biologically interesting because they are a link between invertebrates and vertebrates. Originally, they were only known from fossil records. They are now known to have a worldwide distribution in tropical and temperate waters. They are reported here because in my experience amphioxus occur in low densities and are rarely seen. Main internet sites also report them as being “rare” and only occurring at high densities in a few places. However, Wikipedia (2017) reports that in Asia amphioxus is used for human and animal food. The status of amphioxus in PNG needs to be investigated. Hao et. al. (2014) have written a paper on how environmental impacts, such as changes in sediment grain sizes, impact amphioxus density.

Generally, the samples lacked the high diversity that is expected in shallow water tropical benthos samples. There appeared to be very high numbers of a few taxa and not many taxa with only one or two representatives. Such communities are characteristic of stressed environments. This is an aspect of the data that I believe should be further explored, by comparison with data in the literature from similar sites if possible.

Sample V1 contained high numbers of Anomiidae[2]. Technically, these are not soft bottom benthic animals as like oysters they grow attached to hard substrates. The sample contained a large amount of gravel, some pieces of which were 4 to 5 cm long. Presumably, the Anomiidae had been attached to this gravel. If the full report is to be on soft sediment benthos, Anomiidae could / should be excluded.

Also, there were 92 Sphaeromatidae isopods in Sample V1. This is an unusually high number of these isopods.

The most important observations about the macrofauna samples are not what they contain but what is rare and absent compared to other macrofauna samples I have examined from inshore and estuarine habitats.

Except for the 85 Anomiidae shells in Sample V1, molluscs made up about 2% of the total numbers of macrofauna. I would have expected it to be over 15%. Because of the plant material and the formalin, the samples had become acidic and the shells of most molluscs had been decalcified. This makes identifying them hard but should not have prevented their being found. The decalcified shells tend to wash out and be picked out under the dissecting microscope. Also, not all molluscs are decalcified to the same degree. Nassariidae[3] are common shallow water marine snails. Three specimens were found in the samples. These showed very little decalcification. If there had been substantial numbers of molluscs in the samples, it would have been expected that more Nassariidae would have been found. My conclusion is that the low abundances of molluscs in the samples is genuine and not an artefact caused by the acidity of the samples.

The polychaete group Sedentaria[4] also appeared to be under-represented in the samples. Particularly missing in the polychaetes were the filter feeders and those that feed by spreading tentacles over the sediment surface. The Nereididae are a very successful polychaete group that live in most marine and estuarine habitats and normally have a large number of species present in shallow water habitats. Although not in the Sedentaria group I believe these were also under-represented in the samples.

There were amphipod and tanaid families that I would have expected to find large numbers of that were present in low numbers or absent. I am sure that a detailed examination of the data will reveal more macrofauna animals under-represented in the samples when compared to general tropical subtidal benthic communities.

[2] Common names are jingle shells and saddle oysters.

[3] Dog Whelks

[4] Filter and deposit feeding worms rather than scavengers and predators which belong to the polychaete group Errantia.

4.0 MEIOFAUNA

4.1 Meiofauna Extraction Procedures

Meiofauna is defined as animals that pass through a 500 µm sieve and are retained on a 63 µm sieve (Higgins & Thiel, 1988). Material in the samples larger than 500 µm has been discarded. This was done to reduce the amount of material where there was a large amount of terrestrial organic matter.

Meiofauna was extracted using the flotation techniques in Somerfield & Warwick (1996). This method is a standard procedure for extracting meiofauna for ecological analysis and is recognised to have greater than 95% extraction efficiency.

The meiofauna sample was washed using a series of sieves, 1000 µm, 500 µm and 63 µm. In each sieve, the sample was gently washed and allowed to soak in fresh water until any large particles had lost adhesion and broken apart. The fractions retained on the 1000 µm and 500 µm sieves were discarded.

The material remaining in the 63 µm sieve was placed in a one-litre measuring cylinder. The cylinder was then filled with tap water and inverted several times to ensure thorough mixing. It was then allowed to stand for a few minutes while heavier particles settled. The supernatant was washed using a 63 µm sieve. This step was repeated at least three times, and up to six times where sediment was still being collected. The sediment that had settled in the bottom of the measuring cylinder was discarded. (Figure 4-1).

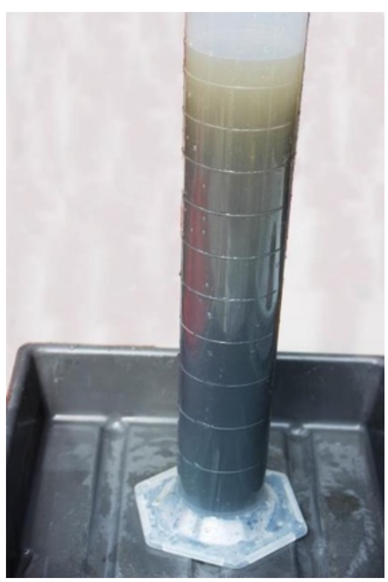

Figure 4-1 W2 meiofauna sample first extraction step.

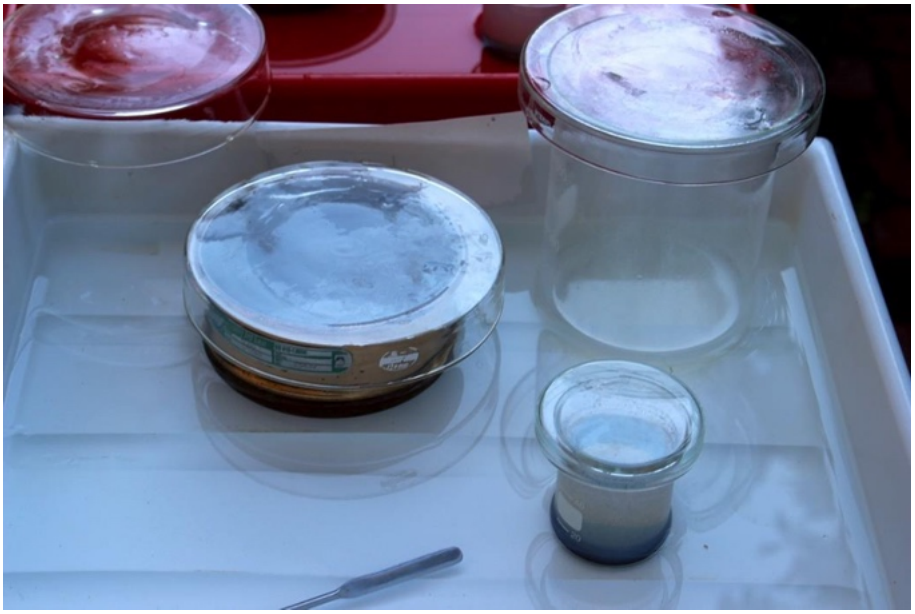

Figure 4-2 W1 meiofauna sample being floated out in Ludox.

The material collected in the sieve was washed into a 50 ml beaker with Ludox TM solution that had been adjusted to a specific gravity of 1.15. The beaker was filled with the Ludox solution and the sample mixed by stirring. After being allowed to settle for 45 minutes, the supernatant was then poured through a 63 µm sieve (Figure 4-2). This process was repeated three times.

The sediment in the bottom of the beaker was discarded and the material retained on the sieve was thoroughly washed with water to remove any Ludox solution. When clean it was washed into glass staining blocks with 7% glycerol in water, and then placed in a drying oven (Figure 4-3). The sample was left in the drying oven until reduced to approximately 25% of its original volume by the evaporation of water (approximately 24 hours). Using a pipette, the sample was transferred from the staining block onto microscope slides[5]. The slide was placed in the drying oven and the remaining water allowed to evaporate, leaving the sample on the microscope slide in glycerol. A cover slip was placed on the slide and then sealed with Safety Mount No 4.

[5] The slides had previously been prepared by placing a ridge of dried Safety Mount No 4 around the edges to contain the sample and to prevent the coverslip crushing the animals.

Figure 4-3 Meiofauna sample in staining blocks being concentrated by evaporation.

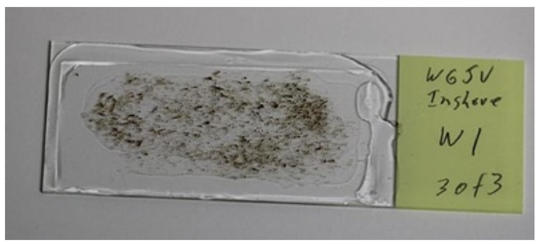

Figure 4-4 Meiofauna sample on a microscope slide.

Such slides can contain over 100 meiofauna animals, though the visible material is organic detritus, which is collected because it has a similar specific gravity to the animals.

4.2 Meiofauna Enumeration Procedures

Meiofauna is defined as metazoan[6] animals that can pass through a 500 μm mesh sieve but are retained on a 63 μm sieve (Higgins & Thiel, 1988). Ciliates, which are single-celled animals, but frequently larger than the smaller metazoans have not been included in the meiofauna counts.

The slides were scanned under a compound microscope (Zeiss, Axioskop 20). On finding a multicellular animal, the animal was identified and recorded on a tablet using an Excel spreadsheet with macros written for recording meiofauna counts. Nematodes and harpacticoids were often counted then the data entered when approximately 20 nematodes had been counted.

Identifications in these surveys have only been made to higher taxonomic groupings such as nematode and harpacticoid.

[6] Multicellular animals with cells differentiated into tissues.

The meiofauna slides prepared for this study have been stored and unless returned to WGJV will be kept for 12 months to allow for more detailed taxonomic identification in the future if required. The storage time can be extended if required.

4.3 Meiofauna Observations

The taxonomic listing and numbers of meiofauna in the samples is presented in Appendix C. These results are summarised in Table 4-1 where the total numbers per sample are presented.

Table 4-1 Numbers of meiobenthic animals collected in the WGJV inshore samples

Sample	Number
W2	4449
W1	927
V1	962
S2	1811
LA3	278
M1	28
LA1	693
B1	27

Without knowing the area sampled, it is not possible to calculate the density of meiofauna in the samples. Thus, it is not possible to comment if these numbers fall within the expected range.

It was observed that those samples with large quantities of terrestrial organic material had low numbers of animals (less than 30). I would have expected the organic material to provide an abundant food source and be associated with high meiofauna numbers.

Sample S2 contained a large proportion of easily identified nematode genera, which were not observed in any of the other samples.

The overall impression was that the meiofauna communities in the different samples tended to be unique. This will probably show up in the higher level taxa data collected, but it was very apparent in the makeup of the nematode and harpacticoid assemblages.

Although there were large numbers of harpacticoids collected only a few were observed carrying eggs and, with the exception of sample S2, the numbers of nauplii were low. Usually, samples with high densities of harpacticoids have many females carrying eggs and nauplii stages very abundant. The observation of low numbers of gravid females and low numbers of the early developmental stage suggests harpacticoid reproduction was not occurring at the places and/or time the samples were collected.

5.0 REFERENCES

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Hao, L., M. Minghui, L. Bin & B. Chenguang (2014) Temporal and spatial dynamics of amphioxus population (Branchiostoma belcheri tsingtaneuse) and its influential factors in Luan River Estuary, China. Ecol. Evol. 4, 3027–37. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4161176/

Higgins, R.P. & H. Thiel (Eds), 1988. Introduction to the Study of Meiofauna. Smithsonian Institute Press, Washington.

Somerfield, P.J. and R.M. Warwick, 1996. Meiofauna in marine pollution monitoring: a laboratory manual. Ministry of Agriculture, Fisheries and Food Directorate of Fisheries Research, Lowestoft.

Wikipedia, 2016. Lancelet [cited 8/7/17] Available from https://en.wikipedia.org/wiki/Lancelet.

APPENDIX A

Laboratory Notes on Sieved Macrofauna Samples

Sample	Sediment
B1	200 ml of dark sand and gravel. Contained organic material of small to large size. Large particles and pieces of leaf up to 1 cm^2.
LA1	160 ml dark sand, some algae and several large organic particles (plant stems), virtually no fine organic material.
M1	Most of the sample was fine sediment that passed through the 0.5 mm sieve leaving about 40ml organic material and two pieces of gravel and a very small amount of gravel/sand retained on 1.0mm sieve.
LA3	Most of the sample was fine sediment that passed through the 0.5 mm sieve leaving about 100 ml organic material. Large pieces about 5 cm long. Three pieces of degraded plastic and nylon thread present. A small amount of coarse sand (approximately 10 ml).
S2	400 ml of sand and a small amount of tangled algae mat. No terrestrial organic matter.
V1	Approximately 1 L gravel and sand, no terrestrial organic matter. Volume not measured because of the large pieces of gravel that may have damaged any delicate animals.
W1	630 ml of sand and gravel. About 30 ml terrestrial organic matter.
W2	Most of the sample was fine sediment that passed through the 0.5 mm sieve leaving about 30 ml sand and gravel.

APPENDIX B

Macrofauna Numbers per Sample

	V1	S2	LA3	W1	B1	M1	LA1	W2
Hydrozoa		1						
Nemertean I				2				
Nemertean 02		1	1					
Nematoda				15				
Ampharetidae	1	3	1	4				
Capitellidae			6		3	1		
Cirratulidae		1	1					
Cossuridae								
Eunicidae	3	9	2	4			1	
Glyceridae	2	4	1	4				
Hesionidae		3	3	3			1	
Lumbrineridae		8	2	1				
Maldanidae								
Nephtyidae	2							
Nereididae					1			
Opheliidae		5	2					
Paraonidae			1	1			1	
Phyllodocidae			3					
Serpulidae			1					
Spionidae	4	2	4	9			1	
Sternaspidae								
Syllidae	2	30	3	27				
Terebellidae		1						
Oligochaete		1	1	1				
Sipunculidea								
Cylindroleberidae	1	1	5	165				
Sarsiellidae		8	1	32			16	
Anthuridae			1	7				1
Paranathuridae				1				
Sphaeromatidae			92					
Leptocheliidae				4				
Ampeliscidae		1						
cf.Leucothoidae	1							
Corophiidae	4		1	2				
Lysianassidae	1	1						
Melitidae								
Oedicerotidae	2							

	V1	S2	LA3	W1	B1	M1	LA1	W2
Phoxocephalidae	7	10					2	
Bodotriidae			1					
Gynodiastylidae	5	1					1	
Nannastacidae		1						
Galatheidae				2				
Diogenidae			3					
Grapsidae			1					
Hymenosomatidae			2					
Leucosiidae				1				
Megalopae				2				
Portunidae		1		1				
Alpheidae	1			3				
Hippolytidae				1				
Ogyrididae		1	1	2				
Palaemonidae				7				
Haminoeidae	1							
Nassariidae	2		1					
Naticidae	1							
Pyramidellidae			2					
Trochidae			1	1				
Ophiuroid banded				3				
Penaedae				2			1	
Anomiidae			85					
Limidae		1						
Nuculidae		1						
Solecurtidae	1							
Tellinidae				2				
Veneridae			1	3				
Branchiostomidae				10				
Ophichthidae	1							

APPENDIX C

Meiofauna Numbers per Sample

	V1	S2	LA3	W1	B1	M1	LA1	W2
Cnidaria	3		5	2	2	4	1	4
Turbellaria	1	1	7	2			1	66
Gnathostomulida								14
Nemertina								2
Nematoda	503	1016	228	376	19	14	413	2557
Gastrotricha								8
cf. Loricifera	1							
Kinorhyncha	1	5	2					77
Polychaeta	179	372	16	47			15	168
Oligochaeta	1	6	9	7			2	27
Ostracoda	9	56	2	88		1	11	20
Harpacticoida	121	277	7	359	2	5	187	1388
Harp. nauplii	3	57		8			1	55
Isopoda	4	2		6	1		2	
Tanaidacea				2				1
Amphipoda	2	1		1		1		5
Cumacea		2		7				
Halacaroidea	2	2	1		2	1		4
cf. Aplacophora		2						
Gastropoda	131	6		12				1
Bivilvia	1	4	1	7	1	2	6	52
Tunicata		2		3				