# MARINE POLLUTION RESEARCH PTY LTD

Marine, Estuarine and Freshwater Ecology, Sediment and Water Quality Dynamics
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## SECTION 75W APPLICATION TO MODIFY CONSENT MP09_0165: PROPOSED AMENDMENT TO BERTHING LAYOUT. SUPERYACHT MARINA PTY LTD, ROZELLE BAY – AQUATIC ECOLOGY ASPECTS

Figure 1 Sydney Superyacht Marina in Rozelle Bay

**Marine Pollution Research Pty Ltd**
**May 2014**

# 1 INTRODUCTION

Marine Pollution Research Pty Ltd (MPR) has been commissioned by Urban Perspectives on behalf of Sydney Superyacht Marina to update studies to support a s75W modification application to MP09_0165. The studies were required to meet the DGRs for the project (updated 23 December 2013).

The Superyacht marina is located on the northern shore of Rozelle Bay (Figure 1) and the whole northern shoreline of Rozelle Bay comprises a reclamation behind a sloping rip-rap stone embankment with concrete and wooden decking overlay plus concrete and wooden wharves supported by piers over the water. There is a major stormwater drain at the head of the bay (i.e., to the west of the subject site). A hydrographic survey of Rozelle Bay prepared by NSW Maritime (Rozelle Bay Maritime Precinct dated 16 Sept 04) indicates that the bathymetry of the bay slopes away to the east from the stormwater drain at the head of the bay with the depth under the Superyacht wharf being about 5.5 m below ISLW and depths offshore from the wharf within the marina berthing area increasing to at least 7m depth. Under the existing approval under which the marina currently operations (DA088-05-08) the marina has approval for water storage of 24 super-yachts.

## 1.1 Previous Assessments

The original Development Application (DA) for alterations to the existing Superyacht Marina in Rozelle Bay was prepared by Planning Matters Pty Ltd and MPR prepared an aquatic ecological assessment of the proposal (MPR 2008). The waterside works required reconfiguration of the existing marina as indicated in the General Arrangement Plan prepared by NSW Maritime (titled "Proposed Superyacht Marina Redevelopment" Plan No SYMOB-2 dated 13 May 2008). In effect the existing 70 m super yacht berthing was to be relocated to the western end of the proposal area, with shorter vessels to be berthed in the middle sections and a number of flexible berths provided at the eastern end to accommodate vessels between 20 and 50 m length. The proposal also required the re-alignment of existing pontoons to a new layout plus added new pontoons where necessary. The new layout would provide for "Mediterranean style" moorings perpendicular to the shore and would reduce the length of the marina by 76m from its then current western extent.

Urban Perspectives (2012) prepared a further Section 96(1A) application to modify the existing development consent 088-05-08. This modification application sought to amend the configuration of pontoons and moorings set out in Plan Nos. SYM08-1 and

SYM08-2 as originally approved under the consent to allow for flexibility of mooring:

- The number of boats able to be moored and the size of boats approved for mooring were not amended and all vessels at the facility were to be moored within the confines of the "Limit of Moorings" as shown of DA drawing SYM08-2 in the original DA.
- The proposed modification sought to amend condition A1 to allow for the greatest flexibility of mooring, pontoons and pontoon securing piles may be erected and altered at any time to provide for the maximum efficiency to accommodate the approved number of vessels, provided all such mooring piles, pontoon securing piles and pontoons are fully contained within the area shown on plan DA100/A dated 24 August 2011 between the land in Part lot 32 and the line shown as "Pontoon and Piles".

MPR (2012) prepared an undated assessment for this modification and concluded that the proposed amendment to allow adaptive reconfiguration of the mooring pens for the Superyacht Marina in Rozelle Bay, could be undertaken in such a way that there would be no significant impacts on water quality and aquatic ecology, and that the project could meet the aquatic ecology conservation requirements of the SREP (Sydney Harbour Catchment) 2005 and could meet the aquatic ecology and fish habitat conservation requirements of the *Fisheries Management Act 1994* (FMA) and the NSW DPI Fisheries' guidelines (NSW Fisheries 1999). The proposed construction works would not require any permits under the FMA. That application was withdrawn in early 2013 before determination.

Figure 2 provides a general arrangement plan for the present proposal. The figure is a portion of the Scott Carver Site Plan (20090002-AD-DA04(E)) and it indicates the proposed pontoon, locator piles and vessel berthing configurations for 43 vessels of 12m length or more plus tender boats to a maximum number of 79 vessels.

### 1.2 Available Information on Aquatic Habitats

Map 8 for the Harbour Foreshores and Waterways Area Development Control Plan 2005 (DCP) indicates "mixed rocky intertidal and rock platform " aquatic habitat to the south-east of the site (Figure 3) and on the western foreshore of Blackwattle Bay. Sheet 4 for the Sydney Regional Environmental Plan, (Sydney Harbour Catchment) 2005 (SREP) shows that there are no designated wetlands on the northern shore of Rozelle Bay with the closest being on the opposite shore (Figure 4). There are additional designated wetlands around the western side of Jones Bay.

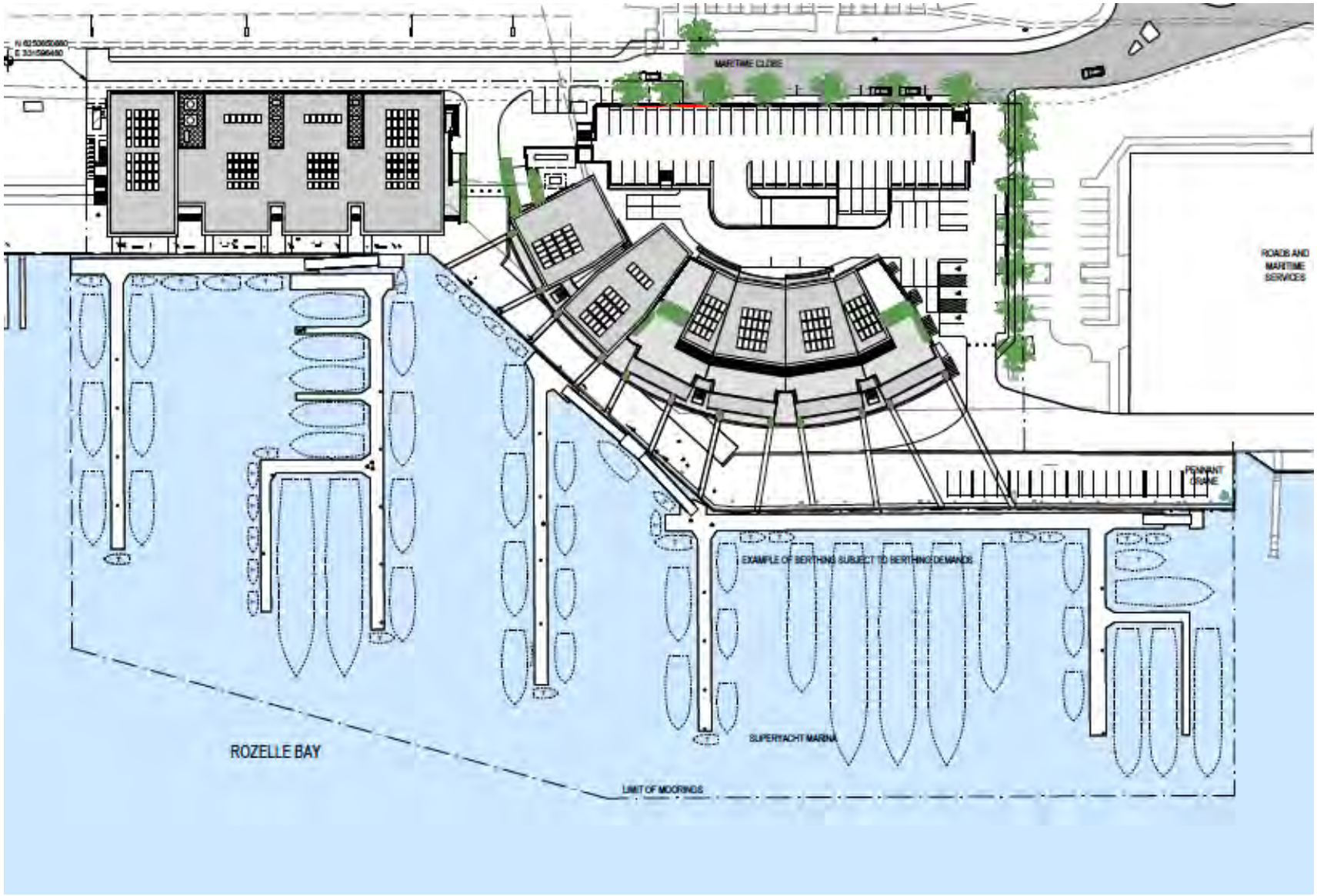


Figure 2 Portion of Scott Carver Site Plan 20090002-AD-DA04(E) showing proposed pontoon and vessel configuration.

These wetland areas have all been identified as rock rubble (or rip-rap) revetments in previous aquatic ecology surveys by MPR for Sydney Slipways (MPR 2004, Baileys Marine Fuels (MPR 2006), Jones Bay Marina (MPR 2010) and Glebe Island Ferry Wharf (MPR 2012) and it is concluded that all the SREP wetland areas discussed above are intertidal to subtidal rip rap rock revetments that support macroalgae (kelp) habitats.

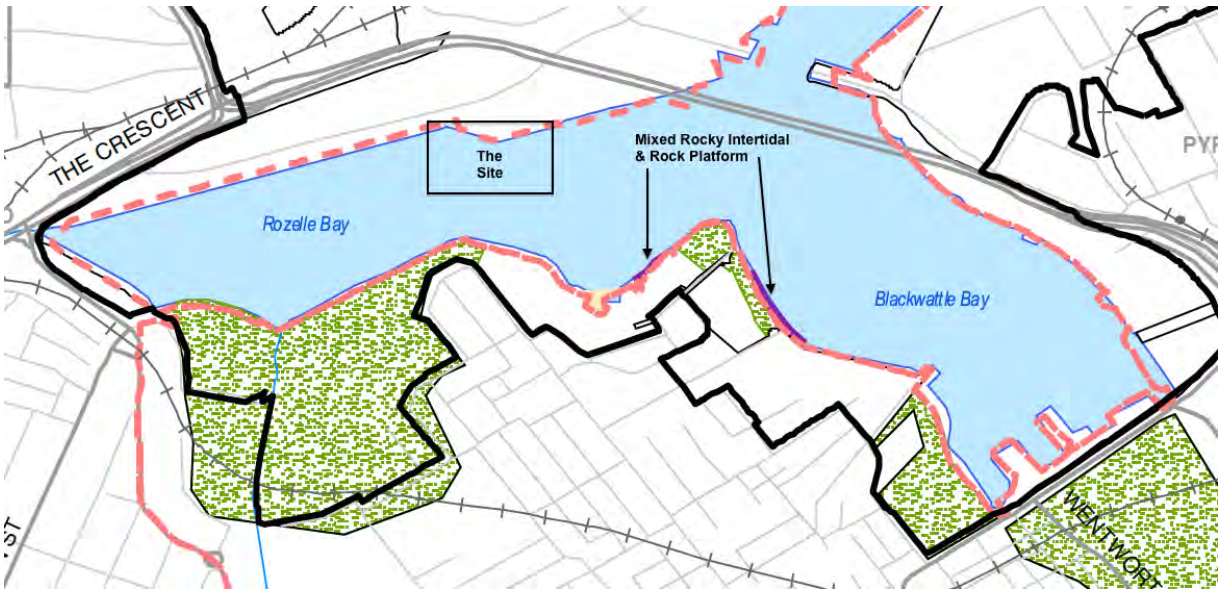


Figure 3 Portion of DCP Map 8, showing mixed rocky intertidal and rock platform habitat to the south-east of the Marina site and along the outer western shore of Blackwattle Bay.

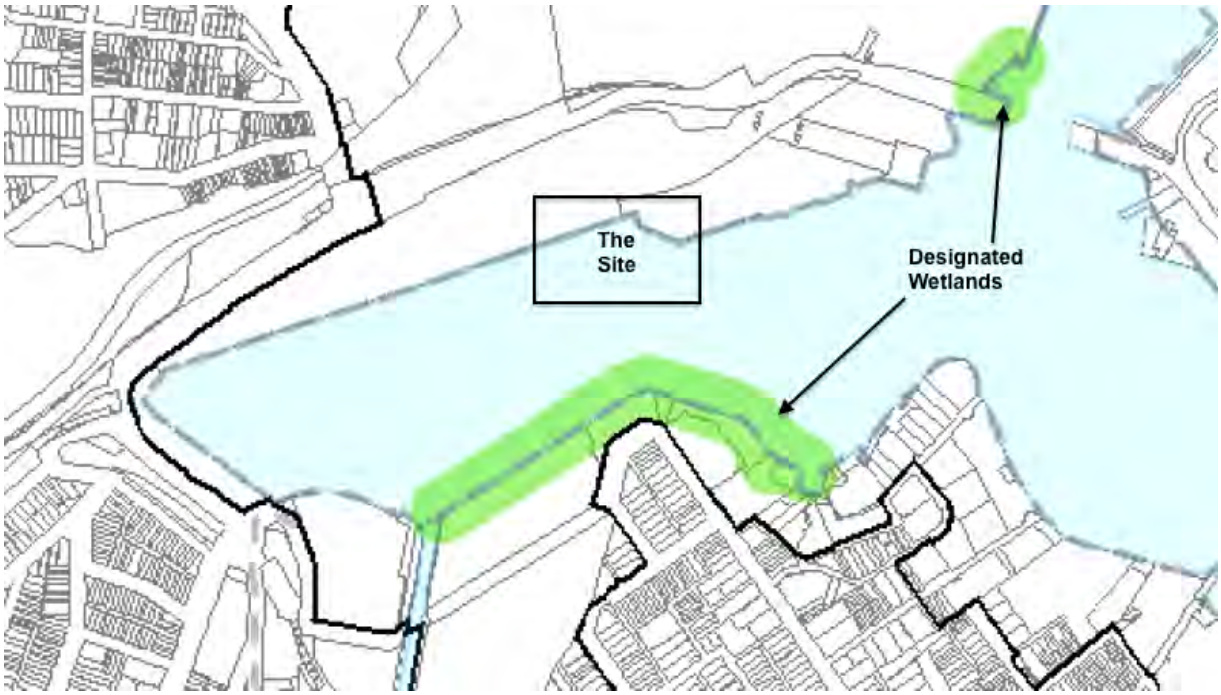


Figure 4 Portion of SREP (Sydney Harbour Catchment) Wetlands Protection Area Sheet 4, showing location of designated 'wetland areas". There are none along the northern shore line of Rozelle Bay.


Figure 5 Portion of Fisheries NSW estuarine vegetation map 39a showing a mangrove patch (green) in Rozelle Bay, Since the mapping in 2005 a *Zostera* seagrass patch has been found and mapped in Blackwattle Bay.

With regard to intertidal marine vegetation there are no mangroves or saltmarsh indicated on the vegetation surveys prepared by Allen et al (2007) and Kelleway et al (2007). However mapping of marine vegetation by Fisheries NSW in 2005 showed a small patch of mangroves in Rozelle Bay (Figure 5).

AMBS (2007) provide a literature review of the aquatic ecology of the Pyrmont Peninsula foreshore and bays including Rozelle Bay, and provide extensive lists of fish and marine invertebrates recorded from Sydney Harbour. They also note that small saltmarsh patches and mangrove stands do occur throughout Rozelle Bay that would have been too small to be recorded in the broad scale studies used to generate the maps shown in Figures 3 to5. Notwithstanding, these small scale studies did not provide any further records of mangroves, saltmarsh or seagrass along the northern forshore of Rozelle Bay. Cardno Ecology Lab (CEL 2012) found and mapped a small *Zostera* bed along the western foreshore of Blackwattle Bay adjacent to the Glebe High School grounds (see location on Figure 5).

## 2 AQUATIC HABITATS AND ECOLOGY

A dive survey (SCUBA and snorkel) was made of the existing marina on 6 March 2008. The survey included inspections of the existing marina infrastructure (piers, pontoons and mooring blocks) plus a search of the seabed for possible marine vegetation (seagrass plus the declared pest algae species *Caulerpa taxifolia* which is reported from the Harbour east of the harbour Bridge). The seabed search was general with a more detailed search of areas which would potentially be impacted by pile driving or pile extraction works.

Additional SCUBA dive surveys were made at the site on 7 November 2013 to investigate several portions of the seabed and new marina piles not investigated during the original field work. This latter survey also included inspections of inshore areas, marina support piles and portions of the seabed originally inspected in 2008, to ascertain whether there were any differences in overall habitat distribution or character since the original survey. The November 2013 survey also included the collection of four cored sediments located in mid water depths along a west to east gradient away from the major stormwater drain at the eastern end of the bay (Figure 6).

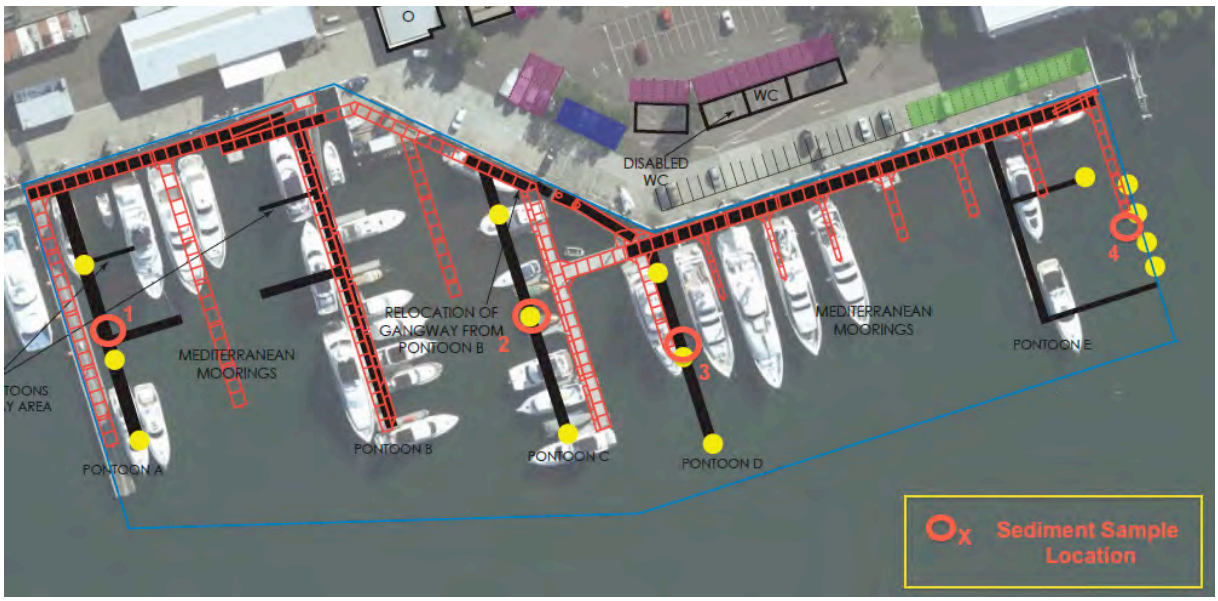


Figure 6 Location of cored sediment samples 7 November2013. The black and yellow marks refer to an earlier iteration of the final marina layout as indicated in Figure 2 and the red outlines refer to the approved layout under consent 088-05-08.

There are four main areas of aquatic habitat in the locality; inshore rock rubble, seabed sediments, pile and pontoon wetted surfaces:

- The intertidal to shallow sub-tidal rock rubble embankment is effectively in permanent shade being decked over by the concrete wharf and there is no marine vegetation in this habitat (Figures 7 and 8).

- Sub-tidally there were two epibiotic taxa observed on wharf support piles and on the inshore rock rubble toe reef against the sandstone revetment wall, a green-yellow encrusting sponge and an orange branching sponge.
- The shallow to deep subtidal mud habitat is more than 6m deep at the inshore pontoons and grades to more than 8m offshore. There was no marine vegetation found anywhere within the study area (seagrass or *Caulerpa taxifolia* - the declared pest algae species), and none are expected at these depths as ambient turbidity severely limits sunlight penetration to the seabed.
- Mooring lines supported a few *Herdmania* ascidians, and there were no biota observed on the mooring blocks or on the adjacent seabed due to excessive siltation on the mooring blocks and lack of hard substratum on the seabed (Figure 9).
- Piles (supported bands of barnacles (*Tesseropora rosea* and *Elminius sp*.) in the upper intertidal (Figure 10), Sydney Rock oysters plus tube worms (*Galeolaria sp*.) in the intertidal and shallow subtidal with Blue mussels in the shallow to mid subtidal (Figure 11). Where there piles are exposed to sunlight there were two algae species present in the shallow subtidal; *Ulva sp*., a green algae and *Sargassum sp*., a brown algae plus there was some tufted brown and green filamentous algae. There was a prolific growth of an unidentified branching Hydroid in the low intertidal and shallow sub-tidal (Figure 14).
- There were other distinct epibenthic assemblages on the lower to deep sub-tidal portions of the piles, dominated by sponges and ascidians with some mussels (Figures 12 and 13).
- The wetted surface areas of floating pontoons supported a range of epibiota similar to that observed on the piles. The vertical surfaces exposed to sunlight supported *Ulva* and *Sargassum spp., Grateloupia sp*., a branching filamentous, red algae, plus tufted brown and green filamentous algae (Figures 15 to 17). As for the piles, there was a prolific growth of the unidentified branching hydroid (Figure 16). Other species observed included *Tesseropora rosea* and *Elminius sp*. barnacles, *Galeolaria* tube worms, blue mussels, and Sydney rock oysters. The undersides of pontoons supported Blue mussels, ascidians plus hydroids and bryozoans (Figure 18).
- There were two blenny species (oyster and horned blennies) commonly observed around the pile and pontoon shallow epibiotic assemblages. Other fish observed in the vicinity of piles and pontoons included silver bream, striped catfish, cardinal fish, smooth toadfish, luderick and yellowtail.

With respect to the other specific requirements of Fisheries NSW and of NSW Roads and Maritime Services (RMS):

- There are no mangroves or saltmarsh along the existing facility foreshore or in the vicinity of the proposed facilities.

- There are no commercial fishing operations or aquacultural activities in the immediate locality of the proposal. Consequently the proposal would not have any impact on commercial fishing operations or aquacultural activities.

**2.1 Threatened Species and Endangered Ecological Communities**

The FMA and EPBC Act list a number of marine and estuarine shark and teleost fish species as Vulnerable Species under Schedule 5 of the Act. Syngnathiformes (seahorses, sea-dragons, pipefish, pipe-horses and sea-moths) are protected under the EPBC and FMA:

- Whilst the listed Grey Nurse and Great White shark species could conceivably visit the locality it is considered highly unlikely and they would be only found in the locality when in pursuit of mobile prey species from other parts of the outer harbour. They would not make use of any of the habitats available in the locality. The likelihood of these species occurring is low and none were observed during the field surveys.
- Of the threatened species of teleost fish known from Sydney Harbour, the Black Rock Cod *Epinephelus daemelli* could potentially occur in the study area. A specific search for Black Rock Cod and Black Rock Cod habitat was made of the shallow to deep sub-tidal revetment plus fill areas in the study area and no Black Rock Cod were found. From the search it was concluded that the rocky revetment sections did not provide suitable cave or rock crevice habitat to support adult Black Rock Cod and accordingly a seven part test of significance is not required.
- Syngnathiformes fish (seahorses, pipe fish and the like) are protected under both the FMA and the Commonwealth EPBC Act. Of the 31 species of syngnathiformes known from NSW waters, three, (White's seahorse *Hippocampus whitei*, Coleman's Seahorse *Hippocampus colemani* and the pygmy pipehorse *Idiotropiscis sp.)*, are endemic to NSW and White's seahorse is common in Sydney Harbour, including Mort Bay at Balmain and at Drummoyne. Whilst there is some seahors- feeding habitat at the site, it is not considered that it would be able to provide suitable shelter habitat. None were noted during either of the field surveys, despite specific searches.
- *Posidonia australis* seagrass beds in Sydney Harbour are listed as Ecologically endangered communities, and no shoots, patches or beds of *Posidonia* were found for the present survey and none are expected.

Figure 7 View of inshore marina concrete pad.

Figure 8. View under concrete pad showing sandstone rock wall inshore

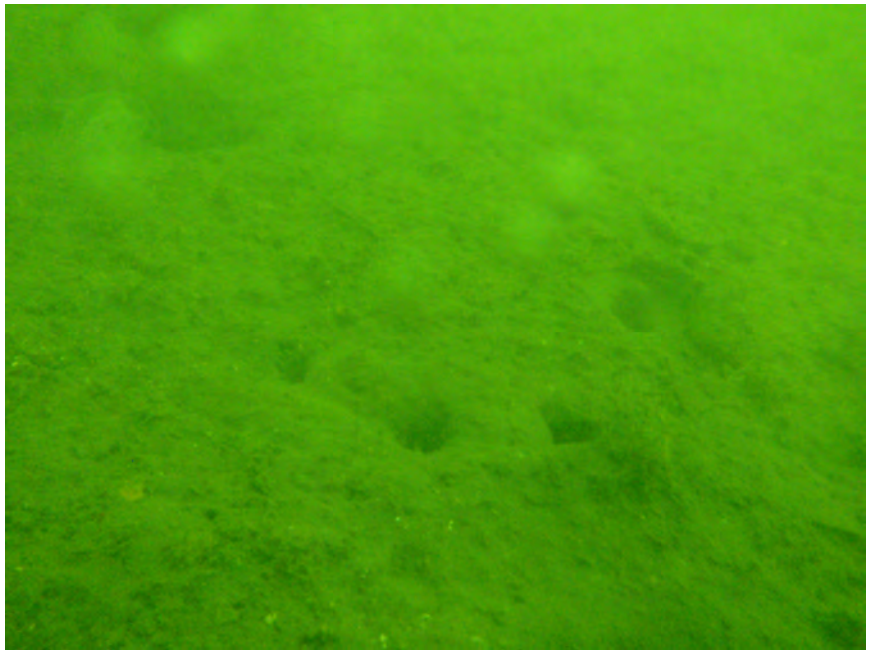

Figure 9 Bottom sediments with snapping shrimp burrows

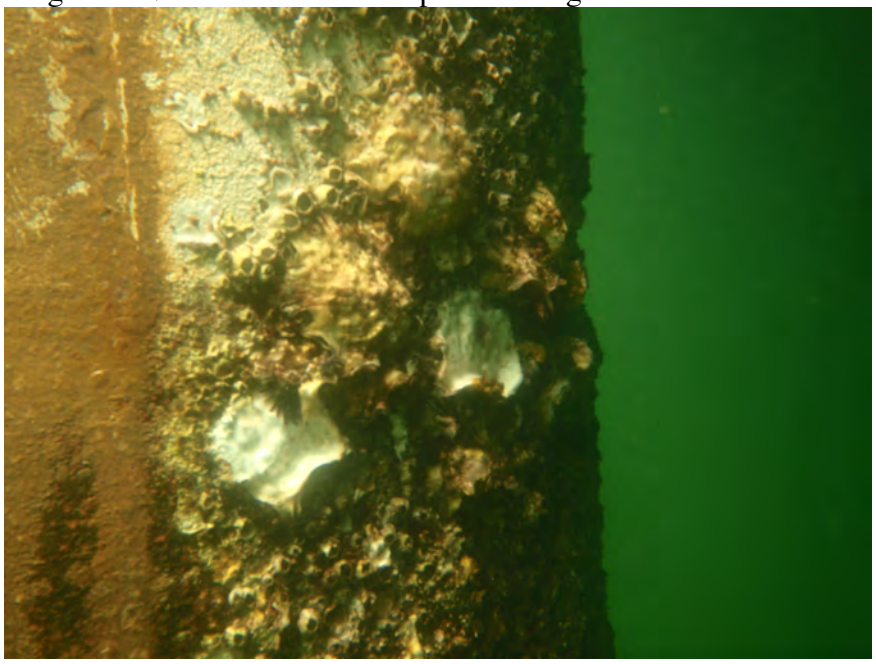

Figure 10 Upper pile surface with barnacles and oysters.

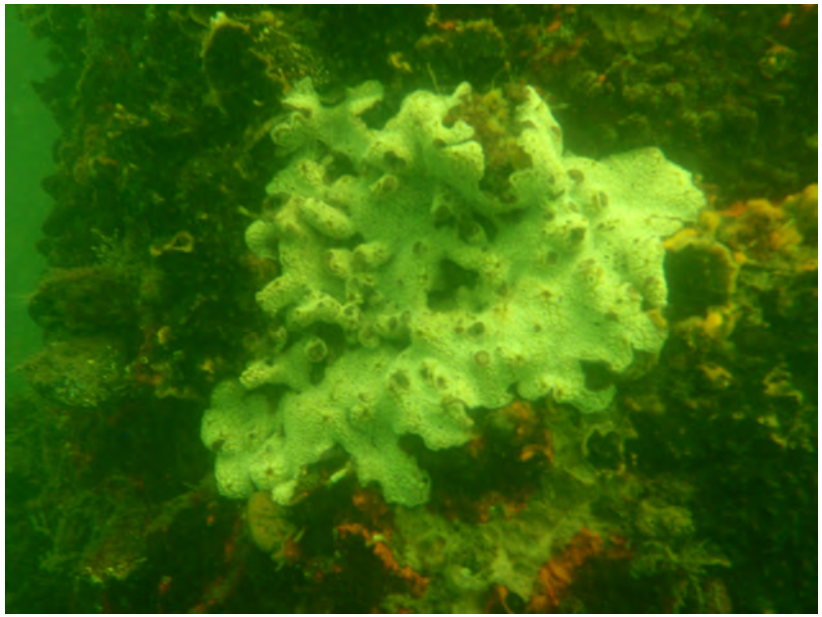

Figure 11 Mid-pile surfaces with mixed sponge and bryozoa fauna.

Figure 12 Deeper pile fauna is generally more branching.

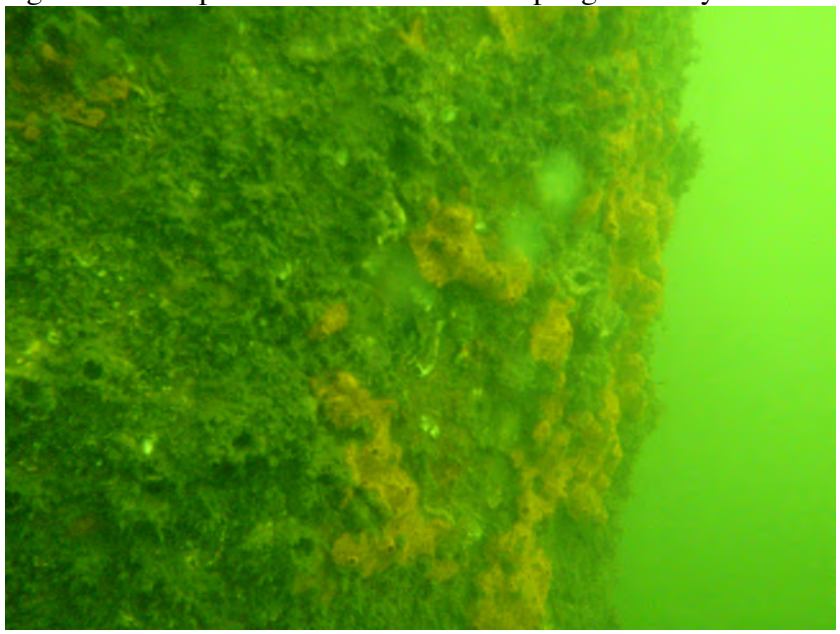

Figure 13 Pile surfaces near the seabed have less fauna.

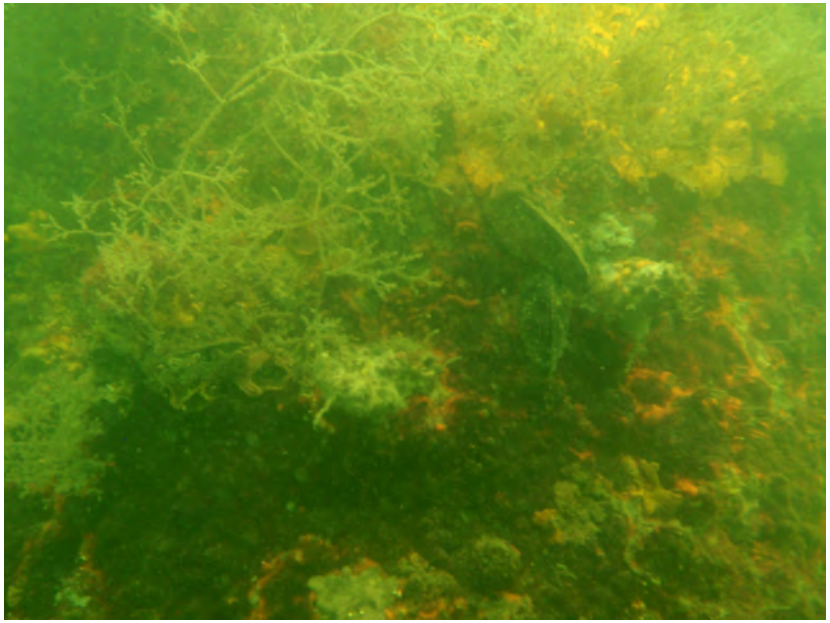

Fig14 An unidentified pile hydroid in shallow waters.

Figure 15. Mixed algae & biota on pontoon surfaces.

Figure 16. Close up showing hydroids and mussels.

Figure 17 Close up of pontoon frondose algae and biota.

Fig18 Mixed hydroids and bryozoans under pontoon.

With regard to other aquatic species or ecological communities listed under the TSC and EPBC Acts, Little Penguins - that are probably members of the endangered population at Manly, are observed fishing and feeding throughout the harbour and would be expected to visit the site from time to time in pursuit of prey. However the site and location do not provide any suitable roosting or nesting habitat and therefore would not constitute important habitat for Little Penguins.

Various listed cetaceans (whales and dolphins), marine mammals (seals and sea lions), marine reptiles (turtles and sea-snakes) and sea-birds (migratory ocean birds and waders) are known from the outer Sydney Harbour and are known to penetrate the main harbour to and beyond the study area, albeit rarely. None have been reported from Rozelle Bay.

Of the species that may occur in the vicinity of the site, few would be utilising the resources of the site to any great extent and would rarely be in the locality, even as transients or opportunistic feeders. The site does not provide any significant habitat features for these species. It is concluded that there would not be any threatened species residing within the locality of the marina and that the marina and the locality do not constitute specific habitat for other threatened aquatic species as listed under the FMA, TSC and EPBC Acts.

With regard to the Fisheries NSW waterway classification scheme as shown in Table 2 of the revised Policy and Guidelines document (NSW Fisheries 2013), Rozelle Bay is a Class 1 "Major key fish habitat" (KFH) by virtue of it being an estuarine waterway. In regard to the sensitivity classification of the specific habitats within Rozelle Bay (as defined in Table 1 of Fisheries NSW 2013) there are no Type 1 "highly sensitive" or Type 2 "moderately sensitive" key fish habitats". The identified habitats are Type 3 "minimally sensitive" KFH.

**2.2 Seabed Contamination**

As noted in Section 2, four seabed samples were collected for sediment contamination determination. At the four sites shown on Figure 6 sediment cores were obtained using a diver operated stainless steel yabbie pump (0.75m long, 50mm diameter). The cores were brought to the surface, emptied into a pre-rinsed tray and mixed to provide a composite sample which was then sub-sampled into the various containers provided by the analytical laboratory for the particular tests (Australian Laboratory Services – ALS). All the cores were uniform fine silty sand with little or no shell of larger fragments.

The full results of the chemical analyses undertaken on the selected samples are shown in the ALS Laboratory reports appended at Appendix A to this report.

### 2.2.1 Physical Characteristics

Samples were analysed for full particle size characterisation, moisture content and Total Organic Carbon (TOC). Results are summarised in Table 1 below.

**Table 1 Sediment Physical Characteristics**

| Analyte | Units | Detect Limit | Sample Number SSY- 01 | 02 | 03 | 04 |
|---|---|---|---|---|---|---|
| Moisture Content | % | 1 | 66.9 | 71.4 | 72.6 | 65.3 |
| Particle Size | % | 1 | | | | |
| Fines (<75 µm) | | | 94 | 98 | 96 | 97 |
| Sand (>75 µm) | | | 4 | 2 | 4 | 3 |
| Gravel (>2mm) | | | 2 | <1 | 1 | 1 |
| Cobbles (>6cm) | | | <1 | <1 | <1 | <1 |
| TOC | % | 0.02 | 5.46 | 5.88 | 5.44 | 4.62 |

Results are summarised as follows:

- Moisture content of samples was fairly constant with a range of 65 to 73%
- Silt and Clay (fines) fractions were very uniform and made up most of the sample (94 to 98%).
- Total sand proportions were very similar (2.6 to 3.9%)
- The gravel/shell component was almost all shell and was also a minor component (1 to 2%).
- TOC contents were slightly elevated for estuarine sediments, at around 4.5 to 6%.

### 2.2.2 Metal Contamination Results

Table 2 shows the results of total metal analysis and for comparison, shows the Maximum plus mean values for all Port Jackson sites (from Birch and Taylor 1999) plus the ANZECC/ARMCANZ (2000) range of contamination from Low to High range where values under Low range are considered acceptable for the protection of marine invertebrates in the sediments, values between the low and high range are considered of concern and may affect marine invertebrates. Values above the high range value are considered likely to harm some marine invertebrates in the sediments:

**Table 2 Metals in Sediments**

| | | Port Jackson* | | ANZECC | Detect | Sample Number SSY- | | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyte | Units | Max | Mean | Range** | Limit | 01 | 02 | 03 | 04 |
| Cadmium | mg/kg | 24.3 | 0.8 | 1.5 to 10 | 0.1 | 1.2 | 1 | 1.2 | 0.7 |
| Chromium | mg/kg | 1427 | 118 | 80 to 370 | 1 | 65.9 | 76 | 71.9 | 67.4 |
| Copper | mg/kg | 1053 | 188 | 65 to 270 | 1 | 350 | 483 | 491 | 354 |
| Cobalt | mg/kg | 54 | 8.3 | | 0.5 | 6.8 | 7.5 | 6.9 | 6.2 |
| Lead | mg/kg | 3604 | 364 | 50 to 220 | 1 | 615 | 632 | 614 | 544 |
| Manganese | mg/kg | 578 | 118 | | 10 | 143 | 107 | 114 | 119 |
| Nickel | mg/kg | 245 | 22 | | 1 | 20.3 | 22.1 | 20.5 | 18.1 |
| Zinc | mg/kg | 7622 | 651 | 200 to 410 | 1 | 1110 | 1310 | 1350 | 1060 |
| Mercury | mg/kg | | | 0.15 to 1.0 | 0.01 | 2.7 | 2.34 | 2.49 | 2.96 |

Notes: *Birch & Taylor 1999. ** ANZECC(2000) range for low to high contamination.

- Cadmium and Chromium concentrations were lower than Port Jackson mean concentrations and below the ANZECC Low Range Value.
- Whilst Cobalt concentrations were below the Port Jackson mean concentrations, Manganese and Nickel concentrations were similar to the Port Jackson mean values.
- Copper, Zinc and Lead concentrations are elevated with most about double the Port Jackson mean and up to three times the ANZECC high range guideline values. No values were near the maximum values recorded for Port Jackson.
- Mercury concentrations were two to three times the ANZECC High Range value and in the order of sediments in Neutral Bay (MPR 2011).

### 2.2.3 Organic Contamination Results

Samples were analysed for Organophosphorus and Organochloride pesticides (OPPs and OCPs), Polychlorinated Biphenyls (PCBs), Polynuclear Aromatic Hydrocarbons (PAH), BTEXN and Total Petroleum Hydrocarbons (TPH). Results for OCPs for which there are ANZECC (2000) criteria and/or Port Jackson data (Birch and Taylor 2000), are summarised in Table 3 below. Table 4 summarises PAH results. For assessment against ANZECC (2000) criteria the tables provide the high range value for comparison as generally the Port Jackson mean is above the low range value. TPH results are summarised in Table 5:

- OPPs and individual PCBs are all below detection.
- Total PCBs were well below the Port Jackson mean of 164$\mu$g/kg, and well below the ANZECC 2000 low range value of 23 $\mu$g/kg.
- Individual OCP compounds were below detection, all below ANZECC (2000) low guideline values and well below the Port Jackson mean of 770 $\mu$g/kg (Birch and Taylor 2000).

**Table 3 OPPs, PCBs and OCPs**

| Analyte | Units | Dect Limit | ANZECC (2000)* | Port Jackson** | Sample Number SSY- 01 | 02 | 03 | 04 |
|---|---|---|---|---|---|---|---|---|
| Organophosphorus Pesticides | µg/kg | 10 | | | <10 | <10 | <10 | <10 |
| Total PCBs | µg/kg | 5 | 23 | 164 | <6.5 | <6.5 | <6.5 | <6.5 |
| 4.4`-DDD | µg/kg | 0.5 | 20 | | <0.5 | <0.5 | <0.5 | <0.5 |
| 4.4`-DDE | µg/kg | 0.5 | 27 | | <0.5 | <0.5 | <0.5 | <0.5 |
| 4.4`-DDT | µg/kg | 05 | | | <0.5 | <0.5 | <0.5 | <0.5 |
| DDT (total) | µg/kg | 0.5 | 46 | 77 | <0.5 | <0.5 | <0.5 | <0.5 |
| Dieldrin | µg/kg | 0.5 | 620 | 12 | <0.5 | <0.5 | <0.5 | <0.5 |
| Endrin | µg/kg | 0.5 | 120 | | <0.5 | <0.5 | <0.5 | <0.5 |
| Total Chlordane | µg/kg | 0.25 | 6 | | <0.25 | <0.25 | <0.25 | <0.25 |

Notes: * ANZECC (200) high range value. ** Birch & Taylor (2000) mean for Port Jackson

**Table 4 PAH Compounds**

| Analyte | Units | Detec Limit | ANZECC* Low | High | Sample Number SSY- 01 | 02 | 03 | 04 | Mean |
|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | µg/kg | 4 | 44 | 640 | 108 | 67 | 89 | 82 | 86.5 |
| Acenaphthylene | µg/kg | 4 | 116 | 500 | 1330 | 1060 | 1050 | 1070 | 1127.5 |
| Anthracene | µg/kg | 4 | 85 | 1100 | 1290 | 637 | 745 | 737 | 852.3 |
| Benz(a)anthracene | µg/kg | 4 | 260 | 1600 | 2410 | 1520 | 2130 | 1630 | 1922.5 |
| Benzo(a)pyrene | µg/kg | 4 | 430 | 1600 | 4680 | 2830 | 3520 | 3440 | 3617.5 |
| Chrysene | µg/kg | 4 | 380 | 2800 | 1850 | 1520 | 1970 | 1720 | 1765.0 |
| Dibenz(a.h)anthracene | µg/kg | 4 | 63 | 260 | 882 | 545 | 582 | 752 | 690.3 |
| Fluoranthene | µg/kg | 4 | 600 | 5100 | 4080 | 2440 | 3200 | 2860 | 3145.0 |
| Fluorene | µg/kg | 4 | 19 | 540 | 258 | 172 | 214 | 199 | 210.8 |
| Naphthalene | µg/kg | 4 | 160 | 2100 | 344 | 259 | 325 | 288 | 304.0 |
| Phenanthrene | µg/kg | 4 | 240 | 1500 | 1620 | 965 | 1310 | 1220 | 1278.8 |
| Pyrene | µg/kg | 4 | 670 | 2600 | 5040 | 2710 | 3710 | 3510 | 3742.5 |
| Total PAH** | mg/kg | .004 | 10 | 50 | 41.1 | 24.5 | 31.8 | 29.7 | 31.8 |

Notes: * ANZECC (2000) low and high range criteria for protection of aquatic life, **ANZECC Total PAH = all PAH compounds, Sample PAH Totals = sum of the 16 listed priority PAH compounds only

- Whilst PAH compound values are elevated and generally fall between the ANZECC (2000) low and high guideline trigger values they are on the low side of the range of PAH concentrations found in Port Jackson sediments where total PAH ranges from <100 to 380mg/kg (McCready et al 2009).
- The relative abundances of individual PAH compounds generally matched that found by McCready et al (2009) for the central section of Sydney Harbour. McCready et al (2009) attributes this to a common source of PAHs in Port Jackson; namely high temperature combustion processes rather than fossil fuel spillages.

| Table 5 Total Recoverable Petroleum Hydrocarbons | | | | | | |
|---|---|---|---|---|---|---|
| Fractions | Units | LOR | 01 | 02 | 03 | 04 |
| C6 - C9 | mg/kg | 3 | <3 | <3 | <3 | <3 |
| C10 - C14 | mg/kg | 3 | 16 | 18 | 25 | 15 |
| C15 - C28 | mg/kg | 3 | 755 | 710 | 911 | 697 |
| C29 - C36 | mg/kg | 3 | 669 | 618 | 817 | 656 |
| C10 - C36 (sum) | mg/kg | 3 | 1440 | 1350 | 1750 | 1370 |

- The most volatile TPH fractions (C6-C9) were below detection and the concentrations of the C10 to C14 fractions were relatively low compared to the heavier fractions indicating more weathered hydrocarbon products in the sediments.
- Whilst the remaining fraction concentrations were correspondingly high, the BTEXN results were all below detection (0.2mg/kg and 0.5mg/kg for total Xylenes), indicating that the TPH residues are likely to be a legacy from past activities, reflecting the long industrial and motorised vessel usage of this bay.

### 2.2.4 Conclusions Regarding Sediment Contamination

The results confirm and extend the conclusions from other Port Jackson sediment contamination studies, namely that the Rozelle Bay sediments contamination is generally similar to that found in other central Port Jackson embayments that supported similar historic shipping, shore industrial and industry related stormwater sources of contamination. In particular the results confirm the ubiquity of gas works related contamination with PAH compounds particularly well represented in the sediment contaminants. The results also lead to the conclusion that there is no evidence of any significant contamination that may be attributed to recent marina usage in Rozelle Bay. That is, the pattern of contamination is more in line with historic uses/sources rather than contemporary uses.

In regard to the provisions of *SEPP55 Remediation of Land,* whilst the seabed sediments contain contaminants at levels elevated in regard to ANZECC (2000) interim trigger guidelines for the protection of aquatic ecosystems, the contamination is similar to, and in some cases less than the levels of contaminants found generally throughout the historically industrialised parts of Port Jackson. Accordingly, it is not considered that the seabed sediments would require active remediation. It is also considered that the lands are suitable for use in that state for marina activities (see also Section 3.2 below) and therefore the proposal satisfies clause 7(1)(a) and (b).

## 3. POSSIBLE CONSTRUCTION & OPERATIONAL IMPACTS

The project approval seeks to increase the mooring capacity for vessels greater than 12m length from the present approved 24 vessels to 43 vessels and provide additional berthing for tender boats to a maximum total vessel number of 79. This entails the reconfiguration of the present floating marina layout, as shown in Figure 2 above.

### 3.1 Construction Related Impacts

With regard to the marina reconfiguration, the only physical works required in the waterway will be removal of some existing locator piles that anchor the floating pontoons, removale and relocation of mooring blocks and driving of piles to accommodate the new floating pontoon configuration. The piles and mooring blocks to be removed would generally be re-used as appropriate and would be stored on barges or at a suitable shore location prior to re-use. No dredging is required within the waterway.

With respect to possible impacts on aquatic habitat and aquatic biota arising from the proposed modification, it is understood that the principle change to the previous assessment in 2012 is that the present proposed configuration will be fixed in place.

Removal of piles would result in the loss of the attached epibiota assemblages. However, as these piles are re-used and as new piles are placed, the new pile wetted surface area would be made available for colonisation by similar epibiota. Also, for the piles that are to be reused, the wetted surface areas would recolonise more rapidly owing to the residual epibenthos remaining on the piles. As there will be a net increase in the area of pile wetted surfaces there would be a net increase in pile epibiota habitat expected associated with the proposal, which is considered a beneficial impact.

Existing pontoons would be relocated for the reconfiguration with some additional new pontoons introduced. Thus, there would be an increase in pontoon wetted surface area suitable for colonisation by epibiota including algae, which is also considered a net beneficial impact.

The piles and blocks that are to be removed/replaced are all located in deep unvegetated sediment, and whilst there would be pulse turbidity events associated with the pile and mooring block removal or placement works, there would be no significant impact on sediment benthic communities arising from these works, as it is known from observations that disturbed sediments would be highly localised in the bottom waters around the pile removal or placement site and that sediments would rapidly re-settle

(Knot and Johnston 2010) . Given the short, pulse-nature of bottom sediment disturbance during piling operations, and the equally rapid settlement of the sediments, it is also concluded that there is a low risk of sediment contaminants being mobilised into the water column. Rather, sediment contaminants are more likely to stay firmly bonded to the fine particulate and organic materials making up the sediments and rapidly re-settle (see also discussion in Knott and Johnston 2010).

The low risk of persistent surface turbidity plumes associated with the construction works can be further mitigated by the use of silt curtains around the active piling works to contain and promote resettlement of surface plumes.

### 3.2 Operational Impacts

The main operational change associated with the proposal is the increase in vessels moored at the site and the concomitant increase in vessel movements to and from the site. In terms of potential aquatic ecological impact the main considerations are risk of water quality deterioration either from (i) fuel and waste contamination from vessel bilge and waste-water discharges or from accidents and (ii) mobilisation of bottom sediments from propeller or vessel wash.

Water quality deterioration from vessels in marinas is managed by the implementation of a strict and comprehensive Marina Operational Management Plan (OMP) that specifies i*nter alia,* the measures to be adopted for the prevention and management of vessel and associated marina bilge and waste water discharges, vessel fuelling activities, in-water vessel maintenance activities, fire risk and management, accidental vessel submergence, solid waste collection and disposal. The marina OMP would also include appropriate monitoring of surface water condition and waste, specifying the frequency of surface water checks, the management of observed slicks and the management and collection of observed floating or semi-submerged objects or waste and the appropriate disposal for all liquid and solid wastes generated by the marina and associated vessels.

In terms of the potential for vessels scouring the seabed or mobilising seabed sediments via propeller wash, it is noted that the water depth within the marina and in the fairways leading out of the marina to Darling Harbour is generally greater than 7m below the lowest astronomical tide (Figure 19) and this is considered more than adequate depth for the prevention of propeller induced sediment mobilisation. In this respect is should also be noted that the marina is well sheltered from high winds and the large modern vessels that would be utilising this marina would in the main (and probably will all) be using bow and stern thrusters for close quarters manoeuvring into and out of berths where the thruster displace water laterally and just under the surface.

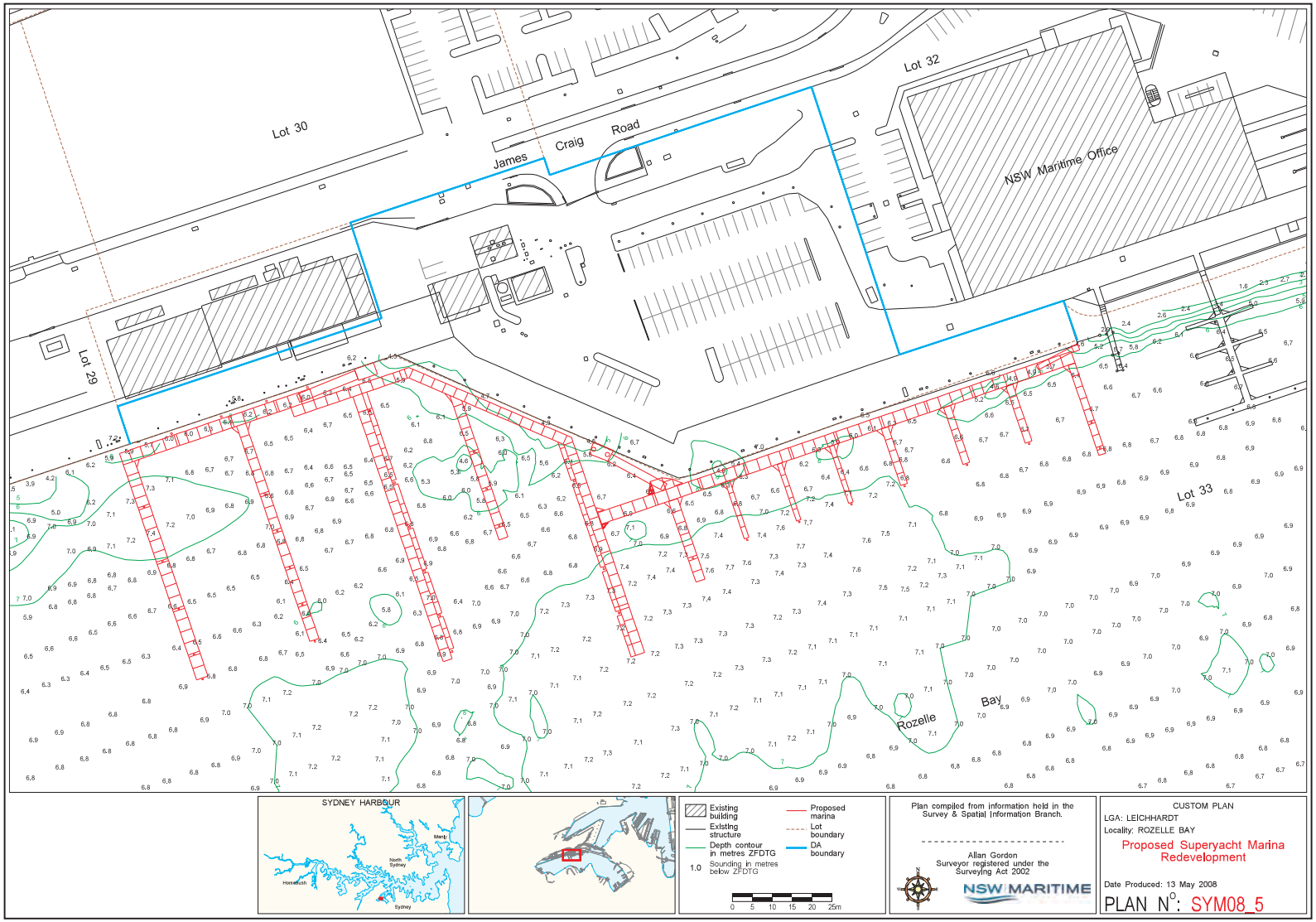


Figure 19 Seabed hydrographic survey of the Sydney Superyacht Marina and approaches.

### 3.3 Fisheries Management Act Permit and Habitat Protection Requirements

Part 7 of the Fisheries Management Act 1994 (FMA) sets out the conditions under which permits are required for various construction activities, and the conditions under which a permit may be granted are specified in the NSW Fisheries' Policy and Guidelines (Fisheries NSW 2013). With respect to estuarine activities, permits are required for reclamation or dredging works and for the taking or harming of marine vegetation. As the proposal does not include dredging or reclamation and as there is no net loss of marine vegetation arising from the proposal for the locality, a permit under the FMA would not be required.

### 3.4 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

Clause 21 of the SREP (Sydney Harbour Catchment) outlines nine criteria for biodiversity, ecology and environmental protection:

*17(a) Need for development to have a neutral or beneficial effect on water quality entering the waterway.*

Provided pile and pontoon relocation works utilise best management practice for containing materials loss to the waters, water quality impacts from pile removal and placement would be minimal and temporary.

*17(b) Need for development to protect and enhance terrestrial and aquatic species, populations and ecological communities and, in particular, should avoid physical damage and shading of aquatic vegetation (such as seagrass, saltmarsh and algal and mangrove communities).*

The existing shore-line comprises a rock retaining wall with a rock rubble revetment and a concrete wharf decked over the water. The proposed works associated with the amendment would not change this configuration so the existing aquatic ecological community would not be affected. The proposed water-based works include removal and relocation of some mooring and locator piles and mooring blocks to reconfigure the marina. As the piles are all located in bare (unvegetated) marine sediments, there are no impacts on aquatic vegetation arising from the works. The losses of marine algae arising from removal of piles will be compensated for by the provision of new fender and locator pile habitat with an overall net neutral impact.

Marine mammals, reptiles and aquatic or migratory birds may utilise the aquatic resources of the site on a transient or opportunistic

basis and would not be impacted in any significant way by marina reconfiguration operations that are proposed to occur from time to time.

Syngnathid fish were not found on the existing pile wetted surfaces and are not expected due to inadequate suitable habitat plus lack of connectivity to other suitable habitat well away along the Balmain shore.

*17(c) Need for development to avoid indirect impacts on aquatic vegetation as a result of increased access.*

There will be no increased access to the aquatic vegetation at the site arising from the development.

*17(d) Need for development to avoid indirect impacts on aquatic vegetation (such as changes to flow, current and wave action and changes to water quality) as a result of increased access.*

Reconfiguration of the berth widths from time to time will not result in any significant changes to tidal flow, currents, wave action or water quality.

*17(e) Need for development to protect and reinstate natural intertidal foreshore areas, natural landforms and native vegetation.*

There are no natural inter-tidal foreshore areas, natural landforms or native vegetation at the marina site, as this is a totally reclaimed and paved site.

*17f) Need for development to retain, rehabilitate and restore riparian land.*

The total foreshore of the project area has been reclaimed and provides a valuable public asset. There are few opportunities aside from appropriate native tree planting (on adjacent non-riparian public land) available to the project.

*17(g) Need for development on land adjoining wetlands to maintain and enhance the ecological integrity of the wetlands and where possible to provide a vegetative buffer to protect wetlands.*

There are no wetlands adjoining the site and the nearest wetland is some 70 m south on the other side of the bay.

*17(h) Need to assess the cumulative environmental impact of the development.*

The proposed amendment will result in small disturbances to the seabed benthic assemblages as piles are removed and replaced and as mooring blocks are moved from place to place. The relative area of disturbance compared to the total area of soft deep substratum habitat in Rozelle Bay is so small that the alterations to benthic assemblages

would not be measurable and certainly not measurable against natural variation following seasonal or climatic changes (i.e., flood impacts). Nevertheless with each disturbance it is likely that fish assemblages will take advantage of the disturbance and benefit from the feeding opportunities afforded by exposed benthic fauna plus encrusting fauna sloughed off piles as they are removed and replaced. As benthic and encrusting assemblages of invertebrates are likely to recolonise rapidly, the overall cumulative impact is considered to be minimal with a possible slight beneficial impact for fish.

*17(i) State whether sediments in the waterway adjacent to the development are contaminated, and what means will minimise their disturbance.*

Contamination investigations undertaken for this study and for other harbour sediments generally have found that there are elevated levels of hydrocarbons, heavy metals and PAH throughout the harbour. The sources of this contamination are varied and would include shipbuilding/maintenance and general runoff from the surrounding urban and former industrial catchments. As there will only be impact disturbance of sediments arising from construction works with rapid settling following disturbance, there are not expected to be any measurable release of contaminants from sediments to the water column but rather a resettling of sediments, with chemical contaminants generally remaining bound within sediment mineral and organic complexes.

### 3.5 Conclusions

It is concluded that proposed amendment to allow reconfiguration of the mooring pens for the Superyacht Marina in Rozelle Bay, can be undertaken in such a way that there would be no significant impacts on water quality and aquatic ecology.

Accordingly, the project could meet the aquatic ecology conservation requirements of the SREP (Sydney Harbour Catchment) 2005 and could meet the aquatic ecology and fish habitat conservation requirements of the Fisheries Management Act 1994 (FMA) and the NSW Fisheries' guidelines (NSW Fisheries 2013). The proposed construction works would not require any permits under the FMA.

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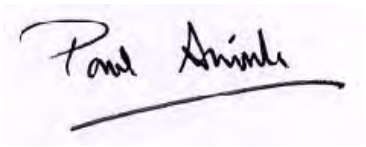


Paul Anink 21 May 2014

Aquatic Ecologist

# ANNEXURES A AND B

## ANNEXURE A

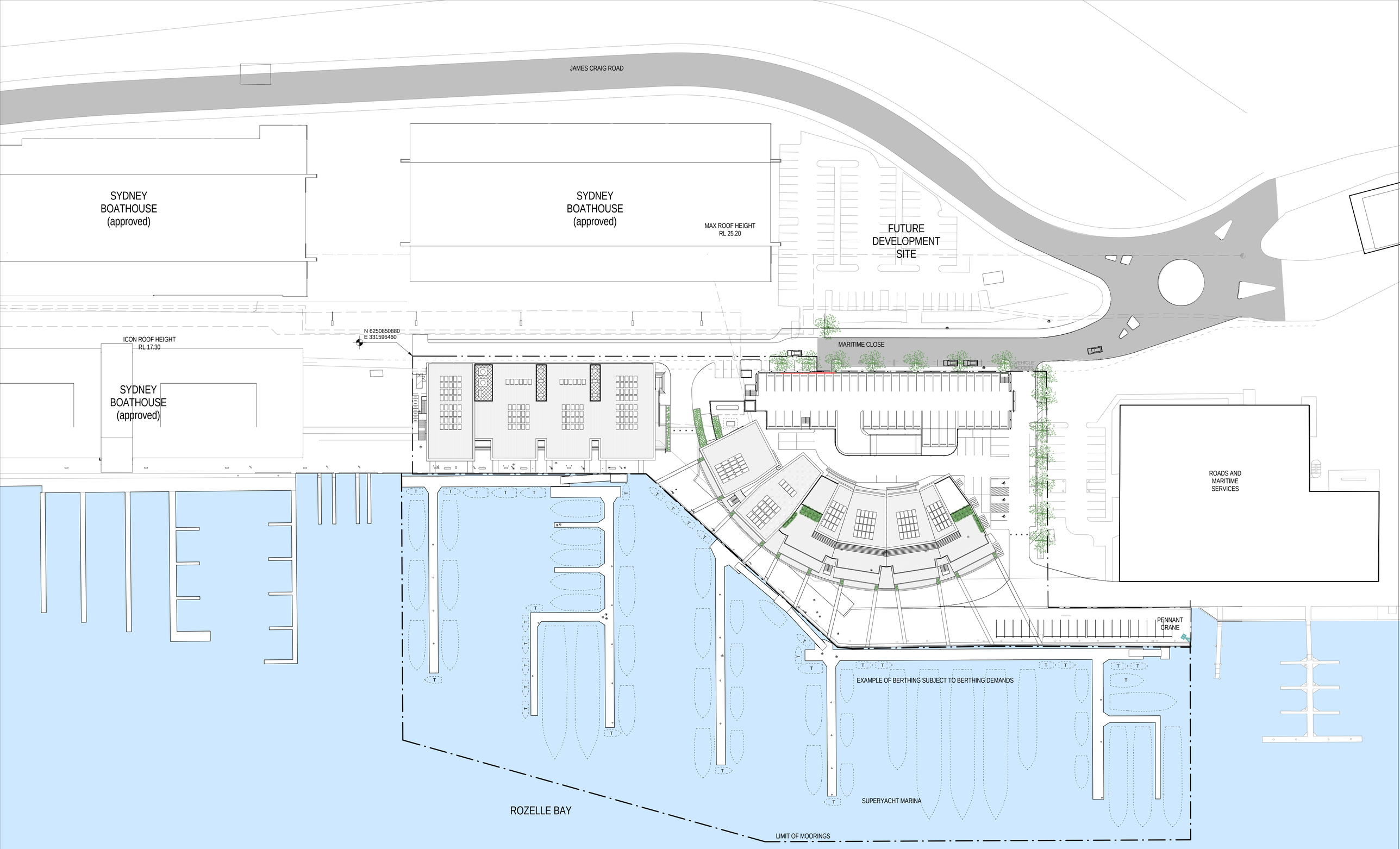
## SCOTT CARVER SITE PLAN 20090002-AD-DA04(E) SHOWING PROPOSED PONTOON AND VESSEL CONFIGURATION

## ANNEXURE B

## SITE SEDIMENT CONTAMINATION STUDY SEDIMENT SAMPLE ANALYLITICAL RESULTS

## ALS LABORATORY REPORT

## ES1324167

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# SYDNEY SUPERYACHT MARINA PTY. LTD.

FOR APPROVAL

Project No: 20090002
Nominated Architect: JOHN FERRES Reg. No. 4955

Scale 1 : 500 @ A1
0 20 40m
Drawn by KC/GD

Drawing Title: SITE PLAN
Date Printed: 07.02.2014
Drawing No: DA04
Issue: E

9/04/2014 4:46:04 PM

# CHAIN OF CUSTODY

ALS Laboratory: please tick →


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- Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com


| | | | |
|---|---|---|---|
| CLIENT: | Marine Pollution Research Pty Ltd | TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) | ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date): |
| OFFICE: | | | |
| PROJECT: | Sydney Superyacht Marina | ALS QUOTE NO.: | MPR Quote |
| ORDER NUMBER: | | | |
| PROJECT MANAGER: | Paul Anink | CONTACT PH: | 0412 562 081 |
| SAMPLER: | Jacob Broom | SAMPLER MOBILE: | 0405 482 811 |
| COC emailed to ALS? ( YES / NO) | | EDD FORMAT (or default): | |
| Email Reports to (will default to PM if no other addresses are listed): | panink@ilmetro.com.au | | |
| Email Invoice to (will default to PM if no other addresses are listed): | panink@ilmetro.com.au | | |

COC SEQUENCE NUMBER (Circle)

COC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Free ice / frozen ice bricks present upon receipt? Yes No N/A

Random Sample Temperature on Receipt: °C

Other comment:

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| DATE/TIME: 7 Nov 2013 | DATE/TIME: 7/11/13 1230 | DATE/TIME: | DATE/TIME: |

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

| ALS USE ONLY | SAMPLE DETAILS MATRIX: Solid(S) Water(W) | | | CONTAINER INFORMATION | | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | | | | | | | | Additional Information |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LAB ID | SAMPLE ID | DATE / TIME | MATRIX | TYPE & PRESERVATIVE (refer to codes below) | TOTAL BOTTLES | Moisture Content & TOC | Total Metals Suite EG020.SD Cd, Cr, Cu, Co, Pb,Mn, Ni, Zn | Hg-D-CVAF Mercury - Low level | EA150 Particle Size | PAH low level | Combined OC/OP/PCB/PAH suite | Low level TPH/BTEX | | Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc. |
| 1 | SSY01 | 7/11/13 1130 | SED | | 4 Plb | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | 4 bottles, 1 Bag |
| 2 | SSY02 | 11 1100 | SED | | 3 Plb | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | 3 bottles, 1 Bag |
| 3 | SSY03 | 11 1030 | SED | | 3 Plb | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | 3 bottles, 1 Bag |
| 4 | SSY04 | 11 1000 | SED | | 3 Plb | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | 3 bottles, 1 Bag |
| | | 4 | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | |
| | | | | TOTAL | | | | | | | | | | |

Environmental Division
Sydney
Work Order
**ES1324167**

Telephone : +61-2-8784 8555

*Water Container Codes:* P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

# CERTIFICATE OF ANALYSIS

| | | | |
|---|---|---|---|
| **Work Order** | : **ES1324167** | Page | : 1 of 8 |
| Client | : **MARINE POLLUTION RESEARCH PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MR PAUL ANINK | Contact | : Client Services |
| Address | : PO BOX 279<br>CHURCH POINT<br>SYDNEY NSW 2105 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| E-mail | : panink@iimetro.com.au | E-mail | : sydney@alsglobal.com |
| Telephone | : +61 02 9997 6541 | Telephone | : +61-2-8784 8555 |
| Facsimile | : ---- | Facsimile | : +61-2-8784 8500 |
| Project | : SYDNEY SUPERYACHT MARINA | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Order number | : ---- | | |
| C-O-C number | : ---- | Date Samples Received | : 07-NOV-2013 |
| Sampler | : JB | Issue Date | : 27-NOV-2013 |
| Site | : ---- | | |
| | | No. of samples received | : 4 |
| Quote number | : SY/196/12 V2 | No. of samples analysed | : 4 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

## 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 sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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

- **EP131B : LOR for samples are raised due to the high amount of moisture is present.**
- **EP132B-SD : Particular samples required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.**



## Signatories

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

| *Signatories* | *Position* | *Accreditation Category* |
|---|---|---|
| Celine Conceicao | Senior Spectroscopist | Sydney Inorganics |
| Hamish Murray | Supervisor - Soils | Newcastle - Inorganics |
| Pabi Subba | Senior Organic Chemist | Sydney Organics |
| SATISH.TRIVEDI | 2 IC Acid Sulfate Soils Supervisor | Brisbane Acid Sulphate Soils |

## Analytical Results

| Sub-Matrix: SEDIMENT (Matrix: SOIL) | | | | Client sample ID | SSY01 | SSY02 | SSY03 | SSY04 | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 07-NOV-2013 11:30 | 07-NOV-2013 11:00 | 07-NOV-2013 10:30 | 07-NOV-2013 10:00 | ---- |
| Compound | CAS Number | LOR | Unit | | ES1324167-001 | ES1324167-002 | ES1324167-003 | ES1324167-004 | ---- |
| **EA150: Particle Sizing** | | | | | | | | | |
| +75µm | ---- | 1 | % | | 6 | 2 | 4 | 3 | ---- |
| +150µm | ---- | 1 | % | | 5 | 2 | 3 | 3 | ---- |
| +300µm | ---- | 1 | % | | 4 | 1 | 3 | 2 | ---- |
| +425µm | ---- | 1 | % | | 4 | 1 | 2 | 2 | ---- |
| +600µm | ---- | 1 | % | | 3 | 1 | 2 | 2 | ---- |
| +1180µm | ---- | 1 | % | | 3 | <1 | 1 | 1 | ---- |
| +2.36mm | ---- | 1 | % | | 2 | <1 | <1 | <1 | ---- |
| +4.75mm | ---- | 1 | % | | <1 | <1 | <1 | <1 | ---- |
| +9.5mm | ---- | 1 | % | | <1 | <1 | <1 | <1 | ---- |
| +19.0mm | ---- | 1 | % | | <1 | <1 | <1 | <1 | ---- |
| +37.5mm | ---- | 1 | % | | <1 | <1 | <1 | <1 | ---- |
| +75.0mm | ---- | 1 | % | | <1 | <1 | <1 | <1 | ---- |
| **EA055: Moisture Content** | | | | | | | | | |
| Moisture Content (dried @ 103°C) | ---- | 1.0 | % | | 66.9 | 71.4 | 72.6 | 65.3 | ---- |
| **EA150: Soil Classification based on Particle Size** | | | | | | | | | |
| Fines (<75 µm) | ---- | 1 | % | | 94 | 98 | 96 | 97 | ---- |
| Sand (>75 µm) | ---- | 1 | % | | 4 | 2 | 4 | 3 | ---- |
| Gravel (>2mm) | ---- | 1 | % | | 2 | <1 | 1 | 1 | ---- |
| Cobbles (>6cm) | ---- | 1 | % | | <1 | <1 | <1 | <1 | ---- |
| **EG020-SD: Total Metals in Sediments by ICPMS** | | | | | | | | | |
| Cadmium | 7440-43-9 | 0.1 | mg/kg | | 1.2 | 1.0 | 1.2 | 0.7 | ---- |
| Chromium | 7440-47-3 | 1.0 | mg/kg | | 65.9 | 76.0 | 71.9 | 67.4 | ---- |
| Copper | 7440-50-8 | 1.0 | mg/kg | | 350 | 483 | 491 | 354 | ---- |
| Cobalt | 7440-48-4 | 0.5 | mg/kg | | 6.8 | 7.5 | 6.9 | 6.2 | ---- |
| Lead | 7439-92-1 | 1.0 | mg/kg | | 615 | 632 | 614 | 544 | ---- |
| Manganese | 7439-96-5 | 10 | mg/kg | | 143 | 107 | 114 | 119 | ---- |
| Nickel | 7440-02-0 | 1.0 | mg/kg | | 20.3 | 22.1 | 20.5 | 18.1 | ---- |
| Zinc | 7440-66-6 | 1.0 | mg/kg | | 1110 | 1310 | 1350 | 1060 | ---- |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | | | |
| Mercury | 7439-97-6 | 0.01 | mg/kg | | 2.70 | 2.34 | 2.49 | 2.96 | ---- |
| **EP003: Total Organic Carbon (TOC) in Soil** | | | | | | | | | |
| Total Organic Carbon | ---- | 0.02 | % | | 5.46 | 5.88 | 5.44 | 4.62 | ---- |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons** | | | | | | | | | |

## Analytical Results

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

| Compound | CAS Number | LOR | Unit | Client sample ID | SSY01 | SSY02 | SSY03 | SSY04 | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 07-NOV-2013 11:30 | 07-NOV-2013 11:00 | 07-NOV-2013 10:30 | 07-NOV-2013 10:00 | ---- |
| | | | | | ES1324167-001 | ES1324167-002 | ES1324167-003 | ES1324167-004 | ---- |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons - Continued** | | | | | | | | | |
| **C6 - C9 Fraction** | ---- | 3 | mg/kg | | <3 | <3 | <3 | <3 | ---- |
| **C10 - C14 Fraction** | ---- | 3 | mg/kg | | **16** | **18** | **25** | **15** | ---- |
| **C15 - C28 Fraction** | ---- | 3 | mg/kg | | **755** | **710** | **911** | **697** | ---- |
| **C29 - C36 Fraction** | ---- | 5 | mg/kg | | **669** | **618** | **817** | **656** | ---- |
| ^ **C10 - C36 Fraction (sum)** | ---- | 3 | mg/kg | | **1440** | **1350** | **1750** | **1370** | ---- |
| **EP080-SD / EP071-SD: Total Recoverable Hydrocarbons** | | | | | | | | | |
| **C6 - C10 Fraction** | C6_C10 | 3 | mg/kg | | <3 | <3 | <3 | <3 | ---- |
| **EP080-SD: BTEXN** | | | | | | | | | |
| **Benzene** | 71-43-2 | 0.2 | mg/kg | | <0.2 | <0.2 | <0.2 | <0.2 | ---- |
| **Toluene** | 108-88-3 | 0.2 | mg/kg | | <0.2 | <0.2 | <0.2 | <0.2 | ---- |
| **Ethylbenzene** | 100-41-4 | 0.2 | mg/kg | | <0.2 | <0.2 | <0.2 | <0.2 | ---- |
| **meta- & para-Xylene** | 108-38-3 106-42-3 | 0.2 | mg/kg | | <0.2 | <0.2 | <0.2 | <0.2 | ---- |
| **ortho-Xylene** | 95-47-6 | 0.2 | mg/kg | | <0.2 | <0.2 | <0.2 | <0.2 | ---- |
| ^ **Total Xylenes** | 1330-20-7 | 0.5 | mg/kg | | <0.5 | <0.5 | <0.5 | <0.5 | ---- |
| ^ **Sum of BTEX** | ---- | 0.2 | mg/kg | | <0.2 | <0.2 | <0.2 | <0.2 | ---- |
| **EP130A: Organophosphorus Pesticides (Ultra-trace)** | | | | | | | | | |
| **Bromophos-ethyl** | 4824-78-6 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Carbophenothion** | 786-19-6 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Chlorfenvinphos (E)** | 18708-86-6 | 10.0 | µg/kg | | <10.0 | ---- | <10.0 | ---- | ---- |
| **Chlorfenvinphos (Z)** | 18708-87-7 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Chlorpyrifos** | 2921-88-2 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Chlorpyrifos-methyl** | 5598-13-0 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Demeton-S-methyl** | 919-86-8 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Diazinon** | 333-41-5 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Dichlorvos** | 62-73-7 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Dimethoate** | 60-51-5 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Ethion** | 563-12-2 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Fenamiphos** | 22224-92-6 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Fenthion** | 55-38-9 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Malathion** | 121-75-5 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Azinphos Methyl** | 86-50-0 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Monocrotophos** | 6923-22-4 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Parathion** | 56-38-2 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |

## Analytical Results

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

| Compound | CAS Number | LOR | Unit | Client sample ID | SSY01 | SSY02 | SSY03 | SSY04 | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 07-NOV-2013 11:30 | 07-NOV-2013 11:00 | 07-NOV-2013 10:30 | 07-NOV-2013 10:00 | ---- |
| | | | | | ES1324167-001 | ES1324167-002 | ES1324167-003 | ES1324167-004 | ---- |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) - Continued** | | | | | | | | | |
| **Parathion-methyl** | 298-00-0 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Pirimphos-ethyl** | 23505-41-1 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **Prothiofos** | 34643-46-4 | 10 | µg/kg | | <10 | ---- | <10 | ---- | ---- |
| **EP131A: Organochlorine Pesticides** | | | | | | | | | |
| **Aldrin** | 309-00-2 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **alpha-BHC** | 319-84-6 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **beta-BHC** | 319-85-7 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **delta-BHC** | 319-86-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **4.4`-DDD** | 72-54-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **4.4`-DDE** | 72-55-9 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **4.4`-DDT** | 50-29-3 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| ^ **Sum of DDD + DDE + DDT** | ---- | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Dieldrin** | 60-57-1 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **alpha-Endosulfan** | 959-98-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **beta-Endosulfan** | 33213-65-9 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Endosulfan sulfate** | 1031-07-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| ^ **Endosulfan (sum)** | 115-29-7 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Endrin** | 72-20-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Endrin aldehyde** | 7421-93-4 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Endrin ketone** | 53494-70-5 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Heptachlor** | 76-44-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Heptachlor epoxide** | 1024-57-3 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **Hexachlorobenzene (HCB)** | 118-74-1 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **gamma-BHC** | 58-89-9 | 0.25 | µg/kg | | <0.25 | ---- | <0.25 | ---- | ---- |
| **Methoxychlor** | 72-43-5 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **cis-Chlordane** | 5103-71-9 | 0.25 | µg/kg | | **3.21** | ---- | **4.11** | ---- | ---- |
| **trans-Chlordane** | 5103-74-2 | 0.25 | µg/kg | | **3.96** | ---- | **4.33** | ---- | ---- |
| ^ **Total Chlordane (sum)** | ---- | 0.25 | µg/kg | | **7.17** | ---- | **8.44** | ---- | ---- |
| **Oxychlordane** | 27304-13-8 | 0.50 | µg/kg | | <0.50 | ---- | <0.50 | ---- | ---- |
| **EP131B: Polychlorinated Biphenyls (as Aroclors)** | | | | | | | | | |
| ^ **Total Polychlorinated biphenyls** | ---- | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **Aroclor 1016** | 12674-11-2 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **Aroclor 1221** | 11104-28-2 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **Aroclor 1232** | 11141-16-5 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |

## Analytical Results

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

| Compound | CAS Number | LOR | Unit | Client sample ID | SSY01 | SSY02 | SSY03 | SSY04 | ---- |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Client sampling date / time | 07-NOV-2013 11:30 | 07-NOV-2013 11:00 | 07-NOV-2013 10:30 | 07-NOV-2013 10:00 | ---- |
| | | | | | ES1324167-001 | ES1324167-002 | ES1324167-003 | ES1324167-004 | ---- |
| **EP131B: Polychlorinated Biphenyls (as Aroclors) - Continued** | | | | | | | | | |
| **Aroclor 1242** | 53469-21-9 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **Aroclor 1248** | 12672-29-6 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **Aroclor 1254** | 11097-69-1 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **Aroclor 1260** | 11096-82-5 | 5.0 | µg/kg | | <6.5 | ---- | <6.5 | ---- | ---- |
| **EP132B: Polynuclear Aromatic Hydrocarbons** | | | | | | | | | |
| **Naphthalene** | 91-20-3 | 5 | µg/kg | | **344** | **259** | **325** | **288** | ---- |
| **2-Methylnaphthalene** | 91-57-6 | 5 | µg/kg | | **154** | **108** | **139** | **132** | ---- |
| **Acenaphthylene** | 208-96-8 | 4 | µg/kg | | **1330** | **1060** | **1050** | **1070** | ---- |
| **Acenaphthene** | 83-32-9 | 4 | µg/kg | | **108** | **67** | **89** | **82** | ---- |
| **Fluorene** | 86-73-7 | 4 | µg/kg | | **258** | **172** | **214** | **199** | ---- |
| **Phenanthrene** | 85-01-8 | 4 | µg/kg | | **1620** | **965** | **1310** | **1220** | ---- |
| **Anthracene** | 120-12-7 | 4 | µg/kg | | **1290** | **637** | **745** | **737** | ---- |
| **Fluoranthene** | 206-44-0 | 4 | µg/kg | | **4080** | **2440** | **3200** | **2860** | ---- |
| **Pyrene** | 129-00-0 | 4 | µg/kg | | **5040** | **2710** | **3710** | **3510** | ---- |
| **Benz(a)anthracene** | 56-55-3 | 4 | µg/kg | | **2410** | **1520** | **2130** | **1630** | ---- |
| **Chrysene** | 218-01-9 | 4 | µg/kg | | **1850** | **1520** | **1970** | **1720** | ---- |
| **Benzo(b)fluoranthene** | 205-99-2 | 4 | µg/kg | | **4830** | **2290** | **3180** | **3090** | ---- |
| **Benzo(k)fluoranthene** | 207-08-9 | 4 | µg/kg | | **1710** | **1230** | **1490** | **1540** | ---- |
| **Benzo(e)pyrene** | 192-97-2 | 4 | µg/kg | | **2290** | **1620** | **1940** | **1630** | ---- |
| **Benzo(a)pyrene** | 50-32-8 | 4 | µg/kg | | **4680** | **2830** | **3520** | **3440** | ---- |
| **Perylene** | 198-55-0 | 4 | µg/kg | | **1060** | **607** | **902** | **776** | ---- |
| **Benzo(g.h.i)perylene** | 191-24-2 | 4 | µg/kg | | **3330** | **1900** | **2580** | **2480** | ---- |
| **Dibenz(a.h)anthracene** | 53-70-3 | 4 | µg/kg | | **882** | **545** | **582** | **752** | ---- |
| **Indeno(1.2.3.cd)pyrene** | 193-39-5 | 4 | µg/kg | | **2540** | **1480** | **2010** | **1870** | ---- |
| **Coronene** | 191-07-1 | 5 | µg/kg | | **1330** | **508** | **706** | **719** | ---- |
| ^ **Sum of PAHs** | ---- | 4 | µg/kg | | **41100** | **24500** | **31800** | **29700** | ---- |
| **EP080-SD: TPH(V)/BTEX Surrogates** | | | | | | | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 0.1 | % | | **86.0** | **88.2** | **97.2** | **114** | ---- |
| **Toluene-D8** | 2037-26-5 | 0.1 | % | | **88.1** | **92.3** | **102** | **115** | ---- |
| **4-Bromofluorobenzene** | 460-00-4 | 0.1 | % | | **87.2** | **90.2** | **98.0** | **120** | ---- |
| **EP130S: Organophosphorus Pesticide Surrogate** | | | | | | | | | |
| **DEF** | 78-48-8 | 0.1 | % | | **35.5** | ---- | **35.7** | ---- | ---- |
| **EP131S: OC Pesticide Surrogate** | | | | | | | | | |

## Analytical Results

| Sub-Matrix: SEDIMENT (Matrix: SOIL) | | | Client sample ID | SSY01 | SSY02 | SSY03 | SSY04 | ---- |
|---|---|---|---|---|---|---|---|---|
| | | | Client sampling date / time | 07-NOV-2013 11:30 | 07-NOV-2013 11:00 | 07-NOV-2013 10:30 | 07-NOV-2013 10:00 | ---- |
| Compound | CAS Number | LOR | Unit | ES1324167-001 | ES1324167-002 | ES1324167-003 | ES1324167-004 | ---- |
| **EP131S: OC Pesticide Surrogate - Continued** | | | | | | | | |
| Dibromo-DDE | 21655-73-2 | 0.1 | % | 38.5 | ---- | 56.9 | ---- | ---- |
| **EP131T: PCB Surrogate** | | | | | | | | |
| Decachlorobiphenyl | 2051-24-3 | 0.1 | % | 51.8 | ---- | 45.9 | ---- | ---- |
| **EP132T: Base/Neutral Extractable Surrogates** | | | | | | | | |
| 2-Fluorobiphenyl | 321-60-8 | 0.1 | % | 124 | 116 | 110 | 100 | ---- |
| Anthracene-d10 | 1719-06-8 | 0.1 | % | 103 | 96.8 | 95.9 | 77.8 | ---- |
| 4-Terphenyl-d14 | 1718-51-0 | 0.1 | % | 110 | 101 | 103 | 91.7 | ---- |

## Surrogate Control Limits

Sub-Matrix: **SEDIMENT**

| Compound | CAS Number | Recovery Limits (%) Low | High |
|---|---|---|---|
| **EP080-SD: TPH(V)/BTEX Surrogates** | | | |
| **1.2-Dichloroethane-D4** | 17060-07-0 | 67 | 137 |
| **Toluene-D8** | 2037-26-5 | 74 | 134 |
| **4-Bromofluorobenzene** | 460-00-4 | 73 | 137 |
| **EP130S: Organophosphorus Pesticide Surrogate** | | | |
| **DEF** | 78-48-8 | 14.4 | 102 |
| **EP131S: OC Pesticide Surrogate** | | | |
| **Dibromo-DDE** | 21655-73-2 | 7.4 | 119 |
| **EP131T: PCB Surrogate** | | | |
| **Decachlorobiphenyl** | 2051-24-3 | 2.22 | 106 |
| **EP132T: Base/Neutral Extractable Surrogates** | | | |
| **2-Fluorobiphenyl** | 321-60-8 | 55 | 135 |
| **Anthracene-d10** | 1719-06-8 | 70 | 136 |
| **4-Terphenyl-d14** | 1718-51-0 | 57 | 127 |

# Certificate of Analysis

**ALS Laboratory Group Pty Ltd**
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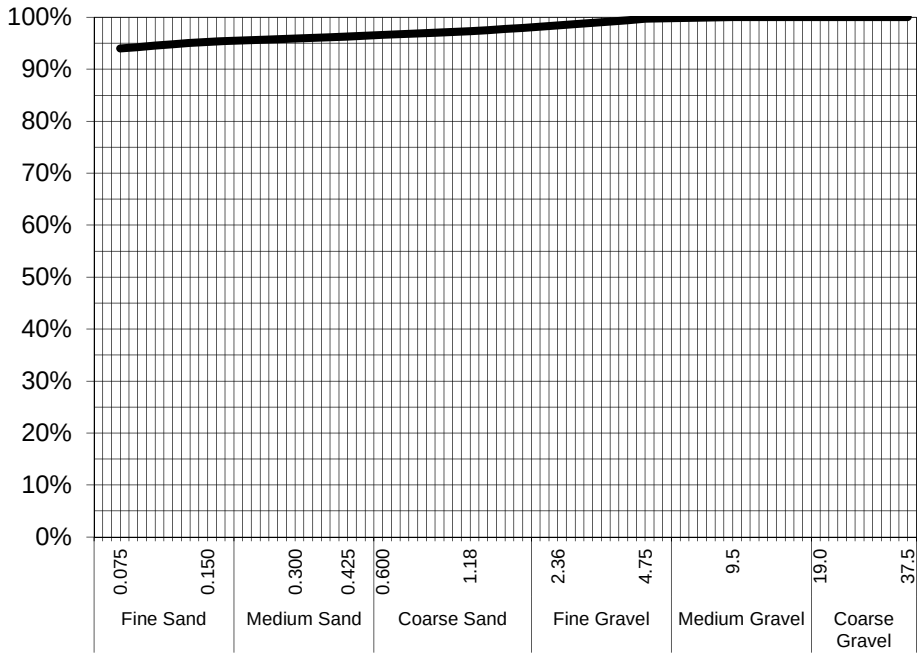
**pH 02 4968 9433**
**fax 02 4968 0349**
**samples.newcastle@alsenviro.com**

## ALS Environmental

## Newcastle, NSW

| | | | |
|---|---|---|---|
| **CLIENT:** | Paul Anink | **DATE REPORTED:** | 27-Nov-2013 |
| **COMPANY:** | Marine Pollution Research Pty Ltd | **DATE RECEIVED:** | 7-Nov-2013 |
| **ADDRESS:** | PO Box 279<br>Church Point<br>Sydney, NSW 2105 | **REPORT NO:** | ES1324167-001 / PSD |
| **PROJECT:** | Sydney Superyacht Marina | **SAMPLE ID:** | SSY01 |

**Particle Size Distribution**




| Particle Size (mm) | Percent Passing |
|---|---|
| | |
| | |
| | |
| 19.0 | 100% |
| 9.5 | 100% |
| 4.75 | 100% |
| 2.36 | 98% |
| 1.18 | 97% |
| 0.600 | 97% |
| 0.425 | 96% |
| 0.300 | 96% |
| 0.150 | 95% |
| 0.075 | 94% |

*Samples analysed as received.*

**Sample Comments:**

**Analysed:** 25-Nov-13

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** Fines

**Test Method:** AS1289.3.6.1

**NATA Accreditation: 825 Site: Newcastle**
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**Hamish Murray**
Laboratory Supervisor, Newcastle
***Authorised Signatory***

# Certificate of Analysis

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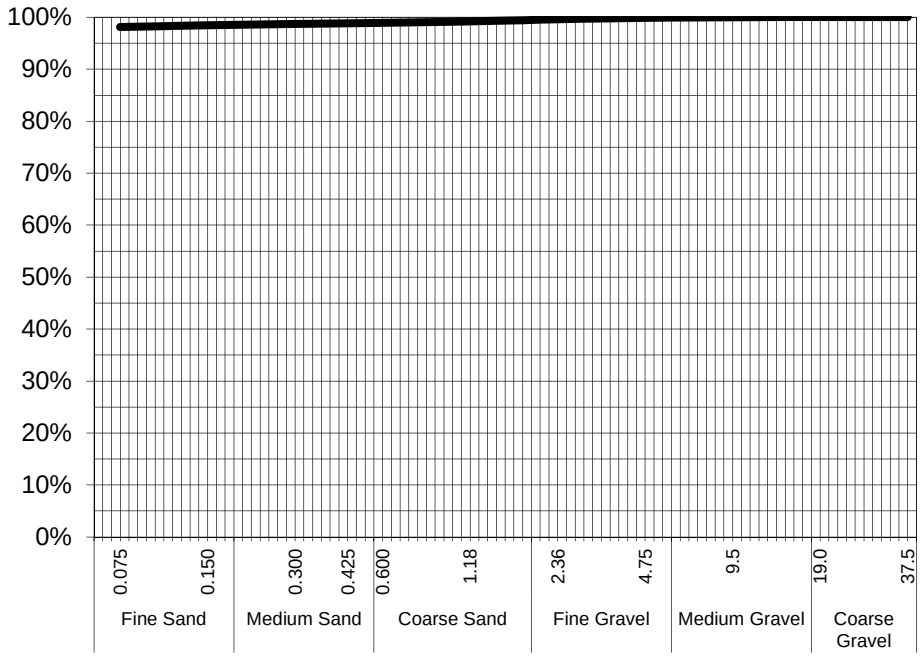
## ALS Environmental

## Newcastle, NSW

| | | | |
|---|---|---|---|
| **CLIENT:** | Paul Anink | **DATE REPORTED:** | 27-Nov-2013 |
| **COMPANY:** | Marine Pollution Research Pty Ltd | **DATE RECEIVED:** | 7-Nov-2013 |
| **ADDRESS:** | PO Box 279<br>Church Point<br>Sydney, NSW 2105 | **REPORT NO:** | ES1324167-002 / PSD |
| **PROJECT:** | Sydney Superyacht Marina | **SAMPLE ID:** | SSY02 |

**Particle Size Distribution**




| Particle Size (mm) | Percent Passing |
|---|---|
| | |
| | |
| | |
| 19.0 | 100% |
| 9.5 | 100% |
| 4.75 | 100% |
| 2.36 | 100% |
| 1.18 | 99% |
| 0.600 | 99% |
| 0.425 | 99% |
| 0.300 | 99% |
| 0.150 | 99% |
| 0.075 | 98% |

*Samples analysed as received.*

**Sample Comments:**

**Analysed:** 25-Nov-13

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** Fines

**Test Method:** AS1289.3.6.1

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# Certificate of Analysis

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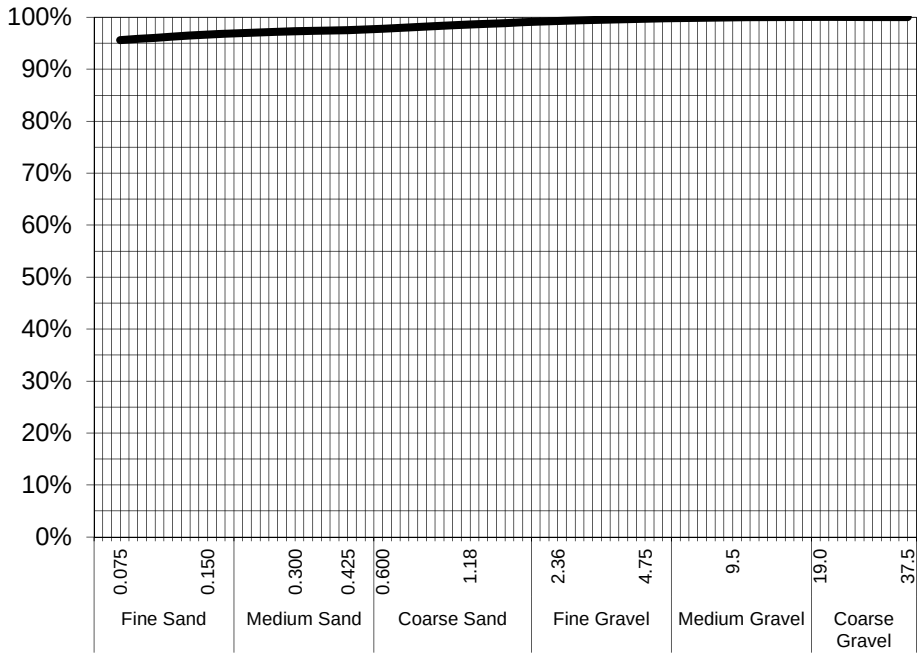
## ALS Environmental

## Newcastle, NSW

| | | | |
|---|---|---|---|
| **CLIENT:** | Paul Anink | **DATE REPORTED:** | 27-Nov-2013 |
| **COMPANY:** | Marine Pollution Research Pty Ltd | **DATE RECEIVED:** | 7-Nov-2013 |
| **ADDRESS:** | PO Box 279<br>Church Point<br>Sydney, NSW 2105 | **REPORT NO:** | ES1324167-003 / PSD |
| **PROJECT:** | Sydney Superyacht Marina | **SAMPLE ID:** | SSY03 |

**Particle Size Distribution**




| Particle Size (mm) | Percent Passing |
|---|---|
| | |
| | |
| | |
| 19.0 | 100% |
| 9.5 | 100% |
| 4.75 | 100% |
| 2.36 | 99% |
| 1.18 | 99% |
| 0.600 | 98% |
| 0.425 | 98% |
| 0.300 | 97% |
| 0.150 | 97% |
| 0.075 | 96% |

*Samples analysed as received.*

| | | | |
|---|---|---|---|
| **Sample Comments:** | | **Analysed:** | 25-Nov-13 |
| **Loss on Pretreatment** | NA | **Limit of Reporting:** | 1% |
| **Sample Description:** | Fines | | |
| **Test Method:** | AS1289.3.6.1 | | |



**Hamish Murray**
Laboratory Supervisor, Newcastle
***Authorised Signatory***

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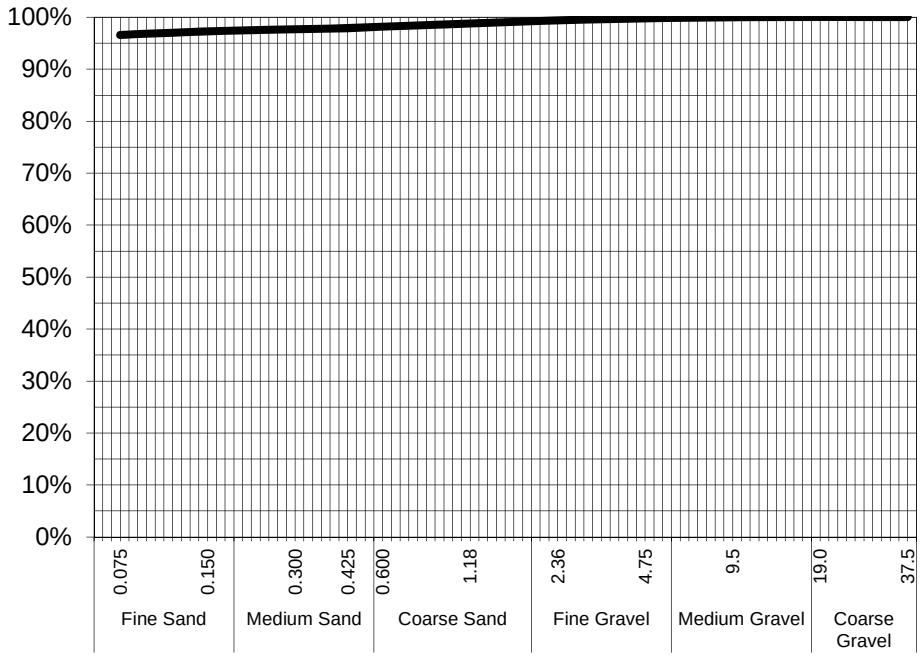
## ALS Environmental

## Newcastle, NSW

| | | | |
|---|---|---|---|
| **CLIENT:** | Paul Anink | **DATE REPORTED:** | 27-Nov-2013 |
| **COMPANY:** | Marine Pollution Research Pty Ltd | **DATE RECEIVED:** | 7-Nov-2013 |
| **ADDRESS:** | PO Box 279<br>Church Point<br>Sydney, NSW 2105 | **REPORT NO:** | ES1324167-004 / PSD |
| **PROJECT:** | Sydney Superyacht Marina | **SAMPLE ID:** | SSY04 |

**Particle Size Distribution**




| Particle Size (mm) | Percent Passing |
|---|---|
| | |
| | |
| | |
| 19.0 | 100% |
| 9.5 | 100% |
| 4.75 | 100% |
| 2.36 | 99% |
| 1.18 | 99% |
| 0.600 | 98% |
| 0.425 | 98% |
| 0.300 | 98% |
| 0.150 | 97% |
| 0.075 | 97% |

*Samples analysed as received.*

| | | | |
|---|---|---|---|
| **Sample Comments:** | | **Analysed:** | 25-Nov-13 |
| **Loss on Pretreatment** | NA | **Limit of Reporting:** | 1% |
| **Sample Description:** | Fines | | |
| **Test Method:** | AS1289.3.6.1 | | |

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NATA
WORLD RECOGNISED ACCREDITATION

**Hamish Murray**
Laboratory Supervisor, Newcastle
***Authorised Signatory***

# QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **ES1324167** | Page | : 1 of 14 |
| Client | : **MARINE POLLUTION RESEARCH PTY LTD** | Laboratory | : Environmental Division Sydney |
| Contact | : MR PAUL ANINK | Contact | : Client Services |
| Address | : PO BOX 279<br>CHURCH POINT<br>SYDNEY NSW 2105 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| E-mail | : panink@iimetro.com.au | E-mail | : sydney@alsglobal.com |
| Telephone | : +61 02 9997 6541 | Telephone | : +61-2-8784 8555 |
| Facsimile | : ---- | Facsimile | : +61-2-8784 8500 |
| Project | : SYDNEY SUPERYACHT MARINA | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Site | : ---- | | |
| C-O-C number | : ---- | Date Samples Received | : 07-NOV-2013 |
| Sampler | : JB | Issue Date | : 27-NOV-2013 |
| Order number | : ---- | | |
| | | No. of samples received | : 4 |
| Quote number | : SY/196/12 V2 | No. of samples analysed | : 4 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

## 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.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

## Signatories

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

| Signatories | Position | Accreditation Category |
|---|---|---|
| Celine Conceicao | Senior Spectroscopist | Sydney Inorganics |
| Hamish Murray | Supervisor - Soils | Newcastle - Inorganics |
| Pabi Subba | Senior Organic Chemist | Sydney Organics |
| SATISH.TRIVEDI | 2 IC Acid Sulfate Soils Supervisor | Brisbane Acid Sulphate Soils |

## 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: 3161254)** | | | | | | | | | |
| EN1304177-020 | Anonymous | EA055-103: Moisture Content (dried @ 103°C) | ---- | 1.0 | % | 14.2 | 13.3 | 6.4 | 0% - 50% |
| ES1324432-002 | Anonymous | EA055-103: Moisture Content (dried @ 103°C) | ---- | 1.0 | % | 13.6 | 13.5 | 1.0 | 0% - 50% |
| **EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 3164571)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EG020-SD: Cadmium | 7440-43-9 | 0.1 | mg/kg | 1.2 | 1.3 | 0.0 | 0% - 50% |
| | | EG020-SD: Cobalt | 7440-48-4 | 0.5 | mg/kg | 6.8 | 7.2 | 6.6 | 0% - 50% |
| | | EG020-SD: Chromium | 7440-47-3 | 1.0 | mg/kg | 65.9 | 71.6 | 8.2 | 0% - 20% |
| | | EG020-SD: Copper | 7440-50-8 | 1.0 | mg/kg | 350 | 399 | 13.2 | 0% - 20% |
| | | EG020-SD: Lead | 7439-92-1 | 1.0 | mg/kg | 615 | 666 | 7.9 | 0% - 20% |
| | | EG020-SD: Nickel | 7440-02-0 | 1.0 | mg/kg | 20.3 | 23.1 | 13.2 | 0% - 20% |
| | | EG020-SD: Zinc | 7440-66-6 | 1.0 | mg/kg | 1110 | 1250 | 11.9 | 0% - 20% |
| | | EG020-SD: Manganese | 7439-96-5 | 10 | mg/kg | 143 | 126 | 12.4 | 0% - 50% |
| **EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3164570)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EG035T-LL: Mercury | 7439-97-6 | 0.01 | mg/kg | 2.70 | 2.86 | 5.7 | 0% - 20% |
| **EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3155737)** | | | | | | | | | |
| EP1308489-001 | Anonymous | EP003: Total Organic Carbon | ---- | 0.02 | % | 0.22 | 0.26 | 16.5 | 0% - 50% |
| ES1324167-001 | SSY01 | EP003: Total Organic Carbon | ---- | 0.02 | % | 5.46 | 5.42 | 0.7 | 0% - 20% |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3155828)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP071-SD: C10 - C14 Fraction | ---- | 3 | mg/kg | 16 | 16 | 0.0 | No Limit |
| | | EP071-SD: C15 - C28 Fraction | ---- | 3 | mg/kg | 755 | 736 | 2.5 | 0% - 20% |
| | | EP071-SD: C29 - C36 Fraction | ---- | 5 | mg/kg | 669 | 637 | 5.0 | 0% - 20% |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 3163450)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP080-SD: C6 - C9 Fraction | ---- | 3 | mg/kg | <3 | <3 | 0.0 | No Limit |
| ES1324776-007 | Anonymous | EP080-SD: C6 - C9 Fraction | ---- | 3 | mg/kg | <3 | <3 | 0.0 | No Limit |
| **EP080-SD: BTEXN (QC Lot: 3163450)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP080-SD: Benzene | 71-43-2 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: Toluene | 108-88-3 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: Ethylbenzene | 100-41-4 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: meta- & para-Xylene | 108-38-3<br>106-42-3 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: ortho-Xylene | 95-47-6 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| ES1324776-007 | Anonymous | EP080-SD: Benzene | 71-43-2 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: Toluene | 108-88-3 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: Ethylbenzene | 100-41-4 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| | | EP080-SD: meta- & para-Xylene | 108-38-3<br>106-42-3 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |

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 (%)* |
| **EP080-SD: BTEXN (QC Lot: 3163450) - continued** | | | | | | | | | |
| ES1324776-007 | Anonymous | EP080-SD: ortho-Xylene | 95-47-6 | 0.2 | mg/kg | <0.2 | <0.2 | 0.0 | No Limit |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QC Lot: 3155829)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP130: Bromophos-ethyl | 4824-78-6 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Carbophenothion | 786-19-6 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Chlorfenvinphos (Z) | 18708-87-7 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Chlorpyrifos | 2921-88-2 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Chlorpyrifos-methyl | 5598-13-0 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Demeton-S-methyl | 919-86-8 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Diazinon | 333-41-5 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Dichlorvos | 62-73-7 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Dimethoate | 60-51-5 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Ethion | 563-12-2 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Fenamiphos | 22224-92-6 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Fenthion | 55-38-9 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Malathion | 121-75-5 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Azinphos Methyl | 86-50-0 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Monocrotophos | 6923-22-4 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Parathion | 56-38-2 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Parathion-methyl | 298-00-0 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Pirimphos-ethyl | 23505-41-1 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Prothiofos | 34643-46-4 | 10 | µg/kg | <10 | <10 | 0.0 | No Limit |
| | | EP130: Chlorfenvinphos (E) | 18708-86-6 | 10.0 | µg/kg | <10.0 | <10.0 | 0.0 | No Limit |
| **EP131A: Organochlorine Pesticides (QC Lot: 3155830)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP131A: gamma-BHC | 58-89-9 | 0.25 | µg/kg | <0.25 | <0.25 | 0.0 | No Limit |
| | | EP131A: cis-Chlordane | 5103-71-9 | 0.25 | µg/kg | 3.21 | 3.59 | 11.1 | 0% - 50% |
| | | EP131A: trans-Chlordane | 5103-74-2 | 0.25 | µg/kg | 3.96 | 4.15 | 4.6 | 0% - 50% |
| | | EP131A: Total Chlordane (sum) | ---- | 0.25 | µg/kg | 7.17 | 7.74 | 7.6 | 0% - 20% |
| | | EP131A: Aldrin | 309-00-2 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: alpha-BHC | 319-84-6 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: beta-BHC | 319-85-7 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: delta-BHC | 319-86-8 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: 4.4`-DDD | 72-54-8 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: 4.4`-DDE | 72-55-9 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: 4.4`-DDT | 50-29-3 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Sum of DDD + DDE + DDT | ---- | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Dieldrin | 60-57-1 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: alpha-Endosulfan | 959-98-8 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: beta-Endosulfan | 33213-65-9 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Endosulfan sulfate | 1031-07-8 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Endosulfan (sum) | 115-29-7 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |

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 (%)* |
| **EP131A: Organochlorine Pesticides (QC Lot: 3155830) - continued** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP131A: Endrin | 72-20-8 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Endrin aldehyde | 7421-93-4 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Endrin ketone | 53494-70-5 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Heptachlor | 76-44-8 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Heptachlor epoxide | 1024-57-3 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Hexachlorobenzene (HCB) | 118-74-1 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| | | EP131A: Methoxychlor | 72-43-5 | 0.50 | µg/kg | <0.50 | <0.50 | 0.0 | No Limit |
| **EP131B: Polychlorinated Biphenyls (as Aroclors) (QC Lot: 3155831)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP131B: Total Polychlorinated biphenyls | ---- | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1016 | 12674-11-2 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1221 | 11104-28-2 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1232 | 11141-16-5 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1242 | 53469-21-9 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1248 | 12672-29-6 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1254 | 11097-69-1 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| | | EP131B: Aroclor 1260 | 11096-82-5 | 5.0 | µg/kg | <6.5 | <6.5 | 0.0 | No Limit |
| **EP132B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3155827)** | | | | | | | | | |
| ES1324167-001 | SSY01 | EP132B-SD: Acenaphthylene | 208-96-8 | 4 | µg/kg | 1330 | 1340 | 0.8 | 0% - 20% |
| | | EP132B-SD: Acenaphthene | 83-32-9 | 4 | µg/kg | 108 | 113 | 3.9 | No Limit |
| | | EP132B-SD: Fluorene | 86-73-7 | 4 | µg/kg | 258 | 263 | 1.6 | No Limit |
| | | EP132B-SD: Phenanthrene | 85-01-8 | 4 | µg/kg | 1620 | 1670 | 2.9 | 0% - 20% |
| | | EP132B-SD: Anthracene | 120-12-7 | 4 | µg/kg | 1290 | 1480 | 13.3 | 0% - 20% |
| | | EP132B-SD: Fluoranthene | 206-44-0 | 4 | µg/kg | 4080 | 4250 | 4.1 | 0% - 20% |
| | | EP132B-SD: Pyrene | 129-00-0 | 4 | µg/kg | 5040 | 5180 | 2.9 | 0% - 20% |
| | | EP132B-SD: Benz(a)anthracene | 56-55-3 | 4 | µg/kg | 2410 | 2560 | 6.1 | 0% - 20% |
| | | EP132B-SD: Chrysene | 218-01-9 | 4 | µg/kg | 1850 | 2080 | 12.0 | 0% - 20% |
| | | EP132B-SD: Benzo(b)fluoranthene | 205-99-2 | 4 | µg/kg | 4830 | 4710 | 2.6 | 0% - 20% |
| | | EP132B-SD: Benzo(k)fluoranthene | 207-08-9 | 4 | µg/kg | 1710 | 1780 | 4.1 | 0% - 20% |
| | | EP132B-SD: Benzo(e)pyrene | 192-97-2 | 4 | µg/kg | 2290 | 2360 | 3.0 | 0% - 20% |
| | | EP132B-SD: Benzo(a)pyrene | 50-32-8 | 4 | µg/kg | 4680 | 4730 | 1.0 | 0% - 20% |
| | | EP132B-SD: Perylene | 198-55-0 | 4 | µg/kg | 1060 | 1120 | 5.2 | 0% - 20% |
| | | EP132B-SD: Benzo(g.h.i)perylene | 191-24-2 | 4 | µg/kg | 3330 | 3410 | 2.2 | 0% - 20% |
| | | EP132B-SD: Dibenz(a.h)anthracene | 53-70-3 | 4 | µg/kg | 882 | 880 | 0.2 | 0% - 50% |
| | | EP132B-SD: Indeno(1.2.3.cd)pyrene | 193-39-5 | 4 | µg/kg | 2540 | 2580 | 1.5 | 0% - 20% |
| | | EP132B-SD: Sum of PAHs | ---- | 4 | µg/kg | 41100 | 42300 | 2.9 | 0% - 20% |
| | | EP132B-SD: Naphthalene | 91-20-3 | 5 | µg/kg | 344 | 360 | 4.3 | No Limit |
| | | EP132B-SD: 2-Methylnaphthalene | 91-57-6 | 5 | µg/kg | 154 | 157 | 1.9 | No Limit |
| | | EP132B-SD: Coronene | 191-07-1 | 5 | µg/kg | 1330 | 1310 | 1.6 | 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 Sample (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 |
| **EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3164571)** | | | | | | | | |
| EG020-SD: Cadmium | 7440-43-9 | 0.1 | mg/kg | <0.1 | 4.64 mg/kg | 107 | 82 | 126 |
| EG020-SD: Chromium | 7440-47-3 | 1.0 | mg/kg | <1.0 | 43.9 mg/kg | 92.6 | 67 | 129 |
| EG020-SD: Copper | 7440-50-8 | 1.0 | mg/kg | <1.0 | 32 mg/kg | 102 | 80 | 136 |
| EG020-SD: Cobalt | 7440-48-4 | 0.5 | mg/kg | ---- | 16 mg/kg | 98.8 | 76 | 132 |
| | | 10 | mg/kg | <10.0 | ---- | ---- | ---- | ---- |
| EG020-SD: Lead | 7439-92-1 | 1.0 | mg/kg | <1.0 | 40 mg/kg | 106 | 75 | 131 |
| EG020-SD: Manganese | 7439-96-5 | 10 | mg/kg | <10 | 130 mg/kg | 102 | 77 | 133 |
| EG020-SD: Nickel | 7440-02-0 | 1.0 | mg/kg | <1.0 | 55 mg/kg | 98.8 | 76 | 128 |
| EG020-SD: Zinc | 7440-66-6 | 1.0 | mg/kg | <1.0 | 60.8 mg/kg | 110 | 83 | 137 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3164570)** | | | | | | | | |
| EG035T-LL: Mercury | 7439-97-6 | 0.01 | mg/kg | <0.01 | 0.11 mg/kg | 101 | 72 | 116 |
| **EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3155737)** | | | | | | | | |
| EP003: Total Organic Carbon | ---- | 0.02 | % | <0.02 | 0.11 % | 99.1 | 70 | 130 |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3155828)** | | | | | | | | |
| EP071-SD: C10 - C14 Fraction | ---- | 3 | mg/kg | <3 | 5 mg/kg | 102 | 78 | 118 |
| EP071-SD: C15 - C28 Fraction | ---- | 3 | mg/kg | <3 | 7.5 mg/kg | 107 | 84 | 118 |
| EP071-SD: C29 - C36 Fraction | ---- | 5 | mg/kg | <5 | 5 mg/kg | 103 | 73 | 119 |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3163450)** | | | | | | | | |
| EP080-SD: C6 - C9 Fraction | ---- | 3 | mg/kg | <3 | 6.2 mg/kg | 98.7 | 61 | 133 |
| **EP080-SD: BTEXN (QCLot: 3163450)** | | | | | | | | |
| EP080-SD: Benzene | 71-43-2 | 0.2 | mg/kg | <0.2 | 0.2 mg/kg | 113 | 66 | 122 |
| EP080-SD: Toluene | 108-88-3 | 0.2 | mg/kg | <0.2 | 0.2 mg/kg | 121 | 69 | 122 |
| EP080-SD: Ethylbenzene | 100-41-4 | 0.2 | mg/kg | <0.2 | 0.2 mg/kg | 115 | 66 | 126 |
| EP080-SD: meta- & para-Xylene | 108-38-3 | 0.2 | mg/kg | <0.2 | 0.4 mg/kg | 119 | 59 | 129 |
| | 106-42-3 | | | | | | | |
| EP080-SD: ortho-Xylene | 95-47-6 | 0.2 | mg/kg | <0.2 | 0.2 mg/kg | 118 | 66 | 126 |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3155829)** | | | | | | | | |
| EP130: Bromophos-ethyl | 4824-78-6 | 10 | µg/kg | <10 | 50 µg/kg | 120 | 45 | 139 |
| EP130: Carbophenothion | 786-19-6 | 10 | µg/kg | <10 | 50 µg/kg | 87.2 | 47 | 117 |
| EP130: Chlorfenvinphos (E) | 18708-86-6 | 10 | µg/kg | <10.0 | 5 µg/kg | 125 | 48 | 156 |
| EP130: Chlorfenvinphos (Z) | 18708-87-7 | 10 | µg/kg | <10 | 50 µg/kg | 112 | 62 | 136 |
| EP130: Chlorpyrifos | 2921-88-2 | 10 | µg/kg | <10 | 50 µg/kg | 105 | 57 | 137 |
| EP130: Chlorpyrifos-methyl | 5598-13-0 | 10 | µg/kg | <10 | 50 µg/kg | 103 | 57 | 121 |
| EP130: Demeton-S-methyl | 919-86-8 | 10 | µg/kg | <10 | 50 µg/kg | 76.6 | 20.4 | 142 |

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 |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3155829) - continued** | | | | | | | | |
| EP130: Diazinon | 333-41-5 | 10 | µg/kg | <10 | 50 µg/kg | 81.8 | 57 | 121 |
| EP130: Dichlorvos | 62-73-7 | 10 | µg/kg | <10 | 50 µg/kg | 96.2 | 47 | 115 |
| EP130: Dimethoate | 60-51-5 | 10 | µg/kg | <10 | 50 µg/kg | 92.7 | 55 | 133 |
| EP130: Ethion | 563-12-2 | 10 | µg/kg | <10 | 50 µg/kg | 105 | 54 | 130 |
| EP130: Fenamiphos | 22224-92-6 | 10 | µg/kg | <10 | 50 µg/kg | 119 | 57 | 131 |
| EP130: Fenthion | 55-38-9 | 10 | µg/kg | <10 | 50 µg/kg | 108 | 38 | 130 |
| EP130: Malathion | 121-75-5 | 10 | µg/kg | <10 | 50 µg/kg | 109 | 62 | 138 |
| EP130: Azinphos Methyl | 86-50-0 | 10 | µg/kg | <10 | 50 µg/kg | 80.0 | 33 | 137 |
| EP130: Monocrotophos | 6923-22-4 | 10 | µg/kg | <10 | 50 µg/kg | 108 | 50 | 148 |
| EP130: Parathion | 56-38-2 | 10 | µg/kg | <10 | 50 µg/kg | 118 | 64 | 140 |
| EP130: Parathion-methyl | 298-00-0 | 10 | µg/kg | <10 | 50 µg/kg | 110 | 56 | 136 |
| EP130: Pirimphos-ethyl | 23505-41-1 | 10 | µg/kg | <10 | 50 µg/kg | 118 | 50 | 132 |
| EP130: Prothiofos | 34643-46-4 | 10 | µg/kg | <10 | 50 µg/kg | 108 | 55 | 135 |
| **EP131A: Organochlorine Pesticides (QCLot: 3155830)** | | | | | | | | |
| EP131A: Aldrin | 309-00-2 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 68.5 | 38 | 150 |
| EP131A: alpha-BHC | 319-84-6 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 70.6 | 17.6 | 156 |
| EP131A: beta-BHC | 319-85-7 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 68.9 | 30.5 | 152 |
| EP131A: delta-BHC | 319-86-8 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 79.3 | 37 | 151 |
| EP131A: 4.4`-DDD | 72-54-8 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 114 | 25.9 | 150 |
| EP131A: 4.4`-DDE | 72-55-9 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 59.9 | 35 | 129 |
| EP131A: 4.4`-DDT | 50-29-3 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 84.4 | 23.4 | 163 |
| EP131A: Sum of DDD + DDE + DDT | ---- | 0.5 | µg/kg | <0.50 | ---- | ---- | ---- | ---- |
| EP131A: Dieldrin | 60-57-1 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 94.6 | 30.2 | 140 |
| EP131A: alpha-Endosulfan | 959-98-8 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 70.0 | 38 | 140 |
| EP131A: beta-Endosulfan | 33213-65-9 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 87.2 | 32 | 152 |
| EP131A: Endosulfan sulfate | 1031-07-8 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 116 | 36 | 162 |
| EP131A: Endosulfan (sum) | 115-29-7 | 0.5 | µg/kg | <0.50 | ---- | ---- | ---- | ---- |
| EP131A: Endrin | 72-20-8 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 132 | 25.8 | 166 |
| EP131A: Endrin aldehyde | 7421-93-4 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 65.4 | 20.1 | 116 |
| EP131A: Endrin ketone | 53494-70-5 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 99.2 | 13.4 | 151 |
| EP131A: Heptachlor | 76-44-8 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 130 | 39 | 173 |
| EP131A: Heptachlor epoxide | 1024-57-3 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 74.5 | 34 | 148 |
| EP131A: Hexachlorobenzene (HCB) | 118-74-1 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 65.7 | 26.1 | 152 |
| EP131A: gamma-BHC | 58-89-9 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 67.7 | 31.2 | 159 |
| EP131A: Methoxychlor | 72-43-5 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 116 | 36 | 160 |
| EP131A: cis-Chlordane | 5103-71-9 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 68.3 | 36 | 142 |
| EP131A: trans-Chlordane | 5103-74-2 | 0.5 | µg/kg | <0.50 | 5 µg/kg | 70.6 | 29.5 | 138 |
| EP131A: Total Chlordane (sum) | ---- | 0.5 | µg/kg | <0.50 | ---- | ---- | ---- | ---- |
| **EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3155831)** | | | | | | | | |

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 |
| **EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3155831) - continued** | | | | | | | | |
| EP131B: Total Polychlorinated biphenyls | ---- | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| EP131B: Aroclor 1016 | 12674-11-2 | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| EP131B: Aroclor 1221 | 11104-28-2 | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| EP131B: Aroclor 1232 | 11141-16-5 | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| EP131B: Aroclor 1242 | 53469-21-9 | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| EP131B: Aroclor 1248 | 12672-29-6 | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| EP131B: Aroclor 1254 | 11097-69-1 | 5 | µg/kg | <5.0 | 50 µg/kg | 99.9 | 50 | 134 |
| EP131B: Aroclor 1260 | 11096-82-5 | 5 | µg/kg | <5.0 | ---- | ---- | ---- | ---- |
| **EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3155827)** | | | | | | | | |
| EP132B-SD: Naphthalene | 91-20-3 | 5 | µg/kg | <5 | 25 µg/kg | 80.9 | 67 | 133 |
| EP132B-SD: 2-Methylnaphthalene | 91-57-6 | 5 | µg/kg | <5 | 25 µg/kg | 107 | 63 | 135 |
| EP132B-SD: Acenaphthylene | 208-96-8 | 4 | µg/kg | <4 | 25 µg/kg | 87.1 | 68 | 132 |
| EP132B-SD: Acenaphthene | 83-32-9 | 4 | µg/kg | <4 | 25 µg/kg | 98.9 | 67 | 133 |
| EP132B-SD: Fluorene | 86-73-7 | 4 | µg/kg | <4 | 25 µg/kg | 111 | 69 | 131 |
| EP132B-SD: Phenanthrene | 85-01-8 | 4 | µg/kg | <4 | 25 µg/kg | 104 | 66 | 138 |
| EP132B-SD: Anthracene | 120-12-7 | 4 | µg/kg | <4 | 25 µg/kg | 104 | 67 | 133 |
| EP132B-SD: Fluoranthene | 206-44-0 | 4 | µg/kg | <4 | 25 µg/kg | 101 | 64 | 130 |
| EP132B-SD: Pyrene | 129-00-0 | 4 | µg/kg | <4 | 25 µg/kg | 100 | 67 | 133 |
| EP132B-SD: Benz(a)anthracene | 56-55-3 | 4 | µg/kg | <4 | 25 µg/kg | 103 | 65 | 133 |
| EP132B-SD: Chrysene | 218-01-9 | 4 | µg/kg | <4 | 25 µg/kg | 99.0 | 70 | 134 |
| EP132B-SD: Benzo(b)fluoranthene | 205-99-2 | 4 | µg/kg | <4 | 25 µg/kg | 93.0 | 63 | 133 |
| EP132B-SD: Benzo(k)fluoranthene | 207-08-9 | 4 | µg/kg | <4 | 25 µg/kg | 103 | 67 | 133 |
| EP132B-SD: Benzo(e)pyrene | 192-97-2 | 4 | µg/kg | <4 | 25 µg/kg | 92.4 | 64 | 130 |
| EP132B-SD: Benzo(a)pyrene | 50-32-8 | 4 | µg/kg | <4 | 25 µg/kg | 101 | 72 | 130 |
| EP132B-SD: Perylene | 198-55-0 | 4 | µg/kg | <4 | 25 µg/kg | 114 | 70 | 132 |
| EP132B-SD: Benzo(g.h.i)perylene | 191-24-2 | 4 | µg/kg | <4 | 25 µg/kg | 107 | 65 | 127 |
| EP132B-SD: Dibenz(a.h)anthracene | 53-70-3 | 4 | µg/kg | <4 | 25 µg/kg | 105 | 67 | 135 |
| EP132B-SD: Indeno(1.2.3.cd)pyrene | 193-39-5 | 4 | µg/kg | <4 | 25 µg/kg | 98.1 | 62 | 126 |
| EP132B-SD: Coronene | 191-07-1 | 5 | µg/kg | <5 | 25 µg/kg | 89.3 | 66 | 134 |
| EP132B-SD: Sum of PAHs | ---- | 4 | µg/kg | <4 | ---- | ---- | ---- | ---- |

## 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 | SpikeRecovery(%) | Recovery Limits (%) | |
| | | | | Concentration | MS | Low | High |
| **EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3164571)** | | | | | | | |

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) Report | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spike | SpikeRecovery(%) | Recovery Limits (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | Low | High |
| **EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3164571) - continued** | | | | | | | |
| ES1324167-002 | SSY02 | EG020-SD: Cadmium | 7440-43-9 | 50 mg/kg | 103 | 70 | 130 |
| | | EG020-SD: Chromium | 7440-47-3 | 50 mg/kg | 125 | 70 | 130 |
| | | EG020-SD: Copper | 7440-50-8 | 250 mg/kg | 73.6 | 70 | 130 |
| | | EG020-SD: Lead | 7439-92-1 | 125 mg/kg | 113 | 70 | 130 |
| | | EG020-SD: Nickel | 7440-02-0 | 50 mg/kg | 111 | 70 | 130 |
| | | EG020-SD: Zinc | 7440-66-6 | 250 mg/kg | 93.0 | 70 | 130 |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3164570)** | | | | | | | |
| ES1324167-001 | SSY01 | EG035T-LL: Mercury | 7439-97-6 | 0.050 mg/kg | # Not Determined | 70 | 130 |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3155828)** | | | | | | | |
| ES1324167-001 | SSY01 | EP071-SD: C10 - C14 Fraction | ---- | 19.75 mg/kg | 85.3 | 70 | 130 |
| | | EP071-SD: C15 - C28 Fraction | ---- | 87.25 mg/kg | 86.4 | 70 | 130 |
| | | EP071-SD: C29 - C36 Fraction | ---- | 60 mg/kg | 100 | 70 | 130 |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3163450)** | | | | | | | |
| ES1324167-001 | SSY01 | EP080-SD: C6 - C9 Fraction | ---- | 6.5 mg/kg | 129 | 70 | 130 |
| **EP080-SD: BTEXN (QCLot: 3163450)** | | | | | | | |
| ES1324167-001 | SSY01 | EP080-SD: Benzene | 71-43-2 | 0.5 mg/kg | 125 | 70 | 130 |
| | | EP080-SD: Toluene | 108-88-3 | 0.5 mg/kg | 105 | 70 | 130 |
| | | EP080-SD: Ethylbenzene | 100-41-4 | 0.5 mg/kg | 108 | 70 | 130 |
| | | EP080-SD: meta- & para-Xylene | 108-38-3<br>106-42-3 | 0.5 mg/kg | 102 | 70 | 130 |
| | | EP080-SD: ortho-Xylene | 95-47-6 | 0.5 mg/kg | 102 | 70 | 130 |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3155829)** | | | | | | | |
| ES1324167-001 | SSY01 | EP130: Bromophos-ethyl | 4824-78-6 | 50 µg/kg | 68.4 | 36 | 144 |
| | | EP130: Carbophenothion | 786-19-6 | 50 µg/kg | 68.4 | 38 | 120 |
| | | EP130: Chlorfenvinphos (E) | 18708-86-6 | 5 µg/kg | 76.6 | 49 | 157 |
| | | EP130: Chlorfenvinphos (Z) | 18708-87-7 | 50 µg/kg | 67.4 | 53 | 145 |
| | | EP130: Chlorpyrifos | 2921-88-2 | 50 µg/kg | 66.1 | 60 | 140 |
| | | EP130: Chlorpyrifos-methyl | 5598-13-0 | 50 µg/kg | 68.0 | 56 | 126 |
| | | EP130: Demeton-S-methyl | 919-86-8 | 50 µg/kg | 61.0 | 9.7 | 148 |
| | | EP130: Diazinon | 333-41-5 | 50 µg/kg | 79.0 | 60 | 122 |
| | | EP130: Dichlorvos | 62-73-7 | 50 µg/kg | 67.4 | 33 | 123 |
| | | EP130: Dimethoate | 60-51-5 | 50 µg/kg | 70.2 | 36 | 142 |
| | | EP130: Ethion | 563-12-2 | 50 µg/kg | 66.4 | 48 | 136 |
| | | EP130: Fenamiphos | 22224-92-6 | 50 µg/kg | 76.1 | 42 | 136 |
| | | EP130: Fenthion | 55-38-9 | 50 µg/kg | 72.4 | 35 | 131 |
| | | EP130: Malathion | 121-75-5 | 50 µg/kg | 62.6 | 55 | 141 |
| | | EP130: Azinphos Methyl | 86-50-0 | 50 µg/kg | 65.1 | 23.5 | 132 |

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) Report | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spike | SpikeRecovery(%) | Recovery Limits (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | Low | High |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3155829) - continued** | | | | | | | |
| ES1324167-001 | SSY01 | EP130: Monocrotophos | 6923-22-4 | 50 µg/kg | 93.0 | 35 | 153 |
| | | EP130: Parathion | 56-38-2 | 50 µg/kg | 68.8 | 57 | 147 |
| | | EP130: Parathion-methyl | 298-00-0 | 50 µg/kg | 68.0 | 48 | 140 |
| | | EP130: Pirimphos-ethyl | 23505-41-1 | 50 µg/kg | 65.9 | 45 | 137 |
| | | EP130: Prothiofos | 34643-46-4 | 50 µg/kg | 71.6 | 51 | 137 |
| **EP131A: Organochlorine Pesticides (QCLot: 3155830)** | | | | | | | |
| ES1324167-001 | SSY01 | EP131A: Aldrin | 309-00-2 | 5 µg/kg | 122 | 23.4 | 153 |
| | | EP131A: alpha-BHC | 319-84-6 | 5 µg/kg | 60.0 | 17.6 | 156 |
| | | EP131A: beta-BHC | 319-85-7 | 5 µg/kg | 60.0 | 24.9 | 153 |
| | | EP131A: delta-BHC | 319-86-8 | 5 µg/kg | 38.8 | 25.2 | 147 |
| | | EP131A: 4.4`-DDD | 72-54-8 | 5 µg/kg | 75.5 | 25.9 | 150 |
| | | EP131A: 4.4`-DDE | 72-55-9 | 5 µg/kg | 69.3 | 31.2 | 125 |
| | | EP131A: 4.4`-DDT | 50-29-3 | 5 µg/kg | 58.6 | 23.4 | 163 |
| | | EP131A: Dieldrin | 60-57-1 | 5 µg/kg | 75.3 | 30.2 | 140 |
| | | EP131A: alpha-Endosulfan | 959-98-8 | 5 µg/kg | 119 | 28.8 | 135 |
| | | EP131A: beta-Endosulfan | 33213-65-9 | 5 µg/kg | 40.3 | 22.6 | 141 |
| | | EP131A: Endosulfan sulfate | 1031-07-8 | 5 µg/kg | 44.5 | 16.1 | 156 |
| | | EP131A: Endrin | 72-20-8 | 5 µg/kg | 37.5 | 17.7 | 162 |
| | | EP131A: Endrin aldehyde | 7421-93-4 | 5 µg/kg | 41.5 | 20.1 | 116 |
| | | EP131A: Endrin ketone | 53494-70-5 | 5 µg/kg | 49.1 | 13.4 | 151 |
| | | EP131A: Heptachlor | 76-44-8 | 5 µg/kg | 67.5 | 23.8 | 170 |
| | | EP131A: Heptachlor epoxide | 1024-57-3 | 5 µg/kg | 38.8 | 28.3 | 140 |
| | | EP131A: Hexachlorobenzene (HCB) | 118-74-1 | 5 µg/kg | 57.4 | 17.7 | 144 |
| | | EP131A: gamma-BHC | 58-89-9 | 5 µg/kg | 58.8 | 21.8 | 158 |
| | | EP131A: Methoxychlor | 72-43-5 | 5 µg/kg | 42.5 | 24.4 | 158 |
| | | EP131A: cis-Chlordane | 5103-71-9 | 5 µg/kg | 32.5 | 27.3 | 139 |
| | | EP131A: trans-Chlordane | 5103-74-2 | 5 µg/kg | 45.0 | 29.5 | 138 |
| **EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3155831)** | | | | | | | |
| ES1324167-003 | SSY03 | EP131B: Aroclor 1254 | 11097-69-1 | 50 µg/kg | 76.1 | 44 | 136 |
| **EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3155827)** | | | | | | | |
| ES1324167-001 | SSY01 | EP132B-SD: Naphthalene | 91-20-3 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: 2-Methylnaphthalene | 91-57-6 | 25 µg/kg | # 61.4 | 70 | 130 |
| | | EP132B-SD: Acenaphthylene | 208-96-8 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Acenaphthene | 83-32-9 | 25 µg/kg | 75.4 | 70 | 130 |
| | | EP132B-SD: Fluorene | 86-73-7 | 25 µg/kg | 81.1 | 70 | 130 |
| | | EP132B-SD: Phenanthrene | 85-01-8 | 25 µg/kg | # Not Determined | 70 | 130 |

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) Report | | | |
|---|---|---|---|---|---|---|---|
| | | | | Spike | SpikeRecovery(%) | Recovery Limits (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | Low | High |
| **EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3155827) - continued** | | | | | | | |
| ES1324167-001 | SSY01 | EP132B-SD: Anthracene | 120-12-7 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Fluoranthene | 206-44-0 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Pyrene | 129-00-0 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Benz(a)anthracene | 56-55-3 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Chrysene | 218-01-9 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Benzo(b)fluoranthene | 205-99-2 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Benzo(k)fluoranthene | 207-08-9 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Benzo(e)pyrene | 192-97-2 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Benzo(a)pyrene | 50-32-8 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Perylene | 198-55-0 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Benzo(g.h.i)perylene | 191-24-2 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Dibenz(a.h)anthracene | 53-70-3 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Indeno(1.2.3.cd)pyrene | 193-39-5 | 25 µg/kg | # Not Determined | 70 | 130 |
| | | EP132B-SD: Coronene | 191-07-1 | 25 µg/kg | # Not Determined | 70 | 130 |

## Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3155827)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP132B-SD: Naphthalene | 91-20-3 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: 2-Methylnaphthalene | 91-57-6 | 25 µg/kg | # 61.4 | ---- | 70 | 130 | ---- | ---- |

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EP132B: Polynuclear Aromatic Hydrocarbons (QCLot: 3155827) - continued** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP132B-SD: Acenaphthylene | 208-96-8 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Acenaphthene | 83-32-9 | 25 µg/kg | 75.4 | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Fluorene | 86-73-7 | 25 µg/kg | 81.1 | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Phenanthrene | 85-01-8 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Anthracene | 120-12-7 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Fluoranthene | 206-44-0 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Pyrene | 129-00-0 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Benz(a)anthracene | 56-55-3 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Chrysene | 218-01-9 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Benzo(b)fluoranthene | 205-99-2 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Benzo(k)fluoranthene | 207-08-9 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Benzo(e)pyrene | 192-97-2 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Benzo(a)pyrene | 50-32-8 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Perylene | 198-55-0 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Benzo(g.h.i)perylene | 191-24-2 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Dibenz(a.h)anthracene | 53-70-3 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Indeno(1.2.3.cd)pyrene | 193-39-5 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| | | EP132B-SD: Coronene | 191-07-1 | 25 µg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3155828)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP071-SD: C10 - C14 Fraction | ---- | 19.75 mg/kg | 85.3 | ---- | 70 | 130 | ---- | ---- |
| | | EP071-SD: C15 - C28 Fraction | ---- | 87.25 mg/kg | 86.4 | ---- | 70 | 130 | ---- | ---- |
| | | EP071-SD: C29 - C36 Fraction | ---- | 60 mg/kg | 100 | ---- | 70 | 130 | ---- | ---- |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3155829)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP130: Bromophos-ethyl | 4824-78-6 | 50 µg/kg | 68.4 | ---- | 36 | 144 | ---- | ---- |

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EP130A: Organophosphorus Pesticides (Ultra-trace) (QCLot: 3155829) - continued** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP130: Carbophenothion | 786-19-6 | 50 µg/kg | 68.4 | ---- | 38 | 120 | ---- | ---- |
| | | EP130: Chlorfenvinphos (E) | 18708-86-6 | 5 µg/kg | 76.6 | ---- | 49 | 157 | ---- | ---- |
| | | EP130: Chlorfenvinphos (Z) | 18708-87-7 | 50 µg/kg | 67.4 | ---- | 53 | 145 | ---- | ---- |
| | | EP130: Chlorpyrifos | 2921-88-2 | 50 µg/kg | 66.1 | ---- | 60 | 140 | ---- | ---- |
| | | EP130: Chlorpyrifos-methyl | 5598-13-0 | 50 µg/kg | 68.0 | ---- | 56 | 126 | ---- | ---- |
| | | EP130: Demeton-S-methyl | 919-86-8 | 50 µg/kg | 61.0 | ---- | 9.7 | 148 | ---- | ---- |
| | | EP130: Diazinon | 333-41-5 | 50 µg/kg | 79.0 | ---- | 60 | 122 | ---- | ---- |
| | | EP130: Dichlorvos | 62-73-7 | 50 µg/kg | 67.4 | ---- | 33 | 123 | ---- | ---- |
| | | EP130: Dimethoate | 60-51-5 | 50 µg/kg | 70.2 | ---- | 36 | 142 | ---- | ---- |
| | | EP130: Ethion | 563-12-2 | 50 µg/kg | 66.4 | ---- | 48 | 136 | ---- | ---- |
| | | EP130: Fenamiphos | 22224-92-6 | 50 µg/kg | 76.1 | ---- | 42 | 136 | ---- | ---- |
| | | EP130: Fenthion | 55-38-9 | 50 µg/kg | 72.4 | ---- | 35 | 131 | ---- | ---- |
| | | EP130: Malathion | 121-75-5 | 50 µg/kg | 62.6 | ---- | 55 | 141 | ---- | ---- |
| | | EP130: Azinphos Methyl | 86-50-0 | 50 µg/kg | 65.1 | ---- | 23.5 | 132 | ---- | ---- |
| | | EP130: Monocrotophos | 6923-22-4 | 50 µg/kg | 93.0 | ---- | 35 | 153 | ---- | ---- |
| | | EP130: Parathion | 56-38-2 | 50 µg/kg | 68.8 | ---- | 57 | 147 | ---- | ---- |
| | | EP130: Parathion-methyl | 298-00-0 | 50 µg/kg | 68.0 | ---- | 48 | 140 | ---- | ---- |
| | | EP130: Pirimphos-ethyl | 23505-41-1 | 50 µg/kg | 65.9 | ---- | 45 | 137 | ---- | ---- |
| | | EP130: Prothiofos | 34643-46-4 | 50 µg/kg | 71.6 | ---- | 51 | 137 | ---- | ---- |
| **EP131A: Organochlorine Pesticides (QCLot: 3155830)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP131A: Aldrin | 309-00-2 | 5 µg/kg | 122 | ---- | 23.4 | 153 | ---- | ---- |
| | | EP131A: alpha-BHC | 319-84-6 | 5 µg/kg | 60.0 | ---- | 17.6 | 156 | ---- | ---- |
| | | EP131A: beta-BHC | 319-85-7 | 5 µg/kg | 60.0 | ---- | 24.9 | 153 | ---- | ---- |
| | | EP131A: delta-BHC | 319-86-8 | 5 µg/kg | 38.8 | ---- | 25.2 | 147 | ---- | ---- |
| | | EP131A: 4.4`-DDD | 72-54-8 | 5 µg/kg | 75.5 | ---- | 25.9 | 150 | ---- | ---- |
| | | EP131A: 4.4`-DDE | 72-55-9 | 5 µg/kg | 69.3 | ---- | 31.2 | 125 | ---- | ---- |
| | | EP131A: 4.4`-DDT | 50-29-3 | 5 µg/kg | 58.6 | ---- | 23.4 | 163 | ---- | ---- |
| | | EP131A: Dieldrin | 60-57-1 | 5 µg/kg | 75.3 | ---- | 30.2 | 140 | ---- | ---- |
| | | EP131A: alpha-Endosulfan | 959-98-8 | 5 µg/kg | 119 | ---- | 28.8 | 135 | ---- | ---- |
| | | EP131A: beta-Endosulfan | 33213-65-9 | 5 µg/kg | 40.3 | ---- | 22.6 | 141 | ---- | ---- |
| | | EP131A: Endosulfan sulfate | 1031-07-8 | 5 µg/kg | 44.5 | ---- | 16.1 | 156 | ---- | ---- |
| | | EP131A: Endrin | 72-20-8 | 5 µg/kg | 37.5 | ---- | 17.7 | 162 | ---- | ---- |
| | | EP131A: Endrin aldehyde | 7421-93-4 | 5 µg/kg | 41.5 | ---- | 20.1 | 116 | ---- | ---- |
| | | EP131A: Endrin ketone | 53494-70-5 | 5 µg/kg | 49.1 | ---- | 13.4 | 151 | ---- | ---- |
| | | EP131A: Heptachlor | 76-44-8 | 5 µg/kg | 67.5 | ---- | 23.8 | 170 | ---- | ---- |
| | | EP131A: Heptachlor epoxide | 1024-57-3 | 5 µg/kg | 38.8 | ---- | 28.3 | 140 | ---- | ---- |
| | | EP131A: Hexachlorobenzene (HCB) | 118-74-1 | 5 µg/kg | 57.4 | ---- | 17.7 | 144 | ---- | ---- |
| | | EP131A: gamma-BHC | 58-89-9 | 5 µg/kg | 58.8 | ---- | 21.8 | 158 | ---- | ---- |
| | | EP131A: Methoxychlor | 72-43-5 | 5 µg/kg | 42.5 | ---- | 24.4 | 158 | ---- | ---- |

Sub-Matrix: **SOIL**

| | | | | Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike | Spike Recovery (%) | | Recovery Limits (%) | | RPDs (%) | |
| Laboratory sample ID | Client sample ID | Method: Compound | CAS Number | Concentration | MS | MSD | Low | High | Value | Control Limit |
| **EP131A: Organochlorine Pesticides (QCLot: 3155830) - continued** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP131A: cis-Chlordane | 5103-71-9 | 5 µg/kg | 32.5 | ---- | 27.3 | 139 | ---- | ---- |
| | | EP131A: trans-Chlordane | 5103-74-2 | 5 µg/kg | 45.0 | ---- | 29.5 | 138 | ---- | ---- |
| **EP131B: Polychlorinated Biphenyls (as Aroclors) (QCLot: 3155831)** | | | | | | | | | | |
| ES1324167-003 | SSY03 | EP131B: Aroclor 1254 | 11097-69-1 | 50 µg/kg | 76.1 | ---- | 44 | 136 | ---- | ---- |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 3163450)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP080-SD: C6 - C9 Fraction | ---- | 6.5 mg/kg | 129 | ---- | 70 | 130 | ---- | ---- |
| **EP080-SD: BTEXN (QCLot: 3163450)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EP080-SD: Benzene | 71-43-2 | 0.5 mg/kg | 125 | ---- | 70 | 130 | ---- | ---- |
| | | EP080-SD: Toluene | 108-88-3 | 0.5 mg/kg | 105 | ---- | 70 | 130 | ---- | ---- |
| | | EP080-SD: Ethylbenzene | 100-41-4 | 0.5 mg/kg | 108 | ---- | 70 | 130 | ---- | ---- |
| | | EP080-SD: meta- & para-Xylene | 108-38-3<br>106-42-3 | 0.5 mg/kg | 102 | ---- | 70 | 130 | ---- | ---- |
| | | EP080-SD: ortho-Xylene | 95-47-6 | 0.5 mg/kg | 102 | ---- | 70 | 130 | ---- | ---- |
| **EG035T: Total Recoverable Mercury by FIMS (QCLot: 3164570)** | | | | | | | | | | |
| ES1324167-001 | SSY01 | EG035T-LL: Mercury | 7439-97-6 | 0.050 mg/kg | # Not Determined | ---- | 70 | 130 | ---- | ---- |
| **EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 3164571)** | | | | | | | | | | |
| ES1324167-002 | SSY02 | EG020-SD: Cadmium | 7440-43-9 | 50 mg/kg | 103 | ---- | 70 | 130 | ---- | ---- |
| | | EG020-SD: Chromium | 7440-47-3 | 50 mg/kg | 125 | ---- | 70 | 130 | ---- | ---- |
| | | EG020-SD: Copper | 7440-50-8 | 250 mg/kg | 73.6 | ---- | 70 | 130 | ---- | ---- |
| | | EG020-SD: Lead | 7439-92-1 | 125 mg/kg | 113 | ---- | 70 | 130 | ---- | ---- |
| | | EG020-SD: Nickel | 7440-02-0 | 50 mg/kg | 111 | ---- | 70 | 130 | ---- | ---- |
| | | EG020-SD: Zinc | 7440-66-6 | 250 mg/kg | 93.0 | ---- | 70 | 130 | ---- | ---- |

# INTERPRETIVE QUALITY CONTROL REPORT

| | | | |
|---|---|---|---|
| **Work Order** | : **ES1324167** | Page | : 1 of 9 |
| Client | : MARINE POLLUTION RESEARCH PTY LTD | Laboratory | : Environmental Division Sydney |
| Contact | : MR PAUL ANINK | Contact | : Client Services |
| Address | : PO BOX 279<br>CHURCH POINT<br>SYDNEY NSW 2105 | Address | : 277-289 Woodpark Road Smithfield NSW Australia 2164 |
| E-mail | : panink@iimetro.com.au | E-mail | : sydney@alsglobal.com |
| Telephone | : +61 02 9997 6541 | Telephone | : +61-2-8784 8555 |
| Facsimile | : ---- | Facsimile | : +61-2-8784 8500 |
| Project | : SYDNEY SUPERYACHT MARINA | QC Level | : NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Site | : ---- | | |
| C-O-C number | : ---- | Date Samples Received | : 07-NOV-2013 |
| Sampler | : JB | Issue Date | : 27-NOV-2013 |
| Order number | : ---- | | |
| | | No. of samples received | : 4 |
| Quote number | : SY/196/12 V2 | No. of samples analysed | : 4 |

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

# Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (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 | | | Analysis | | |
|---|---|---|---|---|---|---|---|
| | | Date extracted | Due for extraction | Evaluation | Date analysed | Due for analysis | Evaluation |
| **EA055: Moisture Content** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EA055-103)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **----** | ---- | ---- | **15-NOV-2013** | 21-NOV-2013 | ✓ |
| **EA150: Particle Sizing** | | | | | | | |
| **Pulp Bag (EA150)** | | | | | | | |
| SSY02, SSY03, SSY04 | **07-NOV-2013** | **---** | 06-MAY-2014 | ---- | **27-NOV-2013** | 24-MAY-2014 | ✓ |
| **Snap Lock Bag (EA150)** | | | | | | | |
| SSY01 | **07-NOV-2013** | **---** | 06-MAY-2014 | ---- | **27-NOV-2013** | 24-MAY-2014 | ✓ |
| **EA150: Soil Classification based on Particle Size** | | | | | | | |
| **Pulp Bag (EA150)** | | | | | | | |
| SSY02, SSY03, SSY04 | **07-NOV-2013** | **---** | 06-MAY-2014 | ---- | **27-NOV-2013** | 24-MAY-2014 | ✓ |
| **Snap Lock Bag (EA150)** | | | | | | | |
| SSY01 | **07-NOV-2013** | **---** | 06-MAY-2014 | ---- | **27-NOV-2013** | 24-MAY-2014 | ✓ |
| **EG020-SD: Total Metals in Sediments by ICPMS** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EG020-SD)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **18-NOV-2013** | 06-MAY-2014 | ✓ | **20-NOV-2013** | 06-MAY-2014 | ✓ |
| **EG035T: Total Recoverable Mercury by FIMS** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EG035T-LL)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **18-NOV-2013** | 05-DEC-2013 | ✓ | **20-NOV-2013** | 05-DEC-2013 | ✓ |
| **EP003: Total Organic Carbon (TOC) in Soil** | | | | | | | |
| **Pulp Bag (EP003)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **13-NOV-2013** | 05-DEC-2013 | ✓ | **13-NOV-2013** | 05-DEC-2013 | ✓ |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP071-SD)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **15-NOV-2013** | 21-NOV-2013 | ✓ | **20-NOV-2013** | 25-DEC-2013 | ✓ |

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 |
| **EP080-SD: BTEXN** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP080-SD)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **18-NOV-2013** | 21-NOV-2013 | ✓ | **18-NOV-2013** | 21-NOV-2013 | ✓ |
| **EP080-SD / EP071-SD: Total Petroleum Hydrocarbons** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP080-SD)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **18-NOV-2013** | 21-NOV-2013 | ✓ | **18-NOV-2013** | 21-NOV-2013 | ✓ |
| **EP130A: Organophosphorus Pesticides (Ultra-trace)** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP130)** | | | | | | | |
| SSY01, SSY03 | **07-NOV-2013** | **15-NOV-2013** | 21-NOV-2013 | ✓ | **20-NOV-2013** | 25-DEC-2013 | ✓ |
| **EP131A: Organochlorine Pesticides** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP131A)** | | | | | | | |
| SSY01, SSY03 | **07-NOV-2013** | **15-NOV-2013** | 21-NOV-2013 | ✓ | **20-NOV-2013** | 25-DEC-2013 | ✓ |
| **EP131B: Polychlorinated Biphenyls (as Aroclors)** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP131B)** | | | | | | | |
| SSY01, SSY03 | **07-NOV-2013** | **15-NOV-2013** | 21-NOV-2013 | ✓ | **20-NOV-2013** | 25-DEC-2013 | ✓ |
| **EP132B: Polynuclear Aromatic Hydrocarbons** | | | | | | | |
| **Soil Glass Jar - Unpreserved (EP132B-SD)** | | | | | | | |
| SSY01, SSY02, SSY03, SSY04 | **07-NOV-2013** | **15-NOV-2013** | 21-NOV-2013 | ✓ | **20-NOV-2013** | 25-DEC-2013 | ✓ |

# 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(where) 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)** | | | | | | | |
| Moisture Content | EA055-103 | 2 | 14 | **14.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Organochlorine Pesticides (Ultra-trace) | EP131A | 1 | 2 | **50.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Organophosphorus Pesticides (Ultra-trace) | EP130 | 1 | 2 | **50.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PAHs in Sediments by GCMS(SIM) | EP132B-SD | 1 | 4 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PCB's (Ultra-trace) | EP131B | 1 | 2 | **50.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS (Low Level) | EG035T-LL | 1 | 4 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals in Sediments by ICPMS | EG020-SD | 1 | 4 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Organic Carbon | EP003 | 2 | 14 | **14.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH - Semivolatile Fraction | EP071-SD | 1 | 4 | **25.0** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH Volatiles/BTEX in Sediments | EP080-SD | 2 | 15 | **13.3** | **10.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| **Laboratory Control Samples (LCS)** | | | | | | | |
| Organochlorine Pesticides (Ultra-trace) | EP131A | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Organophosphorus Pesticides (Ultra-trace) | EP130 | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PAHs in Sediments by GCMS(SIM) | EP132B-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PCB's (Ultra-trace) | EP131B | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS (Low Level) | EG035T-LL | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals in Sediments by ICPMS | EG020-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Organic Carbon | EP003 | 1 | 14 | **7.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH - Semivolatile Fraction | EP071-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH Volatiles/BTEX in Sediments | EP080-SD | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| **Method Blanks (MB)** | | | | | | | |
| Organochlorine Pesticides (Ultra-trace) | EP131A | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Organophosphorus Pesticides (Ultra-trace) | EP130 | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PAHs in Sediments by GCMS(SIM) | EP132B-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PCB's (Ultra-trace) | EP131B | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS (Low Level) | EG035T-LL | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Metals in Sediments by ICPMS | EG020-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Organic Carbon | EP003 | 1 | 14 | **7.1** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH - Semivolatile Fraction | EP071-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH Volatiles/BTEX in Sediments | EP080-SD | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| **Matrix Spikes (MS)** | | | | | | | |
| Organochlorine Pesticides (Ultra-trace) | EP131A | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Organophosphorus Pesticides (Ultra-trace) | EP130 | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PAHs in Sediments by GCMS(SIM) | EP132B-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| PCB's (Ultra-trace) | EP131B | 1 | 2 | **50.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| Total Mercury by FIMS (Low Level) | EG035T-LL | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |

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* | |
| Matrix Spikes (MS) - Continued | | | | | | | |
| Total Metals in Sediments by ICPMS | EG020-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH - Semivolatile Fraction | EP071-SD | 1 | 4 | **25.0** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |
| TPH Volatiles/BTEX in Sediments | EP080-SD | 1 | 15 | **6.7** | **5.0** | ✓ | NEPM 2013 Schedule B(3) and ALS QCS3 requirement |

## 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 | 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 (Sieving) | EA150 | SOIL | Particle Size Analysis by Sieving according to AS1289.3.6.1 - 2009 |
| Total Metals in Sediments by ICPMS | EG020-SD | SOIL | (APHA 21st ed., 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. Analyte list and LORs per NODG. |
| Total Mercury by FIMS (Low Level) | EG035T-LL | SOIL | AS 3550, APHA 21st ed., 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) |
| 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. |
| TPH - Semivolatile Fraction | EP071-SD | SOIL | (USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504) |
| TPH Volatiles/BTEX in Sediments | EP080-SD | SOIL | (USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 501) |
| Organophosphorus Pesticides (Ultra-trace) | EP130 | SOIL | USEPA Method 3640 (GPC cleanup), 8141 (GC/FPD - Capillary Column) This technique is compliant with NEPM (2013) Schedule B(3) (Method 505) |
| Organochlorine Pesticides (Ultra-trace) | EP131A | SOIL | USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (2013) Schedule B(3) (Method 504) |
| PCB's (Ultra-trace) | EP131B | SOIL | USEPA Method 3640 (GPC cleanup),3620 (Florisil), 8081/8082 (GC/uECD/uECD) This technique is compliant with NEPM (2013) Schedule B(3) (Method 504) |
| PAHs in Sediments by GCMS(SIM) | EP132B-SD | SOIL | USEPA 8270 GCMS Capillary column, SIM mode using large volume programmed temperature vaporisation injection. |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Hot Block Digest for metals in soils sediments and sludges | EN69 | SOIL | USEPA 200.2 Mod. 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) |
| Methanolic Extraction of Soils for Purge and Trap | * ORG16 | SOIL | (USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS. |

| Preparation Methods | Method | Matrix | Method Descriptions |
|---|---|---|---|
| Tumbler Extraction of Solids/ Sample Cleanup | ORG17A-UTP | SOIL | In-house, Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. Samples are extracted, concentrated (by KD) and exchanged into an appropriate solvent for GPC and florisil cleanup as required. |
| Tumbler Extraction of Solids for LVI (Non-concentrating) | ORG17D | SOIL | In house: 10g of sample, Na2SO4 and surrogate are extracted with 50mL 1:1 DCM/Acetone by end over end tumbling. An aliquot is concentrated by nitrogen blowdown to a reduced volume for analysis if required. |

# Summary of Outliers

## Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW 846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

### 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** | | | | | | | |
| EG035T: Total Recoverable Mercury by FIMS | ES1324167-001 | SSY01 | **Mercury** | 7439-97-6 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Naphthalene** | 91-20-3 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **2-Methylnaphthalene** | 91-57-6 | 61.4 % | 70-130% | **Recovery less than lower data quality objective** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Acenaphthylene** | 208-96-8 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Phenanthrene** | 85-01-8 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Anthracene** | 120-12-7 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Fluoranthene** | 206-44-0 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Pyrene** | 129-00-0 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Benz(a)anthracene** | 56-55-3 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Chrysene** | 218-01-9 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Benzo(b)fluoranthene** | 205-99-2 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Benzo(k)fluoranthene** | 207-08-9 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |

Matrix: **SOIL**

| Compound Group Name | Laboratory Sample ID | Client Sample ID | Analyte | CAS Number | Data | Limits | Comment |
|---|---|---|---|---|---|---|---|
| **Matrix Spike (MS) Recoveries - Continued** | | | | | | | |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Benzo(e)pyrene** | 192-97-2 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Benzo(a)pyrene** | 50-32-8 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Perylene** | 198-55-0 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Benzo(g.h.i)perylene** | 191-24-2 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Dibenz(a.h)anthracene** | 53-70-3 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Indeno(1.2.3.cd)pyrene** | 193-39-5 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |
| EP132B: Polynuclear Aromatic Hydrocarbons | ES1324167-001 | SSY01 | **Coronene** | 191-07-1 | Not Determined | ---- | **MS recovery not determined, background level greater than or equal to 4x spike level.** |

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

### *Regular Sample Surrogates*

- **For all regular sample matrices, no surrogate recovery outliers occur.**

## *Outliers : Analysis Holding Time Compliance*

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

## *Outliers : Frequency of Quality Control Samples*

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**