# APPENDIX J QA/QC Report

**Appendix J: QA/QC Assessment Report**
**Site: Columbia Precinct Project, Homebush, NSW**
**Project: 00015742 – Preliminary Contamination and Geotechnical Investigation**

## J.1 Background

Data assessment involves identification and evaluation of field and laboratory data quality, as required by WSP Environmental Pty Ltd (WSP) due diligence processes, and to ensure that sample data is of the highest calibre.

Data assessment consists of comparing laboratory QA/QC results to documented USEPA SW-846 guidelines, USEPA CLP National Functional Guidelines for Inorganic and Organic Data Review, and other internationally recognised publications. Reference to Australian "in-house" laboratory methods may be applied which are revisable through laboratory NATA assessments. All laboratory sample and QA/QC data packages have been issued as finalised and checked laboratory reports by the following NATA Registered Laboratories for this project, unless otherwise stated:

- Laboratory: Envirolab Pty Ltd NATA Registration No: 2901
- Laboratory: LabMark Environmental Laboratories NATA Registration No: 1645

## J.2 Definitions

This section outlines various definitions that have been adopted throughout this assessment report. The following definitions are in accordance with current USEPA SW-846 methods (1994) and those that are described by Keith, *Environmental Sampling and Analysis, A Practical Guide* (1991).

The Practical Quantitation Limit 'PQL', Limit of Reporting 'LOR', and Estimated Quantitation Limit 'EQL' all refer to the concentration above which reported results can be expressed with a minimum 95% confidence level. For the purposes of this report, all references to PQLs, LORs, and EQLs shall be referred to as the laboratory reporting limit and shall all be considered to be equivalent. The laboratory reporting limits are generally set at 10 times the SD (standard deviation) for the Method Detection Limit 'MDL' for specific analytes.

Users of laboratory data should be aware that values measured at or near the LOR may have two inherent limitations. Firstly, *"the uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit,"* Keith (1991).

### J.2.1 Accuracy

Definition: The nearness of an averaged result to the true value, where all random errors have been statistically removed.

Unless the true value is known, accuracy may take on a meaning equivalent to the term bias due to the existence of systematic errors. Accuracy is measured by

percent recovery '%R'. Accuracy data is expected to vary within the range of 70-130 %R for inorganics/metals and 60-140% for organics unless otherwise stated.

### J.2.2 Precision

Definition: The degree to which data generated from replicate or repetitive measurements differ from one another due to random errors.

Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'. Based on the Keith (1991) text, replicate data is presented in below, unless otherwise stated.

| ***Organics*** |
|---|
| Concentrations > or = 10 times EQL, RPD criteria of 50%<br>10 times EQL > Concentrations > or = 5 times EQL, RPD criteria of 75%<br>Concentrations < 5 times EQL, RPD criteria of 100% |
| ***Inorganics*** |
| Concentrations > or = 10 times EQL, RPD criteria of 30%<br>10 times EQL > Concentrations > or = 5 times EQL, RPD criteria of 75%<br>Concentrations < 5 times EQL, RPD criteria of 100% |

### J.2.3 Blanks

Laboratory method and field trip blanks are designed to check for artefacts and interferences during the sampling and analysis stages, which may lead to the reporting of false positive results. For this project one trip blank sample was collected to assess if correct sampling procedures were adopted and if cross contamination is likely to have occurred during storage and transport. Refer to Table 1 of this appendix for results of trip blank sample.

There were no detected compounds reported in the trip blank sample indicating that cross contamination during transport and storage was unlikely to have occurred.

In the event that a positive blank is reported for this project, the following remedies shall proceed:

1. Laboratory to review data;
2. Positive blank results may not be subtracted from sample results;
3. No further action necessary if sample results reported less than laboratory reporting limit;
4. Analyse additional field blanks if taken and within holding times;
5. Positive results may be reported if analyte concentrations are significantly greater than the amount reported in the blank (ten times for laboratory reagents such as methylene chloride, chloroform, and acetone etc., and five times for all other analytes). Alternatively, the laboratory LOR may be raised to accommodate blank anomalies provided that regulatory guidelines are not compromised by any adjustment made to the laboratory reporting limit;
6. Professional expertise is used in all cases and may require additional testing to be performed.

### J.2.4 Matrix Spikes

Environmental samples are spiked with laboratory grade standards to determine the interactive effects between the sample matrix and the analytes being measured. Matrix Spikes 'MS' are reported as a percent recovery %R, 1 in every 20 samples for this project. Sample batches submitted of less than 20 samples may be reported with a MS spike from another batch.

- Percent Recovery is expressed as:

$$\%R = \frac{(SSR-SR)}{SA} \times 100$$

where: SSR=spiked sample result
SR =sample result (blank)
SA =spike added

### J.2.5 Duplicates

Laboratory duplicate samples measure precision, which is calculated as standard deviation SD or Relative Percent Difference %RPD. Duplicates are collected in a single sample container in the field and are analysed as two separate extractions, 1 in every 20 samples in the laboratory for this project.

- Relative Percent Difference is expressed as:

$$\%\ RPD = \frac{(D1-D2)}{(D1+D2)/2} \times 100$$

where: D1=sample concentration
D2=duplicate sample concentration

### J.2.6 Field Duplicates & Triplicates

Field generated check samples, which measure repeatability over a short time period. At least 20% of samples were submitted from a larger quantity of sample which are collected from the same sampling point, removed by a single action, where possible, and divided into two duplicate samples.

For this project one (1) intra laboratory (duplicate) soil sample and one (1) inter laboratory (triplicate) soil sample was collected. One (1) intra laboratory (duplicate) water sample was collected.

A total of ten (10) primary soil and three (3) primary groundwater samples were analysed for this project.

### J.2.7 Surrogates

Surrogates are QC monitoring spikes, which are added at the beginning of the sample extraction process in the laboratory where applicable. Surrogates are measured as Percent Recovery %R.

- Percent Recovery is expressed as:

$$\%R=\frac{(SSR)}{} \times 100$$

SA

Where: SSR=spiked sample result
SA =spike added

In the event that a surrogate recovery fails to comply with acceptable control limits, the following remedies shall proceed:

1. Laboratory to review data,
2. No further action necessary if all surrogate recoveries greater than the minimum specified %R and all sample concentration results reported are less than the laboratory reporting limit,
3. Professional expertise is required where surrogate recoveries are reported below the acceptable control limits and may require additional analysis or re-testing.

### J.3 Analytical Procedures

The laboratories selected to provide analytical services for this project were:

Soil
- Primary laboratory — Envirolab Pty Ltd; and
- Secondary laboratory — LabMark Environmental Laboratory.

Water
- Primary laboratory — Envirolab Pty Ltd; and

WSP selected these laboratories based on the following criteria:

1. NATA registration for routine test methods and commonly encountered sample matrices;
2. Qualifications and experience of laboratory staff; and
3. Satisfactory compliance to WSP quality objectives for this project.

#### J.3.1 Laboratory Methodologies

All samples submitted for analysis for this project were analysed by one or more of the following laboratory methods by the primary laboratory Envirolab for soil and groundwater samples. All laboratory test methods were NATA registered at the time of analysis.

Soil:
- Volatile Total Petroleum Hydrocarbons (vTPH): Soil samples are extracted with methanol and spiked in water prior to analysing by purge and trap GC-MS.
- Semi Volatile Total Petroleum Hydrocarbons (TPH): Soil samples are extracted with Dichloromethane/Acetone and analysed by GC-FID.
- BTEX: Soil samples are extracted with methanol and spiked in water prior to analysing by purge and trap GC-MS.
- PAH: Soil samples are extracted with Dichloromethane/Acetone and analysed byGC-MS.
- Metals (As, Cd, Cr, Cu, Ni, Pb, Zn): Determination of various metals by ICP-AES. (Hg): Determination of Mercury by Cold Vapour AAS.

- Phenols: Determined colorimetrically following disitillation.
- Volatile Organic Compounds (VOCs): Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
- ASB.1 Asbestos ID - Qualitative identification of asbestos type fibres in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques.
- AS4964-2004 Asbestos ID - Qualitative identification of asbestos type fibres in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques.

Water:

- Volatile Total Petroleum Hydrocarbons (vTPH): Water samples are analysed directly by purge and trap GC-MS.
- Semi Volatile Total Petroleum Hydrocarbons (TPH): Water samples are extracted with Dichloromethane and analysed by GC-FID.
- BTEX: Water samples are analysed directly by purge and trap GC-MS.
- Metals (As, Cd, Cr, Cu, Ni, Pb, Zn): Determination of various metals by ICP-MS. (Hg): Determination of Mercury by Cold Vapour AAS.
- Volatile Total Petroleum Hydrocarbons (vTPH): Water samples are analysed directly by purge and trap GC-MS.
- Volatile Organic Carbons (VOCs): Water samples are analysed directly by purge and trap GC-MS.

### J.3.2 Data Validation

One field duplicate sample and one field triplicate sample for soil and water were analysed for one or more of the following: PAH, Phenols, TPH, BTEX, VOCs and Metals. Refer to Appendix H for RPD calculations, which identifies blind sample replicate %RPD values.

Soil:
The triplicate sample exceeded the RPD acceptance criteria for Chromium (III + IV) with the duplicate and triplicate samples both exceeding the RPD acceptance criteria for copper, lead, mercury, nickel, zinc, benz(a)anthracene, benzo(a) pyrene, chrysene, fluoranthene, phenanthrene and pyrene. The exceedance is attributed to heterogeneity of fill material in surface soils.

Water:
The duplicate sample did not exceed the RPD acceptance criteria for any analytes.

The guideline acceptance targets for field duplicates are 30% – 50% of mean concentration of analyte determined by both laboratories. This variation can be expected to be higher for organic analysis than for inorganics, and for low concentration of analytes (refer to section H.2.2).

WSP's acceptance targets are used only to flag results warranting further examination.

Variation in original sample and field duplicate results is attributed to a combination of a number of possible factors relating to the sample composition, analyte behaviour and inherent uncertainties in the analytical methods as detailed in the spike recovery discussion above.

Particularly where sample results are close to the PQL, a higher RPD value can be tolerated as low absolute differences will result in high RPD values.

Where both the original sample and duplicate results are outside the most sensitive criteria, the RPD value calculated takes on secondary importance. It merely demonstrates that field conditions are variable due to the nature of the subsurface material, and that analyte concentrations in that area are highly likely to be above/below the criteria.

Where only one of the original or duplicate sample results is outside the most sensitive criteria, the conservative approach is taken and actual concentrations in the field are assumed to exceed the criteria. In this circumstance, and where the RPD value is low, field concentrations are likely to vary around the guideline in a narrow range; where the RPD value is high, the likely field concentrations are considered too variable to be accurately predicted, but should be assumed to exceed the guideline for the sake of conservatism.

WSP consider that the data set does not include any false negative results for the following reasons:

- Internal laboratory QA/QC procedures did not reveal any issues; and
- Where inter-laboratory analysis was undertaken, the result of the primary laboratory was replicated in the secondary laboratory.

### J.3.3 Sample Integrity and Containers

Chain of custody documentation was signed and dated by Envirolab Laboratories stating that all samples:

- were received cool and in good order;
- were presented in adequate sample containers;
- that all samples submitted for volatiles were correctly contained with no headspace; and
- that all samples were labelled appropriately according to current quality field sampling protocols.

### J.3.4 Holding Times

All samples were received by the relevant laboratory within holding times.

### J.3.5 Matrix Spikes

The laboratory spike %recovery results were found to be within acceptable control limits, unless otherwise identified in the laboratory reports. If laboratory spike %recovery results did exceed the adopted control limits, the samples were re-analysed or internal laboratory triplicate results were re-issued.

### J.3.6 Laboratory Control Samples

The laboratory control sample %recovery results were found to be within acceptable control limits. If laboratory control %recovery results did exceed the

adopted control limits, the samples were re-analysed or internal laboratory triplicate results were re-issued.

### J.3.7 Laboratory Duplicates

The laboratory sample duplicate result was found to provide acceptable RPD values compared to control limits set by the relevant laboratories.

### J.3.8 Surrogates (%R)

Surrogate recoveries were reported for TPH, PAH and BTEX. The reported surrogate recoveries were found to be acceptable for the purposes of this project unless otherwise stated in the analytical certificates.

## J.4 Conclusions

Analytical data reported by Envirolab and LabMark laboratories was judged to have met the essential criteria for data quality commissioned by WSP for the assessment of reference project 15742 – Preliminary Contamination and Geotechnical Investigation, Columbia Precinct Project, Homebush NSW.

In summary, data assessment examined laboratory results, COC documentation, and field QA/QC. The following comments can be viewed as an overall summary of the quality of the analytical component for this project.

1. Sample integrity and container requirements were documented as acceptable.
2. Holding time compliances were documented as acceptable. All samples were received by the laboratory within the relevant holding times.
3. Matrix spike and laboratory control sample recovery values indicated that sample accuracy was acceptable.
4. Laboratory surrogate recovery values indicated that laboratory accuracy was acceptable.
5. Sample duplicate and laboratory batch results indicated that sample precision was acceptable.
6. All laboratory QA/QC method blanks and field blanks were found to be acceptable.
7. A qualitative review of blind sample duplicate and triplicate RPD values indicated that field precision was acceptable. The field duplicate and triplicate samples exceeded the RPD acceptance criteria a number of analytes. This is attributed to the heterogeneity of fill in surface soils. WSP believes this result does not affect the validity of results.
8. Laboratory audits have documented the laboratory systems and results as being acceptable which supports the quality of data produced for this project.

In summary, the QA/QC data reported by Envirolab and LabMark laboratories for most of the documented soil and groundwater samples were determined to be of sufficient quality to be considered acceptable to comply with WSP data quality objectives (DQO) for the Preliminary Contamination and Geotechnical Investigation of Columbia Precinct Project, Homebush NSW.

This report therefore concludes that the QA/QC data is of an acceptable standard to ensure validity of the conclusions reached for the investigation.

# APPENDIX K Field Sheets

# WSP Groundwater - Well Sampling Data Form

| Job Information | | | |
|---|---|---|---|
| Date: | 4.2.01 | Time: arrive | depart |
| Project Name: | Columbia Precinct Project | Project Number: | 00015742 |
| Site Location: | Homebush | Operator: | JM/AY |
| Well ID: | GW1/BH2 | Weather: | Fine - hot |

**Equipment**

Water quality equipment description (please circle): (TPS90FLMV) Hanna HI9828

Interface probe number (please circle): (Dipper PRO) Herron IP Geotech IP

Purging equipment (please cirlce)
Bailer type: **Plastic** **Teflon**
Pump type: **Peristaltic** **Submersible** **Micro-purge** **Amazon** **Other:**

**Well Gauging and Purge Volume Calculations**

| Casing Diameter | 25mm | 50mm | 100mm | 125mm | 150mm | 200mm | 250mm | 300mm |
|---|---|---|---|---|---|---|---|---|
| Conversion Factor (volume in factor L/m) | 0.98 | 1.96 | 7.85 | 31.4 | 49.1 | 70.7 | 125.7 | 196.3 |

**Volume of water in well / V = Pr x r x h**
V = volume in litres
P = 3.14159
r = radius in cm
h = height of water column in cm

Total Well Depth (-) Water level (=) Water Column
6.14 m (-) 3.06 m (=) _____ m

Depth to Product (if present)
_____ m

Water Column (x) Conversion Factor (=) Litres per 1 Well Volume
_____ m (x) _____ (=) _____ L

**Water Quality Parameters**

Beginning purge time: µS/cm Ending purge time:

| Litres | Time | pH | Temp C | Cond mS/cm | DO ppm | Redox mV | Comments |
|---|---|---|---|---|---|---|---|
| 10 | | 6.62 | 27.1 | 1740 | 2.34 | 153 | FID = 20.2 |
| 20 | | 6.64 | 26.9 | 1787 | 4.0 | 129 | |
| 25 | | 6.67 | 28.5 | 1853 | 1.0 | 120 | clear - no odour. |
| 30 | | 6.70 | 22.0 | 1876 | 0.35 | 104 | Turbid after purging ≈ 15L |
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| | | | | | | | |
| Stabilisation Criteria | | +/- 0.05 | +/- 10% | +/- 3% | +/- 10% | +/- 10% | Example Comments: clear / slightly cloudy / turbid / very turbid / no odour / slight odour / odour / strong odour |

**Total Well Volume**
Actual amount of water prior to sampling

*pH, temp, cond readings not necessary if well is purged dry

Did field parameters stabilise? (Y) N NA Was the well dry purged? Y (N)

**Field QC Checks**

| | | | |
|---|---|---|---|
| Was pre-cleaning sampling equipment used for these samples? | (Y) | N | |
| Was pre-cleaning sampling equipment properly protected from contamination? | (Y) | N | |
| Was documentation of equipment conducted? | (Y) | N | NA |
| Were air bubbles present in vials at time of collection? | Y | (N) | NA |
| Was sample for metals field filtered prior to preservations? | (Y) | N | NA |
| Duplicate sample collected? | Y | (N) | Duplicate sample ID |

# WSP Groundwater - Well Sampling Data Form

| Job Information | |
|---|---|
| Date: 4.2.11 | Time: arrive depart |
| Project Name: Columbia Precinct Project | Project Number: 15742 |
| Site Location: Homebush | Operator: JM / AY |
| Well ID: GW2 | Weather: Fine-Hot |

| Equipment | | | | | | |
|---|---|---|---|---|---|---|
| Water quality equipment description: | YSI | | | | | |
| Interface probe number: | DIPPER ~~PI~~ PRO | | | | | |
| Purging equipment: (please cirlce) | Bailer type: | Plastic | Teflon | | | |
| | Pump type: | Peristaltic | Submersible | Micro-purge | Amazon | Other: |

**Well Gauging and Purge Volume Calculations**

| Casing Diameter | 25mm | 50mm | 100mm | 125mm | 150mm | 200mm | 250mm | 300mm |
|---|---|---|---|---|---|---|---|---|
| Conversion Factor (volume in factor L/m) | 0.98 | 1.96 | 7.85 | 31.4 | 49.1 | 70.7 | 125.7 | 196.3 |

**Volume of water in well / V**
**= Pr x r x h**
V = volume in litres
P = 3.14159
r = radius in cm
h = height of water column in cm

Total Well Depth (-) Water level (=) Water Column
7.2 m (-) 3.01 m (=) _____ m

Water Column (x) Conversion Factor (=) Litres per 1 Well Volume
_____ m (x) _____ (=) _____ L

**Water Quality Parameters**

Beginning purge time: MS | Ending purge time:

| Litres | Time | pH | Temp C | Cond mS/cm | DO ppm | Redox mV | Comments |
|---|---|---|---|---|---|---|---|
| 10 | | 6.90 | 26.5 | 2.98 | 0.53 | 100 | FID = 44.5 |
| ~~15~~ | | 6.98 | 25.7 | 3.00 | 0.34 | 70 | |
| 20 | | 6.87 | 25.7 | 5.08 | 0.09 | 3 | Turbid brown, no odour |
| 25 | | 6.89 | 25.8 | 4.67 | -0.01 | -36 | |
| 30 | | 6.87 | 27.3 | 5.17 | 0.23 | -47 | |
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| | | | | | | | |
| **Stabilisation Criteria** | | **+/- 0.05** | **+/- 10%** | **+/- 3%** | **+/- 10%** | **+/- 10%** | **Example Comments:** clear / slightly cloudy / turbid / very turbid / no odour / slight odour / odour / strong odour |

**Total Well Volume**
Actual amount of water prior to sampling

**pH, temp, cond readings not necessary if well is purged dry*

Did field parameters stabilise? (Y) N NA  Was the well dry purged? Y (N)

**Field QC Checks**

| | | | | |
|---|---|---|---|---|
| Was pre-cleaning sampling equipment used for these samples? | (Y) | N | | |
| Was pre-cleaning sampling equipment properly protected from contamination? | (Y) | N | | |
| Was documentation of equipment conducted? | (Y) | N | NA | |
| Were air bubbles present in vials at time of collection? | Y | (N) | NA | |
| Was sample for metals field filtered prior to preservations? | (Y) | N | NA | |
| Duplicate sample collected? | (Y) | N | | Duplicate sample ID: DUP1 |

# WSP Groundwater - Well Sampling Data Form

| Job Information | |
|---|---|
| Date: 4-2-11 | Time: arrive depart |
| Project Name: Columbia Precinct Project | Project Number: 15742 |
| Site Location: Homebush | Operator: JM/AY |
| Well ID: BH W3 mL | Weather: Fine - hot |

| Equipment | | | | | | |
|---|---|---|---|---|---|---|
| Water quality equipment description: TPS | | | | | | |
| Interface probe number: Dipper probe | | | | | | |
| Purging equipment: (please cirlce) | Bailer type: | Plastic | Teflon | | | |
| | Pump type: | (Peristaltic) | Submersible | Micro-purge | Amazon | Other: |

**Well Gauging and Purge Volume Calculations**

| Casing Diameter | 25mm | 50mm | 100mm | 125mm | 150mm | 200mm | 250mm | 300mm |
|---|---|---|---|---|---|---|---|---|
| Conversion Factor (volume in factor L/m) | 0.98 | 1.96 | 7.85 | 31.4 | 49.1 | 70.7 | 125.7 | 196.3 |

**Volume of water in well / V = Pr x r x h**
V = volume in litres
P = 3.14159
r = radius in cm
h = height of water column in cm

Total Well Depth (-) Water level (=) Water Column
7.65 m (-) 3.64 m (=) _____ m

Water Column (x) Conversion Factor (=) Litres per 1 Well Volume
_____ m (x) _____ (=) _____ L

**Water Quality Parameters**

Beginning purge time: Ending purge time:

| Litres | Time | pH | Temp C | Cond mS/cm | DO ppm | Redox mV | Comments |
|---|---|---|---|---|---|---|---|
| 5 | | 6.28 | 25.9 | 17.84 | 3.85 | 124 | Initially clear - no odour |
| 10 | | 6.23 | 25.5 | 17.93 | 1.66 | 104 | |
| 15 | | 6.22 | 25.2 | 17.67 | 1.40 | 108 | |
| | | | | | | | |
| | | | | | | | PID & FID not working. |
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| | | | | | | | |
| | | | | | | | |
| Stabilisation Criteria | | +/- 0.05 | +/- 10% | +/- 3% | +/- 10% | +/- 10% | Example Comments: clear / slightly cloudy / turbid / very turbid / no odour / slight odour / odour / strong odour |

Total Well Volume
Actual amount of water prior to sampling

*pH, temp, cond readings not necessary if well is purged dry

Did field parameters stabilise? Y N NA Was the well dry purged? Y N

**Field QC Checks**

| | | | | |
|---|---|---|---|---|
| Was pre-cleaning sampling equipment used for these samples? | (Y) | N | | |
| Was pre-cleaning sampling equipment properly protected from contamination? | (Y) | N | | |
| Was documentation of equipment conducted? | (Y) | N | NA | |
| Were air bubbles present in vials at time of collection? | Y | (N) | NA | |
| Was sample for metals field filtered prior to preservations? | (Y) | N | NA | |
| Duplicate sample collected? | Y | (N) | | Duplicate sample ID |