# Appendix J - Data Validation

# 1. BIOTA SAMPLING – Terrestrial Invertebrates (December 2017)

The Terrestrial Invertebrates sampled during this period included beetles, cicadas, cockroaches, moths, flies, dragonfly, ants, caterpillars, spiders, worms, praying mantis, crickets.

## 1.1. QA/QC General

### 1.1.1. Precision / Accuracy

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Was a NATA registered laboratory used? | ☒ | ☐ |
| 2 | Did the laboratory perform the requested tests? | ☒ | ☐ |
| 3 | Were the laboratory methods adopted consistent with NEPM principles? | ☒ | ☐ |
| 4 | Were the appropriate test procedures followed? | ☒ | ☐ |
| 5 | Were the reporting limits satisfactory? | ☒ | ☐ |
| 6 | Was the NATA Seal on the reports? | ☒ | ☐ |
| 7 | Were the reports signed by an authorised person? | ☒ | ☐ |

**Comments**

At the start of the investigation Australian analytical labs were not NATA certified for PFAS analysis in biota. Coffey initially used National Measurement Institute for biota analysis and then transitioned primary analysis to Eurofins, maintaining NMI as secondary laboratory. In February 2018 Eurofins became NATA certified for PFAS analysis in some biota media (including fish flesh and fruit). Coffey transitioned to ALS as secondary laboratory in March 2018, who also became NATA certified for PFAS analysis in biota in 2018.

| | | |
|---|---|---|
| Precision / Accuracy of the Laboratory Report | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

### 1.1.2. Sample handling

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were the sample **holding times** met? | ☒ | ☐ |
| 2 | Were the samples in **proper custody** between the field and reaching the laboratory? | ☒ | ☐ |
| 3 | Were the samples **properly and adequately** preserved? | ☒ | ☐ |

| | | | |
|---|---|---|---|
| | *This includes keeping the samples chilled, where applicable.* | | |
| 4 | Were the samples received by the laboratory in good condition? | ☒ | ☐ |

**Comments**

Nil

| | | |
|---|---|---|
| Sample Handling was: | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

# 1.2. Field QA/QC

## 1.2.1. Type of QA/QC Samples Collected

| | |
|---|---|
| Primary Samples | 30 composite terrestrial invertebrate samples |
| Days of sampling | 3 days |
| Field Duplicates (at least 1 in 10 samples) | 2 spilt samples created and submitted to NMI for secondary laboratory analysis |
| Trip Blanks (at least 1 per sampling event) | 0 |
| Equipment Rinsate (at least 1/day/matrix/equipment) | No equipment rinsates as no re-usable equipment. Two samples of the ethylene glycol solution used to preserve the samples were collected for analysis. This included one sample of unstrained coolant and one sample of strained coolant. The ethylene glycol samples collected and analysed were samples of preservative that were used in a pit fall trap. This included one sample of ethylene glycol directly from the pit (unstrained) and another sample after it had been strained. |

## 1.2.2. Samples Analysed

Composite terrestrial invertebrate samples were created by combining collected invertebrates of various species. Prior to submission to the laboratory the composite samples were rinsed with PFAS free deionised water. At the laboratory the composite samples were homogenised prior to analysis.

Two split samples were created at the primary laboratory and submitted to the secondary laboratory for analysis.

No re-usable equipment was used in the field, as such no equipment rinsate samples were collected. Two samples of the ethylene glycol preservative used for the terrestrial invertebrate sampling were submitted for analysis as described in the table above.

## Field Duplicates

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were an Adequate Number of field duplicates analysed for each chemical? | ☐ | ☒ |
| 2 | Were RPDs within Control Limits?<br>< 30% for concentrations | ☐ | ☒ |

### Comments

The number of split samples (field duplicates) (2) was less than 1 in 10 primary samples. This was due to difficulties in obtaining representative split composite samples of the terrestrial invertebrates. Where RPDs were outside the acceptable range, sampling procedures, laboratory analytical methods and laboratory results were investigated.

There were two duplicate pair analyses for PFOS and PFOA. Concentrations in the duplicate pairs were within the acceptance target of 30% RPD, with the exception of one pair for PFOS as shown in the table below.

Table 1. RPDs outside Acceptable Range

| **Primary sample** | **Duplicate sample** | **Lab** | **Analyte** | **RPD %** | **Higher than Primary (Y/N)** |
|---|---|---|---|---|---|
| 1302_IV129_171209 (composite terrestrial invertebrate) | Interlab – Split | NMI | Perfluoro-n-octane sulfonic acid (PFOS) | 50 | Y |

The RPD discrepancy observed was attributed to the split sample not being a true duplicate. Although an elevated RPD was reported, the concentration in the split sample was in the same range as the primary sample and adoption of either result would not affect the interpretation. Therefore, the RPDs are likely to reflect the variability in concentration within the media. This highlights the need for sufficient results to develop statistical exposure concentrations where exposure is interpreted likely to be high. Despite the discrepancy observed, the results from the December 2017 terrestrial invertebrate sampling was considered acceptable and able to be relied on for the report, when interpreted statistically.

### Rinsate Blanks

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were Equipment Rinsates collected and analysed every day? | ☐ | ☒ |
| 2 | Were the Equipment Rinsates free of contaminants?<br>(If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.) | ☐ | ☒ Not Applicable |

#### Comments

No rinsate samples were collected as no re-usable equipment was used. However, two samples of the ethylene glycol solution used to preserve the invertebrate samples were collected. This included two samples of ethylene glycol that had come in contact with the invertebrates during the field sampling program. This was undertaken to evaluate whether the coolant was likely to be extracting PFAS compounds from the invertebrates. Coffey submitted a sample of 'fresh' ethylene glycol solution, that had not come in contact with invertebrate samples, to the laboratory prior to conducting the field sampling to determine if it contained any PFAS compounds or other components which may interfere with the PFAS analysis. The laboratory advised that no PFAS compounds were present in the ethylene glycol solution.

Both the strained and unstrained ethylene glycol samples were reported to contain concentrations of PFTrDA (0.05 to 0.12 µg/L) and 6:2 FTS (0.28 to 0.35 µg/L). It is noted that these PFAS compounds were detected in some of the terrestrial invertebrate samples analysed. It is considered possible that the ethylene glycol solution removed traces of the PFTrDA and 6:2 FTS from the invertebrate samples that it came in contact with.

It is noted that PFOS and PFOA, the two PFAS compounds specifically evaluated in the ERA, were not reported at detectable concentrations in the ethylene glycol used, as such the integrity of the PFOS and PFOA terrestrial invertebrate data does not appear to be compromised.

## 1.2.3. Trip Blanks

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Was a trip blank collected on each day of sample? | ☐ | ☒ |
| 2 | Were the Trip Blanks free of contaminants?<br>(If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.) | ☐ | ☐ |

#### Comments

Specific trip blanks were not transported with the samples as due to the nature of the PFAS compounds (i.e. non-volatile) it was considered that cross contamination was unlikely to occur during sample storage and transport.

In summary, the field QC results are considered generally acceptable for the purposes of this investigation.

| | | |
|---|---|---|
| Field QA/QC was: | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |

| | | |
|---|---|---|
| | ☐ | Unsatisfactory |

## 1.3. Laboratory QA/QC

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were the laboratory blanks/reagents blanks free of contamination? | ☒ | ☐ |
| 2 | Were the spike recoveries within control limits? | ☒ | ☐ |
| 3 | Were the RPDs of the laboratory duplicates within control limits? | ☒ | ☐ |
| 4 | Were the surrogate recoveries within control limits? | ☒ | ☐ |

### 1.3.1. Laboratory Blanks.

All laboratory method blank results reported concentrations of contaminants below the laboratory reporting limits.

### 1.3.2. Laboratory Duplicates

All internal laboratory duplicates analysed by Eurofins and NMI were within acceptable limits (<30% RPD).

### 1.3.3. Laboratory Control Samples

None of the laboratory control sample analyses were performed by Eurofins and none were outside of the target range (>50%).

### 1.3.4. Matrix Spikes

Matrix spike analyses were performed by Eurofins and NMI. A total of 12 Matrix spikes were outside of the adopted 70% – 130% acceptability criteria adopted, but all were within 50-150%. indicating the matrix spike results for PFAS compounds was acceptable.

### 1.3.5. Surrogate recoveries

The laboratories reported surrogate recoveries for all PFAS compounds. For the purpose of this report we evaluated the surrogate recoveries for PFOS and PFOA, the two risk-driving PFAS compounds evaluated in the ERA. Only two surrogates for PFOA and one surrogate for PFOS were outside of the acceptable range of 50 – 150 %. This represents a small proportion of the total number of surrogates determined. The discrepancies were related to surrogate analysis being below the recovery limit of 50%, this which would lead the quantification following adjustment to a low recovery, to be an overestimate.

A summary of the internal laboratory quality control results is provided in the table below.

Overall completeness of internal laboratory QC was less than 95%. Many surrogate recoveries were identified out of the 50-150% acceptance range, but typically for precursor compounds, which were not typically reported above reporting limits in samples, and were not used quantitatively.

Internal laboratory QC indicates acceptable laboratory data quality.

| | | |
|---|---|---|
| Laboratory internal QA/QC was: | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

## 1.4. Summary of Terrestrial Invertebrate Sampling (December 2017) Data Quality Review

In general, the data quality of the terrestrial invertebrate sampling undertaken in December 2018 was considered to be acceptable. Concentrations of 6:2 FTS and PFTrDA is samples of the ethylene glycol preservative that had come in contact in invertebrate samples, however PFOS and PFOA were not detected, hence this results for the compounds relied on for the ERA are not considered to be compromised. A small proportion of surrogate recovery discrepancies were noted for PFOS and PFOA. The QC results were considered to indicate acceptable data quality and allow data to be relied on to support the outcome of the assessment.

Field Duplicates (SOIL)
Filter: Lab_Report_Number in('578675','578763')

| Chem_Group | ChemName | Units | EQL | Lab Report Number | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 578763 | | | 578763 | | |
| | | | | Field ID | | RPD | | | RPD |
| | | | | 1302_IV118_171209 | 0990_IV118_171209 | | 1302_IV129_171209 | 0990_IV129_171209 | |
| | | | | Sampled Date/Time | | | | | |
| | | | | 09-12-17 | 09-12-17 | | 09-12-17 | 09-12-17 | |
| PFAS | Perfluoro pentanoic acid (PFPA or PFPeA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-hexanoic acid (PFHxA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-heptanoic acid (PFHpA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-octanoate acid (PFOA) | µg/kg | 0.5 (Primary): 0.3 (Interla | <0.5 | <0.3 | 0 | <0.5 | <0.3 | 0 |
| | Perfluoro-n-nonanoic acid (PFNA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-decanoic acid (PFDA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-undecanoic acid (PFUnDA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-dodecanoic acid (PFDoDA) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluorobutane sulfonic acid (PFBS) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |
| | Perfluoro-n-octane sulfonic acid (PFOS) | µg/kg | 0.3 | 0.6 | 0.75 | 22 | **0.6** | **1.0** | **50** |
| | 1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS) | µg/kg | 0.5 | **1.2** | **<0.5** | **82** | <0.5 | <0.5 | 0 |
| | 1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS) | µg/kg | 0.5 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 |

*RPDs have only been considered where a concentration is greater than 0 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 25 (0-10 x EQL); 25 (10-20 x EQL); 10 ( > 20 x EQL) )
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

| | | |
|---|---|---|
| **Lab Report Number** | 578675 | 578675 |
| **Field ID** | 1302_QC1IV_171210 | 1302_QC2IV_171210 |
| **Sampled Date** | 10-12-17 | 10-12-17 |
| **Sample Type** | Rinsate | Rinsate |

| Chem Group | ChemName | Units | LOR | | |
|---|---|---|---|---|---|
| PFAS | Perfluorobutanoic acid (PFBA) | µg/L | 0.05 | <2 | <2 |
| | Perfluoro pentanoic acid (PFPA or PFPeA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-hexanoic acid (PFHxA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-heptanoic acid (PFHpA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-octanoate acid (PFOA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-nonanoic acid (PFNA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-decanoic acid (PFDA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-undecanoic acid (PFUnDA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-dodecanoic acid (PFDoDA) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-tridecanoic acid (PFTriDA) | µg/L | 0.01 | **0.05** | **0.12** |
| | Perfluoro-n-tetradecanoic acid (PFTeDA) | µg/L | 0.01 | <2 | <2 |
| | Perfluorobutane sulfonic acid (PFBS) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-hexane sulfonic acid (PFHxS) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-heptane sulfonic acid (PFHpS) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-octane sulfonic acid (PFOS) | µg/L | 0.01 | <2 | <2 |
| | Perfluoro-n-decane sulfonic acid (PFDS) | µg/L | 0.01 | <2 | <2 |
| | PFHxS + PFOS | µg/L | 0.01 | <0.01 | <0.01 |
| | Perfluoro-n-pentane sulfonic acid (PFPeS) | µg/L | 0.01 | <2 | <2 |
| | Perfluorooctane sulfonamide (PFOSA) | µg/L | 0.05 | <2 | <2 |
| | N-Methylperfluoro-1-octane sulfonamide (N-MeFOSA) | µg/L | 0.05 | <2 | <2 |
| | N-Ethylperfluoro-1-octane sulfonamide (N-EtFOSA) | µg/L | 0.05 | <2 | <2 |
| | 2-(N-Methylperfluoro-1-octane sulfonamide)-ethanol | µg/L | 0.05 | <2 | <2 |
| | 2-(N-Ethylperfluoro-1-octane sulfonamide)-ethanol | µg/L | 0.05 | <2 | <2 |
| | N-Methyl perfluorooctane sulfonamidoacetic acid | µg/L | 0.05 | <2 | <2 |
| | N-Ethyl perfluorooctane sulfonamidoacetic acid | µg/L | 0.05 | <2 | <2 |
| | 1H.1H.2H.2H-Perfluorohexanesulfonic Acid (4:2 FTS) | µg/L | 0.01 | <2 | <2 |
| | 1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS) | µg/L | 0.05 | **0.28** | **0.35** |
| | 1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS) | µg/L | 0.01 | <2 | <2 |
| | 1H.1H.2H.2H-dodecanesulfonic acid (10:2 FTS) | µg/L | 0.01 | <2 | <2 |
| | Sum of PFASs (n=28) | µg/L | 0.1 | **0.33** | **0.47** |
| | Sum of WA DER PFAS (n=10) | µg/L | 0.05 | **0.28** | **0.35** |

# 1. BIOTA SAMPLING – Terrestrial Vertebrates (March 2018)

The Terrestrial Vertebrates sampled during this period included:

- Small mammals
- Reptiles
- Amphibians

The samples submitted for analysis including whole organisms, composite samples and tissue / organ samples. Some serum samples were also collected.

## 1.1. QA/QC General

### 1.1.1. Precision / Accuracy

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Was a NATA registered laboratory used? | ☒ | ☐ |
| 2 | Did the laboratory perform the requested tests? | ☒ | ☐ |
| 3 | Were the laboratory methods adopted consistent with NEPM principles? | ☒ | ☐ |
| 4 | Were the appropriate test procedures followed? | ☒ | ☐ |
| 5 | Were the reporting limits satisfactory? | ☒ | ☐ |
| 6 | Was the NATA Seal on the reports? | ☒ | ☐ |
| 7 | Were the reports signed by an authorised person? | ☒ | ☐ |

**Comments**

At the start of the investigation Australian analytical labs were not NATA certified for PFAS analysis in biota. Coffey initially used National Measurement Institute for biota analysis and then transitioned primary analysis to Eurofins, maintaining NMI as secondary laboratory. In February 2018 Eurofins became NATA certified for PFAS analysis in some biota media (including fish flesh and fruit). Coffey transitioned to ALS as secondary laboratory in March 2018, who also became NATA certified for PFAS analysis in biota in 2018.

| | | |
|---|---|---|
| Precision / Accuracy of the Laboratory Report | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

### 1.1.2. Sample handling

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were the sample **holding times** met? | ☒ | ☐ |
| 2 | Were the samples in **proper custody** between the field and reaching the laboratory? | ☒ | ☐ |
| 3 | Were the samples **properly and adequately** preserved?<br>*This includes keeping the samples chilled, where applicable.* | ☒ | ☐ |
| 4 | Were the samples received by the laboratory in good condition? | ☒ | ☐ |

**Comments**

Nil

| | | |
|---|---|---|
| Sample Handling was: | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

## 1.2. Field QA/QC

### 1.2.1. Type of QA/QC Samples Collected

| | |
|---|---|
| Primary Samples | 85 vertebrate samples |
| Days of sampling | 2 day |
| Field Duplicates (at least 1 in 10 samples) | 4 intra-lab duplicates of vertebrate sampled were collected<br>1 inter-lab duplicate sample of skinks was collected and submitted to ALS for secondary laboratory analysis |
| Trip Blanks (at least 1 per sampling event) | 0 |
| Equipment Rinsate (at least 1/day/matrix/equipment) | 3 Rinsate samples for dissection equipment (i.e. knife, scissors) |

## 1.2.2. Samples Analysed

Vertebrate samples analysed were either single whole body organisms, composite whole body samples, or specific tissue, organs or segments of organisms. Larger organisms were dissected prior to submission to the laboratory to create specific tissue, organ or segment samples for the organisms collected. Samples were homogenised by the laboratory prior to analysis.

Serum samples were collected from some terrestrial vertebrates captured, this were analysed by the laboratory (Envirolab) as blood plasma samples.

Four quasi field intra-laboratory duplicate samples were collected and analysed including:

- 1302_TVC03_180322: Different sections of a Children's Python collected from the same location
- 1302_TVC03_180322: Different sections of a Keelback snake collected from the same location
- 1302_TVC06_180322: Groups of similar skinks caught at the same location
- 1302_TV114_180322: Similar green-tree frogs caught at the same location.

One field inter-laboratory duplicate sample was collected and analysed including:

- 1302_TVC04_180322: Groups of similar skinks caught in the same area

No duplicate serum samples were able to be collected.

Rinsate samples were collected for analysis from dissection equipment used to dissect larger vertebrate samples collected. No other re-usable sampling equipment was used that could have resulted in cross-contamination of other biota samples.

### Field Duplicates

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were an Adequate Number of field duplicates analysed for each chemical? | ☐ | ☒ |
| 2 | Were RPDs within Control Limits?<br>< 30% for concentrations | ☐ | ☒ |

#### Comments

The number of intra and inter laboratory field duplicates was less than 1 in 10 primary samples. This was due to difficulties in obtaining representative samples of similar organisms from the same location to be consider quasi field duplicates. Where RPDs were outside the acceptable range, sampling procedures, laboratory analytical methods and laboratory results were investigated

There were four intra-laboratory duplicate pair samples and one inter-laboratory duplicate pair sample. In relation to PFOS and PFOA the RPDs of the duplicate pairs were within the acceptance target of 30%, with the exception of three pairs for PFOS.

The RPD discrepancies observed were attributed to the duplicate samples being quasi duplicates rather than true duplicate samples due to difficulties in obtaining similar vertebrate samples from the same location. The concentrations in the duplicate samples were generally in a similar range to the primary sample, therefore the RPDs are likely to reflect the variability in concentration within the media. This highlights the need for sufficient results to develop statistical exposure concentrations

where exposure is interpreted likely to be high. Despite the discrepancy observed, the results from the March 2018 terrestrial vertebrate sampling was considered acceptable and able to be relied on for the report, when interpreted statistically.

Table 1. RPDs outside Acceptable Range

| **Primary sample** | **Duplicate sample** | **Lab** | **Analyte** | **RPD %** | **Higher than Primary (Y/N)** |
|---|---|---|---|---|---|
| 1302_TVC05_180322 | 1302_TVC06_180322 | Eurofins | Perfluoro-n-octane sulfonic acid (PFOS) | 43 | Y |
| 1302_TVC05_180322 | 1302_TVC04_180322 | ALS | Perfluoro-n-octane sulfonic acid (PFOS) | 59 | N |
| 1302_TV113_180322 | 1302_TV114_180322 | Eurofins | Perfluoro-n-octane sulfonic acid (PFOS) | 133 | N |

### Rinsate Blanks

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were Equipment Rinsates collected and analysed every day? | ☒ | ☐ |
| 2 | Were the Equipment Rinsates free of contaminants?<br>(If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.) | ☒ | ☐ Not Applicable |

### Comments

Three rinsate samples were collected from the equipment used for dissection / sample preparation prior to submission to the laboratory. Concentrations of PFAS compounds in all three rinsate samples were below the detectable limits. As such is it considered unlikely that any cross-contamination occurred.

## 1.2.3. Trip Blanks

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Was a trip blank collected on each day of sample? | ☐ | ☒ |
| 2 | Were the Trip Blanks free of contaminants?<br>(If no, comment whether the contaminants present are also detected in the samples and whether they are common laboratory chemicals.) | ☐ | ☐ |

### Comments

Specific trip blanks were not transported with the samples as due to the nature of the PFAS compounds (i.e. non-volatile) it was considered that cross contamination was unlikely to occur during sample storage and transport.

In summary, the field QC results are considered generally acceptable for the purposes of this investigation.

| | | |
|---|---|---|
| Field QA/QC was: | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

## 1.3. Laboratory QA/QC

| ITEM | QUESTION | YES | NO (Comment below) |
|---|---|---|---|
| 1 | Were the laboratory blanks/reagents blanks free of contamination? | ☒ | ☐ |
| 2 | Were the spike recoveries within control limits? | ☒ | ☐ |
| 3 | Were the RPDs of the laboratory duplicates within control limits? | ☒ | ☐ |
| 4 | Were the surrogate recoveries within control limits? | ☐ | ☒ |

### 1.3.1. Laboratory Blanks.

All laboratory method blank results reported concentrations of contaminants below the laboratory reporting limits.

### 1.3.2. Laboratory Duplicates

A ll internal laboratory duplicates were analysed were within acceptable limits (<30% RPD).

### 1.3.3. Laboratory Control Samples

None of the laboratory control sample analyses performed were outside of the target range (>50%).

### 1.3.4. Matrix Spikes

Matrix spike analyses were performed by the laboratories, with 20 matrix spikes being outside of the adopted 70% – 130% acceptability criteria adopted, but all were within 50-150%. indicating the matrix spike results for PFAS compounds was acceptable.

### 1.3.5. Surrogate recoveries

The laboratories reported surrogate recoveries for all PFAS compounds. For the purpose of this report we evaluated the surrogate recoveries for PFOS and PFOA, the two risk-driving PFAS compounds evaluated in the ERA. A total of 31 surrogates for PFOA and one surrogate for PFOS were outside of the acceptable range of 50 – 150 %. This represents a small proportion of the total number of surrogates determined. The discrepancies were predominately related to surrogate analysis being

below the recovery limit of 50%, this which would lead the quantification following adjustment to a low recovery, to be an overestimate.

Overall completeness of internal laboratory QC was less than 95%. Many surrogate recoveries were identified out of the 50-150% acceptance range, but typically for precursor compounds, which were not typically reported above reporting limits in samples, and were not used quantitatively.

Internal laboratory QC indicates acceptable laboratory data quality.

| | | |
|---|---|---|
| Laboratory internal QA/QC was: | ☒ | Satisfactory |
| | ☐ | Partially Satisfactory |
| | ☐ | Unsatisfactory |

## 1.4. Summary of Terrestrial Vertebrate Sampling (March 2018) Data Quality Review

In general, the data quality of the terrestrial invertebrate sampling undertaken in December 2018 was considered to be acceptable. Surrogate recovery discrepancies were identified for PFOS and PFOA, these represented a small proportion of the total number of surrogates determined, in particular for PFOS, the main risk driving PFAS evaluated in the ERA. The QC results were considered to indicate acceptable data quality and allow data to be relied on to support the outcome of the assessment.

RAAF Base Darwin
ERA
Terrestrial Vertebrates
Quality Control RPD Summary Table



| | | | Lab Report Number | 592567 | 592567 | | 592567 | 592567 | | 592567 | 592567 | | 594583 | 594583 | | 592567 | ES1810306 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Field ID | 1302_TV026_180322 | 1302_TVC03_180322 | RPD | 1302_TVC05_180322 | 1302_TVC06_180322 | RPD | 1302_TV045_180322 | 1302_TVC08_180322 | RPD | 1302_TV113_180409 | 1302_TV114_180409 | RPD | 1302_TVC05_180322 | 1302_TVC04_180322 | RPD |
| | | | Sample Date | 23-03-18 | 23-03-18 | | 23-03-18 | 23-03-18 | | 23-03-18 | 23-03-18 | | 09-04-18 | 09-04-18 | | 23-03-18 | 23-03-18 | |
| **Chem Group** | **ChemName** | **Units** | **LOR** | | | | | | | | | | | | | | | |
| PFAS | Perfluorobutanoic acid (PFBA) | µg/kg | 0.5 (Primary): 5 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <5.0 | 0 |
| | Perfluoro pentanoic acid (PFPA or PFPeA) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | Perfluoro-n-hexanoic acid (PFHxA) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-heptanoic acid (PFHpA) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-octanoate acid (PFOA) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-nonanoic acid (PFNA) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 3.6 | 3.5 | 3 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-decanoic acid (PFDA) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 1.5 | 1.4 | 7 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-undecanoic acid (PFUnDA) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 1.5 | 1.3 | 14 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-dodecanoic acid (PFDoDA) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 5.7 | 5.2 | 9 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | Perfluoro-n-tridecanoic acid (PFTriDA) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 2.2 | 2.1 | 5 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | Perfluoro-n-tetradecanoic acid (PFTeDA) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 10.0 | 9.5 | 5 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | Perfluorobutane sulfonic acid (PFBS) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 0.6 | <0.5 | 18 | <0.5 | <1.0 | 0 |
| | Perfluoro-n-hexane sulfonic acid (PFHxS) | µg/kg | 0.3 (Primary): 1 (Interlab) | **3.4** | **2.6** | **27** | **0.8** | **1.6** | **67** | **54.0** | **42.0** | **25** | **14.0** | **2.9** | **131** | 0.8 | 1.0 | 22 |
| | Perfluoro-n-heptane sulfonic acid (PFHpS) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 13.0 | 12.0 | 8 | **4.2** | **1.0** | **123** | <0.5 | <1.0 | 0 |
| | Perfluoro-n-octane sulfonic acid (PFOS) | µg/kg | 0.3 (Primary): 1 (Interlab) | **37.0** | **41.0** | **10** | **22.0** | **34.0** | **43** | **2800.0** | **2500.0** | **11** | **260.0** | **52.0** | **133** | **22.0** | **12.0** | **59** |
| | Perfluoro-n-decane sulfonic acid (PFDS) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 6.8 | 6.4 | 6 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | PFHxS + PFOS | µg/kg | 0.5 | 40.4 | 43.6 | 8 | **22.8** | **35.6** | **44** | **2854.0** | **2542.0** | **12** | **274.0** | **54.9** | **133** | 22.8 | | |
| | Perfluoro-n-pentane sulfonic acid (PFPeS) | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | 1.1 | 1.2 | 9 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | Perfluorooctane sulfonamide (PFOSA) | µg/kg | 0.5 (Primary): 5 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <5.0 | 0 |
| | N-Methylperfluoro-1-octane sulfonamide (N-MeFOSA) | µg/kg | 0.5 (Primary): 5 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <5.0 | 0 |
| | N-Ethylperfluoro-1-octane sulfonamide (N-EtFOSA) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | 2-(N-Methylperfluoro-1-octane sulfonamide)-ethanol | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | 2-(N-Ethylperfluoro-1-octane sulfonamide)-ethanol | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | N-Methyl perfluorooctane sulfonamidoacetic acid | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | N-Ethyl perfluorooctane sulfonamidoacetic acid | µg/kg | 0.5 (Primary): 1 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <1.0 | 0 |
| | 1H.1H.2H.2H-Perfluorohexanesulfonic Acid (4:2 FTS) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | 1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | 1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | 1H.1H.2H.2H-dodecanesulfonic acid (10:2 FTS) | µg/kg | 0.5 (Primary): 2 (Interlab) | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <0.5 | 0 | <0.5 | <2.0 | 0 |
| | Sum of PFASs (n=28) | µg/kg | 0.5 (Primary): 1 (Interlab) | 40.4 | 43.6 | 8 | **22.8** | **35.6** | **44** | **2899.4** | **2584.6** | **11** | **278.8** | **55.9** | **133** | **22.8** | **13.0** | **55** |
| | Sum of WA DER PFAS (n=10) | µg/kg | 0.5 | 40.4 | 43.6 | 8 | **22.8** | **35.6** | **44** | **2854.0** | **2542.0** | **12** | **274.6** | **54.9** | **133** | 22.8 | | |

*RPDs have only been considered where a concentration is greater than 0 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 25 (0-10 x EQL); 25 (10-20 x EQL); 10 ( > 20 x EQL) )
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

| | | | Field_ID | 1302_QCTV001_180323 | 1302_QCTV002_180323 | 1302_QCTV003_180323 |
|---|---|---|---|---|---|---|
| | | | LocCode | 1302_QCTV001 | 1302_QCTV002 | 1302_QCTV003 |
| | | | Sample Type | Rinsate | Rinsate | Rinsate |
| | | | Sample Date | 23-Mar-18 | 23-Mar-18 | 23-Mar-18 |
| **Chem Group** | **ChemName** | **Units** | **LOR** | | | |
| PFAS | Perfluorobutanoic acid (PFBA) | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | Perfluoro pentanoic acid (PFPA or PFPeA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-hexanoic acid (PFHxA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-heptanoic acid (PFHpA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-octanoate acid (PFOA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-nonanoic acid (PFNA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-decanoic acid (PFDA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-undecanoic acid (PFUnDA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-dodecanoic acid (PFDoDA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-tridecanoic acid (PFTriDA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-tetradecanoic acid (PFTeDA) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluorobutane sulfonic acid (PFBS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-hexane sulfonic acid (PFHxS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-heptane sulfonic acid (PFHpS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-octane sulfonic acid (PFOS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-decane sulfonic acid (PFDS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | PFHxS + PFOS | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluoro-n-pentane sulfonic acid (PFPeS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Perfluorooctane sulfonamide (PFOSA) | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | N-Methylperfluoro-1-octane sulfonamide (N-MeFOSA) | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | N-Ethylperfluoro-1-octane sulfonamide (N-EtFOSA) | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | 2-(N-Methylperfluoro-1-octane sulfonamide)-ethanol | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | 2-(N-Ethylperfluoro-1-octane sulfonamide)-ethanol | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | N-Methyl perfluorooctane sulfonamidoacetic acid | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | N-Ethyl perfluorooctane sulfonamidoacetic acid | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | 1H.1H.2H.2H-Perfluorohexanesulfonic Acid (4:2 FTS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | 1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS) | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |
| | 1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | 1H.1H.2H.2H-dodecanesulfonic acid (10:2 FTS) | µg/L | 0.01 | <0.01 | <0.01 | <0.01 |
| | Sum of PFASs (n=28) | µg/L | 0.1 | <0.1 | <0.1 | <0.1 |
| | Sum of WA DER PFAS (n=10) | µg/L | 0.05 | <0.05 | <0.05 | <0.05 |