On-Site Wastewater Management Plan & Preliminary NorBE

92-117 Darkes Forest Road, Darkes Forest

Prepared for

The Banksia Plains Family Trust

29 June 2018

Cardno

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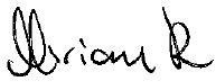

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Tables

1 Introduction

This On Site Wastewater Assessment report and Preliminary Neutral or Beneficial Effect on Water Quality (NorBE) assessment has been prepared by Cardno (NSW/ACT) Pty Ltd ("Cardno") on behalf of Biara Grove Pty Ltd ATF The Banksia Family Trust ("the Client") in support of the Planning Proposal at 92-117 Darkes Forest Road, Darkes Forest. (Refer to **Appendix A** for concept site plan).

The purpose of this report is to provide Wollongong City Council (Council) with additional details on the feasible wastewater management options and a preliminary NorBE assessment to allow the complete assessment of the existing Planning Proposal (PP-2016/4). A more detailed report including a revised NorBE would be prepared to support the Section 68 Application to install an onsite sewage management system (OSSM) once detailed design of the site is completed as part of a future development application (DA) after rezoning.

This report considers only the sanitary waste from the proposed ancillary uses of the site buildings and infrastructure, such as cellar door sales, tours, cooking school and bed and breakfast accommodation, not the waste from the Cider production. Any waste water from cider production is proposed to be irrigated to land south of Darkes Forest Road, outside the Sydney Water catchment and is not the subject of this report.

It is also noted that the owner of the site is also considering constructing a standard storage shed on the southern portion of the site adjacent to the existing dwelling, in addition to the existing infrastructure and that outlined in the original planning proposal. Any required NorBE assessment for this shed will be carried out as part of the DA process associated with this shed. The shed proposal will have no impact on the subject of this report.

The objective of this 'onsite wastewater management study' is to investigate the relevant site, soil, environmental health and public health factors that can impact on the selection, location and design of an onsite wastewater management system to determine:

- whether or not the site is suitable for an on-site wastewater management system complying with NorBE requirements; and
- the best practical on-site wastewater management system for the specific site and proposed development, thus providing confidence to planning authorities that NorBE requirements can be met at the site as part of a future DA after the site is rezoned.

This study has been prepared in accordance with:

- Australian Standard *AS1547:2012 On-site Domestic Wastewater Management*;
- *Designing and Installing On-Site Wastewater Systems: A Sydney Catchment Authority Current Recommended Practice,* Sydney Catchment Authority, 2012;
- *On-site Sewage Management for Single Households (the Silver Book)*, Dept. Local Government, 1998;
- *Chapter 8: On-site Sewage Management Systems*, Wollongong City Council, 2009;
- *Rapid Evaluation Procedure for On-Site Wastewater Management Wollongong City Council*, Martens & Associates;
- *Environmental Guidelines: Use of Effluent by Irrigation*, NSW Department of Environment and Conservation, 2004.
- *Neutral or Beneficial Effect on Water Quality Assessment Guideline*, Sydney Catchment Authority, 2015.

The scope of this investigation involved undertaking the following tasks:

- *Desktop Study:* An initial investigation to collate relevant information about the site and proposed development prior to the site inspection;
- *Site Assessment:* An on-site inspection by an engineer or scientist to record land surface, site features, identify potential site constraints and define the most appropriate land application area;
- *Soil Assessment*: A subsoil investigation by an engineer or scientist to record the soil profile and relevant soil properties within the land application area to determine potential soil limitations; and
- *System Design:* An evaluation of the expected wastewater flowrate, site and soil limitations to select, size and position a waste treatment unit and land application system that will provide the best practical option.

2 Desktop Assessment

As per Section 5.2 of the s117 Direction, consultation with WaterNSW was undertaken regarding the Strategic Land and Water Capability Assessment (SLWCA) to ensure that the proposed development and intensity of land use will not adversely impact on water quality and catchment health. The northern portion of the site has been mapped by Sydney Catchment Authority (SCA) as containing low, moderate, and high SLCWA Risk to water quality levels as shown Error! Reference source not found.. As the development will utilise existing buildings and discharge waste water in previous disturbed areas, according to the SLWCA mapping only low and moderate risks are present for the proposal. The proposed effluent irrigation areas are located predominantly within the low risk area, with a small portion in the moderate risk area. Further assessment is included below to provide certainty that NorBE objectives can be met within the Sydney Drinking Water Catchment area, thus ensuring the proposal will have a low risk to water quality.

Outlined in Table 2-1 are the relevant parameters complied in the desktop assessment.

Table 2-1 Desktop Assessment

Parameter	Input
Address	117 Darkes Forest Road, Darkes Forest
Council	Wollongong City Council
Intended Water Supply Source	Rainfall Water
Source of Wastewater	Sanitary Waste from proposed Cellar Door sales / tours / Cooking Classes / B&B
Design Wastewater Allowance	2.48 L/m^2/day (refer to Section 3)
Floor Area for Designated Use	530 m^2
Design Wastewater Flowrate	1315 L/day (refer to Section 3)
Rainfall Station	68024 Darkes Forest (Kintyre)
Evaporation Station	66037 Sydney Airport AMO

3 Wastewater Loading

The quantity of sanitary wastewater to be disposed of has been estimated based on the estimated potable water demand, assuming all potable water used will be discharged to the wastewater system. This is a conservative assumption.

Sydney Water specifies a water demand of 2.48L/m^2 floor area/day for the type of development proposed at site (café/cooking classes/visitor centre). Based on a floor area of 530m^3, the estimated water demand (and hence wastewater production) is 1315 L/d.

A grease trap would be provided for discharges from the café and cooking class area prior to the treatment system. The wastewater entering the treatment system will be of typical domestic sanitary sewage quality.

4 Site Layout and Geotechnical Information

The total size of the lot is 41.4 ha, which is proposed to be subdivided such that the lot north of Darkes Forest Road will be approximately 13.8 ha, whilst the size of the lot south of Darkes Forest Road will be 27.6 Ha. The proposed Cider Brewery, café and visitor centre is proposed to be located within existing building north of Darkes Forest Road.

The total size of the existing building on the northern portion of the site is 1,954 m^2, of which a maximum of 530 m^2 is proposed to be utilised for cellar door sales, cooking classes and a visitor centre.

The site is sloping towards the north, and is located within the Sydney Water catchment area. There is an existing waterway located in the middle of the site running north-south, which feeds into the Waratah Rivulet. This is a mapped watercourse, therefore classified as a watercourse under Sydney Catchment Authority guidelines for Design and Installation of On-Site Wastewater Systems.

The site surface is heavily disturbed and is covered with grass and forest with the exception of the footprints of buildings and structures that are constructed on concrete slab, roads and the asphalt car park that is located in the southern portion of the site.

4.1 Soil Profile

Three test pits (TP4, TP5, TP6) and two soil bores (SB1, SB2) were sampled by Cardno in locations anticipated to be suitable for disposal of wastewater via land application (Refer to Appendix A for site plan). The test pits were dug to a depth of up to 1.2m and bores to refusal (approx. 0.8m), and the soil has been classified in accordance with AS 1547, as per Table 4-1.

Table 4-1 Soil Classification

Test Pit	Soil Profile	Soil Category
SB1	Loamy Sand	2
SB2	Loamy Sand	2
TP4	Loamy Sand	2
TP5	Gravelly Sand	1
TP6	Sandy Clay Loam	4

4.2 Soil Testing

Soil samples from each test pit were sent to ALS Environmental, a NATA accredited laboratory for testing of the following:

- Modified Emerson's Aggregate
- Electrical Conductivity
- P Sorption (mg/kg)
- Bulk Density
- pH

The results are summarised below (refer to Appendix C for laboratory test results).

4.2.1 Emerson Aggregate Class

The Emerson Aggregate Test is used to assess soil for potential structural degradation at the proposed disposal site. The Emerson Class Number is categorised as either a Minor Limitation (Class 3 & 4), Moderate Limitation (Class 2) or Major Limitation (Class 1), in accordance with the Silver Book, in assessing whether a site is suitable for on-site disposal. The results of the soil testing are summarised below in 0.

Table 4-2 Soil Analysis Results: Emerson Aggregate Test

Test Pit	Emerson Class Number	Limitation
TP4	4	Minor
TP5	8	Minor
TP6	4	Minor

4.2.2 Electrical Conductivity

The Silver Book categorises Electrical Conductivity (dS/m) as a measure of Salinity, in accordance with the following classifications: <4 a minor limitation, 4 to 8 as a moderate limitation, and more than 8 a major limitation. The results of the soil testing for this site are summarised below in Table 4-3.

Table 4-3 Soil Analysis Results: Electrical Conductivity

Test Pit	µS/cm	dS/m	Limitation
TP4	55	0.055	Minor
TP5	43	0.043	Minor
TP6	109	0.109	Minor

4.2.3 Phosphorus Sorption

The Silver Book classifies Phosphorus Sorption Capacity (kg/ha) greater than 6000 as a minor limitation, between 2000 and 6000 as a moderate limitation and less than 2000 as a major limitation. The results of the soil testing for this site are summarised below in Table 4-4.

Table 4-4 Soil Analysis Results: Phosphorus Sorption Capacity

Test Pit	Mg P sorbed / kg	Soil Density (kg/m3)	Kg/ha	Limitation
TP4	536	2240	12,006	Minor
TP5	669	1880	12,577	Minor
TP6	957	2170	20,767	Minor

4.2.4 pH

The Silver Book ranks pH >6 as a minor limitation, and 4.5-6 as a moderation limitation. The results of the soil testing are summarised below in Table 3-5.

Table 4-5 Soil Analysis Results: pH

Test Pit	pH	Limitation
TP4	5.6	Moderate
TP5	7.5	Minor
TP6	8.3	Minor

Therefore, based on the results above, pH poses a minor to moderate limitation to suitability for subsoil disposal purposes.

4.3 Soil Classification

Based on the site investigations outlined above, a soil category of 2 (loamy sand) as per Table 5.1 in AS1547 is the soils type in the proposed effluent disposal area. However test pits at other locations on site noted category 4 soils.

4.4 Depth of soil

The native soils were found to be approximately 0.8m deep on top of highly weathered sandstone in the proposed effluent disposal area.

4.5 Groundwater

A search of the NSW Office of Water Groundwater Database (NSW DPI Water, 2017) on 23 January 2018 identified no registered groundwater bores within a 500m radius of the site.

4.6 Topography and Drainage

The investigation area of the northern allotment has a gentle fall from south to north, with elevation contours on the site plan in **Appendix A** showing an approximate elevation of 370m AHD in the south and 360m AHD in the north. An unnamed tributary flows from the eastern side of the former mine building in a northerly direction and meets with Waratah Rivulet approximately 1.6km north of the site.

Surface water at the investigation area of the northern allotment is expected to flow into the unnamed tributary via engineered drainage features, surface contours and landscaping. Two decommissioned oxidation ponds associated with the former mining operation are located approximately 150m east of the site that historically received waste water from the “wash house” whist the mine was operational. Historically the water from the oxidation ponds was reused for irrigation purposes in the southern allotment, south of Darkes Forest Road, however this no longer occurs.

4.7 Flood Potential

A Section 149 Certificate (parts 2 and 5) was obtained for the site from Wollongong City Council. The certificate indicates that the site is located within an ‘Uncategorised Flood Risk’ precinct but also states that ‘*councils flood maps show that the land is located in an area where flooding has occurred or is suspected’.* Further review of councils flood constraints map indicate that Darkes Forest is not identified as a flood risk area. The site is also located at the top of the Illawarra escarpment and as such is not considered to be at risk of flooding.

5 Concept Wastewater Treatment Design

The proposed method of managing the wastewater on site includes the following:

- Collection of wastewater in a NSW Health accredited Aerated Wastewater Treatment System (AWTS) with a capacity of 2000 L/day.
- Wastewater will be treated to a secondary standard in the AWTS with a disinfection system.
- The AWTS is to be installed and maintained in accordance with the manufacturer’s guidelines and NSW Health regulations.
- The AWTS shall be positioned on a stable, level base on the downslope of the building so there is sufficient fall from drainage outlets in the building.
- The AWTS must be located in accordance with the following requirements:
  - At least 2.5m away from the building
  - At least 6m away from the property boundary; and
  - At least 6m downslope from any in ground water storage tanks.

The typical effluent quality from an AWTS is given in Table 5-1.

Table 5-1 Typical AWTS Effluent Quality (Source: On-site Sewage Management for Single Households – "Silver book", 1998)

Parameter	Concentration
Biochemical oxygen demand	<20 mg/L
Suspended solids	<30 mg/L
Total nitrogen	25 – 50 mg/L
Total phosphorus	10 – 15 mg/L
Faecal coliforms (disinfected effluent)	<30 cfu/100mL

6 Effluent Disposal

6.1 Proposed Method of Effluent Disposal

Irrigation by Low Pressure Effluent Distribution (LPED) has been selected as the preferred method for effluent distribution. LPED is suitable for the shallow soils that are encountered on site.

6.2 Calculation of Required Area

The required land disposal area has been sized for the development based on the following design parameters:

- Wastewater loading of up to 1315 L/day
- Collection and treatment of wastewater in a NSW Health approved AWTS with a capacity of 2000 L/day
- Rainwater supply
- Disposal of treated effluent through subsoil irrigation (LPED)

The irrigation area required to dispose 1315 L/day was calculated using the monthly water (hydraulic) and nutrient balance methods as follows:

- Subsurface irrigation is suitable for all soil types, in particular low permeable subsoils such as light to medium clays and shallow soil sites (500mm minimum soil depth);
- The water balance was calculated using Darkes Forest (Kintyre) Station rainfall data, and the Sydney Airport AMO evaporation station data, sourced from the Bureau of Meteorology. This method adopts a percolation rate of 21 mm/week for sandy clay loam soils (category 4 soil). Note that the site inspection noted category 2 soils were more likely to be found in the proposed effluent disposal area, which would allow a percolation rate of 35 mm/week. For sizing of the LPED system we have selected the more conservative case for category 4 soil. Using this conservative method, the required irrigation area is 1317 m^2.
- The phosphorus balance assumes the AWTS will reduce total phosphorus to 15 mg/L. This method is based on a design life span of 50 years, and a soil phosphorus absorption of 669 mg/kg (see Table 4-4), which equates to 4,192 kg/ha. With a critical loading rate of 3.3 mg/m^2/day, and an expected phosphorus concentration of 15 mg/L to be generated from the AWTS, the phosphorus balance requires a minimum of 751 m^2 of irrigation area.
- The nitrogen balance assumes the AWTS will reduce total nitrogen to 25 mg/L. Vegetative uptake for unmanaged lawn is assumed to be 120 kg/ha/year, which is equivalent to a loading rate of 33 mg/m^2/day. Based on these variables, the nitrogen balance requires a minimum 999m^2 of irrigation area.

The required irrigation area is the larger of the three methods (most limiting), which has been calculated to be 1,317 m^2 based on hydraulic loading.

Outputs from the spreadsheets used to determine the size of the effluent management areas are attached in Appendix D of this report.

6.3 Required Buffers

The following buffers must be applied when installing onsite wastewater management systems in a Sydney Water Catchment area, when treated to a secondary standard, in accordance with the Sydney Catchment Authority Design and Installation of On-site Wastewater Systems guidelines.

Table 6-1 Required Buffer Distances

Feature	Buffer Zone
Buildings, retaining walls	6.0m
Premises boundaries, paths and walkways, recreation areas	2.0m downslope and where flat, or 4.0m upslope
In ground potable water tanks, in ground swimming pools	15.0m – should not be located upslope of the feature
Permanent and intermittent watercourses	100m from the high water level
Bore or well used for domestic consumption	100m from the high water level
Dam and drainage depression	40m from the high water level

6.4 Selected Irrigation Area

A proposed area for irrigation is shown on the site plan in Appendix A. This area is outside the noted buffer zones and provides the required 1,317m^2.

7 Preliminary NorBE Assessment

A NorBE assessment is used to determine the impact a particular development will have on water quality. Developments within the Sydney Water Catchment are required to have neutral or beneficial impacts. A neutral or beneficial effect on water quality is satisfied if the development:

- has no identifiable potential impact on water quality, or
- will contain any water quality impact on the development site and prevent it from reaching any watercourse, waterbody or drainage depression on the site, or
- will transfer any water quality impact outside the site where it is treated and disposed to standards approved by the consent authority.

The NorBE assessment is typically only applied to developments at the DA stage to ensure the above requirements are met in a final design. Despite this it remains a useful tool under wider circumstances to ensure the protection of water catchment areas. As such this preliminary NorBE assessment aims to determine the suitability of the site for the proposed use so that at planning authorities have confidence that neutral or beneficial water quality outcomes for the Planning Proposal can be satisfied during future detailed design and DA stages.

7.1 Module Classification

A development is determined to achieve NorBE if it complies with the criteria of one of the 5 different modules, depending on the development type. Modules 1 to 4 of the assessment apply to forms of residential developments and subdivisions and can be assessed by Council. Module 5 applies to other forms of development and must be assessed by WaterNSW on an individual basis.

The planning proposal aims to rezone the site to allow adaptive reuse of the former Darkes Forest Mine buildings to develop an apple crushing, fermenting and bottling plant as well as permit cellar door sales, cider tasting, tours, cooking school and ancillary accommodation. Additionally, it is proposed to subdivide the site along the current alignment of Darkes Forest Road, separating the northern and southern sites.

This development will involve elements of the site being used for tourism, accommodation and food services, retail and industry.

Under the NorBE Assessment Guidelines 2015, the use of the site as a tourism or recreation or education facility classifies it as Module 5. Industrial developments are also classified as Module 5. It is therefore assumed that upon submission of a DA the development would be assessed as a Module 5 development by WaterNSW.

However as all wastewater from any apple crushing, fermenting and bottling is to be treated and removed from the water catchment area, there is no foreseeable impact from any industrial processes proposed under the site use.

The *NorBE Assessment Guidelines 2015* states that upon confirmation from WaterNSW, some development types within Module 5 such as tourism development may be assessed by Council under a different Module. As impacts from the proposed development fall within the category of tourism it is proposed that preliminary NorBE assessment of the site be conducted under Module 2 for the purpose of this planning proposal.

Module 2 of the NorBE assessment aims to assess wastewater systems, including design loading and site risks. As the only introduced risk to the water catchment within the proposal is the production of sanitary waste as detailed within the wastewater assessment above, this can be considered suitable as a preliminary approach. Once the final site use and final details for the proposed development are confirmed then the NorBE will need to be updated accordingly in conjunction with detailed engineering design, and issued with a future DA.

7.2 Assessment Results

Following the information provided in the wastewater assessment above, a NorBE assessment has been completed for the relevant controls applied within the Module 2 criteria for sanitary effluent produced at the site. Preliminary designs for the wastewater treatment system have been used in conjunction with the site details provided in the original planning proposal and attached site plans to determine if the proposed land use is acceptable. The below table compares the system and site against the requirements set out in the *NorBE Assessment Guidelines 2015* for Module 2 developments.

Table 7-1 NorBE Module 2 Checklist

No.	Requirement Description	Response
Pre – Assessment Checklist		
1	Is the site of the proposed development in the drinking water catchment?	Yes
2	Is the proposed development consistent with any SCA instruments, restrictions or covenants on the title?	N/A
3	Is the proposed development Crown perpetual leasehold land?	No
4	Does the proposal have an identifiable potential impact on water quality?	Yes
5	To which Development Class does the proposal belong?	Proposed development during construction or operation will involve a discharge of effluent, dust, stormwater or other pollutants
6	Is the documentation complete?	Yes
7	Does the water cycle management study meet SCA requirements?	Yes where applicable
Desktop Assessment		

2.01	Is the on-site wastewater system an emerging technology or non-standard system?	No
2,02	Is the application for the same type of system as recommended in the on-site wastewater management report?	Yes
Site Evaluation		
2.03	Can the proposed effluent management area (EMA) be located within the lot or property, and does it correspond to the proposed location specified and discussed in the report (map or GPS coordinates)?	Yes
2.04	Is the size of the construction area less than 250 square metres?	N/A – Proceed to 2.06
Standard Stormwater and Development Site Risks		
2.06	Does the area to be developed have a slope greater than 20% (11.40)?	No – Proceed to 2.10
2.10	Is the area to be disturbed in the development proposal within a 1% annual exceedance probability (AEP) flood level or flood prone area associated with watercourses and drainage depressions?	No
2.11	Are proposed dwellings or building envelopes, and associated works located within 40 metres of a watercourse or waterbody?	No – Proceed to 2.13
2.13	Will more than 250 square metres of native trees and understorey vegetation be removed on the lot (or each proposed lot if a subdivision) including clearing for roads, dwelling access and Asset Protection Zones (APZ)?	No – Proceed to 2.15
2.15	Do the soils in the area to be developed have a wide-spread salinity or sodicity risk?	No – Proceed to 2.17
2.17	Do any of the proposed construction works associated with the development occur where more than 10% of the soils on the site are dispersive?	No
2.18	Are there any potentially contaminated sites on the lot (or proposed lots if a subdivision)?	The site does contain potential sources of contamination, identified by Cardno 2018 in a detailed site investigation. Appropriate management measures have been included as part of that investigation and further measures are not considered necessary in terms of effluent release.
2.19	For the lot (or each lot in the case of a subdivision), are there any other site	No – Proceed to 2.21

	constraints that may impact on the proposed development?	
2.21	Does the application include a swimming pool?	No
2.22	Does the application include other elements such as dwellings and on-site wastewater systems (in addition to a swimming pool)?	Yes
2.23	Is the proposed wastewater system a pump-out?	No – Proceed to 2.25
2.25	Is the use of the wastewater system intermittent (eg holiday cottage)?	No
2.26	Is the lot size less than 2,000 square metres?	No
2.27	Is the slope of the EMA more than 7% (40)?	No – Proceed to 2.30
2.30	Is the site located in an area with more than 1,200 millimetres annual average rainfall?	No – Sub surface irrigation is proposed
2.31	Is the site subject to severe and prolonged frosts?	No
2.32	Does the soil information provided in the consultant's report for the (potential) EMA generally match observations in the field and SCA soils database?	Yes
2.33	Do the salinity, sodicity or dispersion characteristics of the soil pose major limitations for effluent disposal, as identified in Table 6 of the 'Silver Book' (more than 8 dS/m salinity; more than 10% ESP, and Emerson Aggregate Test Class 1)?	No – Proceed to 2.35
2.35	Is the soil depth for the EMA less than 0.25 metres?	No – Proceed to 2.37
2.37	Is the soil depth less than 0.75 metres or is the dominant soil type a medium or heavy clay?	No
2.38	Is the soil depth less than 0.75 metres or is the dominant soil type a gravel, sand or sandy loam?	Yes – An ETA system is not proposed
2.39	Is the design wastewater loading in the consultant's report consistent with the SCA's requirements of loading determined per number of potential bedrooms and tank or reticulated/bore water supply?	Yes
2.40	Is the system a greywater system?	No
2.41	Are the effluent design loading rates (DLR) or design irrigation rates (DIR) used in the consultant's report consistent with the values for the identified soil description (texture and structure) as per AS/NZS1547:2012?	Yes

2.42	Is a spa bath proposed?	No
2.43	Is the septic tank or aerated wastewater treatment system sized in accordance with the design wastewater load?	Yes
2.44	If the wastewater system involves absorption trenches or beds, are they correctly sized according to the appropriate SCA design wastewater load and DLR as per AS/NZS1547:2012?	N/A
2.45	If the wastewater system involves irrigation, is it correctly sized according to the appropriate SCA design wastewater load and DIR as per AS/NZS1547:2012, and the nutrient and water balance methodology as per 'Silver Book'?	Yes
2.46	If the wastewater system involves a sand mound, is it correctly sized according to Converse and Tyler 2000?	N/A
2.47	If the wastewater system involves an amended soil mound, is it sized correctly according to the relevant design wastewater loading and DLR for the limiting soil layer as per AS/NZS1547:2012?	N/A
2.48	Does the wastewater system involve a dry composting toilet?	No
2.49	Are any water bores licensed for domestic water supply located within 100 metres of the proposed EMA?	No – Proceed to 2.51
2.51	Are there other potential problems with the wastewater system as proposed?	No
2.52	Are there any existing wastewater systems on the lot (or lots in the case of a subdivision)?	Yes – however will remain decommissioned and are therefore not included as part of the treatment of WCMS
2.53	Does the proposed EMA (on all lots if a subdivision) meet the SCA's buffer distances:	Yes
2.54	Does the EMA meet the SCA's setback requirements and any other council setback requirements from buildings, boundaries and swimming pools?	Yes – Proceed to 2.56
WEM Evaluation		
2.69	Does the modelled effluent plume cross the proposed lot boundary or intersect with a watercourse, waterbody or drainage depression?	No – NorBE is satisfied

As can be seen in the table above, by comparing the site and proposed effluent release system against the assessment criteria required as part of a NorBE assessment, the proposed land uses and associated effluents can be managed satisfactorily. Roads/Rights-of-way/Dwelling Access (2.56 – 2.64) and S3QM/MUSIC stormwater requirements (2.65 – 2.68) were not considered as they are not relevant to this proposal and do not assess wastewater effluent release.

The Wastewater Effluent Model (WEM), accessed through the online NorBE tool, was also used to assess the proposed system. The report is attached in Appendix E. Note that in order to run the model for a Module 2 system, the development class was entered as “Existing dwelling/dual occ <8bdrm unsewered”. Other details, including actual effluent parameters used in the model, are as per the details in this report.

The WEM found that the system satisfied NorBE requirements. The effluent plume did not reach a lot boundary, drainage depression, top bank of a water course, another disposal field or within 50m of a drinking water bore.

Following these conclusions the proposal can be considered to satisfy NorBE requirements for the onsite disposal of sanitary waste within the Sydney Drinking Water Catchment.

8 Conclusion

The purpose of this report is to assess whether on site wastewater management can be undertaken on the proposed development to achieve the relevant NorBE assessment criteria. This assessment concludes that on site wastewater management can be undertaken for the proposed development and that it will be possible to achieve NorBE for the proposed uses outlined in the Planning Proposal (PP-2016/4).

It is important to note that a final NorBE requires full detailed design and a complete concept description of any proposed development and therefore would need to be submitted with any future DA for works or activities occurring within the Sydney Drinking Water Catchment Area of the site.

The assessment was based on the use of an AWTS for collection and secondary treatment and a LPED irrigation system.

9 Recommendations

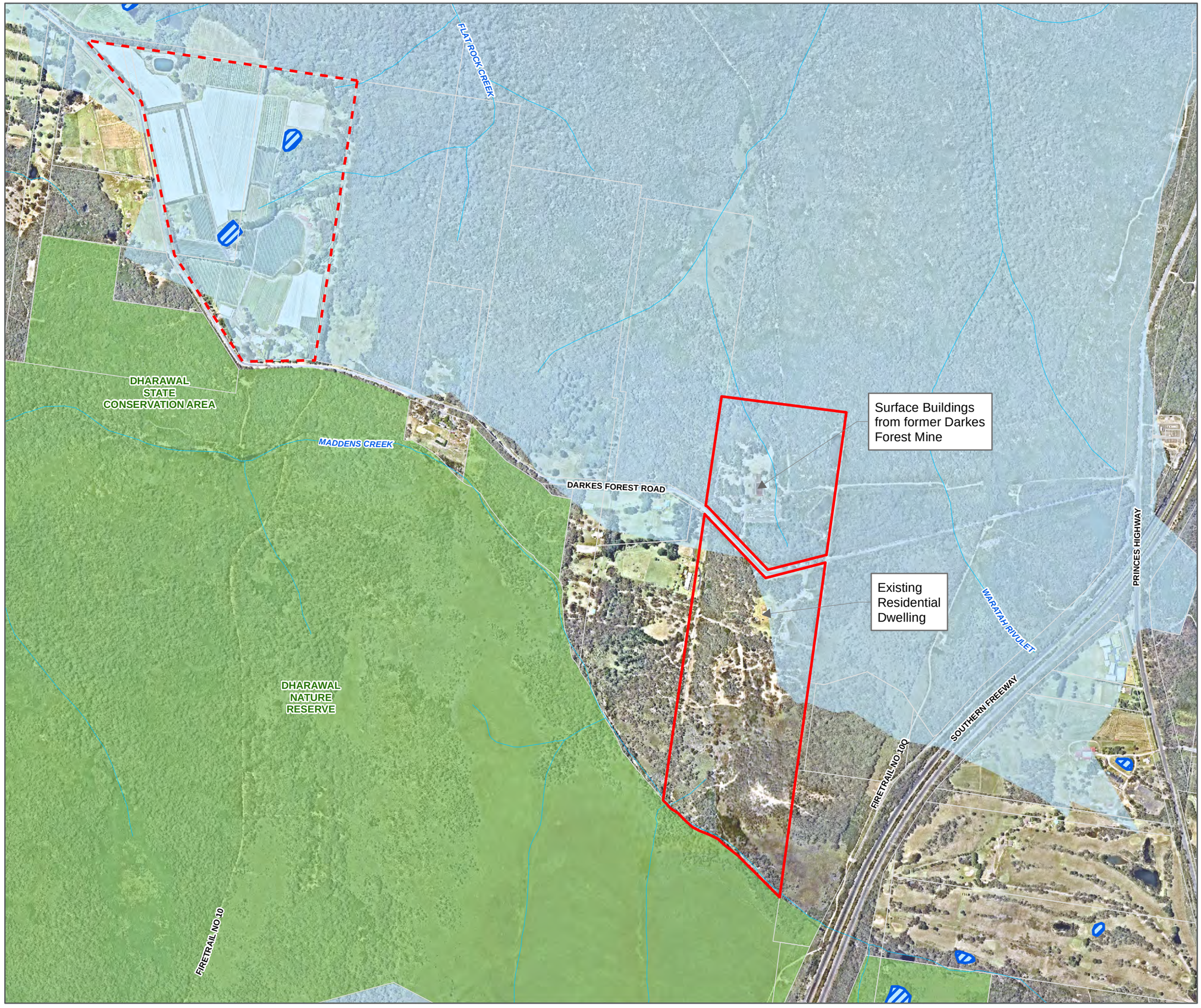
This report recommends the following:

- Installation of an AWTS with a capacity of 2000L/day for the proposed development
- Installation of a minimum of 1317m^2 of subsoil irrigation disposal system, with respect to the relevant setback distances and installed in accordance with AS/NZS 1547:2012
- The appropriate buffers and setback distances must be applied to future design and site operation.
- Although the preliminary NorBE provides confidence that water quality objectives can be met for the purposes of this Planning Proposal stage, an updated NorBE assessment should be completed as part of the future detailed design and DA to assess the final wastewater treatment system. The updated NorBE would be prepared in accordance with the *Neutral or Beneficial Effect on Water Quality Assessment Guideline 2015,* to address appropriate assessment criteria and may require liaison with WaterNSW, depending on final use and associated NorBE assessment module classifications determined, which will need to be identified at a future DA stage.

APPENDIX

A

SITE CONCEPT PLAN



Location Plan

DARKES FOREST, NSW

Legend

- Site Boundary
- Glenbernie Orchard Site Boundary
- Watercourses (LPI)
- Waterbodies (LPI)
- Cadastre (LPI, 2015)
- NPWS Reserve (LPI, 2011)
- Woronora Catchment Special Area (SCA, 2008)

FIGURE 2-1

1:10,000 Scale at A3

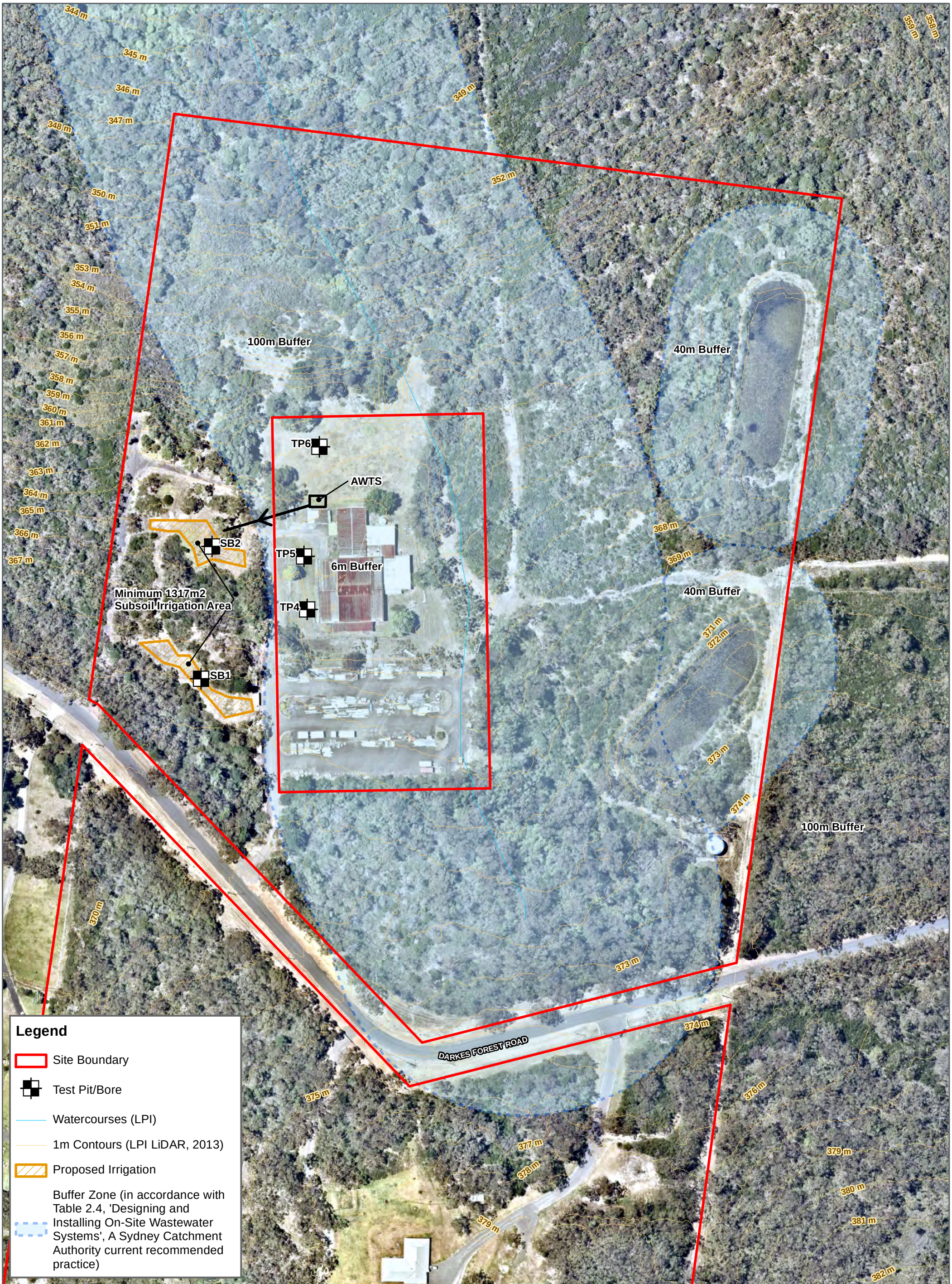
Metres

0 100 200 300 400

N

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2016-05-09
Coordinate System: GDA 1994 MGA Zone 56
Project: 82014085_002
Map: 8201408502-GS-006-Location Plan.mxd 01
Aerial imagery supplied by nearmap (December, 2015)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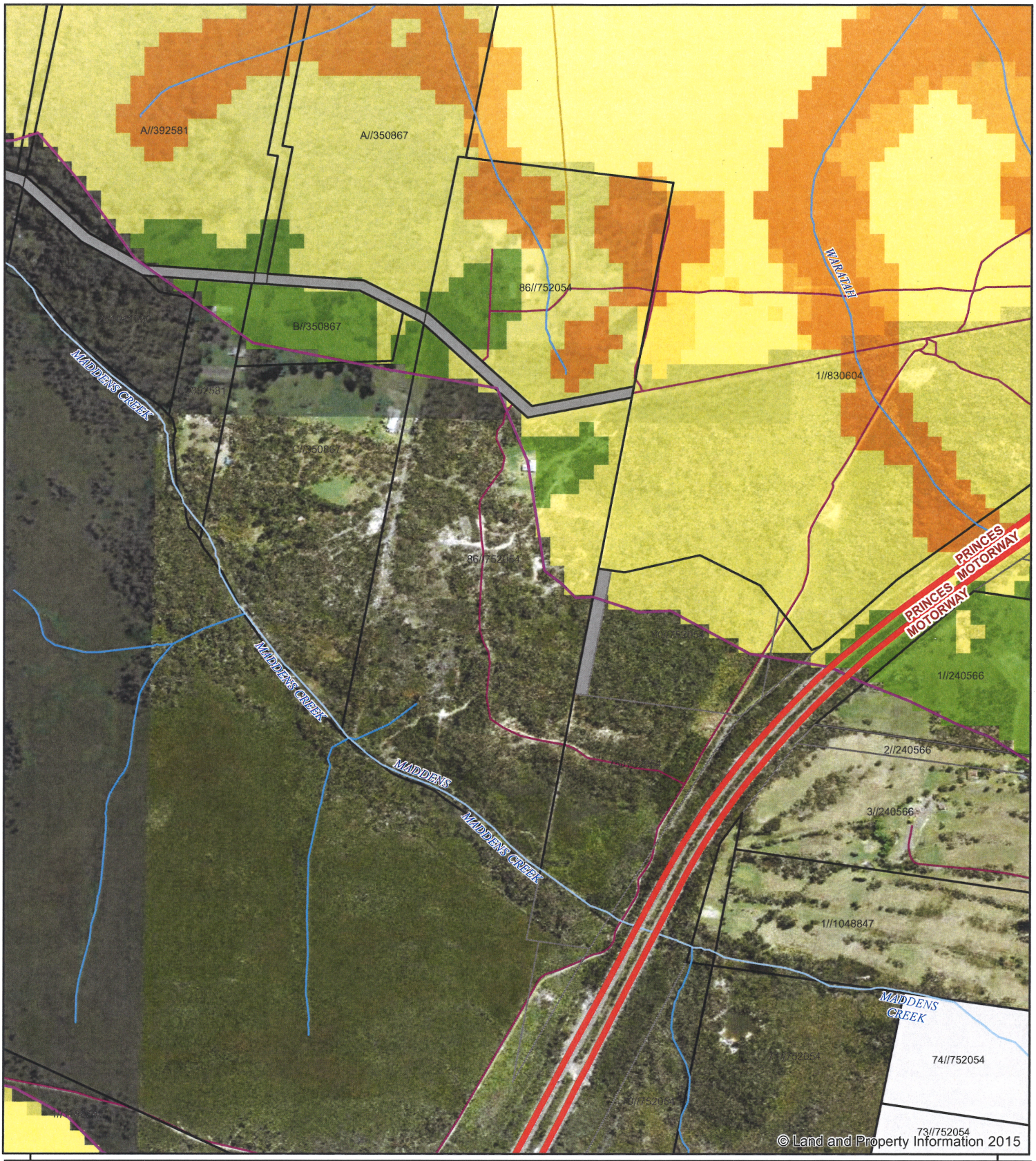
376 m
377 m
378 m
379 m
380 m
381 m
382 m
358 m
359 m
100m Buffer
40m Buffer
TP6
AWTS
SB2
TP5
6m Buffer
Minimum 1317m2
Subsoil Irrigation Area
TP4
SB1
40m Buffer
100m Buffer
DARKES FOREST ROAD
Legend
Site Boundary
Test Pit/Bore
Watercourses (LPI)
1m Contours (LPI LiDAR, 2013)
Proposed Irrigation
Buffer Zone (in accordance with Table 2.4, 'Designing and Installing On-Site Wastewater Systems', A Sydney Catchment Authority current recommended practice)
1:1,750 Scale at A3
m
0
20
40
60
80
On-Site Wastewater Site Plan
DARKES FOREST, NSW
N
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2018-05-30 Project: 8201408502-01
Coordinate System: GDA 1994 MGA Zone 56
Map: 8201408502-GS-015-WastewaterSitePlan.mxd 01
Aerial imagery supplied by nearmap (December, 2015)

APPENDIX B

SLWCA MAP



SLWCA Retail/Commercial and Light Industrial

Disclaimer:

This map was compiled by the Sydney Catchment Authority, GIS Unit, using data believed to be accurate, however, a degree of error is inherent in all maps or geographic information. The information contained in this map is distributed "AS-IS" without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability to a particular purpose of use. The maps are intended for use only at the published scale. The Sydney Catchment Authority will accept no liability for consequential and indirect damages arising from the use of its map products.

Sydney Catchment Authority
Catchment Information Group
PO Box 323
PENRITH NSW 2751
http://www.sca.nsw.gov.au

SYDNEY CATCHMENT AUTHORITY

SLWCA Risk to water quality

- Low
- Moderate
- High
- Extreme

N

0 125 250 500 M

Map Properties
Created By: Patrick Kelly
Date: 18 August 2016
Size: A4

APPENDIX

C

SOIL TESTING RESULTS

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1805566**	Page	: 1 of 25
Amendment	: **1**		
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Mitch Blencowe	Contact	: Customer Services ES
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9496 7700	Telephone	: +61-2-8784 8555
Project	: 8201408502	Date Samples Received	: 21-Feb-2018 19:00
Order number	: ----	Date Analysis Commenced	: 22-Feb-2018
C-O-C number	: ----	Issue Date	: 20-Mar-2018 12:13
Sampler	: SH		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 40		
No. of samples analysed	: 25		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW
Shaun Spooner	Asbestos Identifier	Newcastle - Asbestos, Mayfield West, NSW

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.

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

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

- EG035: Positive Hg results for ES1805566 # 37 have been confirmed by reanalysis
- Amendment (20/03/2018): This report has been amended and re-released to report additional metals (B, Mo, Se) for samples 19, 22, 24 and 26 in this workorder as requested by M.B.
- EA200N: Asbestos weights and percentages are not covered under the Scope of NATA Accreditation.
  Weights of Asbestos are based on extracted bulk asbestos, fibre bundles, and/or ACM and do not include respirable fibres (if present)
  The Asbestos (Fines and Fibrous) weight is calculated from the extracted Fibrous Asbestos and Asbestos Fines as an equivalent weight of 100% Asbestos
  Percentages for Asbestos content in ACM are based on the 2013 NEPM default values.
  All calculations of percentage Asbestos under this method are approximate and should be used as a guide only.
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Trace' - Asbestos fibres ("Free Fibres") detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200 Legend
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.
- EA200N: ALS laboratory procedures and methods used for the identification and quantitation of asbestos are consistent with AS4964-2004 and the requirements of the 2013 NEPM for Assessment of Site Contamination
- EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR.
  Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EA200: For samples larger than 30g, the <2mm fraction may be sub-sampled prior to trace analysis as outlined in ISO23909:2008(E) Sect 6.3.2-2
- EA200: 'Yes' - Asbestos detected by polarised light microscopy including dispersion staining.
- EA200: 'No*' - No asbestos found, at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining. Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg.
- EA200: 'No' - No asbestos found at the reporting limit 0.1g/kg, by polarised light microscopy including dispersion staining.

- ALS is not NATA accredited for the analysis of bulk density in a soil matrix.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP1_0.0-0.1	TP1_0.5-0.6	TP2_0.15-0.2	TP2_0.5-0.6	TP3_0.0-0.1
			Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit	ES1805566-001	ES1805566-002	ES1805566-005	ES1805566-006	ES1805566-008
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	20.4	7.3	10.2	8.8	18.3
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	No	----	----	No	No
Asbestos (Trace)	1332-21-4	5	Fibres	No	----	----	No	No
Asbestos Type	1332-21-4	-	--	-	----	----	-	-
Sample weight (dry)	----	0.01	g	575	----	----	1220	513
APPROVED IDENTIFIER:	----	-	--	C.OWLER	----	----	C.OWLER	C.OWLER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	<0.0004	----	----	<0.0004	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	<0.001	----	----	<0.001	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	0.575	----	----	1.22	0.513
ø Fibrous Asbestos >7mm	----	0.0004	g	<0.0004	----	----	<0.0004	<0.0004
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	5	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	7	5	5	7	8
Copper	7440-50-8	5	mg/kg	89	21	13	<5	<5
Lead	7439-92-1	5	mg/kg	70	14	16	<5	16
Nickel	7440-02-0	2	mg/kg	5	11	8	<2	2
Zinc	7440-66-6	5	mg/kg	257	34	26	<5	13
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	<0.1	----	<0.1	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	<0.05	----	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	<0.05	----	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	----	<0.05	----	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	----	<0.05	----	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	----	<0.05	----	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg	----	<0.05	----	<0.05	----
Aldrin	309-00-2	0.05	mg/kg	----	<0.05	----	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	<0.05	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP1_0.0-0.1	TP1_0.5-0.6	TP2_0.15-0.2	TP2_0.5-0.6	TP3_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-001	ES1805566-002	ES1805566-005	ES1805566-006	ES1805566-008
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
^ Total Chlordane (sum)	----	0.05	mg/kg		----	<0.05	----	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg		----	<0.05	----	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		----	<0.05	----	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg		----	<0.05	----	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg		----	<0.05	----	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg		----	<0.05	----	<0.05	----
Endrin	72-20-8	0.05	mg/kg		----	<0.05	----	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		----	<0.05	----	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		----	<0.05	----	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg		----	<0.05	----	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		----	<0.05	----	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		----	<0.05	----	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg		----	<0.2	----	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg		----	<0.05	----	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg		----	<0.2	----	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		----	<0.05	----	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg		----	<0.05	----	<0.05	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		----	<0.05	----	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	<0.05	----	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg		----	<0.2	----	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg		----	<0.05	----	<0.05	----
Diazinon	333-41-5	0.05	mg/kg		----	<0.05	----	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	<0.05	----	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg		----	<0.2	----	<0.2	----
Malathion	121-75-5	0.05	mg/kg		----	<0.05	----	<0.05	----
Fenthion	55-38-9	0.05	mg/kg		----	<0.05	----	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	<0.05	----	<0.05	----
Parathion	56-38-2	0.2	mg/kg		----	<0.2	----	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	<0.05	----	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	<0.05	----	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	<0.05	----	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg		----	<0.05	----	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg		----	<0.05	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP1_0.0-0.1	TP1_0.5-0.6	TP2_0.15-0.2	TP2_0.5-0.6	TP3_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-001	ES1805566-002	ES1805566-005	ES1805566-006	ES1805566-008
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Ethion	563-12-2	0.05	mg/kg		----	<0.05	----	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg		----	<0.05	----	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg		----	<0.05	----	<0.05	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	**0.6**	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	**0.6**	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	**10**	**15**	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	**12**	**16**	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	**11**	**14**	<10	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP1_0.0-0.1	TP1_0.5-0.6	TP2_0.15-0.2	TP2_0.5-0.6	TP3_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-001	ES1805566-002	ES1805566-005	ES1805566-006	ES1805566-008
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	**0.7**	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	**0.9**	**1.8**	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	**0.9**	**2.5**	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	**0.9**	**1.8**	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		----	**76.4**	----	**75.0**	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	**83.6**	----	**106**	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	**77.0**	----	**63.7**	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**96.7**	**95.6**	**97.4**	**92.5**	**90.4**
2-Chlorophenol-D4	93951-73-6	0.5	%		**76.4**	**76.6**	**78.2**	**76.7**	**74.0**
2.4.6-Tribromophenol	118-79-6	0.5	%		**70.0**	**55.2**	**64.4**	**54.5**	**52.9**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**84.0**	**84.3**	**89.2**	**83.8**	**76.1**
Anthracene-d10	1719-06-8	0.5	%		**86.0**	**85.3**	**91.4**	**87.8**	**85.3**
4-Terphenyl-d14	1718-51-0	0.5	%		**79.1**	**90.9**	**92.8**	**93.0**	**86.4**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**94.9**	**85.3**	**87.7**	**96.5**	**88.9**
Toluene-D8	2037-26-5	0.2	%		**102**	**93.8**	**98.7**	**104**	**95.2**
4-Bromofluorobenzene	460-00-4	0.2	%		**99.1**	**88.4**	**90.2**	**102**	**93.6**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP4_0.0-0.1	TP5_0.0-0.1	TP5_0.5-0.6	TP5_1.0-1.1	TP6_0.0-0.1
			Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit	ES1805566-010	ES1805566-012	ES1805566-013	ES1805566-014	ES1805566-015
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	11.1	17.6	----	8.0	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	No	----	No	----	No
Asbestos (Trace)	1332-21-4	5	Fibres	No	----	No	----	No
Asbestos Type	1332-21-4	-	--	-	----	-	----	-
Sample weight (dry)	----	0.01	g	667	----	728	----	954
APPROVED IDENTIFIER:	----	-	--	C.OWLER	----	C.OWLER	----	C.OWLER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	<0.0004	----	<0.0004	----	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	<0.001	----	<0.001	----	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	0.667	----	0.728	----	0.954
ø Fibrous Asbestos >7mm	----	0.0004	g	<0.0004	----	<0.0004	----	<0.0004
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	----	<5	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	<1	----
Chromium	7440-47-3	2	mg/kg	4	4	----	5	----
Copper	7440-50-8	5	mg/kg	<5	7	----	22	----
Lead	7439-92-1	5	mg/kg	19	8	----	11	----
Nickel	7440-02-0	2	mg/kg	<2	3	----	18	----
Zinc	7440-66-6	5	mg/kg	20	26	----	39	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	----	<0.1	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	----	----	----	<0.1	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	----	----	----	<0.05	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	----	----	----	<0.05	----
beta-BHC	319-85-7	0.05	mg/kg	----	----	----	<0.05	----
gamma-BHC	58-89-9	0.05	mg/kg	----	----	----	<0.05	----
delta-BHC	319-86-8	0.05	mg/kg	----	----	----	<0.05	----
Heptachlor	76-44-8	0.05	mg/kg	----	----	----	<0.05	----
Aldrin	309-00-2	0.05	mg/kg	----	----	----	<0.05	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	----	----	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP4_0.0-0.1	TP5_0.0-0.1	TP5_0.5-0.6	TP5_1.0-1.1	TP6_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-010	ES1805566-012	ES1805566-013	ES1805566-014	ES1805566-015
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
^ Total Chlordane (sum)	----	0.05	mg/kg		----	----	----	<0.05	----
trans-Chlordane	5103-74-2	0.05	mg/kg		----	----	----	<0.05	----
alpha-Endosulfan	959-98-8	0.05	mg/kg		----	----	----	<0.05	----
cis-Chlordane	5103-71-9	0.05	mg/kg		----	----	----	<0.05	----
Dieldrin	60-57-1	0.05	mg/kg		----	----	----	<0.05	----
4.4`-DDE	72-55-9	0.05	mg/kg		----	----	----	<0.05	----
Endrin	72-20-8	0.05	mg/kg		----	----	----	<0.05	----
beta-Endosulfan	33213-65-9	0.05	mg/kg		----	----	----	<0.05	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		----	----	----	<0.05	----
4.4`-DDD	72-54-8	0.05	mg/kg		----	----	----	<0.05	----
Endrin aldehyde	7421-93-4	0.05	mg/kg		----	----	----	<0.05	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg		----	----	----	<0.05	----
4.4`-DDT	50-29-3	0.2	mg/kg		----	----	----	<0.2	----
Endrin ketone	53494-70-5	0.05	mg/kg		----	----	----	<0.05	----
Methoxychlor	72-43-5	0.2	mg/kg		----	----	----	<0.2	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		----	----	----	<0.05	----
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-2	0.05	mg/kg		----	----	----	<0.05	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		----	----	----	<0.05	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		----	----	----	<0.05	----
Monocrotophos	6923-22-4	0.2	mg/kg		----	----	----	<0.2	----
Dimethoate	60-51-5	0.05	mg/kg		----	----	----	<0.05	----
Diazinon	333-41-5	0.05	mg/kg		----	----	----	<0.05	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		----	----	----	<0.05	----
Parathion-methyl	298-00-0	0.2	mg/kg		----	----	----	<0.2	----
Malathion	121-75-5	0.05	mg/kg		----	----	----	<0.05	----
Fenthion	55-38-9	0.05	mg/kg		----	----	----	<0.05	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		----	----	----	<0.05	----
Parathion	56-38-2	0.2	mg/kg		----	----	----	<0.2	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		----	----	----	<0.05	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		----	----	----	<0.05	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		----	----	----	<0.05	----
Fenamiphos	22224-92-6	0.05	mg/kg		----	----	----	<0.05	----
Prothiofos	34643-46-4	0.05	mg/kg		----	----	----	<0.05	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP4_0.0-0.1	TP5_0.0-0.1	TP5_0.5-0.6	TP5_1.0-1.1	TP6_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-010	ES1805566-012	ES1805566-013	ES1805566-014	ES1805566-015
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Ethion	563-12-2	0.05	mg/kg		----	----	----	<0.05	----
Carbophenothion	786-19-6	0.05	mg/kg		----	----	----	<0.05	----
Azinphos Methyl	86-50-0	0.05	mg/kg		----	----	----	<0.05	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	----	**0.6**	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	----	**1.2**	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	----	<10	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	----	<50	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	----	<100	----
C29 - C36 Fraction	----	100	mg/kg		<100	<100	----	<100	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	----	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	----	**11**	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	----	<10	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP4_0.0-0.1	TP5_0.0-0.1	TP5_0.5-0.6	TP5_1.0-1.1	TP6_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-010	ES1805566-012	ES1805566-013	ES1805566-014	ES1805566-015
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	----	<50	----
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	----	<100	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	----	<100	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	----	<50	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	----	<50	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	<0.2	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	----	0.7	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	----	1.8	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	----	<0.5	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	2.5	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	----	1.8	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	----	<1	----
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		----	----	----	81.6	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		----	----	----	116	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		----	----	----	65.5	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		95.9	88.8	----	92.7	----
2-Chlorophenol-D4	93951-73-6	0.5	%		77.2	72.9	----	76.6	----
2.4.6-Tribromophenol	118-79-6	0.5	%		48.9	53.4	----	44.4	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		76.8	82.5	----	87.0	----
Anthracene-d10	1719-06-8	0.5	%		80.1	81.7	----	86.3	----
4-Terphenyl-d14	1718-51-0	0.5	%		81.0	83.2	----	102	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		99.1	89.3	----	92.6	----
Toluene-D8	2037-26-5	0.2	%		107	100	----	104	----
4-Bromofluorobenzene	460-00-4	0.2	%		104	93.0	----	97.7	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP6_0.5-0.6	TP7_0.0-0.1	TP7_0.5-0.6	TP7_2.0-2.1	TP8_0.0-0.1
			Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit	ES1805566-016	ES1805566-019	ES1805566-020	ES1805566-022	ES1805566-024
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	8.9	22.4	8.1	12.7	17.2
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	----	No	----	No
Asbestos (Trace)	1332-21-4	5	Fibres	----	----	No	----	No
Asbestos Type	1332-21-4	-	--	----	----	-	----	-
Sample weight (dry)	----	0.01	g	----	----	1080	----	784
APPROVED IDENTIFIER:	----	-	--	----	----	S.SPOONER	----	S.SPOONER
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	----	<0.0004	----	<0.0004
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	----	<0.001	----	<0.001
ø Weight Used for % Calculation	----	0.0001	kg	----	----	1.08	----	0.784
ø Fibrous Asbestos >7mm	----	0.0004	g	----	----	<0.0004	----	<0.0004
EG005T: Total Metals by ICP-AES								
Boron	7440-42-8	50	mg/kg	----	<50	----	<50	<50
Molybdenum	7439-98-7	2	mg/kg	----	<2	----	<2	<2
Selenium	7782-49-2	5	mg/kg	----	<5	----	<5	<5
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	7	25	24	20	25
Copper	7440-50-8	5	mg/kg	21	25	27	18	30
Lead	7439-92-1	5	mg/kg	126	16	12	23	65
Nickel	7440-02-0	2	mg/kg	3	31	27	19	18
Zinc	7440-66-6	5	mg/kg	113	58	37	43	98
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP6_0.5-0.6	TP7_0.0-0.1	TP7_0.5-0.6	TP7_2.0-2.1	TP8_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-016	ES1805566-019	ES1805566-020	ES1805566-022	ES1805566-024
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
Heptachlor	76-44-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	----	<0.05	<0.05	**0.09**
^ **Total Chlordane (sum)**	----	0.05	mg/kg		**0.08**	----	<0.05	<0.05	**0.09**
trans-Chlordane	5103-74-2	0.05	mg/kg		**0.08**	----	<0.05	<0.05	**0.09**
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg		**0.13**	----	<0.05	<0.05	**0.09**
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg		**0.13**	----	<0.05	<0.05	**0.09**
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	----	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP6_0.5-0.6	TP7_0.0-0.1	TP7_0.5-0.6	TP7_2.0-2.1	TP8_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-016	ES1805566-019	ES1805566-020	ES1805566-022	ES1805566-024
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	----	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		**0.7**	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		**0.7**	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		**1.4**	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	**18**	<10
C10 - C14 Fraction	----	50	mg/kg		**50**	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		**50**	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP6_0.5-0.6	TP7_0.0-0.1	TP7_0.5-0.6	TP7_2.0-2.1	TP8_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-016	ES1805566-019	ES1805566-020	ES1805566-022	ES1805566-024
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	**20**	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	**16**	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	**0.6**	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	**3.0**	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	**3.6**	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	**3.0**	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**83.9**	**----**	**82.3**	**73.8**	**102**
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**109**	**----**	**106**	**105**	**104**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**61.3**	**----**	**65.5**	**70.9**	**87.0**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**95.9**	**86.4**	**89.1**	**84.6**	**92.9**
2-Chlorophenol-D4	93951-73-6	0.5	%		**82.2**	**70.0**	**75.9**	**72.6**	**74.5**
2.4.6-Tribromophenol	118-79-6	0.5	%		**54.0**	**50.7**	**46.3**	**48.7**	**59.8**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**92.1**	**77.1**	**75.6**	**80.6**	**85.3**
Anthracene-d10	1719-06-8	0.5	%		**89.9**	**76.5**	**83.4**	**85.0**	**83.9**
4-Terphenyl-d14	1718-51-0	0.5	%		**99.4**	**90.5**	**93.0**	**98.3**	**98.3**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**99.3**	**93.0**	**102**	**100.0**	**95.4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP6_0.5-0.6	TP7_0.0-0.1	TP7_0.5-0.6	TP7_2.0-2.1	TP8_0.0-0.1
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-016	ES1805566-019	ES1805566-020	ES1805566-022	ES1805566-024
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued									
Toluene-D8	2037-26-5	0.2	%		**109**	**99.3**	**108**	**99.8**	**95.4**
4-Bromofluorobenzene	460-00-4	0.2	%		**104**	**95.3**	**105**	**99.6**	**93.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TP8_1.0-1.1	TP9_0.0-0.1	TP9_1.0-1.1	TP10_0.0-0.1	TP10_0.5-0.6
			Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit	ES1805566-026	ES1805566-029	ES1805566-031	ES1805566-033	ES1805566-034
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	11.2	15.0	19.9	----	13.5
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	No	----	No	----
Asbestos (Trace)	1332-21-4	5	Fibres	----	No	----	No	----
Asbestos Type	1332-21-4	-	--	----	-	----	-	----
Sample weight (dry)	----	0.01	g	----	762	----	978	----
APPROVED IDENTIFIER:	----	-	--	----	S.SPOONER	----	S.SPOONER	----
EA200N: Asbestos Quantification (non-NATA)								
ø Asbestos (Fines and Fibrous <7mm)	1332-21-4	0.0004	g	----	<0.0004	----	<0.0004	----
ø Asbestos (Fines and Fibrous FA+AF)	----	0.001	% (w/w)	----	<0.001	----	<0.001	----
ø Weight Used for % Calculation	----	0.0001	kg	----	0.762	----	0.978	----
ø Fibrous Asbestos >7mm	----	0.0004	g	----	<0.0004	----	<0.0004	----
EG005T: Total Metals by ICP-AES								
Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
Molybdenum	7439-98-7	2	mg/kg	<2	----	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	<1
Chromium	7440-47-3	2	mg/kg	12	7	9	----	8
Copper	7440-50-8	5	mg/kg	8	6	<5	----	<5
Lead	7439-92-1	5	mg/kg	27	10	7	----	10
Nickel	7440-02-0	2	mg/kg	6	<2	<2	----	<2
Zinc	7440-66-6	5	mg/kg	329	33	<5	----	16
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	<0.1	----	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	<0.05	----	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	<0.05	----	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	<0.05	----	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	<0.05	----	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	<0.05	----	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP8_1.0-1.1	TP9_0.0-0.1	TP9_1.0-1.1	TP10_0.0-0.1	TP10_0.5-0.6
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-026	ES1805566-029	ES1805566-031	ES1805566-033	ES1805566-034
					Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued									
Heptachlor	76-44-8	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Aldrin	309-00-2	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg		**0.06**	----	<0.05	----	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg		**0.06**	----	<0.05	----	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Dieldrin	60-57-1	0.05	mg/kg		**0.06**	----	<0.05	----	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Endrin	72-20-8	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg		**0.06**	----	<0.05	----	<0.05
^ Sum of DDD + DDE + DDT	72-54-8/72-55-9/50-29-2	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
Dimethoate	60-51-5	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Diazinon	333-41-5	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
Malathion	121-75-5	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Fenthion	55-38-9	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Parathion	56-38-2	0.2	mg/kg		<0.2	----	<0.2	----	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	----	<0.05	----	<0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP8_1.0-1.1	TP9_0.0-0.1	TP9_1.0-1.1	TP10_0.0-0.1	TP10_0.5-0.6
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-026	ES1805566-029	ES1805566-031	ES1805566-033	ES1805566-034
					Result	Result	Result	Result	Result
EP068B: Organophosphorus Pesticides (OP) - Continued									
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Ethion	563-12-2	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	----	<0.05	----	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	----	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	----	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	----	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	----	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	----	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	----	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP8_1.0-1.1	TP9_0.0-0.1	TP9_1.0-1.1	TP10_0.0-0.1	TP10_0.5-0.6
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-026	ES1805566-029	ES1805566-031	ES1805566-033	ES1805566-034
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	----	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg		<10	<10	<10	----	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	----	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	----	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	----	<100
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg		<50	<50	<50	----	<50
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg		<50	<50	<50	----	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	----	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	**1.1**	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
^ **Sum of BTEX**	----	0.2	mg/kg		<0.2	<0.2	**1.1**	----	<0.2
^ **Total Xylenes**	----	0.5	mg/kg		<0.5	<0.5	<0.5	----	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	----	<1
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**75.6**	----	**93.8**	----	**106**
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.05	%		**118**	----	**105**	----	**114**
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.05	%		**93.5**	----	**63.0**	----	**91.9**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**88.9**	**87.2**	**96.6**	----	**84.2**
2-Chlorophenol-D4	93951-73-6	0.5	%		**74.3**	**76.1**	**77.6**	----	**73.4**
2.4.6-Tribromophenol	118-79-6	0.5	%		**51.6**	**53.4**	**56.7**	----	**48.4**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**82.0**	**80.9**	**84.4**	----	**81.0**
Anthracene-d10	1719-06-8	0.5	%		**77.7**	**87.5**	**85.0**	----	**81.8**
4-Terphenyl-d14	1718-51-0	0.5	%		**121**	**100**	**99.0**	----	**122**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**96.6**	**95.9**	**101**	----	**101**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TP8_1.0-1.1	TP9_0.0-0.1	TP9_1.0-1.1	TP10_0.0-0.1	TP10_0.5-0.6
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-026	ES1805566-029	ES1805566-031	ES1805566-033	ES1805566-034
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued									
Toluene-D8	2037-26-5	0.2	%		**99.9**	**98.5**	**104**	**----**	**104**
4-Bromofluorobenzene	460-00-4	0.2	%		**100**	**96.8**	**102**	**----**	**103**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	QA100	QA200	TP4	TP5	TP6
			Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit	ES1805566-036	ES1805566-037	ES1805566-038	ES1805566-039	ES1805566-040
				Result	Result	Result	Result	Result
EA051 : Bulk Density								
ø **Bulk Density**	BULK_DENSITY	1	kg/m3	----	----	**2240**	**1880**	**2170**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**14.9**	**22.5**	----	----	----
EA058: Emerson Aggregate Test								
Color (Munsell)	----	-	-	----	----	**Light Grey**	**Black**	**Very Dark Grey**
Texture	----	-	-	----	----	**Loamy Sand**	**Gravelly Sand**	**Sandy Clay Loam**
Emerson Class Number	EC/TC	-	-	----	----	**4**	**8**	**4**
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	**7**	**10**	----	----	----
Copper	7440-50-8	5	mg/kg	**94**	<5	----	----	----
Lead	7439-92-1	5	mg/kg	**68**	**16**	----	----	----
Nickel	7440-02-0	2	mg/kg	**5**	**2**	----	----	----
Zinc	7440-66-6	5	mg/kg	**265**	**12**	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	**0.2**	----	----	----
EK072: Phosphate Sorption Capacity								
Phosphate Sorption Capacity	----	250	mg P sorbed/kg	----	----	**536**	**669**	**957**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	QA100	QA200	TP4	TP5	TP6
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-036	ES1805566-037	ES1805566-038	ES1805566-039	ES1805566-040
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	<100	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	<100	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**94.8**	**93.1**	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	QA100	QA200	TP4	TP5	TP6
				Client sampling date / time	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00	20-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1805566-036	ES1805566-037	ES1805566-038	ES1805566-039	ES1805566-040
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	0.5	%		**76.7**	**75.0**	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		**61.9**	**62.3**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**84.3**	**85.4**	----	----	----
Anthracene-d10	1719-06-8	0.5	%		**80.5**	**86.9**	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		**113**	**98.6**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**103**	**92.5**	----	----	----
Toluene-D8	2037-26-5	0.2	%		**103**	**96.6**	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**100**	**93.7**	----	----	----

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in Soils		
EA200: Description	TP1_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP2_0.5-0.6 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP3_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP4_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP5_0.5-0.6 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP6_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP7_0.5-0.6 - 20-Feb-2018 00:00	Mid grey sandy soil.
EA200: Description	TP8_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP9_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.
EA200: Description	TP10_0.0-0.1 - 20-Feb-2018 00:00	Mid brown sandy soil.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1809276**	Page	: 1 of 2
Client	: **CARDNO (NSW/ACT) PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Mitch Blencowe	Contact	: Customer Services ES
Address	: Level 9 The Forum 203 Pacific Highway St Leonards NSW 2065	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9496 7700	Telephone	: +61-2-8784 8555
Project	: 8201408502	Date Samples Received	: 28-Mar-2018 16:20
Order number	:	Date Analysis Commenced	: 29-Mar-2018
C-O-C number	: ----	Issue Date	: 03-Apr-2018 09:35
Sampler	: SH		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dian Dao		Sydney Inorganics, Smithfield, NSW

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.

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

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

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**TP4-0.6**	**TP5-1.2**	**TP6-1.2**	**----**	**----**
			Client sampling date / time	20-Mar-2018 00:00	20-Mar-2018 00:00	20-Mar-2018 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1809276-001**	**ES1809276-002**	**ES1809276-003**	**--------**	**--------**
				Result	Result	Result	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**5.6**	**7.5**	**8.3**	**----**	**----**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**55**	**43**	**109**	**----**	**----**

APPENDIX

D

WATER BALANCE CALCULATIONS

Monthly Water Balance - Nominated Irrigation Land Area

Design Wastewater Flow (Q)	1314.4	l/day	
Design Percolation Rate (R)	21	mm/wk	From Table M1 of AS1547 - 3mm/day x 7 - Soil category 4 - Sandy Clay Loam (worst case scenario out of test pits)
Nominated Land Area (L)	1316.59	m2	Min area for no storage requirements (USE GOALSEEK FUNCTION - SET F30 to 0 BY CHANGING C5)

PARAMETER	SYMBOL	FORMULA	UNITS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	
Days in month	D	-	days	31	28	31	30	31	30	31	31	30	31	30	31	365	
Precipitation	P	-	mm/month	101.3	106.2	110.3	83.1	78.1	93.8	62.5	47.2	54.9	59.5	80.8	75.3	953	BOM - MEDIAN YEAR FROM 1894-2017 DATA
Evaporation	E	-	mm/month	226.3	182	167.4	126	93	75	83.7	114.7	147	186	198	229.4	1828.5	BOM
Crop Factor	C	-		0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	-	Crop factor from "Use of Effluent for Irrigation", Department of Env
OUTPUTS																	
Evapotranspiration	ET	E X C	mm/month	158.4	127.4	117.2	75.6	46.5	33.8	33.5	51.6	80.9	120.9	138.6	160.6	1144.9	
Percolation	B	(R / 7) X D	mm/month	93.0	84.0	93.0	90.0	93.0	90.0	93.0	93.0	90.0	93.0	90.0	93.0	1095.0	
Outputs		ET + B	mm/month	251.4	211.4	210.2	165.6	139.5	123.8	126.5	144.6	170.9	213.9	228.6	253.6	2239.9	
INPUTS																	
Precipitation	P		mm/month	101.3	106.2	110.3	83.1	78.1	93.8	62.5	47.2	54.9	59.5	80.8	75.3	953	
Possible Effluent Irrigation	W	(Q x D) / L	mm/month	30.9	28.0	30.9	30.0	30.9	30.0	30.9	30.9	30.0	30.9	30.0	30.9	364.4	= H
Inputs		P+W	mm/month	132.2	134.2	141.2	113.1	109.0	123.8	93.4	78.1	84.9	90.4	110.8	106.2	1317.4	
Storage	S	(P+W) - (ET + B)	mm/month	-119.2	-77.2	-68.9	-52.5	-30.5	0.0	-33.0	-66.5	-86.0	-123.5	-117.8	-147.3	-	
Cumulative Storage	M		mm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	

IRRIGATION AREA	L	365 x Q / H	m^2	1316.6
			ha	0.13
STORAGE	V	Largest M	mm	0.0
		(V x L)/1000	m^3	0.0

3 days storage recommended = 3943.2 L storage

APPENDIX

E

NORBE WEM REPORT

NorBE Assessment

WEM Summary

version 3

General Information

WEM model ID	**1641858**	Associated DA number	
Model description			
Consultancy	**Cardno**	Consultant	**jonathan.knudsen@cardno.com.au**
Consultant reference number	**DarkesForest1**		
Council	**Wollongong City**	Assessing officer	
Nominated lot	**86//752054**	Associated lots	
Development class	**Existing dwelling/dual occ <8bdrm unsewered**		
Date of model run	**5/29/2018 3:15:31 PM**		

Lot	Section	Plan
86		752054

WEM Model Run Summary

Model run outcome **Satisfied**

Any of the sub-surface plumes reaches:

Lot boundary	**No**
Drainage depression	**No**
Top bank of watercourse	**No**
Another disposal field or onsite stormwater management system	**No**
Within 50m, and up gradient of,a licensed drinking water bore	**No**

Proposed Front End Design

Length (across slope)(m)	**50.0**	Width (up slope)(m)	**26.3**
Proposed area(m2)	**1315.0**	Minimum Required area (m2)	**1003.7**
Number of trenches	**0**		
Effluent volume proposed (l/day)	**1315**		
Effluent volume calculated (l/day)	**1100**		

WEM Model Inputs

Location

Easting	**9661779.025026**	Northing	**4383481.262106**
Slope (m/m)	**0.02291**	Slope is suitable based on site inspection (Applicable to some disposal systems on steep slopes)	**N/A**

Development

Development type	**Dwellings**	Development detail	**7 bedrooms**

WaterNSW

NorBE Assessment

WEM Summary

version 3

Water supply type	**Rainwater**	Spa Bath	**No**
Continuous system use	**Yes**		
Treatment system	**AWTS standard**	Disposal system	**Irrigation sub-surface**

Site

Lot size(m2)	**417408**		
Subject to severe frost	**No**	Bulk density(g/cm3)	**1.58**
Vegetation for nurtrient uptake	**Lawn - unmanaged**	Phosphorus sorption (mg/kg)	**609**
Soil depth (to impermeable layer) (m)	**0.75**	Soil structure	**Massive**
Saturated hydraulic conductivity (Ksat)(m/day)	**2.36**		
Soil texture	**Sandy loams**		

Effluent disposal risk factors

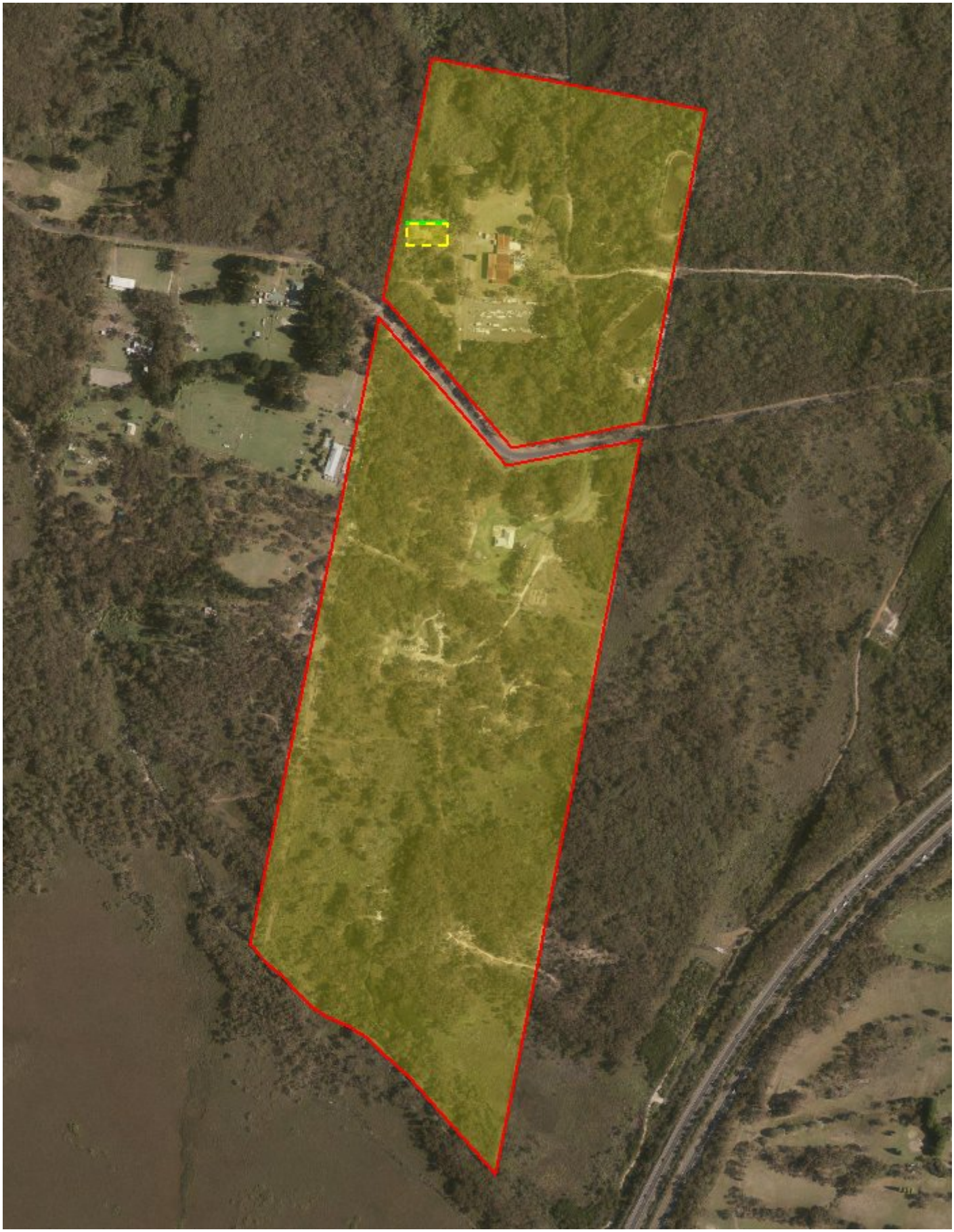
Depth to water table	**0.4 - 1.0**
Flood potential of disposal system	**Above 1 in 50 year ARI**
Landform score	**Hill crests, convex side slopes and plains**
Run-on and upslope seepage	**None-low, diversion possible**
Rock outcrops, scarp and bedrock	**< 5%**
Distance to drainage dpression	**> 50**
Distance to watercourses and water supply reservoirs	**> 120**
Distance to licenced drinking water bores	**> 150**

WaterNSW

WEM Summary

version 3

WEM Plume Map



NorBE Assessment

WEM Summary

version 3

Legend:	
	Selected lots
	Efffluent management area
	Phosphorus
	Nitrogen
	Faecal colifroms

WaterNSW