

ESB West Offaly Power

Risk Screening and Technical Assessment

IEL P0611-02

20 August 2015

47092932

Prepared for: Electricity Supply Board.

Prepared by: AECOM

REVISION SCHEDULE					
Rev	Date	Details	Prepared by	Reviewed by	Approved by
1	30 March 2015	Draft Issue	Cian Friel Environmental Engineer	John Linehan Senior Environmental Scientist	Kevin Forde Technical Director
2	19 May 2015	Issue 2 following client review.	Cian Friel Environmental Engineer	John Linehan Senior Environmental Scientist	Kevin Forde Technical Director
3	20 Aug 2015	Issue3 Final	John Linehan Senior Environmental Scientist	John Linehan Senior Environmental Scientist	Kevin Forde Technical Director

AECOM Infrastructure and Environment
Ireland Limited
410/411 Q House
76 Furze Road
Sandyford
Dublin 18
Ireland

Limitations

AECOM Infrastructure and Environment Ireland Limited (hereafter referred to as "AECOM") has prepared this Report for the sole use of Electricity Supply Board in accordance with the Agreement under which our services were performed (**Proposal – Risk Screening and Technical Assessment dated 19 December 2014**). No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. This Report is confidential and may not be disclosed by the Client or relied upon by any other party without the prior and express written agreement of AECOM.

The information contained in this Report is based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report.

Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Copyright

© This Report is the copyright of AECOM Infrastructure and Environment Ireland Limited. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

1.	INTRODUCTION.....	1
1.1	OBJECTIVE & BACKGROUND INFORMATION	1
2.	SCOPE OF WORKS	1
3.	EXISTING REPORTS	2
4.	SITE SETTING	3
4.1	West Offaly Power Station Site.....	3
4.1.1	<i>Description of the Facility</i>	<i>3</i>
4.1.2	<i>Adjacent Land Use.....</i>	<i>4</i>
4.2	Ash Disposal Facility Site	4
4.2.1	<i>Description of the Facility</i>	<i>4</i>
4.2.2	<i>Adjacent Land Use.....</i>	<i>5</i>
5.	ENVIRONMENTAL SITE SETTING	5
5.1	WOP Site	5
5.2	ADF Site	6
6.	CHEMICALS OF CONCERN.....	7
6.1	WOP Site	7
6.2	ADF Site	8
7.	CONCEPTUAL SITE MODEL	8
7.1	WOP Site	8
7.2	ADF Site	8
8.	ASSESSMENT OF CURRENT GROUNDWATER STATUS...9	
8.1	Generic Risk Assessment.....	10
8.2	Groundwater Chemical Status.....	10
8.2.1	<i>Temporal Trends and Potential Extent of Contamination</i>	<i>11</i>
8.3	Impact on Receptors.....	13
8.3.1	<i>Risks to Controlled Waters</i>	<i>13</i>
8.4	Chemical Status of Groundwater Body	13
9.	CONCLUSIONS AND RECOMMENDATIONS	14

TABLES

FIGURES

GRAPHS

APPENDIX A – BOREHOLE LOGS

APPENDIX B – MATERIAL SAFETY DATA SHEETS

APPENDIX C – INVENTORY OF CHEMICALS STORED ON-SITE

APPENDIX D – AER REPORTS (2005 – 2013)

1. INTRODUCTION

AECOM Infrastructure and Environment Ireland Limited (AECOM) is pleased to present this report to Electricity Supply Board (ESB) which details a risk screening and technical assessment of groundwater quality at the West Offaly Power (WOP) generating station in Shannonbridge, Co Offaly and the associated Ash Disposal Facility (ADF) site at Derrylaghan, Shannonbridge, Co Offaly.

The site location plan, indicating both the WOP site and the ADF site, is presented in Figure 1. The WOP site layout is presented in Figures 2 and 3; the ADF site layout is presented in Figure 4.

1.1 OBJECTIVE & BACKGROUND INFORMATION

ESB operates both the WOP and the ADF sites under an Industrial Emissions Licence (IEL) Licence (Reg. No. P0611-02) issued by the Environmental Protection Agency (EPA). The most recent version of this licence was issued on 06 January 2014.

Under Condition 6.14.3 of the Licence the site is required to complete risk screening and a technical assessment of groundwater quality beneath the site as follows:

Within eighteen months of the date of grant of this licence, the licensee shall carry out a risk screening and where necessary a technical assessment in accordance with the Guidance on the Authorisation of Discharges to Groundwater, published by the Environmental Protection Agency. A report on the outcome of the screening and where relevant the recommendations of the technical assessment in relation to the setting of groundwater compliance points and values, shall be included in the next AER. Any actions required to demonstrate compliance with the European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended, shall be agreed by the Agency and implemented before 22 December 2015. Groundwater monitoring results shall be submitted annually or as required in the Schedules to this licence.

The objective of the works reported herein is to complete an assessment of groundwater beneath the site accordance with the Guidance on the Authorisation of Discharges to Groundwater¹ to comply with Condition 6.14.3 of the site's IEL Licence.

2. SCOPE OF WORKS

AECOM completed the following scope of works to meet the objectives of this report:

- Risk Screening to include:
 - Review of publicly available historical and environmental data on the site and surrounding area, as shown on the available historical maps, aerial photographs and regulatory information;
 - Summarising the environmental site setting; and
 - Development of preliminary conceptual site model
- Tier 1 – Preliminary Site Assessment to include
 - Assessment of the environmental setting of the site and surrounds by reviewing relevant geological, hydrogeological and topographical maps;
 - Review of previous environmental reports;
 - Completion of a site visit and interview with key knowledgeable staff to identify current environmental conditions at the site, which may represent a potential environmental risk;
 - A review of relevant site documentation provided by ESB, including annual environmental reports, IPPC licence application and site material safety data sheets);
 - Interviews with key knowledgeable personnel during the site visit; and

¹ Environmental Protection Agency (2011) Guidance on the Authorisation of Discharges to Groundwater.

- Development of Conceptual Site Model.
- Tier 2 – Generic Quantitative Risk Assessment to include
 - Assessment of available data against generic assessment criteria (GAC);
 - Assess potential groundwater impacts and compliance with groundwater regulations; and
 - Identify any potential data gaps and recommended additional works to demonstrate compliance with the Groundwater Regulations.
- Production of one consolidated report to include the findings of the Tier 1 and Tier 2 assessments.

3. EXISTING REPORTS

AECOM completed a review of existing site specific and regional hydrogeological information from the following sources. The data from these reports was used to inform the following sections.

- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611, Annual Environmental Report, for the period 1st January 2005 to 31st December 2005.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2006 to 31st December 2006.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2007 to 31st December 2007.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2008 to 31st December 2008.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2009 to 31st December 2009.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2010 to 31st December 2010.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2011 to 31st December 2011.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-01, Annual Environmental Report, for the period 1st January 2012 to 31st December 2012.
- Electricity Supply Board, West Offaly Power Generating Station, IPC Licence Reg. No. 611-02, Annual Environmental Report, 2013.
- URS Ireland Limited (2012), West Offaly Power, Ash Disposal Facility, Groundwater Assessment, Issue No. 3, Final, Dated 18 April 2012.
- URS Ireland Limited (2013), Assessment of Dust Deposition Monitoring Locations, West Offaly Power (IPPC Register No. P0-611-02), Dated 19 December 2013, 47092647, DURP0003.
- URS Ireland Limited (2013), Assessment of Dust Deposition Monitoring Locations, West Offaly Power ADF (IPPC Register No. P0-611-02), Dated 19 December 2013, 47092647, DURP0004.
- URS Ireland Limited (2009), Shannonbridge Environmental Exit Audit, Summary Report, dated 01 June 2011, Final, Issue No 3, 49341814/DURP0008.
- ESB (2001), Shannonbridge New Peat Power Station Project, Environmental Impact Statement, February 2001, Report No. P04B003-R1-03.

4. SITE SETTING

For ease of description the following section is separated into two subsections. Subsection 4.1 details the West Offaly Power (WOP) generating site and subsection 4.2 details the Ash Disposal Facility (ADF).

4.1 West Offaly Power Station Site

4.1.1 Description of the Facility

The WOP site is located 400 m south of the village of Shannonbridge on the north-eastern bank of the River Shannon. Construction of the WOP station commenced in the summer of 2002 as a replacement to the former 125 megawatt (MW) Shannonbridge Power Station, a milled peat fired power-generating station. Generating activities ceased at the former Shannonbridge Power Station in 2004 and demolition of the station building was completed in 2010.

Construction of the WOP station was completed in 2004 and the station became commercially operational in January 2005. The WOP site occupies an area of 20 hectares (Ha) on a separate site adjacent to the former Shannonbridge Power Station site.

Along with Lough Ree Power Station, the WOP station is one of Ireland's first power stations to be built in conformance with the Large Combustion Plant Directive. The station consists of a single boiler/turbine unit and auxiliary plant, with an electrical output of 150 MW. The boiler operates through the combustion of milled peat, with the utilisation of gas oil as a start-up fuel. Approximately 1,245,000 tonnes of peat, supplied locally from Bord Na Móna works, is burned at this installation annually.

The plant uses circulating fluidised bed (CFB) combustion. With this technology, the fuel is injected into a hot turbulent bed of sand with air being blown through the bed from the bottom. The fluidised bed has a large thermal mass, leading to more even and controlled combustion. CFB combustion technology is particularly suitable for fuels with a high ash content or low or varying heating values. Fluidised bed combustors also produce lower NO_x emissions compared to alternative combustion systems and allow for simple desulphurisation through the use of sorbent materials in the bed to retain sulphur. With the CFB technology, the air blown through the bed cause particles to become entrained in the hot gases. These particles are removed in a cyclone and a portion of the gases are recirculated through the boiler.

Ash is transported from the main generator building via pipework to the Ash Silo. At the ash silo, the ash moisture content is increased to between 15% and 18% before being dispensed to the ash wagon for transport to the ADF, a non-hazardous lined ash landfill.

The WOP station can be subdivided as follows;

- The power station site which is operated by ESB; and
- The peat handling site which is operated by Bord Na Móna.

The main features of the facility (see Figure 2) are as follows:

- Peat Screening building;
- Intermediate peat house;
- Tippler ;
- Conveyor;
- Combustion Turbine;
- Boiler house;
- Auxiliary Transformers;
- 110kV Compound;

- Transformers;
- One diesel above ground storage tank (AST)
- Chemical Tanks;
- Water Treatment Building;
- Electrical Supply Building
- Offices and administration building
- Stores;
- Workshop;
- Laboratory;
- Water Pump house;
- Demineralisation Water Tank;
- Bord Na Móna Puraflo[®] wastewater treatment; and
- Waste Storage Area.

4.1.2 **Adjacent Land Use**

Site Boundary	Land Use
North	Ash ponds from the former Shannonbridge Power Station are located immediately to the north and northwest of the site. (It is understood that these have been capped with a peat layer and re-vegetated) An agricultural machinery engineering yard is located to the north east of the site. Residential housing is located 180 m north east of the site.
South	Agricultural fields.
East	Agricultural fields with the R357 regional road, and harvested bog beyond.
West	River Shannon, with agricultural fields and harvested bog beyond.

4.2 **Ash Disposal Facility Site**

4.2.1 **Description of the Facility**

The ADF site is located at Derrylahan, 6.5 km north east of the WOP site. It occupies an area of 36 ha located within 800 ha of commercial Bord na Móna peat harvesting land. The site layout is presented in Figure 4.

The ADF is an engineered landfill complete with a geo-synthetic clay liner (GCL) at the base. The GCL consists of sodium bentonite clay, supported by geotextiles, which forms another hydraulic barrier to the leachate. The landfill is subdivided into cells which are filled sequentially. The GCL is overlain with a composite drainage layer (CDL), which collects any leachate generated. The CDL falls to a leachate collection drain at one end of each cell, which transfers leachate to a leachate monitoring manhole. Collected leachate is either pumped over the ash as a means of dust suppression and compaction of ash or pumped to the lined lagoon using electrical submersible pump.

The majority of the leachate generated is recycled over the ash, however any excess (generally only in periods of high rainfall) is agitated in the lagoon, then tested for pH and suspended solids and, if

the values are within the licence limits, it can be discharged under permit to the Gowlan River, a tributary of the River Blackwater.

When each cell has reached capacity, the cell is capped with a permanent low permeability GCL and as a result, leachate production at the ADF will eventually cease.

4.2.2 Adjacent Land Use

<i>Site Boundary</i>	<i>Land Use</i>
North	Peat bog
South	Peat bog
East	Peat bog
West	Peat bog

5. ENVIRONMENTAL SITE SETTING

Information presented within this section has been collated from publicly available sources, including the Environmental Protection Agency (EPA) (www.epa.ie), Ordnance Survey of Ireland (OSI) (www.osi.ie), Geological Survey of Ireland (GSI) (www.gsi.ie), National Parks and Wildlife Service (NPWS) (www.npws.ie), and Water Framework Directive Ireland (www.wfdireland.ie) and abovementioned reports.

5.1 WOP Site

<i>Physical Feature</i>	<i>Details</i>
Topography	<p>The site is generally flat. According to OSI Discovery Series map No.47 the site is located at approximately 40m above Ordnance Datum (OD).</p>
Geology	<p>Information from GSI indicates the underlying bedrock is Dinantian Upper Impure Limestone.</p> <p>Teagasc have identified the subsoil beneath the west of the site as being Alluvium. The eastern portion of the site is underlain by Till derived chiefly from limestone.</p> <p>Borehole logs for the two onsite monitoring wells are attached in Appendix A. Varying ground conditions were encountered at these locations and can be summarised as follows:</p> <p>BH14/GW1 in the north east of the site</p> <ul style="list-style-type: none"> • 0.0 – 2.0 m bgl – Made ground, comprising clayey gravelly sand • 2.0 m bgl – Limestone bedrock <p>BH10/GW2 in the south west of the site</p> <ul style="list-style-type: none"> • 0.0 – 6.0 m bgl – Made ground, comprising clayey gravelly sand • 6.0 – 7.0 m bgl - Peat • 7.0 – 10.0 m bgl – Clayey Gravel • 10.0 m bgl – Limestone bedrock
Hydrogeology	<p>The bedrock aquifer beneath the site is classified as a locally important aquifer which is moderately productive only in Local Zones (LI).</p> <p>The GSI indicates that the site is located on a contact between zones of 'moderate' vulnerability (in the west of the site) and 'high' groundwater vulnerability (in the east of the site).</p> <p>There are no Source Protection Zones within 1 km of the site.</p> <p>Given the proximity of the River Shannon, the groundwater flow direction is expected to be towards the west of the site.</p>
Nearby Groundwater	<p>According to the GSI, the nearest two groundwater abstraction wells are located between 1 - 1.5 km to the north of the site. Both abstraction wells are installed in the limestone bedrock and are reported to be "Good" yielding with respective yields of</p>

Physical Feature **Details**

Abstraction wells	109 m ³ /d and 135.2 m ³ /d; one is reported to be owned by Offaly Board of Health.
Water Framework Directive	Groundwater beneath the site is designated as a WFD protected area for drinking water. The WFD Groundwater beneath the site is identified as the Clara groundwater body IE_SH_G_060. The EPA has classified the water body as having a 'good status' and being 'Possibly at risk of not achieving good status'.
Surface Water	The closest surface water body is the River Shannon which flows along the site's western boundary. According to the EPA, based on the most recent monitoring event at Incherky Quay (downstream from Banagher), 11 km south of the site, the River Shannon has a 'Good' Status.
Protected Areas	The following protected areas were identified within 3 km of the site: <ul style="list-style-type: none">• The River Shannon (000216), a Special Area of Conservation (SAC).• River Suck Callows (004096), a Special Protected Area (SPA), located approximately 1 km to the west and upstream of the site.

5.2 ADF Site

Physical Feature **Details**

Topography	The site is generally flat. According to OSI Discovery Series map No.47 the site is located at approximately 40m above Ordnance Datum (OD).
Geology	The GSI, indicates that the site is located at a contact between the Dinantian Lower Impure Limestones (beneath the northern portion of the site) and the Dinantian (early) sandstones, limestones and shales (beneath the southern half of the site). Teagasc have identified subsoil beneath the site consisting of cut peat bog. Borehole logs for the onsite monitoring wells are attached in Appendix A.
Hydrogeology	The underlying bedrock aquifer is classified by the GSI as a locally important aquifer (bedrock which is moderately productive only in local zones) with 'low' groundwater vulnerability. There are no Source Protection Zones within 5 km radius of the site. Based on groundwater elevation data collected in November 2000, groundwater flow direction is towards the Gowan River northwest of the site.
Nearby Groundwater Abstraction wells	According to GSI records, there are no groundwater abstraction wells within a 5 km radius of the site.
Water Framework Directive	Groundwater beneath the site is designated as a WFD protected area for drinking water. The WFD Groundwater beneath the site is identified as the Clara groundwater body IE_SH_G_060. The EPA has classified the water body as having a 'good status' and being 'Possibly at risk of not achieving good status'.
Surface Water	The closest surface waterbodies are the Gowan River and the Black River. The Gowan River is located 100 m to the northwest of the site boundary. This river joins the Black River downstream of the site. The Black River, located 600 m from the southeast boundary of the site, is a tributary of the Blackwater River. The Blackwater River is located approximately 2.7 km south of the site and flows into the Shannon River 6.5 km south of the site. According to the EPA, based on the most recent monitoring event at Blackwater Bridge, the Blackwater River has a 'Good' Status. The Gowan River and Black River are not monitored by the EPA.
Protected Areas	The following protected areas were identified in within 3 km of the site:

Physical Feature Details

- Fin Lough, (000576), a Special Area of Conservation (SAC), is located 1.5 km to the north of the site.
- Mongan bog, (004017), a Special Protected Area (SPA), is located 3 km to the north of the site.

6. CHEMICALS OF CONCERN

6.1 WOP Site

Historic Contamination

The WOP site was developed adjacent to the former Shannonbridge Power station site. The majority of the site was greenfield pre-development, however the southern portion of the site has been landfilled with waste materials from the previous power station. Much of this has been remediated, however, due to access issues, an area beneath a rail track in the south east of the site remains unremediated and may be a potential source of contaminants. This area is indicated on Figure 3.

Chemical Storage

The following is a list of the major chemicals stored onsite. Storage locations for the below chemicals are indicated on Figure 3.

<i>Chemical</i>	<i>Container Volume</i>
Caustic Soda (NaOH)	30 m ³ (start-up fuel for auxiliary diesel generator)
Sulphuric Acid (H ₂ SO ₄)	30 m ³
Caustic brine	30 m ³
Ammonia (NH ₃)	1 m ³
Diesel (gas oil)	200 m ³ (start-up fuel for auxiliary diesel generator)
	1 m ³ (diesel tank for fire water pump)
	1.3 m ³ (emergency diesel generator tank)
	25 m ³ (back-up fuel source for locomotives)
	2 No. 2.3 m ³
Turbine Lubricating Oil	8 m ³
Gear Oil	2.3 m ³
Anti-freeze	1 m ³
Waste Oil	1 m ³

The material safety data sheets for all bulk chemicals stored on-site listed in the table above are presented in Appendix B.

During the AECOM site visit, it was noted that all chemicals listed above are banded and/or stored in double skinned containers. All bands were reported to be in good condition. Under Condition 6.9 of the IEL Licence the site is required to complete bund integrity testing once every three years. The most recent bund integrity testing was completed during 2014, the result of which is reported in the 2014 Annual Environmental Report (AER). It was reported to AECOM that all bands passed the 2014 integrity testing.

The site achieved ISO14001 certification in 2014. There is an appointed environmental committee for the site which sits biannually. This committee is responsible for the implementation of the following good environmental practices aimed at reducing risks from potential spills and leaks;

- In-house environmental audits are completed monthly;

- All bunds are alarmed;
- Bunds are inspected monthly and alarms tested biannually;
- Oil tanks are filled to maximum of 75% of their total capacity; and
- Chemical tanks are filled to maximum of 90% of their total capacity.

Appendix C contains a complete inventory of all chemicals stored onsite in minor volumes.

Other Potential Contaminants

A number of other contaminant sources were identified from the WOP site:

- Cooling water;
- Blowdown water;
- Water treatment effluent;
- Treated sewage effluent; and
- Surface water drainage infrastructure including settlement tanks.

Spills and Leaks

No Spills or leaks have been reported since development of the site.

6.2 ADF Site

The single contaminant of concern identified at the ADF site is the leachate generated at the landfill.

7. CONCEPTUAL SITE MODEL

7.1 WOP Site

A conceptual site model (CSM) identifying current understanding of source-pathway-receptor linkages based on the most recent reports is tabulated below and presented graphically in Figure 5.

<i>Potential Sources</i>	<i>Viable Pathways</i>	<i>Potential Receptors</i>
Above Ground Storage Tanks	Human Health (inhalation of vapours)	Human Health
Site drainage infrastructure	Controlled waters	<ul style="list-style-type: none"> • On-site employees • Workers onsite undertaking subsurface works
Process water effluent infrastructure	Lateral migration of contaminated groundwater through the permeable fill, made ground and overburden	Controlled Waters
Wastewater infrastructure	Preferential pathways through onsite drainage	<ul style="list-style-type: none"> • Groundwater beneath the site • The River Shannon
Potential Historic Contaminated soil to the south of the site		

7.2 ADF Site

A conceptual site model (CSM) identifying current understanding of source-pathway-receptor linkages based on the most recent reports is tabulated below and presented graphically in Figure 6.

<i>Potential Sources</i>	<i>Viable Pathways</i>	<i>Potential Receptors</i>
Leachate <ul style="list-style-type: none"> Collected at the base landfill Collected in the lagoon 	Controlled waters <ul style="list-style-type: none"> Lateral migration of contaminated groundwater through the peat. 	Controlled Waters <ul style="list-style-type: none"> Groundwater beneath the site The Gowan River

8. ASSESSMENT OF CURRENT GROUNDWATER STATUS

As required by the IEL Licence ESB completes the following groundwater monitoring at the site;

<i>Parameter</i>	<i>Monitoring Frequency</i>
pH, Electrical, Conductivity	Monthly
Total Petroleum Hydrocarbons (TPH) Chloride Sulphate (S04)	Quarterly
COD Total Ammonia Total Nitrogen Metals/non-metals* Nitrate Orthophosphate	Annually

*boron cadmium calcium, chromium, copper, iron lead, magnesium, manganese, mercury, nickel, potassium, sodium, zinc, molybdenum, selenium.

AERs containing results of groundwater monitoring from 2005 to 2013 were provided to AECOM for review and are included in Appendix D. Groundwater monitoring results for 2014 were also provided to AECOM.

There are two groundwater monitoring wells on the WOP site, one up-gradient well and one down-gradient well; providing the minimum coverage for an environmental assessment. Locations of groundwater monitoring wells are indicated on Figure 2.

Monitoring well PS-GW1 is the up-gradient well and is located at the north eastern site boundary.

Monitoring well PS-GW2 is the down-gradient well and is located within a former ash landfill on the western site boundary close to the River Shannon.

There are four groundwater monitoring wells on the ADF site, locations of which are indicated on Figure 4.

Appropriate generic assessment criteria (GAC) protective of controlled water receptors were selected based on the site setting and the conceptual site model for the site, which is summarised below:

- The closest surface water body to the site is the River Shannon (a designated SAC).
- The bedrock aquifer is classified (GSI) as a 'locally important aquifer which is moderately productive only in local zones'.
- The groundwater beneath the site is protected as a drinking water resource under the Water Framework Directive.

- There are no groundwater abstraction wells for drinking water located down-gradient of the site.

Based on the above, the most sensitive receptors identified are the protected groundwater beneath the site and the River Shannon on the eastern boundary of the site.

Given the above site setting, groundwater water quality was assessed by comparing analytical results to appropriate assessment criteria according to the following hierarchy:

- European Communities Environmental Objectives (Groundwater) Regulations, 2011 (Statutory Instrument No. 389 of 2011); and
- Environmental Protection Agency's Draft Interim Guidelines Values (IGVs) for the Protection of Groundwater, 2003².

8.1 Generic Risk Assessment

Annual and quarterly analytical groundwater data for 2014 compared against GAC are presented in Table 1. The following table presents a summary of the results which were reported above the adopted GAC in 2014.

<i>Parameter</i>	<i>GAC</i>	<i>Reported Concentration Range of Exceedences</i>	<i>Exceeding wells</i>
Arsenic	7.5 µg/L (GTV)	18 µg/L	ADF-GW5
Nickel	15 µg/L (GTV)	15.3 µg/L	ADF-GW5
Potassium	5 mg/L (IGV)	24.9 mg/L - 26.7 mg/L	PS-GW2 and ADF-GW4
Sulphate	187.5 µg/L (GTV)	273 µg/L	PS-GW2
Manganese	50 µg/L (IGV)	58.3 µg/L – 550 µg/L	PS-GW2, ADF-GW3, ADF-GW4, ADF-GW5 and ADF-GW6

8.2 Groundwater Chemical Status

The data reviewed in this report has been compared against GAC, including the Groundwater threshold values (GTVs), as set out in the Schedules 5 of the Groundwater regulations.

Elevated concentrations of the following parameters (above the GTVs) were reported at the site during 2014:

- Arsenic, nickel and sulphate.

Elevated concentrations of the above parameters may indicate that the groundwater beneath the site is of 'Poor Status'.

Additionally, the following parameters were reported above Interim Guideline Values (IGVs):

- Potassium and manganese.

Detections of chloride were below the assessment criteria at all groundwater monitoring locations during 2014, however chloride has been detected at concentrations exceeding the GAC in the past and therefore trend analysis for chloride concentrations at each location across the site is presented in Graph 4.

² Environmental Protection Agency, Towards setting guideline values for the protection of groundwater in Ireland (Interim Report).

Since 2011 Total Petroleum Hydrocarbons (TPH) have not been detected at concentrations exceeding the MDL (1 mg/L). However, it should be noted that the MDL is greater than the GAC of 0.01 mg/L.

8.2.1 *Temporal Trends and Potential Extent of Contamination*

Temporal trends for the parameters identified as exceeding the GAC in Section 7.2 are presented in Graphs 1 to 4³. The following is a summary of the apparent trends.

Arsenic (Graph 1)

An elevated concentration of arsenic was detected at ADF-GW5 (18 µg/L) in 2014. Arsenic concentrations exceeding the GTV (7.5 µg/L) were not reported at this location prior to 2014. There is no obvious trend in the arsenic data at ADF-GW5 between 2005 and 2013, with concentrations ranging between 2 µg/L (2011) and 6 µg/L (2010).

The source of the elevated arsenic concentration reported at ADF-GW5 is unclear but it may be associated with;

- elevated background concentrations often associated with the regional geology in the area (impure limestones); or
- the ash landfilled at the site⁴.

Continued monitoring would be required to confirm this and to assess any significant upward trend in well ADF-GW5.

Elevated arsenic concentrations exceeding the GTV were detected at ADF-GW4 between 2011 and 2013. The arsenic concentrations detected in 2013 (11 µg/L) and 2014 (5 µg/L) indicate a general decreasing trend at this location. Continued monitoring would be required to confirm this.

Arsenic was not detected at concentrations exceeding the GTV in water samples collected from monitoring wells PS-GW1 (main WOP site), ADF-GW3 and ADF-GW6 between 2005 and 2014.

Nickel (Graph 2)

An elevated nickel concentration of 15.3 µg/L was detected at ADF-GW5 in 2014. Nickel concentrations exceeding the GTV (15 µg/L) have not been reported at this location prior to 2014. From Graph 2 there is no obvious trend in the nickel data for any of the wells analysed.

An elevated nickel concentration of 49 µg/L was detected at ADF-GW2 in 2008. All other nickel detections at this location have been below the GTV.

Nickel has not been detected at concentrations exceeding the GTV (15 µg/L) in water samples collected from monitoring wells PS-GW1, ADF-GW3, ADF-GW4 and ADF-GW6 between 2005 and 2014.

Nickel concentrations of 11 µg/L, 26.3 µg/L and 6.04 µg/L were reported in samples collected from the leachate over three quarters during 2013. The source of the elevated nickel concentration reported at ADF GW5 is unclear but it may be associated with the ash landfilled at the site. Further monitoring would be required to confirm this and to assess any significant upward trend in well ADF-GW5.

Sulphate (Graph 3)

Graph 3 shows the quarterly sulphate monitoring results available between Quarter 4 (Q4) 2013 and Q4 2014. No sulphate analytical results are available for groundwater samples collected from the

³ No trend analysis is presented for potassium, because this has not been analysed for prior to 2014.

⁴ Arsenic concentrations of 220 µg/L and 213 µg/L were reported in two leachate samples collected during 2013. Considering these elevated concentrations, it is possible that the elevated arsenic concentration reported in wells ADF-GW5 and ADF-GW4 may be associated with the ash landfilled at the site.

site prior to Q4 2013 as there was no licenced requirement to monitor groundwater for sulphate prior to 2013.

Sulphate concentrations at PS-GW2 have remained relatively stable (260 µg/L - 290 µg/L) between Q4 2013 and Q4 2014, exceeding the GTV of 187.5 µg/L during each monitoring event.

Sulphate concentrations at PS-GW1, ADF-GW3, ADF-GW4, ADF-GW5 and ADF-GW6 were either below the GTV or less than the MDL during all monitoring events.

The source of the elevated concentrations of sulphate at PS-GW2 is considered likely to be the former ash landfill located in this area.

Potassium

Elevated concentrations of potassium above the IGV of 5 mg/L were detected in 2014 at monitoring wells PW-GW2 (24.9 mg/L) and ADF-GW4 (26.7 mg/L). No potassium analytical results are available for groundwater samples collected from the site prior to 2014 as there was no licenced requirement to monitor groundwater for potassium until 2014. Further monitoring would be required to assess any trends in potassium concentrations in these wells.

The source of the elevated concentrations of potassium in these wells is not clear, however it may be associated with the landfilling of ash or elevated background concentrations associated with the regional geology.

Manganese

Elevated concentrations of manganese above the IGV of 50 µg/L were detected in 2014 at monitoring wells PW-GW2 (550 µg/L), ADF-GW3 (58.3 mg/L), ADF-GW4 (96.9 µg/L), ADF-GW5 (95.1 µg/L) and ADF-GW6 (242 µg/L). Manganese analytical results are not available for groundwater samples collected from the site prior to 2014 as there was no licenced requirement to monitor groundwater for manganese until 2014.

The source of the elevated concentrations of manganese in these wells is likely to be associated with elevated background concentrations associated with the regional geology (impure limestones). In areas with such a geological make-up, manganese can frequently occur naturally in groundwater at concentrations exceeding the IGV.

Additionally, Teagasc have identified the subsoil beneath the site as consisting of cut peat bog. Peat can contain a large portion of decaying organic matter and typically would be poorly drained and waterlogged. These conditions give rise to oxygen-deficient environments which increases the solubility of manganese, giving rise to elevated manganese concentrations in the groundwater.

Further monitoring would be required to assess any trends in manganese concentrations in these wells.

Chloride (Graph 4)

Graph 4 shows the quarterly chloride monitoring results available between 2009 and 2014. Elevated chloride concentrations above the GTV were reported in groundwater samples collected from ADF-GW4 between Q1 2011 (375 µg/L) and Q3 2013 (324 µg/L). However, following a peak chloride concentration of 1,390 µg/L detected in Q1 2012, chloride concentrations have decreased to 20.1 µg/L in Q4 2014 indicating a decreasing trend.

It is considered likely that the increased chloride concentrations were related to leachate escaping through a breach in the base liner in Cell 1 of the ADF. In 2013 works were undertaken to improve the base liner and the cell was capped. Results of the 2014 sampling round indicate that chloride levels have declined to below the GTV following these remedial works. Chloride has not been detected at concentrations exceeding the GTV (187.5 µg/L) in groundwater samples collected from the remaining monitoring wells at the ADF or the power station site.

8.3 Impact on Receptors

8.3.1 Risks to Controlled Waters

Arsenic and Nickel

The presence of arsenic and nickel at ADF-GW5, at concentrations exceeding the GTV indicates a potential risk to controlled waters receptors. The risk to controlled waters from these elevated concentrations is considered to be low, given that it was only detected in 1 of the 4 wells analysed. Continued monitoring would be required to confirm this assumption and to assess any significant upward trends.

Furthermore, as each cell within the landfill reaches capacity, it is capped with a permanent low permeability GCL and as a result, leachate production at the ADF will eventually cease.

Sulphate

The presence of sulphate at PS-GW2 at concentrations exceeding the GTV over four monitoring rounds during 2014 indicates a potential risk to controlled waters receptors. Groundwater was not analysed for sulphate prior to Q4 2013.

The elevated concentrations are considered likely to be associated with the former ash landfill in which the borehole was installed. It is noted from the 2010 Exit Audit completed for the former landfill⁵ that the elevated concentrations at PS-GW2 did not translate to elevated concentrations in the River Shannon (key receptor). Therefore the risk from the elevated concentrations of sulphate was considered to be low.

Potassium

Elevated concentrations of potassium were detected in PS-GW2, ADF-GW4 and ADF-GW6 indicating a potential risk to controlled waters. Potassium has not been analysed prior to 2014. The temporal trends in potassium at these locations should be assessed over future rounds to confirm this risk and to assess if there is a significant upward trend.

Historic Landfilled Waste

It is understood that a section of the WOP site contains an unremediated section of landfill which was part of the former ESB Shannonbridge power generation site. This area is identified as a potential source of contaminants and consequently a potential risk to controlled waters. It is recommended that groundwater samples are collected down gradient of this location to assess this potential risk.

8.4 Chemical Status of Groundwater Body

The Clara groundwater body IE_SH_G_060 is identified as being 'Possibly at risk of not achieving good status' under the Water Framework Directive (WFD). The status of the groundwater body was identified as 'Good'.

Elevated concentrations of arsenic, nickel, potassium and sulphate were detected at groundwater monitoring locations across the ADF and power station site. However, given that the elevated concentrations were <100 GAC the risk to the overall status of the groundwater body as a whole is considered to be low.

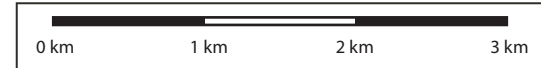
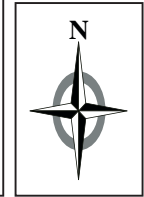
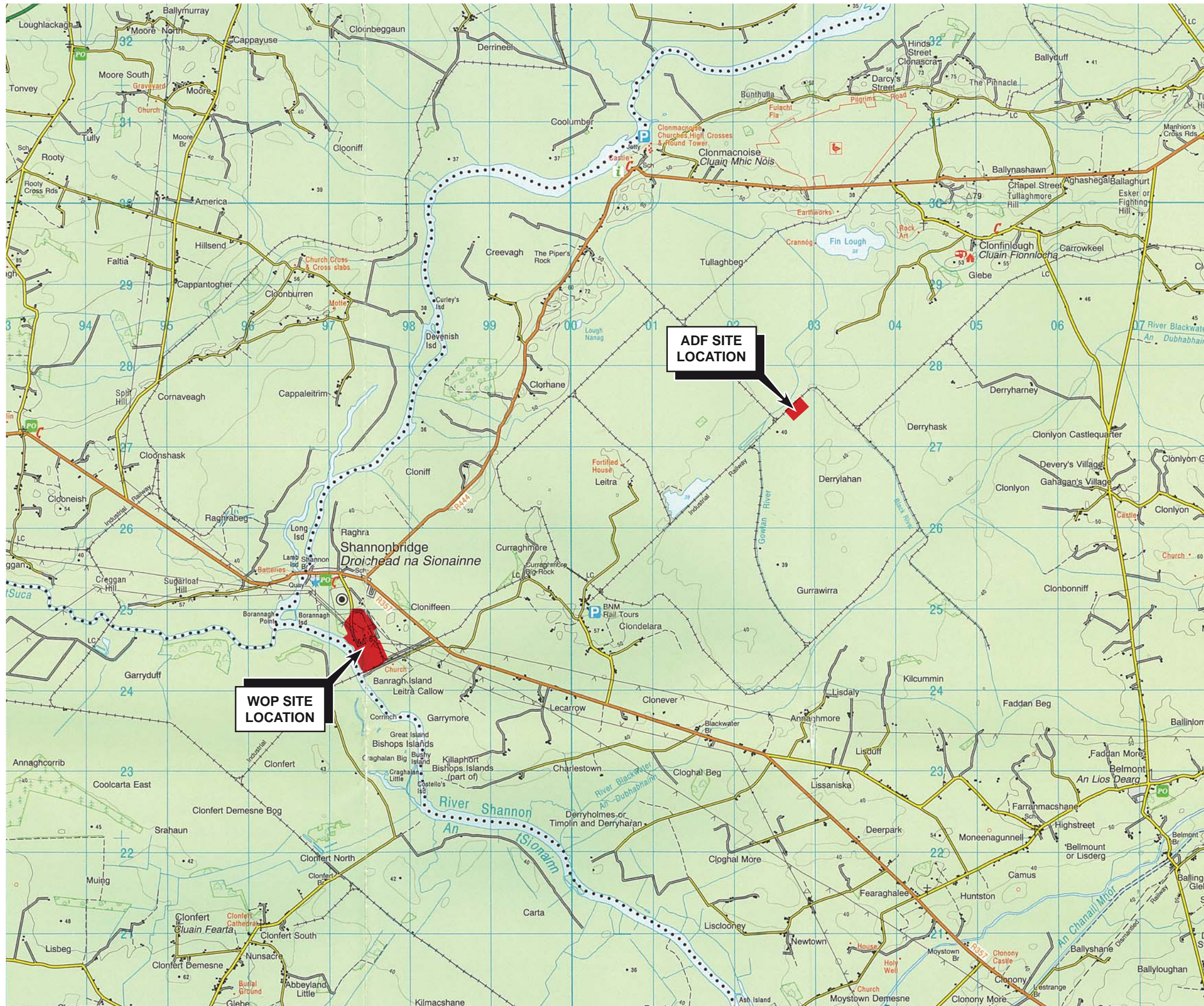
⁵ URS Ireland Limited (2010) *ESB Shannonbridge Exit Audit – Ash Ponds*. Issue No. 3 Dated 30 November 2010

9. CONCLUSIONS AND RECOMMENDATIONS

Based on the hydrogeological assessment completed herein, AECOM conclude the following with respect to the site:

- The following potential on-site sources have been identified:
 - Chemical and Heavy Fuel Oil Storage;
 - Site drainage infrastructure;
 - Process water effluent infrastructure;
 - Wastewater treatment infrastructure;
 - Surface water drainage infrastructure (including Sedimentation tank); and
 - Potentially contaminated land to the south of the site.
- No spills or leaks have been reported since development of the site.
- Potential risks to groundwater were identified from elevated concentrations of arsenic, nickel, potassium and sulphate. Further monitoring is recommended to identify any significant upward trends and to confirm or otherwise the potential risks and to demonstrate compliance with the Groundwater Regulations.
- Given that the elevated concentrations of arsenic, nickel, potassium and sodium were <100 GAC, the risk to the overall status of the groundwater body is considered to be low.
- An area to the south of the site is identified as a potential risk to controlled waters, as it contains landfilled waste materials from the former power station. It is recommended that a groundwater sample is collected down hydraulic gradient of this area to assess possible impact to the groundwater body and to demonstrate compliance with the Groundwater Regulations.
- Bunds were observed to be in a good condition. Bund integrity testing was completed in 2014 and it was reported to AECOM that all bunds passed the respective integrity tests. Good environmental management practices are in place to reduce the risk of spills to the environment.
- As each cell within the landfill reaches capacity, it is capped with a permanent low permeability GCL and as a result, leachate production at the ADF will eventually cease.
- It is recommended that alternative analysis for hydrocarbons is used with an LOD <10ug/L to screen for potential hydrocarbons.

FIGURES



ORDNANCE SURVEY IRELAND LICENCE NO. EN 0001915
 ©ORDNANCE SURVEY IRELAND/GOVERNMENT OF IRELAND

NOTES
WOP West Offaly Power
ADF Ash Disposal Facility



410/411 Q HOUSE, 76 FURZE ROAD, SANDYFORD, DUBLIN 18.
 TEL: +353 (1) 2933200 FAX: +353 (1) 2933201

CLIENT
 ELECTRICITY SUPPLY BOARD

PROJECT
 WEST OFFALY POWER RISK SCREENING
 AND TECHNICAL ASSESSMENT

DRAWING TITLE
FIGURE 1 _ SITE LOCATION PLAN

DRAWN SML	TRACED	CHECKED CF	APPROVED JL/DUB	DATE MAR 2015
SCALE 1:50,000 @ A3	JOB NO. 47092932	REV		

Contains Ordnance Survey Data Crown Copyright and database right 2015. Reproduced from Ordnance Survey digital map data. Crown copyright 2015. All rights reserved. Licence number 0100031673. Copyright Natural England 2015. Material is reproduced with the permission of Natural England 2015. Copyright English Heritage 2015. Reproduced under the terms of the Click-Use Licence. (C) URS 2015.



- NOTES**
- Site Boundary
 - Milled Peat Unloading
 - Maintenance Building
 - Peat Screen
 - Railway Gear Building
 - Laboratory
 - Tippler and Lorry Building
 - Milled Peat Unloading
 - Ash Silo
 - Precipitator
 - Turbine House
 - Boiler House
 - Demineralisation Plant
 - Workshop
 - Office
 - Store
 - Waste Water Treatment
 - Surface Water Settlement Pond
 - Pumping Station
 - Former Shannonbridge Power Station
-Removed from IPPC Licence (PO611-02) 16th June 2012
 - Stack
 - Diesel Tank
 - Conveyor
 - ← Movement of Peat
 - Groundwater Monitoring Location
 - Surface Water Monitoring Location
 - Culvert - Cooling Water



410/411 Q HOUSE, 76 FURZE ROAD, SANDYFORD, DUBLIN 18.
TEL: +353 (1) 2933200 FAX: +353 (1) 2933201

CLIENT
ELECTRICITY SUPPLY BOARD

PROJECT
WEST OFFALY POWER RISK SCREENING AND TECHNICAL ASSESSMENT

DRAWING TITLE
FIGURE 2 _ WEST OFFALY POWER SITE LAYOUT, SHOWING GROUNDWATER AND SURFACE WATER MONITORING POINTS AND KEY FEATURES

DRAWN SML	TRACED	CHECKED CF	APPROVED JL/DUB	DATE MAR 2015
SCALE ILLUSTRATION ONLY	JOB NO. 47092932			REV



Contains Ordnance Survey Data Crown Copyright and database right 2015. Reproduced from Ordnance Survey digital map data. Crown copyright 2015. All rights reserved. Licence number 0100031673. Copyright Natural England 2015. Material is reproduced with the permission of Natural England 2015. Copyright English Heritage 2015. Reproduced under the terms of the Click-Use Licence. (C) URS 2015.



- NOTES**
- Site Boundary
 - Historic Landfill Waste Materials
- Chemical Storage**
- 1 Sulphuric Acid - 30m³
 - 2 Caustic Soda - 30m³
 - 3 Caustic Brine - 30m³
 - 4 Diesel /Gas Oil - 200m³
 - 5 Waste Oil Storage - 1.0m³
 - 6 Bunded Storage Containers - containing various lubricating oils
 - 7 Ammonia - 1m³
 - 8 Diesel - 1.3m³
 - 9 3No. Diesel Tanks - 25m³, 2.3m³, 2.3m³
 - 10 Gear Oil Tanks - 2.3m³
 - 11 Anti Freeze Tank - 1.0m³
- Decommissioned Chemical Storage**
- 1 Sodium Hypochlorite (7m³)
 - 2 Ammonia Tank (50m³)
- Approximate Location of Oil / Water Interceptors
 - CSM Direction



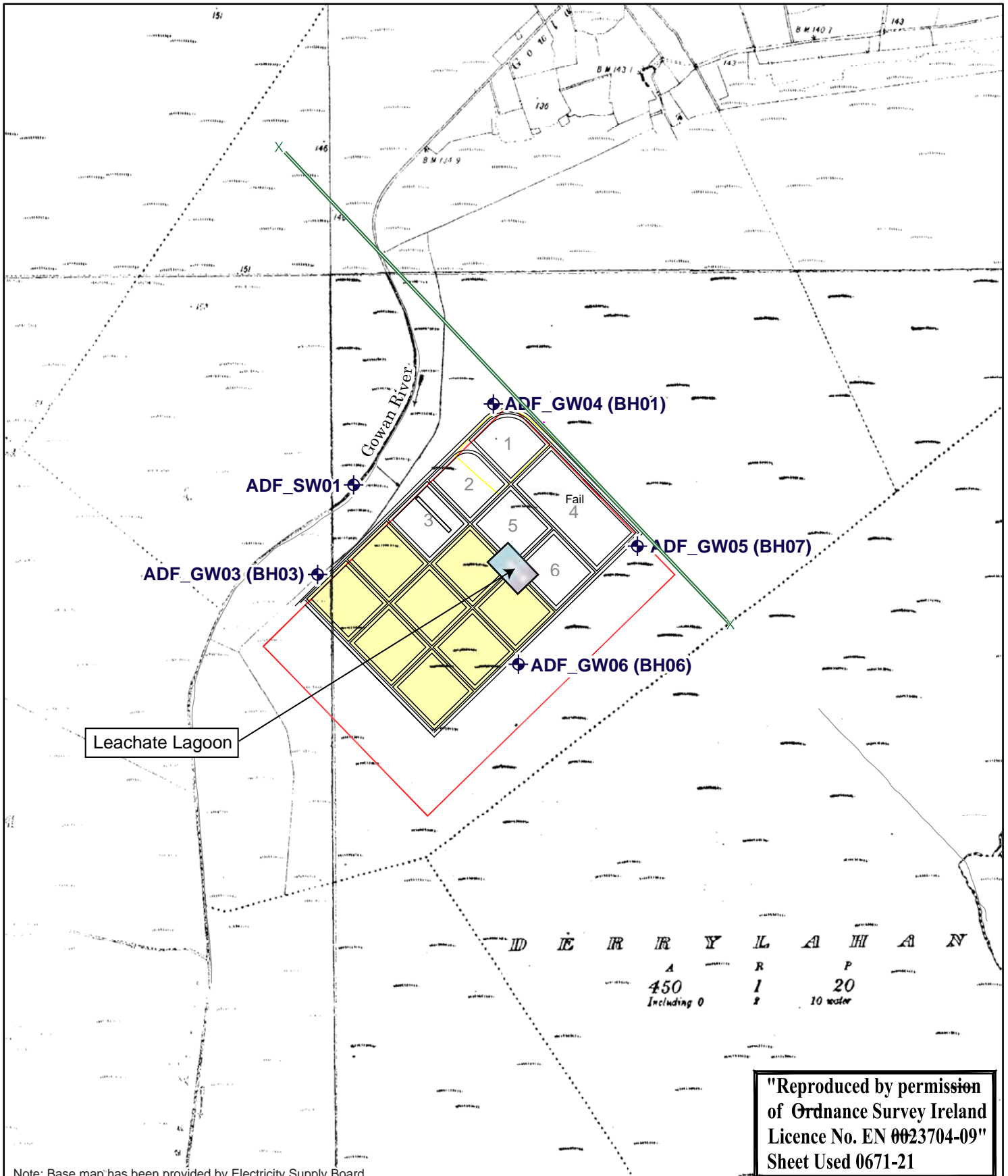
410/411 Q HOUSE, 76 FURZE ROAD, SANDYFORD, DUBLIN 18.
 TEL: +353 (1) 2933200 FAX: +353 (1) 2933201

CLIENT
 ELECTRICITY SUPPLY BOARD

PROJECT
 WEST OFFALY POWER RISK SCREENING AND TECHNICAL ASSESSMENT

DRAWING TITLE
FIGURE 3 _ WEST OFFALY POWER SITE SHOWING LOCATION OF BULK CHEMICAL STORAGE

DRAWN SML	TRACED	CHECKED CF	APPROVED JL/DUB	DATE MAR 2015
SCALE ILLUSTRATION ONLY	JOB NO. 47092932			REV



Leachate Lagoon

Gowon River

ADF_GW04 (BH01)

ADF_SW01

ADF_GW03 (BH03)

ADF_GW05 (BH07)

ADF_GW06 (BH06)

1:20
Including 0
10 water

"Reproduced by permission
of Ordnance Survey Ireland
Licence No. EN 0023704-09"
Sheet Used 0671-21

Note: Base map has been provided by Electricity Supply Board

CLIENT
ELECTRICITY SUPPLY BOARD

PROJECT
WEST OFFALY POWER RISK SCREENING
AND TECHNICAL ASSESSMENT

DRAWING TITLE
FIGURE 4 _ ASH DISPOSAL FACILITY SITE
LAYOUT SHOWING GROUNDWATER AND
SURFACE WATER MONITORING POINTS
AND KEY FEATURES

- NOTES
- Site Boundary
 - ◆ Groundwater Monitoring Well Locations
 - Proposed Cells

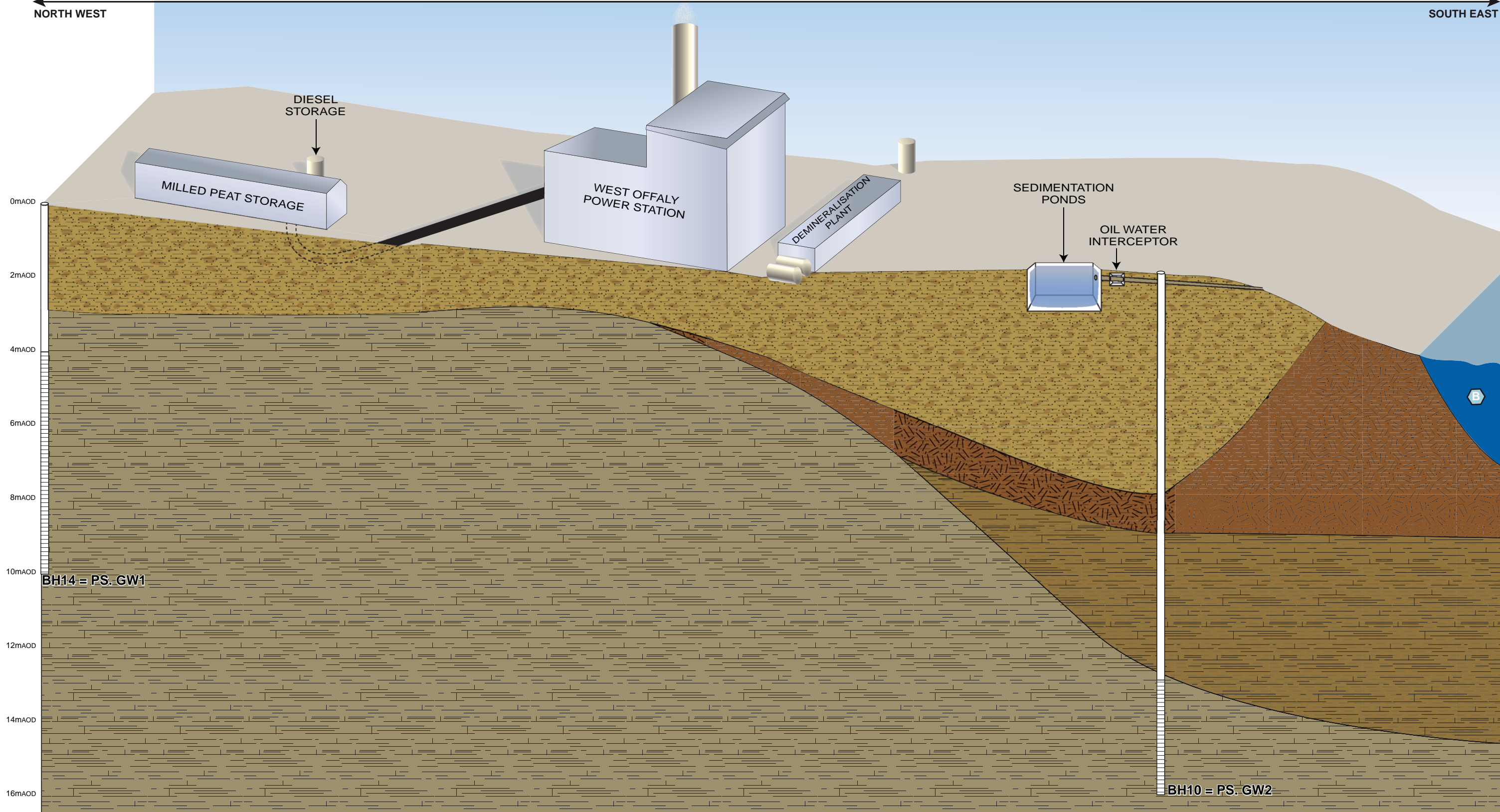
STATUS **DRAFT**

AECOM

410/411 Q HOUSE, 76 FURZE ROAD, SANDYFORD, DUBLIN 18.
TEL: +353 (1) 2933200 FAX: +353 (1) 2933201

DRAWN SML	CHECKED CF	APPROVED JL/DUB	DATE MAR 2015
SCALE ILLUSTRATION ONLY		JOB NO. 47092932	

NORTH WEST ← SOUTH EAST →



CLIENT
ELECTRICITY SUPPLY BOARD

DRAWING TITLE
FIGURE 5 _ CROSS SECTION THROUGH W.O.P SITE

PROJECT
WEST OFFALY POWER RISK SCREENING AND TECHNICAL ASSESSMENT

DRAWN SML	TRACED	CHECKED CF	APPROVED JL/DUB	DATE MAR 2015
SCALE ILLUSTRATION ONLY	JOB NO. 47092932			REV

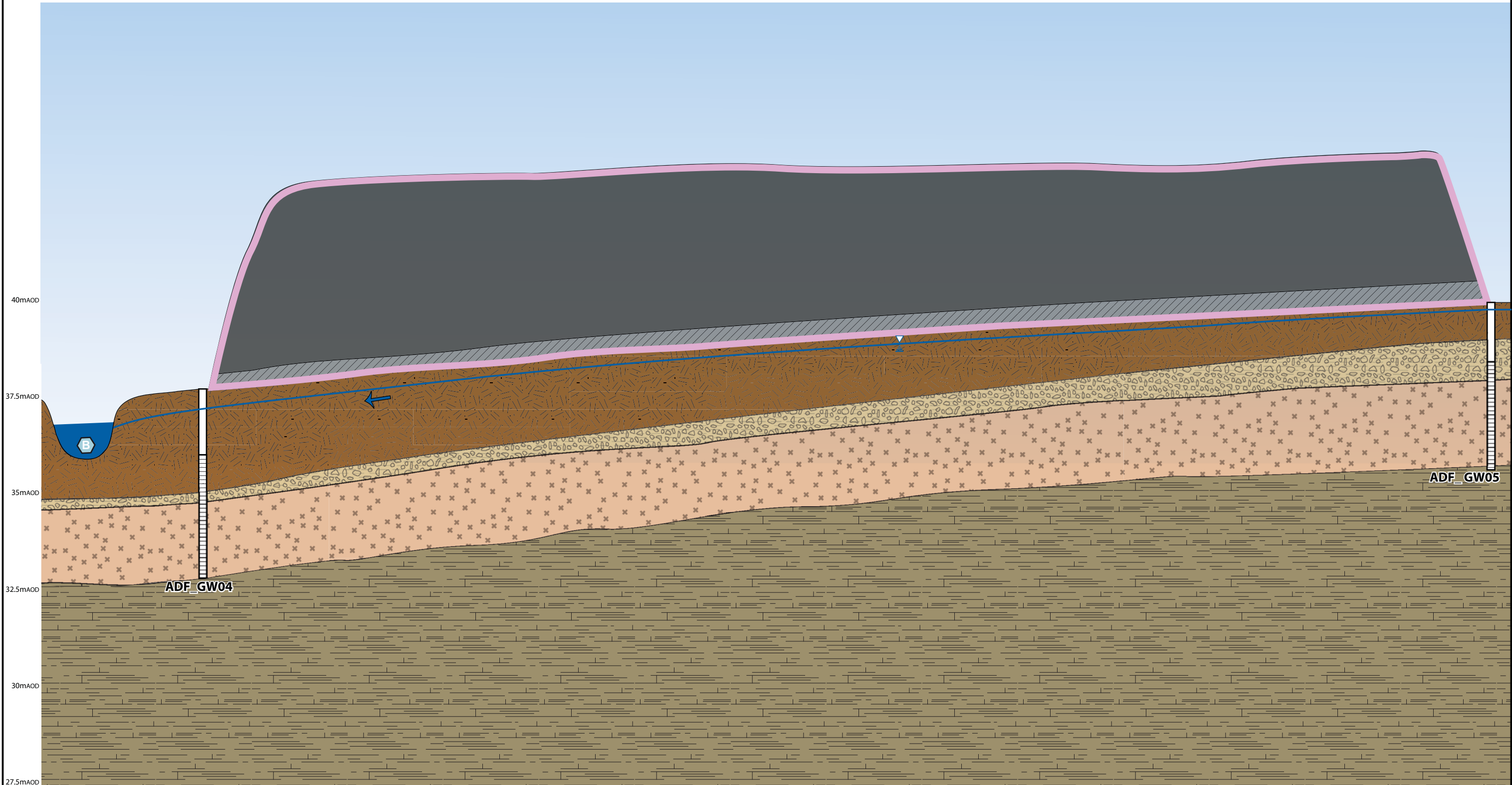
Potential Sources	Identified Sources
1 Ast's	2 Groundwater Source
Receptors	
A Groundwater	E River Shannon
Pathways	
1 Leaching From Impacted Soils	2 Shallow Groundwater Flow

Sources
Clayey Gravelly Sand
Clayey Peat
Clayey Gravel with Weathered Bedrock
Limestone Bedrock



NORTH WEST

SOUTH EAST



CLIENT
ELECTRICITY SUPPLY BOARD

PROJECT
WEST OFFALY POWER RISK SCREENING AND TECHNICAL ASSESSMENT

DRAWING TITLE
FIGURE 6 _ CROSS SECTION THROUGH ADF SITE

DRAWN	TRACED	CHECKED	APPROVED	DATE
SML		CF	JL/DUB	MAR 2015
SCALE ILLUSTRATION ONLY	JOB NO. 47092932		REV	

Potential Sources	Identified Sources
1 Ast's	2 Groundwater Source
Receptors	
A Groundwater	
E Gowan River	
Pathways	
1 Leaching From Impacted Soils	
2 Shallow Groundwater Flow	

Sources
Ash Landfill (estimated elevation)
Composite Drainage Layer
Peat
Clay / Boulder Clay
Silt
Limestone Bedrock
Geosynthetic Clay Liner
Inferred Groundwater Flow Direction
Groundwater Elevation - Measured In November 2000



TABLES

Table 1 - 2014 Groundwater Monitoring Results
West Offaly Power
Risk Screening and Technical Assessment

Sample Identity	Year	Monitoring Round	PS-GW1				PS-GW2				ADF-GW3				ADF-GW4				ADF-GW5				ADF-GW6			
			2014				2014				2014				2014				2014				2014			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC																								
Aluminium	ug/l	150 ⁺	2.9	-	-	-	<2.9	-	-	-	9.82	-	-	-	2.9	-	-	-	2.9	-	-	-	2.9	-	-	-
Arsenic	ug/l	7.5 ⁺	0.615	-	-	-	2.27	-	-	-	1.44	-	-	-	5.09	-	-	-	18.1	-	-	-	1.93	-	-	-
Molybdenum	ug/l	nc	0.757	-	-	-	0.777	-	-	-	0.284	-	-	-	0.393	-	-	-	5.73	-	-	-	1.05	-	-	-
Iron	ug/l	200 [#]	19	-	-	-	0.019	-	-	-	0.345	-	-	-	0.181	-	-	-	0.019	-	-	-	0.168	-	-	-
Cadmium	ug/l	3.75 ⁺	0.1	-	-	-	0.1	-	-	-	0.109	-	-	-	0.1	-	-	-	0.1	-	-	-	0.1	-	-	-
Selenium	ug/l	nc	0.39	-	-	-	3.4	-	-	-	0.39	-	-	-	6.46	-	-	-	0.39	-	-	-	0.498	-	-	-
Copper	ug/l	1500 ⁺	2.54	-	-	-	1.83	-	-	-	2.51	-	-	-	2	-	-	-	1.81	-	-	-	0.85	-	-	-
Nickel	ug/l	15 ⁺	<0.15	-	-	-	0.15	-	-	-	0.493	-	-	-	0.289	-	-	-	15.3	-	-	-	1.62	-	-	-
Zinc	ug/l	100 [#]	2.1	-	-	-	3.48	-	-	-	16.2	-	-	-	0.951	-	-	-	2.55	-	-	-	2.43	-	-	-
Boron	ug/l	750 ⁺	9.4	-	-	-	13.3	-	-	-	9.4	-	-	-	9.4	-	-	-	9.4	-	-	-	9.4	-	-	-
Chromium	ug/l	37.5 ⁺	6.89	-	-	-	5.71	-	-	-	4.41	-	-	-	6.17	-	-	-	6.87	-	-	-	4.19	-	-	-
Lead	ug/l	18.75 ⁺	0.105	-	-	-	0.047	-	-	-	0.593	-	-	-	0.354	-	-	-	0.076	-	-	-	0.183	-	-	-
Manganese	ug/l	50 [#]	0.483	-	-	-	550	-	-	-	58.3	-	-	-	96.9	-	-	-	95.1	-	-	-	242	-	-	-
Magnesium	mg/l	50 [#]	11.7	-	-	-	27.4	-	-	-	5.35	-	-	-	3.5	-	-	-	1.84	-	-	-	6.83	-	-	-
Mercury	ug/l	0.75 ⁺	0.01	-	-	-	0.01	-	-	-	0.01	-	-	-	0.01	-	-	-	0.01	-	-	-	0.01	-	-	-
Calcium	mg/l	200 [#]	133	-	-	-	92	-	-	-	71	-	-	-	104	-	-	-	138	-	-	-	110	-	-	-
Sodium	mg/l	150 ⁺	19.4	-	-	-	127	-	-	-	10.3	-	-	-	50.7	-	-	-	10	-	-	-	11.3	-	-	-
Potassium	mg/l	5 [#]	1.28	-	-	-	24.9	-	-	-	1.84	-	-	-	26.7	-	-	-	2.01	-	-	-	2.99	-	-	-
Chloride	mg/l	187.5 ⁺	40.2	24.6	22	17.9	67.2	58.9	59.1	57.3	18.4	17.1	18.2	11.3	102	135	140	20.1	11.3	9.6	10.6	10.6	10.6	10.7	10.6	10.4
Hydrocarbons (TPH)	mg/l	0.01 [#]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ammonia	mg/l	175 ⁺	0.2	-	-	-	6.3	-	-	-	0.262	-	-	-	2.83	-	-	-	7.42	-	-	-	3.87	-	-	-
Conductivity	us/cm	1875 ⁺	795	833	816	828	1244	785	1312	734	275	360	364	241	679	945	1018	733	676	704	669	679	640	647	628	695
pH	pH units	nc	7.9	7.5	7.5	7.1	7.6	7.5	7.6	7.2	7.4	7.6	7.7	7.2	7.1	7.5	7.1	6.9	7.3	7.1	7.1	7	7.4	7.3	7.2	7.4
COD	mg/l	nc	13.9	-	-	-	14.6	-	-	-	67.4	-	-	-	76.3	-	-	-	29.8	-	-	-	49.2	-	-	-
Sulphate (SO ₄)	mg/l	187.5 ⁺	52.1	45.3	47.1	38.9	273	289	290	282	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Phosphate (PO ₄)	mg/l	nc	0.05	-	-	-	0.314	-	-	-	0.05	-	-	-	0.05	-	-	-	0.05	-	-	-	0.05	-	-	-
Nitrate (NO ₃)	mg/l	37.5 ⁺	0.342	-	-	-	0.3	-	-	-	0.3	-	-	-	0.3	-	-	-	0.461	-	-	-	0.3	-	-	-
Total Oxidised Nitrogen	mg/l	nc	0.1	-	-	-	0.1	-	-	-	0.1	-	-	-	0.1	-	-	-	0.116	-	-	-	0.1	-	-	-
Nitrogen	mg/l	nc	1	-	-	-	6.42	-	-	-	1.03	-	-	-	3.31	-	-	-	7.71	-	-	-	4.48	-	-	-
Total Nitrogen	mg/l	nc	1	-	-	-	6.42	-	-	-	1.03	-	-	-	3.31	-	-	-	7.71	-	-	-	4.48	-	-	-

Notes:
X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

- not analysed

Table 2 - Historical Trend Analysis for Selected Samples - Annual Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity	Date of Sample	Unit	GAC	PS-GW1										PS-GW2										ADF-GW3										
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Arsenic		ug/l	7.5*	1.1	1.1	1	1	4	5	1	1	1	0.615	<1	<1	2	2	6	8	3	5	2	2.27	<2	<2	2	2	4	3	0.2	2	2	1.44	
Nickel		ug/l	15*	<10	<10	1	1	14	3	3	3	2	<0.15	<10	<10	2	49	2	2	1.5	1	1	0.15	<10	<10	2	<1	1	2.5	4	4	3	0.493	
Manganese		ug/l	50#	-	-	-	-	-	-	-	-	-	0.483	-	-	-	-	-	-	-	-	-	550	-	-	-	-	-	-	-	-	-	58.3	
Potassium		mg/l	5#	-	-	-	-	-	-	-	-	-	1.28	-	-	-	-	-	-	-	-	-	24.9	-	-	-	-	-	-	-	-	-	1.84	
Chloride		mg/l	187.5*	91	40	30	30	29	23	17	15	17	40.2	130	180	130	130	96	82	70	77	72	67.2	18	18	22	22	15	13	13	11	17	18.4	
Sulphate (SO ₄)		mg/l	187.5*	-	-	-	-	-	-	-	-	-	27	52.1	-	-	-	-	-	-	-	-	<10	273	-	-	-	-	-	-	-	-	265	2

Notes:
X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

- not analysed

Table 2 - Historical Trend Analysis for Selected Samples - Annual Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity	Date of Sample	Unit	GAC	ADF-GW4										ADF-GW5										ADF-GW6										
				2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
Arsenic		ug/l	7.5*	<2	<2	1	1	4	1.4	23	33	11	5.09	4	4	2	2	4	6	2	3	3	18.1	<2	<2	1	1	2	0.4	0.2	1.3	1	1.93	
Nickel		ug/l	15*	<10	<10	2	5	1	1.7	5	6	2	0.289	<10	<10	9	<1	9	5.5	7	10	7	15.3	<10	<10	1	<1	1	2.0	2	2	2	1.62	
Manganese		ug/l	50#	-	-	-	-	-	-	-	-	-	96.9	-	-	-	-	-	-	-	-	-	95.1	-	-	-	-	-	-	-	-	-	242	
Potassium		mg/l	5#	-	-	-	-	-	-	-	-	-	26.7	-	-	-	-	-	-	-	-	-	2.01	-	-	-	-	-	-	-	-	-	2.99	
Chloride		mg/l	187.5*	18	18	21	21	23	74	891	848	358	102	11	11	14	14	14	10	10	11	10	11.3	13	13	32	32	12	12	12	12	12	10.6	
Sulphate (SO ₄)		mg/l	187.5*	-	-	-	-	-	-	-	-	-	6.6	2	-	-	-	-	-	-	-	-	<2	2	-	-	-	-	-	-	-	-	<2	2

Notes:
X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

- not analysed

Table 3 - Historical Trend Analysis for Selected Samples - Quarterly Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity			PS-GW1																							
			2009				2010				2011				2012				2013				2014			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC	29	36	15	19	26	35	12	17	20	16	21	11	20	15	14	10	17	19.8	16.6	10.3	40.2	24.6	22	17.9
Chloride Quarterly	mg/l	187.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	52.1	45.3	47.1	38.9
Sulphate (SO ₄)	mg/l	187.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	52.1	45.3	47.1	38.9

Notes:

X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

- not analysed

Table 3 - Historical Trend Analysis for Selected Samples - Quarterly Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity			PS-GW2																							
			2009				2010				2011				2012				2013				2014			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC	96	88	111	79	98	89	73	66	66	61	73	81	80	78	73	75	72	69.2	66.5	19.4	67.2	58.9	59.1	57.3
Chloride Quarterly	mg/l	187.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	273	289	290	282
Sulphate (SO ₄)	mg/l	187.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	273	289	290	282

Notes:
 X exceeds GAC

- nc - no criteria available
- MDL - Method Detection Limit
- + Irish Groundwater Threshold values (GTVs) 2010
- # Irish Interim Guideline values (IGVs) 2003
- not analysed

Table 3 - Historical Trend Analysis for Selected Samples - Quarterly Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity			ADF-GW3																							
			2009				2010				2011				2012				2013				2014			
Date of Sample	Unit	GAC	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC																								
Chloride Quarterly	mg/l	187.5*	15.0	16.0	14.5	-	12	14	12	15	10	14	16	11	15	10	10	8	17	14.4	14.9	66.0	18.4	17.1	18.2	11.3
Sulphate (SO ₄)	mg/l	187.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	265	2	2	2	2

Notes:

X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

- not analysed

Table 3 - Historical Trend Analysis for Selected Samples - Quarterly Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity			ADF-GW4																							
			2009				2010				2011				2012				2013				2014			
Date of Sample	Unit	GAC	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC																								
Chloride Quartely	mg/l	187.5*	23	19	19	-	10	10	9	9	375	687	1110	1390	1390	751	778	471	358	324	324	116	102	135	140	20.1
Sulphate (SO ₄)	mg/l	187.5*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	2	2	2	2

Notes:
X exceeds GAC

- nc - no criteria available
- MDL - Method Detection Limit
- + Irish Groundwater Threshold values (GTVs) 2010
- # Irish Interim Guideline values (IGVs) 2003
- not analysed

Table 3 - Historical Trend Analysis for Selected Samples - Quarterly Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity			ADF-GW5																							
			2009				2010				2011				2012				2013				2014			
Date of Sample	Unit	GAC	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC																								
Chloride Quarterly	mg/l	187.5 [#]	14	12	12	-	10	10	9	9	9	11	10	9	12	10	10	10	10	9.3	9.1	9.1	11.3	9.6	10.6	10.8
Sulphate (SO ₄)	mg/l	187.5 [#]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2	2	2	2	2

Notes:

X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

- not analysed

Table 3 - Historical Trend Analysis for Selected Samples - Quarterly Groundwater Monitoring Results
 West Offaly Power
 Risk Screening and Technical Assessment

Sample Identity			ADF-GW6																							
			2009				2010				2011				2012				2013				2014			
Date of Sample			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Analyte	Unit	GAC																								
Chloride Quarterly	mg/l	187.5 [#]	12	13	13	-	12	12	12	12	12	11	12	12	12	12	11	11	12	11.3	1.1	10.7	10.6	10.7	10.6	10.4
Sulphate (SO ₄)	mg/l	187.5 [#]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<2	2	2	2	2

Notes:

X exceeds GAC

nc - no criteria available

MDL - Method Detection Limit

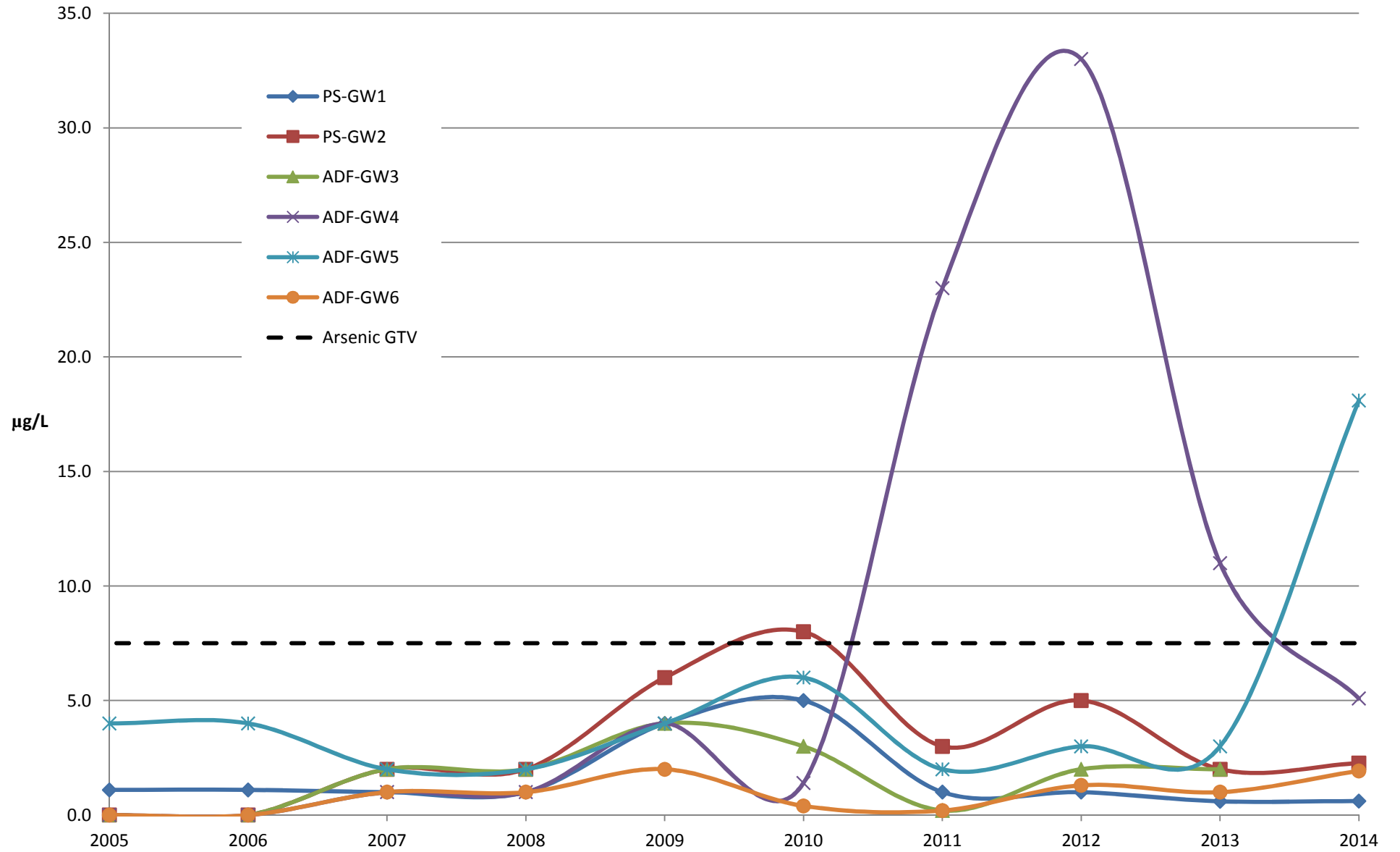
+ Irish Groundwater Threshold values (GTVs) 2010

Irish Interim Guideline values (IGVs) 2003

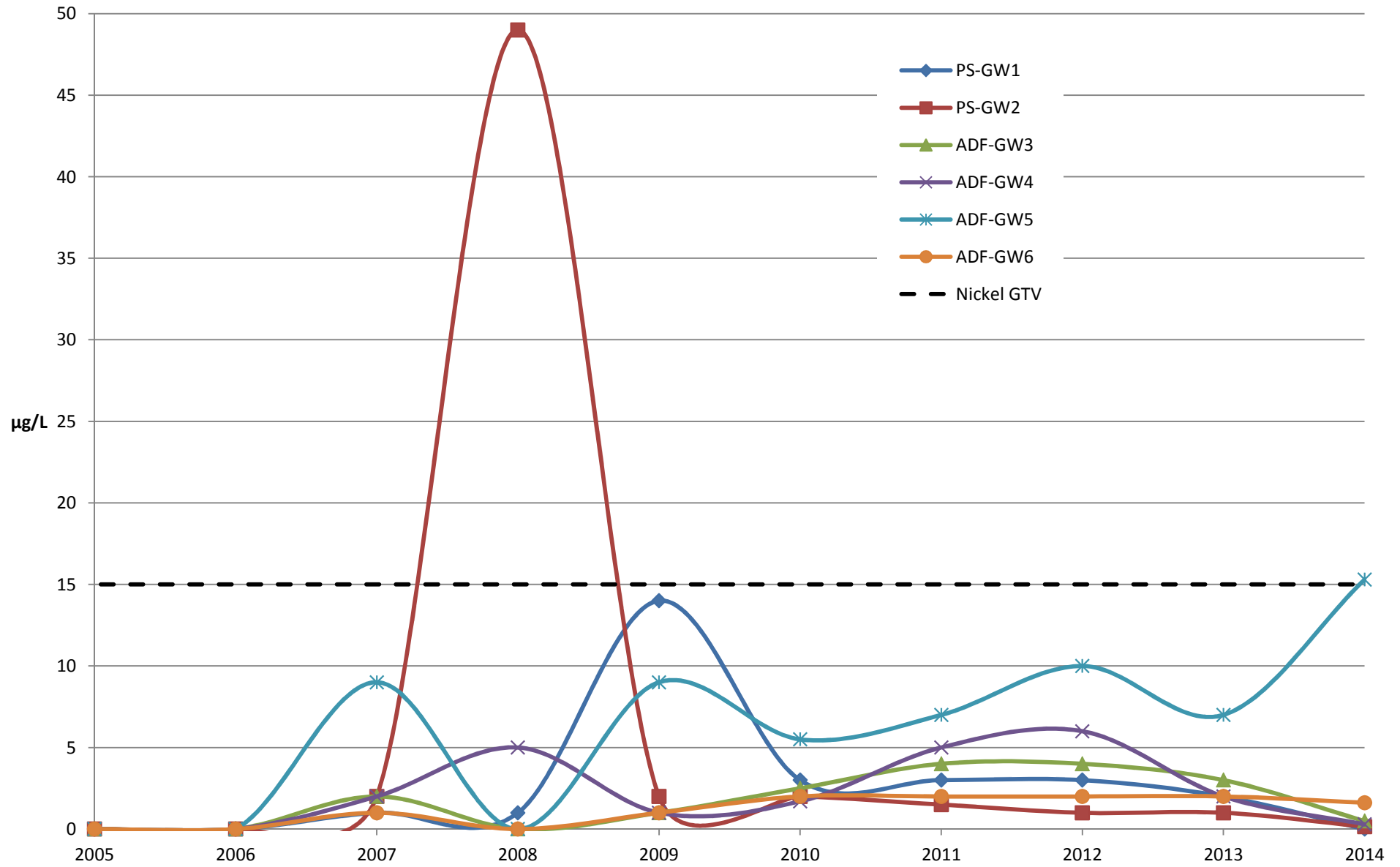
- not analysed

GRAPHS

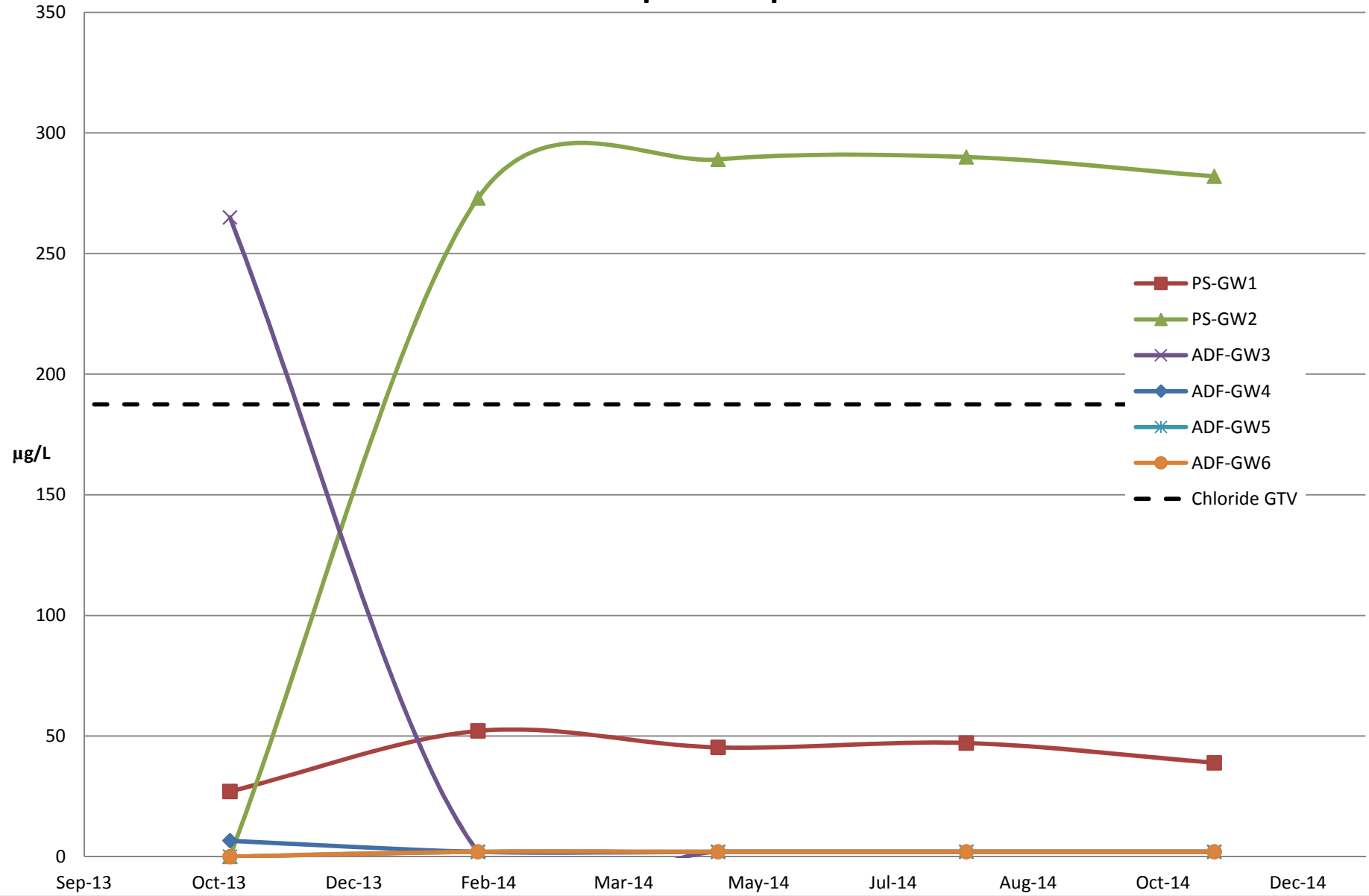
Graph 1: Arsenic



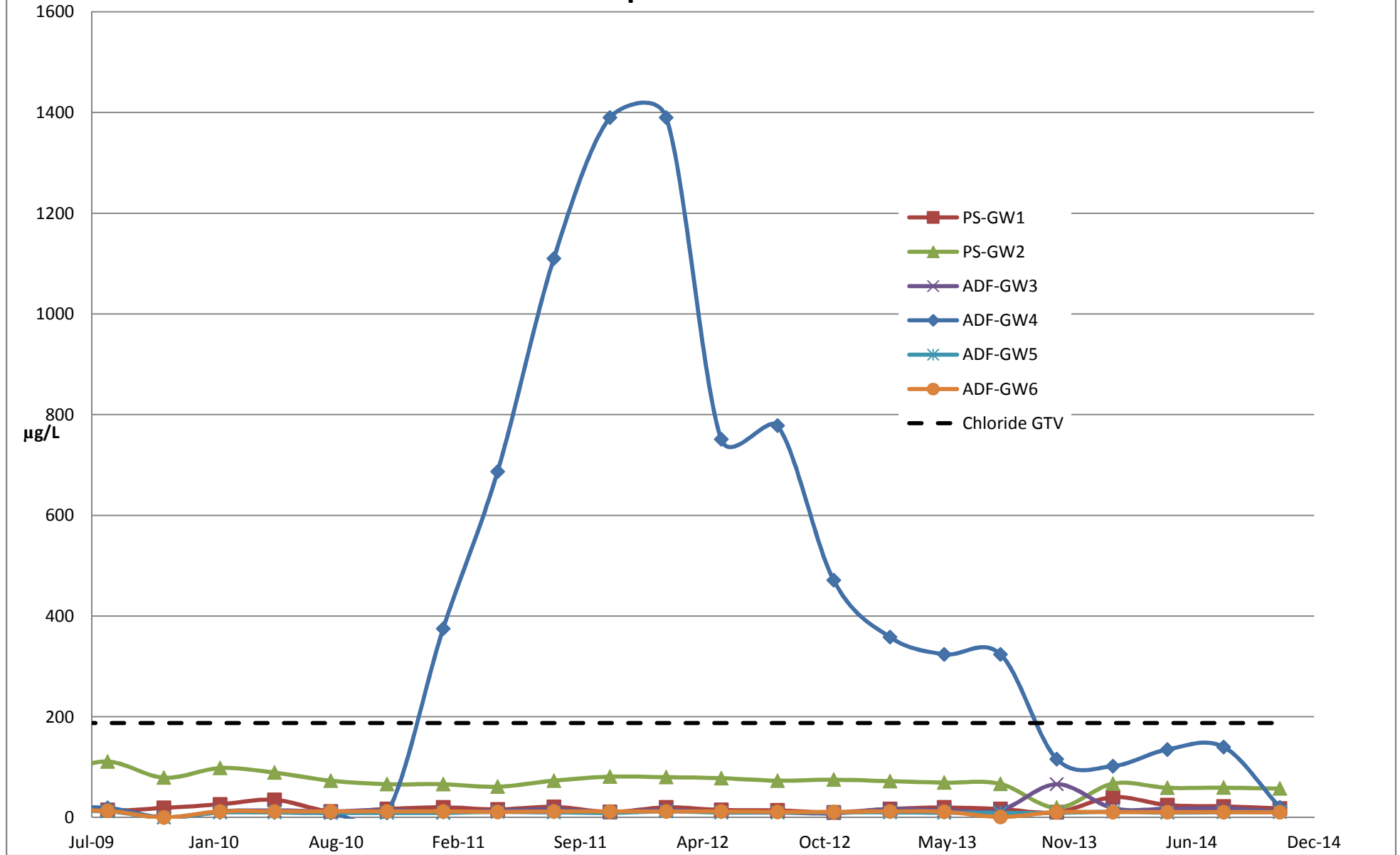
Graph 2: Nickel



Graph 3: Sulphate



Graph 4: Chloride



APPENDIX A – BOREHOLE LOGS

BOREHOLE CONSTRUCTION	SAMPLE		PID READING (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: 10		PAGE 1 of 1	
	ANALYTES	TYPE					DRILLING DATES: 22-Nov-04		DRILLING METHODS : Air Rotary	
							DRILLER : Stephan Peterson		BOREHOLE DIAMETER : 152.4 mm	
							LOGGED BY : Ryan Rafferty		SCREEN TYPE & DIAM: HDPE 50 mm	
							CHECKED BY :		SCREEN SLOT SIZE: 2.5 mm	
						DESCRIPTION	COMMENTS			
						0.0	<p>Madeground Black-brown Clayey Gravelly Sand</p>		0.0	
						1.0			1.0	
						2.0			2.0	
						3.0			3.0	
						4.0			4.0	
						5.0			5.0	
						6.0			6.0	
						7.0			7.0	
						8.0			8.0	
						9.0			9.0	
10.0	10.0									
11.0	11.0	<p>Bedrock Clean grey LIMESTONE</p>		11.0						
12.0	12.0									
13.0	13.0	<p>Bedrock Dark black cherty LIMESTONE</p>								
14.0	14.0	<p>Becoming harder</p>								
15.0	15.0	<p>EOH @ 14.0 m</p>								

LOCATION / NOTES:
 NEC= No Evidence of Contamination

LEGEND

- Disturbed Sample
- Undisturbed Sample
- PID Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title: Monitoring Well Installation
 Location: Shannonbridge
 Client: ESB

	App'd:	Date: November 2004
	Drawn : RR	Ref: RR/CG/DUB
	Scale: As Shown	Job No: 44871-039
	Drg. Size: A4	BOREHOLE LOG

BOREHOLE CONSTRUCTION	SAMPLE		PID READING (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: 14		PAGE 1 of 1	
	ANALYTES	TYPE					DRILLING DATES: 23-Nov-04		DRILLING METHODS : Air Rotary	
							DRILLER : Stephan Peterson		BOREHOLE DIAMETER : 152.4 mm	
							LOGGED BY : Ryan Rafferty		SCREEN TYPE & DIAM: HDPE 50 mm	
							CHECKED BY :		SCREEN SLOT SIZE: 2.5 mm	
						DESCRIPTION	COMMENTS			
						0.0	Madeground Vegetation		0.0	
						1.0	Madeground Clayey gravelly sand		1.0	
						2.0	Weathered Bedrock Weathered light grey LIMESTONE fragments		2.0	
						3.0	Bedrock Solid grey LIMESTONE	Dry	3.0	
						4.0	Bedrock Solid black LIMESTONE	Very wet	4.0	
						5.0			5.0	
						6.0			6.0	
						7.0			7.0	
						8.0			8.0	
						9.0			9.0	
						10.0	EOH @ 10.0 m		10.0	
						11.0			11.0	

LOCATION / NOTES:
 NEC= No Evidence of Contamination

 Not a lot of water encountered

LEGEND

- Disturbed Sample
- Undisturbed Sample
- PID Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title: Monitoring Well Installation
 Location: Shannonbridge
 Client: ESB

App'd:	Date: November 2004
Drawn : RR	Ref: RR/CG/DUB
Scale: As Shown	Job No: 44871-039
Drg. Size: A4	BOREHOLE LOG

Figure 2: BOREHOLE GROUND AND GROUNDWATER CONDITIONS
 STANNONBRIDGE GENERATING STATION - ASH DISPOSAL SITE

	Boreholes							
	BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Ground level mOD	37.7	35.5	36.2	38.9	38.3	40.2	40	39.4
Peat thickness	2.6	1	1	0.9	1.2	1.8	0.9	1.3
Clay/Boulder clay thickness	0.3	0.6	0.3	2	1.9	2.2	1	0.2
Silt thickness	2.1	-	-	-	-	2	2.4	-
Silty gravel thickness	-	3.3	0.8	1.6	3.5	-	-	2.9
Boulder clay thickness	-	2.7	0.9+	-	-	-	-	-
Refusal depth	5.3	-	3	-	-	-	-	-
Refusal mOD	32.4	-	33.2	-	-	-	-	-
Rockhead depth	-	7.6	-	4.5	5.4	6	4.3	4.4
Rockhead mOD	-	27.9	-	34.4	32.9	34.2	35.7	35
Borehole base depth	5.3	15.5	3	12	5.9	12	5.9	9.1
Standpipe Response Zone								
Length	1.55	6.3	1	4	2.2	3.8	2.2	3.5
Top - Bottom depth	3.2 to 4.75	9.2 to 15.5	1.5 to 2.5	8 to 12	2.4 to 4.6	8.2 to 12	1.7 to 3.9	5.6 to 9.1
Bottom mOD	32.95	20	33.7	26.9	33.7	28.2	36.1	30.3
Groundwater depth (1/11/00)	0.68	-	2.5	1.2	0.2	0.12	0.15	0.1
Groundwater mOD (1/11/00)	37.02	-	33.7	37.7	38.1	40.08	39.85	39.3
Field Permeabilities								
Test-top	3.9	9	1.2	5	1.4	7.2	1.5	4.4
Test bottom	4.3	10.2	2.1	9.01	1.9	7.2	1.7	7.05
Value (m/s)*	8.8×10^{-7}	2.3×10^{-7}	7.8×10^{-7}	1.9×10^{-6}	7.6×10^{-7}	4.1×10^{-4}	7×10^{-7}	2.1×10^{-5}

Notes:

All depths in m unless otherwise stated

Note:

* = field permeability were calculated using variable head test data in accordance with BS5930.

APPENDIX B – MATERIAL SAFETY DATA SHEETS

APPENDIX C – INVENTORY OF CHEMICALS STORED ON-SITE

Inventory of Minor Chemicals stored on Site

Chemical	Manufacturer	Pack size	Product name	Quantity	Annual Usage
				21/10/2014	2014
"Bakers" Soldering fluid 3	Frytech	250ml	Bakers no.3 250ml	1	0
#1 GOLD METAL CUTTING FLUID	morgan	500ml	(Bulk liquid)	1	0
388 synthetic tapping fluid	Chesterton	500ml	388 synthetic tapping fluid (Bulk)	0	0
723 Sprasolvo	Chesterton	400ml	723 sprasolvo	7	3
785 Lubricant	Chesterton	500g	787 parting lubricant (Aerosol)	0	0
900 Gold End Paste	Chesterton	200 g	900 Goldend r Paste	0	0
ABS solvent Cement	Glynwed	500ml	B-25	0	0
ABS Special Adhesive	Henkel	650 g	Tangit ABS special adhesive	0	0
ARBO XL 1075 Fire resistant Sealent	ARBO	310 ml	ARBO XL 1075	0	0
Gleitmo 165	BSS Group	500ml	Gleitmo 165	0	0
Butane Gas	R5	200ml	Butane Gas	0	0
Caking agent 97371	Hempel	17L	Caking agent 97371	0	0
Caking agent 97371	Hempel	2.5L	Caking agent 97371	0	0
Chain and Drive Spray	Rocol	400ml	Rocol Chain and Drive Spray	0	0
Cold Galvanising Spray	Rocol	400ml	Gold Galvanising Spray.	0	0
Contractor General Purpose Silicone	Corning	300 ml	Contractor General Purpose Silicone	0	0
Dry PTFE lubricant	Rocol	400ml	DRY PTFE SPRAY	0	0
Easyline	Rocol	750ml	EASYLENE EDGE - ALL COLOURS	0	0
Epoxylite	Elantas	800ml	Epoxy monocomponent resin.	1	0
Evan's Heavy Duty Degreaser	Tick	5 L	Lift	0	0
Firecrl Fire seal	Soudal	310 ml	firecrl FR	0	0
Floor Polish	Diversey	5 L	Floor Polish	0	0
Foliac Superred Jointing Compound	Rocol	400 g	FOLIAC SUPER RED PJC	0	0
Gleitmo 165	Fuchs Lubritech	250 ml	Gleitmo 165	0	0
Glyphosate	Clinic Ace		Glyphosate (Credit DST)	0	0
G-n plus Assemble/running - in paste	Molykote	1kg	MOLYKOTE(R) G-N PLUS PASTE	0	0
G77 Moisture repellent	Novatech	200ml	Art No. 230102000 G77	0	0
Gun Applied Gas Expanding Foam	Evo-Stik	750ml	EVO-STIK GUN APPLIED FOAM	0	0
Heat Mate	Everbuild	300 ml	HEAT MATE SEALANT - ALL COLOURS	12	6
Jizer	Swarfega	25L	DEB JIZER	0	0
Jointing compound	Rocol	400g	FOLIAC MANGANESE PJC	1	0
Lapping Compound	Carborundum	500 g	Lapping Compound	0	0
Loctite 243 Treadlocker	Loctite	50ml	Loctite 243	3	2
Loctite 270 Treadlocker	Loctite	50ml	Loctite 270	0	0
Loctite 3430	Loctite	24 ml	Loctite 3430B Kit component	0	0
Loctite 406 Instant Adhesive	Loctite	20 g	Loctite 406 Prism	0	0
Loctite 454 Gel Adhesive	Loctite	20 g	Loctite 454	0	0
Loctite 542 Treadsealant	Loctite	50ml	Loctite 542	0	0
Loctite 574 Flange Sealent	Loctite	160ml	Loctite 574	5	0
Loctite 577 Tread Sealent	Loctite	50ml	Loctite 577	6	6
Loctite 660 Retaining Compound	Loctite	50ml	Repair	3	0
Loctite 7039 contact cleaner	Loctite	400ml	Loctite 7039	4	6
Loctite 7063 super clean	Loctite	400ml	Loctite 7063	5	11
Loctite 7100 leak detector	loctite	400ml	Loctite 7100	0	0
Loctite 7200 Gasket remover	loctite	400ml	Loctite 7200	4	1
Loctite 7455 activator	loctite	150ml	Loctite 7455	10	2
Loctite 7649	Loctite	500ml	Loctite 7649 500 ML	3	6
Loctite 770 Primer	Loctite	10 g	Loctite 770	2	4
Map//Pro Gas	Rothenberger	1L	MAPP GAS (Petroleum Gas, MAPD)	0	0
Mapp Gas	Rothenberger	1L	MAPP GAS (Petroleum Gas, MAPD)	3	3
Metal Protector Plus Spray	Boss	500 ml	BOSS MEK Cleaner	0	0
Multipurpose Silicon with Fungicide	Molykote	400 ml	MOLYKOTE(R) METAL PROTECTOR PLUS	0	0
fluid	Sealants	300 ml	fluid	0	0
Multiuse Powder Filler	Rocol	5 L	MULTISOL	0	0
Open Gear Spray	Rocol	1800 g	TUFGEAR SPRAY	1	0
Optimol SHF spray	Rocol	400 ml	castrol optimol SHF spray	4	2
Pine Disinfectant	Castrol	400ml	TEEPOL	0	0
Pinty Plus Basic	Teepol	5 L	BASIC SYNTHETIC PAINT (Gloss-Satin-Mat)	0	0
Plastic steel 5 minute putty	Novasolspray	400ml	Plastic steel 5 minute putty	0	0
Polygliss-N spray adhesive	Devcon	500ml	MOLYKOTE(R) POLYGLISS N SPRAY	0	0
PR spray	Molykote	400ml	PR SPRAY	0	0
Propane	Rocol	400ml	Acetylene-Propadiene Mixture	0	0
Pur 7 1- component isolation foam	Rothenberger	450g	PUR 7	0	0
PVC cleaner	Novatech	750ml	Tangit Cleanser PVC-U/C ABS	0	0
RTD Liquid	Tangit	1L	RTD LIQUID	0	0
Rubber Adhesive	Rocol	400g	RU BBER CEMENT	0	0
SKC-S Cleaner/Remover	Devcon	250ml	SKC-S Aerosol	0	0
SKD-S2 Developer	Magnaflux	300g	SKD-S2 Aerosol	0	0
SKL-SP1 Penetrant	Magnaflux	300g	SKD-S2 Aerosol	0	0
Solvent Cement	Magnaflux	300g	fusetite solvent cement	0	0
Special Adhesive for uPVC	Fusetite	250 ml	Tangit PVC-U Special Adhesive	0	0
System foam cleaning	CH	500ml	EVO-STIK PU FOAM CLEANER	0	0
T-88 hard PVC solvent cement	Evo-Stik	500ml	Griffon T 88	0	0
Tangit ABS special adhesive	Griffon	250ml	Tangit ABS special adhesive	5	5
Tetrabor	Henkel	650g		0	0
Titanium HP Putty Epoxy Resin	ESK	100 g	TITANIUM PUTTY RESIN	0	0
Tremsil 500	Boss	500 g	tremsil 500,	0	0
Tufanega Organge Hand Cleaner	Tremco	310 ml	TUFANEGA ORANGE	0	0
Turbo Gas	deb	4 L	Turbo Gas	0	0
Valve Grinding Compound	Turbotorch	1 L	Valve Grinding Compound	0	0
WD-40	Carborundum	500 g	WD40 AEROSOL	5	5
White Spirit	WD-40	250ml	WHITE SPIRIT	4	6
White Spirit	Fleetwood	4L	MANGERS White Spirit	0	0
Wolfrakote top paste	Mangers LTD	2L	WOLFRAKOTE TOP PASTE	0	0
Wood adhesive	Klubr lubricatio	600g	EVO-STIK WOOD ADHESIVE INTERIOR	0	0
Z187 Super Gasket remover	Evo-Stik	1L	Z187 Super Gasket remover	0	0
Zip Patch activator	Corium	400ml	ZIP PATCH ACTIVATOR	0	0
Zip Patch adhesive	Devcon		ZIP PATCH ADHESIVE	6	4
Hempadur 85671	Devcon		Hempadur 85671	0	0

APPENDIX D – AER REPORTS (2005 – 2013)

ABOUT AECOM

In a complex and unpredictable world, where growing demands have to be met with finite resources, AECOM brings experience gained from improving quality of life in hundreds of places.

We bring together economists, planners, engineers, designers and project managers to work on projects at every scale. We engineer energy efficient buildings and we build new links between cities. We design new communities and regenerate existing ones. We are the first whole environments business, going beyond buildings and infrastructure.

Our Europe teams form an important part of our worldwide network of nearly 100,000 staff in 150 countries. Through 360° ingenuity, we develop pioneering solutions that help our clients to see further and go further.

www.aecom.com

Follow us on Twitter: [@aecom](https://twitter.com/aecom)