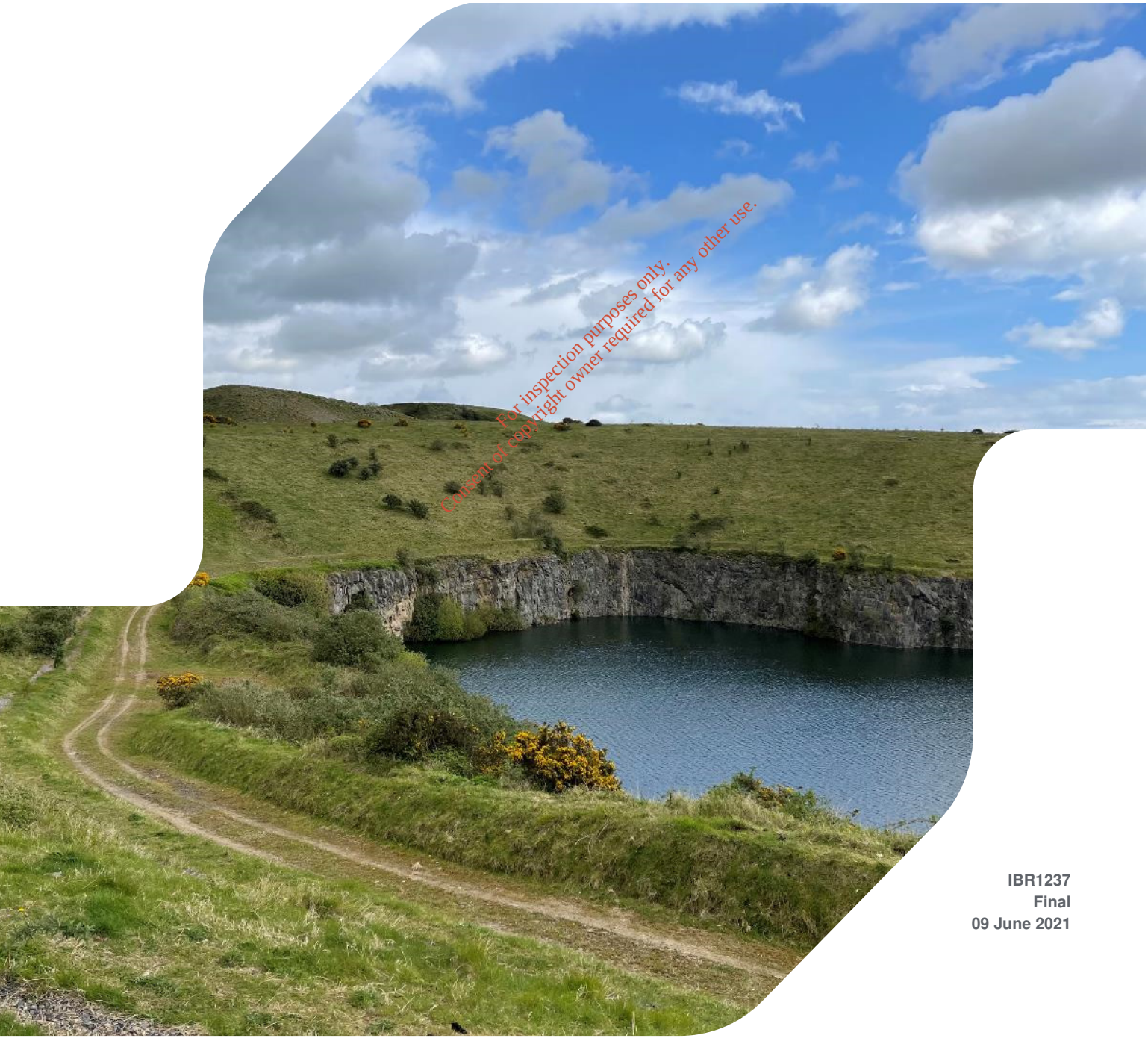
DROGHEDA LANDFILL SITE

Drogheda Licence Review Article 12



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Prepared by:

RPS

Angela McGinley
Senior Scientist -Waste

Enterprise Fund Business Centre, Business Park Road, Ballyraine
Letterkenny, Co. Donegal F92 AF43

T +44 28 9694 9946
E angela.mcginley@rpsgroup.com

Prepared for:

Louth County Council

Sean Callaghan

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1 ARTICLE 12 COMPLIANCE REQUIREMENTS

1.1 Describe the nature of the facility or premises concerned, including the proposed capacity of the facility or premises

Drogheda Landfill Site opened in 1983 and ceased accepting waste for disposal at the landfill since the waste licence was granted on 30th December 1999 as required by the Waste Management (Licensing) Regulations, 1997. Only inert waste for restoration and capping of the landfill have been brought on site following this date. Restoration and capping works have been undertaken in a number of Phases, with Phase 1 capping works being completed in September 2007. Approximately 15,000 m^2 of capping (Phase 2) in the former CRH lands to the north of the site was completed in December 2016.

Phase 3 capping works will be undertaken on a further area to the north of the site which has been acquired by Louth County Council. The capping of this area will deal with the remaining area of waste deposited outside the boundary to the northern part of the site and has an area encompassing approximately 14000 m^2. Louth County Council are applying to change the boundary of the landfill to take in an additional 1.22 hectares of land where waste was historically landfilled by Drogheda Borough Council. This land has been purchased by Louth County Council from a third party and specified engineering works have been submitted to the EPA for approval to cap this area and provide appropriate monitoring infrastructure including gas and groundwater. These works cannot be undertaken until a review of the licence in relation to the boundary change has be completed. As the landfill site is closed there is no remaining landfill capacity at the site.

A Civic Waste Facility is operated at the site. As per Condition 5.9 (c) of the current waste licence the quantity of waste to be accepted at the Civic Waste Facility shall not exceed 10,000 tonnes per annum unless otherwise agreed with the Agency. Site Location and Layout are shown on Drawings IBR01237/100 and IBR01237/101 in Appendix A. The National Grid Reference for the facility is 307013E 276405N.

The site is located within Louth County Council planning authority and the activity constitutes development but is exempted development. An Environmental Impact Assessment (EIS) has not been prepared in support of this application. An Appropriate Assessment Screening has been prepared and was included in the application.

1.2 Specify the class or classes of activity concerned, in accordance with the Third and Fourth Schedules of the Act

The licensed disposal activities, in accordance with the Third Schedule and Fourth Schedule of the Waste Management Act, 1996, are restricted to those listed as per Schedule A: Waste Activities in the current licence (Table 1.1).

Table 1.1: Classes Of Activity Concerned

D and R Codes	Class as per current licence[1]	
Third Schedule of the Waste Management Act		
D15 Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where the waste is produced	**Class 13**	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced. This activity is limited to the temporary storage of waste at the proposed Civic Waste Facility in containers prior to disposal at an alternative appropriate facility
Fourth Schedule of the Waste Management Act		
R3 Organic substance recycling/reclamation	**Class 2**	Recycling or reclamation of organic substances which are not used as solvents (including composting and

[1] Waste Licence W0033-01 Schedule A : Waste Activities

D and R Codes	Class as per current licence[1]	
		other biological transformation processes): This activity is limited to composing of green waste and the recovery of recyclable organic materials including waste oils, paper and cardboard deposited at the proposed Civic Waste Facility
R4 Metal recycling/reclamation	**Class 3**	Recycling or reclamation of metals and metal compounds: This activity is limited to the collection of metals at the proposed Civic Waste Facility.
R5 Inorganic substance recycling/reclamation	**Class 4**	Recycling or reclamation of other inorganic materials: This activity is limited to the collection of glass at the proposed Civic Waste Facility and the recovery and reuse of inert waste for landfill restoration and construction works
R10 Land treatment resulting in benefit to agriculture or ecological improvement	**Class 10**	The treatment of waste on land with a consequential benefit for an agricultural activity or ecological system. This activity is limited to the composting of green waste and the use of such compost for landfill restoration purposes.
R11 Use of waste obtained from any of the operations numbered R1 to R10	**Class 11**	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule: This activity is limited to the use compost for landfill restoration purposes
R13 Storage of waste pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where the waste is produced)	**Class 13**	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced: This activity is limited to the temporary storage of recyclable and reusable waste pending their collection.

1.3 Specify, by reference to the relevant European Waste Catalogue codes (List of Waste codes) as presented by Commission Decision 2000/532/EC of 3 May 2000, the quantity and nature of the waste or wastes which will be treated, recovered or disposed of

The landfill site is closed and no waste is accepted for disposal at the landfill site. A Civic Waste Facility is operated at the site. The Civic Waste facility accepts the following wastes.

- Magazines
- Cardboard
- Newspaper
- Plastic Bottles
- Plastic Milk Bottles
- Plastic Bags and Film
- Aluminum Cans
- Footwear
- Clothes
- Car Batteries
- Fluorescent Tubes

- Glass – Blue, Clear, Brown, Green
- Food & Biscuit Tins
- Small Batteries
- Electrical Equipment - Including Televisions, Computer's, Microwaves, Kettles, Toasters, Hoovers, Radios, Washing Machines, Cookers, and Fridges etc.
- Metal
- Wood

The EWC codes are provided in Table 1.2.

Table 1.2: Waste Quantities (Tonnes) at Civic Waste Facility 2020 and tonnes which could be accepted assuming max 10,000 tonnes.

List of Waste Code	Quantity (Tonnes) 2019	Waste Description	Disposal or Recovery	Quantity (Tonnes) which could be accepted assuming max 10,000	Facility
20 03 01 A	62	Mixed residual waste	D05 - Specifically engineering landfill, non-hazardous waste.	222	Indaver
20 02 01	1032	Garden (green) waste	R03 - Composting (aerobic)	3695	Dundalk Landfill W0034-02
15 01 01	248	Cardboard & paper (segregated packaging waste only) e.g. cardboard boxes	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)	888	Peute Europe NI6000076
20 01 01	106	Cardboard & paper (non-packaging waste only) e.g. news & pams	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)	380	Peute Europe NI6000076
15 01 07	237	Glass (segregated packaging waste only) e.g. glass bottles	R05 - Inorganic materials recycling or reclamation (to end-of-waste)	849	Glassden NI LN06/08
15 01 04	46	Aluminium and steel cans (mixed) (segregated packaging waste)	R04 - Metal and metal component recycling or reclamation (to end-of-waste)	165	Tinnelly NI LN09/I0
20 01 40 C	258	Other municipal metals (non-packaging)	R04 - Metal and metal component recycling or reclamation (to end-of-waste)	924	Tinnelly NI LN09/I0
15 01 02	339	Plastic (segregated packaging waste only) e.g. PET bottles	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)	1214	Sharba Plastics MN 080022-01
20 01 10 & 20 01 11	9	Clothes/textiles for recovery or disposal	R03 - Other recycling or reclamation of organic substances which are not used as	32	Textile Recycling

List of Waste Code	Quantity (Tonnes) 2019	Waste Description	Disposal or Recovery	Quantity (Tonnes) which could be accepted assuming max 10,000	Facility
			solvents (to end-of-waste)		
15 01 03	157	Wood (segregated packaging waste) e.g. pallets, wooden crates	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)	562	Thorntons WO195-02
20 01 38	292	Wood (non-packaging waste, municipal)	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)	1045	Thorntons WO195-02
16 06 01*	7	Lead batteries	R04 - Metal and metal component recycling or reclamation (to end-of-waste)	25	Enva Irl
20 01 33 20 01 34		Batteries and Accumulators (Household		0	Enva Irl
20 01 21		Fluorescent tubes		0	Irish Lamp Recycling
20 01 35 20 01 23		Electrical Goods		0	Radcliffe Waste Mgt Solutions

1.3.1 Storage of Waste and Other Materials

The current maximum amount of waste that is being held or stored at the installation at any one time is 80 tonnes. Storage bins, bays and receptacles on site including capacity to hold and store 30 tonnes. The storage building where baling takes place has a capacity of 50 tonnes. Currently the facility operates at 35% of its capacity and therefore has ample receptacles, containers and storage arrangements in place for current and future operations.

Dry recyclables accepted at the facility deposited at the Civic Waste Facility are placed;

- Into a receptacle for recovery, or
- Into a designated inspection area.

Dry recyclables are stored, compacted and/or baled were required prior to shipping for recovery. The use of compaction/baler equipment increase the efficiency of materials collections at the site, increasing the sites capacity for accepting wastes and reducing the amount of vehicle movements to and from the site to service containers. The size of skips/bins on site are 30 to 40 cubic yards. The estimated storage capacity for the recycling facility for all waste (Table 1.3) is dependent on the number of skips required. This is dependent on the volume of waste being accepted which is currently below the waste licence maximum of 10,000 tonnes. A WEEE storage area has also been provided.

Table 1.3: Waste Storage Capacity at Civic Waste Facility

Material	Storage capacity
Electrical	15 caged receptacles of electronic and electrical equipment with a storage capacity of 3m^3.
Cardboard, Newspaper, Books, Papers, Aluminum Cans, Plastic Milk Bottles, Plastic Bottles	Storage capacity in storage shed = 50 tonnes which includes loose and baled material
Batteries	Storage capacity – 500kg in receptacle

Material	Storage capacity
Food Tins / Biscuit Tins	Storage capacity in bay area of 10 tonnes.
Glass Storage Capacity in Bay Areas	Clear-20 tonnes Blue-20 tonnes Green-20 tonnes Brown-20tonnes
Scrap Metal	Storage capacity in receptacle = 30m^3
Wood	Storage capacity in receptacle = 30m^3
Green Waste	Storage capacity in receptacle = 30m^3
Batteries	Household battery storage capacity = 1m^3
Fluorescent Tubes	Storage capacity in receptacles = 2m^3
Non-Recyclable Waste	Storage capacity in compactor of 5 to 10m^3
Quarantined Waste	Storage capacity of 2 tonnes

1.3.2 Transportation of Materials Off-Site

All material is deposited on-site, checked, sorted and baled (where applicable) and is only transported off site by the appropriate permitted contractors. Transport vehicles arriving to the site are checked by personal at the weighbridge. They are then weighed, loaded and weighed again before departing the site. All the necessary paperwork including weight of material, list of waste codes, date, signature, origin and destination of the material is recorded. Loading is supervised to ensure only the correct material is loaded.

1.4 Specify the raw and ancillary materials, substances, preparations, fuels and energy which will be utilised in or produced by the activity

Drogheda Landfill Site ceased accepting waste for disposal since the waste licence was granted on 30th December 1999. No raw and ancillary materials, substances, preparations are used at the facility. Energy used consists of electricity used by the enclosed landfill gas flare and the Civic Waste Facility.

1.5 Describe the plant, methods, processes, ancillary processes, abatement, recovery and treatment systems and operating procedures for the activity

1.5.1 Landfill

The site ceased to accept waste for disposal since the waste licence was granted in December 1999. The only materials accepted at the site since were inert wastes, which was utilised for capping at the site. Phase 1 capping works were completed in September 2007. Approximately 15,000m^2 of capping (Phase 2) in the former CRH lands to the north of the site was completed in December 2016.

Phase 3 capping works will be undertaken on a further area to the north of the site which has been acquired by Louth County Council. The capping of this area will deal with all areas of waste deposited outside the boundary to the Northern part of the site. This consists of an area encompassing approximately 14,000m^2.

1.5.1.1 Landfill Gas Management

Landfill gas is produced as a result of biodegradation of the organic fraction within the waste body. An active landfill collection and flaring system was agreed with the Agency in February 2001.

The permanent gas extraction system was installed at the facility during 2006. A network of gas wells has been installed on the site for use in an active gas extraction system. The wells are connected via 63mm diameter pipework to a 250mm diameter main gas collection pipe. The gas wells are connected to this flare through a system of connecting pipework and manifolds (to allow better maintenance and to reduce the number of control points on the landfill site) to be installed after final capping of the site takes place. Self-dewatering well heads are used with wells where the connecting pipework falls towards the well.

A 750m^3 enclosed flare unit is located in an enclosed compound adjacent to the site office and a Supervisory Control and Data Acquisition (SCADA) system was installed in 2005. A permanent gas monitoring system was installed in the site buildings. Landfill gas production within the landfill waste body has depleted since waste filling ceased in 1999 and therefore the 750m^3/hr flare was replaced with a 150m^3/hr low calorific high temperature flare with a combustion chamber temperature of between 1,000 and 1,100^{o}C, minimum residence time will be 0.3 seconds and operating range for methane of 12 to 35% in August 2020.

1.5.1.1.1 Procedure

Landfill gas procedure for the site is included in Appendix B.

1.5.2 Civic Waste Facility Site Infrastructure

The main access to the Civic Waste Facility and landfill site is from the Collon Road. The entrance of the Civic Waste Facility consists of 8m wide and 2m high paladin gates which are kept locked when the site is not operational.

1.5.2.1 Enquires/Administrative Office

An enquiry/administrative office has been provided at the entrance of the facility, which contains CCTV (Static and Pan Tilt and Zoom cameras), telephone, facsimile and SCADA system for the Enclosed Landfill Flare. A fire extinguisher and first aid box are also provided. The office is used to process and store documentation. This area also includes:

- Weighbridge (16m wide)
- Parking for employees
- Site identification board
- Security fencing
- Site rules
- A fire hydrant

1.5.2.2 Civic Waste Facility

The Civic Waste Facility consists of:

- Recycling building with individual labelled slots of different waste
- Recycling service yard
- Designated storage area for WEEE
- Collection bins for Wood/Greenery/ Scrap Metal
- Collecting bays for glass
- Waste inspection and waste quarantine area

The Civic Waste Facility is open Monday - Friday 9.30am - 6.00pm and Saturday 9.00am – 3.00pm. The following are accepted at the Civic Waste Facility;

- cardboard
- magazines/paper

- glass (green, brown, clear)
- aluminium cans
- steel food tins
- domestic plastics
- textiles (e.g. clothes) and footwear
- batteries
- scrap metal
- wood
- electrical and domestic appliances
- green garden waste
- miscellaneous.

All waste deposited at the Civic Waste Facility are placed;

- Into a receptacle for recovery, or
- Into a designated inspection area.

The storage containers and storage areas are clearly labelled with yellow backgrounds and black/green writing to indicate their content. There are samples or signage describing the type of waste which can deposited into each container.

1.5.2.3 Process at the Civic Waste Facility

The public must access the site via a barrier with signage which displays the entrance fee. An office is located at the barrier with a trained staff member who monitors material coming in and advises the public on what items can be accepted at the site and where materials should be placed. Throughout the facility there are trained staff members who monitor to ensure that no unauthorised material is deposited at the facility and no contaminated material is deposited, for example pieces of wood with metal fittings attached.

Throughout the site there is also signage listing the correct items to be deposited at particular locations around the site. Staff members also assist with queries, public education, health and safety of the site and monitoring of materials being deposited. The facility operates a one-way system to ensure an orderly and safe experience.

1.5.2.4 Plant at the Civic Waste Facility

The following plant is used at the Civic Waste Facility:

- A compactor is used to reduce and compress waste
- A baler is used to transform waste into solid blocks of recyclable material
- Conveyor is used for sorting of waste materials.

Picture 1 Plant at the Civic Waste Facility

1.5.2.5 Waste Acceptance Procedures

The waste acceptance procedure for the Civic Waste Facility is as follows:

- Incoming Recyclables/Waste to be inspected by trained staff member, if suitable directed to designated clearly labelled areas. Information is given to members of the public how best to segregate at source.
- Unsuitable material e.g. Hazard material is not accepted.

If unsuitable material was to be found, a member of staff would remove, with appropriate PPE and place in quarantine area/bin measuring 2m x 3m has capacity to hold 2 tons. The quarantine area is located at rear of building. This material would then be collected by a suitable licence holder and brought to licence facility

1.5.2.5.1 Procedure for Cardboard, Magazines, Books, Newspaper, Paper

Cardboard, magazines, books, newspaper, and paper materials are deposited into individual and clearly signed receptacles. These are monitored by staff to ensure only correct material is deposited. Once deposited into the receptacles the material is directed to separate bay areas via chutes. Material in these bay areas are checked to ensure no contamination; material is then loaded onto a conveyor and from there into a baling machine. The bales are stored onsite inside a weatherproof shed and transported offsite to the facility; Peute Europe in loads ranging from 20 to 25 tonnes.

Picture 2 Cardboard, Magazines accepted at the Civic Waste Facility

1.5.2.5.2 Procedure for aluminium cans, plastic milk bottles, plastic bottles, plastic film/bags and footwear/clothing

In the same area as above, there are additional receptacles and chutes to separate bay areas for the following materials – aluminum cans, plastic milk bottles, plastic bottles, plastic film/bags, footwear and clothing. These areas are clearly signed and material deposited at these areas is monitored by staff. The material deposited is diverted into separate bays, checked and contaminated material removed where required. These separate streams are pushed onto a conveyor and baled and stored in this storage area.

- Aluminum Cans – Transported off site in 10 tonne loads,
- Plastic Milk Bottles – Transported off site in 10 tonne loads,
- Plastic Bottles – Transported off site in 10 tonne loads,
- Plastic Bags/Film – Transported off site in 10 tonne loads,

This material is collected by a permitted contractor and transported to the following facilities.

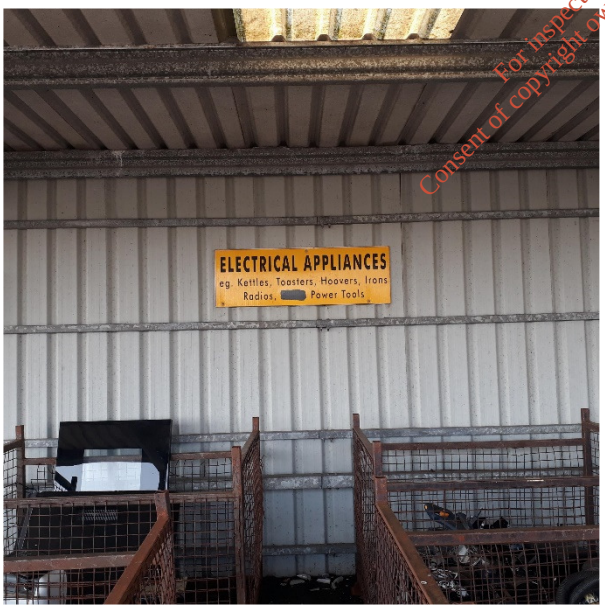
- Aluminum Cans – Tinnelly NI CN 09/10,
- Plastic Milk Bottles – Sharba Plastics MN 080,022-01,
- Plastic Bottles – Sharba Plastics MN 080,022-01,
- Plastic Bag/Film – Sharba Plastics MN 080022-01.

Footwear and clothing material are checked, stored in heavy duty bags, and periodically given to charity.

Picture 3 Aluminium cans and plastics accepted at the Civic Waste Facility

1.5.2.5.3 Procedure for Electrical Goods[2]

Items are deposited by the public in a weatherproof area into various cages and receptacles which are clearly labelled, specifying the materials to be deposited. Materials being deposited are monitored by staff to ensure no non-electrical items are deposited. The area consists of 18 4m³ cages. When the cages are full, the material is transported off site by a permitted contractor. Transport off site occurs twice per week and empty cages are left in place. Annually 650 to 600 tonnes of electrical goods are transported off site to an authorised site (Radcliffe- Waste Management Services).



Picture 4 Electrical Goods accepted at the Civic Waste Facility

[2] The acceptance of electrical items was provided by an amendment to the licence in June 2016.

1.5.2.5.4 Procedure for Fluorescent Bulbs

Fluorescent bulbs are deposited into closed containers and monitored by staff. When capacity is reached, empty containers are put in place and the full containers are transported to Irish Lamp Recycling by a permitted contractor. Annual quantities transported off site are approximately 500kg.

Picture 5 Fluorescent Bulbs accepted at the Civic Waste Facility

1.5.2.5.5 Procedure for Car-Batteries

Car batteries are collected in a sealed container and when full are collected by a permitted contractor and transported to Enva Ireland.

Empty containers are then put in place. Monitoring is carried out to ensure only car batteries are deposited. Container is replaced on average every 3 to 4 months; therefore, 500kg is taken off site every 3 to 4 months.

1.5.2.5.6 Procedure for Household Batteries

Household Batteries are deposited in sealed containers and when full collection is arranged and transported by a permitted contractor to Enva Ireland. Monitoring is carried out to ensure only household batteries are deposited. Quantities removed off site are approximately 2 tonnes per annum.

Picture 6 Household Batteries accepted at the Civic Waste Facility

1.5.2.5.7 Procedure for Food Tins and Biscuit Tins

Food tins and biscuit tines are deposited into a receptacle and from there slide into a bay area. The bay area has a capacity for 10 tonnes of material. Periodically during a working week, this material will be loaded, checked for non-tin material and contamination, put onto a conveyor belt and baled. They are kept in storage prior to transport off site to the following facility Tinnelly NI LN 09/IC in 10-15 tonne loads.

1.5.2.5.8 Procedure for Glass

The facility accepts blue, clear, green and brown glass. They are deposited into clearly marked and colour coded receptacles which lead to separated bays. The material is monitored to ensure that non-glass items are not deposited and that the correct glass colour receptacle is used. Each bay area for each glass colour has the capacity for 20 tonnes. Material in these bays is transported off site to the following facility Glassdon NILN 06-08. Material is transported off site in 20 tonne individual coloured glass loads.

Picture 7 Glass accepted at the Civic Waste Facility

1.5.2.5.9 Procedure for Non-Recyclable Waste

There is provision in the site for the public to deposit black bin bag waste into a compactor. Only non-recyclable non-hazardous waste is accepted. The waste is transported off site by a permitted contractor to a licenced facility (Indaver, Duleek, Co. Meath). The capacity of the compactors ranges from 5 to 10 tonne.

1.5.2.5.10 Procedure for Green Waste

Green waste material consisting of grass, hedge and shrub cuttings is deposited into 30m^3 containers. When full the material is transported to V and W recycling centre in Dundalk and is used in the composting process which is licensed under EPA licence W0034-02. This type of material is seasonal and the number of containers collected on a weekly basis can range from 1 to 3 containers. Material is only stored for a short period in the yard area prior to transport to Dundalk. Monitoring of materials deposited is carried out to ensure only authorized green waste is deposited.

Picture 8 Green waste accepted at the Civic Waste Facility

1.5.2.5.11 Procedure Scrap Metal

Scrap metal is deposited into a 30m^3 container and when full is taken off site by a permitted contractor and brought to the following authorised facility Tinnelly NI LN09/IC. An empty container is left in place and the process continues. The quantity of material deposited will vary and can range from one to two containers a week.

Signage is in place and material deposited in the metal container is monitored by staff to ensure non-metal items are not placed in the container.

1.5.2.5.12 Procedure for Wood

Wood material is deposited in 20 to 30 m^3 containers. There is signage in place and supervision to ensure that non wood items are not placed in the container. When the containers are full, they are stored in the general yard area for a short period, prior to transport by a permitted handler to Thorntons W0195-02. An empty container is put in place and the process continues. 1 to 2 containers of wood are collected on a weekly basis.

Picture 9 Wood accepted at the Civic Waste Facility

1.5.2.5.13 Quarantine

In order to minimize contamination of materials, the facility uses a large amount of signage and trained staff to ensure that materials destined for a receptable or bay is the correct material. The public are further advised by information on the website, telephone queries, onsite queries and educational programmes such as site visits by schools and community groups. In the event of material being found during the course of monitoring and inspection by staff it is immediately removed from the area and placed in the quarantine area which has the capacity for 2 tonnes of material. Materials are then collected by a permitted contractor and brought to the appropriate facility for treatment and/or disposal.

1.5.2.5.14 Raw Materials

No raw materials are used or processed on site as no items are produced or manufactured on site. The facility is essentially for the public to deposit recyclable material, minor sorting of material, loading baling, storage and transport to different facilities. There are no additions of raw material, no magnetic sorting, any electrical or mechanical sorting, any blending or transformation at the facility.

1.5.2.5.15 Ancillary Materials

No ancillary materials are used at the facility.

1.6 Provide particulars of the source, location, nature, composition, quantity, level and rate of emissions arising from the activity and, where relevant, the period or periods during which such emissions are made or are to be made

1.6.1 Air

In accordance with Guidance Note on Landfill Flare and Engine Management and Monitoring, landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared.

As per section 1.5.1.1 of this report, a 150m^3/hr low calorific high temperature flare was installed at the site in 2020 to manage the reducing landfill gas production levels at the closed landfill site. The permanent gas extraction system and an enclosed landfill gas flare was initially installed at the facility during 2006.

Flue gas monitoring is undertaken annually on the landfill gas flare. All monitoring was carried out in accordance with Environmental Protection Agency Office of Environmental Enforcement (OEE) Air Emission Monitoring Guidance Note 2 (AG2). This report is submitted to the EPA via EDEN. There are no monitoring requirement or emission limit values for landfill gas flare in the current licence for the site. The following parameters are currently monitored annually:

- Carbon Monoxide (CO)
- Oxides of Nitrogen (NOx) as NO2

Monitoring results are uploaded to EDEN in the biannual reports and Annual Environmental Reports (AER). There are no processes in the Civic Amenity Site which give rise to air emissions, apart from vehicle emission from the two vehicles (Forklift and Teleporter) which are serviced on a regular basis.

1.6.2 Dust

As per existing licence conditions, dust is monitored at four locations three times per annum and results uploaded to EDEN in the biannual reports and AER's. As the landfill site is closed there are no dust emissions from this part of the facility.

Due to the type of waste being accepted and waste acceptance procedures at the Civic Waste Facility, sources of dust are minimal. Dust monitoring was carried out on three occasions during 2020. The waste licence requires dust deposition limits to be no more than 350 mg/m^2/day. From Table 1.4 it can be seen that all dust deposition levels in all periods are below the limit.

Table 1.4: Results from Dust Monitoring Analysis at Drogheda Landfill Site 2020 (mg/m^2/day)

Sampling Date	Dust Monitor 1	Dust Monitor 2	Dust Monitor 3	Dust Monitor 4
July	137.9	91.22	119	87.02
August	139.5	194.1	285.3	330.1
December	51.6	42.27	52.29	79.13

1.6.3 Surface Water

Clean surface water from hard standing areas in the Civic Waste Facility is collected in a sump and pumped to Irish Water combined sewer and monitored as per licence conditions at monitoring point S1.

Surface water from the landfill site capped areas is discharged to the existing quarry lake at monitoring points SW4 and SW5. Monitoring results are uploaded to EDEN in the biannual reports and AER's. Results from SW4-SW5 were compared to Surface Water (EQS) and Drinking Water (SWQS) Regulations thresholds. Surface water results from the capped area are within their relative thresholds and do not indicate an impact from the landfill except for a spike in ammonia at SW4 and manganese at SW5 in May 2020.

1.6.4 Trade Effluent

There is currently no trade effluent or process effluents emissions to the Irish Water combined sewer from the closed landfill facility. Condensate from the methane stripper on the landfill site is now tankered from site following agreement with EPA and Waste Water Treatment Plant Operator. The volume tankered is minimal equating to approximately 10-20 m^3 per annum

There are no trade effluent or process effluents associated with the Civic Waste Facility. Domestic sewage from the site is pumped to the Irish Water combined sewer and monitored as per licence conditions at monitoring point S1 and treated at Drogheda Waste Water Treatment Plant. Monitoring results are uploaded to EDEN in the biannual reports and AER's. All parameters were below the emission limit value in 2020 except for suspended solids in August (Table 1.5).

Table 1.5: Emissions to Sewer (Civic Waste Facility)

Parameter Emission Limit value	Grab sample Emission Limit	18-Feb-2020	19-May-2020	26/08/2020	17/11/2020
BOD (mg/l)	335	1.15	<1.00	30.70	1.87
COD (mg/l)	450	<25	27	236	123
Ammonia (mg/l as N)	35	<0.2	<0.11	0.33	< 0.11
Suspended Solids (mg/l)	294	88	12	**1,580.00**	6.00
Sulphate (as SO_4) (mg/l)	240	19.7	17.5	6.96	17.00
pH (units)	6 – 9	7.95	7.6	7.46	7.57
Temperature °C	32.0°C	9.1	10	18.7	18.4

1.6.5 Noise

Noise is monitored as per the licence conditions (Table 1.6) on an annual basis and reports uploaded to Eden. As the landfill site is closed there are no sources of operational noise from this part of the facility. The landfill gas flare is located adjacent to the Civic Waste Facility.

Table 1.6: Noise Monitoring at Drogheda Landfill Site[3]

Location	Monitoring Frequency	Parameter	Emission Limits
NSL 1	Daytime:	L(A)EQ [30 minutes]	Day dB(A) LAeq(30 minutes) 55
NSL 2	Evening time:	L(A)10 [30 minutes]	Night dB(A) LAeq(30 minutes) 45
NSL 3	Night time:	L(A) 90 [30 minutes]	
		Frequency Analysis(1/3 Octave band analysis)	

1.7 Provide details, and an assessment of the effects, of any existing or proposed emissions on the environment, including any environmental medium other than that into which the emissions are, or are to be made, and of proposed measures to prevent or eliminate or, where that is not practicable, to limit or abate such emissions

As per Section 1.6 there are existing emissions to air, surface water and sewer. These emissions are monitored as per current waste licence or as agreed with EPA Office of Environmental Enforcement.

The permanent gas extraction system and an enclosed landfill gas flare (750m^3/hr) was initially installed at the facility during 2006 following agreement with the EPA. Air Dispersion Modelling was undertaken at this time. The 750m^3/hr flare was replaced with a 150m^3/hr low calorific high in August 2020 as agreed with EPA Office of Environmental Enforcement (LR045086 LS Approval - Notice C1.2-SEW Approval Replacement of Flare). The Drogheda flare 150m^3 emissions report for 2020 is included in Appendix C.

1.8 Identify monitoring and sampling points and indicate proposed arrangements for the monitoring of emissions and the environmental consequences of any such emissions,

1.8.1 Monitoring Locations

Monitoring is carried out at locations and at frequencies as specified in Schedule F of the waste licence (W0033-01). Permanent access to all monitoring points is maintained. All monitoring points are shown in Drawing No IBR1237/103A Monitoring Locations in Appendix A and Table 1.7.

Table 1.7: Grid References of Monitoring Points

Monitoring Points	Easting	Northing
Groundwater Boreholes[4]		
BH1A	306775	276408
BH2A	306865	276466
BH3A	307057	276060
BH4A	306955	276519

[3] Waste Licence W0033-01 Schedule F.3 Noise and G.1 Noise Emissions

[4] Boreholes BH4A and BH10A were installed in March 2000. Boreholes BH1A, BH2A, BH3A, BH5A, BH6A, BH7, BH8A, BH9A and BH11A were installed in August 2001.

Monitoring Points	Easting	Northing
BH5A	307044	276559
BH6A	307183	275915
BH7	307208	276602
BH8A	307248	275888
BH9A	307396	275852
BH10A	307501	275928
BH11A	307368	276157
Surface Water		
SW1	307164	276270
SW2	307414	276470
SW3	307388	275910
SW4	307076	276233
SW5	307244	276187
Gas Piezometers Boreholes[5]		
LG1A	306783	276395
LG2	306831	276333
LG3	306878	276285
LG4	306923	276221
LG5	306961	276174
LG6	307564	276281
LG7	307580	276241
LG8	307029	276152
LG9	306963	276270
LG10	306925	276277
Leachate Boreholes[6]		
L1A	307016	276244
L2A	307027	276332
L3A	307214	276375
L4A	307290	276332

[5] LG1 to LG7 were installed in October 1998. LG8 to LG10 were installed in February 2012. LG1 was redrilled in 2016 due to a change in boundary and renamed LG1A

[6] Leachate monitoring points L1A to L5A were installed in February 2000. No samples of leachate were collected as these monitoring locations are dry.

Monitoring Points	Easting	Northing
L5A	307359	276279
Noise		
N1	306786	276384
N2	306850	276238
N3	307311	275840
Dust		
DG1	306854	276352
DG2	307024	276073
DG3	307539	275993
DG4	307131	275903

A hydrogeological risk assessment (HRA) was completed 2015. The HRA recommended

- Decommissioning and replacement of monitoring boreholes BH4A and BH5A. Louth County Council have gained access to five boreholes located in CRH lands to the north of the site. It is proposed to monitor one of these boreholes in lieu of BH5A subject to confirmation of fit for purpose by a hydrogeologist until a suitable replacement borehole location is identified. These boreholes will be replaced in the Phase 3 capping works.
- The HRA recommended that monitoring borehole BH6A be decommissioned due to the non-detection of elevated contaminants throughout the monitoring period and due to its proximity to borehole BH8A.

1.8.2 Groundwater

As required under the Waste Licence, groundwater monitoring has been undertaken at the borehole locations as set out in the waste licence. Schedule F of the current waste licence requires the monitoring of certain parameters on either a monthly, quarterly or annual basis. The monitoring frequency has now been reduced to quarterly as agreed with OEE. The proposed groundwater parameters and monitoring frequencies is as shown in Table 1.8.

Table 1.8: Proposed Groundwater and Surface Water Parameters and Monitoring Frequencies

	Proposed Monitoring Locations	
Monitoring Frequency	**BH1A, BH4A (replace), BH5A (replace), BH10A, BH11A only.**	**BH2A, BH3A, BH7A, BH8A & BH9A only**
Weekly	-	-
Monthly	-	-
Quarterly	**BH1A, BH4A, BH5A, BH10A, BH11A only** Visual Inspection and Odour, Groundwater Level Ammoniacal Nitrogen Electrical Conductivity, pH, Temperature, Chloride, Dissolved Oxygen Barium, Cadmium, Chromium, Iron, Lead, Nickel, Manganese, Potassium, Sodium, TON, TOC, Nitrate, Nitrite	
Biannually		**BH2A, BH3A, BH7A, BH8A & BH9A only** Visual Inspection and Odour, Groundwater Level Ammoniacal Nitrogen

Proposed Monitoring Locations		
Monitoring Frequency	**BH1A, BH4A (replace), BH5A (replace), BH10A, BH11A only.**	**BH2A, BH3A, BH7A, BH8A & BH9A only**
		Electrical Conductivity, pH, Temperature, Chloride, Dissolved Oxygen Barium, Cadmium, Chromium, Iron, Lead, Nickel, Manganese, Potassium, Sodium, TON, TOC, Nitrate, Nitrite
Annually	**All boreholes** Boron, Calcium, Copper, Fluoride, Magnesium Sulphate, Total Phosphorous, Total Phenol	
Every 2 years	Faecal Coliforms, Total Coliforms VOCs and sVOCs I	Faecal Coliforms, Total Coliforms VOCs and sVOCs

1.8.3 Surface Water

SW1 and SW3 are located in the lake on site. Water within the former quarry void is considered to be groundwater. Monitoring point SW2 is located in the cement works pond, which is adjacent and upstream of the site. SW2 was relocated slightly north in July 2018 for health and safety reasons as requested by the EPA during a site visit. SW4 and SW5 monitor the surface water arising from the capped area.

Schedule F of the waste licence requires the monitoring of certain parameters on either a quarterly or annual basis. The monitoring frequency has now been reduced to Six Monthly as agreed with OEE. The proposed parameters and monitoring frequencies is as per HRA report 2015 as shown in Table 1.9.

Table 1.9:Surface Water Monitoring Frequency

Monitoring Frequency	Parameter
Six Monthly	Visual Inspection, Ammoniacal Nitrogen, BOD, COD, Chloride, Dissolved Oxygen. Electrical Conductivity, pH, Total Suspended Solids, Temperature, Cadmium, Total Chromium, Iron, Lead, Potassium, Total Phosphorus, Barium, Nickel, Nitrate, Nitrite, Phenol.
Annually	Calcium, Copper, Magnesium, Manganese, Mercury, Sulphate, Sodium, TON (removed Total Alkalinity & Zinc)
Every 2 years	VOCs and sVOCs

1.8.4 Discharge to Sewer

There are two discharge points to sewer; treated condensate from the methane stripper (Closed Landfill Facility) and the discharge point to sewer from Civic Waste Facility. Condensate from the methane stripper is now tankered from site following agreement with EPA and Waste Water Treatment Plant Operator. There are currently no emissions to sewer from Closed Landfill Facility. There are no proposed changes to the current Emission Limit Values for Emissions to Sewer as per Table 1.10.

Table 1.10: Emission Limit Values for Emissions to Sewer Civic Waste Facility and Landfill Facility

Parameter Emission Limit Value	Grab Sample mg/l ELV (1) Civic Waste Facility	Grab Sample mg/l ELV (2) Closed Landfill Facility
BOD	335	1770
COD	450	8000
Ammoniacal Nitrogen NH4-N	35	2040

Suspended Solids	294	1500
Sulphates (as SO4)	240	322
pH	6 – 9	6 – 9
Temperature	32°C	32°C

1.9 Perimeter Gas Monitoring

The licence trigger levels for the following landfill gases are:

- greater than or equal to 1.0% v/v Methane (CH_4) and;
- greater than or equal to 1.5% v/v Carbon Dioxide (CO_2).

There are no proposed changes to the current licence trigger for landfill gases

1.10 Flue Gas Monitoring

As per section 1.6.1 flue gas monitoring was undertaken in 2020 on the landfill gas flare. All monitoring was carried out in accordance with Environmental Protection Agency OEE Air Emission Monitoring Guidance Note 2 (AG2). This report has been submitted to the EPA.

CO and NOx as NO_2 results were compliant with the typical emission limit values used for such installations in Ireland (CO 50 mg/m^3, 150 NO_X mg/m^3).

1.11 Dust Monitoring

As per existing licence conditions, dust is monitored at four locations three times per annum and results uploaded to EDEN in the biannual reports and AER's. Dust monitoring was carried out on three occasions in 2020. Table 1.4 in Section 1.6.2 details the results of the dust monitors installed on site. The waste licence requires dust deposition limits to be no more than 350 mg/m^2/day.

1.12 Noise

Noise monitoring was undertaken on Thursday 5th of March in 2020. Traffic was found to be the predominant source of noise at all locations. Reduced traffic noise levels during the night-time measuring period provides a more accurate representation of background noise against which any potential noise levels arising from the site activities could be compared. The findings show that during the night-time measurements and during lulls in traffic noise there was no noise audible from the landfill site. The Annual Noise Monitoring Report March 2020 is included in Appendix D.

1.13 Describe any proposed arrangements for the prevention, minimisation and recovery of waste arising from the activity concerned,

A Civic Waste Facility is operated at the site. The only waste arising at the facility is from the site office operation on site. All other wastes arising from the activity are from items deposited by members of the public. The facility ensures that material which can be reused, recovered and recycled is not disposed of at landfill and/or incinerator. All the materials, collected, sorted, baled and in containers at the site are sent to facilities which reuse and recycle the materials and thus prevent the disposal of materials.

1.14 Describe any proposed arrangements for the off-site treatment or disposal of solid or liquid wastes.

1.14.1 Landfill

Treated condensate from the methane stripper was previously discharged to sewer. Condensate from the methane stripper is currently tankered offsite to Drogheda Wastewater Treatment Plant following agreement with EPA and Wastewater Treatment Plant Operator. The volume tankered is minimal equating to approximately 10-20 m^3 per annum .

1.14.2 Civic Waste Facility

All waste deposited onsite is checked, sorted and baled (where applicable) is only transported off site by the appropriate permitted contractors. Transport vehicles arriving to the site are checked by personal at the weighbridge. They are then weighed, loaded and weighed again before departing the site. All the necessary paperwork including weight of material, list of waste codes, date, signature, origin and destination of the material is recorded. Loading is supervised to ensure only the correct material is loaded. The current arrangements for the off-site treatment or disposal of solid or liquid wastes is outlined in Section 1.5.2.5 of this report.

1.15 Describe the existing or proposed measures, including emergency procedures, to prevent unauthorised or unexpected emissions and minimise the impact on the environment of any such emissions

The existing Emergency Response Procedure for the facility is included in Appendix E. This includes for

- Fire
- Plant breakdown
- Significant spillages
- Slope Stability.

1.16 Describe the proposed measures for the closure, restoration, remediation or aftercare of the facility concerned, after the cessation of the activity in question

The site ceased to accept waste for disposal when the waste licence was granted in December 1999. The only materials accepted at the site since were inert wastes, which was utilised for capping at the site. Phase 1 capping works were completed in September 2007. This consisted of:

- Installation of 55 No. gas extraction wells;
- Installation and commissioning of an active gas extraction flare (750 m^3 /hr) and methane stripper;
- Installation of capping layers consisting of Gas Drainage Layer, LLDPE capping and Surface Water Drainage Layer (A total area of approximately 101,650m2);
- Reinforcement of the capping system using georgic on slopes greater than 1 in 2.5; • Surface Water Drainage System;
- Construction of a 1.0m high safety bund along cliff edges on the site to improve safety;
- Subsoil and topsoil have been placed above the capping layer to a depth of 850mm and 150mm respectively across the site.

Approximately 15,000m^2 of capping (Phase 2) in the former CRH lands to the north of the site was completed in December 2016. Works included;

- Installation of 4 No. gas extraction wells and horizontal gas extraction pipework.
- Installation of capping layers consisting of Gas Drainage Layer, LLDPE capping and
- Surface Water Drainage Layer (A total area of approximately 14,600m^2).
- Reinforcement of the capping system using geogrid on slopes greater than 1 in 3.
- Surface Water Drainage System.
- Subsoil and topsoil have been placed above the capping layer to a depth of 850mm and 150mm respectively across the site.

Phase 3 capping works will be undertaken on a further area which has been acquired by Louth County Council. The capping of this area will deal with all areas of waste deposited outside the boundary to the Northern part of the site. This consists of an area encompassing approximately 14000m^2 . The proposed works to be undertaken as part of this Contract are outlined below:

- Final capping of waste following re-profiling of the site. The capping will consist of a geonet gas collection layer, a Linear Low Density Polyethylene (LLDPE) layer, surface water drainage layer (geonet), 850mm subsoil layer and a 150mm deep topsoil layer as undertaken in restoration works 2005-2007 and 2016.
- Reinforcement of capping layer on slopes greater than 1 in 4.
- Installation of gas wells, horizontal gas extraction pipework and connection to the existing landfill gas extraction system.
- Installation of surface water drainage channel to the edge of the proposed capping area on its Northern and Eastern fringe.

1.17 In the case of an activity which gives rise or could give rise to an emission into an aquifer containing the List I and II substances specified in the Annex to Council Directive 80/68/EEC of 17 December 1979, describe the existing or proposed arrangements necessary to give effect to Articles 3, 4, 5, 6, 7, 8, 9 and 10 of the aforementioned Council Directive

Drogheda Landfill Site opened in 1983 and has ceased accepting waste for disposal at the landfill since the waste licence was granted on 30th December 1999 as required by the Waste Management (Licensing) Regulations, 1997. This closed landfill is unlined and contains primarily household, commercial, construction and demolition and industrial non-hazardous solid waste. No further waste will be disposed of at the facility.

The site originally operated as a limestone quarry. All quarrying operations ceased in 1979 and water levels were allowed to return to equilibrium on cessation of the reported dewatering activities. The facility subsequently opened as a landfill facility in 1983 for the disposal of household, commercial, construction, demolition and industrial non-hazardous solid waste. The site ceased landfill operations in 1999 and was subsequently capped and developed into open space in 2007.

List I and II substances as per Council Directive 80/68/EEC of 17 December 1979 are listed in Table 1.11. A Hydrogeological Risk Assessment was undertaken in 2015 in accordance with licence requirements. This report noted no List I substances in groundwater for those boreholes and parameters monitored as per licence requirements. List II substances (ammonia, barium, electrical conductivity, chloride, iron, manganese, lead, nickel, potassium) were detected in up and downgradient boreholes at times

Table 1.11: List I and list II substances

List I	List II
List I contains the individual substances which belong to the families and groups of substances enumerated below, with the exception of those which are considered inappropriate to list I on the basis of a low risk of toxicity, persistence and bioaccumulation.	List II contains the individual substances and the categories of substances belonging to the families and groups of substances listed below which could have a harmful effect on groundwater. 1. The following metalloids and metals and their compounds: 1. Zinc 2. Copper 3. Nickel 4. Chrome 5. Lead

List I	List II
Such substances which with regard to toxicity, persistence and bioaccumulation are appropriate to list II are to be classed in list II. 1. Organohalogen compounds and substances which may form such compounds in the aquatic environment 2. Organophosphorus compounds 3. Organotin compounds 4. Substances which possess carcinogenic mutagenic or teratogenic properties in or via the aquatic environment (1) 5. Mercury and its compounds 6. Cadmium and its compounds 7. Mineral oils and hydrocarbons 8. Cyanides.	6. Selenium 7. Arsenic 8. Antimony 9. Molybdenum 10. Titanium 11. Tin 12. Barium 13. Beryllium 14. Boron 15. Uranium 16. Vanadium 17. Cobalt 18. Thallium 19. Tellurium 20. Silver. 2. Biocides and their derivatives not appearing in list I. 3. Substances which have a deleterious effect on the taste and/or odour of groundwater, and compounds liable to cause the formation of such substances in such water and to render it unfit for human consumption. 4. Toxic or persistent organic compounds of silicon, and substances which may cause the formation of such compounds in water, excluding those which are biologically harmless or are rapidly converted in water into harmless substances. 5. Inorganic compounds of phosphorus and elemental phosphorus. 6. Fluorides. 7. Ammonia and nitrites. (1)Where certain substances in list II are carcinogenic, mutagenic or teratogenic, they are included in category 4 of this list.

Mitigation measures have been installed at the site to limit the introduction into groundwater of substances in list II so as to avoid pollution of this water by these substances. Restoration and capping works have been undertaken in a number of Phases, with Phase 1 capping works being completed in September 2007. Approximately 15,000 m^2 of capping (Phase 2) in the former CRH lands to the north of the site was completed in December 2016. Phase 3 capping works will be undertaken on a further area which has been acquired by Louth County Council. The capping of this area will deal with the remaining area of waste deposited outside the boundary to the Northern part of the site. This consists of an area encompassing approximately 14000 m^2. All works have been undertaken as per Specified Engineered Works as agreed with EPA.

The 2015 HRA report also found that based on available site data at the time, the risk posed by Drogheda Landfill to the underlying GWB, the River Boyne and any potential down-gradient groundwater users was considered to be low. This report found that based on the recorded groundwater quality data at Drogheda Landfill, there was no sustained upward trends in groundwater contaminant export from the site. In addition, the report found that all parameters when detected above the GTV were significantly below the 100xGTV rule of thumb with the exception of BH5A and to a lesser extent BH3A. These localised exceedances were not deemed likely to affect the WFD status of the groundwater body or the WFD objectives.

Given the existing relatively good groundwater quality both upgradient and downgradient of the landfill, with the exception of localised impacts at wells BH4A, BH5A and to a lesser extent at BH3A, it was proposed in 2015 to assign compliance values based on a combination of the existing 2010 GTVs, EPA IGVs and 2 x standard deviation levels of the mean values since 2007 (i.e. post landfill capping). Exceedance of these compliance levels would warrant further assessment. Any exceedances would also be considered in conjunction with a trend analysis of the data to ascertain increasing levels over time. Levels below these compliance values in addition to downward or stable trends would confirm that the impact or risk of the landfill on groundwater and surface waters is acceptable. The 2015 HRA report is included in Appendix F. A number of recommendations were provided in the report including the decommissioning and replacement of selected monitoring boreholes. This will be undertaken as part of the Phase 3 capping works following the granting of the licence review. As per section 1.8.2 and Table 1.7 of this report a groundwater monitoring programme is in place at the facility.

A review of Annual Environmental Reports for 2015-2020 show that List I substances were below the relative GTV, DWR and IGV in groundwater for those boreholes and parameters monitored as per licence requirements except Cadmium in BH4A in September 2016 and May 2020.

1.18 Describe in outline the main alternatives, if any, to the proposals contained in the application which were studied

Phase 3 capping works will be undertaken on a further area which has been acquired by Louth County Council. The capping of this area will deal with the remaining area of waste deposited outside the boundary to the Northern part of the site which consists of an area encompassing approximately 14,000 m^2. Louth County Council are applying to change the boundary of the landfill to include an additional 1.22 hectares of land where historically waste was landfilled by Drogheda Borough Council. This land has been purchased by Louth County Council from a third party and specified engineering works have been submitted to the EPA for approval to cap this area and provide appropriate monitoring infrastructure for gas and groundwater. These works cannot be undertaken until a review of the licence in relation to the boundary change has been completed. There are no alternatives to the proposed works to be completed.

1.19 Describe how the waste hierarchy in section 21A of the Act is applied

By the very nature of the operation of the facility the principals of the waste hierarchy are being applied. The facility ensures that material which can be reused, recovered and recycled is not disposed of at landfill and/or incinerator. All the materials, collected, sorted, baled and in containers at the site are sent to facilities which reuse and recycle the materials and thus prevent the disposal of materials. In addition the facility is proactive in education programs through the use of its website, leaflets and site visits by schools and community groups.

Section 29(2A) of the Waste Management Act 1996 as amended states that it shall be the duty of waste producers and holders to ensure that waste undergoes recovery operations in accordance with sections 21A (Waste Hierarchy) and 32(1) of the Waste Management Act.

Dry recyclables are stored, compacted and/or baled were required prior to shipping for recovery. All current waste accepted are sent for recovery as shown in Table 1.12. Only mixed residual waste is sent for disposal.

Table 1.12: Waste Descriptions

List of Waste Code	Waste Description	Disposal or Recovery
20 03 01 A	Mixed residual waste	D05 - Specifically engineering landfill, non-hazardous waste.
20 02 01	Garden (green) waste	R03 - Composting (aerobic)
15 01 01	Cardboard & paper (segregated packaging waste only) e.g. cardboard boxes	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)
20 01 01	Cardboard & paper (non-packaging waste only) e.g. news & pams	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)
15 01 07	Glass (segregated packaging waste only) e.g. glass bottles	R05 - Inorganic materials recycling or reclamation (to end-of-waste)
15 01 04	Aluminium and steel cans (mixed) (segregated packaging waste)	R04 - Metal and metal component recycling or reclamation (to end-of-waste)
20 01 40 C	Other municipal metals (non-packaging)	R04 - Metal and metal component recycling or reclamation (to end-of-waste)
15 01 02	Plastic (segregated packaging waste only) e.g. PET bottles	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)
20 01 10 & 20 01 11	Clothes/textiles for recovery or disposal	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)
15 01 03	Wood (segregated packaging waste) e.g. pallets, wooden crates	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)
20 01 38	Wood (non-packaging waste, municipal)	R03 - Other recycling or reclamation of organic substances which are not used as solvents (to end-of-waste)
16 06 01*	Lead batteries	R04 - Metal and metal component recycling or reclamation (to end-of-waste)

1.20 Describe how the activity is consistent with the objectives of the relevant waste management plan or the hazardous waste management plan,

The three key targets of the Eastern-Midlands Region Waste Management Plan[7] are:

1. Reduce Household Waste
   1% Reduction Per Annum in the Quantity of Household Waste Generated Over the Period of the Plan.
2. Recycle More
   Increase the Reuse and Recycling Rate of Municipal Waste to 50% by 2020.
3. Less to Landfill
   Reduce to 0% the direct disposal of unprocessed residual Municipal waste to Landfill from 2016 onwards

The Civic Waste Facility ensures that material which can be reused, recovered and recycled is not disposed of at landfill and/or incinerator. All the materials, collected, sorted, baled and in containers at the site are sent to facilities which reuse and recycle the materials and thus prevent the disposal of materials.

1.21 Describe how best available techniques (BAT) that will be used to prevent or eliminate or, where that is not practicable, to limit, abate or reduce an emission from the activity concerned

1.21.1 Best available techniques for landfill activities

Louth County Council will employ BAT to limit, abate or reduce an emission from the activity concerned where applicable. As previously stated the site is unlined but has been restored with an engineered cap and landfill gas extraction system. Specified Engineering Works were submitted for agreement to EPA for all works taken to date. For those processes and emissions as per current waste licence are as follows:

1.21.1.1 Process Gas Emissions

In accordance with BAT Guidance Notes for the Waste Sector: Landfill Activities for emissions to air is to:

- *Pre-treat waste to remove/reduce biodegradables.*
- *Selection of appropriate cell sizes.*
- *Maintenance of negative air pressure in the landfill gas extraction wells.*
- *Use of horizontal and vertical gas extraction wells.*
- *Use of appropriate materials for temporary cover, interim and final capping.*
- *Regular monitoring of landfill extraction well field, balancing of wells and elimination of non-design condensate traps.*
- *Use of horizontal landfill gas collection pipework at the top of the side wall riser (beneath cap).*
- *Provide landfill gas management systems,*
- *Control the combustion conditions of enclosed flares, in terms of the carbon monoxide concentration, temperature and retention time by ensuring that combustion occurs at 1,000°C with a product retention time of 0.3 seconds within the combustion zone.*

Drogheda Landfill Site opened in 1983 and has ceased accepting waste for disposal at the landfill since the waste licence was granted on 30th December 1999. During the restoration and capping an active landfill collection and flaring system was installed at the facility in 2006. This consists of a network of vertical gas

[7] Eastern-Midlands Region Waste Management Plan 2015-2021

wells. The wells are connected via 63mm diameter pipework to a 250mm diameter main gas collection pipe. The gas wells are connected to this flare through a system of connecting pipework and manifolds (to allow better maintenance and to reduce the number of control points on the landfill site). Self-dewatering well heads are used with wells where the connecting pipework falls towards the well.

A 750m^3 enclosed flare unit located in an enclosed compound adjacent to the site office and Supervisory Control and Data Acquisition (SCADA) system was originally installed in 2005. Landfill gas production within the landfill waste body has depleted since waste filling ceased in 1999 and therefore the 750m^3/hr flare was replaced with a 150m^3/hr low calorific high temperature flare with a combustion chamber temperature of between 1000 and 1100°C, minimum residence time of 0.3 seconds and operating range for methane of 12% to 35% in August 2020.

1.21.1.2 Discharges To Water

1.21.1.2.1 Discharges to Surface Water

The following is BAT for discharges to surface water:

- *Only roof-water and water from undisturbed unpaved areas (not in landfill footprint and not used for the handling or storage of waste) are appropriate for direct discharge to surface waters.*
- *No untreated trade effluent shall be discharged direct to surface water.*
- *Other surface water discharges must as a minimum be passed through an interceptor (I.S. EN 858-2:2003 Part 2), or in the case of construction areas where solids can build up in storm water runoff, they may be discharged through settlement lagoons or reed bed systems.*
- *The provision of infrastructure to allow for isolation and monitoring of surface water discharges.*
- *The management and control techniques listed in Section 4.4.4.*

Surface Water Drainage Pipework was installed in the capping layer of the landfill site. The capping layers were laid to ensure sufficient falls to a network of drainage channels around the perimeter of the site. These channels consist of 250mm diameter perforated corrugated polyethylene pipes laid within trenches and backfilled with drainage stone. Surface water flows to one of two concrete silt interceptors which discharges surface water collected from capped areas into the quarry lake (SW4 and SW5).

Surface water from the Civic Waste Facility is collected on site from access roads and recycling hardstanding areas via drainage infrastructure including road gullies and precast concrete drainage channels. Water is carried in twin wall PE pipes through precast concrete inspection chambers to a full retention interceptor within the car parking area to the south side of the site. Surface water is subsequently stored within a storm water retention tank of capacity 250m^3. The storm water is in turn pumped from the storm water tank to a storm water discharge chamber 400m to the south of the site.

1.21.1.2.2 Discharges to Sewer

The following is BAT for discharges to sewer:

- *Final effluent quality must meet standards set by the receiving Water Services Authority, to adequately treat the wastewaters it receives, or the Agency. The Agency may apply more stringent ELVs than those suggested by the Water Services Authority if it so considers. The Urban Wastewater Treatment Regulations specify discharge quality parameters to prevent significant discharges of harmful substances.*

There are currently two discharge points to sewer in the current waste licence. Sewage from the Civic Waste Facility collected within PE pipes and discharged to a foul water precast concrete pumping station. The sewage is in turn pumped via pumping main to a foul drainage discharge chamber 400m to the south of the site at the junction of the Mell Rd and Cement Rd.

Treated condensate from the methane stripper was previously discharged to sewer. Condensate from the methane stripper is currently tankered from site following agreement with EPA and Waste Water Treatment Plant Operator. Emission Limit Values have been set in the current waste licence as per Table 1.13.

Table 1.13: Emission Limit Values for Emissions to Sewer[8]

Parameter Emission Limit Value	Grab Sample mg/l ELV (1) Civic Waste Facility	Grab Sample mg/l ELV (2) Closed Landfill Facility
BOD	335	1770
COD	450	8000
Ammoniacal Nitrogen NH4-N	35	2040
Suspended Solids	294	1500
Sulphates (as SO4)	240	322
pH	6 – 9	6 – 9
Temperature	32°C	32°C

1.22 Describe how energy will be used efficiently in the carrying on of the activity

No fuels or energy production is applicable to this facility apart from two vehicles which are used for movement and loading of material. Operation of general office areas, baler, conveyor, compacter and enclosed landfill gas flare is via a standard electrical connection. No energy is produced as a byproduct or final end product.

1.22.1 Energy Usage and Management

Energy usage on the site would apply to the following – lighting of offices, lighting of storage areas, canteen, toilets, computer, conveyor belt and baler.

In order to reduce energy usage staff are instructed to keep lights off when not in use, appliances off when not in use and baler/conveyor off when not in use. Light fittings use energy saving fluorescent tubes and the facility proposes to switch to LED lights on a phased basis as required during maintenance.

Heating of offices and canteens is by the use of electrical storage heaters which make use of the favorable night time rate.

There is no gas-fired or air-fired heating system in use and therefore no oil or fuel storage on site.

The management of the site review their energy supplier every 2 to 3 years to ensure maximum benefit. All office areas, canteen facilities and staff areas are insulated to ensure maximum heat retention. All windows onsite are double glazed. The electrical usage for the facility in 2020 was 29,170 Kwh for civic amenity site and the enclosed landfill gas flare.

There are two diesel operated vehicles on site (i) Forklift (ii) Teleporter. These vehicles are serviced on a regular basis to ensure maximum fuel efficiency.

1.23 Describe how any noise from the activity concerned will comply with, or will not result in the contravention of, any regulations under section 106 of the EPA Act as amended.

Noise monitoring is currently being undertaken as listed in Waste Licence W0033-01(Table 1.14) and monitoring locations are shown in Drawing IBR1237/103A Monitoring Locations in Appendix A. A noise survey

[8] Waste Licence W0033-01 Schedule F.5 Sewer and G.4 Emissions to Sewer

was completed on Thursday 5th of March 2020 to collect measurement results at 3 no. Noise Sensitive Locations (NSLs) to show compliance with the NG4 guideline[9]. The survey found traffic to be the predominant source of noise at all locations. Reduced traffic noise levels during the night-time measuring period provides a more accurate representation of background noise against which any potential noise levels arising from the site activities could be compared. The findings show that during the night-time measurements and during lulls in traffic noise there was no noise audible from the landfill site. Hence it is considered to be in compliance with NG4 and the requirements of Waste Licence W0033 and will not result in the contravention of, any regulations under section 106 of the EPA Act as amended. The 2020 noise survey is included in Appendix D.

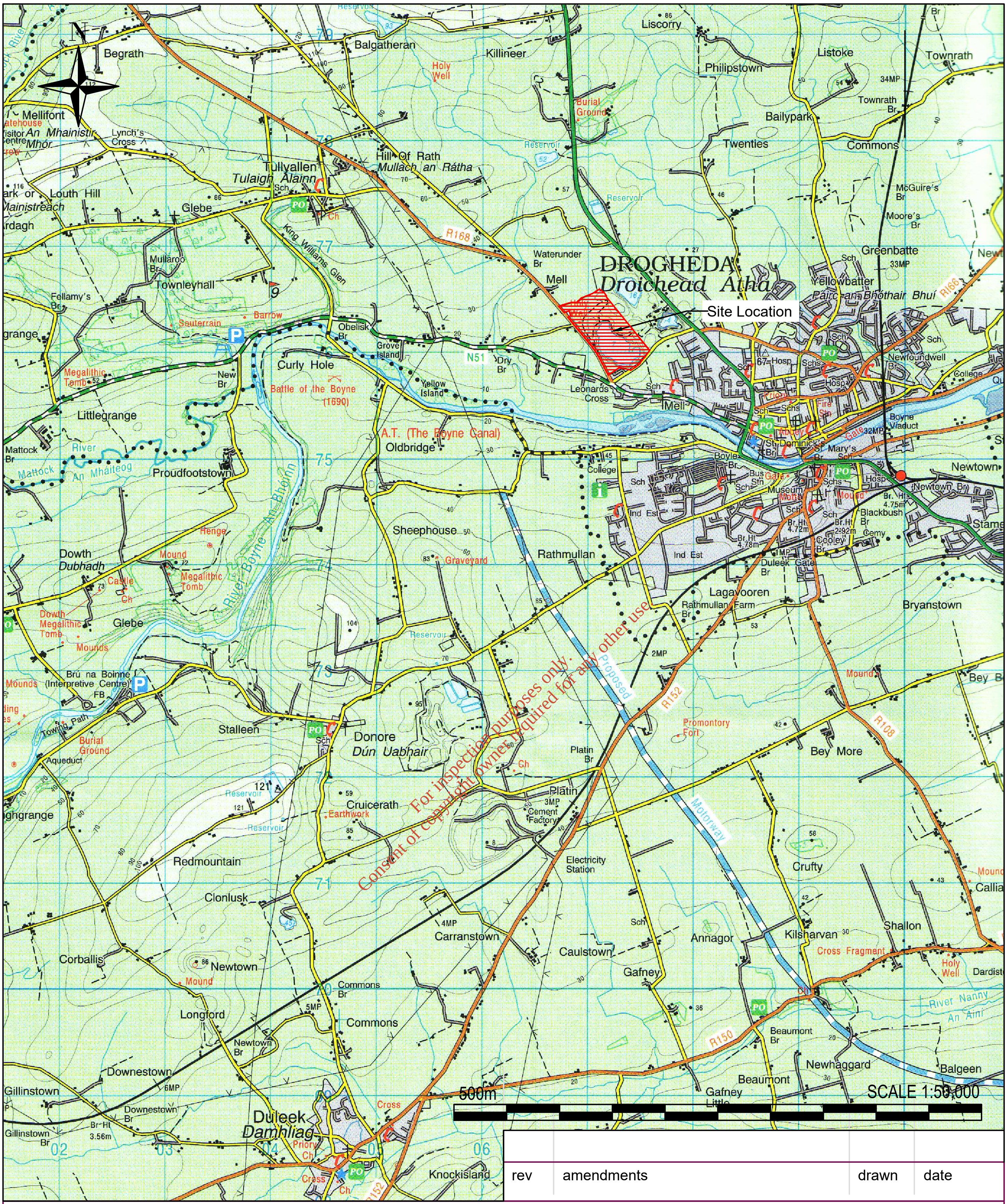
Table 1.14: Noise Monitoring at Drogheda Landfill Site[10]

Location	Monitoring Frequency	Parameter	Emission Limits
NSL 1	Daytime:	L(A)EQ [30 minutes] L(A)10 [30 minutes]	Day dB(A) LAeq(30 minutes) 55 Night dB(A) LAeq(30 minutes) 45
NSL 2	Evening time:	L(A) 90 [30 minutes] Frequency Analysis(1/3 Octave band analysis)	
NSL 3	Night time:		

[9] Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2016.

[10] Waste Licence W0033-01 Schedule F.3 Noise and G.1 Noise Emissions

Appendix A
Drawings



rev	amendments	drawn	date

rps

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44 (0) 28 90 667914
F +44 (0) 28 90 668286
W **www.rpsgroup.com/ireland**
E ireland@rpsgroup.com

Drawing Number: IBR1237/100

Rev: -

Client: Louth County Council

Project: Drogheda Licence Review

Title: Site Location

Project No.	Sheet Size	Drawing Scale	Drawing Status	Drawn By	Checked By	Approved By	Date
IBR1237	A4	1:50,000	Preliminary	MC	AMcG	AMcG	03/07/2020

N

Site Notice Displayed on Entrance Gate to Civic Amenity Site

50m

SCALE 1:2500

NOTES

1. Verifying Dimensions.
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.

2. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.

3. Issue of Drawings.
   Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.

4. Datum.

Proposed Waste Licence Boundary

rev	amendments	check	date

RPS
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44 (0) 28 90 667914
F +44 (0) 28 90 668286
W www.rpsgroup.com/ireland
E ireland@rpsgroup.com

Client
Louth County Council

Project
Droghed Licence Review

Title
Proposed Waste Licence Boundary

Project Number	Sheet Size	Drawing Scale
IBR1237	A3	1:2500

Drawing Number
IBR1237/101

Drawn By	Status	Revision
MC	Preliminary	-

Checked By	Approved By	Date
AmcG	AMcG	03/07/2020

N

50m

SCALE 1:2500

NOTES

1. Verifying Dimensions.
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
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4. Datum.

Proposed Waste Licence Boundary

Existing Waste Licence Boundary

Additional Land to be Incorporated into Waste Licence

rev	amendments	check	date

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44 (0) 28 90 667914
F +44 (0) 28 90 668286
W www.rpsgroup.com/ireland
E ireland@rpsgroup.com

Client

Louth County Council

Project

Droghed Licence Review

Title

Additional Lands to be Incorporated into Waste Licence Boundary

Project Number	Sheet Size	Drawing Scale
IBR1237	A3	1:2500

Drawing Number

IBR1237/102

Drawn By	Status	Revision
MC	Preliminary	-

Checked By	Approved By	Date
AmcG	AMcG	03/07/2020

N

Boreholes BH4A and BH5A to be decommissioned and re-drilled

BH1A
LG1A
N1
DG1
LG2
LG3
LG10
LG9
N2
LG4
LG5
LG8
DG2
S2
BH3A
CRH05
CRH04
BH5A
BH4A
BH2A
BH7
L3A
L2A
L4A
L1A
S1
SW4
SW1
SW5
L5A
BH11A
LG6
LG7
DG3
BH10A
DG4
BH6A
BH8A
SW3
BH9A
N3
SW2

50m

SCALE 1:2500

NOTES

1. Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.

2. Existing Services.
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.

3. Issue of Drawings.
Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.

4. Datum.

- Proposed Waste Licence Boundary
- L2A Leachate Boreholes
- LG3 Landfill Gas Monitoring Point
- DG1 Dust Monitoring Points
- BH1A Groundwater Boreholes
- N1 Noise Monitoring Points
- SW2 Surfacewater Monitoring Points
- S1 Civic Waste Facility Monitoring
- CRH04 Interim Monitoring Borehole

rev	amendments	check	date

rps
Elmwood House
74 Boucher Road
Belfast
BT12 6RZ
T +44 (0) 28 90 667914
F +44 (0) 28 90 668286
W www.rpsgroup.com/ireland
E ireland@rpsgroup.com

Client
Louth County Council

Project
Droghed Licence Review

Title
Monitoring Locations

Project Number	Sheet Size	Drawing Scale
IBR1237	A3	1:2500

Drawing Number
IBR1237/103

Drawn By	Status	Revision
MC	Preliminary	A

Checked By	Approved By	Date
AmcG	AMcG	03/07/2020

Appendix B
Landfill Gas Management Procedure

Gas balancing and fire prevention

The gas balancing and flare procedure is as follows;

Gas balancing

This is carried out by the landfill manager in conjunction with the operator on-site on a minimum of a quarterly basis or when required. The wells are balanced in order to optimise the quantity of methane and oxygen for the flare to operate. The gas balancing is carried out in accordance with documented procedure L-WR-OCP-022-03

In the case where the flare shuts down due to gas levels, breakdown, pipe off, maintenance and/or suction pressure, a text alert system is set up to inform the contractor for the engines and three staff members of Louth County Council. The council will attempt flare restart and in other cases contractor may attend the site. Louth County Council liaises with the contractor on this. If the flare is not restarted in a timely manner an incident is logged on Eden. The landfill will be inspected in certain instances to balance gas levels suitable for a flare restart. Pipe work, well heads on manifolds will be checked as appropriate to determine that there are no leaks and/or broken pipes which may impact oxygen levels. Knock out pots and condensate interceptors are inspected on a regular basis to ensure condensate does not build up and impact gas quality and suction pressure. Where appropriate the gas field will be balanced and the Council staff will liaise with flare contractor in order to restart flare.

Gas Balance	
Document No. L-WR-OCP-022-03	**Issued by: S. Callaghan** **Approved by: J O'Hagan**
Issue Date: 03/07/2018	**Revision No. 2**

Gas Well Balancing Procedure

Scope: To put in place a system to optimise gas extraction from each gas well

Purpose: To set out the necessary steps to balance the gas wells

Responsibility: Landfill manager / Deputy Landfill Manager

Procedure:

1. Steps to balance gas wells

Part Balancing Using Manifolds Only

Using GA 2000 landfill gas meter or GEM 5000

- First monitor the main gas line at the inlet to the flare
- Then monitor the 6 gas manifolds

Based on these monitoring results i.e. suction pressures, methane concentration and oxygen concentrations a targeted approach can be taken to increasing suction on certain wells.

All manifolds should have at least -10mbar of suction on them. If not this must be investigated. Condensate in the gas lines could be blocking the suction. If the suction is varying up and down by a few millibar this is the most likely cause.

If the oxygen level at the flare is close to 5% then each manifold should be tested to see which area of the site the high oxygen is coming from. Once the area has been identified each well in that area should be tested.

Full balancing – At gas wellheads

Using the GA 2000 or GEM 5000 landfill gas meter monitor each gas well at its wellhead. All gas wells should have negative pressure and low oxygen levels.

Each gas well head shall be monitored at least quarterly or more regularly if manifold monitoring indicates issues in a certain area.

Action levels for landfill gases are;

Gas	High Level	Low Level	Comment
Methane	60%	25%	>60% indicates not enough suction. <25% indicates too much suction or poor capping.

Oxygen	>5%	n/a	Ideally <5% oxygen but in some cases in uncapped areas poor quality gas i.e. 8% oxygen gas can be blended into the main, as long as it does not increase the oxygen at the flare to >5%.
Carbon Dioxide	>40%	n/a	Indicator only
Suction	> -20 mbar	Any positive pressure	Positive pressure indicates gas build up

The valve at each well head should be adjusted slightly up or down depending on the suction pressure and methane and oxygen levels.

If there is no suction the pipe work may be blocked with condensation.

If the suction is varying up and down by a few millibar this is due to condensate in the gas line. The gas line should be traced back to determine where the condensate is accumulating and the falls on the line should be repaired to ensure no condensate builds up.

High oxygen levels indicate poor capping or breaks in pipe work.

Table 1: List of Manifolds
6 in total

Appendix C
Flare Emissions Report

Document No.: DRLATL1300920 / 20201162
Visit No: 2
Year: 2020
Office: Trim

EPA Licence No.: WL0034-02
Licence Holder: Louth County Council, F1
Facility Location: Drogheda Landfill
Rev.No: 1

Report Title	Air Emissions Compliance Monitoring Emissions Report
Company address	Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath
Stack Emissions Testing Report Commissioned by	AFS
Facility Name	Drogheda Landfill
Contact Person	Steve Willacy
EPA Licence Number	WL0034-02
Licence Holder	Louth County Council, F1
Stack Reference Number	F1
Dates of the Monitoring Campaign	30/09/2020
Job Reference Number	DRLATL1300920 / 20201162
Report Written By	Amanda Sheridan
Report Approved by	Dr. Brian Sheridan
Stack Testing Team	Dr. John Casey
Report Date	09/10/2020
Report Type	Test Report Compliance Monitoring
Version	1
Signature of Approver	Brian Sheridan Technical Manager

Contents

1. Executive Summary

I. Monitoring Objectives

Overall Aim of the monitoring Campaign

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

Special Requirements

There were no special requirements.

Target Parameters

Carbon Monoxide (CO)
Oxides of Nitrogen (NOx) as NO_2
Sulphur Dioxide (SO_2)
Stack Gas Temperature
Volume ($m^3 h^{-1}$)
Oxygen (O_2)
Carbon Dioxide (CO_2)

Emission Limit Values

Emission Limit Values / Mass Emissions Limit Values	$mg.m^{-3}$	$kg.h^{-1}$
CO	50	-
NOx as NO_2	150	-
SO_2		-
Stack Gas Temperature	-	-
Volume ($m^3.h^{-1}$)	-	-

Reference Conditions

Reference Condition	Value
Oxygen Reference %	3
Temperature K	273.15
Total Pressure kPa	101.3
Moisture Correction	Yes

Executive Summary

Overall Results

	Concentration						Mass Emission		Run 1						
Parameter	**Units**	**Result**	**MU +/-**	**Blanks**	**Limit**	**Compliant**	**Units**	**Result**	**Limit**	**Dates**	**Time on**	**Time off**	**O2 Ref. (%)**	**Accreditation**	**LOD**
CO EN15058:2017	$mg.m^{-3}$	5.02	3.1	-	50	N/A	$kg.h^{-1}$	-	-	30/09/2020	13:05:00	13:38:00	3	Yes	<1.7
NOx EN14792:2017	$mg.m^{-3}$	44.02	4.06	-	150	N/A	$kg.h^{-1}$	-	-	30/09/2020	13:05:00	13:38:00	3	Yes	<1.8
SO_2 CEN/TS 17021:2017	$mg.m^{-3}$	<6.1	3.52	-	-	N/A	$kg.h^{-1}$	-	-	30/09/2020	13:05:00	13:38:00	3	Yes	<6.1
Oxygen (%) EN14789:2017	% v/v	9.86	0.16	-	-	N/A	-	-	-	30/09/2020	13:05:00	13:38:00	3	Yes	-
CO_2 ISO12039:2001	% v/v	9.47	0.32	-	-	N/A	-	-	-	30/09/2020	13:05:00	13:38:00	3	Yes	-
Stack Gas Temperature	K	1306.15	-	-	-	N/A	-	-	-	30/09/2020	12:50:00	12:55:00	3	Yes	-
Stack Gas Velocity EN16911:2013	$m.s^{-1}$	-	-	-	-	N/A	-	-	-	30/09/2020	12:50:00	12:55:00	3	No	-
Volumetric Flow Rate	$m^3.h^{-1}$	-	-	-	-	N/A	-	-	-	-	-	-	3	No	-
Volumetric Flow Rate (Ref)	$m^3.h^{-1}$	-	-	-	-	N/A	-	-	-	-	-	-	3	N/A	-

Accreditation details

Air Scientific Limited	INAB319T
External Analytical Laboratory	-
Other	-

Executive Summary

Monitoring Dates & Times

Parameter	Run	Location ID	Sampling Dates	Sampling Time On	Sampling Time Off	Duration (mins.)
Carbon Monoxide (CO)	Run 1	F1	30/09/2020	13:05:00	13:38:00	00:33:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Oxides of Nitrogen (NOx) as NO_2	Run 1	F1	30/09/2020	13:05:00	13:38:00	00:33:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Sulphur Dioxide (SO_2)	Run 1	F1	30/09/2020	13:05:00	13:38:00	00:33:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Oxygen (%)	Run 1	F1	30/09/2020	13:05:00	13:38:00	00:33:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-
Stack Gas Temperature		F1	30/09/2020	12:50:00	12:55:00	00:05:00
Stack Gas Velocity		F1	30/09/2020	12:50:00	12:55:00	00:05:00
Carbon Dioxide (%)	Run 1	F1	30/09/2020	13:05:00	13:38:00	00:33:00
	Run 2	-	-	-	-	-
	Run 3	-	-	-	-	-

Executive Summary

Monitoring, Equipment & Analytical Methods

Parameter	Monitoring				Analysis	
	Standard	Technical Procedure	Accredited Testing	Testing Lab	Analytical Technique	INAB Analysis
Carbon Monoxide (CO)	EN15058:2017	SOP 2004	Yes	AirSci	NCIR By Horiba PG-250	-
Oxides of Nitrogen (NOx)	EN14792:2017	SOP 2002	Yes	AirSci	Chemiluminescence	-
Sulphur Dioxide (SO_2)	CEN/TS 17021:2017	SOP 2046	Yes	AirSci	NDIR Absorption	-
Oxygen (%)	EN14789:2017	SOP 2008	Yes	AirSci	Paramagnetic	-
Carbon Dioxide	ISO12039:2001	SOP 2045	Yes	AirSci	NDIR	-
Stack Gas Temperature	EN16911:2013	SOP 2005	Yes	AirSci	Thermocouple	-
Stack Gas Velocity	EN16911:2013	SOP 2005	No	AirSci	Pitot tubes	-

List of Equipment

ID	Item of Equipment	Manufacturer	Serial No.
ASLTM12EQ503	SKC Aircheck Sampler SKC 4	SKC	826925
ASLTM12EQ512	Horiba PG2500 Portable Gas Analzer	Horiba	41343020031
ASLTM12EQ526	Knob weights (200,500,1000mg)	KERN & Sohn GmbH	G1117388
ASLTM13EQ509	10 metre industrial heated sample line	Neptech	13B088
ASLTM14EQ514	Mass flow meter	Siargo	A3J04316
ASLTM15EQ507	Buhler Sample Gas Cooler	Buhler Technologies	700000471
ASLTM15EQ508	My weigh ibalance i1200	My Weigh	7.256.358
ASLTM19EQ502	K type thermocouple	TC Direct	N/A
ASLTM18EQ509	Bios Defender	Bios	N/A

Sampling Deviations

Parameter	Deviation
Standard ID	-
Standard ID	-
Standard ID	-
Standard ID	-

Reference Documents

Risk Assessment (RA)	SOP1011
Site Review (SR)	SOP1015
Site Specific Protocol (SSP)	SOP1015

Executive Summary

Suitability of sampling location

General Information	Value
Permanent/Temporary	Permenant
Inside/ Outside	Outside

Platform Details		
Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements	**Value**	**Comment**
Sufficient Working area to manipulate probe and measuring instruments	Yes	-
Platform has 2 handrails (approx. 0.5m & 1.0 m high)	Yes	-
Platform has vertical base boards (approx. 0.25 m high)	Yes	-
Platform has chains / self closing gates at top of ladders	Yes	-
There are no obstructions present which hamper insertion of sampling equipment	No	-
Safe Access Available	Yes	-
Easy Access Available	Yes	-

Sampling Location / Platform Improvement Recommendations
None

BSEN 15259 Homogeneity Test Requirements
1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack

Process details

Parameter	
Process status	Normal
Capacity (per/hour) (if applicable)	88m3/hr
Continuous or Batch Process	Continuous
Feedstock	LFG
Abatement System	No
Abatement Systems Running Status	N/A
Fuel	N/A
Plume Appearance	Yes
Other information	None

The process information below has been supplied by the client and as such ASL assume no responsibility or liability for any errors or omissions in the content of this Process Detail Form. The information provided in this form is provided on an 'as is' basis with no guarantees of completeness, accuracy or reliability.

Licensee			
Reg. number	WL0034-02	Contractor	Air Scientific Ltd.
Site Contact	Steve Willacy	Contractor's contact	Amanda Sheridan
Role		Role	-
Signature		Signature	-

Emissions point		-					
Type of process		**Load of process**	**Abatement system**		**List of Solvents used per process**		
Rotogravure Printing	-	As normal	Bag filter	-	-	-	-
Cement Plant	-		Electrostatic precipitato	-	-	-	-
Electrical generation	-		Cyclone	-	-	-	-
Steam boiler	-		Thermal oxidiser	-	-	-	-
Other	Yes		Active carbon bed	-	-	-	-
			NSCR	-	-	-	-
			SCR	-	-	-	-
			Dry scrubber	-	-	-	-
			Wet scrubber	-	-	-	-
			Lime injection	-	-	-	-
			Biofilter	-	-	-	-
			None	Yes	-	-	-
			Other:	-	-	-	-

Executive Summary

Stack diagram

2. APPENDICES

II. Appendix I - Monitoring Personnel & Equipment

Stack Emissions Monitoring Personnel

Team Leader	**Name**	Dr. John Casey
	Qualifications	PhD. (Eng.), MSc. (Agr.), B. Agr. Sc.
	System approval	Air Scientific Limited Approved
		-
Team Leader	**Name**	-
	Qualifications	-
	System approval	-
		-

III. Appendix II - Stack Details & flow characteristics

Preliminary stack survey calculations

General Stack Details		
Stack details	**Units**	**Value**
Date of survey		30/09/2020
Time of survey		12:50
Type		Circular
Stack Diameter / Depth, D	m	-
Stack Width, W	m	-
Average Stack Gas Temp., Ta	C	1033
Average Static Pressure, P static	kPa	0.1
Average Barometric Pressure, Pb	kPa	100.9
Type of Pitot		-
Are Water Droplets Present?		-
Average Pitot Tube Calibration Coeff, Cp		-
Negative flow		-
Highly homogeneous flow stream/gas velocity		Yes

Sample Port Size	mm	25
Initial Pitot Leak Check	Pa	-
Final Pitot Leak Check	Pa	-
Orientation of Duct		Vertical
Pitot Tube Cp		0.998
Number of Lines Available		1
Number of Lines Used		1

Sampling Line A						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Sampling Line B						
Point	**Distance to duct (m)**	**Pa**	**Temp °C**	**Velocity (m/s)**	**Oxygen (%)**	**Angle of Swirl**
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
6	-	-	-	-	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	-
9	-	-	-	-	-	-
10	-	-	-	-	-	-
Average	-	-	-	-	-	-
Min	-	-	-	-	-	-
Max	-	-	-	-	-	-

Component	Conc. ppm	Conc. Dry % v/v	Conc. Wet % v/v	Molar Mass
Carbon Dioxide CO_2	-	9.4	-	44.01
Oxygen O_2	-	9.8	-	32
Nitrogen N_2	-	80.8	-	28.1
Moisture (H_2O)	-	-	10.4	18.02

Reference Conditions	Units	Numbers
Temperature	^oC	273.15
Total Pressure	kPa	101.3
Moisture	%	
Oxygen (Dry)	%	3

Stack Gas Composition & Molecular Weights								
Component	**Molar Mass M**	**Density Kg/m^3 p**	**Conc. Dry % v/v**	**Dry Volume Fraction r**	**Dry Conc. kg/m^3 pi**	**Conc. wet % v/v**	**Wet Volume Fraction r**	**Wet Conc. kg/m^3 pi**
Carbon Dioxide CO_2	44.01	1.96	9.4	0.094	0.18	8.42	0.08	0.17
Oxygen O_2	32	1.43	9.8	0.098	0.14	8.78	0.09	0.13
Nitrogen N_2	28.1	1.25	80.8	0.808	1.01	72.4	0.72	0.91
Moisture (H_2O)	18.02	0.8	-	-	-	10.4	0.1	0.08
where p=M/22.41								
pi = r x p								

Calculation of Stack Gas Densities		
Determinant	**Units**	**Result**
Dry Density (STP), P STD	$kg.m^{-3}$	1.338
Wet Density (STP), P STW	$kg.m^{-3}$	1.287
Dry Density (Actual), P Actual	$kg.m^{-3}$	0.279
Average wet Density (Actual), P Actual W	$kg.m^{-3}$	0.268
Where		
P STD = sum of component concentrations, kg/m^3 (excluding water vapour)		
P STW = (P STD + pi of H2O) / (1 + (pi of H2O / 0.8036))		
P actual = P STD x (T STP / (P STP)) x (Pa / Ta)		
P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta)		

Sampling Plane Validation Criteria	Value	Units	Requirement	Compliance	Method
Lowest Differential Pressure	-	Pa	>5 Pa	N/A	EN16911:2013
Lowest Gas Velocity	-	m/s	-	N/A	-
Highest Gas Velocity	-	m/s	-	N/A	-
Ratio of Above	-	:1	<3:1	N/A	EN16911:2013
Mean Velocity	-	m/s	-	N/A	-
Angle of flow with regard to duct axis	-	degrees	< 15	N/A	EN16911:2013
No local negative flow	-	-	-	N/A	-
Homogeneous flow stream/gas velocity	-	-	-	N/A	-

Calculation of stack Gas Velocity, V	
Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP) / Density)	-
Where	
Kpt = Pitot tube calibration coefficient	-
Compressibility correction factor, assumed at a constant 0.998	0.998

Gas Volumetric Flowrate	Units	Result
Gas Volumetric Flow Rate (Actual)	$m3.h^{-1}$	-
Gas Volumetric Flow Rate (STP, Wet)	$m3.h^{-1}$	-
Gas Volumetric Flowrate (STP, Dry)	$m3.h^{-1}$	-
Gas Volumetric Flowrate REF to Oxygen	$m3.h^{-1}$	-

Standard uncertainty of velocity (m/s)	-	Expanded uncertainty of velocity (m/s)	-	Volume flow rate expanded uncertainty (m^3/hr)	-

IV. Appendix 3 - Individual parameter sampling details and results

Carbon Monoxide Quality Assurance

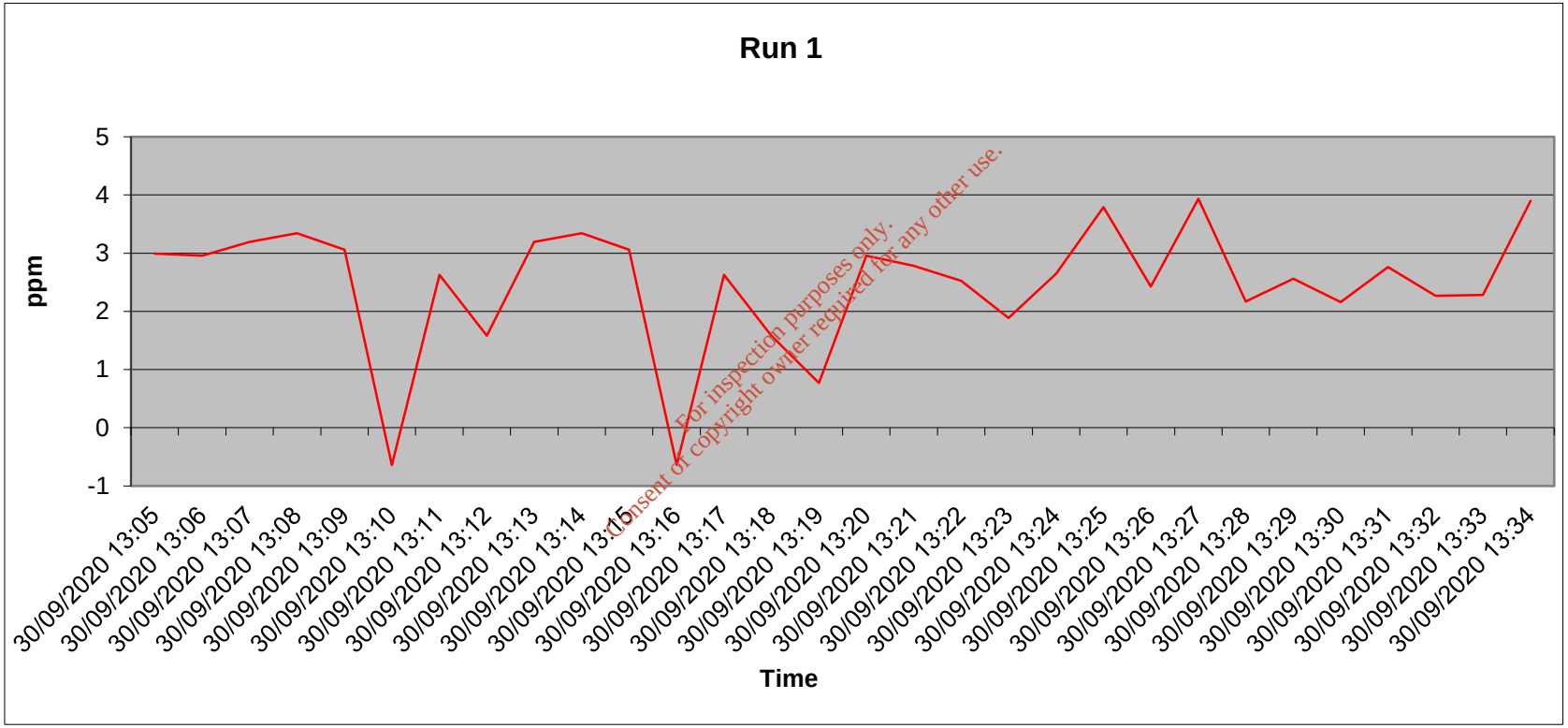
Sampling Details				
Stack ID	F1			
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampling Times	-	13:05	-	-
Sampling Dates	-	30/09/2020	-	-
Instrument Range	ppm	200	-	-
Span Gas Value	ppm	159.8	-	-
Acceptable Gas Range	-	Y	-	-
Quality Assurance	**Units**	**Run 1**	**Run 2**	**Run 3**
Conditioning Unit Temperature	^{0}C	2	-	-
Average Temperature	< ^{0}C	2	-	-
Allowable Temperature	-	4	-	-
Temperature Acceptable	-	Y	-	-
Pump flow rate	l/min	0.4	-	-
Zero Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Zero Down Sampling Line (Pre)	ppm	0.1	-	-
Zero Down Sampling Line (Post)	ppm	0.1	-	-
Zero Drift	ppm	0	-	-
Allowable Zero Drift (5%)	ppm	7.99	-	-
Zero Drift Acceptable	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Zero Drift	%	0	-	-
Span Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Down Sampling Line (Pre)	ppm	159.8	-	-
Span Down Sampling Line (Post)	ppm	159.7	-	-
Span Drift	ppm	0.1	-	-
Allowable Span Drift (5%)	ppm	7.99	-	-
Span Drift Acceptable (Y/N)	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Span Drift	%	0.06	-	-
Leak Check	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Gas Conc.	ppm	159.8	-	-
Recorded Conc. down Line	ppm	159.8	-	-
Leak check acceptable (< 2%)	(Y/N)	Y <2%	-	-
Test Conditions	**Units**	**Run 1**	**Run 2**	**Run 3**
Run Ambient Temperature Range	^{0}C	10	-	-

Carbon Monoxide Results & Sampling Details

Parameter	Units	Run 1	Run 2	Run 3	Mean
Concentration	$mg.m^{-3}$	3.09	-	-	-
Uncertainty	$mg.m^{-3}$	3.1	-	-	-
Mass Emission	$kg.h^{-1}$	-	-	-	-

General Sampling Information	
Parameter	**Value**
Standard	EN15058
Technical Procedure	SOP2004
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Span Gas Reference Number	ASLTM18ING513
Span Gas Expiry Date	22-Dec
Span Gas Start Pressure (bar)	20
Gas Cylinder Concentration (ppm)	159.8
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Carbon Monoxide Trend



Carbon Monoxide Measurement Uncertainty

Measured Quantities	Units	Run 1	Run 2	Run 3
Certified Range of Analyser	ppm	1.36-1000	-	-
Operational Range of Analyser	ppm	200	-	-
Measured Reading	ppm	2.48	-	-
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**
Nonlinearity	%	0.9	-	-
Temperature Dependent Zero drift	%	0.14	-	-
Temperature Dependent Span drift	%	-0.12	-	-
Cross-sensitivity	%	0.08	-	-
Leak	%	0	-	-
Calibration Gas Uncertainty	%	<2	-	-
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Combined uncertainty	$mg.m^{-3}$	0.95	-	-
Expanded uncertainty	$mg.m^{-3}$	1.9	-	-
Uncertainty corrected to std conds.	$mg.m^{-3}$	3.1	-	-
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	6.21	-	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	3.1	-	-
Expanded uncertainty expressed with a level of confidence of 95%	% of value	100.34	-	-
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions				

Oxides of Nitrogen Quality Assurance

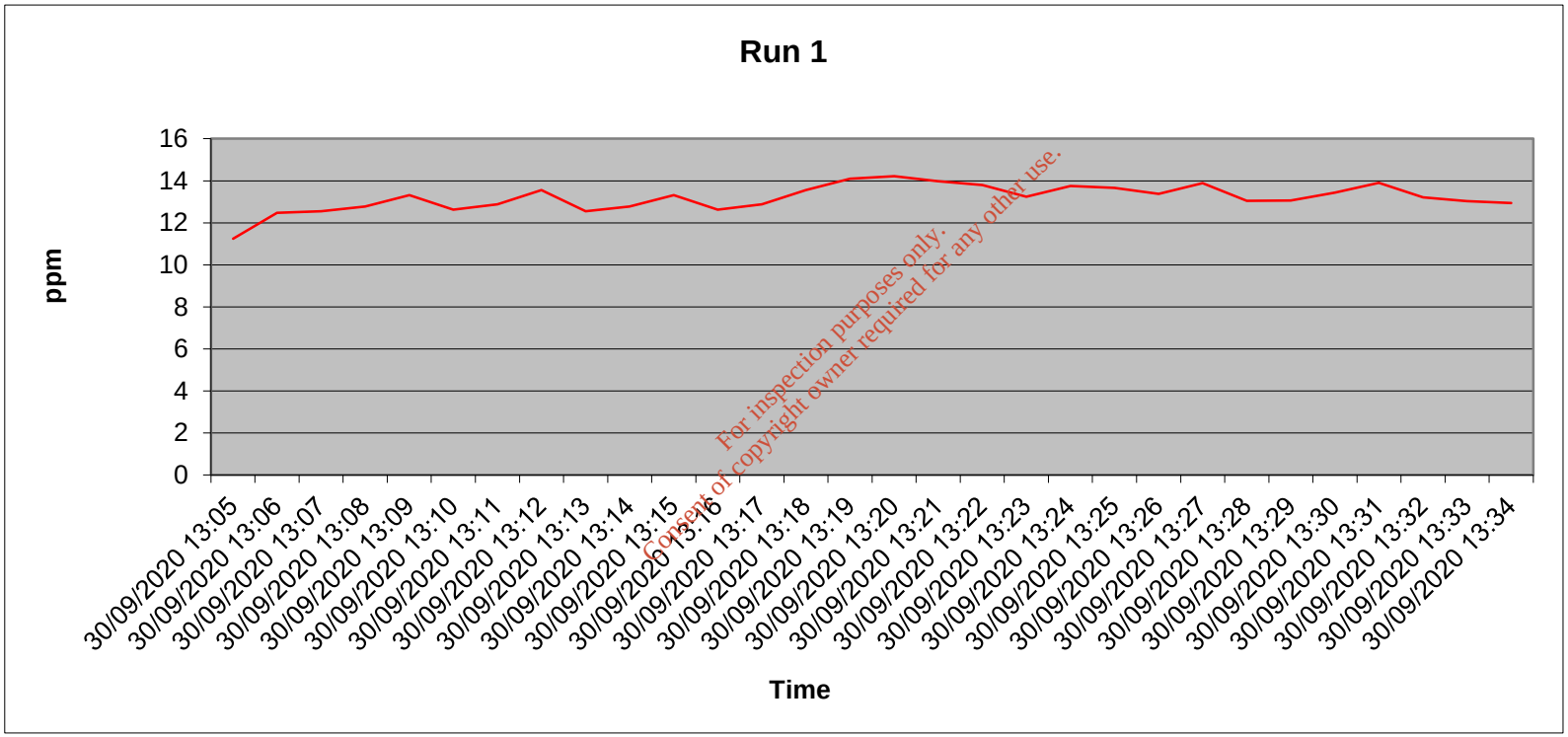
Sampling Details				
Stack ID	F1			
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampling Times	-	13:05	-	-
Sampling Dates	-	30/09/2020	-	-
Instrument Range	ppm	250	-	-
Span Gas Value	ppm	164.9	-	-
Acceptable Gas Range	-	Yes	-	-
Quality Assurance	**Units**	**Run 1**	**Run 2**	**Run 3**
Conditioning Unit Temperature	^{0}C	2	-	-
Average Temperature	< ^{0}C	2	-	-
Allowable Temperature	-	4	-	-
Temperature Acceptable	-	Y	-	-
Pump flow rate	l/min	0.4	-	-
Zero Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Zero Down Sampling Line (Pre)	ppm	0.1	-	-
Zero Down Sampling Line (Post)	ppm	0.1	-	-
Zero Drift	ppm	0	-	-
Allowable Zero Drift (5%)	ppm	8.25	-	-
Zero Drift Acceptable	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Zero Drift	%	0	-	-
Span Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Down Sampling Line (Pre)	ppm	164.9	-	-
Span Down Sampling Line (Post)	ppm	164.9	-	-
Span Drift	ppm	0	-	-
Allowable Span Drift (5%)	ppm	8.25	-	-
Span Drift Acceptable (Y/N)	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Span Drift	%	0	-	-
Leak Check	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Gas Conc.	ppm	164.9	-	-
Recorded Conc. down Line	ppm	164.9	-	-
Leak check acceptable (< 2%)	(Y/N)	Y <2%	-	-
Test Conditions	**Units**	**Run 1**	**Run 2**	**Run 3**
Run Ambient Temperature Range	^{0}C	10	-	-

Oxides of Nitrogen Results & Sampling Details

Parameter	Units	Run 1	Run 2	Run 3	Mean
Concentration	$mg.m^{-3}$	27.15	-	-	-
Uncertainty	$mg.m^{-3}$	4.06	-	-	-
Mass Emission	$kg.h^{-1}$	-	-	-	-

General Sampling Information	
Parameter	**Value**
Standard	EN14792
Technical Procedure	SOP2002
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Date & Result of last converter check	95.4 11/01/2020
Span Gas Reference Number	ASLTM19ING505
Span Gas Expiry Date	20-Aug
Span Gas Start Pressure (bar)	50
Gas Cylinder Concentration (ppm)	164.9
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Oxides of Nitrogen Trend



Oxides of Nitrogen Measurement Uncertainty

Measured Quantities	Units	Run 1	Run 2	Run 3
Certified Range of Analyser	ppm	0.87-1000	-	-
Operational Range of Analyser	ppm	250	-	-
Measured Reading	ppm	13.23	-	-
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**
Nonlinearity	%	1.4	-	-
Temperature Dependent Zero drift	%	-0.04	-	-
Temperature Dependent Span drift	%	-0.25	-	-
Cross-sensitivity	%	0.5	-	-
Leak	%	0	-	-
Calibration Gas Uncertainty	%	<2	-	-
Mass Flow Controllers (Dilution) Uncertainty	%	<1	-	-
NOx Converter Efficiency	%	95.4	-	-
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Combined uncertainty	$mg.m^{-3}$	0.91	-	-
Expanded uncertainty	$mg.m^{-3}$	1.82	-	-
Uncertainty corrected to std conds.	$mg.m^{-3}$	4.06	-	-
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	2.7	-	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	4.06	-	-
Expanded uncertainty expressed with a level of confidence of 95%	% of value	14.94	-	-
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions				

Sulphur Dioxide Quality Assurance

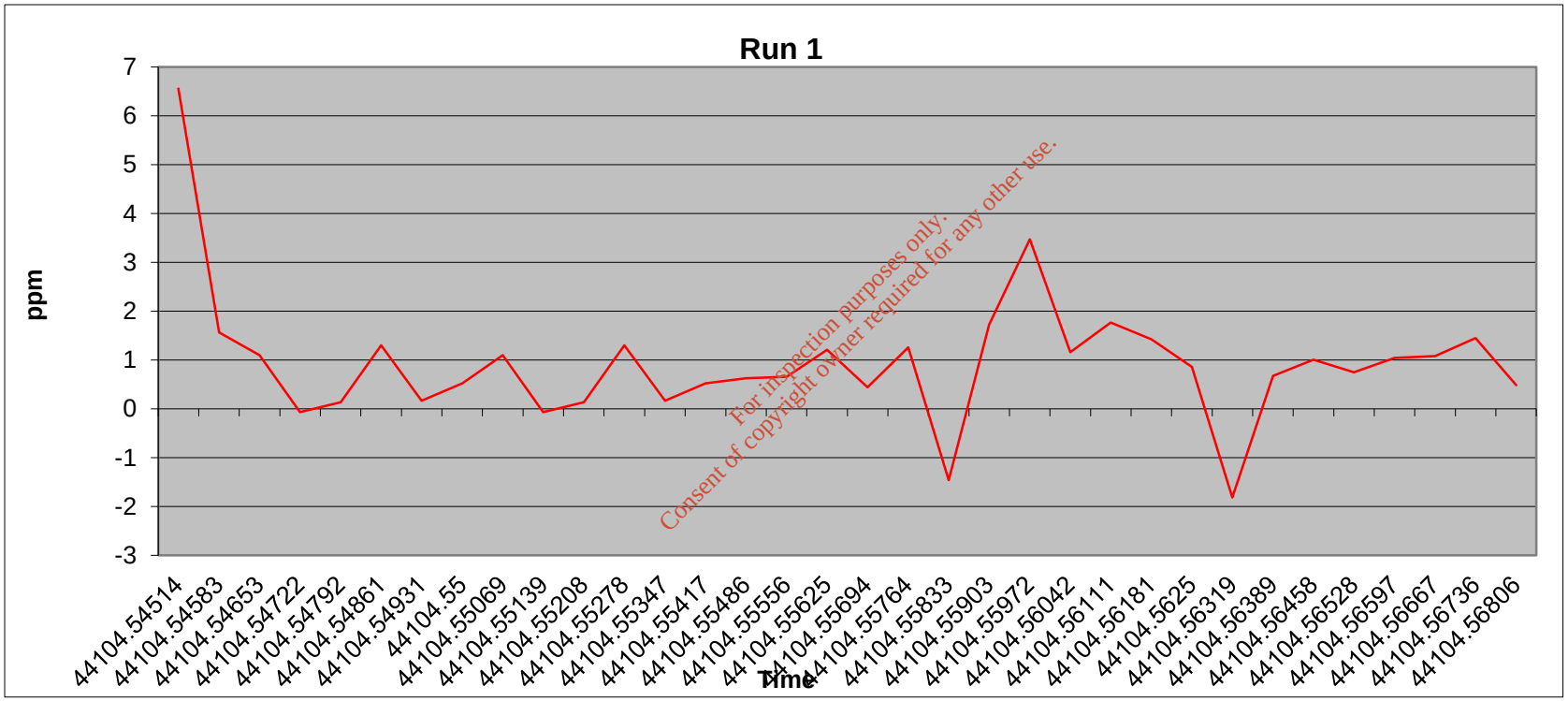
Sampling Details				
Stack ID	F1			
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampling Times	-	13:05	-	-
Sampling Dates	-	30/09/2020	-	-
Instrument Range	ppm	200	-	-
Span Gas Value	ppm	152.4	-	-
Acceptable Gas Range	-	Y	-	-
Quality Assurance	**Units**	**Run 1**	**Run 2**	**Run 3**
Conditioning Unit Temperature	^{0}C	2	-	-
Average Temperature	< ^{0}C	2	-	-
Allowable Temperature	-	4	-	-
Temperature Acceptable	-	Y	-	-
Pump flow rate	l/min	0.4	-	-
Zero Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Zero Down Sampling Line (Pre)	ppm	0.8	-	-
Zero Down Sampling Line (Post)	ppm	1.4	-	-
Zero Drift	ppm	-0.6	-	-
Allowable Zero Drift (5%)	ppm	7.62	-	-
Zero Drift Acceptable	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Zero Drift	%	-0.39	-	-
Span Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Down Sampling Line (Pre)	ppm	152.4	-	-
Span Down Sampling Line (Post)	ppm	155.2	-	-
Span Drift	ppm	-2.8	-	-
Allowable Span Drift (5%)	ppm	7.62	-	-
Span Drift Acceptable (Y/N)	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Span Drift	%	-1.84	-	-
Leak Check	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Gas Conc.	ppm	152.4	-	-
Recorded Conc. down Line	ppm	152.4	-	-
Leak check acceptable (< 2%)	(Y/N)	Y <2%	-	-
Test Conditions	**Units**	**Run 1**	**Run 2**	**Run 3**
Run Ambient Temperature Range	^{0}C	10	-	-

Sulphur Dioxide Results & Sampling Details

Parameter	Units	Run 1	Run 2	Run 3	Mean
Concentration	$mg.m^{-3}$	2.71	-	-	-
Uncertainty	$mg.m^{-3}$	3.52	-	-	-
Mass Emission	$kg.h^{-1}$	-	-	-	-

General Sampling Information	
Parameter	**Value**
Standard	CEN/TS 17021
Technical Procedure	SOP 2046
Probe material	SS
Filtration Type/Size	PTFE
Heated Head Filter Used	Yes
Heated Line Temperature	180
Date & Result of last converter check	-
Span Gas Reference Number	ASLTM19ING511
Span Gas Expiry Date	Feb-21
Span Gas Start Pressure (bar)	40
Gas Cylinder Concentration (ppm)	152.4
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Sulphur Dioxide Trend



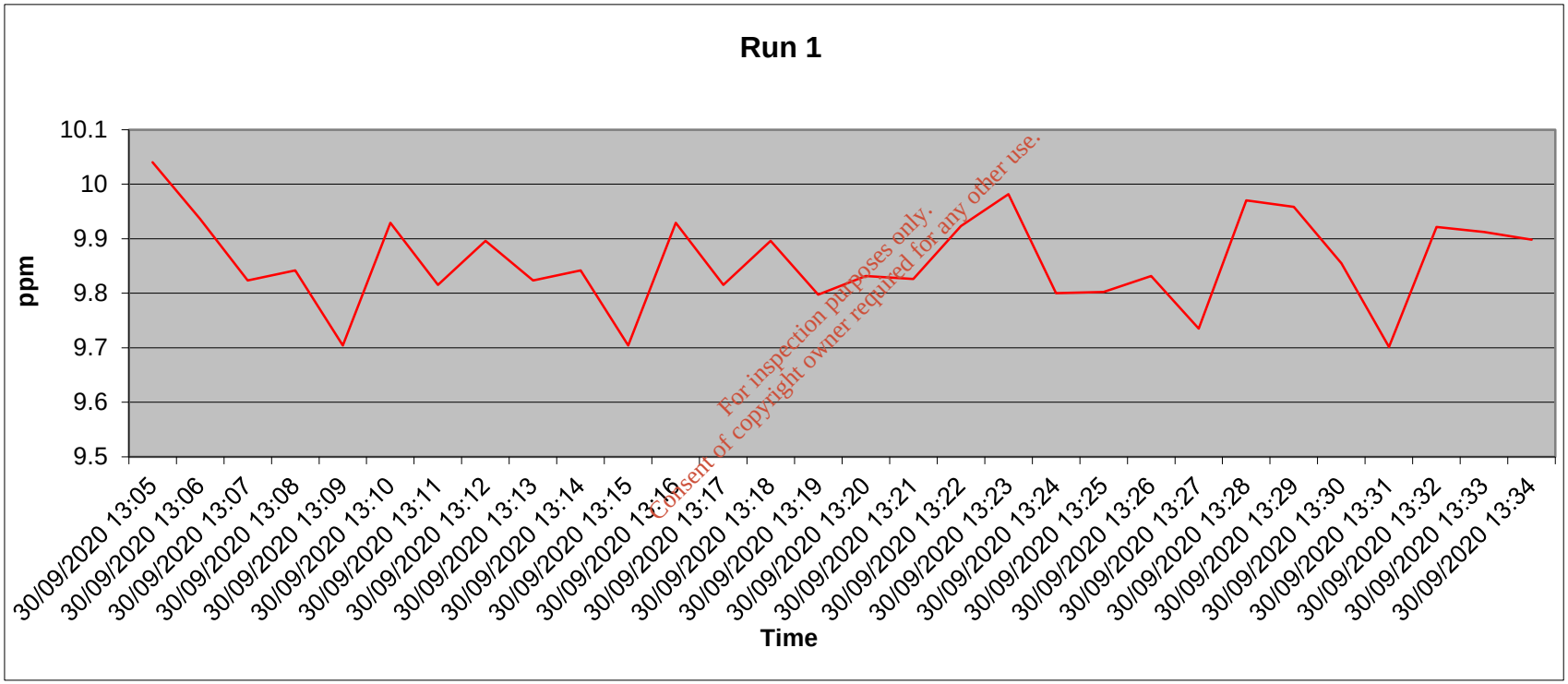
Sulphur Dioxide Measurement Uncertainty

Measured Quantities	Units	Run 1	Run 2	Run 3
Certified Range of Analyser	ppm	2.14 to 1000	-	-
Operational Range of Analyser	ppm	1000	-	-
Measured Reading	ppm	0.95	-	-
Measured Quantities	**Units**	**Run 1**	**Run 2**	**Run 3**
Nonlinearity	%	0.8	-	-
Temperature Dependent Zero drift	%	0.8	-	-
Temperature Dependent Span drift	%	2	-	-
Cross-sensitivity	%	1.5	-	-
Leak	%	0	-	-
Calibration Gas Uncertainty	%	<2 %	-	-
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Combined uncertainty	$mg.m^{-3}$	1.08	-	-
Expanded uncertainty	$mg.m^{-3}$	2.15	-	-
Uncertainty corrected to std conds.	$mg.m^{-3}$	3.52	-	-
Expanded uncertainty expressed with a level of confidence of 95%	% of ELV	-	-	-
Expanded uncertainty expressed with a level of confidence of 95%	$mg.m^{-3}$	3.52	-	-
Expanded uncertainty expressed with a level of confidence of 95%	% of value	129.66	-	-
Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions				

Oxygen Quality Assurance

Sampling Details				
Stack ID	F1			
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampling Times	-	13:05	-	-
Sampling Dates	-	30/09/2020	-	-
Instrument Range	ppm	25	-	-
Span Gas Value	ppm	20.9	-	-
Acceptable Gas Range	-	Y	-	-
Quality Assurance	**Units**	**Run 1**	**Run 2**	**Run 3**
Conditioning Unit Temperature	^{0}C	2	-	-
Average Temperature	< ^{0}C	2	-	-
Allowable Temperature	-	4	-	-
Temperature Acceptable	-	Y	-	-
Pump flow rate	l/min	0.4	-	-
Zero Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Zero Down Sampling Line (Pre)	%	0.1	-	-
Zero Down Sampling Line (Post)	%	0.1	-	-
Zero Drift	%	0	-	-
Allowable Zero Drift (5%)	%	1.05	-	-
Zero Drift Acceptable (Y/N)	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Span Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Down Sampling Line (Pre)	%	20.9	-	-
Span Down Sampling Line (Post)	%	20.9	-	-
Span Drift	%	0	-	-
Allowable Span Drift (5%)	%	1.05	-	-
Span Drift Acceptable (Y/N)	Y <2%/Y 2-5%/N>5%	Y <2%	-	-
Leak Check	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Gas Conc.	%	20.9	-	-
Recorded Conc. down Line	%	20.9	-	-
Leak check acceptable (< 2%)	(Y/N)	Y <2%	-	-
Test Conditions	**Units**	**Run 1**	**Run 2**	**Run 3**
Run Ambient Temperature Range	^{0}C	10	-	-
Combined uncertainty	% vol	0.16	-	-
% of value	%	1.65	-	-
Expanded uncertainty	% of value	3.3	-	-
Expanded uncertainty	% vol	0.33	-	-

Oxygen trend



Carbon Dioxide Quality Assurance

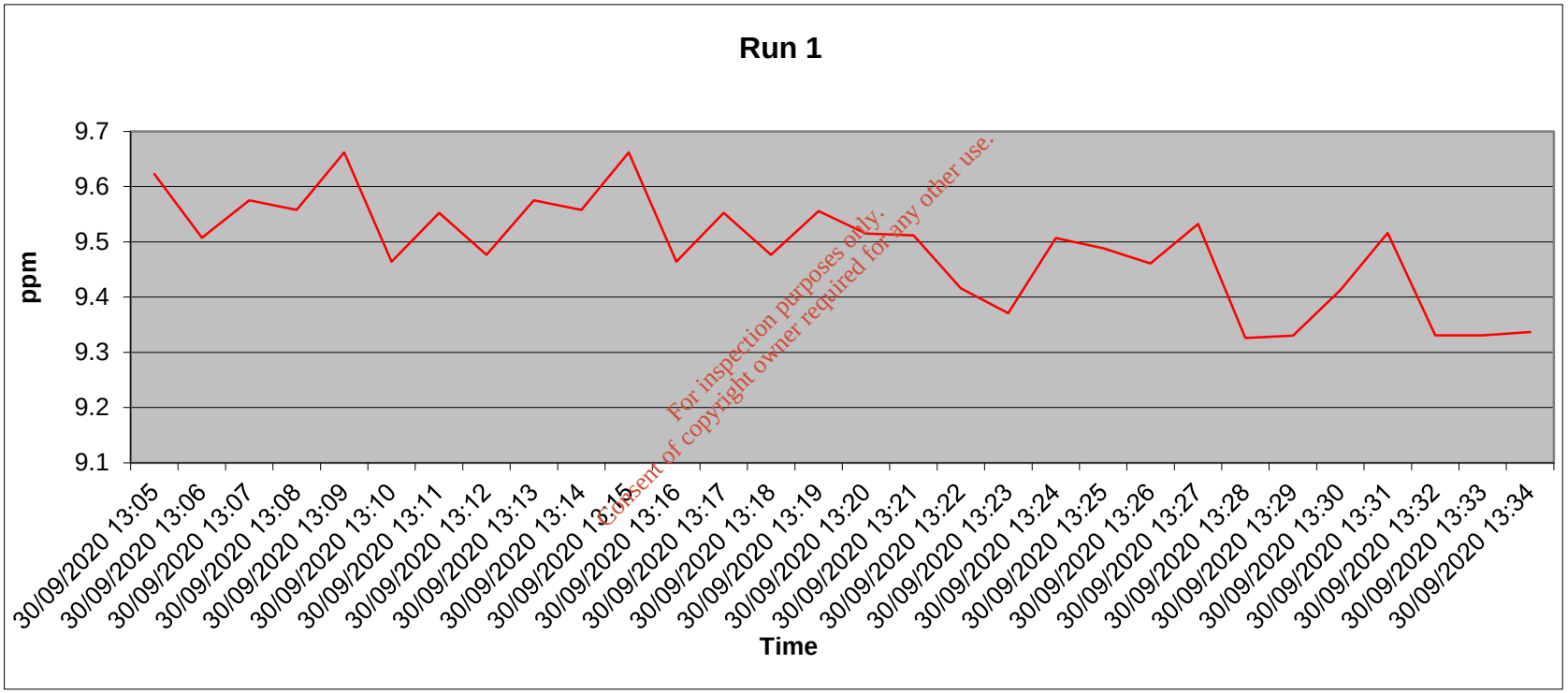
Sampling Details				
Stack ID	F1			
Parameter	**Units**	**Run 1**	**Run 2**	**Run 3**
Sampling Times	-	13:05	-	-
Sampling Dates	-	30/09/2020	-	-
Instrument Range	ppm	20	-	-
Span Gas Value	ppm	15.5	-	-
Acceptable Gas Range	-	Y	-	-
Quality Assurance	**Units**	**Run 1**	**Run 2**	**Run 3**
Conditioning Unit Temperature	^{0}C	2	-	-
Average Temperature	< ^{0}C	2	-	-
Allowable Temperature	-	4	-	-
Temperature Acceptable	-	Y	-	-
Pump flow rate	l/min	0.4	-	-
Zero Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Zero Down Sampling Line (Pre)	%	0.1	-	-
Zero Down Sampling Line (Post)	%	0.1	-	-
Zero Drift	%	0	-	-
Allowable Zero Drift (4%)	%	0.62	-	-
Zero Drift Acceptable	Y <2%/Y 2-4% /N>4%	Y <2%	-	-
Span Drift	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Down Sampling Line (Pre)	%	15.5	-	-
Span Down Sampling Line (Post)	%	15.4	-	-
Span Drift	%	0.1	-	-
Allowable Span Drift (4%)	%	0.62	-	-
Span Drift Acceptable	Y <2%/Y 2-4% /N>4%	Y <2%	-	-
Leak Check	**Units**	**Run 1**	**Run 2**	**Run 3**
Span Gas Conc.	ppm	15.5	-	-
Recorded Conc. down Line	ppm	15.5	-	-
Leak check acceptable (< 2%)	(Y/N)	Y <2%	-	-
Test Conditions	**Units**	**Run 1**	**Run 2**	**Run 3**
Run Ambient Temperature Range	^{0}C	10	-	-
Combined uncertainty	% vol	0.16	-	-
% of value	%	1.68	-	-
Expanded uncertainty	% of value	3.37	-	-
Expanded uncertainty	% vol	0.32	-	-

Carbon Dioxide Results & Sampling Details

Parameter	Units	Run 1	Run 2	Run 3	Mean
Concentration	%	9.47	-	-	-
Uncertainty	%	0.32	-	-	-

General Sampling Information	
Parameter	**Value**
Standard	ISO 12039
Technical Procedure	SOP 2045
Probe material	SS
Filtration Type/Size	Ceramic
Heated Head Filter Used	Yes
Heated Line Temperature	180
Span Gas Reference Number	ASLTM19ING535
Span Gas Expiry Date	24-Jun
Span Gas Start Pressure (bar)	60
Gas Cylinder Concentration (ppm)	15.5
Span Gas Uncertainty (%)	<2
Zero Gas Type	N
Number of Sampling Lines Used	1
Number of Sampling Points Used	1
Sample Point I.D's	F1
Reference Conditions	
Temperature (K)	273.15
Pressure (kPa)	101.3
Gas (Wet or Dry)	Dry
Oxygen	3

Carbon Dioxide Trend



Uncert Sheets

CO Uncert

Uncertainty calculation for Gaseous Measurement CO

Limit value	50	**mg/m3 (corre**	**Cal gas conc**	199.75	**mg.m-3**
Measured concentration	3.09	**mg/m3**	**Full Scale**	200	**mg/m3**
Measured concentration	3.09	**mg/m3 (Corrected)**			

Correction for reference conditions					
		O2, %	**Moisture,**	**Pressure, KPa**	**Temperature, K**
	ref	3.00	0.00	101.30	**273.00**
	measured	9.86	0.00	101.30	**275.15**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		1.62	1.00	1.00	1.01
Uncertainty in factor		0.05	0.01	0.00	0.00
Correction Factor		**1.63**	uf	**0.05**	

Performance characteristics	**Value**				**specification**
Response time		180	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		34	minutes		
Number of readings in measurement		34			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range
Deviation from linearity(lack of fit)		0.7	% of value		<2 % range
Zero drift		0	mg/m3		<2% range / 24hr
Span drift		0.125	mg/m3		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N2O (mg/m3)	20	0.2	mg/m3		
CO2 (% vol)	15	0.2	mg/m3		
CH4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		0.00	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		2	% of value		< 2% of value

Effect of drift	
0.00	mg/m3
0.00	% full scale

	ranges min	max	value at calib	
flow	95.00	105	100	kPa
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	40	0	mg/m3
CO2 range	0	15	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	93	121	110	V

Performance characteristic		**Uncertainty**		**Value of uncertainty quantity**		**mg/m3**
Standard deviation of repeatability at zero		ur0		for mean		use rep at span
Standard deviation of repeatability at span level		urs		for mean		0.05
Lack of fit		ufit				0.01
Drift		u0dr				0.00
volume or pressure flow dependence		uspres				0.04

Uncert Sheets

atmopsheric pressure dependence			uapres				0.05
ambient temperature dependence			utemp				0.00
N2O (mg/m3)			uinterf				0.23
CO2 (% vol)			uinterf				0.12
CH4 (mg/m3)			uinterf				0.58
H2O (% vol)			uinterf				0.01
Dependence on voltage			uvolt				0.17
losses in the line (leak)			uleak				0.00
Uncertainty of calibration gas			ucalib				0.04
Uncertianty in factor			uf				0.16

Use largest of sum of all positive or all negative influences

0.93	all +ves	Criteria
0	all -ves	sum <4% range
0.93	largest	0.061877451

Value to use for intereference uncertainty
uint 0.93

Measurement uncertainty				
Combined uncertainty			0.95	mg/m3
Expanded uncertainty	k =	2	1.90	mg/m3
Uncertainty corrected to std conds			**3.10**	**mg/m3**
Expanded uncertainty	**expressed with a level o**		**6.21**	**% ELV**
Expanded uncertainty	**expressed with a level o**		**3.10**	**mg.m-3**
Expanded uncertainty	**expressed with a level o**		**100.34**	**% value**

Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests

Developed for the STA by R Robinson, NPL

NOx Uncert

Uncertainty calculation for Gaseous Measurement NOx EN14792

RUN 1

Limit value	150	**mg/m3 (corre**	**Cal gas conc**	338.5397 **mg.m-3 (NO2)**
Measured concentration	13	**ppm**		
Measured concentration	27.15	**mg/m3 (101.3**	**Full Scale**	513.25 **mg/m3 (NO2)**
Measured concentration	27.15	**mg/m3 (Corrected)**		

NO/NO2 ratio	100.00

Gas	NO	
Full Scale	250	**ppm**
Cal gas conc	164.9	**ppm**
Conversion	2.053	

Correction for reference conditions					
		O2, %	**Moisture,**	**Pressure, KPa**	**Temperature, K**
	ref	3.00	0.00	101.30	**273.00**
	measured	9.86	0.00	101.30	**275.15**
	Uncert	0.35	0.00	0.00	**1.00**
Factors		1.62	1.00	1.00	1.01
Uncertainty in factor		0.05	0.00	0.00	0.00
Correction Factor		**1.63**	uf	**0.05**	

Uncert Sheets

Performance characteristics	Value				specification
Response time		180	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		34	minutes		
Number of readings in measurement		34			
Repeatability at zero		0.03	% full scale		<1 % range
Repeatability at span level		0.06	% full scale		<2 % range
Deviation from linearity(lack of fit)		0.2	% of value		<2 % range
Zero drift		0.8	mg/m3		<2% range / 24hr
Span drift		1.48	mg/m3		<2% range/24hr
volume or pressure flow dependence		0	%of full scale/kPa		<2 % / kPa
atmospheric pressure dependence		0	%of value /kPa		<3% / kPa
ambient temperature dependence		0.3	% full scale/10K		<3% range / 10 K
NH3 (mg/m3)	20	0.0	mg/m3		
CO2 (% vol)	15	0.2	mg/m3		
H2O (% vol)	30	0.0	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		0	% of value		< 0.1%vol /10 volt
Converter efficency		95.4	%		>95%
Uncertainty of calibration gas		2	% of value		< 2% of value

Effect of drift	
0.00	mg/m3
0.00	% full scale

	ranges min	max	value at calib	
flow	95.00	105	100	kPa
pressure	101.30	101.3	101.3	kPa
temp	289	289	289	K
NH3 range	0	0	0	mg/m3
CO2 range	0	15	0	%vol
H2O range	0	0	0	%vol
Voltage	93	121	110	V

Performance characteristic			Uncertainty		Value of uncertainty quantity		mg/m3
Standard deviation of repeatability at zero			ur0		for mean		use rep at span
Standard deviation of repeatability at span level			urs		for mean		0.05
Lack of fit			ufit				0.03
Drift			u0dr				0.00
volume or pressure flow dependence			uspres				0.00
atmopsheric pressure dependence			uapres				0.00
ambient temperature dependence			utemp				0.00
NH3			uinterf				0.00
CO2 (% vol)			uinterf				0.12
H2O (% vol)			uinterf				0.00
Dependence on voltage			uvolt				0.44
losses in the line (leak)			uleak				0.00
Uncertainty of calibration gas			ucalib				0.31
converter efficiency			uceff				0.72
Uncertainty in factor			uf				1.38

Use largest of sum of all positive or all negative influences

0.12	all +ves	Criteria
0	all -ves	sum <4% range
0.12	largest	0.543038627

Value to use for intereference uncertainty
uint 0.12

Measurement uncertainty				
Combined uncertainty			0.91	mg/m3

Uncert Sheets

Expanded uncertainty	k =	2	1.82	mg/m3
Uncertainty corrected to std conds			**4.06**	**mg/m3**
Expanded uncertainty	**expressed with a level o**		**2.70**	**% ELV**
Expanded uncertainty	**expressed with a level o**		**4.06**	**mg.m-3**
Expanded uncertainty	**expressed with a level o**		**14.94**	**% value**

Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests

Developed for the STA by R Robinson, NPL

corrected drift to be based on mg/m3 reading and the correction alert to be based on % full scale

SO_2 Uncert

Run 1

Uncertainty calculation for Gaseous Measurement SO2 EA M21

Limit value	0	**mg/m3 (corre**	**Cal gas conc**	435.864	**mg.m-3**
Measured concentration	2.71	**mg/m3**	**Full Scale**	572	**mg/m3**
Measured concentration	2.71	**mg/m3 (Corrected)**			

Correction for reference conditions					
		O2, %	**Moisture,**	**Pressure, KPa**	**Temperature, K**
	ref	3.00	0.00	101.30	**273.00**
	measured	9.86	0.00	101.30	**275.15**
	Uncert	0.35	1.00	0.00	**1.00**
Factors		1.62	1.00	1.00	1.01
Uncertainty in factor		0.05	0.01	0.00	0.00
Correction Factor		**1.63**	uf	**0.05**	

Performance characteristics	**Value**				**specification**
Response time		180	seconds		180.000
Logger sampling interval		60	seconds		
Measurement period		34	minutes		
Number of readings in measurement		34			
Repeatability at zero		0.25	% full scale		<1 % range
Repeatability at span level		0.15	% full scale		<2 % range

Effect of drift	
0.00	mg/m3
0.00	% full scale

Uncert Sheets

Deviation from linearity(lack of fit)		0.7	% of value		<2 % range
Zero drift		0	mg/m3		<2% range / 24hr
Span drift		0.5	mg/m3		<2% range/24hr
volume or pressure flow dependence		0.02	% of full scale/3 kPa		<2 % / 3 kPa
atmospheric pressure dependence		0.8	% of full scale/2 kPa		<3% / 2 kPa
ambient temperature dependence		0.01	% full scale/10K		<3% range / 10 K
N2O (mg/m3)	20	0.2	mg/m3		
CO2 (% vol)	15	0.2	mg/m3		
CH4 (mg/m3)	40	0.7	mg/m3		
H2O (% vol)	20	0.2	mg/m3		
dependence on voltage		0.1	% full scale/10V		<2% range
losses in the line (leak)		2	% of value		< 0.1%vol /10 volt
Uncertainty of calibration gas		2	% of value		< 2% of value

	ranges min	max	value at calib	
flow	95.00	105	100	kPa
pressure	100.76	100.92	100.88	kPa
temp	287	288.5	287.5	K
N2O range	0	40	0	mg/m3
CO2 range	0	15	0	%vol
CH4 range	0	57	0	mg/m3
H2O range	0	1	0	%vol
Voltage	93	121	110	V

Performance characteristic			**Uncertainty**		**Value of uncertainty quantity**		**mg/m3**
Standard deviation of repeatability at zero			ur0		for mean		use rep at span
Standard deviation of repeatability at span level			urs		for mean		0.15
Lack of fit			ufit				0.01
Drift			u0dr				0.00
volume or pressure flow dependence			uspres				0.11
atmopsheric pressure dependence			uapres				0.14
ambient temperature dependence			utemp				0.00
N2O (mg/m3)			uinterf				0.23
CO2 (% vol)			uinterf				0.12
CH4 (mg/m3)			uinterf				0.58
H2O (% vol)			uinterf				0.01
Dependence on voltage			uvolt				0.49
losses in the line (leak)			uleak				0.03
Uncertainty of calibration gas			ucalib				0.03
Uncertianty in factor			uf				0.14

Use largest of sum of all positive or all negative influences		
0.93	all +ves	Criteria
0	all -ves	sum <4% range
0.93	largest	0.054272706

Value to use for intereference uncertainty	
uint	0.93

Measurement uncertainty				
Combined uncertainty			1.08	mg/m3
Expanded uncertainty	k =	2	2.15	mg/m3
Uncertainty corrected to std conds			**3.52**	**mg/m3**
Expanded uncertainty	**expressed with a level o**		**0.00**	**% ELV**
Expanded uncertainty	**expressed with a level o**		**3.52**	**mg.m-3**
Expanded uncertainty	**expressed with a level o**		**129.66**	**% value**

Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions

Uncert Sheets

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests

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O_2 Uncert

Run 1

Uncertainty calculation for Gaseous Measurement Oxygen EN14789

Limit value	n/a	**%vol**	**Calibration gas**	**20.9**	**%vol**
Measured concentration	9.86	**%vol**	**Full Scale**	**25**	**%vol**

Performance characteristics	**Value**				**specification**
Response time		180	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		34	minutes		
Number of readings in measurement		34	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0.13	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		2	% of value		< 2% of value
Uncertainty of calibration gas		0.5	% of value		

Effect of drift
0.00 % vol
0.00 % full scale

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO2 range	8	15	0	% vol
NO range	100	150	0	mg/m3
NO2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic		**Uncertainty**	**Value of uncertainty quantity**		**% vol**
Standard deviation of repeatability at zero		ur0	for mean		Only use rep at span

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Office: Trim

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Licence Holder: Louth County Council, F1
Facility Location: Drogheda Landfill
Rev.No: 1

Uncert Sheets

Standard deviation of repeatability at span level			urs		for mean		0.00	
Lack of fit			ufit				0.08	
Drift			u0dr				0.00	
volume or pressure flow dependence			uspres				0.00	
atmospheric pressure dependence			uapres				0.04	
ambient temperature dependence			utemp				-0.02	
CO2							0.05	**Use largest of sum of all positive or all negative influences**
NO							0.01	0.06 all +ves
NO2							0.00	0 all -ves
Combined interference (from mcerts)							0.08	0.06 largest
dependence on voltage			uvolt				0.03	Value to use for intereference uncertainty
losses in the line (leak)			uleak				0.11	uint 0.06
Uncertainty of calibration gas			ucalib				0.03	

Measurement uncertainty			9.86	%vol
Combined uncertainty			0.16	%vol
% of value			1.65	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level o**		**3.30**	**% of value**
Expanded uncertainty	**expressed with a level o**		**0.33**	**% vol**

Requirement for SRM is that Uncertaitny should be < 6% of value, on a dry gas basis

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests
Purple boxes are from manufacturer specification, or CEN standard as MCERTS data not available

Developed for the STA by R Robinson, NPL

corrected drift alert to be based on % full scale

CO_2 Uncert

Run 1

Uncertainty calculation for Gaseous Measurement Carbon Dioxide

Limit value	n/a	**%vol**	**Calibration gas**	**15.5**	**%vol**
Measured concentration	9.47	**%vol**	**Full Scale**	**25**	**%vol**

Uncert Sheets

Performance characteristics	Value				specification
Response time		180	seconds		< 200 s
Logger sampling interval		60	seconds		
Measurement period		34	minutes		
Number of readings in measurement		34	Assuming 1 minute collected over 1 hour		
Repeatability at zero		0.015	% by volume	stdev	<0.2 % range
Repeatability at span level		0.014	% by volume	stdev	<0.4 % range
Deviation from linearity		0.13	% vol	+/-	<0.3 % volume
Zero drift (during measurement period)		0	% vol at zero level	+/-	<2% of volume / 24hr
Span drift (during measurement period)		0	% vol at span level	+/-	<2% volume/24hr
volume or pressure flow dependence		0	% of fs / 10l/h	+- 5 l/h	<1% range
atmospheric pressure dependence		0.3	% of fs/kPa	+- 2kPa	< 1.5 % range
ambient temperature dependence		-0.07	% by volume /10K	+- 15K	<0.3% volume 10 K
CO2 (% vol)	15	0.07	% by volume per	15	
NO (mg/m3)	300	0.02	% by volume per	300	
NO2 (mg/m3)	30	0	% by volume per	30	
Combined interference		0.56	% range		<2% range
Dependence on voltage		0.1	% by volume /10V	+- 5%	< 0.1%vol /10 volt
Losses in the line (leak)		2	% of value		< 2% of value
Uncertainty of calibration gas		0.5	% of value		

Effect of drift	
0.00	% vol
0.00	% full scale

	range of variation from conditions at calibration			
	min	max	value at calib	
flow	5	15	10	l/h
pressure	99.00	101	100	kPa
temp	280	285	285	K
CO2 range	8	15	0	% vol
NO range	100	150	0	mg/m3
NO2 range	5	7.5	0	mg/m3
Voltage	105	115	110	V

Performance characteristic		Uncertainty	Value of uncertainty quantity			% vol
Standard deviation of repeatability at zero		ur0		for mean		Only use rep at span
Standard deviation of repeatability at span level		urs		for mean		0.00
Lack of fit		ufit				0.08
Drift		u0dr				0.00
volume or pressure flow dependence		uspres				0.00
atmospheric pressure dependence		uapres				0.04
ambient temperature dependence		utemp				-0.02
CO2						0.05
NO						0.01
NO2						0.00
Combined interference (from mcerts)						0.08
dependence on voltage		uvolt				0.03
losses in the line (leak)		uleak				0.11
Uncertainty of calibration gas		ucalib				0.03

Use largest of sum of all positive or all negative influences

0.06	all +ves
0	all -ves
0.06	largest

Value to use for intereference uncertainty

uint 0.06

Measurement uncertainty			9.47	%vol
Combined uncertainty			0.16	%vol
% of value			1.68	%
Coverage factor k =	2			
Expanded uncertainty	**expressed with a level o**		**3.37**	**% of value**
Expanded uncertainty	**expressed with a level o**		**0.32**	**% vol**

Uncert Sheets

Requirement for SRM is that Uncertaitny should be < 6% of value, on a dry gas basis

Note: Enter values into green boxes
Dark blue boxes indicate information that can be obtained from MCERTS tests
Purple boxes are from manufacturer specification, or CEN standard as MCERTS data not available

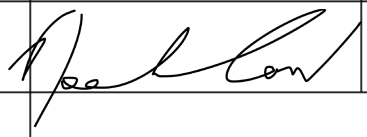
Developed for the STA by R Robinson, NPL

Appendix D
Noise Survey 2020

ANNUAL REPORT 2020

Environmental Noise levels at Drogheda Landfill and Civic Amenity Site

Table of Contents

Report Date:	27/05/2020	**Report No.**	12020
Report Prepared By:	Noel Carr	**Report Approved By:**	Sajin Charles Darwin
Signed:		**Signature:**	
Version	LCCDLF0320ENVNNC		

1.0 Introduction

In order to comply with current Waste Licence conditions (W0033) – Louth County Council commissioned NVM Limited to complete a series of attended day evening and night time noise surveys at pre – determined noise sensitive monitoring locations near the boundaries of their landfill site at Drogheda, Co. Louth.

Drogheda landfill closed to the acceptance of waste for disposal in December 1999. However, a civic amenity site continues to be operated on the site of the old landfill.

The following results show the collected measurement results from the Drogheda landfill survey, including location details and a brief discussion on noise climate at each location.

2.0 Scope of Survey

The current survey was completed on Thursday 5th of March 2020 to collect measurement results at 3 no. Noise Sensitive Locations (NSLs) to show compliance with the NG4 guideline outlined below:

Fig 1. Extract from NG4 2016.

Typical Limit Values for Noise from Licensed Sites

Daytime (07:00 to 19:00hrs) – 55dB $L_{Ar,T}$;
Evening (19:00 to 23:00hrs) – 50dB $L_{Ar,T}$;
Night-time (23:00 to 07:00hrs) – 45dB $L_{Aeq,T}$.

3.0 Noise Survey Details

3.1 Methodology

The measurements were completed in general accordance with the following environmental noise standards:

ISO 1996: 2016 Acoustics – Description and Measurement of Environmental Noise, Parts 1-4

Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) 2016.

The noise survey results are presented in terms the parameters listed in in the Appendix II.

All day time and evening measurements were completed to a reference of ***LAeqT 30 min*** as stated in the guidance documentation. The night time measurements were completed to a reference of ***LAeqT 15 min***.

As the landfill is no longer operating, the presence of any audible tones could not be associated with landfill activities. Therefore, it was not considered necessary to complete octave band analysis at the residential dwellings to establish if such pure tones were present.

It is worth considering that when assessing continuous noise sources from plant machinery, the L_{A90} is an appropriate parameter to use. It describes the background noise level in the absence of once-off events such as cars passing and other loud unexpected noises, (e.g. doors shutting at nearby residential properties).

As all of the locations in the current survey are adjacent to local roads and residential properties, the LA90 measurements at these locations should be considered.

3.2 Personnel and Instrumentation

Surveys were completed by Sajin Charles Darwin (NVM) / Noel Carr evening / night time measurements of NVM Ltd., who meets the criteria for a "competent person" as defined by the EPA in their 2016 EPA publication, "Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)".

The instrumentation used during the attended surveys is presented in Table 3.1 below.

Table 3.1. Noise Instrumentation Calibration Summary

Manufacturer	Instrument Type	Calibrated by	Calibration Reference
Cirrus	Cirrus Noise Level Meter CR:171B Serial No. G056355,	Cirrus Research	Cal no. 259202
Cirrus	Cirrus Acoustic Calibrator CR:511E Serial No 41032,	Cirrus Research	Cal no. 259203
Svantek	SV977 type 1 SLM	AcSoft Calibration	Cal no: 14010137-2

The sound level meter was checked and calibrated before and on completion of the surveys. There were no significant changes found to have occurred (no more than 0.1 dB).

4.0 Weather Report

The weather conditions for the daytime survey can be described as cloudy with sunny spells. There was no rain, temperatures varied from 7 to 5 degrees, and the mean wind speed was c. 4 knots [~ 0.5 m/s]. The wind direction was westerly, varying from 120 to 290 degrees. Conditions remained dry and relatively calm for the night-time survey, with temperatures dropping to between 0 and 2 degrees. The wind speed was lower at between 1 and 3 knots, while the direction was south-easterly.

Table 4.1: Meteorological data from Met Eireann weather station at Dunsany.

Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Grass Min Temp (°C)	Mean Wind Speed (knots)	Max Gust (>= 34 knots)	Sunshine (hours)
05/03/2020	0.1	7.6	-4.2	-6.8	3.2		

5.0 Measurement Locations and Notes on Noise Climate

5.1 Noise Sensitive Locations

The following paragraphs describe the noise monitoring locations, which are shown in accompanying map in Appendix I. All are noted as Noise Sensitive Locations (NSL) at closest proximity to the landfill site.

NSL 1 – Cottage Upper Mell (R168) boundary to landfill
The noise sensitive location comprises an old-style stone cottage surrounded by a yard where stonework on headstones for graves is carried out. The yard forms the boundary to the landfill site. A large perforated fence and entrance gate facilitates trucks driving through yard on a daily basis. The cottage faces (westwards) directly onto the main (R168) road.

A couple of semi-detached cottages of similar design are located on opposite side of road.

NSL 2 – Cottage on Upper Mell (R168) opposite landfill
The noise sensitive location comprises an old stone cottage of similar design to that at NSL 1. The stand-alone cottage faces (eastwards) directly onto the main (R168) road. This dwelling is surrounded by a small garden. The north gable end culminates at a laneway which has a number of detached relatively modern houses along it. The entrance to the recycling amenity and landfill site is approximately 400m south of this location on the opposite side of the road.

NSL 3 – Cement Road

The noise sensitive location comprises a halting site which is located at the junction of the Mell (R168) road and the Cement Road. The site comprises standard halting site housing. A high mound forms the south boundary of the landfill facility which backs onto the halting site.

The road-side boundary consists of overgrown scrub and trees which is separated by a steel barrier entrance.

A development of occupied town houses (Boice Court) is positioned opposite the halting site next to the ALDI store.

5.2 Noise Climate

Traffic is the predominant source of noise at all monitoring locations during both daytime and evening periods. The landfill site, which is currently running as a recycling facility, was not audible at any of the noise sensitive locations.

At NSL 3 noise was intermittent in character due to cars and commercial vehicles entering and leaving the entrance to the ALDI store. During the daytime there was a continuous traffic on the cement Road, and at the junction with the R168. Noise, originating from a refrigeration unit at ALDI, was continuously audible but at a much lower level than the traffic. There was no 'customer traffic' at NSL3 during the night-time period. During the night time measurements, the noise of refrigerated delivery truck was audible from within the ALDI yard.

The hum of distant traffic along the M1 motorway was audible as a constant background noise during the late evening and night-time periods at all monitoring locations.

6.0 Measurement Results

Noise Levels

Traffic is the predominant noise source at all locations during the current survey and is the single-most factor in contributing to noise levels in this busy Drogheda conurbation.

The Tables of results (Tables 1a, 1b), as presented in Appendix III show noise levels at noise sensitive locations NSL 1 and NSL 2 to be similar, as both are subjected to the same levels of traffic.

NSL 3 has lower noise intensity compared to the other two locations – this is indicative of higher traffic volumes on the upper Mel Road.

There is a very gradual decline in traffic volumes through the evening period and this is reflected in just a small reduction in noise results for this period. Night time noise levels show a more pronounced reduction in traffic and corresponding noise intensities compared to daytime and evening noise levels.

Hourly average noise levels as presented in Table 2 reflect the variations in noise levels between measuring locations and respective day evening and night-time periods as discussed above. Similarly, the single day-evening-night (DEN) values as presented in Table 3 demonstrate differences in noise levels between locations.

The following is a brief synopsis of the range of noise levels at each noise sensitive location during the respective measuring periods:

Location	Period	Duration [m]	Range	LA90 range
NSL-1	Day	30	c. 75 – 78 dB(A)	60 - 61
	Evening	30	70 – 73 dB(A)	54
	Night	15	64 – 68 dB(A)	45
NSL-2	Day	30	Consistently 76 – 79 dB(A)	61 - 62
	Evening	30	72 – 74 dB(A)	47
	Night	15	63 – 65 dB(A)	42 - 43
NSL-3	Day	30	7 – 69	Consistently 53
	Evening	30	66	51
	Night	15	44 – 61	39 - 41

7.0 Conclusion

To conclude the landfill site has not been in operation since 1999. Hence the findings of this survey cannot be attributed to landfill activities. Traffic was found to be the predominant source of noise at all locations.

Reduced traffic noise levels during the night-time measuring period provides a more accurate representation of background noise against which any potential noise levels arising from the site activities could be compared.

The findings show that during the night-time measurements and during lulls in traffic noise there was no noise audible from the landfill site. Hence it is considered to be in compliance with NG4 and the requirements of Waste Licence W0033.

Appendix I – Location Map

Appendix II – Glossary of Parameters

LAeq is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. It is typically used as a descriptor for ambient noise.

LAmax is the instantaneous maximum sound level measured during the sample period.

LA10 is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

LA90 is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

Lden is the 24-hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ + 5dB penalty and the L_{night} + 10dB penalty. The formula for L_{den} is contained in Appendix 1.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

Appendix III - Tables of Results

Tables 1a -1c. Results of environmental noise levels as measured at three noise sensitive locations at the boundaries to Drogheda landfill quarry for Day, Evening and Night-time periods respectively.

Table 1a

Date	Measurement Period	Location	Sound Pressure Levels (dB re: 2X 10-5Pa)				
			Times	L_{Aeq}	L_{AMax}	$L_{n\ 10}$	$L_{n\ 90}$
04/02/2019	Daytime 07:00-19:00hrs	NSL 1	11:38 – 12:08	77	90	81	61
		NSL 1	13:56 – 14:26	77	91	81	60
		NSL 1	15:49 – 16:19	77	91	81	60
		NSL 2	10:56 – 11:26	77	91	82	61
		NSL 2	12:51 – 13:21	77	92	82	61
		NSL 2	15:12 – 15:42	77	92	82	62
		NSL 3	10:12 – 10:42	67	85	70	53
		NSL 3	12:14 – 12:44	69	89	72	53
		NSL 3	14:32 – 15:02	69	85	73	53

Table 1b

Date	Measurement Period	Location	Sound Pressure Levels (dB re: 2X 10-5Pa)				
			Times	L_{Aeq}	L_{AMax}	$L_{n\ 10}$	$L_{n\ 90}$
04/02/2019	Evening 19:00-23:00hrs	NSL 1	20:23 – 20:53	73	91	77	54
		NSL 2	21:44 – 22:14	73	93	76	47
		NSL 3	21:00 – 21:30	66	89	68	51

Table 1c

Date	Measurement Period	Location	Sound Pressure Levels (dB re: 2X 10-5Pa)				
			Times	L_{Aeq}	L_{AMax}	$L_{n\ 10}$	$L_{n\ 90}$
04/02/2019 and 05/02/2019	Night-time 23:00-07:00hrs	NSL 1	23:00 – 23:15	69	90	65	45
		NSL 1	00:02 – 00:17	66	87	62	45
		NSL 2	23:41 – 23:56	66	86	65	43
		NSL 2	00:48 – 01:03	64	86	58	42
		NSL 3	23:20 – 23:35	61	83	59	41
		NSL 3	00:24 – 00:39	44	62	46	39

Hourly averages and L_{den} results as calculated using the formulae in Appendix IV for day, evening, and night measurements of noise at three boundary locations to Drogheda Landfill quarry.

Table 2

		$L_{Aeq\ 1hr}$	$L_{AMax\ 1hr}$	$L_{A10\ 1hr}$	$L_{A90\ 1hr}$	L_{den} Value
NSL 1	Day	77	91	81	60	78
	Evening	77	91	81	60	
	Night	67	89	64	45	
NSL 2	Day	77	92	82	61	78
	Evening	77	92	82	62	
	Night	65	86	63	43	
NSL 3	Day	68	87	72	53	70
	Evening	69	85	73	53	
	Night	58	80	56	40	

Appendix IV – Formulae

Hourly Averages – formula used to obtain the $L_{Aeq\ 1hr}$, $L_{AMax\ 1hr}$, $L_{A10\ 1hr}$, L_{A901hr}, values:

$$\boldsymbol{SPL = 10log\left[(10^{L1/10} + 10^{L2/10} \ldots + 10^{Ln/10})/n\right]}$$

L_{den} Calculation:

$$\boldsymbol{L_{den} = 10\log_{10}\left(\frac{1}{24}\right)\left(12 \times 10^{L_{day}/10} + 4 \times 10^{(5+L_{evening})/10} + 8 \times 10^{(10+L_{night})/10}\right)}$$

Appendix V – Calibration Certificates

CERTIFICATE OF CALIBRATION

ISSUED BY **Cirrus Research plc**

DATE OF ISSUE **29/04/19** CERTIFICATE NUMBER **128427**

Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Test engineer:
D.Swalwell
Electronically signed:

Microphone

Microphone capsule

Manufacturer: Cirrus Research plc

Model: MK:224

Serial Number: 210458A

Calibration procedure

Date of calibration: 25 April 2019

Open circuit: 46.6 mV/Pa

Sensitivity at 1 kHz: -26.6 dB rel 1 V/Pa

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to a National Measurement Institute.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Environmental conditions

Pressure: 99.10 kPa

Temperature: 21.0 °C

Humidity: 41.0 %

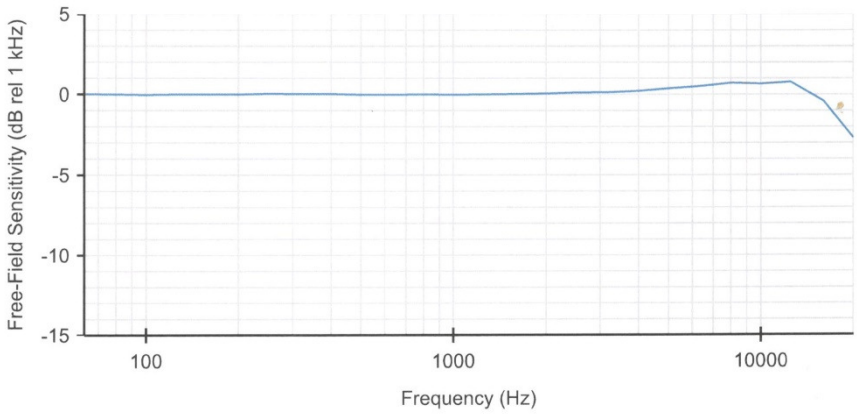
CERTIFICATE OF CALIBRATION

Certificate Number: 128427

Free-Field Frequency Response : Tabular

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
63	0.03	-0.11
80	0.02	-0.01
100	-0.02	0.03
125	0.01	0.08
160	0.01	0.09
200	0.01	0.10
250	0.06	0.11
315	0.05	0.10
400	0.04	0.10
500	0.00	0.06
630	-0.01	0.06
800	0.02	0.04
1 000	0.00	0.02
1 250	0.01	0.00
1 600	0.04	-0.05
2 000	0.08	-0.11
2 500	0.13	-0.20
3 150	0.15	-0.38
4 000	0.24	-0.62
5 000	0.40	-0.98
6 300	0.54	-1.55
8 000	0.73	-2.50
10 000	0.68	-4.08
12 500	0.79	-5.78
16 000	-0.39	-8.24
20 000	-2.70	-11.93

Free-Field Frequency Response : Graphical



AcSoft Calibration
Bedford Technology Park
Thurleigh, Bedford, MK44 2YA
U.K
Tel.: +44 (0) 1234 639551
Fax: +44 (0) 1234 639561
Email: sales@svantek.co.uk
www.svantek.co.uk

SVANTEK

CALIBRATION CERTIFICATE

Date of issue: 09-08-2018 **Certificate No:** 14010137-2 **Page:** 1/7

OBJECT OF CALIBRATION	Sound level meter type SV977, No 36167, manufacturer Svantek with preamplifier type SV12L, No 47685, manufacturer Svantek and microphone type 7052E, No 55967, manufacturer ACO.
APPLICANT	NVM Ireland 1st Floor, Unit 13 Boyne Business Park, Drogheda, Co Louth, Ireland
CALIBRATION METHOD	Method described in instruction MI-02 "Calibration of the sound level meter", issue number 11 date 27.01.2017, written on the basis of international standard EN IEC 61672-3:2013Electroacoustics. Part 3: Periodic tests.
ENVIRONMENTAL CONDITIONS	Temperature: (23.8 – 23.9) °C Ambient pressure: (1000.92 – 1002.62) hPa Relative humidity: (46.3 – 47.7) %
DATE OF CALIBRATION	09-08-2018
UNCERTAINTY OF MEASUREMENTS	Uncertainty of measurement has been evaluated in compliance with EA-4/02:2013. The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor $k = 2$.
CONFORMITY WITH REQUIREMENTS	On the basis of the calibration results, it has been found that, the sound level meter meets metrological requirements specified in the standard IEC 61672-1:2013 Electroacoustics – Sound level meters. Part 1: Specifications, for class 1.
CALIBRATION RESULTS	**The sound level meter submitted for testing has successfully completed the Class 1 periodic tests of IEC 61672-3:2013 (BS EN 61672-3:2013), for the environmental conditions under which the tests were performed.** The results are presented on pages 2 to 7 of this certificate (including measurement uncertainty).
APPROVED BY	B. Hunt

Appendix E
Emergency Response Procedure

Emergency Response Procedure	
Document No. L-DR-ERP	**Issued by: S. Callaghan** **Approved by: J O'Hagan**
Issue Date: 8/4/2019	**Revision No. 3**

Emergency Response Procedure

Scope: This procedure applies to all emergency situations which may effect the environment

Purpose: To identify any emergency situations which may arise at the facility and provide provisions for minimising the effect on the environment**?**

Responsibility: Facility Manager (Sean Callaghan), Recycling Manager V and W-Willy Martin Jim Byrne (General Operative)

Procedure:
Emergency situations which may arise are as follows

- Fire.
- Plant breakdown.
- Significant spillages.
- Slope Stability

FIRE RESPONSE PLAN:

Fire in buildings

- Evacuate the site and proceed to the assembly point at the facility entrance ensuring all persons have left including visitors to site.
- Site operative to notify Facility Manager.
- Facility Manager, Recycling facility Manager and General Operative to assess potential risk. If deemed minor incident, on-site personnel to deal with the fire using fire extinguishers and fire blankets.
- If considered a major fire then site staff must evacuate the building and stay out of the building
- In emergency situations site management will dial 999 and request emergency services to attend:

Fire at Drogheda Landfill

- Site management will nominate a member of staff (if present) to direct the Fire Brigade to site.
- Do not re-enter site until the all clear has been issued by fire officer.
- Investigate cause of the fire.
- Management will consider any implications that the fire may have on the ongoing operation of the site.
- Replace any fire extinguishing equipment that may have been used immediately.

Fire in the waste mass

- On discovering a fire, the site operator will notify the Facility Manager
- The fire brigade will be called and someone will direct the fire tenders to the site.
- If it is not considered safe for the site staff to tackle the fire, no action will be taken until the Fire Brigade arrive and direct activities.
- Management will consider any implications that the fire may have on the ongoing operation of the site.

SIGNIFICANT SPILLAGES

- Establish nature of the spill and clean up immediately.
- Dispose the used absorbent materials at the appropriate waste disposal facility.
- Prevent spillage from entering drains.
- Consider implication of spillage in relation to operational procedures at the landfill and take appropriate action.

ACCIDENT OR INJURY

- If an accident or injury happens on site, assistance will be called immediately by dialling 999 and requesting the appropriate emergency service.

Accident at Drogheda Landfill

- The First Aid trained member of staff should carry out an initial assessment and initiate appropriate first aid.

If injury is considered to be serious:

- Call emergency services immediately. Stop all activities at the site.
- Do not move injured person unless they are in immediate danger.
- Provide first aid and keep injured person warm and comfortable.

If the injury is not considered not to be serious:

- Treat injury with items from first aid box.
- Assess the success of the treatment and assess whether further attention is required.
- Take injured party to hospital or doctor if required.

Slope Stability

- If a slope becomes unstable, cordon off the area and excavate slip material. Do not allow unauthorised personnel or machinery into the area.
- Support the slope with coarse granular fill deposit as a stability berm at the base of the slope.
- Reduce slope height if possible
- Investigate nature of slope failure
- Undertake remedial actions as necessary

EMERGENCY CONTACT NUMBERS:

- **Louth County Council** **(042) 9353130, out of hours 1890 202 303**
- **Fire Department** **999**
- **Fisheries Board** **(01) 2842600**
- **Local Garda** **(042) 9388400**
- **Environmental Protection Agency**
  - **(i) EPA Headquarters Wexford** **(053) 9160600 Fax: (053) 9160699**
  - **(ii) EPA Dublin Regional Inspectorate** **(01) 2680100 Fax: (053) 2680199**
  - **(iii) EPA out of hours number for incidents 1890 3355999**

NOTIFICATION TO THE EPA

- Notify the Agency by phone, fax (business hours 01 2680199 Out of Hours 053 9160699) and in writing as soon as practicable and in any case not later than 10.00am the following working day after the incident has occurred and also through EDEN.
- Notify the Eastern Regional Fisheries Board by phone and in writing as soon as practicable and in any case not later than 10.00am the following working day after any incident which relates to discharges to surface water.
- Submit a written report to the Agency within 5 days of the incident. Any further actions taken after the date of notification of the incident, submit a written report of these actions as soon as practicable, no later than 10 days after the initiation of those actions.

Testing of the procedure

- This procedure shall be tested annually and a record of the testing held onsite. Facility Manager shall determine the appropriate method of testing. Any equipment required to manage an emergency incident is maintained and checked on an annual basis during testing.

- Any areas of concern noted during testing shall be addressed using the Corrective action / Incident notification form.

FIRE RESPONSE

.

AFS Flare - operated by the Council. Maintained by the contractor.

Gas Balancing – being carried out by the council.

In the event of the flare malfunctioning a text message is sent to the contractor and 2 council staff members. Following a period of 12-24 hours if the flare has not been started an external contractor is notified and. An investigation and incident is logged in a timely manner and not closed off until flare becomes operational again. This may be accompanied by gas balancing of the site and checking for any broken pipes and wells. Gas balancing is carried out in accordance with procedure gas well balancing – L-WR-OCP-022-03. The council staff liaises with the contractors for the flare to facilitate a restart of the flare, text messages are received when it has been restarted and can also be viewed remotely. In the scenario of a fire occurring at the facility when managing the

gas balancing and flares, the following procedure is carried out which can also occur in and outside of working hours.

Minor -

- Site operative to notify facility manager
- If of a minor nature, fire will be dealt with by on site staff
- Contractors at flare and engines will be notified of incident
- Flare services contractor will be notified

Major –

- If fire is not of a minor nature all staff and contractors to proceed to fire assembly point
- Fire services will be notified
- Under advise from fire services the contractors may switch off engine and/or flare as the case may be
- In the case of a sub-surface fires there are a number of warning signs such as smoke smouldering, odour emanating from the gas extraction system, levels of CO > 1000pm and combustion residue e.g. soot in extraction wells.
- EPA will be notified of incidents
- Council to investigate and carry out corrective actions

Options for Fire Suppression

- Smothering with soil
- Suppression agent
- Temporarily shut down the gas extraction system

Fire Prevention Plan	
Document No. LDR-FPP-02	**Issued by: S. Callaghan** **Approved by: J O'Hagan**
Issue Date: 08/04/19	**Revision No. 3**

Scope: This procedure applies to prevention of fires on the landfill.

Purpose: To identify any potential sources of fire and minimise any risk from them.

Responsibility: Facility Manager (Sean Callaghan), Facility Manager (V&W-Willy Martin)Jim Byrne (General Operative)

Procedure:

Emergency situations which may arise are as follows;

- Fire in buildings
- Fire in landfill

Fire in buildings

Material stored in building which could be a potential ignition source is minimised.

Out of hours the building has monitored smoke alarm which is linked to the burglar alarm. If the smoke alarm activates a security company respond and will inform the Fire Brigade.

The buildings also have a landfill gas detection alarm.

Fire in the waste mass/underground fire

Risk of fire in the landfill is considered to be limited to the landfill gas collection and flaring system. The flare is manufactured to the ATEX Regulations and is maintained quarterly and where appropriate to keep it in working order.

The only other source of fire is deemed to be malicious starting of fire on the landfill i.e. grass fire. This would have to be started maliciously. Weekly checks of the boundary fence are carried out.

(i) Site has been capped

(ii) Pipes and well heads checked for leaks

Gas Leaks

(i) Gas monitoring detectors are sited in the main office and canteen

(ii) Mobile gas detectors are used when monitoring of gas quality from wells

(iii) Peizometers are monitored on a monthly basis to monitor any gas migration.

(iv) Site checks are carried out for odour

(v) Engines and flares are serviced on a regular basis

(vi) VOC monitoring of site

Explosive Atmosphere

Factors which control the explosion potential of landfills

(i) Concentration of methane in air. If the concentration is between 5-15% there is the potential of explosion

(ii) Concentration of oxygen in the landfill gas. If the concentration of oxygen is >6%, there is the potential for an explosion. All engines and flares shut down if the oxygen concentration exceeds 5%

(iii) Presence of an ignition source. Ignition sources are eliminated by the use of spark proof pumps and specialist landfill welding equipment & grinders. There is a no smoking rule at the site. I also refer to Louth County Council's Ancillary Health & Safety Statement, Appendix 7. Whiteriver landfill, ATEX Explosion Protection Document and Hazardous Area Classification.

(iv) Flaring reduces the risk of explosion to prevent gas build up.

Signage

Signage is located on site at various locations for example no smoking signs, exit signs and fire assembly points

Employee Behaviour

There is a strict no smoking policy on site. Use of naked flames is prohibited. Use of specialist equipment is by prior permission.

Use of intrinsically safe test equipment

All control panels have been installed and fitted by certified electricians.

- Flare meets the ATEX requirements.
- All equipment used by contractors to be certified.
- All submersible pumps are spark proof.
- On site grinder is certified as spark proof.

- All electrical equipment is earthed

Prohibition of uncertified electrical equipment

The use of uncertified equipment on-site is prohibited.

Welding, cutting or other works which may involve sparks or sources of heat/fire/sparks may not be carried out on-site and are subject to a risk assessment and a permit to work from the facility manager.

Gas balancing and fire prevention

The gas balancing and flare procedure is as follows;

Gas balancing

This is carried out by the landfill manager in conjunction with the operator on-site on a minimum of a quarterly basis or when required. The wells are balanced in order to optimise the quantity of methane and oxygen for the flare to operate. The gas balancing is carried out in accordance with documented procedure L-WR-OCP-022-03

In the case where the flare shuts down due to gas levels, breakdown, pipe off, maintenance and/or suction pressure, a text alert system is set up to inform the contractor for the engines and three staff members of Louth County Council. The council will attempt flare restart and in other cases contractor may attend the site. Louth County Council liaises with the contractor on this. If the flare is not restarted in a timely manner an incident is logged on Eden. The landfill will be inspected in certain instances to balance gas levels suitable for a flare restart. Pipe work, well heads on manifolds will be checked as appropriate to determine that there are no leaks and/or broken pipes which may impact oxygen levels. Knock out pots and condensate interceptors are inspected on a regular basis to ensure condensate does not build up and impact gas quality and suction pressure. Where appropriate the gas field will be balanced and the Council staff will liaise with flare contractor in order to restart flare.

Gas Balance	
Document No. L-WR-OCP-022-03	**Issued by: S. Callaghan** **Approved by: J O'Hagan**
Issue Date: 03/07/2018	**Revision No. 2**

Gas Well Balancing Procedure

Scope: To put in place a system to optimise gas extraction from each gas well

Purpose: To set out the necessary steps to balance the gas wells

Responsibility: Landfill manager / Deputy Landfill Manager

Procedure:

1. Steps to balance gas wells

Part Balancing Using Manifolds Only

Using GA 2000 landfill gas meter or GEM 5000

- First monitor the main gas line at the inlet to the flare
- Then monitor the 6 gas manifolds

Based on these monitoring results i.e. suction pressures, methane concentration and oxygen concentrations a targeted approach can be taken to increasing suction on certain wells.

All manifolds should have at least -10mbar of suction on them. If not this must be investigated. Condensate in the gas lines could be blocking the suction. If the suction is varying up and down by a few millibar this is the most likely cause.

If the oxygen level at the flare is close to 5% then each manifold should be tested to see which area of the site the high oxygen is coming from. Once the area has been identified each well in that area should be tested.

Full balancing – At gas wellheads

Using the GA 2000 or GEM 5000 landfill gas meter monitor each gas well at its wellhead. All gas wells should have negative pressure and low oxygen levels.

Each gas well head shall be monitored at least quarterly or more regularly if manifold monitoring indicates issues in a certain area.

Action levels for landfill gases are;

Gas	High Level	Low Level	Comment
Methane	60%	25%	>60% indicates not enough suction. <25% indicates too much suction or poor capping.
Oxygen	>5%	n/a	Ideally <5% oxygen but in some cases in uncapped areas poor quality gas i.e. 8% oxygen gas can be blended into the main, as long as it does not increase the oxygen at the flare to >5%.
Carbon Dioxide	>40%	n/a	Indicator only
Suction	> -20 mbar	Any positive pressure	Positive pressure indicates gas build up

The valve at each well head should be adjusted slightly up or down depending on the suction pressure and methane and oxygen levels.

If there is no suction the pipe work may be blocked with condensation.

If the suction is varying up and down by a few millibar this is due to condensate in the gas line. The gas line should be traced back to determine where the condensate is accumulating and the falls on the line should be repaired to ensure no condensate builds up.

High oxygen levels indicate poor capping or breaks in pipe work.

Table 1: List of Manifolds
6 in total

Appendix F
Hydrogeological Risk Assessment

Drogheda Landfill

Hydrogeological Risk Assessment

Report for:
Louth County Council

Date:
12th November 2015

Report No.:
BRE12007Rp03F03

BlueRock Environmental Limited

Suite 332,
The Capel Building,
Mary's Abbey,

33 Lower Salthill,
Galway.

Tel: 086 3856884 / 091 445988
Fax: 01 888 0830

DOCUMENT INFORMATION

Project Title:	Drogheda Landfill Hydrogeological Risk Assessment
Licence No.: **Project No.:**	EPA Licence W0033-01 BREL Project No. BRE12007
Contract No.:	-
Report Ref.:	BRE12007Rp01F02
Status:	**Final03**
Client:	Louth County Council
Client Details:	Damien Holmes Louth County Council Crowe Street, Dundalk, Co. Louth A91 W20C
Issued by:	Louth County Council

Document Production / Approval Record

	Name	Signature	Date	Position	% Input
Prepared by (consultant /professional)	Niall Mitchell BE, MSc, CEng MIEI, PGeo		12/11/15	Professional Hydrogeologist /Chartered Engineer	100
Approved by (consultant /professional)	Niall Mitchell BE, MSc, CEng MIEI, PGeo		12/11/15	Professional Hydrogeologist /Chartered Engineer	100
Site Approval by					N/A

This report supersedes the previous version (*i.e.* Reference BRE14008RpF02, dated 16th February 2015). It also takes into account the request for clarifications from the EPA to Louth County Council (dated 25th August 2015).

DISCLAIMER:

This report has been prepared by BlueRock Environmental Ltd (BREL) with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our terms and conditions and taking account of the resources devoted to it by agreement with the client. We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above. This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

The conclusions and recommendations contained in this report are 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 BREL has not been independently verified by BREL, unless otherwise stated in the report. Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

BREL 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 BREL 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. BREL specifically does not guarantee or warrant any estimate or projections contained in this report.

Where field investigations are carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in issuing this report.

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APPENDICES

1 EXECUTIVE SUMMARY

- **This report supersedes the earlier version (i.e. Reference BRE14008RpF02, dated 16th February 2015). It also takes into account the request for clarifications from the EPA to Louth County Council (dated 25th August 2015).**
- A Hydrogeological Risk Assessment of Drogheda Landfill Site was undertaken by BREL based on previous investigation reports and monitoring data between 2006 and 2014.
- This closed landfill is unlined and contains primarily household, commercial, construction and demolition and industrial non-hazardous solid waste. The site originally operated as a limestone quarry. All quarrying operations ceased in 1979 and water levels were allowed to return to equilibrium on cessation of the reported dewatering activities. The facility subsequently opened as a landfill facility in 1983 (EPA licence W0033-1) for the disposal of household, commercial, construction, demolition and industrial non-hazardous solid waste. The site ceased landfill operations in 1999 and was subsequently capped and developed into open space in 2007. A civic waste facility was opened adjacent to the area of the waste body in 2002 at the site.
- The site lies approximately 600 metres north of the River Boyne which flows in a west-east direction towards the Irish Sea. The site is bounded by agricultural land to the north and west, a former quarry to the northeast and a housing development to the south and southeast.
- The waste material was laid directly upon the exposed limestone bedrock benches of the former quarry and operates under the dilute and disperses principal. Capping of the waste material was undertaken between November 2006 and September 2007. However it was subsequently identified that during waste infilling operations on the landfill site (*i.e*. pre-1999); waste material was mistakenly buried across the northern waste licensed boundary of the landfill. This material was reportedly placed on existing overburden rather than on exposed bedrock benches of the former quarry. No removal or capping of this material has taken place to-date.
- The regionally important bedrock karst aquifer is the only identified aquifer to-date. No perched groundwater has been identified at the site.
- Leachate appears to continue to migrate vertically into the bedrock aquifer in particular areas of the landfill, particularly along the northern boundary of the site. However the hydrochemistry data suggests that there is significant dilution capacity of the contaminants within the bedrock aquifer in addition to the open void downgradient of the waste body.
- Groundwater generally appears to flow across the site in a north to south/southeasterly direction. Localised variations were observed in the northern region of the site *i.e.* in the vicinity of monitoring well BH1A and monitoring well BH4A. These variations suggest that localised flow occurs in a north to northwesterly direction across the northern boundary of the site at particular times of the year.
- Water levels within the void suggest that this water body has a controlling influence on groundwater levels in its immediate vicinity. As the open water of the quarry void receives close to 100% of potential recharge, in addition to surface water runoff and groundwater flows from upgradient zones, it appears to be acting as a groundwater mound discharging radially to the surrounding aquifer, during certain periods of the year, and thereby affecting the groundwater flow regime within the immediate area of the site. On other occasions the levels within the void are lower than the surrounding groundwater levels to the west and south. Groundwater flow from the void to the southeast remains relatively constant over time.
- No contaminant fluxes appear to be occurring across the southern and southeastern landfill site boundaries in a downgradient direction. However, uncertainty persists regarding the migration of contaminated fluxes in a north to northwesterly direction across the northern site boundary *i.e.* in the vicinity of the non-capped waste material. It is also unclear if the detected contaminant concentrations in monitoring boreholes BH4A and BH5A are attributed to leachate migration from the waste body directly into the underlying bedrock aquifer, are being

detected due to preferential pathways generated by poor borehole installations or a combination of both.

A previous RPS report (Ref: MDE1008Lt0001D01, dated 4th October 2010) concluded that the monitoring borehole BH5A is not facilitating the vertical migration of contamination to the aquifer based on the assumption that the six metre bentonite seal within the monitoring borehole was installed correctly during the drilling works. If this seal was inappropriately installed, the protection layer may not be fulfilling its requirements and potentially facilitates the migration of leachate to groundwater. In addition, the shallow screen in borehole BH4A may also be facilitating the migration of leachate from the waste body to groundwater.

- The non-capped waste material, in close proximity to boreholes BH4A and BH5Aa, is generating leachate from infiltration (*i.e.* rainfall) and is potentially impacting on BH4A and BH5A over time.

- The adjacent former quarry site to the east of the landfill was granted permission to undertake infilling of both domestic and commercial waste material in 1984 for a period of 5 years. In addition, permission was also granted in 1992 to infill the quarry void with builder's rubble, limestone & shale material. No domestic waste was permitted. No further information was available during the compilation of this report; however, the potential presence of this material on the adjacent property may potentially be impacting on the elevated concentrations of contaminants on the northern boundary of the Drogheda Landfill site.

- A preliminary Conceptual Site Model (CSM) was initially developed and identified a number of SPR linkages ranging between Low and High. However, following a detailed review of all site data, these risks were reduced to Low and Low to Moderate.

- The main SPR linkage of concern relates to:

  ✓ The migration of leachate to the underlying groundwater body, to the River Boyne and to Drybridge public groundwater supply.

- Based on average values of Ammoniacal Nitrogen levels between 2006 and 2014 in the northern region of the landfill, the rule of thumb of 100xGTV was regularly exceeded in BH5A throughout the monitoring period. It is noted that the levels recorded are reducing over time. Based on the trends observed and assuming this downward trend continues over time at this location, it is predicted that the mean levels will achieve the GTV by the end of 2016 approximately.

  Occasionally the 100xGTV rule of thumb was exceeded in BH3A for Ammoniacal Nitrogen. However, the levels recorded in BH3A are generally below the GTV with only the most recent data recording slightly elevated levels.

  Isolated exceedances of the 100xGTV was recorded in BH4A for Iron (November 2010), Nickel (August 2010) and Manganese (August 2010). It is unclear if these isolated levels are representative of groundwater conditions considering the significantly lower levels recorded prior to and after these sampling events.

- The site is compliant with the "prevent" or "limit" objectives of the WFD and GWD. The prevention of hazardous of substances entering the groundwater system is being met based on available chemical analysis. Limiting the ingress of non-hazardous substances is also being met by the mitigation measures that have been installed to date at the site *i.e.* landfill capping, the lining of surface water drains and on-going groundwater and surface water monitoring as per the licence requirements.

  The following points are noted:

  ✓ The area of impact from the landfill leachate (i.e. in the northern region of the site) is considered to be minor relative to the groundwater body catchment area of the Drogheda GWB *i.e.* < 0.01%; Therefore it is unlikely that the status of the GWB or the objectives of the WFD will be affected.

- ✓ No groundwater plume has been identified todate.

- Consultations with Louth County Council have confirmed that it is intended to complete the recommended works, as outlined in Section 11.0, by mid-2017. However, capping of the waste outside the boundary remains subject to significant capital budget being made available. Completion of the other works/investigations as per Section 11 will be used to prepare a revised CSM report to be submitted to the Agency in the third quarter of 2017.

- In summary, based on available site data, the risk posed by Drogheda Landfill to the underlying GWB, the River Boyne and any potential down-gradient groundwater users is considered to be low. A series of once-off measures have been provided to develop a more representative understanding of the risk posed by the landfill and address the identified uncertainties in particular relating to potential fluxes discharging to the north of the site.

2 INTRODUCTION

2.1 Introduction

The following hydrogeological risk screening exercise is intended to satisfy the requirements of the Environmental Protection Agency (EPA), relating to a closed landfill facility in the townland of Mel, Drogheda, County Louth (EPA licence W0033-01). The licence was amended in June 2013 under Section 42B(1) of the Waste Management Actions 1996 to 2013. The report has been commissioned on foot of an EPA technical amendment to the waste license as per a notification issued by the EPA on 18th June 2013:

"Within eighteen months of the date of this technical amendment, 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 22nd December 2015. Groundwater monitoring results shall be submitted annually or as required in the Schedules to this license."

It should be noted that this report supersedes the earlier version (i.e. Reference BRE14008RpF02, dated 16th February 2015). It also takes into account the request for clarifications from the EPA to Louth County Council (dated 25th August 2015) and is reported under the new *EPA Guideline Template for Hydrogeological Review/Technical Assessment Report.*

2.2 Objectives

- To consolidate all available historical reports and geological, hydrogeological and hydrological data relating to the site and its immediate environs;
- To assess and interpret all available water quality data recorded to-date;
- To develop an appropriate Conceptual Site Model (CSM) for the site;
- To assess the site's compliance with the Groundwater Regulations (S.I. No. 9 of 2010);
- To assess the level of risk posed to sensitive receptors;
- To develop an appropriate compliance monitoring programme for the site; and,
- Recommend suitable mitigation measures, if deemed necessary.

2.3 Methodology

This report was prepared in accordance with the following documentation:

- Guidance on the Authorisation of Discharges to Groundwater, EPA, 2011;
- Guidance on the Management of Contaminated Land and Groundwater at EPA Licensed Sites (2013),
- Code of Practice Environmental Risk Assessment for Unregulated Waste Disposal Sites, EPA, 2007; and
- Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control and Trigger Levels, Environment Agency, 2003.

2.4 Sources of Information

The following sources of information were reviewed as part of this assessment:

- BREL 2012, Drogheda Landfill Hydrogeological Review.
- Geology of Meath. Bedrock Geology 1:100,000 Scale Map Series, Sheet 13. Geological Survey of Ireland. (McConnell, Phlox, and Geraghty, 2005);
- GSI well and karst database;
- Bedrock and subsoil exposures noted during site visits in 2012 and 2014;
- GSI on-line database;
- Ballymakenny Group Water Scheme Groundwater Source Protection Zone Report, April 2011, Rev A;
- Drybridge Group Water Scheme Groundwater Source Protection Zone Report, P. Conroy, April 2011, Rev D, Draft Report;
- GSI, 2004a. Drogheda Groundwater Body – Water Framework Directive Initial Characterisation Summary – 1st Draft. Geological Survey of Ireland;
- GSI, 2004b. Wilkinstown Groundwater Body – Water Framework Directive Initial Characterisation Summary – 1st Draft. Geological Survey of Ireland;
- NERDO, 1981. Groundwater Resources in the N.E. (R.D.O.) Region. An Foras Forbartha. Northeast Regional Development Organisation;
- BMA, 1996. Drilling logs for the proposed Northern Motorway. E.I.S., Northern Motorway. Bernard Murphy & Associates;
- GSI, Groundwater Protection Schemes, 1999; and,
- Fitzsimons, V., Daly, D. and Deakin, J., 2003. GSI Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination. Draft Report, Geological Survey of Ireland.

All water quality data was supplied to BlueRock Environmental Ltd (BREL) in spreadsheet databases. This report assumes all data provided is accurate and is in accordance with all historical laboratory certificates.

2.5 Report Format

This report comprises of an executive summary for chapter 1 and an introductory chapter 2 which discusses sources of information, general objectives of this hydrogeological assessment and a brief overview of historical investigative reports associated with the site.

Chapter 3 discusses the site location, layout and setting.

Chapter 4 includes detailed information on the underlying soils and bedrock.

Chapter 5 is a brief description of the local hydrology, including details of any site specific surface water bodies.

Chapter 6 discusses the hydrogeology of the site and general region, including any boreholes that have been drilled and monitoring wells in place. It discusses historic groundwater levels and flow direction.

Chapter 7 describes briefly the preliminary Source-Path-Receptor model (SPR) for the landfill.

Chapter 8 is comprehensive review of the hydrochemistry monitoring of the site in terms of groundwater, surface water and leachate quality.

Chapters 9 & 10 defines an updated conceptual site model for the landfill using site specific data coupled with the initial SPR model and provides compliance monitoring recommendations.

Chapters 11 & 12 provide recommendations for future monitoring, investigation and/or remediation and report conclusions.

2.6 Review of Previous Reports

There were a limited number of previous investigation reports available for the Drogheda landfill. However a number of supplementary sources of information were also provided and are summarised below. .

Report 1: Drogheda Landfill Waste Licence Application documents, 1998.

The documentation provided in this application provides a review of the environmental impacts on the ground and surface water quality and includes groundwater and surface water quality results from this period.

The interpretation of the site data concluded that:

- Groundwater quality at BH4 had been impacted by and likely from landfill leachate
- Water within the quarry did not record any List I. List II substances in the form of Ammonia and Chloride was recorded.
- Slightly elevated levels of Chloride and Ammonia were recorded within groundwater migrating off site via fractures in the floor of the southwestern quarry excavation. Elevated List I (Cadmium) and a number of List II (metals) were recorded in BH10 which penetrates a karstic void. It was concluded that this indicated contaminant migration principally confined to isolated fractures rather than widespread across the site.
- The documents conclude that the emissions to groundwater at that time were assessed as not being of a significant extent or pose a risk to the environment. Further monitoring was recommended to confirm this.

Report 2: Assessment of Borehole 5A, RPS letter report, Ref: MDE1008Lt0001D01 (draft), 4th October 1998

This document provides an assessment of groundwater monitoring well BH5A in terms of the potential for migration of contamination to the underlying aquifer from the adjacent waste material via the well installation itself. The report concludes that the borehole is not providing a vertical pathway for migration of leachate to the underlying aquifer. This determination was based on the 6 metre bentonite seal reported within the borehole log and the interpreted confining conditions within the well. In addition, the source of the impact is suggested to be from groundwater impacted underlying the waste body that is migrating towards the well.

It is noted that this interpretation assumes that the installation of the bentonite sealed was appropriately installed to provide sufficient protection of the underlying aquifer.

Report 3 Hydrogeological Site Investigation, Glover Site Investigations Lid, Jan/Feb 1998

This investigation comprised the drilling of 10 no. boreholes using a rotary drilling drill rig in January 1998. A 50 mm diameters monitoring wells was installed within each monitoring well and installed with pea gravel and bentonite. Rising head tests were undertaken in a number of the boreholes. Details of the investigation are incorporated into this 2015 Hydrogeological Assessment report.

Report 4: A review of Environmental Impacts on Groundwater and Surface Water Quality, letter report, dated 29th July 1998.

Based on the results recorded at this time, this document provides a review of groundwater and surface water quality at the site. The report concluded that groundwater below and adjacent to the landfill area had been impacted by leachate percolating through the thick unsaturated zone in the rock. Heavy metal concentrations were locally elevated upgradient of the lake. The results also indicate that highly mobile leachate species such as chloride and ammonia were elevated and widespread, and most significantly within the quarry lakes, which represents sumps for surface water runoff and groundwater in the vicinity of the landfill. It was concluded that chloride an ammonia concentrations were substantially diluted in groundwater samples downgradient of the site.

Report 5: Geophysical Survey to Delineate the Extent and Depth of Fill material at Drogheda Landfill, County Louth, BMA Geoservices, June 2005.

The objective of the survey was to outline the likely extent and depth of the fill material at the site. The findings of the survey are included in this 2015 Hydrogeological Risk Assessment report.

3 SITE DESCRIPTION

3.1 Site Location

Drogheda Landfill is located in the townland of Mel, approximately 600 metres to the north of the River Boyne and to the northwest of Drogheda town.

The site is adjacent to Leonards Cross at the junction of the R168 road to Collon (and there on to the newly constructed M1) and Cement Road, a minor road linking the Slane Road and the N1 primary road northwards from Drogheda to Dundalk.

The site is bounded by agricultural land to the north and west, a former quarry to the northeast and a housing development to the south and southeast.

A site location map is presented as **Figure 1.**

3.2 Topography

The site generally falls in a north to southwest/south/southeast direction. The highest point is in the northern region of the site at 50.0 mOD. From here the site falls to the southwest along the N51 road at approximately 30.0 mOD and to the south towards the flooded former quarry void. The edges of the void comprise cliff faces at an average height of approximately 19.5 mOD along the northern edge and higher cliffs to the south and west of the void at an average height of 34 mOD.

3.3 Site Layout

The site area is approximately 32 hectares comprising of the historic landfilled waste body and the large partially flooded quarry void to the south of the waste body.

A civic waste facility is currently in operation along the northwestern boundary of the landfill and facilitates recycling and waste transfer. The landfill is accessed via an entrance within the civic waste facility.

3.4 Leachate Management

The landfill operates on a dilute and disperse principal where leachate generated by the waste body percolates into the ground and the underlying groundwater body. The landfill cap constructed minimise the effects of rainfall on the volume of leachate being generated. All leachate wells installed at the site have been recorded as dry indicating low levels of perched leachate present within the waste body.

3.5 Site History

The site originally operated as a limestone quarry operated by Irish Cement Ltd. All quarrying operations ceased in 1979 and water levels were allowed to return to equilibrium on cessation of the reported dewatering activities. The facility subsequently opened as a landfill facility in 1983 for the disposal of household, commercial, construction, demolition and industrial non-hazardous solid waste. The site ceased landfill operations in 1999 and was subsequently capped and developed into open space in 2007. A civic waste facility was opened adjacent to the area of the waste body in 2002 at the site.

The landfill is unlined and operates on the principle of dilution and dispersion of the leachate generated into the underlying regionally important groundwater limestone aquifer. It is reported that the landfilled material was placed on the exposed bedrock benches of the quarry. Two independent quarry excavations (one to the south and one to the northeast of the landfilling operations) were abandoned during the quarrying works when the water table was intercepted which resulted in flooding of the works. The larger former quarry void is reported to be flooded to a depth of 1.8 metres over an area of approximately 12 hectares. The smaller former quarry void is not part of the existing licensed landfill facility and water levels within this void are currently unknown.

During waste infilling operations on the landfill site (*i.e*. pre-1999), waste material was mistakenly buried across the northern waste licensed boundary of the landfill. This material was reportedly placed on existing overburden rather than on the exposed bedrock benches of the former quarry. No removal or capping of this material has taken place to-date.

The adjacent site to the east, which partially comprises a smaller former quarry void, was granted permission in 1984 to infill a portion of the site with commercial and domestic waste. The location of this buried material is unclear; however anecdotal evidence suggests this occurred in the northern region of this site. Further permission was granted in 1992 to facilitate the infilling of the quarry void with builders rubble, limestone & shale material. No domestic material was permitted for infilling in this area. It is also reported that a cement works facility was historically operated at the site. No further information in relation to the actual infilling activities that took place was available during the compilation of this report.

Preparation works for the capping contract at Drogheda landfill commenced on the 11th September 2006 and the placement of the gas geocomposite commenced on the 20thNovember 2006. All capping operations were completed by the 14thSeptember 2007.

4 GEOLOGY

4.1 Regional Overburden

Surface cover to the immediate north, east and west of the site is mapped by soils derived from mainly non-calcareous parent material (AminPD). These are generally gravelly sands and silts. A small zone of lacustrine soils or lake sediments is mapped to the northeast of the site. Further east, beyond the racetrack, beach sands and gravels are evident.

4.2 Site Overburden

4.2.1 Subsoils

Most of the overburden was removed during the quarrying activities at the site. However, subsoils surrounding the quarried area of the site (*i.e.* along the northern and western site boundaries) comprise till derived from Lower Palaeozoic shale and sandstones (TLPSsS). Closer to Drogheda and along the Boyne Valley, subsoils are mapped as Irish Sea Till, derived from Irish Sea basin deposits.

Depths of overburden along the boundaries of the landfill waste body range between 0m (in the southern region of the site) and 44 mbgl (borehole BH5A) along the northern boundary of the site (see **Figure 2**). The waste material, as mentioned previously, was placed on the exposed limestone benches of the former quarry site. **Photo 1** illustrates the exposed limestone at the former quarry site.

A drilling programme was undertaken in 1998 with the objective of installing monitoring wells for groundwater monitoring. A summary of the ground conditions encountered is provided in **Table 4.1.**

Description	Depths (metres below ground level)
Boulder Clay	0.3 – 44 m (upgradient) 0.0 – 9.0 m (downgradient)
Limestone Bedrock	30.0-52.5 m

Table 4.1 Summary of Ground Conditions

Borehole logs describing the overburden and bedrock geology of the site are provided **Appendix A**.

Photo 1 View of Exposed Limestone under the waste material

The thickness and depth of this waste material is currently unclear. However, a geophysical survey undertaken by BMA Geoservices in June 2005 suggests a thickness of waste ranging between 5 and 35 mbgl[1]. A suggested cross section of the site is provided in **Figure 3** and **Figure 4**.

4.3 Regional Bedrock Geology

According to the GSI Bedrock Geology Map of Ireland the site is underlain by limestone bedrock of Lower Carboniferous age and classified as Dinantian Pure Bedded Limestones of the Tullyallen Formation (TF). Geological mapping records these rocks dipping less than 20 degrees to the south-southwest with an approximate east-west strike. The Tullyallen Formation is bounded to the north by Silurian metasediments and volcanics belonging to the Glaspistol Formation (GF) and to the west by Dinantian pure bedded limestones of the Platin Formation (PT). The limestones have been deformed into a syncline that dips towards the River Boyne.

The bedrock in the region is tectonically juxtaposed by the Slane Fault which trends in an ENE-WSW direction approximately 650 metres to the north of the northern site boundary. Two cross faults are recorded intersecting the Slane Fault, trending in a NNW – SSE direction – one approximately 700 metres west of the site and the second approximately 1200 metres east of the site. The cross fault to the west throws the Tullyallen Formation against the stratigraphically younger Glaspistol Formation (see Figure 3).

4.4 Site Geology

Depths to bedrock recorded within existing monitoring boreholes at the site range between 0 and 44 mbgl. Exposed limestone is evident at the landfill cliff edges surrounding the flooded former quarry void. The bedrock walls show strong vertical jointing and incorporate clay-infilled collapse structures and solution cavities.

An historical borehole, drilled in 1998 along the southern boundary of the site (*i.e.* borehole BH10), recorded a 6m water filled void 27m below the surface. The width and extent of this karst feature is unknown.

Borehole logs from the surrounding area also record significantly developed karstification. Two trial boreholes drilled in Mell townland through the Tullyallen and Yellowbatter limestone formations (penetrating to 72 and 54.7 metres deep) showed cavities accounting for approximately 10% of the total rock penetration (NERDO, 1981). Both the geological log and the caliper log of the 1979 drilling work at borehole PWSBH01 at Drybridge(to the west of the landfill site) show substantial karstification, including fissure zones at 15 m, 25 m and at 40 mbgl (NERDO, 1981). The three fissures intersected were filled with unconsolidated material. In addition, borehole records from the site investigation for the M1 Northern Motorway recorded cavities/fissures with vertical depths of up to 3 metres (BMA, 1996).

Depths to bedrock were recorded by both boreholes and a Geophysical Survey undertaken by BMA Geoservices in June 2005. Levels recorded ranged between 10 and 30 mOD.

[1]mbgl = metres below ground level

5 HYDROLOGY

5.1 Regional Hydrology

The site is within the catchment of the river Boyne with surface water in this area generally draining from the high ground southwards towards the River Boyne which is located approximately ~~8~~600 metres south of the landfill portion of the site. The river flows in a west-east direction towards the Irish Sea. A stream, named as Drybridge stream for this report, flows in a north-south direction approximately 450 metres to the west of the site.

The River Boyne is estuarine immediately downgradient of the site with tidal flows dominant.

5.2 Site Hydrology

Surface water runoff from the site all flows radially across the waste body to the surface water drainage across the site before discharging into the quarry lake at the site.

5.3 Surface Water Framework Directive Status

The River Boyne (EU Waterbody code: IE_NW_39_2205) has been assigned an overall quality status of 'Moderate' as per the EPA website. It has been assigned an overall risk status of 1a, *i.e.* '**At Risk of Not Achieving Good Status**'. The stretch of the river downgradient of the landfill is tidal and considered to be a transitional water body.

6 HYDROGEOLOGY

6.1 Aquifer Classification

The GSI has classified the underlying bedrock aquifer as a regionally important karstified aquifer (Rkd) dominated by diffuse flow. The site is located within the Drogheda Urban Groundwater Body (GWB) which has been classified as being of "Good" status. The groundwater body descriptions are available from the GSI website: www.gsi.ie and the 'status' is obtained from the Water Framework Directive website: www.wfdireland.ie/maps.html.

An interpretative water level contour map from the NERDO (1981) report is presented in **Appendix B**. The 10 mAOD contour runs approximately east to west to the north of the site suggesting groundwater flows generally in a north to south direction and ultimately provides baseflow to the Boyne River or springs in the area. The map also records a water level of 8 mOD within the flooded quarry void. It is unclear if dewatering activities that were undertaken at the quarry at this time significantly influenced the water level in the quarry and surrounding area at this time. An interpretative regional cross-section, which was adapted from Conroy (2011), is presented as **Figure 3**. A Glover Site Investigation, undertaken at the site in 1998, records a level within the void at 4.2 mOD; however it is unclear if this level represents the floor of the void or the water level present at this time.

The limestones in the area are generally considered to have a moderate to good secondary permeability and joints and fissures are likely to have been enlarged by the solution of limestone. The permeability of these features may have been reduced somewhat by the infilling with Quaternary (*i.e.* sands, silts and clays) deposits over time.

The nature of groundwater flow in the area is dependent on the degree of karstification of the limestone. Where limestone is heavily karstified, groundwater generally flows within a small number of enlarged conduits. However, in areas where karstification is not prevalent, groundwater generally flows through a series of connected fractures, fissures and joints.

As discussed in **Section 4.2**, exposed limestone is evident along the cliff faces of the flooded former quarry void in the southern region of the site. The bedrock walls show strong vertical jointing and incorporate clay-infilled collapse structures and solution cavities. The conduits and fissures are typically expected to be orientated north-northwest to south-southeast, which are in line with the jointing and fault zones of the bedrock which facilitate the karst development. Aquifer transmissivity is also expected to be highest in this direction.

The aquifers within the Drogheda Urban GWB are generally unconfined but localised confining conditions have been reported in areas of low permeability and thicker overburden. Flow is typically reported at depths within the upper 30 metres of the weathered bedrock horizons or via connected underlying fractured zones (GSI, 2004a). Deeper water strikes can also be encountered at deeper depths within isolated fractures or faults.

Hydrogeological characteristics of karstified limestones are considered to be highly heterogeneous by their nature. Conduit flow, when encountered, can have a significant impact on the hydrogeological regime of the area. The hydraulic properties vary depending on the limestone lithology, degree of bedding, structural history and position within the regional groundwater flow system (Drew, 2002). Significant variations in hydrological behaviour are common as each part of this aquifer has its own distinct characteristics *i.e.* void size, frequency and arrangement. Therefore significant variations in water levels can occur over small areas particularly if the boreholes have intersected separate conduits or fracture zones that are not hydraulically connected. In this environment, flow directions are often but not necessarily perpendicular to interpreted water table contours.

In general the regional groundwater flow across the site will be towards the River Boyne, but the karstified nature of the bedrock means that local groundwater flow directions can be highly variable during varying climatic conditions.

6.2 Groundwater Vulnerability

Groundwater vulnerability is dictated by the nature and thickness of the material overlying the uppermost groundwater. This means that vulnerability relates to the permeability and thickness of the subsoils. A detailed description of the groundwater vulnerability categories can be found in the Groundwater Protection Schemes document (DELG/EPA/GSI, 1999) and in the draft GSI Guidelines for Assessment and Mapping of Groundwater Vulnerability to Contamination (Fitzsimons et al, 2003). A draft groundwater vulnerability map for Co. Louth has been developed by the GSI. The vulnerability rating for the site, given the exposed bedrock, is classified as **extreme vulnerability.**

6.3 Background Groundwater Quality

Background groundwater quality for the region has been sourced from the Drogheda GWB. The bedrock is calcareous with a calcium bicarbonate hydrochemical signature. Typical reported electrical conductivity values range from 550 to 650 µS/cm with Moderately Hard to Very Hard waters and Alkalinity values of 150 to 350 mg/l.

6.4 Source Protection Areas

Drybridge PWS borehole is located approximately 950 metres west of the centre of the landfill site and Ballmakenny GWS is located approximately 2km to the north east of the site. Both water supplies have been delineated with outer source protection zones (see **Appendix C**).

6.5 Rainfall

Average monthly gridded rainfall data was sourced from Met Éireann (Walsh, 2012) and is presented in **Table 6.1.**

J	F	M	A	M	J	J	A	S	O	N	D	Annual
89	63	70	59	60	69	63	77	74	88	88	90	891

Table 6.1 Long term mean monthly rainfall data (mm) (*Met Éireann)*

The closest synoptic station to the site is at Clones, 58 km to the northwest of the site, where average potential evapotranspiration (PE) is 438 mm/yr. This value is used as a best estimate of the site PE. Actual evapotranspiration (AE) is estimated by multiplying PE by 0.95, to allow for the reduction in evapotranspiration during periods when a soil moisture deficit is present (Water Framework Directive, 2004). Actual evapotranspiration is therefore 416 mm yr^{-1} (0.95 PE).

The Effective Rainfall (ER) for the site is determined from:

ER = AAR – AE

= 891 mm yr^{-1} – 416 mm yr^{-1}

ER = 475 mm yr^{-1}

The capped area of landfill is 101,650 m^2. Infiltration in restored areas is in the range 2-10% of effective rainfall. This equates to a potential leachate volume of 966 – 4,828 m^3/yr.

6.6 Groundwater WFD Status

Work completed for the Water Framework Directive has assigned 'Status' to surface waters and groundwater (www.wfdireland.ie - watermaps). The Drogheda Urban GWB (EU code: IE_EA_G_029) has been assigned an overall quality status of 'Poor'. It has been given a risk status of **1a, *i.e.* 'At Risk'** of not achieving good status.

6.7 Sensitive Receptors / Designated Protected Areas

A number of groundwater wells have been recorded on the GSI and Louth County Council on-line data base to the south and southeast of the site. Information regarding these wells was not available at the time of compiling this report; however, water quality results provided by Louth County Council indicate that all water quality parameters were recorded below the Drinking Water Limits when previously sampled.

Additional groundwater wells were also recorded to the northwest of the site by Louth County Council (*i.e.* within Lavin Park development). Chemical levels of E-coli and Copper were historically recorded above the drinking water limits at these locations.

Drybridge PWS (Public Water Supply) borehole is located approximately 950 metres west of the site and Ballmakenny GWS (Ground Water Supply) is located approximately 2km to the north east of the site. Both sources recorded levels similar to regional background levels. Neither PWS is considered to be directly downgradient of the landfill site nor is the landfill within the source protection zone for each water supply.

The Rivet Boyne, located approximately 1km south of the centre of the waste body flows in an east to west direction to the Irish Sea. The river is estuarine and tidal immediately downgradient of the landfill and is considered a Special Area of Conservation (SAC). The following habitats and/.or species listed on Annex I/II of the EU habitats Directive are outlined below:

- Alkaline Fens
- Alluvial Forests
- River Lamprey
- Atlantic Salmon
- Otter

6.8 Groundwater Monitoring Wells

As mentioned previously, ten groundwater monitoring boreholes were installed in 1998 at the landfill facility to provide a groundwater monitoring network for the site. These monitoring boreholes were subsequently replaced with new monitoring boreholes in 2001 and were located in close proximity to each of the original boreholes. The 1998 monitoring boreholes were labelled as BH1, BH2, BH3….BH10 and the 2001 monitoring boreholes labelled as BH1A, BH2A, BH3A….BH09A, BH10A. An additional monitoring borehole, BH11A, was subsequently drilled at the site in 2001 and located along the southeastern boundary of the waste body. All borehole logs are provided in **Appendix A.**

The locations of the monitoring boreholes were selected based on anticipated regional groundwater flow directions of the area (*i.e.* north to south towards the River Boyne). Boreholes BH1A, BH2A, BH4A were considered to be upgradient of the waste body and boreholes BH3A, BH6A, BH8A, BH9A, BH10A and BH11A considered as intermediate and downgradient locations.

Five leachate monitoring wells were historically installed within the waste body (*i.e.* L1A to L5A). Monitoring of these wells has consistently recorded dry conditions, which suggests low levels of leachate contained within the waste body.

Table 6.2 summarises the borehole logs from the 2001 drilling programme.

ID	Borehole logs ID	Top Level of Borehole (mOD)	Depth to Bedrock (mbgl)	Bedrock Level (mOD)	Depth (m)	Description
BH1A	1RB	31.95	28.00	3.95	35.5	Boulder clay (overburden) to 28m then moderately strong grey fine grained carboniferous limestone
BH2A	2RB	32.36	8.50	23.86	50	Boulder clay (overburden) to 8.50m then moderately strong grey fine grained carboniferous limestone
BH3A	3RB	33.66	9.00	24.66	52.5	Boulder clay (overburden) to 9m then moderately strong grey fine grained carboniferous limestone
BH4A	BH4A	33.57	21.50	12.07	31.5	Clay to 21.5m then limestone.
BH5A	5RB	36.13	44.00	-7.87	48.5	Boulder clay (overburden) to 44m then moderately strong grey fine grained carboniferous limestone
BH6A	6RB	35.95	1.00	34.95	42.5	Boulder clay (overburden) to 1m then moderately strong grey fine grained carboniferous limestone
BH7A	7RB	25.17	0.30	24.87	30	Boulder clay (overburden) to 0.30m then moderately strong grey fine grained carboniferous limestone
BH8A	8RB	36.15	2.70	33.45	45	Boulder clay (overburden) to 2.70m then moderately strong grey fine grained carboniferous limestone
BH9A	9RB	34.35	2.00	32.35	47	Boulder clay (overburden) to 2m then moderately strong grey fine grained carboniferous limestone
BH10A	BH10A	32.78	0.00	32.78	40	slightly weathered grey fine grained limestone
BH11A	11RB	21.72	0.50	21.22	30	Boulder clay (overburden) to 0.50m then moderately strong grey fine grained carboniferous limestone

Table 6.2 Summary data acquired from site investigation works 2001

The drilling programme revealed a heterogeneous lithological profile beneath the site and is summarised as follows:

- Depths of overburden across the site range between 0 metres (in the southern region of the site with the exposed former quarry void) and 44 metres (borehole BH5A) to the north of the site. The overburden is logged as boulder clay typically comprising brown and grey gravelly sandy CLAY with occasional cobbles.
- Waste material was reported to have been placed directly upon the exposed limestone benches of the former quarry during landfilling operations. Thickness of this waste is currently unclear; however a geophysical report undertaken in 2005 reported waste material ranging between 5 and 35 mbgl.
- Slightly weathered limestone was recorded on borehole logs BH4A and BH10A.
- Depth to bedrock varies across the site but typically fall towards the open void. Bedrock levels to the south of the void increases in a southerly direction. Significant variations in bedrock levels were identified in the northern region of the landfill which may be related to historical quarrying in the area and/or due to natural variations of the limestone bedrock.

6.9 Groundwater Levels & Flow Direction

Groundwater levels have been recorded on a monthly basis as part of the groundwater monitoring programme. Monthly groundwater level data was available for the period January 2006 and February 2014 and is presented and graphed in **Appendix D**. Monthly rainfall data was also sourced from Met

Éireann. Minimum and maximum data recorded during this period are presented in **Table 6.3** and groundwater level trends over time are provided in **Graph 6.1 and Graph 6.2.** Interpreted groundwater contours and flow direction over time are also included in **Appendix D**.

The following was noted from all data collated:

- No bedrock fracturing or encountered fissuring was recorded within the borehole logs with the exception of borehole BH10. The void encountered at this location is typical of highly karstified limestone bedrock.
- The majority of groundwater levels recorded were significantly above the original depth of water strike during the drilling works and the installed well screens which suggests pressurised and confining conditions across much of the site – see **Table 6.3**. A thick layer of low permeability boulder clays were recorded within the northern monitoring boreholes ranging in thickness between 8.5 and 44 metres. This clay and the thick unsaturated limestone are likely to contribute to the partially confining conditions recorded in this area.
- Recorded water levels suggest that groundwater is (a) flowing within a large permeable body of limestone rock with significant interconnected fissures and joints or (b) within a series of partially connected enlarged conduits in localised areas or (c) a combination of both - the latter being most likely.

Borehole	Water Strike (mbgl)	Water Strike (mOD)	Lowest Recorded Water Level (mOD)	Highest Recorded Water Level (mOD)	Variation (m)	Well screen interval (mOD)
BH1A	32.1	-0.70	4.05	16.85	12.80	2.45 to -3.55
BH2A	38.0	-6.00	1.96	17.46	15.5	12.36 to -17.64
BH3A	49.4	-16.22	3.76	12.16	8.40	1.15 to -18.84
BH4A	-	-	5.17	19.07	13.90	32.07 to 2.07
BH5A	45.0	-9.27	6.03	13.83	7.80	-6.37 to – 12.37
BH6A	40.25	-4.73	5.35	11.45	6.10	26.45 to -6.55
BH7A	15.0	9.81	10.37	20.9	10.53	16.17 to -4.83
BH8A	42.75	-6.92	5.15	9.9	4.75	8.65 to -9.35
BH9A	45.0	-10.94	5.24	11.2	5.96	20.35 to -12.66
BH10A	-	-	4.78	12.58	7.80	26.78 to -7.22
BH11A	27.0	-5.58	5.62	12.62	7.0	6.72 to -8.29

mbgl = metres below ground level mOD = metres to Ordnance Datum

Table 6.3 Water Levels and Borehole Details

- Groundwater levels vary significantly over time with the greatest variation recorded within BH 4A (*i.e.* 13.9 metres) and the lowest variation within BH8A (*i.e.* 4.75 metres). The variations are typically a product of recharge (*i.e.* diffuse and/or point infiltration) and groundwater flow mechanisms in karst limestone aquifers and where variations in pressure heads and water levels within conduits, due to variations in climatic and geological conditions, can cause changes to groundwater flow regimes.
- The highest groundwater levels recorded within the upgradient wells were recorded on the 12th February 2013 and 18th February 2014 (see **Graph 6.1**). The highest groundwater levels recorded within the downgradient wells were recorded during similar periods in addition to the 10th May 2011 (see **Graph 6.2**). It is noted that water levels within the upgradient monitoring wells appear to be broadly rising over time with levels within the downgradient remaining relatively consistent.
- The lowest groundwater levels recorded within the upgradient wells were recorded on the 30th May 2006 and the 4th October 2011. The lowest levels within the downgradient wells were recorded on the 27th July 2010.

- Groundwater flow directions were assessed on 11 separate occasions between 2010 and 2014 (*i.e.* 23rd February 2010, 18th May 2010, 10th May 2011, 6th September 2011, 4th October 2011, 7th February 2012, 13th March 2012, 6th June 2012, 6th November 2012, 12th February 2013, 18th February 2014).

  Groundwater contour maps were developed for each of the selected dates and are presented in **Appendix D**.

- The contour maps suggest that groundwater generally flows across the site in a north to south/southeasterly direction. Localised variations were observed in the northern region of the site *i.e.* in the vicinity of monitoring wells BH1A and BH4A.

  Groundwater in the northwestern region of the site is locally interpreted to flow in a northwesterly direction towards BH1A at certain times of the year only (*i.e.* September 2011, and February 2012). Water levels within BH4A record a consistent low point in this region which suggests localised flow towards this area throughout the year. This would suggest that groundwater potentially flows in a north to northwesterly direction across the northern boundary of the site in this area of the site.

- Monthly rainfall data was sourced from Met Éireann between Jan 2006 and Mar 2014 for the Drogheda area. The rain gauge data was sourced from the Togher Rain Gauge station to the northwest of Drogheda town. The data confirms the variable nature of the hydrogeological regime in response to rainfall events.

- Water level data for the open void were reviewed where available. The levels indicate that the void has a controlling influence on groundwater levels. As the open water of the quarry receives close to 100% of potential recharge, in addition to surface water runoff and groundwater flows from upgradient zones, during certain periods of the year it appears to be acting as a groundwater mound discharging radially to the surrounding aquifer, thereby affecting the groundwater flow regime within the immediate area of the site.

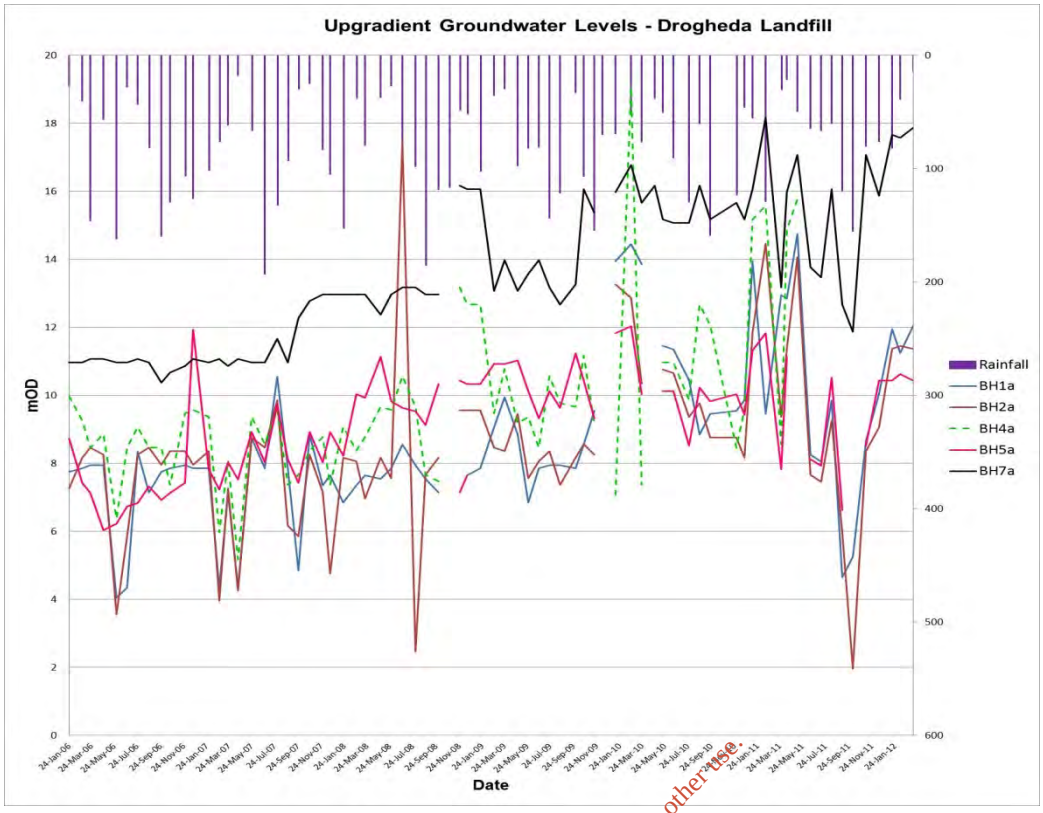
  Water levels within boreholes BH6A, BH8A, BH9A and BH11A, which are located in close proximity to the void, do not appear to vary significantly over time in comparison to the northern boundary boreholes. At particular times of the year, the void discharges water in a westerly, southwesterly, southerly and southeasterly direction. On other occasions, it appears to receive groundwater from the west and south and discharges in a southeasterly direction. Correlation of the mound effects with seasonal and rainfall events have been not identified with the available data.

- Water levels have not been recorded within the smaller flooded former quarry void to the northeast of the site todate and the hydraulic connection between groundwater levels within borehole BH7A and the smaller void is unclear. This void may also be influencing groundwater levels in its vicinity with groundwater levels within BH07A consistently higher than groundwater levels in its proximity.

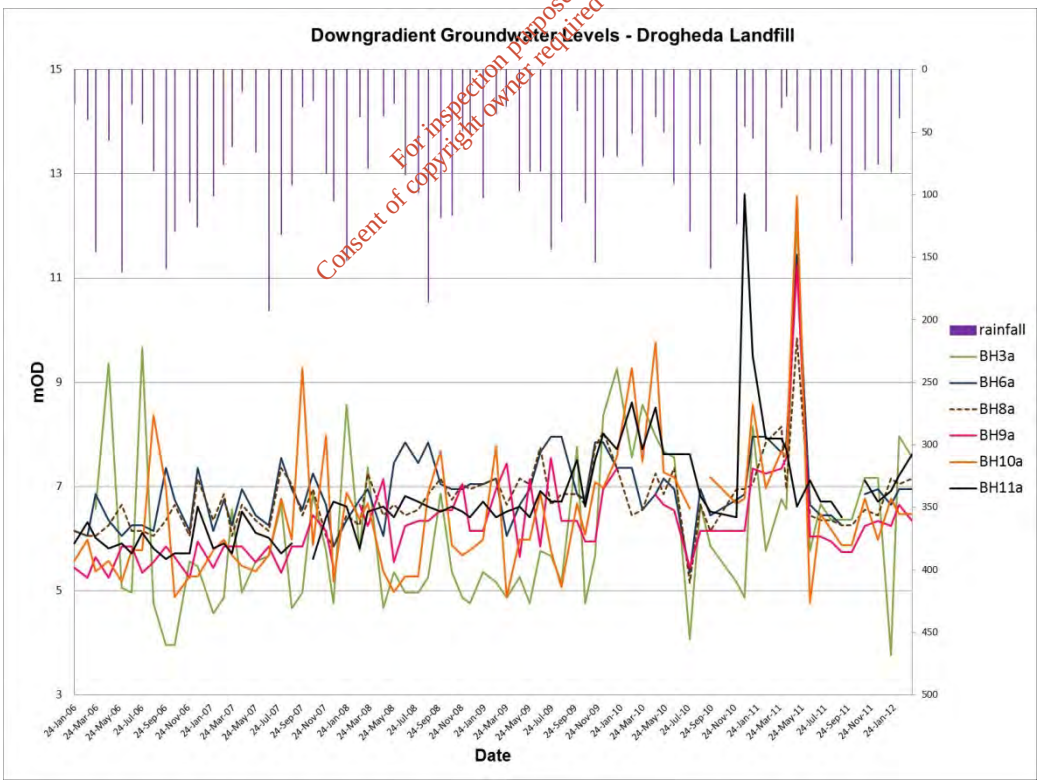
- The hydraulic gradient beneath the site ranges between approximately 0.0004 m/m to 0.012 m/m closer to the quarry void. It is likely to be influenced by the void particularly during high groundwater level periods

- All leachate wells on site were recorded as dry. It is unclear if this relates to the installation of the wells or if leachate levels are lower than the wells installed.

- Given the variability of groundwater levels and interpreted groundwater flow directions in the northern region of the site and the proximity of the waste body to these wells, it appears that the monitoring wells along the northern boundary of the site *i.e.* BH1A, BH2A, BH4A and BH5A do not fully represent upgradient conditions. It appears that BH1A and BH2A are upgradient of the waste body at particular times of the year and possibly downgradient at other times. In addition, the locations of BH4A and BH5A appear to be too close to the waste body to be representative of upgradient conditions.



Graph 6.1 Upgradient Groundwater Levels



Graph 6.2 Downgradient Groundwater Levels

6.10 Permeability

Permeabilities of the limestone bedrock identified within historical boreholes at the landfill site following completion of K-testing in 1998 are as follows:

Borehole	Horizon	Permeability (m/sec)	Permeability (m/day)
BH3	Limestone Bedrock	1.2×10^{-6}	0.13
BH4	Limestone Bedrock	2.2×10^{-5}	1.9
BH7	Limestone Bedrock	7.3×10^{-6}	0.63
BH9	Limestone Bedrock	2.1×10^{-7}	0.018

Table 6.4 Permeability Levels of the Limestone Bedrock

7 PRELIMINARY S-P-R

A conceptual understanding of the hydrogeological regime across Drogheda Landfill is provided in **Figure 4** and illustrates a single groundwater body within the bedrock and within the overburden in the northwestern region of the site. Groundwater within the bedrock is likely to be providing baseflow to the open quarry void within the site boundary.

It is unclear if groundwater intersects the unlined waste cells at particular times of the year as the depth of the base of the waste is unclear. However, based available groundwater level information and current knowledge of the historical quarrying activities at the site, groundwater is likely to be lower than the base of the waste throughout the year.

The impact assessment is guided by the source-pathway-receptor (S-P-R) model. The S-P-R model is used to identify the sources of water and potential contaminants, the environmental assets affected by such, and the pathways by which water and contaminants reach those receptors. **Table 7.1** shows the preliminary S-P-R which will be refined as the assessment evolves and more information is acquired.

Sources	Pathways	Receptors	Risk
Leachate	Leachate vertical migration to groundwater	Drogheda Groundwater Body	High
	Groundwater	Downgradient Groundwater Users	High
	Groundwater	River Boyne	Low

Table 7.1 Preliminary S-P-R

It is noted that although Drybridge PWS is not considered to be directly downgradient of the landfill site, the potential variations in groundwater flow at particular ties of the site suggest that the PWS may be partially downgradient of the landfill and is considered as a conservative measure

8 HYDROCHEMISTRY

Hydrochemical data was acquired from reports as referenced in **Section 2.4.** In addition, a detailed water monitoring database between 2006 and 2014 was reviewed.

Interpretations are provided on the assumption that values significantly outside the normal range are invalid.

In order to identify temporal trends, groundwater quality was graphed over time for the selection of parameters for which data had been collected between January 2006 and January 2014 (see **Appendix E**).

Groundwater and surface water monitoring points used to analyse water quality at various locations and depths are shown in **Figure 2**. Schedule F of the waste licence requires the monitoring of certain parameters on either a monthly, quarterly or annual basis as shown in **Table 8.1**.

Monitoring Frequency	BH1A, BH4A, BH6A, BH9A, BH10A, BH11A	BH2A, BH3A, BH5A, BH7A, BH8A
Monthly	Visual Inspection and Odour, Groundwater Level, Ammoniacal Nitrogen, Chloride, Cadmium, Chromium, Electrical Conductivity, pH, Temperature, Iron, Lead, Manganese, Potassium, Sodium, Barium, Nickel, Nitrate, Nitrite, Phenol, Zinc	Groundwater Level, Ammoniacal Nitrogen, Electrical Conductivity, pH, Temperature
Quarterly	Dissolved Oxygen, Total Suspended Solids, TON, TOC, Zinc	Visual Inspection and Odour, Chloride, Dissolved Oxygen, Cadmium, Chromium, Iron, Lead, Manganese, Potassium, Sodium, TON, TOC, Barium, Nickel, Nitrate, Nitrite, Phenol
Annually	Boron, Calcium, Copper, Cyanide, Fluoride, Magnesium, Mercury, Sulphate, Total Alkalinity, Total Phosphorous, Residues on Evaporation, Faecal Coliforms, Total Coliforms List I & II substances monitored biannually from BH10, annually from other boreholes	Boron, Calcium, Copper, Cyanide, Fluoride, Magnesium, Mercury, Sulphate, Total Alkalinity, Total Phosphorous, Residues on Evaporation, Zinc, Faecal Coliforms, Total Coliforms

Table 8.1 Monitoring Schedule

8.1 Human Health & Environmental Risk Assessment Framework

Groundwater concentrations were compared to the 2010 Groundwater Regulations Guideline Trigger Value (*i.e.* GTV) in addition to the Environmental Protection Agency Interim Guideline Values (IGV) for Groundwater as presented in EPA interim report "Towards Setting Guideline Values for the Protection of Groundwater in Ireland" 2002. The IGVs have been selected on the basis of the lowest of either the drinking water standards, historical environmental quality standards for surface water or GSI trigger values and are therefore highly conservative and protective of all groundwater receptors.

There are currently no published generic assessment criteria for groundwater derived specifically to be protective of human health via direct contact. However it can be assumed that if water is considered safe for human consumption then there are no risks from direct contact. The 2007 Drinking Water Regulations were utilised for this purpose.

All surface water levels have been compared to the 2009 Surface Water Regulations. There are currently no site-specific contaminant trigger levels in place at Drogheda Landfill.

8.2 Leachate Quality

No chemical data is available for the leachate present within the waste body. For the purposes of this report, typical leachate compositions were considered based on the EPA Landfill Manual Landfill Site Design (2000).

8.3 Groundwater Quality

Groundwater monitoring is carried out in monitoring boreholes BH1a to BH11a. The screened section within each of these wells is within the bedrock strata with the exception of monitoring wells BH04A and BH05A, which are screened across both overburden and bedrock. There was little consideration given to the possibility of a perched aquifer by the well installation; however, this is unlikely to be present since the capping measures completed in 2007.

Groundwater samples were collected on a monthly and quarterly basis by the EPA. The suite of analysis includes:

- Alkalinity;
- Ammonia as N;
- Metals (Ba, Cd, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Zn);
- Calcium, Chloride, Cyanide, Fluoride, Nitrite, ORP, Sulphate;
- Chemical Oxygen Demand;
- Dissolved Oxygen, Electrical Conductivity, pH;
- Faecal & Total Coliforms;
- Phenols;
- Total Organic Carbon; and,
- Total Organic Nitrogen

A summary of all the laboratory results is presented in **Appendix E**. The period of results reviewed for this report ranged between January 2006 and December 2014. This 8 year period encompasses the period during and following completion of the capping works at the site and is considered an appropriate time period for this assessment. However from a water quality trend perspective, the period of 2007 (*i.e.* post capping) to 2014 was assessed.

Water samples were collected from all eleven monitoring boreholes and four locations within the flooded quarry void. A summary and interpretation of the results is provided below. It should be noted that water within the former quarry void is considered to be groundwater that has been impacted by rainfall quality. Electrical Conductivity readings from this water body are consistent with groundwater rather than surface water.

8.3.1 Ammonia

Consistently elevated concentrations of Ammonia were recorded in monitoring borehole **BH5A** ranging between 0.03 and 18.3 mg/l N throughout the monitoring period. These levels have been reducing over time with concentrations since April 2013 less than 3 mg/l; however they remain above the GTV threshold levels. Elevated concentrations of Ammonia were detected in borehole BH7A ranging between 0.03 and 10.37 mg/l N. The elevated concentrations are occasional only and no elevated concentrations have been recorded since April 2012 (see **Graph 8.1**). The EPA IGV for Ammonia as N is 0.15 mg/l and the 2010 Regulations for Ammoniacal Nitrogen as N is 0.175 mg/l.

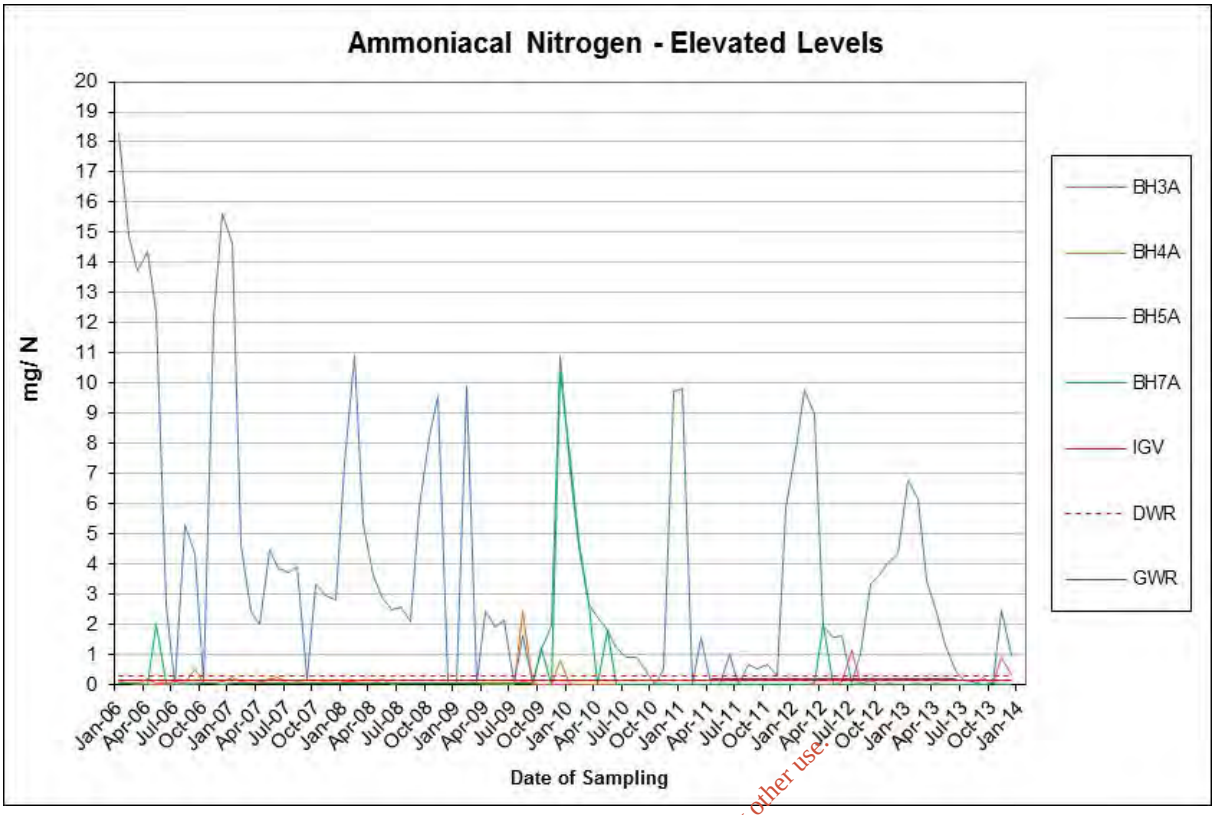
Exceedances of the Ammonia GTV were occasionally recorded within borehole **BH3A** in July 2012 and December 2013 ranging between 0.9 and 1.17 mg/l N and within **BH4A** in August 2009 (2.45 mg/l) and December 2009 (0.82 mg/l). These detections are also occasional only and not consistent over time. The exceedances in BH3A represent a recent increase in levels and on-going monitoring is recommended to ascertain the persistency over time.

One exceedance of Ammonia greater than the 2010 Groundwater Regulations was recorded in borehole **BH10A** (*i.e.* 0.9 mg/l in July 2006) and in borehole **BH11A** (*i.e.* 0.2 mg/l July 2006). No exceedances at these locations have been recorded since (see **Graph 8.2**).

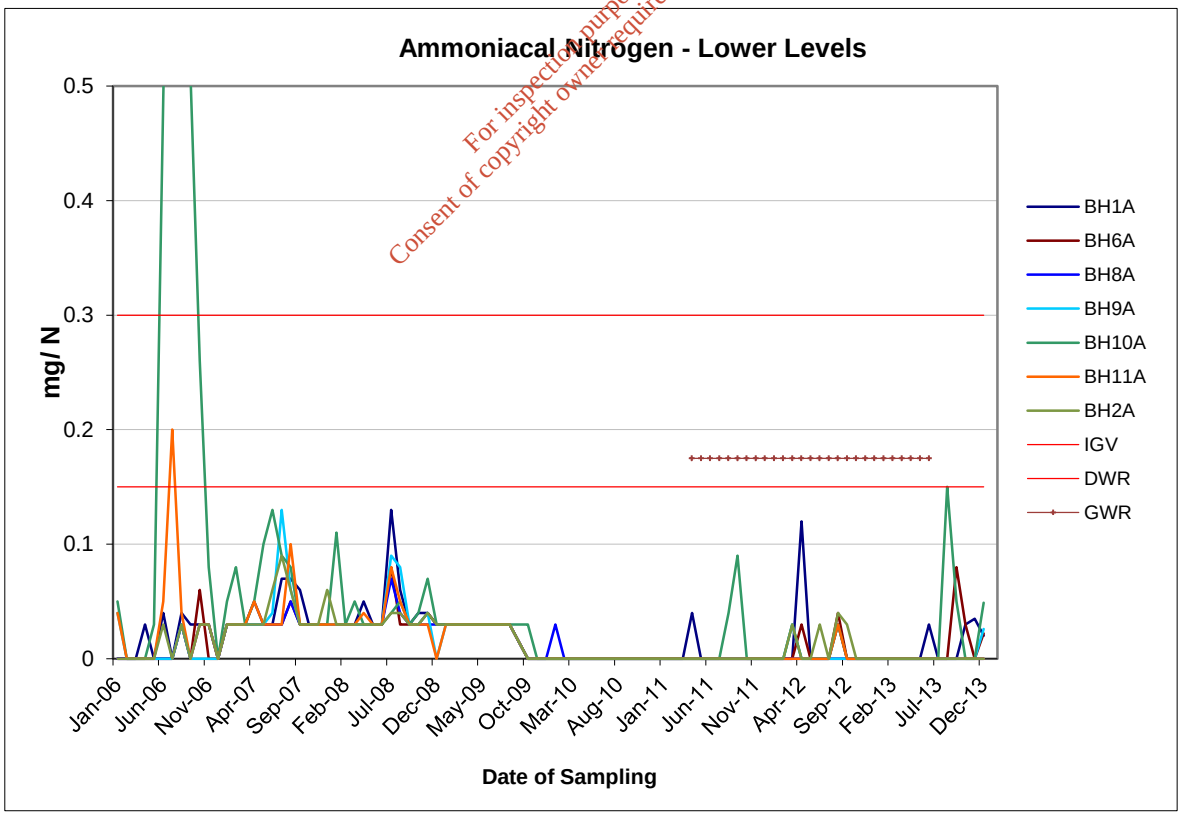
No elevated concentrations of Ammonia were recorded in the remaining boreholes across the site.

Occasional and slightly elevated Ammonia levels within the open void have been recorded above the 2010 Groundwater Regulations (see **Graph 8.3**). The concentrations recorded range between 0.03 and 0.5 mg/l with the highest levels recorded in **SW1** and **SW2** in January 2007. The remaining slightly elevated concentrations were recorded in **SW3** and **SW5**. The most recent elevated concentration was recorded at **SW3** only (*i.e.* 0.23 mg/l October 2013) with the remaining locations all below the threshold levels during the same period.

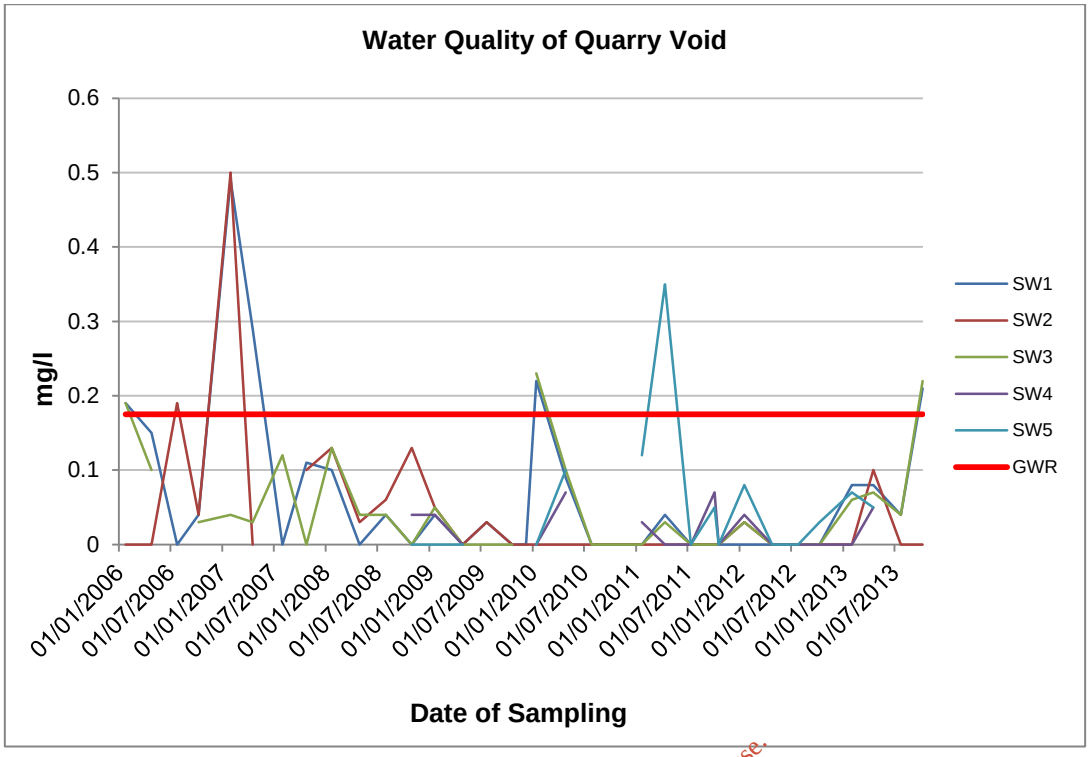
In summary, the Ammonia concentrations have significantly reduced over time with occasionally slightly elevated concentrations being detected. Elevated levels were consistently noted in BH5A with only recent detected elevated levels recorded in BH3A. No correlation with rainfall events was observed. Ammonia concentrations are significantly higher in the northern region of the site in proximity to the waste body in comparison to the locations to the south of the waste body. No notable impact to the water within the former quarry void has been recorded to-date. In addition, no notable flux of Ammonia is evident discharging downgradient from the site to the south and southwest of the open void.



Graph 8.1 Ammonia - Higher Concentrations



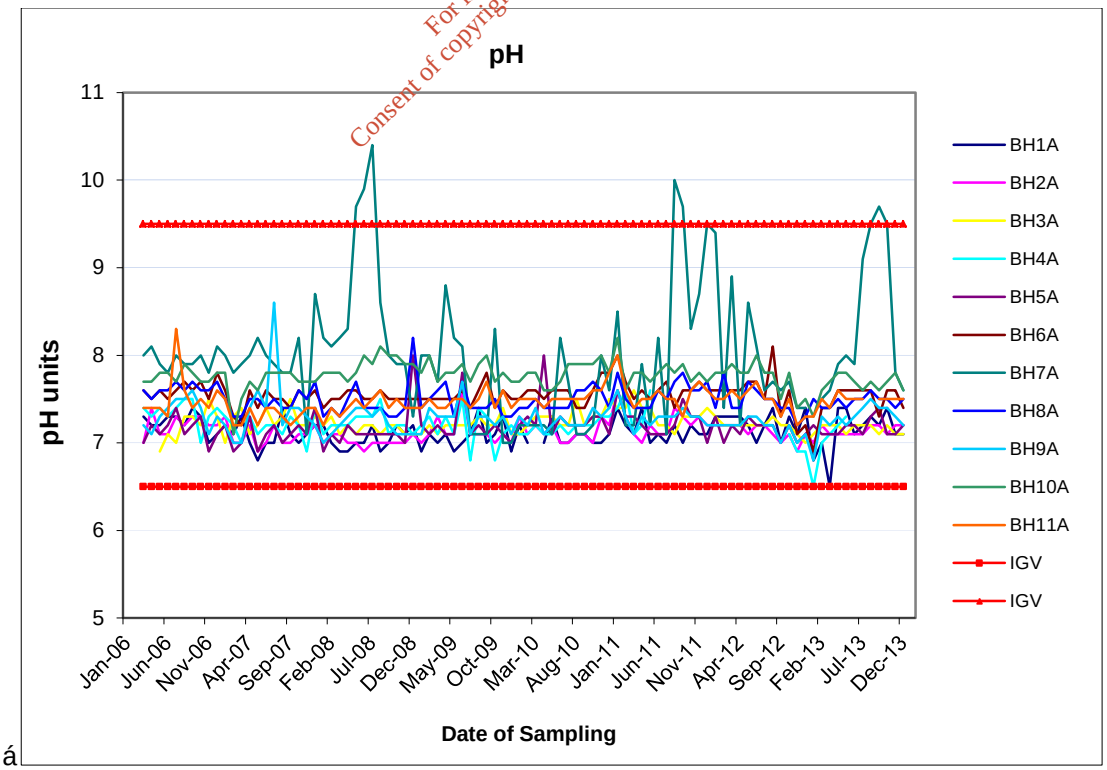
Graph 8.2 Ammonia - Lower Concentrations



Graph 8.3 Ammonia Concentrationsin in Void

8.3.2 pH

The pH levels typically ranged between the 6.5-9.5 pH threshold range (see **Graph 8.4**). Elevated levels of pH were recorded within borehole **BH7A** ranging between 9.7 and 10.4 (the highest level was recorded in July 2008).



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Graph 8.4 pH Levels

Given the proximity of BH7A to the adjacent former quarry and the historical cement works at this site, the elevated levels of pH in this area may be attributed to the historical workings on this site.

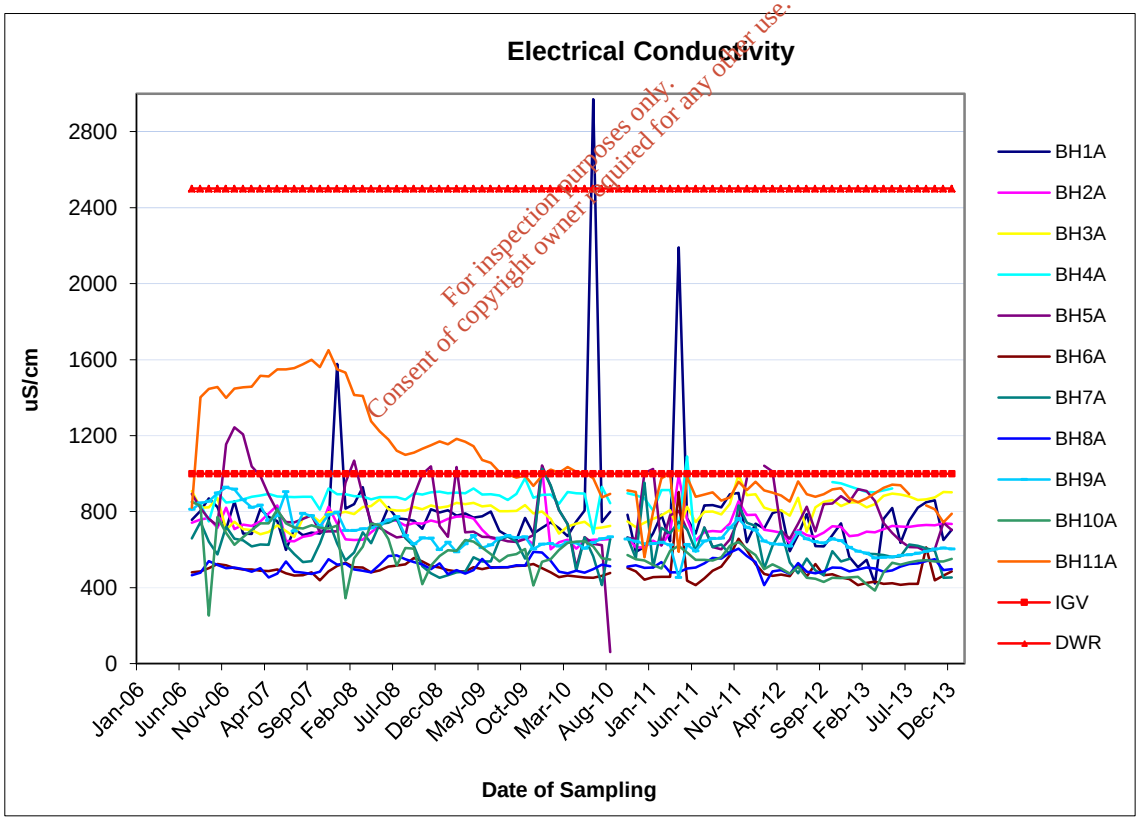
8.3.3 Electrical Conductivity (EC)

All EC levels were recorded below the IGV value of 1,000 µS/cm throughout the monitoring period with the exception of boreholes **BH1A, BH4A, BH5A and BH11A** (see **Graph 8.5**). The elevated concentrations within **BH1A** were recorded on three separate occasions only ranging between 1,577 and 2,970 µS/cm. The remaining detections in BH1A were recorded consistently below the guideline levels. Levels recorded within **BH5A** were occasionally above the IGV guideline level ranging between 1,025 and 1,244 µS/cm in 2006 but have since reduced below the guideline values.

A minor elevated detection within borehole **BH4A** was recorded in May 2011 (*i.e.* 1,090 µS/cm). No further elevated levels were recorded since. Elevated levels recorded within **BH11A** were initially recorded at 1,402 µS/cm in 2006 before gradually reducing to below the IGV concentrations of 1,000 µS/cm in June 2010. No exceedance has been recorded since and the concentrations continue to reduce further over time.

No elevated EC levels were recorded in the remaining upgradient or downgradient monitoring boreholes.

In summary, the EC levels recorded suggest an historical impact from the waste body within **BH5A** and **BH11A** only. However, no elevated levels have been recorded across the site since March 2012.



Graph 8.5 Electrical Conductivity Levels

8.3.4 Manganese

Elevated and highly variable concentrations of Manganese were frequently recorded in monitoring boreholes **BH4A** (ranging between 93.6 and 101,679 µg/l) and **BH5A** (ranging between 96.1 and 986.0 µg/l) throughout the monitoring period (see **Graph 8.6** and **Graph 8.7**). It is noted that concentrations within BH4A dramatically reduced from 2011 and are currently and consistently below threshold levels. Elevated concentrations of Manganese were also recorded in borehole **BH10A**

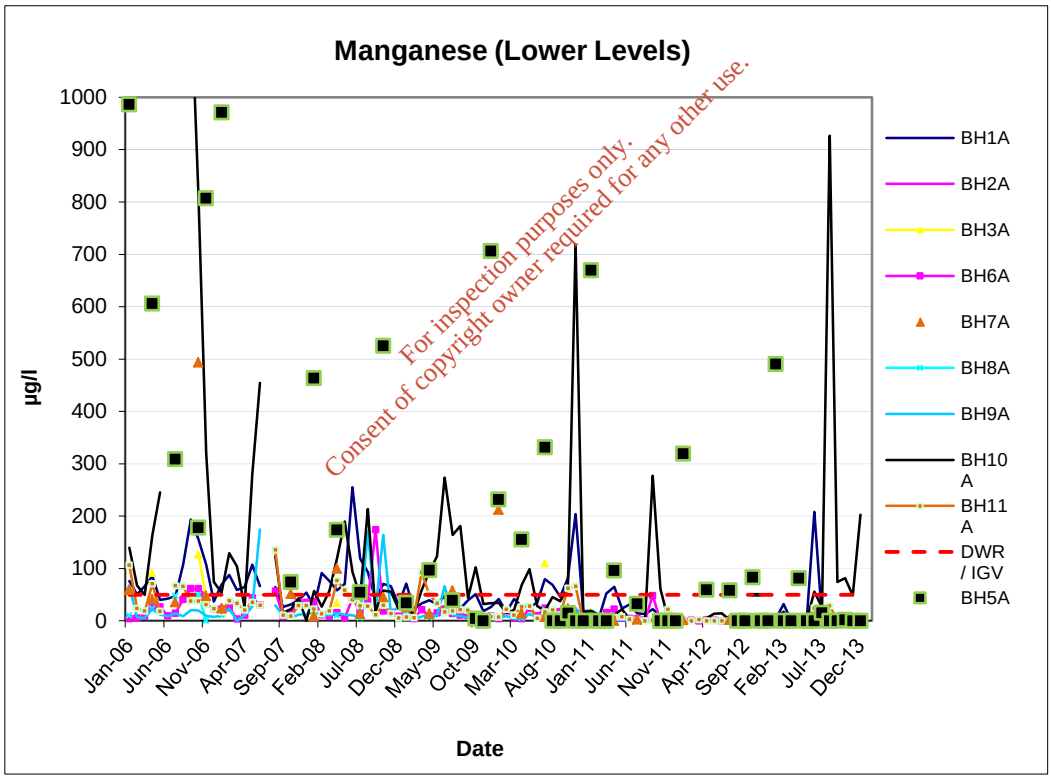
ranging to a maximum of 1,357 in July 2006 and are frequently recorded above the EPA IGV of 50 µg/l.

Background concentrations of Manganese in the general region are generally less than the EPA IGV (Drybridge and Ballymakenny SPZ reports, 2011).

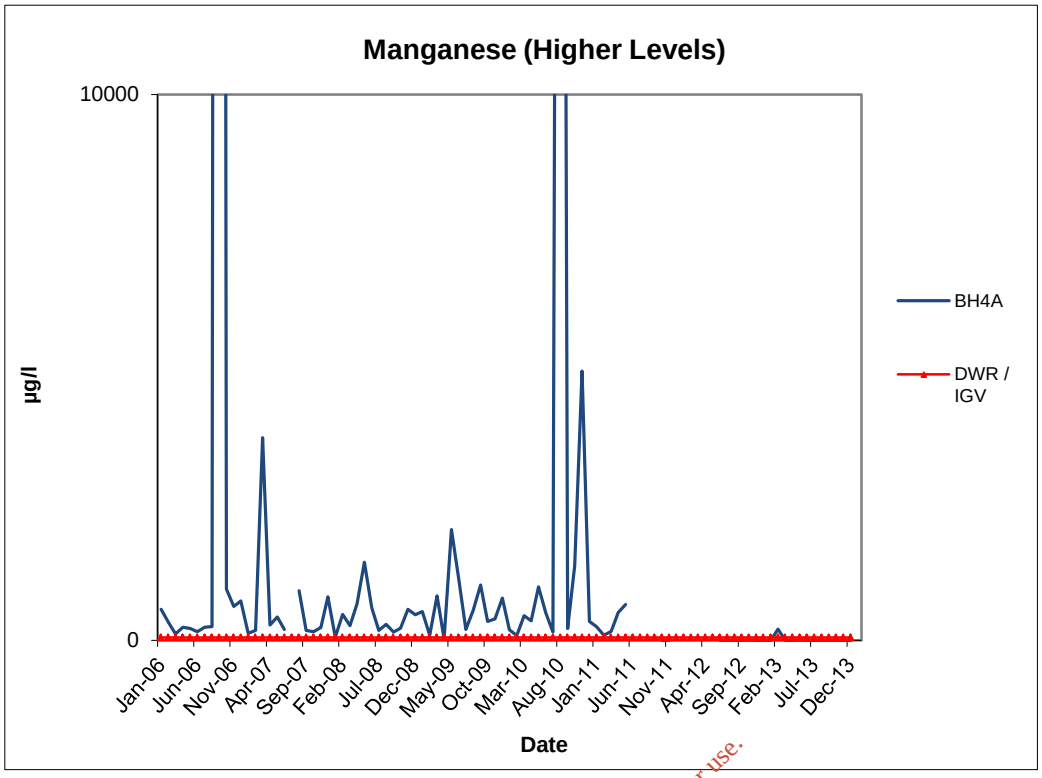
Slightly elevated concentrations of Manganese were recorded at **BH1A** (ranging between 52.4 and 255.1 µg/l) and a single elevated concentration at **BH3A** (109.5 µg/l – July 2010) and **BH7A** (212 January 2010).

Occasionally elevated concentrations of Manganese were recorded within the former flooded quarry void in **SW1** (63.0 and 56 µg/l in April 2010 and October 2013 respectively) and **SW3** (65.7 and 65.8 in April 2010 and October 2013 respectively). No additional elevated concentrations were recorded in the flooded quarry void water samples.

In summary, elevated concentrations of Manganese were observed within the northern region of the landfill with significantly reduced levels downgradient and within the former quarry void. The levels generally appear to be reducing over time within BH10A. The levels within BH5A have reduced over time but remain significantly above the IGV. The elevated levels recorded in BH4A and BH5A suggest an impact by landfill leachate; however it is unclear as to the source of the elevated levels in BH10A. A natural source is most likely given the low levels detected in the surrounding boreholes.



Graph 8.6 Manganese - Lower Concentrations



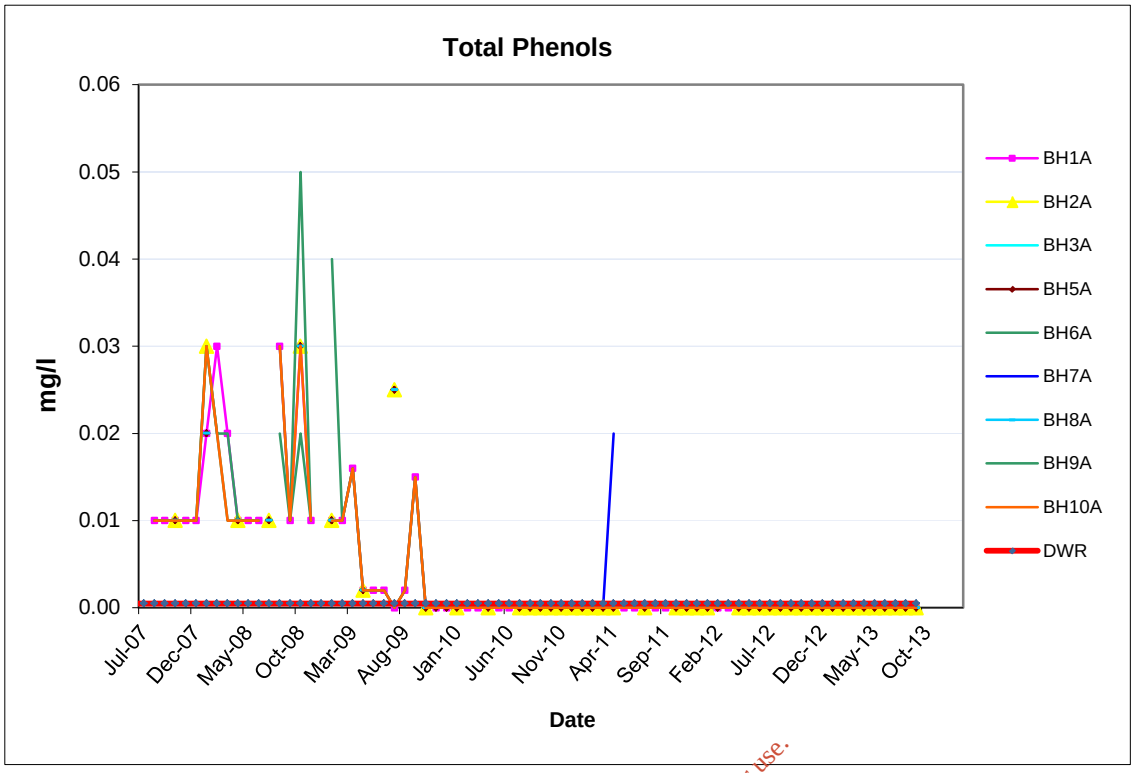
Graph 8.7 Manganese - Higher Concentrations

8.3.5 Phenol

A single elevated concentration of Total Phenol was recorded in borehole **BH11A** (7.5 mg/l in August 2013). No other detections similar to this level were recorded in any borehole and the level is considered to be erroneous. In addition, an elevated level of 1.12 mg/l was recorded in **BH4A**. Similarly, this level is considered to be erroneous and has not been detected before or since.

Slightly elevated concentrations were historically recorded within boreholes **BH06A, BH07A, BH08A and BH10A**. However the concentrations have reduced to below detection concentrations since 2011.

It is noted that the IGV for Total Phenol is 0.0005mg/l which is below the current laboratory limits of detection for phenol. Future analysis should ensure that the limits of detection are reported at or below the EPA IGV.

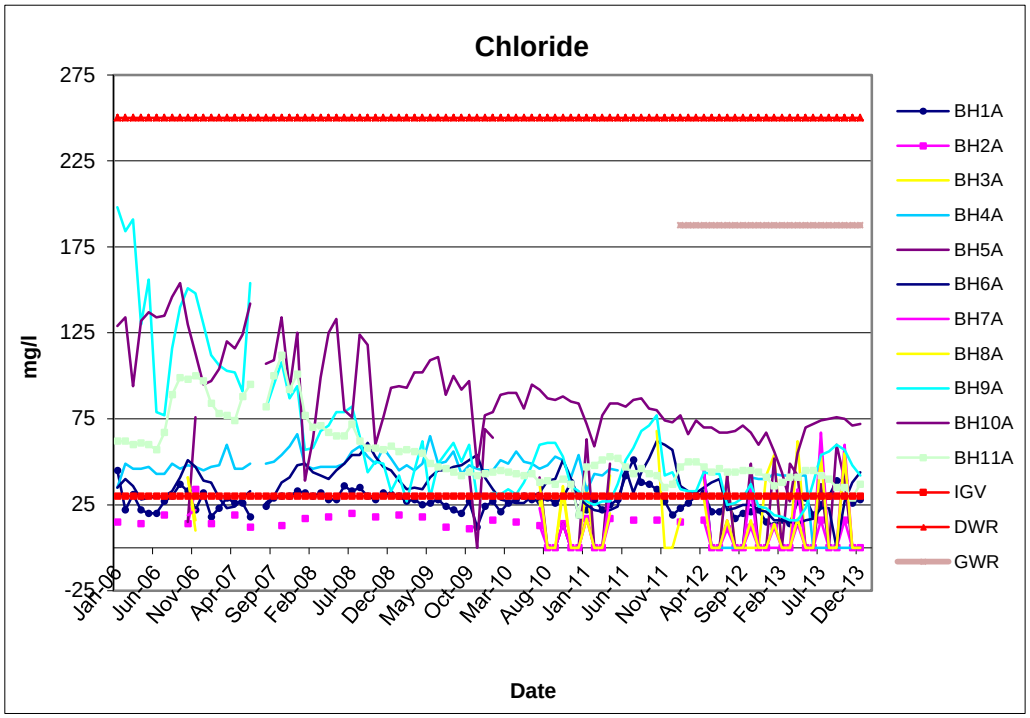


Graph 8.6 Phenol Concentrations

8.3.6 Chloride

Concentrations of Chloride recorded within the monitoring boreholes across the site were typically recorded below the 2010 Groundwater Regulation level of 187.5 mg/l. A slight exceedance was recorded in borehole **BH09A** in 2006 (*i.e.* 198 mg/l) and slightly lower concentrations recorded in **BH10A** (*i.e.* 154 mg/l in September 2006). However no exceedances have been recorded within all monitoring boreholes since.

Since completion of the capping works in 2007, all monitoring locations with slightly elevated concentrations of chloride (*i.e.* above the EPA IGV only of 30 mg/l) generally demonstrate a downward trend over time. The remaining locations demonstrate concentrations typical of background concentrations with no evidence of an impact from landfill leachate.



Graph 8.7 Chloride - Higher Concentrations

8.3.7 Iron

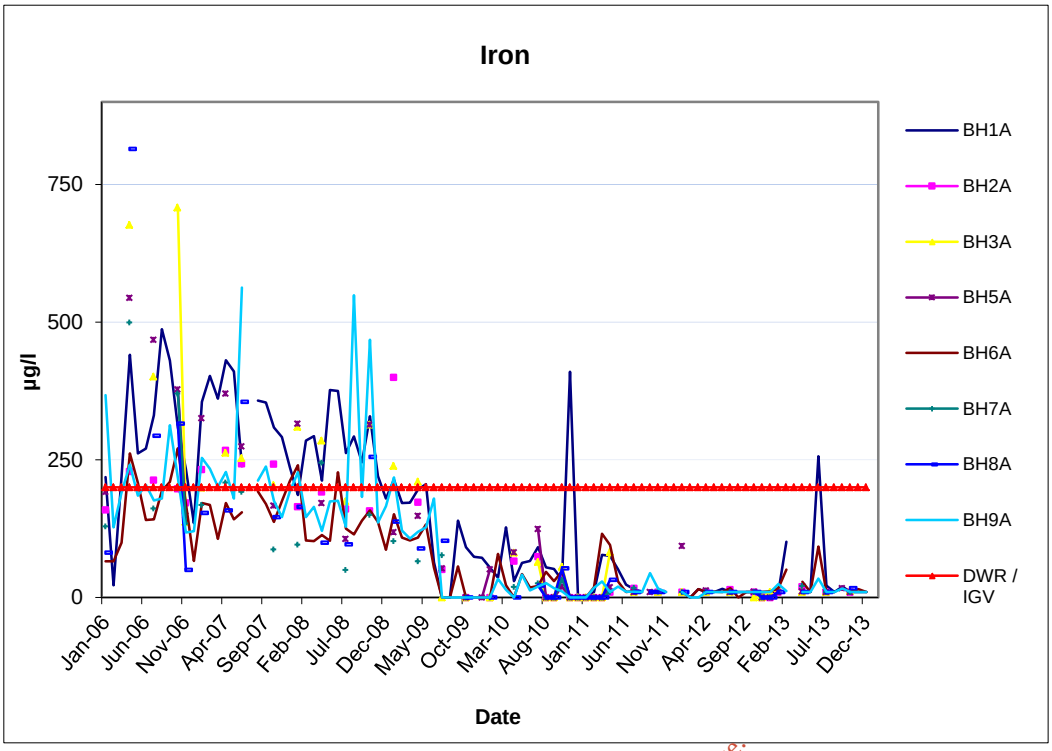
Elevated concentrations of Iron were recorded in monitoring borehole **BH4A** (ranging between 202 and 38,498 µg/l) throughout the monitoring period with no exceedance of the threshold levels recorded since February 2013 (*i.e.* 202 µg/l) – see **Graph 8.8** and **Graph 8.9**. The IGV for Iron is 200 µg/l.

Slightly elevated concentrations of Iron were recorded within the northern upgradient monitoring boreholes **BH01A** (max of 487.5 µg/l), **BH2A** (max of 399.9 µg/l) and within downgradient monitoring boreholes **BH03A** (max of 707.6 µg/l), **BH09A** (max of 563.1 µg/l), **BH10A** (max of 2,464.5 µg/l) and **BH11A** (max of 1,081.9 µg/l). No elevated concentrations of iron were recorded within the remaining wells – see **Graph 8.8**.

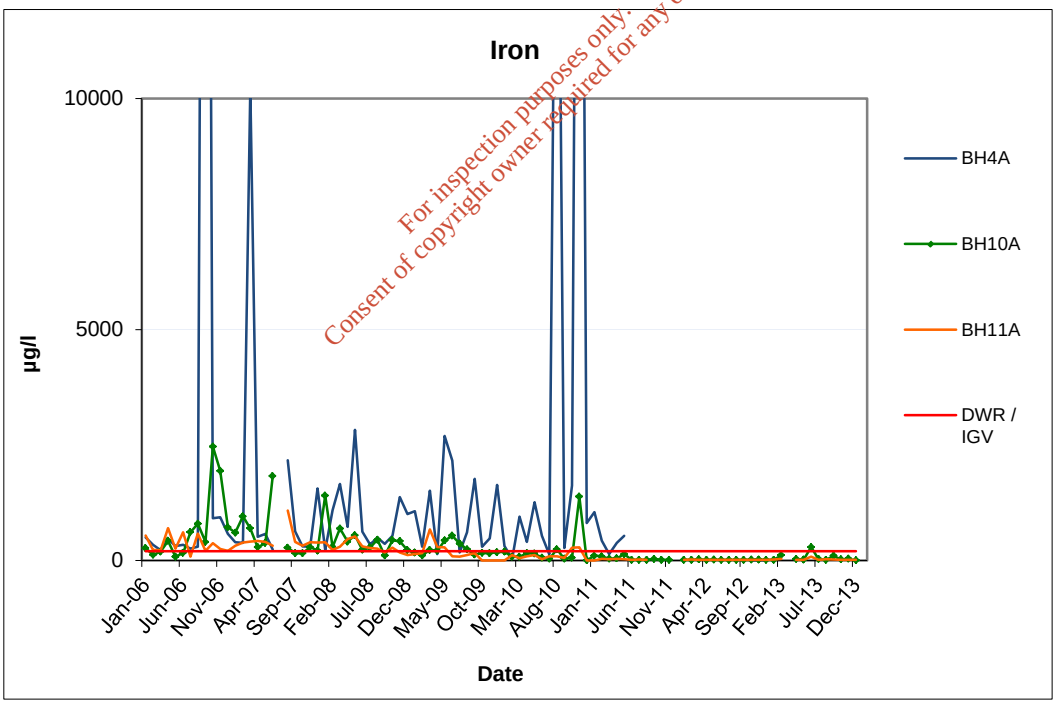
All detections of Iron have significantly reduced over time with the only recent slight exceedances recorded in boreholes **BH01A** and **BH10A** in June 2013 (*i.e.* 256.8 and 287.2 µg/l respectively).

No exceedances of the IGV was recorded from the samples collected from the former quarry void throughout the monitoring period with the exception of a small number of isolated exceedances *i.e.* SW2 (617.9 µg/l in October 2006), SW3 (253.6 in October 2006) and SW4 (385.6 in January 2009).

In summary, the presence of elevated levels of Iron in BH4A pre-2013 suggests an impact from the waste body or from a possible upgradient source at this time.



Graph 8.8 Iron - Lower Concentrations



Graph 8.9 Iron - Higher Concentrations

8.3.8 Faecal Coliforms

Faecal Coliforms were frequently recorded above the EPA IGV on occasions when chemically analysed. The levels ranged between 2 and 250 no. per 100 ml within the upgradient monitoring boreholes and between 7 and 18 no. per 100 ml within the downgradient monitoring boreholes.

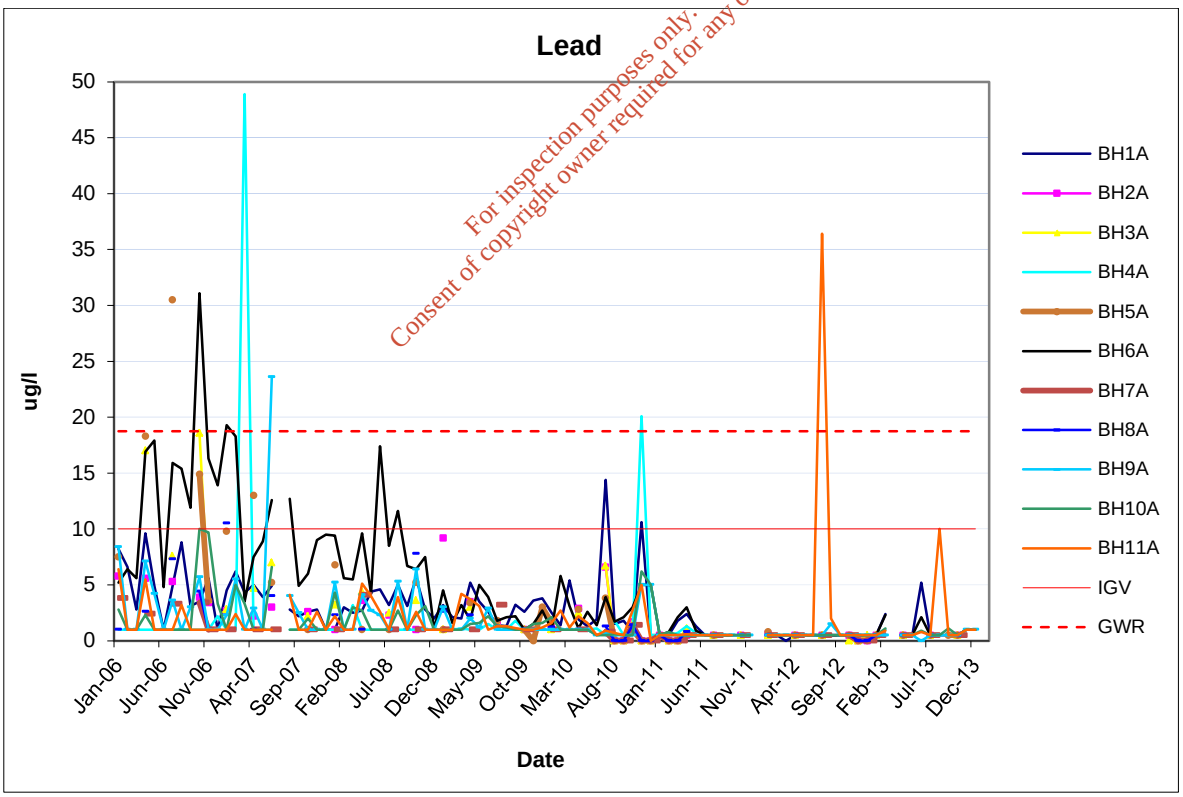
These levels, when detected, are not considered to be resultant from the landfill waste body but likely to be from surrounding region. Faecal coliforms are typically detected in regions with high to extreme vulnerability and in the vicinity of intensive agricultural use and septic tanks.

8.3.9 Lead

Occasionally elevated concentrations of Lead above the 2010 Groundwater Regulations (*i.e.* 18.75 µg/l) and the EPA IGV (10 µg/l) were recorded within monitoring boreholes **BH4A** (48.9 µg/l March 07, 20.1 µg/l Nov 2010), **BH6A** (31.1 µg/l, Oct 2006) and **BH11A** (36.4 µg/l, July 12). A single elevated level of lead was recorded within **BH5A** (30.5 µg/l, July 06) and **BH9A** (23.6, June 2007) – see **Graph 8.10.** No detections of lead were recorded above the threshold since 2012.

No detections of Lead were recorded above threshold levels in any water sample from the landfill site void.

The concentrations recorded within **BH6A** display an obvious downward trend since 2006. This is likely to be attributed to the construction of the landfill cap. The elevated concentrations recorded within the remaining monitoring boreholes are considered to be occasional occurrences and not considered representative of an impact from the waste body on groundwater conditions over time.



Graph 8.10 Lead Concentrations

8.3.10 Potassium

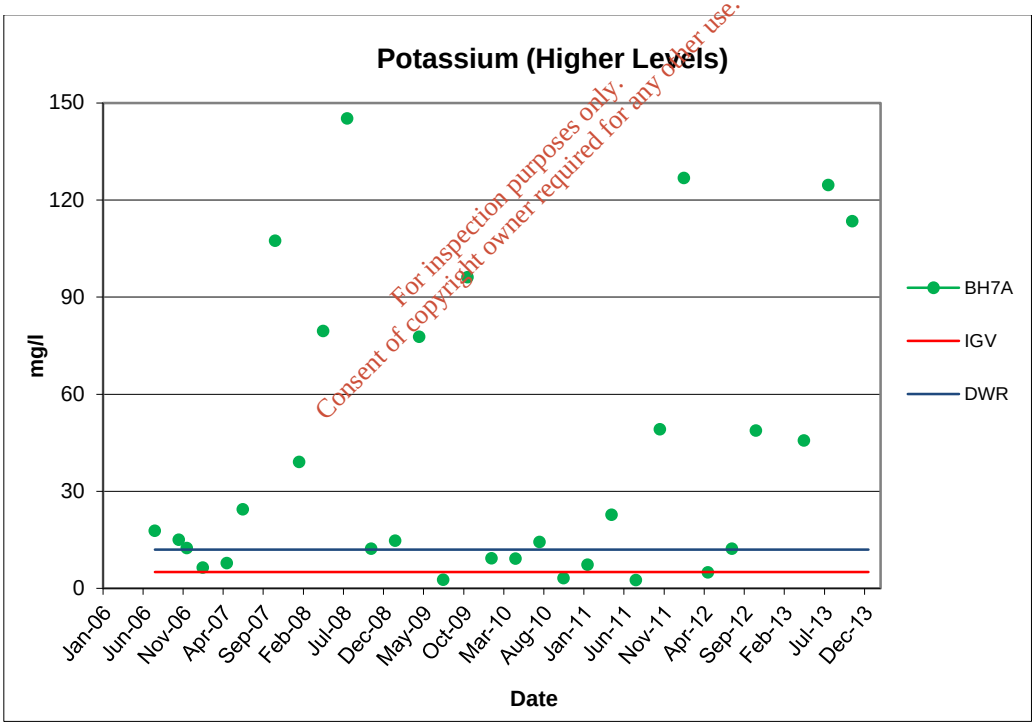
Elevated concentrations of potassium were consistently recorded in boreholes **BH3A** (between 16.9 and 29.2 mg/l), **BH7A** (ranging between 7.2 and 145 mg/l) and **BH11A** (ranging between 13.4 and 34.7 mg/l). The EPA IGV for potassium is 5 mg/l and the drinking water standard is 12 mg/l.

Occasionally elevated concentrations of potassium were recorded within **BH5A** (ranging between 12.51 and 18.89 mg/l) and **BH10A** (ranging between 12.39 and 17.22 mg/l). A single exceedance was recorded within **BH2A** in November 2006 (29.9 mg/l).

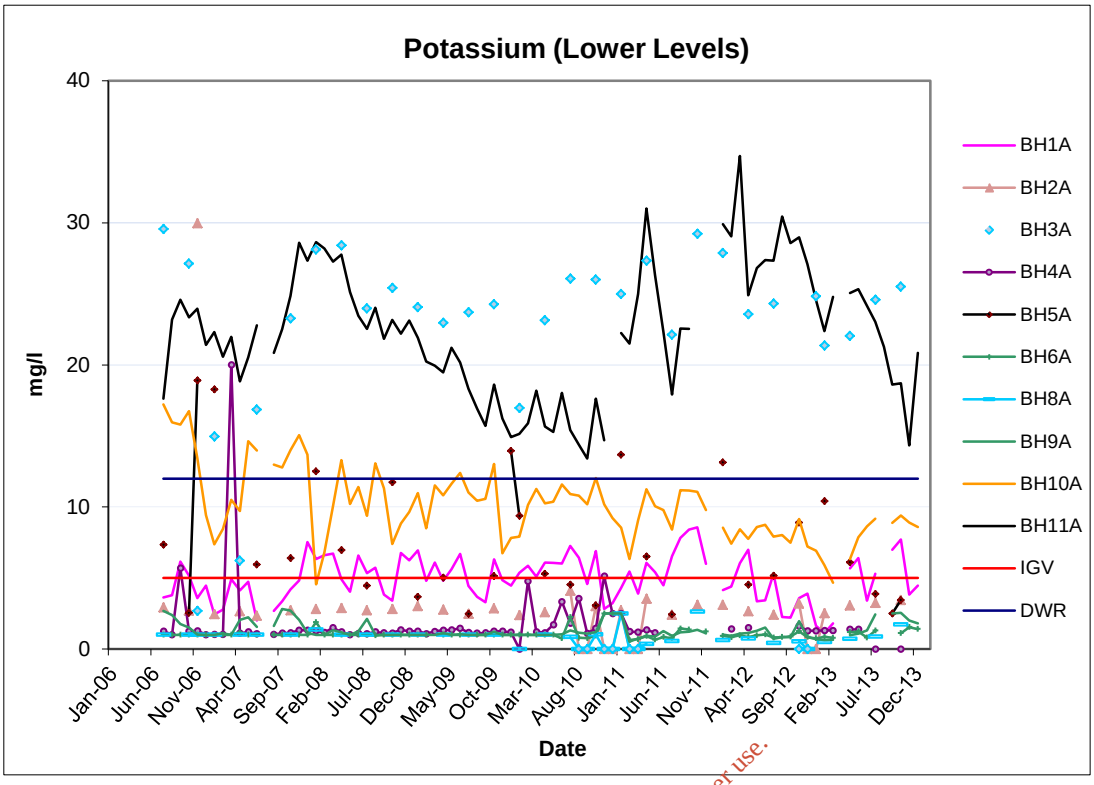
The slightly elevated concentrations of potassium recorded within **BH10A** in 2006 have reduced steadily over time and are now consistently below the drinking water standard (although remaining above the EPA IGV).

Potassium concentrations from water samples collected from the open void were frequently recorded above the threshold values with no discernible downward trend. The concentrations within SW1, SW2 and SW3 are generally higher than SW4 and SW5.

In summary, the concentrations of potassium recorded appear to be attributable to background levels rather than impacts from the landfill waste body. No obvious downward trend in concentrations at these locations was observed with the exception of BH10A and BH11A (see **Graph 8.12**).



Graph 8.11 Potassium - Higher Concentrations



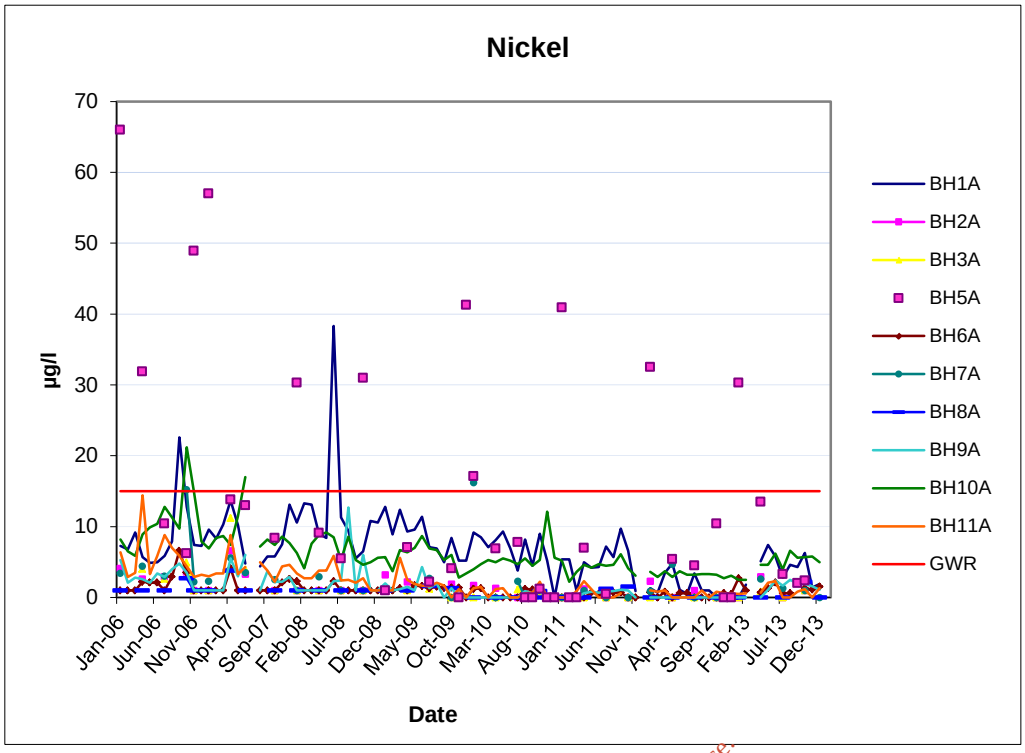
Graph 8.12 Potassium - Lower Concentrations

8.3.11 Nickel

All concentrations of Nickel were recorded below the 2010 Groundwater Regulation threshold of 15 mg/l with the exception of monitoring boreholes **BH4A** and **BH5A (see Graph 8.13)**. Elevated concentrations ranged between 15.4 and 12.682 µg/l in BH4A and significantly lower exceedances ranging between 17.1 and 66 µg/l in BH5A. No exceedances of Nickel have been detected n BH4A since 2011.

Minor exceedances of nickel within boreholes **BH01A** and **BH10A** in 2006 and early 2007 were recorded; however no exceedances have been recorded to-date at these locations nor within the remaining boreholes across the remainder of the site. No detections of Nickel above the threshold concentrations were recorded within samples collected from the former quarry void.

The levels detected suggest a possible impact of the waste body on the underlying groundwater body in the northern region of the site with no obvious elevated flux of nickel discharging from the site.



Graph 8.13 Nickel- Lower Concentrations

8.3.12 Barium

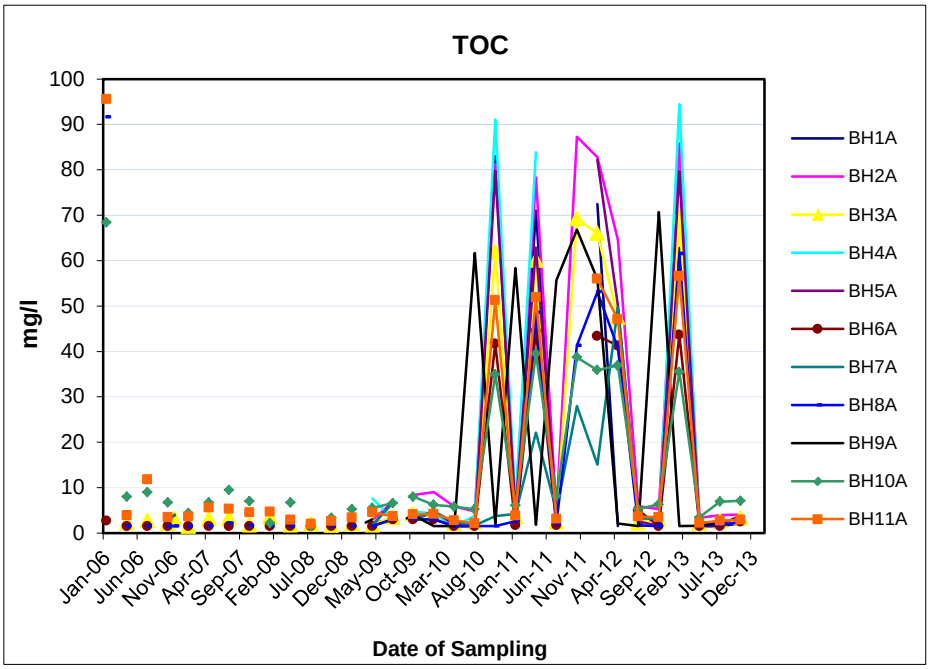
All concentrations of Barium with the landfill monitoring boreholes were recorded below the EPA IGV guideline value of 100 mg/l with the exception of **BH4A.** Elevated concentrations were recorded ranging between 125.3 and 8,635.5 µg/l were recorded in borehole BH4A ranging between 127.8 and 4662.3 µg/l; however, no exceedance of the barium guideline values have occurred at this location since 2010.

8.3.13 Total Organic Carbon

Total Organic Carbon (TOC) concentrations are useful indicators of natural organic matter in addition to contamination by organic compounds above background levels.

TOC concentrations within the monitoring boreholes were typically recorded less than 12 mg/l during the early monitoring periods between 2002 and 2010 (with the exception of elevated levels recorded in January 2006 ranging up to 95.6 mg/l within **BH11A**).

A sudden and marked increase in levels within all boreholes were recorded from April 2010 to April 2013 (see **Graph 8.14**) before returning to levels less than 10 mg/l/ (*i.e.* background levels). The source of this increase is unclear but may be related to a combination of landfill settlement effects or upgradient impacts from agricultural activities.



Graph 8.14 TOC Concentrations

8.3.14 Other Parameters

No detections of **Zinc or Mercury** above the EPA IGV were recorded in any monitoring throughout the monitoring period.

Monitoring for Hydrocarbons and Volatile Organic Compounds (VOCs) was undertaken within selected monitoring wells in between 2009 and 2014.

Analysis for Total and speciated Polycyclic Aromatic Hydrocarbons (PAHs) were below laboratory limits of detection *i.e.* 0.2 µg/l and 0.1 µg/l respectively. Pesticide, Herbicide and semi Volatile Organic Compound parameters were analysed in **BH1A** in April 2013. The results were either below the IGV for those comparable or were below the lower detection limit for the analytical methodology used analysis.

VOC compounds were recorded below the IGVs for those comparable or were below the lower detection limit for the analytical methodology used throughout the monitoring period; although two VOC parameters were detected above the laboratory detection limit in **BH1A** and **BH4A** in 2013. There are no drinking water drinking water standards in Ireland for these substances and the levels detected are considered to be very low.

- BH1A 1,2,4-Trimethylbenzene 0.2 µg/l
- BH4A Styrene 0.1 µg/l

8.4 Water Quality Discussion

The following observations have been made based on the groundwater quality trends over time.

- The water level and water quality data suggests that monitoring boreholes BH1A and BH2A are located upgradient of the landfill at particular times of the year and occasionally partially downgradient during other periods. Boreholes BH4A and BH5A are not considered to be truly upgradient due to their proximity to the waste body.

- Groundwater quality data across the site suggests that monitoring boreholes BH4A and BH5A have been somewhat impacted from leachate generated from the waste body – indicator parameters include Ammonia, Manganese (BH5A only), Iron (BH4A only) and to a lesser extent Nickel. The impact is more evident from historical chemical data; however the concentrations over time, in particular Ammonia concentrations, demonstrate a downward trend which suggests the impact of the landfill in this area is reducing over time.

- Monitoring boreholes BH3A and BH11A are the only boreholes located immediately downgradient from the waste body and partially upgradient of the former quarry void. The only elevated parameters of concern at BH11A relate to Iron and Potassium. No detections of Ammonia were detected at this location. BH3A recorded very occasional exceedances of Ammonia and consistently elevated levels of Potassium. The exceedances in BH3A represent a recent increase in levels and on-going monitoring is recommended to ascertain the persistency over time.

- Since completion of the capping works in 2007, all monitoring locations recorded Chloride concentrations below the GTV of 187.5 mg/l. A small number of boreholes recorded Chloride concentrations above the EPA IGV of 30 mg/l; however reducing trends have been noted since completion of the capping works.

- No detections of PAHs, sVOCs or VOCs were recorded within the monitoring boreholes across the site since 2009. Minor isolated detections of 1,2,4-Trimethylbenzene (0.2 µg/l) and Styrene (0.1 µg/l) were detected in monitoring boreholes BH1A, BH9A and BH11A and former quarry void sample SW1 in 2013. These detections have not been recorded since or prior to this period. Detections of c-1,2-Dichloromethane (0.6 µg/l) was detected within monitoring borehole BH4A in 2013 only.

- Downgradient monitoring boreholes to the south of the flooded former quarry void do not indicate a notable impact from the waste body. In addition, water samples from within the former quarry void also do not indicate a notable impact from the landfill.

9 UPDATED HYDROGEOLOGICAL CONCEPTUAL MODEL

The preliminary source-pathway-receptor approach is now revisited to facilitate a hydrogeological conceptual model of the site. A cross-sectional profile of the site is presented in **Figure 3** and **Figure 4.**

9.1 Source Areas

- The strength of the raw leachate present within the waste body has not been recorded due to the dry conditions within the leachate monitoring wells. However, it is expected that any leachate within this waste body is of a moderate strength with reducing strength occurring over time as the waste biodegrades.
- No Hazardous substances as per the EPA Classification of Hazardous and Non-Hazardous substances in groundwater (2010) were detected at the site;
- Non-Hazardous Substances detected include:
  - ✓ Ammoniacal Nitrogen.
  - ✓ Nickel

The original landfill waste body has been fully capped with an engineered liner and therefore the generation of leachate is primarily from the degradation of the waste body itself rather than the effect of rainfall ingress. The recently deposited waste to the north of the main waste body has not been capped todate and leachate generation is likely to be elevated in this location due to rainfall ingress to the waste material. Groundwater across the entire site does not appear to interact with the waste body thereby further minimising the generation of leachate over time.

9.2 Pathways

- The hydrogeological regime across Drogheda Landfill comprises two groundwater bodies (*i.e.* one likely within the waste body and a separate groundwater body within the underlying bedrock that are likely to be hydraulically connected. The amount of leachate present within the waste body is unclear as all leachate wells are recorded as dry. This may indicate that very low levels of leachate are present within the waste and/or any leachate generated migrates vertically and directly into the underlying bedrock aquifer.
- Given the presence and construction the landfill cap, it is not anticipated that a horizontal pathway of leachate to the open former quarry void is present at the site.
- Groundwater generally appears to flow across the site in a north to south/southeasterly direction. Localised variations were observed in the northern region of the site *i.e.* in the vicinity of monitoring boreholes BH1A and BH4A. These variations suggest that localised flow occurs in a north to northwesterly direction across the northern boundary of the site at particular times of the year. In addition, localised variations to the south of the open former quarry void are also noted on particular occasions. The latter variation appears to be dependant on the water level within the open void which may act as a groundwater mound at particular times of the year.

9.3 Receptors

The key potential environmental receptors that could be impacted by the presence of the contaminant source on the site are Drogheda GWB and the River Boyne. Drybridge PWS is located to the west of the site and is not considered to be immediately downgradient of the landfill site. However, given the uncertainty relating the groundwater flow in the northwestern region of the site, this receptor is conservatively assumed to be potentially at risk for the purposes of this report.

9.4 Assessment of Current Groundwater Impacts & Extent of Plumes

Based on average values of Ammoniacal Nitrogen levels between 2006 and 2014 in the northern region of the landfill, the rule of thumb of 100xGTV was regularly exceeded in **BH5A** throughout the

monitoring period. The last two rounds of monitoring provided recorded 10,457 and 568 times the GTV for Ammoniacal Nitrogen. It is noted that the levels recorded are reducing over time. Based on the trends observed and assuming this downward trend continues over time at this location, it is predicted that the mean Ammoniacal Nitrogen level will achieve the GTV by the end of 2016 approximately. As mentioned previously, the source of the impact to BH5A is likely due to the immediate proximity to the waste body and the potential ingress of leachate via the monitoring well installation.

Occasionally the 100xGTV rule of thumb was exceeded in **BH3A** for Ammoniacal Nitrogen with the last two rounds of monitoring recording 514 and 194 times the GTV. However, the levels recorded in BH3A over the monitoring period are typically below the GTV with only the most recent data recording slightly elevated levels.

No exceedance of the 100xGTV for Ammoniacal Nitrogen was recorded since April 2012 within the remaining monitoring wells. Before April 2012, the next recorded isolated exceedance was May 2010.

Isolated exceedances of the 100xGTV was recorded in **BH4A** for Iron (November 2010), Nickel (August 2010) and Manganese (August 2010). It is unclear if these isolated levels are representative of groundwater conditions considering the significantly lower levels recorded prior to and after these sampling events.

The prevention of hazardous of substances entering the groundwater system is being maintained. Limiting the ingress of non-hazardous substances is being met by the mitigation measures that have been installed to date at the site.

The following points are noted:

- The area of impact from the landfill leachate (i.e. in the northern region of the site) is considered to be minor relative to the groundwater body catchment area of the Drogheda GWB *i.e.* < 0.01%; Therefore it is unlikely that the status of the GWB or the objectives of the WFD will be affected.
- No groundwater plume has been identified todate at the site.

The preliminary source-pathway-receptor approach can now be revisited to outline a hydrogeological conceptual model of the site.

9.5 Updated S-P-R – Risk Screening

The impact assessment is guided by the source-pathway-receptor (S-P-R) model. The S-P-R model is used to identify the sources of water and potential contaminants, the environmental assets affected by such, and the pathways by which water and contaminants reach those receptors. **Table 9.1** summarises an update to the preliminary SPR linkages identified in **Table 7.1** for the landfill.

Sources	Pathways	Receptors	Risk
Leachate	Leachate vertical migration to groundwater	Drogheda Groundwater Body	Low to Moderate
	Groundwater		
		River Boyne	Low
	Leachate vertical migration to groundwater	Downgradient Groundwater Users	Low

Table 9.1 Updated S-P-R

10 COMPLIANCE MONITORING

Discharge activities subject to Tier 2/3 assessments must undertake compliance monitoring to verify predicted impact and check compliance with terms of the authorisation. Compliance monitoring dictates that receptor-based water quality standards (or threshold values) should not be exceeded at receptor locations. For this reason sampling is conducted to monitor water quality at receptors, as appropriate.

10.1 Compliance Monitoring Locations

A compliance point is the point (location, depth) at which a compliance value should be met. Generally it is represented by a borehole or monitoring well from which representative groundwater samples can be obtained. In this case, the aim is to monitor groundwater downgradient of the waste body.

The existing upgradient and downgradient monitoring wells are considered, in the main, to provide appropriate downgradient compliance monitoring locations. Additional monitoring wells have been recommended to replace BH4A and BH5A and decommission the existing installations on site. Also, additional wells in the northwestern region of the facility area are recommended to attempt and ascertain groundwater flow direction in this area and identify any plume from the general area of BH5A.

10.2 Compliance Values

A compliance value is the concentration of a substance and associated compliance regime that, when not exceeded at the compliance point will prevent pollution and/or achieve water quality objectives at the receptor. In this case, the aim is to protect groundwater quality to minimize any risk posed to downgradient receptors such as the Drogheda GWB and to a lesser extent the River Boyne.

The general chemical assessment test identifies groundwater bodies where widespread deterioration in quality has, or will, compromise strategic use of groundwater for existing or planned, human consumption and/or other potential purposes. Schedule 5 of the Groundwater Regulations (SI 9 of 2010) lists Threshold Values for selected parameters that are indicative of potential pollution events when exceeded**.** Where significant and sustained upward trends are identified, correcting action must be taken.

Based on the recorded groundwater quality data todate at Drogheda Landfill, there are **no sustained upward trends in groundwater contaminant export from the site**. In addition, all parameters when detected above the GTV are significantly below the 100xGTV rule of thumb with the exception of BH5A and to a lesser extent BH3A. These localised exceedances are not likely to affect the WFD status of the groundwater body or the WFD objectives.

Given the existing relatively good groundwater quality both upgradient and downgradient of the landfill, with the exception of localised impacts at BH4A, BH5A and to a lesser extent at BH3A, it is proposed to assign compliance values based on a combination of the existing 2010 GTVs, EPA IGVs and 2 x standard deviation levels of the mean values since 2007 (*i.e.* post landfill capping). Exceedance of these compliance levels (see **Table 10.2**) warrants further assessment. Any exceedances should also be considered in conjunction with a trend analysis of the data to ascertain increasing levels over time. Levels below these compliance values in addition to downward or stable trends confirm that the impact or risk of the landfill on groundwater and surface waters is acceptable.

The existing frequency of monitoring as detailed in **Table 10.1** is considered suitable going forward.

	Current Monitoring			Proposed Monitoring		
Monitoring Frequency	**BH1A, BH4A, BH6A, BH9A, BH10A, BH11A**	**BH2A, BH3A, BH5A, BH7A, BH8A**	**SW1, SW2, SW3, SW4 and SW5**	**BH1A, BH2A, BH3A, BH4A (replace), BH5A (replace), BH7A, BH11A**	**BH6A, BH8A, BH9A, BH10A, BH11A**	**SW1, SW2, SW3, SW4 and SW5**
Weekly	-	-	Visual Inspection			
Monthly	Visual Inspection and Odour, Groundwater Level, Ammoniacal Nitrogen, Chloride, Cadmium, Chromium, Electrical Conductivity, pH, Temperature, Iron, Lead, Manganese, Potassium, Sodium, Barium, Nickel, Nitrate, Nitrite, Phenol, Zinc	Groundwater Level, Ammoniacal Nitrogen, Electrical Conductivity, pH, Temperature	-	-	-	-
Quarterly	Dissolved Oxygen, Total Suspended Solids, TON, TOC, Zinc	Visual Inspection and Odour, Chloride, Dissolved Oxygen, Cadmium,	Ammoniacal Nitrogen, BOD, COD, Chloride, Dissolved Oxygen. Electrical Conductivity, pH, Total Suspended	**BH1A, BH4A, BH5A & BH10A only** Visual Inspection and Odour, Groundwater Level, Ammoniacal Nitrogen, Electrical	**BH10A only** Visual Inspection and Odour, Groundwater Level, Ammoniacal Nitrogen, Electrical Conductivity, pH, Temperature Chloride,	Visual Inspection, Ammoniacal Nitrogen, BOD, COD, Chloride, Dissolved Oxygen. Electrical Conductivity, pH,

	Current Monitoring			Proposed Monitoring		
Monitoring Frequency	**BH1A, BH4A, BH6A, BH9A, BH10A, BH11A**	**BH2A, BH3A, BH5A, BH7A, BH8A**	**SW1, SW2, SW3, SW4 and SW5**	**BH1A, BH2A, BH3A, BH4A (replace), BH5A (replace), BH7A, BH11A**	**BH6A, BH8A, BH9A, BH10A, BH11A**	**SW1, SW2, SW3, SW4 and SW5**
		Chromium, Iron, Lead, Manganese, Potassium, Sodium, TON, TOC, Barium, Nickel, Nitrate, Nitrite, Phenol	Solids, Temperature., Cadmium, Total Chromium, Iron, Lead, Potassium, Total Phosphorus, Barium, Nickel, Nitrate, Nitrite, Phenol.	Conductivity, pH, Temperature, Chloride, Dissolved Oxygen, Cadmium, Chromium Iron, Lead, Manganese, Potassium, Sodium, TON, TOC, Barium, Nickel, Nitrate, Nitrite, Phenol.	Dissolved Oxygen, Cadmium, Chromium, Iron, Lead, Manganese, Potassium, Sodium, TON, TOC, Barium, Nickel, Nitrate, Nitrite, Phenol,	Total Suspended Solids, Temperature, Cadmium, Total Chromium, Iron, Lead, Potassium, Total Phosphorus, Barium, Nickel, Nitrate, Nitrite, Phenol.
Biannually	List I & II (BH10 only)	-	List I & II	**BH2A, BH3A, BH7A only** Visual Inspection and Odour, Groundwater Level, Ammoniacal Nitrogen, Electrical Conductivity, pH, Temperature, Chloride, Dissolved Oxygen, Cadmium, Chromium, Iron, Lead, Manganese, Potassium, Sodium, TON,	**BH6A, BH8A, BH9A & BH11A only** Visual Inspection and Odour, Groundwater Level, Ammoniacal Nitrogen, Electrical Conductivity, pH, Temperature Chloride, Dissolved Oxygen, Cadmium, Chromium, Iron, Lead, Manganese, Potassium, Sodium, TON, TOC, Barium, Nickel, Nitrate, Nitrite, Phenol,	-

	Current Monitoring			Proposed Monitoring		
Monitoring Frequency	**BH1A, BH4A, BH6A, BH9A, BH10A, BH11A**	**BH2A, BH3A, BH5A, BH7A, BH8A**	**SW1, SW2, SW3, SW4 and SW5**	**BH1A, BH2A, BH3A, BH4A (replace), BH5A (replace), BH7A, BH11A**	**BH6A, BH8A, BH9A, BH10A, BH11A**	**SW1, SW2, SW3, SW4 and SW5**
				TOC, Barium, Nickel, Nitrate, Nitrite, Phenol.		
Annually	Boron, Calcium, Copper, Cyanide, Fluoride, Magnesium, Mercury, Sulphate, Total Alkalinity, Total Phosphorous, Residues on Evaporation, Faecal Coliforms, Total Coliforms List I & II substances monitored biannually from BH10, annually from other boreholes	Boron, Calcium, Copper, Cyanide, Fluoride, Magnesium, Mercury, Sulphate, Total Alkalinity, Total Phosphorous, Residues on Evaporation, Zinc, Faecal Coliforms, Total Coliforms	Calcium, Copper, Magnesium, Manganese, Mercury, Sulphate, Sodium, total Alkalinity, TON, Zinc	**All boreholes** Boron, Calcium, Copper, Cyanide, Fluoride, Magnesium, Mercury, Sulphate, Total Phosphorous (removed Residues on Evaporation & Total and Faecal Coliforms)		Calcium, Copper, Magnesium, Manganese, Mercury, Sulphate, Sodium, TON (removed Total Alkalinity & Zinc)
Every 2 years	-	-	-	Faecal Coliforms, Total Coliforms List I & II	Faecal Coliforms, Total Coliforms List I & II	List I & II

Table 10.1 – Proposed Revised Monitoring Schedule

Monitoring Well	Parameter	Compliance Value	Source
All groundwater monitoring wells & Open Quarry Void Samples	Lead	18.5 µg/l	2010 GTV
	Ammoniacal Nitrogen	All boreholes (0.175 mg/l) with the exception of BH5A (12.7 mg/l) BH4A (0.73 mg/l) BH3A (0.37 mg/l)	2010 GTV 2 times Standard Deviation of the mean from 2006
	Electrical Conductivity	1000 µS/cm	EPA IGV
	Sulphate	187.5 mg/l	2010 GTV
	Iron	200 µg/l	2007 Drinking Water Regulations
	Manganese	BH1A 144µg/l BH2A 62 µg/l BH3A 75 µg/l BH4A 25668 µg/l BH5A 760 µg/l BH7A 197 µg/l BH8A 32 µg/l BH9A 76.3 µg/l BH10A 661 µg/l BH11A 72 µg/l	2 times Standard Deviation of the mean from 2007
	Chloride	187.5 mg/l	2010 GTV
	Dissolved Oxygen, pH, Temperature, Fluoride, Total Alkalinity, Orthophosphate, Total Oxidised Nitrogen, Total Organic Carbon	-	EPA IGVs, 2010 GTVs & 2007 Drinking Water Regulations
	Metals/Non-Metals (i.e. B, Cd, Ca, Cr, Cu, Hg, Pb, Mg, Ni, K, Na and Zn)	-	EPA IGVs, 2010 GTVs & 2007 Drinking Water Regulations
	Hazardous Substances (*i.e.* VOCs & SVOCs, Total Hydrocarbons)	-	EPA IGVs, 2010 GTVs & 2007 Drinking Water Regulations

Table 10.2 Proposed Compliance Values

11 RECOMMENDATIONS / REMEDIAL STRATEGY

- Re-survey ground and top of casing elevations at all groundwater monitoring boreholes to ensure groundwater levels are accurate and not affected by settlement or other influences to-date.
- Consider short to medium-term (i.e. 3-6 months) installation of groundwater dataloggers at selected boreholes (e.g. 5 to 6 locations) and within the quarry voids to the south and east of the landfill waste body to:
  - ✓ Confirm the hypothesis of a controlling influence of the flooded quarry void on the hydrogeological regime;
  - ✓ Assess the identified localised variations of groundwater flow direction off-site, in particular along the northern perimeter of the site, across a range of climatic conditions; and,
  - ✓ Re-assess the appropriateness of the existing groundwater monitoring network at the site.
- The second flooded former quarry void to the northeast of the site is not within the site boundary of the site. Therefore permission for site access would be required from the adjacent property owner to facilitate water level monitoring of this void.
- BREL understands that Louth County Council is seeking funds to cap the waste outside the licensed boundary in order to further reduce potential leachate generation.
- Based on the available geochemical information recorded to-date at the site, it is recommended that the existing monthly groundwater sampling programme be reduced to quarterly sampling and the existing quarterly monitoring reduced to biannual monitoring (see Table 10.1).
- Water levels within the open former quarry void should be recorded during each groundwater level monitoring event relative to a surveyed reference point. This is to identify the impact of this large body of water on surround groundwater levels over time.
- Decommissioning and replacement of monitoring boreholes BH4A and BH5A is recommended given the uncertainty surrounding the installation details and the proximity to the waste body of these wells. Any works should be supervised by a hydrogeologist to ensure appropriate well installations have been undertaken and that the boreholes are not providing a contaminant pathway to the underlying aquifer. Access restrictions may prove problematic in the location of borehole BH5A and liaisons between Louth County Council and the local landowner may be required
- Two additional boreholes to the north and west of the northern site area are recommended. These boreholes would provide more complete site coverage in addition to providing additional information in relation to variable groundwater flow directions in this area of the site and possible contaminant fluxes offsite to the west and northwest. Any additional boreholes can be installed as part of future capping works of the waste outside the existing site boundary.
- It is recommended that monitoring borehole BH6A be decommissioned due to the non-detection of elevated contaminants throughout the monitoring period todate and due to its proximity to borehole BH8A. All boreholes recommended for decommissioning should be appropriately decommissioned in accordance with UK Environment Agency methodology to minimise the risk of contaminant migration to the underlying aquifer.
- It is recommended that the laboratory detection levels for Phenols be reduced to below 0.0005 mg/l during any further chemical testing to ensure compliance with the relevant groundwater standards.

12 SUMMARY, CONCLUSIONS & RECOMMENDATIONS

- A Hydrogeological Risk Assessment of Drogheda Landfill Site was undertaken by BREL based on previous investigation reports and monitoring data between 2006 and 2014.

- This closed landfill is unlined and contains primarily household, commercial, construction and demolition and industrial non-hazardous solid waste. The site originally operated as a limestone quarry. All quarrying operations ceased in 1979 and water levels were allowed to return to equilibrium on cessation of the reported dewatering activities. The facility subsequently opened as a landfill facility in 1983 (EPA licence W0033-1) for the disposal of household, commercial, construction, demolition and industrial non-hazardous solid waste. The site ceased landfill operations in 1999 and was subsequently capped and developed into open space in 2007. A civic waste facility was opened adjacent to the area of the waste body in 2002 at the site.

- The site lies approximately 600 metres north of the River Boyne which flows in a west-east direction towards the Irish Sea. The site is bounded by agricultural land to the north and west, a former quarry to the northeast and a housing development to the south and southeast.
- The waste material was laid directly upon the exposed limestone bedrock benches of the former quarry and operates under the dilute and disperses principal. Capping of the waste material was undertaken between November 2006 and September 2007. However it was subsequently identified that during waste infilling operations on the landfill site (*i.e*. pre-1999); waste material was mistakenly buried across the northern waste licensed boundary of the landfill. This material was reportedly placed on existing overburden rather than on exposed bedrock benches of the former quarry. No removal or capping of this material has taken place to-date.
- The regionally important bedrock karst aquifer is the only identified aquifer to-date. No perched groundwater has been identified at the site.
- Leachate appears to continue to migrate vertically into the bedrock aquifer in particular areas of the landfill, particularly along the northern boundary of the site. However the hydrochemistry data suggests that there is significant dilution capacity of the contaminants within the bedrock aquifer in addition to the open void downgradient of the waste body.
- Groundwater generally appears to flow across the site in a north to south/southeasterly direction. Localised variations were observed in the northern region of the site *i.e.* in the vicinity of monitoring well BH1A and monitoring well BH4A. These variations suggest that localised flow occurs in a north to northwesterly direction across the northern boundary of the site at particular times of the year.
- Water levels within the void suggest that this water body has a controlling influence on groundwater levels in its immediate vicinity. As the open water of the quarry void receives close to 100% of potential recharge, in addition to surface water runoff and groundwater flows from upgradient zones, it appears to be acting as a groundwater mound discharging radially to the surrounding aquifer, during certain periods of the year, and thereby affecting the groundwater flow regime within the immediate area of the site. On other occasions the levels within the void are lower than the surrounding groundwater levels to the west and south. Groundwater flow from the void to the southeast remains relatively constant over time.
- No contaminant fluxes appear to be occurring across the southern and southeastern landfill site boundaries in a downgradient direction. However, uncertainty persists regarding the migration of contaminated fluxes in a north to northwesterly direction across the northern site boundary *i.e.* in the vicinity of the non-capped waste material. It is also unclear if the detected contaminant concentrations in monitoring boreholes BH4A and BH5A are attributed to leachate migration from the waste body directly into the underlying bedrock aquifer, are being detected due to preferential pathways generated by poor borehole installations or a combination of both.

A previous RPS report (Ref: MDE1008Lt0001D01, dated 4th October 2010) concluded that the monitoring borehole BH5A is not facilitating the vertical migration of contamination to the aquifer based on the assumption that the six metre bentonite seal within the monitoring borehole was installed correctly during the drilling works. If this seal was inappropriately installed, the protection layer may not be fulfilling its requirements and potentially facilitates the migration of leachate to groundwater. In addition, the shallow screen in borehole BH4A may also be facilitating the migration of leachate from the waste body to groundwater.

- The non-capped waste material, in close proximity to boreholes BH4A and BH5Aa, is generating leachate from infiltration (*i.e.* rainfall) and is potentially impacting on BH4A and BH5A over time.

- The adjacent former quarry site to the east of the landfill was granted permission to undertake infilling of both domestic and commercial waste material in 1984 for a period of 5 years. In addition, permission was also granted in 1992 to infill the quarry void with builder's rubble, limestone & shale material. No domestic waste was permitted. No further information was available during the compilation of this report; however, the potential presence of this material on the adjacent property may potentially be impacting on the elevated concentrations of contaminants on the northern boundary of the Drogheda Landfill site.

- A preliminary Conceptual Site Model (CSM) was initially developed and identified a number of SPR linkages ranging between Low and High. However, following a detailed review of all site data, these risks were reduced to Low and Low to Moderate.

- The main SPR linkage of concern relates to:

  ✓ The migration of leachate to the underlying groundwater body, to the River Boyne and to Drybridge public groundwater supply.

- Based on average values of Ammoniacal Nitrogen levels between 2006 and 2014 in the northern region of the landfill, the rule of thumb of 100xGTV was regularly exceeded in BH5A throughout the monitoring period. It is noted that the levels recorded are reducing over time. Based on the trends observed and assuming this downward trend continues over time at this location, it is predicted that the mean levels will achieve the GTV by the end of 2016 approximately.

  Occasionally the 100xGTV rule of thumb was exceeded in BH3A for Ammoniacal Nitrogen. However, the levels recorded in BH3A are generally below the GTV with only the most recent data recording slightly elevated levels.

  Isolated exceedances of the 100xGTV was recorded in BH4A for Iron (November 2010), Nickel (August 2010) and Manganese (August 2010). It is unclear if these isolated levels are representative of groundwater conditions considering the significantly lower levels recorded prior to and after these sampling events.

- The site is compliant with the "prevent" or "limit" objectives of the WFD and GWD. The prevention of hazardous of substances entering the groundwater system is being met based on available chemical analysis. Limiting the ingress of non-hazardous substances is also being met by the mitigation measures that have been installed to date at the site *i.e.* landfill capping, the lining of surface water drains and on-going groundwater and surface water monitoring as per the licence requirements.

  The following points are noted:

  ✓ The area of impact from the landfill leachate (i.e. in the northern region of the site) is considered to be minor relative to the groundwater body catchment area of the Drogheda GWB *i.e.* < 0.01%; Therefore it is unlikely that the status of the GWB or the objectives of the WFD will be affected.
  ✓ No groundwater plume has been identified todate.

- Consultations with Louth County Council have confirmed that it is intended to complete the recommended works, as outlined in Section 11.0, by mid-2017. However, capping of the waste outside the boundary remains subject to significant capital budget being made available. Completion of the other works/investigations as per Section 11 will be used to prepare a revised CSM report to be submitted to the Agency in the third quarter of 2017.

- In summary, based on available site data, the risk posed by Drogheda Landfill to the underlying GWB, the River Boyne and any potential down-gradient groundwater users is considered to be low. A series of once-off measures have been provided to develop a more representative understanding of the risk posed by the landfill and address the identified uncertainties in particular relating to potential fluxes discharging to the north of the site.

ooOOoo

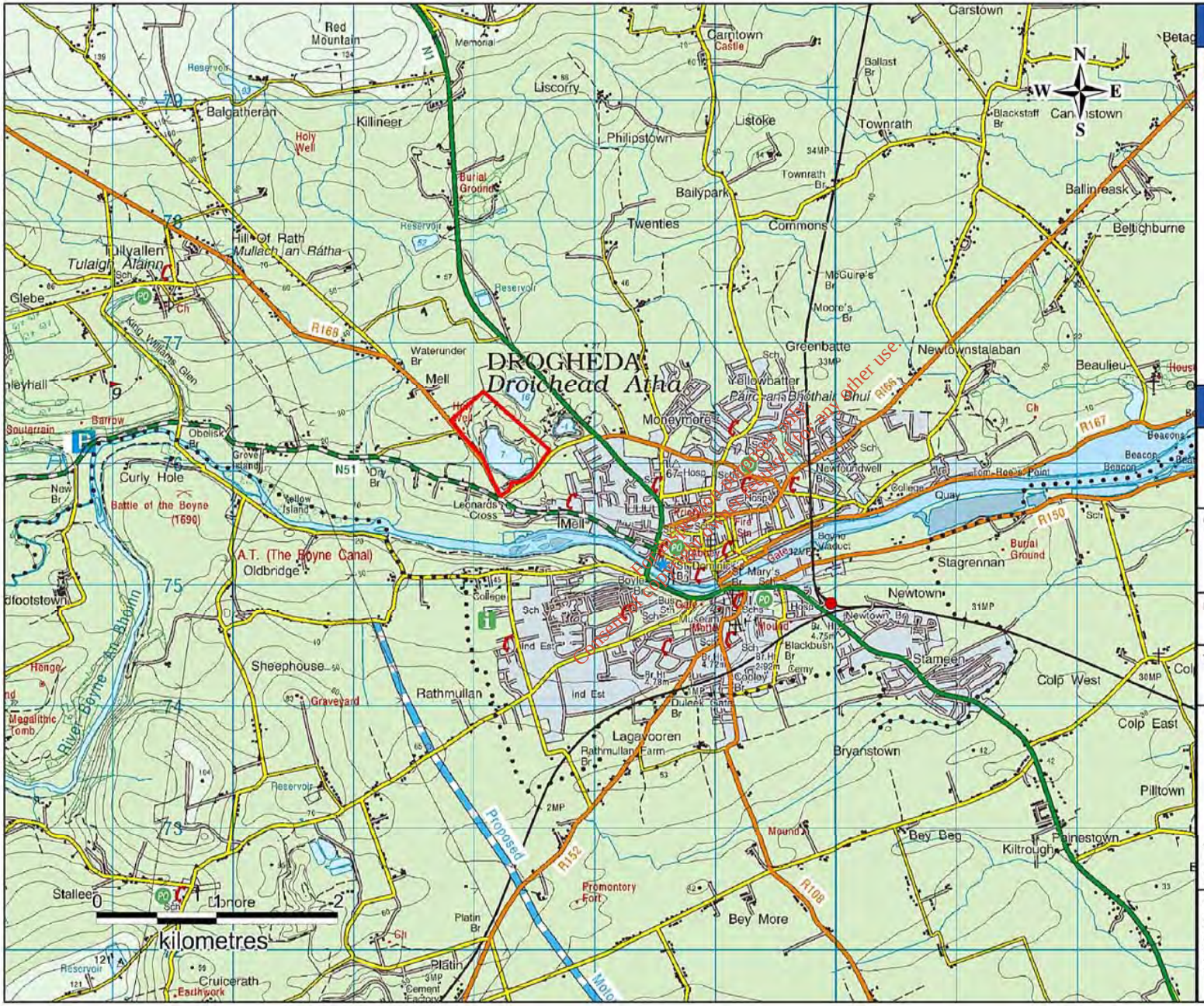
Respectfully submitted by

Niall Mitchell

Hydrogeologist / Chartered Engineer

On behalf of Louth County Council (Waste Licence No. W0033-1)

FIGURES



Legend

Site Boundary

Project

Drogheda Landfill Hydrogeological Risk Assessment

Client
Louth County Council

Drawing
Figure 1

Title
Site Location Map

BlueRock Environmental
The Hydrogeological and Contaminated Land Consultancy.

T 00353 863856884
E admin@bluerockenv.ie
W www.bluerockenvironmental.ie

File Ref :	BRE12007
Drawing Ref :	BRE12007DG02
Revision :	V01
Date :	20/01/2015
Drawn by:	NM
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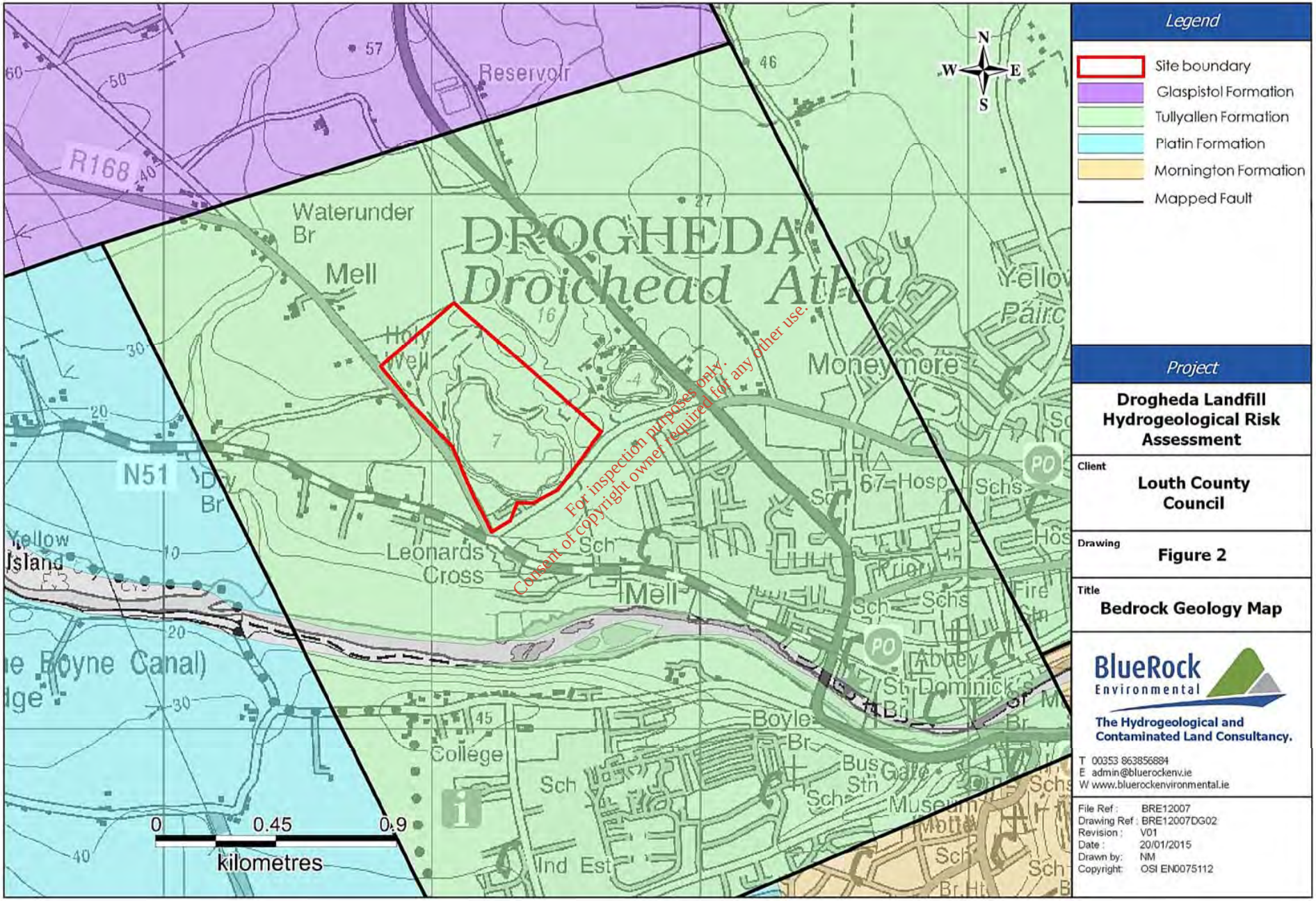

Project

Drogheda Landfill Hydrogeological Risk Assessment

Client

Louth County Council

Drawing

Figure 2

Title

Bedrock Geology Map

BlueRock Environmental
The Hydrogeological and Contaminated Land Consultancy.
T 00353 863856884
E admin@bluerockenv.ie
W www.bluerockenvironmental.ie

File Ref :	BRE12007
Drawing Ref :	BRE12007DG02
Revision :	V01
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Drawn by:	NM
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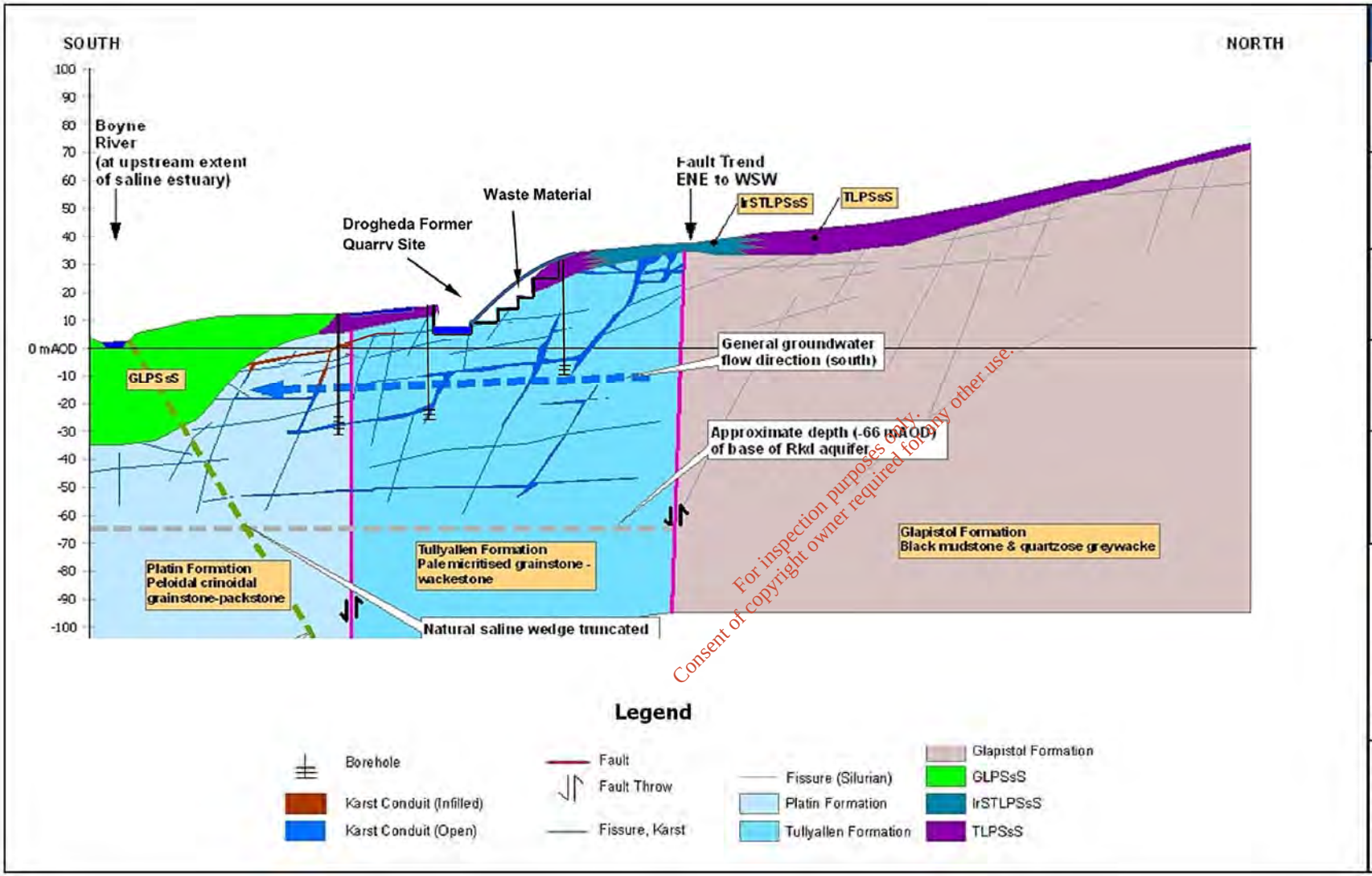


Project

Drogheda Landfill Hydrogeological Risk Assessment

Client
Louth County Council

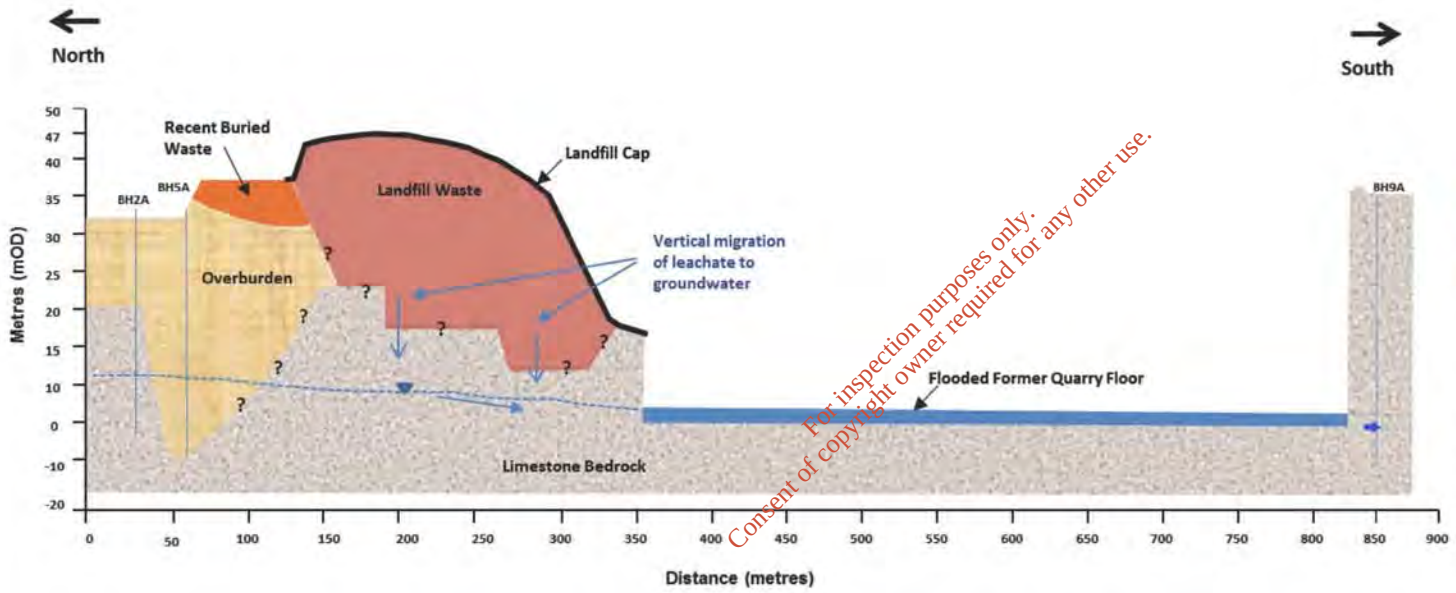
Drawing
Figure 3

Title
Graphical Regional Conceptual Site model

Source
Adopted from Conroy (2010)

BlueRock Environmental
The Hydrogeological and Contaminated Land Consultancy.
T 00353 863856884
E admin@bluerockenv.ie
W www.bluerockenvironmental.ie

File Ref : BRE12007
Drawing Ref : BRE12007DG02
Revision : V01
Date : 10/07/2012
Drawn by: SH



Legend

Project

Drogheda Landfill Hydrogeological Risk Assessment 2015

Client: **Louth County Council**

Drawing: **Figure 4**

Title: **Conceptual Site Model**

BlueRock Environmental
The Hydrogeological and Contaminated Land Consultancy
T 00353 863856884
E admin@bluerockenv.ie
W www.bluerockenvironmental.ie

File Ref : BRE12007
Drawing Ref : BRE12007Dg004
Revision : V01
Date : 06/11/2015
Scale: NTS
Drawn by: SH
Copyright: BlueRock Env Ltd

APPENDIX A

Monitoring Location	Borehole logs	Installed	Depth m	Standpipe	Description
Ground water monitoring boreholes					
BH1A	**1RB**	15/08/2001	35.5	100mm diameter standpipe, slotted from 35.5m to 29m. Gravel pack form 35.5m to 29m. Bentontite seal from 29m to 23m. Annulus backfilled with arisngs.	Boulder clay (overburden) to 28m then moderately strong grey fine grained carboniferous limestone
BH2A	**2RB**	15/08/2001	50	100mm diameter standpipe to 50m. Slotted form 50m to 20m. Gravel from 50m to 9m. Bentonite seal from 9m to 3m. Arising from 3m to 1m	Boulder clay (overburden) to 8.50m then moderately strong grey fine grained carboniferous limestone
BH3A	**3RB**	15/08/2001	52.5	100mm diameter standpipe to 52.5m. Slotted from 52.5m to 32.5m. Gravel pack from 52.5m to 32m . Bentonite seal from 32m to 26m	Boulder clay (overburden) to 9m then moderately strong grey fine grained carboniferous limestone
BH4A	**BH4A**	08/03/2000	31.5	100mm diameter standpipe, slotted from 1.5 to 31.50m	Clay to 21.5m then limestone.
BH5A	**5RB**	15/08/2001	48.5	100mm diameter standpipe to 48.5m. Slotted from 48.5m to 42.5m. Gravel from 48.5m to 42m. Bentonite seal from 42m to 36m. Annulus backfilled	Boulder clay (overburden) to 44m then moderately strong grey fine grained carboniferous limestone
BH6A	**6RB**	16/08/2001	42.5	100mm diameter standpipe to 42.5m. Slotted from 42.5m to 9.5m. Gravel from 42.5m to 9m. Bentonite seal from 9m to 1m.	Boulder clay (overburden) to 1m then moderately strong grey fine grained carboniferous limestone
BH7A	**7RB**	16/08/2001	30	100mm diameter standpipe to 30m. Slotted from 30m to 9m. Gravel from 30m to 8.5m. Bentonite seal from 8.5m to 2.5m. Annulus backfilled with arisings	Boulder clay (overburden) to 0.30m then moderately strong grey fine grained carboniferous limestone
BH8A	**8RB**	16/08/2001	45	100mm diameter standpipe to 45.5m. Slotted from 45.5m to 27.5m. Gravel from 45.5m to 27m. Bentonite seal from 27m to 21m. Annulus backfilled	Boulder clay (overburden) to 2.70m then moderately strong grey fine grained carboniferous limestone
BH9A	**9RB**	16/08/2001	47	100mm diameter standpipe to 47m. Slotted from 47m to 14m. Gravel from 47m to 14m. Bentonite seal from 6m to 0m.	Boulder clay (overburden) to 2m then moderately strong grey fine grained carboniferous limestone
BH10A	**BH10A**	08/03/2000	40	100mm diameter standpipe, slotted from 6.0 to 40.0m	slightly weathered grey fine grained limestone
BH11A	**11RB**	15/08/2001	30	100mm diameter standpipe to 30m. Slotted from 15m to 30m. Gravel from 30m to 13m. Bentonite seal from 13m to 6m.Annulus backfilled with arisings	Boulder clay (overburden) to 0.50m then moderately strong grey fine grained carboniferous limestone

Glover Site Investigations Ltd

Site: DROGHEDA LANDFILL			Borehole Number: BH4A
Machine: HANDS ENGLAND A60	Dates: 28/03/00 - 08/03/00	Client: CORPORATION OF DROGHEDA	Sheet: 1/1
Flush: AIR			
Bit Size: 200.00mm	Location: AS PLAN	Engineer:	Ground Level (mOD):
Method: ROTARY DTH			

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
Firm brown gravelly sandy CLAY containing occasional cobbles	(10.00)									
Firm brown gravelly sandy CLAY containing occasional cobbles	10.00 (10.00)									
Firm brown gravelly sandy CLAY containing occasional cobbles	20.00 (1.50)									
Slightly weathered grey fine grained LIMESTONE	21.50 (8.50)									
Slightly weathered grey fine grained LIMESTONE	30.00 (1.50)									
END OF BOREHOLE 31.5m	31.50								05/03/00	

Remarks
200mm diameter mass standpipe installed

Scale	Logged By
1:200	TR

Figure No: 3640/B1

Borehole Number: BH4A

Glover Site Investigations Ltd

Site: DROGHEDA LANDFILL			Bore Number: BH4A
Machine : HANDS ENGLAND A60 Flush : AIR Bit Size : 200.00mm Method : ROTARY DTH	Dates: 08/03/00 - 08/03/00 Location: AS PLAN	Client: CORPORATION OF DROGHEDA Engineer:	Sheet: 1/1 Ground Level (mOD):

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
Firm brown gravelly sandy CLAY containing occasional cobbles	(10.00) 10.00									
m brown gravelly sandy CLAY containing occasional cobbles	20.00									
Firm brown gravelly sandy CLAY containing occasional cobbles	(1.50) 21.50									
Slightly weathered grey fine grained LIMESTONE	(8.50) 30.00									
Slightly weathered grey fine grained LIMESTONE	(1.50) 31.50									
END OF BOREHOLE 31.5m									08/03/00	

Remarks
100mm diameter gas standpipe installed.

Scale	Logged By
1:200	TR

Figure No. 3640.B1

Borehole Number BH4A

Glover Site Investigations Ltd

Site: DROGHEDA LANDFILL			Borehole Number: BH4A
Installation Type: GAS STANDPIPE	Dimensions: Internal Diameter of Tube (A) = 100 mm Diameter of Filter Zone = 200 mm	Client: CORPORATION OF DROGHEDA	Job Number: 3649
	Location: AS PLAN	Ground Level (mOD):	Engineer:
			Sheet: 1/1

Legend	Inst. (A)	Level (mOD)	Depth (m)	Description
		+0.50	0.50	Concrete
		+1.50	1.50	Cement/Bentonite Grout
				Gravel Filter
		-6.50	8.50	
				Slotted Standpipe
		-31.50	31.50	

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)
					5 min	10 min	15 min	20 min	

Groundwater Observations During Drilling

Date	Start of Shift					End of Shift				
	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
14/03/00							31.50			

Instrument Groundwater Observations

Inst. (A) Type :

Date	Instrument (A)			Remarks
	Time	Depth (m)	Level (mOD)	

Remarks

Copright lockable cover fitted.

Glover Site Investigations Ltd

Site: DROGHEDA LANDFILL			Borehole Number: BH10A
Machine: HANDS ENGLAND A60 Flush: AIR Bit Size: 200.00mm Method: ROTARY DTH	Dates: 08/03/00 - 08/03/00 Location: AS PLAN	Client: CORPORATION OF DROGHEDA Engineer:	Sheet: 1/1 Ground Level (mOD):

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
Slightly weathered grey fine grained LIMESTONE	(10.00)									
	10.00									
ghtly weathered grey fine grained LIMESTONE	(10.00)									
	20.00									
Slightly weathered grey fine grained LIMESTONE	(10.00)									
	30.00									
Slightly weathered grey fine grained LIMESTONE	(10.00)									
END OF BOREHOLE 40.0m	40.00									08/03/00

Remarks
100mm diameter gas standpipe installed.

Scale	Logged By
1:200	TR

Figure No. 3640.82

Borehole Number: BH10A

Glover Site Investigations Ltd

Site	Borehole Number
DROGHEDA LANDFILL	BH10A

Installation Type	Dimensions	Client	Job Number
GAS STANDPIPE	Internal Diameter of Tube [A] = 100 mm Diameter of Filter Zone = 200 mm	CORPORATION OF DROGHEDA	3649

Location	Ground Level (mOD)	Engineer	Sheet
AS PLAN			1/1

Legend	Inst. [A]	Level (mOD)	Depth (m)	Description
				Concrete
		-3.00	3.00	
				Cement/Bentonite Grout
		-5.00	5.00	
				Gravel Filter
		-6.00	6.00	
				Slotted Standpipe
		-40.00	40.00	

Groundwater Strikes during Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	Readings 10 min	Readings 15 min	Readings 20 min	Depth Sealed (m)

Groundwater Observations During Drilling

Date	Start of Shift Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	End of Shift Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
[illegible]				-			40.00			

Instrument Groundwater Observations

Inst. [A] Type :

Date	Instrument [A] Time	Depth (m)	Level (mOD)	Remarks

Remarks

Upright lockable cover fitted.

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 1RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/1
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD):

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(28.00)									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	28.00 (7.50)								Water struck at 32.10m.	
END OF BOREHOLE 35.5m.	35.50								15/08/01	

Remarks

Installed 100mm standpipe to 35.5m.
Slotted from 35.5 to 29.5m.
Gravel pack from 35.5 to 29.0m
Bentonite seal from 29.0 to 23.0m
Annulus backfilled with arising.
Lockable cover fitted.
Jar sampler taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.1RB

Borehole Number 1RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 2RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(8.50)									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	8.50									
	(31.50)									
	40.00								Water struck at 38.00m.	

Remarks

Installed 100mm standpipe to 50.0m.
Slotted from 50.0 to 20.0m.
Gravel from 50.0 to 9.0m
Bentonite seal from 9.0 to 3.0m
Arising from 3.0 to 1.0m
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.2

Borehole Number 2RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 2RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01 Location: AS PLAN	Client: LOUTH COUNTY COUNCIL Engineer: KIRK McCLURE MORTON	Sheet: 2/2 Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(10.00)									
	50.00								15/08/01	
END OF BOREHOLE 50.0m.										

Remarks

Installed 100mm standpipe to 50.0m.
Slotted from 50.0 to 20.0m.
Gravel from 50.0 to 9.0m
Bentonite seal from 9.0 to 3.0m
Arising from 3.0 to 1.0m
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.2

Borehole Number 2RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 3RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(9.00)									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	9.00									
	(31.00)									
	40.00									

Remarks

Installed 100mm standpipe to 52.5m
Slotted from 52.5m to 32.5m
Gravel pack from 52.5m to 32.0m.
Bentonite seal from 32.0m to 26.0m.
Lockable cover fitted.
jar sample taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.3

Borehole Number 3RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 3RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 2/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(12.50)								Water struck at 49.40m.	
	52.50									15/08/01
END OF BOREHOLE 52.5m.										

Remarks

Installed 100mm standpipe to 52.5m
Slotted from 52.5m to 32.5m
Gravel pack from 52.5m to 32.0m.
Bentonite seal from 32.0m to 26.0m.
Lockable cover fitted.
jar sample taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.3

Borehole Number 3RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 5RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(40.00)									
	40.00									

Remarks

Installed 100mm standpipe to 48.5m
Slotted from 48.5 to 42.5m
Gravel pack from 48.5 to 42.0m.
Bentonite seal from 42.0 to 36.0m.
Annulus backfilled with arisings.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.5

Borehole Number 5RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 5RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01 Location: AS PLAN	Client: LOUTH COUNTY COUNCIL Engineer: KIRK McCLURE MORTON	Sheet: 2/2 Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
BOULDER CLAY (OVERBURDEN)	(4.00)									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	44.00 (4.50)								Water struck at 45.00m.	
END OF BOREHOLE 48.5m.	48.50								15/08/01	

Remarks

Installed 100mm standpipe to 48.5m
Slotted from 48.5 to 42.5m
Gravel pack from 48.5 to 42.0m.
Bentonite seal from 42.0 to 36.0m.
Annulus backfilled with arisings.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.5

Borehole Number 5RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 6RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(1.00) 1.00									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(39.00)									
	40.00									

Remarks

Installed 100mm standpipe to 42.5m.
Slotted from 42.5 to 9.5m.
Gravel pack from 42.5 to 9.0m
Bentonite seal from 9.0 to 1.0m
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.6

Borehole Number 6RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 6RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 2/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(2.50)								Water struck at 40.25m.	
	42.50								16/08/01	
END OF BOREHOLE 42.5m.										

Remarks

Installed 100mm standpipe to 42.5m.
Slotted from 42.5 to 9.5m.
Gravel pack from 42.5 to 9.0m
Bentonite seal from 9.0 to 1.0m
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.6

Borehole Number 6RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 7RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/1
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level	Daily Progress
BOULDER CLAY (OVERBURDEN)	0.30									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(29.70)								Water struck at 15.00m.	
END OF BOREHOLE 30.0m.	30.00								16/08/01	

Remarks

Installed 100mm standpipe to 30.0m.
Slotted from 30.0 to 9.0m.
Gravel pack from 30.0 to 8.5m
Bentonite seal from 8.5 to 2.5m
Annulus backfilled with arisings.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.7

Borehole Number 7RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 8RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(2.70)									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	2.70									
	(37.30)									
	40.00									

Remarks

Installed 100mm standpipe to 45.5m.
Slotted from 45.5m to 27.5m
Gravel pack from 45.5 to 27.0m.
Bentonite seal from 27.0 to 21.0m
Annulus backfilled with arisings.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.8

Borehole Number 8RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 8RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 2/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(5.00)								Water struck at 42.75m.	
	45.00								16/08/01	
END OF BOREHOLE 45.5m.										

Remarks

Installed 100mm standpipe to 45.5m.
Slotted from 45.5m to 27.5m
Gravel pack from 45.5 to 27.0m.
Bentonite seal from 27.0 to 21.0m
Annulus backfilled with arisings.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.8

Borehole Number 8RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 9RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	(2.00)									
	2.00									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(38.00)									
	40.00									

Remarks

Installed 100mm standpipe to 47.0m.
Slotted from 47.0 to 14.0m.
Gravel pack from 47.0 to 6.0m.
Bentonite seal from 6.0 to 0.0m.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.9

Borehole Number 9RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 9RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 16/08/01 - 16/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 2/2
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(7.00)								Water struck at 45.00m.	
	47.00								16/08/01	
END OF BOREHOLE 47.0m.										

Remarks

Installed 100mm standpipe to 47.0m.
Slotted from 47.0 to 14.0m.
Gravel pack from 47.0 to 6.0m.
Bentonite seal from 6.0 to 0.0m.
Lockable cover fitted.
Jar samples taken every metre.

Scale	Logged By
1:200	DC

Figure No. 4230.9

Borehole Number 9RB

Glover Site Investigations Ltd

Site: DROHEDA LANDFILL SITE, COLLON ROAD, DROHEDA			Borehole Number: 11RB
Machine : DOWN THE HOLE HAMMER Flush : Bit Size : Method :	Dates: 15/08/01 - 15/08/01	Client: LOUTH COUNTY COUNCIL	Sheet: 1/1
	Location: AS PLAN	Engineer: KIRK McCLURE MORTON	Ground Level (mOD)

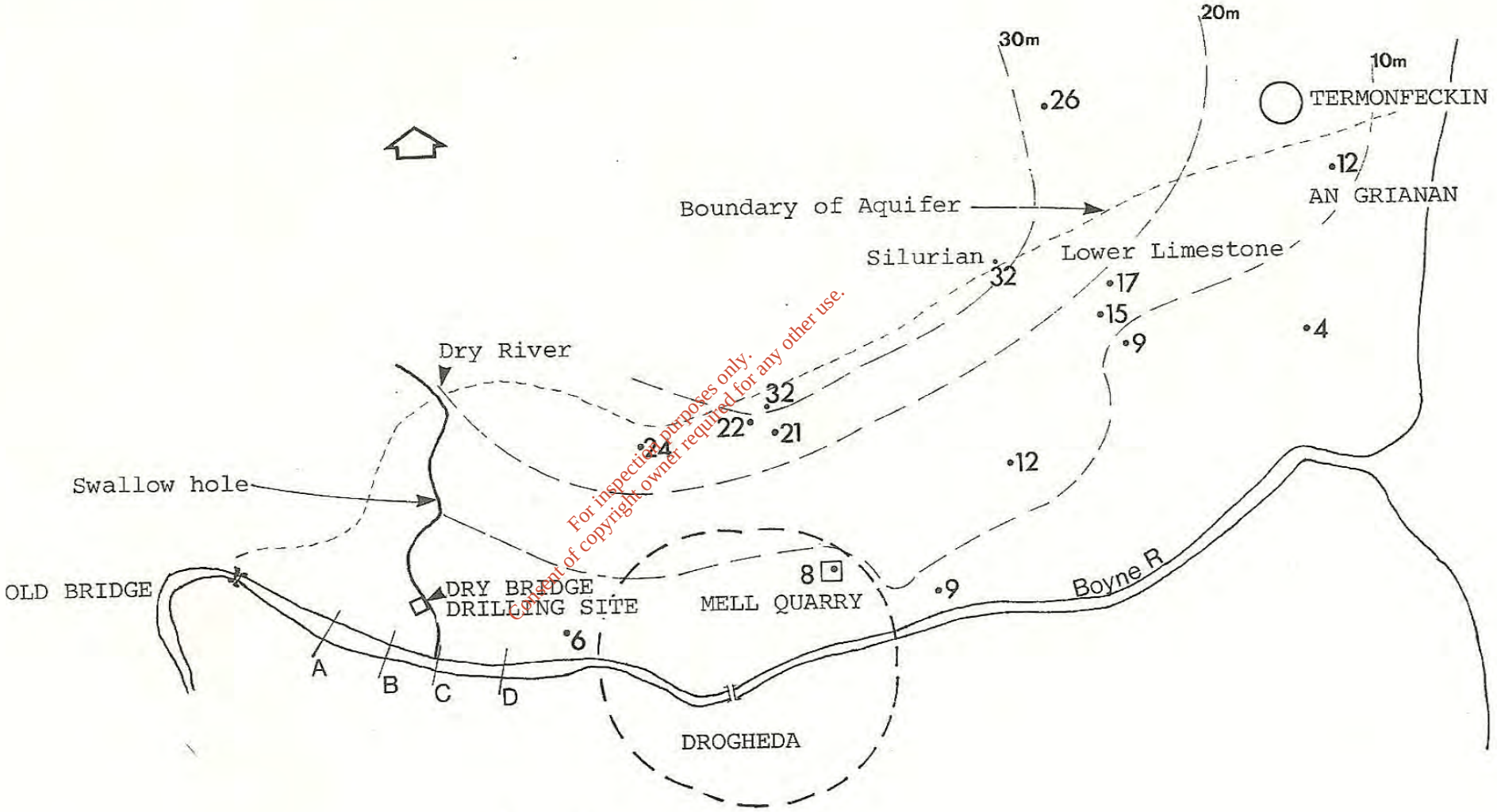
Description	Depth m (Thickness)	Legend	Level (mOD)	Samples / Tests: Depth (m)	TCR	SCR	RQD	FI	Water Level *	Daily Progress
BOULDER CLAY (OVERBURDEN)	0.50									
Moderately strong grey fine grained CARBONIFEROUS LIMESTONE	(29.50)								Water struck at 27.00m.	
END OF BOREHOLE 30.0m.	30.00								15/08/01	

Remarks

Installed 100mm standpipe to 30.0m.
Slotted from 15.0 to 30.0m.
Gravel from 30.0 to 13.0m.
Bentonite seal from 13.0 to 6.0m
Annulus backfilled with arisings.
Lockable cover fitted.
Jar samples taken every metre.

Scale: 1:200	Logged By: DC
Figure No.: 4230.11RB	
Borehole Number: 11RB	

APPENDIX B



Water Table Contours — — — — 10m

Water Levels in Wells m O.D. .21

Boundary Aquifer - - - - - - - - - - - - - - -

Scale 1 : 63360

APPENDIX C

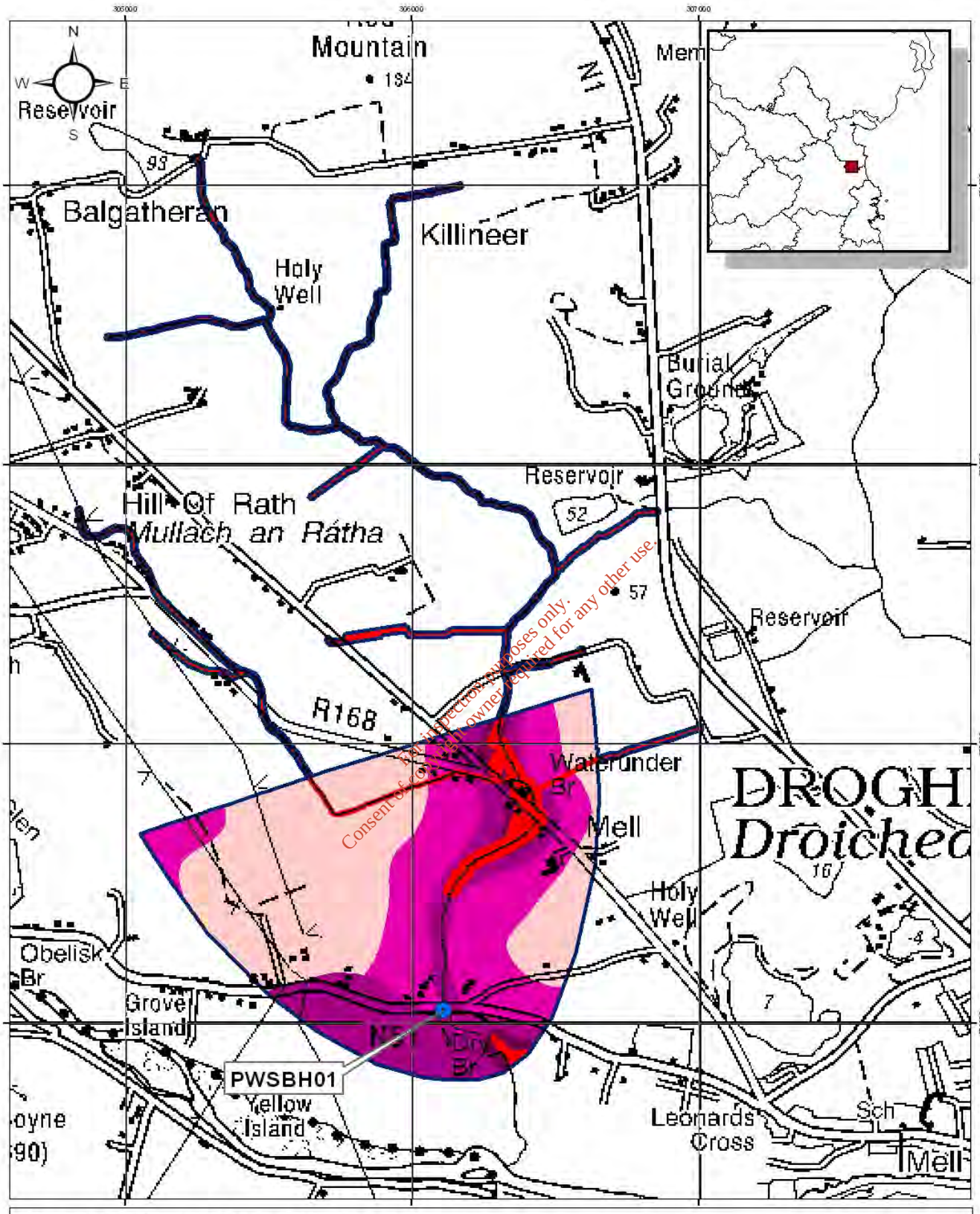


Figure 11 Source Protection Zones

PWS Abstraction

Stream

Drybridge PWS Zone of Contribution (ZOC)

SI/X

SI/H

SI/L

SI/E

SI/M

0 0.125 0.25 0.5 0.75 km

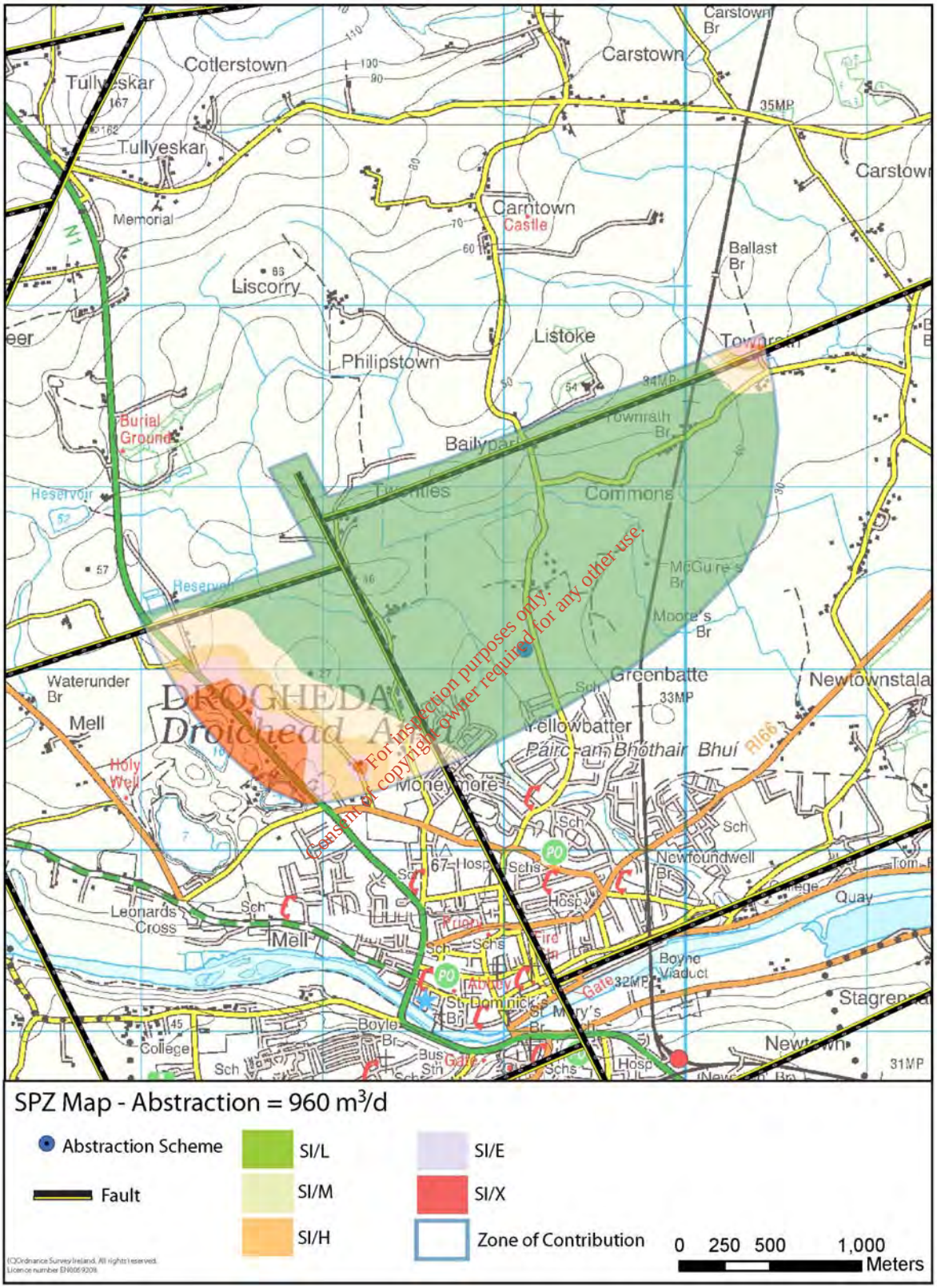
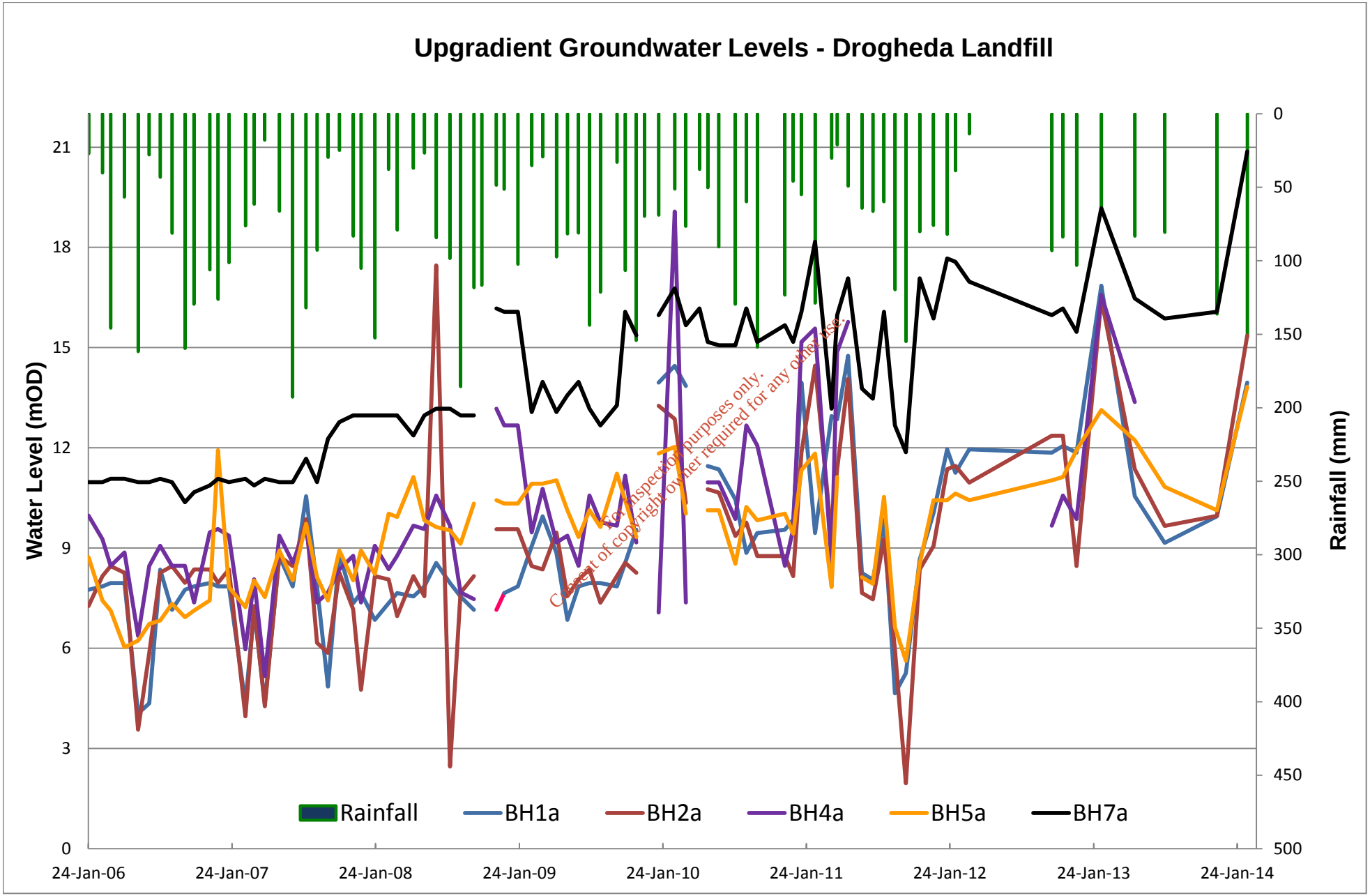
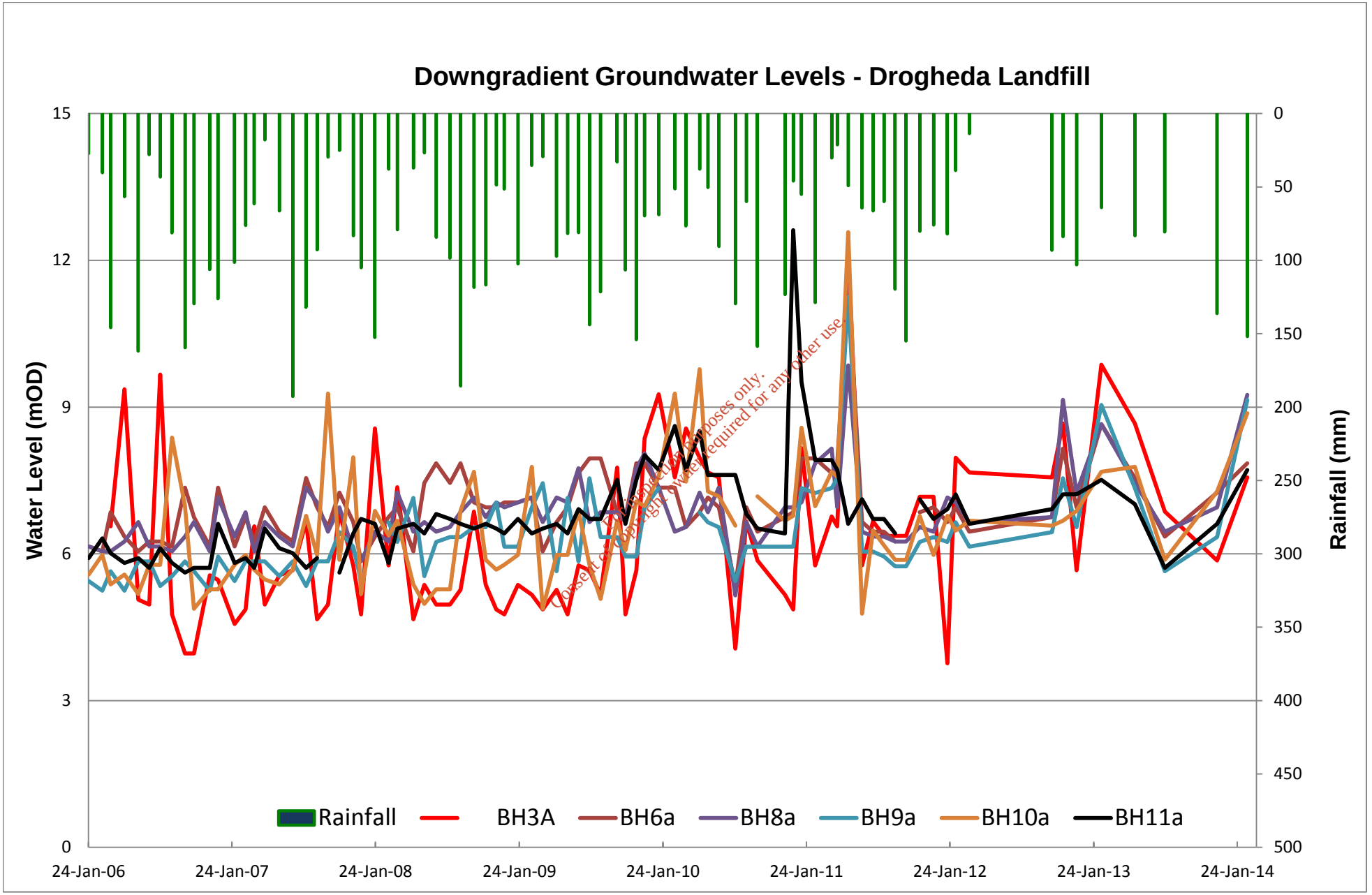
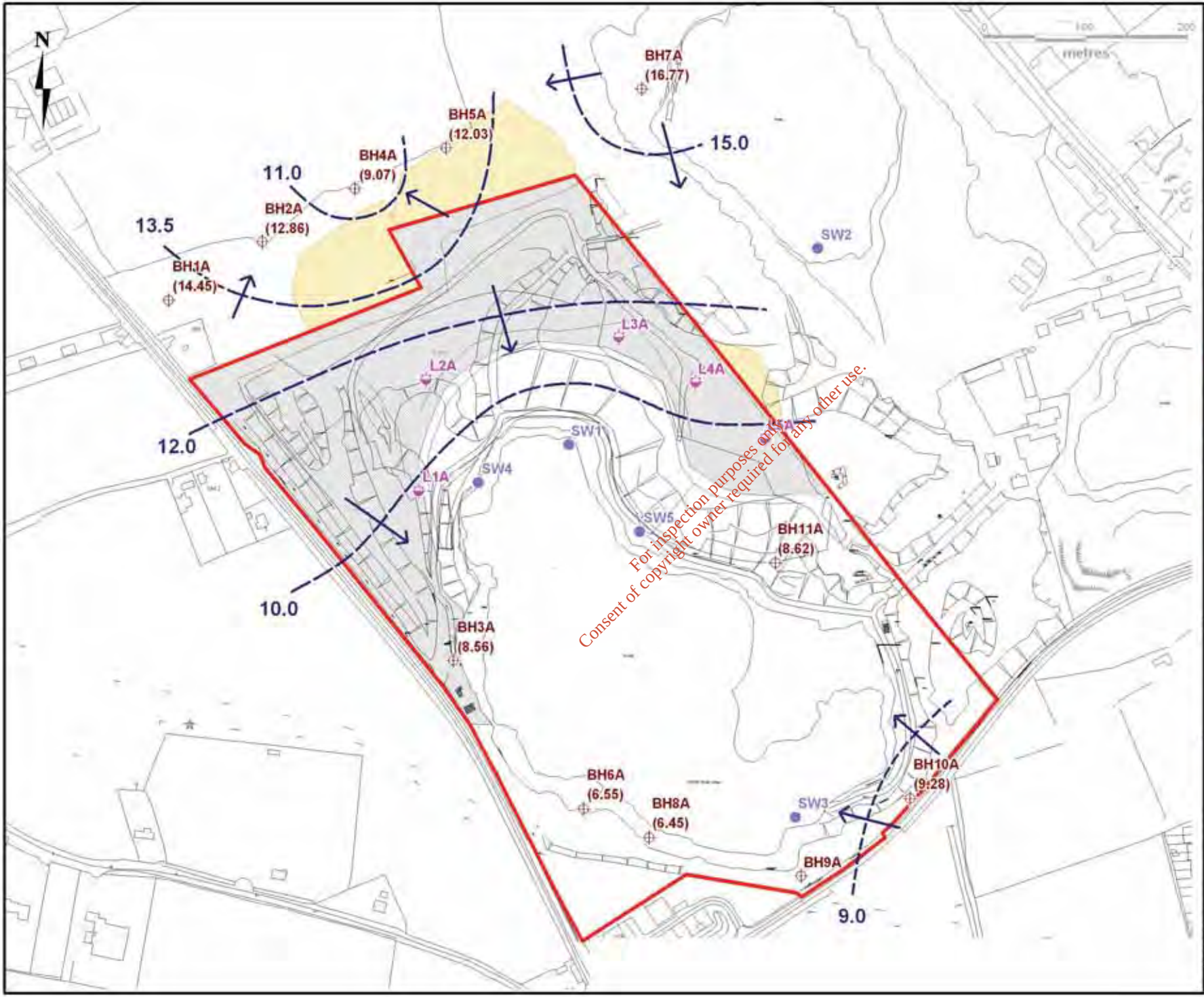


Figure 18: Source Protection Zones, Abstraction = 960 m^3/d

APPENDIX D







Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 23/02/10

Title

Figure D1
Groundwater Contours
23/02/10

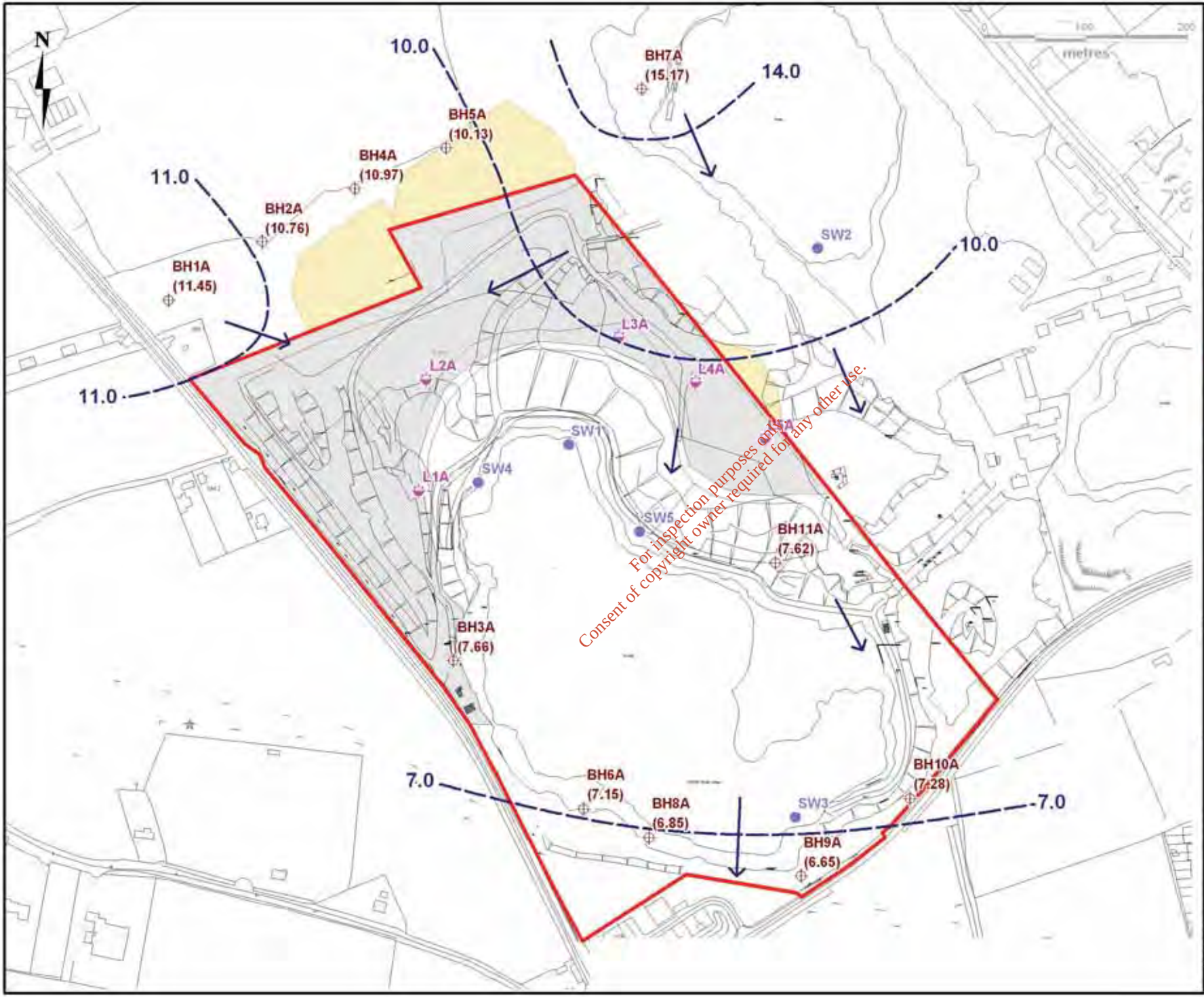
BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway

Tel: +353 66 3856884
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 18/05/10

Title

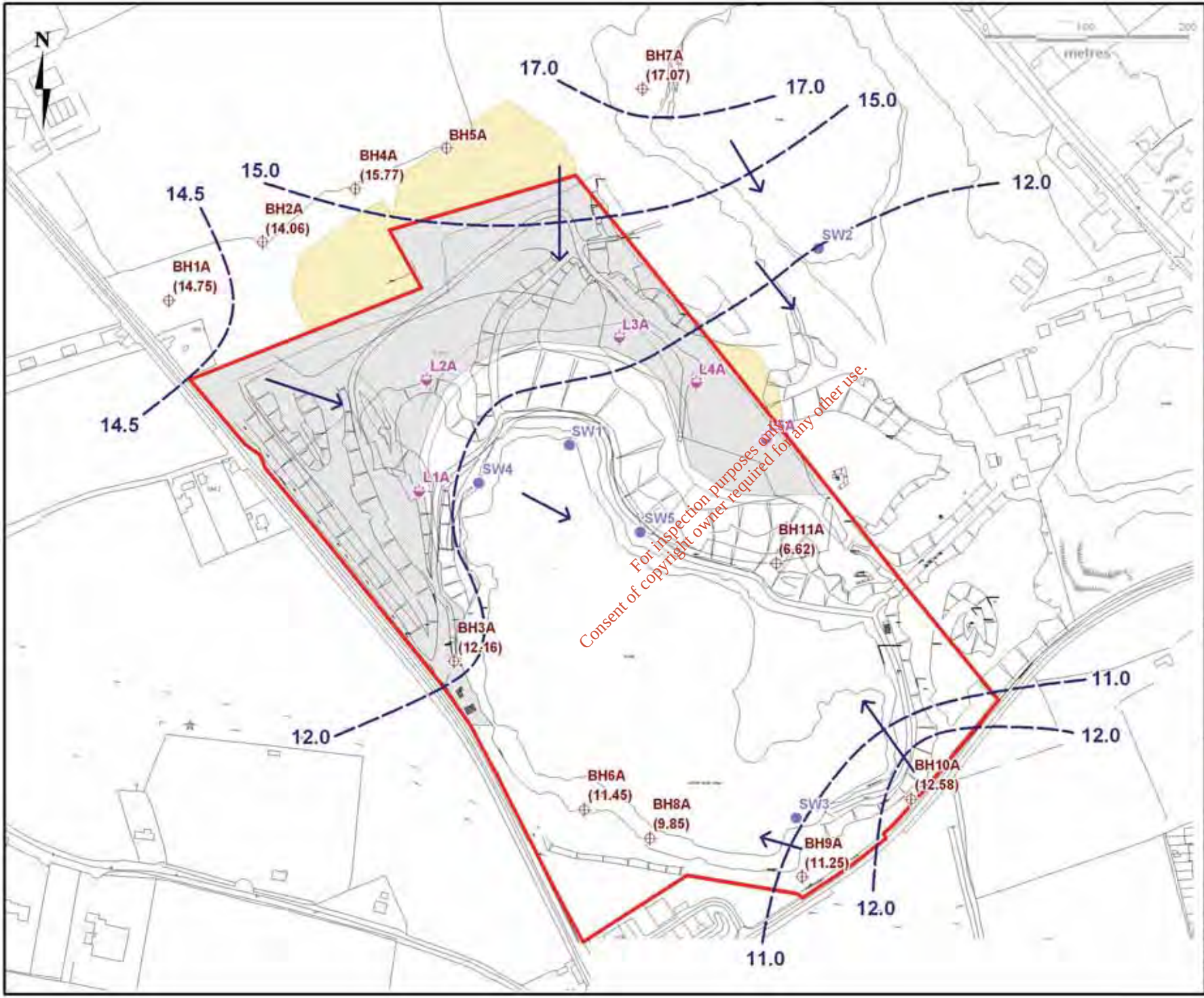
Figure D2
Groundwater Contours 18/05/10

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856584
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 10/05/11

Title

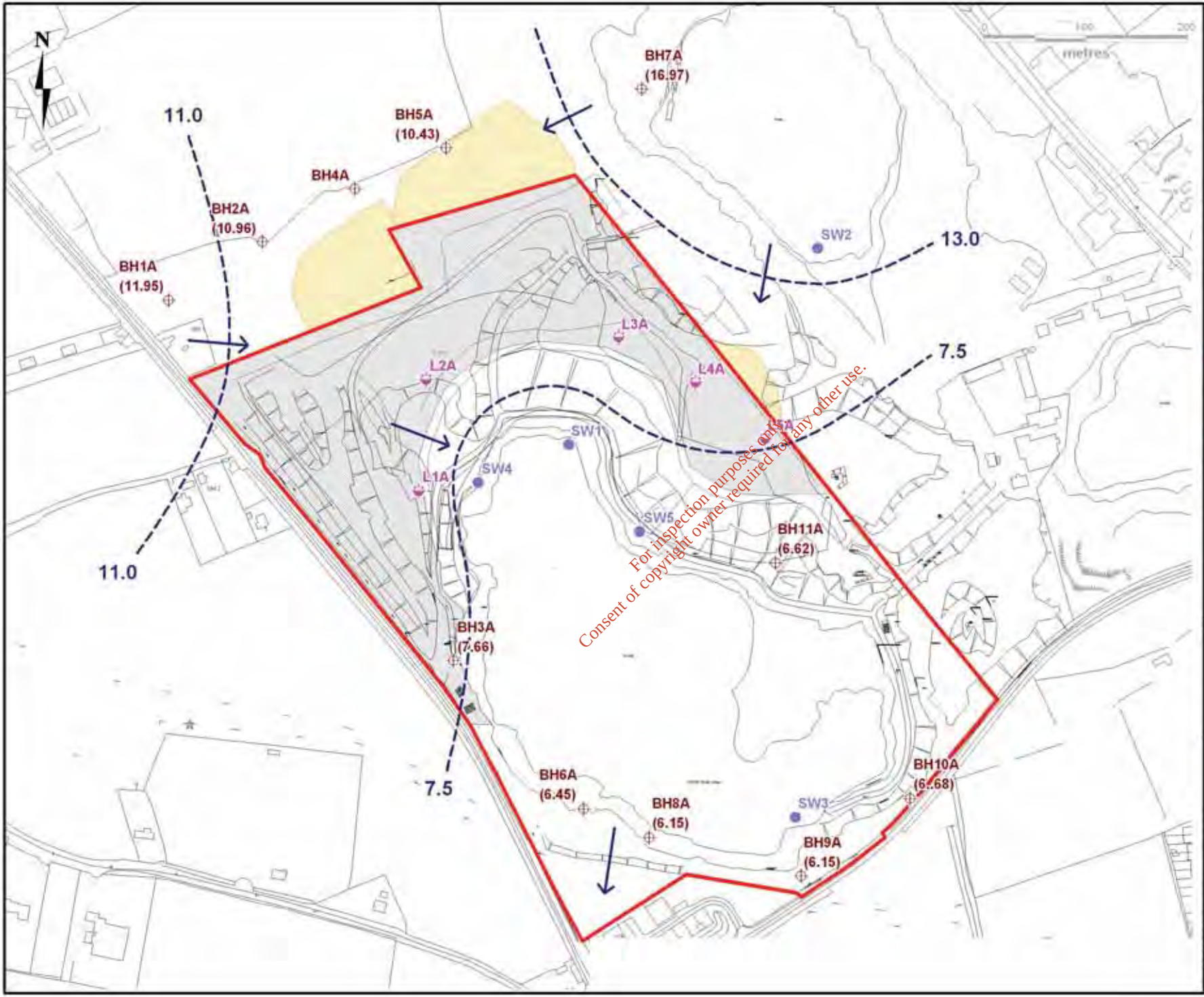
Figure D3 Groundwater Contours 10/05/11

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856584
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	[illegible]	Project No.	[illegible]
Approved:	[illegible]	File Ref:	[illegible]
Date:	[illegible]	Scale:	1:5,000 @ A4



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 07/06/11

Title

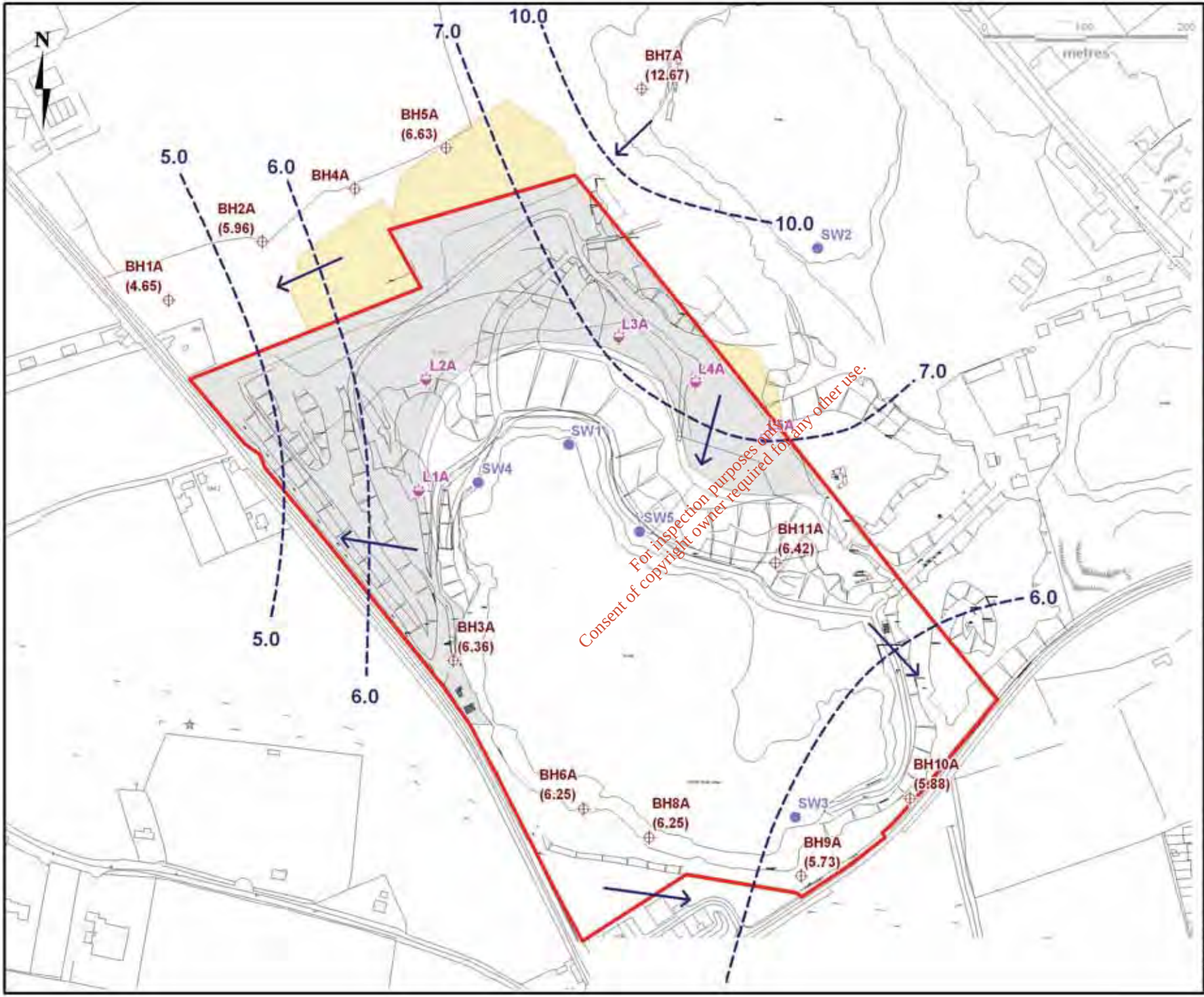
Figure D4
Groundwater Contours
07/06/2011

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856884
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 06/09/11

Title

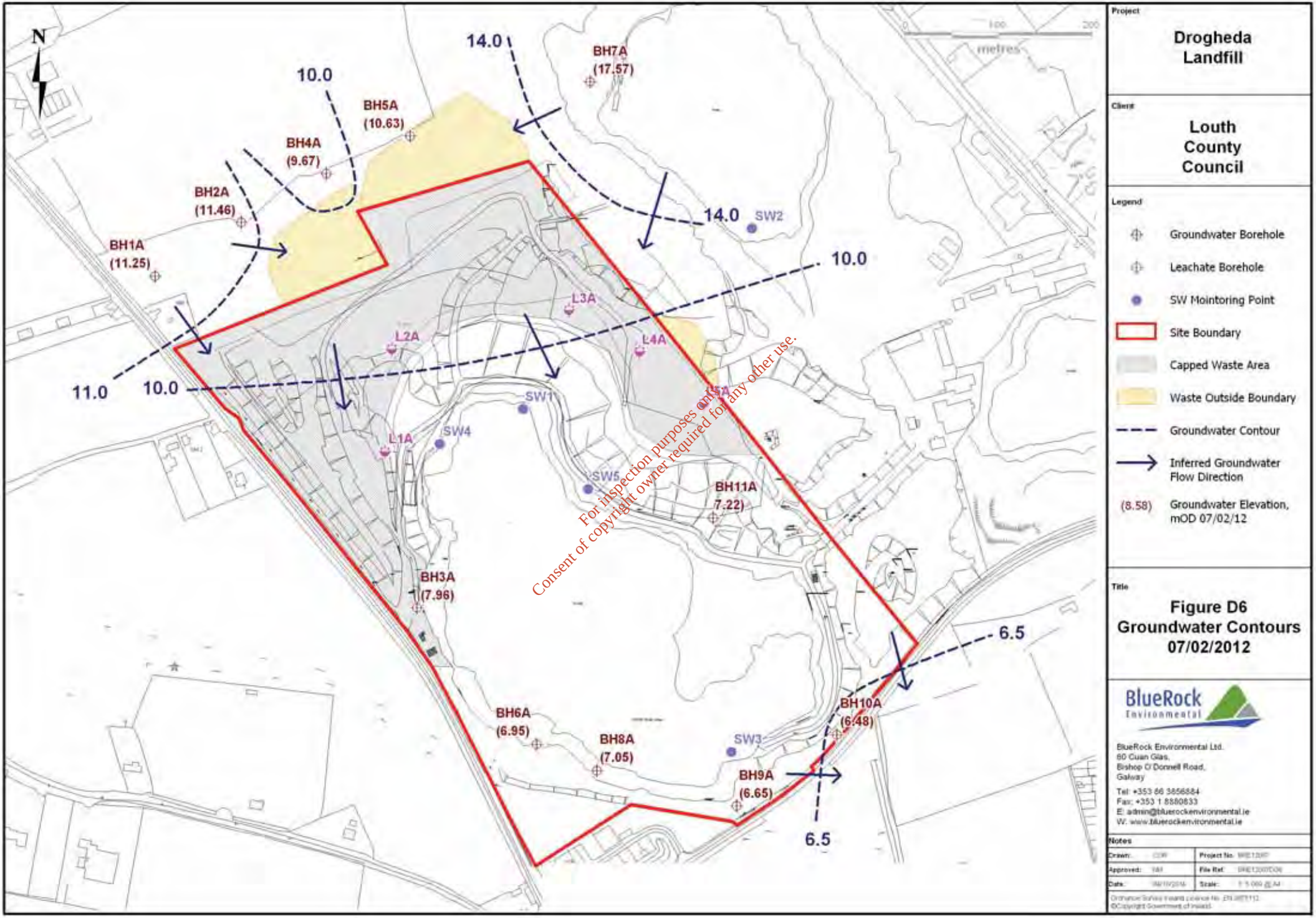
Figure D5
Groundwater Contours
06/09/2011

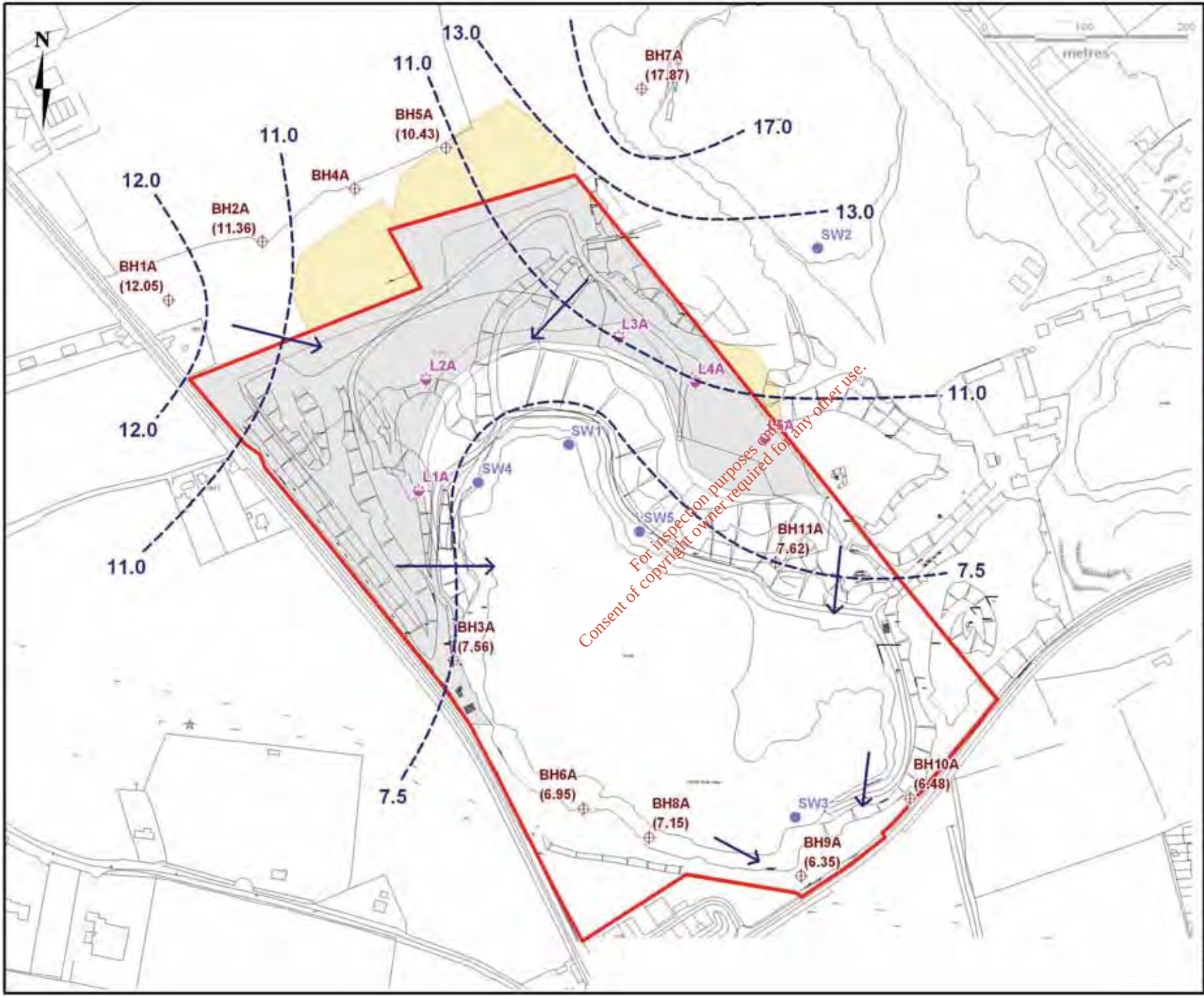
BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856884
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:





Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 13/03/12

Title

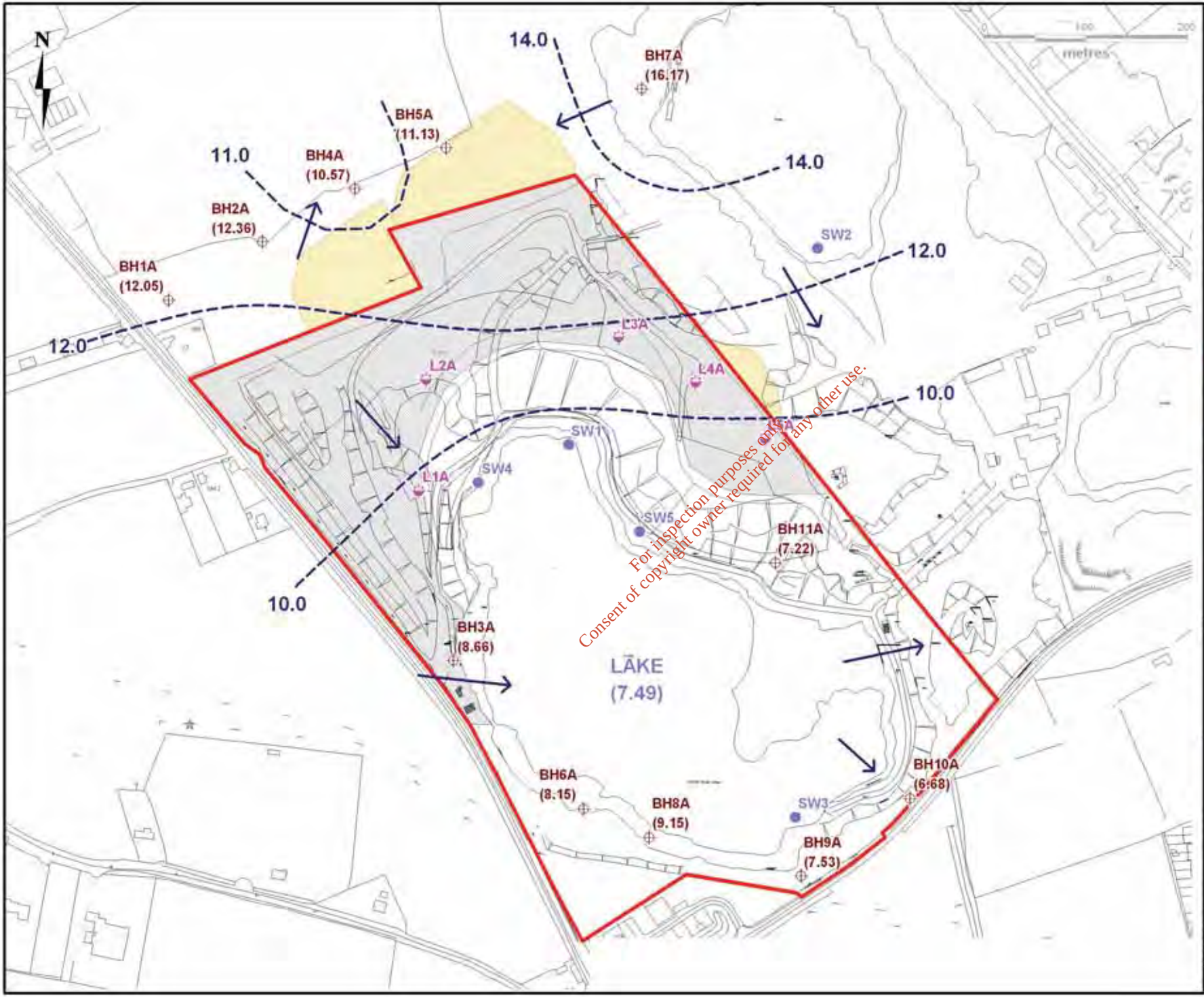
Figure D7
Groundwater Contours
13/03/2012

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856884
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 06/11/12

Title

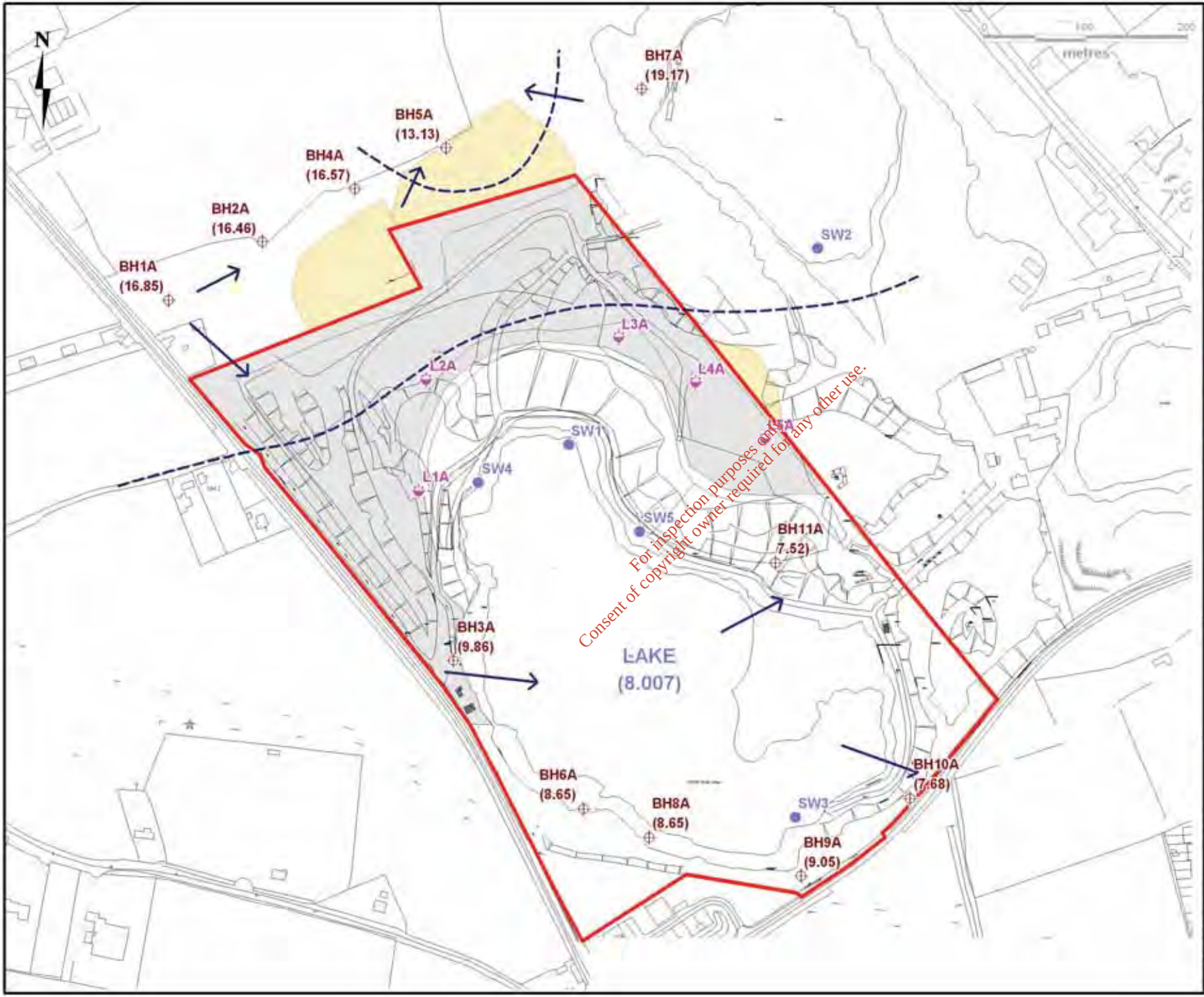
Figure D8
Groundwater Contours
06/11/2012

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856584
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 12/02/13

Title

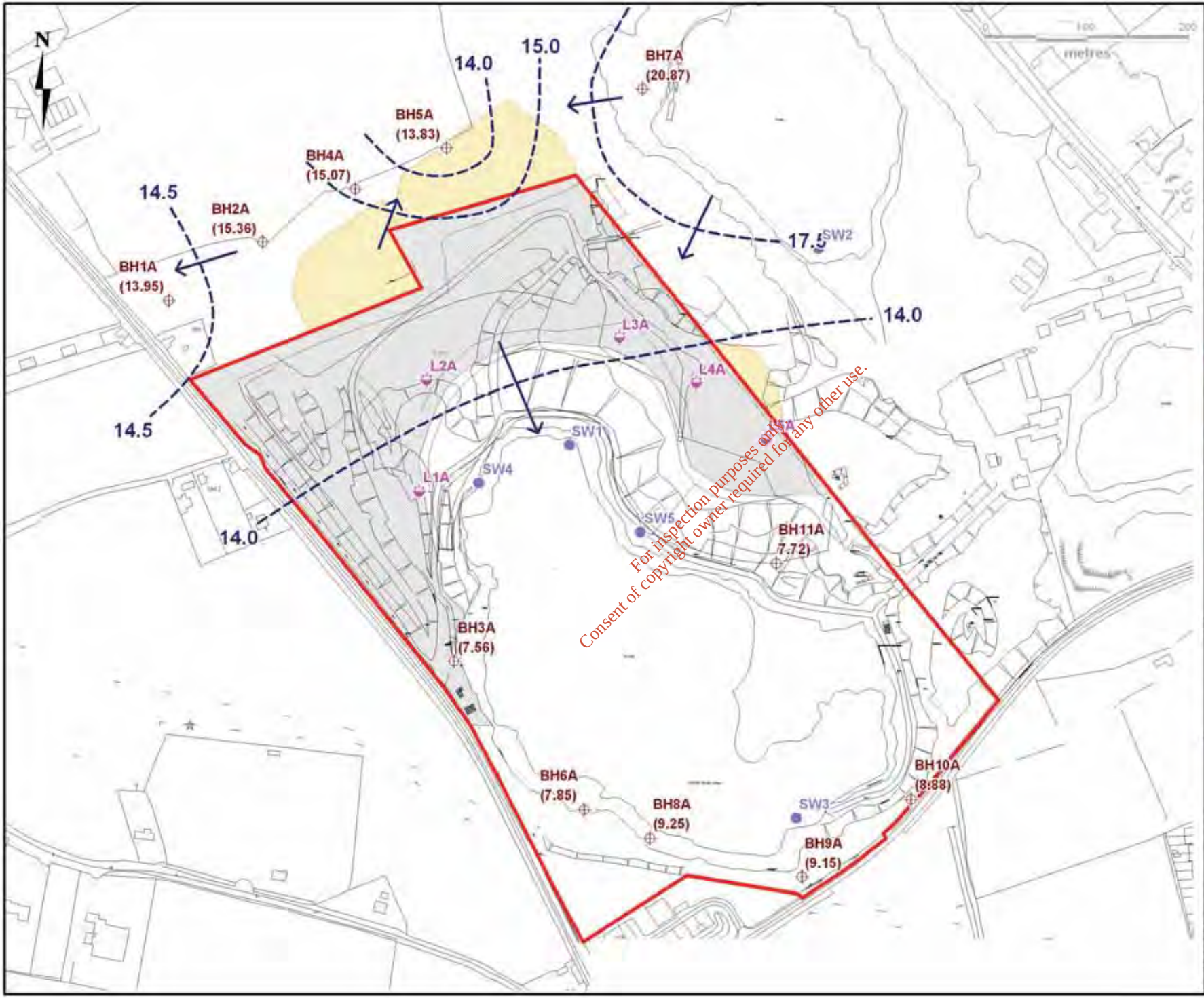
Figure D9 Groundwater Contours 12/02/2013

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856584
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:



Project

Drogheda Landfill

Client

Louth County Council

Legend

- Groundwater Borehole
- Leachate Borehole
- SW Mointoring Point
- Site Boundary
- Capped Waste Area
- Waste Outside Boundary
- Groundwater Contour
- Inferred Groundwater Flow Direction
- (8.58) Groundwater Elevation, mOD 18/02/14

Title

Figure D10
Groundwater Contours
18/02/2014

BlueRock Environmental

BlueRock Environmental Ltd.
60 Cuan Glas,
Bishop O'Donnell Road,
Galway
Tel: +353 66 3856884
Fax: +353 1 8880833
E: admin@bluerockenvironmental.ie
W: www.bluerockenvironmental.ie

Notes

Drawn:	Project No.
Approved:	File Ref:
Date:	Scale:

APPENDIX E

BOREHOLE BH1A																										
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	**24-Jan-06**	**28-Feb-06**	**21-Mar-06**	**25-Apr-06**	**30-May-06**	**27-Jun-06**	**25-Jul-06**	**24-Aug-06**	**26-Sep-06**	**19-Oct-06**	**28-Nov-06**	**19-Dec-06**	**16-Jan-07**	**27-Feb-07**	**21-Mar-07**	**17-Apr-07**	**24-May-07**	**27-Jun-07**	**31-Jul-07**	**28-Aug-07**	**25-Sep-07**	**24-Oct-07**	**28-Nov-07**	**18-Dec-07**
Alkalinity	**mg/l CaCO3**							344												360								
Aluminium	**ug/l**	**200**	**200**	**150**																								
Ammonia	**mg/l N**	**0.23 mg/l**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	0.03	<0.03	0.04	<0.03	0.04	0.03	0.03	0.03	<0.03	<0.03	0.03	<0.03	0.05	<0.03	0.03	0.07	0.07	0.06	<0.03	0.03	<0.03
Antimony	**ug/l**	**5**																										
Arsenic	**ug/l**		**10**	**7.5**																								
Barium	**ug/l**		**100**		52.1	50.7	<50	52.3	56.1	<50	<50	<50	<50	<50	61.1	<50	61.8	56.7	<50	<50	<50	78.7	58.7	58.3	<50	<50	nm	<50
Beryllium	**ug/l**																											
B.O.D.	**mg/l O2**																											
Boron	**µg/l**	**1000**	**1000**	**750**				<50												<50								
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.2	<0.10	0.3	<0.10	<0.10	<0.10	<0.10	0.2	0.7	0.5	0.2	0.3	<0.10	<0.10	0.3	0.3	0.2	<0.10	<0.10	<0.10	<0.10	0.2	<0.10	0.4
Calcium	**mg/l Ca**		**200**					120												122.39								
C.O.D.	**mg/l O2**																											
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	45	22	31	22	20	20	27	30	37	33	22	32	18	23	29	26	26	18	25	24	29	30	30	33
Chromium	**µg/l**	**50**	**30**	**37.5**	10.4	5.5	6.1	7.7	3.4	<1	2.9	4.7	8.3	2.7	3.8	2.3	4.0	<1	4.6	<1	<1	<1	<1	<1	<1	2.3	<1	2.4
Cobalt	**µg/l**																											
Coliform Bacteria	**(No/100 ml)**	**0**																										
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	698	705	812	726	694	682	756	804	869	824	706	855	685	683	814	772	750	598	710	675	690	684	727	1577
Copper	**µg/l**	**2000**	**30**	**1500**				6.4												5.0								
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05								
D.O.	**% Saturation**				60			65			55			35			62			50			66			53		
E_Coli	**No/100 ml**	**0**						0																				
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150								
Iron	**µg/l**	**200**	**200**		219	222.1	219.9	440.6	261.6	270.8	330.8	487.5	430.1	308.6	233.6	134.9	355.6	402.6	361.2	431.1	410.4	238.6	396.4	357.7	354.5	308.8	291.2	236
Lead	**µg/l**	**25**	**10**	**18.75**	8.2	6.6	2.8	9.6	4.9	<1	4.9	8.8	3.1	3.5	5.6	<1	4.5	6.2	4.3	5.0	3.9	4.9	3.4	2.8	2.2	2.6	2.8	<1
Magnesium	**mg/l Mg**		**50**					10.3												9.31								
Manganese	**µg/l**	**50**	**50**		76.1	50.3	66.3	85	40.1	42.5	47.4	107.2	193.4	155.6	107.6	36.7	69.2	87.7	59.2	64.8	107.5	66.4	254.9	64.2	26.5	31.7	39.8	54.4
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.10								
Molybdenum	**µg/l**		**35**																									
Nickel	**µg/l**	**20**	**20**	**15**	7.3	6.8	9.2	5.7	4.9	5	5.9	7.9	22.6	12.8	7.4	7.3	9.6	8.3	10.3	13.7	10.2	4.8	26.2	4.4	5.8	5.8	7.5	13.1
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.06	0.007	<0.003	0.01	0.004	0.007	0.003	0.008	0.027	<0.003	0.012	0.003	0.004	0.007	0.004	0.008	<0.003	nm	0.018	0.011	0.014	0.011	0.013	0.004
o-Phosphate	**mg/l P**		**30**					0.07												0.04								
pH		**6.5 - 9.5**			7.3	7.2	7.2	7.3	7.3	7.2	7.4	7.3	7	7.1	7.2	7.1	7.3	7.0	6.8	7.0	7.0	7.4	7.1	7.0	7.1	7.2	7.2	7
Phenol	**mg/l**		**0.0005**		0.014	0.004	0.168	<0.001	0.179	0.127	<0.001	0.008	<0.001	<0.001	0.11	<0.001	0.007	<0.001	<0.001	<0.001	<0.01	nm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	**mg/l**		**5**		2.52	2.37	4.89	2.96	3.11	1.89	3.64	3.8	6.16	5.17	3.58	4.46	2.43	2.77	4.91	4.12	4.74	2.02	3.95	2.69	3.36	4.19	4.83	7.52
Sampling Depth	**m**				24.2	24.1	24	24	27.9	27.6	23.6	24.8	24.2	24.1	24	24.1	24.1	27.6	24.8	27.6	23.2	24.1	21.4	24.1	27.1	23.1	24.6	24.3
Selenium	**µg/l**	**10**																										
Silver	**µg/l**																											
Sodium	**mg/l**	**200**	**150**	**150**	15.36	11.23	21.74	16.5	17.2	11.72	16.79	16.97	16.63	16.76	17.9	15.71	12.42	14.44	16.71	16.76	18.32	12.07	14.46	15.31	14.46	16.49	19.08	23.76
Strontium	**µg/l**																											
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				19.7												21.6								
Suspended Solids	**mg/l**																											
Temp	**°C**				9.5	7	6	13.1	14	13	21.1	13	12	14.4	9	9	9.5	12.0	9.0	15.0	15.0	15.0	19.6	15.0	10.0	12.6	12	11
Thallium	**µg/l**																											
Time sampled								11.2	11.35	11.35	11.3	11.35	11.4	11.2	11.3	11.3	11.25	11.20	11.30	11.20	11.25	11.00	11.15	11.20	11.35	11.25	10	11.55
Tin (µg/l)	**µg/l**																											
T.O.C.	**mg/l**	**NAC**			137.5			2.6			4			<1.5			<1.5			1.5			2.3			<1.5		
T.O.N	**mg/l N**		**NAC**		1.64	1.72	3.01	1.71	1.45	1.06	2.22	2.9	4.06	3.57	2.04	3.39	1.66	1.92	3.33	2.84	2.74	1.16	2.95	1.96	2.34	2.95	3.41	5.29
Total S Solids	**mg/l**																											
Uranium	**µg/l**																											
Vanadium	**µg/l**																											
Zinc	**µg/l**		**100**		22.3	17.8	16.3	22.3	13.7	15.7	16.9	22.4	25.6	25	27.8	54.3	31.0	24.5	23.3	21.9	3.7	16.3	6.6	16.2	10.7	38.3	31.7	32.6

BOREHOLE BH1A																										
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	**22-Jan-08**	**26-Feb-08**	**19-Mar-08**	**29-Apr-08**	**27-May-08**	**26-Jun-08**	**31-Jul-08**	**27-Aug-08**	**30-Sep-08**	**20-Oct-08**	**26-Nov-08**	**16-Dec-08**	**20-Jan-09**	**24-Feb-09**	**24-Mar-09**	**28-Apr-09**	**26-May-09**	**23-Jun-09**	**21-Jul-09**	**18-Aug-09**	**29-Sep-09**	**20-Oct-09**	**17-Nov-09**	**08-Dec-09**
Alkalinity	**mg/l CaCO3**							360												356								
Aluminium	**ug/l**	**200**	**200**	**150**																								
Ammonia	**mg/l N**	**0.23 mg/l**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	0.03	0.05	0.03	<0.03	0.13	0.06	0.03	0.04	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																										
Arsenic	**ug/l**		**10**	**7.5**																								
Barium	**ug/l**		**100**		<50	<50	<50	<50	<50	<50	<50	<50	57.2	66.5	<50		<50	<50	<50	<50	<50	<50	<50	52.9	58.56	<50	53.6	51.3
Beryllium	**ug/l**																											
B.O.D.	**mg/l O2**																											
Boron	**µg/l**	**1000**	**1000**	**750**				<50												<50								
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.4	0.6	0.5	0.3	0.3	1.1	0.5	0.4	0.2	<0.10	0.5	0.4	0.6	0.4	0.5	0.4	0.4	0.5	0.2	0.3	0.2	0.4	0.2	0.2
Calcium	**mg/l Ca**		**200**					135.57												130.2								
C.O.D.	**mg/l O2**																											
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	32	30	32	28	28	36	33	36	30	28	32	31	30	27	28	25	26	28	24	22	20	27	12	24
Chromium	**µg/l**	**50**	**30**	**37.5**	<1	<1	3.5	<1	2.4	11.4	<1	<1	<1	<1	<1	<1	4.5	3.5	1.5	2.9	3	7.4	6.4	6.4	5.5	2.7	7.1	6.5
Cobalt	**µg/l**																											
Coliform Bacteria	**(No/100 ml)**	**0**																										
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	816	840	929	725	716	824	765	760	752	709	812	796	808	778	791	769	776	801	697	673	651	766	684	715
Copper	**µg/l**	**2000**	**30**	**1500**				4												9.2								
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.01								
D.O.	**% Saturation**				50			45			34			47			42			44			nm	62		46		
E_Coli	**No/100 ml**	**0**						0																2				
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150								
Iron	**µg/l**	**200**	**200**		186	285	293.3	212.5	376.6	375.3	262.1	292.6	245.5	329.2	220.4	180.1	214	172	172.3	196	206.3	64.4	<50	<50	139.53	91.3	74.0	72.5
Lead	**µg/l**	**25**	**10**	**18.75**	<1	3	2.5	2.7	4.4	4.6	3.2	5	3.1	5.6	2.8	2	3.2	2.1	2	5.2	3.5	2.6	1.4	1.3	3.23	2.6	3.6	3.8
Magnesium	**mg/l Mg**		**50**					9.75												9.31								
Manganese	**µg/l**	**50**	**50**		27.1	91.3	76	58.2	70.9	255.4	119.1	93.4	40.6	70.8	66.4	30.7	71.1	22.4	33.3	39.5	31.8	47.4	16.7	23.8	39.44	51.3	18.8	26.4
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.1								
Molybdenum	**µg/l**		**35**																									
Nickel	**µg/l**	**20**	**20**	**15**	10.6	13.3	13.1	9	8.4	38.3	11.3	9.4	5.5	6.5	10.8	10.6	12.8	8.9	12.4	9.3	9.6	11.4	7.1	6.9	4.96	8.4	5.2	5.2
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.007	0.006	0.007	0.019	0.009	0.004	0.024	0.149	0.01	0.01	0.003	0.003	0.005	0.004	0.002	0.003	0.002	0.002	<0.002	0.007	<0.002	<0.002	<0.002	0.003
o-Phosphate	**mg/l P**		**30**					0.03									<0.02			0.04								
pH		**6.5 - 9.5**			6.9	6.9	7	7	7.2	6.9	7	7.2	7.1	7.2	6.9	7.1	7	7.1	6.9	7	7.1	7.4	7	7.1	7.3	6.9	7.2	7.0
Phenol	**mg/l**		**0.0005**		0.02	0.03	0.02	<0.01	<0.01	<0.01	nm	0.03	<0.01	0.03	<0.01		<0.01	<0.01	<0.016	<0.002	<0.002	<0.002	nm	<0.002	<0.015	<0.015	<0.0005	<0.015
Potassium	**mg/l**		**5**		6.33	6.6	6.72	4.92	4.04	6.59	5.34	5.72	3.83	3.41	6.76	6.24	6.94	4.81	6.08	4.81	5.62	6.69	4.45	3.68	3.29	6.32	4.85	4.46
Sampling Depth	**m**				25.1	24.6	24.3	24.4	24.1	23.4	24	24.4	24.8	nm	24.8	24.3	24.1	22.9	22	23.1	25.1	24.1	24	24	24.1	23.4	22.4	nm
Selenium	**µg/l**	**10**																										
Silver	**µg/l**																											
Sodium	**mg/l**	**200**	**150**	**150**	19.57	18.82	20.98	16.44	14.21	18.55	16.52	17.76	16.69	16.28	17.81	18.34	19.26	16.11	17.38	15.63	16.53	13.94	14.6	13.76	13.34	16.39	16.61	13.68
Strontium	**µg/l**																											
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				20.9												20.4								
Suspended Solids	**mg/l**																											
Temp	**°C**				9	11	11	12	nm	15.6	15.5	14	13	8.3		10	7	12	11	15	13	13	16	14.6	11	10.3	10.0	10.1
Thallium	**µg/l**																											
Time sampled					nt	11.35	11.3	11.3	11.15	11.15	11.1	11.25	11.35	11	11.3	10.55	11.3	13.15	11.3	11.15	11.2	11.2	11	10.45	11.15	11.00	9.35	11.15
Tin (µg/l)	**µg/l**																											
T.O.C.	**mg/l**	**NAC**			1.7			2.9			1.7			<1.5			2.8			2.2			<3.0			<3.0		
T.O.N	**mg/l N**		**NAC**		4.7	4.88	4.46	3.38	3.31	5.56	4.3	4.01	2.7	2.27	5.1	4.31	4.79	3.27	3.51	2.99	4.28	4.09	2.94	2.95	2.21	3.81	2.95	2.74
Total S Solids	**mg/l**																											
Uranium	**µg/l**																											
Vanadium	**µg/l**																											
Zinc	**µg/l**		**100**		30.2	29	29.8	25.3	6.8	59.4	23.4	29.3	27.1	50.9	23.6	29.7	37.4	43.7	30.5	32.6	28.5	23.3	20.2	15.3	112.21	19.8	22.6	26.9

BOREHOLE BH1A																									
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	**13-Jan-10**	**23-Feb-10**	**23-Mar-10**	**27-Apr-10**	**18-May-10**	**15-Jun-10**	**27-Jul-10**	**24-Aug-10**	**21-Sep-10**	**19-Oct-10**	**30-Nov-10**	**21-Dec-10**	**11-Jan-11**	**15-Feb-11**	**29-Mar-11**	**12-Apr-11**	**10-May-11**	**14-Jun-11**	**12-Jul-11**	**09-Aug-11**	**06-Sep-11**	**04-Oct-11**	**08-Nov-11**	**13-Dec-11**
Alkalinity	**mg/l CaCO3**							336												332								
Aluminium	**ug/l**	**200**	**200**	**150**																								
Ammonia	**mg/l N**	**0.23 mg/l**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																										
Arsenic	**ug/l**		**10**	**7.5**																								
Barium	**ug/l**		**100**		39.3	39.1	51.5	34	16.9	21.4	35.8	23.6	36.0	32.1	77.7	57.6	45.7	26.8	52.7	39.4	25	32.1	21.6	18.8	20.7	22	25.2	
Beryllium	**ug/l**																											
B.O.D.	**mg/l O2**																											
Boron	**µg/l**	**1000**	**1000**	**750**				30.3												24.3								
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.5	0.3	0.2	0.4	0.4	0.2	0.3	0.4	0.2	0.4	<1	<1	<1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.5	0.3	0.1	
Calcium	**mg/l Ca**		**200**					126.65												148.12								
C.O.D.	**mg/l O2**																											
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	27	21	26	28	30	28	27	29	26	29	38	19	22	28	22	25	28	42	51	38	37	34	27	19
Chromium	**µg/l**	**50**	**30**	**37.5**	<1	1.5	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	0.6	<5	<5	<5	2.2	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	
Cobalt	**µg/l**																											
Coliform Bacteria	**(No/100 ml)**	**0**																										
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	744	713	670	749	805	2970	745	799		783	589	613	686	784	644	2190	765	685	832	834	822	891	899	638
Copper	**µg/l**	**2000**	**30**	**1500**				4												2.1								
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05								
D.O.	**% Saturation**				74			32			51			34			70			58			24					
E_ Coli	**No/100 ml**	**0**						0												nm								
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150								
Iron	**µg/l**	**200**	**200**		54.6	36.2	127.4	30.1	62.8	66.6	91.3	55.2	52.0	31.5	409.9	<100	<100	<10	77.8	76.1	51.6	23.8	15.6	<10	<10	<10	<10	
Lead	**µg/l**	**25**	**10**	**18.75**	2.5	1.4	5.4	1.9	1.3	1.9	14.4	1.5	1.8	0.8	10.6	<5	<5	<0.5	1.8	2.4	1.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Magnesium	**mg/l Mg**		**50**					8.4												11.08								
Manganese	**µg/l**	**50**	**50**		42	16.9	42.1	27.8	27.2	34.4	79.9	69.0	46.4	81.4	203.9	18.3	19.6	4.2	52.4	65.3	23.7	31.2	14.1	12.9	22.6	10.1	5.8	
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.1												<0.05								
Molybdenum	**µg/l**		**35**																									
Nickel	**µg/l**	**20**	**20**	**15**	9.2	8.5	7.1	8.1	9.3	6.9	3.8	8.2	4.5	9.0	5.2	<5	5.4	5.4	0.9	5	4.2	4.3	7.2	5.7	9.7	6.6	0.9	
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.002	<0.002	<0.002	0.004	0.002	<0.002	0.002	<0.002	<0.002	<0.002	nm	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
o-Phosphate	**mg/l P**		**30**					0.02												0.02								
pH		**6.5 - 9.5**			7	7	7.3	7	7	7.1	7.1	7.0		7.1	7.4	7.2	7.1	7.4	7.0	7.1	7	7.2	7	7.2	7.1	7.1	7.3	7.3
Phenol	**mg/l**		**0.0005**		<0.015	<0.015	<0.015	<0.015	<0.2	<0.1	<0.025	<0.015	<0.015	<0.025	<0.015	<0.025	<0.025	<0.025	<0.01	<0.013	<0.013	<0.008	<0.008	<0.016	<0.016	<0.016	<0.025	
Potassium	**mg/l**		**5**		5.37	5.87	5.09	6.1	6.07	6.03	7.25	6.42	4.59	6.91	2.83	3.23	4.32	5.45	3.90	6.07	5.42	4.48	6.54	7.83	8.4	8.56	6	
Sampling Depth	**m**				18	17.5	18.1	nm	20.5	20.6	21.5	23.1	22.5	nm	22.4	22.1	18.0	22.5	19.0	19.1	17.2	23.7	23.9	22.1	27.3	26.7	23.3	21.9
Selenium	**µg/l**	**10**																										
Silver	**µg/l**																											
Sodium	**mg/l**	**200**	**150**	**150**	14.03	14.66	16.34	15.96	15.04	16.91	12.97	16.21	15.21	18.62	12.98	12.38	13.86	15.24	14.10	17.54	16.21	13.68	14.78	16.05	18.23	19.19	15.68	
Strontium	**µg/l**																											
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				22.8												21.1								
Suspended Solids	**mg/l**																											
Temp	**°C**				6.8	9.4	11	15.5	12	12	21.0	12.2	16.0	11.3	9.7	9.7	8.9	11.2	11.5	14.8	15	13.3	12.8	13	13.9	14	12.4	11.5
Thallium	**µg/l**																											
Time sampled					11.1	11.2	11.15	11.2	11.1	11.15	10.35	11.15	11.45	nt	14:35	10:35	11.30	11:15	11:05	11:05	11:15	11:15	11:25	13:50	13:15	11:20	12:10	14:00
Tin (µg/l)	**µg/l**																											
T.O.C.	**mg/l**	**NAC**			4.6			<1.5			1.5			83.0			2.4			71			3.4					
T.O.N	**mg/l N**		**NAC**		3.09	2.67	2.84	4.05	4.2	3.89	3.56	4.19	3.19	3.84	1.70	1.95	2.86	3.90	2.55	4.7	3.7	2.86	3.67	3.95	3.77	3.28	3.29	1.69
Total S Solids	**mg/l**																											
Uranium	**µg/l**																											
Vanadium	**µg/l**																											
Zinc	**µg/l**		**100**		27.2	23.3	34.1	23.6	21.3	13.9	16.1	16.0	13.9	17.7	52.8	32.2	63.1	15.7	15.9	28	16.1	69	13.7	11.1	21.2	16.9	14.6	

BOREHOLE BH1A																									
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	**17-Jan-12**	**07-Feb-12**	**13-Mar-12**	**24-Apr-12**	**15-May-12**	**07-Jun-12**	**24-Jul-12**	**14-Aug-12**	**11-Sep-12**	**09-Oct-12**	**06-Nov-12**	**11-Dec-12**	**31-Jan-13**	**12-Feb-13**	**26-Mar-13**	**16-Apr-13**	**08-May-13**	**11-Jun-13**	**23-Jul-13**	**07-Aug-13**	**17-Sep-13**	**08-Oct-13**	**19-Nov-13**	**03-Dec-13**
Alkalinity	**mg/l CaCO3**							320												344								
Aluminium	**ug/l**	**200**	**200**	**150**				<5	<5	5.6	<5	<5	<5	<5	<5	<5	<5	55		<5	<5	113.7	<5	<5	<5	<5	<10	<10
Ammonia	**mg/l N**	**0.23 mg/l**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	0.12	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	0.03	0.035	0.02
Antimony	**ug/l**	**5**						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.55	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
Arsenic	**ug/l**		**10**	**7.5**				1.16	2.55	2.4	1.85	1.61	1.92	2.16	2.76	0.89	0.6	1.24		2.29	1.27	1.12	1.58	2.42	1.95	1.5	2.14	3.24
Barium	**ug/l**		**100**		34.2	26.2	14.9	24.7	43.6	40.8	32.6	68.6	61.4	49	36.2	63.4	84.2	75		26.5	17.8	66.1	33.3	18.4	19.9	19.1	46.8	29.7
Beryllium	**ug/l**							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
B.O.D.	**mg/l O2**																											
Boron	**µg/l**	**1000**	**1000**	**750**	21.4	25.8	25.3	21.7	16.4	18	22.1	17.8	16.2	21.8	21.5	15.5	11.7	14.3		20	21.3	17	26.8	22.8	21.6	22.4	21.6	27.6
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.1	<0.1	0.1	0.3	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.1	0.1
Calcium	**mg/l Ca**		**200**		111.28	126.48	132.28	144.66	106.88	113.97	132.43	92.43	96.8	112.86	117.5	78.15	81.1	85.97		131.99	136.73	114.28	135.45	139.73	138.33	147.88	102.77	104.95
C.O.D.	**mg/l O2**																											
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	23	26	30	32	21	21	26	17	20	21	22	15	13	16	14	27	29	19	25	30	39	39	26	28
Chromium	**µg/l**	**50**	**30**	**37.5**	<0.5	1.6	0.7	<0.5	0.9	0.9	<0.5	<0.5	0.5	1.2	1.5	<0.5	<0.5	0.9		1.6	1.4	0.7	1.5	0.9	1	1.7	1.3	3.9
Cobalt	**µg/l**							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<1	<1
Coliform Bacteria	**(No/100 ml)**	**0**						248												21								
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	736	711	792	808	591	677	787	619	617	676	738	561	508	546	422	761	819	636	752	820	849	860	650	704
Copper	**µg/l**	**2000**	**30**	**1500**	1.2	1	2.6	3.9	1.2	1.3	2.8	2.5	1.2	1	0.9	0.9	1.1	1.8		2.2	4.9	6.5	3.9	4.5	3.5	5.1	2	2
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05								
D.O.	**% Saturation**				60			21			39			56			51			32			28			30		
E_ Coli	**No/100 ml**	**0**						20												0								
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150								
Iron	**µg/l**	**200**	**200**		<10	<10	15.5	<10	<10	16	<10	<10	<10	<10	<10	<10	<10	101.3		11.4	<10	256.8	21.9	<10	20	<10	<10	<10
Lead	**µg/l**	**25**	**10**	**18.75**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.4		<0.5	<0.5	5.2	<0.5	<0.5	<0.5	<0.5	<1	<1
Magnesium	**mg/l Mg**		**50**		9.18	10.23	8.91	9.5	9.62	8.96	10.28	8.74	9.29	10.47	9.7	9.28	8.92	9.17		10.32	9.08	10.47	10.27	9.82	9.14	9.27	9.99	9.41
Manganese	**µg/l**	**50**	**50**		3.8	2.4	1.8	5.8	2	4	3.8	8.8	3.4	5.6	1.7	1.5	4.6	32.2		3.2	1.2	208.4	3	1.5	1.9	1.5	<5	<5
Mercury	**µg/l**	**1**	**1**	**0.75**	nm	nm	nm	<0.05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		<0.05	nm	nm	nm	nm	nm	nm	nm	nm
Molybdenum	**µg/l**		**35**					<0.5	0.9	0.7	<0.5	0.8	0.5	0.8	0.9	<0.5	<0.5	<0.5		0.5	<0.5	<0.5	1.4	<0.5	<0.5	<0.5	<1	<1
Nickel	**µg/l**	**20**	**20**	**15**	1.3	0.7	3.5	4.8	1.1	0.5	3.4	1	1	<0.5	<0.5	<0.5	<0.5	1.8		5.1	7.4	5.8	2.8	4.6	4.3	6.3	1.4	1.9
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	0.002	0.004	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.004
o-Phosphate	**mg/l P**		**30**					0.05												0.07								
pH		**6.5 - 9.5**			7.3	7.3	7.2	7	7.2	7.4	7	7.3	7.1	7.4	6.8	7	6.1	7.4	7.4	7.1	7.2	7.3	7.2	7.4	7.1	7.1	7.3	7.1
Phenol	**mg/l**		**0.0005**		<0.002	<0.002	<0.002	<0.025	<0.002	<0.025	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Potassium	**mg/l**		**5**		4.15	4.4	6.05	6.99	3.36	3.43	5.29	2.27	2.21	3.59	3.91	1.62	1.14	1.81		5.68	6.41	3.4	5.31		7	7.72	3.84	4.47
Sampling Depth	**m**				20	20.7	19.9	20	22.5	20	19.9	20.3	20.3	20.6	20.1	19.9	17.6	15.1	15.7	19.9	21.4	20.9	22.8	23.2	24.1	22.6	22.9	22
Selenium	**µg/l**	**10**						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5		<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<1	<1
Silver	**µg/l**							0.8	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		nm								
Sodium	**mg/l**	**200**	**150**	**150**	14.7	15.25	16.71	16.98	13.33	13	15.31	11.25	12.24	15.27	14.69	10.2	8.98	10.52		16.14	16.21	12.88	15.21	16.53	17.7	18.69	15.72	15.19
Strontium	**µg/l**							204.35	194.49	202.79	211.39	193.82	195.48	188.73	202.12	166.96	189.6	196.78		209.45	200.11	220.4	210.61	218.41	199.58	212.03	189.86	189.2
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				26.2												22.4								
Suspended Solids	**mg/l**																											
Temp	**°C**				10.8	11.4	11.7	13.1	13.4	12.6	16.1	16.4	11.7	16.3	9.8	10.1	9.1	8.3	7.2	10.7	11.5	11.3	21.3	14.2	10.7	13.4	8.2	8.1
Thallium	**µg/l**							0.45	0.17	0.17	0.32	0.16	0.14	0.17	0.22	<0.1	<0.1	<0.1		0.3	0.34	0.2	0.27	0.33	0.4	0.45	<1	<1
Time sampled					12:30	12:45	13:00	11:00	12:15	13:55	12:40	13:30	12:00	10:50	13:15	13:10	11:00	13:25	13:50	10:20	13:20	12:55	10:50	13:10	13:30	10:50	10:35	13:35
Tin (µg/l)	**µg/l**							<1	<1	<1	<1	<1	<1	<1	<1	<1	nm	nm		nm								
T.O.C.	**mg/l**	**NAC**			72.5			<1.5			nm			2.3			62.8			<1.5			<1.5			2.1		
T.O.N	**mg/l N**		**NAC**		2.14	2.55	3.12	3.37	1.77	2.09	2.55	0.98	1.21	1.84	2.35	0.73	0.33	0.99	0.45	2.82	2.9	1.47	2.27	3.11	2.73	2.83	1.5	2.2
Total S Solids	**mg/l**																											
Uranium	**µg/l**							10.79	18.16	18.24	16.01	10.99	11.64	17.38	22.53	6.74	3.79	9.14		20.52	14.34	9.42	15.06	21.38	14.94	12.51	17.88	26.88
Vanadium	**µg/l**							1.54	3.83	3.28	2.92	2.13	2.3	3.26	3.91	0.97	1.06	1.91		2.8	1.67	1.75	2.5	3.48	2.78	1.83	3.5	5.55
Zinc	**µg/l**		**100**		22	17.4	11.2	13.9	11.8	19	19	25	19.2	14.9	15.6	21.4	20.5	25		20.4	20.5	23.9	23.6	13.3	11.4	13.6	15.2	15.1

BOREHOLE BH2A																													
Date Collected		DWR	IGV	2010 GW Regs	######	28-Feb-06	21-Mar-06	25-Apr-06	30-May-06	27-Jun-06	25-Jul-06	24-Aug-06	26-Sep-06	19-Oct-06	28-Nov-06	19-Dec-06	16-Jan-07	27-Feb-07	21-Mar-07	17-Apr-07	24-May-07	27-Jun-07	31-Jul-07	28-Aug-07	26-Sep-07	24-Oct-07	28-Nov-07	18-Dec-07
Alkalinity	mg/l CaCO3							336												368									
Aluminium	ug/l	200	200	150																									
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.03	<0.03	0.03	0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	0.06	0.09	0.06	<0.03	<0.03	<0.03	0.06	
Antimony	ug/l	5																											
Arsenic	ug/l		10	7.5																									
Barium	ug/l		100		60.5			62.7			<50			67.3	68.6		57.5			65.5		69.4	61.4			64.5			
Beryllium	ug/l																												
B.O.D.	mg/l O2																												
Boron	µg/l	1000	1000	750				<50												<50									
Cadmium	µg/l	5	5	3.75	<0.10			<0.10			<0.10			<0.10	<0.10		<0.10			<0.10		<0.10	<0.10			<0.10			
Calcium	mg/l Ca		200					126.24												121.02									
C.O.D.	mg/l O2																												
Chloride	mg/l Cl	250	30	187.5	15			14			19			14	10		14			19		12	12			13			
Chromium	µg/l	50	30	37.5	11.1			7.9			3.7			<1	4.2		5.6			<1		<1	<1			2.5			
Cobalt	µg/l																												
Coliform Bacteria	(No/100 ml)	0																											
Conductivity	µS/cm @ 25	2500	1000	1875	690	710	720	708	687	696	742	758	766	715	704	707	731	725	748	790	833	645	644	668	676	700	826	737	
Copper	µg/l	2000	30	1500				4.8												2.6									
Cyanide	mg/l	0.05	10					<0.05												<0.05									
D.O.	% Saturation				67			70			58			55			52			55			74			46			
E_Coli	No/100 ml	0						0																					
Fluoride	mg/l	0.8	1000					<0.150												<0.150									
Iron	µg/l	200	200		159.3			228.7			213.2			197.3	137.4		232.6			267.3		243.2	227.1			242.6			
Lead	µg/l	25	10	18.75	5.8			5.6			5.3			3.9	3.7		2.7			2.2		3.0	3.0			2.6			
Magnesium	mg/l Mg		50					10.5												9.35									
Manganese	µg/l	50	50		54.3			39.1			40.4			58.7	44.5		39.8			17.7		41.9	28.1			17.6			
Mercury	µg/l	1	1	0.75				<0.10												<0.10									
Molybdenum	µg/l		35																										
Nickel	µg/l	20	20	15	4.1			2.6			2.9			3.6	<1		<1			6.6		3.3	2.5			<1			
Nitrite	mg/l N	0.5	0.1	0.375	0.009			0.004			0.004			0.004	<0.003		0.005			0.005		nm	0.015			0.007			
o-Phosphate	mg/l P		30					0.04												<0.02									
pH		6.5 - 9.5			7.3	7.1	7	7.4	7.1	7.1	7.3	7.2	7.3	7.3	7	7.2	7.3	7.0	7.0	7.2	6.9	7.0	7.2	7.0	7.0	7.1	7.1	7.2	
Phenol	mg/l		0.0005		0.019			<0.001			<0.001			0.016			0.064			<0.001			<0.01			<0.01			
Potassium	mg/l		5		2.57			2.84			2.93			2.7	2.68		2.46			2.65		2.34	2.47			2.72			
Sampling Depth	m				25.1	24.2	23.9	24.1	28.8	26.5	24.1	23.9	24.4	24	24	24.4	24.0	28.4	25.1	28.1	23.6	23.9	22.5	26.2	26.5	24.1	25.2	27.6	
Selenium	µg/l	10																											
Silver	µg/l																												
Sodium	mg/l	200	150	150	10.31			10.99			15.99			13.36	11.32		13.84			17.68		7.86	8.66			10.67			
Strontium	µg/l																												
Sulphate	mg/l SO4	250	200	187.5				18.5												28.2									
Suspended Solid	mg/l																												
Temp	°C				9.4	7	7	12.5	13	14	20.3	14	12	13.8	10	9	9.4	12.0	10.0	15.2	14.0	16.0	18.7	14.0	9.0	12.3	12	11	
Thallium	µg/l																												
Time sampled								11.4	11.55	11.55	12.15	11.5	11.55	11.4	11.45	11.45	11.40	11.45	11.45	11.50	11.45	11.20	11.30	11.45	11.50	11.40	10.2	12.15	
Tin (µg/l)	µg/l																												
T.O.C.	mg/l	NAC			150.4			4.1			3.5			3.5	3.2		2.2			2.8			2.00			3.5			
T.O.N	mg/l N		NAC		1.37			1.42			2.64			2.5	1.44		2.70			4.87		1.57				2.39			
Total S Solids	mg/l																												
Uranium	µg/l																												
Vanadium	µg/l																												
Zinc	µg/l		100		18			11.7			8.4			14.7	7.7		10.4			5.0		7.6	4.2	<1		12.2			

BOREHOLE BH2A																													
Date Collected		DWR	IGV	2010 GW Regs	######	26-Feb-08	19-Mar-08	29-Apr-08	27-May-08	26-Jun-08	31-Jul-08	27-Aug-08	30-Sep-08	30-Oct-08	26-Nov-08	16-Dec-08	20-Jan-09	24-Feb-09	24-Mar-09	28-Apr-09	26-May-09	23-Jun-09	21-Jul-09	18-Aug-09	29-Sep-09	20-Oct-09	17-Nov-09	08-Dec-09
Alkalinity	mg/l CaCO3							368												364									
Aluminium	ug/l	200	200	150																									
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.04	0.04	<0.03	<0.03	0.04	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	10.52	
Antimony	ug/l	5																											
Arsenic	ug/l		10	7.5																									
Barium	ug/l		100		65			58.8			63.7			65.6			65.9			58.9			59.4			57.6			
Beryllium	ug/l																												
B.O.D.	mg/l O2																												
Boron	µg/l	1000	1000	750				<50												<50									
Cadmium	µg/l	5	5	3.75	<0.10			<0.10			<0.10			<0.10			<0.10			0.2			<0.1			<0.1			
Calcium	mg/l Ca		200					140.69												133.02									
C.O.D.	mg/l O2																												
Chloride	mg/l Cl	250	30	187.5	17			18			20			18			19			18			12			11			
Chromium	µg/l	50	30	37.5	3			<1			<1			<1			4.4			3.1			7.1			1.1			
Cobalt	µg/l																												
Coliform Bacteria	(No/100 ml)	0																											
Conductivity	µS/cm @ 25	2500	1000	1875	654	651	652	691	726	760	752	727	740	737	754	742	762	774	776	763	704	661	649	670	638	662	627	1028	
Copper	µg/l	2000	30	1500				3.2												2.6									
Cyanide	mg/l	0.05	10					<0.05												<0.01									
D.O.	% Saturation				70			58			48			39			41			49			nm	46		49			
E_Coli	No/100 ml	0						1																6					
Fluoride	mg/l	0.8	1000					<0.150												<0.150									
Iron	µg/l	200	200		165			192			160.9			157.3			399.9			173.3			51			<50			
Lead	µg/l	25	10	18.75	<1			3.6			2.3			<1			9.2			3.5			1.7			<1			
Magnesium	mg/l Mg		50					10.77												10.37									
Manganese	µg/l	50	50		7.5			35.5			37.5			7.5			106			46.4			21.5			2.4			
Mercury	µg/l	1	1	0.75				<0.10												<0.1									
Molybdenum	µg/l		35																										
Nickel	µg/l	20	20	15	<1			<1			<1			<1			3.2			2.2			1.9			1.9			
Nitrite	mg/l N	0.5	0.1	0.375	0.008			0.007			0.008			0.003			<0.002			<0.002			<0.002			<0.002			
o-Phosphate	mg/l P		30					0.04									<0.02			0.03									
pH		6.5 - 9.5			7	7.1	7.1	7	7	6.9	7	7	7	7	7	7.1	7	7.1	7.3	7.1	7.1	7.6	7.1	7.1	7.1	7.0	7.1	7.0	
Phenol	mg/l		0.0005		0.03			<0.01			0.01			0.03			<0.01			<0.002			<0.025			<0.015			
Potassium	mg/l		5		2.82			2.88			2.72			2.8			3.01			2.76			2.48			2.85			
Sampling Depth	m				24.2	24.3	25.4	24.2	24.8	14.9	29.9	24.7	24.2	nm	22.8	22.8	22.8	23.9	24	22.9	24.8	24.3	24	25	24.2	23.8	24.1	nm	
Selenium	µg/l	10																											
Silver	µg/l																												
Sodium	mg/l	200	150	150	10.35			11.08			11.49			10.89			17.54			15.65			9.94			9.95			
Strontium	µg/l																												
Sulphate	mg/l SO4	250	200	187.5				21.5												25.5									
Suspended Solid	mg/l																												
Temp	°C				9	11	12	12	nm	14.8	15.6	15	13	8.6	11	11	6.7	13	10	15	13	14	15.5	13.7	12	10.4	10.5	10.3	
Thallium	µg/l																												
Time sampled					nt	11.5	11.5	11.5	11.35	11.4	11.35	11.45	11.5	11.2	11.45	11.2	11.45	13.35	11.45	11.35	11.3	11.5	11.2	11.15	11.3	11.15	9.55	11.40	
Tin (µg/l)	µg/l																												
T.O.C.	mg/l	NAC			4.4			2.9			2.7			2.5			3.6			2.9			6.8			8.4			
T.O.N	mg/l N		NAC		1.42			2.22			3.02			2.52			4.22			2.91			0.91			0.75			
Total S Solids	mg/l																												
Uranium	µg/l																												
Vanadium	µg/l																												
Zinc	µg/l		100		6.6			9.7			8.8			12.5			17.5			11.8			9			11.1			

BOREHOLE BH2A																														
Date Collected		DWR	IGV	2010 GW Regs	######	23-Feb-10	23-Mar-10	27-Apr-10	18-May-10	15-Jun-10	27-Jul-10	24-Aug-10	21-Sep-10	19-Oct-10	30-Nov-10	21-Dec-10	11-Jan-11	15-Feb-11	29-Mar-11	12-Apr-11	10-May-11	14-Jun-11	12-Jul-11	09-Aug-11	06-Sep-11	04-Oct-11	08-Nov-11	13-Dec-11
Alkalinity	mg/l CaCO3							286												333										
Aluminium	ug/l	200	200	150																										
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																												
Arsenic	ug/l		10	7.5																										
Barium	ug/l		100		54.9			54.4			60.0			65.7				57.2		58.5			58.1			54.8				
Beryllium	ug/l																													
B.O.D.	mg/l O2																													
Boron	µg/l	1000	1000	750				26.7												36.8										
Cadmium	µg/l	5	5	3.75	<0.1			<0.1			0.1			0.1				<1		<0.1			<0.1			<0.1				
Calcium	mg/l Ca		200					106.81												157.1										
C.O.D.	mg/l O2																													
Chloride	mg/l Cl	250	30	187.5	16			15			13			14				17		17			16			16				
Chromium	µg/l	50	30	37.5	<1			<1			<0.5			0.6				<5		<0.5			<0.5			<0.5				
Cobalt	µg/l																													
Coliform Bacteria	(No/100 ml)	0																												
Conductivity	µS/cm @ 25	2500	1000	1875	602	638	652	605	646	652	652	656		664	611	611	691	647	622	989	760	648	693	697	695	739	855	782		
Copper	µg/l	2000	30	1500				3.4												1.3										
Cyanide	mg/l	0.05	10					<0.05												<0.05										
D.O.	% Saturation				90			75			70			55				81		65			54			46				
E_Coli	No/100 ml	0						2												nm										
Fluoride	mg/l	0.8	1000					<0.150												<0.150										
Iron	µg/l	200	200		<50			66.1			74.3			33.8				<100		<10			16.9			<10				
Lead	µg/l	25	10	18.75	1.4			2.9			6.6			1.7				<5		<0.5			<0.5			<0.5				
Magnesium	mg/l Mg		50					9.11												14.31										
Manganese	µg/l	50	50		7.7			27.8			29.0			25.9				<10		<1			1.7			2.4				
Mercury	µg/l	1	1	0.75				<0.1												<0.05										
Molybdenum	µg/l		35																											
Nickel	µg/l	20	20	15	1.7			1.3			<0.5			1.3				<5		1.2			<0.5			<0.5				
Nitrite	mg/l N	0.5	0.1	0.375	<0.002			<0.002			<0.002			<0.002				<0.002		<0.002			<0.002			<0.002				
o-Phosphate	mg/l P		30					0.02												0.02										
pH		6.5 - 9.5			7.3	7.1	7.2	7.1	7.2	7	7.0	7.1		7.0	7.3	7.2	7.1	7.6	7.3	7	7.2	7.1	7.1	7.4	7.3	7.2	7.3	7.2		
Phenol	mg/l		0.0005		<0.015			<0.015			<0.025			<0.025				<0.025		<0.013			<0.008			<0.016				
Potassium	mg/l		5		2.38			2.59			4.09			3.01				2.72		3.54			2.4			3.1				
Sampling Depth	m				19.1	19.5	19.2	nm	21.6	21.7	23.0	22.6	23.6	nm	23.6	24.2	20.5	17.9	23.0	21	18.3	24.7	24.9	23.1	26.4	30.4	24	23.3		
Selenium	µg/l	10																												
Silver	µg/l																													
Sodium	mg/l	200	150	150	7.54			9.56			8.12			10.89				9.57		12.81			8.77			12.23				
Strontium	µg/l																													
Sulphate	mg/l SO4	250	200	187.5				13.4												17.4										
Suspended Solid	mg/l																													
Temp	°C				7.3	9.8	11	15.7	13	12.3	21.0	12.7	16.4	11.1	9.6	9.4	11.0	9.1	11.0	14.1	14	13.4	13	13	14.1	14.1	12.3	11.4		
Thallium	µg/l																													
Time sampled					11.25	11.4	11.35	11.45	11.25	11.35	10.55	11.35	12.05	nt	15:10	10:55	11:25	11.45	11:40	11:30	11:40	11:45	11:45	14:10	13:30	11:40	12:30	14:20		
Tin (µg/l)	µg/l																													
T.O.C.	mg/l	NAC			9			5.8			4.8			81.3				5.9		78.3			4.6			87.3				
T.O.N	mg/l N		NAC		0.36			0.99			1.40			1.80				0.83		2.58			2.45			2.09				
Total S Solids	mg/l																													
Uranium	µg/l																													
Vanadium	µg/l																													
Zinc	µg/l		100		9.6			9.1			7.3			9.4				28.0		2.8			9.4			9.8				

BOREHOLE BH2A																														
Date Collected		DWR	IGV	2010 GW Regs	######	07-Feb-12	13-Mar-12	24-Apr-12	15-May-12	07-Jun-12	24-Jul-12	14-Aug-12	11-Sep-12	09-Oct-12	06-Nov-12	11-Dec-12	31-Jan-13	12-Feb-13	26-Mar-13	16-Apr-13	08-May-13	11-Jun-13	23-Jul-13	07-Aug-13	17-Sep-13	08-Oct-13	19-Nov-13	03-Dec-13
Alkalinity	mg/l CaCO3							348												348										
Aluminium	ug/l	200	200	150				<5			5.9			<5			<5			5.5			5.1			<5				
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	<0.03	<0.03	0.03	<0.03	<0.03	0.03	<0.03	0.04	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.020	<0.020		
Antimony	ug/l	5						<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5				
Arsenic	ug/l		10	7.5				0.59			0.51			0.64			0.51			0.6			<0.5			<0.5				
Barium	ug/l		100		60.9			57.3			56.5			59.6			69.8			63			64.2			62.9				
Beryllium	ug/l							<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5				
B.O.D.	mg/l O2																													
Boron	µg/l	1000	1000	750	27.6			22.2			21.6			25.8			19.3			28.5			30.3			33.1				
Cadmium	µg/l	5	5	3.75	<0.1			<0.1			<0.1			<0.1			<0.1			<0.1			<0.1			<0.1				
Calcium	mg/l Ca		200		124.18			109.38			116.31			127.44			118.55			124.92			128.86			128.36				
C.O.D.	mg/l O2																													
Chloride	mg/l Cl	250	30	187.5	15			16			11			12			12			14			16			16				
Chromium	µg/l	50	30	37.5	<0.5			<0.5			<0.5			1.5			<0.5			1.5			1.4			1.4				
Cobalt	µg/l							<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5				
Coliform Bacteria	(No/100 ml)	0						>2420												10										
Conductivity	µS/cm @ 25	2500	1000	1875	783	705	698	690	633	702	675	668	689	723	720	671	675	694	691	707	724	722	719	726	730	728	738	735		
Copper	µg/l	2000	30	1500	2.8			2			3			2.9			2.8			5.3			1.6			1.8				
Cyanide	mg/l	0.05	10					<0.05												<0.05										
D.O.	% Saturation				54			48			65			50			39			47			36			98				
E_Coli	No/100 ml	0						345												0										
Fluoride	mg/l	0.8	1000					<0.150												<0.150										
Iron	µg/l	200	200		<10			<10			14.7			<10			<10			20			<10			<10				
Lead	µg/l	25	10	18.75	0.6			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5				
Magnesium	mg/l Mg		50		11.41			10.59			10.96			12.09			10.03			11.3			11.42			11.27				
Manganese	µg/l	50	50		7			3.9			5.5			5.6			2.3			2.6			3.2			<1				
Mercury	µg/l	1	1	0.75	nm			<0.05			nm			nm			nm			<0.05			nm			nm				
Molybdenum	µg/l		35					<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5				
Nickel	µg/l	20	20	15	2.3			<0.5			1			<0.5			<0.5			2.9			<0.5			1				
Nitrite	mg/l N	0.5	0.1	0.375	<0.002			<0.002			<0.002			<0.002			<0.002			<0.002			<0.002			<0.002				
o-Phosphate	mg/l P		30					0.04												0.04										
pH		6.5 - 9.5			7.2	7.2	7.2	7.2	7.1	7.2	7.2	7.1	7	7.1	6.9	7.1	7	7.2	7.1	7.1	7.1	7.1	7.1	7.2	7.2	7.1	7.2	7.2		
Phenol	mg/l		0.0005		<0.002			<0.025			<0.002			<0.002			<0.002			<0.002			<0.002			<0.002				
Potassium	mg/l		5		3.11			2.65			2.4			3.19			2.51			3.06			3.23			3.44				
Sampling Depth	m				21	20.9	21	21.2	22	21.4	19.8	20.2	20.2	20.1	20	20	17.8	15.9	15.6	19.4	21	21.7	22.7	24.5	25	14.2	14.9	22.4		
Selenium	µg/l	10						<0.5			<0.5			<0.5			<0.5			0.7			0.7			<0.5				
Silver	µg/l							<0.5			nm			nm			nm			nm										
Sodium	mg/l	200	150	150	12.6			10.39			9.27			11.6			8.92			10.64			11.19			11.83				
Strontium	µg/l							202.28			199.86			199.22			199.05			213.84			219.43			228.56				
Sulphate	mg/l SO4	250	200	187.5				15.6												15.8										
Suspended Solid	mg/l																													
Temp	°C				10.4	11.4	11.6	12.9	12.7	12.6	16	17	11.8	16	10.7	10	9.4	7.4	6	11	11.5	11.3	21.4	14.5	10.5	15.2	9.2	nm		
Thallium	µg/l							<0.1			<0.1			<0.1			<0.1			0.11			<0.1			0.11				
Time sampled					12:50	13:00	12:40	0.46875	0.5243056	0.5590278	12:15	13:50	12:15	11:10	13:00	12:55	11:25	13:10	13:25	10:55	13:00	12:40	11:15	12:50	13:05	11:20	10:50	13:15		
Tin (µg/l)	µg/l							<1			<1			<1			nm			nm										
T.O.C.	mg/l	NAC			82.8			64.6			5.9			5.3			85.9			3.4			3.9			4.1				
T.O.N	mg/l N		NAC		1.87			1.59			0.48			1.01			0.73			1.74			2			2.13				
Total S Solids	mg/l																													
Uranium	µg/l							0.98			0.94			0.98			0.94			1.06			0.99			1.07				
Vanadium	µg/l							<0.5			0.61			0.78			0.75			<0.5			0.55			0.75				
Zinc	µg/l		100		17.5			8.8			10.6			5.8			9.6			7.4			6.4			7.6				

BOREHOLE BH3A																										
Date Collected		DWR	IGV	2010 GW Regs	24-Jan-06	28-Feb-06	21-Mar-06	25-Apr-06	30-May-06	27-Jun-06	25-Jul-06	24-Aug-06	26-Sep-06	19-Oct-06	28-Nov-06	19-Dec-06	16-Jan-07	27-Feb-07	21-Mar-07	17-Apr-07	24-May-07	27-Jun-07	31-Jul-07	28-Aug-07	26-Sep-07	24-Oct-07	28-Nov-07	18-Dec-07
Alkalinity	mg/l CaCO3							420												232								
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175			<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	0.06	0.04	0.07	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100					70			<50			57.8	50.4		<50			<50		56.5	<50			<50		
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				77.6												160.8								
Cadmium	µg/l	5	5	3.75				<0.10			<0.10			<0.10	<0.10		<0.10			0.2		<0.10	<0.10			<0.10		
Calcium	mg/l Ca		200					160.68												108.01								
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5				58			37			41	34		30			30		32	30			34		
Chromium	µg/l	50	30	37.5				9.2			2.4			3.2	4.1		4.4			5.1		<1	2.7			3.1		
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875			1076	1056	1049	995	908	821	823	872	821	747	707	703	681	692	728	698	668	765	781	746	797	791
Copper	µg/l	2000	30	1500				6.7												2.3								
Cyanide	mg/l	0.05	10					<0.05												<0.05								
D.O.	% Saturation							60			75			68			73			81			76			62		
E_Coli	No/100 ml	0						0																				
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200					676.3			401			707.6	171.8		199.6			262.7		252.8	346.0			204.0		
Lead	µg/l	25	10	18.75				17			7.6			18.6	3.4		2.8			4.7		7.0	7.8			2.2		
Magnesium	mg/l Mg		50					11.48												16.70								
Manganese	µg/l	50	50					91			33.5			126.5	50.4		17.9			86.1		143.3	69.9			15.0		
Mercury	µg/l	1	1	0.75				<0.10												<0.10								
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15				4			2.6			4.9	<1		<1			11.2		3.9	2.9			<1		
Nitrite	mg/l N	0.5	0.1	0.375				0.008			<0.003			<0.003	0.011		<0.003			0.006		nm	0.007			0.005		
o-Phosphate	mg/l P		30					0.03												<0.02								
pH		6.5 - 9.5					6.9	7.1	7	7.3	7.3	7.2	7.5	7.3	7.2	7.3	7.4	7.1	7.2	7.4	7.2	7.3	7.5	7.2	7.2	7.3	7.2	7.3
Phenol	mg/l		0.0005					0.124			0.004			0.019			0.023			<0.001			<0.01			<0.01		
Potassium	mg/l		5					28.69			29.56			27.13	29.95		14.96			6.21		16.84	17.02			23.26		
Sampling Depth	m						27.1	24.3	28.6	28.7	24	28.9	29.7	29.7	28.1	28.2	29.1	28.8	27.1	28.7	28.1	28.0	27.0	29.0	28.7	26.8	27.9	28.9
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150				28.5			24.72			23.19	25.98		14.93			36.12		14.50	15.31			20.09		
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				85												73.4								
Suspended Solid	mg/l																											
Temp	°C						6	11.8	14	13	17.5	11	11	11.5	11	8.0	9.6	11.0	10.0	13.6	nm	15.0	14.0	13.0	10.0	11.4	12	11
Thallium	µg/l																											
Time sampled								13.15	13.25	13.45	11.1	13.2	13.15	13.55	13.15	13.45	11.00	13.10	13.25	14.05	nt	13.30	10.30	13.35	13.20	14.00	12.15	13.4
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC						2.2			2.8			2.1	1.7		1.5			3.1			3.3			1.8		
T.O.N	mg/l N		NAC					6.91			4.46			4.92	3.88		5.02			4.53		4.36	4.57			5.06		
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100					13.5			5.8			17	6.7		5.4			8.7		17.3				12.5		

BOREHOLE BH3A																										
Date Collected		DWR	IGV	2010 GW Regs	22-Jan-08	26-Feb-08	19-Mar-08	29-Apr-08	27-May-08	26-Jun-08	31-Jul-08	27-Aug-08	30-Sep-08	30-Oct-08	26-Nov-08	16-Dec-08	20-Jan-09	24-Feb-09	24-Mar-09	28-Apr-09	26-May-09	23-Jun-09	21-Jul-09	18-Aug-09	29-Sep-09	20-Oct-09	17-Nov-09	08-Dec-09
Alkalinity	mg/l CaCO3							304												288								
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	0.06	<0.03	<0.03	0.03	0.03	<0.03	0.05	0.06	<0.03	0.05	0.04	<0.03	0.03	<0.03	<0.03	0.03	0.03	<0.03	<0.03	0.1	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100		53			<50			<50			51.2			<50			<50			<50			<50		
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				68.4												64.5								
Cadmium	µg/l	5	5	3.75	<0.10			<0.10			<0.10			<0.10			<0.10			<0.1			<0.1			<0.1		
Calcium	mg/l Ca		200					140.98												131.6								
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	36			40			39			40			42			43			44			40		
Chromium	µg/l	50	30	37.5	<1			<1			<1			<1			3.8			1.5			4.5			2.8		
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875	799	787	824	830	864	813	805	805	824	812	833	820	828	846	840	846	827	833	802	803	804	834	790	800
Copper	µg/l	2000	30	1500				3.6												2.1								
Cyanide	mg/l	0.05	10					<0.05												<0.01								
D.O.	% Saturation				58			61			57			61			60			63			nm	68		56		
E_Coli	No/100 ml	0						0																0				
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200		309.5			284.7			174.2			313.9			238.9			210.6			<50			<50		
Lead	µg/l	25	10	18.75	3.2			4.4			2.5			3.6			<1			3			1.6			<1		
Magnesium	mg/l Mg		50					8.73												8.22								
Manganese	µg/l	50	50		17.4			33.7			32.7			28.1			31.1			15.5			18.8			3.3		
Mercury	µg/l	1	1	0.75				<0.10												<0.1								
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15	<1			<1			<1			<1			<1			<1			1.2			<1		
Nitrite	mg/l N	0.5	0.1	0.375	0.023			0.012			0.009			0.004			0.004			0.002			<0.002			<0.002		
o-Phosphate	mg/l P		30					0.02									<0.02			0.02								
pH		6.5 - 9.5			7.1	7.2	7.1	7.2	7.2	7.1	7.2	7.2	7.1	7.1	7.1	7.2	7.1	7.2	7.2	7.2	7.2	7.3	7.2	7.2	7.4	7.1	7.1	7.2
Phenol	mg/l		0.0005		0.02			<0.01			<0.01			0.03			0.01			<0.002			<0.025			<0.015		
Potassium	mg/l		5		28.12			28.4			23.97			25.41			24.05			22.95			23.69			24.26		
Sampling Depth	m				25.1	27.9	26.3	29	28.3	28.7	28.7	28.4	26.8	28.3	28.8	28.9	28.3	28.5	28.8	28.4	28.9	27.9	28	28.5	25.9	28.9	28.0	25.3
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150	22.14			21.6			19.92			19.54			20.96			20.01			21.26			20.97		
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				81.7												80.1								
Suspended Solid	mg/l																											
Temp	°C				9.1	11	12	11	13	13.5	12.1	14	13	9.8	11	10	9.1	12	11	13	12.5	14	14	14.9	11.5	10.8	10.2	10.0
Thallium	µg/l																											
Time sampled					nt	13.1	13.3	14.2	13.2	13.3	14	13.15	13.15	13.3	13.05	12.2	10.55	10.15	13.1	14.15	13.2	13.3	13.3	10.15	13.1	13.45	11.30	13.40
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC			3.5			1.8			2			1.7			2			1.8			3.5			4.2		
T.O.N	mg/l N		NAC		4.85			5.67			4.07			4.29			4.35			4.04			3.94			4.06		
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100		15.6			14.8			10.9			13.3			10.4			10.8			10.2			8.6		

BOREHOLE BH3A																										
Date Collected		DWR	IGV	2010 GW Regs	13-Jan-10	23-Feb-10	23-Mar-10	27-Apr-10	18-May-10	15-Jun-10	27-Jul-10	24-Aug-10	21-Sep-10	19-Oct-10	30-Nov-10	21-Dec-10	11-Jan-11	15-Feb-11	29-Mar-11	12-Apr-11	10-May-11	14-Jun-11	12-Jul-11	09-Aug-11	06-Sep-11	04-Oct-11	08-Nov-11	13-Dec-11
Alkalinity	mg/l CaCO3							280												294								
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	nm	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100		45.7			45.1			46.8			51.8			46.3			47.6			46.7			41.8		
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				55.3												67.5								
Cadmium	µg/l	5	5	3.75	<0.1			<0.1			0.2			<0.1			<1			<0.1			<0.1			<0.1		
Calcium	mg/l Ca		200					111.87												148.12								
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	32			33			27			32			36			42			40			39		
Chromium	µg/l	50	30	37.5	1.2			<1			0.5			0.9			<5			0.6			0.6			<0.5		
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875	762	722	685	737	746	712	716	724		748	718	742	762	780	808	699	826	745	798	800	786	841	995	886
Copper	µg/l	2000	30	1500				2.1												0.7								
Cyanide	mg/l	0.05	10					<0.05												<0.05								
D.O.	% Saturation				72			78			63			57			71			65			57			51		
E_Coli	No/100 ml	0						1												nm								
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200		<50			81.5			64.6			56.0			<100			82.8			<10			<10		
Lead	µg/l	25	10	18.75	<1			2.5			6.7			1.5			<5			1.1			<0.5			<0.5		
Magnesium	mg/l Mg		50					6.71												9.81								
Manganese	µg/l	50	50		5.4			27			109.5			20.6			16.3			10.7			2.3			2.5		
Mercury	µg/l	1	1	0.75				<0.1												0.1								
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15	<1			<1			1.1			0.7			<5			<0.5			<0.5			<0.5		
Nitrite	mg/l N	0.5	0.1	0.375	0.002			0.002			0.005			0.024			<0.002			<0.002			<0.002			0.005		
o-Phosphate	mg/l P		30					<0.02												<0.02								
pH		6.5 - 9.5			7.3	7.3	7.3	7.2	7.2	7.5	7.2	7.3		7.5	7.4	7.4	7.6	7.4	7.4	7.2	7.2	7.1	7.3	7.3	7.3	7.4	7.3	7.2
Phenol	mg/l		0.0005		<0.015			<0.015			<0.025			<0.025			<0.025			<0.013			<0.008			<0.016		
Potassium	mg/l		5		16.96			23.13			26.06			26.00			24.97			27.33			22.13			29.22		
Sampling Depth	m				24.4	26.1	25.1	25.7	26	26.1	29.6	27.0	27.8	nm	28.5	28.8	25.5	27.9	26.9	27.1	21.5	27.9	27	27.3	27.3	27.3	26.5	26.5
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150	16.07			17.78			14.63			20.10			19.29			21.49			15.86			19.76		
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				79.2												78.7								
Suspended Solid	mg/l																											
Temp	°C				10.4	10	10.4	16.2	14	12.4	23.0	11.5	15.6	11.1	9.6	9.6	10.2	11.0	11.5	13.5	12.7	12.8	12.7	13	12.8	13	12.2	11.5
Thallium	µg/l																											
Time sampled					14	13.15	13.05	14	13.05	13.3	10.35	13.05	11.50	14:15	14:00	13:00	14:00	13:10	13:15	nt	13:10	13:30	nt	12:40	10:30	13:50	14:40	11:45
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC			4.6			2.1			2.4			61.9			3.6			60.1			2.4			69.3		
T.O.N	mg/l N		NAC		2.94			3.12			2.16			2.76			3.12			3.84			3.59			2.9		
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100		2.5			7.5			7.0			10.3			35.4			7.6			14.7			12.6		

BOREHOLE BH3A																										
Date Collected		DWR	IGV	2010 GW Regs	17-Jan-12	07-Feb-12	13-Mar-12	24-Apr-12	15-May-12	07-Jun-12	24-Jul-12	14-Aug-12	11-Sep-12	09-Oct-12	06-Nov-12	11-Dec-12	31-Jan-13	12-Feb-13	26-Mar-13	16-Apr-13	08-May-13	11-Jun-13	23-Jul-13	07-Aug-13	17-Sep-13	08-Oct-13	19-Nov-13	03-Dec-13
Alkalinity	mg/l CaCO3							288												272								
Aluminium	ug/l	200	200	150				<5			<5					<5	<5			<5			<5			5.2		
Ammonia	mg/l N	0.23 mg/l	.11 mg/l	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	0.09	1.17	<0.03	0.13	<0.03	0.04	<0.03	<0.03	0.03	<0.03	0.03	<0.03	<0.03	<0.03	0.23	0.04	0.9	0.34
Antimony	ug/l	5						<0.5			<0.5					<0.5	<0.5			<0.5			<0.5			<0.5		
Arsenic	ug/l		10	7.5				<0.5			<0.5					<0.5	<0.5			<0.5			<0.5			<0.5		
Barium	ug/l		100		47.1			45.7			44.7					45.1	56.6			54.5			54.3			56.5		
Beryllium	ug/l							<0.5			<0.5					<0.5	<0.5			<0.5			<0.5			<0.5		
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750	58.3			56.2			58					69.7	52.7			56.4			61.6			59.4		
Cadmium	µg/l	5	5	3.75	<0.1			<0.1			<0.1					<0.1	<0.1			<0.1			<0.1			<0.1		
Calcium	mg/l Ca		200		121.68			109.81			122.63					130.33	128.73			135.93			139.73			134.28		
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	41			41			42					42	54			62			56			51		
Chromium	µg/l	50	30	37.5	<0.5			<0.5			0.5					1.6	0.6			1.7			2			2		
Cobalt	µg/l							<0.5			<0.5					<0.5	<0.5			<0.5			<0.5			<0.5		
Coliform Bacteria	(No/100 ml)	0						108												14								
Conductivity	µS/cm @ 25	2500	1000	1875	892	820	807	807	779	873	694	822	851	862	829	847	849	822	840	883	895	889	879	862	864	874	903	901
Copper	µg/l	2000	30	1500	0.6			<0.5			0.8					1.4	1.1			0.8			<0.5			1.2		
Cyanide	mg/l	0.05	10					<0.05												<0.05								
D.O.	% Saturation				60			46			53					55	56			61			50			62		
E_Coli	No/100 ml	0						7												0								
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200		<10			<10			<10					<10	17.4			<10			<10			11.9		
Lead	µg/l	25	10	18.75	<0.5			<0.5			<0.5					<0.5	<0.5			<0.5			<0.5			<0.5		
Magnesium	mg/l Mg		50		8.51			8.25			8.27					9.45	8.18			8.89			9.09			9.03		
Manganese	µg/l	50	50		<1			2.9			2.2					2.2	7.5			6.5			3.1			4.6		
Mercury	µg/l	1	1	0.75	nm			<0.05			nm					nm	nm			<0.05			nm			nm		
Molybdenum	µg/l		35					<0.5			<0.5					<0.5	<0.5			<0.5			<0.5			<0.5		
Nickel	µg/l	20	20	15	<0.5			<0.5			<0.5					<0.5	<0.5			0.8			<0.5			1		
Nitrite	mg/l N	0.5	0.1	0.375	0.002			0.002			0.056					0.01	0.004			0.004			0.002			0.012		
o-Phosphate	mg/l P		30					<0.02												0.02								
pH		6.5 - 9.5			7.2	7.2	7.2	7.2	7.2	7.3	7.2	7.2	7.1	7	7.1	7.2	7.2	7.2	7.1	7.2	7.2	7.2	7.1	7.2	7.1	7.1	7.1	7.1
Phenol	mg/l		0.0005		<0.002			<0.025			<0.002					<0.002	<0.002			<0.002			<0.002			<0.002		
Potassium	mg/l		5		27.87			23.56			24.31					24.83	21.35			22.02			24.58			25.5		
Sampling Depth	m				29.9	25.7	26.1	26.5	27	26	27.3	26	27	26.1	25	26	23	23.8	26.1	24.9	25	26.4	26.8	26.3	27	13	13.2	27.8
Selenium	µg/l	10						<0.5			1					<0.5	0.9			0.6			0.7			0.7		
Silver	µg/l							<0.5			nm					nm	nm			nm								
Sodium	mg/l	200	150	150	20.45			17.97			18.48					23.3	17.77			20.7			20.88			20.53		
Strontium	µg/l							169.4			168.17					161.63	177.3			189.75			195			204.77		
Sulphate	mg/l SO4	250	200	187.5				74.8												75.4								
Suspended Solid	mg/l																											
Temp	°C				11.3	11.2	12.2	12.2	13.4	12.5	16.1	14.6	12.2	10.6	10.2	14.2	9.4	9.5	9.2	11.1	11.1	11	13.8	13	10.7	11.8	10.4	8.6
Thallium	µg/l							<0.1			<0.1					<0.1	<0.1			<0.1			<0.1			<0.1		
Time sampled					10:00	10:45	14:15	0.600694444	0.4375	0.607638889	14:40	09:45	09:50	14:00	14:00	13:15	13:05	10:15	10:25	13:45	10:35	10:10	10:30	10:00	14:30	10:40	11:35	nt
Tin (µg/l)	µg/l							<1			<1					<1	nm			nm								
T.O.C.	mg/l	NAC			66			47.5			2.2					3	69.6			2.1			2.6			3.3		
T.O.N	mg/l N		NAC		3.15			3.5			4.89					4.5	3.76			4.03			4.52			4.16		
Total S Solids	mg/l																											
Uranium	µg/l							0.62			0.62					0.65	0.66			0.69			0.71			0.73		
Vanadium	µg/l							<0.5			<0.5					0.58	0.56			<0.5			<0.5			0.59		
Zinc	µg/l		100		37.5			9.2			15					4.8	17.1			19.5			5.9			25		

BOREHOLE BH4A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	28-Aug-07	25-Sep-07	24-Oct-07	28-Nov-07	18-Dec-07
Alkalinity	mg/l CaCO3							316												376								
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	0.41	0.22	0.04	<0.03	0.13	0.04	0.08	0.06	<0.03	0.17	0.07	0.06	0.09	0.03	0.52	<0.03	<0.03	0.09	0.22	0.08	0.03	0.04	0.19	0.26
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100		71	<50	<50	<50	<50	<50	<50	<50	8635.5	73.5	<50	<50	<50	<50	<1000	<50	<50	891.7	<50	57.1	<50	<50	nm	<50
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				<50												<50								
Cadmium	µg/l	5	5	3.75	2.7	0.9	<0.10	0.2	0.2	<0.10	0.4	0.5	500.1	2.1	1.1	0.4	<0.10	<0.10	6.3	0.5	0.9	0.4	0.3	1.0	0.4	0.5	0.3	1.3
Calcium	mg/l Ca		200					143.07												140.70								
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	35	49	46	46	47	43	43	49	46	48	47	45	47	48	60	46	46	49	55	49	50	54	59	66
Chromium	µg/l	50	30	37.5	10.4	3.8	4.7	7.5	2.7	<1	<1	3.3	14.7	2.1	4.6	2.1	4.5	<1	27.6	<1	<1	<1	<1	3.5	<1	<1	<1	3
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875	850	849	845	862	851	859	851	837	748	902	847	853	864	878	885	893	880	878	876	878	878	810	922	892
Copper	µg/l	2000	30	1500				4.1												2.1								
Cyanide	mg/l	0.05	10					<0.05												<0.05								
D.O.	% Saturation				85			75			97			57			60			71			78			74		
E_ Coli	No/100 ml	0						0																				
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200		499.8	335.2	221.5	466.6	313.9	339.4	253	298.3	38498	910.8	935.6	576.8	395.4	379.1	10233.5	514.2	571.0	233.4	594.6	2167.7	628.4	302.1	299.8	1557.3
Lead	µg/l	25	10	18.75	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2.2	<1	<1	48.9	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	mg/l Mg		50					12.14												11.77								
Manganese	µg/l	50	50		570.3	328.3	114.7	236.7	214.1	159.4	238.9	252.6	101679	939.6	621.3	718.9	130.1	178.4	3712.2	280.8	429.1	198.5	277.6	908.2	179.9	155.6	234.9	796.9
Mercury	µg/l	1	1	0.75				0.4												<0.10								
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15	52.4	15.4	3.8	6.3	4.2	5.3	6.6	8.9	12682.6	34.6	24.5	8.5	3.5	3.4	109.7	15.3	17.4	4.7	8.1	22.9	7.5	5.5	6.4	27
Nitrite	mg/l N	0.5	0.1	0.375	>0.1	0.114	0.012	0.01	0.046		0.047	0.018	0.064	0.062	0.015	0.01	0.024	0.008	0.139	<0.003	0.007	nm	0.094	0.074	<0.003	0.030	0.045	0.096
o-Phosphate	mg/l P		30					0.03												0.02								
pH		6.5 - 9.5			7.4	7.3	7.4	7.3	7.4	7.3	7.4	7.5	7.5	7	7.3	7.4	7.3	7.2	7.0	7.3	7.1	7.2	7.2	7.1	7.3	7.2	6.9	7.4
Phenol	mg/l		0.0005		0.02	0.021	0.172	<0.001	0.016	0.178	<0.001	0.02	<0.001	0.094	<0.001	<0.001	0.088	0.048	0.033	0.033	<0.01	nm	<0.01	1.190	<0.01	<0.01	<0.01	<0.01
Potassium	mg/l		5		1.15	1.1	1.2	1.22	1.37	0.99	1.26	1.01	5.69	1.25	1.28	1.01	1.03	1.04	<20	1.11	1.21	1.08	1.04	1.02	1.13	1.14	1.33	1.32
Sampling Depth	m				23.6	24.3	25.1	24.7	27.2	25.1	24.5	25.1	25.1	26.2	24.1	24	24.2	27.6	25.5	28.4	24.2	25.0	24.0	26.2	25.9	25.2	24.8	26.2
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150	16.51	13.98	20.4	17.97	20.05	13.94	17.59	15.08	14.67	16.74	20.43	15.33	15.11	17.14	<20	18.62	20.84	16.76	16.33	17.13	15.32	17.30	20.57	21.72
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				47.6												53.8								
Suspended Solids	mg/l																											
Temp	°C				9.4	8	7	12.4	13	13	17.1	14	13	13.5	9	8	9.9	11.0	9.0	15.5	16.0	16.0	19.1	14.0	10.0	12.3	13	10
Thallium	µg/l																											
Time sampled								12.05	12.1	12.15	12	12.1	12.2	12	12	12.05	11.55	12.05	12.10	12.10	12.10	11.45	11.45	12.05	12.10	12.00	11	12.45
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC			108.4			1.7			<10			<1.5			1.5			<1.5			3.0			1.8		
T.O.N	mg/l N		NAC		6.31	6.21	6.09	6.16	5.81	6.1	6.27	10.04	6.05	6.26	5.83	5.59	5.80	5.73	5.49	5.85	5.78	5.51	5.73	5.63	6.01	5.85	6.12	5.81
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100		99.2	19.9	3.8	9.6	6.1	5.6	11.3	13.7	19167	48.3	34.7	12	6.1	5.0	257.1	9.3	2.6	168.5	15.1	25.7	4.1	13.1	9.4	34.8

BOREHOLE BH4A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	18-Aug-09	29-Sep-09	20-Oct-09	17-Nov-09	08-Dec-09
Alkalinity	mg/l CaCO3							336												320								
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	0.03	0.07	0.04	0.04	0.11	0.05	0.11	0.11	0.03	0.04	0.17	0.07	<0.03	<0.03	0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100		<50	<50	<50	<50	125.3	74.4	<50	<50	<50	<50	<50		<50	50	51.5	581.9	239.1	93.4	<50	50.4	59.99	<50	<50	52.9
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				<50												102.1								
Cadmium	µg/l	5	5	3.75	<0.10	<0.10	0.3	1.3	3.8	2.6	0.5	0.9	<0.10	<0.10	0.5	0.6	0.9	<0.10	1.3	0.1	6.5	3.4	0.6	1.5	1.89	0.6	1.0	0.9
Calcium	mg/l Ca		200					162.99												153.49								
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	48	46	47	47	47	49	56	59	53	49	58	62	45	48	45	49	65	49	50	56	43	48	46	45
Chromium	µg/l	50	30	37.5	<1	3.2	5.6	7.2	3.5	11.7	<50	5.8	<1	2.4	3.9	<1	4.8	2.7	2.9	4	4.4	8.5	9.8	6.9	7.41	4.1	4.5	7.8
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875	892	882	879	864	877	876	876	863	896	890	902	905	896	900	896	922	889	891	884	862	893	976	873	888
Copper	µg/l	2000	30	1500				5.8												2.5								
Cyanide	mg/l	0.05	10					<0.05												<0.01								
D.O.	% Saturation				38			74			101			63			69			112			nm	101		59		
E_ Coli	No/100 ml	0						0																1				
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200		229.5	1086.5	1657.1	727.9	2828.3	623.8	345	491.3	359.7	530	1373.8	1004.6	1063.5	299.4	1508.6	135.2	2692.5	2163	169	610.1	1765.17	297.7	476.8	1632.6
Lead	µg/l	25	10	18.75	<1	<1	3.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.1	<1	<1	1.5	<1	<1	1.79	<1	<1	<1
Magnesium	mg/l Mg		50					13.31												12.78								
Manganese	µg/l	50	50		57.1	475.6	269.5	665.5	1432.1	599.5	179.2	290.1	152.8	220.8	566.8	467.1	525.9	95.1	816.4	28.1	2026.7	1114.7	198.9	550.5	1016.18	347.2	391.8	770.8
Mercury	µg/l	1	1	0.75				<0.10												<0.1								
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15	<1	9.6	11.9	21.3	80.1	39.9	9.1	15.8	3.3	4.1	12.1	12	15.4	1.9	30.2	1.1	139.9	68.5	9.3	33.8	33.32	11.8	20.7	16.9
Nitrite	mg/l N	0.5	0.1	0.375	0.016	0.02	0.011	0.013	0.047	0.042	0.039	0.221	0.036	0.008	0.016	0.009	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Phosphate	mg/l P		30					0.02									<0.02			<0.02								
pH		6.5 - 9.5			7.1	7.2	7.2	7.2	7.3	7.3	7.3	7.5	7.1	7.2	7.2	7.1	7.2	7.3	7.1	7.3	7.1	7.5	6.8	7.4	7.3	6.8	7.1	7.2
Phenol	mg/l		0.0005		0.03	0.02	<0.01	<0.01	<0.01	<0.01	nm	0.03	<0.01	0.03	<0.01		<0.01	<0.01	<0.016	<0.002	<0.002	<0.002	nm	<0.002	<0.015	<0.015	<0.0005	<0.015
Potassium	mg/l		5		1.27	1.17	1.5	1.21	1.01	1.09	1.08	1.21	1.14	1.13	1.35	1.25	1.26	1.08	1.24	1.33	1.34	1.47	1.16	1.11	1.14	1.26	1.25	1.18
Sampling Depth	m				24.5	25.2	24.8	23.9	24	23	23.9	25.9	26.1	nm	20.4	20.9	20.9	24.1	22.8	24.4	24.2	25.1	23	23.8	23.9	22.4	24.4	nm
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150	20.84	19.73	22.65	19.28	16.8	18.32	18.07	17.38	18.29	18.59	20.19	22.33	20.89	19.12	19.45	23.91	19.62	16.26	17.48	18.67	17.68	19.53	19.59	16.37
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				47.4												52.9								
Suspended Solids	mg/l																											
Temp	°C				9.4	10	12	12	nm	15.6	15.4	14	12	8.9	11	10	6.8	12	11	14	12.8	13	16	13.7	11	10.0	10.3	10.2
Thallium	µg/l																											
Time sampled					nt	12.1	12.1	12.15	11.55	11.15	12	12.05	12.1	11.45	12.05	11.4	12.05	13.55	12.05	12	11.55	12.1	11.5	12	11.55	11.40	10.20	12.00
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC			1.5			2.1			1.6			<1.5			2.3			7.6			3.1			4.8		
T.O.N	mg/l N		NAC		5.63	5.57	5.18	5.62	5.66	5.56	5.76	4.94	5.47	5.47	5.39	4.99	5.18	4.06	3.97	3.91	5.1	4.8	4.76	5.06	4.79	4.09	4.86	3.29
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100		2.5	11.3	14.8	31.5	100.5	79.6	13.7	24.5	5.1	6.5	15.8	15.6	24.2	7.2	35.7	135.6	242.9	103.7	16.2	49.6	153.3	17.8	31.0	74.0

BOREHOLE BH4A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**09-Aug-11**	**06-Sep-11**	**04-Oct-11**	**08-Nov-11**	**13-Dec-11**
Alkalinity	**mg/l CaCO3**							372												364									
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	2.45	<0.03	<0.03	<0.03	0.82	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03							
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		21.3	20.1	39.3	42.5	67.3	34.7	18.9	4662.3	20.9	127.8	233.5	18.5	18.1	34.3	14.9	35.6	48.9								
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				39												34.5									
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.2	0.1	0.8	1.1	2.4	0.8	0.4	185.5	0.6	3.6	2.7	<1	0.1	<1	<0.1	0.6	1.4								
Calcium	**mg/l Ca**		**200**					153.91												177.64									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	45	51	49	56	50	49	46	48	53	51	41	54	42	33	43	46	45								
Chromium	**µg/l**	**50**	**30**	**37.5**	<1	3.4	<1	<1	1.8	4.8	<0.5	2.2	<0.5	1.3	27.9	<5	<0.5	<5	2.4	<0.5	0.6								
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	890	841	903	896	895	685	930	845		897	886	870	914	805	913	712	1090								
Copper	**µg/l**	**2000**	**30**	**1500**				4.7												2.4									
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05									
D.O.	**% Saturation**				81			79			84			81				55		79									
E_ Coli	**No/100 ml**	**0**						0												nm									
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150									
Iron	**µg/l**	**200**	**200**		312.8	31.9	947.4	403.8	1262.7	530.3	128.1	19614.2	268.2	1619.4	29519.5	809.9	135.7	1048.3	431.1	379	530.9								
Lead	**µg/l**	**25**	**10**	**18.75**	<1	<1	<1	<1	<1	1.1	<0.5	1.8	<0.5	0.5	20.1	<5	0.7	<5	0.5	1.3	0.7								
Magnesium	**mg/l Mg**		**50**					12.12												15.77									
Manganese	**µg/l**	**50**	**50**		190.3	89	452.7	355.1	978.1	495.3	153.9	43975.2	218.1	1366.6	4932.1	343.0	161.8	253.6	93.6	505.9	657.7								
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.1												<0.05									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	4.2	6.3	13.9	18.2	47.5	27.7	4.1	4892.0	11.1	81.6	121.5	<5	0.9	<5	1.0	6.9	20								
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002	0.003	<0.002	<0.002	0.005	<0.002	<0.002	0.003	<0.002	<0.002	nm	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002								
o-Phosphate	**mg/l P**		**30**					<0.02												<0.02									
pH		**6.5 - 9.5**			7.1	7.1	7.2	7.1	7.1	7.2	7.1	7.2		7.2	7.3	7.3	7.1	7.4	7.6	7.2	7.6								
Phenol	**mg/l**		**0.0005**		<0.015	<0.015	<0.015	<0.015	<0.2	<0.1	<0.025	<0.015	<0.015	<0.025	<0.015	<0.025	<0.01	<0.025	<0.025	<0.008	<0.013								
Potassium	**mg/l**		**5**		<1	4.78	1.22	1.15	1.71	3.33	1.81	3.56	1.10	1.45	5.13	<2.5	1.19	<2.5	1.23	1.35	1.15								
Sampling Depth	**m**				26.5	14.5	26.2	nm	22.6	22.6	23.7	20.9	21.5	nm	25.1	24.0	18.4	18.0	25.0	18.7	17.8								
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	16.47	25.63	19.67	19.12	16.16	21.61	16.25	17.31	18.43	21.91	21.02	18.50	21.34	16.15	18.83	21.37	19.9								
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				55.8												54.4									
Suspended Solids	**mg/l**																												
Temp	**°C**				6.8	9.5	10	16.1	11	12	19.0	12.3	16.3	11.6	9.7	9.5	11.0	8.8	11.3	13	14								
Thallium	**µg/l**																												
Time sampled					11.45	12	11.55	12.15	11.5	11.55	11.20	11.55	12.35	nt	15:50	11:30	11:45	12.05	12:00	11:55	12:00								
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			4.2			<1.5			3.8			91.1				6.1		83.9									
T.O.N	**mg/l N**		**NAC**		2.84	3.86	3.32	4.01	4.52	5.91	4.78	4.61	4.55	4.25	4.53	4.42	4.70	3.28	4.35	1.32	4.45								
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		10.1	6.9	23.7	36.2	70.9	27.5	9.6	8197.5	15.4	129.3	249.9	25.5	2.7	30.1	3.2	<14	32.4								

BOREHOLE BH4A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**07-Aug-13**	**17-Sep-13**	**08-Oct-13**	**19-Nov-13**	**03-Dec-13**
Alkalinity	**mg/l CaCO3**							320												376									
Aluminium	**ug/l**	**200**	**200**	**150**				<5						<5	<5	<5	11.3	843.6		<5	<5								
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**		0.03		<0.03						<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03								
Antimony	**ug/l**	**5**						<0.5						<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5								
Arsenic	**ug/l**		**10**	**7.5**				<0.5						0.53	<0.5	0.54	<0.5	1.5		<0.5	<0.5								
Barium	**ug/l**		**100**			11.5		9.5						11.4	11.5	12.3	12.8	26.6		10	9.5								
Beryllium	**ug/l**							<0.5						<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5								
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**		36.3		30						41.3	35	35	31.7	31.7		27.3	29.5								
Cadmium	**µg/l**	**5**	**5**	**3.75**		<0.1		<0.1						<0.1	<0.1	<0.1	<0.1	0.2		<0.1	<0.1								
Calcium	**mg/l Ca**		**200**			154.27		137.47						151.13	146.23	143.55	156.38	157.46		149.85	150.84								
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**		44		47						41	40	40	43	42	42	42	42								
Chromium	**µg/l**	**50**	**30**	**37.5**		<0.5		<0.5						1	0.8	<0.5	<0.5	2.3		1.2	1.1								
Cobalt	**µg/l**							<0.5						<0.5	<0.5	<0.5	<0.5	1.3		<0.5	<0.5								
Coliform Bacteria	**(No/100 ml)**	**0**						49												40									
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**		929		814						955	949	933	919	904	901	911	921								
Copper	**µg/l**	**2000**	**30**	**1500**		0.5		0.8						<0.5	0.5	0.8	1	3.1		2.3	0.8								
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05									
D.O.	**% Saturation**							83						67			22			83									
E_ Coli	**No/100 ml**	**0**						6												0									
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150									
Iron	**µg/l**	**200**	**200**			<10		<10						<10	<10	<10	74.1	1451.2		24.6	<10								
Lead	**µg/l**	**25**	**10**	**18.75**		<0.5		<0.5						<0.5	<0.5	<0.5	<0.5	1		<0.5	<0.5								
Magnesium	**mg/l Mg**		**50**			14.99		13.76						15.05	14.23	13.79	13.05	13.24		13.24	12.89								
Manganese	**µg/l**	**50**	**50**			1.7		7.3						1.9	1.1	1.1	<1	202.4		<1	2.4								
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.05						nm	nm	nm	nm	nm		<0.05	nm								
Molybdenum	**µg/l**		**35**					1.1						<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5								
Nickel	**µg/l**	**20**	**20**	**15**		<0.5		<0.5						<0.5	<0.5	1.9	<0.5	3.7		13.3	1.1								
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**		<0.002		<0.002						<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002								
o-Phosphate	**mg/l P**		**30**					0.05												0.02									
pH		**6.5 - 9.5**				7.2		7.5						7.1	6.9	6.9	6.4	7	7.1	7.2	7.3								
Phenol	**mg/l**		**0.0005**			<0.002		<0.025						<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002								
Potassium	**mg/l**		**5**			1.42		1.51						1.61	1.28	1.28	1.31	1.31		1.39	1.39								
Sampling Depth	**m**					23.9		nm						23.9	23	23.7	16.9	17	18	20.2	22								
Selenium	**µg/l**	**10**						<0.5						0.6	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5								
Silver	**µg/l**							<0.5						nm	nm	nm	nm	nm		nm									
Sodium	**mg/l**	**200**	**150**	**150**		20.43		19.13						23.86	20.28	19.33	18.46	19.02		18.58	17.94								
Strontium	**µg/l**							256.17						256.23	259.39	232.57	258.6	270.93		255.14	248.87								
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				50.6												52.1									
Suspended Solids	**mg/l**																												
Temp	**°C**					11.2		13.1						15.1	10.4	10	9.3	8.2	7.1	10.8	11.7								
Thallium	**µg/l**							<0.1						<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1								
Time sampled						13:20								11:35	12:40	12:40	11:55	12:50	13:10	11:30	12:45								
Tin (µg/l)	**µg/l**							<1						<1	<1	<1	nm	nm		nm									
T.O.C.	**mg/l**	**NAC**						59.4						1.9			94.5			<1.5									
T.O.N	**mg/l N**		**NAC**			2.9		3.18						3.72	2.78	3.48	3.15	3.27	3.14	3.27	3.11								
Total S Solids	**mg/l**																												
Uranium	**µg/l**							3.84						4.35	4.09	3.94	4.2	4.63		4.98	4.58								
Vanadium	**µg/l**							<0.5						0.55	<0.5	<0.5	0.61	2.19		<0.5	<0.5								
Zinc	**µg/l**		**100**			5		2.7						58.5	7.5	5.9	4.1	10.4		3.7	4.7								

BOREHOLE BH5A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	28-Aug-07	26-Sep-07	24-Oct-07	28-Nov-07	18-Dec-07
Alkalinity	mg/l CaCO3							380												332								
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	18.3	14.87	13.75	14.37	12.33	2.63	<0.03	5.29	4.34	0.04	12.18	15.65	14.63	4.63	2.43	2.01	4.48	3.87	3.71	3.89	0.20	3.32	2.96	2.82
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100		119.7			71.5			<50			75.9	106.7		127.6			<50		<50	<50			<50		
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				322.7												156.5								
Cadmium	µg/l	5	5	3.75	1.4			0.6			0.3			<0.10	0.6		<0.10			0.3		0.6	0.4			<0.10		
Calcium	mg/l Ca		200					118.62												108.97								
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	113			94			52			15	76		99			63		54	54			55		
Chromium	µg/l	50	30	37.5	15.7			7.5			6.4			<1	6.1		6.4			5.1		5.9	5.9			6.6		
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875	1346	1205	1163	1174	1162	989	893	819	762	726	1155	1244	1207	1038	988	888	802	745	744	762	780	693	696	696
Copper	µg/l	2000	30	1500				11.1												3.7								
Cyanide	mg/l	0.05	10					<0.05												<0.05								
D.O.	% Saturation				35			41			90			54	nm		65			60			39			48		
E. Coli	No/100 ml	0						0																				
Fluoride	mg/l	0.8	1000					<0.150												<0.150								
Iron	µg/l	200	200		191.6			544.2			468.1			377.8	148.7		325.3			370.0		274.1	319.7			166.5		
Lead	µg/l	25	10	18.75	7.5			18.3			30.5			14.9	3.6		9.8			13.0		5.2	3.0			<1		
Magnesium	mg/l Mg		50					21.25												16.53								
Manganese	µg/l	50	50		986			605.7			308.6			177.9	807.2		970.7			209.3		333.4	263.8			73.9		
Mercury	µg/l	1	1	0.75				0.5												<0.10								
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15	66			31.9			10.4			6.2	48.9		57.0			13.8		13.0	11.4			8.4		
Nitrite	mg/l N	0.5	0.1	0.375	0.076			0.046			0.012			<0.003	0.035		0.130			0.040		nm	0.026			0.013		
o-Phosphate	mg/l P		30					0.04												0.07								
pH		6.5 - 9.5			7.2	7.1	7	7.2	7.1	7.2	7.4	7.1	7.2	7.3	6.9	7.1	7.2	6.9	7.0	7.3	6.9	7.1	7.2	7.0	7.1	7.2	7.1	7.4
Phenol	mg/l		0.0005		0.043			0.089			0.004			<0.001			0.085			<0.001			<0.01			<0.01		
Potassium	mg/l		5		25.33			16.49			7.34			2.55	18.89		18.27			6.22		5.95	6.28			6.39		
Sampling Depth	m				27.4	28.7	29	30.1	29.9	29.4	29.3	28.8	29.2	29	28.7	24.2	28.3	28.9	28.1	28.6	27.2	28.1	26.4	28.0	28.7	27.2	28.1	27.2
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150	67.57			60.5			35.3			13.03	69.43		49.90			35.74		24.03	26.98			28.60		
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				33.1												20.6								
Suspended Solids	mg/l																											
Temp	°C				11	7	6	12.9	13	14	22.2	13	12	13.7	9	7	9.9	12.0	9.0	15.8	14.0	15.0	18.8	14.0	9.0	12.8	12	11
Thallium	µg/l																											
Time sampled								12.2	12.3	12.4	13	12.3	12.4	12.2	12.2	12.25	12.15	12.30	12.40	12.35	12.35	12.10	12.30	12.30	12.20	12.20	11.2	13.1
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC			194			4.8			2.4			3	3.9		4.4			2.5		3.0				1.6		
T.O.N	mg/l N		NAC		11.28			9.27			17.15			2.67	8.54		15.22			3.77		6.91	7.50			6.99		
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100		47.1			32			19.7			14.2	30.1		43.5			12.9		12.2	2.4	3.3	14.7	8.0		

BOREHOLE BH5A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	18-Aug-09	29-Sep-09	20-Oct-09	17-Nov-09	08-Dec-09
Alkalinity	mg/l CaCO3							288												253								368
Aluminium	ug/l	200	200	150																								
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	7.35	10.94	5.36	3.63	2.89	2.49	2.59	2.09	5.88	8.18	9.58	<0.03	<0.03	9.9	<0.03	2.42	1.93	2.16	<0.03	1.64	0.03	1.19	1.98	10.91
Antimony	ug/l	5																										
Arsenic	ug/l		10	7.5																								
Barium	ug/l		100		76.2			<50			<50			63			<50			<50			61.9			<50		104.7
Beryllium	ug/l																											
B.O.D.	mg/l O2																											
Boron	µg/l	1000	1000	750				125.3												111.7								257.3
Cadmium	µg/l	5	5	3.75	0.5			<0.10			<0.10			0.6			<0.10			0.2			0.1			<0.1		0.6
Calcium	mg/l Ca		200					100.45												93.55								118.73
C.O.D.	mg/l O2																											
Chloride	mg/l Cl	250	30	187.5	68			52			47			72			31			48			11			44		69
Chromium	µg/l	50	30	37.5	5.6			6			<1			<1			6.7			6.4			5.4			7.6		9.9
Cobalt	µg/l																											
Coliform Bacteria	(No/100 ml)	0																										
Conductivity	µS/cm @ 25	2500	1000	1875	952	1068	884	743	715	687	664	670	884	998	1038	725	668	1035	691	694	667	665	655	643	640	655	676	1043
Copper	µg/l	2000	30	1500				2.5												2.4								8.3
Cyanide	mg/l	0.05	10					<0.05												<0.01								<0.05
D.O.	% Saturation				34			44			38			31			64			38			nm	88		30		52
E. Coli	No/100 ml	0						0																				
Fluoride	mg/l	0.8	1000					<0.150												0.15								<0.150
Iron	µg/l	200	200		315.6			171.2			106.5			314			118.7			148			92.8			<50		<50
Lead	µg/l	25	10	18.75	6.8			<1			<1			5.2			<1			3.4			1.8			<1		3.0
Magnesium	mg/l Mg		50					13.56												12.33								16.77
Manganese	µg/l	50	50		463.5			173.8			54.4			524.9			34			96.9			88.9			4.1		706.3
Mercury	µg/l	1	1	0.75				<0.10												<0.1								<0.1
Molybdenum	µg/l		35																									
Nickel	µg/l	20	20	15	30.3			9.1			5.5			31			<1			7.1			2.2			4.1		41.3
Nitrite	mg/l N	0.5	0.1	0.375	0.309			0.02			0.013			0.029			<0.002			0.007			<0.002			0.030		0.104
o-Phosphate	mg/l P		30					0.04									<0.02			0.05								<0.02
pH		6.5 - 9.5			6.9	7.1	7	7.2	7.1	7.1	7.1	7.1	7.1	7.1	7	8	7.2	7.1	7.2	7.1	7.1	7.8	7.1	7.2	7.1	7.2	7.1	7.0
Phenol	mg/l		0.0005		0.02			<0.01			<0.01			0.03			<0.01			<0.002			<0.025			<0.015		<0.015
Potassium	mg/l		5		12.51			6.96			4.46			11.73			3.66			5.02			2.48			5.13		13.94
Sampling Depth	m				27.9	26.1	26.2	25	26.3	26.5	26.6	27	25.8	nm	25.7	25.8	25.8	25.2	25.2	25.1	26	26.8	26	26.5	24.9	25.7	26.8	nm
Selenium	µg/l	10																										
Silver	µg/l																											
Sodium	mg/l	200	150	150	45.36			28.07			22.72			44.36			24.25			25.96			9.94			23.89		40.59
Strontium	µg/l																											
Sulphate	mg/l SO4	250	200	187.5				19												15								45.8
Suspended Solids	mg/l																											
Temp	°C				9.2	11	11	13	nm	15.5	15.5	15	13	8.9	11	10	7.1	12	11	15	12.5	14	15	14.9	11	11.2	10.1	10.7
Thallium	µg/l																											
Time sampled					nt	12.3	12.35	12.45	12.15	12.35	12.25	12.2	14.1	12.1	12.3	12	12.2	14.15	12.2	12.2	12.15	12.25	12.1	12.2	12.15	11.55	11.00	14.30
Tin (µg/l)	µg/l																											
T.O.C.	mg/l	NAC			3.4			<1.5			<1.5			3			<1.5			1.6			6.9			3.2		4.6
T.O.N	mg/l N		NAC		10.75			10.31			6.57			9.77			5.79			5.94			0.91			6.00		4.40
Total S Solids	mg/l																											
Uranium	µg/l																											
Vanadium	µg/l																											
Zinc	µg/l		100		33.8			4.1			5.9			38			7			11.7			8.8			4.5		34.1

BOREHOLE BHSA																													
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**09-Aug-11**	**06-Sep-11**	**04-Oct-11**	**08-Nov-11**	**13-Dec-11**
Alkalinity	**mg/l CaCO3**							236						327						317									
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	7.11	4.6	2.67	2.25	1.82	1.26	0.89	0.90	0.51	<0.03	0.55	9.73	1.59	9.80	<0.03	<0.03	<0.03	1.01	<0.03	0.65	0.51	0.66	0.29	5.88
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		43.7			19.4			18.3			65.2				109.7		16.6			63.5						
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				113						26.4						132.9									
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.3			0.2			0.3			<0.1				<1		0.1			<0.1						
Calcium	**mg/l Ca**		**200**					96.12						137.42						113.47									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	64			45			41			14				63		49			16			37			
Chromium	**µg/l**	**50**	**30**	**37.5**	1.3			4.3			6.4			0.6				<5		4.8			<0.5						
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	934	808	735	506	666	630	624	61		662	655	1002	780	1025		804	705	589	717	614	601	654	760	976	
Copper	**µg/l**	**2000**	**30**	**1500**				2.2						4.2						1									
Cyanide	**mg/l**	**0.05**	**10**					<0.05						<0.05						<0.05						<0.05			
D.O.	**% Saturation**				75			36			40			53				51		36			39			17			
E_Coli	**No/100 ml**	**0**						1						nm						nm									
Fluoride	**mg/l**	**0.8**	**1000**					<0.150						<0.150						<0.150						<0.150			
Iron	**µg/l**	**200**	**200**		51.2			82.2			124.2			19.9				<100		18.5			<10						
Lead	**µg/l**	**25**	**10**	**18.75**	1.6			2.8			3.8			1.0				<5		<0.5			<0.5						
Magnesium	**mg/l Mg**		**50**					12.33						11.16						15.83									
Manganese	**µg/l**	**50**	**50**		231.9			155.2			331.4			14.8				669.4		96.1			32.5						
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.1						<0.05						<0.05									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	17.1			6.9			7.8			1.2				40.9		7			<0.5						
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.006			0.006			0.008			<0.002				0.067		0.031			<0.002						
o-Phosphate	**mg/l P**		**30**					0.05						0.03						0.02						0.04			
pH		**6.5 - 9.5**			7.2	7.3	7.2	8	7.1	7.3	7.2	7.2		7.3	7.3	7.1	7.3	7.6	7.3	7.2	7.1	7.1	7.1	7.2	7.5	7.3	7.3	7	
Phenol	**mg/l**		**0.0005**		<0.015			<0.015			<0.025			<0.025				<0.025		<0.013			<0.008			<0.016			
Potassium	**mg/l**		**5**		9.37			5.3			4.52			3.07				13.66		6.51			2.43						
Sampling Depth	**m**				24.3	24.1	26.1	2	26	26	27.6	25.9	26.3	nm	26.1	26.7	24.8	24.3	28.3	25	15.5	28	28.2	25.6	29.5		27.6	25.7	
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	34.28			25.63			19.19			10.90				41.13		29.62			11.44						
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				17.1						13.5						21.6						13.5			
Suspended Solids	**mg/l**																												
Temp	**°C**				6.7	9.7	11	15.9	12	12	21.0	12.5	16.7	10.9	9.4	9.5	12.0	9.0	11.3	12	12	12.7	13.1	12	15.2	13.8	12.4	11.4	
Thallium	**µg/l**																												
Time sampled					12.1	12.25	12.15	12.4	12.1	12.15	11.40	12.15	12.55	nt	16:20	12:00	12:10	12.30	12:20	12:20	12:20	12:30	12:20	14:35	14:10	12:20	13:00	14:45	
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			4.8			1.9			<1.5			79.8				4.6		62.9			4.4						
T.O.N	**mg/l N**		**NAC**		5.79			7			6.73			1.82				10.55		8.37			2.13			5.14			
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		14			9.5			12.9			8.1				50.2		5.4			9.3						

BOREHOLE BHSA																													
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**07-Aug-13**	**17-Sep-13**	**08-Oct-13**	**19-Nov-13**	**03-Dec-13**
Alkalinity	**mg/l CaCO3**							284												266									
Aluminium	**ug/l**	**200**	**200**	**150**				20.6			<5			<5				<5		<5			<5		<5	<5			
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	7.82	9.76	8.97	1.97	1.59	1.63	0.05	1.04	3.34	3.63	4.12	4.35	6.78	6.13	3.44	2.37	1.27	0.49	0.15	0.08	<0.03	0.04	2.5	0.06	
Antimony	**ug/l**	**5**						<0.5			<0.5			<0.5			<0.5			<0.5			<0.5		<0.5	<0.5			
Arsenic	**ug/l**		**10**	**7.5**				<0.5			<0.5			0.54			<0.5			<0.5			<0.5		<0.5	<0.5			
Barium	**ug/l**		**100**		69.8			15.1			17.3			32.1			101.2			20.9			10.9		27.9	9.7			
Beryllium	**ug/l**							<0.5			<0.5			<0.5			<0.5			<0.5			<0.5		<0.5	<0.5			
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**	237.8			100.3			100.4			162.1			169.7			105.4			68.7		117.3	87.5			
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.3			0.1			0.1			0.2			0.5			0.1			<0.1		<0.1	<0.1			
Calcium	**mg/l Ca**		**200**		121.69			83.77			92.61			110.39			117.23			99.8			89.33		73.45	84.2			
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	63			46			42			49			52		49	42			37		50	39			
Chromium	**µg/l**	**50**	**30**	**37.5**	1.7			5			3.1			4.1			<0.5			5.2			7.7		<0.5	8.3			
Cobalt	**µg/l**							<0.5			<0.5			<0.5			0.6			<0.5			<0.5		<0.5	<0.5			
Coliform Bacteria	**(No/100 ml)**	**0**						206												78									
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	1112	1041	1011	700	657	736	825	696	840	842	881	851	919	908	856	740	688	645	613	601	590	601	742	702	
Copper	**µg/l**	**2000**	**30**	**1500**	4.7			0.9			1.3			1.7			5.1			2.1			0.6		0.9	<0.5			
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05									
D.O.	**% Saturation**				31			27			23			25			22		25	19			19			31			
E_Coli	**No/100 ml**	**0**						6												61									
Fluoride	**mg/l**	**0.8**	**1000**					0.15												<0.150									
Iron	**µg/l**	**200**	**200**		93.7			12.5			<10			10.6			<10			10.9			<10		16.8	<10			
Lead	**µg/l**	**25**	**10**	**18.75**	0.8			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5		<0.5	<0.5			
Magnesium	**mg/l Mg**		**50**		17.59			11.9			12.84			15.82			15.37			13.44			01.33		4.74	10.48			
Manganese	**µg/l**	**50**	**50**		319.1			59			58.1			83.1			490.3			81.1			15.3		<1	1.7			
Mercury	**µg/l**	**1**	**1**	**0.75**	nm			<0.05			nm			nm			nm			<0.05			nm		nm	nm			
Molybdenum	**µg/l**		**35**					<0.5			<0.5			<0.5			<0.5			<0.5			<0.5		<0.5	<0.5			
Nickel	**µg/l**	**20**	**20**	**15**	32.5			5.4			4.5			10.4			30.3			13.5			3.3		2	2.4			
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.254			0.014			0.019			0.013			0.053			0.006			0.016		<0.002	<0.002			
o-Phosphate	**mg/l P**		**30**					0.05											0.03	0.04									
pH		**6.5 - 9.5**			7.3	7	7.2	7.1	7.3	7.2	7.2	7.2	7	7.2	7	7.1	7.2	7.1	7.1	7.1	7.2	7.2	7.1	7.3	7.4	7.1	7.1	7.2	
Phenol	**mg/l**		**0.0005**		<0.002			<0.025			<0.002			<0.002			<0.002			<0.002			<0.002		<0.002	<0.002			
Potassium	**mg/l**		**5**		13.13			4.53			5.16			8.89			10.4			6.11			3.87		2.5	3.45			
Sampling Depth	**m**				25.7	25.5	25.7	25.8	25.7	25.8	25.1	25.2	25.2	25.1	25	24.2	22.7	23		24	23.9	25.9	25.3	27.6	28.1	27.1	18	26	
Selenium	**µg/l**	**10**						<0.5			0.7			<0.5			0.6			0.5			<0.5		<0.5	<0.5			
Silver	**µg/l**							<0.5			nm			nm			nm			nm									
Sodium	**mg/l**	**200**	**150**	**150**	44.23			21.46			22.1			34.57			31.31			25.51			19.42		31.43	17.64			
Strontium	**µg/l**							138.64			129.35			163.24			227.34			143.67			108.87		94.35	109.61			
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				18											31.9	24.5									
Suspended Solids	**mg/l**																												
Temp	**°C**				11.9	10.8	12.3	12.7	13.8	12.6	15.8	17	12.7	16	10.4	10.4	9.2	10.2	9.8	10.8	12.6	12.2	20.2	14.8	10.5	14	9.9	nm	
Thallium	**µg/l**							0.38			0.46			0.82			2.66			0.57			0.22		<0.1	0.13			
Time sampled					13:10	13:45	12:15	12:10	13:10	12:50	11:45	12:20	12:50	12:00	12:20	12:25	12:25	12:35	12:05	11:55	12:30	12:15	11:45	12:30	11:45	11:50	11:20	13	
Tin (µg/l)	**µg/l**							<1			<1			<1			nm			nm									
T.O.C.	**mg/l**	**NAC**			82.2			50.1			2.5			1.6			79.7			<1.5			1.9			3.8			
T.O.N	**mg/l N**		**NAC**		6.64			6.17			2.89			9.06			7.12		7.85	7.36			5.96		0.23	4.89			
Total S Solids	**mg/l**																												
Uranium	**µg/l**							1.1			1.02			1.18			0.93			1.34			1.03		0.24	1.04			
Vanadium	**µg/l**							<0.5			0.64			0.86			0.75			<0.5			0.58		<0.5	0.77			
Zinc	**µg/l**		**100**		32.1			7.9			12.3			14.9			30.9			9.2			6.2		5.1	5.3			

BOREHOLE BH6A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**28-Aug-07**	**25-Sep-07**	**24-Oct-07**	**28-Nov-07**	**18-Dec-07**
Alkalinity	**mg/l CaCO3**							186												200										
Aluminium	**ug/l**	**200**	**200**	**150**																										
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.06	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																												
Arsenic	**ug/l**		**10**	**7.5**																										
Barium	**ug/l**		**100**		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	nm	<50
Beryllium	**ug/l**																													
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**				<50												<50										
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10
Calcium	**mg/l Ca**		**200**					75.04												73.02										
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	35	40	36	28	29	30	30	33	41	51	47	39	38	29	23	24	29	33	25	26	30	38	41	48
Chromium	**µg/l**	**50**	**30**	**37.5**	6.2	2.5	3.3	<1	2.5	<1	<1	2.7	3.6	<1	2.2	<1	3.2	<1	2.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Cobalt	**µg/l**																													
Coliform Bacteria	**(No/100 ml)**	**0**																												
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	508	514	566	490	488	489	481	486	502	525	518	503	495	496	489	487	496	476	463	465	480	439	486	514
Copper	**µg/l**	**2000**	**30**	**1500**				4.5												<1										
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05										
D.O.	**% Saturation**				49			68			85			56			63			65			82			50				
E_Coli	**No/100 ml**	**0**						0																						
Fluoride	**mg/l**	**0.8**	**1000**					0.16												<0.150										
Iron	**µg/l**	**200**	**200**		65.9	66	99.5	261.6	208.4	141.1	142.1	194	209.9	271.3	170.3	66.8	171.5	168.3	106.4	171.5	142.2	154.8	166.9	192.7	169.7	137.7	175.1	212.1
Lead	**µg/l**	**25**	**10**	**18.75**	5.2	6.4	5.6	16.9	17.9	4.8	15.9	15.4	11.9	31.1	16.3	13.9	19.3	18.3	3.5	7.5	8.9	12.6	18.0	12.7	4.9	6.0	9	9.5
Magnesium	**mg/l Mg**		**50**					2.93												2.80										
Manganese	**µg/l**	**50**	**50**		4	5.4	9.2	28.1	27.1	9.5	14.6	41	61.5	61.8	32.2	23.5	22.6	25.0	3.7	10.8	43.9	30.8	48.4	56.9	8.8	16.1	35.9	35.5
Mercury	**µg/l**	**1**	**1**	**0.75**				0.4												<0.10										
Molybdenum	**µg/l**		**35**																											
Nickel	**µg/l**	**20**	**20**	**15**	<1	<1	<1	2.2	2.1	2.1	<1	2.9	6.6	3.5	<1	<1	<1	<1	<1	4.1	<1	<1	<1	<1	<1	<1	2.1	2.6
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.003	<0.003	0.003	0.005	<0.003		<0.003	<0.003	<0.003	0.017	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	nm	0.003	0.005	0.003	0.005	<0.003	0.006
o-Phosphate	**mg/l P**		**30**					0.02												<0.02										
pH		**6.5 - 9.5**			7.6	7.6	7.6	7.5	7.6	7.5	7.6	7.7	7.6	7.7	7.5	7.8	7.6	7.3	7.2	7.6	7.4	7.6	7.5	7.5	7.4	7.6	7.5	7.6
Phenol	**mg/l**		**0.0005**		<0.001	<0.001	0.009	<0.001	0.174	0.196	0.002	0.009	0.005	<0.001	0.131	<0.001	0.007	nm	<0.001	<0.001	<0.01	nm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	**mg/l**		**5**		1.52	0.6	0.7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.17	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sampling Depth	**m**				29.8	29.9	29.1	29.6	29.9	29.7	29.7	29.8	28.6	29.2	29.8	28.6	29.8	29.2	29.7	29.0	29.5	29.7	28.4	29.0	29.4	28.7	29.3	30.1
Selenium	**µg/l**	**10**																												
Silver	**µg/l**																													
Sodium	**mg/l**	**200**	**150**	**150**	20.64	20.29	25.75	18.44	21.97	15.1	19.85	18.78	22.06	24.64	28.83	20.16	16.86	16.06	13.72	16.50	22.78	16.96	15.81	16.79	15.10	19.03	23.18	25.78
Strontium	**µg/l**																													
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				19.5												19.8										
Suspended Solids	**mg/l**																													
Temp	**°C**				9.5	8	6	13.6	12	14	22	14	13	13.6	10	9	9.3	12.0	10.0	13.8	14.0	14.0	18.4	14.0	10.0	10.4	13	11
Thallium	**µg/l**																													
Time sampled								10.45	11.1	11.15	11.45	11.1	11.05	10.5	11.1	11.15	11.20	11.00	11.10	11.10	10.55	11.20	11.30	11.10	11.15	11.10	9.15	11.3
Tin (µg/l)	**µg/l**																													
T.O.C.	**mg/l**	**NAC**			2.7			<1.5			<1.5			1.5			<1.5			<1.5			<1.5			<1.5			
T.O.N	**mg/l N**		**NAC**		0.69	0.75	0.83	0.89	0.91	0.94	0.99	0.86	0.59	0.61	0.68	0.68	0.75	0.73	0.90	1.20	1.05	0.89	1.08	1.30	1.12	0.79	0.65	0.52
Total S Solids	**mg/l**																													
Uranium	**µg/l**																													
Vanadium	**µg/l**																													
Zinc	**µg/l**		**100**		5.2	5.8	3.9	9.5	8.8	6.2	5.7	9.7	10.5	11.2	10.4	8.3	14.0	10.4	4.6	3.2	<1	3.6				6.0	8.6	7.3

BOREHOLE BH6A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**18-Aug-09**	**29-Sep-09**	**20-Oct-09**	**17-Nov-09**	**08-Dec-09**
Alkalinity	**mg/l CaCO3**							162												196										
Aluminium	**ug/l**	**200**	**200**	**150**																										
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.08	0.03	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																												
Arsenic	**ug/l**		**10**	**7.5**																										
Barium	**ug/l**		**100**		51.4	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Beryllium	**ug/l**																													
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**				63.4												<50										
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium	**mg/l Ca**		**200**					77.49												83.89										
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	49	44	42	40	45	49	54	54	61	53	47	45	39	34	35	34	41	45	45	47	48	51	54	41
Chromium	**µg/l**	**50**	**30**	**37.5**	<1	<1	<1	<1	<1	6	<1	3.4	<1	<1	<1	<1	2.3	2.1	1.1	2.2	2.2	3.7	3.5	3.7	2.89	1.4	3.5	4.1
Cobalt	**µg/l**																													
Coliform Bacteria	**(No/100 ml)**	**0**																												
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	531	508	506	480	490	510	516	522	556	537	514	506	493	486	485	508	497	508	506	508	514	516	525	503
Copper	**µg/l**	**2000**	**30**	**1500**				2.6												<1										
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.01										
D.O.	**% Saturation**				51			80			52			53			58			101			nm	75		42			
E_Coli	**No/100 ml**	**0**						0																1						
Fluoride	**mg/l**	**0.8**	**1000**					0.16												<0.150										
Iron	**µg/l**	**200**	**200**		240.2	103.5	102.8	113.4	103.4	227.4	125.1	115	139.9	158.4	137.4	87	151.3	108.9	103.9	108.8	132.7	54.6	<50	<50	56.51	<50	<50	<50
Lead	**µg/l**	**25**	**10**	**18.75**	9.4	5.6	5.5	9.6	4.2	17.4	8.5	11.6	6.7	6.4	7.5	<1	4.5	1.6	3.2	1.9	5	3.9	1.8	2.1	2.19	1.4	1.5	2.7
Magnesium	**mg/l Mg**		**50**					2.73												3.06										
Manganese	**µg/l**	**50**	**50**		36.4	11.8	9	15.6	6.1	43.4	18.6	37.9	174.2	19	16.2	9.4	15.2	4.5	21.5	8.9	15.3	22.8	14.2	10.9	10.33	9.5	5.9	9.3
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.1										
Molybdenum	**µg/l**		**35**																											
Nickel	**µg/l**	**20**	**20**	**15**	2.3	<1	<1	<1	<1	2.3	<1	<1	<1	<1	<1	<1	<1	<1	1.3	<1	1.7	1.6	1.3	1.5	1.35	1.4	1.4	<1
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.006	<0.003	<0.003	0.006	<0.003	0.006	0.005	0.777	0.055	<0.003	<0.003	<0.003	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	0.004	<0.002
o-Phosphate	**mg/l P**		**30**					0.03									<0.02			0.02										
pH		**6.5 - 9.5**			7.4	7.5	7.5	7.6	7.6	7.5	7.5	7.6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.6	7.4	7.6	7.8	7.4	7.6	7.5
Phenol	**mg/l**		**0.0005**		0.03	0.02	0.02	<0.01	<0.01	<0.01	nm	0.02	<0.01	0.05	<0.01		<0.01	0.01	<0.016	<0.002	<0.002	<0.002	nm	<0.002	<0.015	<0.015	<0.0005	<0.015
Potassium	**mg/l**		**5**		1.89	<1	<1	<1	<1	<1	<1	0.96	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sampling Depth	**m**				29.6	29.2	29	29.9	28.5	28.1	28.5	28.1	28.9	29	29	28.9	28.9	28.8	29.9	29.3	29	28.3	28	28	29.1	29.2	28.1	28.1
Selenium	**µg/l**	**10**																												
Silver	**µg/l**																													
Sodium	**mg/l**	**200**	**150**	**150**	25.1	23.4	27.54	23.82	20.1	23.99	23.92	25.75	26.12	26.21	26.89	28.36	26.96	21.36	23.31	16.76	25.05	23.27	24.88	24.73	25.02	27.44	28.80	23.38
Strontium	**µg/l**																													
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				21.8												16.6										
Suspended Solids	**mg/l**																													
Temp	**°C**				6.8	11	12	11	12	15.9	15.8	14	11	8.9	11	10	6.8	13	10	13	11	13	16	13.9	11	10.7	10.1	10.0
Thallium	**µg/l**																													
Time sampled					nt	11.1	11.15	11.15	11	11	11.15	11	11.15	10.5	11.05	10.15	11.2	11	11.1	11	11.15	10.55	11	10.5	10.5	10.50	9.05	11.00
Tin (µg/l)	**µg/l**																													
T.O.C.	**mg/l**	**NAC**			<1.5			<1.5			<1.5			<1.5			1.5			<1.5			<3.0			<3.0			
T.O.N	**mg/l N**		**NAC**		0.73	0.95	1.19	1.09	0.9	0.68	0.7	0.5	0.49	0.83	0.92	0.95	1.39	1.15	1.08	0.62	0.68	0.53	0.44	0.44	0.37	0.29	0.22	0.60
Total S Solids	**mg/l**																													
Uranium	**µg/l**																													
Vanadium	**µg/l**																													
Zinc	**µg/l**		**100**		15.5	9.4	8.9	12.4	<1	18.1	13.9	18.7	16.1	12.3	8.5	6.5	10.5	9.2	7	3.1	8.5	8.3	5.5	4.5	118.76	5.4	6.0	7.7

BOREHOLE BH6A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**09-Aug-11**	**06-Sep-11**	**04-Oct-11**	**08-Nov-11**	**13-Dec-11**
Alkalinity	**mg/l CaCO3**							170						180						174										
Aluminium	**ug/l**	**200**	**200**	**150**																										
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																												
Arsenic	**ug/l**		**10**	**7.5**																										
Barium	**ug/l**		**100**		43.2	42.9	42	40.1	36.3	37.2	39.7	40.5	42.0	48.6	46.5	40.6	42.2	42.8	41.5	37.6	37.6	38.2	37.3	32.4	38.4		44.4		
Beryllium	**ug/l**																													
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**				60.7						79.5						48.1										
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		
Calcium	**mg/l Ca**		**200**					68.22						85.11						80.4										
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	34	28	27	26	26	30	32	39	40	51	40	29	21	25	22	22	24	46	32	44	52	62	60	57		
Chromium	**µg/l**	**50**	**30**	**37.5**	<1	1.5	<1	<1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	0.6	<5	1.7	<0.5	0.6	0.5	<0.5	<0.5	<0.5		<0.5		
Cobalt	**µg/l**																													
Coliform Bacteria	**(No/100 ml)**	**0**																												
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	480	455	464	458	454	451	461	477		504	485	442	456	455	456	903	436	413	449	488	511	570	657	596		
Copper	**µg/l**	**2000**	**30**	**1500**				<1						1.3						0.8										
Cyanide	**mg/l**	**0.05**	**10**					<0.05						nm						<0.05						<0.05				
D.O.	**% Saturation**				64			76			74			40				95		73			61			22				
E_Coli	**No/100 ml**	**0**						3						nm						nm										
Fluoride	**mg/l**	**0.8**	**1000**					0.18						0.200						0.15						0.15				
Iron	**µg/l**	**200**	**200**		<50	79.1	22.5	<10	42.9	18.4	21.4	46.7	29.8	48.0	<100	<100	115.9	<100	19.0	95.5	29.1	<10	12.1	<10	<10		<10		
Lead	**µg/l**	**25**	**10**	**18.75**	<1	5.8	3.1	1.1	2.6	1.4	3.9	1.7	2.1	3.0	<5	<5	2.1	<5	0.8	3	0.9	<0.5	<0.5	<0.5	<0.5		<0.5		
Magnesium	**mg/l Mg**		**50**					2.3						2.82						3.03										
Manganese	**µg/l**	**50**	**50**		4.2	19.5	6.3	4.5	23.8	9.6	24.7	19.7	17.7	19.7	14.7	<10	15.8	11.1	3.2	22.4	5.1	4.8	4.1	1.9	48.3		2.5		
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.1						<0.05						<0.05										
Molybdenum	**µg/l**		**35**																											
Nickel	**µg/l**	**20**	**20**	**15**	1.2	1.3	<1	<1	<1	<1	<0.5	1.2	1.1	1.3	<5	<5	<0.5	<5	<0.5	<0.5	0.7	0.5	0.5	0.7	0.7		<0.5		
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	nm	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002		<0.002	<0.002		
o-Phosphate	**mg/l P**		**30**					<0.02						<0.02						<0.02						<0.02				
pH		**6.5 - 9.5**			7.5	7.6	7.6	7.5	7.6	7.6	7.6	7.4		7.6	7.8	7.8	7.5	8.0	7.7	7.6	7.5	7.6	7.7	7.4	7.6	7.6	7.7	7.6		
Phenol	**mg/l**		**0.0005**		<0.015	<0.015	<0.015	<0.015	<0.2	<0.1	<0.025	<0.015	<0.015	<0.025	<0.015	<0.025	<0.01	<0.025	<0.025	<0.013	<0.013	<0.008	<0.008	<0.016	<0.016	<0.016	<0.025		
Potassium	**mg/l**		**5**		<1	<1	<1	<1	<1	0.75	2.24	0.79	0.77	0.93	<2.5	<2.5	0.70	<2.5	0.63	0.91	0.67	0.85	0.78	1.44	1.37		1.23		
Sampling Depth	**m**				28.6	28.6	29.4	29.1	28.8	29	30.6	29.0	29.5	nm	29.2	29.1	28.0	28.0	28.3	28.1	24.5	29.3	29.5	29.5	29.7		29.1	29		
Selenium	**µg/l**	**10**																												
Silver	**µg/l**																													
Sodium	**mg/l**	**200**	**150**	**150**	19.97	20.67	21.3	20.42	18.48	22.84	18.31	21.53	22.10	28.99	25.16	18.67	17.20	18.65	15.53	17.8	18.89	17.45	16.3	20.17	25.24		30.62		
Strontium	**µg/l**																													
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				22.7						19.3						17.7						19.7				
Suspended Solids	**mg/l**																													
Temp	**°C**				10	10	10	13.1	11	12.2	25.0	10.8	14.7	10.5	9.8	9.7	12.0	10.0	11.2	11.8	15	12.3	12.4	12	14.2	12.4	12.5	11.3		
Thallium	**µg/l**																													
Time sampled					10.55	10.5	10.55	11.05	10.55	10.55	11.00	10.50	12.20	11:15	9:50	10:00	10:45	11.00	11:30	10:55	11	10:55	10:20	10:20	11:00	10:50	10:40	09:00		
Tin (µg/l)	**µg/l**																													
T.O.C.	**mg/l**	**NAC**			<3.0			<1.5			<1.5			41.7				1.7		44.5			1.7							
T.O.N	**mg/l N**		**NAC**		1.15	1.2	1.2	1.08	0.87	0.63	0.61	0.31	0.34	0.22	0.56	0.98	1.26	1.03	1.23	1.32	0.86	0.59	0.71	0.44	0.26	0.18	0.28	0.46		
Total S Solids	**mg/l**																													
Uranium	**µg/l**																													
Vanadium	**µg/l**																													
Zinc	**µg/l**		**100**		5.7	12.7		4.3	5.3	3.7	11.0	6.3	7.9	7.3	33.9	20.9	7.8	27.8	5.6	7.9	7.7	11.7	30.6	9.8	9.8		13.3		

BOREHOLE BH6A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**07-Aug-13**	**17-Sep-13**	**08-Oct-13**	**19-Nov-13**	**03-Dec-13**
Alkalinity	**mg/l CaCO3**							166												182										
Aluminium	**ug/l**	**200**	**200**	**150**				<5	<5	<5	<5	<5	<5	<5	7.8	<5	<5	19		8.8	<5	25.1	<5	<5		5.5	<10	<10		
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.08	0.03	<0.020	0.022		
Antimony	**ug/l**	**5**						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<1	<1		
Arsenic	**ug/l**		**10**	**7.5**				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<1	<1		
Barium	**ug/l**		**100**		37	38.2	35.1	35.8	39.4	36.1	37.1	40.4	37	36.3	34.8	32.2	40.3	41.5		40.9	35.2	33.7	36	36		36	38.5	39.5		
Beryllium	**ug/l**							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<1	<1		
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**	63.4	65.6	63.1	64.3	65.1	69.4	46.9	54	53.8	63.4	53.7	52.1	45.6	45.6		24.9	27.1	34.9	42.3	42.3		44	49.4	55.9		
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1		
Calcium	**mg/l Ca**		**200**		66.88	73.27	66.64	68.28	72.05	66.73	71.45	63.68	65.72	72.07	65.77	61.46	63.29	63.76		70.98	67.47	70.84	69.16	69.16		66.69	66.58	64.84		
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	36	33	32	35	38	40	22	23	25	25	22	24	16	16	15	14	16	17	23	23		27	38	44		
Chromium	**µg/l**	**50**	**30**	**37.5**	<0.5	0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.9	0.8	0.5	<0.5	1		0.9	0.8	0.7	1	1		1.2	<1	1.8		
Cobalt	**µg/l**							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<1	<1		
Coliform Bacteria	**(No/100 ml)**	**0**						172												13										
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	524	472	462	468	460	523	459	525	465	471	453	445	413	424	431	420	423	415	419	419	611	438	463	485		
Copper	**µg/l**	**2000**	**30**	**1500**	0.6	0.8	1	<0.5	1.4	1.4	0.5	2	<0.5	0.7	1.3	<0.5	1.1	1.6		0.9	0.6	1.3	0.5	0.5		0.7	<1	1.2		
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05										
D.O.	**% Saturation**				65			61			79			74			76			78			54	54		65				
E_Coli	**No/100 ml**	**0**						15												0										
Fluoride	**mg/l**	**0.8**	**1000**					0.17												0.15										
Iron	**µg/l**	**200**	**200**		<10	<10	15.1	<10	10.9	<10	17.1	<10	<10	<10	<10	11.4	17.2	50.7		29	<10	92.9	<10	<10		<10	15.5	10.1		
Lead	**µg/l**	**25**	**10**	**18.75**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.3		<0.5	<0.5	2.1	<0.5	<0.5		<0.5	<1	<1		
Magnesium	**mg/l Mg**		**50**		2.5	2.72	2.44	2.55	2.61	2.52	2.56	2.33	2.47	2.7	2.58	2.43	2.34	2.56		2.96	2.68	2.79	2.65	2.65		2.58	2.76	2.68		
Manganese	**µg/l**	**50**	**50**		<1	1.2	<1	1.6	1.1	<1	1.6	<1	<1	<1	1	<1	2.6	8.8		4.5	1.1	17	1.5	1.5		1.6	<5	<5		
Mercury	**µg/l**	**1**	**1**	**0.75**	nm	nm	nm	<0.05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		<0.05	nm	nm	nm	nm		nm	nm	nm		
Molybdenum	**µg/l**		**35**					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<1	<1		
Nickel	**µg/l**	**20**	**20**	**15**	0.7	<0.5	0.8	<0.5	0.6	0.6	<0.5	<0.5	<0.5	<0.5	0.6	0.5	2.7	1		0.7	1.3	2.1	0.6	0.6		1.3	1.1	1.5		
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.007	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		0.002	<0.004	<0.004		
o-Phosphate	**mg/l P**		**30**					0.02												0.02										
pH		**6.5 - 9.5**			7.6	7.6	7.6	7.6	7.7	7.7	7.5	8.1	7.3	7.6	7.1	7.2	6.9	7.4	7.4	7.6	7.6	7.6	7.6	7.6	7.3	7.6	7.6	7.4		
Phenol	**mg/l**		**0.0005**		<0.002	nm	<0.002	<0.025	<0.002	<0.025	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	nm		
Potassium	**mg/l**		**5**		0.92	0.83	0.97	0.84	0.97	1.02	0.81	0.85	0.88	1.25	0.84	0.75	0.86	0.79		1.19	1.23	0.81	1.3			1.11	1.54	1.41		
Sampling Depth	**m**				29.3	29	29	29.1	29.3	29.5	29.3	29	28.8	29.2	27.8	29	27.5	27.3	26.8	27.8	28.4	28.8	29.6	29.6	27.6	28.6	29.2	28.7		
Selenium	**µg/l**	**10**						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<1	<1		
Silver	**µg/l**							<0.5	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		nm										
Sodium	**mg/l**	**200**	**150**	**150**	24.14	21.83	22.78	22.93	25.19	25.13	17.59	18.54	19.5	22.7	19.74	18	15.25	16.09		11.91	11.86	14.56	15.87	15.87		16.44	18.56	19.86		
Strontium	**µg/l**							90.71	95.41	95.13	93.2	90.67	92.9	88.25	86.1	75.96	83.88	90		92.43	88.59	92.25	88.38	88.38		93.63	89.41	91.79		
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				19.5												11.6										
Suspended Solids	**mg/l**																													
Temp	**°C**				11	11.4	12	12.8	12.7	12.7	15.6	14	12	14.8	10.6	10.4	9.4	10.2	9.6	10.5	10.4	10.6	13.8	13.8	14.8	11	10	8.3		
Thallium	**µg/l**							<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<1	<1		
Time sampled					10:35	11:10	10:30	0.4375	0.44792	0.44444	09:50	10:15	10:20	10:35	10:15	10:30	10:40	10:30	10:45	10:00	10:50	10:25	11:20	11:20	12:30	11:20	12:10	10:45		
Tin (µg/l)	**µg/l**							<1	<1	<1	<1	<1	<1	<1	<1	<1	nm	nm		nm										
T.O.C.	**mg/l**	**NAC**			43.4			41.3			5			<1.5			43.7			<1.5			<1.5	<1.5		2.5				
T.O.N	**mg/l N**		**NAC**		0.9	1.1	0.98	0.73	0.73	0.73	1.11	1.19	0.96	1.15	0.86	1.1	0.86	1.1	1.12	1.11	1.25	1.04	0.78	0.78		1.51	0.59	0.3		
Total S Solids	**mg/l**																													
Uranium	**µg/l**							0.38	0.44	0.4	0.47	0.42	0.38	0.41	0.36	0.34	0.41	0.42		0.4	0.39	0.47	0.39	0.39		0.44	<1	<1		
Vanadium	**µg/l**							<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.54	<0.5	<0.5	0.51	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		0.52	<1	<1		
Zinc	**µg/l**		**100**		11.9	12.7	11.4	7.3	9.8	10.5	10.2	10.3	4.4	3.2	19.4	4.4	22.4	29.7		30.6	8.6	13.6	4.4	4.4		18.7	29.7	17.2		

BOREHOLE BH7A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**28-Aug-07**	**26-Sep-07**	**24-Oct-07**	**28-Nov-07**	**18-Dec-07**
Alkalinity	**mg/l CaCO3**							102												166									
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.05	0.03	0.03	<0.03	2	0.03	<0.03	0.03	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.08	<0.03	0.04	<0.03	0.09	0.04	<0.03	0.05	<0.03	
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		<50			<50			<50			66.7	<50		<50			<50		<50	<50			<50			
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				<50												52.2									
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10			<0.10			<0.10			0.9	<0.10		<0.10			<0.10		<0.10	<0.10			0.2			
Calcium	**mg/l Ca**		**200**					82.67												87.90									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	37			31			32			19	22		19			21		34	25			77			
Chromium	**µg/l**	**50**	**30**	**37.5**	11.6			9			6.5			7.8	6.5		5.9			4.2		5.9	5.0			18.1			
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	580	556	566	620	649	941	659	745	642	574	722	658	649	617	627	625	815	624	577	535	539	632	754	632	
Copper	**µg/l**	**2000**	**30**	**1500**				7												<1									
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05									
D.O.	**% Saturation**				95			98			104			100			91			96			109			65			
E_ Coli	**No/100 ml**	**0**						0																					
Fluoride	**mg/l**	**0.8**	**1000**					0.23												0.180									
Iron	**µg/l**	**200**	**200**		128.8			499			161.6			370.3	134.1		167.9			208.6		191.5	189.0			87.0			
Lead	**µg/l**	**25**	**10**	**18.75**	3.8			2.4			3.3			3.4	<1		<1			<1		<1	<1			<1			
Magnesium	**mg/l Mg**		**50**					9.74												9.50									
Manganese	**µg/l**	**50**	**50**		59.5			40.7			35.5			493.4	47.4		24.0			14.9		128.1	65.6			51.2			
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.10									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	3.4			4.4			3			15.2	2.2		2.3			5.6		3.5	2.5			2.5			
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.003			<0.003			<0.003			<0.003	0.008		0.004			<0.003		nm	<0.003			0.009			
o-Phosphate	**mg/l P**		**30**					0.03												<0.02									
pH		**6.5 - 9.5**			7.6	8.1	8	8.1	7.9	7.8	8	7.9	7.9	8	7.8	8.1	8.0	7.8	7.9	8.0	8.2	8.0	7.9	7.8	7.8	8.2	7.1	8.7	
Phenol	**mg/l**		**0.0005**		0.021			<0.001			0.01			<0.001			0.183			<0.001			<0.01			<0.01			
Potassium	**mg/l**		**5**		31.65			17.87			17.69			14.91	12.34		6.32			7.67		24.24	11.01			107.29			
Sampling Depth	**m**				14.2	14.2	14.1	14.1	14.2	14.2	14.1	14.2	14.8	14.5	14.3	14.1	14.2	14.1	14.3	14.1	14.2	14.2	13.5	14.2	12.9	12.4	12.2	12.2	
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	12.23			14.05			14.86			10.83	17.44		11.74			13.35		11.14	11.29			21.01			
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				143.9												144.1									
Suspended Solids	**mg/l**																												
Temp	**°C**				9.8	6	6	12.1	14	13	18.1	14	12	13.2	10	8	9.5	11.0	10.0	15.2	15.0	15.0	16.9	14.0	10.0	12.6	13	11	
Thallium	**µg/l**																												
Time sampled								12.45	13	13.1	13.2	13	13.05	12.55	13	13	12.50	13.10	12.55	13.00	13.00	12.45	12.45	13.10	12.50	12.45	12	13.4	
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			29.3			3.1			4.1			2.7	4.1		3.4			3.1			3.9			2.2			
T.O.N	**mg/l N**		**NAC**		0.59			0.36			0.31			0.57	0.12		0.12			0.13		0.24	0.26			0.82			
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		7.9			10.8			12.2			25.6	5		7.6					5.6				5.7			

BOREHOLE BH7A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**18-Aug-09**	**29-Sep-09**	**20-Oct-09**	**17-Nov-09**	**08-Dec-09**
Alkalinity	**mg/l CaCO3**							89												71									
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.04	0.04	0.03	0.03	0.03	<0.03	0.04	0.04	<0.03	0.04	0.04	0.03	<0.03	<0.03	<0.03	0.03	0.03	0.03	<0.03	<0.03	0.03	1.21	<0.03	10.37	
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		<50			<50			<50			<50			<50			<50			62.3			<50			
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				<50												<50									
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10			<0.10			0.2			<0.10			<0.10			0.1			0.1			0.1			
Calcium	**mg/l Ca**		**200**					48.62												31.19									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	38			59			91			22			23			55			11			44			
Chromium	**µg/l**	**50**	**30**	**37.5**	10.1			14.7			25.1			5.1			7.2			16.4			6.7			16.6			
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	543	585	691	633	734	741	761	661	617	513	475	452	465	481	484	560	537	538	653	669	642	553	621	1027	
Copper	**µg/l**	**2000**	**30**	**1500**				5.1												2.1									
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.01									
D.O.	**% Saturation**				87			76			58			93			90			87			nm	56		83			
E_ Coli	**No/100 ml**	**0**						0																nm					
Fluoride	**mg/l**	**0.8**	**1000**					0.41												0.48									
Iron	**µg/l**	**200**	**200**		95.7			244.7			<50			149.9			102.3			65.8			76.7			<50			
Lead	**µg/l**	**25**	**10**	**18.75**	<1			4.1			<1			<1			<1			1			3.2			<1			
Magnesium	**mg/l Mg**		**50**					5.14												3.41									
Manganese	**µg/l**	**50**	**50**		8.7			99.6			13.2			45.3			26.3			13.2			57.4			2.1			
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.1									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	<1			2.9			<1			<1			<1			1.1			2.7			<1			
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.005			0.007			0.004			0.004			<0.002			<0.002			<0.002			0.029			
o-Phosphate	**mg/l P**		**30**					0.03									<0.02			0.03									
pH		**6.5 - 9.5**			8.2	8.1	8.2	8.3	9.7	9.9	10.4	8.6	8	7.9	7.9	7.3	8	8	7.7	8.8	8.2	8.1	7.1	7.1	7.1	8.3	7.0	7.0	
Phenol	**mg/l**		**0.0005**		0.02			<0.01			<0.01			0.03			<0.01			<0.002			<0.025			<0.015			
Potassium	**mg/l**		**5**		38.91			79.42			145.08			12.12			14.54			77.66			2.52			96.02			
Sampling Depth	**m**				12.2	12.2	12.2	12.8	12.2	12	12	12.2	12.2	nm	9	9.1	9.1	12.1	11.2	12.1	11.6	11.2	12	12.5	11.9	9.1	9.8	nm	
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	13.59			15.05			22.58			10.3			9.68			15.74			10.28			15.49			
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				96.7												85.9									
Suspended Solids	**mg/l**																												
Temp	**°C**				9.4	11	12	11	nm	13.6	14.9	15	14	9.1	11	10	6.5	13	11	16	12.8	13	16	14.1	12	11.0	10.5	10.2	
Thallium	**µg/l**																												
Time sampled					nt	13.1	13.1	13.15	12.5	13	13.2	12.5	12.45	12.4	13.05	12.2	12.45	14.35	13	13	12.5	12.55	13	13	12.45	12.20	11.35	12.35	
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			2.2			2.2			1.5			2.2			2.6			1.8			6.6			<3.0			
T.O.N	**mg/l N**		**NAC**		0.33			0.71			1.29			0.24			0.32			0.53			0.93			5.77			
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		5.6			4.7			3.7			9.2			8.2			9.5			12			2.5			

BOREHOLE BH7A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**09-Aug-11**	**06-Sep-11**	**04-Oct-11**	**08-Nov-11**	**13-Dec-11**
Alkalinity	**mg/l CaCO3**							144												103										
Aluminium	**ug/l**	**200**	**200**	**150**																										
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	7.47	4.75	2.69	<0.03	1.82	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																												
Arsenic	**ug/l**		**10**	**7.5**																										
Barium	**ug/l**		**100**		43			28.3			28.7			64.8				31.0		27.8			58.8			22.6				
Beryllium	**ug/l**																													
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**				50.3												64.5										
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.3			<0.1			<0.1			<0.1				<1		<0.1			<0.1			<0.1				
Calcium	**mg/l Ca**		**200**					73.63												77.58										
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	64			22			23			14				18		31			16			31				
Chromium	**µg/l**	**50**	**30**	**37.5**	1.9			4			7.9			0.6				<5		10.2			<0.5			10				
Cobalt	**µg/l**																													
Coliform Bacteria	**(No/100 ml)**	**0**																												
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	939	809	733	488	664	564	413	655		664	554	953	686	505	715	747	708	593	716	613	627	575	832	741		
Copper	**µg/l**	**2000**	**30**	**1500**				2												0.9										
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05										
D.O.	**% Saturation**				89			105			102			54				95		101			58			87				
E_Coli	**No/100 ml**	**0**						9												nm										
Fluoride	**mg/l**	**0.8**	**1000**					0.2												0.21										
Iron	**µg/l**	**200**	**200**		<50			19.2			25.8			32.6				<100		<10			17.6			10.6				
Lead	**µg/l**	**25**	**10**	**18.75**	<1			<1			0.8			1.4				<5		<0.5			<0.5			<0.5				
Magnesium	**mg/l Mg**		**50**					9.41												8.92										
Manganese	**µg/l**	**50**	**50**		212			14.1			7.1			23.1				<10		<1			2.5			1.3				
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.1												<0.05										
Molybdenum	**µg/l**		**35**																											
Nickel	**µg/l**	**20**	**20**	**15**	16.2			<1			2.3			1.0				<5		1			<0.5			<0.5				
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.005			<0.002			<0.002			<0.002		<0.002		<0.002		<0.002			<0.002			<0.002				
o-Phosphate	**mg/l P**		**30**					0.02												<0.02										
pH		**6.5 - 9.5**			7.2	7.2	7.2	7.2	7.1	8.2	7.7	7.1		7.2	8.0	7.6	7.2	8.5	7.2	7.9	7.2	8.2	7.1	10	9.7	8.3	8.7	9.5		
Phenol	**mg/l**		**0.0005**		<0.015			<0.015			<0.025			<0.025		<0.025		<0.025		0.02			<0.008			<0.016				
Potassium	**mg/l**		**5**		9.15			9.01			14.16			3.06				7.19		22.6			2.43			48.99				
Sampling Depth	**m**				9.2	8.4	9.5	9	10	10.1	10.1	9.0	10.0	nm	9.5	10.0	9.1	7.0	12.0	9.2	8.1	11.4	11.7	9.1	12.5	13.3	8.1	9.3		
Selenium	**µg/l**	**10**																												
Silver	**µg/l**																													
Sodium	**mg/l**	**200**	**150**	**150**	32.72			9.85			8.65			11.20				9.45		11.25			9.08			11.37				
Strontium	**µg/l**																													
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				85.2												99.3										
Suspended Solids	**mg/l**																													
Temp	**°C**				6.8	9.4	11	15.1	12	12.5	20.0	13.0	16.7	11.1	9.6	13.4	11.0	8.4	10.5	12.6	14	13.3	12.9	12	13.1	13.8	12.6	11.4		
Thallium	**µg/l**																													
Time sampled					12.3	13	12.45	13.05	12.45	12.55	12.00	12.45	13.30	nt	17:00	12:15	12:45	12.55	12:55	13:00	13:05	13:05	12:50	15:00	14:40	13:00	13:30	15:10		
Tin (µg/l)	**µg/l**																													
T.O.C.	**mg/l**	**NAC**			4.8			2.4			1.7			3.7				4.2		22.1			4.9			28				
T.O.N	**mg/l N**		**NAC**		5.9			0.15			0.35			1.79		2.68		<0.08		0.36			2.53			0.25				
Total S Solids	**mg/l**																													
Uranium	**µg/l**																													
Vanadium	**µg/l**																													
Zinc	**µg/l**		**100**		11.3			3			89.9			7.8				33.9		2.5			5.3			6.6				

BOREHOLE BH7A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**07-Aug-13**	**17-Sep-13**	**08-Oct-13**	**19-Nov-13**	**03-Dec-13**
Alkalinity	**mg/l CaCO3**							284												140										
Aluminium	**ug/l**	**200**	**200**	**150**				<5			5.3			8			nm			14.6			29.4			59.5			
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	0.03	2	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	nm	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	<0.020	<0.020		
Antimony	**ug/l**	**5**						<0.5			<0.5			0.59			nm			0.58			0.95			1.16			
Arsenic	**ug/l**		**10**	**7.5**				<0.5			6.86			8.74			nm			8.74			44.61			47.05			
Barium	**ug/l**		**100**		8.2			14.7			37.2			31			nm			32.6			10.3			8.4			
Beryllium	**ug/l**							<0.5			<0.5			<0.5			nm			<0.5			<0.5			<0.5			
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**	28.7			95.2			66.1			66.7			nm			38.8			26.2			33.6			
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.1			0.1			<0.1			<0.1			nm			<0.1			0.2			0.1			
Calcium	**mg/l Ca**		**200**		14.36			85.16			79.24			56.18			nm			58.95			13.39			12.16			
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	68			46			16			34			nm			34			67			60			
Chromium	**µg/l**	**50**	**30**	**37.5**	22.1			4.9			4.7			11			nm			11.7			24.7			24.6			
Cobalt	**µg/l**							<0.5			<0.5			<0.5			nm			<0.5			<0.5			<0.5			
Coliform Bacteria	**(No/100 ml)**	**0**						>2420												41										
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	725	500	621	700	532	476	553	491	465	592	537	551	nm	578	577	571	561	565	627	621	606	595	451	454		
Copper	**µg/l**	**2000**	**30**	**1500**	1.4			0.7			1.6			2			nm			1.9			1			1.4			
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05										
D.O.	**% Saturation**				57			29			102			79			nm			90			50			57			
E_Coli	**No/100 ml**	**0**						250												0										
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												0.2										
Iron	**µg/l**	**200**	**200**		<10			<10			<10			<10			nm			20.7			<10			<10			
Lead	**µg/l**	**25**	**10**	**18.75**	<0.5			<0.5			<0.5			<0.5			nm			<0.5			<0.5			<0.5			
Magnesium	**mg/l Mg**		**50**		1.83			12.19			11.29			9.47			nm			7.53			1.59			2.1			
Manganese	**µg/l**	**50**	**50**		1.3			55.9			1.8			<1			nm			1.4			<1			<1			
Mercury	**µg/l**	**1**	**1**	**0.75**	nm			<0.05			nm			nm			nm			0.1			nm			nm			
Molybdenum	**µg/l**		**35**					<0.5			2.7			14.5			nm			18.8			63.9			70			
Nickel	**µg/l**	**20**	**20**	**15**	0.9			4.7			<0.5			<0.5			nm			2.6			1.3			1			
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002			0.012			<0.002			<0.002			nm			<0.002			<0.002			<0.002			
o-Phosphate	**mg/l P**		**30**					0.04												<0.02										
pH		**6.5 - 9.5**			9.4	7.4	8.9	7.2	8.6	8.1	7.6	7.7	7.6	7.7	7.4	7.4	nm	7.5	7.6	7.9	8	7.9	9.1	9.5	9.7	9.5	7.8	7.6		
Phenol	**mg/l**		**0.0005**		<0.002			<0.025			<0.002			<0.002			nm			<0.002			<0.002			<0.002			
Potassium	**mg/l**		**5**		126.67			4.8			12.14			48.65			nm			45.55			124.56			113.3			
Sampling Depth	**m**				7.5	7.6	7.3	7.4	9.1	8.2	7.9	9.2	9.2	9.2	9	9.7	nm	6	5.4	6.8	8.7	9.2	9.3	10.2	13.1	9.8	10.3	9.1		
Selenium	**µg/l**	**10**						<0.5			73.5			72.7			nm			71.8			109			100			
Silver	**µg/l**							<0.5			nm			nm			nm			nm										
Sodium	**mg/l**	**200**	**150**	**150**	20.29			22.02			9.89			15.39			nm			13.55			18.09			16.66			
Strontium	**µg/l**							128.15			294.76			163.61			nm			218.29			267.75			47.14			
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				17.6												82.2										
Suspended Solids	**mg/l**																													
Temp	**°C**				10.6	11.4	11.7	12.7	13.4	12.6	15.2	18.2	11.5	15.1	10.6	9.8	nm	7.2	6	11	nm	11.4	19.5	14.6	10.6	14	9.6	nm		
Thallium	**µg/l**							0.38			0.1			<0.1			nm			<0.1			<0.1			<0.1			
Time sampled					13:30	14:10	13:35	0.52778	0.5625	0.51736	13:10	11:55	13:15	12:30	12:00	12:05	13:05	12:10	12:20	12:35	12:10	11:50	12:35	12:00	12:30	12:35	14:25	12:30		
Tin (µg/l)	**µg/l**							<1			<1			<1			nm			nm										
T.O.C.	**mg/l**	**NAC**			15.1			49.8			3.2			3.1			nm			2			1.8			2.3			
T.O.N	**mg/l N**		**NAC**		0.92			6.02			0.1			0.33			nm			0.32			0.9			0.79			
Total S Solids	**mg/l**																													
Uranium	**µg/l**							1.08			1.69			1.19			nm			1.23			0.36			0.3			
Vanadium	**µg/l**							<0.5			1.15			2.71			nm			2.23			41			44.47			
Zinc	**µg/l**		**100**		5.5			7.4			6.8			22			nm			10.8			1.3			5.8			

BOREHOLE BH8A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	28-Aug-07	26-Sep-07	24-Oct-07	28-Nov-07	18-Dec-07
Alkalinity	mg/l CaCO3							216													212									
Aluminium	ug/l	200	200	150																										
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																												
Arsenic	ug/l		10	7.5																										
Barium	ug/l		100		<50			<50			<50			<50	<50		<50			<50		<50	<50			<50			
Beryllium	ug/l																													
B.O.D.	mg/l O2																													
Boron	µg/l	1000	1000	750																	<50									
Cadmium	µg/l	5	5	3.75	<0.10			<0.10			<0.10			<0.10	<0.10		<0.10			<0.10		<0.10	<0.10			<0.10			
Calcium	mg/l Ca		200					83.63													73.33									
C.O.D.	mg/l O2																													
Chloride	mg/l Cl	250	30	187.5	17			16			21			41	16		15			13		22	13			41			
Chromium	µg/l	50	30	37.5	6.5			4.8			2.2			<1	18.1		3.8			<1		<1	<1			<1			
Cobalt	µg/l																													
Coliform Bacteria	(No/100 ml)	0																												
Conductivity	µS/cm @ 25	2500	1000	1875	491	477	500	480	503	471	465	479	540	519	502	505	497	484	503	454	473	538	484	478	472	483	550	520		
Copper	µg/l	2000	30	1500				2.8												<1										
Cyanide	mg/l	0.05	10					<0.05												<0.05										
D.O.	% Saturation				88			99			108			79			85			90			98			70				
E_Coli	No/100 ml	0						0																						
Fluoride	mg/l	0.8	1000					<0.150												<0.150										
Iron	µg/l	200	200		81.5			814.3			293.6			315.5	<50		153.7			158.1		354.9	206.4			145.6				
Lead	µg/l	25	10	18.75	<1			2.6			7.3			4.4	<1		10.5			<1		4.0	3.6			<1				
Magnesium	mg/l Mg		50					3.53												2.95										
Manganese	µg/l	50	50		10.6			23.1			47.5			49.5	<1		11.2			6.5		65.2	28.0			7.9				
Mercury	µg/l	1	1	0.75				<0.10												<0.10										
Molybdenum	µg/l		35																											
Nickel	µg/l	20	20	15	<1			<1			<1			2.7	<1		<1			3.8		<1	<1			<1				
Nitrite	mg/l N	0.5	0.1	0.375	<0.003			<0.003			<0.003			<0.003	0.007		0.003			<0.003		nm	<0.003			0.003				
o-Phosphate	mg/l P		30					<0.02												<0.02										
pH		6.5 - 9.5			7.1	7.7	7.6	7.5	7.6	7.6	7.7	7.6	7.7	7.6	7.6	7.7	7.5	7.3	7.3	7.5	7.5	7.4	7.5	7.4	7.4	7.6	7.5	7.7		
Phenol	mg/l		0.0005		0.021			0.19			0.036			<0.001			0.142			<0.001			<0.01			<0.01				
Potassium	mg/l		5		0.65			<1			<1			1.01	<1		<1			<1		<1	<1			<1				
Sampling Depth	m				30	30.1	30.1	29.9	29.5	30	30	30.1	29.8	29.5	30.1	29	29.8	29.3	30.1	29.5	29.8	30.0	28.8	29.1	29.7	29.2	30.1	30.3		
Selenium	µg/l	10																												
Silver	µg/l																													
Sodium	mg/l	200	150	150	12.22			12.58			11.83			19.83	16.04		9.48			11.61		11.74	11.72			19.24				
Strontium	µg/l																													
Sulphate	mg/l SO4	250	200	187.5				13.4												12.0										
Suspended Solids	mg/l																													
Temp	°C				9.8	8	6	13.2	12	13	22.8	14	12	13.7	10	8	9.7	11.0	9.0	13.7	15.0	15.0	17.6	14.0	11.0	10.5	13	11		
Thallium	µg/l																													
Time sampled								11.15	11.25	11.4	12.1	11.3	11.2	11.1	11.3	11.4	11.40	11.20	11.30	11.30	11.20	11.45	11.50	11.25	11.35	11.35	9.35	11.5		
Tin (µg/l)	µg/l																													
T.O.C.	mg/l	NAC			91.6			<1.5			<1.5			<1.5	<1.5		<1.5			<1.5			2.1			1.6				
T.O.N	mg/l N		NAC		0.69			0.59			0.45			0.52	0.39		0.34			0.20		1.02	0.57			0.33				
Total S Solids	mg/l																													
Uranium	µg/l																													
Vanadium	µg/l																													
Zinc	µg/l		100		3.6			5			4.4			4.7	<1		1135.9					2.9		27.2	7.5	2.8				

BOREHOLE BH8A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	18-Aug-09	29-Sep-09	20-Oct-09	17-Nov-09	08-Dec-09
Alkalinity	mg/l CaCO3							196													170									
Aluminium	ug/l	200	200	150																										
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.07	0.04	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																												
Arsenic	ug/l		10	7.5																										
Barium	ug/l		100		<50			<50			<50			<50			<50			<50			<50			<50				
Beryllium	ug/l																													
B.O.D.	mg/l O2																													
Boron	µg/l	1000	1000	750				<50												65.6										
Cadmium	µg/l	5	5	3.75	<0.10			<0.10			<0.10			<0.10			<0.10			<0.10			<0.1			<0.1				
Calcium	mg/l Ca		200					83.58												74.96										
C.O.D.	mg/l O2																													
Chloride	mg/l Cl	250	30	187.5	13			31			64			21			19			40			34			49				
Chromium	µg/l	50	30	37.5	<1			<1			<1			<1			<1			1.1			8.4			2.1				
Cobalt	µg/l																													
Coliform Bacteria	(No/100 ml)	0																												
Conductivity	µS/cm @ 25	2500	1000	1875	526	495	489	481	521	566	570	549	534	522	498	528	470	493	474	493	551	504	507	508	518	516	588	584		
Copper	µg/l	2000	30	1500				<1												<1										
Cyanide	mg/l	0.05	10					<0.05												<0.01										
D.O.	% Saturation				82			91			81			80			89			82			nm	91		48				
E_Coli	No/100 ml	0						2																2						
Fluoride	mg/l	0.8	1000					<0.150												0.18										
Iron	µg/l	200	200		164.6			99.2			96.7			255.3			138			88.7			102.7			<50				
Lead	µg/l	25	10	18.75	2.3			<1			<1			7.8			2.6			2.3			1.3			<1				
Magnesium	mg/l Mg		50					2.91												2.51										
Manganese	µg/l	50	50		11.4			10.4			6.1			33.3			13.7			7			19.6			4.1				
Mercury	µg/l	1	1	0.75				<0.10												<0.1										
Molybdenum	µg/l		35																											
Nickel	µg/l	20	20	15	<1			<1			<1			<1			<1			<1			1.6			1.3				
Nitrite	mg/l N	0.5	0.1	0.375	0.008			0.004			0.003			<0.003			<0.002			<0.002			<0.002			<0.002				
o-Phosphate	mg/l P		30					<0.02									<0.02			<0.02										
pH		6.5 - 9.5			7.3	7.4	7.3	7.5	7.7	7.4	7.4	7.4	7.3	7.3	7.4	8.2	7.4	7.5	7.6	7.7	7.3	7.7	7.4	7.4	7.4	7.5	7.3	7.3		
Phenol	mg/l		0.0005		0.02			<0.01			<0.01			0.03			0.01			<0.002			<0.025			<0.015				
Potassium	mg/l		5		1.36			<1			<1			<1			<1			<1			<1			<1				
Sampling Depth	m				29.7	29.9	28.9	29.7	29.5	29.7	29.6	29.3	29	29.4	29.1	29.2	29.1	29	29.5	29	29.1	28.4	29.5	29.3	29.3	29.5	28.4	28.1		
Selenium	µg/l	10																												
Silver	µg/l																													
Sodium	mg/l	200	150	150	15.32			13.52			30.19			13.95			13.49			23.4			20.11			24.43				
Strontium	µg/l																													
Sulphate	mg/l SO4	250	200	187.5				15.6												23										
Suspended Solids	mg/l																													
Temp	°C				6.5	12	11	12	12	15.5	15.7	14	11	9	11	10	6.8	12	11	13	11.2	14	15.5	13.5	11	10.5	10.1	10.5		
Thallium	µg/l																													
Time sampled					nt	11.2	11.4	11.4	11.2	11.3	11.45	11.2	11.35	11.1	11.2	10.35	11.4	11.2	11.4	11.2	11.35	11.15	11.25	11.2	11.15	11.15	9.30	11.20		
Tin (µg/l)	µg/l																													
T.O.C.	mg/l	NAC			1.5			<1.5			<1.5			<1.5			<1.5			<1.5			<3.0			3.1				
T.O.N	mg/l N		NAC		0.97			0.65			0.55			1.13			1			0.62			0.92			0.61				
Total S Solids	mg/l																													
Uranium	µg/l																													
Vanadium	µg/l																													
Zinc	µg/l		100		4.3			<1			3.3			14.4			6.1			5.8			3.4			3.2				

BOREHOLE BH8A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**09-Aug-11**	**06-Sep-11**	**04-Oct-11**	**08-Nov-11**	**13-Dec-11**
Alkalinity	**mg/l CaCO3**							208												204										
Aluminium	**ug/l**	**200**	**200**	**150**																										
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																												
Arsenic	**ug/l**		**10**	**7.5**																										
Barium	**ug/l**		**100**		19.7			18.6			19.8			21.4					21.5		18			18.7			18.7			
Beryllium	**ug/l**																													
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**				27												28.6										
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.1			<0.1			<0.1			<0.1					<1		<0.1			<0.1			<0.1			
Calcium	**mg/l Ca**		**200**					84.82												104.57										
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	19			18			37			36					17		20			48			68			
Chromium	**µg/l**	**50**	**30**	**37.5**	<1			<1			<0.5			0.8					<5		<0.5			<0.5			<0.5			
Cobalt	**µg/l**																													
Coliform Bacteria	**(No/100 ml)**	**0**																												
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	541	484	475	488	479	497	520	513		511	517	504	480	505	535	480	500	506	527	556	553	585	605	566		
Copper	**µg/l**	**2000**	**30**	**1500**				<1												<0.5										
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05										
D.O.	**% Saturation**				82			94			80			73					97		88			69			45			
E_Coli	**No/100 ml**	**0**						2												nm										
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150										
Iron	**µg/l**	**200**	**200**		<50			<10			21.7			52.6					<100		32.1			<10			<10			
Lead	**µg/l**	**25**	**10**	**18.75**	1.2			<1			1.3			1.4					<5		0.8			<0.5			<0.5			
Magnesium	**mg/l Mg**		**50**					3.47												4.46										
Manganese	**µg/l**	**50**	**50**		6.4			5.3			20.7			14.2					15.0		6.9			<1			<1			
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.1												<0.05										
Molybdenum	**µg/l**		**35**																											
Nickel	**µg/l**	**20**	**20**	**15**	<1			<1			<0.5			0.9					<5		<0.5			1.2			1.5			
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002			<0.002			<0.002			<0.002					<0.002		<0.002			<0.002			<0.002			
o-Phosphate	**mg/l P**		**30**					0.02												<0.02										
pH		**6.5 - 9.5**			7.4	7.4	7.5	7.4	7.4	7.4	7.4	7.6		7.7	7.6	7.4	7.4	7.8	7.5	7.4	7.4	7.6	7.5	7.7	7.8	7.6	7.6	7.7		
Phenol	**mg/l**		**0.0005**		<0.015			<0.015			<0.025			<0.025					<0.025		<0.013			<0.006			<0.016			
Potassium	**mg/l**		**5**		<1			<1			0.85			1.03					<2.5		0.36			0.55			2.62			
Sampling Depth	**m**				28.8	29.7	29.6	28.9	29.3	28.8	31.0	29.5	30.0	nm	29.2	29.2	29.1	28.3	28.0	29.2	26.3	29.7	29.8	29.8	29.9	29.9	29.6	29.7		
Selenium	**µg/l**	**10**																												
Silver	**µg/l**																													
Sodium	**mg/l**	**200**	**150**	**150**	12.28			12.67			18.76			24.28					13.50		14.95			19.51			39.09			
Strontium	**µg/l**																													
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				12.9												12.6										
Suspended Solids	**mg/l**																													
Temp	**°C**				10	10.1	10	13.2	11	13	23.0	10.7	14.1	10.4	9.9	9.6	11.0	9.9	11.7	11.9	15	12	12.3	13	14.1	12.3	12.4	6		
Thallium	**µg/l**																													
Time sampled					11.15	11.1	11.15	11.25	11.15	11.15	11.35	11.20	12.35	nt	10:30	10:20	11:10	11.15	11:20	11:25	11:20	11:25	10:40	10:50	11:20	11:12	11:10	09:20		
Tin (µg/l)	**µg/l**																													
T.O.C.	**mg/l**	**NAC**			<3.0			<1.5			<1.5			<1.5					2.6		48.5			2			41.3			
T.O.N	**mg/l N**		**NAC**		2.61			1.31			0.98			1.03					1.25		0.58			0.39			0.32			
Total S Solids	**mg/l**																													
Uranium	**µg/l**																													
Vanadium	**µg/l**																													
Zinc	**µg/l**		**100**		5.2			2.5			3.0			12.7					35.2		2.9			15.8			5.4			

BOREHOLE BH8A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**07-Aug-13**	**17-Sep-13**	**08-Oct-13**	**19-Nov-13**	**03-Dec-13**
Alkalinity	**mg/l CaCO3**							202												210										
Aluminium	**ug/l**	**200**	**200**	**150**				<5			<5			<5			<5			<5			<5			<5			
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.020	<0.020	
Antimony	**ug/l**	**5**						<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			
Arsenic	**ug/l**		**10**	**7.5**				<0.5			<0.5			<0.5			<0.5			0.61			<0.5			<0.5			
Barium	**ug/l**		**100**		19.8			18.9			17.3			17.5			21.1			19.3			18.4			20.9			
Beryllium	**ug/l**							<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			
B.O.D.	**mg/l O2**																													
Boron	**µg/l**	**1000**	**1000**	**750**	26.9			31.8			23.7			28.8			20.7			20.6			55.1			78.7			
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.1			<0.1			<0.1			<0.1			<0.1			<0.1			<0.1			<0.1			
Calcium	**mg/l Ca**		**200**		81.14			77.59			79.96			85.91			85.4			81.62			77.41			76.42			
C.O.D.	**mg/l O2**																													
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	17			29			16			16			14			17			53			55			
Chromium	**µg/l**	**50**	**30**	**37.5**	<0.5			<0.5			<0.5			1.2			0.8			1.3			1.1			1.2			
Cobalt	**µg/l**							<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			
Coliform Bacteria	**(No/100 ml)**	**0**						152												16										
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	535	413	485	493	472	529	483	476	486	505	504	485	496	505	500	484	491	510	524	528	539	549	492	497		
Copper	**µg/l**	**2000**	**30**	**1500**	0.6			<0.5			<0.5			<0.5			0.7			<0.5			<0.5			0.5			
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05										
D.O.	**% Saturation**				94			70			102			89			86			90			56			49			
E_Coli	**No/100 ml**	**0**						18												0										
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150										
Iron	**µg/l**	**200**	**200**		<10			<10			<10			<10			<10			<10			<10			17.1			
Lead	**µg/l**	**25**	**10**	**18.75**	<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			
Magnesium	**mg/l Mg**		**50**		3.73			3.2			3.84			4.04			3.95			3.77			3.2			3.72			
Manganese	**µg/l**	**50**	**50**		<1			<1			<1			<1			1.7			2			1.4			1.9			
Mercury	**µg/l**	**1**	**1**	**0.75**	nm			<0.05			nm			nm			nm			<0.05			nm			nm			
Molybdenum	**µg/l**		**35**					<0.5			<0.5			<0.5			<0.5			<0.5			2			0.9			
Nickel	**µg/l**	**20**	**20**	**15**	<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			<0.5			2.2			
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.002			0.002			<0.002			<0.002			<0.002			<0.002			<0.002			<0.002			
o-Phosphate	**mg/l P**		**30**					<0.02												<0.02										
pH		**6.5 - 9.5**			7.4	7.8	7.4	7.4	7.7	7.6	7.5	7.5	7.4	7.4	7.2	7.3	7.5	7.4	7.4	7.5	7.4	7.5	7.5	7.6	7.5	7.5	7.4	7.5		
Phenol	**mg/l**		**0.0005**		<0.002			<0.025			<0.002			<0.002			<0.002			<0.002			<0.002			<0.002			
Potassium	**mg/l**		**5**		0.63			0.73			0.43			0.54			0.5			0.71			0.87			1.73			
Sampling Depth	**m**				29	29.1	29	29.1	29.5	29.5	28.5	29.3	28.9	29.4	27	28.9	26.2	27.5	26.7	28.2	28.7	29.1	29.7	29.3	29.6	28.2	28.9	29.2		
Selenium	**µg/l**	**10**						<0.5			0.7			1.4			1.5			2.1			<0.5			<0.5			
Silver	**µg/l**							0.8			nm			nm			nm			nm										
Sodium	**mg/l**	**200**	**150**	**150**	12.94			13.37			12.08			14.31			10.93			11.09			23.65			27.8			
Strontium	**µg/l**							86.17			93.95			86.57			94.44			89.39			85.5			91.66			
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				14												10.3										
Suspended Solids	**mg/l**																													
Temp	**°C**				11	11.4	12	13	13.1	12.7	16	14.1	11.7	14.7	10.8	10.1	9.4	10.1	9.7	10.5	10.5	10.4	12.4	11.9	10.4	11	9.9	8.4		
Thallium	**µg/l**							<0.1			<0.1			<0.1			<0.1			<0.1			<0.1			0.1			
Time sampled					11:00	11:35	10:50	0.45833	0.46181	0.45833	10:15	10:40	10:45	10:55	10:35	10:55	11:05	10:55	11:05	10:25	11:10	10:40	11:50	10:55	11:20	11:40	12:40	11:10		
Tin (µg/l)	**µg/l**							<1			<1			<1			nm			nm										
T.O.C.	**mg/l**	**NAC**			53.1			40.8			1.7			<1.5			61.5			<1.5			1.8			2.4			
T.O.N	**mg/l N**		**NAC**		0.53			0.46			0.49			0.72			0.33			0.35			0.12			0.27			
Total S Solids	**mg/l**																													
Uranium	**µg/l**							0.27			0.31			0.3			0.36			0.33			0.25			0.27			
Vanadium	**µg/l**							<0.5			<0.5			0.52			<0.5			<0.5			<0.5			<0.5			
Zinc	**µg/l**		**100**		6.2			2.6			3.9			1.5			12.3			12.3			14.6			12.3			

BOREHOLE BH9A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**31-Jul-07**	**28-Aug-07**	**25-Sep-07**	**24-Oct-07**	**28-Nov-07**
Alkalinity	**mg/l CaCO3**							242													214								
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	0.13	0.06	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		56.4	<50	51.7	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	57.2	55.9	<50	<50	<50	nm
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				88.1													115.2								
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium	**mg/l Ca**		**200**					137.04													88.16								
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	198	184	191	130	156	79	77	116	140	151	148	130	112	106	103	103	102	91	154	136	81	95	108	87
Chromium	**µg/l**	**50**	**30**	**37.5**	10	3.6	4.6	6.3	3.3	<1	2.2	2.9	4.1	<1	3.6	<1	4.3	2.7	3.5	3.5	<1	<1	<1	<1	<1	<1	<1	<1
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	1141	1030	1107	922	976	796	811	845	854	897	927	917	862	822	833	833	752	779	904	697	790	777	723	782
Copper	**µg/l**	**2000**	**30**	**1500**				3.2													<1								
Cyanide	**mg/l**	**0.05**	**10**					<0.05													<0.05								
D.O.	**% Saturation**				67			72			79			63			78				68			107			48		
E_Coli	**No/100 ml**	**0**						0																					
Fluoride	**mg/l**	**0.8**	**1000**					<0.150													<0.150								
Iron	**µg/l**	**200**	**200**		367.7	127.7	190.8	241.4	184.9	205.1	176.3	179.6	312.7	217.2	118.5	120.8	253.4	234.2	201.1	201.1	228.2	180.0	563.1	91.1	212.3	237.9	175.7	146.2
Lead	**µg/l**	**25**	**10**	**18.75**	8.4	<1	<1	7.1	4.2	<1	3.6	<1	3	5.7	<1	<1	2.3	5.5	<1	<1	2.9	<1	23.6	<1	4.0	2.5	<1	<1
Magnesium	**mg/l Mg**		**50**					7.4													5.32								
Manganese	**µg/l**	**50**	**50**		67.1	6.7	5.9	22.6	11.8	8.8	14.3	8.8	20.3	20.1	9.7	7.4	9.9	23.8	<1	<1	10.9	27.1	174.6	96.9	29.6	9.8	5.9	11.7
Mercury	**µg/l**	**1**	**1**	**0.75**				0.4													<0.10								
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	5.3	2.1	2.8	2.6	2.1	3.4	2.9	4	4.8	3.5	<1	<1	<1	<1	<1	<1	5.5	3.0	6.0	8.7	<1	3.7	2.2	2.9
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.012	<0.003	<0.003	<0.003	<0.003		<0.003	<0.003	<0.003	<0.003	0.009	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	nm	0.010	0.004	0.004	0.003	<0.003
o-Phosphate	**mg/l P**		**30**					<0.02													<0.02								
pH		**6.5 - 9.5**			7	7.3	7.2	7.1	7.3	7.4	7.5	7.5	7.6	7.4	7.1	7.3	7.2	7.0	7.0	7.0	7.4	7.6	7.4	8.6	7.2	7.4	7.4	7.3
Phenol	**mg/l**		**0.0005**		0.011	<0.001	0.179	<0.001	0.005	0.177	<0.001	0.014	<0.001	0.009	<0.001	0.016	<0.001	0.065	<0.001	<0.001	<0.001	<0.01	nm	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	**mg/l**		**5**		1.3	1.89	1.47	1.7	1.28	1.93	2.69	2.4	1.76	1.51	1.03	<1	<1	1.10	<1	<1	2.06	2.24	1.55	13.92	1.62	2.82	2.72	2.05
Sampling Depth	**m**				28.9	29.1	28.7	29.1	28.5	28.5	29	28.8	28.5	28.7	29.1	28.4	28.9	28.5	28.5	28.5	28.8	28.5	29.0	28.5	28.5	27.9	28.2	28.9
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	22.82	29.78	32.18	26.4	19.3	26.25	40.02	33.08	37.47	33.91	21.72	12.62	8.34	18.16	11.30	11.30	32.52	41.84	25.55	68.71	26.86	33.83	42.44	42.56
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				18													23.1								
Suspended Solids	**mg/l**																												
Temp	**°C**				9.8	7	12.4	13.1	12	13	21.5	14	12	13.5	10	8	9.6	11.0	9.0	9.0	14.2	14.0	14.0	20.6	15.0	10.0	10.7	12
Thallium	**µg/l**																												
Time sampled								11.45	11.45	12.05	12.4	11.5	11.4	11.3	11.5	11.55	12.05	11.40	11.50	11.50	11.55	11.50	12.10	12.15	11.45	11.55	11.5	10
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			38.2			1.6			1.9			1.5			<1.5				2.0			11.2			2.4		
T.O.N	**mg/l N**		**NAC**		0.25	0.2	0.18	0.23	0.2	0.16	0.13	0.14	0.14	0.12	0.12	0.14	0.08	0.09	<0.05	<0.05	0.13	0.18	0.19	<0.05	0.13	<0.05	<0.05	<0.05
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		8.4	<1	<1	4.7	5.2	3.3	2.5	4.4	2	4.1	2.3	2.9	3.4	3.0	<1	<1	<1	<1	<1	7.7	3.5	2.2		3.8	2.7

BOREHOLE BH9A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**18-Aug-09**	**29-Sep-09**	**20-Oct-09**	**17-Nov-09**	**08-Dec-09**
Alkalinity	**mg/l CaCO3**							238													248								
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	0.03	0.03	<0.03	<0.03	0.09	0.08	<0.03	0.03	0.04	0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				76.5													80.1								<50
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1		<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium	**mg/l Ca**		**200**					120.78													108.06								111.18
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	57	58	68	71	79	79	82	65	44	50	49	33	42	27	45		62	29	49	55	61	50	60	29	29
Chromium	**µg/l**	**50**	**30**	**37.5**	<1	2.4	4.1	<1	<1	7.9	<1	5.8	<1	<1	<1	<1	3.7	3.2	1.1		2.7	2.7	3.9	5.6	5.9	5	3.2	5.9	7.7
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	701	700	709	713	733	755	772	673	629	661	659	599	638	588	629		673	610	624	660	673	662	667	603	628
Copper	**µg/l**	**2000**	**30**	**1500**				<1													1.6								1.1
Cyanide	**mg/l**	**0.05**	**10**					<0.05													<0.01								<0.05
D.O.	**% Saturation**				96			77			69			76			78				80		nm	78		67		83
E_Coli	**No/100 ml**	**0**						0																1					
Fluoride	**mg/l**	**0.8**	**1000**					<0.150													<0.150								<0.150
Iron	**µg/l**	**200**	**200**		227.3	146.3	164.7	121.2	174.7	176	129	548.7	183	468.1	136.2	165.8	218.3	121.9	107.1		119.7	127.7	179.9	<50	<50	<50	<50	<50	<50
Lead	**µg/l**	**25**	**10**	**18.75**	5.2	<1	<1	4.1	2.7	2.3	<1	5.3	<1	6.4	<1	<1	3	<1	<1		2	1.2	2.9	<1	<1	<1	<1	<1	<1
Magnesium	**mg/l Mg**		**50**					5.87													5.21								4.40
Manganese	**µg/l**	**50**	**50**		17.5	11.5	11	14.9	12.2	10.7	7.4	170.1	18.9	164.2	14.3	27.2	48.3	3.3	8.3		12.6	8.6	66.5	10.5	9.2	5.86	3.5	6.7	6.1
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10													<0.1								<0.1
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	<1	<1	<1	<1	<1	2.3	2.4	12.7	<1	6	<1	<1	2	<1	1.2		1.5	<1	4.3	1.3	2	<1	1.3	<1	<1
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.007	<0.003	0.003	0.004	<0.003	<0.003	<0.003	0.019	0.005	0.005	<0.003	0.003	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Phosphate	**mg/l P**		**30**					<0.02									<0.02				0.02								<0.02
pH		**6.5 - 9.5**			7	7.1	7.2	7.3	7.4	7.4	7.3	7.4	7.2	7.1	7.1	7.1	7.1	7.4	7.3		7.3	7.3	7.7	7.1	7.3	7.3	7.2	7.3	7.1
Phenol	**mg/l**		**0.0005**		0.03	0.02	0.01	<0.01	<0.01	<0.01	nm	0.03	<0.01	0.02	<0.01		0.04	<0.01	<0.016		<0.002	<0.002	<0.002	nm	<0.002	<0.015	<0.015	<0.0005	<0.015
Potassium	**mg/l**		**5**		<1	<1	1.34	1.17	<1	1.25	2.13	<1	<1	<1	<1	<1	<1	<1	<1		1.13	<1	1.04	<1	<1	<1	1.23	<1	<1
Sampling Depth	**m**				27.7	28.1	27.2	28.8	28.1	28	28	27.8	27.8	27.3	28.2	28.2	27.4	26.9	28.7		27.2	28.5	26.8	28	28	28.4	28.4	27.4	27.0
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	8.29	11.09	24.68	22.52	21.71	26.9	38.05	8.91	8.14	9.55	9.48	7.29	10.61	6.03	15.82		22.02	7.68	14.34	18.13	19.1	15.39	23.35	8.11	7.42
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				15.7													15.9								7.2
Suspended Solids	**mg/l**																												
Temp	**°C**				6.9	11	12	11	12	15.5	15	13	11.5	9.5	11	11	10	12	10		13	11.5	13	16	14.9	11	10.7	10.5	10.4
Thallium	**µg/l**																												
Time sampled					nt	11.5	11.55	12	11.45	11.5	12.05	11.5	11.55	11.35	11.4	11	12	11.4	11.55		11.45	11.55	11.35	11.5	11.4	11.4	11.35	9.50	11.55
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			<1.5			2.2			1.9			<1.5			<1.5				2.3			<3.0			3.2		3.9
T.O.N	**mg/l N**		**NAC**		0.15	0.08	0.11	0.12	0.14	0.11	0.12	0.13	0.12	0.09	0.05	0.1	0.6	<0.08	0.1		<0.08	0.08	0.1	0.08	0.11	<0.08	<0.08	<0.08	<0.08
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		3.1	2.6	6.1	3.4	<1	6.3	3.1	18.3	3.6	15.7	2.3	4.2	7.5	3.9	3.1		5.4	2.1	5.6	4.2	1.8	98.78	3.4	4.3	4.0

BOREHOLE BH9A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	09-Aug-11	06-Sep-11	04-Oct-11	08-Nov-11	13-Dec-11
Alkalinity	mg/l CaCO3				284												276								
Aluminium	ug/l	200	200	150																					
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/l	5																							
Arsenic	ug/l		10	7.5																					
Barium	ug/l		100		28.4	27	29.6	31.5	30.0	31.8	34.1	32.5	29.4	29.2	28.6	29.1	29.8	29.8	30.4	30.3	29.7	31	29.9	31.4	
Beryllium	ug/l																								
B.O.D.	mg/l O2																								
Boron	µg/l	1000	1000	750	45.2												45.9								
Cadmium	µg/l	5	5	3.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Calcium	mg/l Ca		200		114.31												140.91								
C.O.D.	mg/l O2																								
Chloride	mg/l Cl	250	30	187.5	31	38	48	60	61	61	53	36	33	27	27	25	27	37	51	58	68	71	77	42	44
Chromium	µg/l	50	30	37.5	<1	<1	0.5	<0.5	0.7	<0.5	0.7	<5	<5	0.6	<5	2.5	<0.5	0.6	0.6	<0.5	<0.5	0.6	<0.5	<0.5	
Cobalt	µg/l																								
Coliform Bacteria	(No/100 ml)	0																							
Conductivity	µS/cm @ 25	2500	1000	1875	635	606	637	657	666		655	643	630	624	631	638	453	626	593	644	658	659	714	762	717
Copper	µg/l	2000	30	1500	<1												<0.5								
Cyanide	mg/l	0.05	10		<0.05												<0.05								
D.O.	% Saturation				81			80			61				75		65			42			36		
E_Coli	No/100 ml	0			2												nm								
Fluoride	mg/l	0.8	1000		<0.150												<0.150								
Iron	µg/l	200	200		<10	41.5	13.3	19.9	26.3	17.4	11.1	<100	<100	29.6	<100	17.6	<10	19.9	10.6	11	<10	<10	16.5	<10	
Lead	µg/l	25	10	18.75	<1	<1	<0.5	0.7	0.5	<0.5	<0.5	<5	<5	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Magnesium	mg/l Mg		50		4.94												6.44								
Manganese	µg/l	50	50		4	13.3	6.2	15.0	8.6	6.4	4.2	24.7	<10	4.6	<10	2.0	2.3	2.2	2.6	<1	<1	<1	<1	<1	
Mercury	µg/l	1	1	0.75	<0.1												<0.05								
Molybdenum	µg/l		35																						
Nickel	µg/l	20	20	15	<1	<1	<1	<0.5	0.9	0.6	0.8	<5	<5	<0.5	<5	<0.5	0.6	0.8	0.7	0.8	0.9	1.1	1	<0.5	
Nitrite	mg/l N	0.5	0.1	0.375	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	nm	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Phosphate	mg/l P		30		<0.02												<0.02								
pH		6.5 - 9.5			7.1	7.2	7.3	7.2	7.2		7.4	7.3	7.4	7.1	7.6	7.3	7.3	7.2	7.3	7.3	7.3	7.4	7.3	7.3	7.2
Phenol	mg/l		0.0005		<0.015	<0.2	<0.1	<0.025	<0.015	<0.015	<0.025	<0.015	<0.025	<0.01	<0.025	<0.025	<0.008	<0.013	<0.008	<0.008	<0.016	<0.016	<0.016	<0.025	
Potassium	mg/l		5		<1	<1	1.05	1.32	1.16	1.09	1.21	<2.5	<2.5	0.75	<2.5	0.52	0.93	0.88	1.27	0.93	1.17	1.23	1.36	1.12	
Sampling Depth	m				27.5	27.7	27.8	28.9	28.2	28.2	nm	28.2	28.2	27.0	27.1	27.0	26.8	23.1	28.3	28.3	28.4	28.6	28.6	28.1	28
Selenium	µg/l	10																							
Silver	µg/l																								
Sodium	mg/l	200	150	150	10.52	12.11	18.5	19.66	21.41	21.87	21.81	11.99	9.61	10.95	9.41	8.23	13.43	16.01	19.53	19.92	24.41	31.53	36.73	17.09	
Strontium	µg/l																								
Sulphate	mg/l SO4	250	200	187.5	8.6												8.9								
Suspended Solids	mg/l																								
Temp	°C				14.5	11	12	26.0	10.9	14.5	10.6	9.3	9.7	11.0	10.0	11.3	12	14	12.3	12.4	13	14.2	12.4	12.6	11.3
Thallium	µg/l																								
Time sampled					12.05	11.5	11.45	11.50	11.35	12.55	12:10	11:20	10:55	11:40	11.40	11:50	11:55	11:50	11:55	11:10	11:10	11:55	11:40	11:30	09:45
Tin (µg/l)	µg/l																								
T.O.C.	mg/l	NAC			<1.5			<1.5			61.7				2.1		58.4			1.8			55.7		
T.O.N	mg/l N		NAC		<0.08	<0.08	<0.08	0.09	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.1	<0.08	<0.08	<0.08	<0.08	<0.08	0.09
Total S Solids	mg/l																								
Uranium	µg/l																								
Vanadium	µg/l																								
Zinc	µg/l		100		3.4	1.7	2.2	3.4	4.0	2.5	2.7	29.5	23.2	4.6	24.9	3.0	2.9	5	10.8	14	5.2	6.7	11.3	37.8	

BOREHOLE BH9A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	07-Aug-13	17-Sep-13	08-Oct-13	19-Nov-13	03-Dec-13
Alkalinity	mg/l CaCO3				250												268								
Aluminium	ug/l	200	200	150	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	20.4		<5	<5	18.7	<5	<5	<5	<5	<10	<10
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.020	0.026
Antimony	ug/l	5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
Arsenic	ug/l		10	7.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
Barium	ug/l		100		29.8	32.4	29.2	28.7	33.2	30.7	31	28.9	26.3	29.2	29.6		26.2	24.2	27.9	28.2	26.8	27.9	28.6	29.2	28.6
Beryllium	ug/l				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
B.O.D.	mg/l O2																								
Boron	µg/l	1000	1000	750	68.6	61.3	65.8	32.3	34.8	40	73	38.3	31.7	24.7	23.7		25.3	30.6	69.5	112.2	108.5	117.3	109	86.8	78.8
Cadmium	µg/l	5	5	3.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02
Calcium	mg/l Ca		200		91.62	111.64	114.34	114.1	107.42	107.57	111.22	110.22	103.72	108.07	108.06		106.02	97.02	94.68	80.88	75.04	73.45	82.83	86.84	89.65
C.O.D.	mg/l O2																								
Chloride	mg/l Cl	250	30	187.5	44	43	43	25	26	29	37	24	23	19	18	16	16	23	38	54	56	60	57	48	42
Chromium	µg/l	50	30	37.5	<0.5	0.6	<0.5	<0.5	<0.5	0.5	1.2	1.1	0.7	<0.5	1.7		1.3	1	0.7	1	<0.5	<0.5	1.9	<1	2
Cobalt	µg/l				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
Coliform Bacteria	(No/100 ml)	0			51												3								
Conductivity	µS/cm @ 25	2500	1000	1875	627	618	690	656	641	634	656	647	611	591	581	556	559	561	569	573	580	590	602	608	603
Copper	µg/l	2000	30	1500	<0.5	0.6	3.2	<0.5	4	<0.5	1.2	1	0.5	0.8	1.1		<0.5	0.5	1	0.7	0.8	0.9	0.6	<1	<1
Cyanide	mg/l	0.05	10		<0.05												<0.05								
D.O.	% Saturation				33			64			48			66			63			26			24		
E_Coli	No/100 ml	0			11												0								
Fluoride	mg/l	0.8	1000		<0.150												<0.150								
Iron	µg/l	200	200		<10	<10	<10	<10	<10	<10	<10	<10	<10	24.4	11.7		<10	<10	34.5	<10	<10	16.8	<10	<10	<10
Lead	µg/l	25	10	18.75	<0.5	<0.5	<0.5	<0.5	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
Magnesium	mg/l Mg		50		5.48	5.6	4.89	4.9	5.24	4.91	5.04	4.73	4.92	5.78	5.21	4.87	4.26	4.41		4.55	4.28	4.88	5.16	4.78	4.74	4.9	4.89	5.03
Manganese	µg/l	50	50		<1	<1	<1	<1	<1	<1	<1	<1	<1	2.8	<1	2.2	7.4		1.1	<1	13	<1	<1	<1	<1	<5	<5
Mercury	µg/l	1	1	0.75	nm	nm	nm	<0.05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	<0.05	nm	nm	nm	nm	nm	nm	nm	nm
Molybdenum	µg/l		35		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
Nickel	µg/l	20	20	15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	1.1	2.4	1.7	2.5	2	1.9	1.6	1.1
Nitrite	mg/l N	0.5	0.1	0.375	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.004	<0.004
o-Phosphate	mg/l P		30		0.02												0.02								
pH		6.5 - 9.5			7.2	7.3	7.3	7.2	7.2	7	7.2	7	7.1	6.8	7.3	7.2	7.3	7.2	7.3	7.4	7.5	7.4	7.4	7.3	7.2
Phenol	mg/l		0.0005		<0.025	<0.002	<0.025	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Potassium	mg/l		5		1.13	1.28	1.52	0.72	0.84	0.83	1.97	0.84	0.71	0.63	0.66		0.97	1.08	1.31	2.45		2.5	2.55	2	1.81
Sampling Depth	m				28	25.9	28.2	28	28.1	26.4	27.9	26.8	27.8	26.5	25.3	26.2	27.3	27	27.4	28.7	27.5	28.1	27.1	27.5	28
Selenium	µg/l	10			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5		<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<1	<1
Silver	µg/l				<0.5	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		nm								
Sodium	mg/l	200	150	150	21.2	20.75	20.49	9.76	10.78	11.94	20.62	10.98	9.7	7.16	7.33		8.81	10.29	21.46	31.21	30.46	31.43	30.16	24.85	21.42
Strontium	µg/l				116.83	123.97	126.59	135.72	123.61	129.38	123.06	124.93	109.51	119.54	123.42		116.71	110.48	110.3	99.91	103.42	94.35	107.75	109.47	107.5
Sulphate	mg/l SO4	250	200	187.5	12.3												6								
Suspended Solids	mg/l																								
Temp	°C				13	13	12.5	15.8	14	12.2	15	10.2	10.3	9.1	10.1	9.8	10.6	10.5	10.6	11.8	12.3	10.5	11	9.7	8.7
Thallium	µg/l				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1
Time sampled					0.47222	0.47917	0.47569	10:40	11:00	11:05	11:20	11:00	11:15	11:30	11:15	11:25	10:55	11:30	11:05	12:10	11:15	11:45	12.05	13:00	11:35
Tin (µg/l)	µg/l				<1	<1	<1	<1	<1	<1	<1	<1	<1	nm	nm		nm								
T.O.C.	mg/l	NAC			55.9			2.1			<1.5			70.7			<1.5			1.6			2.3		
T.O.N	mg/l N		NAC		<0.08	0.34	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.16	<0.08	0.08	<0.08	<0.08	0.16	0.23	<0.08	<0.20	<0.20
Total S Solids	mg/l																								
Uranium	µg/l				0.25	0.24	0.26	0.29	0.29	0.31	0.28	0.27	0.25	0.27	0.28		0.27	0.25	0.27	0.23	0.24	0.24	0.24	<1	<1
Vanadium	µg/l				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.51	<1	<1
Zinc	µg/l		100		3	4.9	6.3	3.7	11.9	2	4.1	6	2.8	6.4	3.1		4.8	4.4	3.5	2.7	4.2	5.1	7.6	21.2	5.6

BOREHOLE BH10A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**28-Aug-07**	**25-Sep-07**	**24-Oct-07**	**28-Nov-07**	**18-Dec-07**
Alkalinity	**mg/l CaCO3**							140												159									
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.05	<0.03	<0.03	<0.03	0.03	0.49	0.9	0.73	0.51	0.26	0.08	<0.03	0.05	0.08	0.03	0.05	0.10	0.13	0.09	0.08	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		75.8	75.3	<0.03	79.1	70.7	91.3	91.9	87.7	106.8	<500	89.9	59	57.6	59.5	69.0	60.8	76.4	100.7	69.4	54.8	<50	62.6	nm	<50
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				293.5												228.5									
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.2	<0.10	<0.10	<0.10	0.6	<0.10	<0.10
Calcium	**mg/l Ca**		**200**					44.45												51.65									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	129	134	94	132	137	134	135	146	154	130	113	95	97	104	120	116	124	142	135	107	109	134	92	125
Chromium	**µg/l**	**50**	**30**	**37.5**	6.4	2.7	3.7	2.3	<1	<1	2.5	2.5	3.4	12.3	5	2.5	3.8	3.4	3.2	<1	<1	4.0	2.3	<1	<1	<1	<1	<1
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	794	776	656	795	760	819	851	831	253	772	687	626	666	702	739	738	811	739	717	711	728	714	712	727
Copper	**µg/l**	**2000**	**30**	**1500**				8.7												3.8									
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05									
D.O.	**% Saturation**				51			53			53			60			51			50			60			41			
E_Coli	**No/100 ml**	**0**						2																					
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150									
Iron	**µg/l**	**200**	**200**		268.4	119.6	192	424.4	81.2	159.4	608.7	793.1	399.6	2464.5	1938.1	719.1	601.6	951.8	694.4	283.2	375.5	1822.9	1114.7	273.7	154.7	151.7	287.2	210.8
Lead	**µg/l**	**25**	**10**	**18.75**	2.8	<1	<1	2.3	<1	<1	<1	<1	<1	<10	9.7	3.3	<1	5.0	3.3	<1	<1	6.6	4.4	<1	<1	2.0	<1	<1
Magnesium	**mg/l Mg**		**50**					11.31												9.64									
Manganese	**µg/l**	**50**	**50**		139.6	67.4	50.1	164	245.6	1021.3	1357	1336.3	1206.9	810	320.5	74.5	54.2	129.3	104.2	26.2	279.9	454.7	316.8	124.0	15.4	22.5	43	36
Mercury	**µg/l**	**1**	**1**	**0.75**				0.5												<0.10									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	8.2	6.5	5.9	8.9	9.9	10.4	12.8	11.3	9.7	21.2	14.8	7.9	6.9	8.4	8.7	7.4	11.5	17.0	13.4	7.2	8.2	7.4	8.6	7.7
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	<0.003	0.004	<0.003	0.004	0.006		<0.003	0.003	<0.003	0.009	0.033	0.011	0.024	0.024	0.010	0.007	0.018	nm	0.013	0.004	0.004	0.007	0.003	0.006
o-Phosphate	**mg/l P**		**30**					<0.02												0.03									
pH		**6.5 - 9.5**			7.7	7.9	7.7	7.7	7.8	7.8	7.7	7.9	7.8	7.7	7.7	7.8	7.8	7.1	7.5	7.7	7.6	7.8	7.8	7.8	7.8	7.7	7.7	7.7
Phenol	**mg/l**		**0.0005**		0.014	<0.001	0.003	<0.001	0.087	0.119	0.005	0.011	0.005	0.005	0.009	<0.001	0.041	0.018	<0.001	nm	<0.01	nm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	**mg/l**		**5**		13.45	13.34	10.73	14.24	17.73	13.71	17.22	15.96	15.79	16.75	13.43	9.43	7.38	8.45	10.50	9.72	14.62	13.97	13.36	12.98	12.79	13.99	15.06	13.69
Sampling Depth	**m**				27.2	26.8	27.4	27.2	27.6	27	27	24.4	25.8	27.9	27.5	27.5	27.0	26.8	27.1	27.3	27.4	27.1	26.0	26.8	23.5	26.9	24.8	27.6
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	74.77	62.24	63.61	69.39	84.79	64.79	84.86	70.2	77.98	78.57	75.68	>50	38.84	51.62	57.52	58.01	78.73	61.26	70.49	70.87	71.02	74.70	76.73	77.08
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				33.2												34.5									
Suspended Solids	**mg/l**																												
Temp	**°C**				10	7	6	13.1	13	14	22	17	11	14.3	11	8	9.7	11.0	10.0	12.6	14.0	14.0	20.1	14.0	16.0	14.1	13	11
Thallium	**µg/l**																												
Time sampled								12.15	12.15	12.25	13	12.15	12	11.5	12.1	12.1	12.30	11.55	12.15	12.20	12.15	12.40	12.45	12.15	12.20	12.15	10.2	12.35
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			68.4			8			9			6.7			4.4			6.7			9.5			7.0		
T.O.N	**mg/l N**		**NAC**		0.65	0.87	1.29	0.58	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	0.44	0.63	1.35	1.52	1.50	1.58	0.32	0.32	0.31	0.23	0.23	0.22	0.81	0.84
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		5.8	3	2.2	9.7	3.7	2.8	4.2	6.7	<1	54.4	20.1	8	7.6	9.4	7.4	<1	6.5	15.8	29.5	9.7	5.4	6.4	3.6	<1

BOREHOLE BH10A																														
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**18-Aug-09**	**29-Sep-09**	**20-Oct-09**	**17-Nov-09**	**08-Dec-09**
Alkalinity	**mg/l CaCO3**							140												129									
Aluminium	**ug/l**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.11	0.03	0.05	<0.03	0.03	<0.03	0.04	0.05	<0.03	0.04	0.07	0.04	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03
Antimony	**ug/l**	**5**																											
Arsenic	**ug/l**		**10**	**7.5**																									
Barium	**ug/l**		**100**		<50	<50	54	80	70.3	<50	<50	<50	<50	<50	<50		<50	<50	62.6	57.7	57.6	51.9	<50	<50	<50	<50	<50	<50
Beryllium	**ug/l**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				302.2												263.6									
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium	**mg/l Ca**		**200**					58.76												44.63									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	39	63	99	125	133	>80	76	124	118	60	76	93	94	93	102	102	109	111	89	100	92	97	47	77
Chromium	**µg/l**	**50**	**30**	**37.5**	3.3	<1	3.4	<1	<1	3.6	<1	2.4	<1	<1	<1	<1	<1	1.9	<1	1.5	1.2	2.7	3.1	1.9	1.91	1.7	3.0	3.3
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	344	555	616	736	730	655	516	609	605	418	515	567	597	594	651	642	610	577	537	568	576	604	411	536
Copper	**µg/l**	**2000**	**30**	**1500**				5.4												3.8									
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.01									
D.O.	**% Saturation**				91			73			51			64			74			69			nm	45		18			
E_Coli	**No/100 ml**	**0**						6																260					
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150									
Iron	**µg/l**	**200**	**200**		1403.6	290	688.6	407.3	545	230.4	278.3	448.4	105.8	435.5	416.5	223.1	167.2	107.7	227	206.9	428.8	534.9	365	238.6	126.77	159.0	156.4	178.5
Lead	**µg/l**	**25**	**10**	**18.75**	4.3	<1	3	2.7	<1	<1	<1	2.7	<1	2.3	3.1	<1	<1	<1	<1	1.5	1.6	2.2	1.3	1.2	<1	<1	1.5	1.6
Magnesium	**mg/l Mg**		**50**					13.34												11.05									
Manganese	**µg/l**	**50**	**50**		56.9	27.1	57.1	120.3	190.1	93.8	46.1	213.8	18.3	58	56	22.8	23.1	13.2	58.6	93.6	123	273.6	164.1	181.1	44.21	102.4	31.9	34.1
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.1									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	6.3	4.1	7.6	8.8	9.2	8.5	5.3	8.6	5.3	4.6	5	5.6	5.7	3.7	6.7	6.4	7	8.7	6.9	6.7	5.28	6.0	2.8	3.4
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.089	0.012	0.027	0.006	0.004	0.009	0.013	0.762	<0.003	0.02	0.017	0.008	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Phosphate	**mg/l P**		**30**					0.02									<0.02			0.03									
pH		**6.5 - 9.5**			7.8	7.8	7.8	7.7	7.8	8	7.9	8.1	8	8	7.9	7.9	7.8	8	7.7	7.8	7.8	7.9	7.7	7.9	8	7.7	7.8	7.7
Phenol	**mg/l**		**0.0005**		0.03	0.02	0.01	<0.01	<0.01	<0.01	nm	0.03	<0.01	0.03	<0.01		<0.01	<0.01	<0.016	<0.002	<0.002	<0.002	nm	<0.002	<0.015	<0.015	<0.0005	<0.015
Potassium	**mg/l**		**5**		4.55	6.81	10.07	13.29	10.21	11.4	9.38	13.07	11.31	7.4	8.84	9.65	10.98	8.49	11.52	10.82	11.64	12.39	11.02	10.44	10.57	13.02	6.75	7.83
Sampling Depth	**m**				25.9	26.4	26.1	27.4	27.8	27.5	27.5	25.9	25.1	26.9	27.1	27	26.8	25	27.9	26.8	26.8	25.9	27	27.7	26.1	26.7	25.7	25.8
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	27.1	41.36	66.44	69.47	56.82	64.44	45.74	67.51	59.14	34.23	45.4	57.79	59.72	47.06	59.15	57.33	60.41	55.57	52.86	54.95	54.54	64.27	30.70	38.67
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				42.9												31.2									
Suspended Solids	**mg/l**																												
Temp	**°C**				7	12	12	11	13	16.8	16.5	14	15	10.4	11	12	8.7	13	11	11.5	12.9	17	17	17	15.4	14.2	12.5	11.3
Thallium	**µg/l**																												
Time sampled					nt	12.1	12.15	12.2	12.15	12.25	12.45	12.15	12.2	11.55	12.05	11.2	12.2	12	12.15	12.15	12.2	11.55	12.2	12	12.05	11.53	10.20	12.20
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			2.2			6.7			<1.5			3.3			5.2			5.5			6.6			8.0		
T.O.N	**mg/l N**		**NAC**		0.88	1.63	1.47	0.84	0.32	0.14	0.82	0.13	0.23	0.57	0.38	0.29	0.8	0.35	0.18	0.18	0.13	0.21	0.2	0.15	0.09	0.14	0.51	0.60
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		10.7	3.4	7.1	6.7	<1	10.9	3.5	8.2	2.1	11.6	5.9	5	6.5	3.8	3.4	4.9	4.4	7	4.7	3.5	137.55	6.3	6.4	4.4

BOREHOLE BH10A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	09-Aug-11	06-Sep-11	04-Oct-11	08-Nov-11	13-Dec-11
Alkalinity	mg/l CaCO3							156												164									
Aluminium	ug/l	200	200	150																									
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.04	0.09	<0.03	<0.03	<0.03
Antimony	ug/l	5																											
Arsenic	ug/l		10	7.5																									
Barium	ug/l		100		53.4	62.4	77.4	75.3	67.6	61.8	45.5		61.8	51.3	93.3	50.4	49.6	49.2	59.9	62.1	57.3	53.8	43.7	38.1	47.5	51.2	47.5		
Beryllium	ug/l																												
B.O.D.	mg/l O2																												
Boron	µg/l	1000	1000	750				225.7												256									
Cadmium	µg/l	5	5	3.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Calcium	mg/l Ca		200					51.49												57.26									
C.O.D.	mg/l O2																												
Chloride	mg/l Cl	250	30	187.5	79	89	90	90	81	95	92	88	95	88	85	84	72	59	77	84	84	82	86	87	81	80	74	73	
Chromium	µg/l	50	30	37.5	<1	<1	<1	<1	<1	<0.5	<0.5		<0.5	<0.5	<5	<5	<5	1.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Cobalt	µg/l																												
Coliform Bacteria	(No/100 ml)	0																											
Conductivity	µS/cm @ 25	2500	1000	1875	550	599	636	642	644	617	555	572	617	572	549	542	519	500	593	621	584	546	546	543	560	621	640	604	
Copper	µg/l	2000	30	1500				3												1.9									
Cyanide	mg/l	0.05	10					<0.05												<0.05									
D.O.	% Saturation				70			53			48			35			88			54			49				15		
E_Coli	No/100 ml	0						6												nm									
Fluoride	mg/l	0.8	1000					<0.150												<0.150									
Iron	µg/l	200	200		188.5	79.5	77.1	156.5	147.2	57.8	34.6		57.8	56.0	1381.4	<100	100.7	87.3	36.1	43.1	134.9	10.7	12	<10	44.4	<10	<10		
Lead	µg/l	25	10	18.75	2.1	<1	<1	1	<1	<0.5	<0.5		<0.5	<0.5	6.2	<5	<5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Magnesium	mg/l Mg		50					10.34												12.99									
Manganese	µg/l	50	50		34.4	14.9	21.3	68.5	98.7	28.2	19.5		28.2	64.7	719.5	14.3	19.0	11.7	5.9	11.2	22.2	3	2.3	<1	277	61.3	3.9		
Mercury	µg/l	1	1	0.75				<0.1												<0.05									
Molybdenum	µg/l		35																										
Nickel	µg/l	20	20	15	4	4.7	5.3	5	5.5	5.2	4.7		5.2	5.3	12.1	5.6	5.2	2.2	3.6	4.6	4.2	4.7	4.5	4.6	6.1	4.1	3.1		
Nitrite	mg/l N	0.5	0.1	0.375	<0.002	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	nm	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.005	0.003	<0.002	<0.002	
o-Phosphate	mg/l P		30					<0.02												<0.02									
pH		6.5 - 9.5			7.7	7.8	7.8	7.6	7.6	7.7	7.9	7.9	7.7	7.9	8.0	7.8	8.2	7.6	7.8	7.8	7.7	7.8	7.9	7.8	7.9	7.7	7.8	7.7	
Phenol	mg/l		0.0005		<0.015	<0.015	<0.015	<0.015	<0.2	<0.1	<0.025		<0.1	<0.025	<0.015	<0.025	<0.025	<0.025	<0.01	<0.013	<0.013	<0.008	<0.008	<0.016	nm	<0.016	<0.025		
Potassium	mg/l		5		7.91	10.14	11.27	10.25	10.37	11.59	10.91		11.59	12.04	10.18	9.22	8.54	6.33	9.06	11.25	10.05	9.79	8.42	11.17	11.15	11.07	9.79		
Sampling Depth	m				25.2	23.5	25.3	23	25.5	25.6	26.2		25.6	nm	26.1	26.0	24.2	25.8	25.1	25.2	20.2	28	26.3	26.6	26.9	26.9	26	26.8	
Selenium	µg/l	10																											
Silver	µg/l																												
Sodium	mg/l	200	150	150	40.28	53.46	56.27	52.85	47.79	57.04	47.20		57.04	61.78	52.50	46.08	42.10	34.68	47.80	54.91	51.53	47.14	40.98	48.86	53.86	52.47	45.4		
Strontium	µg/l																												
Sulphate	mg/l SO4	250	200	187.5				29.2												27.3									
Suspended Solids	mg/l																												
Temp	°C				7.8	5.1	6	14	12	16	26.0		16.0	14.0	10.8	6.4	6.1	9.3	9.0	12	15	15.6	17.1	16	16.7	15.8	12.9	12.3	
Thallium	µg/l																												
Time sampled					12	12	11.55	12.35	12.1	12.15	12.20		12.15	12:40	12:20	11:20	12.05	12:10	12:10	12:30	12:10	12:20	11:35	11:40	12:15	12:10	11:45	10:15	
Tin (µg/l)	µg/l																												
T.O.C.	mg/l	NAC			6.2			5.8			5.2			34.9			6.1			39.5			8.1			38.7			
T.O.N	mg/l N		NAC		0.5	0.51	0.42	0.43	0.33	0.23	0.13	<0.08	0.23	<0.08	0.11	0.27	0.23	0.42	0.28	<0.08	0.3	0.12	0.17	0.08	0.29	0.15	0.12	0.2	
Total S Solids	mg/l																												
Uranium	µg/l																												
Vanadium	µg/l																												
Zinc	µg/l		100		6	2.2	2.3	3.2	1.4	1.6	1.8			2.7	45.1	27.8	25.2	3.6	1.5	1.6	5.9	6.7	4.6	4.5	8.5	4	4.1		

BOREHOLE BH10A

Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	07-Aug-13	17-Sep-13	08-Oct-13	19-Nov-13	03-Dec-13
Alkalinity	mg/l CaCO3							122												135									
Aluminium	ug/l	200	200	150				5.1	8.8	5.5	6.3	6.5	6.6	9	11.9	5.1	5.8	99.5		16.2	6.6	200.3	10.3	6.3	13.3	11.9	14	<10	
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.15	0.05	<0.03	<0.020	0.049	
Antimony	ug/l	5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
Arsenic	ug/l		10	7.5				0.64	0.77	0.86	0.76	1.1	1.37	1.23	1.07	0.91	0.76	0.52		0.57	0.63	1.23	1.78	2.45	1.56	1.25	<1	<1	
Barium	ug/l		100		47.8	43.5	47.1	43.2	44.1	38.1	30.5	31	28.4	26.1	29.1	30.4	40.3	36.2		39.6	47.3	53.9	58.7	65.7	58.6	63.3	68.6	72.3	
Beryllium	ug/l							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
B.O.D.	mg/l O2																												
Boron	µg/l	1000	1000	750	176.1	158.5	184.2	174.5	183.9	185.7	175.6	187	183.4	212.4	159.3	179.9	127.7	98.4		139.6	172.1	191.8	206.4	193.6	194.7	204.2	191.6	186.9	
Cadmium	µg/l	5	5	3.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Calcium	mg/l Ca		200		40.39	42.58	39.62	37.49	37.7	35.55	27.56	23.9	23.18	26.98	30.5	30.99	41.9	41.64		46.86	41.82	43.75	42.68	40.85	38.97	41.5	42.65	42.38	
C.O.D.	mg/l O2																												
Chloride	mg/l Cl	250	30	187.5	77	66	74	70	70	67	67	68	71	67	60	67	56	44	27	55	70	72	74	75	76	75	71	72	
Chromium	µg/l	50	30	37.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.6		1.2	<0.5	0.6	0.5	<0.5	<0.5	0.7	<1	<1	
Cobalt	µg/l							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
Coliform Bacteria	(No/100 ml)	0						140												2									
Conductivity	µS/cm @ 25	2500	1000	1875	572	498	523	500	473	509	452	446	430	451	450	453	457	418	385	481	531	521	532	541	545	537	538	551	
Copper	µg/l	2000	30	1500	2.5	2.4	3.3	1.9	2.8	2.7	2.4	1.6	1.5	2.2	1.7	1.2	1.4	1.8		1.5	2.5	2.5	7.2	1.3	1.9	1	1.3	1.2	
Cyanide	mg/l	0.05	10					<0.05												<0.05									
D.O.	% Saturation				64			27			32			58			67			71			13			30			
E_Coli	No/100 ml	0						12												1									
Fluoride	mg/l	0.8	1000					<0.150												<0.150									
Iron	µg/l	200	200		<10	10.1	22.4	<10	13.5	<10	<10	<10	<10	15.8	16.9	<10	<10	112.9		28.4	18	287.2	26.4	24.7	98.6	20.2	35	<10	
Lead	µg/l	25	10	18.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.1		<0.5	<0.5	0.9	<0.5	<0.5	1.1	<0.5	<1	<1	
Magnesium	mg/l Mg		50		9.62	9.08	9.55	8.99	9.33	8.11	8.38	8.08	8.41	9.48	8.58	9.22	7.41	6.29		8.24	9.04	10.17	10.44	9.9	10.02	10.17	10.46	10.58	
Manganese	µg/l	50	50		<1	<1	2	5.2	13.9	14.2	2.2	3.2	3.8	1.3	2.5	<1	6.7	17.4		1.5	2	56.2	25.5	926.7	74.1	81.7	48.4	202.8	
Mercury	µg/l	1	1	0.75	nm	nm	nm	<0.05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		<0.05	nm	nm	nm	nm	nm	nm	nm	nm	
Molybdenum	µg/l		35					0.5	1	0.9	1	1.1	<0.5	0.6	0.8	0.7	0.6	0.7		0.6	<0.5	0.6	1	1.1	1	0.7	<1	<1	
Nickel	µg/l	20	20	15	3.6	2.9	3.7	2.9	3.7	3.2	3.2	3.3	3.3	3.2	2.7	3.1	2.5	2.5		4.6	4.6	6.2	4	6.6	5.6	5.7	5.8	5	
Nitrite	mg/l N	0.5	0.1	0.375	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.012	0.009	<0.002	<0.004	<0.004	
o-Phosphate	mg/l P		30					0.02												<0.02									
pH		6.5 - 9.5			7.8	7.8	7.9	7.8	7.8	8	7.8	7.8	7.5	7.8	7.4	7.5	7.3	7.6	7.7	7.8	7.8	7.7	7.6	7.7	7.6	7.7	7.8	7.6	
Phenol	mg/l		0.0005		<0.002	<0.002	<0.002	<0.025	<0.002	<0.025	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Potassium	mg/l		5		8.55	7.42	8.43	7.75	8.58	8.74	7.92	8.02	7.48	9.15	7.21	6.93	5.92	4.67		6.33	7.88	8.64	9.18		8.89	9.4	8.91	8.6	
Sampling Depth	m				26	26.3	26.3	26.4	26	26.1	26	26.9	26.2	26.2	26.1	25.9	25.2	25.1	23.8	25.3	25	25.3	26.9	26	25.9	17.9	18.2	25.5	
Selenium	µg/l	10						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
Silver	µg/l							<0.5	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		nm									
Sodium	mg/l	200	150	150	43.94	38	44.31	39.01	43.83	40.45	39.8	40.34	39.6	46.47	37.78	39.15	31.47	25.45		34.02	39.01	43.05	44.14	42.45	42.79	43.54	41.79	41.1	
Strontium	µg/l							99.56	101.88	99.1	88.08	81.74	79.53	76.76	81.63	77.77	96.05	95.59		103.21	108.46	114.26	114.08	116.26	113.36	122.44	118.3	120.41	
Sulphate	mg/l SO4	250	200	187.5				24.1												19.7									
Suspended Solids	mg/l																												
Temp	°C				11.2	10.6	10.5	12	13.3	12.7	16.7	18.1	14.6	16.2	10.5	11.3	8.7	7.6	6.4	6.7	9.6	14.6	20.1	18.9	16.3	15.9	10.7	8.8	
Thallium	µg/l							<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	0.13	0.18	0.13	0.12	<1	<1	
Time sampled					11:50	12:15	11:45	0.48958	0.48958	0.49653	11:05	11:20	11:25	11:40	11:20	11:40	11:45	11:35	11:50	11:20	11:45	11:25	12:30	11:35	12:00	12:20	13:15	11:55	
Tin (µg/l)	µg/l							<1	<1	<1	<1	<1	<1	<1	<1	<1	nm	nm		nm									
T.O.C.	mg/l	NAC			35.9			36.9			5.3			6.3			35.5			3.5			6.9			7.1			
T.O.N	mg/l N		NAC		0.12	0.37	0.14	0.1	0.48	0.12	<0.08	0.27	<0.08	<0.08	0.14	0.33	0.27	0.51	0.97	0.51	0.3	0.31	0.09	0.09	0.22	0.28	0.29	<0.20	
Total S Solids	mg/l																												
Uranium	µg/l							0.46	0.47	0.41	0.38	0.35	0.3	0.38	0.39	0.4	0.46	0.5		0.57	0.43	0.44	0.31	0.26	0.3	0.28	<1	<1	
Vanadium	µg/l							<0.5	<0.5	<0.5	<0.5	<0.5	0.58	0.62	<0.5	<0.5	0.51	<0.5		<0.5	<0.5	0.78	<0.5	<0.5	<0.5	0.61	<1	<1	
Zinc	µg/l		100		3.7	4	5.3	1.3	6.8	1.3	5.5	4.6	1	1.1	6.5	2.3	2.6	26.6		5.1	4	5	2.3	4.7	61.3	2.3	16.7	2	

BOREHOLE BH11A																													
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**28-Aug-07**	**25-Sep-07**	**24-Oct-07**	**28-Nov-07**	**18-Dec-07**
Alkalinity	**mg/l CaCO3**							230												252									
Aluminium	**ug/1**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	0.04	<0.03	<0.03	<0.03	<0.03	0.05	0.2	0.04	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.05	0.03	0.03	<0.03	0.10	0.03	<0.03	<0.03	<0.03
Antimony	**ug/1**	**5**																											
Arsenic	**ug/0**		**10**	**7.5**																									
Barium	**ug/1**		**100**		50.5	<50	<50	51.2	<50	<50	54.6	94.2	53	52.7	55.8	<50	<50	<50	53.3	52.7	56.9	56.1	53.0	62.7	<50	58.2	nm	<50
Beryllium	**ug/2**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				180.4												243.3									
Cadmium	**µg/l**	**5**	**5**	**3.75**	0.2	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium	**mg/l Ca**		**200**					142.36												154.20									
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	62	62	60	61	60	57	67	89	99	98	100	97	84	78	77	74	88	95	88	82	100	112	92	101
Chromium	**µg/l**	**50**	**30**	**37.5**	9.2	4	4.8	10	3	2.8	2	3	4.7	2.4	3.5	<1	4.6	3.4	4.0	<1	<1	3.1	2.8	3.3	<1	2.3	2.2	3.5
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	1295	1294	1300	1294	1300	1318	820	1402	1446	1456	1398	1447	1454	1458	1515	1511	1549	1549	1555	1576	1600	1561	1650	1549
Copper	**µg/l**	**2000**	**30**	**1500**				6												3.2									
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.05									
D.O.	**% Saturation**				43			41			108			48			54			55			74			37			
E_Coli	**No/100 ml**	**0**						0																					
Fluoride	**mg/l**	**0.8**	**1000**					0.15												<0.150									
Iron	**µg/l**	**200**	**200**		536	227	217.2	697.9	255.6	605.5	79.1	583.1	207.9	372.5	246.5	208.2	315.9	384.8	404.5	419.3	403.9	315.2	532.2	1081.9	400.4	319.9	394.9	388.2
Lead	**µg/l**	**25**	**10**	**18.75**	6.4	<1	<1	5.5	<1	<1	<1	3.2	<1	<1	<1	<1	<1	2.4	<1	<1	<1	<1	4.5	4.1	<1	<1	2.6	<1
Magnesium	**mg/l Mg**		**50**					59.83												47.63									
Manganese	**µg/l**	**50**	**50**		106.2	24	18.7	70.7	18.2	30.8	67.5	66	37.7	37.7	31.4	23.3	17.1	38.8	33.5	21.0	35.3	30.0	54.6	135.7	10.8	9.2	29.3	29.1
Mercury	**µg/l**	**1**	**1**	**0.75**				0.6												<0.10									
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	6.4	2.9	3.5	14.4	3.3	5.9	8.8	7	5.9	4.4	2.9	3.2	3.0	3.4	3.4	8.8	3.3	4.3	4.7	5.0	3.8	2.2	4.4	4.6
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.013	0.003	<0.003	0.006	<0.003		0.011	0.006	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004	<0.003	nm	0.005	0.003	0.006	0.006	<0.003	0.008
o-Phosphate	**mg/l P**		**30**					0.02												0.02									
pH		**6.5 - 9.5**			7.5	7.4	7.4	7.4	7.4	7.3	8.3	7.6	7.4	7.5	7.4	7.6	7.5	7.2	7.2	7.4	7.2	7.4	7.4	7.3	7.2	7.3	7.4	7.4
Phenol	**mg/l**		**0.0005**		0.019	<0.001	<0.001	<0.001	0.013	0.198	0.007	0.016	<0.001	0.035	<0.001	<0.001	0.045	<0.001	<0.001	<0.001	<0.01	nm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	**mg/l**		**5**		25.95	23.52	22.29	22.67	26.88	21.17	17.63	23.19	24.58	23.34	23.95	21.41	22.31	20.57	21.98	18.85	20.54	22.78	22.09	20.85	22.52	24.86	28.6	27.34
Sampling Depth	**m**				15.8	15.4	15.7	15.9	15.8	16	15.6	15.9	16.1	16	16	15.1	15.9	15.8	16.0	15.2	15.6	15.7	16.0	15.8	nm	16.1	15.3	15
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	47.95	47.21	59.29	51.82	56.89	46	86.66	50.74	59.14	65.88	69.93	>50	53.54	57.57	58.29	53.92	>50	60.76	63.88	63.53	69.66	78.24	83.42	91.25
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				296.2												464.6									
Suspended Solids	**mg/l**																												
Temp	**°C**				13	13	12	14.1	15	16	21.7	16	13	14.4	12	10	11.7	14.0	13.0	16.0	16.0	15.0	18.4	16.0	15.0	14.3	16	14
Thallium	**µg/l**																												
Time sampled								13	12.5	13	13.3	12.45	12.35	12.3	12.4	12.4	13.05	12.30	12.50	12.50	12.50	13.05	13.30	12.45	12.55	12.50	11	13
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			95.6			3.9			11.8			3.5			3.6			5.6			5.3			4.5		
T.O.N	**mg/l N**		**NAC**		6.1	6.03	6.01	5.88	6.29	5.99	0.11	7.53	7.7	8.5	8.46	7.73	7.75	7.47	7.31	7.40	8.33	7.94	7.82	9.21	8.61	9.58	10.36	8.44
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		5.8	9.1	7.7	15.7	10.8	14.2	2.9	12	9.2	10.9	7.9	13.1	13.5	12.5	14.0	3.4	8.1	10.3	2.1	9.9	16.1	14.1	14.4	17

BOREHOLE BH11A																													
Date Collected		**DWR**	**IGV**	**2010 GW Regs**	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	**18-Aug-09**	**25-Sep-07**	**20-Oct-09**	**17-Nov-09**	**08-Dec-09**
Alkalinity	**mg/l CaCO3**							232												226									206
Aluminium	**ug/1**	**200**	**200**	**150**																									
Ammonia	**mg/l N**	**0.23 mg/l N**	**0.11 mg/l N**	**0.175**	<0.03	<0.03	0.03	0.04	<0.03	<0.03	0.08	0.05	<0.03	<0.03	0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	**ug/1**	**5**																											
Arsenic	**ug/0**		**10**	**7.5**																									
Barium	**ug/1**		**100**		55.5	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Beryllium	**ug/2**																												
B.O.D.	**mg/l O2**																												
Boron	**µg/l**	**1000**	**1000**	**750**				309.7												207.2									131.1
Cadmium	**µg/l**	**5**	**5**	**3.75**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Calcium	**mg/l Ca**		**200**					158.01												129.87									101.44
C.O.D.	**mg/l O2**																												
Chloride	**mg/l Cl**	**250**	**30**	**187.5**	77	70	71	67	65	65	72	62	58	58	57	59	56	57	56	55	49	47	46	44	42	44	42	43
Chromium	**µg/l**	**50**	**30**	**37.5**	5.5	3.5	4.7	7.6	4.5	8.3	<50	6.6	4.1	4.4	3.5	3.5	5	4.2	3.7	4.1	5	7.4	7.1	7.3	5.08	4.9	7.1	6.6
Cobalt	**µg/l**																												
Coliform Bacteria	**(No/100 ml)**	**0**																											
Conductivity	**µS/cm @ 25**	**2500**	**1000**	**1875**	1531	1414	1408	1275	1222	1179	1120	1098	1110	1130	1149	1170	1155	1183	1167	1145	1071	1056	1008	996	979	989	936	989
Copper	**µg/l**	**2000**	**30**	**1500**				4.4												3.9									1.8
Cyanide	**mg/l**	**0.05**	**10**					<0.05												<0.01									<0.05
D.O.	**% Saturation**				68			72			83			65			70			76			nm	95		71		93
E_Coli	**No/100 ml**	**0**						3																60				
Fluoride	**mg/l**	**0.8**	**1000**					<0.150												<0.150									0.180
Iron	**µg/l**	**200**	**200**		391.7	226.4	293.3	466.1	516.4	305.8	270.2	256.7	172.4	277.5	169.2	116.1	136.7	156.9	670.9	290	279.9	91.7	83.8	118	156.25	<50	<50	<50
Lead	**µg/l**	**25**	**10**	**18.75**	2.2	<1	<1	5.1	4	2.6	<1	3.9	<1	2.6	<1	<1	<1	<1	4.2	3.7	3.1	<1	1.3	1.3	1.12	<1	<1	1.2
Magnesium	**mg/l Mg**		**50**					92.07												41.72									30.50
Manganese	**µg/l**	**50**	**50**		22.9	13.7	19.1	76.8	58.4	40.5	28.6	28.3	11.8	29.8	13.9	5.4	7.2	6.1	92.4	50.5	33.5	17.4	18.7	21.2	19.97	<1	8.3	7.8
Mercury	**µg/l**	**1**	**1**	**0.75**				<0.10												<0.1									<0.1
Molybdenum	**µg/l**		**35**																										
Nickel	**µg/l**	**20**	**20**	**15**	3.4	2.7	2.7	3.8	3.8	5.9	2.4	2.5	2.1	2.7	<1	<1	<1	<1	5.6	2.5	1.9	1.7	1.6	2.1	1.66	<1	1.2	<1
Nitrite	**mg/l N**	**0.5**	**0.1**	**0.375**	0.009	0.004	0.004	0.011	<0.003	0.011	0.016	0.017	0.008	0.004	0.031	<0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Phosphate	**mg/l P**		**30**					<0.02									<0.02			<0.02									<0.02
pH		**6.5 - 9.5**			7.2	7.4	7.3	7.4	7.5	7.4	7.5	7.6	7.4	7.5	7.4	7.4	7.4	7.5	7.4	7.4	7.5	7.5	7.4	7.5	7.7	7.4	7.6	7.4
Phenol	**mg/l**		**0.0005**		0.02	0.02	0.02	<0.01	<0.01	<0.01	nm	0.03	0.01	0.03	<0.01		<0.01	<0.01	<0.016	<0.002	<0.002	<0.002	nm	<0.002	<0.015	<0.015	<0.0005	<0.015
Potassium	**mg/l**		**5**		28.64	28.19	27.27	27.76	25.13	23.47	22.53	24.02	21.84	23.16	22.2	23.13	21.91	20.24	19.95	19.48	21.2	20.17	18.33	16.93	15.72	18.61	16.22	14.92
Sampling Depth	**m**				15.1	15.9	15.2	15.1	15.3	14.9	15	15.1	15.2	15.1	15.2	15.3	15	15.3	15.2	15.1	15.3	14.8	15	15	14.2	15.1	14.2	13.7
Selenium	**µg/l**	**10**																											
Silver	**µg/l**																												
Sodium	**mg/l**	**200**	**150**	**150**	76.35	66.42	64.19	54.56	44.75	46.50	43.81	41.56	39.54	41.89	44.31	49.61	45	43.22	43.05	40.23	38.71	32.25	32.87	32.61	30.2	34.03	31.82	27.31
Strontium	**µg/l**																												
Sulphate	**mg/l SO4**	**250**	**200**	**187.5**				347.7												279.2									230.7
Suspended Solids	**mg/l**																												
Temp	**°C**				9	16	14	14	15	16.3	15.7	16	14	11.8	13	14	13.8	14	14	14.5	14.3	16	17	15.2	14.3	14.1	14.0	14.0
Thallium	**µg/l**																												
Time sampled					nt	12.4	12.45	13.3	12.55	12.55	13	12.55	13	12.3	12.2	11.45	13.05	12.3	12.45	13.5	13	12.2	13	12.3	12.4	12.20	10.50	13.05
Tin (µg/l)	**µg/l**																												
T.O.C.	**mg/l**	**NAC**			4.7			2.9			2			2.6			3.4			4.5			3.7			4.1		<3.0
T.O.N	**mg/l N**		**NAC**		7.65	7.4	7.09	6.05	5.04	4.59	3.84	3.47	3.89	4.31	4.64	4.34	2.36	2.61	2.27	2.1	3.08	2.92	2.29	2.68	2.4	1.82	2.40	1.44
Total S Solids	**mg/l**																												
Uranium	**µg/l**																												
Vanadium	**µg/l**																												
Zinc	**µg/l**		**100**		21.3	16.4	13.5	15	<1	13.1	10.1	13.3	9.2	18.9	7.6	10.7	14.4	17.6	16.9	12.4	11.3	7.6	8	7.7	126.6	5.8	93.9	8.8

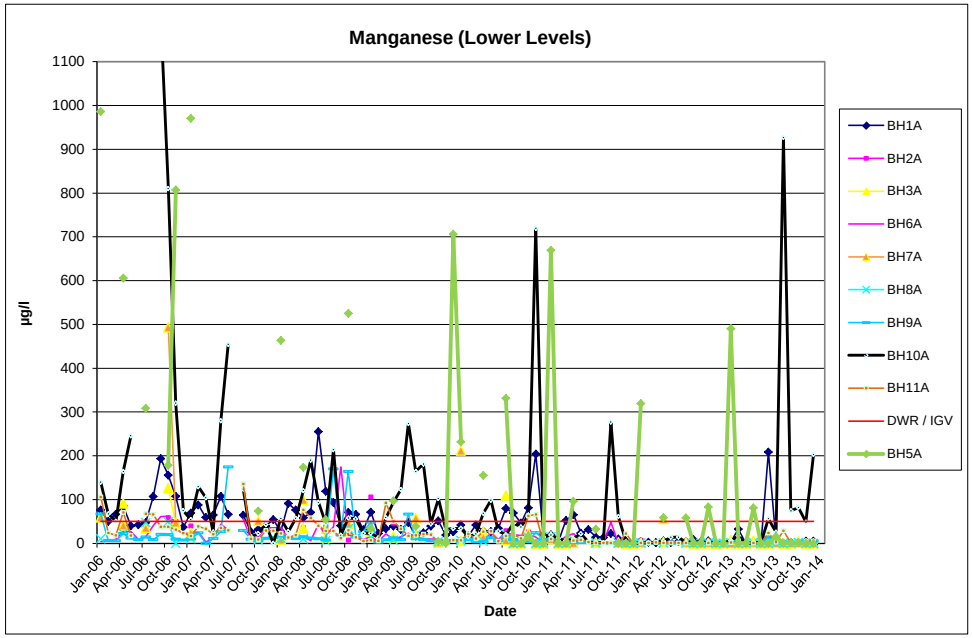
BOREHOLE BH11A

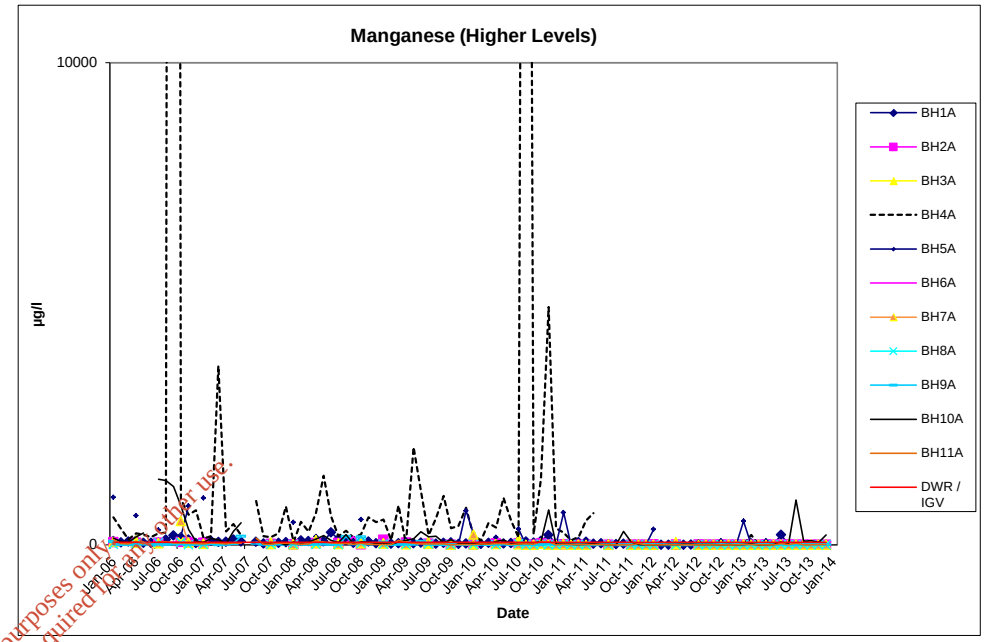
Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	09-Aug-11	06-Sep-11	04-Oct-11	08-Nov-11	13-Dec-11
Alkalinity	mg/l CaCO3							206						214						243									
Aluminium	ug/1	200	200	150																									
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Antimony	ug/1	5																											
Arsenic	ug/0		10	7.5																									
Barium	ug/1		100		31.8	32.8	33.9	30.6	28	28.9	28.9	28.0	26.8	35.3	35.5		36.8	37.7	37.7	37.5	36.4	33.7	30.4	28.4	27.9		26.7	
Beryllium	ug/2																												
B.O.D.	mg/l O2																												
Boron	µg/l	1000	1000	750				161.1						163.8						297.5									
Cadmium	µg/l	5	5	3.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1		<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	
Calcium	mg/l Ca		200					115.01						119.31						131.13									
C.O.D.	mg/l O2																												
Chloride	mg/l Cl	250	30	187.5	44	45	44	43	42	43	43	38	39	40	37	19	47	48	51	53	52	47	43	46	43	42	35	37
Chromium	µg/l	50	30	37.5	2.3	3.7	2.9	2	2.7	2.2	2.2	3.2	3.2	3.3	<5		<5	2.7	1.5	1.2	1.2	1.6	1.8	1.7	2.1		3.3	
Cobalt	µg/l																												
Coliform Bacteria	(No/100 ml)	0																											
Conductivity	µS/cm @ 25	2500	1000	1875	1022	1005	1034	1009	1005	975	975	875	893	912	903	560	798	976	999	589	982	878	889	901	857	875	958	914
Copper	µg/l	2000	30	1500				2.5						2.3						<0.5									
Cyanide	mg/l	0.05	10					<0.05						<0.05						<0.05						<0.05			
D.O.	% Saturation				64			76				80		62			46			30			50			49			
E_ Coli	No/100 ml	0						4						nm						nm									
Fluoride	mg/l	0.8	1000					<0.150						<0.150						<0.150						<0.150			
Iron	µg/l	200	200		<50	119.7	49.9	90.6	117.4	26.3	26.3	90.3	89.2	275.2	282.3		<100	34.6	23.3	31	28.2	10.2	19.6	<10	32.6		209.3	
Lead	µg/l	25	10	18.75	1.6	2.7	1.2	2.2	1.6	<0.5	<0.5	0.9	0.7	2.7	<5		<5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5		1	
Magnesium	mg/l Mg		50					35.46						37.45						43.36									
Manganese	µg/l	50	50		7.2	21.7	11.2	26.9	27.9	5.1	5.1	17.1	20.5	62.6	66.1		<10	2.8	4.1	6.6	7.9	2.9	1.2	<1	1.3		22.3	
Mercury	µg/l	1	1	0.75				<0.1						<0.05						<0.05									
Molybdenum	µg/l		35																										
Nickel	µg/l	20	20	15	1.3	1.5	<1	1.2	1.3	<1	<1	<0.5	0.6	2.2	<5		<5	<0.5	0.9	2.3	1.2	<0.5	<0.5	<0.5	0.6		<0.5	
Nitrite	mg/l N	0.5	0.1	0.375	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	nm	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002
o-Phosphate	mg/l P		30					<0.02						<0.02						<0.02						<0.02			
pH		6.5 - 9.5			7.5	7.5	7.5	7.4	7.5	7.5	7.5	7.5	7.5	7.6	7.6	7.8	8.0	7.6	7.4	7.5	7.5	7.6	7.5	7.5	7.3	7.6	7.7	7.6
Phenol	mg/l		0.0005		<0.015	<0.015	<0.015	<0.015	<0.2	<0.1	<0.1	<0.025	<0.015	<0.025	<0.015		<0.025	<0.025	<0.01	<0.008	<0.013	<0.008	<0.008	<0.016	<0.016	<0.016	<0.025	
Potassium	mg/l		5		15.14	15.9	18.18	15.66	15.28	18.03	18.03	15.41	14.38	17.63	14.69		22.25	21.49	25.00	31.01	26.29	22.33	17.91	22.56	22.53		17.36	
Sampling Depth	m				14	13.1	14	13.2	14.1	14.1	14.1	14.9	15.2	nm	15.3	9.1	12.2	13.8	13.8	14	15.1	14.6	15	15	15.3		14.6	15
Selenium	µg/l	10																											
Silver	µg/l																												
Sodium	mg/l	200	150	150	30.18	31.12	36.82	32.4	27.15	35.37	35.37	23.49	25.85	34.07	29.93		36.77	35.20	39.86	46.44	40.69	32.45	27.14	30.39	35.8		25.92	
Strontium	µg/l																												
Sulphate	mg/l SO4	250	200	187.5				226						299.6						208.5						164.3			
Suspended Solids	mg/l																												
Temp	°C				14	13.7	14	15.8	14	16	16.0	28.0	14.1	13.8	13.6	9.6	13.5	15.0	14.0	15.1	16	15.4	15	15	15.1	15.3	13.8	11.9
Thallium	µg/l																												
Time sampled					12.45	12.3	12.45	13.1	12.35	13	13.00	13.20	12.30	13:35	13:20	12:40	12.35	12:40	12:40	12:50	12:40	12:55	12:05	12:10	12:40	12:50	14.1	11:00
Tin (µg/l)	µg/l																												
T.O.C.	mg/l	NAC			4.2			2.8				2.1		51.3			3.8			51.9			3.1						
T.O.N	mg/l N		NAC		1.22	1.17	1.09	1.93	2.66	2.22	2.22	2.48	2.18	2.59	2.17		2.19	2.66	3.25	2.92	2.85	2.27	2.25	2.42	2.3	1.57	1.69	1.52
Total S Solids	mg/l																												
Uranium	µg/l																												
Vanadium	µg/l																												
Zinc	µg/l		100		7.1	9.2		7.5	4.3	2.1	2.1	3.4	3.9	6.2	33.3		23.6	5.0	3.6	3.5	3.6	9.6	6.9	8.6	6.1		2.9	

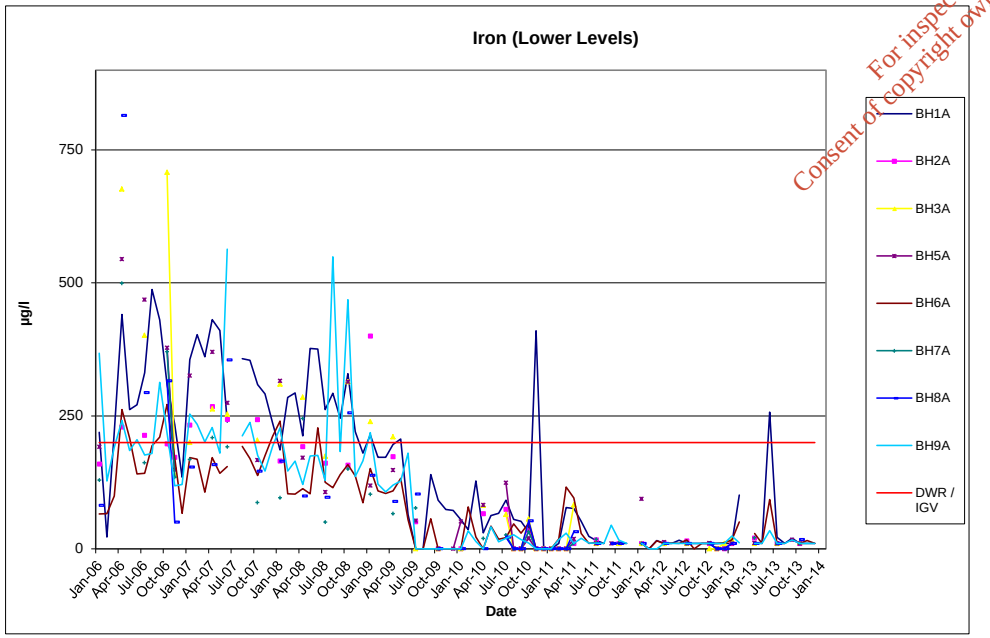
BOREHOLE BH11A

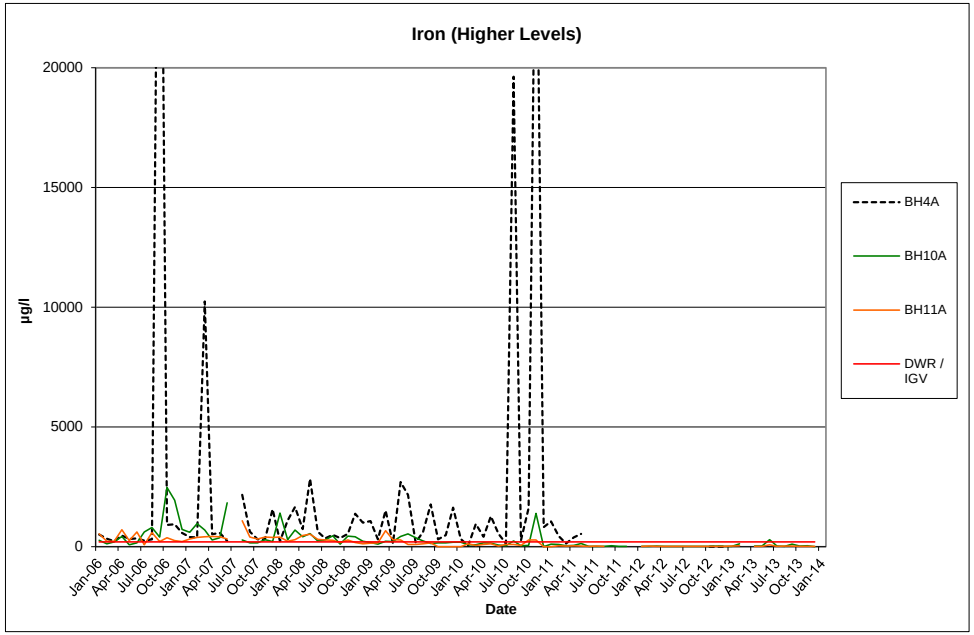
Date Collected		DWR	IGV	2010 GW Regs	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	########	07-Aug-13	17-Sep-13	08-Oct-13	19-Nov-13	03-Dec-13
Alkalinity	mg/l CaCO3							220												226									
Aluminium	ug/1	200	200	150				<5	<5	<5	<5	<5	<5	<5	5.6	<5	<5	17.7		<5	<5	28	<5	<5	<5	<5	<10	<10	
Ammonia	mg/l N	0.23 mg/l N	0.11 mg/l N	0.175	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.020	<0.020
Antimony	ug/1	5						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
Arsenic	ug/0		10	7.5				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
Barium	ug/1		100		34.8	36	34.9	33.9	35.3	29.6	37.3	39.7	36.2	36.1	35.5	34.3	41.4	43.2		39.6	36.3	40.6	36.5	32.5	31.6	31.1	27.4	31.6	
Beryllium	ug/2							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
B.O.D.	mg/l O2																												
Boron	µg/l	1000	1000	750	226.3	270.9	256.5	227.5	218	216.2	231	232.9	236	292	236.5	226.3	174.2	193.5		212.6	207.2	208.2	189.2	176.3	149.3	150.3	102.7	173.1	
Cadmium	µg/l	5	5	3.75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Calcium	mg/l Ca		200		92.43	95.38	88.22	92.43	99.23	84.89	92.62	85.17	90.19	94.47	88.24	84.02	90.18	93.9		98.86	96.47	107.97	101.55	92.89	85.98	89.87	81.77	81.41	
C.O.D.	mg/l O2																												
Chloride	mg/l Cl	250	30	187.5	47	50	50	47	44	46	44	44	45	45	44	41	36	38	41	41	45	45	42	40	35	35	29	37	
Chromium	µg/l	50	30	37.5	1.2	2	1.4	1.2	2.1	1.5	2.3	1.4	1.3	2	2	1.7	1.6	2.5		3.2	2	1.7	2.3	1.6	2	2.6	2.9	3.7	
Cobalt	µg/l							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	
Coliform Bacteria	(No/100 ml)	0						>2420												5									
Conductivity	µS/cm @ 25	2500	1000	1875	958	911	900	884	852	959	892	878	891	916	923	869	849	869	896	925	942	938	892	877	833	812	744	788	
Copper	µg/l	2000	30	1500	1.2	1	2.6	<0.5	0.9	1.1	1.1	3.3	1	2	1.3	1.2	1.4	2.2		0.8	1	1.5	<0.5	0.9	0.8	<0.5	<1	1	
Cyanide	mg/l	0.05	10					<0.05												<0.05									
D.O.	% Saturation				35			42			37			33			45			40			37			55			
E_ Coli	No/100 ml	0						72												0									
Fluoride	mg/l	0.8	1000					0.15												<0.150									
Iron	µg/l	200	200		<10	18.3	15.2	<10	13.6	<10	<10	<10	<10	<10	<10	<10	16.3	31.3		<10	<10	79.4	10.2	<10	19.2	<10	<10	<10	
Lead	µg/l	25	10	18.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	36.4	2	<0.5	<0.5	<0.5	<0.5	<0.5	0.9		<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<1	<1	
Magnesium	mg/l Mg		50		27.38	27.89	25.42	28.67	32.05	27.37	28.73	27.97	27.96	28.44	26.79	26.82	27.61	28.81		31.37	32.65	30.7	32.08	29.03	29.72	27.85	28.43	28.66	
Manganese	µg/l	50	50		1.3	<1	2.7	<1	<1	<1	<1	<1	<1	<1	1.7	<1	2	5.9		<1	<1	24.2	2.9	<1	<1	<1	<5	<5	
Mercury	µg/l	1	1	0.75	nm	nm	nm	<0.05	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		<0.05	nm	nm	nm	nm	nm	nm	nm	nm	
Molybdenum	µg/l		35		0.6	0.5	<0.5	1.2	<0.5	<0.5	<0.5	0.5	0.6	<0.5	0.6	0.6	0.5	0.6		0.6	<0.5	<0.5	1.1	<0.5	0.6	<0.5	<1	<1	
Nickel	µg/l	20	20	15	1	0.8	1	<0.5	<0.5	<0.5	<0.5	1	<0.5	0.8	0.6	0.6	0.5	0.6		0.7	2.1	2.3	<0.5	1.9	0.8	1.2	<1	1.3	
Nitrite	mg/l N	0.5	0.1	0.375	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.004	
o-Phosphate	mg/l P		30					0.02												<0.02									
pH		6.5 - 9.5			7.5	7.5	7.6	7.5	7.6	7.7	7.5	7.5	7.3	7.5	7.2	7.3	7.3	7.5	7.4	7.6	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	
Phenol	mg/l		0.0005		<0.002	<0.002	<0.002	<0.025	<0.002	<0.025	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
Potassium	mg/l		5		29.91	29.05	34.71	24.9	26.82	27.39	27.33	30.45	28.58	28.97	27.08	24.55	22.37	24.78		25.07	25.32	24.15	23.03	21.28	18.62	18.71	14.33	20.84	
Sampling Depth	m				14.8	14.5	14.1	14.2	14.8	15.1	14.3	10	14.8	14.8	14.5	14.5	12.4	14.2	11.1	13.9	14.7	14	16	14.3	15	15.8	16.3	15.1	
Selenium	µg/l	10						<0.5	0.6	0.7	0.8	0.6	<0.5	1.1	<0.5	0.7	0.9	1.1		1.4	0.9	0.9	1.1	0.8	1.1	1.3	<1	<1	
Silver	µg/l							0.7	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm		nm									
Sodium	mg/l	200	150	150	39.52	38.97	39.83	34.81	36.49	33.75	33.83	34.63	35.59	43.03	35.87	33.71	27.35	30.31		33.26	32.72	36.08	32.35	29.48	26.01	26.16	20.78	30.98	
Strontium	µg/l							155.96	167.48	163.32	158.1	149.07	151.56	150.68	155.75	147.13	189.63	176.52		192.15	173.86	187.86	175.08	169.09	151.87	161.31	141.87	148.07	
Sulphate	mg/l SO4	250	200	187.5				163												190.2									
Suspended Solids	mg/l																												
Temp	°C				14.3	11.2	14.3	14.7	14.5	13.2	15.8	16.8	13.9	16.5	10.6	10.6	11.2	13.5	13	13.5	13.5	13.4	14.7	16	13.5	13.8	13.2	9.2	
Thallium	µg/l							0.28	0.25	0.35	0.36	0.33	0.35	0.38	0.31	0.26	0.27	0.36		0.3	0.33	0.33	0.23	0.23	0.19	0.17	<1	<1	
Time sampled					14:20	14:40	14:00	12:40	14:00	14:15	13:55	14:15	13:40	12:35	13:40	13:35	12:20	13:50	14:15	12:15	13:55	13:25	13:10	13:40	14:00	13:15	13:35	13:50	
Tin (µg/l)	µg/l							<1	<1	<1	<1	<1	<1	<1	<1	<1	nm	nm		nm									
T.O.C.	mg/l	NAC			56			47.1			3.6			3.5			56.6			2.2			2.7			2.9			
T.O.N	mg/l N		NAC		1.77	2.17	2.13	2.07	1.96	2.39	1.41	1.85	2.07	2.84	1.7	2.2	1.81	1.92	2.09	1.68	2.41	1.59	1.91	2.14	1.31	1.32	1.6	2.1	
Total S Solids	mg/l																												
Uranium	µg/l							0.73	0.71	0.68	0.72	0.79	0.8	0.79	0.72	0.79	1.03	0.92		0.96	0.82	0.87	0.82	0.75	0.78	0.75	<1	<1	
Vanadium	µg/l							<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.54	<0.5	<0.5	0.61	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<1	1.13	
Zinc	µg/l		100		6.5	2.4	8.3	3.1	3.7	6.4	7.9	8.1	1.8	2.5	11.5	5.4	7.4	6.8		3.6	2.6	7.2	3.8	2.4	7	5	17.3	6.2	

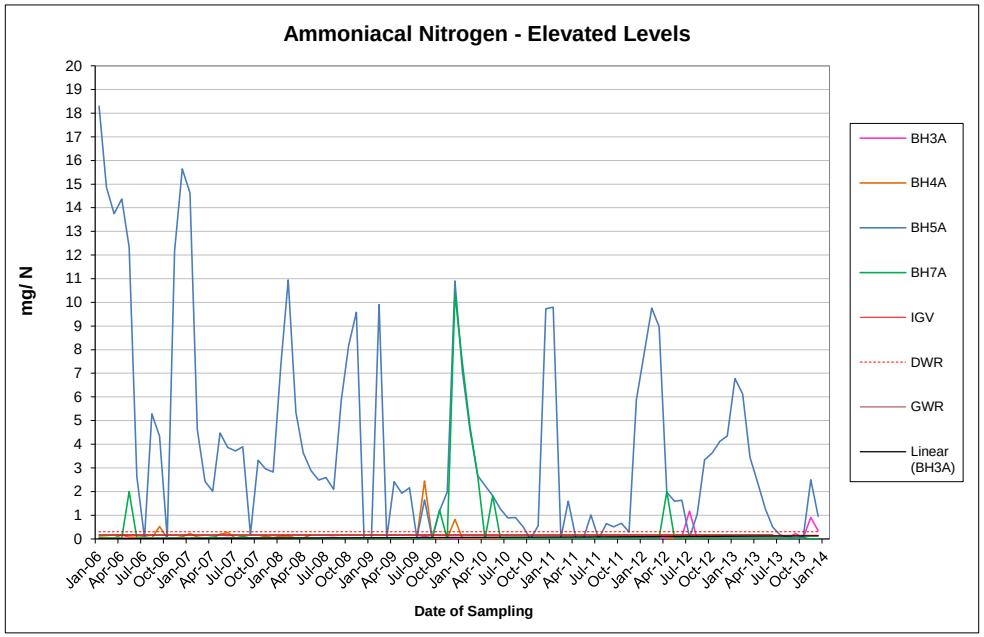
Groundwater Quality Data - Drogheda Landfill

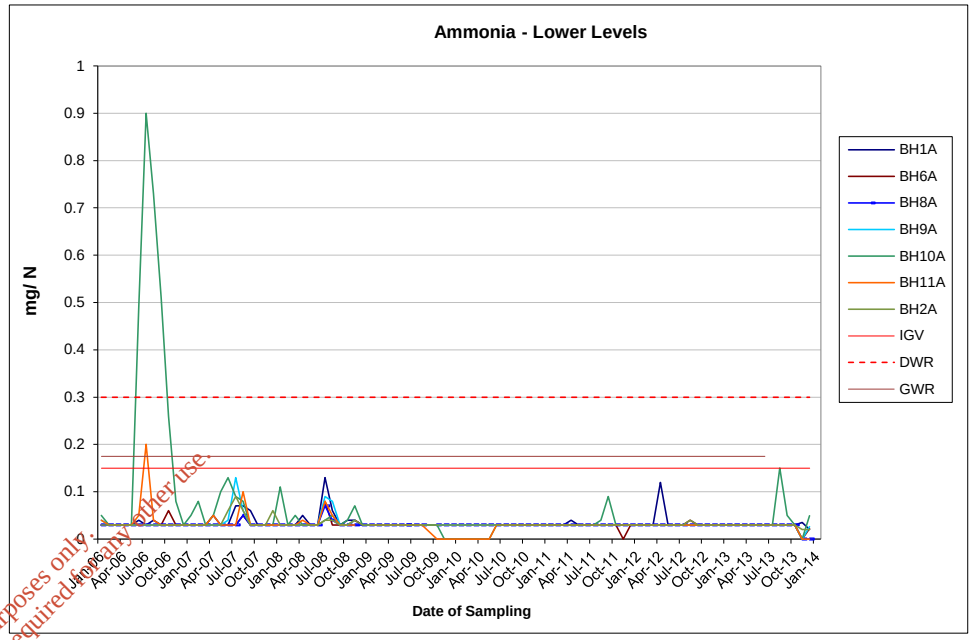


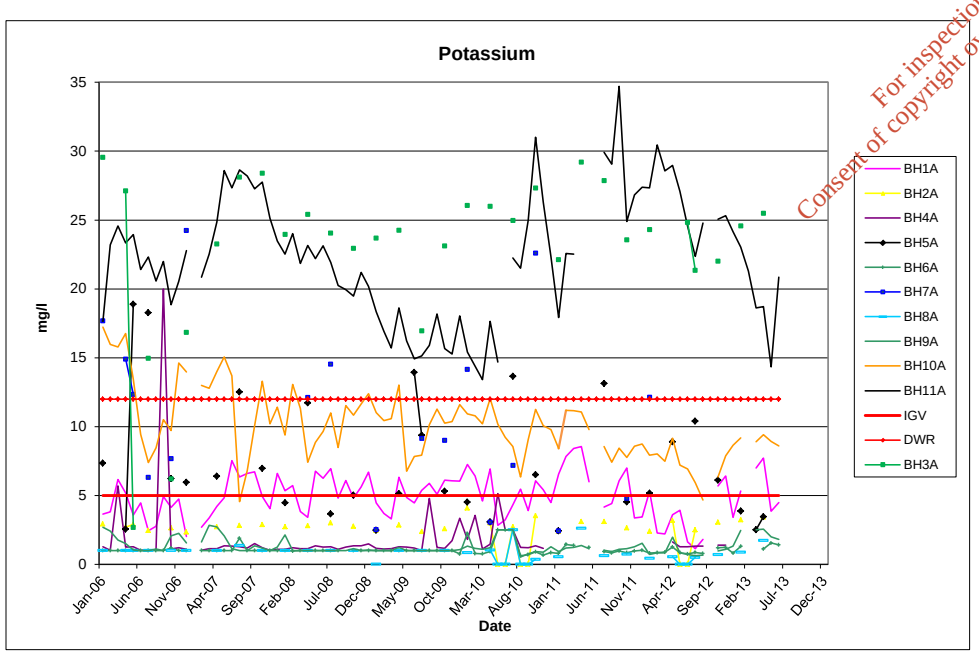


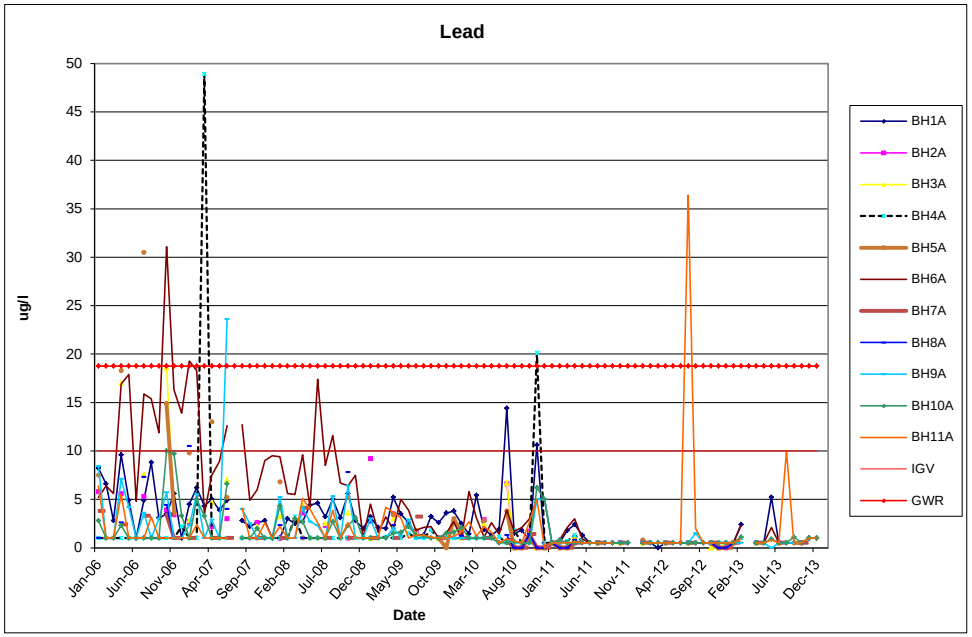


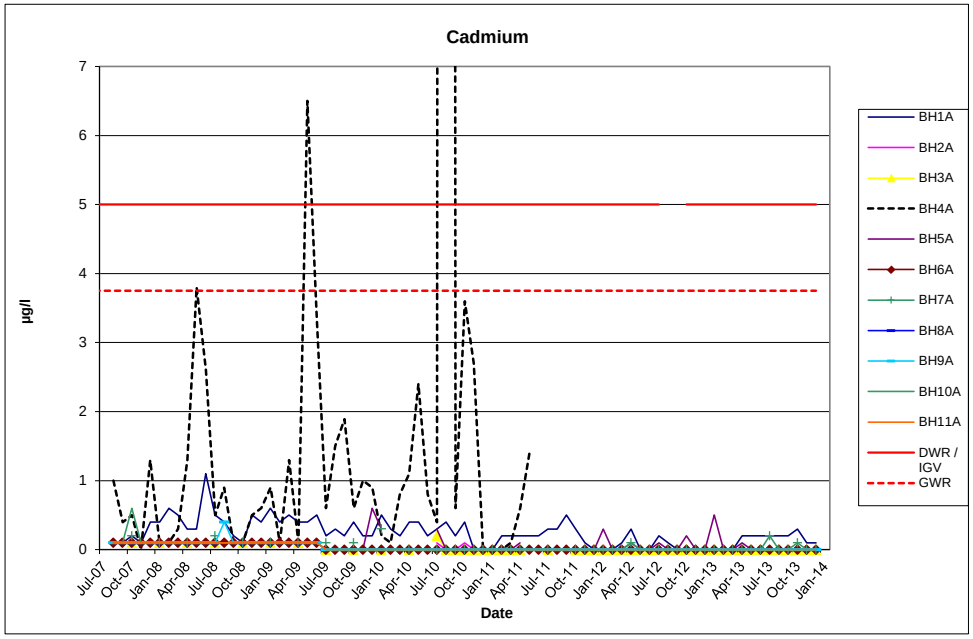


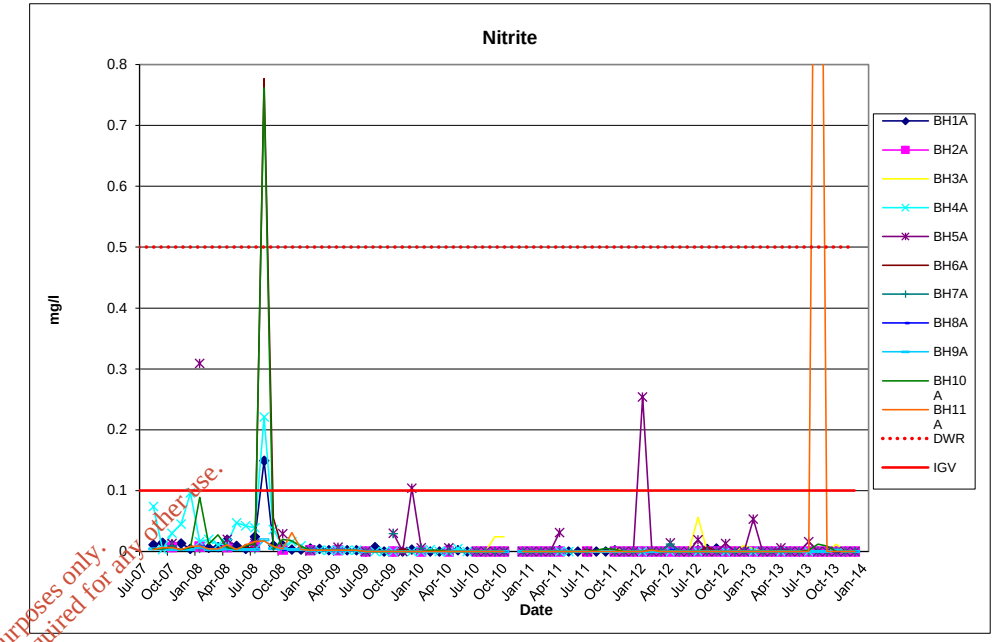


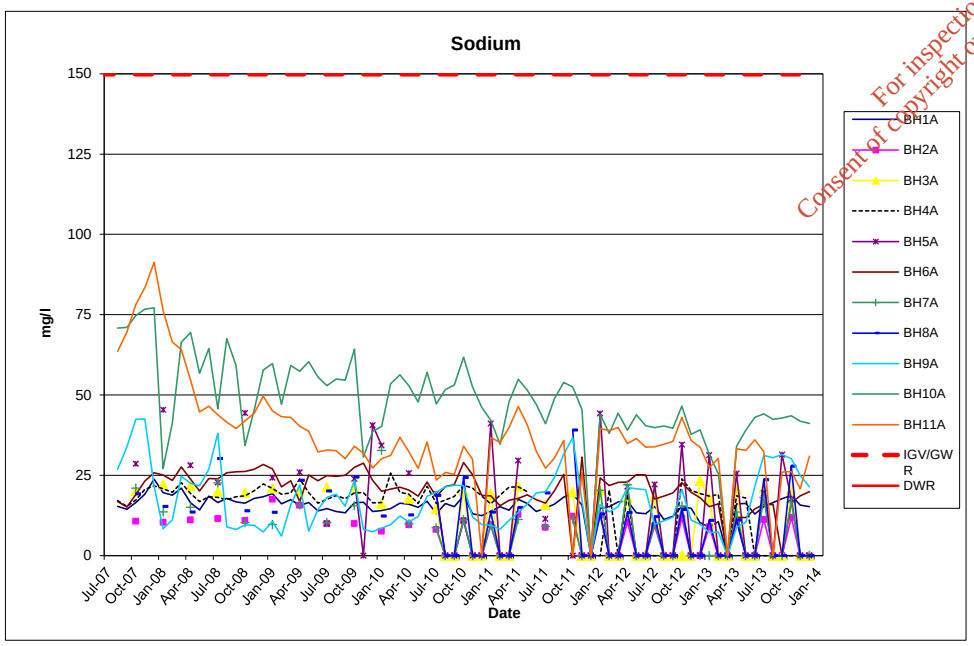


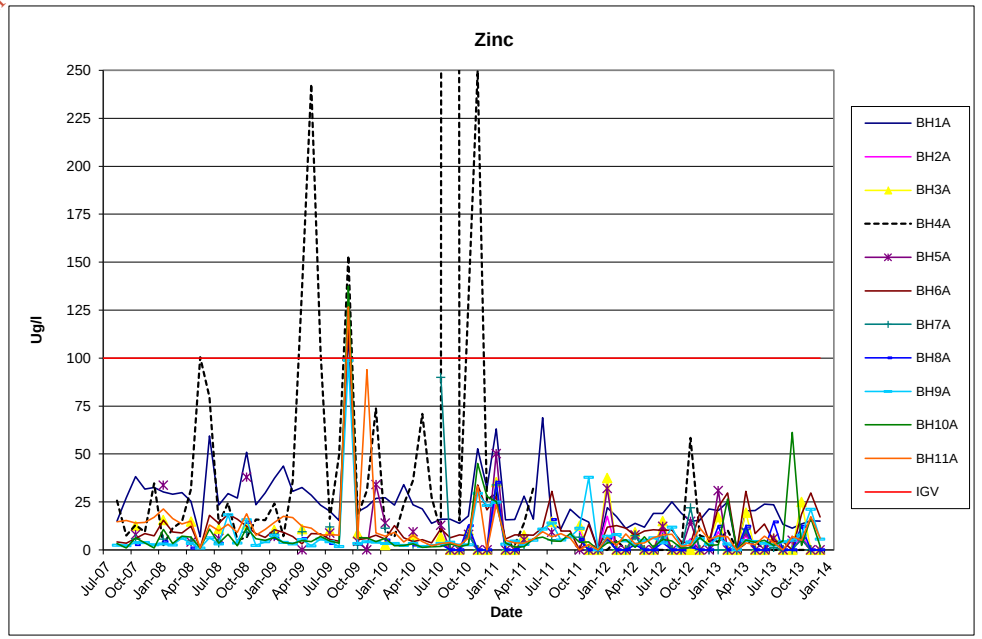












Groundwater Quality Data - Drogheda Landfill