



# Trecatti Landfill: HRA review 2018



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Prepared for

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**Cover photo: Trecatti landfill from the south-east**

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Appendix B: RAM model (provided in electronic form)

Appendix C: Groundwater Compliance Analysis

Appendix D: Surface Water Emissions Analysis

# 1 Introduction

## 1.1 Background

Biffa Waste Services Ltd (Biffa) operates Trecatti Landfill (“the Site”) near Merthyr Tydfil in Glamorgan. The Site is an operational landfill that accepts non-hazardous waste. The Site also accepts hazardous soils, which are treated at a soil treatment facility, and includes a cell for stabilised, non-reactive, hazardous waste. It is regulated by Environmental Permit EPR/RP3733PC/V010<sup>1</sup> (“the Permit”), issued by Natural Resources Wales (NRW) in January 2016 (see Appendix A).

In accordance with regulatory requirements, the Hydrogeological Risk Assessment (HRA) for the Site must be reviewed every six years. The previous assessment was completed in 2012 and the next review (this report) is due. Biffa engaged Stantec UK Ltd (Stantec) to carry out the HRA review.

## 1.2 Scope of Work

The scope of work includes a full review of all aspects of the original and previous HRAs, including:

- Outline of current site engineering and management including updates since the last review;
- Review of environmental monitoring data collected since the last HRA review;
- Review of the site hydrogeological conceptual model, in light of the updated data;
- Evaluation of the modelling software approach used and model scenarios assessed, to ensure that these remain applicable to the Site and its setting;<sup>2</sup>
- Review of the parameterisation of the risk assessment models to ensure that all values and probability distributions used remain appropriate;
- Appraisal of the essential and technical precautions in place at the Site, as well as the appropriateness of the monitoring programme;
- A review of any outstanding improvement conditions relevant to controlled waters;
- A review of relevant monitoring activities and compliance limits; and
- A judgement as to whether the Site is and may be expected to continue to be in compliance with the Permit and Environmental Permitting regulations.

## 1.3 Report Structure

This report is structured as follows:

- Information regarding the Site is contained in Section 2 including baseline geological and hydrological conditions and the landfill engineering;
- Review of collected water level and water quality data is provided in Section 3;
- Section 4 assesses the information in section 2 and 3 to review the conceptual model and add in any updates as required;
- Section 5 contains an updated HRA based on the updated conceptual model;
- Section 6 contains any proposed changes to the environmental monitoring requirement of the Permit; and
- Key conclusions of this HRA review are presented in Section 7.

---

<sup>1</sup> Permit variation EPR/RP3733PC/V010 was issued after the review period.

<sup>2</sup> We note that two model scenarios were developed in the calibration of the 2012 model – these have been reviewed for validity in light of the updated monitoring data before other parameters are considered.

## 2 Site Information

### 2.1 Site setting

The Site is situated on high ground at an elevation of approximately 400 m Above Ordnance Datum (AOD), above the suburb of Dowlais at the northeast edge of Merthyr Tydfil (approximate National Grid Reference (NGR) SO082077). The location and Environmental Permit installation boundary are shown in Figure 2.1.

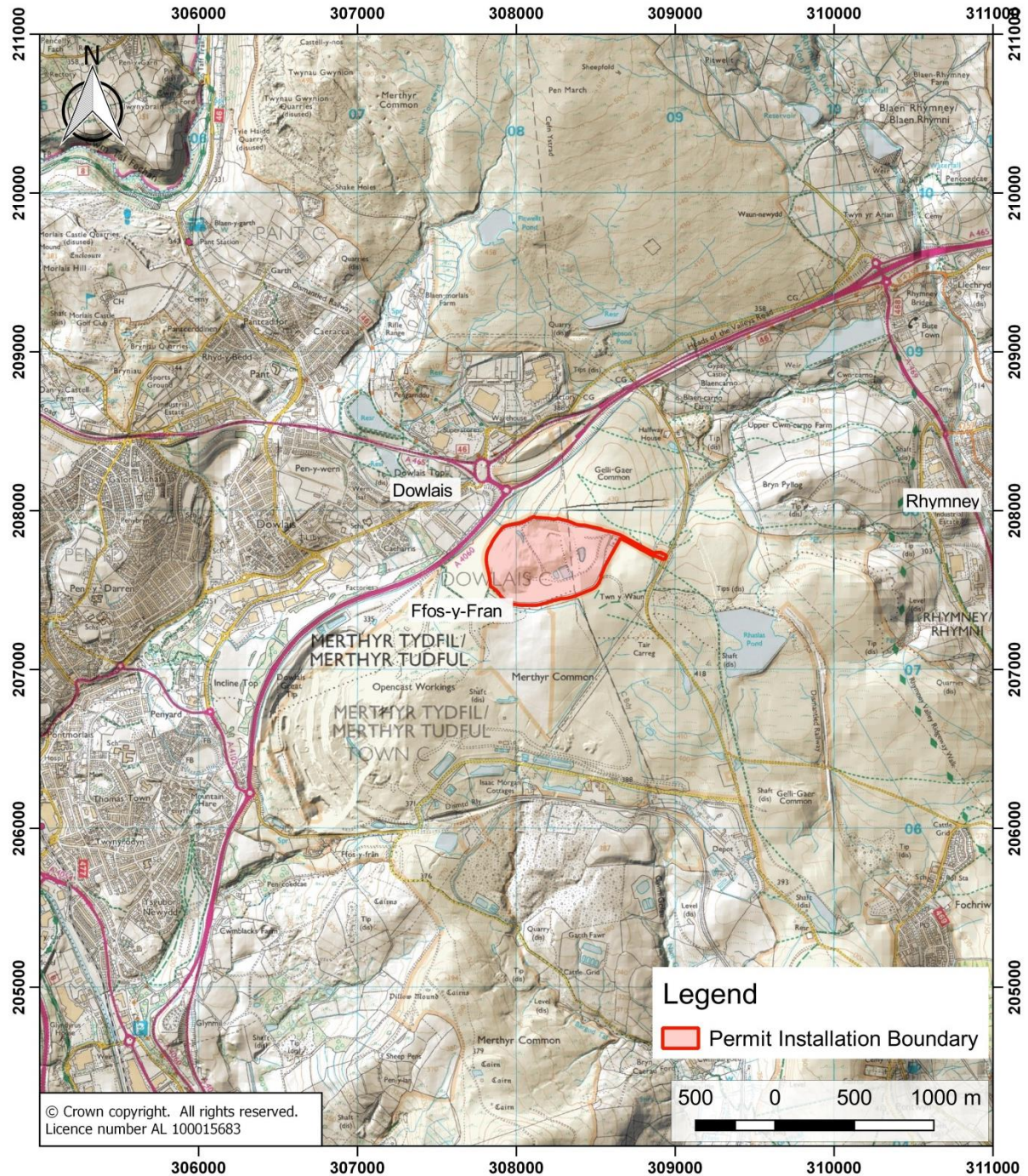


Figure 2.1 Site Location

Ground levels fall fairly steeply to around 250 m AOD 1.6 km west of the Site, towards Dowlais. The Site lies on a regional north-south orientated ridge. A local peak of 445 m AOD lies around 50 m

south of the Site. Towards the peak, the sides of the ridge flatten and, in the area immediately surrounding the Site, the ridge widens to form an elevated, gently sloping promontory. East and south of the ridge, topography slopes towards the Rhymney valley and the Bargod Taf valley respectively. Ground levels also drop off to the north towards the A4060 750 m north of the Site but rise again towards the Brecon Beacons.

Dowlais, a suburb of Merthyr Tydfil, is the closest residential area and the outskirts are around 390 m west of the Site. Rhymney lies 1.7 km west of the Site and an industrial estate and retail park lie 700 m to the north.

The Site is located on the northern edge of the South Wales Coal Field and both the Site and surrounding land have a long history of mining (both opencast and underground mineral workings). Immediately south of the Site is the Ffos-y-fran opencast mine area, which is the subject of the third phase of the East Merthyr Reclamation Scheme (EMRS). EMRS involves the extraction of around 10 million tonnes of coal from within the Ffos-y-fran area (Edwards, 2004).

## 2.2 Geology

The regional and local geological setting of the Site has been previously described in detail by ESI (2012).

### 2.2.1 Bedrock

The Site is located on the northern limb of the syncline that forms the South Wales Coal Field. The Site lies within the Carboniferous South Wales Middle Coal Measures Formation, which comprises interbedded mudstones, siltstones and sandstones with intermittent ironstones and coal seams. The regional bedrock geology around the Site is shown in Figure 2.2. The green and khaki coloured units within the Middle and Lower Coal Measures formations correspond to dominantly sandstone layers. One of these units underlies the southern portion of the Site. Thick black lines represent coal seams.

The Site is located over an area of former ironstone workings and a number of significant coal seams that were also worked, both via tunnelling and opencast methods (ESI, 2012). Geological strata in the area dip to the south-east at between 5 and 15 degrees and are segmented by a number of normal faults to the south-west of the Site (the Dowlais Fault, Penydarren Fault and an unnamed fault located between these two (Edwards, 2004)). Faults trend in a north-west to south-east direction, which is typical of the region. The uppermost coal seam to outcrop under the footprint of the Site is the Pentre Seam, which is present above a sandstone unit exposed on the southern face of the former quarry void (ESI, 2012). It is understood that prior to opencast mining, a number of coal seams, as well as the ironstone, were worked in the Trecatti area (SLR, 2004a). The subsequent opencast mining exploited a thickness of up to 120 m of Coal Measures.

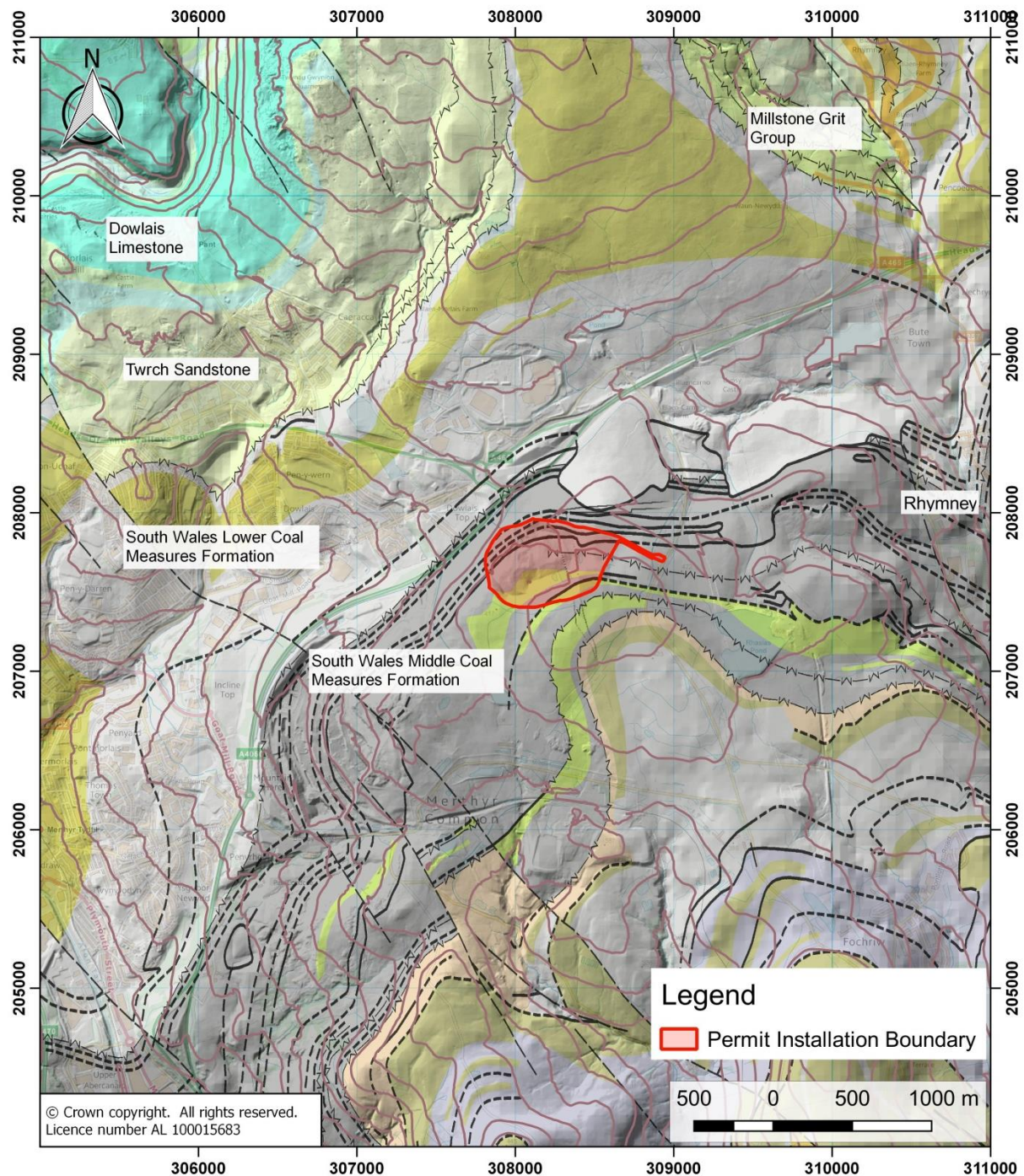


**Figure 2.2 Bedrock Geology**

### 2.2.2 Superficial deposits

Figure 2.3 shows mapped superficial deposits around the Site. Glacial Till (blue) is present widely in the area around the Site and alluvium (yellow) is associated with river valleys. However, superficial coverage at the Site itself is largely absent.

Glacial Till that was present in and around the Site has subsequently been removed during by historic opencast mining and no natural superficial deposits remain. Some of this Till may have been incorporated in the material used to partially backfill the opencast void that existed prior to construction of Trecatti landfill.

Regardless of whether Glacial Till was incorporated in the backfill, it is understood that the majority of the backfill material is waste from the mining process, and the infill as a whole is known as “colliery

spoil". The backfill is described as comprising sand to cobbled-sized fragments of mudstone, siltstone, shale and sandstone, in a clayey, silty matrix (Kennedy and Donkin, 1998 in SLR, 2004a). Its use in the containment of the Site is described in Section 2.6.3.

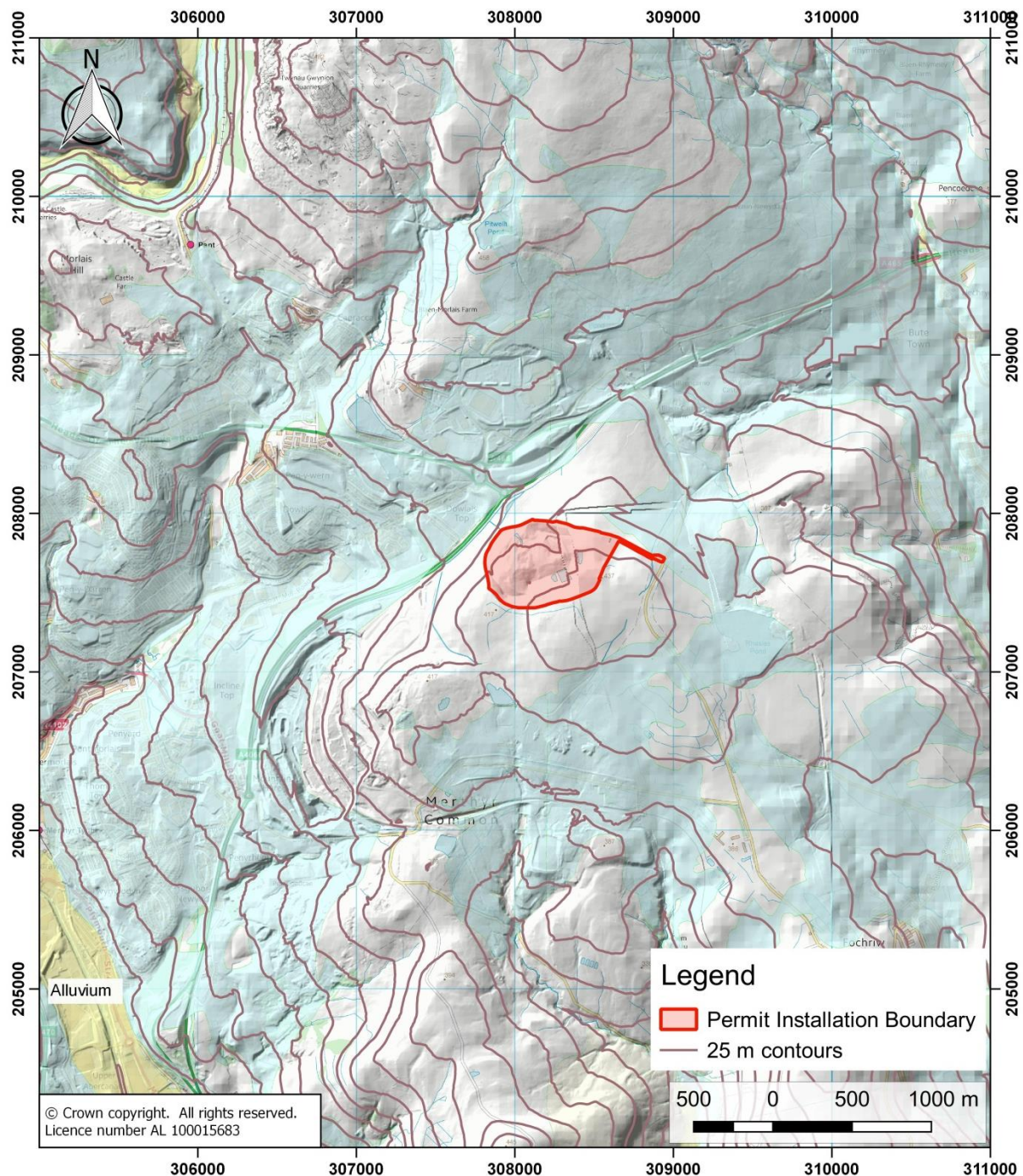


**Figure 2.3 Superficial Geology**

## 2.3 Hydrology

### 2.3.1 Rainfall

The area around Trecatti is subject to relatively heavy rainfall. Met Office data indicate that effective annual rainfall ranges from 1,820 to 2,785 mm (SLR, 2004b). Biffa has provided rainfall data from April 2012 to March 2018. During this time, annual rainfall varied from 1,212 mm in 2017 to 2,530

mm in 2015. The data indicate that rainfall is typically greatest over the winter months and is much lower in summer although, since February 2016, monthly rainfall has been largely consistent with suppressed seasonal variations. Mean monthly rainfall since February 2016 is 103 mm.

### 2.3.2 Watercourse and waterbodies

The Site lies on a ridge between the valleys of the River Taff and Rhymney River to the west and east of the Site respectively. No large watercourses pass close to the Site, although nearby ditches carry significant flows during intense rainfall events. Rhaslas Pond which drains to the Rhymney River lies 500 m south-east of the Site. Surface water management at the Site is described in Section 2.9.

## 2.4 Hydrogeology

The Coal Measures are highly heterogeneous and whilst the sandstone units may well have been capable of supporting local abstractions, the natural hydrogeological regime has been altered significantly by the network of deep mine workings and drainage channels. These will either provide a preferential pathway for flow, or potentially, impede flow where low-permeability backfill has been emplaced. Details of historical mine workings and the sequence of seams are presented by ESI (2012).

Subsidence and settlement resulting from the collapse of historical workings are also likely to have affected the permeability of overlying strata, with the potential for an enhanced degree of fracturing and fissuring.

An artificial drainage scheme, known as the Dowlais Free Drainage System (DFDS), was developed during the period of active mining. This was constructed to direct water to the Dowlais and Penydarren Steelworks and also to facilitate drainage of the underground mine workings (Edwards, 2004). The DFDS still drains groundwater towards the west and maintains groundwater levels far below the ground surface (see Section 3.3). It is described in more detail by ESI (2012).

The DFDS induces a generally southerly groundwater flow pattern beneath the Site. Recent dewatering at Ffos-y-Fran also drain groundwater southwards from the Site area and it is possible that this has temporarily increased the local groundwater gradient.

## 2.5 Landfill Details

### 2.5.1 Site history

Mining operations (first underground and later opencast) are understood to have left a void which had an initial minimum elevation around 280 m AOD. Prior to licensed landfilling, the void was partially infilled with colliery waste to a base level of around 330 m AOD (ESI, 2012).

Landfilling commenced at the Site in 1986, undertaken by Merthyr Tydfil Borough Council, who deposited wastes of up to 30 m in thickness across 4 ha within the eastern part of the void (Figure 2.4). This initial deposition of wastes did not benefit from an engineered geological or artificial containment system. Instead wastes are understood to have been placed directly upon existing colliery spoil present within the base of the quarry void, relying on 'natural containment' (SLR, 2004b). Operation of the Site passed to Biffa in 1993, and since then further phases of landfilling have been developed as summarised in the following sections.

### 2.5.2 Permitted activities

As outlined in Section 1, the Site is regulated under Environmental Permit RP3733PC, varied most recently in November 2016 by Variation notice number EPR/RP3733PC/V009. The permit authorises the disposal of non-hazardous waste within an engineered landfill under Section 5.2 Part A(1)(a) of the Environmental Permitting (England and Wales) Regulations 2010 (EP). Inputs of non-hazardous wastes, including inert wastes imported for restoration activities are limited under the permit to 625,000 tonnes per annum. Permitted wastes are defined by European Waste Code (EWC) under Table S2.2 of the permit.

In addition to the disposal of non-hazardous waste by landfilling, the permit also authorises the biological treatment of leachate and utilisation of landfill gas for energy recovery as further activities listed under Schedule 1 of the EP regulations. Furthermore, a number of Directly Associated Activities are authorised which include:

- the flaring of landfill gas;
- discharge of treated leachate to sewer;
- discharge of site drainage to controlled waters;
- storage of fuel for on-site plant equipment;
- storage of other raw materials; and
- the production and storage of waste oils prior to subsequent off-site disposal.

Additional activities were authorised in Permit Variation EPR/RP3733PC/V010 which was determined in August 2018:

- treatment of hazardous waste; and
- storage of hazardous waste

## 2.6 Landfill Engineering

### 2.6.1 Installation phasing

The installation was initially subdivided into six engineered phases. Phases 1 and 2A have 'flat' lined basal areas and side slopes, whereas subsequently installed phases feature sidewall lining systems and drain towards the base of Phase 2A. Figure 2.4 shows phases 1 and 2A as well as currently uncapped areas (being actively filled).

Further development will complete the infill of the Site to the south, east and above the phases shown in Figure 2.4. The landfill phases developed by Biffa are referred to as 'modern phases' in this report, because they are engineered to modern standards. This is in contrast to the previous 'Merthyr waste' (also shown in Figure 2.4).

The phases additional to Phase 2A have no engineered separation from each other, and all drain to the Phase 2A base, they are referred to as 'Phase 2+' in this report. This includes all modern landfill phases with the exception of Phase 1.

Phase 1 is at a higher elevation on the western side of the excavation; its base lies approximately 30 m above that of Phase 2A.

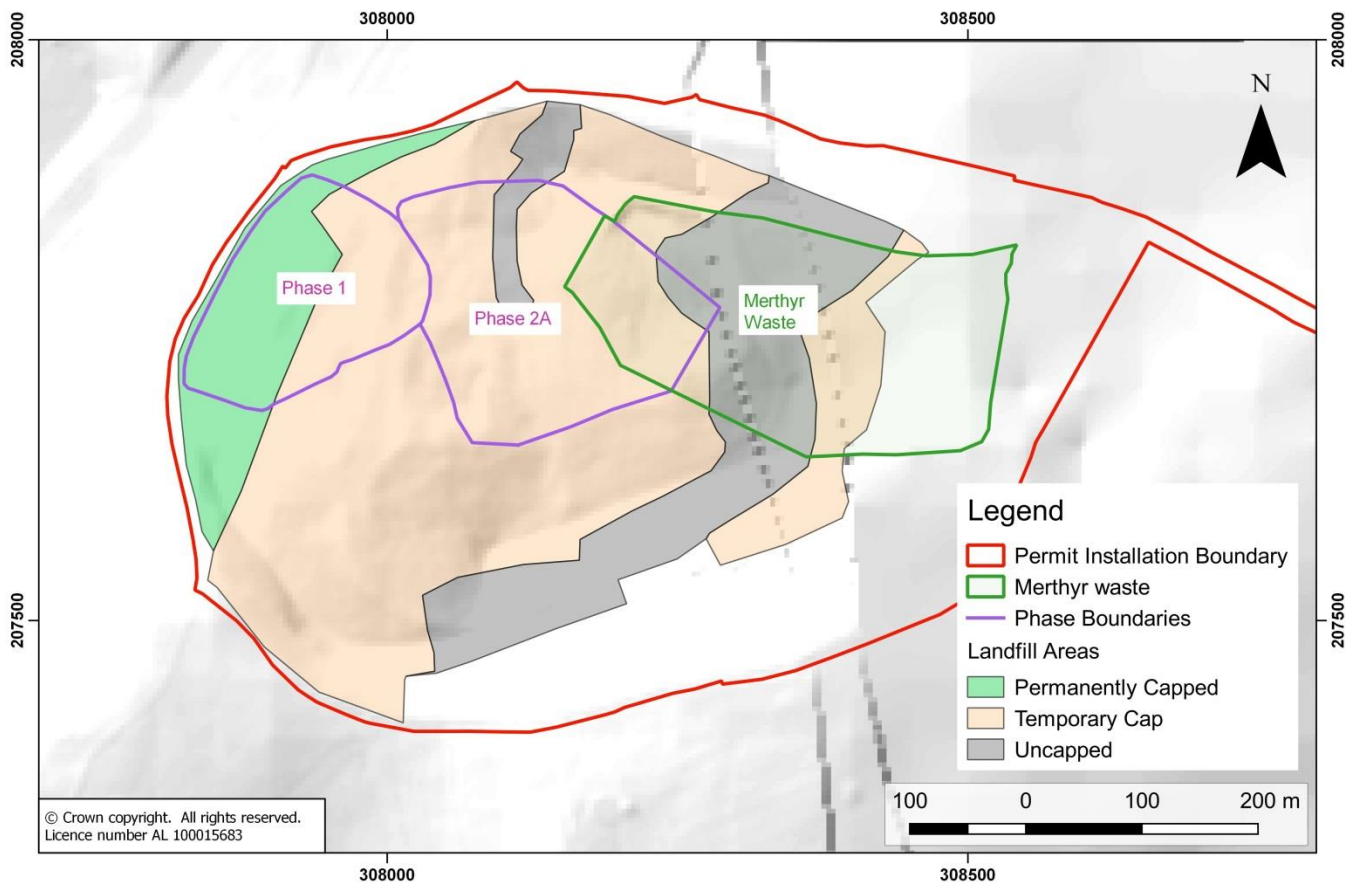


**Figure 2.4 Landfill phasing and capping areas**

### 2.6.2 Lining system

Because only phases 1 and 2A have any flat base, they feature a basal lining system and all other phases instead include a sidewall lining system. However, in all phases the lining, whether basal or sidewall, is a composite system comprising both an artificial sealing liner and an artificially engineered geological barrier. The engineered lining system is summarised in the following sections.

### 2.6.3 Basal lining system

#### General

The minimum requirements of the basal lining system are a geological barrier at least equivalent to a layer of 1 m thickness with a maximum permeability of  $1 \times 10^{-9}$  m/s including an artificial sealing layer. A detailed review of the engineered specification of the basal lining system has been previously provided by Golder Associates (2011) however, a summary is provided below.

#### Merthyr Waste

The area in which wastes were deposited between 1986 and 1993 by Merthyr Tydfil Borough Council (the Merthyr waste) did not include either an artificial or engineered artificial geological barrier. Wastes deposited within this area of the Site are isolated from the surrounding environment by historical colliery spoil which is understood to reach thicknesses of around 50 m within the quarry void. These colliery spoils are generally of relatively low permeability and act as an artificially established geological barrier to the migration of contaminants from the waste to underlying groundwater (SLR, 2004b).

#### Phase 1

The engineered basal lining system, from top to bottom, consists of:

- Minimum 300 mm thick protection layer;
- Protective geotextile;
- 2.5 mm thick HDPE geomembrane (artificial sealing liner);
- 150 mm sand protection layer; and
- 600 mm thick strengthening/support layer comprising selected colliery spoil between two layers of geogrid (the artificial geological barrier).

It is understood that Phase 1 includes a 1 m high HDPE-encapsulated bund around its eastern edge (SLR, 2004b).

#### Phase 2A

The Phase 2 engineered basal liner, from top to bottom, consists of:

- Minimum 300 mm thick protection layer;
- Protective geotextile;
- 2.5 mm thick HDPE geomembrane (artificial sealing liner);
- Protective geotextile; and
- 600 mm thick strengthening/support layer comprising colliery soil between two layers of geogrid (the artificial geological barrier).

With both Phases 1 and 2A, the 600 mm of colliery spoil at the base of the lining sequence constitutes an artificially engineered geological barrier. The historical backfilled colliery spoil and in situ Coal Measures provide a natural low permeability geological barrier and unsaturated zone between deposited wastes and underlying groundwater.

#### 2.6.4 Side slope lining

The side slope lining system that overlies the Merthyr waste directs the flow of leachate generated in the overlying phases towards the base area of the Site (Phases 1 and 2A).

##### Phase 1

The Phase 1 side slope liner, from top to bottom, consists of:

- 300 mm protection layer above;
- Protective geotextile overlying;
- 2.5 mm thick HDPE geomembrane overlying;
- 150 mm sand protection layer overlying; and
- 600 mm thick strengthening/support layer comprising colliery soil between two layers of geogrid (the artificial geological barrier).

##### Phases 2+

The side slope liner, from top to bottom, consists of:

- 300 mm protection/drainage layer overlying;
- Protective geotextile (base and lower side slopes only);
- 2.5 mm thick HDPE geomembrane overlying;
- Protective geotextile overlying; and
- 600 mm thick strengthening/support layer comprising colliery soil between two layers of geogrid (the artificial geological barrier).

It is understood that the side slope engineering was undertaken in a staged manner. Where the engineering was installed above the Merthyr waste, the support layer was thickened to 750 mm.

### 2.6.5 Capping

A small area of the Site on the western boundary of Phase 1, which is nearest to the community of Dowlais, has been restored and capped using a geosynthetic capping system (Golder Associates, 2011). As of November 2014, the total permanently capped area at the Site was reported to be 23,959 m<sup>3</sup> (Biffa, 2014).

The remainder of the Site has not yet been subject to the installation of a permanent capping system or associated restoration works. This is because much of the Site has yet to reach final pre-settlement waste levels.

The remainder of Phase 1 and parts of Phase 2+ have been temporarily capped with a 1.5 mm smooth HDPE geomembrane, secured in place by either roped tyres or sandbags. Approximately 15% of the landfill area is uncapped at any one time. Biffa (2014) estimates infiltration rates over temporary capped areas to be around 50 mm/year based on the temporary capping material used, which is 1.5 mm smooth HDPE. Rough HDPE (which is 2.5 mm in thickness) is used on common routes used to access the leachate and gas wells. This temporary capping is an interim measure to limit the infiltration of rainfall, increase gas capture and reduce odour. Figure 2.4 shows the current extent of permanent and temporary capping at the Site. Limiting rainfall infiltration also reduces the volume of leachate generated.

The proposed design of the final capping system is detailed in the ESID report and associated drawings (SLR, 2004b).

## 2.7 Groundwater Management

Landfilling at the Site is above the regional groundwater table and therefore a permanent groundwater management system is not required. Perched groundwater inflows and seepages are understood to derive from more permeable horizons. Therefore, a temporary under-liner drainage system was installed, as required, beneath the modern phases to prevent disruption to the liner.

It is understood that this system was installed in phases 1, 2A, 2B, 3A, 3B and 4A. As waste levels in the operational phases increased, extraction from the temporary system was no longer required (SLR, 2004b).

This under-drainage system comprises a granular blanket (200 mm or 300 mm thick) installed beneath the basal and lateral engineering. The drainage blanket is understood to have been supplemented by a separator geotextile in a number of phases and also by toe drains and backslope extraction risers (SLR, 2004b). Collected groundwater was historically discharged to the nearest surface water drainage ditch and routed off-site under the conditions of a discharge consent.

## 2.8 Leachate Management

### 2.8.1 Phase 1

The leachate collection system within Phase 1 initially comprised a herringbone system of gravel-surrounded perforated HDPE leachate collection pipes which fed a collection sump in the west of the base of Phase 1. Leachate levels within the sump were controlled by a 400 mm sidewall riser until this riser became inoperable.

Leachate wells LW5 and LW6 were drilled in early 2009 to replace the previous extraction system, and these wells are now used to extract leachate. The engineered basal lining system slopes to the west at a gradient of approximately one in 50.

### 2.8.2 Phase 2+

In Phase 2+, the leachate extraction system originally comprised a leachate drainage blanket and four leachate collection pipes which extracted from a single vertical leachate well (known as the Baku Well). The system was replaced in 2005 to 2006, when the four present leachate wells (LW1

to LW4) were retro-drilled (Golder Associates, 2011). These wells were retro-drilled to within 5 to 6 m of the base of the Site and are now used for leachate extraction. In 2012, two further leachate wells (LW7 and LW8) were drilled. They were connected to the leachate extraction system in October 2012 and have been utilised for the extraction of leachate since then.

### 2.8.3 Leachate extraction

Extracted leachate is pumped to an on-site leachate treatment plant prior to being discharged under a discharge consent (No. TE456, March 1993), to a foul sewer. This consent allows for treated effluent to be discharged at a maximum rate of 432 m<sup>3</sup>/day.

The Site uses a total of 8 pumps each capable, dependent on conditions, of removing up to 3-4 m<sup>3</sup>/hour. Leachate extraction rates have varied through time. In 2010, typical rates of extraction were around 150 m<sup>3</sup>/day, but the installation of further wells has caused these rates to increase. Data for monthly abstraction volumes has been provided by Biffa for the 2013 to 2017 period. Since 2013 mean annual abstraction rates have varied from 179 – 228 m<sup>3</sup>/day. Mean monthly pumping rates range from 97 – 296 m<sup>3</sup>/day. Whilst the leachate pumping rate is typically lower over the summer months, when rainfall is typically lower, data for 2016 and 2017 shows that this is not always the case.

The purple line in Figure 2.5 tracks the mean pumping rate through time (after 2013). This shows that since July 2015, leachate abstraction has been mostly consistent at the mean (2013 – 2017 inclusive) rate of around 204 m<sup>3</sup>/day. Comparisons with recorded monthly rainfall show that there is some correlation, although pumping limits and logistical constraints will likely be equally as important.

Biffa regularly services the leachate wells to ensure that leachate extraction rates are optimised. All of the leachate wells have migrated from air pumps to electric pumps due to blockages caused by the leachate itself which the air pumps were unable to cope with. Leachate pumping is disrupted intermittently by tipping activities or issues with the pumps themselves. Biffa (2014) reports that LW5 and LW6 give a much lower extraction yield than the best performing wells at LW1 and LW8.

Leachate extraction in the last HRA model was set at 200 m<sup>3</sup>/day, which closely matches the achieved mean pumping rate. In the model, leachate extraction only controls depletion of the source during the managed phase and does not influence leachate heads.

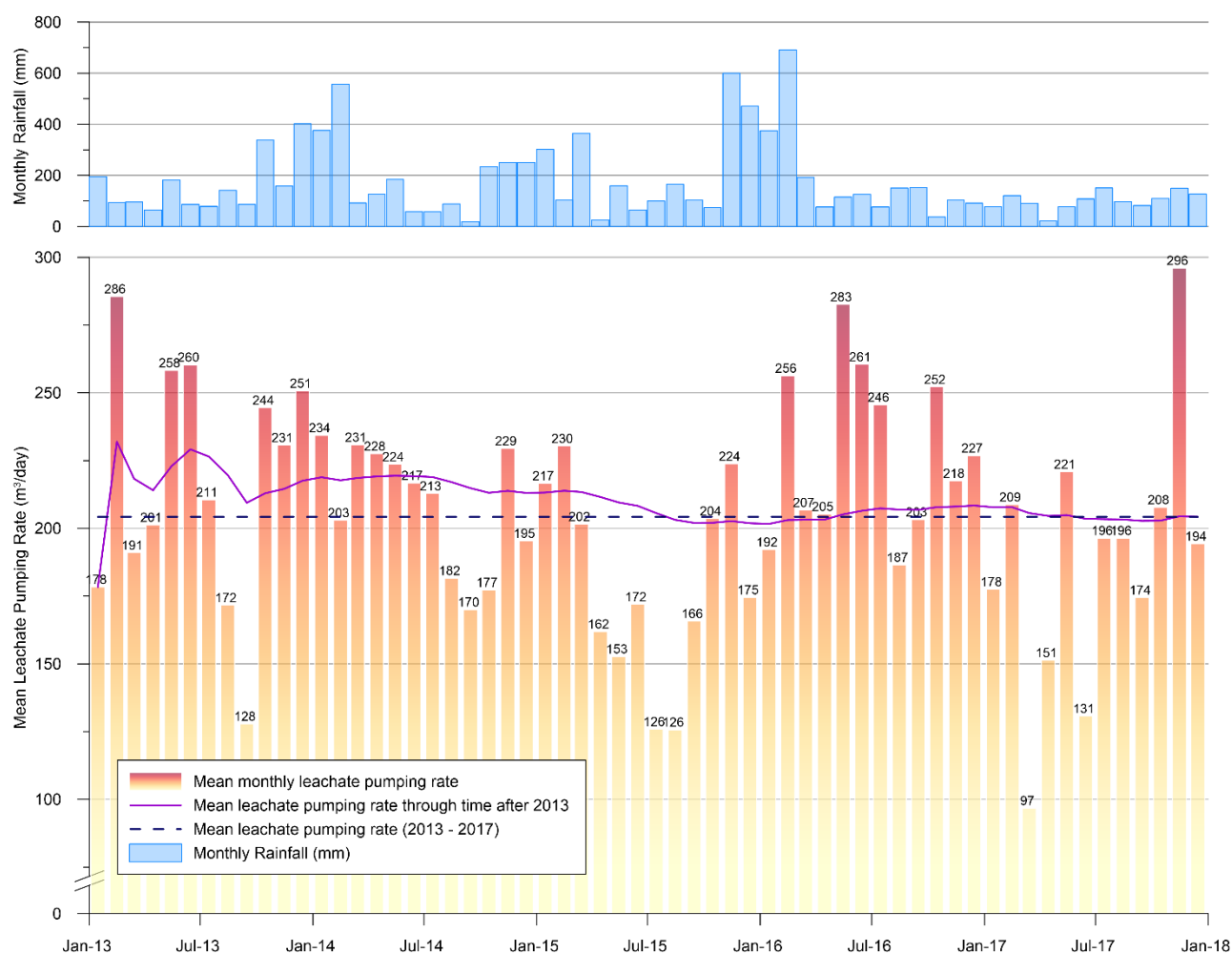


**Figure 2.5 Leachate pumping rates since 2013**

#### 2.8.4 Leachate treatment

Treatment of leachate at the Site is undertaken using a Sequence Batch Reactor (SBR) and Membrane Batch Reactor (MBR). Combined, the leachate treatment plant is capable of treating up to 532 m³/day (Biffa, 2014).

### 2.9 Surface Water Management

A proportion of incident rainfall at the Site runs off temporary membrane capping on non-active landfill areas and is collected in clean water lagoons. The number and location of these lagoons varies through time in accordance with operational requirements.

The lagoons variably act as catchment, holding and settlement lagoons. Discharges to surface water are made from the lagoons to perimeter surface water drains, which also collect clean runoff from the area immediately outside the installation. It is assumed that these perimeter drains will continue to collect runoff from the completed phases of the landfill once the final profile has been achieved and the phases have been permanently capped.

Discharge from the lagoons enters the local surface water drainage network on the north western Site boundary. This discharge is controlled in terms of both quality and quantity by a discharge consent incorporated in the Environmental Permit issued in 2005. The Permit allows discharge of up to 8,985 m³/day to Nant Dowlais.

## 3 Review of monitoring data

### 3.1 Outline

A review of the leachate, groundwater and surface water monitoring data that has been collected at the Site between November 2012 and December 2017 is presented in this section.

The locations of the relevant monitoring infrastructure and locations are presented in Figure 3.1 and the monitoring points are listed in Table 3.1. SWC is located south of the Site and is not shown on Figure 3.1.

**Table 3.1 Monitoring locations at the Site**

| Monitoring Locations | Monitoring    | Bottom Elevation (m AOD) | Monitoring Locations | Monitoring  | Bottom Elevation (m AOD) |
|----------------------|---------------|--------------------------|----------------------|-------------|--------------------------|
| LW1                  | Leachate      | 328.4                    | GW1                  | Groundwater | 210                      |
| LW2                  | Leachate      | 330.3                    | GW2                  | Groundwater | 206                      |
| LW3                  | Leachate      | 330.3                    | GW3                  | Groundwater | 216                      |
| LW4                  | Leachate      | 333.2                    | GW4                  | Groundwater | 277                      |
| LW5                  | Leachate      | 369.7                    | GW5                  | Groundwater | 239                      |
| LW6                  | Leachate      | 372.2                    | GW6                  | Groundwater | 246                      |
| LW7                  | Leachate      | 341                      | GW7                  | Groundwater | 270                      |
| LW8                  | Leachate      | 331                      | GW8                  | Groundwater | 266                      |
| SWA                  | Surface Water | N/A                      | GW9                  | Groundwater | 256                      |
| SWB                  | Surface Water | N/A                      | GW10                 | Groundwater | 282                      |
| SWC                  | Surface Water | N/A                      | GW11                 | Groundwater | 262                      |
| SWD                  | Surface Water | N/A                      | GW12                 | Groundwater | 267                      |
| SW Monocell          | Surface Water | N/A                      | GW13                 | Groundwater | 271                      |

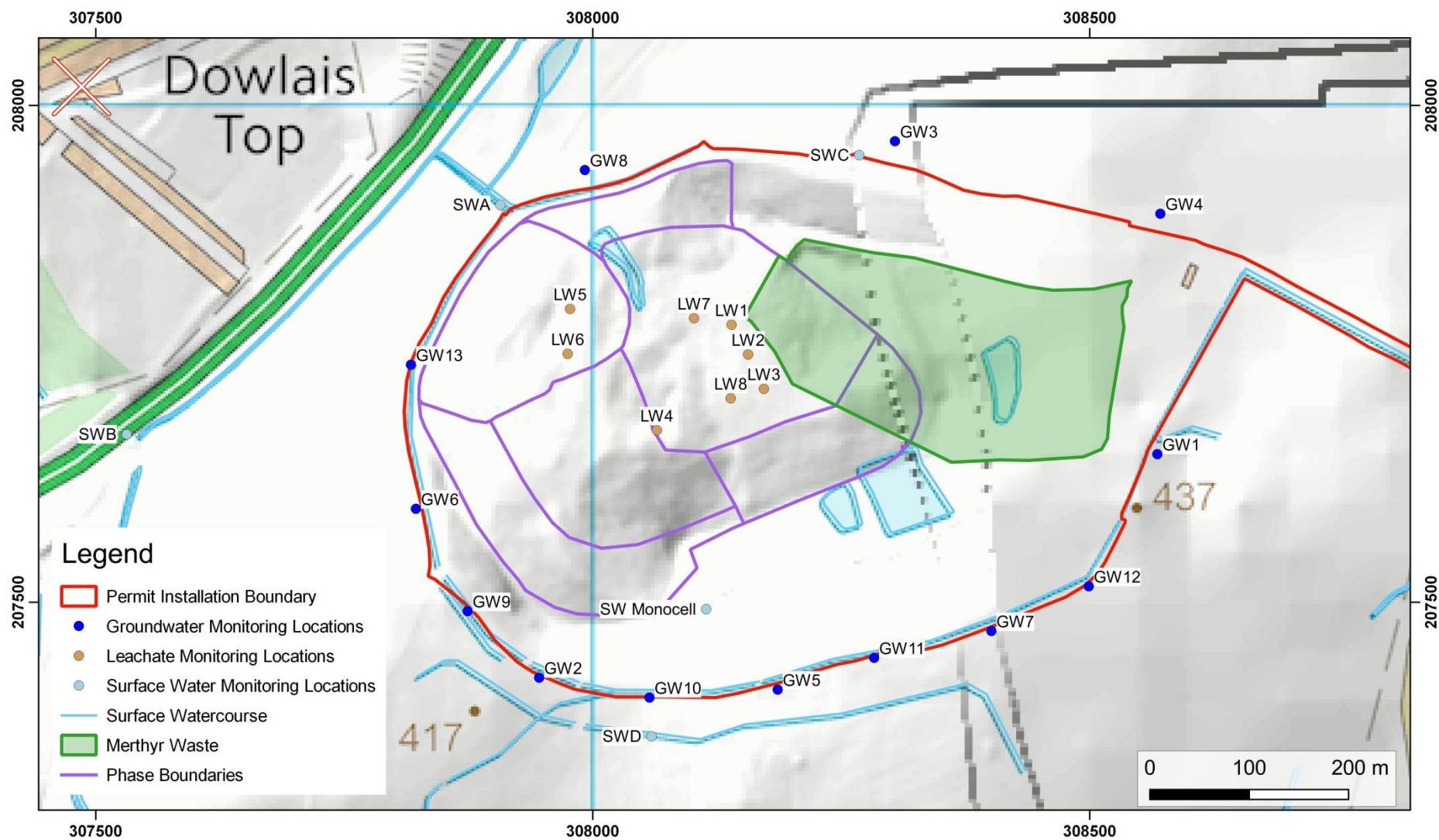


Figure 3.1 Monitoring locations

### 3.2 Leachate Levels

Table 3.2 gives leachate level compliance limits as specified in the environmental permit for the Site.

**Table 3.2 Leachate level compliance limits**

| Monitoring Locations                                               | Frequency | Limit                                    |
|--------------------------------------------------------------------|-----------|------------------------------------------|
| LW5 and LW6 (monitoring locations in Phase 1)                      | Monthly   | 5 m above base of well <sup>3</sup>      |
| LW1, LW2, LW3, LW4, LW7 and LW8 (monitoring locations in Phase 2+) | Monthly   | 33 m above the base of well <sup>3</sup> |

Figure 3.2 shows leachate levels at Phase 1. Leachate levels in LW5 and LW6 have declined through time. Prior to the HRA review period, levels in LW6 were often in breach of the compliance limits. LW6 levels then show a rapid decline and a period of stable levels but show a recent rising trend. However, levels remain below the compliance limit. Levels in LW5 have been more stable during the review period. Both wells are pumped, and this is the reason for the range in recorded leachate levels.

Figure 3.3 also shows declining leachate level trends in wells installed at Phase 2+ at the start of the HRA review period. As with the Phase 1 leachate wells, the Phase 2+ wells are pumped and this causes the large amplitude, high frequency changes in leachate levels. LW8 was not monitored for most of 2015 due to access issues.

Table 3.3 shows statistics for absolute leachate levels in the review period. These show that exceedances of the leachate level compliance limit in the Phase 1 and Phase 2+ leachate wells are generally uncommon, with all wells reporting exceedances of < 4% during the review period. No exceedances have been recorded in LW3, LW7 or LW8. Compared to the time before the last HRA review period, leachate levels have decreased, due to the increased pumping rates that have been implemented. Across Phase 2+ no exceedances have been recorded since 2013. Some of the exceedances are likely caused by pumping disruptions related to tipping activities or pumping issues.

Table 3.4 provides statistics of leachate head above the base of the waste since the last HRA review. These data indicate that mean heads of around 14 – 22 m are present over the Phase 2+ waste, while heads are typically 2 – 2.5 m above base in Phase 1. The RAM model developed by ESI (2013) uses a cap water balance to calculate leachate heads based on the recharge rate into the waste and flow through the base. In the model, the cap water balance parameters were adjusted to calibrate leachate heads to ensure that they are consistent with measured heads.

The RAM model does assume that the Phase 1 and Phase 2+ leachate systems behave independently when levels in both systems are ≤ 366 m AOD with possible overtopping from Phase 1 to Phase 2+ when levels in Phase 1 are > 366 m AOD. The two systems are separated by a bund along the eastern side of Phase 1 that extends to an elevation of around 1 m above the base of Phase 1 (i.e. 366 m AOD).

Figure 3.2 shows that leachate levels in Phase 1 were always greater than 366 m AOD during the HRA review period. Levels in Phase 2+ shown in Figure 3.3 indicate that, in accordance with the modelling, the prevailing condition is for leachate to be overtopping from Phase 1 to Phase 2+. Occasionally, likely after a period of reduced pumping in Phase 2+ or high rainfall, the two phases

<sup>3</sup> At a meeting between Biffa and the Environment Agency (EA) on 25 May 2011, it was agreed to use the base of the leachate wells as the base of the waste (ESI, 2012).

might behave as a single system. The RAM model also allows leachate to pass to external drainage when the head reaches 53 m on Phase 2+. In the model this corresponds to an elevation of 385 m AOD. Data in Table 3.4 shows that this did not occur during the monitoring period.

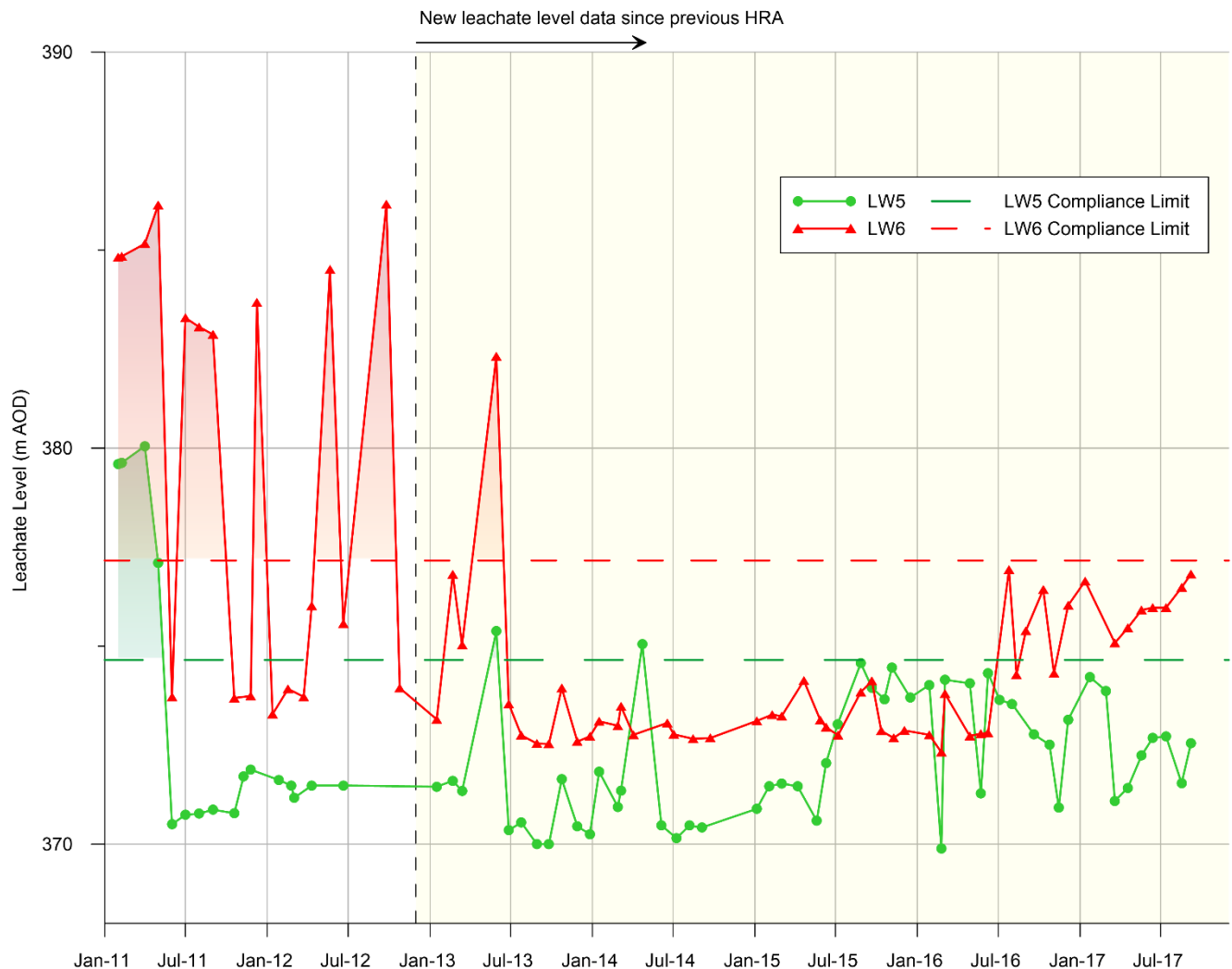


**Figure 3.2 Phase 1 leachate levels**

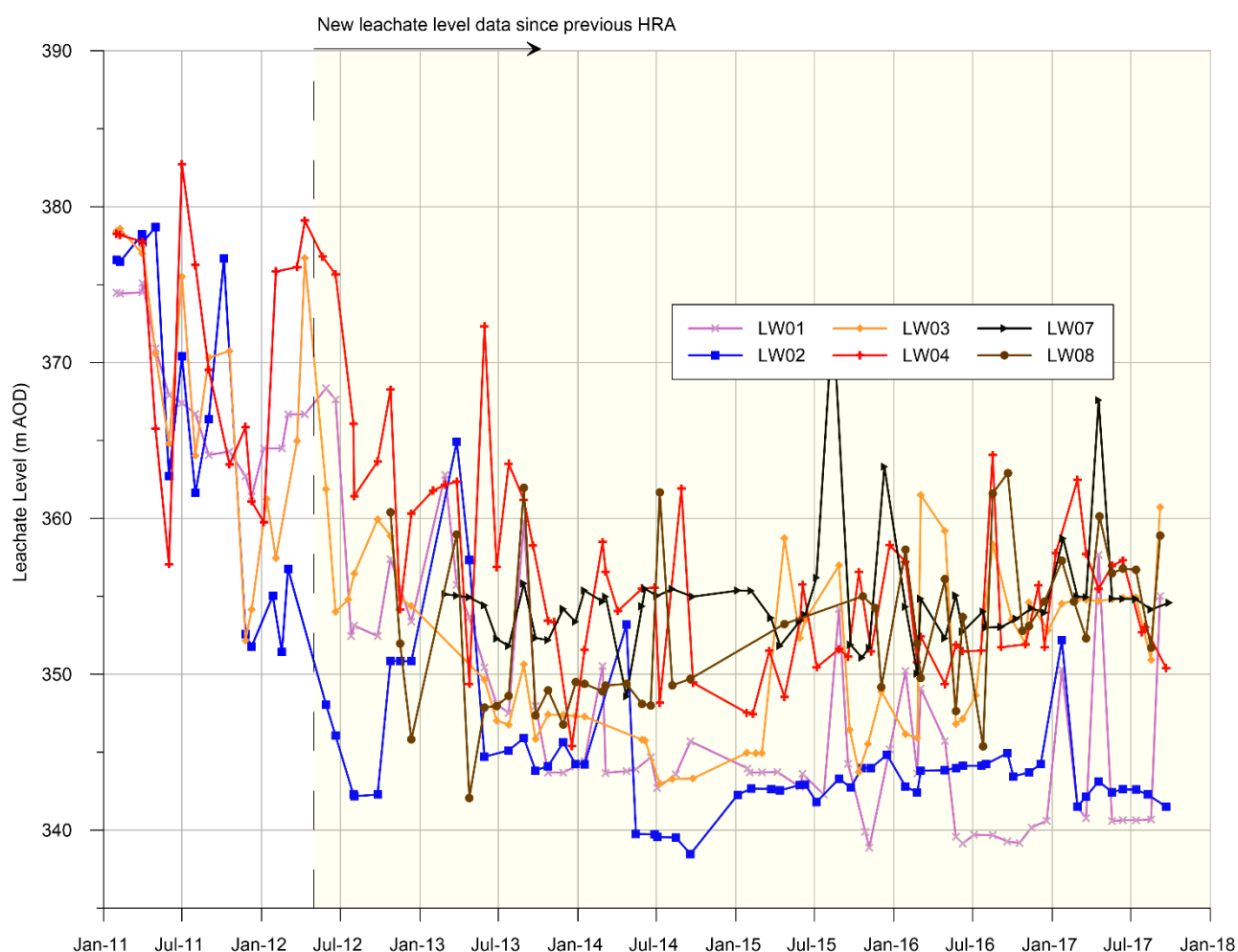
**Table 3.3 Leachate level statistics since previous HRA (mAOD, from November 2012)**

| Parameter               | LW1        | LW2        | LW3   | LW4        | LW5        | LW6        | LW7   | LW8        |
|-------------------------|------------|------------|-------|------------|------------|------------|-------|------------|
| Count                   | 58         | 54         | 51    | 59         | 55         | 54         | 56    | 49         |
| Minimum (mAOD)          | 338.9      | 338.5      | 338.4 | 345.4      | 369.9      | 372.3      | 348.6 | 342.1      |
| Maximum (mAOD)          | 362.8      | 364.9      | 361.5 | 376.5      | 375.4      | 382.3      | 373.2 | 375.0      |
| Mean (mAOD)             | 345.8      | 344.3      | 350.0 | 355.5      | 372.1      | 374.0      | 354.9 | 353.0      |
| Standard Dev (m)        | 5.7        | 4.4        | 5.4   | 6.0        | 1.5        | 1.8        | 3.9   | 5.8        |
| 5th Percentile (mAOD)   | 339.2      | 339.6      | 343.2 | 347.5      | 370.0      | 372.5      | 350.9 | 345.6      |
| 95th Percentile (mAOD)  | 357.8      | 354.2      | 359.8 | 367.5      | 374.7      | 376.8      | 364.2 | 362.4      |
| Compliance Limit (mAOD) | 361.4      | 363.3      | 363.3 | 366.2      | 374.7      | 377.2      | 374   | 364        |
| Exceedances (%)         | 1.7%       | 1.9%       | 0.0%  | 5.1%       | 3.6%       | 1.9%       | 0%    | 2.0%       |
| Date of last exceedance | 28/02/2013 | 27/03/2013 | None  | 01/12/2014 | 23/04/2014 | 30/05/2013 | None  | 01/12/2014 |

**Table 3.4 Leachate head statistics since previous HRA (m above base, from November 2012)<sup>1</sup>**

| Parameter           | LW1  | LW2  | LW3  | LW4  | LW5  | LW6  | LW7  | LW8  |
|---------------------|------|------|------|------|------|------|------|------|
| Minimum (m)         | 10.4 | 8.1  | 8.0  | 12.2 | 0.2  | 0.2  | 7.6  | 11.1 |
| Maximum (m)         | 34.4 | 34.6 | 31.2 | 43.3 | 5.7  | 10.2 | 32.2 | 44.0 |
| Mean (m)            | 17.3 | 14.0 | 19.6 | 22.3 | 2.4  | 1.9  | 13.9 | 22.0 |
| 5th Percentile (m)  | 10.7 | 9.2  | 12.8 | 14.3 | 0.4  | 0.4  | 9.9  | 14.6 |
| 95th Percentile (m) | 29.3 | 23.9 | 29.5 | 34.3 | 5.0  | 4.7  | 23.2 | 31.4 |
| Exceedances (%)     | 1.7% | 1.9% | 0.0% | 5.1% | 3.6% | 1.9% | 0.0% | 2.0% |

<sup>1</sup>Cells highlighted in red exceed the compliance limits, cells in green are below compliance limits

**Figure 3.3 Phase 2+ leachate levels**

### 3.3 Groundwater Levels

Figure 3.4 shows groundwater level time series for boreholes around the northern perimeter of the Site where groundwater levels are generally highest. Figure 3.5 shows groundwater levels in boreholes installed along the southern boundary of the Site. For both of these graphs, groundwater data provided by Biffa which appears erroneously high and/or low has been removed from the datasets.

Rainfall for the period shows summer lows and winter highs and the same is observed in the groundwater hydrographs. The winter peak in groundwater levels is more subdued at all locations for the winter of 2014 - 2015 due to lower rainfall. Despite having the highest rainfall, the peak in groundwater levels for the winter of 2015 - 2016 is not the highest. This is likely because rainfall intensity was sufficiently high to cause a significant proportion of runoff over this period. Groundwater levels generally show a decline and less pronounced seasonality since the winter of 2015 - 2016. This correlates with rainfall since this time which has been much lower than recent years and shows a lack of difference between the seasons.

For a period in 2012, it appears that data records for GW4 and GW3 may have been incorrectly assigned (swapped). Groundwater levels in the northern boreholes are largely consistent with time (Figure 3.4). GW3 shows a slight increasing trend to 2016 but levels appear to have declined since then. GW8 and GW1 both show a sharp drop in 2013 but after this time, levels have been consistent. Slight declining trends are evident in GW1 and GW13. Groundwater levels in GW13 and GW9 have been reported by Biffa to be too low to obtain a groundwater quality sample. Figure 3.4 shows levels in GW13 being constant during summer with winter rises. The low and flat summer level is interpreted to be due to the borehole being dry.

The relatively high water levels recorded at GW3 may reflect the fact that it is installed rather deeper than other boreholes (with the exception of GW1). Different hydraulic heads might be expected in such a multi-layered aquifer system with strata of rather varied permeability. It is also possible that this borehole is less well connected to the mine drainage system than others. It is also notable that GW3 is the only borehole in Figure 3.4 that shows a rising trend over the period, where the others are stable or declining. There may therefore be differences also in the degree to which they are affected by the dewatering operations at Ffos-y-Fran.

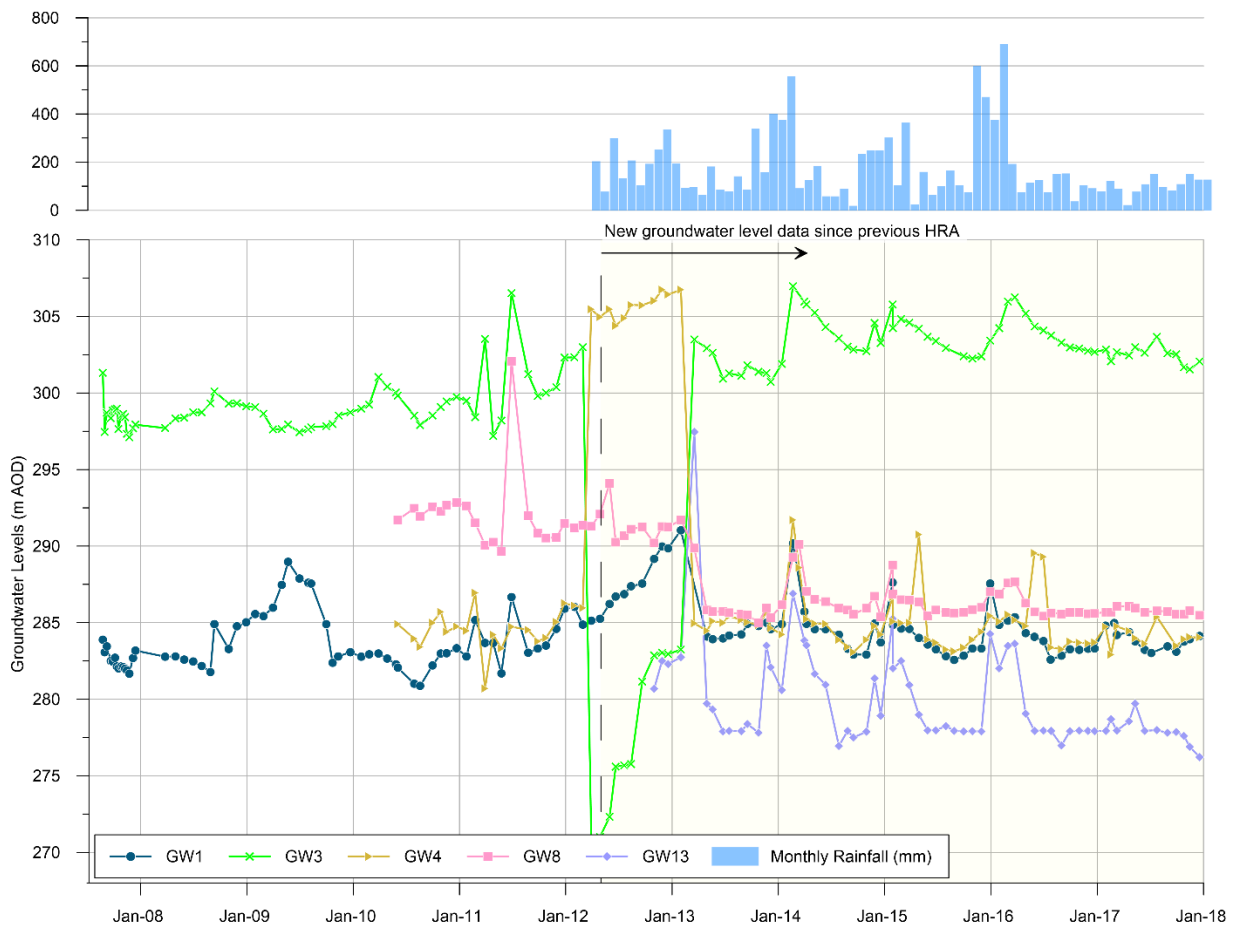


**Figure 3.4 Groundwater level time series for northern boreholes**

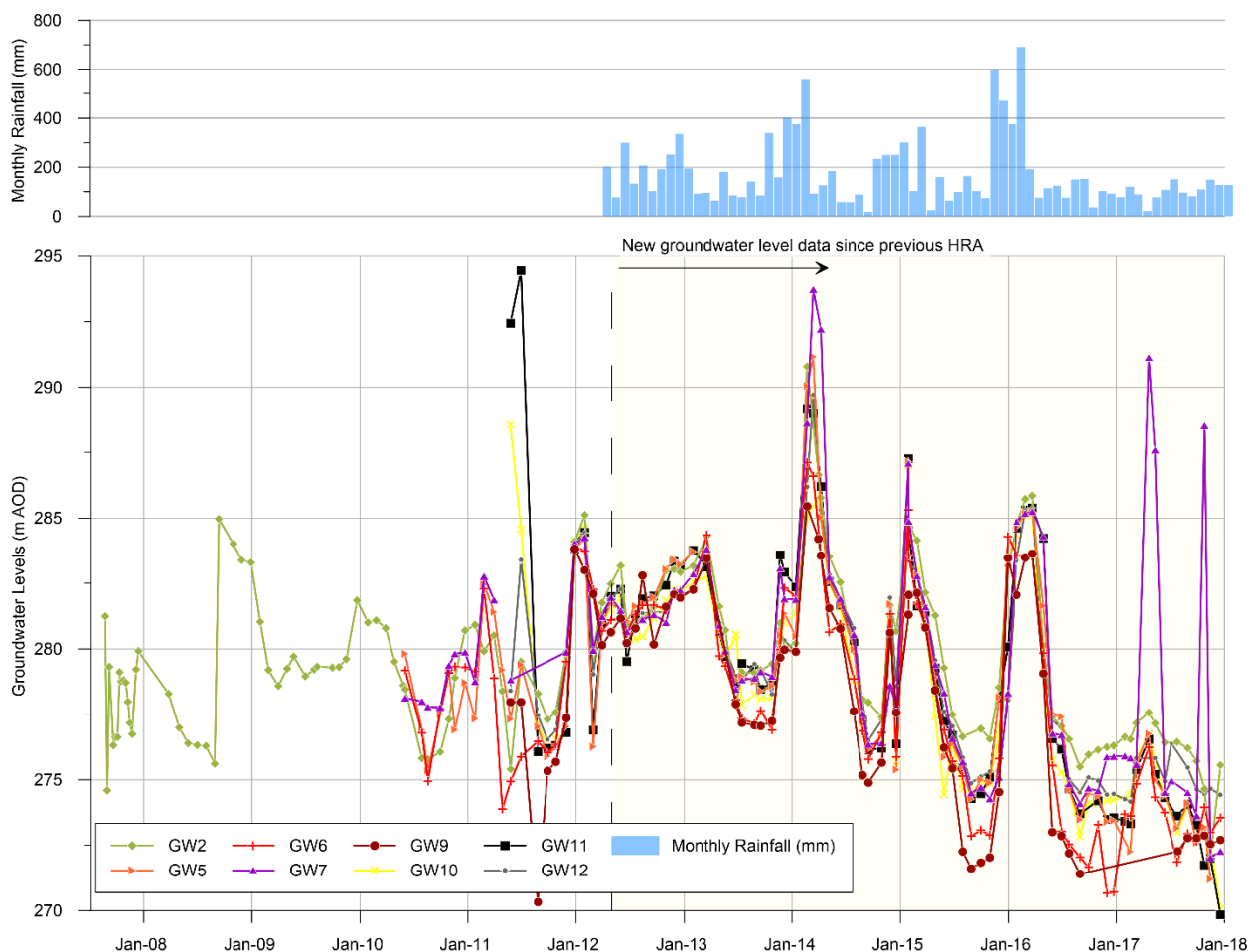


**Figure 3.5 Groundwater level time series for southern boreholes**

Figure 3.5 shows that groundwater levels in all of the southern boreholes are largely consistent with a slight declining trend evident since 2013. It seems likely that this is related to dewatering occurring at the Miller Argent Ffos-Y-Fran operation south-west of the Site, which could be expected to have a greater impact on those boreholes in the southern part of the Site.

Typical seasonal variations in groundwater levels can exceed 10 m, and at most, the declining trends observed total less than half of this. The large seasonal changes are indicative of a low permeability and/or low storage system.

Generally, groundwater levels are as expected by the conceptual model developed by ESI (2012). Given the rising trends in GW3 and GW4 and the falling trends in boreholes to the south of the Site, the hydraulic gradient across the landfill may be increasing. However, given the expected low permeability of the waste, any flux through the colliery spoil will likely remain small. Groundwater flow remains broadly to the south and south-west across the Site. Presently the average long-term levels north and south of the Site are little changed. At the following HRA review, we suggest that the groundwater level trends should be examined again to see whether they have continued. If so it might be warranted to alter the hydraulic gradient used in the model.

### 3.4 Leachate Quality

#### 3.4.1 Monitoring overview

Leachate is required to be monitored for water quality for the parameters, and at the frequency, listed in Table 3.5. There are no defined leachate quality compliance limits within the Permit. Leachate quality has been monitored in accordance with Table 3.5 when access to monitoring locations has been possible.

**Table 3.5 Leachate monitoring as required by the Permit**

| Parameters                                                                                                                                                                                                                                                           | Monitoring Frequency | Monitoring Locations         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|
| Electrical Conductivity, chloride, ammoniacal nitrogen, pH, total alkalinity, magnesium, potassium, total sulphates, calcium, sodium, BOD, COD, TOC, TON, manganese, iron, chromium, copper, lead, zinc, nickel, mecoprop, toluene, xylene, naphthalene, and cadmium | Quarterly            | LW1 - LW8<br>(all locations) |
| Hazardous substances screen, depth to base of monitoring well                                                                                                                                                                                                        | Annually             |                              |

The focus of this leachate quality section is on data collected since the end of the last HRA review period (i.e. after December 2012).

#### 3.4.2 Modelled data comparison

A summary of leachate quality data is included in Table 3.6 and Table 3.7. Data in these tables include the parameters specified in Table 3.5 which are required to be monitored as part of the Permit and together give a good indicator of leachate quality.

Monitoring data from May 2012 to December 2017 have been compared with the source term data used in the 2012 HRA review.<sup>4</sup> This comparison is shown in Table 3.6. Outlying maximum and minimum concentrations for all determinands were removed from the data sets prior to processing and Table 3.6 shows results for the modelled determinands excluding these outliers. Outliers were determined by examining times series plots for each modelled species at each monitoring location. Across all leachate sampling locations, ten outliers were removed. This total includes six ammoniacal nitrogen and four chloride outliers which equate to fewer than 3% of samples for each determinand. No outliers were removed for the other modelled species.

Maximum measured ammoniacal nitrogen and chloride concentrations have increased, but these are relatively isolated measurements, although they have been inferred to not be outliers. Although maximum concentrations show an increase for these species, mean concentrations are lower than were previously modelled.

Maximum cadmium concentrations have decreased since the last HRA review and are more often than not below the Limit of Detection (LOD). Calculated mean cadmium concentrations have increased but this appears to be due to changes in the LOD. Mecoprop concentrations show a general decrease compared to those reported previously (ESI, 2012). Concentrations fluctuate through time and, although present, the decreasing trend is not consistent across all wells.

Naphthalene concentrations have remained broadly consistent since the time of the last HRA review. In 2016, a spike in concentrations was identified at LW4 and this is responsible for the

<sup>4</sup> April 2012 was the cut-off for data analysed in the previous HRA review.

maximum being greater than for the previous HRA review. Since 2017, concentrations have reduced to <0.3 mg/l which is less than the modelled maximum. The maximum measured concentration of toluene is greater than that previously modelled. However, mean concentrations have fallen (albeit slightly) since the time of the last HRA review. The increased maximums are isolated peaks in concentrations in LW7 and LW8.

Measured maximum, mean and minimum concentrations of xylenes are shown to be greater than the modelled source terms. Measured data shown in Table 3.6 are greater than the values applied to the model. The previous model used values for o-xylene whilst the measured values shown are for m- and p-xylenes. The m- and p-xylene concentrations have been used here because these are greater than the o-xylene concentrations and this is therefore more conservative. (O-xylene concentrations also show an increase, with a maximum concentration of 0.0999 mg/l and mean concentration of 0.0244 mg/l. O-xylene concentrations are generally < 0.05 mg/l across all wells with the exception of an isolated peak in LW8.)

m- and p-xylene concentrations are generally < 0.1 mg/l across all wells with the exception of sporadic peaks at LW7 and LW8 which occur at a similar time to the peaks in toluene and o-xylene concentrations. This coincidence in peaks of organic species suggests that they may be related. These peaks, and those identified for naphthalene, are considered to be real and are likely representative of heterogeneity in the waste mass.

**Table 3.6 Comparison of modelled source terms and recent monitoring data<sup>1</sup>**

| Determinand              | Statistic | Modelled Values<br>for 2012 HRA<br>(mg/l) | Measured values<br>May 12 – Dec 17<br>(mg/l) <sup>2</sup> |
|--------------------------|-----------|-------------------------------------------|-----------------------------------------------------------|
| Ammoniacal Nitrogen as N | Min.      | 61.6                                      | 149                                                       |
|                          | Mean      | 2,027                                     | 2,004                                                     |
|                          | Max.      | 3,960                                     | 4,310                                                     |
| Chloride                 | Min.      | 1,920                                     | 1,240                                                     |
|                          | Mean      | 4,688                                     | 4,229                                                     |
|                          | Max.      | 7,420                                     | 7,960                                                     |
| Mecoprop                 | Min.      | 0.0143                                    | 0.00243                                                   |
|                          | Mean      | 0.0787                                    | 0.0537                                                    |
|                          | Max.      | 0.149                                     | 0.133                                                     |
| Cadmium                  | Min.      | $6.0 \times 10^{-4}$                      | $6.0 \times 10^{-4}$                                      |
|                          | Mean      | $6.70 \times 10^{-4}$                     | $7.82 \times 10^{-4}$                                     |
|                          | Max.      | 0.076                                     | 0.0135                                                    |
| Toluene                  | Min.      | 0.0206                                    | 0.0168                                                    |
|                          | Mean      | 0.0576                                    | 0.0408                                                    |
|                          | Max.      | 0.129                                     | 0.212                                                     |
| Naphthalene              | Min.      | 0.0211                                    | 0.0085                                                    |
|                          | Mean      | 0.112                                     | 0.106                                                     |
|                          | Max.      | 0.581                                     | 0.785                                                     |
| Xylenes <sup>3</sup>     | Min.      | 0.0155                                    | 0.0225                                                    |
|                          | Mean      | 0.0195                                    | 0.0476                                                    |
|                          | Max.      | 0.0474                                    | 0.356                                                     |

<sup>1</sup> Cells in green and red represent decreases and increases in measured concentrations respectively when compared to the modelled source term in the previous HRA (ESI, 2013).

<sup>2</sup> Where a result is below the LOD, half the LOD is used to calculate the mean and the minimum is conservatively taken as the minimum detected value.

<sup>3</sup> Xylene values here are for m- and p-xylene for the measured column and o-xylene for the modelled column, as indicated in the preceding text.

### 3.4.3 Non-hazardous pollutants

A time series of ammoniacal nitrogen concentrations in leachate is presented in Figure 3.6. ESI (2012) reported increasing trends in ammoniacal nitrogen concentrations across most of the leachate wells, particularly LW4, LW3, LW3 and LW6. These increasing concentrations have since stabilised and have begun to decrease.

Recent declining trends are present in the Phase 1 leachate wells (LW5 and LW6). The declining trend at LW6 is more pronounced than that at LW5. Declining trends are also evident in wells LW4, LW7 and LW8. There are no consistent increasing trends present.

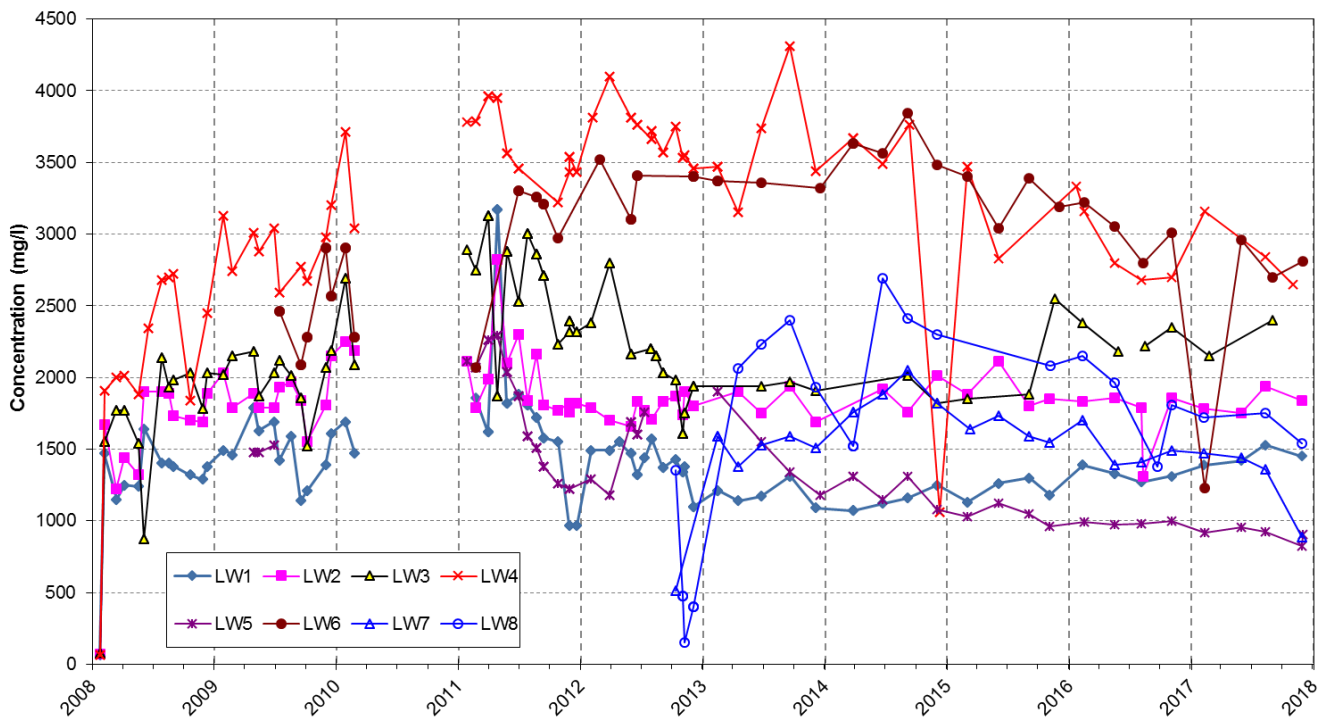


**Figure 3.6 Time series of ammoniacal nitrogen concentrations in leachate**

Figure 3.7 shows a time series of chloride concentrations in leachate. ESI (2012) previously reported that leachate strength with regard to chloride was increasing through time. Chloride concentrations in each well are mostly consistent across the review period. Slight declining trends are evident in LW5, LW7 and LW8, while LW3 appears to show an irregular trend that rises slightly since 2015. Concentrations in this well remain below the maximum leachate concentration recorded at the Site in LW4 and LW6.

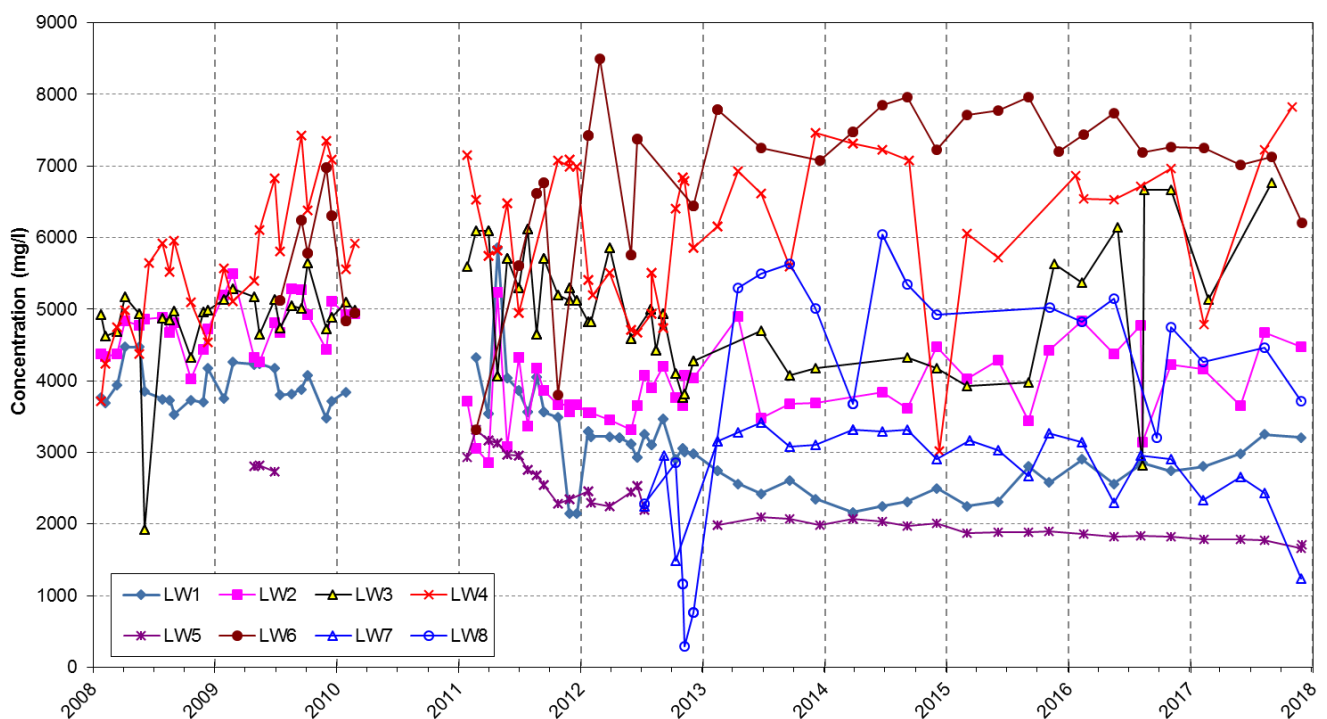


**Figure 3.7 Time series of chloride concentrations in leachate**

A statistical summary of concentrations of major ions and non-hazardous pollutants is provided in Table 3.7 for the review period. Only selected determinands where  $\geq 25\%$  of samples exceeded the LOD are shown and results are compared to the Drinking Water Standards (DWS). Generally, the leachate is characterised by high concentrations of major ions, mostly chloride, magnesium and sodium. Sulphate concentrations are not as elevated as is found in some leachates implying that reducing conditions are present.

Concentrations of non-hazardous heavy metals including iron, boron, manganese and nickel are also high; however, cadmium and copper concentrations are generally below the DWS. Mecoprop, naphthalene and phenol are typically detected in the leachate at relatively high concentrations. However, concentrations are either stable or show a slight declining trend as is shown in Figure 3.8 for mecoprop, for which concentrations in many wells appear to have broadly stabilised after 2015.

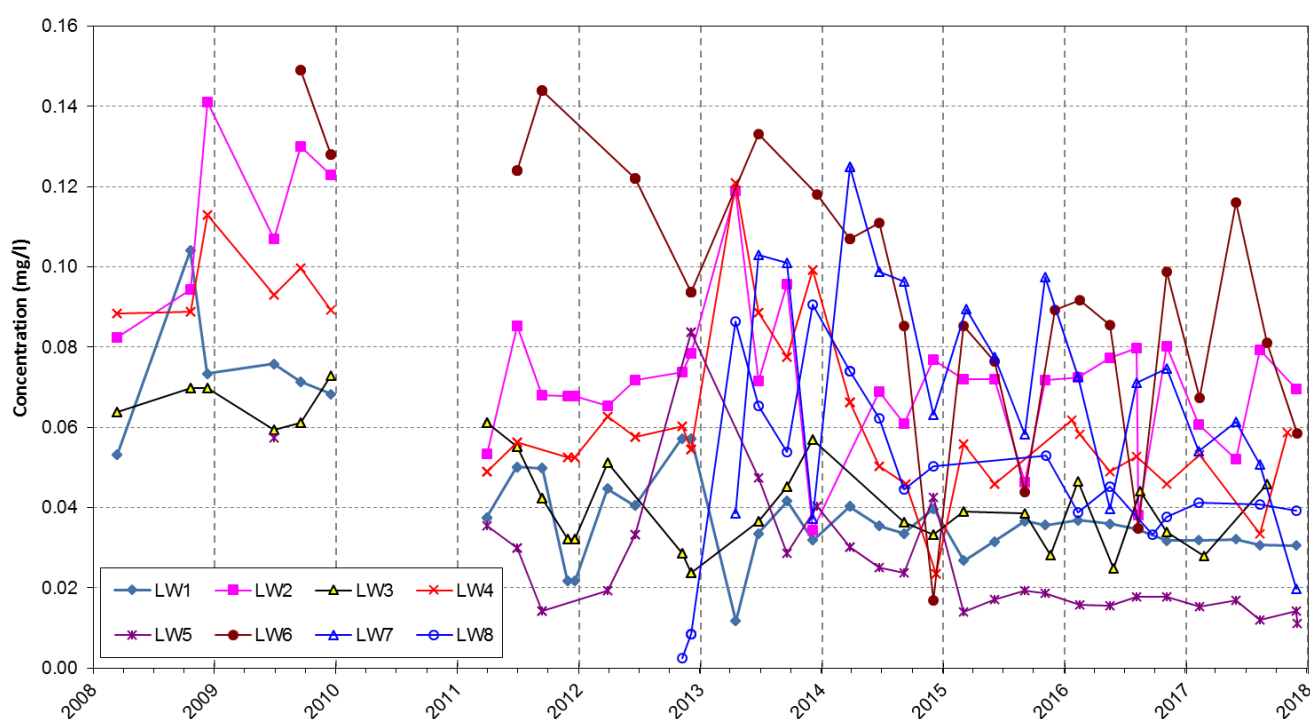


**Figure 3.8 Time series of mecoprop concentrations in leachate**

Compared to the previous HRA, concentrations of non-hazardous determinands have remained broadly similar and most determinands show fluctuating but stable concentrations with some broadly decreasing trends.

**Table 3.7 Summary statistics for selected non-hazardous pollutants in leachate (mg/l)**

| Determinand <sup>1,2</sup> | No. Results | Min     | Max    | Mean     | Median | Stan. Dev. | > LOD (%) | Exceeding (%) | DWS    |
|----------------------------|-------------|---------|--------|----------|--------|------------|-----------|---------------|--------|
| Chloride                   | 203         | 291     | 8,890  | 4,201    | 3,810  | 1,883      | 100       | 100           | 250    |
| Magnesium                  | 165         | 43.4    | 527    | 143      | 112    | 79         | 100       | 98.8          | 50     |
| Sodium                     | 165         | 173     | 6,760  | 2,349    | 2,110  | 1,112      | 100       | 99.4          | 200    |
| Sulphate as SO4            | 168         | <5      | 2,220  | 114      | 20.7   | 251        | 85.1      | 12.5          | 250    |
| Antimony                   | 50          | <0.012  | 0.255  | 0.0225   | 0.0106 | 0.0435     | 86        | 86            | 0.005  |
| Barium                     | 47          | 0.432   | 4.81   | 1.72     | 1.24   | 1.23       | 100       | 70.2          | 1      |
| Boron                      | 46          | 9.53    | 45.6   | 25.7     | 24.8   | 9.62       | 100       | 100           | 1      |
| Cadmium                    | 168         | <0.0006 | 0.0135 | 0.000782 | n.d.   | n.d.       | 45.8      | 0.6           | 0.005  |
| Copper                     | 167         | <0.009  | 3.49   | 0.184    | 0.047  | 0.436      | 94.6      | 1.2           | 2      |
| Iron                       | 165         | 0.8     | 94.4   | 7.5      | 3.91   | 11.8       | 100       | 100           | 0.2    |
| Manganese                  | 165         | 0.091   | 4.36   | 0.506    | 0.245  | 0.586      | 100       | 100           | 0.05   |
| Nickel                     | 167         | 0.055   | 0.387  | 0.201    | 0.19   | 0.061      | 100       | 100           | 0.02   |
| Ammoniacal Nitrogen as N   | 203         | <0.41   | 4,420  | 1,967    | 1,800  | 922        | 99.5      | 99.5          | 0.39   |
| Fluoride                   | 47          | 0.6     | 9.62   | 3.59     | 3.5    | 1.58       | 100       | 91.5          | 1.5    |
| Mecoprop                   | 165         | <0.0016 | 0.133  | 0.0537   | 0.0465 | 0.0287     | 98.8      | -             | -      |
| Naphthalene                | 163         | <0.04   | 0.785  | 0.106    | 0.0721 | 0.117      | 72.4      | -             | -      |
| Phenol                     | 162         | <0.008  | 199    | 13.6     | 0.938  | 22.3       | 75.9      | 75.9          | 0.0005 |
| Selenium                   | 50          | <0.008  | 0.367  | 0.052    | 0.0088 | 0.0949     | 68        | 34            | 0.019  |
| Total Cyanide              | 49          | 0.019   | 2.7    | 0.212    | 0.087  | 0.398      | 100       | -             | -      |

<sup>1</sup> Rows in dark red show > 50% exceedance of DWS, rows in light red show 10 – 25% exceedances of DWS

<sup>2</sup> n.d. indicates not determinable

### 3.4.4 Hazardous substances

Table 3.8 summarises statistics for hazardous substances in the leachate where the overall percentage of detections is at least  $\geq 15\%$ . Arsenic and chromium are always above the LOD and DWS. Concentrations of arsenic and chromium are consistent across all leachate wells. Most locations show at least a small decrease in comparison to the previous HRA. Most notable is a declining trend in chromium concentrations at LW7 from 2013 to 2017.

Concentrations of hydrocarbons and other organics are consistently above the LOD and show fluctuating but mostly consistent concentrations in all leachate wells across the Site.

The modelled parameters encompass each of the different contaminant groups known to be present in leachate and these cover the range of transport properties and the risk associated with the hazardous determinands known to be present in leachate.

Generally, the leachate is typical of a non-hazardous landfill that has accepted domestic waste. LW4 and LW6 typically show the highest leachate concentrations. Leachate strength has stabilised and shows evidence of decreasing contaminant concentrations since the last HRA review. Even for determinands that show decreasing trends, occasional peaks are present. This is most likely to be caused by heterogeneity in the waste mass. There are no obvious differences between waste deposited in Phase 1 and Phase 2+ in terms of chemistry and whilst LW6 typically shows the highest contaminant concentrations, LW5, which is also in Phase 1, typically shows the lowest concentrations. This is a further indication of the heterogeneity in the waste mass.

**Table 3.8 Summary statistics for selected hazardous substances in leachate (mg/l)**

| Determinand <sup>1,2</sup> | No. Results | Min       | Max     | Mean     | Median  | Stan. Dev. | > LOD (%) | Exceeding (%) | DWS Limit |
|----------------------------|-------------|-----------|---------|----------|---------|------------|-----------|---------------|-----------|
| Arsenic                    | 50          | 0.02      | 0.415   | 0.154    | 0.145   | 0.104      | 100       | 100           | 0.005     |
| Chromium                   | 168         | 0.0158    | 0.717   | 0.22     | 0.2     | 0.121      | 100       | 99.4          | 0.05      |
| Lead                       | 167         | <0.006    | 0.334   | 0.0172   | 0.008   | 0.0315     | 62.3      | 18.6          | 0.025     |
| EH C10-C16                 | 162         | 0.129     | 5.72    | 2.26     | 2       | 1.13       | 100       | -             | -         |
| EH C16-C24                 | 162         | <0.1      | 22      | 1.64     | 0.715   | 2.62       | 98.1      | -             | -         |
| EH C24-C40                 | 162         | <0.1      | 13.6    | 1.02     | 0.479   | 1.67       | 84        | -             | -         |
| EH C6-C40                  | 164         | 0.129     | 39.1    | 5.32     | 3.92    | 4.84       | 100       | -             | -         |
| EH C6-C8                   | 162         | <0.19     | 0.653   | 0.143    | 0.109   | 0.107      | 52.5      | -             | -         |
| EH C8-C10                  | 162         | <0.1      | 1.16    | 0.358    | 0.334   | 0.2        | 92.6      | -             | -         |
| Benzene                    | 156         | <0.08     | 0.0838  | 0.028    | n.d.    | n.d.       | 28.8      | 28.8          | 0.001     |
| Ethylbenzene               | 156         | <0.08     | 0.166   | 0.0278   | n.d.    | n.d.       | 29.5      | -             | -         |
| m,p xylenes                | 156         | <0.08     | 0.356   | 0.0476   | 0.04    | 0.0377     | 56.4      | -             | -         |
| O-Xylene                   | 156         | <0.08     | 0.0999  | 0.0244   | n.d.    | n.d.       | 20.5      | -             | -         |
| Toluene                    | 156         | <0.08     | 0.212   | 0.0408   | n.d.    | n.d.       | 39.7      | -             | -         |
| 1,2,4-Trimethylbenzene     | 156         | <0.08     | 0.0759  | 0.0232   | n.d.    | n.d.       | 17.9      | -             | -         |
| Dichlobenil                | 47          | <0.000165 | 0.00189 | 0.000203 | n.d.    | n.d.       | 46.8      | -             | -         |
| Dichlorprop                | 165         | <0.002    | 0.136   | 0.0179   | 0.00619 | 0.0285     | 66.1      | 66.1          | 0.0001    |

<sup>1</sup>Rows in dark red show > 50% exceedance of DWS, rows in light red show 10 – 25% exceedances of DWS

<sup>2</sup>n.d. indicates not determinable

### 3.5 Groundwater Quality

#### 3.5.1 Monitoring overview

Groundwater quality has been monitored on a quarterly basis in line with the requirements of the Permit which are specified in Table 3.9.

**Table 3.9 Groundwater monitoring as required by the Permit**

| Parameters                                                                                                                                                                                                                                                             | Monitoring Frequency | Monitoring Locations       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------|
| Electrical Conductivity, chloride, ammoniacal nitrogen, pH, total alkalinity, magnesium, potassium, total sulphates, calcium, sodium, nitrates, phosphates, manganese, iron, chromium, copper, lead, zinc, nickel, mecoprop, toluene, xylene, naphthalene, and cadmium | Quarterly            | GW1 – GW13 (all locations) |
| Hazardous substances, depth to base of monitoring well                                                                                                                                                                                                                 | Annually             |                            |

The focus of this groundwater quality section is on data collected since the end of the last HRA review period (i.e. after May 2012). Information from Biffa indicates that groundwater levels in GW9 and GW13 have been too low since the first quarter of 2015 and the second quarter of 2014 respectively to take a groundwater quality sample. Therefore, water quality data is not available in these boreholes since these times.

#### 3.5.2 Compliance limits

The Permit includes compliance limits for seven water quality parameters within groundwater. These compliance criteria vary spatially, dependent on the sampled borehole, and are summarised in Table 3.10.

**Table 3.10 Permit compliance limits for groundwater quality**

| Parameter           | Unit | Borehole |      |      |      |      |      |      |
|---------------------|------|----------|------|------|------|------|------|------|
|                     |      | GW1      | GW2  | GW9  | GW10 | GW11 | GW12 | GW13 |
| Ammoniacal nitrogen | mg/l | 1.5      | 17   | 2.80 | 74   | 1.5  | 1.5  | 1.5  |
| Cadmium             | µg/l | 0.1      | 0.16 | 21   | 0.25 | 0.1  | 0.1  | 0.1  |
| Chloride            | mg/l | 250      | 650  | 550  | 950  | 250  | 250  | 250  |
| Mecoprop            | µg/l | 0.04     | 1    | 0.34 | 4.2  | 0.04 | 0.04 | 0.07 |
| Naphthalene         | µg/l | 1        | 1    | 1    | 1    | 1    | 1    | 1    |
| Toluene             | µg/l | 4        | 65   | 4    | 4    | 4    | 4    | 4    |
| Xylene              | µg/l | 3        | 15   | 3    | 3    | 3    | 3    | 3    |

A summary of compliance with these limits is provided in Table 3.11. Where the LOD is greater than the compliance limit, this is not treated as an exceedance. Table 3.11 indicates that all boreholes have exceeded compliance limits for at least one determinand with the exception of GW13. Most of these exceedances occur in fewer than 10% of samples and relate only to ammoniacal nitrogen, mecoprop, cadmium and toluene. The greatest exceedance rate (38%) is seen for cadmium at GW12. It is unclear why this borehole should show relatively frequent cadmium exceedances. GW11, which has a higher mean concentration, is the only other borehole

to show cadmium exceedances. We note that these boreholes are not affected by the high concentrations of ammoniacal nitrogen and other determinands that are seen at GW2 and GW10. This suggests a different source for the cadmium at these boreholes.

An assessment of the appropriateness of the compliance limits has been undertaken and the results of this are presented in Section 6.3.

**Table 3.11 Summary of permit compliance for groundwater quality (cells coloured by exceedance percentage)**

| Borehole | Statistics      | Parameter                  |                |                 |                 |                    |                |               |
|----------|-----------------|----------------------------|----------------|-----------------|-----------------|--------------------|----------------|---------------|
|          |                 | Ammoniacal nitrogen (mg/l) | Cadmium (µg/l) | Chloride (mg/l) | Mecoprop (µg/l) | Naphthalene (µg/l) | Toluene (µg/l) | Xylene (µg/l) |
| GW1      | Mean            | 0.302                      | 0.047          | 10.1            | 0.025           | 0.185              | 1.22           | 0.652         |
|          | Above LOD (%)   | 50%                        | 0%             | 100%            | 3%              | 39%                | 18%            | 15%           |
|          | Exceedances (%) | 0%                         | 0%             | 0%              | 3.23%           | 0%                 | 7.14%          | 0%            |
| GW2      | Mean            | 13.6                       | 0.050          | 454             | 0.653           | 0.224              | 1.62           | 2.89          |
|          | Above LOD (%)   | 98%                        | 7%             | 100%            | 97%             | 55%                | 31%            | 41%           |
|          | Exceedances (%) | 4.88%                      | 0%             | 0%              | 0%              | 0%                 | 0%             | 0%            |
| GW9      | Mean            | 2.4                        | 0.056          | 469             | 0.240           | 0.299              | 1.05           | 1.05          |
|          | Above LOD (%)   | 100%                       | 16%            | 100%            | 100%            | 21%                | 0%             | 0%            |
|          | Exceedances (%) | 3.13%                      | 0%             | 0%              | 0%              | 0%                 | 0%             | 0%            |
| GW10     | Mean            | 61.9                       | 0.066          | 678             | 2.41            | 0.409              | 1.72           | 1.72          |
|          | Above LOD (%)   | 100%                       | 14%            | 100%            | 97%             | 21%                | 0%             | 0%            |
|          | Exceedances (%) | 4.88%                      | 0%             | 0%              | 0%              | 0%                 | 0%             | 0%            |
| GW11     | Mean            | 0.865                      | 0.424          | 49.4            | 0.021           | 0.169              | 1.11           | 0.50          |
|          | Above LOD (%)   | 97%                        | 14%            | 100%            | 0%              | 21%                | 26%            | 0%            |
|          | Exceedances (%) | 0%                         | 6.90%          | 0%              | 0%              | 0%                 | 3.70%          | 0%            |
| GW12     | Mean            | 0.560                      | 0.242          | 54.4            | 0.020           | 0.167              | 0.50           | 0.50          |
|          | Above LOD (%)   | 83%                        | 41%            | 100%            | 0%              | 14%                | 0%             | 0%            |
|          | Exceedances (%) | 0%                         | 37.9%          | 0%              | 0%              | 0%                 | 0%             | 0%            |
| GW13     | Mean            | 0.184                      | 0.057          | 96.3            | 0.038           | 0.258              | 0.78           | 0.50          |
|          | Above LOD (%)   | 25%                        | 0%             | 100%            | 33%             | 10%                | 20%            | 0%            |
|          | Exceedances (%) | 0%                         | 0%             | 0%              | 16.7%           | 0%                 | 0%             | 0%            |

### 3.5.3 Modelled calibration statistics

The HRA model developed for the previous HRA review undertook calibration to the estimated increase in contaminant concentrations across the Site. This was done by subtracting mean upstream groundwater concentrations from mean downstream concentrations. It is assumed that this difference is equivalent to the contribution from sources at the Site. The same calculation has been undertaken for this HRA review period using data obtained since May 2012. The results of this are provided in Table 3.12.

GW13 has been installed since the last HRA review. Based on contaminant concentrations, this has been designated as an upstream well because its concentrations are much more consistent with those in other upstream boreholes. The differences in the mean of means indicate that for all contaminants with the exception of ammoniacal nitrogen and cadmium, the increase in groundwater concentrations between the upstream and downstream groundwater is less than for the previous HRA review.

From the available data, it is inferred that the increase in ammoniacal nitrogen concentrations is because this determinand is retarded in groundwater and therefore breakthrough is delayed. Concentrations of cadmium are generally below the LOD; only GW12 has locally increased concentrations. Therefore the increase in mean cadmium does not represent a material increase in cadmium concentrations in the wider groundwater environment. These differences in concentration do not represent a significant change from those presented in the last HRA review and the same general trends are apparent between upstream and downstream groundwater.

**Table 3.12 Updated mean groundwater concentrations by borehole (since May 2012)**

| Location                                                  | Ammoniacal Nitrogen (mg/l) | Cadmium (mg/l)         | Chloride (mg/l) | Mecoprop (mg/l)       | Naphthalene (mg/l)    | Toluene (mg/l)        | m,p Xylenes (mg/l)    |
|-----------------------------------------------------------|----------------------------|------------------------|-----------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <b>Upstream Locations</b>                                 |                            |                        |                 |                       |                       |                       |                       |
| <b>GW1</b>                                                | 0.302                      | $4.71 \times 10^{-5}$  | 10.1            | $2.48 \times 10^{-5}$ | $1.85 \times 10^{-4}$ | $1.22 \times 10^{-3}$ | $6.52 \times 10^{-4}$ |
| <b>GW3</b>                                                | 0.810                      | $5.28 \times 10^{-5}$  | 26.1            | $3.70 \times 10^{-5}$ | $1.76 \times 10^{-4}$ | $7.00 \times 10^{-4}$ | $7.00 \times 10^{-4}$ |
| <b>GW4</b>                                                | 1.18                       | $1.66 \times 10^{-4}$  | 29.6            | $2.00 \times 10^{-5}$ | $2.78 \times 10^{-4}$ | $5.00 \times 10^{-4}$ | $5.00 \times 10^{-4}$ |
| <b>GW8</b>                                                | 0.175                      | $1.51 \times 10^{-4}$  | 246             | $2.00 \times 10^{-5}$ | $2.44 \times 10^{-4}$ | $5.00 \times 10^{-4}$ | $5.00 \times 10^{-4}$ |
| <b>GW13</b>                                               | 0.184                      | $5.70 \times 10^{-5}$  | 96.3            | $3.75 \times 10^{-5}$ | $2.58 \times 10^{-4}$ | $7.80 \times 10^{-4}$ | $5.00 \times 10^{-4}$ |
| <b>Mean of means</b>                                      | 0.53                       | $9.50 \times 10^{-5}$  | 81.5            | $2.79 \times 10^{-5}$ | $2.28 \times 10^{-4}$ | $7.40 \times 10^{-4}$ | $5.70 \times 10^{-4}$ |
| <b>Downstream Locations</b>                               |                            |                        |                 |                       |                       |                       |                       |
| <b>GW2</b>                                                | 13.6                       | $4.97 \times 10^{-5}$  | 454             | $6.53 \times 10^{-4}$ | $2.24 \times 10^{-4}$ | $1.62 \times 10^{-3}$ | $2.89 \times 10^{-3}$ |
| <b>GW5</b>                                                | 0.773                      | $4.16 \times 10^{-4}$  | 59.8            | $2.00 \times 10^{-5}$ | $1.82 \times 10^{-4}$ | $2.32 \times 10^{-3}$ | $5.00 \times 10^{-4}$ |
| <b>GW6</b>                                                | 1.20                       | $4.50 \times 10^{-4}$  | 76.1            | $6.29 \times 10^{-5}$ | $3.08 \times 10^{-4}$ | $7.17 \times 10^{-4}$ | $5.00 \times 10^{-4}$ |
| <b>GW7</b>                                                | 0.872                      | $1.67 \times 10^{-4}$  | 145             | $2.13 \times 10^{-5}$ | $2.82 \times 10^{-4}$ | $7.96 \times 10^{-4}$ | $5.57 \times 10^{-4}$ |
| <b>GW9</b>                                                | 2.42                       | $5.58 \times 10^{-5}$  | 469             | $2.40 \times 10^{-4}$ | $2.99 \times 10^{-4}$ | $1.05 \times 10^{-3}$ | $1.05 \times 10^{-3}$ |
| <b>GW10</b>                                               | 61.9                       | $6.62 \times 10^{-5}$  | 678             | $2.41 \times 10^{-3}$ | $4.09 \times 10^{-4}$ | $1.72 \times 10^{-3}$ | $1.72 \times 10^{-3}$ |
| <b>GW11</b>                                               | 0.865                      | $4.24 \times 10^{-4}$  | 49.3            | $2.06 \times 10^{-5}$ | $1.69 \times 10^{-4}$ | $1.11 \times 10^{-3}$ | $5.00 \times 10^{-4}$ |
| <b>GW12</b>                                               | 0.560                      | $2.42 \times 10^{-4}$  | 54.4            | $2.00 \times 10^{-5}$ | $1.67 \times 10^{-4}$ | $5.00 \times 10^{-4}$ | $5.00 \times 10^{-4}$ |
| <b>Mean of means</b>                                      | 10.3                       | $2.34 \times 10^{-4}$  | 248             | $4.30 \times 10^{-4}$ | $2.55 \times 10^{-4}$ | $1.23 \times 10^{-3}$ | $1.03 \times 10^{-3}$ |
| <b>Difference</b>                                         | 9.75                       | $1.39 \times 10^{-4}$  | 167             | $4.03 \times 10^{-4}$ | $2.69 \times 10^{-5}$ | $4.89 \times 10^{-4}$ | $4.57 \times 10^{-4}$ |
| <b>South-West Group of Wells (GW2, GW6, GW9 and GW10)</b> |                            |                        |                 |                       |                       |                       |                       |
| <b>Mean of means</b>                                      | 19.8                       | $1.55 \times 10^{-4}$  | 419             | $8.40 \times 10^{-4}$ | $3.10 \times 10^{-4}$ | $1.28 \times 10^{-3}$ | $1.54 \times 10^{-3}$ |
| <b>Difference</b>                                         | 19.3                       | $6.05 \times 10^{-5}$  | 338             | $8.13 \times 10^{-4}$ | $8.19 \times 10^{-5}$ | $5.38 \times 10^{-4}$ | $9.70 \times 10^{-4}$ |
| <b>Maximum Group of Wells (GW2, GW9 and GW10)</b>         |                            |                        |                 |                       |                       |                       |                       |
| <b>Mean of means</b>                                      | 26.0                       | $5.72 \times 10^{-5}$  | 533             | $1.10 \times 10^{-3}$ | $3.11 \times 10^{-4}$ | $1.46 \times 10^{-3}$ | $1.89 \times 10^{-3}$ |
| <b>Difference</b>                                         | 25.4                       | $-3.77 \times 10^{-5}$ | 452             | $1.07 \times 10^{-3}$ | $8.26 \times 10^{-5}$ | $7.24 \times 10^{-4}$ | $1.32 \times 10^{-3}$ |

Note: Green and red cells indicate a decrease and increase in concentrations compared to the previous HRA review respectively.

### 3.5.4 Non-hazardous pollutants

Table 3.13 displays summary statistics for non-hazardous pollutants and major ions in groundwater. Concentrations of these determinands are generally lower in groundwater than in leachate. Sulphate is an exception to this, possibly due to background groundwater concentrations being elevated or because the groundwater environment is more oxidising. Manganese concentrations are similar to those in leachate, possibly because there is another source that could be natural. (Ironstones are present in the geological sequence and may contain manganese.) In the context of the relatively high cadmium concentrations observed in GW12 in particular, it is useful to note that the overall frequency of exceedance of this parameter's DWS is less than 1% of samples.

Figure 3.9 shows times series of ammoniacal nitrogen concentrations in groundwater. This shows that concentrations are generally < 5 mg/l in all boreholes except GW2 and GW10. GW2 and GW10 are sited to the south of the landfill and are therefore downgradient. It is therefore inferred that

these boreholes are affected by leachate from the Site which could be either from the engineered landfill phases or the Merthyr Waste. Concentrations in GW10 show a gradual increasing trend since the last HRA review, as well as a marked seasonal variation, presumably related to dilution by recharge. Concentrations in GW2 also show a slight increase but appear to have stabilised. Concentrations in the other boreholes are mostly in excess of the DWS.

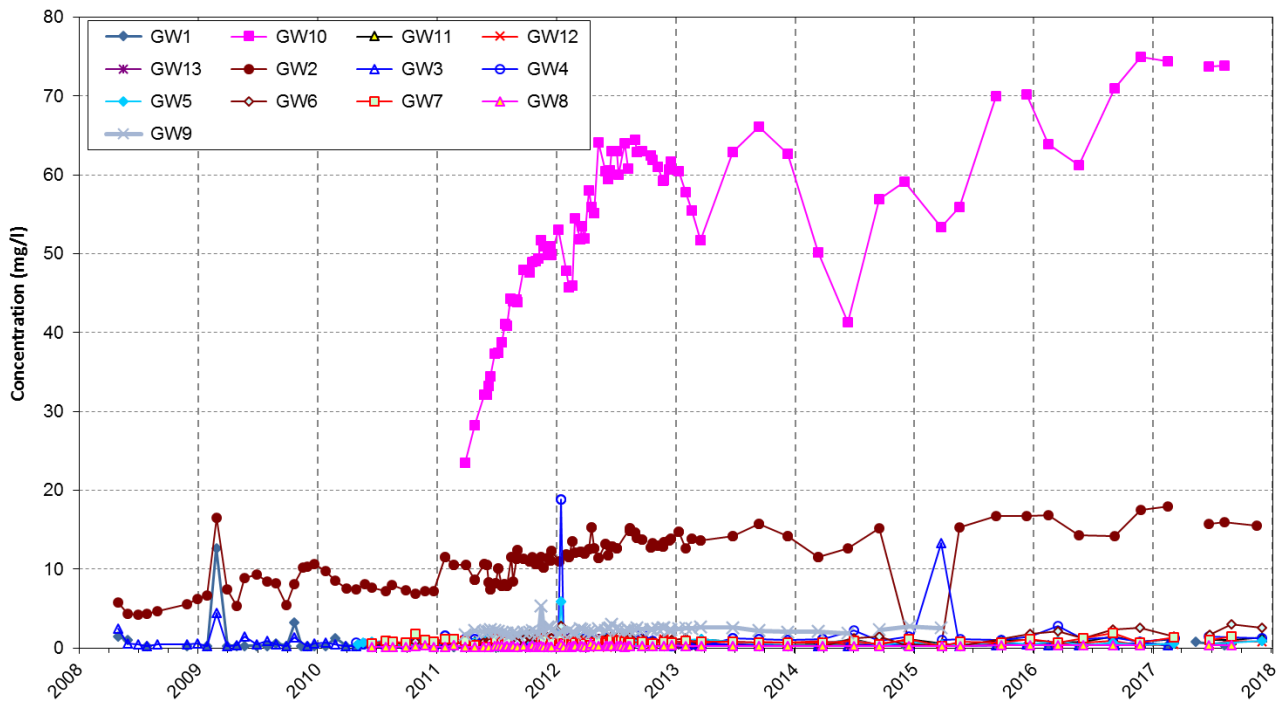


**Figure 3.9 Time series of ammoniacal nitrogen concentrations in groundwater**

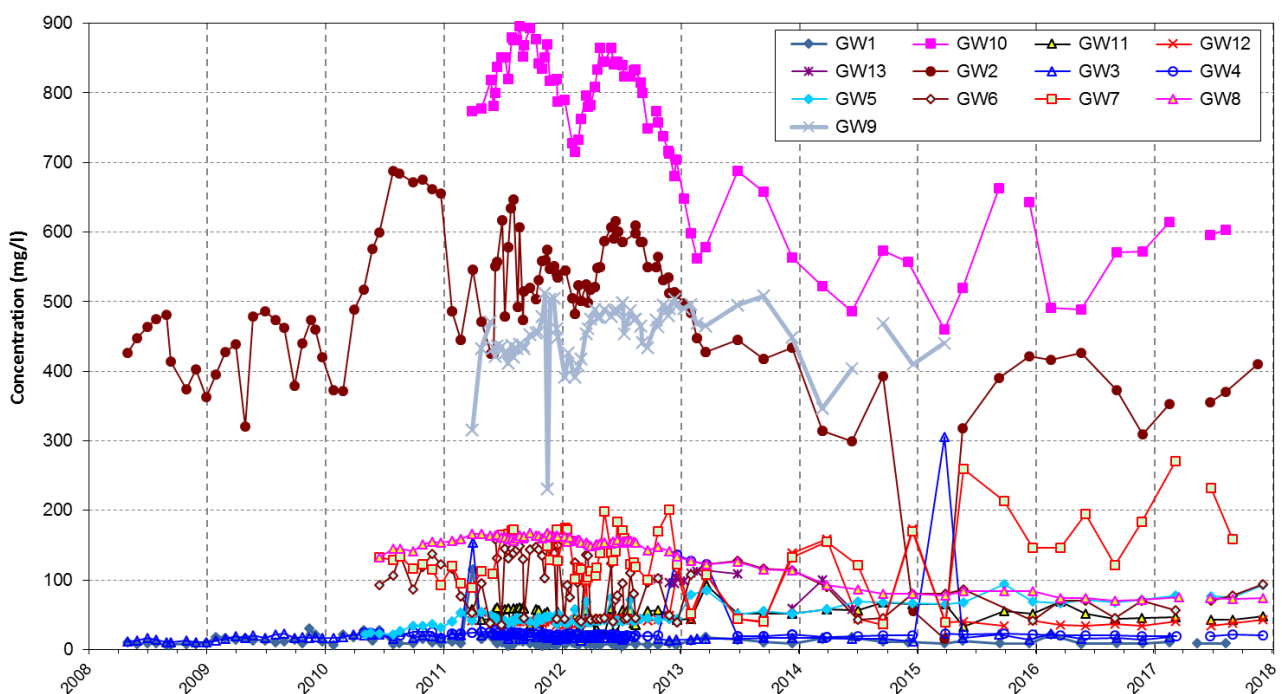


**Figure 3.10 Time series of chloride concentrations in groundwater**

Figure 3.10 shows chloride concentrations through time in groundwater. Concentrations are greatest and above DWS in GW10, GW2, GW9 and GW7. All of these wells are downgradient of the main

landfill. Since that last HRA review, concentrations in GW10 and GW2 have declined but appear to have stabilised at around 550 and 400 mg/l respectively since 2014. Chloride concentrations in GW7 show a recent rise from 2015 but have generally been below the DWS. There are declining trends in some of the other boreholes, particularly GW8, but concentrations have always been less than DWS at these locations.

The behaviour of chloride is different to that of ammoniacal nitrogen in that it shows decreasing concentrations rather than increasing concentrations. This is inferred to be because chloride behaves conservatively in groundwater – i.e. it tends not to degrade or to be retarded, unlike ammoniacal nitrogen. Therefore, the peak in concentrations in ammoniacal nitrogen will appear later than the peak for chloride. This was predicted by the modelling undertaken as part of the last HRA review.

Tritium is a radioactive isotope of hydrogen that is sourced from landfill leachate. Tritium activities (measured in Bq/l) are typically much higher in landfill leachate than in natural groundwater environments. Tritium is also conservative in groundwater transport. Figure 3.11 shows tritium activity through time in groundwater. Activity is greatest in GW10, GW2 and GW9 and is relatively low (< 50 Bq/l) in the other boreholes. The presence of tritium activity shows that GW10, GW2 and GW9 are most influenced by leachate from the Site (including the Merthyr waste). This is not unexpected given that they are located downgradient of the landfill. Figure 3.11 appears similar to the time series of chloride concentrations, likely because they are both unreactive in groundwater.

Figure 3.11 suggests that boreholes other than GW10, GW2 and GW9, are less affected by contamination from leachate sourced at the Site. Based on the results for other determinands this is considered to be true. However, dependent on the hydrogeological environment, other parts of the aquifer could be more or less affected dependent on how the hydrogeological regime is influenced by fracturing and other conduits. Contamination could therefore bypass other downgradient boreholes, but it is unlikely that concentrations will exceed those presented in Table 3.13.

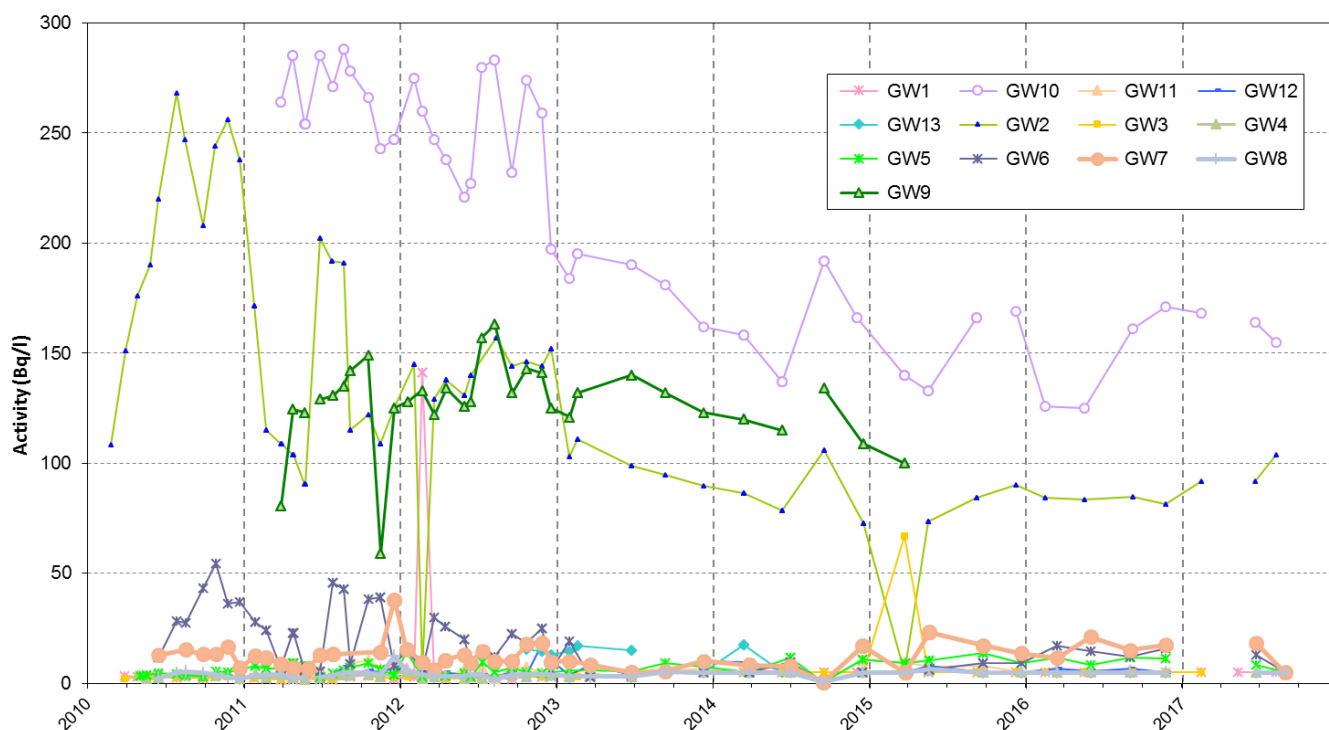


**Figure 3.11 Time series of tritium activity in groundwater**

Figure 3.12 shows a time series of mecoprop concentrations in groundwater. Concentrations are

highest in GW10 and GW2 and always  $< 0.5 \mu\text{g/l}$  in the other boreholes. Since the last HRA review, concentrations in GW10 have shown a decreasing trend. A slight decline is observed in GW2 and since the end of 2016 concentrations have been  $< 0.5 \mu\text{g/l}$ .

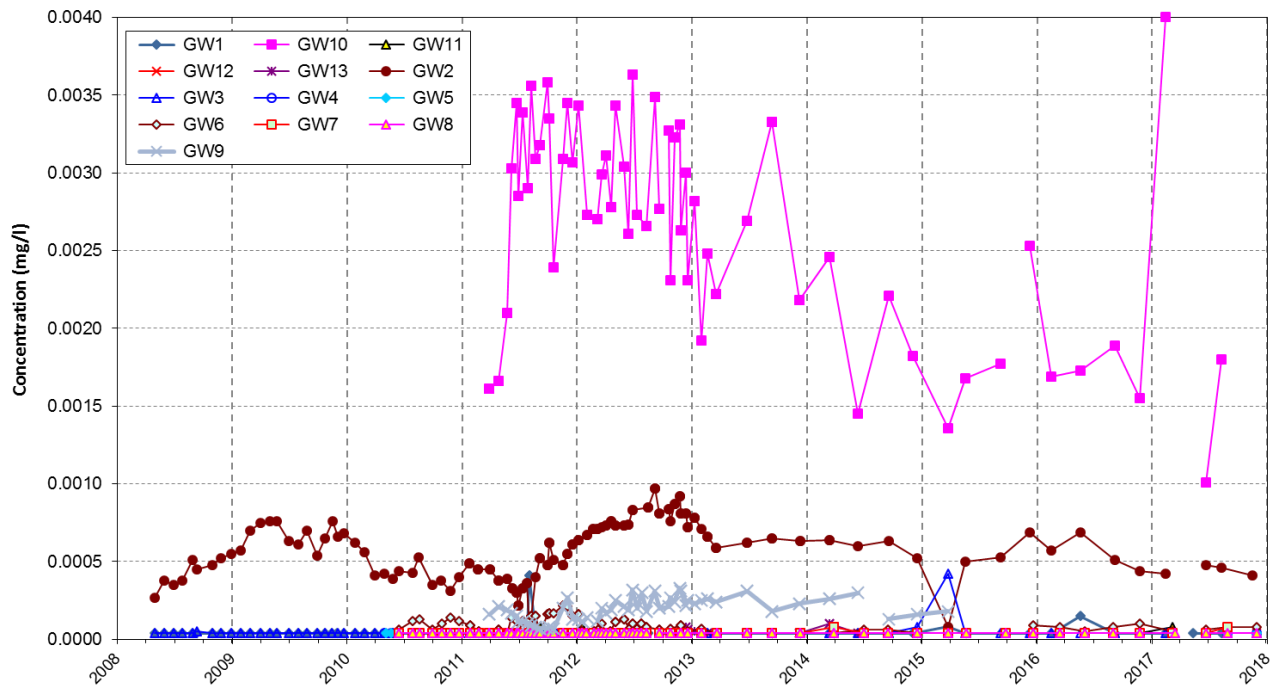


**Figure 3.12 Time series of mecoprop concentrations in groundwater**

**Table 3.13 Summary statistics for selected non-hazardous pollutants in groundwater (mg/l)**

| Determinand <sup>1,2</sup> | No. Results | Min                   | Max     | Mean     | Median | Stan. Dev. | > LOD (%) | Exceeding (%) | DWS    |
|----------------------------|-------------|-----------------------|---------|----------|--------|------------|-----------|---------------|--------|
| Chloride                   | 439         | 5.18                  | 4,970   | 201      | 73.8   | 322        | 100       | 26.6          | 250    |
| Magnesium                  | 263         | <0.6                  | 277     | 105      | 104    | 60.3       | 96.2      | 80.2          | 50     |
| Sodium                     | 263         | 3.46                  | 303     | 70       | 50.6   | 68.8       | 100       | 7.98          | 200    |
| Sulphate as SO4            | 263         | <1.3                  | 1,270   | 221      | 132    | 260        | 90.9      | 30.4          | 250    |
| Antimony                   | 67          | <0.0012               | 0.0029  | n.d.     | n.d.   | n.d.       | 13.4      | 1.49          | 0.005  |
| Barium                     | 67          | 0.023                 | 2.17    | 0.393    | 0.11   | 0.547      | 100       | 8.96          | 1      |
| Boron                      | 67          | <0.23                 | 2.03    | 0.358    | n.d.   | 0.482      | 35.8      | 7.46          | 1      |
| Cadmium                    | 340         | <0.0005               | 0.0112  | n.d.     | n.d.   | n.d.       | 13.8      | 0.88          | 0.005  |
| Copper                     | 262         | <0.009                | 0.04    | n.d.     | n.d.   | n.d.       | 2.29      | 0             | 2      |
| Iron                       | 263         | <0.23                 | 45.3    | 2.17     | n.d.   | 6.12       | 41.4      | 41.4          | 0.2    |
| Manganese                  | 263         | <0.007                | 6.35    | 0.547    | 0.176  | 0.844      | 87.8      | 79.1          | 0.05   |
| Nickel                     | 358         | <0.003                | 0.216   | 0.0207   | 0.008  | 0.0257     | 79.9      | 35.8          | 0.02   |
| Ammoniacal Nitrogen as N   | 438         | <0.27                 | 3,730   | 16.3     | 0.865  | 179        | 80.8      | 73.7          | 0.39   |
| Fluoride                   | 67          | <0.2                  | 0.66    | 0.141    | n.d.   | 0.112      | 35.8      | 0             | 1.5    |
| Mecoprop                   | 391         | <4 x 10 <sup>-5</sup> | 0.00363 | 0.000327 | n.d.   | 0.00073    | 33.2      | 0             | -      |
| Naphthalene                | 341         | <0.001                | 0.0041  | 0.000243 | n.d.   | 0.000498   | 24.6      | 0             | -      |
| Phenol                     | 341         | <0.002                | 0.0194  | n.d.     | n.d.   | n.d.       | 9.97      | 9.97          | 0.0005 |
| Selenium                   | 67          | <0.0016               | 0.049   | 0.00212  | n.d.   | 0.00656    | 22.4      | 1.49          | 0.019  |
| Total Cyanide              | 67          | <0.009                | 0.064   | n.d.     | n.d.   | n.d.       | 5.97      | 0             | -      |

<sup>1</sup>Rows in dark red show > 50% exceedance of DWS, rows in light red show 10 – 25% exceedances of DWS

<sup>2</sup>n.d. indicates not determinable

The declining trends in chloride, mecoprop and other determinands are as is expected by the modelling undertaken as part of the last HRA review. Although ammoniacal nitrogen locally shows the opposite trend (increasing) because this determinand is more strongly retarded in natural groundwater, this too is in keeping with the previous modelling results.

### 3.5.5 Hazardous substances

Of the hazardous substances found in leachate shown in Table 3.8, most are typically not detected in groundwater. The following exceedances of DWS have been identified (where the sample results are also above the LOD):

- Chromium: two exceedances in November 2017 in GW6 and GW12.
- Benzene: one exceedance in September 2015 in GW6.
- Dichlorprop: two exceedances, in GW2 in May 2012 and in GW10 in January 2013.

All these boreholes are downgradient and such exceedances could be sourced from the landfill itself. However, given the low frequency and sporadic nature of the DWS exceedances, these could equally be caused by sampling or laboratory errors.

Arsenic, which appears in relatively high concentrations in leachate, has not been detected in groundwater.

Short and long chain hydrocarbons are regularly detected in groundwater. However, there are no trends that have been identified and both upgradient and downgradient boreholes have been affected.

Concentrations of other organics including xylenes and toluene are generally below the LOD. Again, GW2 and GW10 exhibit the highest concentrations but, for toluene and m- and p-xylenes GW2 shows a declining trend.

## 3.6 Surface Water Quality

### 3.6.1 Monitoring overview

Surface water quality has been monitored on a quarterly basis in line with the requirements of the Permit which are specified in Table 3.14.

**Table 3.14 Surface water monitoring as required by the Permit**

| Parameters                                                                             | Monitoring Frequency | Monitoring Locations                                                                            |
|----------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------------------------------|
| Electrical Conductivity, chloride, ammoniacal nitrogen, pH, suspended solids, BOD, COD | Monthly              | 81702001 (SW Point A West),<br>81702002 (SW Point B East) and<br>81702003 (SW Point C Upstream) |

The focus of this surface water quality section is on data collected since the end of the last HRA review period (i.e. after May 2012). Other determinands have been analysed for previously, but the focus of this assessment is on those listed in Table 3.14. A statistical summary of surface water chemistry is presented in Table 3.18.

SW Point A is the surface water discharge location, SW Point B is located along the drain east of the Site and SW Point C is sited upstream to the north.

### 3.6.2 Emissions limits

The Permit includes emissions limits for four water quality parameters within surface water. These emissions limits apply to SWA, SWB and SW Monocell locations. The compliance criteria for each of these locations are summarised in Table 3.15.

**Table 3.15 Permit limits for surface water quality**

| Parameter              | Unit | Location |       |             |
|------------------------|------|----------|-------|-------------|
|                        |      | SWA      | SWB   | SW Monocell |
| Suspended Solids       | mg/l |          | 100   |             |
| Chemical Oxygen Demand | mg/l |          | 120   |             |
| Ammoniacal nitrogen    | mg/l |          | 5     |             |
| pH                     | -    |          | 6 - 8 |             |

The emissions relate to surface water drainage from the Site and include the discharge of process water. SWB also includes runoff from surrounding agricultural land.

A summary of compliance with the emissions limits of the permit is shown in Table 3.16 and Table 3.17. Exceedances were detected of at least one determinand at all locations. Many of the exceedances occur as isolated peaks, and results are generally compliant. Some of these isolated peaks, particularly for suspended solids, may be related to heavy rainfall or storm events that subsequently lead to high runoff flows that can mobilise and entrain sediment at the Site.

An assessment of the appropriateness of the emissions limits has been undertaken as part of this HRA review and the results of the assessment are outlined in Section 6.5.

**Table 3.16 Assessment of compliance with permit emissions limits for surface water**

| Location | Statistic       | Parameter                  |            |                         |        |
|----------|-----------------|----------------------------|------------|-------------------------|--------|
|          |                 | Ammoniacal nitrogen (mg/l) | COD (mg/l) | Suspended Solids (mg/l) | pH (-) |
| SWA      | Mean            | 0.77                       | 26.2       | 31.4                    | 7.78   |
|          | Above LOD (%)   | 59%                        | 90%        | 100%                    | n/a    |
|          | Exceedances (%) | 0%                         | 3.5%       | 6.9%                    | 10.3%  |
| SWB      | Mean            | 0.2                        | 37.0       | 464                     | 7.84   |
|          | Above LOD (%)   | 9%                         | 82%        | 100%                    | n/a    |
|          | Exceedances (%) | 0%                         | 0%         | 18.2%                   | 0.0%   |

**Table 3.17 Assessment of surface water monocell data**

| Location                 | Statistic       | Parameter                  |                  |                         |                  |
|--------------------------|-----------------|----------------------------|------------------|-------------------------|------------------|
|                          |                 | Ammoniacal nitrogen (mg/l) | COD (mg/l)       | Suspended Solids (mg/l) | pH (-)           |
| SW Monocell <sup>1</sup> | Mean            | 0.86                       | 69.7             | 45.7                    | 7.75             |
|                          | Above LOD (%)   | 57%                        | 96%              | 100%                    | n/a              |
|                          | Exceedances (%) | N/A <sup>1</sup>           | N/A <sup>1</sup> | N/A <sup>1</sup>        | N/A <sup>1</sup> |

<sup>1</sup> Water from SW Monocell was not discharged to surface water. If it was above the limit, then water was treated on-site.

### 3.6.3 Non-hazardous pollutants

Table 3.18 summarises surface water quality results for non-hazardous pollutants at all locations since the last HRA review period. In accordance with the Permit, only chloride and ammoniacal nitrogen have been monitored on a regular basis. Results are almost always below the Environmental Quality Standard (EQS) limit for fresh water. However, SWB, SWC and SWD show exceedances of EQS for copper all occurring on 7 June 2012 which is the last occasion copper was sampled for.

**Table 3.18 Summary statistics for selected non-hazardous pollutants in surface water (mg/l)**

| Determinand <sup>1,2</sup> | No. Results | Min                   | Max     | Mean   | Median | Stan. Dev. | > LOD (%) | Exceeding (%) | EQS                    |
|----------------------------|-------------|-----------------------|---------|--------|--------|------------|-----------|---------------|------------------------|
| Chloride                   | 143         | <3                    | 276     | 21.5   | 10.8   | 34.8       | 89.5      | 0.7           | 250                    |
| Magnesium                  | 6           | 4.19                  | 51.7    | 14.9   | 8.01   | 18.4       | 100       | 0             | -                      |
| Sodium                     | 6           | 1.55                  | 6.89    | 3.68   | 3.26   | 1.84       | 100       | 0             | 170                    |
| Sulphate as SO4            | 6           | 11.5                  | 122     | 39.8   | 24.5   | 42.1       | 100       | 0             | 400                    |
| Antimony                   | 2           | <0.0016               | <0.0016 | n.d.   | n.d.   | n.d.       | 0         | 0             | -                      |
| Barium                     | 2           | 0.0109                | 0.0167  | 0.0138 | 0.0138 | 0.0041     | 100       | 0             | -                      |
| Boron                      | 2           | <0.23                 | <0.23   | n.d.   | n.d.   | n.d.       | 0         | 0             | 2                      |
| Cadmium                    | 6           | <0.0006               | <0.0006 | n.d.   | n.d.   | n.d.       | 0         | 0             | 9.0 x 10 <sup>-5</sup> |
| Copper                     | 6           | <0.009                | 0.025   | 0.0112 | 0.0075 | 0.00826    | 50        | 50            | 0.006                  |
| Iron                       | 6           | <0.23                 | <0.23   | n.d.   | n.d.   | n.d.       | 0         | 0             | 1                      |
| Manganese                  | 6           | 0.01                  | 0.397   | 0.0823 | 0.02   | 0.154      | 100       | 0             | -                      |
| Nickel                     | 6           | <0.003                | 0.007   | 0.0045 | 0.0045 | 0.00243    | 66.7      | 0             | 0.02                   |
| Ammoniacal Nitrogen as N   | 143         | <0.41                 | 4.62    | 0.542  | n.d.   | 0.75       | 37.1      | 0             | -                      |
| Fluoride                   | 2           | <0.2                  | <0.2    | n.d.   | n.d.   | n.d.       | 0         | 0             | -                      |
| Mecoprop                   | 22          | <4 x 10 <sup>-5</sup> | <0.001  | n.d.   | n.d.   | n.d.       | 0         | 0             | -                      |
| Naphthalene                | 22          | <0.005                | <0.015  | n.d.   | n.d.   | n.d.       | 0         | 0             | 0.0024                 |
| Phenol                     | 2           | <0.0016               | <0.0016 | n.d.   | n.d.   | n.d.       | 0         | 0             | 0.0077                 |
| Selenium                   | 2           | <0.009                | <0.009  | n.d.   | n.d.   | n.d.       | 0         | 0             | -                      |
| Total Cyanide              | 143         | <3                    | 276     | 21.5   | 10.8   | 34.8       | 89.5      | 0             | -                      |

<sup>1</sup>Rows in dark red show > 50% exceedance of EQS, rows in light red show 10 – 25% exceedances of DWS

<sup>2</sup>n.d. indicates not determinable

Figure 3.13 shows a time series of ammoniacal nitrogen concentrations in surface water. The discharge location, SWA generally shows the highest concentrations and concentrations fluctuate over 4 mg/l through time. Concentrations at SWB, SWC and SWD are generally below the LOD of 0.41 mg/l. Given that the upstream monitoring point does not detect ammoniacal nitrogen, peaks may correspond to high rainfall events when rain falling uncapped areas may reach internal surface water lagoons. The peaks for SWA are always below the compliance limit of 5 mg/l and have only occasionally risen above 2 mg/l.

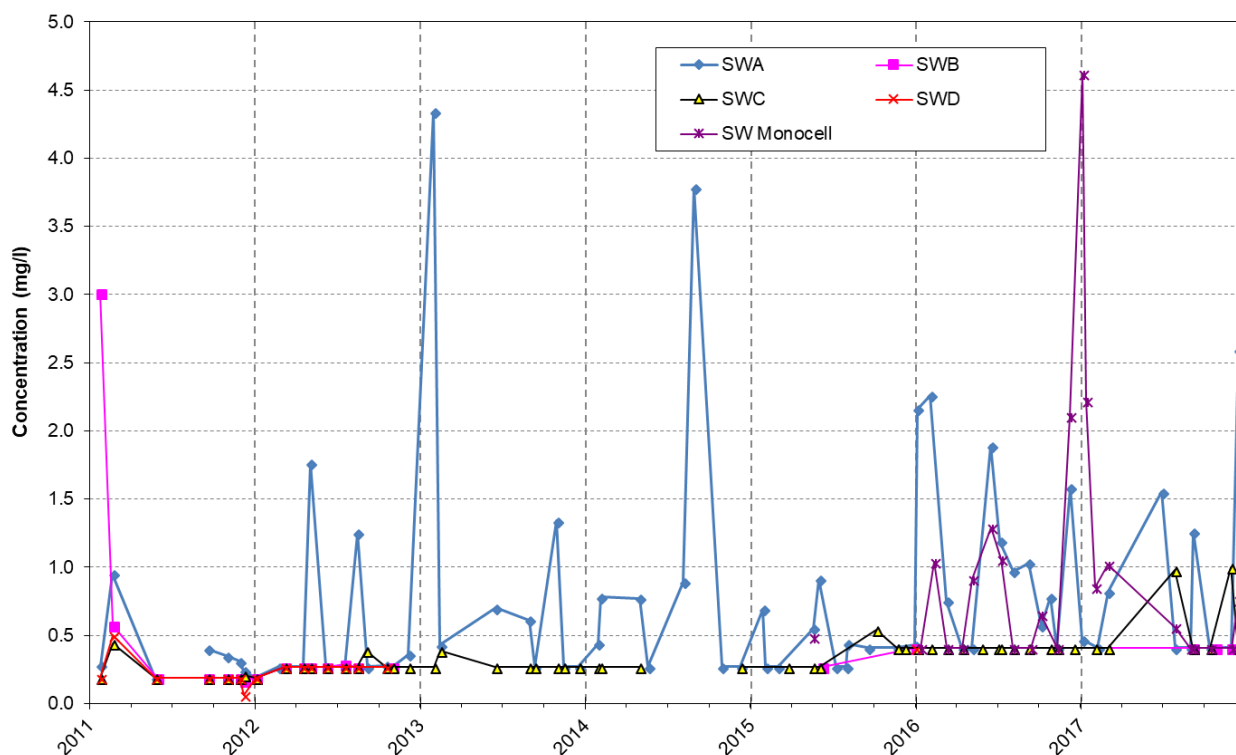


**Figure 3.13 Time series of ammoniacal nitrogen concentrations in surface water**

Figure 3.14 shows a time series of chloride concentrations in surface water. Other than isolated high concentrations at SWB and SW Monocell, concentrations are generally < 50 mg/l which is well below the Environmental Quality Standard (EQS) for freshwater of 250 mg/l.

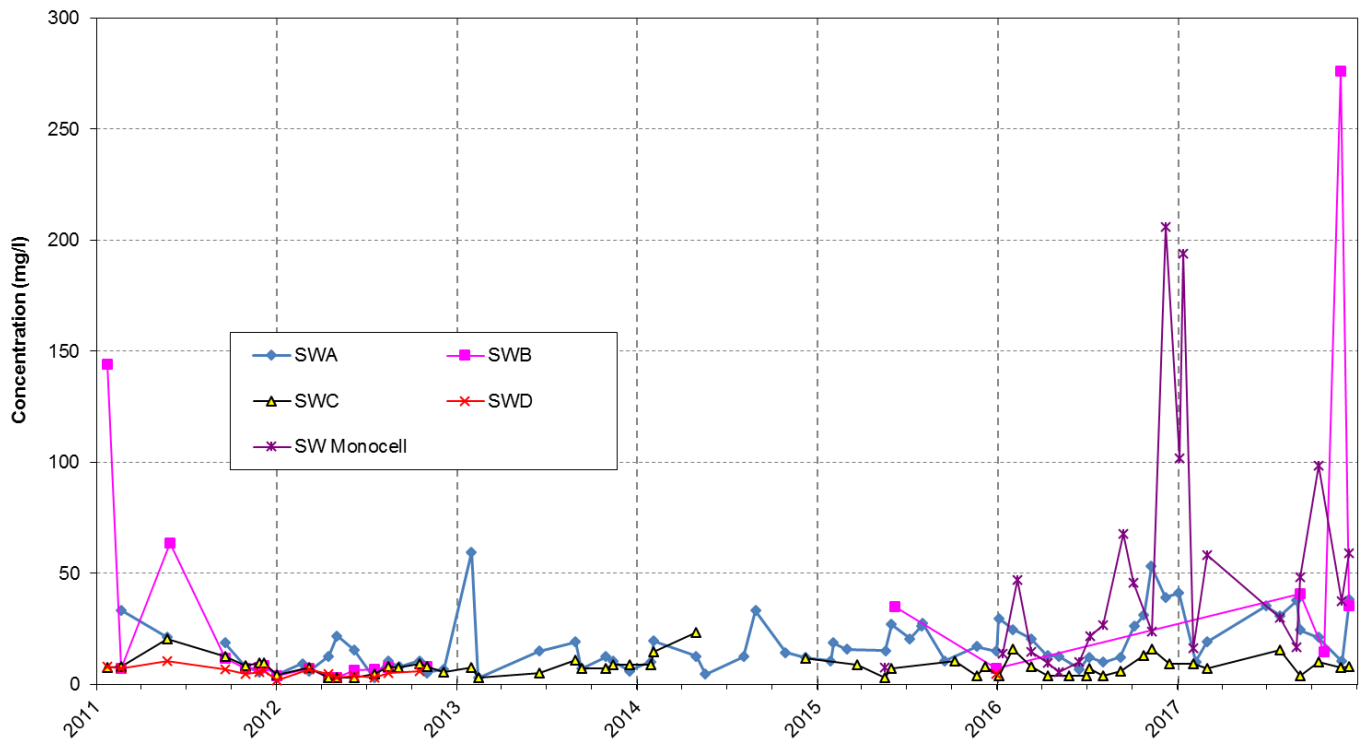


**Figure 3.14 Time series of chloride concentrations in surface water**

### 3.6.4 Hazardous substances

Hazardous substances are not required to be monitored as part of the Permit. However, some monitoring has been undertaken during the HRA review period. The following exceedances and detections have been recorded:

- Hydrocarbons – mostly C24 – C40 range (42% of samples were above the LOD); and
- Polyaromatic hydrocarbons – exceedances of the EQS were identified on 17 October 2012 for a number of PAH species at SWA.

These hazardous substance detections could be related to the leachate, but other sources of heavy hydrocarbons include oils and asphalt, as well as peaty soils. The detections are in any case insufficiently frequent to suggest that there may be a contamination issue related to the landfill activities.

## 4 Review of Conceptual Site Model

### 4.1 Overview

This section uses the data presented in the preceding sections to provide a review of the conceptual site model developed for the previous HRA review. Any changes to the conceptual site model are used to inform and revise the modelling and HRA detailed in Section 5.

### 4.2 Landfill Design

Since the last HRA review, there have been no significant changes to the landfill design. The main change to the landfill operation since the last HRA review is that leachate heads within Phase 1 are higher than previously modelled. This is because the leachate abstraction wells within Phase 1 were drilled to 15 m above the base of that phase.

In the HRA model for the last HRA review, Phase 1 was simulated in the model with a controlled head of 1 m above the base. In the model, once the head in Phase 1 rises above 1 m, it was assumed to overtop the bund and flow into Phase 2+. In reality, much more leachate accumulates within Phase 1 with heads rising above the bund elevation because the leachate wells within this phase are insufficiently deep to extract it to the previously modelled levels. This means that more leachate would overtop into Phase 2+ from Phase 1. However, absolute leachate levels still vary between the phases and heads in Phase 1 do rise above the bund elevation. This is assumed to be because there is very slow lateral leachate movement through the waste mass due to its low hydraulic conductivity, and because the quantity of leachate generated in Phase 1 is relatively small. The existing model has been updated to reflect this change (Section 5.3).

### 4.3 Source – Pathway – Receptor Linkages

#### 4.3.1 Sources

In the last HRA review, the Merthyr Waste was modelled separately from waste in Phase 1 and Phase 2+. Previously, the source term was based on measured leachate concentrations in a triangular distribution for the Phase 1 and Phase 2+ waste and these modelled values are shown in Table 3.6. Both Phase 1 and Phase 2+ were assigned the same source term concentrations.

Table 3.6 compares the recent measured leachate concentrations (for Phase 1 and Phase 2+ waste) to the modelled concentrations used in the last HRA review. These indicate that mean concentrations have fallen for all modelled determinands with the exception of xylenes. The o-xylene isomer was modelled in the last HRA review. Concentrations of the m- and p-xylene isomers are greater than the o-xylene isomer and, therefore, to be conservative, this has been adopted in Table 3.6 for the 2012 – 2017 period. Minimum, mean and maximum concentrations are around an order of magnitude greater for this determinand and these concentrations have been incorporated into the model. Attenuation and decay parameters for m- and p-xylenes are reported to be very similar to those for o-xylene (US EPA, 1999), and therefore these have not been altered in the model.

Maximum concentrations of naphthalene, toluene, chloride and ammoniacal nitrogen have also increased, although mean concentrations have fallen. Whilst the previously modelled source term is considered to remain appropriate and conservative for these, and other, modelled determinands, the source term in the model has none-the-less been amended to account for these changes.

Leachate quality data for the Merthyr Waste are only available for a short period in 2007/8. Leachate quality in the Merthyr Waste at this time is significantly different to leachate quality in waste confined at Phase 1 and Phase 2+ (ESI, 2012). For the last HRA review, two scenarios for leachate quality in the Merthyr Waste were considered as follows.

- The first, “Model A” uses the 2007/8 leachate quality data and assumes that Phase 1 and Phase 2+ are complete at the start of the model.
- The second, “Model B” infers that the dilute leachate monitored in 2007/8 in the Merthyr Waste was likely a consequence of flushing of the waste by rainfall through the non-engineered base. The low concentrations are therefore a consequence of a depleted source term and initial concentration would be significantly greater. This model therefore assumed a source term typical of domestic waste landfills with contaminant concentrations taken from LandSim default ranges, where available. Model B allows for a brief period with only the Merthyr Waste mass present to reflect the 1987 to 1993 period during which it was deposited. After this period, Phase 1 and Phase 2+ are then added as additional sources.

There are no further leachate quality data available for the Merthyr Waste.

We conclude that, apart from the small changes to source term concentrations, parameters and structure for both Model A and Model B remain appropriate.

#### 4.3.2 Pathways

The pathways modelled in the previous HRA review included a membrane liner beneath all source material except the Merthyr Waste. Different pathway scenarios and sensitivity assessments were provided by incorporating a rapid flow pathway to the edge of the Site. The rapid flow pathway was used only in Model A, because contaminant transport without a rapid pathway is too slow to affect groundwater. The full set of modelled pathways is shown in Table 4.1 and Figure 4.1.

**Table 4.1 Modelled pathways as part of previous HRA review**

| No. <sup>1</sup> | Source        | Pathway                        | Receptor     |
|------------------|---------------|--------------------------------|--------------|
| 1                | Phase 1       | Colliery Spoil                 | Water table  |
| 3                |               | Colliery Spoil → Coal Measures | Edge of Site |
| 4                | Merthyr Waste | Colliery Spoil                 | Water table  |
| 6                |               | Colliery Spoil → Coal Measures | Edge of Site |
| 7                | Phase 2+      | Colliery Spoil                 | Water table  |
| 8                |               | Colliery Spoil → Rapid pathway | Edge of Site |
| 9                |               | Colliery Spoil → Coal Measures | Edge of Site |

<sup>1</sup> Numbers refer to the pathway numbers used in the model (Appendix B, pathways tab). Numbers 2 and 5 were not used.

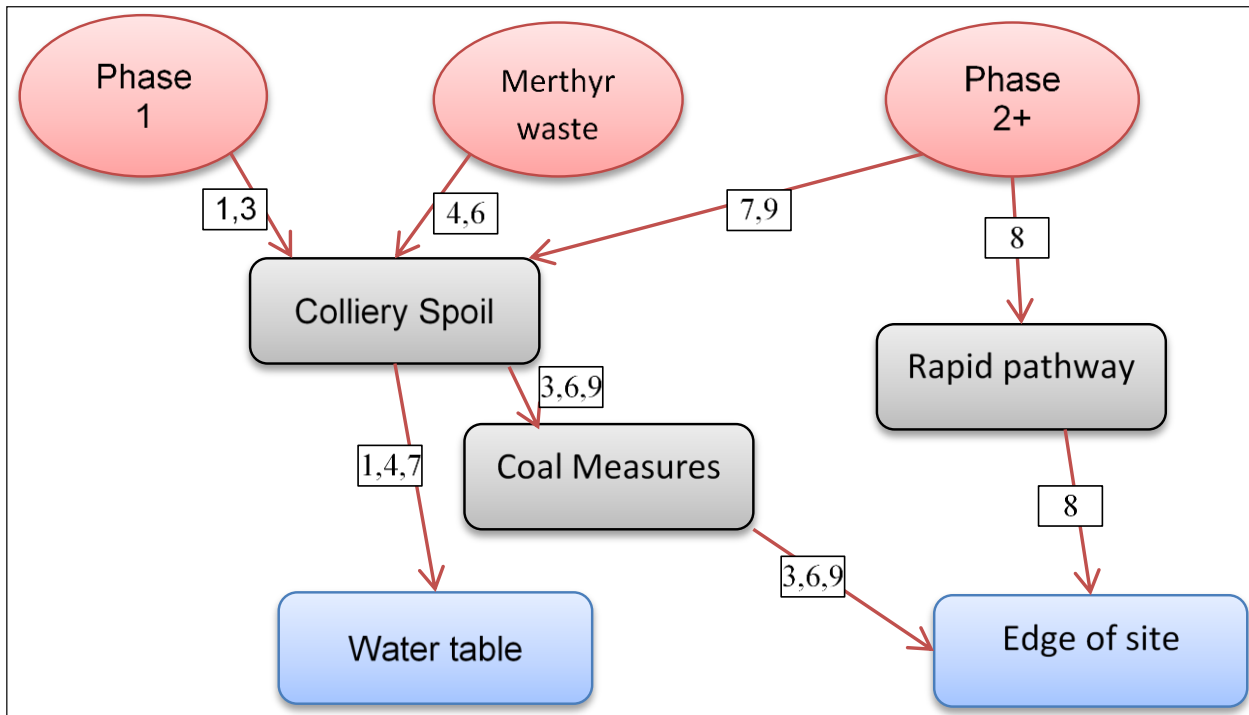


**Figure 4.1 Conceptual model diagram with numbered pathways**

Model A assumed that all leakage from the Merthyr Waste and leakage from Phase 1 through the engineered liner system passes downwards through the full thickness of Colliery Spoil to the water table and then the Coal Measures to the edge of Site receptor (pathways 3, 6 and 9). A portion of leakage from the largest source (Phase 2+) was modelled to follow the same route (pathway 9), while the remaining portion travels along the rapid pathway to the edge of the Site. The velocity through the Colliery Spoil was determined by the ratio of the calculated leakage to the effective porosity.

In Model B, the rapid pathway was not simulated and all leakage from the different sources passes through the Colliery Spoil to the water table and then via the Coal Measures to the edge of the Site. For this HRA review, only Model B is considered appropriate and Model A is not considered further. This is because in the last HRA review, it was concluded that Model B was more appropriate because Model A underestimates the impact of the Merthyr Waste. Model B typically predicts higher contaminant concentrations with a later peak as a rapid pathway is assumed to not be present. This is more representative of what has been observed in reality.

For the last HRA review, a hydraulic gradient of 0.04 – 0.08 was used for the Coal Measures strata. Based on mean groundwater levels for the review period, the largest mean head difference is between GW3 and GW6 (22 m). The boreholes are separated by a distance of 600 m and this gives a gradient of 0.037. The mean hydraulic gradient across the Site is therefore currently lower than the minimum modelled. However, the model was calibrated to groundwater velocity rather than hydraulic gradient. Any updates to the gradient could be plausibly balanced by a change in hydraulic conductivity and/or effective porosity which would result in the same or a similar groundwater velocity (in order to achieve the same calibrated concentrations).

Ongoing dewatering at Ffos-Y-Fran is likely to have increased the hydraulic gradient by lowering heads in boreholes nearest to this operation (i.e. on the downgradient southern part of the Site). This dewatering is a temporary operation whose effects are not relevant over the long time scales of the model.

Given these considerations, the modelled hydraulic gradient has not been altered.

### 4.3.3 Receptors

In the previous HRA review and original HRA, two receptors were simulated dependent on the type of contamination. Models A and B both used the same receptors. These are as follows.

- For hazardous substances, groundwater directly beneath the Site was the receptor.
- For non-hazardous pollutants, groundwater at the edge of the installation was the receptor.

These receptors remain appropriate and no revisions have been made to the model.

## 4.4 Summary of Changes to the Conceptual Model

The principal changes to the conceptual model are as follows:

- Increased leachate heads in Phase 1 of the landfill resulting in higher rates of overtopping to Phase 2+; and
- Modified source terms for the modelling contaminants with the exception of xylenes where m- and p-xylenes have been modelled rather than o-xylene.

Based on the last HRA review, Model B is considered more appropriate and relevant than Model A and therefore, Model A is not considered further in this HRA review.

There are no other changes to the conceptual model that require a material change to the HRA modelling or the implementation of an additional assessment scenario.

## 5 Hydrogeological Risk Assessment

### 5.1 Numerical Modelling Approach

The modelling approach undertaken in the last HRA review is considered to remain valid. The last HRA review used Risk Assessment Model 3 (RAM3). This software package was used as it allows the development of a complex, user-defined water balance. This tool remains appropriate for this HRA update.

The modelling approach incorporated the calibration of a deterministic model to observed data.

### 5.2 Model Re-Run

#### 5.2.1 Parameterisation

The changes to the HRA model from the last model run are as follows:

- Updating source term concentrations to match with those in the “Measured values May 12 – Dec 17” column of Table 3.6; and
- Amending the water balance for Phase 1 to allow head to accumulate in this phase.

The water balance has been amended by increasing the simulated elevation of the Phase 1 bund. This allows a greater head to accumulate and act on the base of Phase 1. Increasing the elevation of the bund also means that overtopping does not occur. This will not affect the model results as the main driver on the flow of contaminants through the base of the modelled landfill is the head acting on the base of each of the phases. This was calibrated to be at least equal to observed leachate heads by altering the infiltration into the phases (which is controlled by cap permeability in the model).

Heads of 10 m on Phase 1 and 32.6 m on Phase 2+ were calibrated and applied to the model. This compares with leachate heads of 1 m and 33.6 m on phases 1 and 2+ respectively which were calibrated for the previous HRA review. The updated assessment of heads considered a larger, more conservative dataset than that required by the permit monitoring schedule. This has resulted in higher leachate heads being used and a more conservative outcome. The revised heads are higher than the mean values for each phase shown in Table 3.4 but are lower than maximum values. The modelled leachate heads are considered to be consistent with measured values (i.e. of the same order and within the range of fluctuation) but conservative (i.e. higher than the mean).

#### 5.2.2 Calibration

The model was re-run deterministically with the updated parameters and the results compared to the updated differences in the mean of means provided in Table 3.12. The model assumes that the Merthyr Waste was emplaced in 1986 and therefore the measured groundwater concentrations have been calibrated to the modelled concentrations after a 32-year model run. Without changing any other parameters (in addition to those highlighted in Section 5.2.1), results consistent with the mean concentrations in Table 3.12, and similar to those that were achieved at the last HRA review, were obtained. Additional calibration and parameter adjustment was therefore not necessary.

### 5.3 Model Re-Run Results

#### 5.3.1 Deterministic results

Figure 5.1 shows results for the calibrated deterministic model for the first 100 years following deposition of the Merthyr Waste. Peak concentrations for chloride and mecoprop are predicted to occur after 10 years but, due to retardation, the peak concentration of ammoniacal nitrogen is expected much later after around 70 years. For the previous HRA review, the peak in mecoprop

concentrations was retarded, occurring after 20 years.

The reason for the earlier peak in the current model is because of the greater modelled leachate heads in Phase 1 (more than 9 m higher than in the previous model). This allows a flux approximately 19 times greater early in the model run. The waste signature is therefore observed more quickly at the Site boundary receptor. By contrast, the difference in heads at Phase 2+ between the models is very small (approximately 1 m less in the current model). This makes the flux from the Phase 2+ waste slightly lower, but insufficiently changed to negate the increased flux from Phase 1.

### 5.3.2 Probabilistic results

The 50th and 95th percentile concentrations for chloride, ammoniacal nitrogen and mecoprop are presented in Figure 5.2 for the first 100 years and in Figure 5.3 for the first 1,000 years of the model run. Results from the deterministic runs ('Det') are also shown for comparison.

Figure 5.3 shows results for the first 1,000 years of the long term. The second peak, occurring after 350 years, is due to the assumed degradation of the engineering in the modern landfill phases. Generally, the long term concentrations are also similar to those presented in the last HRA review.

Table 5.1 summarises peak concentrations simulated by the model. Results for cadmium, toluene, naphthalene and m and p xylenes are all much less than the LOD. This is consistent with the results obtained from the last HRA review and concentrations observed in groundwater which generally (with the exception of GW2) do not show any obvious indication that the concentrations of these contaminants in groundwater are caused by landfill contamination.

**Table 5.1 Simulated peak concentrations (mg/l)**

| Run                         | Chloride | Ammoniacal Nitrogen | Mecoprop              | Cadmium                  | Toluene | Naphthalene | m, p xylenes |
|-----------------------------|----------|---------------------|-----------------------|--------------------------|---------|-------------|--------------|
| Deterministic               | 836      | 137                 | $1.66 \times 10^{-3}$ | $< 1.00 \times 10^{-40}$ |         |             |              |
| 50 <sup>th</sup> Percentile | 745      | 47.4                | $1.92 \times 10^{-4}$ | $< 1.00 \times 10^{-40}$ |         |             |              |
| 95 <sup>th</sup> Percentile | 2,275    | 304                 | $6.04 \times 10^{-3}$ | $< 1.00 \times 10^{-40}$ |         |             |              |

While higher modelled leachate heads during the managed phase will cause a greater contaminant flux to groundwater and permit less decay, this is balanced by the lower (except for xylenes) source term concentrations. These competing effects mean that the latest time-series results are generally similar to the previous HRA findings.

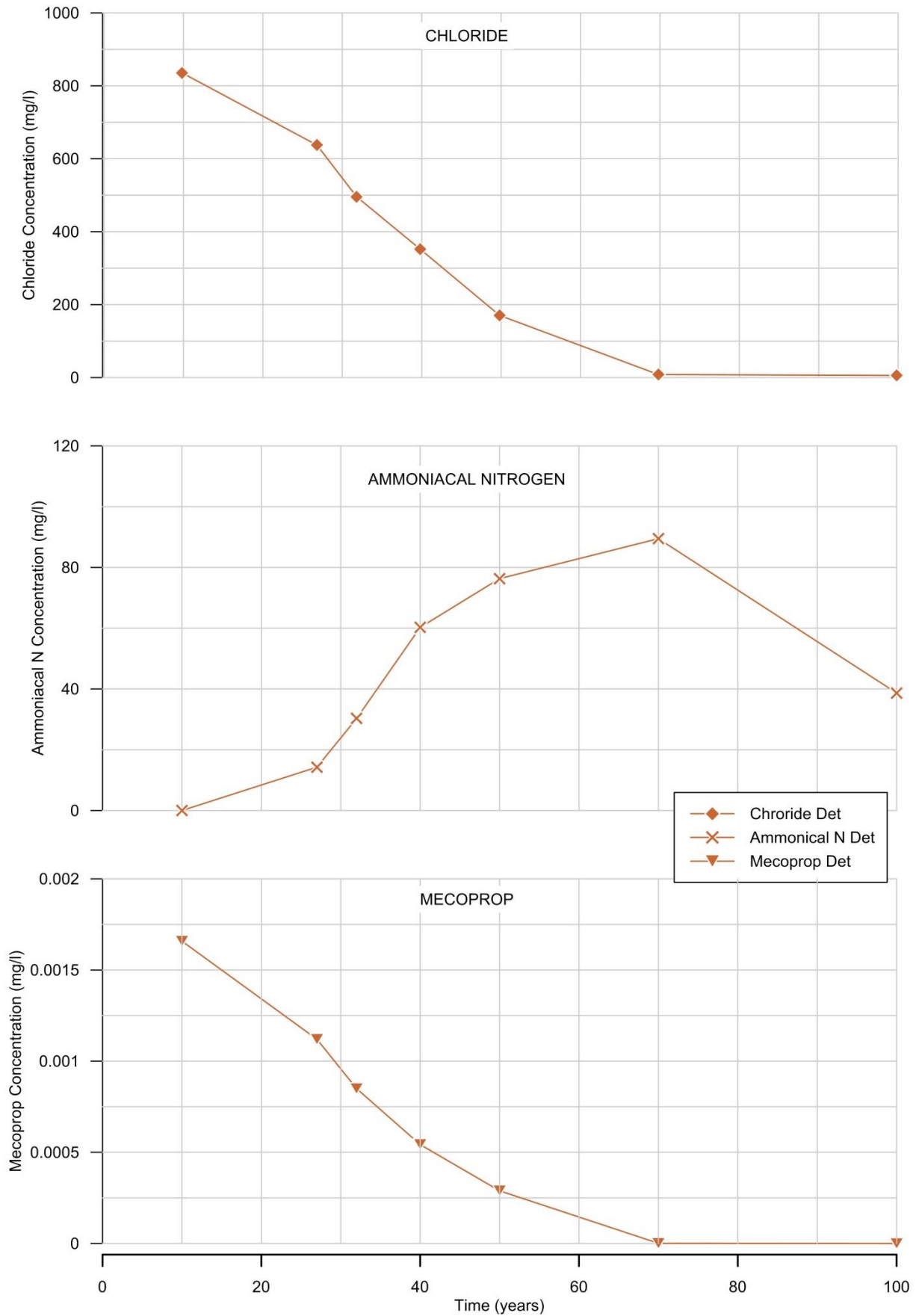


**Figure 5.1 Modelled groundwater concentrations at the Site boundary receptor for the calibrated deterministic model**

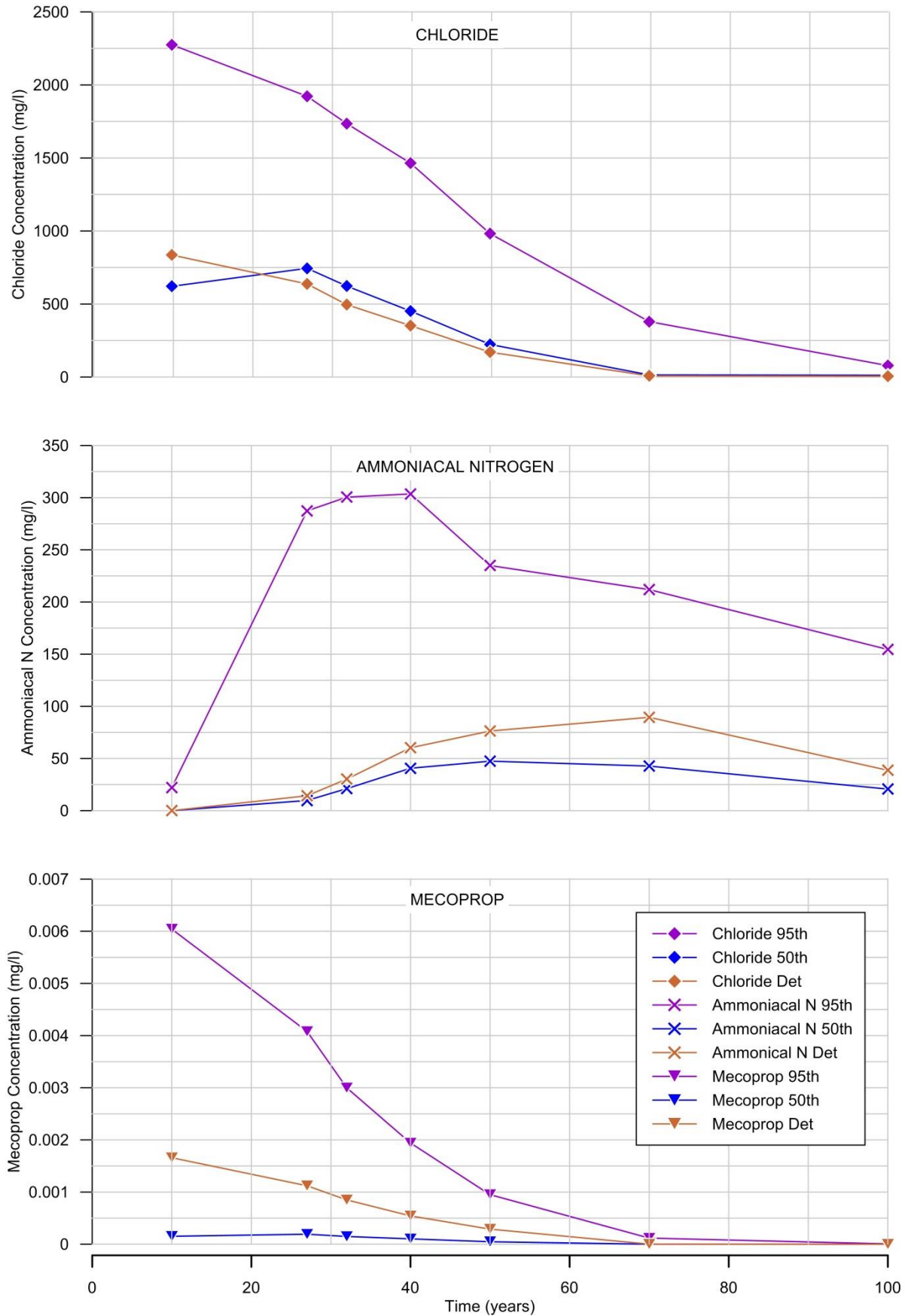


**Figure 5.2 Modelled groundwater concentrations at the Site boundary receptor for the calibrated probabilistic models during the first 100 years**

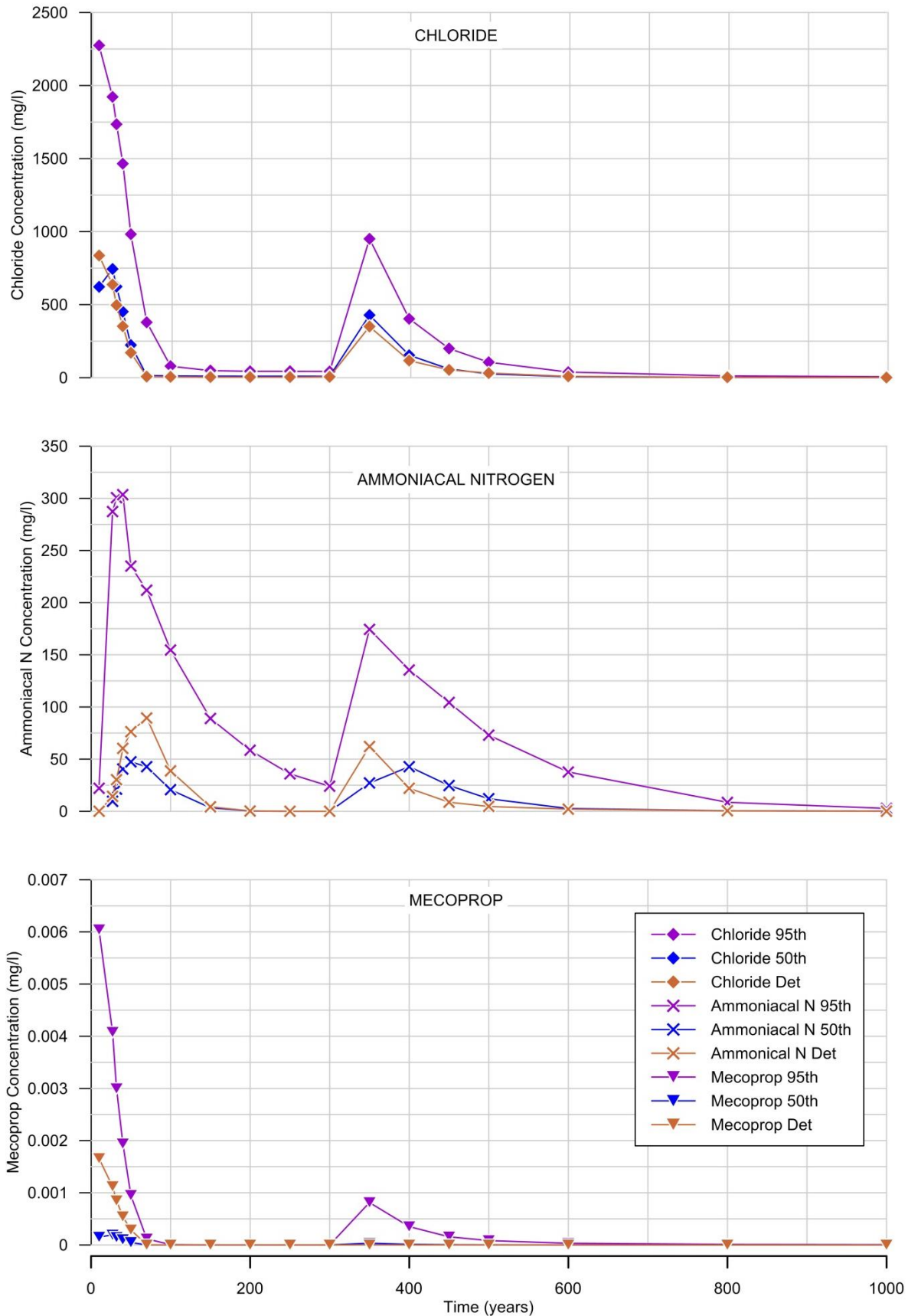


**Figure 5.3 Modelled long-term groundwater concentrations at the Site boundary receptor for the calibrated probabilistic models**

## 5.4 Sensitivity Analyses

Given the similarities in the model results to those presented in the last HRA, the sensitivity analyses undertaken previously remain appropriate and these have not been updated here. The same applies to the assessment of potential impacts related to dewatering at the Ffos-Y-Fran mine site.

## 6 Requisite Environmental Monitoring

### 6.1 Leachate Monitoring

Leachate is currently monitored at the frequencies and locations given in Table 3.5. The locations referenced in Table 3.5 should remain unchanged. The current monitoring suite of parameters is considered to remain appropriate. There are no water quality compliance limits set for leachate in the Permit and, given the inherent heterogeneity of the waste mass, it is not considered appropriate to set compliance limits at this stage.

### 6.2 Groundwater Monitoring

Groundwater is currently monitored at the locations and frequencies given in Table 3.9. The locations referenced in Table 3.9 should remain unchanged. The current monitoring suite of parameters is considered to remain appropriate.

### 6.3 Groundwater Quality Compliance Limits

Groundwater quality compliance limits have been reviewed against the monitoring data for the Site since the time of the last HRA review. Where results are consistently above the LOD, a statistical compliance analysis has been undertaken and is provided in Appendix C. The compliance limit is calculated as the mean values plus three standard deviations. Statistical analysis has not been undertaken on samples from GW9 and GW13 as there have been insufficient samples collected in the review period due to low groundwater levels in these boreholes. In some cases, many or most of the results within the sample dataset for the review period are at or below the LOD or where a consistent trend has been identified that would affect the statistical analysis. In these cases, the compliance assessment has been undertaken by visually inspecting the time series chart against the existing compliance criteria.

No compliance assessment has been undertaken where the following conditions apply:

- All samples are below the compliance limit, which is already at the DWS. In this case, it is inappropriate to increase or decrease the compliance limit given that it is already at the DWS and there have been no exceedances in the review period. This situation applies to chloride at GW1, GW11, GW12 and GW13.
- Where all samples recorded results below the LOD and the compliance limit is also below the LOD or below the typical LOD. In this case, it is inappropriate to raise or lower the compliance limit as any breaches would indicate a new detect. This situation applies to the following determinands:
  - GW1: cadmium;
  - GW11: mecoprop;
  - GW12: mecoprop; and
  - GW13: cadmium and mecoprop.
- Where the compliance limit is at the LOD or generally at the LOD (i.e. where the LOD changes with time, and the compliance limit is mostly at or below the LOD most of the time) and there have been no exceedances during the review period. In this case, it is inappropriate to alter the compliance limit for the same reason outlined above. This applies to all boreholes sampled for naphthalene during the review period.

In the above cases, it is recommended that the compliance limit is unchanged.

Table 6.1 summarises the proposed changes to the compliance limits based on the compliance analysis.

LOD varies between sampling rounds and is dependent on the laboratory and methodology used. In the samples taken to date, the LOD for toluene and m- and p-xylenes is typically 1 µg/l. Therefore, where samples have been below the compliance limit and below the LOD for the review period, it is suggested that the LOD of 1 µg/l is set as the new compliance limit. This applies to GW9, GW10 and GW12 for both xylene and toluene and to GW11 and GW13 for xylene.

Ammoniacal nitrogen results show an increasing trend (see below) and the number of samples showing exceedances for this determinand is increasing in some boreholes. It is therefore suggested that the compliance limit is increased for GW2, GW9, GW10 and GW11. Other increases are suggested for GW12 (cadmium) and GW13 (mecoprop). These increases are recommended because there are either increasing trends or a number of exceedances in these boreholes. Any breaches of the suggested raised limits would indicate that there is a (continued) rising trend. (Suggested upward revisions to compliance limits are shown by the beige cells in Table 6.1.)

It is advised that a number of compliance limits are lowered (as per the green highlighted cells in Table 6.1), as there is either a declining trend in these boreholes since the last monitoring period or there have been only limited or sporadic detections. Lowering the compliance limits will allow any contaminant concentration increases to be identified early.

Table 6.1 Proposed changes to permit compliance limits

| Parameter           | Unit | Existing/Proposed | Borehole |      |      |      |      |      |      |
|---------------------|------|-------------------|----------|------|------|------|------|------|------|
|                     |      |                   | GW1      | GW2  | GW9  | GW10 | GW11 | GW12 | GW13 |
| Ammoniacal nitrogen | mg/l | Existing          | 1.5      | 17   | 2.80 | 74   | 1.5  | 1.5  | 1.5  |
|                     |      | Proposed          | 0.92     | 19.9 | 3.09 | 80   | 1.77 | 1.4  | 1.5  |
| Cadmium             | µg/l | Existing          | 0.1      | 0.16 | 21   | 0.25 | 0.1  | 0.1  | 0.1  |
|                     |      | Proposed          | 0.1      | 0.1  | 1    | 0.15 | 0.1  | 1    | 0.1  |
| Chloride            | mg/l | Existing          | 250      | 650  | 550  | 950  | 250  | 250  | 250  |
|                     |      | Proposed          | 250      | 500  | 550  | 834  | 250  | 250  | 250  |
| Mecoprop            | µg/l | Existing          | 0.04     | 1    | 0.34 | 4.2  | 0.04 | 0.04 | 0.07 |
|                     |      | Proposed          | 0.04     | 0.8  | 0.34 | 3.5  | 0.04 | 0.04 | 0.1  |
| Naphthalene         | µg/l | Existing          | 1        | 1    | 1    | 1    | 1    | 1    | 1    |
|                     |      | Proposed          | 1        | 1    | 1    | 1    | 1    | 1    | 1    |
| Toluene             | µg/l | Existing          | 4        | 65   | 4    | 4    | 4    | 4    | 4    |
|                     |      | Proposed          | 3        | 10   | 1    | 1    | 3    | 1    | 1    |
| Xylenes             | µg/l | Existing          | 3        | 15   | 3    | 3    | 3    | 3    | 3    |
|                     |      | Proposed          | 2        | 12   | 3    | 1    | 1    | 1    | 1    |

## 6.4 Surface Water Monitoring

Surface water monitoring is currently undertaken at the locations and frequencies given in Table 3.14.

## 6.5 Surface Water Emissions Limits

Surface water emissions limits have been reviewed against monitoring data collected for the Site during the HRA review period. Where results are consistently above the LOD, a statistical compliance analysis has been undertaken in accordance with the methodology detailed in Appendix D. Statistical analysis has not been undertaken on samples from SWB as there are insufficient data points for this location. It is advised that emissions limits at this location remain unchanged.

For pH, results are largely compliant and the emission limit range (6 – 8) is considered appropriate. Therefore, an assessment has not been undertaken for pH.

For SWB and the SW Monocell monitoring locations, insufficient samples have been collected to undertake a robust analysis to determine whether changes in the emissions limits are appropriate. In these cases, it is proposed to continue with the existing emissions limits.

It is suggested that emissions limits are lowered at SWA for ammoniacal nitrogen and COD. This is because results from these locations have been consistently below the emissions limits or show a declining trend.

**Table 6.2 Proposed changes to permit emissions limits**

| Parameter                    | Unit | Existing/Proposed | SW Monitoring Location |       |             |
|------------------------------|------|-------------------|------------------------|-------|-------------|
|                              |      |                   | SWA                    | SWB   | SW Monocell |
| Ammoniacal nitrogen          | mg/l | Existing          | 5                      | 5     | 5           |
|                              |      | Proposed          | 4                      | 5     | 5           |
| Chemical Oxygen Demand (COD) | mg/l | Existing          | 120                    | 120   | 120         |
|                              |      | Proposed          | 53                     | 120   | 120         |
| Suspended Solids             | mg/l | Existing          | 100                    | 100   | 100         |
|                              |      | Proposed          | 100                    | 100   | 100         |
| pH                           | -    | Existing          |                        | 6 - 8 |             |
|                              |      | Proposed          |                        | 6 - 8 |             |

## 7 Conclusions

Stantec has undertaken an HRA review for Trecatti Landfill operated by Biffa. A review of all monitoring data collected since the last HRA review has been undertaken. Contaminant concentrations in leachate and groundwater have generally decreased, although ammoniacal nitrogen and cadmium show increases in some downgradient groundwater boreholes. Based on the monitoring data, the existing conceptual site model has been reviewed. Monitoring data are generally consistent with the conceptual model with two exceptions:

- Leachate source term concentrations in Phase 1 and Phases 2+ are on average lower than previously modelled; and
- Leachate heads in Phase 1 are higher than those modelled previously.

The existing HRA model has been updated to account for these changes, and results from the updated model are generally consistent with those modelled for the last HRA review. The competing effects of a higher leachate head and lower source term concentration effectively cancel out to produce this result.

Groundwater and surface water quality is mostly compliant with the existing compliance and emissions limits. Compliance analyses have been undertaken to determine the validity of the existing groundwater quality and surface water emissions limits. Suggested changes to these limits have been made where this is considered appropriate.

It is recommended that the existing monitoring continues and that the suggested changes to compliance and emissions limits are incorporated into a revised environmental permit.



# REFERENCES

- Biffa. (2014). *Trecatti Landfill Site: EPR Improvement Condition Response*.
- Edwards. (2004). *Ffos-y-Fran land reclamation scheme at Merthyr Tydfil: Statement of evidence to Planning Inspectorate*.
- ESI. (2012). *Trecatti landfill: Data review and conceptual model report*.
- ESI. (2013). *Trecatti Landfill: HRA Review 2012*.
- Golder Associates. (2011). *Trecatti Landfill: Leachate Management Plan*.
- SLR. (2004a). *Trecatti Landfill Site PPC application: Section B: hydrogeological risk assessment*.
- SLR. (2004b). *Trecatti Landfill Site PPC application: Section A: Environmental setting and installation design*.
- US EPA. (1999). Screening level ecological risk assessment protocol for hazardous waste combustion facilities, Volume 2, Appendix A.



# APPENDICES



# Appendix A

Trecatti Landfill Site Permit number EPR/RP3733PC



**Cyfoeth  
Naturiol**  
Cymru  
**Natural  
Resources**  
Wales

## Permit with introductory note

The Environmental Permitting (England & Wales) Regulations 2016

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Biffa Waste Services Limited

Trecatti Landfill Site  
Fochriw Road  
Merthyr Tydfil  
Glamorgan  
CF48 4AB

Permit number

EPR/RP3733PC

# **Trecatti Landfill Site**

## **Permit number EPR/RP3733PC**

### **Introductory note**

#### **This introductory note does not form a part of the permit**

The main features of the permit are as follows.

Trecatti landfill is located to the immediate north-east of Merthyr Tydfil and approximately 3km west of Rhymney at National Grid Reference SO 082077. It is located within an area of historic open-cast coal and ironstone working and lies to the north-west of the Gelligaer and Merthyr Common. The site is immediately surrounded by common land that includes vegetated colliery spoil tips and is used for rough grazing. The nearest residential area is Dowlais Top which lies approximately 200 metres to the northwest of the landfill. Access to the site is from the unclassified Fochriw Road to the east. The main watercourses present in the vicinity are the River Taff and Rhymney River, which flow in a general southerly direction 3.5km west and 2.1km east of the site respectively.

The permitted installation includes all areas of the existing and proposed landfill and site infrastructure in addition to the landfill gas utilisation and leachate treatment plants. The following non-listed directly associated activities are also included as part of the permitted installation: discharge of treated leachate to sewer; discharge of surface water drainage to a controlled watercourse; and gas flaring.

Merthyr Tydfil Borough Council commenced landfilling at Trecatti in 1986 and operated the site up until 1992 when the management transferred to Biffa Waste Services Limited. The site was licensed at that time to receive domestic, commercial and industrial wastes including difficult and special wastes. Engineered containment principles were introduced at Trecatti from 1993 in Phase 1 within the north-western corner. Subsequent landfilling took place within Phase 2, which then formed the basal containment for Phases 2A, 3A, and 4A. Phase 2A also forms the basal containment for all the remaining 7 Phases to be developed.

Trecatti Landfill has been constructed above the regional groundwater table of the Coal Measures strata and therefore no permanent groundwater management system is required. However, temporary underliner drainage systems have been installed beneath the Phases developed to date due to the presence of perched groundwater. Leachate accumulating within the site is abstracted and treated at the on-site treatment plant, which will in the future be supplemented by a further treatment plant. Landfill gas is collected and pumped to an on-site gas management plant which should eventually be capable of producing approximately 4MW electricity. Surplus gas is flared off.

The landfill has recently been permitted to allow the deposit of asbestos containing wastes within a dedicated cell constructed on the engineered southern side slope area of the landfill. The deposit of stable Non-Reactive Hazardous Wastes (SNRHW) (including asbestos) was previously authorised through the original PPC permit issues for the site, but was removed by a permit holder initiated application in December 2007. Conditions stated in this permit allow asbestos to be accepted at Trecatti Landfill Site in accordance with stringent regulatory standards.

This permit introduces a Multipurpose Waste Treatments and Remediation Pad (MWTRP) to the permitted activities undertaken at the site. As such, the Standard Rules Permit set SR2012 No. 8 has been included within the permit to allow for the operation of a composting facility on the Multipurpose Pad.

The MWTRP will allow the following two distinct waste activities to take place:

1. Waste Treatment Facility (WTF) – treatment and bioremediation of hazardous and non-hazardous waste including soils and sludges; and
2. Green Waste Composting Facility (GWCF).

The MWTRP comprises a single impermeable surfaced pad. The northern most part of the pad is used for the composting of green waste at approximately 3,250m<sup>2</sup>. Adjoining this is an area used for the bioremediation of contaminated soils or sludges, with a footprint of approximately 6,000m<sup>2</sup>. Each area is separated by a low level bund. The MWTRP site infrastructure is located in the southern area of the application site which includes two process water tanks (within a bunded enclosure), a biofilter, air/water separators with attendant process equipment and a substation. The area to the west is used for processing the green waste and compost. Additionally, there are two surface water drainage lagoons; one located within the southern part of the site and the other within the north-eastern part of the site.

The status log of the permit sets out the permitting history, including any changes to the permit reference number.

| <b>Status log of the permit</b>                                                      |                         |                                                                                                                             |
|--------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Description</b>                                                                   | <b>Date</b>             | <b>Comments</b>                                                                                                             |
| Application<br>EPR/RP3733PC<br>(reference<br>EPR/RP3733PC/A001)                      | Received<br>07/05/2004  | Duly Made on 21/05/2004                                                                                                     |
| Permit EPR/RP3733PC<br>determined                                                    | 09/03/2005              |                                                                                                                             |
| Application for permit<br>variation YP3037UA<br>(reference<br>EPR/RP3733PC/V002)     | Received<br>28/09/2007  | Duly Made 09/10/2007                                                                                                        |
| Application for permit<br>variation EPR/DP3037UY<br>(reference<br>EPR/RP3733PC/V003) | Received<br>17/12/2007  | Duly Made 02/01/2008                                                                                                        |
| Variation notice<br>DP3037UY (reference<br>EPR/RP3733PC/V003)<br>determined          | 18/01/2008              |                                                                                                                             |
| Variation notice<br>YP3037UA (reference<br>EPR/RP3733PC/V002)<br>determined          | 14/04/2008              |                                                                                                                             |
| EA-initiated Variation<br>EPR/RP3733PC/V004<br>determined                            | 18/01/2011              |                                                                                                                             |
| Admin variation<br>determined<br>EPR/RP3733PC/V005                                   | 17/10/2012              |                                                                                                                             |
| Admin variation<br>determined<br>EPR/RP3733PC/V006                                   | 12/02/2013              |                                                                                                                             |
| Agency variation<br>determined<br>EPR/RP3733PC/V007                                  | 12/06/2013              | Agency variation to implement the<br>changes introduced by IED.                                                             |
| Application<br>EPR/RP3733PC/V008                                                     | Duly Made<br>16/05/2014 | Application for variation and<br>consolidation of permit to allow the<br>acceptance of asbestos in a<br>dedicated monocell. |
| Additional information<br>received                                                   | 13/06/2014              | Addendum to Stability Risk<br>Assessment                                                                                    |
| Additional information<br>received                                                   | 26/09/2014              | Revised Stability Risk Assessment                                                                                           |
| Additional information<br>received                                                   | 12/09/2014              | Response to Schedule 5 Notice                                                                                               |
| Additional information<br>received                                                   | 21/10/2014              | Further information relating to<br>Schedule 5 Notice                                                                        |
| Additional information<br>received                                                   | 02/12/2014              | Clarification of information relating<br>to Stability Risk Assessment                                                       |

|                                                                            |                         |                                                     |
|----------------------------------------------------------------------------|-------------------------|-----------------------------------------------------|
| Permit determined                                                          | 27/02/2015              | Consolidated Permit issued                          |
| Application for substantial variation<br>EPR/RP3733PC/V009                 | Received<br>04/08/2015  | Duly Made 07/08/2015                                |
| Application for a substantial variation<br>EPR/RP3733PC/V009<br>determined | 15/01/2015              |                                                     |
| Application received<br>EPR/RP3733PC/V010                                  | Duly made<br>11/07/2018 | Application to add additional waste codes to permit |
| Application determined<br>EPR/RP3733PC/V010                                | 22/08/2018              | Varied and consolidated permit issued               |

**Other existing licenses/authorisations/registrations relating to this site**

| <b>Operator</b>              | <b>Reference Number</b>                                            | <b>Date of issue</b> |
|------------------------------|--------------------------------------------------------------------|----------------------|
| Biffa Waste Services Limited | Trade effluent discharge consent (to sewer) reference number TE456 | 14/04/1993           |

End of introductory note.

# Permit

The Environmental Permitting (England and Wales) Regulations 2016

Permit number  
**EPR/RP3733PC**

This is the consolidated permit referred to in the variation and consolidation notice for the application EPR/RP3733PC/V010 authorising

**Biffa Waste Services Limited** (“the operator”),

whose registered office is

**Coronation Road  
Cressex  
High Wycombe  
Bucks  
HP12 3TZ**

company registration number **00946107**

to operate an installation at

**Trecatti Landfill Site  
Fochriw Road  
Merthyr Tydfil  
Glamorgan  
CF48 4AB**

to the extent authorised by and subject to the conditions of this permit.

| Name               | Date              |
|--------------------|-------------------|
| <b>Holly Noble</b> | <b>22/08/2018</b> |

Authorised on behalf of Natural Resources Wales

# Conditions

## 1 Management

### 1.1 General management

- 1.1.1 The operator shall manage and operate the activities:
- (a) in accordance with a written management system that identifies and minimises risks of pollution, including those arising from operations, maintenance, accidents, incidents, non-conformances, closure and those drawn to the attention of the operator as a result of complaints; and
  - (b) using sufficient competent persons and resources.
- 1.1.2 Records demonstrating compliance with condition 1.1.1 shall be maintained.
- 1.1.3 Any person having duties that are or may be affected by the matters set out in this permit shall have convenient access to a copy of it kept at or near the place where those duties are carried out.
- 1.1.4 The operator shall comply with the requirements of an approved competence scheme.

### 1.2 Finance

- 1.2.1 The financial provision for meeting the obligations under this permit agreement made between the operator and Natural Resources Wales was dated 09/03/2005 shall be maintained by the operator throughout the subsistence of this permit and the operator shall produce evidence of such provision whenever required by Natural Resources Wales.
- 1.2.2 The financial provision provided under condition 1.2.1 above shall thereafter be maintained by the operator throughout the subsistence of this permit and the operator shall produce evidence of such provision whenever required by Natural Resources Wales.
- 1.2.3 The operator shall ensure that the charges it makes for the disposal of waste in the landfill cover all of the following:
- a) The costs of setting up and operating the landfill;
  - b) The costs of the financial provision required by condition 1.2.1; and
  - c) The estimated costs for the closure and aftercare of the landfill.

### 1.3 Energy efficiency

- 1.3.1 The operator shall:
- (a) take appropriate measures to ensure that energy is used efficiently in the activities;
  - (b) review and record at least every four years whether there are suitable opportunities to improve the energy efficiency of the activities; and
  - (c) take any further appropriate measures identified by a review.

## **1.4 Efficient use of raw materials**

1.4.1 The operator shall:

- (a) take appropriate measures to ensure that raw materials and water are used efficiently in the activities;
- (b) maintain records of raw materials and water used in the activities;
- (c) review and record at least every four years whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw material and water use; and
- (d) take any further appropriate measures identified by a review.

## **1.5 Avoidance, recovery and disposal of wastes produced by the activities**

1.8.1 The operator shall take appropriate measures to ensure that:

- (a) the waste hierarchy referred to in Article 4 of the Waste Framework Directive is applied to the generation of waste by the activities; and
- (b) any waste generated by the activities is treated in accordance with the waste hierarchy referred to in Article 4 of the Waste Framework Directive; and
- (c) where disposal is necessary, this is undertaken in a manner which minimises its impact on the environment.

1.5.2 The operator shall review and record at least every four years whether changes to those measures should be made and take any further appropriate measures identified by a review.

# **2 Operations**

## **2.1 Permitted activities**

2.1.1 The operator is only authorised to carry out the activities specified in schedule 1 table S1.1 (the “activities”).

2.1.2 Waste authorised by this permit shall be clearly distinguished from any other waste on the site.

## **2.2 The site**

2.2.1 The activities shall not extend beyond the site, being the land shown edged in green on the site plan at schedule 7 to this permit.

## **2.3 Operating techniques**

2.3.1 Operating techniques to be adhered to by the operator are as follows:

- a) The activities shall, subject to the conditions of this permit, be operated using the techniques and in the manner described in the documentation specified in schedule 1, table S1.2, unless otherwise agreed in writing by Natural Resources Wales.

- b) If notified by Natural Resources Wales that the activities are giving rise to pollution, the operator shall submit to Natural Resources Wales for approval within the period specified, a revision of any plan or other documentation ("plan") specified in schedule 1, table S1.2 or otherwise required under this permit which identifies and minimises the risks of pollution relevant to that plan, and shall implement the approved revised plan in place of the original from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.
- 2.3.2 Any raw materials or fuels listed in schedule 2 table S2.1 shall conform to the specifications set out in that table.
- 2.3.3 Waste for disposal in the landfill shall only be accepted if:
- (a) it is of a type and quantity listed in schedule 2 table S2.2 and S2.4;
  - (b) it conforms to the description in the documentation supplied by the producer and holder;
  - (c) they are non- hazardous waste or asbestos and construction materials containing asbestos;
  - (d) they are not whole used tyres (other than bicycle tyres and tyres with an outside diameter of more than 1400mm);
  - (e) they are not shredded used tyres;
  - (f) they are not liquid waste (including waste waters but excluding sludge);
  - (g) they are not chemical substances from research and development or teaching activities, for example laboratory residues, which are unidentified and/or which are new and whose effects on man and/or the environment are unknown;
  - (h) all the relevant waste acceptance procedures have been completed;
  - (i) they fulfil the relevant waste acceptance criteria;
  - (j) they have not been diluted or mixed solely to meet the relevant waste acceptance criteria;
  - (k) they are wastes which have been treated, except for: inert wastes for which treatment is not technically feasible; or it is waste other than inert waste and treatment would not reduce its quantity or the hazards which it poses to human health or the environment, [or liquid waste accepted for treatment at a permitted leachate treatment activity; and
  - (l) where they are wastes with a code beginning with 07 05 and 16 03, they shall exclude waste medicinal products and pharmaceutically active waste materials arising from their manufacture.
- 2.3.4 The operator shall ensure that where waste produced by the activities is sent to a relevant waste operation, that operation is provided with the following information, prior to the receipt of the waste:
- (a) the nature of the process producing the waste;
  - (b) the composition of the waste;
  - (c) the handling requirements of the waste;
  - (d) the hazardous property associated with the waste, if applicable; and
  - (e) the waste code of the waste.
- 2.3.5 The operator shall ensure that where waste produced by the activities is sent to a landfill site, it meets the waste acceptance criteria for that landfill.

- 2.3.6 Asbestos containing wastes and construction materials containing asbestos shall only be disposed of with other suitable wastes and not in cells containing biodegradable non-hazardous waste. Asbestos waste and construction material containing asbestos must meet the relevant waste acceptance criteria and must be covered daily and before each compaction operation with appropriate material.
- 2.3.7 The operator shall visually inspect:
- (a) without unloading it, waste that is not in an enclosed container or enclosed vehicle on arrival at the landfill;
  - (b) waste at the point of deposit;
  - (c) waste at the point of dispatch;
- and shall satisfy itself that it conforms to the basic characterisation documentation submitted by the holder.
- 2.3.8 Where the operator has taken samples to establish that the waste is in conformity with the documentation submitted by the holder then the samples taken shall be retained for at least one month and results of any analysis for at least two years.
- 2.3.9 The operator on accepting each delivery of waste shall provide a receipt to the person delivering it.
- 2.3.10 The total quantity of waste that shall be deposited in the landfill shall be limited by the pre-settlement levels shown on drawing BF4857/10/04 dated 04/04/2014.
- 2.3.11 The quantity of waste that is deposited in the landfill in any year shall not exceed the limits in schedule 1 table S1.5.
- 2.3.12 The operator shall maintain and implement a system which ensures that a record is made of the quantity, characteristics, date of delivery and, where practicable, origin of any waste that is received for disposal or recovery and of the identity of the producer, or in the case of municipal waste and multiple collection vehicles, of the collector of such waste. Any information regarded by the operator as commercially confidential shall be clearly identified in the record.
- 2.3.13 The operator shall maintain and implement a system to record the disposal location of any hazardous waste.

## **Hazardous waste storage and treatment**

- 2.3.14 Hazardous waste shall not be mixed, either with a different category of hazardous waste or with other waste, substances or materials, unless it is authorised by schedule 1 table S1.1 and appropriate measures are taken.

## **2.4 Improvement programme**

- 2.4.1 The operator shall complete the improvements specified in schedule 1 table S1.3 by the date specified in that table unless otherwise agreed in writing by Natural Resources Wales.
- 2.4.2 Except in the case of an improvement which consists only of a submission to Natural Resources Wales, the operator shall notify Natural Resources Wales within 14 days of completion of each improvement.

## **2.5 Landfill Engineering**

- 2.5.1 No construction of any new cell of the landfill shall commence until the operator has submitted construction proposals and Natural Resources Wales has confirmed that it is satisfied with the construction proposals.
- 2.5.2 Where the operator proposes to construct any new cell other than the first cell, but proposes no change from the design of the most recently approved cell which could have any impact on the performance of any element of the design, no construction of the new cell shall commence until the operator has submitted a cell layout drawing and Natural Resources Wales has confirmed that it is satisfied with the cell layout drawing.

- 2.5.3 The construction of a new cell shall take place only in accordance with the approved construction proposals unless:
- a) any change to the approved construction proposals would have no impact on the performance of any element of the design; or
  - b) a change has otherwise been agreed in writing by Natural Resources Wales.
- 2.5.4 No disposal of waste shall take place in a new cell until the operator has submitted a CQA Validation Report and Natural Resources Wales has confirmed that it is satisfied with the CQA Validation Report (except for the Asbestos cell CQA report). A CQA report shall be submitted for each lift of the Asbestos cell.
- 2.5.5 No construction of landfill infrastructure shall commence until the operator has submitted relevant construction proposals or a written request to use previous construction proposals and Natural Resources Wales has confirmed that it is satisfied with the construction proposals.
- 2.5.6 The construction of the landfill infrastructure shall take place only in accordance with the approved construction proposals unless:
- a) any change to the approved construction proposals would have no impact on the performance of any element of the design; or
  - b) a change has otherwise been agreed in writing by Natural Resources Wales missions and monitoring.
- 2.5.7 The operator shall submit a CQA Validation Report as soon as practicable following the construction of the relevant landfill infrastructure.
- 2.5.8 Where pollution controls are immediately necessary to prevent an incident or accident, then conditions 2.5.5 and 2.5.6 do not apply and the relevant landfill infrastructure may be constructed, provided that the construction proposals are submitted to Natural Resources Wales as soon as practicable.
- 2.5.9 For the purposes of conditions 2.5.1, 2.5.2, 2.5.4 and 2.5.5 (except for the report required for the asbestos cell), Natural Resources Wales shall be deemed to be satisfied where it has not, within the period of four weeks from the date of receipt of the relevant construction proposals or CQA Validation Report, either:
- a) confirmed whether or not it is satisfied; or
  - b) informed the operator that it requires further information.
- 2.5.10 Where Natural Resources Wales has required further information under condition 2.5.9(b), Natural Resources Wales shall be deemed to be satisfied where it has not, within the period of four weeks from the date of receipt of the further information, either:
- a) confirmed whether or not it is satisfied; or
  - b) informed the operator that it requires further information.

## **2.6 Leachate Levels**

- 2.6.1 The limits for the level of leachate listed in schedule 3 table S3.1 shall not be exceeded.

## **2.7 Closure and aftercare**

- 2.7.1 The operator shall maintain a closure and aftercare management plan.

## **2.8 Landfill gas management**

- 2.8.1 The operator shall take appropriate measures, including, but not limited to, those specified in any approved landfill gas management plan, to:
- (a) collect landfill gas; and
  - (b) control the migration of landfill gas.
- 2.8.2 The operator shall use the collected landfill gas to produce energy. If the collected landfill gas cannot be used to produce energy, the operator shall flare the gas.
- 2.8.3 The operator shall:
- (a) if notified by Natural Resources Wales, submit to Natural Resources Wales for approval within the period specified, a revised landfill gas management plan;
  - (b) implement the revised landfill gas management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.

## **3 Emissions and monitoring**

### **3.1 Emissions to water, air or land**

- 3.1.1 There shall be no point source emissions to water, air or land except from the sources and emission points listed in schedule 3 tables S3.2, S3.3 and S3.4.
- 3.1.2 The limits given in schedule 3 shall not be exceeded, save that compliance with an emission limit in that table shall include incorporation of the uncertainty allowance stated in Environment Agency guidance LFTGN 05 and LFTGN 08.
- 3.1.3 There shall be no emission from the activities into groundwater of any hazardous substances contrary to the EP Regulations.
- 3.1.4 There shall be no emission from the activities into groundwater of any non-hazardous pollutants so as to cause pollution.
- 3.1.5 The trigger levels for emissions into groundwater for the parameters and monitoring points set out in schedule 3 table S3.5 shall not be exceeded.
- 3.1.6 The operator shall submit to Natural Resources Wales a review of the Hydrogeological Risk Assessment:
- (a) between nine and six months prior to the sixth anniversary of the granting of the permit, and
  - (b) between nine and six months prior to every subsequent six years after the sixth anniversary of the granting of the permit.
- 3.1.7 The limits for landfill gas arising from the installation set out in schedule 3, tables S3.6 and S3.7 shall not be exceeded.
- 3.1.8 The limits for particulate matter arising from the installation set out in schedule 3, table S3.12 shall not be exceeded.
- 3.1.9 For the following activities referenced in schedule 1, table S1.1 (A1 to A4 etc.) Where a substance is specified in schedule 3 table S3.2 or S3.3 but no limit is set for it, the concentration of such substance in emissions to water from the relevant emission point shall be no greater than the background concentration.
- 3.1.10 Total annual emissions from the emission point(s) set out in tables schedule 3 S3.1, S3.2 and S3.3 of a substance listed in schedule 3 table S3.4 shall not exceed the relevant limit in table S3.4.

- 3.1.11 Periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination.

## **3.2 Emissions of substances not controlled by emission limits**

- 3.2.1 Emissions of substances not controlled by emission limits (excluding odour) shall not cause pollution. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved emissions management plan, have been taken to prevent or where that is not practicable, to minimise, those emissions.
- 3.2.2 The operator shall:
- (a) if notified by Natural Resources Wales that the activities are giving rise to pollution, submit to Natural Resources Wales for approval within the period specified, an emissions management plan which identifies and minimises the risks of pollution from emissions of substances not controlled by emission limits;
  - (b) implement the approved emissions management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.
- 3.2.3 All liquids in containers, whose emission to water or land could cause pollution, shall be provided with secondary containment, unless the operator has used other appropriate measures to prevent or where that is not practicable, to minimise, leakage and spillage from the primary container.

## **3.3 Monitoring**

- 3.3.1 The operator shall, unless otherwise agreed in writing by Natural Resources Wales, undertake the monitoring specified in the following tables in schedule 3 to this permit:
- (a) Leachate specified in tables S3.1 and S3.9;
  - (b) Point source emissions specified in tables S3.2, S3.3 and S3.4;
  - (c) Groundwater specified in tables S3.5 and S3.11;
  - (d) Landfill gas specified in table S3.6, S3.7 and S3.8;
  - (e) Surface water specified in table S3.10;
  - (f) Particulate matter specified in table S3.12;
  - (g) Separation bund topography as specified in table S3.13; and
  - (h) Separation bund inclination specified in table S3.13.
- 3.3.2 The operator shall maintain records of all monitoring required by this permit including records of the taking and analysis of samples, instrument measurements (periodic and continual), calibrations, examinations, tests and surveys and any assessment or evaluation made on the basis of such data.
- 3.3.3 A topographical survey of the site referenced to ordnance datum shall be carried out:
- (a) annually;
  - (b) prior to the disposal of waste in any new cell or new development area of the landfill; and
  - (c) following closure of the landfill or part of the landfill.

The topographical survey shall be used to produce a plan of a scale adequate to show the surveyed features of the site.

- 3.3.4 Monitoring equipment, techniques, personnel and organisations employed for the emissions monitoring programme and the environmental or other monitoring specified in condition 3.3.1 shall have either MCERTS certification or MCERTS accreditation (as appropriate), where available, unless otherwise agreed in writing by Natural Resources Wales.
- 3.3.5 Permanent means of access shall be provided to enable sampling/monitoring to be carried out in relation to the emission points specified in schedule 3 tables S3.1 to S3.2 unless otherwise agreed in writing by Natural Resources Wales.

### **3.4 Odour**

- 3.4.1 Emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable to minimise the odour.
- 3.4.2 The operator shall:
- (a) if notified by Natural Resources Wales that the activities are giving rise to pollution outside the site due to odour, submit to Natural Resources Wales for approval within the period specified, an odour management plan which identifies and minimises the risks of pollution from odour;
  - (b) implement the approved odour management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.

### **3.5 Noise and vibration**

- 3.5.1 Emissions from the activities shall be free from noise and vibration at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved noise and vibration management plan to prevent or where that is not practicable to minimise the noise and vibration.
- 3.5.2 The operator shall:
- (a) if notified by Natural Resources Wales that the activities are giving rise to pollution outside the site due to noise and vibration, submit to Natural Resources Wales for approval within the period specified, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration;
  - (b) implement the approved noise and vibration management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales.

### **3.6 Pests**

- 3.6.1 The activities shall not give rise to the presence of pests which are likely to cause pollution, hazard or annoyance outside the boundary of the site. The operator shall not be taken to have breached this condition if appropriate measures, including, but not limited to, those specified in any approved pests management plan, have been taken to prevent or where that is not practicable, to minimise the presence of pests on the site.
- 3.6.2 The operator shall:
- (a) if notified by Natural Resources Wales, submit to Natural Resources Wales for approval within the period specified, a pests management plan which identifies and minimises risks of pollution, hazard or annoyance from pests;

- (b) implement the pests management plan, from the date of approval, unless otherwise agreed in writing by Natural resources Wales

## **4 Information**

### **4.1 Records**

4.1.1 All records required to be made by this permit shall:

- (a) be legible;
- (b) be made as soon as reasonably practicable;
- (c) if amended, be amended in such a way that the original and any subsequent amendments remain legible, or are capable of retrieval; and
- (d) be retained, unless otherwise agreed in writing by Natural Resources Wales, for at least 6 years from the date when the records were made, or in the case of the following records until permit surrender:
  - (i) off-site environmental effects;
  - (ii) matters which affect the condition of the land and groundwater;
  - (iii) the results of groundwater monitoring;
  - (iv) sub-surface landfill gas monitoring;
  - (v) leachate levels, quality and quantities;
  - (vi) landfill gas generation and collection;
  - (vii) waste types and quantities;
  - (viii) the location of hazardous waste deposits;
  - (ix) the specification and as built drawings of the basal, sidewall and capping engineering systems; and
  - (x) the results of the asbestos cell separation bund topographic and inclination surveys.

4.1.2 The operator shall keep on site all records, plans and the management system required to be maintained by this permit, unless otherwise agreed in writing by Natural Resources Wales.

### **4.2 Reporting**

4.2.1 The operator shall send all reports and notifications required by the permit to Natural Resources Wales using the contact details supplied in writing by Natural Resources Wales.

4.2.2 A report or reports on the performance of the activities over the previous year shall be submitted to Natural Resources Wales by 31 January (or other date agreed in writing by Natural Resources Wales) each year. The report(s) shall include as a minimum:

- (a) a review of the results of the monitoring and assessment carried out in accordance with the permit including an interpretive review of that data;
  - (b) the energy consumed at the site, reported in the format set out in schedule 4 table S4.3;
  - (c) the annual production /treatment data set out in schedule 4 table S4.2;
  - (d) the topographical surveys required by condition 3.5.3 other than those submitted as part of a CQA validation report;
  - (e) the volumetric difference (reported in cubic metres) between the most recent topographical survey and the previous annual topographical survey i.e. the additional volume of the landfill void that is occupied by waste;
  - (f) an assessment of the settlement behaviour of the landfill body based on the difference between the most recent topographical survey and previous annual topographical survey for the areas of the landfill which did not receive waste between the surveys;
  - (g) a calculation of the remaining capacity (reported in cubic metres) derived from the pre-settlement contours and the most recent topographical survey;
  - (h) an assessment of the deformation behaviour of the separation bund based on the results of topographic surveys and inclinometer readings together with a comparison of this measured deformation to the deformation predicted during the Stability Risk Assessment Review until completion of the asbestos cell; and
  - (i) the performance parameters set out in schedule 4 table S4.3 using the forms specified in table S4.4 of that schedule.
- 4.2.3 Within 28 days of the end of the reporting period the operator shall, unless otherwise agreed in writing by Natural Resources Wales, submit reports of the monitoring and assessment carried out in accordance with the conditions of this permit, as follows:
- (a) in respect of the parameters and emission points specified in schedule 4 table S4.1;
  - (b) for the reporting periods specified in schedule 4 table S4.1 and using the forms specified in schedule 4 table S4.4 ; and
  - (c) giving the information from such results and assessments as may be required by the forms specified in those tables.
- 4.2.4 The operator shall, unless notice under this condition has been served within the preceding four years, submit to Natural Resources Wales, within six months of receipt of a written notice, a report assessing whether there are other appropriate measures that could be taken to prevent, or where that is not practicable, to minimise pollution.
- 4.2.5 Within 1 month of the end of each quarter, the operator shall submit to Natural Resources Wales using the form made available for the purpose, the information specified on the form relating to the site and the waste accepted and removed from it during the previous quarter.

## 4.3 Notifications

- 4.3.1 (a) In the event that the operation of the activities gives rise to an incident or accident which significantly affects or may significantly affect the environment, the operator must immediately—
- (i) inform Natural Resources Wales,
  - (ii) take the measures necessary to limit the environmental consequences of such an incident or accident, and
  - (iii) take the measures necessary to prevent further possible incidents or accidents;
- (b) in the event of a breach of any permit condition the operator must immediately—
- (i) inform Natural Resources Wales, and
  - (ii) take the measures necessary to ensure that compliance is restored within the shortest possible time;
- (c) in the event of a breach of permit condition which poses an immediate danger to human health or threatens to cause an immediate significant adverse effect on the environment, the operator must immediately suspend the operation of the activities or the relevant part of it until compliance with the permit conditions has been restored.
- 4.3.2 Any information provided under condition 4.3.1 (a)(i), or 4.3.1 (b)(i) shall be confirmed by sending the information listed in schedule 5 to this permit within the time period specified in that schedule.
- 4.3.3 Where Natural Resources Wales has requested in writing that it shall be notified when the operator is to undertake monitoring and/or spot sampling, the operator shall inform Natural Resources Wales when the relevant monitoring and/or spot sampling is to take place. The operator shall provide this information to Natural Resources Wales at least 14 days before the date the monitoring is to be undertaken.
- 4.3.4 Natural Resources Wales shall be notified within 14 days of the occurrence of the following matters, except where such disclosure is prohibited by Stock Exchange rules:
- Where the operator is a registered company:
- (a) any change in the operator's trading name, registered name or registered office address; and
  - (b) any steps taken with a view to the operator going into administration, entering into a company voluntary arrangement or being wound up.
- Where the operator is a corporate body other than a registered company:
- (a) any change in the operator's name or address; and
  - (b) any steps taken with a view to the dissolution of the operator.
- In any other case:
- (a) the death of any of the named operators (where the operator consists of more than one named individual);
  - (b) any change in the operator's name(s) or address(es); and

- (c) any steps taken with a view to the operator, or any one of them, going into bankruptcy, entering into a composition or arrangement with creditors, or, in the case of them being in a partnership, dissolving the partnership.
- 4.3.5 Where the operator proposes to make a change in the nature or functioning, or an extension of the activities, which may have consequences for the environment and the change is not otherwise the subject of an application for approval under the Regulations or this permit:
  - (a) Natural Resources Wales shall be notified at least 14 days before making the change; and
  - (b) the notification shall contain a description of the proposed change in operation.
- 4.3.6 Natural Resources Wales shall be given at least 14 days notice before implementation of any part of the site closure plan.

## **4.4 Interpretation**

- 4.4.1 In this permit the expressions listed in schedule 6 shall have the meaning given in that schedule.
- 4.4.2 In this permit references to reports and notifications mean written reports and notifications, except where reference is made to notification being made “without delay”, in which case it may be provided by telephone.

# Schedule 1 - Operations

**Table S1.1 activities**

| Activity reference                  | Activity listed in Schedule 1 of the EP Regulations                                                                                | Description of specified activity and WFD Annex I and II operations                                                                                                                                                                                                               | Limits of specified activity                                                                                                                              |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| A1                                  | S5.2 A(1)(a) The disposal of waste in a landfill                                                                                   | Landfill for non-hazardous waste<br><br>D5: Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.)                                                                                     | Receipt, handling, storage and disposal of wastes, consisting of the types and quantities specified in conditions 2.3 as an integral part of landfilling. |
| A2                                  | S5.4 A(1)(a)(i) Disposal of non-hazardous waste in a facility with a capacity exceeding 50 tonnes per day by biological treatment. | Storage and treatment of leachate in a facility with a capacity of >50 tonnes/day.<br><br>D8: Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12. | Leachate arising from the landfill.                                                                                                                       |
| <b>Directly Associated Activity</b> |                                                                                                                                    |                                                                                                                                                                                                                                                                                   |                                                                                                                                                           |
| A3                                  | Burning of waste as a fuel.                                                                                                        | Combustion of landfill gas for the purpose of electricity generation.                                                                                                                                                                                                             | Landfill gas arising from the landfill.                                                                                                                   |
| A4                                  | Landfill gas flaring.                                                                                                              | Flaring of landfill gas for disposal in an appliance.                                                                                                                                                                                                                             | Landfill gas arising from the landfill.                                                                                                                   |
| A5                                  | Effluent discharge to sewer.                                                                                                       | Discharge of treated leachate to sewer.                                                                                                                                                                                                                                           | Leachate arising from the landfill.                                                                                                                       |
| A6                                  | Water discharges to controlled waters.                                                                                             | Discharges of site drainage from the landfill.                                                                                                                                                                                                                                    | From surface water management system to point of entry to controlled waters.                                                                              |
| A7                                  | Fuel storage.                                                                                                                      | Storage of fuel for operation of plant and equipment.                                                                                                                                                                                                                             | From storage of fuel to use in the operation of plant and equipment.                                                                                      |
| A8                                  | Storage of other raw materials including lubricating oils and antifreeze.                                                          | Storage in bulk storage tanks.                                                                                                                                                                                                                                                    | From receipt of raw materials to their use within the installation.                                                                                       |
| A9                                  | Production and storage of waste oils.                                                                                              | Production of waste oil during the operation of the listed activity and subsequent storage.                                                                                                                                                                                       | From the production of the waste to storage at the installation prior to removal by a third party.                                                        |

**Table S1.1 activities**

| Activity reference | Activity listed in Schedule 1 of the EP Regulations |                                                                                                                                    | Description of specified activity and WFD Annex I and II operations                                                                                                                    | Limits of specified activity                                                                                                                                                                              |
|--------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A10                | Landfill                                            |                                                                                                                                    | R10: Land treatment resulting in benefit to agriculture or ecological improvement                                                                                                      | Recovery of waste (specified within Table S2.3) for restoration above the landfill cap                                                                                                                    |
| A11                | Multipurpose waste treatment and remediation pad    | Waste treatment facility (WTF)                                                                                                     | R5: Recycling/reclamation of other inorganic products.                                                                                                                                 | WTF can treat up to 30,000 tonnes of hazardous soils per year.                                                                                                                                            |
|                    |                                                     | S5.3 A(1)(a)(i): Recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving biological treatment.           | R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it was produced).                          | Waste shall be treated on an impermeable surface.                                                                                                                                                         |
|                    |                                                     | S5.4 A(1)(b)(i): Recovery of non-hazardous waste soils with a capacity exceeding 75 tonnes per day involving biological treatment. | D8: Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D1 to D 12. | Waste accepted shall be pre-booked and characterised prior to acceptance to confirm accepted materials are suitable and can be treated.                                                                   |
|                    |                                                     | S5.6 A(1)(a): Temporary storage of hazardous waste with a total capacity exceeding 50 tonnes.                                      | D15: Storage pending any of the operations numbered D1 to D14 (excluding temporary storage, pending collection, on the site where it was produced).                                    | All loads of waste shall be visually inspected before accepting the waste for deposit.<br><br>The treatment pad and associated WTF infrastructure shall have sufficient low level bunding surrounding it. |

**Table S1.1 activities**

| Activity reference | Activity listed in Schedule 1 of the EP Regulations | Description of specified activity and WFD Annex I and II operations                                                                                                                                                                                  | Limits of specified activity                                                                                                                                                                                                                                                                                               |
|--------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | Green waste composting facility (GWCF)              | R3: Recycling/reclamation of organic substances which are not used as solvents.<br><br>R13: Storage of wastes pending any of the operations numbered R1 to R12 (excluding temporary storage, pending collection, on the site where it was produced). | GWCF can treat up to 75,000 tonnes of source segregated green wastes per year in accordance with SR2012 No.8.<br><br>Composting operations shall take place on an impermeable surfaced pad.<br><br>The composting area of the pad shall be surrounded by low level bunding to prevent the escape of material and leachate. |

**Table S1.2 Operating techniques**

| Description | Parts                                                                                                                                                   | Date Received |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Application | The response to questions 2.1, 2.2, 2.3, 2.4 and 2.5 in part B of the Application;                                                                      | 07/05/2004    |
|             | The response to questions raised to the Schedule 4 Further Information Notice dated 21 <sup>st</sup> July 2004;                                         | 01/09/2004    |
|             | The e-mail from Biffa Waste Services Limited confirming that the Application should include the European Waste Code 16 01 03 as a permitted waste type; | 08/03/2005    |

**Table S1.2 Operating techniques**

| Description                                                           | Parts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Date Received |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
|                                                                       | <p>With the following exclusions:</p> <ul style="list-style-type: none"> <li>• Response to question B2.1.1</li> <li>• Response to question B2.1.5; and</li> <li>• Response to question B2.2.36 insofar as it applies to monitoring of the surface water discharge; and</li> <li>• Response to question B2.2.65 insofar as particulate monitoring is not carried out in accordance with Agency guidance 'M17 - Monitoring of particulate matter in ambient air around waste facilities'; and</li> <li>• Response to question B2.2.31 insofar as it applies to the leachate head control and trigger levels; and</li> <li>• The proposed methane trigger level for landfill gas boreholes 1-3 as detailed in Table LFGRA21 of the Landfill Gas Risk Assessment; and</li> <li>• Response to question B3.1.10 insofar as the proposed CO emission level for the future landfill gas flares (Haase HTN) as detailed in Table LFGRA23 of the Landfill Gas Risk Assessment; and</li> <li>• Table 2.10.1 of the generic part B form insofar as it applies to the daily frequency for the monitoring of suspended solids; and</li> <li>• The paragraph titled Perimeter Borehole Location and Spacing of section 3.3.2 of the Landfill Gas Risk assessment submitted as part of the Application; and</li> <li>• Section 3.3.3 of the Landfill Gas Risk Assessment submitted as part of the Application; and</li> <li>• Drawing ESID 4a, entitled 'Site Layout and Waste Deposition' and dated 04/05/04 insofar as it has been superseded by Drawing ESID 4a Rev. 1, entitled 'Site Layout and Waste Deposition' dated 27/08/04; and</li> <li>• Drawing ESID7b, entitled 'Leachate Management Construction Details' and dated insofar as it has been superseded by Drawing ESID7b Rev. 1 dated 04/05/04.</li> </ul> |               |
| Provision of information                                              | Particulate monitoring information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 17/06/2005    |
| Provision of information                                              | Report in response to improvement condition 15a, dated 8 <sup>th</sup> September 2005, on the trace gases found in BH5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | -             |
| Variation application – Remove SNRHW and asbestos waste Ref. DP3037UY | All parts, removing provision to construct a separate cell(s) for SNRHW and asbestos wastes, as detailed on Drawings ESID 4a Rev. 1, and Drawing ESID 4b.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 17/12/2007    |
| Variation application – LFG Engines Ref. YP3037UA                     | The response to questions C2.1 and C2.2 and given in section 1.2, Table 1/1 and Appendix 2 of the Variation Supporting Statement reference 407-0034-00246-002/SS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 28/09/2007    |
| Provision of information                                              | Report 08514290139.500/B.0 on landfill gas management Trecatti landfill site dated March 2009                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -             |
|                                                                       | Action plan for the investigation of the exceedance of groundwater trigger levels in borehole GW2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 21/05/2016    |

**Table S1.2 Operating techniques**

| <b>Description</b>                                                                                           | <b>Parts</b>                                                                                                                                                                                 | <b>Date Received</b> |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Variation application<br>EPR/RP3733PC/V008                                                                   | Supporting Statement – Section 2 – Summary of Additional Management Techniques – Report Reference BF4857/04<br><br>Construction and Operational Management Plan – Report Reference BF4858/01 | 16/05/2014           |
| Stability Risk Assessment Review:<br>BF4857/SRA Revision 1 Final issue                                       | All parts                                                                                                                                                                                    | 25/09/2014           |
| Nuisance and Health Risk Assessment – Report Reference BF4857/09 rev02                                       | All                                                                                                                                                                                          | 21/10/2014           |
| Letter from Stratus in response to concerns relating to stability risk Assessment – Reference BF4858/2/RW001 | N/A                                                                                                                                                                                          | 02/12/2014           |
| Substantial variation application<br>EPR/RP3733PC/V009                                                       | All                                                                                                                                                                                          | 04/08/2015           |

**Table S1.3 Improvement programme requirements**

| <b>Reference</b> | <b>Requirement</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Date</b> |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1                | The operator is to implement a geotechnical monitoring system as described in the Stability Risk Assessment Review (SNRHW Cell revision 1 dated September 2014) and is to be monitored at the intervals stated. The monitoring data is to be reviewed annually, compared with the finite element models and the results reported to Natural Resources Wales for approval.                                                                                                                                           | Complete    |
| 2                | The operator is to submit for approval by Natural Resources Wales a plan showing additional monitoring points for airborne asbestos fibres at the eastern and northern most perimeter of the site.                                                                                                                                                                                                                                                                                                                  | Complete    |
| 3                | The operator is to carry out background monitoring to establish baseline levels of airborne asbestos fibre levels prior to disposal of any asbestos wastes. Once a baseline is established all monitoring points are to be monitored on a 6 monthly basis.                                                                                                                                                                                                                                                          | Complete    |
| 4                | The Operator is to provide a report quantifying how much inert waste is accepted for disposal, how much is to be utilised for engineering purposes and how much will be required for restoration purposes. Using this information the Operator is to provide a restoration plan specifying appropriate quantities, waste acceptance criteria and waste acceptance procedures for approval to Natural Resources Wales. Upon approval, this Restoration Plan will be incorporated into the Operators Management Plan. | Complete    |

## Schedule 2 - Waste types, raw materials and fuels

**Table S2.1 Raw materials and fuels**

| Raw materials and fuel description | Specification |
|------------------------------------|---------------|
| Lubricants (oil and grease)        | -             |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| Waste code   | Description                                                                                                                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>01</b>    | <b>WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING, AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS</b>                                                                                                          |
| <b>01 01</b> | <b>wastes from mineral excavation</b>                                                                                                                                                                                 |
| 01 01 01     | wastes from mineral metalliferous excavation                                                                                                                                                                          |
| 01 01 02     | wastes from mineral non-metalliferous excavation                                                                                                                                                                      |
| <b>01 03</b> | <b>wastes from physical and chemical processing of metalliferous minerals</b>                                                                                                                                         |
| 01 03 06     | tailings other than those mentioned in 01 03 04 and 01 03 05                                                                                                                                                          |
| 01 03 08     | dusty and powdery wastes other than those mentioned in 01 03 07                                                                                                                                                       |
| 01 03 09     | red mud from alumina production other than the wastes mentioned in 01 03 07                                                                                                                                           |
| <b>01 04</b> | <b>wastes from physical and chemical processing of non-metalliferous minerals</b>                                                                                                                                     |
| 01 04 08     | waste gravel and crushed rocks other than those mentioned in 01 04 07                                                                                                                                                 |
| 01 04 09     | waste sand and clays                                                                                                                                                                                                  |
| 01 04 10     | dusty and powdery wastes other than those mentioned in 01 04 07                                                                                                                                                       |
| 01 04 11     | wastes from potash and rock salt processing other than those mentioned in 01 04 07                                                                                                                                    |
| 01 04 12     | tailings and other wastes from washing and cleaning of minerals other than those mentioned in 01 04 07 and 01 04 11                                                                                                   |
| 01 04 13     | wastes from stone cutting and sawing other than those mentioned in 01 04 07                                                                                                                                           |
| <b>01 05</b> | <b>drilling muds and other drilling wastes</b>                                                                                                                                                                        |
| 01 05 04     | freshwater drilling muds and wastes                                                                                                                                                                                   |
| 01 05 07     | barite-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06                                                                                                                        |
| 01 05 08     | chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06                                                                                                                      |
| <b>02</b>    | <b>WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING</b>                                                                                             |
| <b>02 01</b> | <b>wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing</b>                                                                                                                              |
| 02 01 01     | sludges from washing and cleaning                                                                                                                                                                                     |
| 02 01 02     | animal-tissue waste                                                                                                                                                                                                   |
| 02 01 03     | plant-tissue waste                                                                                                                                                                                                    |
| 02 01 04     | waste plastics (except packaging)                                                                                                                                                                                     |
| 02 01 06     | animal faeces, urine and manure (including spoiled straw), effluent, collected separately and treated off-site                                                                                                        |
| 02 01 07     | wastes from forestry                                                                                                                                                                                                  |
| 02 01 09     | agrochemical waste other than those mentioned in 02 01 08                                                                                                                                                             |
| 02 01 10     | waste metal                                                                                                                                                                                                           |
| <b>02 02</b> | <b>wastes from the preparation and processing of meat, fish and other foods of animal origin</b>                                                                                                                      |
| 02 02 01     | sludges from washing and cleaning                                                                                                                                                                                     |
| 02 02 03     | materials unsuitable for consumption or processing                                                                                                                                                                    |
| 02 02 04     | sludges from on-site effluent treatment                                                                                                                                                                               |
| <b>02 03</b> | <b>wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation</b> |
| 02 03 01     | sludges from washing, cleaning, peeling, centrifuging and separation                                                                                                                                                  |
| 02 03 02     | wastes from preserving agents                                                                                                                                                                                         |
| 02 03 03     | wastes from solvent extraction                                                                                                                                                                                        |
| 02 03 04     | materials unsuitable for consumption or processing                                                                                                                                                                    |
| 02 03 05     | sludges from on-site effluent treatment                                                                                                                                                                               |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                                        |
|-------------------|-----------------------------------------------------------------------------------------------------------|
| <b>02 04</b>      | <b>wastes from sugar processing</b>                                                                       |
| 02 04 01          | soil from cleaning and washing beet                                                                       |
| 02 04 02          | off-specification calcium carbonate                                                                       |
| 02 04 03          | sludges from on-site effluent treatment                                                                   |
| <b>02 05</b>      | <b>wastes from the dairy products industry</b>                                                            |
| 02 05 01          | materials unsuitable for consumption or processing                                                        |
| 02 05 02          | sludges from on-site effluent treatment                                                                   |
| <b>02 06</b>      | <b>wastes from the baking and confectionery industry</b>                                                  |
| 02 06 01          | materials unsuitable for consumption or processing                                                        |
| 02 06 02          | wastes from preserving agents                                                                             |
| 02 06 03          | sludges from on-site effluent treatment                                                                   |
| <b>02 07</b>      | <b>wastes from the production of alcoholic and non-alcoholic beverages (except coffee, tea and cocoa)</b> |
| 02 07 01          | wastes from washing, cleaning and mechanical reduction of raw materials                                   |
| 02 07 02          | wastes from spirits distillation                                                                          |
| 02 07 03          | wastes from chemical treatment                                                                            |
| 02 07 04          | materials unsuitable for consumption or processing                                                        |
| 02 07 05          | sludges from on-site effluent treatment                                                                   |
| <b>03</b>         | <b>WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD</b>  |
| <b>03 01</b>      | <b>wastes from wood processing and the production of panels and furniture</b>                             |
| 03 01 01          | waste bark and cork                                                                                       |
| 03 01 05          | sawdust, shavings, cuttings, wood, particle board and veneer other than those mentioned in 03 01 04       |
| <b>03 03</b>      | <b>wastes from pulp, paper and cardboard production and processing</b>                                    |
| 03 03 01          | waste bark and wood                                                                                       |
| 03 03 02          | green liquor sludge (from recovery of cooking liquor)                                                     |
| 03 03 05          | de-inking sludges from paper recycling                                                                    |
| 03 03 07          | mechanically separated rejects from pulping of waste paper and cardboard                                  |
| 03 03 08          | wastes from sorting of paper and cardboard destined for recycling                                         |
| 03 03 09          | lime mud waste                                                                                            |
| 03 03 10          | fibre rejects, fibre-, filler- and coating-sludges from mechanical separation                             |
| 03 03 11          | sludges from on-site effluent treatment other than those mentioned in 03 03 10                            |
| <b>04</b>         | <b>WASTES FROM THE LEATHER, FUR AND TEXTILE INDUSTRIES</b>                                                |
| <b>04 01</b>      | <b>wastes from the leather and fur industry</b>                                                           |
| 04 01 01          | fleshings and lime split wastes                                                                           |
| 04 01 02          | liming waste                                                                                              |
| 04 01 06          | sludges, in particular from on-site effluent treatment containing chromium                                |
| 04 01 07          | sludges, in particular from on-site effluent treatment free of chromium                                   |
| 04 01 08          | waste tanned leather (blue sheetings, shavings, cuttings, buffing dust) containing chromium               |
| 04 01 09          | wastes from dressing and finishing                                                                        |
| <b>04 02</b>      | <b>wastes from the textile industry</b>                                                                   |
| 04 02 09          | wastes from composite materials (impregnated textile, elastomer, plastomer)                               |
| 04 02 10          | organic matter from natural products (for example grease, wax)                                            |
| 04 02 17          | dyestuffs and pigments other than those mentioned in 04 02 16                                             |
| 04 02 20          | sludges from on-site effluent treatment other than those mentioned in 04 02 19                            |
| 04 02 21          | wastes from unprocessed textile fibres                                                                    |
| 04 02 22          | wastes from processed textile fibres                                                                      |
| <b>05</b>         | <b>WASTES FROM PETROLEUM REFINING, NATURAL GAS PURIFICATION AND PYROLYTIC TREATMENT OF COAL</b>           |
| <b>05 01</b>      | <b>wastes from petroleum refining</b>                                                                     |
| 05 01 10          | sludges from on-site effluent treatment other than those mentioned in 05 01 09                            |
| 05 01 13          | boiler feedwater sludges                                                                                  |
| 05 01 14          | wastes from cooling columns                                                                               |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                                                                                                 |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 05 01 16          | sulphur-containing wastes from petroleum desulphurisation                                                                                                          |
| 05 01 17          | bitumen                                                                                                                                                            |
| <b>05 06</b>      | <b>wastes from the pyrolytic treatment of coal</b>                                                                                                                 |
| 05 06 04          | waste from cooling columns                                                                                                                                         |
| <b>05 07</b>      | <b>wastes from natural gas purification and transportation</b>                                                                                                     |
| 05 07 02          | wastes containing sulphur                                                                                                                                          |
| <b>06</b>         | <b>WASTES FROM INORGANIC CHEMICAL PROCESSES</b>                                                                                                                    |
| <b>06 03</b>      | <b>wastes from the MFSU of salts and their solutions and metallic oxides</b>                                                                                       |
| 06 03 14          | solid salts and solutions other than those mentioned in 06 03 11 and 06 03 13                                                                                      |
| 06 03 16          | metallic oxides other than those mentioned in 06 03 15                                                                                                             |
| <b>06 05</b>      | <b>sludges from on-site effluent treatment</b>                                                                                                                     |
| 06 05 03          | sludges from on-site effluent treatment other than those mentioned in 06 05 02                                                                                     |
| <b>06 09</b>      | <b>wastes from the MFSU of phosphorous chemicals and phosphorous chemical processes</b>                                                                            |
| 06 09 02          | phosphorous slag                                                                                                                                                   |
| 06 09 04          | calcium-based reaction wastes other than those mentioned in 06 09 03                                                                                               |
| <b>06 11</b>      | <b>wastes from the manufacture of inorganic pigments and opacifiers</b>                                                                                            |
| 06 11 01          | calcium-based reaction wastes from titanium dioxide production                                                                                                     |
| <b>06 13</b>      | <b>wastes from inorganic chemical processes not otherwise specified</b>                                                                                            |
| 06 13 03          | carbon black                                                                                                                                                       |
| <b>07</b>         | <b>WASTES FROM ORGANIC CHEMICAL PROCESSES</b>                                                                                                                      |
| <b>07 01</b>      | <b>wastes from the manufacture, formulation, supply and use (MFSU) of basic organic chemicals</b>                                                                  |
| 07 01 12          | sludges from on-site effluent treatment other than those mentioned in 07 01 11                                                                                     |
| <b>07 02</b>      | <b>wastes from the MFSU of plastics, synthetic rubber and man-made fibres</b>                                                                                      |
| 07 02 12          | sludges from on-site effluent treatment other than those mentioned in 07 02 11                                                                                     |
| 07 02 13          | waste plastic                                                                                                                                                      |
| 07 02 15          | wastes from additives other than those mentioned in 07 02 14                                                                                                       |
| 07 02 17          | wastes containing silicones other than those mentioned in 07 02 16                                                                                                 |
| <b>07 03</b>      | <b>wastes from the MFSU of organic dyes and pigments (except 06 11)</b>                                                                                            |
| 07 03 12          | sludges from on-site effluent treatment other than those mentioned in 07 03 11                                                                                     |
| <b>07 04</b>      | <b>wastes from the MFSU of organic plant protection products (except 02 01 08 and 02 01 09), wood preserving agents (except 03 02) and other biocides</b>          |
| 07 04 12          | sludges from on-site effluent treatment other than those mentioned in 07 04 11                                                                                     |
| <b>07 05</b>      | <b>wastes from the MFSU of pharmaceuticals</b>                                                                                                                     |
| 07 05 12          | sludges from on-site effluent treatment other than those mentioned in 07 05 11                                                                                     |
| 07 05 14          | solid wastes other than those mentioned in 07 05 13                                                                                                                |
| <b>07 06</b>      | <b>wastes from the MFSU of fats, grease, soaps, detergents, disinfectants and cosmetics</b>                                                                        |
| 07 06 12          | sludges from on-site effluent treatment other than those mentioned in 07 06 11                                                                                     |
| <b>07 07</b>      | <b>wastes from the MFSU of fine chemicals and chemical products not otherwise specified</b>                                                                        |
| 07 07 12          | sludges from on-site effluent treatment other than those mentioned in 07 07 11                                                                                     |
| <b>08</b>         | <b>WASTES FROM THE MANUFACTURE, FORMULATION, SUPPLY AND USE (MFSU) OF COATINGS (PAINTS, VARNISHES AND VITREOUS ENAMELS), ADHESIVES, SEALANTS AND PRINTING INKS</b> |
| <b>08 01</b>      | <b>wastes from MFSU and removal of paint and varnish</b>                                                                                                           |
| 08 01 12          | waste paint and varnish other than those mentioned in 08 01 11                                                                                                     |
| 08 01 14          | sludges from paint or varnish other than those mentioned in 08 01 13                                                                                               |
| 08 01 16          | aqueous sludges containing paint or varnish other than those mentioned in 08 01 15                                                                                 |
| 08 01 18          | wastes from paint or varnish removal other than those mentioned in 08 01 17                                                                                        |
| <b>08 02</b>      | <b>wastes from MFSU of other coatings (including ceramic materials)</b>                                                                                            |
| 08 02 01          | waste coating powders                                                                                                                                              |
| 08 02 02          | aqueous sludges containing ceramic materials                                                                                                                       |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                            |
|-------------------|-----------------------------------------------------------------------------------------------|
| <b>08 03</b>      | <b>wastes from MFSU of printing inks</b>                                                      |
| 08 03 07          | aqueous sludges containing ink                                                                |
| 08 03 13          | waste ink other than those mentioned in 08 03 12                                              |
| 08 03 15          | ink sludges other than those mentioned in 08 03 14                                            |
| 08 03 18          | waste printing toner other than those mentioned in 08 03 17                                   |
| <b>08 04</b>      | <b>wastes from MFSU of adhesives and sealants (including waterproofing products)</b>          |
| 08 04 10          | waste adhesives and sealants other than those mentioned in 08 04 09                           |
| 08 04 12          | adhesive and sealant sludges other than those mentioned in 08 04 11                           |
| 08 04 14          | aqueous sludges containing adhesives or sealants other than those mentioned in 08 04 13       |
| <b>09</b>         | <b>WASTES FROM THE PHOTOGRAPHIC INDUSTRY</b>                                                  |
| <b>09 01</b>      | <b>wastes from the photographic industry</b>                                                  |
| 09 01 07          | photographic film and paper containing silver or silver compounds                             |
| 09 01 08          | photographic film and paper free of silver or silver compounds                                |
| 09 01 10          | single-use cameras without batteries                                                          |
| 09 01 12          | single-use cameras containing batteries other than those mentioned in 09 01 11                |
| <b>10</b>         | <b>WASTES FROM THERMAL PROCESSES</b>                                                          |
| <b>10 01</b>      | <b>wastes from power stations and other combustion plants (except 19)</b>                     |
| 10 01 01          | bottom ash, slag and boiler dust (excluding boiler dust mentioned in 10 01 04)                |
| 10 01 02          | coal fly ash                                                                                  |
| 10 01 03          | fly ash from peat and untreated wood                                                          |
| 10 01 05          | calcium-based reaction wastes from flue-gas desulphurisation in solid form                    |
| 10 01 15          | bottom ash, slag and boiler dust from co-incineration other than those mentioned in 10 01 14  |
| 10 01 17          | fly ash from co-incineration other than those mentioned in 10 01 16                           |
| 10 01 19          | wastes from gas cleaning other than those mentioned in 10 01 05, 10 01 07 and 10 01 18        |
| 10 01 21          | sludges from on-site effluent treatment other than those mentioned in 10 01 20                |
| 10 01 23          | aqueous sludges from boiler cleansing other than those mentioned in 10 01 22                  |
| 10 01 24          | sands from fluidised beds                                                                     |
| 10 01 25          | wastes from fuel storage and preparation of coal-fired power plants                           |
| 10 01 26          | wastes from cooling-water treatment                                                           |
| <b>10 02</b>      | <b>wastes from the iron and steel industry</b>                                                |
| 10 02 01          | wastes from the processing of slag                                                            |
| 10 02 02          | unprocessed slag                                                                              |
| 10 02 08          | solid wastes from gas treatment other than those mentioned in 10 02 07                        |
| 10 02 10          | mill scales                                                                                   |
| 10 02 14          | sludges and filter cakes from gas treatment other than those mentioned in 10 02 13            |
| 10 02 15          | other sludges and filter cakes                                                                |
| <b>10 03</b>      | <b>wastes from aluminium thermal metallurgy</b>                                               |
| 10 03 02          | anode scraps                                                                                  |
| 10 03 05          | waste alumina                                                                                 |
| 10 03 16          | skimmings other than those mentioned in 10 03 15                                              |
| 10 03 18          | carbon-containing wastes from anode manufacture other than those mentioned in 10 03 17        |
| 10 03 20          | flue-gas dust other than those mentioned in 10 03 19                                          |
| 10 03 22          | other particulates and dust (including ball-mill dust) other than those mentioned in 10 03 21 |
| 10 03 24          | solid wastes from gas treatment other than those mentioned in 10 03 23                        |
| 10 03 26          | sludges and filter cakes from gas treatment other than those mentioned in 10 03 25            |
| 10 03 28          | wastes from cooling-water treatment other than those mentioned in 10 03 27                    |
| 10 03 30          | wastes from treatment of salt slags and black drosses other than those mentioned in 10 03 29  |
| <b>10 04</b>      | <b>wastes from lead thermal metallurgy</b>                                                    |
| 10 04 10          | wastes from cooling-water treatment other than those mentioned in 10 04 09                    |
| <b>10 05</b>      | <b>wastes from zinc thermal metallurgy</b>                                                    |
| 10 06 01          | slags from primary and secondary production                                                   |
| 10 06 04          | other particulates and dust                                                                   |
| 10 05 11          | dross and skimmings other than those mentioned in 10 05 10                                    |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                                |
|-------------------|---------------------------------------------------------------------------------------------------|
| <b>10 06</b>      | <b>wastes from copper thermal metallurgy</b>                                                      |
| 10 06 01          | slags from primary and secondary production                                                       |
| 10 06 02          | dross and skimmings from primary and secondary production                                         |
| 10 06 04          | other particulates and dust                                                                       |
| 10 06 10          | wastes from cooling-water treatment other than those mentioned in 10 06 09                        |
| <b>10 07</b>      | <b>wastes from silver, gold and platinum thermal metallurgy</b>                                   |
| 10 07 01          | slags from primary and secondary production                                                       |
| 10 07 02          | dross and skimmings from primary and secondary production                                         |
| 10 07 03          | solid wastes from gas treatment                                                                   |
| 10 07 04          | other particulates and dust                                                                       |
| 10 07 05          | sludges and filter cakes from gas treatment                                                       |
| 10 07 08          | wastes from cooling-water treatment other than those mentioned in 10 07 07                        |
| <b>10 08</b>      | <b>wastes from other non-ferrous thermal metallurgy</b>                                           |
| 10 08 04          | particulates and dust                                                                             |
| 10 08 09          | other slags                                                                                       |
| 10 08 11          | dross and skimmings other than those mentioned in 10 08 10                                        |
| 10 08 13          | carbon-containing wastes from anode manufacture other than those mentioned in 10 08 12            |
| 10 08 14          | anode scrap                                                                                       |
| 10 08 16          | flue-gas dust other than those mentioned in 10 08 15                                              |
| 10 08 18          | sludges and filter cakes from flue-gas treatment other than those mentioned in 10 08 17           |
| 10 08 20          | wastes from cooling-water treatment other than those mentioned in 10 08 19                        |
| <b>10 09</b>      | <b>wastes from casting of ferrous pieces</b>                                                      |
| 10 09 03          | furnace slag                                                                                      |
| 10 09 06          | casting cores and moulds which have not undergone pouring other than those mentioned in 10 09 05  |
| 10 09 08          | casting cores and moulds which have undergone pouring other than those mentioned in 10 09 07      |
| 10 09 10          | flue-gas dust other than those mentioned in 10 09 09                                              |
| 10 09 12          | other particulates other than those mentioned in 10 09 11                                         |
| 10 09 14          | waste binders other than those mentioned in 10 09 13                                              |
| <b>10 10</b>      | <b>wastes from casting of non-ferrous pieces</b>                                                  |
| 10 10 03          | furnace slag                                                                                      |
| 10 10 06          | casting cores and moulds which have not undergone pouring, other than those mentioned in 10 10 05 |
| 10 10 08          | casting cores and moulds which have undergone pouring, other than those mentioned in 10 10 07     |
| 10 10 10          | flue-gas dust other than those mentioned in 10 10 09                                              |
| 10 10 12          | other particulates other than those mentioned in 10 10 11                                         |
| 10 10 14          | waste binders other than those mentioned in 10 10 13                                              |
| <b>10 11</b>      | <b>wastes from manufacture of glass and glass products</b>                                        |
| 10 11 03          | waste glass-based fibrous materials                                                               |
| 10 11 05          | particulates and dust                                                                             |
| 10 11 10          | waste preparation mixture before thermal processing, other than those mentioned in 10 11 09       |
| 10 11 12          | waste glass other than those mentioned in 10 11 11                                                |
| 10 11 16          | solid wastes from flue-gas treatment other than those mentioned in 10 11 15                       |
| 10 11 18          | sludges and filter cakes from flue-gas treatment other than those mentioned in 10 11 17           |
| 10 11 20          | solid wastes from on-site effluent treatment other than those mentioned in 10 11 19               |
| <b>10 12</b>      | <b>wastes from manufacture of ceramic goods, bricks, tiles and construction products</b>          |
| 10 12 01          | waste preparation mixture before thermal processing                                               |
| 10 12 03          | particulates and dust                                                                             |
| 10 12 05          | sludges and filter cakes from gas treatment                                                       |
| 10 12 06          | discarded moulds                                                                                  |
| 10 12 08          | waste ceramics, bricks, tiles and construction products (after thermal processing)                |
| 10 12 10          | solid wastes from gas treatment other than those mentioned in 10 12 09                            |
| 10 12 12          | wastes from glazing other than those mentioned in 10 12 11                                        |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                                                                                                                                                           |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10 12 13          | sludge from on-site effluent treatment                                                                                                                                                                                       |
| <b>10 13</b>      | <b>wastes from manufacture of cement, lime and plaster and articles and products made from them</b>                                                                                                                          |
| 10 13 01          | waste preparation mixture before thermal processing                                                                                                                                                                          |
| 10 13 04          | wastes from calcination and hydration of lime                                                                                                                                                                                |
| 10 13 06          | particulates and dust (except 10 13 12 and 10 13 13)                                                                                                                                                                         |
| 10 13 07          | sludges and filter cakes from gas treatment                                                                                                                                                                                  |
| 10 13 10          | wastes from asbestos-cement manufacture other than those mentioned in 10 13 09                                                                                                                                               |
| 10 13 11          | wastes from cement-based composite materials other than those mentioned in 10 13 09 and 10 13 10                                                                                                                             |
| 10 13 13          | solid wastes from gas treatment other than those mentioned in 10 13 12                                                                                                                                                       |
| 10 13 14          | waste concrete and concrete sludge                                                                                                                                                                                           |
| <b>11</b>         | <b>WASTES FROM CHEMICAL SURFACE TREATMENT AND COATING OF METALS AND OTHER MATERIALS; NON-FERROUS HYDRO-METALLURGY</b>                                                                                                        |
| <b>11 01</b>      | <b>wastes from chemical surface treatment and coating of metals and other materials (for example galvanic processes, zinc coating processes, pickling processes, etching, phosphatising, alkaline degreasing, anodising)</b> |
| 11 01 10          | sludges and filter cakes other than those mentioned in 11 01 09                                                                                                                                                              |
| 11 01 14          | degreasing wastes other than those mentioned in 11 01 13                                                                                                                                                                     |
| <b>11 02</b>      | <b>wastes from non-ferrous hydrometallurgical processes</b>                                                                                                                                                                  |
| 11 02 03          | wastes from the production of anodes for aqueous electrolytical processes                                                                                                                                                    |
| 11 02 06          | wastes from copper hydrometallurgical processes other than those mentioned in 11 02 05                                                                                                                                       |
| <b>11 05</b>      | <b>wastes from hot galvanising processes</b>                                                                                                                                                                                 |
| 11 05 01          | hard zinc                                                                                                                                                                                                                    |
| 11 05 02          | zinc ash                                                                                                                                                                                                                     |
| <b>12</b>         | <b>WASTES FROM SHAPING AND PHYSICAL AND MECHANICAL SURFACE TREATMENT OF METALS AND PLASTICS</b>                                                                                                                              |
| <b>12 01</b>      | <b>wastes from shaping and physical and mechanical surface treatment of metals and plastics</b>                                                                                                                              |
| 12 01 01          | ferrous metal filings and turnings                                                                                                                                                                                           |
| 12 01 02          | ferrous metal dust and particles                                                                                                                                                                                             |
| 12 01 03          | non-ferrous metal filings and turnings                                                                                                                                                                                       |
| 12 01 04          | non-ferrous metal dust and particles                                                                                                                                                                                         |
| 12 01 05          | plastics shavings and turnings                                                                                                                                                                                               |
| 12 01 13          | welding wastes                                                                                                                                                                                                               |
| 12 01 15          | machining sludges other than those mentioned in 12 01 14                                                                                                                                                                     |
| 12 01 17          | waste blasting material other than those mentioned in 12 01 16                                                                                                                                                               |
| <b>15</b>         | <b>WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED</b>                                                                                                          |
| <b>15 01</b>      | <b>packaging (including separately collected municipal packaging waste)</b>                                                                                                                                                  |
| 15 01 01          | paper and cardboard packaging                                                                                                                                                                                                |
| 15 01 02          | plastic packaging                                                                                                                                                                                                            |
| 15 01 03          | wooden packaging                                                                                                                                                                                                             |
| 15 01 04          | metallic packaging                                                                                                                                                                                                           |
| 15 01 05          | composite packaging                                                                                                                                                                                                          |
| 15 01 06          | mixed packaging                                                                                                                                                                                                              |
| 15 01 07          | glass packaging                                                                                                                                                                                                              |
| 15 01 09          | textile packaging                                                                                                                                                                                                            |
| <b>15 02</b>      | <b>absorbents, filter materials, wiping cloths and protective clothing</b>                                                                                                                                                   |
| 15 02 03          | absorbents, filter materials, wiping cloths and protective clothing other than those mentioned in 15 02 02                                                                                                                   |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| Waste code                                           | Description                                                                                                                                                                                               |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>16 WASTES NOT OTHERWISE SPECIFIED IN THE LIST</b> |                                                                                                                                                                                                           |
| <b>16 01</b>                                         | <b>end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)</b> |
| 16 01 03                                             | end-of-life tyres                                                                                                                                                                                         |
| 16 01 12                                             | brake pads other than those mentioned in 16 01 11                                                                                                                                                         |
| 16 01 17                                             | ferrous metal                                                                                                                                                                                             |
| 16 01 18                                             | non-ferrous metal                                                                                                                                                                                         |
| 16 01 19                                             | plastic                                                                                                                                                                                                   |
| 16 01 20                                             | glass                                                                                                                                                                                                     |
| <b>16 02</b>                                         | <b>wastes from electrical and electronic equipment</b>                                                                                                                                                    |
| 16 02 14                                             | discarded equipment other than those mentioned in 16 02 09 to 16 02 13                                                                                                                                    |
| 16 02 16                                             | components removed from discarded equipment other than those mentioned in 16 02 15                                                                                                                        |
| <b>16 03</b>                                         | <b>off-specification batches and unused products</b>                                                                                                                                                      |
| 16 03 04                                             | inorganic wastes other than those mentioned in 16 03 03                                                                                                                                                   |
| 16 03 06                                             | organic wastes other than those mentioned in 16 03 05                                                                                                                                                     |
| <b>16 06</b>                                         | <b>batteries and accumulators</b>                                                                                                                                                                         |
| 16 06 04                                             | alkaline batteries (except 16 06 03)                                                                                                                                                                      |
| 16 06 05                                             | other batteries and accumulators                                                                                                                                                                          |
| <b>16 08</b>                                         | <b>spent catalysts</b>                                                                                                                                                                                    |
| 16 08 01                                             | spent catalysts containing gold, silver, rhenium, rhodium, palladium, iridium or platinum (except 16 08 07)                                                                                               |
| 16 08 03                                             | spent catalysts containing transition metals or transition metal compounds not otherwise specified                                                                                                        |
| <b>16 11</b>                                         | <b>waste linings and refractories</b>                                                                                                                                                                     |
| 16 11 02                                             | carbon-based linings and refractories from metallurgical processes others than those mentioned in 16 11 01                                                                                                |
| 16 11 04                                             | other linings and refractories from metallurgical processes other than those mentioned in 16 11 03                                                                                                        |
| 16 11 06                                             | linings and refractories from non-metallurgical processes others than those mentioned in 16 11 05                                                                                                         |
| <b>17</b>                                            | <b>CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)</b>                                                                                                              |
| <b>17 01</b>                                         | <b>concrete, bricks, tiles and ceramics</b>                                                                                                                                                               |
| 17 01 01                                             | concrete                                                                                                                                                                                                  |
| 17 01 02                                             | bricks                                                                                                                                                                                                    |
| 17 01 03                                             | tiles and ceramics                                                                                                                                                                                        |
| 17 01 07                                             | mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06                                                                                                                   |
| <b>17 02</b>                                         | <b>wood, glass and plastic</b>                                                                                                                                                                            |
| 17 02 01                                             | wood                                                                                                                                                                                                      |
| 17 02 02                                             | glass                                                                                                                                                                                                     |
| 17 02 03                                             | plastic                                                                                                                                                                                                   |
| <b>17 03</b>                                         | <b>bituminous mixtures, coal tar and tarred products</b>                                                                                                                                                  |
| 17 03 02                                             | bituminous mixtures other than those mentioned in 17 03 01                                                                                                                                                |
| <b>17 04</b>                                         | <b>metals (including their alloys)</b>                                                                                                                                                                    |
| 17 04 01                                             | copper, bronze, brass                                                                                                                                                                                     |
| 17 04 02                                             | aluminium                                                                                                                                                                                                 |
| 17 04 03                                             | lead                                                                                                                                                                                                      |
| 17 04 04                                             | zinc                                                                                                                                                                                                      |
| 17 04 05                                             | iron and steel                                                                                                                                                                                            |
| 17 04 06                                             | tin                                                                                                                                                                                                       |
| 17 04 07                                             | mixed metals                                                                                                                                                                                              |
| 17 04 11                                             | cables other than those mentioned in 17 04 10                                                                                                                                                             |
| <b>17 05</b>                                         | <b>soil (including excavated soil from contaminated sites), stones and dredging spoil</b>                                                                                                                 |
| 17 05 04                                             | soil and stones other than those mentioned in 17 05 03                                                                                                                                                    |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                                                                                                                    |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 05 06          | dredging spoil other than those mentioned in 17 05 05                                                                                                                                 |
| 17 05 08          | track ballast other than those mentioned in 17 05 07                                                                                                                                  |
| <b>17 06</b>      | <b>insulation materials and asbestos-containing construction materials</b>                                                                                                            |
| 17 06 04          | insulation materials other than those mentioned in 17 06 01 and 17 06 03                                                                                                              |
| <b>17 09</b>      | <b>other construction and demolition wastes</b>                                                                                                                                       |
| 17 09 04          | mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03                                                                                |
| <b>18</b>         | <b>WASTES FROM HUMAN OR ANIMAL HEALTH CARE AND/OR RELATED RESEARCH (except kitchen and restaurant wastes not arising from immediate health care)</b>                                  |
| <b>18 01</b>      | <b>wastes from natal care, diagnosis, treatment or prevention of disease in humans</b>                                                                                                |
| 18 01 04          | wastes whose collection and disposal is not subject to special requirements in order to prevent infection (for example dressings, plaster casts, linen, disposable clothing, diapers) |
| 18 01 07          | chemicals other than those mentioned in 18 01 06                                                                                                                                      |
| <b>18 02</b>      | <b>wastes from research, diagnosis, treatment or prevention of disease involving animals</b>                                                                                          |
| 18 02 03          | wastes whose collection and disposal is not subject to special requirements in order to prevent infection                                                                             |
| 18 02 06          | chemicals other than those mentioned in 18 02 05                                                                                                                                      |
| <b>19</b>         | <b>WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE</b>        |
| <b>19 01</b>      | <b>wastes from incineration or pyrolysis of waste</b>                                                                                                                                 |
| 19 01 02          | ferrous materials removed from bottom ash                                                                                                                                             |
| 19 01 12          | bottom ash and slag other than those mentioned in 19 01 11                                                                                                                            |
| 19 01 14          | fly ash other than those mentioned in 19 01 13                                                                                                                                        |
| 19 01 16          | boiler dust other than those mentioned in 19 01 15                                                                                                                                    |
| 19 01 18          | pyrolysis wastes other than those mentioned in 19 01 17                                                                                                                               |
| 19 01 19          | sands from fluidised beds                                                                                                                                                             |
| <b>19 02</b>      | <b>wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)</b>                                                                     |
| 19 02 03          | premixed wastes composed only of non-hazardous wastes                                                                                                                                 |
| 19 02 06          | sludges from physico/chemical treatment other than those mentioned in 19 02 05                                                                                                        |
| 19 02 10          | combustible wastes other than those mentioned in 19 02 08 and 19 02 09                                                                                                                |
| <b>19 03</b>      | <b>stabilised/solidified wastes <sup>1</sup></b>                                                                                                                                      |
| 19 03 05          | stabilised wastes other than those mentioned in 19 03 04                                                                                                                              |
| 19 03 07          | solidified wastes other than those mentioned in 19 03 06                                                                                                                              |
| <b>19 04</b>      | <b>vitrified waste and wastes from vitrification</b>                                                                                                                                  |
| 19 04 01          | vitrified waste                                                                                                                                                                       |
| <b>19 05</b>      | <b>wastes from aerobic treatment of solid wastes</b>                                                                                                                                  |
| 19 05 01          | non-composted fraction of municipal and similar wastes                                                                                                                                |
| 19 05 02          | non-composted fraction of animal and vegetable waste                                                                                                                                  |
| 19 05 03          | off-specification compost                                                                                                                                                             |
| <b>19 06</b>      | <b>wastes from anaerobic treatment of waste</b>                                                                                                                                       |
| 19 06 04          | digestate from anaerobic treatment of municipal waste                                                                                                                                 |
| 19 06 06          | digestate from anaerobic treatment of animal and vegetable waste                                                                                                                      |
| <b>19 08</b>      | <b>wastes from waste water treatment plants not otherwise specified</b>                                                                                                               |
| 19 08 01          | screenings                                                                                                                                                                            |
| 19 08 02          | waste from desanding                                                                                                                                                                  |
| 19 08 05          | sludges from treatment of urban waste water                                                                                                                                           |
| 19 08 09          | grease and oil mixture from oil/water separation containing only edible oil and fats                                                                                                  |

<sup>1</sup> Stabilisation processes change the dangerousness of the constituents in the waste and thus transform hazardous waste into non-hazardous waste. Solidification processes only change the physical state of the waste (e.g. liquid into solid) by using additives without changing the chemical properties of the waste.

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| <b>Waste code</b> | <b>Description</b>                                                                                                                             |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| 19 08 12          | sludges from biological treatment of industrial waste water other than those mentioned in 19 08 11                                             |
| 19 08 14          | sludges from other treatment of industrial waste water other than those mentioned in 19 08 13                                                  |
| <b>19 09</b>      | <b>wastes from the preparation of water intended for human consumption or water for industrial use</b>                                         |
| 19 09 01          | solid waste from primary filtration and screenings                                                                                             |
| 19 09 02          | sludges from water clarification                                                                                                               |
| 19 09 03          | sludges from decarbonation                                                                                                                     |
| 19 09 04          | spent activated carbon                                                                                                                         |
| 19 09 05          | saturated or spent ion exchange resins                                                                                                         |
| 19 09 06          | solutions and sludges from regeneration of ion exchangers                                                                                      |
| <b>19 10</b>      | <b>wastes from shredding of metal-containing wastes</b>                                                                                        |
| 19 10 01          | iron and steel waste                                                                                                                           |
| 19 10 02          | non-ferrous waste                                                                                                                              |
| 19 10 04          | fluff-light fraction and dust other than those mentioned in 19 10 03                                                                           |
| 19 10 06          | other fractions other than those mentioned in 19 10 05                                                                                         |
| <b>19 12</b>      | <b>wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified</b>          |
| 19 12 01          | paper and cardboard                                                                                                                            |
| 19 12 02          | ferrous metal                                                                                                                                  |
| 19 12 03          | non-ferrous metal                                                                                                                              |
| 19 12 04          | plastic and rubber                                                                                                                             |
| 19 12 05          | glass                                                                                                                                          |
| 19 12 07          | wood other than that mentioned in 19 12 06                                                                                                     |
| 19 12 08          | textiles                                                                                                                                       |
| 19 12 09          | minerals (for example sand, stones)                                                                                                            |
| 19 12 10          | combustible waste (refuse derived fuel)                                                                                                        |
| 19 12 12          | other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11                      |
| <b>19 13</b>      | <b>Wastes from soil and groundwater remediation</b>                                                                                            |
| 19 13 02          | Solid wastes from soil remediation other than those mentioned in 19 13 01                                                                      |
| <b>20</b>         | <b>MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS</b> |
| <b>20 01</b>      | <b>separately collected fractions (except 15 01)</b>                                                                                           |
| 20 01 01          | paper and cardboard                                                                                                                            |
| 20 01 02          | glass                                                                                                                                          |
| 20 01 08          | biodegradable kitchen and canteen waste                                                                                                        |
| 20 01 10          | clothes                                                                                                                                        |
| 20 01 11          | textiles                                                                                                                                       |
| 20 01 25          | edible oil and fat                                                                                                                             |
| 20 01 28          | paint, inks, adhesives and resins other than those mentioned in 20 01 27                                                                       |
| 20 01 30          | detergents other than those mentioned in 20 01 29                                                                                              |
| 20 01 34          | batteries and accumulators other than those mentioned in 20 01 33                                                                              |
| 20 01 36          | discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35                                    |
| 20 01 38          | wood other than that mentioned in 20 01 37                                                                                                     |
| 20 01 39          | plastics                                                                                                                                       |
| 20 01 40          | metals                                                                                                                                         |
| 20 01 41          | wastes from chimney sweeping                                                                                                                   |
| 20 01 99          | other fractions not otherwise specified                                                                                                        |
| <b>20 02</b>      | <b>garden and park wastes (including cemetery waste)</b>                                                                                       |
| 20 02 01          | biodegradable waste                                                                                                                            |
| 20 02 02          | soil and stones                                                                                                                                |
| 20 02 03          | other non-biodegradable wastes                                                                                                                 |

**Table S2.2 Permitted waste types and quantities for disposal by non-hazardous landfill**

| Waste code   | Description                   |
|--------------|-------------------------------|
| <b>20 03</b> | <b>other municipal wastes</b> |
| 20 03 01     | mixed municipal waste         |
| 20 03 02     | waste from markets            |
| 20 03 03     | street-cleaning residues      |
| 20 03 04     | septic tank sludge            |
| 20 03 06     | waste from sewage cleaning    |
| 20 03 07     | bulky waste                   |

**Table S2.3 Permitted waste types and quantities for restoration**

| Waste code   | Description                                                                                                                                                                    |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>01</b>    | <b>WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING, AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS</b>                                                                   |
| <b>01 04</b> | <b>wastes from physical and chemical processing of non-metalliferous minerals</b>                                                                                              |
| 01 04 08     | waste gravel and crushed rocks other than those mentioned in 01 04 07                                                                                                          |
| 01 04 09     | waste sand and clays                                                                                                                                                           |
| <b>02</b>    | <b>WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING</b>                                                      |
| <b>02 04</b> | <b>wastes from sugar processing</b>                                                                                                                                            |
| 02 04 01     | soil from cleaning and washing beet                                                                                                                                            |
| <b>03</b>    | <b>WASTES FROM WOOD PROCESSING AND THE PRODUCTION OF PANELS AND FURNITURE, PULP, PAPER AND CARDBOARD</b>                                                                       |
| <b>03 03</b> | <b>wastes from pulp, paper and cardboard production and processing</b>                                                                                                         |
| 03 03 05     | de-inking sludges from paper recycling                                                                                                                                         |
| 03 03 09     | lime mud waste                                                                                                                                                                 |
| <b>17</b>    | <b>CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)</b>                                                                                   |
| <b>17 05</b> | <b>soil (including excavated soil from contaminated sites), stones and dredging spoil</b>                                                                                      |
| 17 05 04     | soil and stones other than those mentioned in 17 05 03                                                                                                                         |
| 17 05 06     | dredging spoil other than those mentioned in 17 05 05                                                                                                                          |
| <b>19</b>    | <b>WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE</b> |
| <b>19 05</b> | <b>wastes from aerobic treatment of solid wastes</b>                                                                                                                           |
| 19 05 03     | off-specification compost                                                                                                                                                      |
| <b>19 06</b> | <b>wastes from anaerobic treatment of waste</b>                                                                                                                                |
| 19 06 04     | digestate from anaerobic treatment of municipal waste                                                                                                                          |
| <b>19 08</b> | <b>wastes from waste water treatment plants not otherwise specified</b>                                                                                                        |
| 19 08 05     | sludges from treatment of urban waste water                                                                                                                                    |
| <b>19 09</b> | <b>wastes from the preparation of water intended for human consumption or water for industrial use</b>                                                                         |
| 19 09 02     | sludges from water clarification                                                                                                                                               |
| <b>19 12</b> | <b>wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified</b>                                          |
| 19 12 09     | minerals (for example sand, stones)                                                                                                                                            |
| <b>19 13</b> | <b>wastes from soil and groundwater remediation</b>                                                                                                                            |
| 19 13 02     | solid wastes from soil remediation other than those mentioned in 19 13 01                                                                                                      |
| 19 13 04     | sludges from soil remediation other than those mentioned in 19 13 03                                                                                                           |
| <b>20</b>    | <b>MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS</b>                                 |
| <b>20 02</b> | <b>garden and park wastes (including cemetery waste)</b>                                                                                                                       |
| 20 02 02     | soil and stones                                                                                                                                                                |

**Table S2.4 Permitted waste types and quantities for disposal in the asbestos cell**

| Waste code   | Description                                                                                                                                                                                               |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>06</b>    | <b>WASTES FROM INORGANIC CHEMICAL PROCESSES</b>                                                                                                                                                           |
| <b>06 07</b> | <b>wastes from the MFSU of halogens and halogen chemical processes</b>                                                                                                                                    |
| 06 07 01*    | wastes containing asbestos from electrolysis                                                                                                                                                              |
| <b>06 13</b> | <b>wastes from inorganic chemical processes not otherwise specified</b>                                                                                                                                   |
| 06 13 04*    | wastes from asbestos processing                                                                                                                                                                           |
| <b>10</b>    | <b>WASTES FROM THERMAL PROCESSES</b>                                                                                                                                                                      |
| <b>10 13</b> | <b>wastes from manufacture of cement, lime and plaster and articles and products made from them</b>                                                                                                       |
| 10 13 09*    | wastes from asbestos-cement manufacture containing asbestos                                                                                                                                               |
| <b>15</b>    | <b>WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED</b>                                                                                       |
| <b>15 01</b> | <b>packaging (including separately collected municipal packaging waste)</b>                                                                                                                               |
| 15 01 11*    | metallic packaging containing a dangerous solid porous matrix (for example asbestos), including empty pressure containers                                                                                 |
| <b>16</b>    | <b>WASTES NOT OTHERWISE SPECIFIED IN THE LIST</b>                                                                                                                                                         |
| <b>16 01</b> | <b>end-of-life vehicles from different means of transport (including off-road machinery) and wastes from dismantling of end-of-life vehicles and vehicle maintenance (except 13, 14, 16 06 and 16 08)</b> |
| 16 01 11*    | brake pads containing asbestos                                                                                                                                                                            |
| <b>16 02</b> | <b>wastes from electrical and electronic equipment</b>                                                                                                                                                    |
| 16 02 12*    | discarded equipment containing free asbestos                                                                                                                                                              |
| <b>17</b>    | <b>CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)</b>                                                                                                              |
| <b>17 05</b> | <b>soil (including excavated soil from contaminated sites), stones and dredging spoil</b>                                                                                                                 |
| 17 05 03*    | soil and stones containing dangerous substances                                                                                                                                                           |
| <b>17 06</b> | <b>insulation materials and asbestos-containing construction materials</b>                                                                                                                                |
| 17 06 01*    | insulation materials containing asbestos                                                                                                                                                                  |
| 17 06 03*    | other insulation materials consisting of or containing dangerous substances                                                                                                                               |
| 17 06 05*    | construction materials containing asbestos <sup>2</sup>                                                                                                                                                   |
| <b>19 13</b> | <b>Wastes from soil and groundwater remediation</b>                                                                                                                                                       |
| 19 13 01*    | Solid wastes from soil remediation containing hazardous substances                                                                                                                                        |

**Table S2.5 Permitted waste types and quantities for multipurpose waste treatment facility**

| Maximum Quantity | The total annual throughput must not exceed 30,000 tonnes per annum.                                         |
|------------------|--------------------------------------------------------------------------------------------------------------|
| Waste code       | Description                                                                                                  |
| <b>01</b>        | <b>WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING, AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS</b> |
| 01 04 07*        | wastes containing dangerous substances from physical and chemical processing of non-metalliferous minerals   |
| 01 04 08         | waste gravel and crushed rocks other than those mentioned in 01 04 07                                        |
| 01 04 09         | waste sand and clays                                                                                         |
| <b>01 05</b>     | <b>drilling muds and other drilling wastes</b>                                                               |
| 01 05 04         | freshwater drilling muds and wastes                                                                          |
| 01 05 05*        | oil-containing drilling muds and wastes                                                                      |
| 01 05 06*        | drilling muds and other drilling wastes containing dangerous substances                                      |

<sup>2</sup> As far as the landfilling of waste is concerned, Member States may decide to postpone the entry into force of this entry until the establishment of appropriate measures for the treatment and disposal of waste from construction material containing asbestos. These measures are to be established according to the procedure referred to in Article

17 of Council Directive 1999/31/EC on the landfill of waste (OJ L 182, 16.7.1999, p.1) and shall be adopted by 16 July 2002 at the latest.'

**Table S2.5 Permitted waste types and quantities for multipurpose waste treatment facility**

**Maximum Quantity**                      **The total annual throughput must not exceed 30,000 tonnes per annum.**

| <b>Waste code</b> | <b>Description</b>                                                                                                                                                             |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>13</b>         | <b>OIL WASTES AND WASTES OF LIQUID FUELS (except edible oils, and those in chapters 05, 12 and 19)</b>                                                                         |
| <b>13 05</b>      | <b>oil/water separator contents</b>                                                                                                                                            |
| 13 05 01*         | solids from grit chambers and oil/water separators                                                                                                                             |
| 13 05 02*         | sludges from oil/water separators                                                                                                                                              |
| 13 05 03*         | interceptor sludges                                                                                                                                                            |
| 13 05 08*         | mixtures of wastes from grit chambers and oil/water separators                                                                                                                 |
| <b>17</b>         | <b>CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)</b>                                                                                   |
| <b>17 05</b>      | <b>soil (including excavated soil from contaminated sites), stones and dredging spoil</b>                                                                                      |
| 17 05 03*         | soil and stones containing dangerous substances                                                                                                                                |
| 17 05 04          | soil and stones other than those mentioned in 17 05 03                                                                                                                         |
| 17 05 05*         | dredging spoil containing dangerous substances                                                                                                                                 |
| 17 05 06          | dredging spoil other than those mentioned in 17 05 05                                                                                                                          |
| 17 05 07*         | track ballast containing dangerous substances                                                                                                                                  |
| 17 05 08          | track ballast other than those mentioned in 17 05 07                                                                                                                           |
| <b>19</b>         | <b>WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE</b> |
| <b>19 02</b>      | <b>wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)</b>                                                              |
| 19 02 05*         | sludges from physico/chemical treatment containing dangerous substances                                                                                                        |
| 19 02 06          | sludges from physico/chemical treatment other than those mentioned in 19 02 05                                                                                                 |
| <b>19 03</b>      | <b>stabilised/solidified wastes <sup>3</sup></b>                                                                                                                               |
| 19 03 07          | solidified wastes other than those mentioned in 19 03 06                                                                                                                       |
| <b>19 08</b>      | <b>wastes from waste water treatment plants not otherwise specified</b>                                                                                                        |
| 19 08 13*         | sludges containing dangerous substances from other treatment of industrial waste water                                                                                         |
| 19 08 14          | sludges from other treatment of industrial waste water other than those mentioned in 19 08 13                                                                                  |
| <b>19 10</b>      | <b>wastes from shredding of metal-containing wastes</b>                                                                                                                        |
| 19 10 05*         | other fractions containing dangerous substances                                                                                                                                |
| 19 10 06          | other fractions other than those mentioned in 19 10 05                                                                                                                         |
| <b>19 13</b>      | <b>wastes from soil and groundwater remediation</b>                                                                                                                            |
| 19 13 01*         | solid wastes from soil remediation containing dangerous substances                                                                                                             |
| 19 13 02          | solid wastes from soil remediation other than those mentioned in 19 13 01                                                                                                      |
| 19 13 03*         | sludges from soil remediation containing dangerous substances                                                                                                                  |
| 19 13 04          | sludges from soil remediation other than those mentioned in 19 13 03                                                                                                           |

<sup>3</sup> Stabilisation processes change the dangerousness of the constituents in the waste and thus transform hazardous waste into non-hazardous waste. Solidification processes only change the physical state of the waste (e.g. liquid into solid) by using additives without changing the chemical properties of the waste.

**Table S2.5 Permitted waste types and quantities for remediation pad (to aid in the remediation process)**

| <b>Waste code</b>       | <b>Description</b>                                                                                                                                                             |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maximum Quantity</b> | <b>The total annual throughput must not exceed 30,000 tonnes per annum.</b>                                                                                                    |
| <b>17</b>               | <b>CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)</b>                                                                                   |
| <b>17 02</b>            | <b>wood, glass and plastic</b>                                                                                                                                                 |
| 17 02 01                | wood                                                                                                                                                                           |
| <b>19</b>               | <b>WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE</b> |
| <b>19 05</b>            | <b>wastes from aerobic treatment of solid wastes</b>                                                                                                                           |
| 19 05 03                | off-specification compost                                                                                                                                                      |
| <b>19 08</b>            | <b>wastes from waste water treatment plants not otherwise specified</b>                                                                                                        |
| 19 08 01                | screenings                                                                                                                                                                     |
| 19 08 02                | waste from desanding                                                                                                                                                           |
| <b>19 12</b>            | <b>wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified</b>                                          |
| 19 12 07                | wood other than that mentioned in 19 12 06                                                                                                                                     |
| <b>20</b>               | <b>MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS</b>                                 |
| <b>20 01</b>            | <b>separately collected fractions (except 15 01)</b>                                                                                                                           |
| 20 01 38                | wood other than that mentioned in 20 01 37                                                                                                                                     |
| <b>20 02</b>            | <b>garden and park wastes (including cemetery waste)</b>                                                                                                                       |
| 20 02 01                | biodegradable waste                                                                                                                                                            |
| <b>20 03</b>            | <b>other municipal wastes</b>                                                                                                                                                  |
| 20 03 03                | street-cleaning residues                                                                                                                                                       |

## Schedule 3 – Emissions and monitoring

**Table S3.1 Leachate level limits and monitoring requirements**

| Monitoring point ref. & location                                                                                                                                                                  | Limit (including unit)              | Monitoring frequency | Monitoring standard or method                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 81703050 (LW5) and 81703060 (LW6) (Monitoring points located in Phase 1) identified on Site Monitoring Plan BF4857/10/06 (rev 2).                                                                 | 5 metres above the base of Phase 1  | Monthly              | Unless otherwise agreed in writing with Natural Resources Wales, monitoring methods used shall be in accordance with Environment Agency document 'Guidance on monitoring of landfill leachate, groundwater and surface water' (LFTGN02). |
| 81703010 (LW1), 81703020 (LW2), 81703030 (LW3), 81703040 (LW4), 81703070 (LW7) and 81703080 (LW8) (Monitoring points located in Phase 2) identified on Site Monitoring Plan BF4857/10/06 (rev 2). | 33 metres above the base of Phase 2 | Monthly              | Unless otherwise agreed in writing with Natural Resources Wales, monitoring methods used shall be in accordance with Environment Agency document 'Guidance on monitoring of landfill leachate, groundwater and surface water' (LFTGN02). |
| Lagoon 2 as part of MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/ RP3733PC/V009                                                                                       | Within Lagoon                       | Monthly              | Unless otherwise agreed in writing with Natural Resources Wales, monitoring methods used shall be in accordance with Environment Agency document 'Guidance on monitoring of landfill leachate, groundwater and surface water' (LFTGN02). |

**Table S3.2 Point source emissions to air – emission limits and monitoring requirements**

| Emission point ref. & location                                                     | Parameter                                                                 | Source                | Limit (including unit) | Reference period | Monitoring frequency | Monitoring standard or method                                                  |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------|------------------------|------------------|----------------------|--------------------------------------------------------------------------------|
| T1G1, T2G1 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                | Oxides of Nitrogen (NO and NO <sub>2</sub> expressed as NO <sub>2</sub> ) | Gas utilisation plant | 650 mg/m <sup>3</sup>  | Hourly mean      | Annually             | As per M2 version 7 issued August 2016 'Monitoring of stack emissions to air'. |
|                                                                                    | CO                                                                        |                       | 1500 mg/m <sup>3</sup> |                  |                      |                                                                                |
|                                                                                    | Total VOCs                                                                |                       | 1750 mg/m <sup>3</sup> |                  |                      |                                                                                |
| T1G2, T2G2, T2G3 and T2G4 identified on Site Monitoring Plan BF4857/10/06 (rev 2). | Oxides of Nitrogen (NO and NO <sub>2</sub> expressed as NO <sub>2</sub> ) | Gas utilisation plant | 150 mg/m <sup>3</sup>  | Hourly mean      | Annually             | As per M2 version 7 issued August 2016 'Monitoring of stack emissions to air'. |
|                                                                                    | CO                                                                        |                       | 1400 mg/m <sup>3</sup> |                  |                      |                                                                                |
|                                                                                    | Total VOCs                                                                |                       | 1000 mg/m <sup>3</sup> |                  |                      |                                                                                |

**Table S3.2 Point source emissions to air – emission limits and monitoring requirements**

| Emission point ref. & location                                                                                                                | Parameter                                                                 | Source              | Limit (including unit)                                       | Reference period | Monitoring frequency    | Monitoring standard or method                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------|--------------------------------------------------------------|------------------|-------------------------|-------------------------------------------------------------------------------|
| A8, A9 and A10 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                                                                       | Oxides of Nitrogen (NO and NO <sub>2</sub> expressed as NO <sub>2</sub> ) | Landfill Gas Flares | 150 mg/m <sup>3</sup>                                        | Hourly mean      | Annually <sup>(1)</sup> | As per M2 version 7 issued August 2016 Monitoring of stack emissions to air'. |
|                                                                                                                                               | CO                                                                        |                     | 100 mg/m <sup>3</sup> (50 mg/m <sup>3</sup> ) <sup>(2)</sup> |                  |                         |                                                                               |
|                                                                                                                                               | Total VOCs                                                                |                     | 10 mg/m <sup>3</sup>                                         |                  |                         |                                                                               |
|                                                                                                                                               |                                                                           |                     |                                                              |                  |                         |                                                                               |
| MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/ RP3733PC/ V008                                                      | VOCs                                                                      | Biofilter           | -                                                            | Hourly mean      | Monthly                 | .                                                                             |
|                                                                                                                                               | TPHs                                                                      |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | Benzene                                                                   |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | Toluene                                                                   |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | Ethyl Benzene                                                             |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | Xylene                                                                    |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | PAHs                                                                      |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | CO <sub>2</sub>                                                           |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | PM <sup>10</sup>                                                          |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | Outlets from biofilters emitting treated air from inside building         |                     | -                                                            |                  |                         |                                                                               |
|                                                                                                                                               | Inlet from biofilters accepting untreated air from inside building        |                     |                                                              |                  |                         |                                                                               |
|                                                                                                                                               | Dust                                                                      |                     | None specified                                               |                  | Weekly                  | Visual and Olfactory Observations                                             |
|                                                                                                                                               | Odour                                                                     |                     |                                                              |                  |                         |                                                                               |
|                                                                                                                                               | Temperature                                                               |                     |                                                              |                  |                         |                                                                               |
| MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/ RP3733PC/ V008                                                      | Dust                                                                      | Biopiles            | None specified                                               | -                | Weekly                  | Visual Observations                                                           |
| Note (1): Annual monitoring of flares is only required when flare operate in excess of 10% of the time, taken on an annual assessment period. |                                                                           |                     |                                                              |                  |                         |                                                                               |
| Note (2): 50 mg/m <sup>3</sup> limit applies for flares commissioned after 31 December 2003.                                                  |                                                                           |                     |                                                              |                  |                         |                                                                               |

**Table S3.3 Point Source emissions to water (other than sewer) and land – emission limits and monitoring requirements**

| Emission point ref. & location                                                          | Source                                                                                                 | Parameter                  | Limit (incl. unit)                       | Reference Period | Monitoring frequency | Monitoring standard or method                                                                                     |
|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------|------------------|----------------------|-------------------------------------------------------------------------------------------------------------------|
| 81702001 and 81702002 identified on Site Monitoring Plan BF4857/10/06 (rev 2).          | Site drainage and uncontaminated groundwater from beneath composite liner via balancing lagoon system. | Volume of pumped discharge | 8985 cubic metres per day                | -                | Daily                | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. |
|                                                                                         |                                                                                                        | Rate of pumped discharge   | 150 litres per second                    | -                | Continuous           |                                                                                                                   |
|                                                                                         |                                                                                                        | Suspended solids           | 100 mg/l                                 | Spot sample      | Monthly              |                                                                                                                   |
|                                                                                         |                                                                                                        | COD                        | 120 mg/l                                 |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Ammoniacal nitrogen        | 5 mg/l                                   |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | pH                         | Minimum 6 pH units<br>Maximum 8 pH units |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Oil and grease             | None visible                             | Observation      |                      |                                                                                                                   |
| 81702014 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                       | Monocell surface water side-riser and sump (operational areas of asbestos monocell area)               | Suspended solids           | 100 mg/l                                 | Spot sample      | Monthly              | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. |
|                                                                                         |                                                                                                        | COD                        | 120 mg/l                                 |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Ammoniacal Nitrogen        | 5 mg/l                                   |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | pH                         | Minimum 6 pH units<br>Maximum 8 pH units |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Asbestos fibres            | None detectable                          |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Oil and grease             | Non visible                              | Observation      |                      |                                                                                                                   |
|                                                                                         |                                                                                                        |                            |                                          |                  |                      |                                                                                                                   |
| MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/RP3733PC/V0 08 | Process water discharged to surface water from Biopiles <sup>1</sup>                                   | Suspended solids           | 100 mg/l                                 | Spot sample      | Monthly              | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. |
|                                                                                         |                                                                                                        | COD                        | 120 mg/l                                 |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Ammoniacal Nitrogen        | 5 mg/l                                   |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | pH                         | Minimum 6 pH units<br>Maximum 8 pH units |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        | Oil and grease             | Non visible                              | Observation      |                      |                                                                                                                   |
|                                                                                         |                                                                                                        |                            |                                          |                  |                      |                                                                                                                   |
|                                                                                         |                                                                                                        |                            |                                          |                  |                      |                                                                                                                   |

**Table S3.3 Point Source emissions to water (other than sewer) and land – emission limits and monitoring requirements**

| Emission point ref. & location                                                                                  | Source                                                                                                                     | Parameter           | Limit (incl. unit)                      | Reference Period | Monitoring frequency | Monitoring standard or method                                                                                     |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|------------------|----------------------|-------------------------------------------------------------------------------------------------------------------|
| Process water tanks at MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/ RP3733PC/V0 08 | Process water discharge to surface water from Biopiles and the air/water separators located on composting pad <sup>1</sup> | Suspended solids    | 100mg/l                                 | Spot sample      | Monthly              | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. |
|                                                                                                                 |                                                                                                                            | COD                 | 120mg/l                                 |                  |                      |                                                                                                                   |
|                                                                                                                 |                                                                                                                            | Ammoniacal Nitrogen | 5mg/l                                   |                  |                      |                                                                                                                   |
|                                                                                                                 |                                                                                                                            | pH                  | Minimum 6pH units<br>Maximum 8 pH units |                  |                      |                                                                                                                   |
|                                                                                                                 |                                                                                                                            | Oil and grease      | None visible                            | Observation      |                      |                                                                                                                   |
| Lagoon 1 at MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/ RP3733PC/V0 08            | Clean surface water run off collected within the bunding surrounding the MWTRP infrastructure <sup>2</sup> .               | Suspended solids    | 100mg/l                                 | Spot sample      | Monthly              | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. |
|                                                                                                                 |                                                                                                                            | COD                 | 120mg/l                                 |                  |                      |                                                                                                                   |
|                                                                                                                 |                                                                                                                            | Ammoniacal Nitrogen | 5mg/l                                   |                  |                      |                                                                                                                   |
|                                                                                                                 |                                                                                                                            | pH                  | Minimum 6pH units<br>Maximum 8 pH units |                  |                      |                                                                                                                   |
|                                                                                                                 |                                                                                                                            | Oil and grease      | None visible                            | Observation      |                      |                                                                                                                   |

Note 1: Effluent from biopiles shall be discharged to surface waters subject to testing results. If test results exceed allowable limits for discharge to surface waters they will be either tankered off to a suitably licensed facility or released to the existing Trecatti leachate treatment system. Water will only be discharged to surface water if compliant.

Note 2: A cut-off valve will be provided at Lagoon 1 and should any contamination be evident, the water will be prevented from entering the existing surface water management system and controlled waters.

**Table S3.4 Point source emissions to sewer, effluent treatment plant or by tankering or other transfers off-site– emission limits and monitoring requirements**

| <b>Emission point<br/>ref. &amp; location</b>                                                        | <b>Source</b>                                                                      | <b>Parameter</b> | <b>Limit<br/>(incl.<br/>Unit)</b> | <b>Reference<br/>period</b> | <b>Monitoring<br/>frequency</b> | <b>Monitoring<br/>standard or<br/>method</b> |
|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------|-----------------------------------|-----------------------------|---------------------------------|----------------------------------------------|
| 81703400<br>identified on Site<br>Monitoring Plan<br>BF4857/10/06<br>(rev 2).                        | Landfill<br>Leachate                                                               | -                | -                                 | -                           | -                               | -                                            |
| WTP on Drawing<br>002/Proposed site<br>layout and<br>boundary for<br>variation EPR/<br>RP3733PC/V008 | Process<br>water<br>(effluent)<br>from Biopiles<br>located on<br>composting<br>pad | -                | -                                 | -                           | -                               | -                                            |

**Table S3.5 Trigger levels for emissions to groundwater and monitoring requirements**

| <b>Emission point ref. &amp; location</b>                               | <b>Parameter</b>    | <b>Limit (incl. Unit)</b> | <b>Reference period</b> | <b>Monitoring frequency</b> | <b>Monitoring standard or method</b>                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------|---------------------|---------------------------|-------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 81701110 (GW1) identified on Site Monitoring Plan BF4857/10/06 (rev 2). | Ammoniacal Nitrogen | 1.50 mg/l                 | Spot sample             | Quarterly                   | As per LFTGN02 (issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. H1 - Technical Annex to Annex (j): Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control Levels and Compliance Limits, v2.0, April 2010. |
|                                                                         | Chloride            | 250 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Cadmium             | 0.10 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Mecoprop            | 0.04 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Toluene             | 4.00 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Xylene              | 3.00 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Naphthalene         | 1.00 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
| 81701120 (GW2)                                                          | Ammoniacal Nitrogen | 17 mg/l                   |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Chloride            | 650 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Cadmium             | 0.16 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Mecoprop            | 1.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Toluene             | 65 µg/l                   |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Xylene              | 15 µg/l                   |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Naphthalene         | 1.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
| 81701209 (GW9)                                                          | Ammoniacal Nitrogen | 2.8 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Chloride            | 550 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Cadmium             | 21 µg/l                   |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Mecoprop            | 0.34 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Toluene             | 4.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Xylene              | 3.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Naphthalene         | 1.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
| 81701210 (GW10)                                                         | Ammoniacal Nitrogen | 74 mg/l                   |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Chloride            | 950 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Cadmium             | 0.25 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Mecoprop            | 4.2 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Toluene             | 4.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Xylene              | 3.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Naphthalene         | 1.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
| 81701211 (GW11)                                                         | Ammoniacal Nitrogen | 1.5 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Chloride            | 250 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Cadmium             | 0.1 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Mecoprop            | 0.04 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Toluene             | 4.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Xylene              | 3.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Naphthalene         | 1.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
| 81701212 (GW12)                                                         | Ammoniacal Nitrogen | 1.5 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Chloride            | 250 mg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Cadmium             | 0.1 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Mecoprop            | 0.04 µg/l                 |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Toluene             | 4.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Xylene              | 3.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |
|                                                                         | Naphthalene         | 1.0 µg/l                  |                         |                             |                                                                                                                                                                                                                                                                                                |

|                    |                     |           |
|--------------------|---------------------|-----------|
| 81701213<br>(GW13) | Ammoniacal Nitrogen | 1.5 mg/l  |
|                    | Chloride            | 250 mg/l  |
|                    | Cadmium             | 0.1 µg/l  |
|                    | Mecoprop            | 0.07 µg/l |
|                    | Toluene             | 4.0 µg/l  |
|                    | Xylene              | 3.0 µg/l  |
|                    | Naphthalene         | 1.0 µg/l  |

**Table S3.6 Landfill gas in external monitoring boreholes – limits and monitoring requirements**

| Emission point ref. & location                                                                                                                                                                                                          | Parameter            | Limit (incl. Unit) | Monitoring frequency | Monitoring standard or method                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|--------------------|----------------------|-------------------------------------------------------------------------------------|
| 81701001, 81701002, 81701003, 81701006, 81701007, 81701009, 81701010, 81701011, 81701012, 81701013, 81701014, 81701017, 81701018, 81701019, 81701020, 81701022, 81701023 and . identified on Site Monitoring Plan BF4857/10/06 (rev 2). | Methane              | 1.0 %v/v           | Monthly              | As per LFTGN 03 issued September 2004 'Guidance on the management of landfill gas'. |
|                                                                                                                                                                                                                                         | Carbon Dioxide       | 10.0 %v/v          |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Oxygen               | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Atmospheric pressure | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Meteorological data  | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         |                      |                    |                      |                                                                                     |
|                                                                                                                                                                                                                                         |                      |                    |                      |                                                                                     |
| 81701004 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                                                                                                                                                                       | Methane              | 3.0 %v/v           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Carbon Dioxide       | 10.0 %v/v          |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Oxygen               | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Atmospheric pressure | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Meteorological data  | No limit           |                      |                                                                                     |
| 81701005 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                                                                                                                                                                       | Methane              | 13.0 %v/v          |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Carbon Dioxide       | 17.0 %v/v          |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Oxygen               | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Atmospheric pressure | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Meteorological data  | No limit           |                      |                                                                                     |
| 81701008 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                                                                                                                                                                       | Methane              | 1.0 %v/v           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Carbon Dioxide       | 12.0 %v/v          |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Oxygen               | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Atmospheric pressure | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Meteorological data  | No limit           |                      |                                                                                     |
| 81701015 identified on Site Monitoring Plan BF4857/10/06 (rev 2).                                                                                                                                                                       | Methane              | 1.0 %v/v           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Carbon Dioxide       | No limit           |                      |                                                                                     |
|                                                                                                                                                                                                                                         | Oxygen               | No limit           |                      |                                                                                     |

**Table S3.6 Landfill gas in external monitoring boreholes – limits and monitoring requirements**

| Emission point ref. & location                                                                               | Parameter            | Limit (incl. Unit) | Monitoring frequency | Monitoring standard or method |
|--------------------------------------------------------------------------------------------------------------|----------------------|--------------------|----------------------|-------------------------------|
| 81701016, 81701021, 81701024, 81701025 and 81701026 identified on Site Monitoring Plan BF4857/10/06 (rev 2). | Atmospheric pressure | No limit           |                      |                               |
|                                                                                                              | Meteorological data  | No limit           |                      |                               |
|                                                                                                              | Methane              | No limit           |                      |                               |
|                                                                                                              | Carbon Dioxide       | No limit           |                      |                               |
|                                                                                                              | Oxygen               | No limit           |                      |                               |
|                                                                                                              | Atmospheric pressure | No limit           |                      |                               |
|                                                                                                              | Meteorological data  | No limit           |                      |                               |

**Table S3.7 Landfill gas from capped surfaces – limits and monitoring requirements**

| Emission point ref. & location | Parameter                                       | Limit (incl. Unit)                               | Monitoring frequency | Monitoring standard or method                                                                 |
|--------------------------------|-------------------------------------------------|--------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------|
| Permanently capped zone        | Average methane flux and total methane emission | Average zone emission rate of 0.001 mg/m2/second | Annually             | As per LFTGN 07 issued September 2004 'Guidance on monitoring landfill gas surface emissions' |
| Temporarily capped zone        | Average methane flux and total methane emission | Average zone emission rate of 0.1 mg/m2/second   |                      |                                                                                               |

**Table S3.8 Landfill gas – other monitoring requirements**

| Emission point ref. & location                                                                 | Parameter                                                                               | Monitoring frequency | Monitoring standard or method                                                      |                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| T1G1, T1G2, T2G1, T2G2, T2G3 and T2G4 identified on Site Monitoring Plan BF4857/10/06 (rev 2). | NOx and CO                                                                              | Quarterly            | Portable combustion analyser, as agreed Natural Resources Wales.                   | -                                                                                                                                                                                                                                                              |
|                                                                                                | Sulphur Dioxide                                                                         | Annually             | As per M2 version 7 issued August 2016 'Monitoring of stack emissions to air'.     |                                                                                                                                                                                                                                                                |
| Gas collection system at well control valve and manifolds on gas system                        | Methane                                                                                 | Weekly               | As per LFTGN03 issued September 2004 'Guidance on the management of landfill gas'. | Where the oxygen concentration exceeds 5% or the % balance gas is greater than 20% an assessment of air ingress into the system shall be undertaken. Where the concentration of carbon monoxide exceeds 100ppm then further investigation shall be undertaken. |
|                                                                                                | Carbon Dioxide                                                                          |                      |                                                                                    |                                                                                                                                                                                                                                                                |
|                                                                                                | Oxygen                                                                                  |                      |                                                                                    |                                                                                                                                                                                                                                                                |
|                                                                                                | Carbon Monoxide                                                                         |                      |                                                                                    |                                                                                                                                                                                                                                                                |
|                                                                                                | Atmospheric pressure                                                                    |                      |                                                                                    |                                                                                                                                                                                                                                                                |
|                                                                                                | Differential pressure                                                                   |                      |                                                                                    |                                                                                                                                                                                                                                                                |
|                                                                                                | Suction                                                                                 |                      |                                                                                    |                                                                                                                                                                                                                                                                |
|                                                                                                | % Balance Gas (calculated as the difference between the sum of measured gases and 100%) |                      |                                                                                    |                                                                                                                                                                                                                                                                |

**Table S3.8 Landfill gas – other monitoring requirements**

| <b>Emission point<br/>ref. &amp; location</b>                                                                 | <b>Parameter</b>                                                                                                                                               | <b>Monitoring<br/>frequency</b>      | <b>Monitoring standard<br/>or method</b>                                                                             |                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Manifolds 1, 2,<br>3, 3A, 4, 5 and 7                                                                          | Gas flow rate                                                                                                                                                  |                                      |                                                                                                                      |                                                                                                                                                                             |
| Input to LFG<br>Utilisation<br>Compound.<br>identified on Site<br>Monitoring Plan<br>BF4857/10/06<br>(rev 2). | Trace gas<br>analysis in<br>accordance with<br>LFTGN04.                                                                                                        | Annually                             | As per LFTGN04<br>issued September<br>2004 'Guidance for<br>Monitoring Trace<br>Components in<br>Landfill Gas'.      | The concentration of<br>trace gas components<br>shall be assessed<br>against the<br>assumptions made in<br>the Landfill gas risk<br>assessment and<br>dispersion modelling. |
| Flares- A8, A9,<br>and A10.<br>identified on Site<br>Monitoring Plan<br>BF4857/10/06<br>(rev 2).              | Temperature                                                                                                                                                    | Weekly while<br>flare<br>operational | As per M2 version 7<br>issued August 2016                                                                            | -                                                                                                                                                                           |
| Input to LFG<br>Utilisation<br>Compound.<br>Identified on Site<br>Monitoring Plan<br>BF4857/10/06<br>(rev 2). | Methane<br>Carbon Dioxide<br>Oxygen<br>Gas flow rate<br>% Balance Gas<br>(calculated as the<br>difference<br>between the sum<br>of measured<br>gases and 100%) | Weekly                               | As per LFTGN05<br>issued September<br>2004 'Guidance for<br>monitoring enclosed<br>landfill gas flares'.             | Where the oxygen<br>concentration exceeds<br>5% or the % balance<br>gas is greater than 20%<br>an assessment of air<br>ingress into the system<br>shall be undertaken.      |
| 81701005<br>identified on Site<br>Monitoring Plan<br>BF4857/10/06<br>(rev 2).                                 | Methane<br>Carbon Dioxide<br>Oxygen<br>Atmospheric<br>pressure<br>Differential<br>pressure                                                                     | Monthly                              | -<br><br><br><br><br>As per LFTGN 03<br>issued September<br>2004 'Guidance on<br>the management of<br>landfill gas'. | -                                                                                                                                                                           |

**Table S3.9 Leachate – other monitoring requirements**

| Emission point ref. & location                                                                                                                                                                                                                                                          | Parameter               | Monitoring frequency | Monitoring standard or method                                                                                     | Other specifications |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------|----------------------|
| 81703050 (LW5) and 81703060 (LW6).<br>(Monitoring points located in Phase 1)<br>81703010 (LW1), 81703020 (LW2), 81703030 (LW3) and 81703040 (LW4), 81703070 (LW7) and 81703080 (LW8)<br>(Monitoring points located in Phase 2) identified on Site Monitoring Plan BF4857/10/06 (rev 2). | Electrical conductivity | Quarterly            | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. | -                    |
|                                                                                                                                                                                                                                                                                         | Chloride                |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Ammoniacal Nitrogen     |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | pH                      |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Total alkalinity        |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Magnesium               |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Potassium               |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Total sulphates         |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Calcium                 |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Sodium                  |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | BOD                     |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | COD                     |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | TOC                     |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | TON                     |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Manganese               |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Iron                    |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Chromium                |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Copper                  |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Lead                    |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Zinc                    |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Nickel                  |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Mecoprop                |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Toluene                 |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Xylene                  |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Naphthalene             |                      |                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                         | Cadmium                 |                      |                                                                                                                   |                      |
| Hazardous substances                                                                                                                                                                                                                                                                    | Annually                |                      |                                                                                                                   |                      |
| Depth to base of monitoring well                                                                                                                                                                                                                                                        |                         |                      |                                                                                                                   |                      |

**Table S3.10 Surface water – other monitoring requirements**

| Emission point ref. & location                                                              | Parameter               | Monitoring frequency | Monitoring standard or method                                                                                     | Other specifications |
|---------------------------------------------------------------------------------------------|-------------------------|----------------------|-------------------------------------------------------------------------------------------------------------------|----------------------|
| 81702001, 81702002 and 81702003<br>identified on Site Monitoring Plan BF4857/10/06 (rev 2). | Electrical conductivity | Monthly              | As per LFTGN02 issued February 2003 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'. | -                    |
|                                                                                             | Chloride                |                      |                                                                                                                   |                      |
|                                                                                             | Ammoniacal Nitrogen     |                      |                                                                                                                   |                      |
|                                                                                             | pH                      |                      |                                                                                                                   |                      |
|                                                                                             | Suspended solids        |                      |                                                                                                                   |                      |
|                                                                                             | BOD                     |                      |                                                                                                                   |                      |

**Table S3.10 Surface water – other monitoring requirements**

| Emission point ref. & location | Parameter | Monitoring frequency | Monitoring standard or method | Other specifications |
|--------------------------------|-----------|----------------------|-------------------------------|----------------------|
|                                | COD       |                      |                               |                      |

**Table S3.11 Groundwater – other monitoring requirements**

| Emission point ref. & location                                                                                                                                                                                                                                                                                                | Parameter                        | Monitoring frequency | Monitoring standard or method                                                                                                            | Other specifications |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 81701110 (GW1),<br>81701120 (GW2),<br>81701130 (GW3),<br>81701140 (GW4),<br>81701150 (GW5),<br>81701160 (GW6),<br>81701170 (GW7),<br>81701180 (GW8),<br>81701209 (GW9),<br>81701210 (GW10),<br>81701211 (GW11) and<br>81701212(GW12) and<br>81701213 (GW13)<br>identified on Site<br>Monitoring Plan<br>BF4857/10/06 (rev 2). | Water level                      | Monthly              | As per LFTGN02                                                                                                                           | -                    |
|                                                                                                                                                                                                                                                                                                                               | Electrical conductivity          | Quarterly            | issued February 2003                                                                                                                     |                      |
|                                                                                                                                                                                                                                                                                                                               | Chloride                         |                      | 'Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water'.                                                            |                      |
|                                                                                                                                                                                                                                                                                                                               | Ammoniacal Nitrogen              |                      | H1 - Technical Annex to Annex (j):                                                                                                       |                      |
|                                                                                                                                                                                                                                                                                                                               | pH                               |                      | Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control Levels and Compliance Limits, v2.0, April 2016. |                      |
|                                                                                                                                                                                                                                                                                                                               | Total alkalinity                 |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Magnesium                        |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Potassium                        |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Total sulphates                  |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Calcium                          |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Sodium                           |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Nitrates                         |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Nitrites                         |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Phosphates                       |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Manganese                        |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Iron                             |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Chromium                         |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Copper                           |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Lead                             |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Zinc                             |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Nickel                           |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Mecoprop                         |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Toluene                          |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Xylene                           |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Naphthalene                      |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Cadmium                          |                      |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Hazardous substances             | Annually             |                                                                                                                                          |                      |
|                                                                                                                                                                                                                                                                                                                               | Depth to base of monitoring well |                      |                                                                                                                                          |                      |

**Table S3.12 Particulate matter in ambient air – limits and monitoring requirements**

| Emission point ref. & location                                             | Parameter             | Limit (including unit)                                                                                           | Reference Period | Monitoring frequency | Monitoring standard or method                                                                          |
|----------------------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------|------------------|----------------------|--------------------------------------------------------------------------------------------------------|
| D1, D2, D3 and D4 identified on Site Monitoring Plan BF4857/10/06 (rev 2). | PM <sup>10</sup>      | 40µm/m <sup>3</sup> - annual mean.<br>50µm/m <sup>3</sup> - 24 hour mean, not to be exceeded >35 times per year. | 24 hours         | Six monthly          | As per M17 issued July 2013 'Monitoring of Particulate Matter in ambient air around waste facilities'. |
|                                                                            | Deposited particulate | 200mg/m <sup>2</sup> day <sup>-1</sup>                                                                           |                  |                      |                                                                                                        |
|                                                                            | Asbestos fibres       | 0.001 asbestos fibres/mL                                                                                         | 24 hours         | Six monthly          |                                                                                                        |

**Table S3.13 Asbestos Cell Stability Monitoring Requirements**

| Emission point ref. & location                         | Parameter                                                                   | Monitoring frequency                                                                               | Monitoring standard or method                          | Other specifications |
|--------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------|
| Asbestos cell separation bund inclinometers 1, 2 and 3 | Deformation behaviour of the separation bund measured at each inclinometer. | Prior to commencement and upon completion of each separation bund lift and at 6 monthly intervals. | Separation bund inclination and topography assessment. | -                    |

**Table S3.14 Annual waste input limits**

| Category                                                   | Limit (Tonnes/Year)   |
|------------------------------------------------------------|-----------------------|
| Non-hazardous waste                                        | 625,000               |
| Inert waste including inert waste imported for restoration | Awaiting NRW approval |
| Asbestos containing wastes                                 | 50,000                |
| Total waste deposits                                       | 675,000               |
| Hazardous soils for WTF                                    | 30,000                |

## Schedule 4 - Reporting

Parameters, for which reports shall be made, in accordance with conditions of this permit, are listed below.

| Table S4.1 Reporting of monitoring data                                        |                                                                                                                                                                                                                                                                                                  |                    |                                             |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------|
| Parameter                                                                      | Emission or monitoring point/reference                                                                                                                                                                                                                                                           | Reporting period   | Period begins                               |
| Leachate levels<br>As required by condition 3.5.1                              | 81703010 (LW1),<br>81703020 (LW2),<br>81703030 (LW3),<br>81703040 (LW4),<br>81703050 (LW5),<br>81703060 (LW6),<br>81703070 (LW7) and<br>81703080 (LW8).                                                                                                                                          | Every 3 months     | 1 January 1<br>April, 1 July, 1<br>October  |
| Emissions to air<br>Parameters as required by<br>condition 3.5.1               | T1G1, T1G2, T2G1,<br>T2G2, T2G3, T2G4, A8,<br>A9 and A10.                                                                                                                                                                                                                                        | Every 12<br>months | 1 January                                   |
| Emissions to water<br>Parameters as required by<br>condition 3.5.1             | 81702001 and<br>81702002                                                                                                                                                                                                                                                                         | Every 3 months     | 1 January, 1<br>April, 1 July, 1<br>October |
| Groundwater<br>Parameters as required by<br>condition 3.5.1                    | 81701110 (GW1),<br>81701120 (GW2),<br>81701091 (GW9),<br>81701101 (GW10),<br>81701111 (GW11),<br>81701121 (GW12) and<br>81701213 (GW13).                                                                                                                                                         | Every 3 Months     | 1 January, 1<br>April, 1 July, 1<br>October |
| Landfill gas lateral migration<br>Parameters as required by<br>condition 3.5.1 | 81701001, 81701002,<br>81701003, 81701004,<br>81701006, 81701007,<br>81701008, 81701009,<br>81701010, 81701011,<br>81701012, 81701013,<br>81701014, 81701015,<br>81701016, 81701017,<br>81701018, 81701019,<br>81701020, 81701021,<br>81701022, 81701023,<br>81701024, 81701025<br>and 81701026. | Every 3 months     | 1 January, 1<br>April, 1 July, 1<br>October |
| Landfill gas surface emissions<br>Parameters as required by<br>condition 3.5.1 | Permanently and<br>Temporarily capped<br>zone                                                                                                                                                                                                                                                    | Every 12<br>months | 1 January                                   |
| Other Landfill gas monitoring<br>Parameters as required by<br>condition 3.5.1  | 81701005                                                                                                                                                                                                                                                                                         | Every 3 months     | 1 January, 1<br>April, 1 July, 1<br>October |
|                                                                                | Input to LFG Utilisation<br>Compound                                                                                                                                                                                                                                                             | Every 12<br>months | 1 January                                   |

**Table S4.1 Reporting of monitoring data**

| Parameter                                                                   | Emission or monitoring point/reference                                                                                                                   | Reporting period                                              | Period begins                         |
|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------|
| Other leachate monitoring<br>Parameters as required by condition 3.5.1      | 81703010 (LW1),<br>81703020 (LW2),<br>81703030 (LW3),<br>81703040 (LW4),<br>81703050 (LW5),<br>81703060 (LW6),<br>81703070 (LW7) and<br>81703080 (LW8)   | Monthly and quarterly parameters every 3 months               | 1 January, 1 April, 1 July, 1 October |
| Hazardous substances Screen                                                 | As above                                                                                                                                                 | Every 12 months                                               | 1 January                             |
| Other surface water monitoring<br>Parameters as required by condition 3.5.1 | 81702001, 81702002 and 81702003.                                                                                                                         | Every 3 months                                                | 1 January, 1 April, 1 July, 1 October |
| Other groundwater monitoring<br>Parameters as required by condition 3.5.1   | 81701110 (GW1),<br>81701120 (GW2),<br>81701130 (GW3),<br>81701140 (GW4),<br>81701150 (GW5),<br>81701160 (GW6),<br>81701170 (GW7), and<br>81701180 (GW8). | Monthly and quarterly parameters every 3 months               | 1 January, 1 April, 1 July, 1 October |
| Hazardous Substances Screen                                                 | 81701209 (GW9),<br>81701210 (GW10),<br>81701211 (GW11),<br>81701212 (GW12) and<br>81701213 (GW13).                                                       | Every 12 months                                               | 1 January                             |
| Particulate matter<br>Parameters as required by condition 3.5.1             | D1, D2, D3 and D4                                                                                                                                        | Every 6 months                                                | 1 January, 1 July                     |
| Separation bund topography as required by condition 3.5.1                   | Asbestos cell separation bund                                                                                                                            | After Each lift but in any case no longer than every 6 months | Upon commencement of construction     |
| Separation bund inclination as required by condition 3.5.1                  | Asbestos cell separation bund                                                                                                                            | After Each lift but in any case no longer than every 6 months | Upon commencement of construction     |
| Biofilter Efficiency                                                        | MWTRP on Drawing 002/Proposed site layout and boundary for variation EPR/ RP3733PC/V008                                                                  | Every 6 months                                                | 1 January, 1 July                     |

**Table S4.2: Annual production/treatment**

| Parameter                                                                                                                      | Units             |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Leachate:<br>Disposed of off site;<br>Disposed of to any onsite effluent treatment plant;<br>Recirculated into the waste mass. | Cubic metres/year |
| Surface water and/ or groundwater:<br>Disposed of off site;<br>Disposed of to any onsite effluent treatment plant.             | Cubic metres/year |

**Table S4.2: Annual production/treatment**

| Parameter                                                                                                 | Units                        |
|-----------------------------------------------------------------------------------------------------------|------------------------------|
| Landfill gas:<br>combustion in flares;<br>combustion in gas engines;<br>Other methods of gas utilisation. | Normalised cubic metres/year |

**Table S4.3 Performance parameters**

| Parameter                                       | Frequency of assessment | Units  |
|-------------------------------------------------|-------------------------|--------|
| Water usage                                     | Annually                | tonnes |
| Energy usage (including for leachate treatment) | Annually                | MWh    |
| Total raw material used                         | Annually                | tonnes |

**Table S4.4 Reporting forms**

| Media/parameter                                        | Reporting format                                                                                  | Date of form |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------|
| Leachate                                               | Form leachate 1 or other reporting format to be agreed in writing with Natural Resources Wales    | 18/01/11     |
| Air                                                    | Form air 1 or other form as agreed in writing by Natural Resources Wales                          | 18/01/11     |
| Controlled water                                       | Form water 1 or other form as agreed in writing by Natural Resources Wales                        | 18/01/11     |
| Groundwater                                            | Form Groundwater 1 or other reporting format to be agreed in writing with Natural Resources Wales | 18/01/11     |
| Sewer                                                  | Form sewer 1 or other form as agreed in writing by Natural Resources Wales                        | 18/01/11     |
| Landfill gas                                           | Form LFG 1 or other reporting format to be agreed in writing with Natural Resources Wales         | 18/01/11     |
| Particulate matter                                     | Form Particulate 1 or other reporting format to be agreed in writing with Natural Resources Wales | 18/01/11     |
| Waste return                                           | Waste tonnage return form version: 1.2                                                            | 20/09/14     |
| Landfill topographical surveys and interpretation      | Reporting format to be agreed in writing with Natural Resources Wales                             | 28/01/15     |
| Inclinometer readings of asbestos bund separation bund | Reporting format to be agreed in writing with Natural Resources Wales                             | 28/01/15     |
| Water usage                                            | Form water usage 2 or other form as agreed in writing by Natural Resources Wales                  | 23/11/15     |
| Energy usage                                           | Form energy 2 or other form as agreed in writing by Natural Resources Wales                       | 23/11/15     |
| Other performance indicators                           | Form performance 1 or other form as agreed in writing by Natural Resources Wales                  | 23/11/15     |
| Biofilter efficiency                                   | Form biofilter 1 or other form as agreed in writing by Natural Resources Wales                    | 23/11/15     |

# Schedule 5 - Notification

These pages outline the information that the operator must provide.

Units of measurement used in information supplied under Part A and B requirements shall be appropriate to the circumstances of the emission. Where appropriate, a comparison should be made of actual emissions and authorised emission limits.

If any information is considered commercially confidential, it should be separated from non-confidential information, supplied on a separate sheet and accompanied by an application for commercial confidentiality under the provisions of the EP Regulations.

## Part A

|                                |                                                                                                  |
|--------------------------------|--------------------------------------------------------------------------------------------------|
| Permit Number                  | <b>EPR/RP3733PC</b>                                                                              |
| Name of operator               | <b>Biffa Waste Services Limited</b>                                                              |
| Location of Facility           | <b>Trecatti Landfill Site<br/>Fochriw Road<br/>Merthyr Tydfil<br/>Mid Glamorgan<br/>CF48 4AB</b> |
| Time and date of the detection |                                                                                                  |

| <b>(a) Notification requirements for any activity that gives rise to an incident or accident which significantly affects or may significantly affect the environment</b> |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>To be notified Immediately</b>                                                                                                                                        |  |
| Date and time of the event                                                                                                                                               |  |
| Reference or description of the location of the event                                                                                                                    |  |
| Description of where any release into the environment took place                                                                                                         |  |
| Substances(s) potentially released                                                                                                                                       |  |
| Best estimate of the quantity or rate of release of substances                                                                                                           |  |
| Measures taken, or intended to be taken, to stop any emission                                                                                                            |  |
| Description of the failure or accident.                                                                                                                                  |  |

| <b>(b) Notification requirements for the breach of a permit condition</b> |  |
|---------------------------------------------------------------------------|--|
| <b>To be notified immediately</b>                                         |  |
| Emission point reference/ source                                          |  |
| Parameter(s)                                                              |  |
| Limit                                                                     |  |
| Measured value and uncertainty                                            |  |
| Date and time of monitoring                                               |  |
| Measures taken, or intended to be taken, to stop the emission             |  |

| Time periods for notification following detection of a breach of a limit |                     |
|--------------------------------------------------------------------------|---------------------|
| Parameter                                                                | Notification period |
|                                                                          |                     |
|                                                                          |                     |
|                                                                          |                     |

|                                                                                                                                                                                           |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>(c) In the event of a breach of permit condition which poses an immediate danger to human health or threatens to cause an immediate significant adverse effect on the environment:</b> |  |
| <b>To be notified immediately</b>                                                                                                                                                         |  |
| Description of where the effect on the environment was detected                                                                                                                           |  |
| Substances(s) detected                                                                                                                                                                    |  |
| Concentrations of substances detected                                                                                                                                                     |  |
| Date of monitoring/sampling                                                                                                                                                               |  |

## Part B - to be submitted as soon as practicable

|                                                                                                                                                        |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Any more accurate information on the matters for notification under Part A.                                                                            |  |
| Measures taken, or intended to be taken, to prevent a recurrence of the incident                                                                       |  |
| Measures taken, or intended to be taken, to rectify, limit or prevent any pollution of the environment which has been or may be caused by the emission |  |
| The dates of any unauthorised emissions from the facility in the preceding 24 months.                                                                  |  |

|                  |  |
|------------------|--|
| <b>Name*</b>     |  |
| <b>Post</b>      |  |
| <b>Signature</b> |  |
| <b>Date</b>      |  |

\* authorised to sign on behalf of the operator

## Schedule 6 - Interpretation

*“accident”* means an accident that may result in pollution.

*“Annually”* means once every year.

*“application”* means the application for this permit, together with any additional information supplied by the operator as part of the application and any response to a notice served under Schedule 5 to the EP Regulations.

*“authorised officer”* means any person authorised by Natural Resources Wales under section 108(1) of The Environment Act 1995 to exercise, in accordance with the terms of any such authorisation, any power specified in section 108(4) of that Act.

*“background concentration”* means such concentration of that substance as is present in:

- for emissions to surface water, the surface water quality up-gradient of the site; or
- for emissions to sewer, the surface water quality up-gradient of the sewage treatment works discharge; or
- for emissions of landfill gas, the ground or air outside the site and not attributable to the site.

*“Cell layout drawing”* means:

(a) A drawing or drawings of the proposed new cell that illustrate(s) in sufficient detail:

- i. the location of the new cell on the site;
- ii. the proposed level (Above Ordnance Datum) of the base of the excavation;
- iii. the proposed finished levels of all containment and leachate drainage layers;
- iv. the positions of leachate management infrastructure; and
- v. the positions of landfill gas infrastructure (if appropriate).

(b) A detailed written explanation of any minor design changes from the most recently approved cell that result from the new cell layout. This would include, for example:

- i. changes to slope length and gradient within the cell;
- ii. new leachate or landfill gas infrastructure construction design;
- iii. slope stability issues such as new basal excavation level; and/or
- iv. depth of waste.

*“Construction Proposals”* means written information, at a level of detail appropriate to the complexity and pollution risk, on the design, specifications of materials selected, stability assessment (where relevant) and the construction quality assurance (CQA) programme in relation to the New Cell or Landfill Infrastructure.

*“CQA Validation Report”* means the final “as built” construction and engineering details of the New Cell or of the Landfill Infrastructure. It must provide a comprehensive record of the construction and must include, where relevant:

- The results of all testing required by the CQA programme - this must include the records of any failed tests with a written explanation, details of the remedial action taken, referenced to the appropriate secondary testing;
- Plans showing the location of all tests;
- “As-built” plans and sections of the works;
- Copies of the site engineer’s daily records;
- Records of any problems or non-compliances and the solution applied;

- Any other site specific information considered relevant to proving the integrity of the New Cell or Landfill Infrastructure;
- Validation by a qualified person that all of the construction has been carried out in accordance with the Construction Proposals.

*“disposal”* means any of the operations provided for in Annex IIA to Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on Waste.

*“emissions to land”* includes emissions to groundwater.

*“EP Regulations”* means The Environmental Permitting (England and Wales) Regulations SI 2016 No.675 and words and expressions used in this permit which are also used in the Regulations have the same meanings as in those Regulations.

*“emissions of substances not controlled by emission limits”* means emissions of substances to air, water or land from the activities, either from the emission points specified in schedule 3 or from other localised or diffuse sources, which are not controlled by an emission or background concentration limit.

*“groundwater”* means all water, which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.

*“hazardous property”* has the meaning given in Schedule 3 of the Hazardous Waste (England and Wales) Regulations 2005 No.894 and the Hazardous Waste (Wales) Regulations 2005 No. 1806 (W.138).

*“Industrial Emissions Directive”* means DIRECTIVE 2016/75/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 November 2016 on industrial emissions

*“Landfill Infrastructure”* means any specified element of the:

- permanent capping;
- temporary capping (i.e. engineered temporary caps not cover materials);
- leachate abstraction systems;
- leachate transfer, treatment and storage systems;
- surface water drainage systems;
- leachate monitoring wells;
- groundwater monitoring boreholes;
- landfill gas monitoring boreholes;
- landfill gas management systems;
- lining within the installation;

within the site.

*“Liquids”* means any liquid other than leachate within the engineered landfill containment system.

*“LFTGN 05”* means Environment Agency Guidance for monitoring enclosed landfill gas flares.

*“LFTGN 07”* means Environment Agency Guidance on monitoring landfill gas surface emissions.

*“LFTGN 08”* means Environment Agency Guidance for monitoring landfill gas engines.

*“MCERTS”* means the Environment Agency's Monitoring Certification Scheme.

*“Medicinal product”* means any medicine licensed by the Medicines and Healthcare products Regulatory Agency (MHRA) of their predecessors under the Medicines Act 1968, section 130.

*“M2”* means Environment Agency Guidance Monitoring of stack emissions to air.

*“New Cell”* means any new cell, part of a cell or other similar new area of the site where waste deposit is to commence after issue of this permit and can comprise:

- groundwater under-drainage system;
- permanent geophysical leak location system;
- leak detection layer;
- sub-grade;
- barriers;
- liners;
- leachate collection system;
- leachate abstraction system;
- separation bund/layer;
- cell or area surface water drainage system;
- side wall subgrade and containment systems;

for the New Cell.

*“No impact”* means that the change made to the construction process will not affect the agreed design criteria, specification or performance in a way that has a negative effect.

*Pests”* means *Birds, Vermin and Insects*.

*“quarter”* means a calendar year quarter commencing on 1 January, 1 April, 1 July or 1 October.

*“recovery”* means any of the operations provided for in Annex IIB to Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on Waste.

*“Review of the Hydrogeological Risk Assessment”* means a written review of the hydrogeological risk assessment included in the Application, together with any other parts of the Application that addressed the requirements of the EP Regulations. The review shall assess whether the activities of disposal or tipping for the purpose of disposal of waste authorised by the permit continue to meet the requirements of the EP Regulations.

*“Solvent Emissions Directive”* means Directive 1999/13/EC (as amended by Directive 2004/42/EC) on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.

*“Waste code”* means the six digit code referable to a type of waste in accordance with the List of Wastes (England) Regulations 2005, or List of Wastes (Wales) Regulations 2005, as appropriate, and in relation to hazardous waste, includes the asterisk.

*“WFD”* means Waste Framework Directive Directive 2008/98/EC of the European Parliament and of the Council on waste

*“year”* means calendar year ending 31 December.

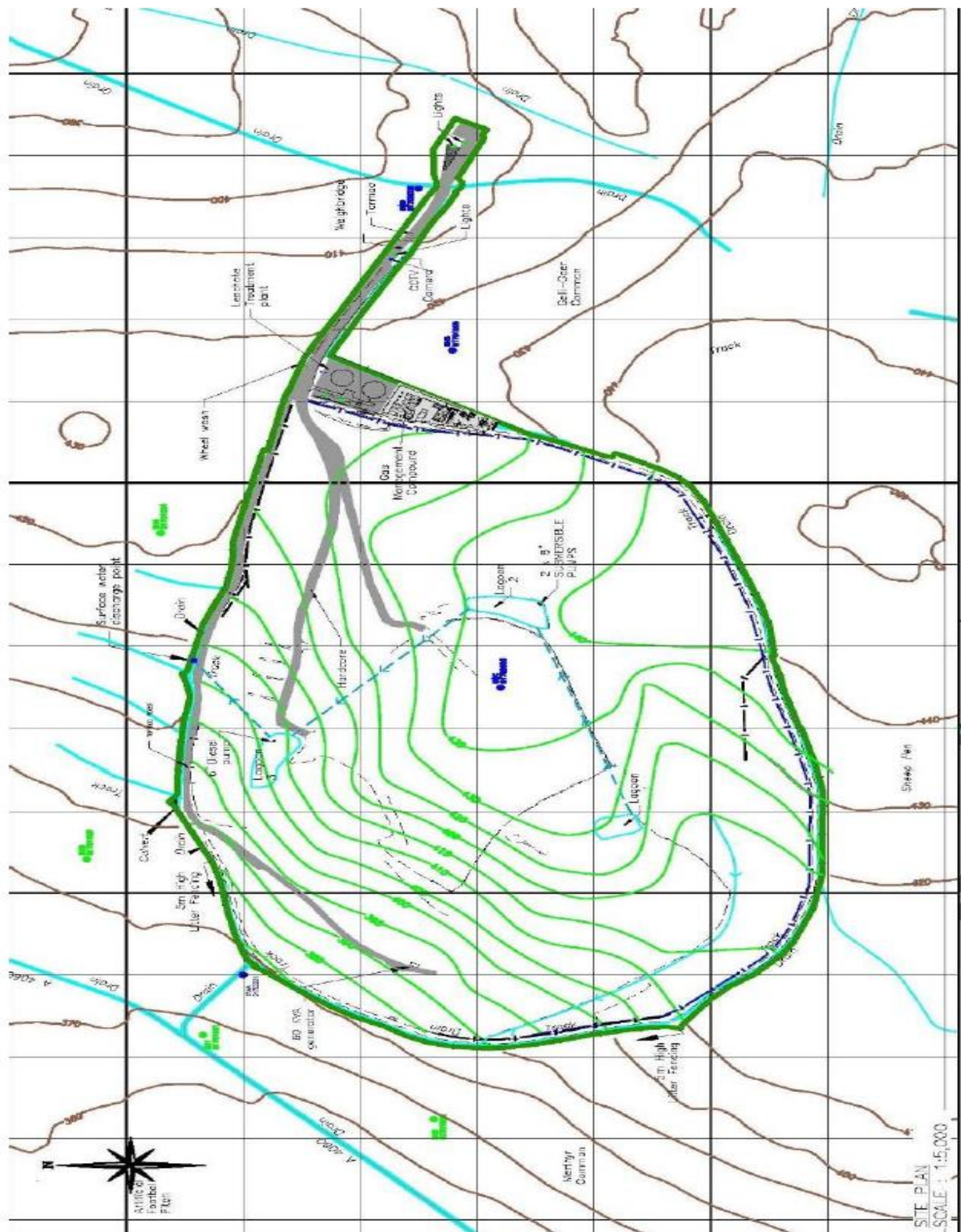
Where a minimum limit is set for any emission parameter, for example pH, reference to exceeding the limit shall mean that the parameter shall not be less than that limit.

Unless otherwise stated, any references in this permit to concentrations of substances in emissions into air means:

in relation to emissions from combustion processes, the concentration in dry air at a temperature of 273K, at a pressure of 101.3 kPa and with an oxygen content of 3% dry for liquid and gaseous fuels, 6% dry for solid fuels; and/or

in relation to emissions from non-combustion sources, the concentration at a temperature of 273K and at a pressure of 101.3 kPa, with no correction for water vapour content

## Schedule 7 - Site plan



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END OF PERMIT

# Appendix B

RAM model (provided in electronic form)

# Appendix C

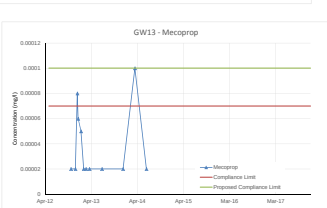
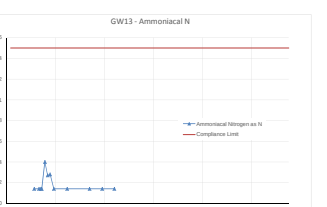
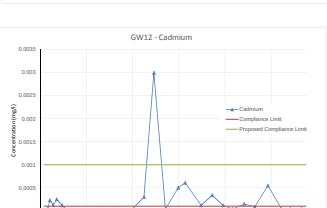
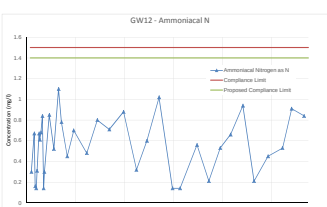
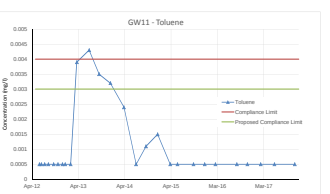
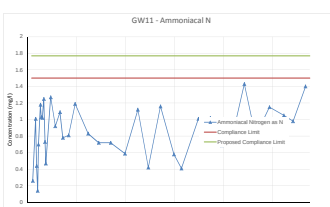
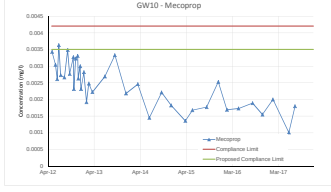
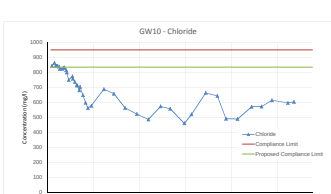
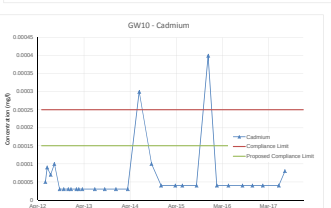
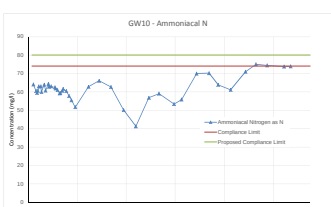
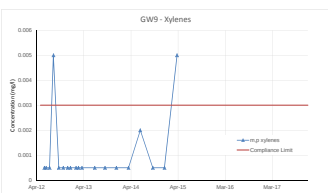
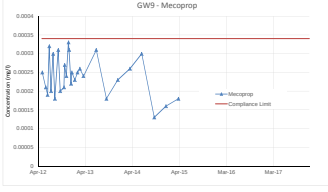
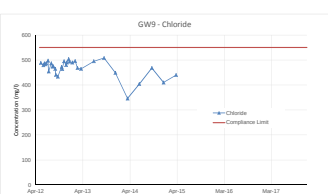
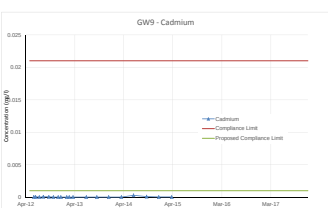
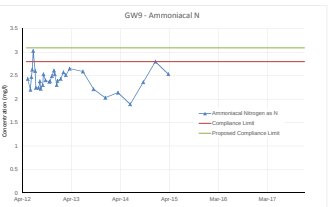
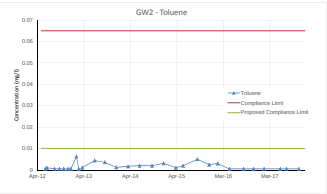
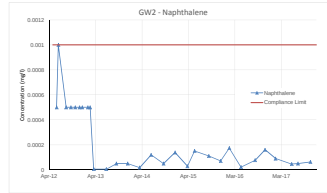
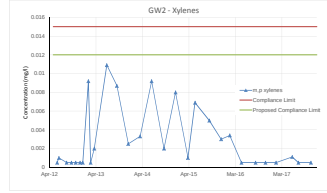
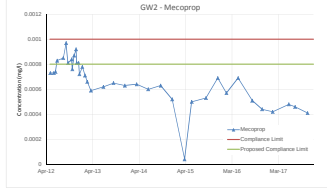
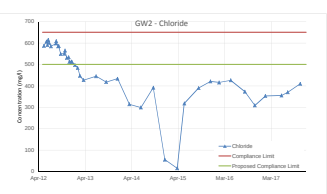
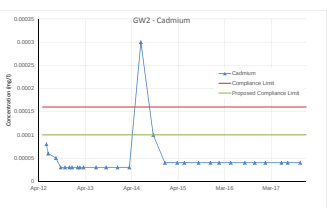
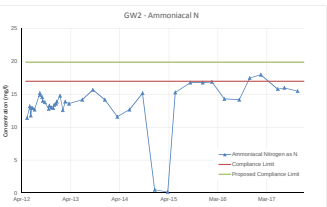
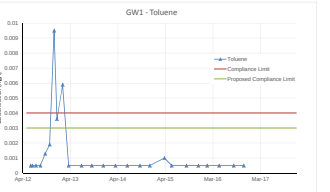
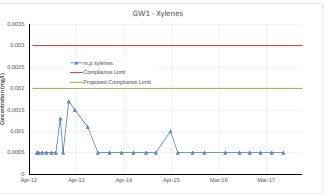
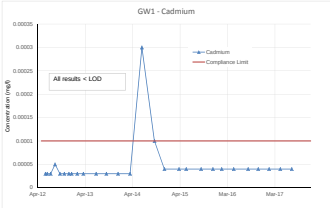
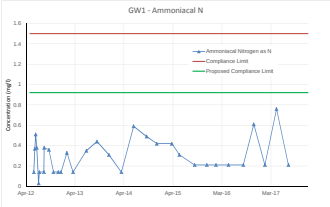
## Groundwater Compliance Analysis

| Compliance Limits   |      |         |        |         |         |         |         |         |     |
|---------------------|------|---------|--------|---------|---------|---------|---------|---------|-----|
| Parameter           | Unit | GW1     | GW2    | GW9     | GW10    | GW11    | GW12    | GW13    | P-3 |
| Ammoniacal Nitrogen | mg/l | 0.52    | 19.9   | 3.89    | 80      | 1.37    | 1.4     | 1.5     |     |
| Cadmium             | mg/l | 0.0001  | 0.0001 | 0.0001  | 0.0001  | 0.0001  | 0.0001  | 0.0001  |     |
| Chloride            | mg/l | 250     | 500    | 500     | 804     | 250     | 250     | 250     |     |
| Mecoprop            | mg/l | 0.00004 | 0.0004 | 0.00004 | 0.00004 | 0.00004 | 0.00004 | 0.00004 |     |
| Naphthalene         | mg/l | 1       | 1      | 1       | 1       | 1       | 1       | 1       |     |
| Toluene             | mg/l | 0.001   | 0.01   | 0.001   | 0.001   | 0.001   | 0.001   | 0.001   |     |
| Xylenes             | mg/l | 0.002   | 0.01   | 0.001   | 0.001   | 0.001   | 0.001   | 0.001   |     |
| Xylenes             | mg/l | 0.002   | 0.012  | 0.003   | 0.001   | 0.001   | 0.001   | 0.001   |     |
| Xylenes             | mg/l | 0.002   | 0.012  | 0.003   | 0.001   | 0.001   | 0.001   | 0.001   |     |

Compliance Limit

| Proposed Compliance Limit |      |         |        |         |         |         |         |         |  |
|---------------------------|------|---------|--------|---------|---------|---------|---------|---------|--|
| Parameter                 | Unit | GW1     | GW2    | GW9     | GW10    | GW11    | GW12    | GW13    |  |
| Ammoniacal Nitrogen       | mg/l | 0.52    | 19.9   | 3.89    | 80      | 1.37    | 1.4     | 1.5     |  |
| Cadmium                   | mg/l | 0.0001  | 0.0001 | 0.0001  | 0.0001  | 0.0001  | 0.0001  | 0.0001  |  |
| Chloride                  | mg/l | 250     | 500    | 500     | 804     | 250     | 250     | 250     |  |
| Mecoprop                  | mg/l | 0.00004 | 0.0004 | 0.00004 | 0.00004 | 0.00004 | 0.00004 | 0.00004 |  |
| Naphthalene               | mg/l | 1       | 1      | 1       | 1       | 1       | 1       | 1       |  |
| Toluene                   | mg/l | 0.001   | 0.01   | 0.001   | 0.001   | 0.001   | 0.001   | 0.001   |  |
| Xylenes                   | mg/l | 0.002   | 0.01   | 0.001   | 0.001   | 0.001   | 0.001   | 0.001   |  |
| Xylenes                   | mg/l | 0.002   | 0.012  | 0.003   | 0.001   | 0.001   | 0.001   | 0.001   |  |
| Xylenes                   | mg/l | 0.002   | 0.012  | 0.003   | 0.001   | 0.001   | 0.001   | 0.001   |  |

Statistical analysis undertaken for tabulated values



# Appendix D

## Surface Water Emissions Analysis

|            |     |     |                  |
|------------|-----|-----|------------------|
|            | NH3 | COD | Suspended Solids |
| 01/05/2012 | 5   | 120 | 100              |
| 31/12/2017 | 5   | 120 | 100              |

Compliance Limit

SWA

| Parameter                    | Unit | SW Monitoring Location |     |     |     |             |
|------------------------------|------|------------------------|-----|-----|-----|-------------|
|                              |      | SWA                    | SWB | SWC | SWD | SW Monocell |
| Ammoniacal nitrogen          | mg/l | 4                      | 5   | 2   | 5   | 5           |
|                              |      | 4                      | 5   | 2   | 5   | 5           |
| Chemical Oxygen Demand (COD) | mg/l | 53                     | 120 | 110 | 120 | 120         |
|                              |      | 53                     | 120 | 110 | 120 | 120         |
| Suspended Solids             | mg/l | 100                    | 100 | 52  | 100 | 100         |
|                              |      | 100                    | 100 | 52  | 100 | 100         |

