



Chapter Eleven

GROUND CONDITIONS, DRAINAGE AND FLOOD RISK

INTRODUCTION

11.1 When choosing a site for development consideration is naturally given to the supply and demand for the proposed operation in the area concerned. Planning policy is increasingly directing the development regime in order to protect the amenity and environment of towns, cities and the countryside in the public interest while promoting high quality, sustainable development. This chapter aims to give an understanding of the ground conditions, water resources and drainage in relation to the site for the proposed Enviroparks development, taking into consideration the current resources and their quality, any contamination either historic or potential, and the potential impact of the development on flood risk.

11.2 The Enviroparks Hirwaun Ltd development on the Hirwaun Industrial Estate proposes to use a currently empty, brownfield site to co-locate a recycling and commercial operation. By recycling diverse streams of waste using advanced and integrated technologies, Enviroparks hope to demonstrate maximum recycling rates and energy generation, with minimal residual waste and environmental impact.

11.3 The site chosen is located over boulder clay, a material with a low permeability, and historical and recent evidence suggests that areas of the site can become saturated. That said, the development proposes to incorporate appropriate measures to manage the quantities of water likely to be experienced at the site, and thus ensure that the risk of damage to the site operations, and the potential impact of the site on other local receptors is minimised.

11.4 This chapter is divided into two main sections. The first, details the current status of the site ground conditions, with consideration of historical activities and potential pollution, before going on to detail the proposed development of the site and assessing potential future impacts. The second section of the chapter presents the details of the current water resources at and around the site, and provides information on the local water quality. A flood risk assessment has also been undertaken for the proposed site, and considers the present flood risk to the existing site and the potential impacts on the hydrological characteristics of the area resulting from the proposed changes to the site use.

Legislation

11.5 Details included in the Planning Policy Wales document⁽²⁾, highlight the key planning principles and policy objectives in Welsh planning. Specific policy objectives appropriate to the flood risk and choice of site of the proposed development include:

11.6 *Promoting resource-efficient settlement patterns that minimise land-take and urban sprawl, especially through preference for the re-use of suitable previously developed land and buildings, wherever possible avoiding development on greenfield sites.* The development is to be situated on a brownfield site.



11.7 *Minimise the risks posed by, or to, development on, or adjacent to, unstable or contaminated land and land liable to flooding. This includes managing and seeking to mitigate the effects of climate change.* The proposed site is not liable to flooding, although may have flooded historically, as suggested by the presence of drift deposits. Historical site investigations suggest that an old refuse tip on the site contained wastes such as bricks, concrete, cinders, glass, metal and wood, and no elevated levels of contaminants have been found in soils from analysis undertaken thus far.

11.8 Additionally, Local Authorities are required to:
Support the shift towards a green economy by encouraging the development of clusters of industrial and commercial uses deriving environmental benefit from co-location, especially through the development of waste stream technologies and practices (i.e. eco-industrial networks). The Enviroparks scheme is such a development, with the co-location of the recycling park and energy production with a high energy use industry.

11.9 *Waste should be managed (or disposed of) as close to the point of its generation as possible, in line with the proximity principle. This is to ensure, as far as is practicable, that waste is not exported to other regions. It also recognises that transportation of wastes can have significant environmental impacts. The waste hierarchy, the proximity principle and regional self-sufficiency should all be taken into account during the determination of the BPEO for the network of waste management installations that provides the best solution to meet environmental, social and economic needs.* The proposed site aims to provide localised waste management facilities for the Rhondda Cynon Taf area. It is situated approximately 5 miles from the Bryn Pica landfill site and waste management facility, which is the main site in the area presently. Therefore any diversion from Bryn Pica to enable the Local Authority to meet its recycling and diversion from landfill targets, will result in minimal disruption to the current waste transportation, providing appropriate waste management facilities within the Borough and enabling the small percentage of waste arising from the Enviroparks facility to be disposed of locally.

11.10 As well as establishing an integrated and adequate network of waste disposal installations Local Authorities are also required, in conjunction with the Environment Agency to ensure that waste is recovered or disposed of without harming the environment, without endangering human health, without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours, and without adversely affecting the countryside or places of special interest, including areas of acknowledged importance in relation to the natural and cultural heritage.

11.11 The potential for pollution affecting the use of land will be a material consideration in deciding whether to grant planning permission. Material considerations in determining applications for potentially polluting development are likely to include:

- location, taking into account such considerations as the reasons for selecting the chosen site itself;
- impact on health and amenity;
- the risk and impact of potential pollution from the development insofar as this might have an effect on the use of other land and the surrounding environment (the environmental regulatory regime may well have an interest in these issues, particularly if the development would impact on an Air Quality Management Area or a SAC);



- prevention of nuisance;
- the need, where relevant, and feasibility of restoring the land (and water resources) to standards sufficient for an appropriate after use.

11.12 Water-related issues should be taken into account from an early stage in the process of identifying land for development and redevelopment. New development should be located and its implementation planned in such a way as to allow for sustainable provision of water services. Design approaches and techniques that improve water efficiency and minimise adverse impacts on water resources, on water quality, the ecology of rivers, and on groundwater are encouraged.

11.13 Development proposals in sewered areas are expected to connect to the main sewer, and the proposed Enviroparks site will indeed connect to the nearest main sewer for foul waters. Surface water run off will be used in the process where possible, discharging excess surface water via a Sustainable Urban Drainage System.

11.14 It is noted that the Rhondda Cynon Taf (Rhondda) Local Plan⁽³⁾ which now forms part of the Development Plan, includes Policy DCP5 which states that development in areas liable to flood risk will not normally be permitted unless in exceptional circumstances. Additionally, the Brecon Beacons National Park Authority includes several policies within the Local Unitary Development Plan⁽⁴⁾ which consider water quality and flood risk:

11.15 Policy G3: Development in the National Park

All proposals for development or change of use of land or buildings in the National Park must comply with the following criteria, where they are relevant to the proposal:

- *the proposed development does not have an unacceptable impact on, nor detract from or prevent the enjoyment of, the special qualities, natural beauty, wildlife and cultural heritage of the National Park;*
- *the proposed development does not have an unacceptable impact on surface waters or groundwater resources in either quality or quantity;*

11.16 Policy ES47: Water and Sewage Supply for New Development

Development will only be permitted if adequate water and sewerage infrastructure exists or can be provided without detriment to water quality, nature conservation interests or residential amenity. Where appropriate the National Park Authority will impose a planning condition or obligation to ensure that adequate services are available to serve the development.

11.17 Policy H2: Development and the Risk of Flooding

Development, including the raising of land, will not be permitted where that development would:

- *be on land at high risk of flooding*
- *result in an unacceptable risk of flooding either on or off site;*
- *adversely affect flood management or maintenance schemes;*
- *impede flood flows or result in changes in flow regime; or*
- *result in a net loss of flood-plain storage.*



11.18 *Where, exceptionally, development is allowed on land at high risk of flooding, such exceptional circumstances will be justified where it can be demonstrated that:-*

- *It needs to be located in a high risk area, or be part of a local strategy sustaining the settlement; or*
- *It is necessary to contribute to key employment objectives; and*
- *The proposal is on previously developed land; and*
- *The potential consequences of flooding have been considered and found to be acceptable.*

11.19 Highly vulnerable development will not be permitted on land at high risk of flooding where that land is without significant flood risk infrastructure.

11.20 Policy H3: Reducing the Risk of Flooding
Development will only be permitted where:-

- *it can be demonstrated that there is no increased risk of flooding locally or elsewhere due to additional surface run-off or changes in flow regime; or*
- *where adequate mitigation works which are necessary to achieve such aims can be provided.*

11.21 This chapter will consider the potential impact of the proposed Enviroparks development, and will consider how the site proposals will ensure that national and local policies are met. It begins with baseline analyses of the site. These consider the current ground and water quality conditions at the site, as well as the likelihood of flooding and whether or not the proposed location is appropriate for the development.



GROUND CONDITIONS

METHODOLOGY USED

11.22 The land earmarked for the proposed development of the Enviroparks Hirwaun Ltd site is located within the Hirwaun Industrial Estate. The site is located immediately north of Fifth Avenue, and immediately west of Ninth Avenue. The aim of this sub-chapter is to identify the soils and geology at the site, and to assess the potential for any historic contamination which may be present in, on or under the ground. The purpose of the study is to consider the suitability of the land on which the proposed development will sit, and coupled with details of any pollution prevention measures, to demonstrate that the likelihood of future pollution of the land either beneath the site, or adjacent to it, is limited.

11.23 The study will also work towards the provision of a baseline of pollution for the site, which serves to inform the planning process, but which will also be beneficial to the Environmental Permitting process. Although there are currently limited signs of development at the site, the area is brownfield land, having historically been developed as an ordnance works, and the study will assess the levels of any natural pollutants in the ground, those which may be present as a result of historical contamination, and the future potential for the Enviroparks site to further contribute to contamination of the land. Any residual impacts predicted to remain despite the pollution prevention measures which will be incorporated into the development, will be assessed for potential impact on the land quality of the site and the surrounding area.

11.24 The assessment begins with a desk based study of available information. Several reports have been prepared for the site and date from the 1970's to a very recent study which specifically considers the proposed Enviroparks development. The studies and other sources of local information are reviewed to provide a baseline of information regarding the geology and soil quality of the current site as a result of natural features and historic uses. Study data have been obtained for the site and the surrounding area and a site visit has been undertaken in order to develop an understanding of the physical environment of the site and of the likely environmental impacts of the proposed development.

11.25 Once the initial desk study information has been compiled, it will be possible to identify any requirement for further site investigation works, and a description of any such works undertaken and their findings will be presented.

11.26 Should any unacceptable levels of contamination be found at the site, potential remediation measures will be considered using an options appraisal methodology. The options appraisal will assess the nature of available remedial methods, the work, disruption and timescales involved in remediating the site, and the costs associated with each proposal, as well as the likely effectiveness of the methods in removing contamination. Where remediation is required, this will not be undertaken prior to the submission of the planning application, and thus no final baseline of pollution will be available for inclusion in the planning application. That said, the assessment of the future potential for contamination and the likely impact of any such pollution can continue, as the impact of the proposed site can be considered independently of any baseline.



11.27 Once the current status of the site is detailed, it will be possible to assess the likely impact of proposed future operations at the site, and hence details of the construction and operational phases of the development, coupled with information on the pollution prevention measures which are planned for the site will be presented in the impacts section. The likely impact will be considered by assessing the 'pollutant linkage'; that is the source, pathway and receptor of potential future pollution. Essentially, where the source, pathway and receptor linkage is complete, the possibility for pollution to occur exists, and further mitigation measures should be considered. Without a complete pollutant linkage either through a lack of source, pathway or receptor, there is no risk of land contamination.

11.28 Any further proposed mitigation measures will be detailed, and an assessment of the residual effects of any pollutant linkage will be detailed. Note that specific effects on the water environment are discussed in the Drainage and Flood Risk section of this Chapter

11.29 The methodology employed is broadly in accordance with current UK guidance 'Model Procedures for the Management of Land Contamination' (CLR11)⁽¹⁾.

BASELINE ANALYSIS

11.30 Baseline data has been gathered from various sources including a site visit, library studies, maps and plans, an EnviroCheck report procured from Landmark, and a review of historical surveys and studies of the site. The first stage of the baseline analysis is to investigate the history of the site and determine the potential impact which may have occurred due to earlier operations. The potential for impact is largely dependant on the nature of the geology and hydrology at the site, and where this is known, an assessment of likely contamination can be made. Where it is considered that the potential for historical contamination exists, or where the study data has deficiencies, further intrusive investigation should be commissioned at the site. This has been the case for the proposed Enviroparks site, and thus the detail of the investigation most recently commissioned is included, and a summary of the findings of the investigation to date will complete the baseline study. All available studies and surveys of the proposed site are included in full as appendices to this chapter.

Geology

11.31 The most recently available geological map of the area has been obtained (BGS 1:50,000 series map of Merthyr Tydfil. Sheet 231) and shows the site to be two thirds covered in alluvium, above boulder clay. The north eastern corner of the site lies directly over boulder clay. Below this glacial drift sits Farewell Rock, and indeed an outcrop of Farewell Rock is located immediately west of the site. The Farewell Rock formation (Langsettian; Westphalian A) is an outcrop is around the margins of the productive coal basin. The strata consists of a series of coarsening upwards cycles with marine bands at there bases and thick fluvial sandstones above. The sandstones are collectively known as the 'Farewell Rock'. This quartzitic sandstone unit has the *Gastrioceras Subcrenatum* marine band at its base. Below the marine bands is a basal grit strata, which lies over limestone stratum. The surrounding area is heavily faulted, although no faults are noted as running through the site. Figures 1 and 2 present copies of the relevant area of the Ordnance Survey and Geological map.



History of the Site

11.32 The proposed development site was greenfield land until the H-N Royal Ordnance Factory, Hirwaun, South Wales was set up as part of the 1939-45 war emergency expansion plan. As can be the case with ordnance works, there is limited data available on the operations at the site, however it is understood to have been located on the proposed development site and was involved in the production of .303 cartridges in only a very limited way⁽³⁾. The site engineered shell cases and other small metal based components⁽⁴⁾, and no evidence has been found to suggest that it was also involved in filling the cases. Therefore the site is understood to have been an engineering works only, with no explosives or filling. The site ceased operations after the war and was demolished in full sometime between 1969 and 1979. The site has since remained empty, although some works have been facilitated in order to improve the drainage at the site for potential future use.

Historical Investigations and Site Status

Proposed development of the Northern Section of Hirwaun Industrial Estate; Wimpey Laboratories Ltd; Reference S/8731 January 1972 (See Appendix 1)

Review of Body of Report

11.33 This report details work undertaken at the site between 12th and 30th November 1971. The works were commissioned in light of the proposal at the time to develop the northern section of the Hirwaun Industrial Estate. Three distinct areas were investigated:

- The northern area; the land previously occupied by the Ordnance Factory and the currently proposed location for the Enviroparks site.
- The south eastern area; situated between the old disused railway line (essentially Fifth Avenue) and the Heads of the Valley's Road.
- The south western area; again, between the old disused railway line and the Heads of the Valley's Road, but further west and separated by the sewage works.

11.34 Therefore, it is the detail of the northern area from this study which is of most concern to the Enviroparks site. The report notes that the remains of the factory were evident at the time of the investigation, including concrete, roads, disused pill boxes, old foundations, sub-station buildings and a rubbish tip.

11.35 Geological maps available at the time of the report were viewed and identified that the site was covered by glacial drift (Boulder Clay) with areas of peat underlain by the Fairwell Rock Sandstone. Conflicting records between the two geological maps viewed, of the extent of peat to the north of the disused railway line, was confirmed by the site investigation, which recorded the area consisting of mainly alluvium, although some small areas of peat were recorded.



11.36 The northern area of the site under investigation was assessed extensively through a series of boreholes, trial pits and probe holes. Five of the eight bore holes drilled were to the north of Fifth Avenue. Nine of the sixteen trial pits were dug to the north of Fifth Avenue, and twenty two of the fifty one Mackintosh probes (which determine the presence or otherwise of peat) were made in this northern area. Although some peat was identified, no extensive deposits of peat were found. Although some laboratory analysis was undertaken, this was limited to soil moisture contents, compaction testing, sulphate and pH. A summary of the borehole logs from the northern area is provided below:

Table 11.1 Borehole 1 (North western corner of the site)

<i>Depth</i>	<i>Description</i>
0 – 1.5 m	Dark grey silty Clay
1.5 – 3 m	Boulder
3 – 4 m	Firm grey sandy silty Clay with gravel, cobbles and boulders
4 – 4.5 m	Very dense grey slightly clayey sandy fine to coarse Gravel with cobbles

Table 11.2 Borehole 2 (North mid point of the site)

<i>Depth</i>	<i>Description</i>
0 – 1.5	Brown sandy silty Clay with gravel, cobbles and some organic matter
1.5 – 2	Boulder
2 – 3	Very dense brown fine to coarse Gravel and medium to coarse Sand
3 - 4	Fine grey Sandstone with brown staining on fracture planes

Table 11.3 Borehole 3 (North eastern corner of the site)

<i>Depth</i>	<i>Description</i>
0 – 2 m	Stiff grey sandy silty Clay with gravel, cobbles and boulders
2 – 4 m	Dense grey clayey fine to coarse Gravel with cobbles and boulders

Table 11.4 Borehole 5 (Centre of the site)

<i>Depth</i>	<i>Description</i>
0 – 1 m	Fill – concrete
1 – 4 m	Firm becoming stiff grey sandy silty Clay with gravel, cobbles and boulders
4 – 4.5 m	Grey slightly clayey sandy fine to coarse Gravel with cobbles
4.5 – 5 m	Firm grey sandy silty Clay with gravel, cobbles and boulders



Table 11.5 Borehole 6 (South eastern corner of the site)

<i>Depth</i>	<i>Description</i>
0 – 0.2 m	Organic Topsoil
0.2 – 4 m	Grey clayey medium to coarse Gravel, Cobbles and Boulders; very dense below 3 m
4 – 5 m	Firm mottled blue grey and yellow brown sandy silty Clay with gravel, cobbles and boulders
5 – 10 m	Boulders

11.37 Ground water was observed in Boreholes 1-3. Water was present in Boreholes 5 and 6, however water had had to be added to assist boring and thus no groundwater depth could be determined. The report notes that ground water in the northern area was observed at depths between 0.35 m and 1.3 m below ground level. It was also encountered in trial pits, and filled trial pits 1,2,4,6 and 9 quickly. The report suggests that groundwater is unlikely to present problems when excavating the higher parts of the site providing that cuts are shallow and that proper attention is paid to drainage.

11.38 Trial pits were dug to shallower depths and revealed the following general stratum:

Trial Pit 1, 2, 7 and 8
Fill to between 0.6 and 1.85 m
Sandy silty Clay to 2.75m with gravel, cobbles and boulders (to 3.65 in TP 8).

11.39 Note: trial pits 1 and 2 are in the vicinity of the old rubbish tip. Fill included cinders, bricks, glass, metal and wood fragments, bricks, building rubble, reinforcing steel, concrete and pulp cardboard.

Trial Pit 3, 4, 10
Topsoil to between 0.1 and 0.3 m
Some Fill over sandy silty Clay with gravel, cobbles and boulders to 2.75 m

Trial Pit 6
Dark brown Peat to 0.6 m
Various Clay strata to 2.45 m
Sandy fine to coarse Gravel with cobbles and boulders to 2.75 m

Trial Pit 9
Topsoil to 0.3 m
Sandy silty Clay with gravel, cobbles and boulders to 1.2 m
Clayey sandy fine to coarse Gravel with cobbles and some boulders to 2.15 m

Trial Pit 11
Fill to 0.95 m
Topsoil to 1.15 m
Stiff Clay with gravel, cobbles and boulders to 2.45 m

11.40 The results of the moisture content determinations indicate that the natural moisture content of the clayey glacial drift is wet of optimum. The results of chemical testing suggest that the deterioration of good quality cement concrete in foundations or other buried structures due to sulphate attack is unlikely to occur at this site, although the report does note that adequate site drainage should be provided to avoid the contact of potentially acidic waters with the concrete.



**Trial Pits of the Hirwaun Industrial Estate, Dated 15th July 1988;
Provided by Thomas Morgan Associates. (See Appendix 2)**

11.41 No information is available as to the location of the trial pits on the Estate, however they were provided to Exploration Associates, by the Welsh Development Agency in 1995 for use in undertaking an investigation and preparing a report. A summary of the findings of the logs is presented below.

11.42 Seven logs are provided and demonstrate the following general stratum:

Ground Level to 75-100 mm	Subsoil
75-100 mm to 600-1,000 mm	Light brown clay with angular stone
600-1,000 mm to 1,100-1,900 mm	Dark brown clay with cobbles
1,900 mm to 2,900 mm	Peat observed in two trial pits
1,100-2,900 mm to 2,200-3,000 mm	Clay ranging from dark brown clay with cobbles / stones to organic stiff clay.

**17 Acre Site, Hirwaun Industrial Estate; Interpretive Report on Ground Investigation;
Exploration Associates; Report Number 155102. (See Appendix 2)**

11.43 This report was prepared on the instruction of Thomas Morgan & Associates and was intended to determine the nature, depth, chemical and engineering properties of the materials underlying the site to assess bearing capacities and likely differential settlements, together with groundwater and gas levels present at the site.

11.44 Fieldwork was undertaken at the site between 12th and 28th June 1995 and comprised eight cable percussive boreholes drilled to depths of between 3.1 and 10 m, and thirteen excavated trial pits. All excavations were logged and samples were taken for subsequent analysis. The works also included a series of eighteen dynamic cone penetration tests to determine the extent of any peat deposits, which had been highlighted in the earlier, 1972 report. Laboratory testing of samples includes analysis for moisture content, Atterberg Limits, particle size distribution, specific gravity, pH, total sulphate and standard compaction tests. Additionally, four samples were tested for chemical content.

11.45 Similarly to the earlier studies, the geological map of the area was assessed and identified the site as being underlain by Recent Alluvium and Glacial Boulder Clay. The boreholes and trial pits showed the ground to be underlain by Made Ground overlying Alluvial Clay deposits or Glacial Sands and Boulder Clay. Several metres of Sand and Gravel were encountered in all boreholes. Where bedrock was encountered this was Grey Mudstone and Grey Sandstone.

11.46 The findings of the intrusive investigation are summarised below:

11.47 Made ground was encountered in all locations to a maximum depth of 4.2 m below ground level (BGL), based on information provided in the borehole logs. The material generally consisted of very compact sandy clayey gravel and cobbles of sandstone with some stiff, silty, sandy, gravelly clay. The report considered this likely to be Reworked Sand and Gravels and Boulder Clay.

11.48 Alluvial deposits were encountered in all boreholes except 2 and 3, located to the north and south east of the site respectively, and were present to depths of between 1.7 and 6.1 m BGL. The alluvium, consisted of brown grey silty, slightly sandy gravelly clay with occasional woody relics.



11.49 Some trial pits revealed a dark, black clayey stratum directly below the Made Ground, and this is considered to be decomposed plant material, perhaps from a grassed area which has subsequently been buried by the Made Ground.

11.50 Glacial Boulder Clay was encountered in trial pits 2 and 3 at between 2.8 and 4 m BGL. The Clay consisted of a stiff grey, silty, sandy clay with some gravel and cobbles of sandstone.

11.51 Sands and Gravels were encountered below the Alluvium / Glacial Clay and comprised the remainder of most of the logs. The Sand and Gravels were generally brown, very sandy, angular to sub rounded fine to coarse gravels of mudstone and sandstone.

11.52 Investigations in boreholes 1, 2, 3 and 7A encountered bedrock, a fine grained grey sandstone, from depths as little as 2.45 m BGL, but generally deeper than 6.5 m BGL.

11.53 Groundwater was struck in all boreholes apart from the shallow (1.4 m BGL) borehole 7. Strikes occurred between 2.8 and 6.5 m BGL and generally corresponded to the Sand and Gravel strata. The report does note however that groundwater levels fluctuate at different times of the year, and this is supported by the earlier findings of the 1972 report. Groundwater movement is considered to be in a southerly direction generally, although no movement of groundwater was proven during the 1995 investigation.

11.54 Similarly to the 1972 report by Wimpey, the Exploration Associates report provides an engineering assessment and significant information on foundation design etc. Of key interest to the land quality study, is the provision of the results from the chemical tests on soil samples, which enable an initial baseline assessment to be provided. Four samples were taken from trial pits and were analysed in accordance with the Interdepartmental Committee for the Redevelopment of Contaminated Land suite of contaminants (ICRCL suite)⁽⁵⁾. The results are reported below and are compared against the more recent Soil Guideline Values (SGV) (a)⁽⁶⁾, where available. Where no SGV is available, the New Dutch List (b)⁽⁷⁾ has been applied, and where no other reference value is available, or where the ICRCL limits are lower than the Dutch List limits, the ICRCL assessment limit* has been included, despite these limits no longer being in use in the UK.

11.55 The levels of contaminants recorded do not exceed the relevant Soil Guideline Values, the ICRCL threshold levels, or the action levels of the Intervention values and target values - soil quality standards issued by the Ministry of Housing, Spatial Planning and Environment, The Hague (The New Dutch List).

11.56 Whilst the analysis over page suggests that the site has not suffered from contamination, it is noted that the samples were drawn from trial pits and were taken at relatively shallow depths. Since the site has been re-graded, including the removal of unsuitable overburden, it may be that much of the strata from which the samples were drawn may have been removed. Additionally, the samples were taken from the north of the site, approximately half way along the northern boundary line (TPB), or along the southern boundary line (TP1, TP2 and TP4). Therefore no samples have been taken from key areas such as that which is known to have been used as a small landfill area. Additionally, further pH and sulphate results collected from across the site during this investigation suggests that some pH results were as low as 4.5, and elevated sulphate conditions can be experienced in some locations. Thus, the report suggests that there may be a requirement for an increased class of concrete.

Table 11.6 Results and Assessment of Identified Pollutant Concentrations. Thomas Morgan and Associated 1995

<i>mg kg⁻¹ unless otherwise stated</i>	<i>TP1(2.5 m)</i>	<i>TP2(1.0m)</i>	<i>TP4(1.55m)</i>	<i>TPB(2.0m)</i>	<i>Assessment Limit</i>
Arsenic	8	1.8	27.4	2.2	500 (a)
Cadmium	2	1.7	3.8	0.8	1,400 (a)
Chromium	5	5	17	9	5,000 (a)
Copper	20	5	19	3	130*
Lead	53	5	86	15	750 (a)
Mercury	< 0.5	< 0.5	< 0.5	0.6	480 (a)
Nickel	25	7	16	9	5,000 (a)
Selenium	1.9	< 0.5	0.7	< 0.5	8,000 (a)
Zinc	94	25	147	36	300*
Water Soluble Boron	< 0.5	< 0.5	0.6	< 0.5	3*
pH Value	6.5	6.3	5.5	6.1	No Limit
Phenols	< 1	< 1	< 1	< 1	21,900 (a)
PAH	< 0.5	< 0.5	< 0.5	0.9	40 (b)
Total Cyanide	< 1	< 1	< 1	< 1	50 (b)
Total Sulphate (% as SO ₄)	0.14	0.07	0.11	0.14	-
Sulphide	< 1	< 1	< 1	< 1	250*
Elemental Sulphur	570	146	1,880	2,820	5,000*
Thiocyanate	No result	< 2	No result	No result	50*



**Report on 17 Acre Site at the Hirwaun Industrial Estate;
Thomas Morgan Associates; Reference P329.01 September 1995. (See Appendix 3)**

11.57 This report presents a proposal for works at the site, presented to the Welsh Development Agency in September 1995. It provides a summary of the aforementioned studies, and presents advice on the likelihood of mining subsidence and the nature of supplies to the site.

11.58 The report identifies that the areas of peat identified in the 1972 report have been further assessed and the area does not extend as widely or deeply as originally anticipated, with only shallow depths of peaty soil at the site. The dynamic probe investigations did identify a soft area of peat or very soft clay in the extreme south eastern corner of the site and it is suggested that structures are not placed in this area without the use of piled foundations. The site also appears to be outside of the zone of influence from two local mining subsidence zones.

11.59 The report notes that the level of the roadways is slightly elevated above general ground level in the area, and thus the site appears to be relatively low lying. The report details a building and a subsurface tank on the site, however the building has since been removed and the tanks has been filled in. The site is noted as having poor ground drainage. Although no issues of flooding were raised, and it was considered suitable that the storm water from any proposed development could drain into the Camnant as do the storm water systems for the southern and northern areas of the estate, it was suggested that any storm water run off be routed through a dedicated drain to avoid possible overloading of the current system. The local foul water system is routed adjacent to Fifth Avenue and connects to the sewage pumping station, joins the foul water system from the eastern and western areas of the estate, and enters the sewage treatment works located to the south west of the proposed development site. It is considered possible for any new development to join this system.

11.60 It is noted that servicing of the site should not present a problem as all mains facilities are in close proximity. At the time of writing, the report notes that the sewage treatment works, situated to the south west was receiving 1,000,000 litres per day, approximately 50 % of its design inflow, and thus dealing with effluent flow from any proposed development was not considered to be a constraint.

**Summary of Works at Hirwaun 17 Acre Site;
Provided by Thomas Morgan Associates. (See Appendix 4)**

11.61 In additional description of the site provided by Thomas Morgan and Associates notes that the original factory was demolished at some point in the 1960's and a cut and fill operation ensured, followed by capping with sub soil. This suggests that the site would have been suitably cleared of any potential ordnance at this point. The description of works undertaken by Thomas Morgan identifies that the site had become heavily waterlogged prior to their works, assumed to have been undertaken in the mid 1990's. The ensuing re-grading included removing the unsuitable overburden, placing this at the extremities of the site for landscaping purposes, and re-grading the boulder clay to give acceptable cross grades to the site. The site was then drained with temporary open channels and ditches, assumed to be the existing herringbone ditches.



**Hirwaun Ecopark. Phase 1 Environmental Desk Study
Final Report; November 2007. ERM. (See Appendix 5)**

11.62 The report by ERM included as Appendix 5 was produced with full consideration of the proposed Enviroparks development. It provides an initial desk based study and give consideration to the two 1995 reports by Thomas Morgan Associates, and includes the provision of an EnviroCheck report from Landmark. In summary, the site is described as being located with the Penderyn Reservoir to the north, a manufacturing unit to the east with farm land beyond, further small industrial units to the south with the A465 beyond and farm land to the west. The site is described as having generally flat topography and being waterlogged to the southern end of the site.

11.63 The historical maps of the EnviroCheck report demonstrate that the site is undeveloped until between 1922 and 1951. The Penderyn Reservoir is first shown on a map of 1921. The first evidence of a refuse tip at the site is on the 1:10,560 Scale map of 1968-1969, which shows a refuse tip immediately east of the stream which intersects the site, in the north western corner of the site. As detailed in the Wimpey laboratories report of 1972, the fill included cinders, bricks, glass, metal and wood fragments, bricks, building rubble, reinforcing steel, concrete and pulp cardboard. The ordnance factory is then demolished at some point between 1969 and 1979, and remains undeveloped to the present day.

11.64 The remainder of the local area has developed gradually with the first identified industrial plant, an engine house, noted in 1891 to the south east of the site. By the map of 1900, this is associated with a brick works, and several quarries are noted in the area, although the Hirwaun Ironworks dates back to Roman times. The maps between 1900 and 1951 change little, however the 1:10,560 Scale map of 1951 show the development of the industrial estate to the north of the A465, as well as the ordnance factory, further north, below the Penderyn Reservoir. Since then, the Hirwaun Industrial Estate has gradually expanded to fill the area between the original factory units and the proposed Enviropark development. Industries which have located on the estate include a concrete works, a glass factory, a radio factory, engineering works, a bakery and a meat factory, and chemical and pharmaceutical factories. Current industries in the immediate vicinity of the site include the Dwr Cymru Hirwaun Sewage Treatment Works, Eden Industries Ltd, who produce shop fittings and shelving, and DAR Products who produce pipes and fittings. Other local industries include engineering companies, food processors, plastic moulding and products manufacturers, road haulage companies, builders merchants and metal spinners.

11.65 Two prosecutions have been brought against companies in the area which relate to authorise processes, and both relate to the illegal storing and treatment of wastes. Local waste and landfilling activities are listed as the historical Hugh Patches site, which was a landfill, operating approximately 800 m to the south west of the site between 1970 and 1980. The site accepted inert, industrial, commercial and household wastes. There was also a small landfill adjacent the Tower Colliery Washery approximately 925 m to the south east, which accepted hardcore, rubble and excavated natural minerals. This licence has since been cancelled. Two other waste management facilities are listed in the area, one of which is located on the Hirwaun Industrial Estate and is described as a material recycling treatment facility. The second licence is also for recycling or reclamation and is issued to EMS Togo Ltd in Rhigos for the recycling and reclamation of polyurethane, PVC and associated packaging.

Current Site Investigation

11.66 Although several rounds of intrusive monitoring have been undertaken at the site, these have primarily focussed on the engineering requirements of any future development.



In order to produce a representative baseline of any potential contaminative presence in the ground, it is considered prudent to undertake a further investigation to support those which have gone before. Although not anticipated that any significant contamination would be encountered, it was suggested that a survey of ground conditions be undertaken across the site, in order to ensure that the historical presence of industrial operations on and around the site, including refuse tips and underground storage tanks, had not resulted in any notable levels of contamination. The works will also enable a baseline of contamination to be drawn, against which any future investigation of the site can be compared.

11.67 The study was combined with further engineering investigations, however the study of contamination levels was limited to key sample areas and depths. The proposed sampling regime included a series of fifteen trial pits, five observation pits and nine boreholes across the site. Each of the boreholes was to have a combined gas and groundwater installation finished with a suitable sampling head.

11.68 The request to the geotechnical team was that samples should be representative of each soil type and any apparent pollution, and where additional samples were taken due to suspicions of contamination, these samples should be analysed. Spare samples were to be retained for potential leachability tests, and the samples of any permeable gravels from each borehole should be retained for potential particle size analysis, in the event that contamination was found.

11.69 The general suite of testing for soil samples included; Total Organic Carbon (TOC), pH, heavy metals suite (arsenic, antimony, barium, water soluble boron, cadmium, chromium (hexavalent and total), copper, lead, mercury, molybdenum, nickel, selenium, zinc), sulphate, sulphide, sulphur phenol, BTEX, chloride, fluoride, cyanide (free and complex), thiocyanate and 19 speciated plus coronene and total PAH.

11.70 Six groundwater monitoring visits were proposed to enable assessment of the hydraulic gradient at the site, and during two of these, groundwater samples should be taken assuming it was encountered.

11.71 The general suite of testing for groundwater samples collected from standpipes should include pH, Total Organic Carbon (TOC), heavy metals suite (arsenic, antimony, barium, water soluble boron, cadmium, chromium (hexavalent and total), copper, lead, mercury, molybdenum, nickel, selenium, zinc), sulphate, sulphide, sulphur, phenol, BTEX, 19 speciated plus total PAH, chloride, fluoride, cyanide (free and complex), thiocyanate, COD, BOD and ammonia and electrical conductivity.

11.72 The purpose of the site investigation detailed above is to identify the presence of any contamination in, on or under the site either due to naturally elevated concentrations or due to historical activities on or local to the site. The results of the survey will be used to inform the planning process and to create a baseline of the land quality at the site against which any future site investigation results can be compared.



Currently Available Results

11.73 The intrusive works were undertaken at the site between 18th August 2008 and 15th September 2008. The trial pit and borehole logs are presented in Appendix 6, along with a map of their locations, and initial analysis results. In summary, the trial pits revealed Made Ground to depths of 0.3 – 3.5 m in all but one location, trial pit 12, which was considered to possibly consist of weathered bedrock from ground level. Made Ground generally consisted of brown clayey, sandy Gravel, sometimes changing to Clay or Silt at deeper levels. Where natural ground was encountered in the trial pits, this was generally described as clayey Gravel although soft to firm orange Clay was also encountered in several pits which was described as possibly being reworked natural material. Some trial pits revealed strata of Silt or Cobbles and Boulders.

11.74 Borehole strata were similarly described for the most part, with lower strata consisting of Cobbles of sandstone and quartzite, or Sandstone. Groundwater was identified mainly in the northern and western sections of the site, but also in the south eastern corner.

11.75 Groundwater strike levels are detailed in Table 11.7 below, alongside the actual groundwater elevation. Groundwater contour plots which identify the assumed direction of flow are presented in Appendix 7, the Flood Risk Assessment report.

Table 11.7 Groundwater Levels Recorded by Soil Mechanics. August / September 2008

<i>Location</i>	<i>Strike Level mBGL</i>	<i>Groundwater Elevation mAOD</i>
Trial Pit 2	2.4	197.04
Trial Pit 11	1.4	198.58
Trial Pit 11A	1.4	198.43
Trial Pit 12	1.7	198.2
Trial Pit 12A	1.8	198.76
Trial Pit 14	1.8	198.59
Trial Pit 15	1.8	199.3
Trial Pit 16	0.3	201.18
Trial Pit 217	1.3	202.14
Borehole 103	8.4	190.48
Borehole 104	9.1	190.17

11.76 A summary of the preliminary available contamination test results are reported below and are compared against Soil Guideline Vales (SGV) (a)⁽⁶⁾, where available. Where no SGV is available, the New Dutch List (b)⁽⁷⁾ has been applied, and where no other reference value is available, or where the ICRCCL limits are lower than the Dutch List limits, the ICRCCL assessment limit^{*(5)} has been included, despite these limits no longer being in use in the UK.

Table 11.8 Summary of Preliminary Results and Assessment of Identified Pollutant Concentrations. August / September 2008.

<i>Contaminant</i>	<i>Concentration Range mg kg⁻¹ unless otherwise stated</i>	<i>Assessment Limit</i>
Elemental Sulphur	<20 - 306	20,000
SO ₄ ⁻⁻ (acid sol)	82 - 1,740	2,000 / No limit *
Antimony	<0.5 – 1.2	-
Arsenic	5.3 – 13.9	500 (a)



Contaminant	Concentration Range mg kg⁻¹ unless otherwise stated	Assessment Limit
Cadmium	<0.1 – 0.76	1,400 (a)
Chromium	12 – 22.5	5,000 (a)
Copper	12.7 – 26.5	130 *
Lead	19.7 – 46.9	750 (a)
Mercury	<0.1	480 (a)
Molybdenum	<0.5 – 0.6	200 (b)
Nickel	11.7 – 28.2	5,000 (a)
Selenium	<0.5 – 1.4	8,000 (a)
Zinc	34.6 – 212.4	300 *
Total Moisture % at 105°C	11.6 – 21.8	-
Total Petroleum Hydrocarbons by GCFI	<11.3 – 114	5,000 (b)
>C12 - C16	<2 – 4.51	5,000 (b)
>C16 - C21	<2 – 2.62	5,000 (b)
>C21 - C35	<4.95 – 65.8	5,000 (b)
pH units	7.3 – 10.1	-
Boron (Water Soluble)	<0.5 – 2.3	3 *
Barium	<0.1 – 420	625 (b)
Chloride	20 – 102	-
Chromium VI	<0.1	No limit
PAH (screening)	<10 – 123	40 (b)
Cyanide (Free)	<0.6	20 (b)
Cyanide (Total)	<0.6	50 (b)
Phenol Index	<0.6	21,900 (a)
Thiocyanate (SCN)	<2.6	50 *
Sulphide as S	<0.6	1,000 *
Organic Carbon %	0.32 – 3.16	-
Asbestos (screening)	No bulk fibres observed	-

11.77 Benzene, Toluene, Ethylbenzene and Xylene were all below the laboratory limits of detection, as were PCB congeners and hydrocarbons within the C8-C10 and C10 – C12 ranges.

11.78 The results of analysis to date suggest that there are no elevated levels of pollution, when considering the contaminants assessed, and thus despite being a brownfield site, the status of the land is good, with minimal evidence of historical contamination.

PREDICTION OF POTENTIAL IMPACTS

11.79 The following section details the proposed development and its potential impacts on the land quality of the site.

Proposed Operations

11.80 The proposed development will handle incoming waste feedstocks, which will largely comprise solids, but will also include an element of liquid. Through processing, the material is converted largely to oil based and gaseous fuels, with the residual solid portion forming a



very small percentage of the original. The oil and gaseous fuels will be pumped from the process to holding tanks and then into engines where they will combust to release energy. The main sources of potential ground contaminants are therefore the incoming feedstock material, the processed or part processed feedstock in liquid form (effluent and oil), and the solid residues. Additionally, as with any industrial application, various cleaning chemicals, lubricants and fuels will likely be stored around the site for use in day to day operations. Any release of these substances could result in pollution of the ground.

11.81 The site is currently empty and undeveloped and as such the proposed development by Enviroparks will require new and comprehensive infrastructure to be installed at the site:

- All operational areas will be completely covered with impermeable hardstanding;
- Some areas of below ground operation will be required with pits and basements constructed within buildings or externally to house tanks. These will be constructed appropriately of impermeable concrete hardstanding;
- Roadways will be constructed of concrete or tarmacadam;
- Drainage channels will run below ground, however any additional below ground pipe runs will pass through a pipe gully;
- All remaining landscaped areas of the site will be fully protected from site operations through the use of hardstanding and kerbs.

11.82 On-going maintenance of the site infrastructure will be promoted through the requirements of the site Environmental Permit, which Enviroparks is obliged to have in place prior to operation. Environmental Permits include the requirement to protect land and water resources during the course of the Permit lifetime by avoiding pollution risks resulting from the operation of the regulated facility, and also through the requirement to return the site of the regulated facility to a satisfactory state, which considers its status before the facility was put into operation. As a result, any operator of a permitted site must have a management system that produces and maintains adequate records on how the land and groundwater have been protected throughout the facility's lifetime. Enviroparks Hirwaun Ltd will therefore produce and work to a system which regularly assess the integrity of the infrastructure around the site and promotes preventative maintenance where possible, coupled with efficient and effective repairs where required.

11.83 Prior to operation, the site must be developed, and there is the potential for emissions from construction works to impact on the quality and status of the land. Potential releases would include:

- Raw materials, lubricants and fuels through improper handling, poor storage or accidental spills
- Emissions such as oils or fuels from vehicles working on and travelling across the site
- Incorrect storage of waste materials resulting in direct exposure of the ground to stored or escaping materials.

11.84 The potential for contamination of the land occurring during construction will be controlled through the use of a Site Management Plan (incorporated as Appendix 3 in Chapter 9 Air Quality), and the implementation of a Site Waste Management Plan. The Site Management Plan considers all elements of environmental control during construction and specifically, with regard to protection of the ground and water resources, it controls traffic movements, deliveries, energy use, water use and disposal, and waste. The implementation of the Site Management Plan, which will be implemented by the principal contractor and overseen by the developer, should ensure that as far as is practically possible, the protection of the land, water and sensitive features and receptors around the site are protected during construction.



11.85 The prediction of the potential impact of the proposed development on the quality of the ground beneath and surrounding the site have been considered using a “Source, Pathway, Receptor” template, presented in Table 11.9. This summarises how the proposed development could affect the land quality.

Table 11.9 Impacts of Proposed Development on Ground Conditions

<i>Phase</i>	<i>Source</i>	<i>Pathway</i>	<i>Receptor</i>	<i>Mitigation</i>	<i>Likelihood of Pollution</i>
Current	No known sources although the potential for illegal use and fly tipping could provide a source	Open land with no barrier between any potential source of pollution and the ground below	Upper Made Ground strata. Presence of Clay and clayey Gravels will slow movement through the strata and towards the minor aquifer and surface waters	None	Limited Likelihood of Pollution
Construction	Intentional or accidental release of: Raw Materials Lubricants Fuels Waste Effluent	Prior to the surfacing of the site, open land or permeable hardcore could provide a pathway for pollution.	Upper Made Ground strata. Presence of Clay and clayey Gravels will slow movement through the strata and towards the minor aquifer and surface waters	The Site Management Plan will ensure that systems are in place and maintained to prevent leaks and spills where possible, and to effect efficient clean up where they do occur. All materials will be stored in suitable containers with secondary containment where necessary or practicable. Impervious surfacing will be laid as soon as practicable	Some Possibility of Pollution
Operation	Intentional or accidental release of: Waste Effluent Oils/Lubricants/Fuels Chemicals (cleaning / maintenance)	Impervious hardstanding in all operational areas prevents pathway to ground or surrounding landscaped areas	If a pathway was to exist, the receptor would be the Upper Made Ground strata or the surrounding landscaping. Presence of Clay and clayey Gravels will slow movement through the strata and towards the minor aquifer and surface waters slow movement towards the minor aquifer and surface waters	Primary and secondary containment measures will be installed and will be subject to on-going monitoring and maintenance to ensure their integrity. Monitoring and operational procedures will be implemented where necessary	Limited Likelihood of Pollution



MITIGATION

11.86 A summary of the mitigation measures proposed for the development in order to prevent or minimise the potential of pollution of the land are detailed below:

- The use of a Site Management Plan to control construction site operations and potential environmental impacts.
- Suitable and sufficient containment and bunding facilities around the site, both during construction and operation.
- The provision of suitable effluent removal facilities (e.g. foul sewer or collection and bulk removal) from the construction site, and the provision of adequate treatment and removal facilities for the operational facility.
- The provision of impermeable hardstanding across all operational areas of the site.
- The provision of fully metalled road surfaces across the development.
- Kerbed roadways and site edgings to protect landscaped areas and natural features from potential run-off.
- On-going monitoring and maintenance of the suitability and integrity of equipment and infrastructure.
- The provision of relevant procedures to facilitate well managed operations, such as delivery and handling procedures, emergency procedures, and process change reviews.

EVALUATION OF RESIDUAL EFFECTS

11.87 The Envioparks Hirwaun Ltd development on the Hirwaun Industrial Estate proposes to use a currently empty, brownfield site to co-locate a recycling and commercial operation. The development of the land will convert approximately 5.4 hectares of the seven hectare site to hardstanding or buildings, all of which require construction, but will ultimately result in a protective barrier being formed between site movements and operations, and the ground beneath.

11.88 To evaluate the potential impacts of the site and determine whether or not there are any residual effects which should be considered, the following matrix has been applied:



Table 11.10 Significance Matrix for the Assessment of Land Pollution Potential from the Proposed Development

<i>Positive or Negative</i>	<i>Significance</i>	<i>Description of Impact</i>
Negative	High	Serious probability of land contamination potential and / or Serious effects on groundwater
Negative	Medium	Moderate probability of land contamination potential and / or Moderate effects on groundwater
Negative	Low	Some possibility of land contamination potential and / or Slight effects on groundwater
Either	Negligible	Little likelihood of pollution potential to land or groundwater
Positive	Low	Some reduction in the potential for land contamination and / or Slight reduction in the effects on groundwater
Positive	Medium	Moderate reduction in the potential for land contamination and / or Moderate reduction in the effects on groundwater
Positive	High	Significant reduction in the potential for land contamination and / or Significant reduction in the effects on groundwater

11.89 The potential for effects on ground conditions differ during the two distinct phases of the development, those being the construction and operation of the site. Both phases have similar sources of pollution to consider, although the potential pathways vary greatly.

11.90 During construction, the currently undeveloped site will be stripped and excavated prior to the installation of infrastructure. During this time, the ground will be bare or will have minimal protection from construction works, raw materials storage and vehicle movements. It could therefore be considered that without the proposed protection and mitigation measures in place, there would be a moderate potential for pollution, however Enviroparks propose to ensure that their chosen contractor works to a Site Management Plan to control potential impacts, providing suitable and sufficient containment measures and clean up procedures, operated by fully trained staff. Therefore the residual effect of the construction phase on the land quality of the area is of **low negative** impact.

11.91 All operational areas of the Enviroparks site will be over areas of impervious hardstanding such as concrete. This will prevent the release of any pollution to the ground below. Additionally, adjoining natural and landscaped areas will be kerbed to prevent the release of pollution from run off. Therefore, the operation of the site over an impervious base results in a **negligible** or **low positive** change impact on the ground conditions from the current status of the site, which is presently at risk from potential fly tipping or unlawful use.

11.92 The on-going monitoring and maintenance procedures which will be implemented as required under the site Environmental Permit will ensure that site equipment and infrastructure is maintained for the lifetime of the Permit.



REFERENCES

- 1) Model Procedures for the Management of Land Contamination (CLR11). DEFRA and the Environment Agency. ISBN Number 1844322955 September 2004
- 2) Environmental Studies in the Cynon Valley. Mid Glamorgan County Council. (No date).
- 3) www.harringtonmuseum.org.uk
- 4) www.CommuniGate.co.uk
- 5) ICRCL 59/83 Guidance on the assessment and redevelopment of contaminated land. Second Edition, July 1987 – Now Withdrawn
- 6) www.environment-agency.gov.uk/subjects/landquality (Various documents)
- 7) Intervention Values and Target Values – Soil Quality Standards. The Ministry of Housing, Spatial Planning and Environment. Directorate-General for Environmental Protection. The Netherlands.



DRAINAGE AND FLOOD RISK

METHODOLOGY USED

11.93 The drainage and flood risk sub-chapter aims to detail the potential impact of the proposed development on local water resources. An initial review will detail the resources in the area and assess their current quality. A desk study assessment of the potential influences of the proposed development will then be made, which will consider the likely impacts upon water resources throughout the course of the development and the on-going operation of the site.

11.94 Consideration of flood risk is an important aspect of assessing the potential influence of a development and as such a flood risk assessment has been produced. This is presented as an appendix to this chapter, but the results of the study are summarised throughout. The flood risk assessment has been prepared in line with the requirements of the Welsh Assembly Government's Technical Advice Note (TAN) 15: Development and Flood Risk⁽¹⁾. The methodology applied is therefore one of a staged assessment, with each requirement and the level of detail provided, being dictated by the previous level of enquiry. The overall aim of the flood risk assessment is to ensure that appropriate consideration is given to flooding issues by applying a precautionary approach.

11.95 Once the current baseline of water quality and flood risk has been described, the potential impact of the development as a whole will be considered. This will include assessment of the impacts on the development itself, and on downstream receptors in the local area, with consideration to the potential impact of flood water contributions to other locations and the impact on local water quality from both normal site operations and site emergencies. The source, pathway, receptor methodology will be applied.

11.96 Where the suitability of the location is not immediately apparent, this will be justified appropriately, through consideration of the proposed mitigation and management measures.

11.97 The proposed mitigation measures will be detailed, with consideration given to any additional requirements identified by the potential impacts likely to be caused.

11.98 Finally, any residual risk will be detailed and a suitable management plan adopted to ensure that these are managed appropriately.



BASELINE ANALYSIS

Water Resources and Water Quality

11.99 The proposed development will be situated on the Hirwaun Industrial Estate, on land to the north of Fifth Avenue. The site is in the northern portion of the industrial estate and is located between Fifth Avenue (north of the A465) and the embanked Penderyn reservoir. Ninth Avenue runs along the eastern boundary of the site and a wooded hedgerow follows the western boundary. The site is roughly square in shape and is approximately 7 hectares in area. The land has previously been developed, siting an Ordnance Factory between 1939 and 1945, with the last remaining buildings finally being demolished in the 1960s. The site has remained as flat scrub grassland since then, although was re-graded in the mid 1990s, and now has a series of well defined drainage ditches in a regular herringbone pattern.

11.100 No historical information on groundwater quality is available, however recent sampling and analysis has been undertaken. This information will enable Envioparks to set a baseline of groundwater quality prior to their development of the site, and will therefore enable them to monitor and assess groundwater during the operation of the site. Historical and more recent ground water monitoring has however enabled groundwater contour plots to be prepared, which demonstrate the direction of flow of the groundwater beneath the site. These are presented in the flood risk assessment report in Appendix 7.

11.101 Hirwaun is located in the Cynon Valley, and thus is approximately 20 km from the nearest coastal waters (to the south west). Water features are in abundance in the area however, with brooks, rivers, ponds and reservoirs in the locality. The site is located over Lower Coal Measures and these are classified as a minor aquifer. Above the Lower Coal Measures however are Alluvium and Glacial Till stratum, and these, coupled with the Boulder Clay known to lie across the site will provide some protection to the minor aquifer. That said, the prevention of downward migratory movement promotes lateral movement and could therefore increase the risk of water or pollution flowing off site or to local surface waters.



11.102 An EnviroCheck report has been reviewed and confirms that the site is located over a minor aquifer of variable permeability. These can be fractured or potentially fractured rocks which do not have a high primary permeability, or may be other formations of variable permeability. Despite not producing large quantities of water for abstraction, they can be important for local supplies and for supplying the base flow to rivers. The boulder clay strata present at the site is of low leaching potential and therefore pollutants are less likely to penetrate the soil layer vertically, with lateral flow being of primary importance. As a result of lateral flow, surface water run off and ground water flow is likely to contribute to re-charge elsewhere in the catchment, rather than directly beneath the site, and the transportation of any pollutants in the upper made ground or topsoil layers can also result in pollution of areas away from the contaminating activity. There are five abstraction licences detailed in the area, although at least two of these will no longer be in use as they were used by the Tower Colliery which closed in January 2008. These two abstraction points were located to the south of the site. Two other abstraction licences are located to the north east and these supply the Welsh Whiskey Company and the Penderyn Reservoir (from the Penderyn borehole). Both are located more than 1,450 m away from the site. The final abstraction licence also serves the Penderyn Reservoir, and is the abstraction of water by Dwr Cymru from the Nant y Bwllfa, located to the east of the development site at almost 2 km distance.

11.103 As smaller abstraction rates (less than 20 cubic metres per day) are not necessarily registered with the Environment Agency through the Abstraction Licensing scheme, an assessment has been made of other buildings in the vicinity which may not be served by a mains water supply. The criteria applied to the assessment has assumed that any property which is equal to or more than 500 m from the nearest built up area, may not have access to mains water. It is not certain whether or not the buildings identified are or are not served by the mains, however by way of producing a robust assessment, each of the buildings detailed below will be assumed to abstract water from ground or surface water resources:

Table 11.11 Buildings within 2 km of the Proposed Development Which May Draw Supplies from Ground or Surface Waters

<i>Location</i>	<i>Approximate Grid Reference</i>	<i>Nature of Building</i>	<i>Distance from Nearest Built Up Area</i>
Close to Pen-Cae Drain	291550 207725	Likely residential / farm	Approximately 1 km from Pontneddfechan
Bodwigiad	295375208450	Residential / farm	Approximately 600 m from Pontbren Llwyd and Penderyn
Pen-y-Cae	295475 207500	Residential / farm	Approximately 500 m from Pontbren Llwyd
Bwllfa Cottage	295450 207125	Residential	Approximately 600 m from Pontbren Llwyd
Lletty-Rhys	295175 207000	Residential	Approximately 600 m from Pontbren Llwyd
North of Penderyn Reservoir	2941125 2075125	Likely residential / farm	Approximately 700 m from Pontbren Llwyd
North east corner of Penderyn Reservoir	294100 207250	Residential	Approximately 750 m from Pontbren Llwyd
Ty Newydd Hotel and local buildings	294350 206950	Hotel	Approximately 750 m from Pontbren Llwyd

11.104 There are seven discharge consents in the area, three of which are operated by Dwr Cymru as sewage discharges or as the overflow from the Penderyn Reservoir, and two of



which are operated by the Coal Authority. Of the other two consents listed, one has expired, and the other which is still believed to be current serves the drainage from an industrial site. There are seven Local Authority Pollution Prevention and Control Environmental Permits in the vicinity, and six of these are located within the Hirwaun Industrial Estate. Process operations include coating processes (5), oil extraction and refining and screening and crushing processes. There have been 23 pollution incidents to controlled waters since 1991. Seventeen of these were minor incidents and consisted of minor spills and leakages of oils, sewage or slurry. Of the remaining six incidents, each of which was classed as significant, four involved the release of sewage, one was the result of a release of milk / creamery effluent, and one involved the release of coal solids.

11.105 Initial discussions with Dwr Cymru Welsh Water, by way of a Pre-Planning Assessment and a Trade Effluent Consent Preliminary Information Form suggest that mains water can be supplied to the site. It is also considered that any domestic discharges from the site will be acceptable to the local waste water treatment works. With regards to the requirement of a Trade Effluent Consent, initial discussions suggest that the local treatment works could accept the proposed volume of discharge from the Envioparks site, 240 m³ per day, however it would not have sufficient capacity to treat effluent with high concentrations of biological oxygen demand (BOD), ammonia or total suspended solids (TSS). Copies of Dwr Cymru Welsh Water's response to the pre-planning and Trade Effluent Consent requests are provided in Appendix 8.

11.106 The information included in the Trade Effluent Consent Primary Information Form, provided details of potential BOD from the site as equivalent to a population of 20,000. This figure assumed limited treatment by Envioparks prior to discharge to sewer, Following further discussions with Dwr Cymru Welsh Water, Envioparks will ensure that the treatment systems in place, which will consist of sequencing batch reactors (SBR) / reverse osmosis (RO) / equivalent technologies, will treat the outgoing effluent to a standard acceptable for release to the local waste water treatment works.

11.107 Key sensitive features in the area are detailed in Table 11.12 overleaf, and include the Cors Bryn-y-Gaer lowland bog. This is the nearest Designated Site to the proposed Envioparks development and is located approximately 500 m to the east.

11.108 The development will include the conversion of much of the site to hardstanding, with the current estimated area covering approximately 5.4 hectares. It is proposed that hardstanding will be impermeable across the operational areas of the site, and surface water from the building roofs will be collected and stored in tanks for use in the process. Surface water from the site surfaces will be directed to the sustainable drainage system holding pond, passing through interceptors en-route to remove any oils or grease collected from the site roadways. This will ensure protection of groundwater sources from any potential pollution impacts, and purpose built drainage and treatment systems will control the release of any surface water run-off or effluent. The remainder of the land will be left landscaped and will include a large water storage feature by way of a water holding pond running along much of the southern boundary line of the site. Should the proposed development not proceed, there would be no change to the site layout or drainage and hence the situation would remain much as it is today.



11.109 Details of other designated and sensitive sites have been obtained from the Countryside Council for Wales and are detailed below:

Table 11.12 Designated Sites within 2 km of the Proposed Development Site

<i>Site and Designation</i>	<i>Location</i>	<i>Approximate Distance From Development</i>	<i>Reason for Designation</i>
Cors Bryn-y-Gaer / Blaen Cynon (SAC and SSSI)	SN 945065	Within 500 m east	Cors Bryn-y-Gaer is of special interest for its lowland bog and for areas of soligenous flush, marshy grassland, dry neutral grassland and lowland acid grassland. These habitats occur in a complex with wet heath, swamp and semi-improved grassland. The site is also of special interest for the marsh fritillary butterfly <i>Eurodryas aurinia</i> . The site is located immediately north-west of Hirwaun and south of the Brecon Beacons National Park.
Woodland Park and Pontpren (SSSI)	SN 946077, SN 952075, SN 948071	1 km north east 1.25 km ENE 850 km east	Woodland Park and Pontpren is of special for the interest for the marsh fritillary butterfly <i>Eurodryas aurinia</i> . Additional special interest is provided by its mixture of habitat types, including marshy grassland, dry acid and neutral grassland, heathland and woodland, which add to the ecological and biodiversity interest of the site and which also provide food and shelter necessary for the survival of the marsh fritillary. This site consists of three separate blocks of land, approximately 1km south of the village of Penderyn.
Dyffrynoedd Nedd a Mellte (SSSI)	SN 907100, SN 921090, SN 937088	4.5 km NNW 2.6 km NNW 2 km north	Dyffrynoedd Nedd a Mellte, a Moel Penderyn is of special interest for its extensive and diverse semi-natural woodland, important populations of several flowering plants and supporting outstanding assemblages of mosses, liverworts and lichens. The site includes a range of geological features, well-exposed in the cliffs and rocky river beds. This site includes the wooded valleys of the rivers Nedd and Mellte, and their tributaries above Pontneddfechan



Note; SAC is a Special Area of Conservation and SSSI is a Site of Special Scientific Interest.

11.110 Of the three Designated Sites detailed above, it is considered that the changes to the water characteristics of the site through the potential development could most impact the Cors Bryn-y-Gaer SAC, which is a lowland bog and therefore dependant on ground and surface waters.

Ground Water

11.111 Historical site investigations at the site suggest that the ground water level in the area is relatively high at times, with a study report from 1972⁽³⁾ noting that “Ground-water was present in all boreholes and was observed at depths between 0.35 and 1.3 m below ground level in the northern area”, that is, the area of potential development, although this was prior to the re-grading of the site, which used the underlying Boulder Clay to give acceptable cross grades to the site and incorporated drainage channels. Later assessments in 1995⁽⁴⁾ were undertaken in June, and the ground water levels detected were much lower at this drier time of year, ranging from depths of 2.8 to 6.5 metres below ground level.

11.112 The low permeability of the Boulder Clay will result in slow ground water movement and surface water soakaway, and the site has been observed to be saturated in areas not served by the drainage channels. By plotting the ground water levels encountered during the historical site investigation, against the borehole locations, it is apparent that the southern area of the site experienced the higher ground water levels during the study in November 1971. This is also the area which appeared to be most saturated during a recent site visit (March 2008) although the whole site suffers from marshy conditions. That said, in the June study undertaken in 1995, the highest ground water levels were recorded to the north of the site, albeit these were all lower than the previous ground water logs.

Surface Water

11.113 Hirwaun is located within the Cynon Valley, and the River Cynon passes through the town. An extract from Environmental Studies in the Cynon Valley⁽⁵⁾ identifies some of the geological characteristics which have influenced the river flow and drainage in the area.

“It is claimed that the original headwaters of the Cynon continued in a north westerly direction beyond Hirwaun. Indeed, a glance at a map would suggest that the Afon Pyrddin formerly flowed into the Cynon. That this is no longer so is a result of the capture of the Pyrddin, Mellte and Little Neath by the River Neath, which has cut back its valley along a major fault. This would explain the limited drainage to the west of Hirwaun and the gorge on the Sychryd.”

11.114 Copies of the Ordnance Survey and British Geological maps of today are presented in Figures 1 and 2 and demonstrate the theory above. The area is heavily faulted, however the major fault referred to is likely to be the Dinas Fault, and the Hirwaun Industrial Estate, which lies to the west of Hirwaun, certainly has areas of limited natural drainage.



11.115 The two main surface water features present at the site today are the small stream which intersects the north western corner of the site, continuing down the western boundary and currently accepting the surface water run off from the site, and the Penderyn reservoir located to the north. Historical maps do however show that the Nant Yr Ochain historically passed through the southern area of the site, having come from the south, beyond the extents of the current industrial estate. The Nant Yr Orchain flows into the River Camnant which is still present today extending to the south of Fifth Avenue around the sewage treatment works. The boundary between the Rhondda Cynon Taf County Borough Council and the Brecon Beacons National Park Authority jurisdictions follows the historical path of the Nant Yr Ochain from approximately half way across the southern edge of the site. The Camnant now accepts the waters of the stream which intersect the north western side of the site, however this historically flowed into the Nant Yr Ochain prior to joining the Camnant. The Nant Yr Ochain is shown on historical maps until the introduction of the present day Fifth Avenue, which replaced the original railway, at some point in the first half of the 1970's. From this point on the only indication that the Nant Yr Ochain ever flowed through the site is the lasting path etched by the Authorities boundaries. A series of drains and ponds has instead been formed to the south of the industrial estate, close to Pont Yr Ochain. Had the Nant Yr Ochain still been present on the site, it is possible that the saturated areas now experienced along the southern boundary may have remained better drained, with ground and surface waters flowing into the river channel.

11.116 The River Camnant is of marginal river quality, although this is a marked improvement as previously the river has significantly failed to meet its targets. Despite missing its targets, the overall quality of the river is C, fairly good. Appendix 9 provides details of the recent quality status of the river. By comparison, the River Sychryd has a good river quality (B), and the River Gwrrangon to the west has a very good river quality (A).

11.117 The Penderyn Reservoir was built between 1911 and 1920. It is an Impounding Reservoir, which has virtually no catchment area of its own and is reliant on the support of three separate resource systems to maintain storage. These systems are:

- The Bodwigiad and Nant y Bwlfa streams
- Nant Hir and Nant Moel Reservoirs
- Pont Bren Llwyd Borehole

11.118 The dam is fed from these local streams and a pumped main. The water is fed from an adjacent inlet chamber which includes an overflow arrangement which enables the stream flow to by-pass the dam. Any overflow is discharged via the stream that runs through the proposed Enviroparks development site.



11.119 During normal operations the two stream sources at Nant y Bwlfa and Bodwigiad are sufficient to maintain storage in the Penderyn Reservoir. Under low flow conditions both the Bodwigiad and Nant y Bwlfa streams are required to maintain modest informal residual flow conditions to sustain raw supplies for local livestock watering. The Nant Hir and Nant Moel reservoirs are of small capacity themselves but are capable of contributing storage to Penderyn through a combination of gravity and low lift pumping. However given the hydraulic configuration of the intake arrangements, any flow in excess of a residual flow from any of these source will automatically gravitate to the Penderyn reservoir.⁽⁶⁾ In the event of heavy flows, the mechanical means of water pumping from the two reservoir sources or the boreholes would not be activated.

11.120 In addition to the water courses in the immediate vicinity of the site, the area has numerous surface water courses including the Rivers Cynon, Neath, Mellte and Hepste; several reservoirs and ponds, plus smaller water courses such as brooks and streams.

Flood Risk

11.121 Full consideration has been given to the natural aspects of the area which may affect the water resources or contribute to flooding, through the provision of a flood risk assessment (Appendix 7).

11.122 The proposed development of the land adjacent Fifth and Ninth Avenues on the Hirwaun Industrial Estate for use as a waste recycling and energy production facility will entail major development of the site which is currently an open field. Despite the proposed conversion of 5.4 hectares of the 7 hectare site to impermeable hardstanding or buildings, it is considered that the development will not suffer from flood risk and will likely result in an overall reduced risk to down gradient receptors of flood waters. This is due to the proposed collection and use of a large quantity of surface water run-off, and the controlled discharge of excess run-off from that which is stored. The site is considered to have flooded at some time in the past due to the presence of alluvium at the site, however the overall risk of flooding at the site is believed to be less than 0.1 %.



PREDICTION OF POTENTIAL IMPACTS

11.123 The following section details the proposed development and its potential impacts on water resources, their quality and the potential for flooding at and around the site.

Water Resources and Water Quality

11.124 The proposed development consists of a combination of hardstanding and landscaped areas, with approximately 5.4 hectares housing buildings or roadways and 1.6 hectares being landscaped. By turning the majority of the to hardstanding areas with controlled drainage, the land and ground water management of the site can be controlled. Less of the site area will be absorbing water and therefore contributing to the ground water levels, reducing the likely risk of saturation and pooling of water. The captured water from the building roofs will be held separately in local storage tanks for use across the site. The hard surface drainage water from the site will be directed to a sustainable drainage system with 3,110 m³ volume storage capacity, which will be used for water storage to feed the process. This will run along the southern boundary, alongside Fifth Avenue. Consideration of the ability of this system to retain flood waters has been made within the flood risk assessment (Appendix 7).

11.125 The holding pond will have a combination of an impermeable and a permeable lining and will include a one way flow system back to the natural stream. This will result in a set level of water being retained in the pond at most times, drought conditions perhaps causing the pond level to lower. The holding pond will discharge to the natural stream once a pre-determined capacity is reached, and further filling of the holding pond will then be subject to soak away, once the permeable liner is reached. This staged release will ensure that where possible, rain water and run off is used in the process, and the site release to water courses and ground waters is reduced from the present levels, whilst still providing higher level releases to the natural water courses to prevent any flood potential within the site.

11.126 Water resource flow will therefore be altered by the proposed development, with contributions to ground water and the stream to the west of the site being reduced. That said, domestic effluent and part treated site waters will be sent to the local waste water treatment works and waters will therefore re-join the River Camnant downstream of the works. Although the throughput of waste water at the waste water treatment works will increase, the quality of the Enviroparks process waters, which will have been pre-treated to a high standard prior to discharge, should assist in maintaining a higher output quality of waters from the treatment plant, through dilution of incoming effluent with cleaner waters.

11.127 Despite the conversion of 5.4 of the seven hectares to buildings and hardstanding, the measures proposed will benefit the site and wider area. Of particular note, the use of the storage pond to the south of the site, sits comfortably with the historical run of the Nant Yr Ochain, and may assist with control of the current water logging potential of the site.

11.128 As the Penderyn Reservoir is located upstream of the site, it is considered that it may impact on the water quality in the local area of the site, but that water and effluent discharges from the site will not impact on the reservoir.



11.129 Site impacts on water resources flow or water quality could be caused by:

Re-directing the Watercourse	Short term impact during re-routing
Waste Water discharges to controlled waters or sewer	Modification of flows and increased potential of pollution from discharges
Accidental Release	Pollution to ground or surface waters through accidental release

11.130 Whilst it is considered necessary to re-route and culvert the existing stream at the site, and therefore a short term impact on this water course is inevitable, the redirection and culverting of the stream will ensure the long term protection of the water course from any possible impact from the day to day operations of the proposed site. Additionally, it is acknowledged that the Enviroparks site will require a mains water supply and plan to discharge effluent into the public water treatment system, assuming Consent is approved by Dwr Cymru Welsh Water, however where possible, the site plans to utilise as much process and surface water run off from the site as possible in order to reduce the call on potable mains supplies, and will also pre-treat their effluent to ensure that the discharge is of an acceptable quality to Dwr Cymru Welsh Water.

11.131 The groundwater contour plots presented in the flood risk assessment in Appendix 7 have been produced from both recent and historical data. The plot produced from the recent site investigation work denotes the water strike level data. Each of the contour plots show the groundwater movement in a generally south westerly direction. Each of the three current holders of Abstraction Licences and the eight potential small abstractors are located to the north, north east or east of the proposed development site. As groundwater is moving in a south westerly direction, any potential impact on groundwaters caused by accidental pollution from the site would not therefore affect these abstraction points. Similarly, any impact on the groundwater beneath the site is unlikely to have an impact on the Designated Sites in the vicinity of the development, as those within a 2 km radius are all located to the north or east of the site.

Other Run-Off

11.132 There is no proposed modification to the routing of other surface run off.

11.133 The overall impact of the proposed development will be to reduce the likelihood of flooding. The individual impacts considered either have no overall effect on the release, or reduce the likelihood of flooding, when considering both the site itself and any down stream or down gradient receptors. The use of adequate drainage, storage and control techniques will result in less water entering surface and ground waters directly, and can control the release to sewer such that, although the loading on the treatment works will increase with this proposed additional source, the discharge can remain within its regulated limits.



Construction Impacts

11.134 Due to the close relationship between the site and a number of watercourses, including the stream running through the site, the River Camnant and the high groundwater (although this is possibly perched), the potential impacts to the water environment during the construction phase have the potential to be significant.

11.135 The primary potential impacts are related to:

- Diversion of the stream;
- Site drainage and the potential to silt surface waters;
- Delivery and storage of construction materials;
- Storage and handling of materials/oils/chemicals, including material preparation (concrete) and refuelling of plant and vehicles;
- Contamination of groundwater and geological strata during piling or excavation;
- Site staff rest and welfare facilities.

11.136 During construction, the greatest risk will be experienced initially, when preparing storage and work areas and when a suitable and satisfactory drainage system may not be in place. Sudden rainfall events can mobilise silt and materials held within the site, and if not controlled these could be conveyed to the local surface waters. Some of the earliest activities at the site will involve the protection of the watercourses, through the provision of a site connection to the foul sewer for all suitable wastes, and the provision of an earth bund to protect the stream. Hardstanding will be laid and / or secondary containment measures such as bunds or spill trays will be used to protect land and watercourses from accidental spillages on site. Additionally, a regular visual assessment of the stream and the River Camnant will be undertaken, and emergency equipment such as booms will be maintained on site for use as required.

Waste Water

11.137 Site water will be controlled in one of four ways once the site is operational. As discussed earlier, roof water run off will be captured and stored in holding tanks for use around the site, in process and domestic facilities. Run off from hard surfacing across the site, including that from the Anaerobic Digestion base, which will incorporate anti-floatation valves, will pass through Class 1 interceptors, through a reed bed drainage system and into the holding pond. Should the roof water holding tanks reach full capacity, they will also overflow to the holding pond.

11.138 The holding pond, which contains clean and treated surface water run off is used to provide process waters across the site, however should this become full, it will initially overflow to the stream, which currently takes all of the undeveloped site drainage. Should the pond level continue to increase, this stored surface water run-off will reach a permeable layer in the pond liner and will pass to soak away. This clean and treated surface water run-off should have no negative impact on the ground or surface waters it may enter, and will be similar to the run off from the undeveloped areas of the site which are proposed to continue to pass to the stream running along the western boundary.

11.139 Dirty site water will either pass directly to sewer when considering waste from domestic facilities such as toilets and showers, or in the case of process waters, will



initially pass through one of two water treatment plants for processing, before being discharged to sewer. The proposed water treatment plants will consist of sequencing batch reactors / reverse osmosis or equivalent technology which can be operated to very high standards, thus ensuring that the discharge to sewer will remain within any limits specified by Welsh Water. The sewer directs waste to the Hirwaun Sewage Treatment Works. As the Envioparks site will endeavour always to meet the limits of discharge placed on it by Welsh Water and the Environment Agency, and the Hirwaun Sewage Treatment Works must also operate within the limits of their discharge consent, it is not considered that the proposed site will have any significant negative impact on the River Camnant during normal operating conditions.

Accidental Release

11.140 As an operational industrial facility, which stores and treats waste, the Envioparks site at Hirwaun has the potential to affect ground and surface water quality through the accidental release of polluting matter to land or directly to water course. Materials stored on site which could impact on ground and water quality include wastes, oils and concentrated liquors. All roads and operational areas of the site are to be located over impermeable hardstanding and materials storage will be strictly controlled, meeting all environmental legislative requirements, such as the Oil Storage Regulations. Where necessary through legislation or best practice, secondary containment facilities will be incorporated, and the provision of oil interceptors across the site to control discharges from the drainage runs will ensure that the release of oils to the holding pond and thus to the stream or soak away are prevented. Spillages will be dealt with efficiently, being contained and cleared away promptly, and the integrity of the hardstanding across the site will be reviewed on a regular basis to identify any damage or cracks in the hardstanding which could result in a pathway for pollution.

11.141 The prediction of the potential impact of the proposed development on the flow and effect of water have been considered using a “Source, Pathway, Receptor” template presented in Table 11.13 below. This summarises how the proposed development will affect the sources of water to and from the site, their impact on the site and the receptors affected, both currently and when considering the development’s ability to influence water flow and quality, and flood potential.

Table 11.13 Impacts of Proposed Development on Water Resources and Quality and Flood Potential

<i>Source</i>	<i>Current Pathway</i>	<i>Current Receptors</i>	<i>Modifications and Mitigation</i>	<i>Likely Pathway</i>	<i>Likely Receptors</i>	<i>Increase or Reduction in Impact</i>
Ground water	Site drainage is currently poor with hydrogeological movement restrained by the low permeability boulder clay	Slow movement of ground water and inadequate drainage facilities results in rainfall water logging the site. The groundwater contour plots suggest that ground water movement is to the south west	The site will have approximately 5.4 hectares turned over to hardstanding areas. Contributions to ground water from the site area will therefore be reduced. Water will continue to pass to groundwater from non developed areas of the site, and from the part permeable holding pond liner, which will allow a controlled level of soakaway from the pond. Direct releases to watercourses will therefore continue to be from uncontaminated sources.	The general pathway for ground water movement will remain unchanged, with ground water moving in a south westerly direction.	Although the receptors will remain unchanged the contribution of rainwater to the ground waters beneath the site will reduce (see below) and thus the overall ground water levels down gradient of the site will be reduced.	The development will result in a site which is more effectively drained thereby avoiding water logging, and will reduce the ground water levels down gradient of the site. Thus the likelihood of flooding either at the site or at other local receptors from ground water sources will be reduced .

Source	Current Pathway	Current Receptors	Modifications and Mitigation	Likely Pathway	Likely Receptors	Increase or Reduction in Impact
Stream to the west	The stream passes through the site and the banks were raised in the 1990s to eliminate the risk of flooding. The stream accepts water from streams to the north and run off from the local area including the French Drains associated with the reservoir and the current site drainage.	The stream flows to the River Camnant.	The stream currently accepts all of the drainage from the site. Development will reduce the surface water run off sent to the stream.	5.4 hectares of the 7 hectare site will become hardstanding. Surface water run-off from this area will be diverted away from the stream. Drainage from the 1.6 remaining hectare will continue to be directed to the stream.	The River Camnant remains the receptor for the stream. The flow to the stream and thus to the Camnant will be reduced, however the SUDS system will overflow to the stream. Pre-treated effluent from the process will be sent to the STW, which discharges clean water back into the Camnant.	The reduced drainage from the site into the stream will reduce the likelihood of the stream, and the River Camnant which it joins, from flooding.
Penderyn Reservoir	Penderyn Reservoir has minimal impact, with maintenance and repair removing pathways for potential impact. The reservoir is a man-made tank with flow directed via pipes for use. Any small failings in the bank are managed through a system of French drains.	Penderyn Reservoir supplies the Hirwaun Water Treatment Works, which will supply the site with potable water. Water is directed to the water treatment works for use. French drains discharge into the stream which passes through and to the west of the site.	None.	No Change.	No Change.	The Penderyn Reservoir is unlikely to impact on the proposed development and the proposed development is unlikely to impact on the Penderyn Reservoir. No change in impact.

Source	Current Pathway	Current Receptors	Modifications and Mitigation	Likely Pathway	Likely Receptors	Increase or Reduction in Impact
River Camnant	The River Camnant receives water from the stream which runs to the west of the site and accepts treated water from the Hirwaun STW.	The River Camnant flows to the River Sychryd.	Run-off water will be diverted from the stream which flows to the Camnant, reducing the flow from this source, however the overflow from the SUDS storage system will still enter the stream, and treated waste water from the site will re-join the Camnant down stream of the sewage treatment works.	The Camnant will receive less water run off directly from the site via the stream as rainwater will be collected for use in the process. However pre-treated waste water which cannot be used in the process will pass through the STW and will enter the Camnant at the discharge.	Although the pathway will undergo some diversion, the receptor, the River Sychryd will remain the same.	Overall flow to the Camnant from the site will increase through the use of water resources in the process which are then discharged via the STW. There will be no additional potential for flooding of the Camnant through the proposals, as the STW must regulate their flow. Passage of effluent from the site, some of which is pre-treated through the site effluent plants, should minimise the reduction in dilution potential of the run off from the present site in the River Camnant, helping to maintain the river quality.

Source	Current Pathway	Current Receptors	Modifications and Mitigation	Likely Pathway	Likely Receptors	Increase or Reduction in Impact
Rainfall	Rainfall across the site currently accumulates due to poor drainage. Rainfall will partially seep to the soil and enter the ground water and will partially enter the drainage channels and ultimately the surface waters.	Movement of ground water is towards the south west. The surface water runs to the River Camnant and on to the River Sychryd.	Approximately 5.4 hectares of the site will be developed to buildings and hardstanding. Rainfall from building roofs will be stored in tanks, whilst surface water runoff from hardstanding will pass via a SUDS system for use in the process. Overflow from the SUDS system will discharge back into the stream and treated effluent from the water treatment systems will be sent to sewer. Proposal to store water in tanks and holding pond enables controlled and suitably managed release.	Pathway of rainfall from landscaped areas remains unchanged. Pathway of rainfall from hardstanding areas is diverted for use in the process. Should the SUDS holding pond reach critical levels, it will first overflow to the stream and, will then be served by the upper permeable bank, removing excess water to soakaway. Quantity of rainwater entering the Camnant directly will reduce, however the volume of treated effluent from the site entering the Camnant after the sewage treatment works will increase.	Although receptors remain unchanged the contribution of rainwater to the ground waters and the stream will reduce due to the reduction in surface area discharging runoff directly. Thus the overall ground water levels down gradient of the site will be reduced. Quantities of pre-treated effluent discharged to sewer and therefore the Camnant and Sychryd, will increase, but will be well controlled for volume and quality.	Discharges to ground water and the stream alongside the site will reduce , thereby reducing the likelihood of flooding. Discharge will be of un contaminated rainwater only. Overall flow to the Camnant will increase, however discharge from the STW must remain within regulated limits. There will therefore be no additional potential for flooding of the River Camnant arising from the proposed operations, than that which may currently be present due to the STW. Additionally, as the process discharge from the Enviroparks site will be pre-treated, the reduction in dilution potential from the diversion of the water should be minimised.

<i>Source</i>	<i>Current Pathway</i>	<i>Current Receptors</i>	<i>Modifications and Mitigation</i>	<i>Likely Pathway</i>	<i>Likely Receptors</i>	<i>Increase or Reduction in Impact</i>
Construction	None	None	Construction sites can impact on water courses through the release of pollution directly to surface waters or indirectly to groundwaters. A site management plan will be implemented and will consider the potential for water pollution. Mitigation measures will include the installation of earth bunds, the use of other bunding and spill protection, emergency response equipment and the early laying of hardstanding areas.	Release to the stream or to permeable ground – this can be exacerbated through piling or excavations.	The stream, and then on to the River Camnant and River Sychryd, or the groundwaters and minor aquifer below the site	The potential impact from the construction process increases, however comprehensive control measures will be implemented to minimise the risk of pollution, and the local surface waters will be inspected on a regular basis.
Site Effluent / Water	None	None	Proposed development will include a holding pond to receive the surface water run off from the hardstanding areas of land. The location of this proposed water feature takes into account the most marshy area of the site and the area through which the Nant Yr Ochain historically ran. The site effluent treatment plants will discharge to sewer.	Water stored in the holding pond will largely be used within the process. Should levels rise, the pond will first overflow to the stream and then to the upper permeable bank to remove water to soak away.	Releases to the stream will flow to the River Camnant. Releases to sewer will also discharge into the River Camnant, which flows to the River Sychryd.	Any discharge will be in line with the capacity of the WWTW, and thus there will be no change in the potential impact arising from this source. Volume of water sent directly to surface waters and ground water will reduce due to controlled drainage systems, reducing the site's marshy and waterlogged status and the quantity of water flowing from the site to down gradient receptors.

Source	Current Pathway	Current Receptors	Modifications and Mitigation	Likely Pathway	Likely Receptors	Increase or Reduction in Impact
Waste Water	None	None	Waste water will be treated in sequencing batch reactor water treatment plants, to a quality which is at least acceptable for discharge to sewer. Surface water run off from hardstanding areas around the site will pass through interceptors and the SUDS system.	Dirty process water will pass through the site treatment plants, and will discharge to sewer for further treatment by Welsh Water. STW releases to the River Camnant. Surface water run off from higher risk areas around the site will pass through site drains and interceptors before treatment in the SUDS system	Effluent discharged to sewer will pass to the Camnant. Treated surface waters will pass to holding pond and are ultimately used as process water. In the event of elevated levels, some of this water will discharge to the stream and onto the River Camnant, and some will discharge to groundwater via a soak away.	Similarly to the flow from the STW any discharge must be of a suitable quality. Enviroparks will ensure that their treated water at least meets the acceptable standard for the STW, however additionally, Welsh Water will be required to remain within the terms of their Discharge Consent and thus there will be no change in the potential impact on water quality from this source through the proposed development than that which is currently present due to the STW.
Accidental Release	None	None	Site process and storage areas to consist of impermeable hardstanding. Secondary containment measures incorporated where required and spills cleared away immediately. Regular review of hardstanding areas to be incorporated into procedures.	None.	None.	Potential for an accidental impact from the site to occur will increase as site is currently vacant and thus no incident is likely, however proposed control and mitigation measures, will result in little likelihood of an accidental release from the site impacting on water quality.



MITIGATION

11.142 A summary of the mitigation measures proposed for the development in order to control the potential impacts on water quality and quantity are detailed below:

- Recirculation of process waters where possible and the collection and use of surface water run off;
- Provision of adequate storage for surface water run off, with the provision of tanks for clean roof run-off and a SUDS system with holding pond for other waters;
- Abatement techniques such as interceptors and reed beds to ensure that potentially dirty run-off water is cleaned prior to entering the holding pond;
- Provision of high performance effluent treatment systems to enable the site to re-use water where possible, or to discharge within any potential consent;
- The provision of comprehensive impermeable hardstanding in operational areas, whilst retaining landscaping in non-operational areas;

11.143 Envioparks will also implement a comprehensive system of management and maintenance procedures in order to ensure that the mitigation measures implemented remain effective and efficient operations.

EVALUATION OF RESIDUAL EFFECTS

11.144 The Envioparks Hirwaun Ltd development on the Hirwaun Industrial Estate proposes to use a currently empty, brownfield site to co-locate a recycling and commercial operation. The development of the land will convert approximately 5.4 hectares of the seven hectare site to hardstanding or buildings, and thus the water flows from the site will be altered.

11.145 To evaluate the potential impacts of the site and determine whether or not there are any residual effects which should be considered, the following matrices have been applied:



Table 11.14 Significance Matrix for Inherent Flood Risk from the Proposed Development

<i>Significance</i>	<i>Description of Impact</i>
High	Significant flood potential at the site
Medium	Flooding likely at the site
Low	Some evidence of historical flooding at the site
Negligible	No risk of flooding at the site

Table 11.15 Significance Matrix for the Assessment of Water Movement and Water Quality from the Proposed Development

<i>Positive or Negative</i>	<i>Significance</i>	<i>Description of Impact</i>
Negative	High	A significant deterioration in the water or drainage quality of resources on / around the site and / or A significant potential to increase flood risk down gradient of the site
Negative	Medium	A moderate deterioration in the water or drainage quality of resources on / around the site and / or A moderate potential to increase flood risk down gradient of the site
Negative	Low	A small deterioration in the water or drainage quality of resources on / around the site and / or Some potential to increase flood risk down gradient of the site
Either	Negligible	Minimal modification to the flow or quality of water around the site
Positive	Low	A small improvement in the water or drainage quality of resources on / around the site and / or Some potential to reduce the risk of flooding down gradient of the site
Positive	Medium	A moderate improvement in the water or drainage quality of resources on / around the site and / or A moderate potential to reduce the risk of flooding down gradient of the site
Positive	High	A significant improvement in the water or drainage quality of resources on / around the site and / or A significant potential to reduce the risk of flooding down gradient of the site

11.146 The site is considered to have a less than 0.1 % annual probability of river or sea flooding, although the presence of alluvium at the site suggests that the site may have flooded historically and therefore the flood potential is considered to be **low**.



11.147 The land is currently often water logged due to poor drainage. The strata beneath the site is Boulder Clay, which naturally has a low permeability, and thus installing suitably designed, comprehensive drainage at the site will assist in keeping the site free from standing water. It is not thought that the site is in hydraulic continuity with any of the environmentally sensitive areas in the vicinity, and the gradient of water flow is to the south west, whereas each of these sites is located to the north or east. The presence of Boulder Clay across the site will prevent the groundwater in any surface stratum from being in hydraulic continuity with the minor aquifer beneath the site. The conversion of much of the site to hardstanding with controlled drainage will also reduce the quantity of water flowing to surface waters and draining to ground water, thereby reducing the flood potential of down stream or down gradient sources. As such, the development proposal is considered to have a **medium positive** impact on the site.

11.148 The anticipated flow of surface water from the site to the stream which runs to the west, can be assumed to reduce by more than 75 % during normal conditions, as a result of the proposed development. During the re-grading works of the 1990's, low lying areas adjacent to the stream were raised to remove any risk of flooding, however the reduction in potential run off from the site to this water course can only assist in ensuring sufficient defence during high flow events. The reduction of the site's contribution to the stream will also assist in protecting down stream receptors. In times of drought, the reduction of flow from the site will reduce the stream's ability to continue to flow, and a reduced contribution to the River Camnant may result in a reduced water quality of the river downstream of the sewage treatment works. That said, pre-treated effluent from the site will be discharged to the sewage treatment works and may therefore assist firstly in diluting the incoming waste effluent to the works, and subsequently re-contributing to the flow of the River Camnant from the works discharge.

11.149 As the requirements of Dwr Cymru Welsh Water have not been finalised, coupled with the Enviroparks commitment to pre-treat their waste effluent to any required level, the overall impact of the Enviroparks site is considered to range from a **low positive** impact to a **low negative** impact.

11.150 As the only proposed releases from the site are of surface water run off from the landscaped area, the overflow of clean run off from the SUDS system, or the discharge of domestic and treated process effluent to sewer, and these have been demonstrated to have reduced or minimal effects on the potential for flooding or deterioration of water quality, the overall impact of the proposed site on the water quality and flood risk in the area is considered to be **low**.



REFERENCES

1. Planning Policy Wales Technical Advice Note 15: Development and Flood Risk. July 2004. Welsh Assembly Government. ISBN 0 7574 3501 1.
2. Planning Policy Wales. March 2002. Welsh Assembly Government. ISBN 0 7504 2854 6.
3. Rhondda Cynon Taff (Rhondda) Local Plan 1991 – 2006 (adopted 1998)
4. Brecon Beacons National Park Authority. Authority Approved Unitary Development Plan; March 2007
5. Welsh Industrial Estates Corporation. Proposed Development of the Northern Section of the Hirwaun Industrial Estate. Report on Site Investigation. Lab Ref No S/8731. January 1972.
6. 17 Acre Site, Hirwaun Industrial Estate. Interpretive Report on Ground Investigation. Exploration Associates. Report Number 155102. July 1995.
7. Environmental Studies in the Cynon Valley. Mid Glamorgan County Council. (No date).
8. Dwr Cymru Drought Plan.