20 WATER ENVIRONMENT

20.1 Introduction

20.1.1 This Chapter has been prepared by Wardell Armstrong LLP and reports the likely significant effects of the Proposed Development in respect to the water environment. In particular, it considers the likely significant effects relating to changes in the hydrological and hydrogeological regime or change to water quality. For the purpose of this chapter 'Proposed Development' refers to the wind and solar development and the 'Site' refers to the land on which the Proposed Development will be located.

20.1.2 This Chapter (and its associated figure and appendices) is not intended to be read as a standalone assessment and reference should be made to the front end of this Environmental Statement (ES) (Chapters 1 to 6), as well as the final chapter, 'Summary of Residual and Cumulative Effects' (Chapter 24). Appendix 20.1 – Flood Consequence Assessment (FCA) considers the flood risk to and from the Proposed Development and provides a drainage strategy for the Proposed Development.

20.2 Legislation, Policy and Best Practice

20.2.1 The relevant legislation, policy and best practise are listed below, with details provided in Appendix 20.2.

Legislative Framework

20.2.2 The applicable legislative framework is summarised as follows:

- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, which transposes The Water Framework Directive (WFD) (2000/60/EC);
- The Groundwater (England and Wales) Regulations (2009), which transposes The Groundwater Daughter Directive (2006/118/EC);
- The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015, which transposes The Priority Substances Directive (2008/105/EC);
- The Environment Act 2021;
- The Environment Protection Act 1990;
- The Land Drainage Act 1991; and
- The Water Resources Act 1991, Water Act 2003, and the Water Act 2014.

Planning Policy

20.2.3 The applicable planning policy is summarised as follows:

- Future Wales: The National Plan 2040;
- Planning Policy Wales (Edition 12);
- Caerphilly County Borough Council Local Development Plan 2010 (CW5: Protection of the Water Environment).

Additional Guidance

20.2.4 The applicable guidance is summarised as follows:

- CIRIA C741: Environmental Good Practice on Site Guide (4th Edition);
- CIRIA C750: Groundwater control: design and practice (2nd Edition);
- CIRIA C753: Sustainable Urban Drainage Systems Manual;
- CIRIA C532: Control of Water Pollution from Construction Sites;
- CIRIA C650: Environmental Good Practice on Site (Expansion of C502);
- Natural Resources Wales (NRW) Guidance for Pollution Prevention (GPP) documents:
  - GPP1: General Guide to the Prevention of Pollution;
  - GPP2: Above Ground Oil Storage;
  - GPP4: Treatment & Disposal of Sewage Where no Foul Sewer;
  - GPP5: Works & Maintenance In, Or Near Water;
  - GPP6: Working at Construction and Demolition Sites;
  - GPP8: Safe Storage and Disposal of Used Oils;
  - GPP21: Polluting Incident Response Planning;
  - GPP22: Dealing with Spills;
- UK Technical Advisory Group on the WFD, UK Environmental Standards & Conditions (Phase 2) (Final, 2008); and
- Environment Agency's Groundwater Protection Guides (adopted by NRW), including but not limited to: 'Protect Groundwater and Prevent Groundwater Pollution'; 'Groundwater Protection Technical Guidance'; and 'Groundwater Protection Position Statements'.

20.3 Assessment Methodology

Study Area and Assessment Site

20.3.1 A desk-based study has been undertaken to establish the baseline water environment of the Site and other relevant features located within 2 km of the boundary of the Site. The desk-based study has collated information, reviewed published NRW and British Geological Survey (BGS) maps and reviewed available site-specific data to determine the baseline conditions of the Site and develop a hydrogeological conceptual site model (HCSM) of the water environment.

20.3.2 The aims of the assessment were the following:

- Establish the water environment baseline condition.
- Identify water environment sensitive receptors.
- Identify potential likely effects as a result of the Proposed Development and arrive at a conclusion about the likely effect of these.
- Discuss embedded design mitigation and good industry practice that would be implemented as part of the Proposed Development.
- Determine the scale of any potential effects, assuming design mitigation and good industry practise, by assessing the degree of sensitivity of the hydrological and hydrogeological receptors and the potential magnitude of change from the baseline condition.
- Establish if the scale of the effect is considered to be 'Significant' (in EIA terms).
- If required, identify specific receptor mitigation and/or monitoring measures (if required).
- Identify any residual effects.
- Identify any cumulative effects.

Receptor Sensitivity

20.3.3 The sensitivity of receptors to hydrological and hydrogeological impacts has been determined using Table 20.1, which documents a hierarchy of factors relating to the water environment. Examples of the environmental criteria contained within Table 20.1 include international and national designations, work undertaken by NRW and professional judgement of the assessment team. When a receptor meets multiple

criteria or there is an absence of verified published data, the highest applicable sensitivity category is assigned to allow an assessment of the 'worst-case' scenario.

Table 20.1 Criteria for Determining Receptor Sensitivity

Sensitivity	Criteria	Typical Examples
Very High	Receptor has a high quality and rarity on a national or regional scale and limited potential for substitution. Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long-term or not possible.	<u>Groundwater:</u> Source Protection Zone 1 <u>Abstractions:</u> Abstractions for public drinking water supply
High	Receptor has a high quality and rarity on a local scale and limited potential for substitution. Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly.	<u>Groundwater:</u> Principal Aquifer providing a regionally important resource or supporting a site protected under EU and UK habitat legislation (i.e., Groundwater Dependent terrestrial ecosystems GWDTEs) Source Protection Zone 2 or 3 <u>Surface Water:</u> Protected under EU or UK habitat legislation (e.g., Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Ramsar Site) Designated Salmonid/Cyprinid Waters and/or fishery present Surface water providing a regionally important resource or supporting a site protected under EU and UK habitat legislation (i.e., water dependent ecological receptors) <u>Abstractions:</u> Abstractions for private drinking water supply Abstractions for non-potable use >20m^3/d (e.g., industry / process water, spray irrigation, river augmentation) <u>Hydro-ecological receptors:</u> Nationally and internationally designated sites where hydrology/hydrogeology is a key factor in designation (e.g., Ramsar/Sites of Special Scientific Interest (SSSI)/Special Areas of Concern (SAC)/Special Protection Areas (SPA) sites)

Table 20.1 Criteria for Determining Receptor Sensitivity		
Sensitivity	**Criteria**	**Typical Examples**
Medium	Receptor has a medium quality and rarity, local scale and limited potential for substitution or replacement. Receptor is somewhat vulnerable to impacts that may arise from the project and/or has moderate to high recoverability.	<u>Groundwater:</u> Secondary A Aquifer Secondary B Aquifer providing water supply to private abstractions Principal Aquifer providing a locally important resource or supporting river ecosystem Groundwater in peat deposits <u>Surface Water:</u> Classified as a main river with no further designations Large lakes and non-potable reservoirs <u>Abstractions:</u> Abstractions for non-potable use <20m^3/d (e.g., industry/process water, spray irrigation, river augmentation) <u>Hydro-ecological Receptors:</u> Statutory designated sites where hydrology/hydrogeology is a key factor in designation (National Nature Reserves (NNR), Local Nature Reserves (LNR)).
Low	Receptor with a low quality and rarity, local scale and limited potential for substitution. Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability.	<u>Groundwater:</u> Secondary B Aquifer Secondary Undifferentiated Aquifer Aquifers supporting potentially water dependent ecosystems i.e., Local Wildlife Sites (LWS) wetland. <u>Surface Water:</u> Ordinary watercourse and no designated features Non-sensitive water resources (non-NRW/WFD classified i.e., small lakes, ponds) Man-made feature not in hydraulic continuity (e.g., canal) <u>Abstractions:</u> Abstractions for industrial use (e.g., dust suppression/washing machinery) <u>Hydro-ecological Receptors:</u> Non-statutory designated sites where hydrology/hydrogeology is a key factor in

Table 20.1 Criteria for Determining Receptor Sensitivity		
Sensitivity	**Criteria**	**Typical Examples**
		designation. (Sites of Importance for Nature Conservation (SINC), Local Wildlife Site (LWS)
Very Low	Attribute has a very low environmental importance and/or rarity on local scale. Receptor is of negligible value, not vulnerable to impacts that may arise from the project and/or has high recoverability.	<u>Surface Water:</u> Man-made feature with no ecological importance (e.g., land drains)
Note Professional judgement based on the baseline condition of the receptor should be used to determine a receptor's sensitivity.		

20.3.4 Table 20.2 describes the guideline criteria used to assess the magnitude of change from the baseline condition that may result from the Proposed Development.

Table 20.2 Criteria for Determining the Magnitude of Change	
Magnitude of Change	**Typical Example**
High	Total loss of, or alteration to, the baseline resource such that post-development characteristics or quality would be fundamentally and irreversibly changed.
Medium	Loss of or alteration to the baseline resource such that post-development characteristics or quality would be partially changed.
Low	Small changes to the baseline resource, which are detectable, but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions.
Negligible	A very slight change to the baseline conditions, which is barely distinguishable, and approximates to the 'no change' situation.

20.3.5 The scale or level of effects is determined in relation to the sensitivity of the receptor and the potential magnitude of change from baseline conditions, using the matrix shown in Table 20.3. Effects can be negligible, minor, moderate or major. The nature of effects can be neutral, beneficial or adverse.

Table 20.3 Matrix for Determining Scale of Potential Effects						
		Receptor Sensitivity				
		Very High	**High**	**Medium**	**Low**	**Very Low**
Magnitude of Change from	**High**	Major	Major	Moderate	Moderate	Minor
	Medium	Major	Moderate	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible	Negligible

Table 20.3 Matrix for Determining Scale of Potential Effects						
		Receptor Sensitivity				
		Very High	High	Medium	Low	Very Low
Baseline Condition	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Significance Criteria

20.3.6 Guideline criteria for categories of significant effect are included in Table 20.4. Effects that have been determined to be Major or Moderate are considered to be 'Significant' in EIA terms and require mitigation to address them. Effects that are identified as Minor or Negligible are considered to be 'Not Significant' and no mitigation is required.

Table 20.4 Guideline Criteria for Categories of Significant Effect			
Scale of Effect	Significant Effect?	Definition	Guideline Criteria
Major	Yes	A fundamental change to the environment	Changes in water quality or quantity affecting widespread catchment or groundwater resources of strategic significance or changes resulting in substantial loss of conservation value to aquatic habitats and designations.
Moderate	Yes	A large, but non-fundamental change to the environment	Changes in water quality or quantity affecting part of a catchment or groundwaters of moderate vulnerability, or changes resulting in loss of conservation value to aquatic habitats or designated areas.
Minor	No	A small but detectable change to the environment	Localised changes in drainage patterns or groundwater flow, or changes resulting in minor and reversible impacts on surface and groundwater quality or aquatic habitats.
Negligible	No	No detectable change to the environment	No impact on drainage patterns, surface and groundwater quality or aquatic habitat.

Consultation Undertaken to Date

20.3.7 A request for a Scoping Opinion was submitted to Caerphilly County Borough Council on 8 November 2023 and a formal Scoping Opinion was received 16 January 2024. The Scoping Opinion included a number of hydrology and hydrogeology comments for discussion and/or consideration within the EIA.

20.3.8 Table 20.5 summarises the relevant opinion relating to the water environment.

Table 20.5 Summary of Water Environment Scoping Opinion		
Consultee	**Relevant Key Consultee Comments**	**Comment/Action Taken**
Caerphilly County Borough Council 10 January 2024	• Local Development Plan Policy CW5 (Protection of the Water Environment) should be included as considerations; • Parts of the site are identified as being at risk from surface water and small watercourse flooding on the Flood Map for Planning; • From 7th January 2019, Schedule 3 of the Flood and Water Management Act 2010 commenced in Wales requiring all new developments of more than one house or where the construction area is of 100 m^2 or more to implement sustainable drainage to manage on-site surface water. Surface water drainage systems must be designed and built in accordance with mandatory standards for sustainable drainage published by Welsh Ministers; • The site is situated within an area susceptible to groundwater flooding; • Drainage needs to be considered, particularly where rainwater collects from solar panel surfaces to avoid erosion to the tip surface; • Ensure that no water from the permitted area flows onto the public rights of way. • No Private Water Supplies (PrWS) in the vicinity of the Site.	EIA assessment (section 20.7) has considered these points and no Significant effects have been identified. Flood risk is considered and addressed and a drainage strategy is presented in the Flood Consequence Assessment (Appendix 20.1).
Natural Resources Wales 18 December 2023	• Identification of appropriate pollution contingency and emergency measures for watercourses on site; • Desk study for historical land use of the site to determine the extent of potential groundwater contamination; • Water Features Survey with a radius of 300m including all surface and groundwater features; • May require groundwater features to be monitored during proposed workings; • Construction Environmental Management Plan (CEMP) should include details on watercourse or surface drain management and details of water consumption and wastewater use; • The provision of a surface water management plan is highly advised; • WFD assessment can be scoped out of the report as the nearest WFD waterbody (Nant	Consideration of the water environment including surface water and groundwater is addressed in section 20.4 (baseline) and 20.6 (mitigation). A Water Features survey was carried out on 19 December 2023 by a WA Hydrogeologist (Appendix 20.3). Construction Environmental Management Plan (CEMP) has been produced addressing details on watercourse and surface drain management for planning. Details of water consumption and wastewater use will be added later, ahead of construction.

Table 20.5 Summary of Water Environment Scoping Opinion		
Consultee	**Relevant Key Consultee Comments**	**Comment/Action Taken**
	Bargoed) is approximately 1.23km south of the Site with no direct connections or pathways; • DCWW Fros y Fran potable water pump station 0.18km west of the Site.	Flood Consequence Assessment provides a surface water management plan (Appendix 20.1). Noted that no WFD assessment is required. DCWW potable water pump station is scoped out of the assessment due to there not being a hydraulic pathway.
Dwr Cymru Welsh Water (DCWW) 27 November 2023	• Need to consider surface water runoff from hardstanding; • Encourage the use of Sustainable Urban Drainage Systems (SuDS); • Ffos y Fran Water Pumping Station and access track must be protected during the course of Site development; • The Site does not fall within drinking water catchment so there are no concerns from a water resources perspective.	Flood risk and SuDS are considered and addressed in the Flood Consequence Assessment (Appendix 20.1). Ffos y Fran Water Pumping Station and access track are not located within the Proposed Development boundary. Noted that there are no water resource concerns. DCWW potable water pump station is outside of the Site boundary so therefore there will be no impact and is scoped out of the assessment.
South Wales Fire and Rescue 30 November 2023	• Adequate water supplies on the Site are required for firefighting purposes.	Comment will be taken into consideration in the design of the Proposed Development. Water will come from a tank during construction.

20.3.9 Table 20.6 provides a summary of the consultation activities undertaken in support of the preparation of this chapter.

Table 20.6 Summary of Consultation Undertaken to Date		
Organisation	**Individual(s)**	**Summary of Outcome of Discussion**
Natural Resources Wales	Data requested by email on 08 December 2023	Data received by email on 11 December 2023: - Abstraction licence data - Water Framework Directive Data - Permitted discharges

Table 20.6 Summary of Consultation Undertaken to Date		
Organisation	**Individual(s)**	**Summary of Outcome of Discussion**
Caerphilly County Borough Council	Data requested by electronic form on 08 December 2023	Request for Private Water Supplies (PrWS) data from Caerphilly County Borough Council. Follow up email sent on week commencing 15th January 2024. Scoping response stated that there were no PrWS in the vicinity of the Site.

20.4 Baseline Conditions

Rainfall

20.4.1 Average rainfall data has been obtained the nearest Met Office climate station to the Site (located at Tredegar, Blaenau Gwent)[1], approximately 4 km east of the Site at National Grid Reference (NGR) SO 14158 08904 for the period 1991 to 2020, as shown in Table 20.7. The UK Climate Projection (UKCP18) data for the Wales are available on the Met Office website[2].

20.4.2 On average, it is colder and wetter in Tredegar compared to Wales. The annual average minimum and maximum temperature for Tredegar is 5.76°C and 12.73°C respectively which is lower than the average for Wales which is 6.49°C and 13.67°C respectively. The annual rainfall for Tredegar is 1715.85mm which is higher than Wales which is 1464.63mm.

Table 20.7 presents the percentage change in precipitation for the 90th percentiles for the four emission scenarios for winter and summer periods for the available time slices, referred to in the Note in Table 20.7 as Representative Concentration Pathways (RCP). The UKCP18 for the majority of the emission scenarios and time slices predict that winters are likely to get wetter and the summers are expected to show little change.

[1] Met Office (2023) Tredegar (Blaenau Gwent) – Climate Station [online]. Accessed 11/12/2023. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcjww0udy

[2] Met Office (2023) Land Projections Maps: Probabilistic Projections [online]. Accessed 11/12/2023. Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/land-projection-maps

Table 20.7: Average Rainfall and Climate Change Projections								
Projective Change in Precipitation (%) for Wales Winter and Summer Periods								
Season:	**Winter**				**Summer**			
Time Slice:	**2020-2039**	**2040-2059**	**2060-2079**	**2080-2099**	**2020-2039**	**2040-2059**	**2060-2079**	**2080-2099**
RCP2.6*	+10% to +20%	+20% to +30%	+40% to +50%	+50% to +60%	0% to +10%	0% to +10%	-10% to 0%	-10% to 0%
RCP4.5*	+10% to +20%	+20% to +30%	+30% to +40%	+40% to +50%	+10% to +20%	0% to +10%	0% to +10%	-10% to 0%
RCP6.0*	+10% to +20%	+20% to +30%	+30% to +40%	+30% to +40%	+10% to +20%	0% to +10%	0% to +10%	-10% to 0%
RCP8.5*	+10% to +20%	+20% to +30%	+20% to +30%	+20% to +30%	+10% to +20%	0% to +10%	0% to +10%	0% to +10%

Month	**Average Rainfall (mm)**	**Average Rainfall (mm) With Projective Change in Precipitation**						
		-10%	**+10%**	**+20%**	**+30%**	**+40%**	**+50%**	**+60%**
January	206.19	185.57	226.81	247.42	268.05	288.67	309.29	329.90
February	157.25	141.53	172.98	188.70	204.43	220.15	235.88	251.60
March	125.77	113.19	138.35	150.92	163.50	176.08	188.66	201.23
April	102.85	92.57	113.14	123.42	133.71	143.99	154.28	164.56
May	101.15	91.04	111.27	121.38	131.50	141.61	151.73	161.84
June	83.79	75.41	92.17	100.55	108.93	117.31	125.69	134.06
July	105.84	95.26	116.42	127.01	137.59	148.18	158.76	169.34
August	115.25	103.73	126.78	138.39	149.83	161.35	172.88	184.40
September	124.87	112.38	137.36	149.84	162.33	174.82	187.31	199.79
October	189.26	170.33	208.19	227.11	246.038	264.96	283.89	302.82
November	184.86	166.37	203.35	221.83	240.32	258.80	277.29	295.78
December	218.77	196.89	240.65	262.52	284.40	306.28	328.16	350.03
Annual Total	1715.85	1544.27	1887.44	2059.02	2230.61	2402.19	2573.78	2745.36
Summer Average	105.63	95.07	116.19	126.77	137.32	147.88	158.44	169.00
Winter Average	180.35	162.31	198.39	216.42	234.46	252.49	270.53	288.56

Note
Rainfall data obtained from Tredegar, Blaenau Gwent Met Office climate station (NGR SO 14158 08904)
Average rainfall does not include provision for evaporation and evapotranspiration.
Emission Scenarios: RCPs (Representative Concentration Pathways) are scenarios of future concentrations of greenhouse gases and other forcings.
RCP2.6 = 1.6°C (0.9-2.3°C) change in global temperature by 2081-2100
RCP4.5 = 2.4°C (1.7-3.2°C) change in global temperature by 2081-2100
RCP6.0 = 2.8°C (2.0-3.7°C) change in global temperature by 2081-2100
RCP8.5 = 4.3°C (3.2-5.4°C) change in global temperature by 2081-2100
* 90th Percentile selected – the three percentiles (10th, 50th and 90th reflect the likelihood of those temperatures occurring under that emissions scenario).

Topography

20.4.3 The Site topography slopes from approximately 380 m Above Ordnance Datum (AOD) in the south west to approximately 293 m AOD in the north east by the Site entrance.

Surface Water Features

20.4.4 Drawing BR10167-033 shows the hydrology of the Site and surrounding area. Appendix 20.3 provides details of a hydrological walkover survey undertaken by a WA Hydrogeologist on 19 December 2023. Locations from the drawing and appendix are referred to in this section.

20.4.5 There are several mapped watercourses within the Site. There are three watercourses (unnamed watercourse 1, 2 and 3), labelled in Drawing BR10167-033, which are culverted beneath the access track in the north of the Site and flow east. Unnamed watercourse 1 (location 17) has a concrete culvert and unnamed watercourse 2 (location 14) has a metal pipe culvert. Unnamed watercourse 3 was not clearly visible during the hydrological site walkover, but there was a visible flow from location 12, which flowed north (location 13) until it joined unnamed watercourse 2 (location 14).

20.4.6 There is a concrete drain the east of the Site (location 11) which flows south towards the River Rhymney. The concrete drain runs adjacent to an unclassified road and the Heads of the Valley industrial estate.

20.4.7 Unnamed watercourse 1, 2 and 3 flow east into the concrete drain (location 11).

20.4.8 There is a watercourse running along and across the southern Site boundary (location 8), which also flows east towards the concrete drain (location 11).

20.4.9 Water flows from the high point (380 mAOD) found in the south west of the Site. Water flows north, through the agricultural fields (location 1) and towards Nant Carno, a tributary of the River Rhymney (location 22). Water in the east of the Site flows down topographic gradient towards the concrete drain (location 11), which then flows into the River Rhymney. Runoff in south of the Site flows towards the watercourse along the southern Site boundary (location 8) and then flows easterly in the River Rhymney. During the hydrological site walkover, the watercourse along the southern Site boundary (location) was mostly dry, with some areas of stagnant water. Some areas of the site were highly saturated (location 1, 10 and 18). Some of the water forms ponds in topographic depressions (location 4, 5 and 15).

20.4.10 Approximately 0.08 km south of the Site, there is an unnamed watercourse (location 7) which flows easterly towards the concrete drain (location 11), which then flows into the River Rhymney.

20.4.11 The River Rhymney (location 23) is designated by NRW as a Main River, it is located approximately 0.04 km east of the Site and flows south towards and into the Mouth of the River Severn.

20.4.12 Nant Carno (location 22) is located just north of the Site boundary and flows east towards and into the River Rhymney (location 23).

20.4.13 Butetown Reservoir (location 25) is found approximately 0.32 km north of the Site, which is a manmade fishing lake. There are several inflows to the north of the reservoir (location 26 and 28), which flow south into the reservoir. Water in the reservoir outfalls via a weir (location 29) and flows south east into a tributary of Nant Carno.

20.4.14 Approximately 0.46 km north of the Site, just north of Butetown Reservoir, is a small pond associated with Lakeside Farm (location 24).

20.4.15 Approximately 0.75 km south of the Site is Rhaslas Pond, which is impounded by a dam on its northern and southern sides and collects water draining from Gelli-Gaer Common and Merthyr Common watercourses. The pond drains through an outlet to the north, into a watercourse that flows approximately 0.07 km west of the Site boundary. The drain flows north until it reaches Nant Carno.

20.4.16 There are 5 mapped manmade ponds and drainage associated with Trecatti landfill site, located approximately 1.2 km south west of the Site (see drawing BR10167-032).

20.4.17 Jepson's Pond and Pitwellt Pond are found approximately 1.26 km and 2.15 km north west of the Site (see drawing BR10167-032). Both ponds collect drainage from Pen March and flow towards Nant Carno, which then flows into the River Rhymney.

20.4.18 Nant Pitwellt flows south east into a reservoir, found approximately 1.86 km north of the Site. This reservoir flows south east into another reservoir, found approximately 1.4 km north of the Site, which flows into the River Rhymney.

20.4.19 A reservoir is found 1.99 km west of the Site, which flows south west into a larger reservoir which is located 2.25 km west of the Site.

20.4.20 There are various watercourses, drains and ponds associated with Rhymney Hill, which flow south west into the River Rhymney, following the topography.

Surface Water Quality

20.4.21 The Site is located within the Severn River Basin District, the South East Valleys Management Catchment, the Rhymney Operational Catchment, and the Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body (ID: GB109057033130)[3], which has an Ecological status of Moderate, a Chemical status of High and an Overall waterbody status as Moderate. All surface water features are located in the Rhymney Operational Catchment except for the water features associated with Trecatti landfill, which are in the Taff DS Cynon Operational Surface Water Operational Catchment, and the Taff – confluence Taf Fechan to confluence River Cynon Surface Water Body Catchment[3]. The surface water catchments can be seen in Drawing BR10167-057.

Flood Risk

20.4.22 Appendix 20.1 presents the findings of the FCA, which are summarised in the following paragraphs.

20.4.23 The Site is located within Flood Zone A, described in Technical Advice Note 15: development, flooding and coastal erosion (TAN15) as an area 'considered to be at little or no risk of fluvial or tidal/coastal flooding' on the Welsh Government's Development Advice Map[4]. The Proposed Development is a 'Greener Grid Park' energy centre, which is categorised as 'Less Vulnerable' development, and a Less Vulnerable development is permitted in Flood Zone A. The watercourses to the south of the Site (location 7 and 8) and sections of the concrete drain (location 11) and unnamed watercourse 2 are in Flood Zone 3 for Surface Water and Small Watercourses. There are small sections of the Site, for example near unnamed watercourse 3, which are considered to be Flood Zone 2 for Surface Water and Small Watercourses[5]. Flood Zone 2 are areas with 0.1% to 1% chance of flooding and Flood Zone 3 are areas with more than 1% chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change[5].

[3] Water Watch Wales (2023) – Cycle 3 (2021) Rivers and Waterbodies Map [online] Accessed 28/01/2024. Available at: https://waterwatchwales.naturalresourceswales.gov.uk/en/

[4] Development Advice Maps (DAM) [online] Accessed 29/01/2024. Available at: https://datamap.gov.wales/layergroups/geonode:nrw_development_advice_map#:~:text=The%20Development%20Advice%20Map%20(DAM,risk%20of%20flooding%20wherever%20possible.

[5] Flood Map for Planning [online] Accessed 29/01/2024 Available at: https://flood-map-for-planning.naturalresources.wales/

20.4.24 The risk of fluvial, surface water, and artificial flooding are considered to be Very Low, and the risk of groundwater flooding is considered to be Low. Tidal and sewer flooding are both discounted.

Geology

20.4.25 The artificial and superficial geology of the Site can be seen in Drawing BR10167-058 and the bedrock and linear geology can be seen in Drawing BR10167-059.

Made Ground and Soils

20.4.26 According to LandIS Soilscape Viewer[6], the Site is underlain by restored soils mostly from quarry and opencast spoil, which is described as loamy with variable drainage.

20.4.27 According to British Geological Survey (BGS) mapping[7], the majority of the Site is composed of Made Ground (Undivided) – artificial deposit, which is described as an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits[8] (see Drawing BR10167-058).

20.4.28 The north west and a small part of the north east of the Site is composed of Worked Ground (Undivided) – void, which is described as an area where the land surface (natural or artificial) has been lowered as a result of man-made excavations[9] (see Drawing BR10167-058).

Superficial Deposits

20.4.29 According to BGS mapping[7], the majority of the Site is not underlain by superficial deposits except for the north eastern corner of the Site, which is underlain by Till, Devensian – diamicton[10] (see Drawing BR10167-058). Where the Till is mapped, there is also Made Ground meaning that the Till is likely to not be present or have a reduced thickness. The majority of the area surrounding the Site is also underlain by Till.

[6] LandIS (2023) Soilscapes Viewer [online] Accessed 28/01/2024Available at: https://www.landis.org.uk/soilscapes/
[7] British Geological Survey (2023) GeoIndex [online] Accessed 28/01/2024 Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html
[8] British Geological Survey (2023) BGS Lexicon: Made Ground [online] Accessed 28/01/2024Available at: https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=MGR
[9] British Geological Survey (2023) BGS Lexicon: Worked Ground [online] Accessed 28/01/2024Available at: https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=WGR
[10] British Geological Survey (2023) BGS Lexicon: Till, Devensian [online] Accessed 28/01/2024 Available at: https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=TILLD

Bedrock Geology

20.4.30 According to BGS mapping[7], the north west and north east of the Site is underlain by South Wales Lower Coal Measures Formation – mudstone, siltstone and sandstone[11] and the remainder of the Site is underlain by the South Wales Middle Coal Measures Formation – mudstone, siltstone and sandstone[12], which are both described as grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones (see Drawing BR10167-059). The Lower Coal Measures Formation underlies the Middle Coal Measures Formation.

20.4.31 The South Wales Lower Coal Measures Formation thickness ranges from 80 m to 300 m[11] and the South Wales Middle Coal Measures Formation thickness ranges from 120 m to 240 m[12].

20.4.32 Hereafter, the South Wales Lower Coal Measures Formation and the South Wales Middle Coal Measures Formation are referred to as the Coal Measures Formation.

Linear Features

20.4.33 According to BGS mapping[7], there are numerous observed and inferred coal seams across the Site, which generally trend west to east. There is an observed coal seam and a marine band between the Middle and Lower Coal Measures Formation. There is one fault in the east of the Site which trends north to south. The linear features can be seen in Drawing BR10167-059.

Hydrogeology

20.4.34 The Till underlying part of the Site and the surrounding area is classified by NRW as a Secondary (Undifferentiated) Aquifer – assigned in cases where it has not been possible to attribute either category A or B to a rock type, due to the variable characteristics of the rock type[13].

20.4.35 The Coal Measures underlying the Site is classified by NRW as a Secondary A Aquifer – permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers[13].

[11] British Geological Survey (2023) BGS Lexicon: South Wales Lower Coal Measures Formation [online] Accessed 28/01/2024Available at: https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=SWLCM
[12] British Geological Survey (2023) BGS Lexicon: South Wales Middle Coal Measures Formation [online] Accessed 28/01/2024 Available at: https://webapps.bgs.ac.uk/lexicon/lexicon.cfm?pub=SWMCM
[13] NRW BGS (2023) Aquifer Designations [online] Accessed 28/01/2024Available at: https://www.bgs.ac.uk/datasets/aquifer-designation-data/

According to the BGS, the Coal Measures Formation aquifer is moderately productive[14].

20.4.36 The Site is located in the Severn River Basin District, the South East Valleys Groundwater Management Catchment, the South East Valleys Carboniferous Coal Measures Operational Catchment, and the South East Valleys Carboniferous Coal Measures Water Body (ID: GB40902G201900)[3], which has a Quantitative status of Good, a Chemical status of Poor and an Overall status of Poor.

Private Water Supplies, Public Water Supplies, Abstractions and Discharges

20.4.37 According to Caerphilly County Borough Council's scoping response, there are no known Private Water Supplies (PrWS) within the vicinity of the Site.

20.4.38 Data regarding abstractions and discharges was gathered from NRW DataMapWales[15]. There are four abstractions within 2 km of the Site: three surface water and one groundwater. There are seven discharges: four sewage, two trade and one miscellaneous, all of which are discharged to a river, stream or ditch. The available data for abstractions and discharges is provided in Table 20.8 and Table 20.9 respectively and are presented in Drawing BR10167-034.

Table 20.8: Licensed Abstractions within 2km of the Site

Licence No.	Licence Holder	Source Type	NGR	Approximate Distance from Site (km)
WA/057/0022/002	Merthyr (South Wales) Limited	Surface Water – Rhaslas Pond	SO0940607143	1 km south
21/57/11/0001	Dwr Cymru Cyfyngedig	Surface Water	SO1033010230	1.41 km north
21/57/11/0019	Pontlottyn Fishing Club	Surface Water	SO1110006400	1.65 km south east
21/57/11/0022	Dwr Cymru Cyfyngedig	Groundwater – Millstone Grit and Carboniferous Limestone	SO1014010580	1.78 km north

[14] British Geological Survey (2023) GeoIndex Onshore [online] Accessed 28/01/2024 Available at: https://mapapps2.bgs.ac.uk/geoindex/home.html
[15] NRW (2023) DataMapWales [online] Accessed 28/01/2024 Available at: https://datamap.gov.wales/maps/new#/

Table 20.9: Permitted Discharges within 2km of the Site					
Permit No.	**Permit Holder**	**Discharge Type**	**Receiving Environment**	**NGR**	**Approximate Distance from Site (km)**
AN0093901	Dwr Cymru Cyfyngedig	Sewage – Water Undertaker	River, stream or ditch – River Rhymney	SO1075008520	0.24km east
DB3093HS	Caerphilly County Borough Council	Miscellaneous	River, stream or ditch – unnamed tributary of Nant Carno	SO1007208968	0.41km north
AF3001301	Dwr Cymru Cyfyngedig	Sewage – Water Undertaker	River, stream or ditch – River Rhymney	SO1108507650	0.71km south east
CB3697FR (a)	FCC Construccion S A, UK Branch Office	Trade	River, stream or ditch – Afon Cynon, Afon Taf and Afon Rhymni	SO0853708631	1.05km west
AF3001302	Dwr Cymru Cyfyngedig	Sewage – Water Undertaker	River, stream or ditch – River Rhymney	SO1126007220	1.1km south east
CB3697FR (b)	FCC Construccion S A, UK BRANCH OFFICE	Trade	River, stream or ditch – Afon Cynon, Afon Taf and Afon Rhymni	SO0766808201	1.87km west
CB3098HF	JN Bentley Ltd	Sewage – non Water Undertaker	River, stream or ditch	SO0763308861	1.97km west

Designations

20.4.39 The Site is not located within a Nitrate Vulnerable Zone (NVZ)[3] for surface water or groundwater or a groundwater Source Protection Zone (SPZ)[15].

20.4.40 The Site is not located in a Groundwater Drinking Water Protected Area with Risk but is within a not at risk Drinking Water Protected Area River Catchments 2021[3].

20.4.41 Lower House Stream Section Site of Special Scientific Interest (SSSI) is located approximately 1.27 km north west of the Site. Lower House Stream Section is

designated due to its geological and geomorphological value[16]. There are no other SSSI within 2km of the Site.

20.4.42 There are no Groundwater Dependent Terrestrial Ecosystems[3], National Nature Reserves, Ramsar Sites, Special Areas of Conservation or, Special Protection Areas within 2 km of the Site[17].

Non Designations

20.4.43 Information on Sites of Importance for Nature Conservation (SINC) and Local Wildlife Site (LWS) have been requested from Caerphilly County Borough Council but a response was not received at the time of writing this chapter.

Active and Historic Landfills

20.4.44 According to NRW[15] there are eight effective waste permits within 2 km of the Site, details of which are summarised in **Error! Reference source not found.** and presented in Drawing BR10167-060.

Table 20.10: Active Waste Permits within 2km of the Site

Site Name	Permit Number	Waste Activity	NGR	Distance from Site
Green Steel Works Ltd	BB3298HN	S0803: SR2008 No3 : HCI Waste TS + treatment <75000 tonnes per annum	SO 11225 06990	1.23km south east
Lawn Civic Amenity Site	QP3899FY	A13: Household Waste Amenity Site <5445 tonnes per annum	SO 11536 07302	1.28 south east
Bpi Recycled Products	UB3897TG	A16: Physical Treatment Facility R03: organic materials recovery activities <30000 tonnes per annum	SO 11481 07065	1.37km south east
Mekatek Ltd	AB3698ZE	A11: Household, Commercial & Industrial Waste Transfer Station R05: recovery of inorganic wastes <30999 tonnes per annum	SO 11601 06726	1.68km south east
Merthyr Borough Recycling Centre Ltd-transfer Station	ZP3899FX	A11: Household, Commercial & Industrial Waste Transfer Station <120000 tonnes per annum	SO 07979 08830	1.65km north west
Abba Scrap	DP3299FD	A20: Metal Recycling Site (mixed MRS's) R02: Solvent recovery <24999 tonnes per annum	SO 07898 08829	1.72km north west
Heads Of The Valley Salvage Limited	YP3992EN	A20: Metal Recycling Site (mixed MRS's) R02: Solvent recovery <6000 tonnes per annum	SO 07878 08834	1.75km north west

[16] Caerphilly County Borough Council (2023) Appendix 5: Statutory Protected Sites For Biodiversity Conservation [online] Accessed 28/01/2024Available at: https://caerphilly.opus3.co.uk/ldf/documents/appendices/appendix_5

[17] DEFRA (2023) Magic Map Application [online] Accessed 28/01/2024Available at: https://magic.defra.gov.uk/MagicMap.aspx

Pengarnddu Ind Est Transfer Station	BB3995FD	A09: Hazardous waste transfer station D09: Physical / physico-chemical treatment of waste prior to any other disposal operation. <11600 tonnes per annum	SO 07780 08940	1.87km north west

20.4.45 According to NRW[15] there are nine historic landfills located within 2 km of the Site, details of which are summarised in Table 20.11 and presented in Drawing BR10167-060.

Table 20.11: Historic Landfills within 2km of the Site

Site Name	Waste Activity	NGR	Distance from Site
Nant Liesg Quarry, Nant Liesg	Accepted inert waste between 31 December 1959 and 31 December 1992.	SO 10600 07300	0.6km south
Ty Coch, Rhymney, Powys	Accepted commercial waste from 17 August 1970. Last input is unknown.	SO 11500 08600	0.72km east
Trecatti North, Dowlais, Glamorgan	Accepted household waste between 31 December 1980 and 31 December 1989.	SO 08700 08300	0.8km west
Trecatti South, Dowlais, Glamorgan	Accepted household waste between 31 December 1980 and 31 December 1989.	SO 08600 07400	1.19km south west
Trecatti Council, Fochrin Road, Merthyr Tydfil, Dowlais Top	Accepted inert, industrial, commercial, household and special waste between 31 December 1974 and 21 July 1993.	SO 08200 07700	1.2km west
Royal Arms Group, Pant-y-waun, Merthyr Tydfil, Mid Glamorgan	Accepted industrial, commercial and household between 30 September 1970 and 31 December 1989.	SO 08000 08200	1.33km west
Felinfach, Brecon	Accepted industrial and household waste.	SO 08300 09300	1.6km north west
Jasonic. Dowlais Top	Accepted inert waste between 31 December 1991 and 31 December 1992.	SO 07800 08400	1.63km west
West Hill Tip, Tredegar, Gwent	Accepted commercial waste between 31 December 1967 and 31 December 1980.	SO 12900 09400	1.86km north east

Future Baseline

20.4.46 The UK Climate Projections have predicted a +10% to +60% change in rainfall values. An increase in rainfall could affect runoff across the Site and may alter river processes (e.g. erosion, deposition and the frequency and intensity of river flooding and ponding in depressions). This may correspond with an increase in groundwater levels and associated groundwater flooding.

20.4.47 In a scenario where the Proposed Development is not constructed the water flows through the Site are likely to continue as per the baseline, although the frequency and intensity of flooding may increase due to climate change.

20.5 Hydrogeological Conceptual Site Model (HCSM)

20.5.1 The Hydrogeological Conceptual Site Model (HCSM) illustrates the water movement pathways from the ground surface to the bedrock aquifer. The following source-pathway-receptor relationships have been identified for the Site in relation to the water environment:

Baseline HCSM

20.5.2 The baseline HCSM illustrates the water movement pathways under the current conditions at the Site. The baseline HCSM can be summarised as follows:

- The Site is located within the Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment. Precipitation falls directly into mapped watercourses within the Site: unnamed watercourse 1, 2 and 3 (locations 17, 14 and 13 respectively), the concrete drain (location 11) and the watercourse along the southern Site boundary (location 8), all of which flow towards and into the River Rhymney (NRW main river).
- Precipitation falls onto the restored soils and quarry / opencast spoil. Due to the restored soils having variable drainage, precipitation will either infiltrate or runoff.
- Precipitation runs off from the high point (380 mAOD) found in the south west of the Site down topographic gradient into watercourses: Nant Carno in the north; the River Rhymney in the east; and Rhaslas Pond watercourse in the west, all of which are found within the Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment.
- The remaining precipitation will infiltrate vertically into Made Ground or Worked Ground or where present, Till. Water will either percolate through to the bedrock or runoff and flow downgradient towards watercourses. Where Till is present, the water will either runoff due to contact with impermeable clay or percolate through to the bedrock, where there are more permeable layers within the Till.
- Water that percolates into the bedrock Coal Measures aquifer, will migrate vertically from the Middle Coal Measures Formation to the Lower Coal Measures Formation. Groundwater within the bedrock will flow laterally along more

permeable layers (such as coal seams and through siltier and sandier geological layers). Less-permeable layers (mudstones and shales) will inhibit groundwater flow.

- During periods of intensified rainfall, the proportion of direct runoff to surface water features is increased. These storm events create a more direct, faster pathway from a potential source to receptor. If surface water were present due to intensified rainfall, runoff would travel down the topographic gradient across both the onsite and offsite surface waterbodies and watercourses.
- Precipitation falling onto Butetown Reservoir, Rhaslas Pond, Jepson's Pond and Pitwellt Pond will also eventually flow into the River Rhymney via Nant Carno.
- The five mapped manmade ponds and drainage associated with Trecatti landfill are located in the Taff – confluence Taf Fechan to confluence River Cynon Surface Water Body Catchment and are therefore scoped out of the assessment.
- Precipitation falling into Lower House Stream Section SSSI will also flow into the River Rhymney, however, due to being upstream from the Site, it is not likely that there is a hydraulic connection between the Site and the SSSI.
- Licensed abstractions WA/057/0022/002, 21/57/11/0001 and 21/57/11/0019, 21/57/11/0022 are located within 2 km of the Site. However, all of these features can be scoped out of the assessment due to the absence of a pathway between the site and the features. Licensed abstractions WA/057/002 and 21/57/11/0001 are located in Taff – confluence Taf Fechan to confluence River Cynon Surface Water Body Catchment, 21/57/11/0019 is located upstream of the Site and 21/57/11/0022 is abstracted from Millstone Grit and Carboniferous Limestone.
- The Heads of the Valley industrial estate and eight active and nine historic landfills located within 2 km of the Site which are a potential source of pollution.

Source-Pathway-Receptor HCSM

20.5.3 The following Source-Pathway-Receptor relationships have been identified for the Proposed Development in relation to the water environment:

Potential Sources

20.5.4 Baseline sources:

- Existing pollution associated with the coal industrial legacy of the Site / Made Ground / Worked Ground;
- Potential pollution from historic and active landfills; and
- Pollution from neighbouring Heads of the Valley industrial estate.

20.5.5 Potential sources of contamination that may result from the Proposed Development:

- The use and storage of fuels and other potentially polluting materials may lead to accidental spills/leaks from machinery and fuel storage areas during construction / decommission and maintenance during operation;;
- Remobilisation of existing contamination from coal spoil during earthworks / excavations;
- Sediment production associated with vehicle movement, earthworks and demolition;
- Subsurface seepages (alkaline leachate) into the groundwater from cement and concrete leachate; and
- Use of cement bound sand in cable trenches causing high alkaline water;
- Land use changes may affect runoff/infiltration characteristics and hence affect water resources.

Potential Pathways

20.5.6 The following pathways describe how baseline water moves through the Site:

- Runoff (above ground surface flow) flows across the Site from areas of high to low elevation in accordance with topography into Nant Carno or other unnamed watercourses, which eventually flow into the River Rhymney;
- Infiltration of precipitation into the restored soils and coal spoil and subsequently into the Made Ground/Worked Ground or Till;
- Percolation from the Made Ground/Worked Ground or Till into the bedrock Coal Measures Formation;
- Groundwater flow within the Coal Measures Formation aquifer through coal seams, other discontinuities and the siltier/sandier layers.

20.5.7 In addition to the baseline pathways, which may continue unaltered, the following water pathways have been identified that may be altered by the Proposed Development:

- The removal/reduction of overburden for excavations or construction works such as piling for turbine foundations could result in direct recharge to the Coal Measures Formation aquifer;
- Construction and decommissioning works could cause a release of sediment and destabilise slopes and drainage channels, leading to erosion and further release of sediment. The creation of access roads and the digging of cable trenches are examples of activities that will all cause ground disturbance, exposing soil and increasing the risk of sedimentation to surface flows;
- Rainwater can be channelised via infrastructure, such as access tracks creating shorter pathways for mobilised sediment and contaminants to be carried as runoff down gradient to low lying areas;
- Potential contamination sources are typically associated with vehicles / machinery, such as fuel and oil that could infiltrate through soils and superficial deposits to contaminate aquifers;
- Presence of turbine associated hard standing areas introduces new impermeable surfaces during the operational phase which will lead to increased runoff downgradient to low lying areas, which could increase flooding;
- Increased runoff will be managed by SuDS (conveyance and attenuation swales). It is planned that the surface water runoff from the site access will discharge to the drainage ditch adjacent to the southern boundary (location 8) and the surface water runoff from the Proposed Development will discharge to the watercourse to the west of the Site;

Sensitive Receptors

20.5.8 Table 20.12 summarises the potential receptors and the reasons for inclusion or exclusion from the assessment. The water receptors identified in Table 20.12 that are not at risk from the Proposed Development have been scoped out of the assessment and are not considered further.

Table 20.12: Summary of Receptors and Sensitivity				
Receptor	**Distance from Site**	**Summary of Receptor Characteristics**	**Receptors Sensitivity**	**Receptor at Risk from Proposed Development?**
Made Ground/Worked Ground/coal spoil	Underlies the Site	Artificial ground/historic coal spoil. Not an aquifer.	Low	No – the receptor is not an aquifer.
The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	The Site is within this catchment	All waterbodies which flow into the River Rhymney including: 3 unnamed watercourses on Site, mapped watercourse to the south and east of the Site, Nant Carno, Butetown Reservoir, Lakeside Farm pond, Rhaslas Pond, Jepson's Pond, Pitwellt Pond). Locally important watercourse/catchment.	Medium	Yes – the Proposed Development is within this catchment
Taff – confluence Taf Fechan to confluence River Cynon Surface Water Body Catchment	The Site is not within this catchment	Ponds and drainage associated with Trecatti landfill. Locally important watercourse/catchment	Medium	No – the Proposed Development is not within this catchment
Groundwater in Till	Underlies part of the Site	Secondary (undifferentiated) aquifer. Perched water due to clay.	Low	Yes – the Proposed Development is partially overlying Till
Groundwater in Coal Measures Aquifer	Underlies the Site	Secondary A aquifer. Moderately productive aquifer	Medium	Yes – the Proposed Development Area is located on the Middle and Lower Coal Measures Formation
Licensed abstractions (WA/057/0022/002, 21/57/11/0001 and 21/57/11/0019, 21/57/11/0022)	1 km south, 1.41 km north, 1.65 km south east and 1.78 km north from the Site respectively	3 surface water and 1 groundwater licenced abstraction	High	No – WA/057/002 and 21/57/11/0001 are located in Taff – confluence Taf Fechan to confluence River Cynon Surface Water Body Catchment, 21/57/11/0019 is located upstream of the Site and 21/57/11/0022 is abstracted from Millstone Grit and Carboniferous Limestone.
Lower House Stream Section SSSI	1.27km north of the Site	Designated for its geological and geomorphological value	High	No – the SSSI is located upstream of the Proposed Development and it is unlikely that there is a hydraulic connectivity.

Limitations

20.5.9 The following represent potential limitations to the baseline descriptions:

- No groundwater level or quality monitoring data is available for the Site; and
- Although NRW has confirmed there are no PrWS in the vicinity of the site, the search area used to determine this has not been confirmed.

20.6 Mitigation Measures

20.6.1 Embedded mitigation, such as incorporating SuDS into the design of the Proposed Development and mitigation described in Appendix 20.1 Flood Consequence Assessment, have been considered in the assessment. As discussed in Section 20.3, following the assessment only significant effects will require additional mitigation above embedded mitigation and industry best practice measures.

20.6.2 Mitigation of effects upon flow rates and volumes of watercourses within the surface water catchment would be achieved through design of a suitable surface water drainage scheme for the Proposed Development, which takes into account climate change (1 in 100 years plus climate change event). The drainage proposals would ensure that the existing greenfield rate of surface water runoff discharged to the adjacent watercourses is maintained and in the long term can take into account and accommodate climatic changes.

20.6.3 Pre-construction water quality monitoring of watercourses will be undertaken in order to establish a baseline condition. Monitoring during construction and at the start of the operational phase would: identify if changes to the baseline water quality is due to the proposed Development; and form the basis of remediation works (if required).

Primary Mitigation Measures

20.6.4 Primary mitigation measures include modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken.

20.6.5 The proposed surface water management plan is shown in Appendix 20.1 on Drawing No. ST19905-019-A Indicative Surface Water Management Plan. It is proposed to use conveyance and attenuation swales. Surface water runoff from the site access would be discharged to the drainage ditch adjacent to the southern boundary (location 8). Surface water runoff from the Proposed Development would discharge to the watercourse to the west of the Site. Discharge would be restricted to the QBAR greenfield runoff rate for all storm events up to and including the 1 in 100 year storm event (plus a 40% climate change allowance) with all flows in excess of this rate attenuated within the Proposed Development.

20.6.6 The surface water drainage strategy has considered other SuDS and incorporates SuDS principles wherever possible, such as green roofs, infiltration devices, pervious

surfaces, bioretention systems and underground attenuation to provide further enhancement to the water quality of surface water runoff.

20.6.7 The proposed Surface Water Management Plan incorporates measures that would ensure that the risk of flooding to areas downstream of the Site are not increased as a result of the Proposed Development.

20.6.8 It is likely that there will be some groundwater seepage into the excavations during construction. In order to minimise groundwater seepage, benches and a well point system should be used whilst excavating. If required, a cofferdam can be used which will result in there being no groundwater seepage. Should water still enter the excavation, groundwater will be managed and removed to ensure that the excavation will not fill with water.

Tertiary Mitigation Measures

20.6.9 Tertiary mitigation measures are actions that would occur with or without input from the EIA feeding into the design process including actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.

20.6.10 The Proposed Development would be undertaken in line with the current guidance and codes of best practice. Table 20.13 lists accepted, good practice industry guidance that is intended to prevent adverse environmental effects during construction and decommissioning. The measures detailed in the guidance documents would limit the potential for disturbance or contamination of water resources and would be adopted.

Table 20.13: Good Practice Guide and Guidance Documents to Protect the Water Environment
Documents
GPP1 Understanding your environmental responsibilities - good environmental practices GPP2 Above Ground Oil Storage Tanks GPP4 Treatment and disposal of wastewater where there is no connection to the public foul sewer GPP5 Works and Maintenance In or Near Water GPP6 Working at Construction and Demolition Sites GPP8 Safe Storage and Disposal of Used Oils GPP13 Vehicle washing and cleaning GPP21 Pollution Incident Response Planning GPP22: Dealing with spills GPP26 Safe storage - drums and intermediate bulk containers Construction Information Research and Information Association (CIRIA) C532 Control of Water Pollution from Construction Sites CIRIA C741 Environmental good practice onsite guide CIRIA C750 Groundwater control - design and practice CIRIA C753 The SuDS manual CIRIA C786 Culvert, screen and outfall manual

Construction Phase

20.6.11 The Construction Environmental Management Plan (CEMP) incorporates the key principles of the good practice, legislation, regulations and guidance. The CEMP would provide practical measures to avoid and minimise the effect of the Proposed Development on ground and surface waters, as well as providing emergency preparedness and corrective actions together with measures for monitoring, recording and dissemination of information.

20.6.12 The key principles of the water-related components of the CEMP would include (but are not limited to) the following:

- Construction design to minimise disruption to the natural flow regime.
- Planning and preparation of works to ensure all precautions are taken in order to provide protection to watercourses, groundwater and attenuation features, including the supervision of sub-contractors and liaison with Local Authority and the NRW area staff.
- Installation of attenuation features and drainage at the outset to allow establishment before any surface connections.
- Adoption of measures to prevent and control the release of sediment, such as directing surface water across vegetated zones or through mesh fencing in order to capture the sediment. Sediment traps or settlement lagoons may be considered if the quantity of sediment laden water is anticipated to be large. The CEMP would specify the maintenance requirements to ensure that sediment control measures, drains and pot holes are regularly inspected, cleared, infilled and/or repaired.
- Securely storing all fuel, oils and other polluting substances within suitably bunded containers and placed upon impermeable surfaces in accordance with GPP2: Above Ground Oil Storage and GPP8: Safe Storage & Disposal Of Used Oils. The total quantity and range of potential pollutants to be used onsite is anticipated to be small.
- The use of integral drip trays (of 110% of the capacity of the fuel tank) for any static machinery/ plant, where practicable. All plant, vehicles and machinery would also be regularly inspected for leaks.
- Refuelling would be undertaken in a designated refuelling area and the use of biodegradable oils and lubricants will be considered where possible.

- The preparation of pollution incident response plans, identifying the type and location of onsite resources (spill kits, absorbent materials, oil booms etc.) available for the control of accidental releases of pollution and other environmental incidents. These resources would be available to contractors at all times of operation.
- Cement/concrete mixes will be calculated to ensure that sufficient quantities are supplied without needing disposal of excess and cement/sand mix ratio would be monitored for consistency and suitability.
- Should abstraction and discharge be required for construction activities (e.g., removing water from excavations), appropriate environmental consents would be sought and all activities would be undertaken in line with any exemptions, regulatory position statements, registrations, licences or permits. The CEMP would also include measures on the management of water relating to these activities (e.g., requiring a permit to pump and preparation of task-specific Risk Assessment Methods Statement (RAMS)).

Operational Phase

20.6.13 The Proposed Development would have an operation and maintenance management team who, as part of their role, would ensure all drainage systems are fully maintained and managed in accordance with best practice/guidance (Table 20.13) and the Environmental Management System (EMS). In addition, during the operational phase to mitigate potential for pollution from maintenance activities there will be a requirement for vehicles and plant to carry a spill kit.

Decommissioning Phase

20.6.14 A Decommissioning Environmental Management Plan (DEMP) would be prepared and adhered to. It is considered that the contents of the DEMP would be similar to the CEMP and the document would have similar aims and purpose.

20.7 Assessment of Environmental Effects

20.7.1 The following assessment assumes that construction would be undertaken in accordance with industry best practice, and that a Construction Environmental Management Plan (CEMP), or equivalent, would be developed, adopted, and adhered to throughout the construction phase of the Proposed Development.

Construction Phase

20.7.2 Construction effects can be categorised into two types: i) those that relate to the act of carrying out construction (e.g., earthworks causing sedimentation of watercourses); and ii) those that relate to the construction of the development itself (e.g., the creation impermeable surfaces). Table 20.14 details potential effects that may arise from the activities of the Proposed Development during construction.

Table 20.14: Potential Construction Phase Effects

Project Component	Activity	Potential effects	Comments/embedded mitigation
Access Track and Underground Cabling	Use of access track	Increased sediment mobilisation and transport from road material through surface wash off.	Access track drains and potholes will be regularly inspected and cleared/infilled/repaired. This will reduce the potential for sediment to mobilise and wash off from the access track surface. Sediment traps will be used, as necessary. The track will be comprised of a running layer of permeable geotextile membrane, which will also avoid fine particles entering surface water features.
	Restored soil / coal spoil removal	Removal of restored soil / coal soil reduces interception and therefore a more direct route to the bedrock aquifer.	The total area of the new access tracks and the upgrade works to existing access tracks compared to the associated catchments is small (Drawing BR10167-057). Therefore, any change to interception rates are unlikely to substantially alter the runoff within the catchments.
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Good industry practice such as pollution prevention measures detailed in Guidance for Pollution Prevention (GPP) GPP1, GPP21 and GPP22 will reduce the risk and the overall impact if a spill or leakage were to occur.
	Use of cement bound sand	Pollution from spills or leakage of highly alkaline water that has come into contact with cement bound sand.	Good industry practice such as pollution prevention measures detailed in GPP1 will reduce the risk and the overall impact if a spill or leakage were to occur.
Turbines and Associated Hardstanding and Storage Areas	Restored soil / coal spoil removal	Removal of restored soil /coal spoil reduces interception and therefore a more direct route to the bedrock aquifer.	The total area of the turbines and hardstanding compared to the associated catchments is small (Drawing BR10167-057). Therefore, any change to interception rates are unlikely to substantially alter the runoff within the catchments.

Table 20.14: Potential Construction Phase Effects			
Project Component	**Activity**	**Potential effects**	**Comments/embedded mitigation**
	Excavation of Made Ground / Worked Ground / restored soil	Excavation of Made Ground / Worked Ground / restored soil can lead to the release of contaminants which may run off and enter watercourses.	Good industry practice such as pollution prevention measures detailed in GPP1.
	Construction of turbine foundations	Increased impermeable area may lead to increased runoff and shorter rainfall-runoff response time. Impermeable underground structure that may disrupt and/or disconnect the hydraulic connectivity of the Site and the surrounding area.	The foundations of the proposed turbines may cause localised diversions in subsurface flow pathways around the foundations but will not substantially alter the overall flow direction from high to low elevations and towards watercourses. The hardstanding areas will be composed of aggregate (compacted stone) with a suitable camber) and cross-drains (as appropriate) to allow runoff, thus maintaining the hydraulic connectivity of the site.
	Placement of aggregate for hardstanding	Impermeable underground structure that may disrupt and/or disconnect the hydraulic connectivity of the Site and the surrounding area.	The hardstanding areas will be composed of aggregate (compacted stone) with a suitable camber) and cross-drains (as appropriate) to allow runoff, thus maintaining the hydraulic connectivity of the site.
	Use of machinery and use of concrete or equivalent	Pollution from spills or leakage of concrete or equivalent and fuel, and oil from use of machinery.	Good industry practice such as pollution prevention measures detailed in GPP1, GPP21 and GPP22 will reduce the risk and the overall impact if a spill or leakage were to occur.
Construction of Temporary Construction and Storage Compounds, Transformers, Electricity Sub-station and Control Building	Restored soil / coal spoil removal	Removal of restored soil / coal spoil reduces interception and therefore a more direct route to the bedrock aquifer.	The total areas of the temporary construction compounds, transformers and electricity sub-station compared to the associated catchments is small (Drawing BR10167-057). The temporary construction compounds will be restored at the end of the construction period. Therefore, any change to interception rates are unlikely to substantially alter the runoff within these catchments.
	Placement of aggregate for hardstanding	Impermeable underground structure that may disrupt and/or disconnect the hydraulic connectivity of the Site and the surrounding area.	The hardstanding areas will be composed of aggregate (compacted stone) with a suitable camber) and cross-drains (as appropriate) to allow runoff, thus maintaining the hydraulic connectivity of the site.

Table 20.14: Potential Construction Phase Effects			
Project Component	**Activity**	**Potential effects**	**Comments/embedded mitigation**
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Good industry practice such as pollution prevention measures detailed in GPP1, GPP21 and GPP22 will reduce the risk and the overall impact if a spill or leakage were to occur.
Fence Posts	Excavations	Release of sediment from excavations into the water environment.	Good industry practice such as pollution prevention measures detailed in GPP1. Sediment traps will be used, as necessary.
	Use of cement products	Pollution from spills or leakage of highly alkaline water that has come into contact with cement.	Good industry practice such as pollution prevention measures detailed in GPP1 will reduce the risk and the overall impact if a spill or leakage were to occur.
Solar Panel Installation	Excavations (piling)	Release of sediment from excavations into the water environment. This could lead to localised groundwater flooding.	Good industry practice such as pollution prevention measures detailed in GPP1. Sediment traps will be used, as necessary.
	Use of cement products	Pollution from spills or leakage of highly alkaline water that has come into contact with cement.	Good industry practice such as pollution prevention measures detailed in GPP1 will reduce the risk and the overall impact if a spill or leakage were to occur.
	Soil compaction from vehicle plant	Compaction due to use of heavy machinery reduces infiltration, increases runoff, and shortens the rainfall–runoff response and may lead to flooding.	Good industry practice such as pollution prevention measures detailed in GPP1. Use of track mats to prevent unnecessary soils compaction.
	Restored soil / coal spoil removal	Removal of restored soil reduces interception and evapotranspiration rates and increases runoff.	The total area of the solar panel area compared to the associated catchments is small (Drawing BR10167-057). Therefore, any change to interception and rates are unlikely to substantially alter the runoff within the catchments
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Good industry practice such as pollution prevention measures detailed in GPP1, GPP21 and GPP22 will reduce the risk and the overall impact if a spill or leakage were to occur.
	Installation of solar panels	Interception of rainfall by panels causing an intensification of runoff and reduces interception and evapotranspiration rates.	Good industry practice such as pollution prevention measures detailed in GPP1.

20.7.3 The construction phase assessment is detailed within Table 20.17. The potential change to the water environment is likely to be small or slight / barely distinguishable from the current baseline condition due the use of appropriate water management during construction and the implementation of such measures as pollution incident response plans and sediment runoff containment and treatment. Therefore, with appropriate mitigation in place, the magnitude of change from the baseline condition

caused by the construction operations as identified in Table 20.14 has been assessed as negligible or low.

20.7.4 As demonstrated in Table 20.17, no effect was found to be greater than minor adverse, which has no significant effect. As such, no additional receptor specific mitigation was found to be required.

Operational Phase

20.7.5 Table 20.15 details the likely significant effects that may occur as a result of the presence and operation of the Proposed Development.

Table 20.15: Potential Operational Phase Effects

Project Component	Activity	Potential effects	Comments/embedded mitigation
Site maintenance	Use of motorised vehicles/maintenance of turbines	Pollution from leaks or spills, which may cause a degradation in water quality.	Good industry practice such as pollution prevention measures detailed in GPP1, GPP21 and GPP22 and following EMS will reduce the risk and the overall impact if a spill or leakage were to occur.
Substation inverters, transformers, and impermeable surfaces	Presence of Substation and impermeable surfaces	Reduction in recharge to the underlying aquifer therefore locally reducing groundwater levels. This will also increase runoff to surface water drains/ponds and may lead to flooding.	Good industry practice such as pollution prevention measures detailed in GPP1. SuDS (conveyance and attenuation swales) in place to manage surface water.
Solar Panels	Presence of solar panels	Rainfall onto the angled panels may cause erosion beneath the lower edge of each panel, resulting in erosion and sediment laden runoff.	Appendix 20.1 presents the surface water management plan which addresses the increased run off from the solar panel surfaces.

20.7.6 There are two types of operational effects on the water environment: i) those which result from the creation of the Proposed Development; and ii) those that occur associated with the used of the Proposed Development. Table 20.15 details potential effects that may arise from the activities of the Proposed Development during operation.

20.7.7 The operational phase assessment is detailed within Table 20.17. The potential change to the water environment would be small or slight / barely distinguishable from the current baseline condition due to the implementation of a suitably designed surface water drainage scheme and controlled discharges offsite. The drainage scheme, which includes the use of SuDS, would ensure that the existing greenfield rate of surface water runoff discharged to the adjacent watercourses is maintained.

20.7.8 As demonstrated in Table 20.17, with appropriate mitigation in place, the magnitude of change from the baseline condition caused by the operational phase (identified in

Table 20.15) has been assessed as negligible or low. No effect was found to be greater than minor adverse, which has no significant effect. As such no additional receptor specific mitigation was found to be required.

Decommissioning Phase

20.7.9 Table 20.16 details potential impacts that may arise from the activities of the Proposed Development during the decommissioning phase.

Table 20.16 Potential Decommissioning Phase Effects

Project Component	Activity	Potential effects	Comments/embedded mitigation
Decommission Principal Features and Restoration	Removal of principle features e.g., all PV modules, mounting structure, cabling, inverters, and transformers.	Increased sediment mobilisation from earthworks / regrading / decompaction associated with removal of principal features. Decrease in impermeable area leading to pre-development runoff conditions and pre-development rainfall-runoff response time.	The access tracks would remain in situ for land management purposes, after the end of the operational period. As the access track would be constructed with a permeable geotextile membrane, which may need re-grading overtime. It is likely that the turbine foundations will also remain in place. Good industry practice such as pollution prevention measures detailed in GPP1. Sediment management measures such as sediment traps will be used, as necessary. No other mitigation measures identified as activity reinstates baseline characteristic, as far as practicable.
	Backfilling	Backfilling may lead to pre-development infiltration rates and to pre-development runoff conditions.	No further comments.
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Good industry practice such as pollution prevention measures detailed in GPP1, GPP21 and GPP22 will reduce the risk and the overall impact if a spill or leakage were to occur.

20.7.10 With mitigation in place, the magnitude of change from the baseline condition caused by the decommissioning operations identified in Table 20.16 has been assessed as Negligible or Low for all operations. The potential change to the water environment is likely to be barely distinguishable from the current baseline condition with the use of SuDS and the implementation of measures such as pollution incident response plans. No effect arising from the decommissioning phase was found to be greater than Minor Adverse, which is assessed as Not Significant (see Table 20.17).

Table 20.17: Assessment of Effects with Mitigation

Project Component	Activity	Potential Effect	Nature & Geographical Significance Of Effect	Receptor	Sensitivity Of Receptor	Magnitude Of Change	Scale Of Effect*	Significant Effect? **
Construction Phase								
Access Track and Underground Cabling	Use of access track	Increased sediment mobilisation and transport from road material through surface wash off.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Restored soil removal	Removal of restored soil reduces interception and therefore a more direct route to the bedrock aquifer.	Long-term, reversible, adverse and local	Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
	Placement of aggregate	Disruption to lateral flow from the placement of aggregate.	Long-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
	Use of cement bound sand	Pollution from spills or leakage of highly alkaline water that has come into contact with cement bound sand.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
Turbines and Associated Hardstanding Area	Restored soil removal	Removal of restored soil reduces interception and therefore a more direct route to the bedrock aquifer.	Long-term, reversible, adverse and local	Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
	Excavation of Made Ground / Worked Ground / restored soil	Excavation of Made Ground / Worked Ground / restored soil can lead to the release of contaminants which may run off and enter watercourses.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
	Construction of turbine foundations	Increased impermeable area may lead to increased runoff and shorter rainfall-runoff response time. Impermeable underground structure that may disrupt and/or disconnect the hydraulic connectivity of the Site and the surrounding area.	Long-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Placement of aggregate for hardstanding	Impermeable underground structure that may disrupt and/or disconnect the hydraulic connectivity of the Site and the surrounding area.	Long-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Use of machinery and use of concrete or equivalent	Pollution from spills or leakage of concrete or equivalent and fuel, and oil from use of machinery.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
Construction of Temporary Construction and Storage Compounds, Transformers, Electricity Sub-station and Control Building	Restored soil removal / coal spoil removal	Removal of restored soil reduces interception and therefore a more direct route to the bedrock aquifer.	Long-term, reversible, adverse and local	Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
	Placement of aggregate for hardstanding	Impermeable underground structure that may disrupt and/or disconnect the hydraulic connectivity of the Site and the surrounding area.	Long-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
Fence Posts	Excavations	Release of sediment from excavations into the water environment.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
	Use of cement products	Pollution from spills or leakage of highly alkaline water that has come into contact with cement.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No

Table 20.17: Assessment of Effects with Mitigation								
Project Component	**Activity**	**Potential Effect**	**Nature & Geographical Significance Of Effect**	**Receptor**	**Sensitivity Of Receptor**	**Magnitude Of Change**	**Scale Of Effect***	**Significant Effect? ** **
				Water in Till	Low	Low	Negligible	No
Solar Panel Installation	Excavations (piling)	Release of sediment from excavations into the water environment.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
	Use of cement products	Pollution from spills or leakage of highly alkaline water that has come into contact with cement.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
	Soil compaction from vehicle plant	Compaction due to use of heavy machinery reduces infiltration, increases runoff, and shortens the rainfall–runoff response and may lead to flooding.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Meduim	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Restored soil removal / coal spoil removal	Removal of restored soil reduces interception and evapotranspiration rates and increases runoff.	Long-term, reversible, adverse and local	Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
	Installation of solar panels	Interception of rainfall by panels causing an intensification of runoff and reduces interception and evapotranspiration rates.	Long-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Meduim	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
Operational Phase								
Site maintenance	Use of motorised vehicles/maintenance of turbines	Pollution from leaks or spills, which may cause a degradation in water quality.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Meduim	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
Substation inverters, transformers, and impermeable surfaces	Presence of Substation and impermeable surfaces	Reduction in recharge to the underlying aquifer therefore locally reducing groundwater levels. This will also increase runoff to surface water drains/ponds and may lead to flooding.	Long-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
Solar Panels	Presence of solar panels	Rainfall onto the angled panels may cause erosion beneath the lower edge of each panel, resulting in erosion and sediment laden runoff.	Short-term, reversible, adverse and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Meduim	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
				The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Medium	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
Decommissioning Phase								
Decommission Principal Features and Restoration	Removal of principle features e.g., all PV modules, mounting structure, cabling, inverters, and transformers.	Decrease in impermeable area leading to pre-development runoff conditions and pre-development rainfall-runoff response time.	Long-term, irreversible, neutral, and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Meduim	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Backfilling	Backfilling may lead to pre-development infiltration rates and to pre-development runoff conditions.	Long-term, irreversible, neutral, and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Negligible	Negligible	No
				Water in Coal Measures Formation Aquifer	Meduim	Negligible	Negligible	No
				Water in Till	Low	Negligible	Negligible	No
	Use of machinery	Pollution from spills or leakage of fuel and oil from use of machinery.	Short-term, reversible, adverse, and local	The Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment	Medium	Low	Minor	No
				Water in Coal Measures Formation Aquifer	Medium	Low	Minor	No
				Water in Till	Low	Low	Negligible	No
Note								

Table 20.17: Assessment of Effects with Mitigation								
Project Component	**Activity**	**Potential Effect**	**Nature & Geographical Significance Of Effect**	**Receptor**	**Sensitivity Of Receptor**	**Magnitude Of Change**	**Scale Of Effect***	**Significant Effect? ** **
* The assessment has considered the magnitude of change from the baseline with mitigation (as described in Section 20.6) in place. ** Effects that have been determined to be major or moderate are considered to have a significant effect. Effects that are identified as minor or negligible are not considered to have a significant effect. R= Reversible, Ir = Irreversible, Lt = Long Term, St = Short Term, Ad = Adverse, Be = Beneficial, Ne = Neutral, Lo = Local, Re = Regional, Na = National, D = Direct, Id = Indirect								

20.8 Residual Effects

20.8.1 As demonstrated in Table 20.17, there are no effects that are likely to give rise to significant effects. Therefore, no additional mitigation is required above those measures already considered in the assessment such as the use of SuDS and pollution prevention measures and therefore, there are no residual effects.

20.9 Assessment of Cumulative Effects

20.9.1 Cumulative impacts on the water environment may occur when two or more major developments are under construction, decommissioning or are operational within the same catchment at the same time. Potential cumulative impacts include a deterioration in water quality as a result of pollutants entering into the waterbodies during earthworks and an alteration to the hydrogeological regime from changes in the amount of permeable surface and potential increase in flood risk from inappropriate drainage design.

20.9.2 Owing to strict planning guidance and regulation over the water environment, other developments, which are within the same catchment as the Site, will have to demonstrate that appropriate drainage design and pollution prevention measures have been incorporated into each development's design and appropriate additional mitigation measures be in place during, construction, operational and decommissioning phases.

20.9.3 In Table 2.2 in Chapter 2 details 170 developments within 25 km of the Site for consideration in the cumulative assessment; of those 170 developments, 103 are in their operational phase. This means that there will be no overlap in the construction phases and it is unlikely that there will be overlapping decommission phases between the Proposed Development and these operational developments. Out of the remaining 67 developments, some are located within the same surface water and / or groundwater catchments as the Site, however, none are located within 2 km of the Site. Given the separation distance between these other developments and the Proposed Developments, it is unlikely that cumulative effects will occur in common local water receptors. See Chapter 2 for further details on the cumulative developments.

20.9.4 In terms of the water environment, the greatest risk to water receptors generally occurs during the construction and decommissioning phases. As stated, it has been assumed that the other developments have been designed and implemented with

mitigation measures such as the use of a SuDS, which would mitigate operational phase effects from the scheme. Therefore, the operational phase cumulative effects of the Proposed Development and the other scheme would be negligible on the sensitive receptors, and therefore not significant.

20.9.5 None of the other development in Table 2.2 of Chapter 2 have been identified to have potential for cumulative effects with the Proposed Development. There is only likely to be cumulative effects with future developments if they are in the same surface water and groundwater catchment as the Proposed Development, as well as being in close proximity to the Site and have the have overlapping contraction / decommissioning phases.

20.9.6 It is expected that any additional surface water runoff resulting from increased impermeable surfaces associated with the above developments will be attenuated to greenfield runoff rates, reducing any potential cumulative impact relating to flood risk. SuDS will provide a measure of water quality benefit, and it would be expected that construction and decommissioning will be undertaken in line with industry best practice, and implementation of a CEMP / DEMP where appropriate. In addition, pollution prevention measures in a CEMP / DEMP (or equivalent) including emergency response plans are likely to be implemented during the construction / decommissioning of the other scheme. Therefore, the potential cumulative effects arising from other developments within the same catchment as the Site with the Proposed Development are considered to be negligible, which is not considered to be significant.

20.10 Conclusion

20.10.1 The Site lies within the Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body Catchment and the South East Valleys Carboniferous Coal Measures Groundwater Catchment. Key sensitive receptors include the Rhymney River – Source to Confluence Nant Bargod Rhymni Water Body catchment and shallow groundwater at the Site.

20.10.2 Mitigation measures, such as, CEMP / DEMP and a surface water management plan (including SuDS), have been incorporated into the design of the Proposed Development. The assessment has assumed the implementation of good industry guidance and best practice measures, such as pollution prevention plan and sediment management measures, would avoid the likelihood of potentially significant effects occurring.

20.10.3 Potential effects on the water environment are those which may change the hydrological and hydrogeological flow regime, and those which may cause pollution and a degradation in water quality. The assessment found that, with appropriate mitigation in place, the scale of potential effects was no greater than minor adverse. As such, effects on the water environment would be not significant.

20.10.4 The cumulative effect assessment identified that as other developments will need to comply with the strict planning guidance and regulation relating to the water environment to be acceptable in planning and permitting terms, the potential cumulative effects arising from the Proposed Development and other cumulative scheme are considered to be negligible, which is not significant.