

Wylfa Newydd Project

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8 Surface water and groundwater

8.1 Introduction

- 8.1.1 This chapter describes the assessment of potential surface water and groundwater effects resulting from the construction, operation and decommissioning of the Park and Ride at Dalar Hir.
- 8.1.2 Please refer to chapter B8 (surface water and groundwater) (Application Reference Number: 6.2.8) for the technical basis for the assessment including a summary of legislation, policy and guidance; key points arising in consultation that have guided the surface water and groundwater assessment; and assessment methodologies and criteria.
- 8.1.3 This chapter includes a Flood Consequence Assessment as appendix F8-1 (Dalar Hir – Flood Consequence Assessment, Application Reference Number: 6.6.16) with pertinent information from that appendix included in the main text below. Only limited information is included in this chapter regarding Water Framework Directive (WFD) water bodies as these are discussed in the Water Framework Directive Compliance Assessment (Application Reference Number: 8.26). Assessment of effects on WFD water bodies is included in that document which forms part of the Environmental Statement.

8.2 Study area

- 8.2.1 This section describes the study area relevant to the surface water, fluvial geomorphology and groundwater assessment for the proposed Park and Ride.

Surface water

- 8.2.2 The study area for surface water focuses on the area that could be physically affected by the proposed Park and Ride. In general, the study area extends 500m in all directions from the proposed Park and Ride site (figure F8-1, Application Reference Number: 6.6.38). There is one exception, where it is extended 900m downstream, as the Nant Dalar Hir enters Llyn Traffwll; a 44.8ha lake designated as a Site of Special Scientific Interest (SSSI). The 500m study area is based on professional judgement, the use of which is outlined in section 8.4 of chapter B8 (Application Reference Number: 6.2.8) and allows the inclusion of all surrounding water features and off-site receptors that may be affected by the development.
- 8.2.3 The assessment of flood risk takes a catchment approach. The surface water study area with respect to flood risk is therefore based on the stream catchments in and around the proposed Park and Ride. In both an upstream and a downstream direction flood risk is considered for as far as any identified flood risk extends (see appendix F8-1, Application Reference Number: 6.6.16).

Fluvial geomorphology

8.2.4 The fluvial geomorphology study area is based upon the indicative land surface and watercourses that could potentially be affected by the proposed Park and Ride. The study area covers the development site and in general, extends 250m in all directions from the proposed Park and Ride. The study area is extended to a distance of 1km upstream and downstream of a watercourse where there is a proposed crossing or modification. This is based on professional judgement, the use of which is outlined in section 8.4 of chapter B8 (Application Reference Number: 6.2.8) to capture any potential changes to fluvial geomorphology within the channel caused by disturbances from the Park and Ride, including potential effects on flow and sediment processes.

Groundwater

8.2.5 The study area for the groundwater assessment includes all groundwater-associated receptors that could be physically affected by the proposed Park and Ride. The groundwater study area covers the proposed Park and Ride and the surrounding area to a distance of 1km around the site in all directions (figure F8-1, Application Reference Number: 6.6.38). The size of the study area is based on professional judgement regarding the maximum potential extent of effects likely in the type of aquifer present and given the nature and scale of the development.

8.2.6 Vertically, the groundwater assessment has considered the possible effects on the groundwater environment in the underlying bedrock aquifer, which is considered as a groundwater receptor at the Park and Ride.

8.3 Baseline environment

8.3.1 This section provides a summary of the baseline conditions for surface water and groundwater within the study areas described in section 8.2.

8.3.2 The values ascribed to the receptors in the following section are detailed in table B8-11 of chapter B8 (Application Reference Number: 6.2.8).

Surface water

Catchment and water features

8.3.3 The main watercourse within the site is an unnamed ordinary watercourse that is hereafter referred to as the Nant Dalar Hir. The watercourse flows across the site from the north-eastern corner in a south-westerly direction prior to being culverted beneath both Holyhead Road and the A55. The Nant Dalar Hir is assessed as having a medium value as a surface water receptor as it is an important watercourse in the context of this area as it flows into the Llyn Traffwll SSSI.

8.3.4 The site is crossed by a series of man-made ditches and wetted field boundaries which generally discharge in a southerly direction. A small, ephemeral and poorly defined drain flows south of the site boundary from west to east, where there are also a number of ponds. These are situated to the

south of Holyhead Road and the A55, and are thought to be associated with the existing road drainage network. The ditches within the proposed Park and Ride site, the surface water drain and the ponds are classified as having a low value for surface water. This is based on the low environmental importance of these features, the modification involved with their development, and the limited flows and volumes stored or conveyed.

8.3.5 Downstream of the site, located approximately 900m south, is a moderately base-rich lake designated as part of the Llyn Traffwll SSSI. The lake is designated as a SSSI due to the range of aquatic plants and wintering wildfowl [RD1]. Nant Dalar Hir flows into the lake. The lake has been classified as having a high value for surface water as it would be particularly sensitive to any change in the chemical composition of the Nant Dalar Hir.

8.3.6 There are also a series of smaller lakes (including Llyn Dinam and Llyn Penrhyn), designated as the Llynnaau y Fali SSSI, located over 1.2km southwest of the proposed Park and Ride site. There are no surface water routes into these lakes from the proposed Park and Ride; therefore, they have been scoped out of further assessment for surface water.

Flood risk

8.3.7 The Flood Consequence Assessment (FCA) (appendix F8-1, Application Reference Number: 6.6.16) identifies that the proposed Park and Ride site is within Flood Zone A [RD2] (see figure F8-01.02 in appendix F8-1, Application Reference Number: 6.6.16), which according to Technical Advice Note 15 (TAN 15) [RD3] means that there is considered to be little to no risk of fluvial or tidal flooding to the site. However, the size of Nant Dalar Hir and its catchment means that it will not have been included in the modelling used to produce TAN 15's Development Advice Maps [RD2]. Therefore, site-specific modelling was carried out to assess the fluvial flood risk.

8.3.8 The site-specific modelling provided in appendix F8-1 (Application Reference Number: 6.6.16) showed that there is a high risk of fluvial flooding associated with the Nant Dalar Hir, which is influenced by the culvert under the A55 which acts as a point of constriction thereby limiting flows. This risk area spans approximately 250m across the southern edge of the Park and Ride and through the centre of the proposed site, although the risk lessens towards the northern edge.

8.3.9 Modelling for the pluvial flood risk (appendix F8-1, Application Reference Number: 6.6.16) has shown that there are four high-risk areas within the proposed Park and Ride site. These are as follows:

- the eastern edge of the proposed Park and Ride, along the Nant Dalar Hir;
- the southern edge of the proposed Park and Ride, where flows pond along both Holyhead Road and the A55 as the Nant Dalar Hir enters culverts under these roads;
- the centre of the proposed Park and Ride from north to south; and
- the north-western corner.

- 8.3.10 There are also numerous other small areas of risk associated with the flow paths and drains across the site.
- 8.3.11 Groundwater flood risk at the proposed Park and Ride is considered to be low. This is based on the presence of low permeability soils and glacial till at the site, which results in the majority of rainfall forming surface water runoff, rather than recharging the groundwater body and having the potential to cause groundwater flooding.
- 8.3.12 The flood risk to the Park and Ride from all sources of flooding is detailed in the FCA included in appendix F8-1 (Application Reference Number: 6.6.16). This also includes details of the flood modelling undertaken.
- 8.3.13 Within the study area there are also a number of off-site receptors that could be at risk of flooding. The proposed Park and Ride site is located immediately to the north of the A55 and A5 roads. The topography of the area is such that water drains across the proposed Park and Ride site towards the roads. The roads are slightly raised above the natural ground level. The roads are considered to be high value receptors, in accordance with the methodology in the FCA.
- 8.3.14 Approximately 50m to the east of the proposed Park and Ride (250m east of the Nant Dalar Hir) is Cartio Môn go-karting centre. According to Natural Resources Wales (NRW) surface water mapping [RD4] there is no direct risk of pluvial flooding to this site (see figure F8-01.03 in appendix F8-1, Application Reference Number: 6.6.16), although there is a localised risk between the go-karting track and Holyhead Road. However, due to the local topography (see figure F8-01.01 in appendix F8-1, Application Reference Number: 6.6.16), any surface flows from the Park and Ride site are unlikely to reach Cartio Môn go-karting centre. Cartio Môn go-karting centre is considered to be a medium value receptor, in accordance with table B8-11 in chapter B8 (Application Reference Number: 6.2.8).
- 8.3.15 Caer Elen Farm is located approximately 600m downstream of the proposed Park and Ride, next to Nant Dalar Hir. The NRW surface water flood mapping [RD4] indicates that surface water affects some of the farm buildings by less than 1m (appendix F8-1, Application Reference Number: 6.6.16). The site specific modelling (appendix F8-1, Application Reference Number: 6.6.16) shows no significant pluvial or fluvial risk and the risk of surface water flooding to this receptor is considered to be low. The farm is considered to be a high value receptor in accordance with TAN 15 which classes all off-site developments as highly sensitive. An increase in flood risk here may impact the access road and the farmhouse at Caer Elen Farm. A detailed assessment of the flood risk is contained in appendix F8-1 (Application Reference Number: 6.6.16).

Surface water quality

- 8.3.16 The water features within the study area are not designated as standalone WFD water bodies and therefore specific water quality details are unknown. The proposed Park and Ride site does lie within the Crigyll WFD water body catchment (table F8-2) which is currently classed by NRW as having a Good

chemical status, a Moderate ecological status and a Moderate overall status [RD5].

8.3.17 NRW has recorded that pollutants from agricultural runoff are a problem for this catchment.

Surface water abstractions and discharges

8.3.18 Surface water from watercourses can be abstracted for a variety of uses, including as a potable supply, for use in agriculture (for watering crops or as a water supply for animals) or for industrial uses. Anglesey has, until January 2018, been a licence-exempt area and so, at the time of writing, NRW does not hold any records of abstractions from surface water.

8.3.19 The development site sits on the boundary of the Crigyll catchment abstraction management area, which is considered to have water available for abstraction according to the Ynys Môn Management Catchment Summary [RD5]. The downstream lake in the Llyn Traffwll SSSI has been used as a water supply in the past but there are currently no known major abstractions or discharges within the study area. However, there could be abstractions of which there are no records. If there are abstractions, they are most likely to be small informal abstractions for agricultural use, such as irrigation, or for livestock watering in areas used for grazing.

8.3.20 There are no known industrial water discharges within the study area, but there could be agricultural water discharges of which there are no formal records.

Fluvial geomorphology

8.3.21 The Nant Dalar Hir is a watercourse with an artificially modified cross-section measuring between approximately 1m and 1.5m wide and between 0.5m and 0.8m deep. The channel has a diverse and densely vegetated riparian zone along the right bank (looking downstream), with intensive agricultural land use to the edge of both banks. The channel exhibits signs of lateral adjustment and comprises a gravel substrate, which has allowed a pool and riffle sequence to develop, and has a natural range of geomorphological features (including deposits) visible within the channel. Nant Dalar Hir is therefore considered to be of medium value for fluvial geomorphology (see table B8-11 in chapter B8 (Application Reference Number: 6.2.8) for criteria used to establish the value of a receptor).

8.3.22 There are a number of smaller channels and drainage ditches present within the study area which are typically man-made with uniform, trapezoidal cross-sections. These have either been modified or are artificial extensions to the drainage network and are therefore considered to have a low value for fluvial geomorphology.

Groundwater

Soils, geology and aquifer characteristics

8.3.23 A detailed description of the soils, geology and made ground is included in chapter F7 (soils and geology) (Application Reference Number: 6.6.7), with figures F7-2 to F7-3 (Application Reference Number: 6.6.38) respectively showing the extent of the superficial and bedrock deposits at the proposed Park and Ride, as indicated by the British Geological Survey 1:50,000 scale geological maps. Only elements pertinent to the groundwater assessment are included below.

8.3.24 The soils within the Park and Ride groundwater study area are defined by the Cranfield Soil and Water Institute as 'slowly permeable seasonally wet acid loamy and clayey soils' [RD6]. The infiltration potential at the site is, therefore, likely to be limited and areas underlain by these soils are typically prone to surface water ponding, high rates of surface water runoff generation and low groundwater recharge rates.

8.3.25 With the exception of a small area in the south of the site, immediately north of Holyhead Road, superficial deposits at the proposed Park and Ride predominantly comprise glacial till. Engineering logs from two trial pits excavated along the A55, record the presence of glacial till to a thickness of more than 4m adjacent to the two small ponds to the south of the A5 and 1.5m immediately east of the Nant Dalar Hir culvert beneath the A55. In both of these locations, the till comprises stiff brownish-grey silty clay.

8.3.26 Where dominated by a clay matrix, the till will generally have a low permeability and limited significance for groundwater supply or river base flow. Recharge through till is likely to be very low, with rates estimated by the British Geological Survey [RD7] in other parts of the UK (two locations in Shropshire, with lodgement till considered to be broadly representative of the glacial lithology in the UK), as typically being around 20% of the total annual effective rainfall.

8.3.27 Although the glacial till is unlikely to have significant groundwater flow through it due to its clay matrix, it is categorised as a Secondary (undifferentiated) aquifer by NRW. It is therefore included within this assessment, albeit with a low value.

8.3.28 The bedrock underlying the majority of the site comprises mica schist and psammite, belonging to the New Harbour Group rock formation. Two igneous intrusions cut into the New Harbour Group in the centre of the proposed Park and Ride and trend north-east to south-west. The eastern portion of the site, to the east of the Nant Dalar Hir, is underlain by interbedded sandstone and conglomerate.

8.3.29 The New Harbour Group bedrock is defined by NRW as a Secondary B aquifer, that has predominantly lower permeability layers of rock which may store and yield limited amounts of groundwater. The presence of igneous intrusions may act as impermeable barriers limiting lateral groundwater movement through the aquifer, although the role of the intrusions is not known.

Groundwater quality

- 8.3.30 NRW does not have any groundwater monitoring boreholes in the area, and as a result, no groundwater sampling for chemical analysis has been undertaken. The proposed Park and Ride site does however lie within the Ynys Môn Secondary WFD groundwater body and the baseline assessment is therefore informed by the general aquifer quality designation information provided by NRW.
- 8.3.31 According to NRW [RD5], the Ynys Môn Secondary WFD groundwater body as a whole is currently achieving 'Poor' quality status. The quality status is likely to be spatially very variable across the water body and the areas of poor quality could be due to localised pollution associated with historical mining activities at Parys Mountain, which lies 17km north-east of the proposed Park and Ride.
- 8.3.32 The combination of low permeability soils and clay dominated superficial deposits at the proposed Park and Ride affords the bedrock aquifer some protection from any above-ground contaminant sources, although this also depends on the depth of the water table. Based on the predominantly agricultural land use (livestock grazing) in the area, the distance of the development site from the contaminant sources at Parys Mountain (17km north-east), and the general westerly/north-westerly flow direction of bedrock groundwater in the Parys Mountain area, the groundwater quality at the proposed Park and Ride is likely to be better than that stated for the whole WFD water body.

Groundwater flow and levels

- 8.3.33 Given the absence of groundwater-monitoring boreholes in the area, there is no groundwater level or flow data available for this assessment. Based on the soils and geology information, most incident rainfall would runoff or become shallow through flow to local streams and ditches.
- 8.3.34 The site walkover carried out by Jacobs in January 2016 found the watercourse which feeds into the Nant Dalar Hir to be dry and unlikely to be sustained by baseflow from springs or seeps.
- 8.3.35 The general groundwater flow direction in the bedrock, at the regional scale, is likely to be west towards the coast. Given the presence of impermeable soils and glacial till, limiting recharge into the bedrock aquifer, groundwater from bedrock is unlikely to support streams and drains on-site.

Groundwater abstractions

- 8.3.36 The proposed Park and Ride lies in an area that until January 2018 was exempt from groundwater abstraction licensing, and NRW does not (at the time of writing) therefore hold any records of groundwater abstractions in the area. The Isle of Anglesey County Council (IACC) does hold details of Private Water Supplies (PWSs) and public wells for its administrative boundary. However, current regulations do not require the local authority to monitor PWSs to an individual dwelling and hence this list, although useful, may be incomplete.

8.3.37 The data provided by the IACC indicate that there are no known public wells within 1km of the proposed Park and Ride, but there are two known PWSs within this area. The closest is a PWS located approximately 750m south of the site at Alltwen-wen, although the IACC records show that this is no longer in use and therefore it is not considered further in this assessment.

8.3.38 The closest active abstraction is a commercial PWS that lies 830m north-west of the site at Bodowyr, see table F8-1 and figure F8-1, (Application Reference Number: 6.6.38) at a commercial caravan site and hotel. Abstractions such as this from Secondary B aquifers are always small as, due to the inherent nature of the aquifers, they cannot support large abstractions. The typical recharge area/zone of influence for a small abstraction in a Secondary B aquifer could be up to the order of several hundred metres. Given its distance from the site, this abstraction is unlikely to be affected by the Park and Ride. In line with the assessment criteria in table B8-11 of chapter B8 (Application Reference Number: 6.2.8) of this Environmental Statement, the value of this receptor is assessed as medium for the groundwater assessment.

Table F8-1 PWSs within 1km radius of the Park and Ride

Address	Usage	Easting	Northing	Distance from site	Direction from site
Bodowyr, Cefn Rhosydd, Bodedern, Holyhead, LL65 3SS	Large Commercial (caravan site)	232139	379375	830m	North- west

8.3.39 Ordnance Survey mapping shows the presence of two wells within the immediate vicinity of the proposed Park and Ride: one located within the Park and Ride boundary, immediately south of the Dalar Hir farmhouse; and another which is located 150m north of the northern border of the proposed Park and Ride (figure F8-1, Application Reference Number: 6.6.38). These are not recorded by the IACC so they are unlikely (though this is not certain) to be currently used for potable purposes, although they could be used for agricultural purposes, or they could be redundant wells. Given the location of these wells on or close to the proposed Park and Ride site, they are scoped in for further assessment. In line with the assessment criteria in table B8-11 of chapter B8 (Application Reference Number: 6.2.8) of this Environmental Statement, the value of these wells is assessed as low for the groundwater assessment.

8.3.40 There is also the potential for small unlicensed abstractions to be present within 1km of the site that are not recorded in the list provided by the IACC, but as there are only a small number of farms in the immediate vicinity of the proposed Park and Ride there is limited potential for this.

8.3.41 In Wales, all WFD designated groundwater bodies, including the Ynys Môn Secondary groundwater body, are designated as Groundwater Drinking Water Protected Areas. Under the WFD, these areas have to be protected with the aim of avoiding deterioration in their quality which would compromise a relevant abstraction of groundwater intended for human consumption.

Groundwater dependent terrestrial ecosystems

8.3.42 The Llyn Traffwll SSSI and Llynnau y Fali SSSI lie 900m south and 1.2km south-west of the proposed Park and Ride site, respectively. Neither of the SSSI citations refers to any significant groundwater dependence and the percentage of groundwater to total water inflows is likely to be negligible. In addition to this, in the absence of any significant ground dewatering activities proposed, there is no potential for significant effects on the two lakes from the proposed works, and both SSSIs have been scoped out of the groundwater assessment.

Water Framework Directive

8.3.43 The Nant Dalar Hir and the drains within the Park and Ride study area form part of the Crigyll WFD (fluvial) water body catchment, currently classified by NRW [RD5] as achieving Moderate overall status. As all tributaries are considered to form part of the overall WFD water body catchment, the Park and Ride would need to comply with the WFD.

8.3.44 The bedrock aquifer underlying the proposed Park and Ride forms part of the Ynys Môn Secondary WFD groundwater body which covers much of Anglesey. The aquifer was designated in 2015 as being of 'Good' quantitative status, with no significant pressures on groundwater resources and with sufficient water to support stream flows and groundwater inputs to terrestrial ecosystems.

8.3.45 Table F8-2 provides a summary of the WFD quality elements and status as per the Western Wales River Basin Management Plan [RD8]. A detailed WFD assessment is provided as part of the development consent (Application Reference Number: 8.26).

Table F8-2 WFD waterbody status

Name	Details	
Crigyll	ID	GB110102058970
	Type	Fluvial
	Length	14.8km
	Heavily modified	Not designated
	Overall status	Moderate
	Chemical status	Good
	Ecological status	Moderate
Ynys Môn Secondary	WFD ID	GB41002G204400
	Type	Groundwater
	Area	623km ²
	Overall status	Poor
	Quantitative status	Good
	Chemical status	Poor

Summary of receptors

8.3.46 Surface water and groundwater receptors that have been identified and which may potentially be impacted by the Park and Ride are listed in table F8-3 along with the value of each. The value is used later in this chapter as part of the assessment of effects. The receptors within the study areas that have been scoped out of this assessment are summarised below:

- drains to the south of the A5, despite being downstream of the proposed Park and Ride, are hydraulically isolated from the site by the main drain culverted beneath the A5;
- Llynau y Fali SSSI as there are no hydrological connections from the proposed Park and Ride;
- groundwater in the superficial deposits, based on the presence of clay dominated glacial till and impermeable clay soils at the Park and Ride;
- the PWS located 750m south of the proposed Park and Ride, based on the IACC records showing that this is no longer in use; and
- the well within the proposed Park and Ride as this is not used.

Table F8-3 Summary of water environment receptors and values

Category	Key receptors	Value ¹
Surface water	Nant Dalar Hir: watercourse that flows across the Park and Ride and is culverted underneath the A5 and the A55. This is an important watercourse as it flows into Llyn Traffwll SSSI.	Medium
	On-site drains and ditches: numerous present across the Park and Ride. Some of these are dry and many are man-made.	Low
	Llyn Traffwll SSSI: SSSI downstream of Nant Dalar Hir.	High
	Park and Ride development: on-site flood risk.	High
	A55 and A5: off-site flood risk.	High
	Cartio Môn go-karting centre: off-site flood risk.	Medium
Fluvial geomorphology	Caer Elen Farm downstream: off-site flood risk.	High
	Nant Dalar Hir: a watercourse with artificially modified banks, a pool-riffle sequence and gravel substrate. Nant Dalar Hir and the drains within the Dalar Hir site form part of the Crigyll WFD (fluvial) water body catchment, currently classified by NRW as achieving Moderate status.	Medium
Groundwater	Other watercourses (including drains): typically man-made extensions to the drainage network with a limited range of morphological features.	Low
	Secondary (undifferentiated) aquifer (glacial till) and Secondary B Bedrock Aquifer. The aquifers are low productivity and form part of the Ynys Môn Secondary WFD groundwater body, which is currently achieving Poor status.	Low
	Well: shown on Ordnance Survey maps to north of the Park and Ride.	Low

Note 1: basis of value is defined in table B8-11 in chapter B8 (Application Reference Number: 6.2.8).

Evolution of the baseline

- 8.3.47 Nant Dalar Hir is currently exhibiting evidence of channel adjustment. This channel has been assessed as having a low to moderate energy, with limited potential to actively move the course of the planform. It is anticipated that if left undisturbed, the watercourse would continue to adjust slowly laterally and potentially through incision within the defined wider corridor.
- 8.3.48 The remaining channels within the study area exhibited less evidence of adjustment, with lower energies (arising from a combination of low slope/discharge). These were observed to be typically artificial field drains and artificial extensions to the drainage network. These could potentially continue receiving fine sediment, which would become deposited and in the absence of maintenance to remove accumulated deposits remain on the channel bed.
- 8.3.49 The Western Wales River Basin Management Plan provides details of the anticipated ecological status for the Crigyll WFD water body within the study area for years 2021 and subsequently 2027. As mitigation detailed in the Western Wales River Basin Management Plan is put in place, it is anticipated that the WFD water body status would improve from Moderate to Good.
- 8.3.50 Over a medium to long-term time period, climate change could potentially alter the hydrological regime of the watercourses. Increased frequency/severity of droughts and floods could potentially lead to the watercourses adjusting to different patterns of erosion and deposition. However, it is likely that the adjustment would remain localised and of relatively low magnitude given the channel types.
- 8.3.51 It is not anticipated that there would be any significant changes to the groundwater regime, unless there are any new abstractions in the area; this is currently considered to be unlikely. In the foreseeable future, climate change is unlikely to result in any significant effects to groundwater levels and flows given the limited recharge rates into the bedrock aquifer.

8.4 Design basis and activities

- 8.4.1 This section sets out the design basis for this assessment of effects. It sets out where any assumptions have been made to enable the assessment to be carried out at this stage in the evolution of the design. This section also identifies the embedded and good practice mitigation that will be adopted to reduce adverse effects as inherent design features or by implementation of standard industry good working practice.
- 8.4.2 As noted in section 1.4 of chapter F1 (proposed development) (Application Reference Number: 6.6.1), the approach adopted for the design of the Park and Ride has been to utilise a parameter based approach to the development. Parameters have been set for the ten parameter zones (Zones 6-1 to 6-10) comprising car spaces, bus spaces, bus facilities, a staff car park, a cycle store and a new roundabout. The location and extent of these zones is shown in figure F1-6 (Application Reference Number: 6.6.38), with details of the relevant maximum parameters in table F1-1 of chapter F1 (Application Reference Number: 6.6.1).

8.4.3 The parameters listed in chapter F1 (Application Reference Number: 6.6.1) only allow the size of the hardstanding and buildings to be changed. However, a reduction in the size of a parking area in one part of the Park and Ride site is likely to be offset by an increase in the size of a parking area in another part of the Park and Ride site (in order to meet the total number of spaces required). The total area of impermeable ground (hardstanding and buildings) would not significantly change and there would be no substantial change to the rainfall/runoff relationship or groundwater recharge. If there were to be a change in the impermeable area it would be a reduction rather than an increase. Basing the assessment of effects on these defined parameters, in combination with the assumptions outlined below, is therefore a worst case assessment.

Construction

Basis of assessment and assumptions

8.4.4 The construction programme is anticipated to last for 18 months. There are a number of construction activities required for the Park and Ride which could have potential impacts on surface water and groundwater. The activities that would take place on the Park and Ride site are as follows.

- Site clearance, including demolition of agricultural buildings and vegetation clearance.
- Locating and establishing site compound, perimeter fencing, welfare facilities and storage of fuel and oil for plant and equipment.
- Earthworks would be undertaken which involve:
 - Topsoil strip of all areas outside buffer zones. This topsoil would be re-used on-site or removed from site, with no long-term topsoil storage on-site.
 - Excavation for foundations for new building (minimum 900mm below ground level) and below-ground storm water attenuation tank.
 - Landscaping activities that may include locating landscaping bunds to control surface water movement during flood events.
- Car park areas would be permeable comprising a thick layer of aggregate on top of a drainage layer which would be built from topsoil strip depth upwards. The aggregate would provide storm water attenuation.
- The construction of site drainage channels, outfalls, culverts and the storm water attenuation tank.
- Construction of a clear span bridge across Nant Dalar Hir.
- Surface water discharges into Nant Dalar Hir, including discharge from the package sewage treatment plant and any drainage required during construction. Such drainage may require an appropriate permit or consent from the regulators (the IACC in the case of an Ordinary Watercourse).

8.4.5 Groundwater levels could be high in some parts of the proposed Park and Ride site, particularly in winter, but we do not have any on-site ground investigation data to support this. However, as no deep foundations are proposed, nor any deep excavations, any dewatering required for construction would be short-term and would likely be limited to wetter periods as rainwater influx to excavations for foundations is likely to be more significant than groundwater influx. It has therefore been assumed that there would not be a requirement for dewatering as part of any construction activity. If there is a requirement, it would be small-scale, localised and short-term and would not affect any receptors and so has been scoped out of the assessment.

Embedded mitigation

8.4.6 All active watercourses identified on-site would be retained.

8.4.7 The access road to each car park area would require new crossings over man-made ditches and wetted field boundaries that are present on site. The development layout has been designed to keep the number of watercourse crossings on the access road to each car park to a minimum by optimising the size of each car park to the number of access points. In addition, the size, shape and orientation of each parking area has been designed to avoid unnecessary watercourse crossings. This helps to reduce the effects on surface water. There is only one crossing of the Nant Dalar Hir and that bridge will be clear span (single span) and will be sited with a soffit level to be above the 1% Annual Exceedance Probability (1 in 100 year storm event) plus climate change flood level.

8.4.8 The following buffer strips have been embedded into the design (chapter F1, Park and Ride - Proposed development (Application Reference Number: 6.6.1)):

- 15m buffer either side of the Nant Dalar Hir; and
- 10m buffer either side of drainage ditches.

8.4.9 No development would occur within the buffers aside from where structures are required, such as culverts, outfalls and the proposed clear span bridge over the Nant Dalar Hir. The vegetated buffers would reduce the potential for fine sediment and pollutants to enter the watercourses and mitigate effects on water quality and fluvial geomorphology on-site and downstream.

Good practice mitigation

8.4.10 Good practice mitigation would comprise the adherence to all relevant legislation, statutory and non-statutory guidance as detailed in section 8.2 of chapter B8 (Application Reference Number: 6.2.8) and as stated in the Wylfa Newydd Code of Construction Practice (CoCP) (Application Reference Number: 8.6).

8.4.11 The Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10) set out the overarching pollution management principles to be applied across the Park and Ride site through the construction period. The Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference

Number: 8.10) detail good practice procedures that the Contractor would be required to follow. The implementation of this mitigation would be the responsibility of the Contractor, with no work being commenced before all contractors are familiar with the CoCPs. This would include management of materials; management of drainage and sediment; and emergency response procedures. The processes for checking and reporting compliance would be detailed, as would the process for changes if significant pollution of the water environment were to be identified. Specific good practice, as outlined in the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10), would include the following.

- A risk assessment will be undertaken for use of any cementitious materials within 50m of any active watercourse. Appropriate controls, proportionate to the level of risk identified, will be applied to the works.
- All refuelling, oiling and greasing will take place above drip trays or on impermeable surfaces (e.g. plant nappy) with sealed drainage and an oil interceptor, which provides protection to underground strata and watercourses, and away from drains as far as is reasonably practicable. Vehicles and plant would not be left unattended during refuelling. Appropriate spill kits will be easily accessible during these activities. Only construction equipment and vehicles free of oil/fuel leaks which could cause material contamination will be permitted on-site. Drip trays will be placed below static mechanical plant.
- Measures would be taken to prevent the deposition of silt or other material arising from work operations in existing watercourses or catchment areas. The measures will accord with the principles set out in industry guidelines, including NRW's *Works and maintenance in or near or water: GPP 5* [RD9]. Measures include use and maintenance of temporary lagoons, tanks, bunds, silt fences or silt screens, as well as consideration of the type of plant used and the time of year for working in watercourses.

8.4.12 As stated in the Wylfa Newydd CoCP (Application Reference Number: 8.6), any temporary storage of over 200 litres of oil in drums and mobile bowsers, as well as ancillary pipe work, valves, filters, sight gauges and equipment require secondary containment, e.g. bunding or drip trays, will need to comply with the Water Resources (Control of Pollution) (Oil Storage) (Wales) Regulations 2016. Emergency response procedures would be developed to deal with any spills or leaks of fuels or oils.

8.4.13 Good practice mitigation during construction would include following guidance on pollution control and relevant Construction Industry Research and Information Association (CIRIA) guidance on good construction practice, such as *Control of Water Pollution from Construction Sites* [RD10], as stated in the Wylfa Newydd CoCP (Application Reference Number: 8.6).

8.4.14 As stated in the Wylfa Newydd CoCP (Application Reference Number: 8.6) in order to reduce the potential effect of culverts and outfalls, the structures would be designed following industry guidelines including CIRIA, particularly C689, *Culvert Design and Operating Guide* [RD11].

Operation

8.4.15 A summary is given below of the activities and design basis associated with the operation of the Park and Ride.

Basis of assessment and assumptions

8.4.16 The operational activities relate to the daily use of the Park and Ride. These include private cars parked on-site, staff using the Park and Ride building, staff being picked up from the bus parking area and the bus movements to and from the Park and Ride. The Park and Ride would be operational for approximately six years. During the operational period rainfall runoff would be collected and discharged to the surrounding watercourses via outfalls and there would be a permanent crossing over the Nant Dalar Hir.

8.4.17 The nearest village (Llanfihangel-yn-Nhywyn) lies 1km south-west of the Park and Ride and is likely to be the closest public sewer system. As there is no foul sewer within close proximity of the Park and Ride, foul water from the building facilities would be treated via a package treatment plant before discharging to the Nant Dalar Hir. Discharge from the treatment plant would be subject to an Environmental Permit with conditions bespoke for the Nant Dalar Hir and downstream receptors, including Llyn Traffwll.

Embedded mitigation

8.4.18 A potential increase in flood risk from storm water runoff has been mitigated by the drainage design developed for the Park and Ride site which includes the measures outlined below.

- Permeable paving across the car parking areas, reducing the increase in impermeable area.
- Underground storm water attenuation/storage, sized to contain a 1% Annual Exceedance Probability (1 in 100 year) storm event, with a 20% allowance for climate change.
- The majority of car parking would be on permeable paving with a granular sub-base which would form a below-ground storm water attenuation/storage facility.

8.4.19 To protect surface water and groundwater quality the drainage design for the access road, bus parking and pickup area would incorporate oil separators on drainage from the impermeable areas. The oil separators would be located on the inflow to the attenuation tank.

8.4.20 To protect surface water and groundwater quality, the aggregate laid down for car parking would be underlain by an impermeable membrane that would route drainage to oil separators prior to discharge to surface water. In order to manage runoff throughout the lifetime of the Park and Ride, the drainage system would be implemented from as early as practicable in construction. This would limit the effect of water, sediment and pollutants throughout the construction phase as well as the operation and decommissioning phases.

Good practice mitigation

8.4.21 The Park and Ride sub-CoCP (Application Reference Number: 8.10) details mitigation that would apply during operation of the Park and Ride facility. This is outlined below and has been used in this chapter to assess the potential effects of the Park and Ride on the water environment.

- Surface water drainage from all car parking areas where there is a potential for leaks of fuels, oils or other liquids would incorporate attenuation and appropriate pollution treatment.
- The on-site sewage treatment plant would be designed to treat water to appropriate standards as set out in the consenting conditions of the Environmental Permit, and would be fitted with monitoring and controls to check discharge quality, and if necessary prevent discharge of water that does not meet the limits of the Environmental Permit.
- There would be no bulk fuel storage or refuelling on-site.
- Regular inspection, maintenance and management of the oil interceptors and the drainage system would take place. In particular, this would focus on removing any silt or other debris build-up in the drainage and interceptors to ensure that they function as designed.
- There would be regular inspection of the parking area for fuel and oils. This would include a visual inspection across all parking areas to look for any oil sheen or staining that could indicate contamination that would require mitigation.
- Spill response and clean-up procedures would be implemented to prevent pollution of watercourses. These would follow guidance provided by NRW in GPP 21 [RD12].

Decommissioning

8.4.22 A summary is given below of the activities and design basis associated with the decommissioning of the Park and Ride.

Basis of assessment and assumptions

8.4.23 The decommissioning would focus on re-establishing the site to its current agricultural state, preserving the enhanced hedgerows and areas of habitat created along the Nant Dalar Hir and associated tributaries. The bridge would remain *in situ* across the Nant Dalar Hir and some culverts would remain along the other watercourses.

8.4.24 It is anticipated that decommissioning would follow a programme broadly the reverse of construction. The activities which could have a potential effect on surface water and groundwater include:

- the formation of a site compound;
- plant mobilisation and traffic movements;

- demolition and removal of temporary buildings, structures and services, including removal of the below-ground storm water attenuation tank;
- the breaking up and removal of road surfacing;
- the removal of sub-base and reinstatement of topsoil; and
- reinstatement to agricultural land use.

8.4.25 The process of decommissioning the Park and Ride is anticipated to take about 12 months. The actual dates and durations would be confirmed as work on the Power Station progresses.

Embedded and good practice mitigation

8.4.26 The embedded and good practice mitigation would be broadly the same as for the construction phase, although a landscape restoration plan would be developed to ensure appropriate reinstatement of watercourses and drainage ditches. The landscape restoration plan would be agreed between Horizon and the Contractor.

8.4.27 Where structures such as bridges and culverts would remain within the watercourses, these would be checked following the decommissioning of the site to ensure that they are still in good condition and functioning correctly.

8.5 Assessment of effects

8.5.1 This section presents the findings of the assessment of effects associated with the construction, operation and decommissioning of the Park and Ride.

Construction

Surface water

8.5.2 The key potential effects from the construction of the Park and Ride on the surface water environment (all watercourses) relate to water quality. The potential effects on the receptors identified in table F8-3 include:

- degradation of surface water quality due to leaks and spillages of fuels or oils used by construction plant;
- degradation of surface water quality due to spillage of cementitious materials, either via groundwater migration or via surface flow pathways; and
- degradation of water quality due to increased exposure of bare soils resulting in high sediment loadings in runoff from earthworks and in channel works, which could affect the water quality within Nant Dalar Hir and downstream at Llyn Traffwll.

8.5.3 To reduce the above effects there would be no fuel storage or vehicle refuelling on-site. In line with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10), there would be emergency response procedures for any fuel/oil leaks from vehicles, the use of well-maintained equipment and requirements to carry spill kits and provide training in their use. With the application of these

mitigation measures, the magnitude of change on water quality would be negligible and, based on the value of the receptors detailed in table F8-3, the potential effect would also be negligible. This is not a significant effect.

8.5.4 To reduce potential effects on water quality there would be no concrete pouring within 50m of a watercourse without a bespoke risk assessment, in line with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10). Therefore, the magnitude of change on water quality would be negligible and, based on the value of the receptors detailed in table F8-3, the potential effect would also be negligible. This is not a significant effect.

8.5.5 To alleviate the potential impact of high sediment loading and the effect on water quality, vegetated buffer strips have been incorporated into the design to capture runoff and retain fine sediment and pollutants, preventing them moving downstream in high concentrations. These buffer strips are also areas within which no bulk earthworks would take place, and any minor earthworks (e.g. construction of outfalls) would be subject to bespoke risk assessment. In accordance with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10), appropriate methods would be used to control sediment runoff. With the application of these mitigation measures, the magnitude of change on water quality would be small and, based on the value of the receptors detailed in table F8-3, the potential effect would be minor adverse for Llyn Traffwll and Nant Dalar Hir, and negligible for all other watercourses. These are not significant effects.

Flood risk

8.5.6 An FCA has been undertaken for the proposed Park and Ride (appendix F8-1, Application Reference Number: 6.6.16). The assessment follows the requirements of TAN 15 [RD3] which focuses on the flood risks of a development post-construction, but due to the relatively short timescale of construction activities (which would not be affected by climate change), does not consider the risks during construction. Flood risks during construction are therefore considered below.

8.5.7 During construction the risk of flooding at a site is initially the same as that identified for the baseline condition, but depending upon the nature and timing of the construction activities that risk could change, principally through either an increase in exposure of people and plant or through changes to landforms that might increase the risk of flooding elsewhere. However, the risks are normally managed by the contractor's construction management procedures which may (depending upon site location) include a flood risk management plan that draws on NRW issued flood warnings or Met Office issued weather warnings.

8.5.8 It is normally the case that drainage is one of the first elements of the construction. Where such drainage is an integral part of flood risk management, including attenuation facilities for instance, then this can be assessed in a similar way to the risks during operation, albeit without consideration of climate change.

8.5.9 The key issues relating to the construction phase of the Park and Ride on flood risk to the receptors in table F8-3 include:

- high sediment loading within watercourses from construction activities reducing conveyance in culverts beneath roads and downstream, which could increase the existing flood risk; and
- increase in surface water flooding risk within the proposed Park and Ride to off-site receptors as a result of soil compaction causing greater rates of surface runoff.

8.5.10 The implementation of buffer strips and adherence to the management requirements for flood risk during construction, as outlined in the Wylfa Newydd CoCP (Application Reference Number: 8.6), would serve to prevent an increase in fluvial and pluvial flood risk due to a reduction in conveyancing caused by sediment build-up. The potential magnitude of change on fluvial and pluvial flood risk to the proposed Park and Ride site and off-site receptors due to sediment build-up is assessed as negligible and the effects are also assessed as negligible. This is not a significant effect.

8.5.11 Localised surface water flooding due to runoff from compaction would be managed by several means. Once soil has been stripped in an area, permeable aggregate would be laid in the car parking areas as soon as practicable. This would alleviate the effect of high rainfall by providing attenuation. The Contractor would detail procedures for dealing with high rainfall events during construction, such as locations where equipment vulnerable to water ingress should not be stored (i.e. out of anticipated flowpaths), and the placement of stockpiles and bunds, in line with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10). The implementation of good practice and embedded mitigation outlined above is considered to result in a small magnitude of change in flood risk during construction which would result in a minor adverse effect on the risk of flooding to the proposed Park and Ride site and off-site receptors. This is not a significant effect.

Fluvial geomorphology

8.5.12 Exposed bare earth surfaces could potentially lead to increased fine sediment loading in runoff to the watercourses. This could have potential effects downstream through sedimentation and smothering of the natural bed substrate and associated habitats. Additional fine sediment deposits within the system also have the potential to reduce channel capacity, particularly close to channel margins or near structures. It is anticipated that the good practice mitigation detailed above to control potential effects from sediment on water quality would also reduce effects on fluvial geomorphology by mitigating the release of suspended sediment into Nant Dalar Hir which could otherwise affect the stream's morphology. The magnitude of change on the Nant Dalar Hir would be small, and based on its medium value, this would lead to a minor adverse effect. This is not a significant effect.

8.5.13 The construction of the Park and Ride would lead to increased impermeable areas and changes to existing flow pathways due to the construction of compounds and compaction of the ground in the short-term, prior to drainage

being installed. This could lead to changes in the flows in the watercourses, altering both the morphology and fluvial processes. Taking into account the mitigation outlined above to control flood risk, which would reduce the potential for increased rates and volumes of surface water runoff into the Nant Dalar Hir, the magnitude of change on the Nant Dalar Hir would be small, resulting in a minor adverse effect. This is not a significant effect.

8.5.14 The Park and Ride would require construction of new permanent outfalls, culverts and a clear span bridge requiring in-channel working during construction. This could lead to the additional mobilisation of sediment from the channel bed and disruption to the natural bed and banks of the watercourses. This could potentially result in changes to the sediment regime and flow processes as well as leading to channel adjustment through erosion. With the implementation of good practice mitigation measures, such as appropriate construction methods for working in watercourses and on banks the magnitude of change to the Nant Dalar Hir would be small, leading to a minor adverse effect. This is not a significant effect.

Groundwater

8.5.15 Changes to groundwater quality could occur due to leaks and/or spills of fuels or other polluting materials used in plant or for construction activities. In the event of a leak or spill, potential contamination could migrate into the glacial till and bedrock aquifer and affect groundwater quality. However, the clayey nature of the topsoil and glacial drift (where dominated by clays) would limit contaminant migration into the underlying bedrock. The effectiveness of this would depend on the soil, the extent of clay matrix of the superficial deposits and the bedrock water level. As stated in section 8.3, glacial till was found to be more than 4m thick adjacent to the two small ponds to the south of the A5 and 1.5m thick immediately east of the Nant Dalar Hir/A55 culvert, comprising stiff clay, in two trial pits associated with the A55. With the implementation of the mitigation measures such as no on-site fuel storage, no on-site plant refuelling and use of spill kits and spill response plans (e.g. in the event of a fuel or hydraulic pipe failure), the magnitude of change to groundwater receptors (table F8-3) would be negligible and, based on the value of the receptors detailed in table F8-3, the effects on the Secondary aquifers, commercial PWSs and wells would also be negligible. This is not a significant effect.

8.5.16 Increased impermeable areas created during the construction period, including construction compounds and compacted ground, could reduce rainwater reaching the groundwater table, potentially altering local recharge rates and resource availability for PWSs, groundwater levels and groundwater flow directions. However, based on the British Geological Survey 1:50,000 scale maps and the two trial pits excavated along the A55, the Park and Ride would be underlain by low permeability glacial till, which currently limits recharge. Furthermore, the impermeable areas created during construction would form only a very small proportion of the wider groundwater catchment. The magnitude of change to the Secondary aquifers, commercial PWSs and wells would be negligible and so the effect on these receptors would also be negligible. This is not a significant effect.

Operation

8.5.17 This assessment has not considered the potable water requirements for the operational site as they are considered insignificant. The full-time workforce to be employed at the Park and Ride would be relatively small (chapter F1, Application Reference Number: 6.6.1), so it is anticipated that the potable water requirements would be met by existing Dŵr Cymru Welsh Water supplies.

Surface water

8.5.18 The presence of vehicles at the Park and Ride means that there would be a possibility of leaks of fuels or oils which could affect surface water quality. The permeable car park surface would be underlain by an impermeable geotextile that would route drainage water through oil interceptors prior to discharge to the Nant Dalar Hir. This, along with management and maintenance procedures (e.g. for oil water interceptors) as outlined in the Wylfa Newydd CoCP (Application Reference Number: 8.6), would mean that the magnitude of change to water quality in the Nant Dalar Hir would be negligible, along with the effects. This is not a significant effect.

8.5.19 Sewage discharge from welfare facilities could also result in degradation of surface water quality. However, the on-site treatment plant would be designed to treat water to appropriate standards to be agreed with NRW and set out in the conditions attached to the Environmental Permit, and would be fitted with monitoring controls to check discharge quality and if necessary prevent discharge of poor quality water. This, along with management and maintenance procedures for the treatment plant, would mean that the magnitude of change to water quality in the Nant Dalar Hir would be negligible to small and the effects would be negligible to minor. This is not a significant effect.

Flood risk

8.5.20 The FCA (appendix F8-1, Application Reference Number: 6.6.16) assesses the flood risk associated with the Park and Ride post-construction. The method applied within the FCA to determine the significance of effect is informed by TAN 15 [RD3], as outlined in the FCA appendix F8-1.4 (Application Reference Number: 6.6.16), differs from the methodology used for this Environmental Impact Assessment (see section 8.4 of chapter B8, Application Reference Number: 6.2.8). The key differences relate to how the value of the receptor and the magnitude are assigned, which therefore drives slightly differing significances of effect. The FCA assigns the value of a receptor based on categories defined within TAN 15 that are specific to flood risk only and are not applicable to other aspects of surface water and groundwater.

8.5.21 In order to assess the flood risk consistently with other surface water and groundwater effects within this Environmental Statement, the following assessment of flood risk during operation of the Park and Ride considers changes that would potentially be caused by the development. The assessment therefore assigns a magnitude of change to the risk of flooding to

receptors based on the method stated in section 8.4 in chapter B8 (Application Reference Number: 6.2.8). The FCA is the key source of information for this assessment; however, given the difference in methods between the FCA and the Environmental Statement, the magnitude of change within this assessment is not directly comparable to the magnitude of hazard or flood risk within the FCA. Nevertheless, whilst the significance of effect may vary between the FCA and the Environmental Statement, the overall conclusions are consistent (i.e. significant or not significant effect).

8.5.22 There is an existing high flood risk at the site proposed for the Park and Ride associated with the Nant Dalar Hir, the floodplain of which currently extends across part of the site. The flood extents (shown in the appendix F8-1.3 of the FCA, (Application Reference Number: 6.6.16) indicate that the land adjacent to the Nant Dalar Hir would be affected and that water would also flow westwards along the site boundary along the A5 and pond in the centre of the Park and Ride. It is likely that the flood risk is partly due to the culvert beneath the A5 which constrains stream flows. The maximum depth increases with return period. It reaches depths greater than 2m at the 0.1% Annual Exceedance Probability event in the south central area of the Park and Ride. The surface water flood risk is broadly similar in both extent and flood depth to that from fluvial flooding. The magnitude of change in fluvial flooding to the Park and Ride and the A5 is high, which would result in a moderate and high significance of effect, respectively. Without additional mitigation, this would be a significant effect.

8.5.23 The flood risk at the proposed Park and Ride could increase if new outfalls, culverts and a bridge were not appropriately designed and constructed as these structures could alter the flow regime and restrict flows during a flood event. The impact of these structures on the risk of flooding to the Park and Ride and off-site receptors during operation of the Park and Ride would be mitigated through embedded design features and good practice, including:

- following good practice for the design and operation of culverts as outlined in guidance in the Wylfa Newydd CoCP (Application Reference Number: 8.6);
- implementing inspection, maintenance and management of the drainage system to avoid blockage, in line with the Park and Ride sub-CoCP (Application Reference Number: 8.10); and
- constructing a clear span bridge with piers outside the watercourse.

8.5.24 Due to the above mitigation, the structures would have a negligible effect on the risk of flooding to the Park and Ride site and off-site receptors. This is not a significant effect.

8.5.25 There is potential for an increase in surface water flooding at the proposed Park and Ride due to the increase in impermeable areas and changes in land levels resulting in an increase in runoff and a reduction in flood storage. The embedded mitigation includes permeable parking areas across the majority of the site, a below-ground attenuation tank, and installation of a granular sub-base to allow surface flows in permeable car park areas to permeate to the below-ground storage. Despite this mitigation a flood risk to the proposed

Park and Ride remains due to the Park and Ride being constructed within the natural floodplain of Nant Dalar Hir and the associated loss of flood storage. The magnitude of change to flood risk is considered to be medium (as defined in table B8-12 of chapter B8, Application Reference Number: 6.2.8) as the changes would remain for the lifetime of the Park and Ride and there would be changes in flow paths and rates. In addition, as the Park and Ride would be subject to flooding the significance of effect to the Park and Ride is considered to be moderate adverse. This is a significant effect and options for additional mitigation are considered in section 8.6.

8.5.26 During the operation of the Park and Ride there could also be a flood risk to off-site receptors. However, due to the presence of the culvert constraining the amount of flow downstream, the likelihood of passing the flood risk downstream to the farm and Llyn Traffwll SSSI would be very low. The magnitude of change is assessed as small and so the effect would be minor. This is not a significant effect. Cartio Môn go-karting centre to the east of the Park and Ride is not likely to experience an increased risk of flooding as Cartio Môn sits at a higher elevation relative to the Park and Ride. Consequently, flows from the Park and Ride would not be passed to the go-karting track and therefore the magnitude of change and significance of impact are both considered to be negligible. This is not a significant effect.

Fluvial geomorphology

8.5.27 The proposed outfall structures within the watercourses would require permanent removal of a small area of natural bed and banks and a localised area of vegetation from the riparian corridor. The addition of new discharge points would also cause localised changes to flow processes within the channels. This could potentially cause localised erosion and changes to the sediment regime. By taking into account good practice mitigation (including following industry outfall design guidelines) and embedded mitigation (including discharging at greenfield runoff rates), the magnitude of change on the drains and minor watercourses from the outfalls would be small resulting in a negligible effect. The magnitude of change on the Nant Dalar Hir would also be reduced to small and, based on the value of the receptors detailed in table F8-3, would result in a minor adverse effect. This is not a significant effect. Land drainage and discharge consents would be required prior to any formal discharges or modifications being made to drainage ditches or watercourses, respectively.

8.5.28 A series of culverts are proposed within the man-made drains and the small tributary of Nant Dalar Hir. The culverts have the potential to affect the flow regime and disrupt connectivity of the watercourses with the floodplain. The culverts would also result in the localised loss of natural banks and bed, as well as the adjacent vegetated riparian zone. However, the channels proposed to be culverted are man-made and embanked on either side and so have low morphological value. The total area lost would also be comparatively small. Furthermore, several of the ditches are dry for several months of the year and so the effects on flow would be negligible at these times. By taking this into account and considering the proposed good practice mitigation (such as following culvert design guidelines), the magnitude of change to the drains,

minor watercourses and Nant Dalar Hir would be small. Based on the value of the receptors detailed in table F8-3 this would result in a negligible effect for the drains and minor watercourses, and a minor adverse effect for the Nant Dalar Hir. These are not significant effects.

8.5.29 Nant Dalar Hir would be crossed by a clear span bridge rather than installing a culvert, minimising the potential for effects on the watercourse. The clear span bridge would require the permanent localised removal of some of the existing vegetation on the banks (particularly the right bank when looking downstream); however, it would still allow for the existing bed and banks up to the bridge abutments to be unmodified. There is currently an existing crossing at the location of the proposed bridge, which would be widened as part of the Park and Ride construction. The magnitude of change of the clear span bridge on the Nant Dalar Hir is considered to be small, resulting in a minor beneficial effect due to the improved connectivity and decreased impact of the bridge structure on the channel banks compared to the existing structure. This is not a significant effect.

8.5.30 The presence of hardstanding across the site during the operational phase of the Park and Ride could lead to changes in the flows in the watercourses altering both the morphology and fluvial processes. With the inclusion of embedded mitigation in the form of using permeable paving (where possible) and the presence of an attenuation tank discharging at existing greenfield runoff rates, the magnitude of change on Nant Dalar Hir would be small, leading to a minor adverse effect. This is not a significant effect.

Groundwater

8.5.31 The most significant potential effect of the proposed Park and Ride on the groundwater environment, during the operational phase of the development, relates to changes in groundwater quality associated with leaks of fuels and oils in the car park and other vehicle parking areas. However, there would be a number of mitigation measures in place, including those identified below.

- No bulk fuel storage or refuelling on-site.
- Limited potential for significant leaks from car parking since typically cars have only between 40 and 80 litres of fuel in them and 4 to 6 litres of oil and the likelihood of complete loss due to equipment failure is low.
- The permeable aggregate would be underlain by a low permeability geotextile with discharge routed through an oil/water interceptor.
- There would be a management and maintenance procedure for the oil/water interceptor.

8.5.32 In addition, the PWS is distant from the site, the typical recharge area/zone of influence for a small abstraction in a Secondary B aquifer is likely to be of the order of several hundred metres and the predominant groundwater flow direction in the bedrock is likely to be towards the west, with limited connectivity between the proposed Park and Ride and the PWS. The magnitude of change on groundwater quality due to leaks of fuel and oil is assessed as negligible and so the effect on the Secondary aquifers,

commercial PWSs and wells is also assessed as negligible. This is not a significant effect.

8.5.33 The magnitude of change on groundwater quality due to leaks from the package treatment plant is also assessed as negligible and so the effect on the Secondary aquifers, commercial PWSs and wells is also assessed as negligible. The plant would be constructed on hardstanding and there would be procedures for checking and maintaining the effluent treatment plant to ensure that there are no leaks.

8.5.34 As the new area of hardstanding is a very small part of the Park and Ride, and the low permeability soils and superficial deposits that currently exist across the site already limit groundwater recharge, the magnitude of change in recharge is assessed as small to negligible. Therefore, the effect on groundwater flows or levels in the Secondary aquifers would be negligible. This is not a significant effect.

Decommissioning

Surface water

8.5.35 The effects of decommissioning of the Park and Ride would be similar to the effects during construction. There could be leaks and spillages of fuels or oils used in plant, which would impact surface water quality. There could also be the degradation of water quality due to earthworks and reinstatement activities, causing high sediment loading in runoff. However, it is assumed that the drainage system would stay in place during decommissioning, as would the vegetated buffer strips. Therefore, the likely magnitude of change would be the same as for construction (small to negligible) and the significance of the effects would be the same (minor adverse to negligible). These would not be significant effects.

Flood risk

8.5.36 The potential for high sediment loading from earthworks could cause a reduction in the conveyance of flows through culverts and outfalls. This could result in an increased flood risk during flood events. However, as with the mitigation employed during construction, the magnitude of change on the risk of flooding to the Nant Dalar Hir would be negligible and the effect would also be negligible. This is not a significant effect.

8.5.37 During the return of the Park and Ride site to agricultural land use there is a possibility that the risk of flooding to off-site receptors could increase, as runoff rates could increase because the land would be un-vegetated for a period of approximately 12 months. However, as it is assumed that the drainage system would remain in place, it is likely that the flood risk would not change significantly from the operational phase.

8.5.38 There should be no increase in flood risk to the off-site receptors as the runoff rates should not differ significantly from the operational phase.

Fluvial geomorphology

8.5.39 The culverts installed within the field drains and the clear span bridge across the Nant Dalar Hir would not be removed as part of decommissioning of the Park and Ride. These structures would result in the permanent removal of a small area of natural bed and banks and a localised area of vegetation from the riparian corridor. The effect of this is considered to be negligible for the other drains at the operational stage and minor adverse for the Nant Dalar Hir. As the structures would not change, this remains the case during decommissioning. However, the potential for fine sediment input from the decommissioning works could cause additional sedimentation, smothering of habitats and bed and reduction in channel capacity. With good practice mitigation (as per construction) the magnitude of change would be small on the Nant Dalar Hir, leading to a minor adverse effect during decommissioning. This is not a significant effect.

Groundwater

8.5.40 During decommissioning there would be potential effects on groundwater quality from leaks and/or spills of fuels or other polluting materials used in plant or for decommissioning activities. However, by adhering to the good practice mitigation measures used during construction, the magnitude of change to the Secondary aquifers, commercial PWSs and wells during decommissioning would be negligible and effects to groundwater would also be negligible. This is not a significant effect.

8.6 Additional mitigation

8.6.1 In accordance with chapter B1 (introduction to the assessment process) (Application Reference Number: 6.2.1), embedded and good practice mitigation measures relevant to surface water and groundwater were taken into account when determining the 'pre-mitigation' significance of effects. These are detailed in the design basis and activities section of this chapter.

8.6.2 The proposed additional mitigation measures would be implemented to address potential significant effects identified in the assessment of effects section. Additional mitigation measures have only been identified for the operational period and are summarised in table F8-4.

Table F8-4 Additional surface water and groundwater mitigation measures – operation

Proposed additional mitigation measures	Objective	Achievement criteria and reporting requirements
<p>Further detailed manipulation of the topography of the Park and Ride to be progressed and redirection of flow paths would be used to manage the flood waters from both fluvial and pluvial sources within the Park and Ride without increasing flood risk elsewhere.</p>	<p>Management of flood waters from both fluvial and pluvial sources within the Park and Ride.</p>	<p>Acceptable management of flood risk to Park and Ride.</p>

8.7 Residual effects

8.7.1 This section describes the residual effects for surface water and groundwater having taken into account the embedded, good practice and additional mitigation described above. Table F8-5 provides a summary of significant residual effects identified either prior to or post application of additional mitigation for the operational phase.

8.7.2 No significant adverse effects were identified for the construction and decommissioning phases or for fluvial geomorphology and groundwater.

8.7.3 Additionally, all effects of minor significance or greater identified in the assessment of effects section are summarised in appendix I3-1 (master residual effects table, Application Reference Number: 6.9.8) of this Environmental Statement.

8.7.4 The Water Framework Directive Compliance Assessment (Application Reference Number: 8.26) provides a detailed overview of the potential impacts of the proposed Park and Ride on each quality element of the Crigyll WFD and the Ynys Môn Secondary water bodies. The assessment concludes that the Park and Ride would be compliant and would not cause a deterioration or prevent the water bodies from achieving Good Status. The construction and operation of the Park and Ride are not anticipated to prevent any mitigation measures required by third parties, such as NRW, for the WFD water bodies from being implemented.

Table F8-5 Summary of residual effects

Receptor (or group of receptors)	Value of receptor(s)	Description of potential effect	Nature of effect	Potential magnitude of change	Potential significance of effect	Additional mitigation	Post- mitigation magnitude of change	Significance of residual effect
Operation								
Park and Ride	Medium	Increased flooding to Park and Ride due to the change in land levels and impermeable areas.	Adverse Local Temporary Medium-term	Medium	Moderate adverse	Further detailed manipulation of the topography of the Park and Ride to be progressed and redirection of flow paths would be used to manage the flood waters from both fluvial and pluvial sources within the Park and Ride without increasing flood risk elsewhere.	Small	Minor

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8.8 References

Table F8-6 Schedule of references

ID	Reference
RD1	Countryside Council for Wales. 2017. <i>Site of Special Scientific Interest: Citation – Anglesey Llyn Traffwl</i> . [Online]. [Accessed: 08 June 2017]. Available from: http://angleseynature.co.uk/webmaps/llyntraffwldesc.htm
RD2	Welsh Government. <i>Development Advice Maps</i> . Hosted on NRW website. [Online]. [Accessed on 06 June 2017]. Available from: https://www.naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en
RD3	Welsh Assembly Government. 2004. <i>Technical Advice Note 15: Development and Flood Risk</i> . (TAN 15). [Online]. [Accessed: 16 May 2017]. Available from: http://gov.wales/docs/desh/publications/040701tan15en.pdf .
RD4	Natural Resources Wales. 2015. [Online]. [Accessed: 09 June 2017]. Available at: https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en .
RD5	Natural Resources Wales. <i>Water Watch Wales Map Gallery</i> . [Online]. [Accessed: 06 June 2017]. Available from: http://waterwatchwales.naturalresourceswales.gov.uk/en/
RD6	Cranfield Soil and Water Institute. 2015. <i>Soilscapes</i> . [Online]. [Accessed: 06 June 2017]. Available from: http://www.landis.org.uk/soilscapes/
RD7	British Geological Survey. 1997. The Hydrogeological Classification of Superficial Clay: The Hydrogeological Characterisation of Glacial Till and Glacio-lacustrine Sediments in Shropshire. Technical Report W29. Bristol: Environment Agency.
RD8	Natural Resources Wales. 2015. <i>Western Wales River Basin Management Plan 2015-2021</i> . [Online]. [Accessed: January 2016]. Available from: https://naturalresources.wales/media/676165/wwrbdssummary.pdf
RD9	NIEA, SEPA, NRW. 2017. <i>Works and maintenance in or near water: GPP 5</i> . [Online]. [Accessed: 14 December 2017]. Available from: http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf
RD10	Masters-Williams, H., Heap, A., Kitts, H., Greenshaw, L., Davis, S., Fisher, P., Hendrie, M. and Owens, D. 2001. <i>Control of water pollution from construction sites: Guidance for consultants and contractors (C532)</i> . London: CIRIA.

ID	Reference
RD11	Balkham, M., Fosbeary, C., Kitchen, A. and Rickard, C. 2010. <i>Culvert Design and Operating Guide</i> (C689). London: CIRIA.
RD12	NIEA, SEPA, NRW. 2017. <i>Pollution incident response plans: GPP 21</i> . [Online]. [Accessed: 12 January 2018]. Available from: http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf