HORIZON
NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

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1 Introduction

1.1.1 This appendix provides an overview of the proposed management arrangements for all radioactive wastes and spent fuel arising during the operation and decommissioning of the Power Station. No radioactive waste would be generated during construction of the Power Station.

1.1.2 Operation and decommissioning of the Power Station would result in the unavoidable generation of quantities of radioactive waste and spent fuel. This is a known and justifiable consequence of nuclear power generation and the UK regulatory permissions regime for nuclear power stations defines precise regulatory requirements and expectations for the management of this waste.

1.1.3 Horizon will apply the principles of waste minimisation, so far as is reasonably practicable (SFAIRP), in the design of the Power Station. Wherever reasonably practicable, measures will be taken to prevent materials either becoming radioactively contaminated or activated, or as being classified as radioactively contaminated due to the inadvertent placement of inert material adjacent to radioactive material.

1.1.4 Waste processing systems have been specified to treat radioactive liquid and gaseous effluents and discharges and solid wastes in order to reduce the environmental impact as low as reasonably achievable (ALARA) prior to disposal. The activity and volume of radioactive wastes discharged and disposed of shall be minimised through the application of Best Available Techniques (BAT) and the use of the waste hierarchy.

1.1.5 Horizon's strategy will be to manage and process radioactive wastes as they arise where this is reasonably practicable, thereby reducing risks and preventing the creation of a legacy that has to be dealt with by future generations. The approach to radioactive waste management has been developed based on lessons learnt from the operation and decommissioning of the UK’s early nuclear power stations.

1.1.6 Potential radiological effects resulting from aerial and liquid discharges, and from the storage and transport of solid wastes, are summarised as part of the assessments within chapter D14 (Radiological effects, Application Reference Number: 6.4.14).

2 Legislation, policy and guidance

2.1 Introduction

2.1.1 This section summarises the policies and key authorities that Horizon works with regarding the management of radioactive wastes and spent fuel. Horizon's principles for the implementation of the strategy for the management of radioactive waste and spent fuel are also described. This demonstrates that there are clear systems and procedures in place to ensure that the radioactive waste and spent fuel will be handled and treated in compliance with legislation, policy, guidance and specifications.

2.2 Regulatory context

2.2.1 The management of wastes on a nuclear licenced site is the sole responsibility of the waste producer (i.e. the operator and site licensee). It is the waste producer that implements appropriate waste management operations on the Power Station Site in compliance with statutory legislation, policy, guidance and specifications. The UK Government, regulators and technical authorities have the following roles:

- the UK Government determines statutory legislation and policy in the light of international agreements and guidance;
- technical authorities specify requirements for the treatment and disposal of radioactive waste; and
- nuclear regulators enforce the radioactive waste legislation and ensure that policies are implemented.

2.2.2 The UK Advanced Boiling Water Reactor (UK ABWR) technology to be used for the Power Station is a progression of the boiling water reactor designs constructed and operated in Japan and the US, in compliance with their respective environmental legislation. ABWRs are already operational at four sites in Japan and are approved for use in the USA and Taiwan. No nuclear reactor could be constructed in the UK unless the nuclear regulators are completely satisfied that it can operate safely.

2.2.3 The nuclear regulators have undertaken the Generic Design Assessment (GDA) of the UK ABWR design to confirm that this technology will meet the UK's legislative and permitting standards [RD1]. In December 2017, the Office for Nuclear Regulation (ONR), the Environment Agency and Natural Resources Wales (NRW) issued Design Acceptance Confirmation and a Statement of Design Acceptability for the UK ABWR reactor design.

2.3 Key authorities

Nuclear regulators

2.3.2 The management of radioactive waste is a highly regulated activity with robust statutory legislation in place to minimise any adverse effect on human health

and the environment. All radioactive waste would be managed in accordance with legislation as enforced by regulators.

2.3.3 There are several regulators overseeing the enforcement of radioactive wastes that would be generated by the Wylfa Newydd Project. The regulators have different roles and responsibilities depending on the category of waste produced.

- The ONR regulates on-site radioactive waste management through conditions attached to the nuclear site licence. The ONR consults the appropriate environmental agency regarding radioactive waste management activities and would not issue the nuclear site licence (to the nuclear site operator) without taking full and meaningful account of any environmental issues raised.
- NRW regulates radioactive disposals (including the discharge of gaseous and aqueous emissions) and the transfer of radioactive wastes between the Power Station and waste treatment and disposal sites. NRW issues Environmental Permits and would regulate the transfer, treatment and disposal of all wastes (including the discharge of gaseous and aqueous wastes).

Nuclear Decommissioning Authority

2.3.4 The Nuclear Decommissioning Authority (NDA) is responsible for the decommissioning and clean-up of all legacy civil nuclear sites in the UK, including the management of radioactive wastes. The NDA establishes waste management plans with the operator and consults on these plans with the relevant regulators. The NDA has overall responsibility for implementation of UK lower activity waste (LAW) policy including the operation of the Low-Level Waste Repository (LLWR) near Drigg in Cumbria. The NDA is also responsible for the implementation of the UK higher activity waste (HAW) policy including the future operation of the Geological Disposal Facility (GDF) by Radioactive Waste Management.

2.3.5 With specific reference to the Wylfa Newydd Project, the NDA will advise the Department of Business, Energy and Industrial Strategy on the quality of decommissioning plans and associated cost estimates, as required for new Nuclear Power Stations under the UK Government Funded Decommissioning Programme (FDP) arrangements.

2.4 Summary of key legislation, policies and guidance

2.4.1 Table 2-1 lists the main UK legislation relevant to the management of radioactive waste and spent fuel. Table 2-2 identifies the main UK national strategy, policies and guidance that apply to the management of spent fuel and radioactive wastes, and therefore would be integral to Horizon's approach to this topic.

Table 2-1 UK legislation relevant to radioactive waste and spent fuel management

Legislation	Description
Nuclear Installations Act,1965	ONR grant nuclear site licences under this Act, and have a standard set of licence conditions. The licence holder is required to comply with defined licence conditions (LCs), as per schedule 2 of the standard nuclear site licence, which ensure the safe operation and maintenance of a nuclear installation. Standard LCs relevant to the management of waste on a licenced site include: • LC4: Restrictions on nuclear matter on the site, "The licensee shall ensure that no nuclear matter is stored on the site except in accordance with adequate arrangements made by the licensee for this purpose." • LC5: Consignment of nuclear matter, "The licensee shall not consign nuclear matter (other than excepted matter and radioactive waste) to any place in the United Kingdom other than a relevant site except with the consent of ONR." • LC32: Accumulation of radioactive waste, "The licensee shall make and implement adequate arrangements for minimising so far as is reasonably practicable the rate of production and total quantity of radioactive waste accumulated on the site at any time and for recording the waste so accumulated." • LC33: Disposal of radioactive waste, "The licensee shall, if so directed by ONR, ensure that radioactive waste accumulated or stored on the site is disposed of as ONR may specify and in accordance with an environmental permit, or an existing permit..." • LC34: Leakage and escape of radioactive material and radioactive waste, "The licensee shall ensure, so far as is reasonably practicable, that radioactive material and radioactive waste on the site is at all times adequately controlled or contained so that it cannot leak or otherwise escape from such control or containment." • LC35: Decommissioning, "The licensee shall make and implement adequate arrangements for the decommissioning of any plant or process which may affect safety." The ONR is responsible for issuing site licences as well as monitoring an operator's compliance with the LCs.
The Ionising Radiations Regulations 2017	Under these regulations, the exposure to radiation of the public and workers must be below legal limits and must be shown to be as low as reasonably practicable (ALARP). In this context, doses to workers must be kept ALARP while operating radioactive waste systems or handling radioactive waste.
Energy Act 2008 and 2013	Under section 45 of the Energy Act 2008, a person who applies for a nuclear site licence to install or operate a nuclear power station must notify the Secretary of State of the application and prepare a FDP for approval. It is an offence under section 47 of the Act for a person to use a

Legislation	Description
	site, or permit another person to use a site, by virtue of a nuclear site licence, without an approved FDP. The Energy Act 2013 established the ONR as the body responsible for the enforcement of statutory provisions within the Act in regard to nuclear regulation. This includes responsibilities for the issuing and regulation of nuclear site licences under the Nuclear Installations Act 1965 (as amended).
Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999	These regulations require nuclear power station operators to obtain consent from the ONR prior to the commencement of decommissioning. This requires the submission of an Environmental Statement and Environmental Impact Assessment and a period of consultation.
Environmental Permitting (England and Wales) Regulations 2016	These regulations seek to ensure that permitted activities and their discharges do not endanger the environment or human health. Environmental Permits must be sought from NRW for both radioactive and conventional wastes and discharges. They combine the requirements for an integrated waste management approach and the requirements for hazardous waste management. They provide a framework for regulation that enables NRW and ONR (as well as other interested government or regulatory departments) to assess permitting and compliance with a common approach. These regulations apply to all wastes (radioactive and conventional), effluent treatment plants and generator boilers discharges.
Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009	This legislation incorporates the European Agreement concerning the International Carriage of Dangerous Goods by Road and the Regulations concerning the International Carriage of Dangerous Goods by Rail. It defines the requirements for the safe transportation of radioactive waste materials.

Table 2-2 Main national strategy, policies and guidance relevant to radioactive waste and spent fuel management

Policy/Guidance	Description
Long-term Nuclear Energy Strategy [RD2]	The UK Long-term Nuclear Energy Strategy lays out the Government's policy on the use of nuclear energy as part of a low carbon future, including through the construction of new nuclear facilities. As part of this strategy, the Government lays out key priorities for the sector, including the issue of both legacy nuclear wastes and the treatment of radioactive wastes from nuclear new build. This strategy builds upon the existing legislative requirements for new nuclear facilities to have a funded decommissioning programme in place prior to the granting of a nuclear site

Policy/Guidance	Description
	licence. The Government commitment includes the establishment of the ONR to regulate the sector. With regards to radioactive waste management, the strategy assumes that spent fuel and intermediate level waste (ILW) will be disposed of within the proposed national GDF once the facility becomes available.
UK Strategy for Radioactive Discharges [RD3]	This strategy describes how the UK will continue to implement the UK's obligations under the OSPAR Radioactive Substances Strategy objective for 2020 [RD4], namely for progressive and substantial reductions in radioactive discharges, radionuclide concentrations in the marine environment and human exposure to ionising radiations due to radioactive discharges.
The Review of Radioactive Waste Management Policy: Final Conclusions [RD5]	From this policy, the following key principles arise: • radioactive wastes should not be unnecessarily created; • such wastes as are created should be safely and appropriately managed and treated; and • wastes should be safely disposed of at appropriate times and in appropriate ways. These are underpinned by general requirements that: • radioactive wastes should be managed and disposed of in ways which protect the public, workforce and the environment; and • radioactive waste management should safeguard the interest of existing and future generations and the wider environment, and in a manner that commands public confidence and takes due account of costs. The review is amended and replaced in parts by the Policy for the Long-Term Management of Solid Low-Level Radioactive Waste in the United Kingdom, 2007 [RD6].
UK Strategy for the Management of Solid Low-Level Radioactive Waste from the Nuclear Industry [RD7]	The aim of this strategy is to provide a high level framework within which Low Level Waste (LLW) management decisions can be taken flexibly to ensure safe, environmentally acceptable and cost-effective management solutions that reflect the nature of the LLW concerned. There are three strategic themes: • the application of the waste hierarchy; • the best use of existing LLW management assets; and • the need for new, fit-for-purpose waste management routes for LLW. This strategy is subject to periodic review and an updated Strategy was issued in February 2016. The revised strategy is in line with the original version (for example based upon the waste hierarchy), whilst reflecting the changes to available options for the treatment of LLW since the issue of the original version.
The management of higher activity radioactive	Joint guidance from the ONR, NRW, the Environment Agency and the Scottish Environmental Protection Agency is provided to nuclear licensees in addressing higher activity wastes throughout their lifecycle. The production of

Policy/Guidance	Description
wastes on nuclear licensed sites [RD8]	a Radioactive Waste Management Case is recommended by the guidance. It also includes guidance on waste management, characterisation and segregation, condition and disposability, storage of radioactive waste and managing information and records relating to waste.
Industry Guidance: Interim Storage of Higher Activity Waste Packages – Integrated Approach [RD9]	NDA co-ordinated guidance. It is intended that the Guidance will be used by those involved in managing any aspect of current and future UK stores of packaged HAW. The guidance seeks to cover all the significant technical issues arising from interim storage of packaged HAW, to be practicable in implementation and relevant to all UK storage system designs. It is expected that operators will implement the guidance to maintain and improve existing waste storage systems and when planning new stores. Other organisations will continue to be able to freely access and use the guidance.
Isle of Anglesey County Council (IACC) New Nuclear Build at Wylfa Supplementary Planning Guidance [RD10]	The overarching purpose of this Supplementary Planning Guidance is to provide guidance on important local, direct and indirect matters. It sets out the IACC's vision and objectives regarding the Wylfa Newydd Project, for which it is the most up-to-date guidance available. It also aspires to: • inform the IACC's position in its Local Impact Report and subsequently the Statement of Common Ground (documents to be submitted to the Planning Inspectorate as part of Development Consent Order examination); • provide a planning framework to guide applicants and influence the Wylfa Newydd Project's design and development to ensure sustainable outcomes, with a focus on Associated Development; • inform Pre-Application Consultation for the Wylfa Newydd Development Area and Associated Development; and • offer supplementary local-level guidance consistent with the National Policy Statements; and form a material consideration in the assessment of the Wylfa Newydd Project elements that are subject to Town and Country Planning Act applications.
Funded Decommissioning Programme Guidance for New Nuclear Power Stations [RD11]	The Government legislated in the Energy Act 2008 to ensure that operators of new nuclear power stations have secure financing arrangements in place to meet the full costs of decommissioning and their full share of waste management and disposal costs. Before nuclear-related construction can begin on site, an operator of a new nuclear power station must have a FDP in place approved by the Secretary of State. This guidance sets out the principles the Secretary of State will expect to see satisfied in the FDP prepared by an operator. The Guidance gives information on ways in which an operator might satisfy those principles, thereby assisting operators in understanding their obligations under the Energy Act 2008.

Policy/Guidance	Description
Waste Transfer Pricing Methodology [RD12]	The purpose of the Waste Transfer Pricing Methodology is to set out how the waste transfer price will be determined. This methodology will form the basis of more detailed provisions to be set out in the waste contract that will be agreed between the government and the operator. It is intended to ensure that the entire costs of disposal now and in the future are met by the operator.
Managing Radioactive Waste Safely [RD13]	A white paper that sets out the UK Government's framework for managing higher activity radioactive waste in the long term through geological disposal, coupled with safe and secure interim storage and ongoing research and development to support its optimised implementation.
National Policy Statements (NPS) Energy EN-1 2011 [RD14].	This National Policy Statement, designated by the Secretary of State in July 2011, sets out the overarching national policy for delivery of major energy infrastructure projects. This forms the primary policy context for a decision on Horizon's application for a Development Consent Order for the Power Station.
NPS Nuclear Power Generation EN-6 2011 [RD15].	The National Policy Statement designated by the Secretary of State in July 2011 that sets out national policy on new nuclear power stations identified as potentially suitable for deployment by 2025, and provides specific considerations with regard to radioactive waste (which are set out in section 2.11 and annex B of the NPS). This also forms the primary policy context for a decision on Horizon's application for a Development Consent Order for the Power Station. EN-6 recognises that "The UK has robust legislative and regulatory systems in place for the management (including interim storage, disposal and transport) of all forms of radioactive waste that will be produced by new nuclear power stations." "As the licensing and permitting of nuclear power stations by the nuclear regulators is a separate regulatory process, the Examining Authority for the DCO should act on the basis that: • the relevant licensing and permitting regimes will be properly applied and enforced; and • it should not duplicate the consideration of matters that are within the remit of the nuclear regulators." In relation to long-term radioactive waste management, Annex B of EN-6 sets out that other facilities for the interim storage of waste may come forward. "*However, in the absence of any proposal the IPC should expect that waste would be on site until the availability of a geological disposal facility*".
Guidance on International Safeguards and Nuclear Material	The guidance includes nuclear material accountancy and safeguards best practice for the life of a nuclear plant from design to decommissioning. This regulation details safeguards reporting requirements for nuclear materials

Policy/Guidance	Description
Accountancy at Nuclear sites in the UK [RD16]	and implements Commission Regulation (Euratom) 302/2005 which details safeguards reporting requirements for nuclear materials.

2.5 Horizon's radioactive waste management principles

Nuclear, safety, security and environmental principles

2.5.2 The UK nuclear regulatory approach is underpinned by national nuclear, safety, security and environmental principles, which, among other things, provide the framework for how environmental effects are reduced (see chapter B14 Radiological effects, Application Reference Number: 6.2.14). These take due consideration of the objectives and principles published by the regulators (ONR and NRW) and are intrinsic to Horizon's approach to waste management.

Design principles

2.5.3 Principles relevant to the management of waste are summarised in table 2-3. The following criteria are being taken into account in the design stage of the UK ABWR to reduce construction wastes, radioactive wastes and facilitate the later decommissioning of the plant (as required by the demonstration of BAT for the Environmental Permit).

Table 2-3 Design principles for waste management

Principle	Description
Application of BAT and ALARP	These are the fundamental underpinning philosophies on which all decision making relating to management of all wastes (solid, liquid and gaseous, conventional and radioactive) will be based. They are intended to ensure that potential risk to people and the environment is minimised so far as is reasonably practicable throughout the entire lifecycle of the power station. The BAT and ALARP methodologies will be applied proportionately based on the extent of the hazard.
Application of the Waste Hierarchy	Horizon will implement the waste hierarchy to ensure that optimisation of wastes is achieved so far as is reasonably practicable throughout the entire lifecycle of the Power Station.
Application of Waste Minimisation	Wherever reasonably practicable the generation of waste is to be avoided and if unavoidable the quantity of waste generated is to be kept to levels that are as low as reasonably achievable.
Waste Identification and Characterisation	In order to demonstrate robust control over the management of wastes it is essential that all potential waste sources are identified and assessed to provide sufficient definition on waste characteristics to enable the selection of appropriate management and disposition strategies.

Principle	Description
Segregation of Waste at Source	To maximise the effectiveness of disposition routes it is essential that wastes are segregated as close to the source of arising as possible, and that risks of downstream cross-contamination are mitigated through appropriate separation of waste routes.
Holistic Waste Strategy Development	Wastes should be considered holistically throughout their entire lifecycle from production to disposition and options for their management should be based on this holistic consideration.
Waste Process Optimisation	Waste disposition options should be identified through a rigorous process of options identification, assessment and selection. In considering options all relevant factors including safety, environmental impact, cost, time and difficulty should be taken into account.
Passive Safe Storage	Where appropriate, wastes will be processed into a passively safe state as soon as is reasonably practicable, and stored in accordance with relevant good practice.
Waste Led Approach	Specific requirements associated with discrete disposition routes are provided by the operators of the downstream waste management facilities. These are generally expressed as Waste Acceptance Criteria (WAC) or Conditions for Acceptance. Horizon will in turn produce compliance criteria associated with on-site waste management processes which waste producers will be required to comply with.
Proximity Principle	Wherever reasonably practicable Horizon will utilise the proximity principle when sending waste and materials off-site, both to minimise the environmental impact of transporting wastes over long distances, and as part of corporate social responsibilities to engage with and promote the use of local facilities and services.
Application of Relevant Good Practice	Horizon will identify and apply relevant good practice through engagement with subject matter experts, identification of relevant industry guidance and interaction with other industry bodies.
Stakeholder Engagement	Early and ongoing engagement with relevant stakeholders will be undertaken to ensure that a holistic and compliant set of waste management processes are defined and implemented.
Waste Records and Traceability	As part of an overarching ‘waste management system’ waste records will be produced, managed and stored under appropriate quality management arrangements.

3 Introduction to radioactive waste and spent fuel

3.1 Introduction

3.1.1 This section briefly describes the sources of radioactive waste at the Power Station, the permitted discharge routes, and gives a description of the UK classification of solid radioactive waste by activity levels. In addition, a brief discussion is provided of the status of spent fuel in a UK context. Project specific details are given in later sections. The regulation of these wastes will be covered as part of the nuclear licensing and permitting activities.

3.2 Radioactive waste

3.2.1 Radioactive waste would be generated during the operation of the Power Station, primarily due to nuclear fission of the fuel, activation of impurities in the reactor water and activation of corrosion products in the reactor circuit.

3.2.2 Waste processing systems would be in place to treat radioactive waste materials arising during operation and decommissioning of the Power Station, in order to reduce the activity of radioactive waste that is subsequently released to the environment such that it meets the conditions set out in the Environmental Permit as further discussed in section 5.

3.2.3 The waste that is ultimately disposed of to the environment can be broadly grouped into three streams:

- gaseous waste discharged via stacks on the reactor buildings and other permitted outlets;
- liquid waste discharged via the liquid effluent discharge outlet; and
- solid waste that is treated and disposed of at permitted off-site facilities (this includes some wet solid waste, such as resins and sludges, which would be processed and disposed of as solid waste).

3.3 Solid radioactive waste classification

3.3.1 The management of solid radioactive waste depends, among other things, on its radioactivity level. In the UK, radioactive wastes are classified in terms of the nature and quantity of radioactivity they contain and the heat they produce. The categories are broadly divided into higher activity radioactive waste (HAW) and lower activity radioactive waste (LAW) as below.

HAW

- High Level Radioactive Waste (HLW): waste that is sufficiently radioactive for its decay heat to significantly increase its temperature and the temperature of its surroundings, such that heat generation has to be taken into account in the design of storage and disposal facilities.

- Intermediate Level Radioactive Waste (ILW): wastes exceeding the upper boundaries for LLW but that do not require heat generation to be taken into account in the design of storage or disposal facilities.
- The HAW definition also includes for any LAW that does not conform to disposal requirements and therefore has to be managed as HAW (note for the Wylfa Newydd Project, no LAW of this type has been identified).

LAW

- Low Level Radioactive Waste (LLW): waste that has a radioactive content not exceeding 4GBq (giga becquerels) per tonne of alpha activity, or 12GBq per tonne of beta/gamma activity.
- Very Low Level Radioactive Waste (VLLW): VLLW is a sub-set of LLW with lower levels of radioactivity which enables its disposal to specific landfill sites that hold appropriate Environmental Permits.

3.3.2 There is no currently available UK disposal facility for HAW and therefore it is required to be managed on-site in the interim. The design incorporates facilities and capabilities to manage the production, processing and storage of HAW.

3.3.3 LAW would be transported from site to treatment and/or disposal facilities that hold appropriate Environmental Permits. The wastes would generally be removed from site shortly after being produced and therefore on-site storage is limited to the collation of transportable quantities of waste, with some in-built contingency should any off-site route be temporarily unavailable. The design incorporates facilities and capabilities to manage the production, processing and buffer storage of LAW.

3.4 Spent fuel

3.4.1 To maintain reactor generating efficiency, fuel elements are replaced in the reactor core every few years. The removed assemblies of spent fuel are placed in the spent fuel pool until they have cooled sufficiently for transfer to the spent fuel storage facility.

3.4.2 The 2016 UK Radioactive Waste Inventory [RD17] describes spent fuel as follows:
"*Nuclear fuel that is being or has been used to power nuclear reactors is referred to as 'irradiated'. When it has reached the end of its life and is no longer capable of efficient fission, it is known as 'spent fuel'. Spent fuel still contains large amounts of uranium (and some plutonium), which can be separated out by reprocessing and used to make new fuel*".

3.4.3 In the absence of a commercially available reprocessing facility, UK policy is for spent fuel to be stored pending disposal to a future national GDF. Horizon's strategy is to store the spent fuel on-site until the GDF is made available. At this point the spent fuel will be repackaged into a disposable form,

and having declared Horizon's intent to dispose of it, the spent fuel will then be termed waste in accordance with the EC Waste Framework Directive definition of waste and subsequently managed as HLW.

4 Radioactive waste during construction

4.1.1 Radioactive sources would be used to support geophysics and radiography during construction of the Power Station. There is a legal requirement under the Ionising Radiation Regulations 2017 for Horizon to have procedures in place to control the use of radioactive sources.

4.1.2 No other radioactive material would be used during construction. There is therefore no potential for radioactive waste to be generated during construction of the Power Station.

4.1.3 It is not anticipated that residual radioactive materials from the Existing Power Station would be encountered in soils and sediments excavated during clearance and excavation activities, beyond those already reported in routine monitoring programmes.

4.1.4 A rock and soil sampling survey across the Power Station Site found concentrations of naturally occurring radionuclides typical of natural soils and rock. There was no evidence of elevated radionuclide concentrations above typical background for north Wales [RD18].

4.1.5 Measurements of radioactivity in marine rock and sediment samples taken from the proposed location of the Marine Off-Loading Facility [RD19] show low levels similar to those observed in the routine monitoring programme around the Existing Power Station [RD20].

4.1.6 There is therefore no evidence of existing in-ground contamination arising from the Existing Power Station. However, the risk of future contamination from the Existing Power Station (either in soil or via migration of groundwater) will continue to be assessed.

4.1.7 The discovery of radioactive contamination would be managed in accordance with the controls defined in the Wylfa Newydd Code of Construction Practice (Application Reference Number: 8.6).

5 Radioactive waste streams and proposed management during operation

5.1 Introduction

5.1.1 This section discusses the proposed management of radioactive waste types in turn.

5.2 Gaseous radioactive waste

5.2.1 Radioactive gaseous and particulate emissions would be generated during the operation of the Power Station. These gaseous emissions would originate as the result of the following:

- activation of entrained atmospheric air in coolant;
- fission products from fuel; and
- thermal neutron irradiation of reactor water.

5.2.2 Under normal operating conditions and expected abnormal situations, there are two systems for the control, treatment and monitoring of aerial discharges:

- the Off-gas (OG) system for each reactor; and
- the heating, ventilation and air conditioning system (HVAC).

5.2.3 The OG system would reduce and control the release of the entrained radioactive gaseous emissions to the atmosphere by providing for hold-up (via cooler-condensers and activated charcoal adsorbers) and the resulting radioactive decay of gases. Entrained particulate material is filtered before discharge via the main reactor stack using High Efficiency Particulate in Air (HEPA) filters.

5.2.4 The key environmental function of the HVAC system is to limit the spread of radioactive materials from contaminated plant and equipment by filtering contaminated air, prior to its discharge to atmosphere, using HEPA filters. The HVAC system would comprise independent sub-systems serving separate areas of the Power Station. Of these areas, the reactor area, the turbine area and the controlled area inside the radioactive waste building would be the three main areas with the potential to generate radioactive gaseous emissions, and all three of these systems would discharge to atmosphere via the main reactor stack. The service building and lower activity waste management facility would have separate discharge points but the generation of gaseous radioactive waste would be negligible.

5.2.5 The HVAC system would generate solid LAW in the form of used HEPA filters that would be managed as LAW through the LAW management facility (see table 5-2).

Gaseous emissions monitoring

5.2.6 The filtration system and sampling and monitoring equipment would be in line with relevant nuclear industry code of practice and guidance (for example [RD21]).

5.2.7 The inlet and outlet of the OG charcoal absorber, as well as the turbine gland steam OG system and the mechanical vacuum pump exhaust, would be monitored using a radiation detector that continuously measures the gross radiation level of the OG. The measured radiation level would be indicated and recorded in the main control room. If the system detects a high radiation level, it would activate an alarm in the main control room and appropriate action taken, as defined in local operating instructions. The radiation level of the HVAC exhaust would not be monitored continuously because the activity discharged would be very low compared with the OG and turbine gland steam OG systems. The sampling and monitoring design of these facilities will be developed during Horizon's detailed design process.

5.2.8 Sampling and monitoring systems are expected to run at all times, measuring gaseous discharges from the main stack. These systems would sample and measure discharge flow, sampling flow, radioactivity, radioactive noble gases, tritium and carbon-14.

5.2.9 Chapter D14 (Application Reference Number: 6.4.14) provides a summary of the controls of radioactive gaseous and particulate emissions being considered, the discharged radioactivity and the assessment of potential effects on human receptors and the environment.

5.3 Liquid radioactive effluents and waste

5.3.1 The design of the radioactive contaminated liquid effluent systems is ongoing and will continue to be developed through the Power Station design.

5.3.2 The reactor cooling circuit and fuel pool (i.e. the plant areas containing water that comes into direct contact with irradiated fuel elements) would be operated as far as is practicable as closed loop systems in the turbine building and the reactor building. Water would be treated for reuse in the following three systems:

- condensate water clean-up system in the turbine building;
- reactor clean-up water system in the reactor building; and
- fuel pool clean-up system and suppression pool clean-up system in the reactor building.

5.3.3 Periodically, discharges from these systems would be transferred to the liquid effluent management system for treatment.

5.3.4 The liquid effluent management system would consist of the following systems, all located within the shared radioactive waste building that services both reactor Units:

- Low Chemical Impurity Waste (LCW) treatment system;

- High Chemical Impurity Waste (HCW) treatment system; and
- the controlled area drain.

5.3.5 The LCW and HCW systems would be used to treat radioactively contaminated effluent. Radioactive liquid effluents would be treated and re-used where practicable. On occasion, it would be necessary to discharge excess liquid effluent from the HCW system which cannot be reused due to water balance in the Power Station.

5.3.6 The LCW system is designed to allow the efficient treatment of relatively large volumes of effluent containing low levels of both insoluble and soluble impurities. Cartridge filters would be used to remove the insoluble impurities. The filtered water would then pass through a mixed bed demineraliser packed with bead ion exchange resins to remove soluble impurities. The treated effluent would then be returned to the condensate storage tank for re-use in the reactor, if it meets the appropriate criteria. If the criteria are not met, the effluent could be recirculated through the system for further treatment.

5.3.7 The HCW system is designed for treatment of effluent containing higher levels of both insoluble and soluble impurities. The effluent received by the HCW system would first be subjected to evaporation. The distillate would then pass through a mixed bed demineraliser packed with bead ion exchange resin to remove any soluble contaminants that could potentially be carried over from the evaporator. Following sampling and monitoring, treated effluent would either be transferred to the condensate storage tank for reuse or, in the event that the effluent volumes exceed the available capacity in the condensate storage tank, discharged to the environment via the Cooling Water System outfall. Prior to discharge, the treated effluent would be sampled to ensure that residual levels of radioactive and chemical contamination are within the discharge limits and conditions in the Environmental Permit.

5.3.8 The controlled area drain system would collect the effluent from notionally uncontaminated systems in controlled areas, such as the local air conditioning systems. Effluent is collected in the controlled area drain collection tanks and sampled. If the effluent meets the discharge criteria, it would be discharged via the Cooling Water System outfall. If effluent requires further treatment prior to discharge to the environment, it would be routed to the HCW system.

5.3.9 Liquid effluent treatment systems would produce dry-solid LAW, wet-solid LLW and wet-solid ILW, the management of which is described in the solid radioactive waste section in table 5-1, table 5-2 and table 5-3.

Liquid effluent monitoring

5.3.10 The overall liquid effluent management system (LCW, HCW and the controlled area drain) would incorporate monitoring systems for all of the main process parameters (pressure, flow, temperature, tank levels, etc.) with appropriate alarms provided to the operators in the event of abnormal conditions.

5.3.11 Prior to discharge to the environment, a representative sample of the liquid effluent from the HCW and the controlled area drain systems would be

analysed to confirm it met the discharge criteria. If the liquid effluent did not meet the discharge criteria, it would be redirected back to the liquid effluent management system for additional treatment.

5.3.12 Samples would also be collected from the final discharge line using a flow proportional sampler. At the sample location the flow of the discharge would also be measured. Redundancy for discharge sampling would be provided in the form of duplicate flow measurement apparatus along with a second flow proportional sampler.

5.3.13 In addition to the sample collection, a continuous radiation monitor would be provided in the liquid discharge line. If the system detected a high radiation level, the monitor would activate an alarm and close an isolation valve to stop the discharge to the environment.

5.3.14 Chapter D14 (Application Reference Number: 6.4.14) provides a summary of the controls of radioactive liquid effluents being considered, the discharged radioactivity and the assessment of potential effects on human receptors and the environment.

5.4 Solid radioactive waste

5.4.1 Operation of the Power Station would result in the generation of the following types of solid radioactive wastes (see paragraph 3.3.1 for definitions of waste categories):

- wet-solid LLW;
- dry-solid LAW;
- wet-solid ILW; and
- dry-solid HLW.

5.4.2 Tables 5-1 to table 5-4 describe the radioactive wastes by type and include descriptions, anticipated volumes and the proposed waste management strategy to handle and manage each waste type and the facilities required. The tables provide additional information on the nature and quantity of individual radioactive wastes streams anticipated to arise from the operation of two UK ABWRs at the Power Station over a 60-year operational life. The waste quantities are derived from information presented in the GDA for the UK ABWR amended to reflect a two Unit site. The estimates provided are based on a conservative assessment of the waste-generating processes and will undergo further refinement and optimisation as the site-specific design progresses.

5.4.3 The approach to the management of spent fuel is described in table 5-5.

Management of LAW generated during operation

5.4.4 The following two tables set out details regarding the proposed management of LAW generated during operation. There are anticipated to be14 third-height ISO containers of cement-encapsulated, wet, solid LLW, as well as nine half-height ISO containers and six full-height ISO containers of dry, solid LLW and

VLLW disposed of per year, with different destinations depending on disposal route. Estimates of LLW and VLLW transports are very conservative at this stage of design development.

Table 5-1 Wet-solid LLW

Wet-solid LLW	
Category description	LLW – waste that has a radioactive content not exceeding 4GBq per tonne of alpha activity or 12GBq per tonne of beta/gamma activity.
Typical sources	Wet-solid LLW would arise from the HCW and LCW systems and the condensate demineraliser system. The treatment systems would use evaporation, ion-exchange and/or filtration, and the following wet-solid LLW streams would be produced: • spent bead resins generated from the demineralisers; and • concentrates from the evaporator.
Annual volumes	Annual operational volumes arising of wet-solid LLW for the two Units is expected to be approximately: • 23m^3 per year of bead resins; and • 2m^3 per year of concentrates.
Management strategy	Placed in buffer storage tanks in the radioactive waste building. Transferred to the wet solid LLW processing system, to be packaged by cement immobilisation. Processed in campaigns. Transported to the LLWR, near Drigg in Cumbria.
Power Station Site facilities	Buffer storage tanks in radioactive waste building. Additional mobile processing equipment provided by the supply chain (required approximately 10 years after the start of operations).
External facilities	LLWR

Table 5-2 Dry-solid LAW

Dry-solid LAW	
Category description	VLLW – waste for bulk disposal that has a radioactive content not exceeding 4MBq per tonne of total activity (40MBq per tonne for tritium). LLW – waste that has a radioactive content not exceeding 4GBq per tonne of alpha activity or 12GBq per tonne of beta/gamma activity.
Typical sources	Dry-solid LLW (including VLLW) is generated through routine operation, maintenance and decommissioning. This waste stream consists of the following items: • HEPA filters used to abate airborne particulates in HVAC systems in controlled contamination areas in the reactor, turbine, radioactive waste and service buildings as well as waste treatment facilities; • cartridge filters used to remove insoluble impurities in the LCW and condensate filter system; and • heterogeneous LLW anticipated to arise as a result of operation and maintenance activities. Wastes will include metals, organic plastics, paper, card, wood, glass, building materials, insulation, motors, cables and pipes, miscellaneous filters and strainers.

Dry-solid LAW	
Annual volumes	Annual operational volumes arising of dry-solid LAW) for the two Units is expected to be approximately: • HVAC filters 47m^3; • cartridge filters 4.5m^3; and • heterogeneous LAW 112m^3.
Management strategy	HVAC filters: Filters will be removed, packaged and transferred to the LAW management facility where they will be loaded into suitable transport containers for transfer to an appropriately permitted off-site supercompaction or incineration facility. The resultant waste will be packaged for transfer and disposal at LLWR. Cartridge filters: On removal, the filter module is loaded into suitable containers. These will be transferred to the LAW management facility, where they will be consigned to appropriately permitted off-site supercompaction or incineration facilities. If the filters do not meet the WAC for these facilities, they will be transferred to the LLWR for direct disposal. Heterogeneous LLW: Sorting, segregation and characterisation at source to comply with the waste acceptance criteria; and where practicable, wastes would be recycled (via metal melting), volume reduced (compaction and/or incineration) or disposed of directly to the LLWR or permitted VLLW landfill.
Power Station Site facilities	Lower activity waste management facility.
External facilities	LLW direct disposal locations: • LLWR in Cumbria. LLW recycling (metal melting) services: • Cyclife (formally Studsvik) Metal Recycling Facility, Workington, Cumbria; and • Tradebe Inutec, Winfrith, Dorset. LLW incineration locations: • Tradebe, Fawley, Fawley Thermal Treatment Centre, Southampton; • Augean Treatment Ltd, Kent High Temperature Incinerator, Sandwich, Kent; • Grundon, Colnbrook, Berkshire; and • Veolia, Ellesmere Port, Cheshire. LLW supercompaction locations: • Tradebe Inutec, Winfrith, Dorset. VLLW direct disposal locations: • Augean, East Northants Resource Management Facility, Northamptonshire; • Sita, Clifton Marsh Landfill Site, Lancashire; and • FCC Environment, Lillyhall Landfill Site, Cumbria. It is currently assumed that the proposed transport route to these facilities would be by road using approved radioactive waste transport containers.

Management of ILW generated during operation

5.4.5 The following table sets out the details regarding the proposed management of ILW generated during operation.

Table 5-3 Wet-solid ILW

Wet-solid ILW	
Category description	ILW - waste that has a radioactive content exceeding the LLW limit and that does not have a significant heat output.
Typical sources	Wet-solid ILW arises from the reactor water clean-up system, fuel pool clean-up system, the backwashing of filters in the condensate filter system and the LCW system. The following wet solid ILW streams are produced: • sludge from backwashing filters; and • powder resins from filter demineralisers.
Annual volumes	Annual operational volumes arising of wet-solid ILW is expected to be approximately: • 3.0m^3 per year of sludge; and • 8.8m^3 per year of powder resins.
Management strategy	Store in buffer storage tanks in the radioactive waste building. Transfer to the wet solid ILW processing system, where it would be packaged by cement immobilisation in 3m^3 stainless steel drums (expected arisings indicate the wet solid ILW processing system is not required until approximately ten years after commencement of operations). The drums would then be transferred to the ILW storage facility, which can store all of the ILW generated during operation of the Power Station. Transferred for final disposal to the GDF.
Power Station Site facilities	Buffer storage tanks in radioactive waste building. Wet solid ILW processing system in the radioactive waste building (required approximately ten years after the start of operations). ILW storage facility (required approximately ten years after the start of operations).
External facilities	The current assumption is that the GDF would not be available to receive ILW from the Power Station until after completion of the Power Station Site decommissioning phase.

Management of HLW generated during operation

5.4.6 The following table sets out the details regarding the proposed management of HLW generated during operation.

Table 5-4 Dry-solid HLW

Dry-solid HLW	
Category description	HLW - waste that has a radioactive content exceeding the LLW limit and has a significant heat output. Note: Although the HLW generated at the Power Station would be heat-generating immediately upon removal from the reactor, it would be decay-cooled such that it could be managed as ILW at the point of disposal.

Dry-solid HLW	
Typical sources	This waste stream predominately consists of the following: • controls rods; and • reactor components including monitors, probes; and neutron sources.
Annual arisings	Annual operational arisings of dry solid HLW for the two Units is expected to be approximately 2,640 kg/yr.
Management strategy	Stored in the spent fuel pool for approximately 10 years. Packaged into stainless steel canisters and transfer overpacks prior to transfer to the spent fuel storage facility. In the spent fuel storage facility, transfer of canisters from the transfer overpacks to the storage overpacks. Prior to final disposal, repackaged into 3m^3 stainless steel boxes. Final transportation and disposal to the GDF.
Power Station Site facilities	Spent fuel pool. Spent fuel storage facility (required approximately ten years after the start of operations). Cask preparation area (required approximately ten years after the start of operations). Cask transporter garage (required approximately ten years after the start of operations). Repackaging facility to inspect the HLW when the spent fuel pool is no longer available and to provide repackaging capability (only required after completion of the main power plant site decommissioning phase). Decommissioning ILW storage facility to store repackaged decayed HLW and decommissioning ILW arisings (only required after completion of the main power plant site decommissioning phase).
External facilities	The current assumption is that the GDF would not be available to receive ILW from the Power Station until after completion of the Power Station Site decommissioning phase.

5.5 Spent fuel

5.5.1 The following table sets out the details regarding the proposed management of spent fuel generated during operation.

Table 5-5 Spent fuel

Spent fuel	
Category description	Spent fuel is fuel that has been used in a nuclear reactor (fuel assemblies consist of 92 fuel rods containing uranium dioxide fuel pellets, which are stacked in a cladding tube, plugged and seal welded).
Typical sources	Spent fuel would be generated by the two UK ABWRs at the Power Station.
Annual arisings	It is anticipated that the total number of fuel assemblies discharged over 60 years of operation is 9600 per reactor, which gives an annual average arising of 320 assemblies for the Power Station.
Management strategy	Replacement of spent fuel:

Spent fuel	
	• Approximately 224 complete fuel assemblies would be replaced per Unit every outage; • there would be an outage every 18 months for each Unit; and • this is an assumed operational regime that may change during the life of the reactor, and as such, the number of spent fuel assemblies is subject to change during the operational phase. Spent fuel pool: • spent fuel assemblies would be stored in the spent fuel pool for approximately 10 years; • the spent fuel assemblies would be put into stainless steel canisters and transfer overpacks. The stainless steel canisters and overpacks, combined, are referred to as 'casks'; and • the assumption is that each spent fuel cask takes 68 fuel assemblies. Spent fuel storage facility: • the spent fuel cask would be transported to the spent fuel storage facility; • the spent fuel canisters would be transferred from the transfer overpacks to the storage overpacks within the spent fuel storage facility; • the spent fuel storage facility would be designed to accomodate the entire spent fuel and HLW arisings over the lifetime of the Power Station; and • the spent fuel storage facility would be required approximately 10 years after the start of operation of reactor Unit 1. GDF: • prior to disposal to the GDF, the spent fuel would require repackaging into a suitable disposal container, as specified by the GDF operator.
Power Station Site facilities	Spent fuel pool. Spent fuel storage facility (required approximately ten years after the start of operations). Cask preparation area (required approximately ten years after the start of operations). Cask transporter garage (required approximately ten years after the start of operations). Repackaging facility to inspect the spent fuel when the spent fuel pool is no longer available and to provide repackaging capability prior to spent fuel disposal (only required after completion of the main power plant site decommissioning phase).
External facilities	There is current uncertainty when the GDF would be available to receive spent fuel from the Power Station. The storage facilities will be designed to be safely operated and maintained for up to 140 years from end of generation (although this is a worst case and is expected to be reduced to less than 75 years after the end of generation).

6 Radioactive waste and proposed management during decommissioning

6.1.1 Horizon is developing a decommissioning strategy which outlines the approach to be taken in decommissioning the Power Station, with all waste arising (including the radioactive waste) from this process treated using the same overall approaches as for operation. At this early stage, the NDA bodies responsible for the GDF and LLWR have been consulted to ensure that the envisaged radioactive wastes would be able to be disposed of in line with current practices.

6.1.2 The decommissioning strategy will use Horizon's nuclear, safety and environmental principles to provide a framework for how wastes would be handled and managed in order to reduce environmental effects. It will also set out plans to ensure compliance with legislative requirements and to clarify how Horizon will work with the relevant parties.

6.1.3 Horizon has considered a number of high-level strategy options for decommissioning based on the Power Station Site configuration, the key project timing assumptions and various other factors. The conclusion is that a prompt decommissioning strategy is preferred which aims to start the decommissioning of the Power Station Site as soon as is practicable after the end of generation. The strategy is currently estimated to remove the power plant buildings within 20 years of end of generation. As part of the decommissioning process, the following actions would be carried out within the first 20 years:

- final de-fuelling of the reactor Units;
- removal of all materials used in operational plant, systems and facilities;
- treatment and disposal of radioactive and hazardous materials;
- demolition of buildings and structures; and
- nuclear licenced site boundary will be reduced to encompass the remaining facilities, including the spent fuel storage facility, ILW storage facilities for operational and decommissioning wastes and the repackaging facility.

6.1.4 Spent fuel will remain on site in the spent fuel storage facility until the GDF is available (between 75 and 140 years after the end of generation). The following actions would then be required:

- repackaging of spent fuel prior to disposal;
- transfer of stored ILW and spent fuel to the GDF; and
- the final step is for the remainder of the nuclear licenced site to be de-licenced, which will allow alternative use for the land.

6.1.5 These activities may continue to require permitted discharges of radioactivity to air and sea, and the waste stores would be a source of direct radiation.

Small direct radiation doses would also result from the transport of waste material away from the site to authorised disposal sites.

6.1.6 Horizon currently estimates that the following approximate waste quantities would arise from decommissioning activities (see table 6-1). Preliminary waste quantification information is also presented in chapters 4 and 5 of EP-RSR permit application [RD22].

Table 6-1 Estimates of decommissioning waste arisings

Waste type	Waste source	Estimated total waste quantities
Primary Decommissioning LAW	LLW/VLLW from de-planting operations, post-operational clean out, scabbling etc.	18,000 tonnes
Secondary Decommissioning LAW	LLW/VLLW filters, used equipment, personal protective equipment, decontamination resins etc.	8,500 tonnes
Primary Decommissioning ILW	ILW activated materials, segmentation of reactor pressure vessel and reactor internals, control rods etc.	4,000m^3
Secondary Decommissioning ILW	ILW decontamination resins, cutting abrasives etc.	250m^3

7 Availability of LAW treatment and disposal facilities

7.1.1 The operational period of the UK ABWRs is assumed to be 60 years. A prompt decommissioning strategy would aim to remove the power plant buildings within 20 years of the end of generation. However, the operation and decommissioning of the ILW storage facility and spent fuel storage facility would extend several decades beyond that. The production of LAW would continue throughout the operational and decommissioning periods.

7.1.2 The envisaged processing and disposal routes for LAW during operation and decommissioning, will conform to the application of the waste management hierarchy and include:

- metals treatment and recycling;
- volume reduction by incineration;
- volume reduction by high force compaction;
- disposal to permitted landfill (VLLW); and
- disposal to LLWR (LLW).

7.1.3 Extensive facilities for the treatment and disposal of LAW currently exist in the UK and overseas and there is a robust and mature national waste programme (NWP) that oversees the provision of the required capabilities. The services for treatment and disposal are provided either directly with the supply chain or through a Waste Services Contract administered by the LLWR operator, LLWR Ltd.

7.1.4 Horizon strategy for the management of LAW is predicated on the national arrangement described above. LAW from the power station would be despatched off-site for treatment and disposal as soon as reasonably practicable after it was generated.

7.1.5 A key thread of national strategy is to ensure that LAW is suitably segregated at source to maximise the application of the waste hierarchy and thereby minimise the amounts of wastes that are sent for disposal. In this way Horizon would contribute towards one of the key objectives of the NWP which is to make the best use of existing national waste management assets, namely LLWR waste disposal capacity.

7.1.6 It is recognised that in the planned timescales for construction, commissioning and operation of the Power Station there may be technological developments in the field of radioactive waste processing and disposal that could improve on the current strategies. Horizon is therefore maintaining ongoing dialogue with the relevant stakeholders to ensure that proposed approaches remain demonstrably BAT, or could be adjusted to reflect the state of the art.

7.1.7 The continued availability of disposal facilities for LAW is stated in the UK Government policy for the long-term management of solid LLW in the UK [RD6]. It is therefore assumed that new and similar disposal facilities would

be provided after existing facilities, such as the LLWR, have ceased to accept waste, and would have the capacity for the direct disposal of LAW.

7.1.8 The NDA are responsible for implementation of the UK LLW policy and undertake consultation with consignors and suppliers via engagement with the NWP. Horizon will continue to engage with the NWP to ensure disposal routes are optimised.

7.1.9 Horizon would continue to explore alternative disposal routes and strategies, to ensure that the best use was made of existing UK LAW management facilities. If LAW disposal facilities are not available to receive waste, LAW would be stored on-site until a suitable disposal route is available. The storage of this waste would require a variation to the envisaged Environmental Permit, in addition to being regulated by the ONR, through the conditions of the nuclear site licence and in consultation with NRW.

8 Availability of the Geological Disposal Facility

8.1.1 The UK Government white paper 'Meeting the Energy Challenge' [RD23] states that new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed. As such, spent fuel should instead be disposed of to the GDF.

8.1.2 At present there is no national disposal facility for HAW and spent fuel. A GDF is planned for the disposal of spent fuel and HAW but this would not be available until 2040 at the earliest. Once available there would be a phased transfer of packaged waste from existing sites before Horizon would be able to access this facility for disposal of HAW and spent fuel. There is therefore a requirement to manage HAW and spent fuel on site in the intervening period. As stated in paragraph 3.4.3, Horizon's strategy is to store the spent fuel until the GDF is made available. The storage facilities would be sufficient to accommodate arisings from a 60-year operational lifespan, until a GDF is available.

8.1.3 The current conservative estimate of the timescale for which spent fuel storage would be required on the Power Station Site is for a maximum of 140 years after the end of generation. However, work is currently on-going to optimise this and to produce a more accurate estimate of the storage duration. Early work suggests that a period of 70 to 80 years after the end of generation may be a more realistic estimate.

8.1.4 Timescales for spent fuel will also be dependent on the characteristics of the host rock of the future GDF, for example higher strength rock or lower strength rock. The characteristics of the host rock will determine the acceptable levels of thermal heat output from waste packages consigned for disposal and therefore, will determine the required length of on-site storage required to 'cool' the spent fuel prior to disposal.

8.1.5 The timescales for which ILW storage would be required on the Power Station Site are expected to be significantly shorter than those associated with spent fuel. The current assumption based on the availability of the GDF is that ILW disposal will commence in 2130, approximately 45 years after the end of generation.

8.1.6 On-site storage periods for ILW are comparable with other decommissioning projects currently on-going, since the availability of a GDF is also fundamental to the completion of those projects, as well as the use of 'Care and maintenance' periods in the decommissioning plan (for example [RD24]). The storage facilities would be designed to be safely operated and maintained for this period.

9 Conclusions

9.1.1 Radioactive waste and spent fuel would be generated during the operation and decommissioning of the Power Station and would be processed and stored under strict controls prior to disposal. No radioactive waste would be generated during the construction phase.

9.1.2 There are pre-existing UK legislative processes that Horizon must follow and nuclear regulators and technical authorities that Horizon works with regarding the management of radioactive wastes. Horizon will ensure that a consistent and safe approach is adopted for making decisions on waste management for the Power Station. Horizon will ensure that environmental protection legislation for all waste types is complied with.

9.1.3 The fundamentals of managing radioactive waste are to ensure that the amount of waste is minimised and is then disposed of via the most appropriate route. Wherever reasonably practicable, measures will be taken to prevent materials either becoming radioactively contaminated or activated, or as being classified as radioactively contaminated due to the inadvertent placement of inert material adjacent to radioactive material. Recycling and re-use will be applied wherever reasonably practicable.

9.1.4 In order to maximise the effectiveness of decisions made on waste consignment, it is imperative that wastes are accurately characterised as soon as possible following generation and segregated effectively to optimise subsequent waste treatment processes. Mixing or cross-contamination of wastes would be avoided wherever reasonably practicable and wastes would generally be reduced to the lowest achievable classification. All of these considerations would be taken into account when considering handling, treatment and disposal of radioactive waste.

9.1.5 Horizon has developed a management strategy to provide confidence that there are clear systems and procedures in place for ensuring that the radioactive waste and spent fuel would be handled and processed in a safe manner and in compliance with UK legislation.

9.1.6 There will be waste processing systems in place to treat radioactive effluents and gaseous emissions, in order to reduce the activity and volume of discharges to as low as reasonably achievable whilst also ensuring they are below permitted levels prior to discharge. Potential effects are summarised as part of the assessments in chapter D14 (Application Reference Number: 6.4.14).

9.1.7 Any solid radioactive waste and spent fuel produced both during the operational and decommissioning phases would be handled at the facilities on the Power Station Site that are designed for the sole use of the Wylfa Newydd Project. All radioactive waste would be handled and treated in compliance with UK legislation regarding transportation, storage and processing of the radioactive waste.

9.1.8 As the site-specific design progresses, Horizon will liaise with the relevant nuclear regulators to ensure the waste management strategy is compliant with legislation and includes protection of the public, workers and environment to reduce risk SFAIRP through keeping radiological doses ALARP and environmental effects ALARA. All discharges and waste arisings will be reduced to ALARA levels through the application of BAT and use of the waste hierarchy (as required by the Environmental Permit).

10 References

Table 10-1 Schedule of references

ID	Reference
RD1	Office for Nuclear Regulation. 2018. *Generic design assessment of the UK ABWR reactor* [Accessed: 15 January 2018]. Available at: http://www.onr.org.uk/new-reactors/uk-abwr/index.htm
RD2	Department of Energy and Climate Change. 2013. *HM Government, Long-term Nuclear Energy Strategy*. BIS/13/630. Department of Energy and Climate Change. London: The Stationery Office.
RD3	Department of Energy and Climate Change. Department of the Environment (Northern Ireland), Scottish Executive and Welsh Assembly Government. 2009. *UK Strategy for Radioactive Discharges*. Department of Energy and Climate Change. London: The Stationery Office.
RD4	The Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention') 1998.
RD5	Department of the Environment. 1995. *Review of Radioactive Waste Management Policy: Final Conclusions*, Cm 2919. London: The Stationery Office.
RD6	Department for Environment, Food and Rural Affairs, Department of the Environment (Northern Ireland), Department for Trade and Industry, Scottish Executive and Welsh Assembly Government. 2007. *Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom.* PB 12522. Published by the Department for Environment, Food and Rural Affairs. London: The Stationery Office.
RD7	Department of Energy and Climate Change. Department of the Environment (Northern Ireland), Scottish Executive and Welsh Assembly Government. 2016. *UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry.* URN 15D/472. Published by the Department of Energy and Climate Change. London: The Stationery Office.
RD8	Office for Nuclear Regulation, Natural Resources Wales, the Environment Agency and the Scottish Environmental Protection Agency. 2015. *The management of higher activity radioactive wastes on nuclear licensed sites*.
RD9	Nuclear Decommissioning Authority. 2012. *Industry Guidance. Interim Storage of Higher Activity Waste Packages – Integrated Approach*. The Nuclear Decommissioning Authority, Moor Row, Cumbria.
RD10	Isle of Anglesey County Council. 2014. *New Nuclear Build at Wylfa Supplementary Planning Guidance*.
RD11	Department of Energy and Climate Change. 2011. *The Energy Act 2008. Funded Decommissioning Programme. Guidance for New Nuclear Power Stations.* URN 11D/924. Department of Energy and Climate Change. London: The Stationery Office.
RD12	Department of Energy and Climate Change. 2011. *Waste Transfer Pricing Methodology for the disposal of higher activity waste from new nuclear power stations.* URN 11D/923. Department of Energy and Climate Change. London: The Stationery Office.
RD13	Department for Environment, Food and Rural Affairs, Department for Business Enterprise and Regulatory Reform, Wales Office and Northern Ireland Office.

ID	Reference
	2008. *Managing Radioactive Waste Safely. A Framework for Implementing Geological Disposal. A White Paper by Defra, BERR and the devolved administrations for Wales and Northern Ireland*. Cm 7386.
RD14	Department of Energy and Climate Change. 2011. *Overarching National Policy Statement for Energy (EN-1)*. URN 11D/711. London: The Stationery Office.
RD15	Department of Energy and Climate Change. 2011. *National Policy Statement for Nuclear Power Generation (EN-6)*. URN 11D/716. London: The Stationery Office.
RD16	UK Safeguards Office. 2010. *Guidance on International Safeguards and Nuclear Material Accountancy at Nuclear sites in the UK*. London: The Stationery Office.
RD17	Department for Business, Energy and Industrial Strategy and the Nuclear Decommissioning Authority. 2016. *Radioactive Wastes in the UK: UK Radioactive Waste Inventory Report.* The Nuclear Decommissioning Authority, Moor Row, Cumbria.
RD18	Horizon. 2015. *Radiological reference state of Wylfa Newydd Site*. WN01.03.03-S3-EWM-REP-00001
RD19	Amec Foster Wheeler. 2016. *Radiometric and Radiochemical Analysis of Wylfa Rock and Soil Samples*. 206352-0000-DM00-RPT-0001
RD20	Centre for Environment, Fisheries and Aquaculture Science (CEFAS). 2017. *Radioactivity and Food in the Environment 2016.* RIFE-22.
RD21	Nuclear Industry Safety Directors Forum. 2009. *An aid to the design of ventilation of radioactive areas*. Issue 1. NVF/DG001.
RD22	Horizon. 2017. *Wylfa Newydd Project Radioactive Substances Regulation – Environmental Permit Application*. WN0908-HZCON-PAC-REP-00003.
RD23	Department for Business Enterprise and Regulatory Reform. 2008. *Meeting the Energy Challenge. A White Paper on Nuclear Power.* Cm 7296. London: The Stationery Office.
RD24	Magnox North (2008). *Environmental statement in Support of the Application to Decommission Wylfa Nuclear Power Station.* As required by Statutory Instrument 1999 No. 2892: Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (as amended)

HORIZON
NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.4.98 ES Volume D - WNDA Development App D14-2 - Analysis of accidental releases

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1 Introduction

1.1.1 A consideration of effects from accidental releases is included within this appendix to fulfil two requirements.

- The April 2016 Scoping Opinion advises that Horizon should take into account the requirements of article 15 of the new Environmental Impact Assessment directive 2014/52/EU which states that for certain projects (because of their vulnerability to major accidents, and/or natural disasters) "*it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment*".
- The requirements of the Espoo treaty [RD1] whereby when severe accidental impacts, however unlikely, are associated with a project, the parties will engage in consultation.

1.1.2 This appendix presents background information on the safety features of the UK Advanced Boiling Water Reactor (UK ABWR) and an assessment of the environmental effects that might result in the event of accidental release scenarios.

1.1.3 For new nuclear designs, the safety of a generic reactor design is assessed under the Generic Design Assessment (GDA) process, overseen by the Office for Nuclear Regulation (ONR) and the environment agencies. In December 2017, ONR, the Environment Agency and Natural Resources Wales granted Design Acceptance Confirmation and a Statement of Design Acceptability for the UK ABWR reactor design [RD2].

1.1.4 The safety of a site-specific implementation of that design of nuclear reactor is assessed as part of the review process undertaken prior to granting of the nuclear site licence by the ONR [RD3].

1.1.5 The general approach to safety design follows safety assessment, analysis and verification and is outlined in both International Atomic Energy Agency (IAEA) and ONR guidance.

1.1.6 IAEA guidance (see paragraph 3.2.4) can be summarised as follows.

- Safety assessment is an iterative and systematic process that is carried out throughout the design process to ensure that all the relevant safety requirements are met by the design of the plant.
- A safety analysis of the plant design is conducted in which methods of both deterministic and probabilistic analysis are applied. On the basis of this analysis, the design basis for items important to safety would be established and confirmed. It would also be demonstrated that the plant as designed is capable of meeting any prescribed limits for radioactive releases and acceptable limits for potential radiation doses for each category of plant states, and that defence in depth has been effected.

- The independent verification should be carried out under the responsibility of the operating organization by a team of experts who are, as far as possible, independent of the designers and those performing the safety assessment.

1.1.7 This appendix describes the following.

- The main features of the UK ABWR reactor, including safety provisions and design and system features which lead to the containment of radioactive substances.
- Aspects of the development of the nuclear safety case relevant to accidental releases and the identification of candidate reference accidents.
- The reference accidents selected for assessment.
- Assumptions and methods used to calculate doses resulting from releases, and the results of the dose assessment.
- Mitigation via emergency planning.
- An impact assessment based on the likely required countermeasures for the reference accidents.

1.1.8 Detailed documentation on the various aspects of the UK ABWR safety case are available in the relevant chapters of the GDA reference material [RD4], particularly the generic pre-construction safety report (PCSR), but a summary of the information is presented here. In addition, Horizon has prepared an assessment as required by Article 37 of the Euratom treaty document, which includes consideration of doses to the local population and the nearest member state resulting from routine and accidental releases.

The Control of Major Accident Hazards assessment

1.1.9 An assessment of scenarios relevant to the Control of Major Accident Hazards (COMAH) regulations will be undertaken for the Power Station. At present the potential scenarios and relevant inventories are being compiled. An assessment will be developed as this work progresses. It is expected that the site will be managed so that the COMAH Regulations do not apply during the construction stage, and that at operation, the site will be a Lower Tier COMAH site.

2 Description of the Power Station

2.1.1 The general layout of the Power Station is shown in figure A2-1 in the Introduction to the project and approach to the EIA Figure Booklet (Application Reference Number: 6.1.11) and figure D14-2 in the WNDA Development figure booklet (Application Reference Number: 6.4.101). The buildings, structures and systems within the site are arranged into the following groupings.

- Main plant – those parts of the Power Station that enable generation of power. Two UK ABWR units would operate on a single power island, comprising:
  - Unit 1 buildings, structures and facilities;
  - Unit 2 buildings, structures and facilities; and
  - Cooling Water System (excluding common structures).
- Common plant – those parts of the Power Station that service the generation of power, including:
  - shared service building, Cooling Water System common structures; and
  - combined radioactive waste facilities and buildings for both units.
- Supporting facilities, buildings, structures and features – those parts of the Power Station that are integral to the Power Station, but would not be process related.

2.1.2 The main plant components within the Power Station Site are on the twin unit power island which includes two reactor buildings, two turbine buildings and two control buildings and a common service building.

2.1.3 Some of the Cooling Water System elements are common to both generating units, namely the cooling water intake, pumping plant, seal pit, discharge tunnel and outfall and the reserve ultimate heat sink.

2.2 Overview of UK ABWR

2.2.1 Boiling water reactors (BWR) are one of the most common types of nuclear power generating plants. BWR technology has continued to evolve and the first advanced BWR (ABWR) was built in Japan and commenced commercial operation in 1996. The ABWR design introduced features to enhance safety and reliability as well as making the plant easier to operate and maintain. Another key feature was modular design, which resulted in shorter construction times.

2.2.2 The design reference for the UK ABWR is the first ABWRs (Kashiwazaki-Kariwa units 6 and 7, plus improvements implemented at Shika unit 2, Shimane unit 3 and Ohma unit 1, in addition to incorporation of post-Fukushima enhancements).

2.2.3 The UK ABWR will incorporate further safety enhancements and additional resilience against severe external hazards. These include aircraft impact countermeasures and post-Fukushima countermeasures based on learning

from that event. Specifically, the UK ABWR will include enhancements such as:

- enhanced strategies for comprehensive management of accidents;
- provision of diverse connections for mobile equipment;
- systems to provide alternative and flexible water injection for cooling the reactor and the spent fuel storage pool;
- structural enhancements for protection against aircraft impacts to primarily protect the reactor and control buildings;
- mobile equipment to provide alternative power supplies and coolant injection capability, as well as heavy machinery to maintain plant access in the event of wide-spread disruption;
- engineered measures to enable manual operation of specific isolation valves if power supplies are lost; and
- robust instrumentation that will provide credible data in the hostile environment of a severe accident.

2.2.4 In the UK ABWR, ordinary (light) water is used to remove the heat produced inside the reactor core by the thermal nuclear fission process. The water coolant boils in the reactor pressure vessel (RPV) and the resulting steam passes through a steam separator and dryer above the core and then, via the main steam lines, to the turbine generator which generates electricity. This is called the nuclear steam supply system. The steam passes through condensers where it is water-cooled and returns as feedwater to the reactor. The water coolant also acts as a moderator to enable thermal fission.

2.2.5 The reactor building is a reinforced-concrete structure with a steel frame supporting a reinforced-concrete roof. The external structure of the reactor building provides protection against aircraft impact.

2.2.6 The nuclear steam supply system is comprised of the following systems:

- RPV and internal components;
- reactor recirculation system;
- control rod drive system; and
- nuclear boiler system.

2.2.7 The RPV houses the reactor core (nuclear fuel) which is the heat source for steam generation. The vessel contains the heat, produces steam within its boundaries and serves as one of the fission product barriers during normal operation.

2.2.8 The reactor recirculation system has two main functions:

- provision of forced circulation of reactor coolant for energy transfer from the fuel to the coolant and, as a result, generates a larger amount of steam compared to passive circulation; and
- variation of reactor power by changing the recirculation flow by adjusting the reactor internal pumps speed.

2.2.9 The control rod drive system controls changes in core reactivity during power operation by movement and positioning of the neutron absorbing control rods within the core. The drive mechanism for this mode of operation is the fine motion control rod drive which uses two different power sources for shutdown: an electric motor drive for normal operation and a conventional hydraulic drive for rapid insertion, in the event of an emergency shutdown of the reactor (colloquially known as a SCRAM).

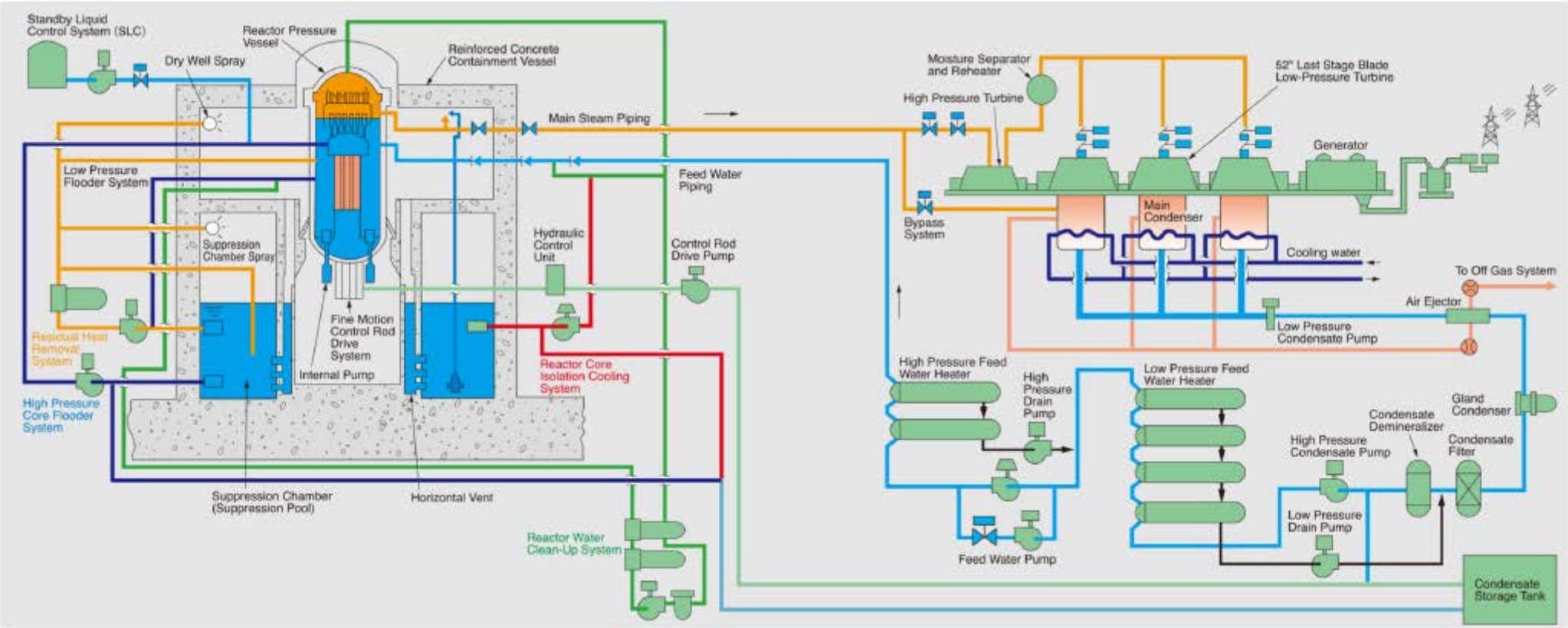
2.2.10 The nuclear boiler system is divided into two subsystems:

- the main steam system which consists of four steam lines to direct the steam flow from the RPV to the main turbine; and
- the feedwater system consists of two lines that transport the feedwater from the condensers in the turbine building back to the RPV.

2.2.11 The power conversion system is designed to produce electricity by passing the steam generated in the RPV through turbines, collect and condense this steam into water and then link back to the nuclear steam supply systems. Steam is fed first through a single high pressure turbine; it is then reheated and fed through three low pressure turbines. The exhaust steam is condensed in a single condenser, which is supplied with cooling water from the sea by three circulating water pumps; heat extracted from the condensate is removed by the cooling water and discharged to the heat sink (the sea). The condensate is then returned to the RPV via the feedwater system.

2.2.12 Figure 2-1 shows a schematic of the configuration and the main systems of the UK ABWR.

Figure 2-1 Schematic diagram showing the configuration and main systems of the UK ABWR



2.3 Safety features of the design

2.3.1 Many plant features have intrinsic safety functions during normal operation, but there are also specific safety systems which are invoked in the event of non-operational scenarios, as described in section 3.

2.3.2 Engineered safety systems comprise the reactor containment systems and the emergency core cooling system (ECCS). These are provided in order to suppress or prevent fuel damage or the potential discharge of large amounts of radioactive substances, in the unlikely event of failure or damage to structures, systems and components (SSC) of the reactor installation.

2.3.3 The engineered safety systems are the principal means of delivering the key safety functions of containment and long-term heat removal. The containment systems are provided in order to:

- minimise the release of radioactive materials to the environment (the primary containment vessel (PCV) and reactor building); and
- ensure the integrity of the primary and secondary containment structures is maintained.

2.3.4 Individual systems which are included in the ECCS and the containment systems are as follows:

- ECCS:
  - high pressure core flooder;
  - reactor core isolation cooling system;
  - automatic depressurisation system;
  - low pressure flooder system;
  - filtered containment venting system; and
  - emergency generators.
- Containment systems:
  - PCV;
  - primary containment isolation system;
  - PCV gas control system;
  - containment heat removal system;
  - drywell cooling system;
  - reactor building; and
  - standby gas treatment system.

Emergency Core Cooling system

2.3.5 The ECCS is provided to maintain cooling to the reactor and prevent fuel temperature limits being exceeded in the event of faults, which could result in fuel damage. The ECCS provides the principal means of core heat removal and long-term cooling in fault scenarios.

2.3.6 The ECCS configuration comprises three redundant divisions provided with high pressure and low pressure water injection systems, which are powered from the respective divisions of the redundant emergency diesel generator systems, in the event of loss of off-site power (LOOP). The ECCS injection network is comprised of one reactor core isolation cooling system train and two high pressure core flooder trains for high pressure injection, and three low pressure flooder system trains for low pressure injection in conjunction with the automatic depressurisation system which assists the injection network under certain conditions.

Containment systems

2.3.7 The reactor containment systems have the function of isolating the radioactive substances generated in the reactor from release to the environment. Leakage rates are kept below a specified low level, thus minimising the amount of radioactive substances discharged into the atmosphere.

Primary containment facility

2.3.8 The PCV is a reinforced-concrete structure with an internal steel liner. It consists of components such as a cylindrical drywell surrounding the RPV, a cylindrical suppression chamber and a basemat.

2.3.9 In the event of a loss of coolant accident (LOCA, see section 3), the steam-water mixture released into the drywell is fed into the suppression pool water through the vent pipes. The steam is cooled and condensed by this pool water, thus suppressing the pressure rise in the drywell. Any radioactive substances are retained inside the containment vessel.

Primary containment isolation system

2.3.10 The main role of the primary containment isolation system is to provide protection against the dispersion of radioactive material from the primary containment to the environment during normal operations as well as fault conditions. This is achieved by completely isolating the system pipes penetrating the primary containment and thus forming a barrier to confine the radioactive material within the primary containment boundary.

PCV gas control system

2.3.11 The PCV gas control system consists of the flammability control system and the atmospheric control system with the principal role of maintaining an inert and non-explosive atmosphere within the PCV. The systems are designed to prevent build-up of hydrogen and oxygen which could be generated within the reactor and released into the PCV in a design basis event (see section 3).

- The flammability control system is provided to control the potential build-up of hydrogen from the radiolysis of water.
- The atmospheric control system is provided to establish and maintain an inert atmosphere within the PCV except during shutdown for refuelling outages or equipment maintenance and during limited periods of time to permit access for inspection at low reactor power.

Containment heat removal system

2.3.12 The principal role of the containment heat removal system is to prevent excessive containment temperatures and pressure, thus maintaining containment integrity in the long term following a design basis event or a beyond design basis event including severe accidents (see section 3).

Drywell cooling system

2.3.13 The drywell cooling system is designed for the following purposes.

- To maintain the required thermal environment and humidity so that the components in the drywell operate in a proper manner during plant normal operation and in the event of a LOOP.
- To cool the atmosphere in the drywell so that the working environment temperature during plant inspection and maintenance is acceptable for personnel access.

Secondary containment facility - reactor building

2.3.14 The secondary containment boundary completely surrounds the PCV except for the basemat, and together with the clean zone, comprises the reactor building. The secondary containment encloses all penetrations through the PCV and all those systems external to the PCV that may become a potential source of radioactive release after an accident.

2.3.15 During normal plant operation, the secondary containment areas are kept at a negative pressure with respect to the environment and clean zone by the heating, ventilation and air conditioning (HVAC) system. Radioactive substances (fission products, activation products) which, following an accident, may leak from the primary to secondary containment are processed and captured by the standby gas treatment system, which ensures adequate delay time before discharge to the environment. The HVAC exhaust systems and standby gas treatment system are located within the secondary containment to ensure collection of any leakage.

2.3.16 The building gaseous effluents are monitored for radioactivity. If the level of radioactivity rises above defined levels, the secondary containment discharge can be routed through the standby gas treatment system, which incorporates high efficiency particulate air filters and charcoal beds to remove radioactivity before release.

Severe accident management systems

2.3.17 The severe accident management systems provide backup safety facilities, separate from the engineered safety features, to deliver safety functions in the event of beyond design basis events that potentially lead to multiple losses of safety facilities (see section 3).

2.3.18 The backup safety facilities are designed to deliver the following safety functions.

- Provide cooling water to the reactor core in order to prevent reactor core damage and to maintain reactor core cooling, in case of station blackout and/or loss of all function of digital control and instrumentation equipment.
- Supply water to the PCV spray header, directly cooling the upper drywell atmosphere and scrubbing airborne fission products.
- Provide water to the lower drywell under the severe accident condition of RPV failure to remove decay heat from molten core.
- Provide water to the reactor well to prevent PCV flange failure due to excess temperature.
- Provide makeup water to the spent fuel storage pool to remove decay heat and to maintain the pool water level.
- Provide a filtered vent to prevent damage of the PCV due to overpressure in the event of a severe accident.

Emergency generators

2.3.19 Standby alternating current power generation would provide power to the Power Station safety systems that would be required to shut down and cool the reactor in the event of a LOOP.

2.3.20 As a generic design, the UK ABWR is designed to be kept in a stable state by utilising on-site provisions for seven days and DC battery can supply power to site for at least 24 hours.

2.3.21 In order to provide the necessary capacity, resilience and reliability to meet the demands of the Power Station, the following equipment would be installed at the Power Station Site.

Emergency Diesel Generators

2.3.22 The role of the emergency diesel generators is to supply the power needed to shut down the reactor safely when off-site power is lost, and to supply power to the electrical systems supporting the delivery of safety functions if a LOCA (see section 3) occurs simultaneously with a LOOP. The emergency diesel generators are fully independent of each other and are each housed, together with their related ancillary plant, within separate buildings.

Backup Building Generators

2.3.23 The backup building will provide alternative safety management capacity during an emergency if the main control building and associated safety systems are not operational.

2.3.24 Two backup building generators and associated equipment would service each generating unit, and would be installed in a single backup building. The backup building generators are rated to supply power to the backup building equipment when off-site power is lost.

3 Accident scenarios

3.1.1 A key component of the nuclear site licensing process is the nuclear safety case. This is a set of documents that describe the radiological hazards in terms of a facility or site and modes of operation (including potential undesired modes) and the measures that prevent or mitigate against harm being incurred. The safety case should provide a coherent demonstration that relevant standards have been met and that risks to persons have been reduced to As Low As Reasonably Practicable (ALARP).

3.1.2 Plant safety is assured by several nested layers of protection. The plant is protected by safety-related SSCs. Safety functions and the SSCs that provide them are then classified according to their importance in ensuring plant safety. Deterministic and probabilistic safety assessments demonstrate that the resulting design reduces risks to ALARP.

3.1.3 The UK ABWR design aims to provide four fundamental safety functions:

- control of reactivity;
- fuel cooling;
- long-term heat removal; and
- confinement and containment of radioactive materials.

3.1.4 As part of the safety evaluation, a fault schedule is developed to analyse systems and equipment failure modes. This details the sequence of events leading to specific failures and documents the likely frequency of occurrence of the initiating events. The fault schedule will demonstrate adequate safety measures for each design and beyond design basis event:

- for each event, the schedule identifies the categories of the required UK ABWR safety functions;
- for each UK ABWR safety function, the schedule identifies the claimed SSCs and their safety classifications; and
- for each UK ABWR safety function, the schedule identifies the SSCs that are passive, initiated automatically or initiated manually.

3.1.5 For frequent faults (those with a frequency of occurrence of $>10^{-3}$ per year – see section 3.2), two diverse means of protection are required to deliver the fundamental safety functions. The SSCs which form the principal means of delivering each safety function are termed Class 1 and those providing the secondary means are at least Class 2.

3.1.6 Class 1 safety systems are provided with sufficient redundancy to ensure that even in the event of failure, the function can still be delivered. Safety systems and the systems that support them are physically separated to prevent common cause failure of all systems delivering an essential function due to an internal hazard. The systems providing this function would also be independent of each other to avoid common cause failure due to the loss of a support system.

3.2 Identification of accident scenarios

3.2.1 Based on the UK ABWR design, the fault schedule was developed from the systematic identification of initiating events, which are grouped based on similar fault sequences and demands on safety functions during the event.

3.2.2 The initiating events to be analysed were initially identified by using logic tree analysis. The scope of the logic tree analysis involved all plant operating modes and plant facilities. Abnormal states which may lead to damage to nuclear fuel or the reactor coolant pressure boundary, and potentially lead to the release of radioactive materials from the nuclear facility were identified. Next, the causes of abnormal states were identified for each abnormal state and grouped together. Finally, postulated disturbances were identified for each cause.

3.2.3 In addition, a bounding fault is identified for each fault group in terms of severity of consequence among the fault group. These are then used for further analysis, and to establish the list of initiating events to be evaluated by probabilistic safety assessment (PSA), design basis analysis, beyond design basis analysis and severe accident analysis.

3.2.4 Bounding faults identified in the logic tree analysis were compared with IAEA Specific Safety Guides ([RD5], [RD6], [RD7]) and the US-ABWR design control document [RD8], and the completeness of bounding faults was confirmed. As a result, bounding faults for the UK ABWR are almost the same as those in the IAEA Safety Guides and the US-ABWR design control document.

3.2.5 Full details of the fault schedule for the UK ABWR can be found in the GDA PCSR [RD4] and accompanying documentation. Initiating events are grouped according to their plant impact and an indication of their frequency of occurrence is provided. The fault schedule identifies both frequent and infrequent design basis faults, and some beyond design basis faults, but does not identify severe accidents.

Probabilistic Safety Assessment

3.2.6 International best practice recommends that PSA should be used to inform the design process and help ensure the safe operation of the site and facilities [RD9]. PSA is an established technique to numerically quantify risk measures and determines what undesired scenarios can occur, with what likelihood, and what the impact could be.

3.2.7 A full-scope Level 3 PSA, which considers risks to the public from off-site releases, has been developed for the UK ABWR adopting a general approach.

- All sources of radioactivity on the Power Station Site are identified, as are all postulated initiating events which can result in a release of the radioactivity.
- The faults and hazards (both internal and external) which can result in a postulated initiating event are identified for all modes of operation.
  - Events may be consolidated into bounding events.

- Unlike the design basis analysis (described below), the probabilistic assessment should not exclude events of low dose or low frequency.

- The preliminary PSA analyses the risks to the public and workers arising from all events. This takes into account any passive safety features and claimed safety measures, but at this time does not take benefit from any additional risk reduction measures such as systems that have an appreciable reliance on operator action.
- The annual summated risks are compared with the limits and targets for public risk.

Design Basis Analysis

3.2.8 Design basis analysis is a further method for demonstrating the adequacy of the design of the plant. The approach uses conservative assessment methodologies and/or assumptions to provide high confidence that the design will achieve its design intent.

3.2.9 The purpose of design basis analysis is to assess all the initiating faults/events identified as falling within the design basis. The ONR Safety Assessment Principles (SAPs) [RD9] define the design basis as "*the range of conditions and events that should be explicitly taken into account in the design of the facility, according to established criteria, such that the facility can withstand them without exceeding authorised limits by the planned operation of safety systems*".

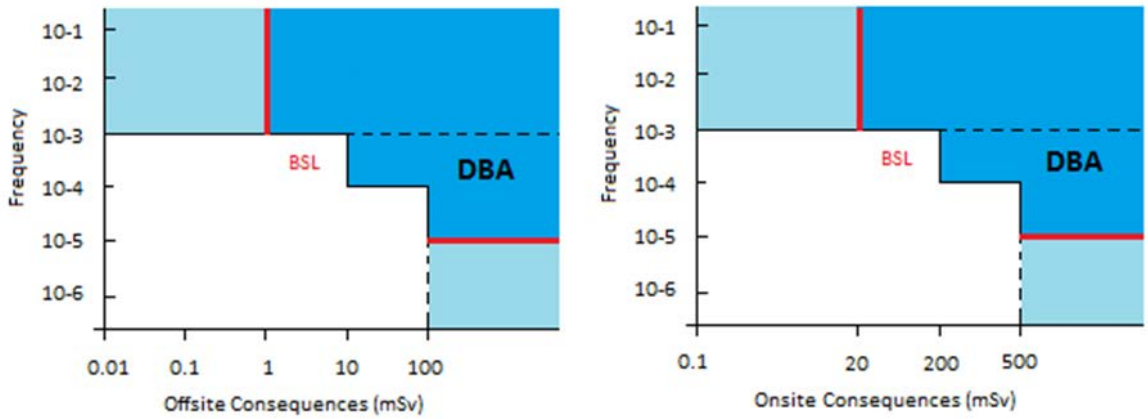
3.2.10 The fault frequency estimates are also used in combination with the unmitigated consequences to determine the further fault analysis that each initiating fault/event should be subject to, and by extension the number of diverse safety measures providing the required safety function (i.e. frequent faults recognise the possibility of common cause failures in the primary protective measures which may defeat provisions of redundancy).

3.2.11 The initiating events/faults consequences and frequencies are captured in the fault schedule. The design basis fault frequency is classified as either 'frequent' ($>10^{-3}$ per year) or 'infrequent' ($\leq 10^{-3}$ per year).

3.2.12 The lower consequence threshold of the design basis region is the basic safety limit, which is the legal limit for annual doses to members of the public of 1milliSievert (mSv) or workers (20mSv) identified within safety assessment principle Target 4 [RD9]. Frequent ($>10^{-3}$ per year) low consequence (<basic safety limit) events are considered to be foreseeable events and are assessed as part of normal operations assessment.

3.2.13 Figure 3-1 shows the relationship between frequency and dose that defines the basic safety level interface with the design basis analysis.

Figure 3-1 Design basis region for off-site and on-site consequences



3.2.14 By this approach, the bounding fault sequences in the design basis analysis should have core damage frequencies below 10^{-7} per year, thus representing a plant design that is of low overall risk (as confirmed by the complementary PSA, see above).

Beyond Design Basis Analysis

3.2.15 In addition to the assessment of the design basis faults discussed above, the ONR also expects the licensee to consider "*fault sequences initiated by internal and external hazards beyond the design basis should be analysed applying an appropriate combination of engineering, deterministic and probabilistic assessments*".

3.2.16 The purpose of beyond design basis analysis is to:

- confirm that no cliff-edge effects exist (i.e. there is no potential for sudden and significant consequences associated with events located just outside the design basis boundary (e.g. 9 x 10^{-6} per year));
- provide an input into the severe accident analysis; and
- provide inputs into the PSA to assess whether the overall risk targets are met and confirm that no single fault type dominates the risk profile.

3.2.17 The beyond design basis analysis considers fault and hazard initiating events that have been excluded from the design basis analysis on the basis of low frequency ($<10^{-5}$ per year) but whose frequency is not sufficiently low ($>10^{-7}$ per year) for them to be discounted completely.

Severe Accident Analysis

3.2.18 While the combination of design basis analysis, beyond design basis analysis and PSA should ensure that all credible fault scenarios are identified, and suitable and sufficient safety measures are incorporated into the design to prevent/protect/mitigate against the consequences and ensure that the residual risk is ALARP, the ONR also expects that licensees undertake severe accident analysis.

3.2.19 A severe accident is defined in the SAPs [RD9] as "*an accident with offsite consequences with the potential to exceed 100mSv, or [lead] to a substantial unintended relocation of radioactive material within the facility that places a demand on the integrity of the remaining physical barriers*".

3.2.20 The main purpose of severe accident analysis is to demonstrate the plant safety features included in the design to mitigate the consequences of rare events that involve severe core damage and/or core relocation. The rare events are derived from highly pessimistic assumptions, such as multiple failures of safety systems provided to fulfil fundamental safety functions.

3.2.21 Severe accident analysis looks at the accident progression in the event that the identified design basis safety measures fail. It is primarily concerned with accidents with the potential to result in the loss of coolable core geometry and hence significant release of radioactive fission products from within the fuel cladding boundary.

3.3 Reference accidents identified from the fault analysis

3.3.1 A review of the fault schedule was undertaken and three reference design basis accidents (DBA) were identified from the list of faults identified using the methods described in section 3.2. The DBAs presented were chosen on the basis of their radiological consequences. Their predicted frequency of occurrence is greater than 10^{-5} per year.

3.3.2 In addition to the DBAs, a Severe Accident (SA) was chosen which is considered to be well beyond the design basis in terms of likelihood, and involves making a number of pessimistic assumptions concerning the failure of safety-classified plant. The SA is presented to demonstrate plant safety features to mitigate consequences of a rare event that involves core meltdown (including ex-vessel scenarios) and potential radiological releases.

3.3.3 An SA is an accident that will require the implementation of a severe accident management regime and the activation of key response measures. The SA considered has a very low predicted frequency of occurrence and is presented for illustration of the potential impact of such rare events.

3.3.4 The accidents identified result in atmospheric releases. No accidents involving foreseeable significant liquid effluent releases have been identified (see section 3.5).

3.3.5 The selected reference accidents are:

- Reference DBAs:
  - Loss of Coolant Accident (LOCA);
  - Fuel Handling Accident (FHA); and
  - Off-gas system failure (OGF).
- Severe Accident scenario (SA):
  - core melt scenario.

3.3.6 The quantities of noble gases and selected radionuclides which are significant from the point of view of health, along with the total activity released, are presented in table 4-3 in section 4.1.

Loss of Coolant Accident

Accident scenario

3.3.7 For the design basis LOCA, coolant loss is assumed to occur through a limiting line (i.e. feedwater line or main steamline) which suffers a double ended guillotine rupture inside the PCV. All radioactivity in the coolant and an 'iodine spike' originating from assumed pre-existing minor pin hole defects in the fuel cladding are immediately released into the containment from the ruptured pipe.

3.3.8 Any leakage from the PCV to the reactor building is released from the plant stack via the standby gas treatment system and is considered as a pathway to the environment for radioactive material. The design leakage rate of the primary containment is 0.4% containment volume/day at design pressure and atmospheric temperature. When due account is taken of the primary containment pressure/temperature rise associated with the LOCA transient the leak rate is calculated to be 0.6% containment volume/day for the first 10 hours of the event.

Release to the environment

3.3.9 It is assumed that during a LOCA of this type, of the iodine available for release, 91% is in elemental form, 4% is in organic form and the remaining 5% is in particulate form. Once released to the containment atmosphere, a number of factors further reduce the amounts available for release to the environment. These include radioactive decay, removal processes and leakage to other plant areas. The two credible pathways for the release of fission products to the environment are leakage from the PCV into the reactor building and via the main steamline isolation valves.

Fuel Handling Accident

Accident scenario

3.3.10 During a refuelling operation, a fuel assembly is moved over the top of the core. An equipment failure is assumed to occur while the fuel assembly is raised over the core, allowing the assembly, fuel grapple mast and head to fall on top of the core impacting a group of four assemblies, in turn causing fuel rods to fail. The accident is assumed to occur at the earliest time after shutdown that fuel handling operations can begin.

3.3.11 When fuel rods in the dropped and impacted assemblies fail, radioactive gases are released into the water of the reactor cavity. These gases pass from the reactor water to the reactor building fuel handling area. In response to the increased radioactivity level resulting from the gas release, high radiation alarms on the reactor building operational floor are activated, alerting plant personnel to the situation and initiating the isolation of the reactor building HVAC system. The standby gas treatment system is automatically initiated.

3.3.12 A maximum of two bundles or 184 fuel rods are assumed to be damaged in the accident, out of a total of 872 bundles.

3.3.13 The activity in the gap and plenum regions of the failed fuel is released to the reactor water. The fragments generated by the impact are much larger than aerosols and do not disperse on the pool surface; therefore, radionuclides other than noble gases, halogens and alkali metals are not included in the release estimate.

3.3.14 Chemical fractions of the iodine released to the environment are taken to be 96% elemental and 4% organic iodine. Pool decontamination factors are not credited for organic and elemental iodine; however, the particulate is retained in the pool.

Release to the environment

3.3.15 It is assumed that the reactor building ventilation system is isolated and that upon the receipt of a high radiation alert on the operational floor that the standby gas treatment system is initiated. This is an automatic response to the detection of increased radioactivity from the surface of the pool. As the reactor building has been isolated, the only pathway to the environment is through the standby gas treatment system which releases via the stack. Radioactive decay over the time taken to draw the radioactive air from the reactor building, combined with 99.9% filter efficiency of the standby gas treatment system for all iodine species, reduces the discharge to the environment.

3.3.16 The high radiation level associated with the FHA would be automatically detected by the reactor building gamma monitors. Any delay in terms of environmental release due to the detection time of the radiation monitoring system is considered negligible when considered in the context of the assumed 24-hour period of release.

Off-Gas system Failure

Accident scenario

3.3.17 A number of failure scenarios are considered for the Off-Gas (OG) system:

- rupture of a line or an equivalent gross system failure;
- failure of a thin wall in a process line;
- corrosion of a process line by turbulent flow; or
- process line fails at a thin wall or junction caused by stress concentration due to flow-induced or external vibration.

3.3.18 Ruptures and failures are assumed to occur in the upstream section of a process line in this scenario as the radioactive concentration of the gas is higher.

3.3.19 A rupture or break in the OG system is assumed to be discovered by a high radiation level signal in the turbine hall. The automatic isolation valve for the system normally closes within 10 minutes in response to this signal. However, it is conservatively assumed in this scenario that a manual isolation of this system is undertaken by the plant operator which takes one hour following detection of the high radiation level.

3.3.20 Key parameters are assumed to be the same as for a LOCA.

Release to the environment

3.3.21 The release of fission products from the OG system is assumed to be isolated one hour after the detection of high radiation levels due to operator action. The pipe break is assumed to occur before the charcoal beds, so the radioactivity of the gas in the system is not reduced.

3.3.22 Radioactivity is instantaneously released into the turbine building in this scenario. The release to the environment is assumed to be at ground level and operations that divert the release to the Reactor Building stack are not credited.

3.4 Core melt accidents

3.4.1 Core melt scenarios are considered as part of the severe accident analysis for the UK ABWR. The predicted frequency of such event falls well below that quoted as the threshold for the beyond design basis analysis.

3.4.2 The assessment that follows is included to provide information on the potential consequences of a multiple failure of safety-related measures that result in a damaged core. For the sake of creating the analytical basis of a damaged core, a number of pessimistic assumptions regarding plant and operational staff responses have been necessary.

3.4.3 In the main, initial plant response is based on ‘beyond design basis’ systems in a conservative timeframe, until such time that recovery of ‘design basis’ systems can reasonably be claimed. For this reason, no specific initiating event is identified to cause the interruption of feedwater to an operating reactor.

Severe Accident scenario

3.4.4 For a reactor operating at full power, a loss of feedwater leads to a rapid decrease in reactor water level. The transient leads to an emergency reactor shutdown SCRAM or alternatively the standby liquid control system will initiate in the unlikely event that control rods fail to insert into the core. Core cooling should normally be delivered by the main condenser of the plant system; however, this is assumed to be unavailable in this scenario as it is not a safety-classified system.

3.4.5 At this point the high pressure ECCS is expected to start, but in this instance it is assumed to fail. The water inventory in the core is not replenished and continues to be reduced by boiling due to decay heat.

3.4.6 When the water level falls below 20% of the bottom of active fuel, two safety release valves are opened manually in order to depressurise the RPV by relief into the suppression pool within the PCV, so the event progresses at low pressure. This will normally allow for initiation of the low pressure injection feature of the ECCS but it is also assumed to fail in this accident scenario, as it is part of the residual heat removal system which is assumed to be wholly unavailable.

3.4.7 In the absence of any core cooling or water injection, the decay heat boils off the remaining core coolant inventory and the fuel becomes exposed. Steam generated during this process continues to pass to the suppression pool via safety release valves.

3.4.8 As the water level in the RPV decreases, the fuel is cooled by steam flow which is a poor method of heat removal and fails to halt rising fuel and cladding temperatures once the water level falls below 20% of bottom of active fuel. Fuel cladding failure occurs due to creep, melting or ballooning at elevated temperatures.

3.4.9 Rising fuel temperatures cause fission product gases to migrate from the pellet to the pellet cladding gap which is not accredited as a retention measure at high cladding temperatures. Water-metal reactions can lead to hydrogen gas production; however, hydrogen burning within the primary containment of the UK ABWR is considered implausible as there is a nitrogen injection system in place to maintain an inert atmosphere.

3.4.10 Damaged fuel melts and slumps to the bottom of the core due to gravity. The melted fuel-containing material (corium) perforates the core support plate and the molten debris drains through the failure opening into the lower drywell as a debris jet. The debris jet disintegrates as it enters the water pooled in the lower plenum and settles into segregated entities of a molten pool, corium oxidic crusts, an overlying metallic layer and a particulate bed.

3.4.11 Operators inject water into the drywell in anticipation of RPV failure, using the flooder systems. This is a severe accident response system located in the backup building. The lower drywell is filled with water to a depth of 2m, which mitigates the possibility of molten core/concrete interaction and breaks up the corium to leave it with a geometry that can be more readily cooled.

3.4.12 In addition to the active flooding of the lower drywell there is a separate dedicated lower drywell flooder system. This provides the passive means to flood the lower drywell by using the water inventory of the suppression pool.

3.4.13 The weld which holds the control rod penetration tubes to the lower head is weakened by the molten corium in the lower vessel. The analysis predicts that a control rod drive tube is ejected due to the melting of the attachment weld or the stress caused by the pressure difference between inside and outside of the RPV and corium weight on the RPV lower head, leading to failure of the lower head after about seven hours.

3.4.14 Corium falls through the perforated RPV into the PCV drywell. The flow rate may increase as the opening in the RPV is expanded by the ablating effect of mobile corium. Sprays into the drywell are provided by the flooder systems. This controls the PCV pressure increase and removes fission products from the containment atmosphere.

3.4.15 Additional cooling of the corium debris is provided by the core injection function of the flooder systems. Water injected into the core falls onto the molten core in the drywell via the breach in the RPV.

3.4.16 Drywell sprays are continued until the water level within the PCV rises to within 1m of the vacuum breaker. It is assumed that operators successfully recover

the residual heat removal system, approximately 17 hours after the accident begins. Restoration of the residual heat removal system by the operator is considered credible at this time. This system facilitates sprays into the drywell, provides debris cooling and removes heat to the ultimate heat sink via suppression pool cooling.

3.4.17 Successful residual heat removal system initiation allows for long-term heat removal to be maintained and PCV pressure can be effectively controlled without venting.

Release to the environment

3.4.18 After the initial transient, some fission products are removed from the reactor to the wetwell via the safety release valves. When the RPV fails, more fission products are released into the drywell, some of which are transported to the wetwell through the vacuum breaker between the chambers of the drywell and wetwell.

3.4.19 Leakage of fission products from the drywell to the reactor building is expected at the containment design pressure leakage rate (0.4% of containment volume per day at less than design pressure, 1.3% per day at higher pressures).

3.4.20 Radioactive contamination released to the reactor building is removed via the standby gas treatment system and discharged to the environment via the reactor building stack. Radioactive material leaking into the reactor building may in turn be subject to removal mechanisms due to plate out and deposition, or be lost from the reactor building via leakage and diffusion.

3.5 Spent fuel storage facility and ILW storage facility

3.5.1 A spent fuel storage facility would be provided on-site, for the storage of spent fuel (and decay storage of High Level Waste (HLW) and Intermediate Level Waste (ILW)) until such time as a Geological Disposal Facility becomes operational. As stated in appendix D14-1 (Radioactive waste) (Application Reference Number: 6.4.97), the store would be required about five to 10 years after the start of generation until up to 140 years after the end of generation. With regard to this facility, a safety case would be drawn up based on the high level claims stated below and reviewed by the regulator prior to construction.

3.5.2 During normal operation and following frequent and infrequent faults and hazards:

- containment of spent fuel would be maintained;
- temperatures of spent fuel would be maintained within specific limits such that fuel cladding does not fail due to overheating;
- spent fuel assemblies would be maintained in a subcritical state;
- shielding and contamination control would be maintained to reduce radiological dose to the public and operators to ALARP; and
- handling and retrieval of spent fuel would be maintained and faults and hazards would be shown to be of acceptably low frequency.

3.5.3 This facility would be housed in its own building on-site. The possibility of interaction with other facilities leading to a fault scenario would be addressed as part of the site-specific safety case in conjunction with measures to prevent such scenarios or mitigate any impacts. This facility would be designed with respect to the ALARP principle and would be subject to fault assessment in a manner that is commensurate with the recognised risks.

3.5.4 Spent fuel that is moved to the spent fuel storage facility would have spent a number of years in the spent fuel storage pool. This decay time means that spent fuel stored in this facility would be significantly less active than fuel recently removed from the reactor.

3.5.5 The ILW storage facility is a heavily shielded, self-contained, multi-storey building. The on-site ILW store is a stand-alone, self-supporting facility. The store is designed to hold all of the packaged ILW generated in the operating lifetime of the Power Station (i.e. 60 years) plus any additional ILW resulting from post operation clean out of the liquid effluent management systems.

3.5.6 During the storage phase, inspection and monitoring of packages are part of the storage procedures. When corrosion of a waste package is detected, early measures are possible, preventing potential spreading of contamination. Thus, release of contamination from a waste package is considered extremely unlikely and it can be expected that only conventional wastes are generated during operation of the interim on-site storage facilities.

3.5.7 Accidents arising from the improper handling of ILW and HLW have not been selected as reference accidents. It was found that handling accidents involving irradiated fuel were more significant in terms of radiological impact, and therefore ILW/HLW handling accidents have been scoped out.

3.6 Release to the aquatic environment

3.6.1 There are two potential routes for liquid radioactive wastes to enter the environment from the UK ABWR as a result of a fault or accident:

- release from the reactor building – the reactor building houses structures containing radioactive liquids, namely the reactor coolant; and
- release from the radioactive waste building – this houses the liquid effluent management system and, therefore, radioactive liquids.

3.6.2 The confinement of radioactive material offered by the primary and secondary containment structures of the UK ABWR is considered sufficiently robust to negate the risk of a significant release of liquid radioactive effluent to the aquatic environment.

3.6.3 The primary containment of the UK ABWR is a reinforced concrete containment vessel consisting of the reinforced concrete, liner and metal containment components (such as the drywell head). The reinforced concrete containment vessel is integrated with the reactor building. This containment provides an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment (see section 2.3).

3.6.4 In the event of a LOCA, all lines from the drywell sumps are automatically isolated to preclude uncontrolled release of primary coolant outside the

primary containment. In the event of a fault condition which results in excessive inflow rates of radioactive liquid waste into the drywell sump, an alarm is actuated.

3.6.5 A release of liquid radioactive effluent from the radioactive waste building resulting from an operator error is not considered likely due to the design of the facility and passive mitigation measures in place. In the event of a release of liquid radioactive effluent, the radioactive waste building is equipped with floor drain sump pumps which upon receipt of a high water level alarm automatically remove the spilled liquid to the contained storage tank.

3.6.6 A number of other features have been included in the design which reduce the likelihood of a release of liquid radioactive effluent to the aquatic environment.

- Measures would be taken, so far as is reasonably practicable, to minimise leakages from pipework transferring radioactive effluents.
- The liquid effluent management control system includes monitoring of all the main process parameters (pressure, flow, temperature, tank levels etc.) with appropriate alarms provided to the operators in the event of abnormal conditions.
- The liquid effluent management control system includes level control for all tanks including appropriate interlocks to prevent tank overflows. However, all high chemical impurity waste, low chemical impurity waste and controlled active drains system tanks would also have engineered overflow routes to alarmed sumps where appropriate.
- Bunding would be provided in line with UK regulatory requirements and relevant industry good practice, including all tanks and, where appropriate, any other piece of equipment containing liquids.
- Bunding sumps include leak detectors/alarms and pumps to recover any spilt liquids into the liquid effluent management system.
- Bunding is provided at all external doors to liquid effluent management system buildings to prevent the spread of any spilt liquids to the outside of the buildings.

3.6.7 The measures outlined provide sufficient control that accidents resulting in releases to the aquatic environment have been scoped out.

4 Assessment of the radiological impact of the reference accidents

4.1 Assumptions used to calculate the impacts from releases to atmosphere

4.1.1 The assessment considers the radiological consequences of releases to atmosphere for two reference groups comprising members of the public:

- a local reference group close to the Power Station Site; and
- a reference group in the nearest country (Ireland).

4.1.2 The local reference group is assumed to be members of the public located at the distance at which maximum exposure levels are experienced, for distances greater than 200m (i.e. beyond the site boundary).

4.1.3 The nearest country (Ireland) reference group is assumed to be located at a distance of 118km and a bearing of 266° from north.

4.1.4 For both groups, the results presented are based on a Gaussian plume model and correspond to the plume centreline and therefore the maximum concentrations for the distance considered.

4.1.5 It is assumed that the weather conditions remain constant for the duration of the release. For the assessment for the nearest country (Ireland) it is also assumed that the weather conditions are constant during the period of plume travel.

4.1.6 For both the short-range and long-range assessments for local and Ireland reference groups respectively, the radionuclides which make up the reference accident source terms are modelled. Decay and ingrowth of radiologically-significant daughter radionuclides are also modelled during the period of plume travel.

4.1.7 For reasons discussed in section 3.6, an accident scenario resulting in a liquid release to the aquatic environment is not considered.

Release paths and release durations

4.1.8 The release paths and release durations for the reference accidents are summarised in table 4-1. For the LOCA and FHA scenarios, a nominal release period of 24 hours was chosen. For the OGF, a period of one hour was chosen for the release, which is consistent with the description of the accident scenario given in section 3.3. For the SA, the release paths and release durations are consistent with the PSA analysis for internal events at power (leading to a degraded core).

4.1.9 The long-range model used for calculations to the nearest country is based on a nominal release duration of 12 hours. For the OGF and SA scenarios, this minimum release duration of 12 hours has been applied to the calculations for Ireland whereas the release duration for calculations for areas close to the Power Station site is less than 12 hours. It is noted that the main effect of an increased release duration is the broadening of the plume in the cross-wind

direction due to wind meander (i.e. small variations in the wind direction over time).

4.1.10 The release height for the reactor building stack is assumed to be 75m. For releases from the building, it is assumed that a release into the building wake occurs as described in section 4.1.16. The release height makes little difference to the assessed concentrations to the Ireland reference group due to the much greater distance involved.

Table 4-1 Release paths and release durations

Accident identifier	Reference accident	Release duration – local (hours)	Release duration – Ireland (hours)	Release paths
LOCA	Loss of Coolant Accident	24	24	88% from the plant stack 12% from the turbine building
FHA	Fuel Handling Accident	24	24	100% from the plant stack
OGF	Off-Gas system Failure	1	12	100% from the turbine building
SA	Containment leakage from Drywell (failed RPV)	4	12	100% from the plant stack

Amounts and physico-chemical forms of radionuclides

4.1.11 Some radionuclides can be released in different physico-chemical forms which may affect their behaviour in the environment and the radiological consequences. For these assessments, the most important of these are the iodine isotopes which can have three main forms: particulate (ionic iodide, most likely caesium iodide), elemental iodine (molecular iodine vapour, I_2), and organic iodine (many forms are possible but usually considered to be methyl iodide, CH_3I). The particulate form will behave like other particulates.

4.1.12 Elemental iodine is reactive and has a low boiling point (184°C), and therefore will deposit more readily than particulate iodine. Organic iodine, on the other hand, is relatively inert chemically and will deposit less readily than particulate iodine.

4.1.13 Each chemical form will behave differently in the body after inhalation and thus have a different inhalation dose coefficient; elemental iodine being the most radiotoxic and organic iodine the least radiotoxic.

4.1.14 Treating the different forms of iodine explicitly is therefore important. It is assumed that the proportions of different iodine species for the accident scenarios are as shown in table 4-2.

Table 4-2 Proportions of iodine species assumed for the assessments

Reference accident scenario	Percentage of iodine species		
	Organic iodine	Elemental iodine	Particulate iodine
LOCA			100%
FHA			100%
OGF			100%
SA	4%	91%	5%

4.1.15 The core melt scenario source terms have been generated using a simple modifying factors approach to incorporate iodine chemistry effects and the effect of filters in the standby gas treatment system. The standby gas treatment system filter array provides a decontamination factor of 1,000 for all iodine types.

Table 4-3 Summary of reference accident source terms

Nuclide	Release (Bq)			
	LOCA	FHA	OGF	SA
H-3	5.60E+09	0.00E+00	1.00E+11	0.00E+00
I-131	1.40E+06	7.40E+05	1.60E+09	2.50E+09
I-133	1.10E+05	4.90E+04	2.00E+09	2.91E+09
Cs-134	1.80E+05	2.10E+06	6.90E+05	3.18E+08
Cs-137	9.70E+04	1.90E+08	5.70E+05	1.86E+08
Kr-83m	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Kr-85	2.50E+09	9.70E+13	7.10E+06	4.38E+14
Kr-85m	6.40E+07	2.20E+08	2.20E+10	1.49E+14
Kr-87	1.20E+07	0.00E+00	1.20E+11	5.70E+13
Kr-88	0.00E+00	4.80E+05	7.80E+10	1.45E+14
Xe-131m	3.90E+08	3.60E+12	8.70E+07	0.00E+00
Xe-133	3.90E+10	4.70E+14	6.70E+10	3.13E+16
Xe-133m	4.00E+08	6.50E+12	1.40E+09	0.00E+00
Xe-135	1.00E+09	2.40E+11	9.10E+10	5.24E+15
Xe-135m	6.20E+07	0.00E+00	1.70E+11	0.00E+00
Xe-138	1.4E+06	0.00E+00	2.50E+12	0.00E+00
Other	5.74E+09	0.00E+00	4.22E+12	1.45E+12
Total	4.92E+10	5.77E+14	7.27E+12	3.74E+16

4.1.16 For all of the reference accidents, a large fraction of the total release is made up of noble gases. The quantities of noble gases and selected radionuclides which are significant from the point of view of health, along with the total

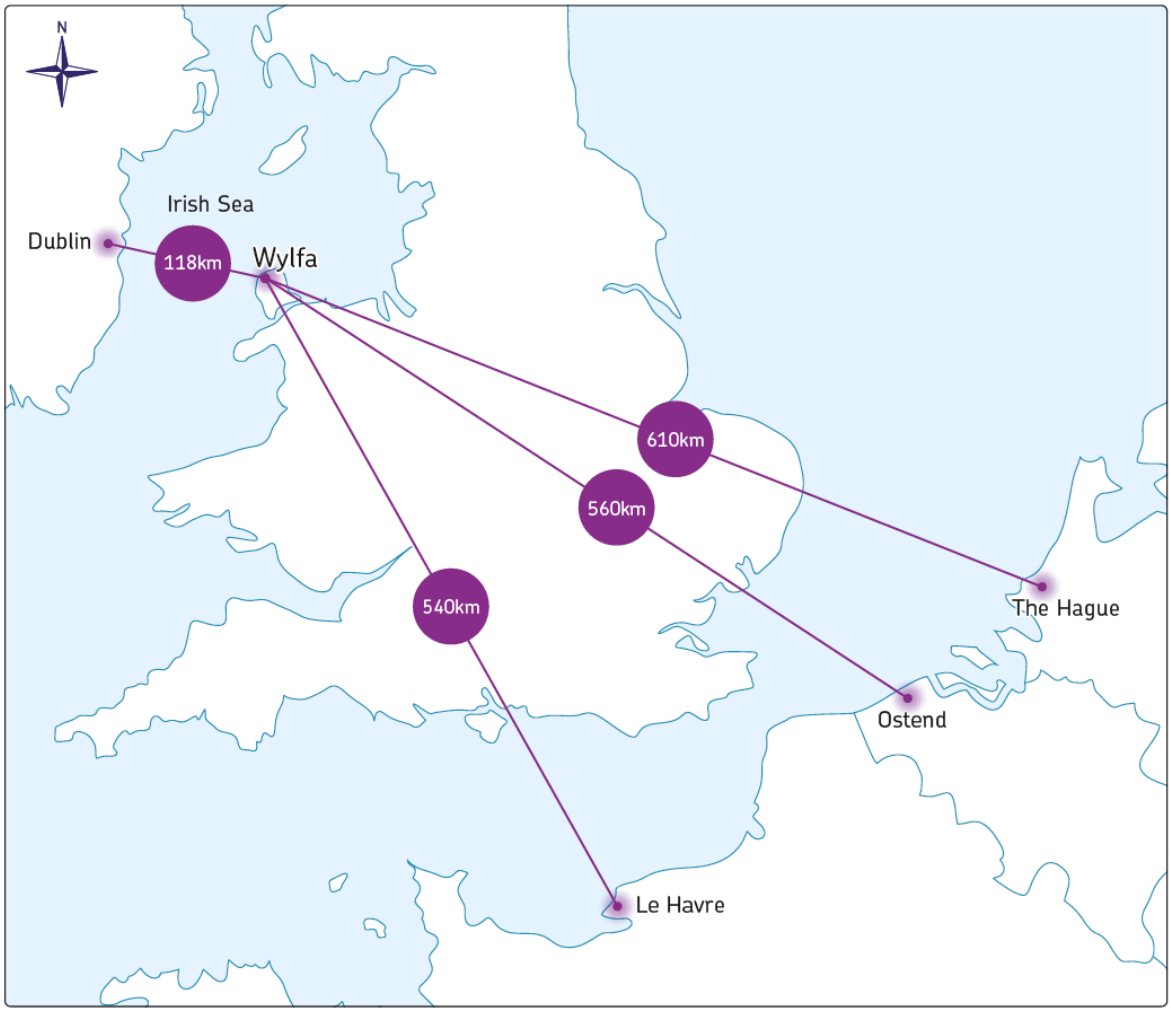
activity released, are presented in table 4-3. It should be noted that the radionuclides identified are not significant for the OGF scenario as less than half the release is represented by the short list of radionuclides. This is demonstrated as those marked 'Other' make up a larger proportion of the total release.

4.2 Models and parameter values used

Distances to nearest countries

4.2.2 The nearest country to the Power Station is Ireland, which is approximately 118km away. The distances to the nearest major conurbations in the nearest countries, and their populations, are provided in table 4-4. Figure 4-1 details the location of the Power Station in relation to Europe and its nearest major conurbations.

Figure 4-1 Location of the Power Station in relation to Europe and its nearest major conurbations



4.2.3 The potential impact of radioactive discharges from the Power Station to other countries has been assessed by considering the impact to reference groups in Ireland (Dublin), as it is closest to the Power Station. Activity concentrations in air decline rapidly with increasing distance. The impacts of the radioactive

discharges from the Power Station to reference groups in Ireland are assumed to be bounding over reference groups in any other country.

Table 4-4 Nearest major international conurbations to the Power Station

Centre	Country	Distance/km	Population
Dublin	Ireland	118	516,255 (estimate)
Le Havre	France	540	238,171
Ostend	Belgium	560	69,980
The Hague	Netherlands	610	495,083

Local reference group assessment

Dispersion and deposition

4.2.4 For the local assessment, time-integrated activity concentrations are calculated using the model described in NRPB-R91 [RD10]. Depletion of the plume by dry and wet deposition is included using the approach described in NRPB-R122 [RD11]. The dry deposition velocities and the washout coefficients used are presented in table 4-5.

Table 4-5 Dry and wet deposition parameters

Species	Dry deposition velocity (m/s)	Washout coefficient (s-1 per mm/hr of rain)
Particulate	1E-03	1E-04
Organic iodine	1E-05	2E-08
Elemental iodine	3E-03	3E-06
Noble gases and CO_2	0E+00	0E+00

4.2.5 For releases from a building, it is assumed that a release into the building wake occurs at a height of one third of the building height from a virtual source upwind of the building as described in NRPB-R157 [RD12]. The effect of the virtual source is to broaden the plume in the vertical and cross-wind directions leading to increased dispersion. This approach assumes that the building wake is well-mixed and the release is effectively from the downwind face of the building.

Meteorological conditions

4.2.6 The meteorological conditions are based on the NRPB-W54 methodology [RD13] for assessing short-term discharges, which states that these conditions are realistically cautious. A surface roughness length of 0.4m has been selected, which is appropriate for the area around the Power Station; consisting of farmland and residential areas. These meteorological parameters are presented in table 4-6. The wind is assumed to blow in the same direction for the duration of the release. A wind meander factor which depends on the duration of the release is applied.

Table 4-6 Meteorological parameters for the local reference group assessment

Pasquill stability category	Mixing layer depth (m)	Windspeed at a height of 10m (m/s)	Rainfall rate in wet conditions (mm/hr)	Surface roughness length (m)
D	800	3	0.1	0.4

Habit data

4.2.7 The Centre for Environment, Fisheries and Aquaculture Science (Cefas) undertakes periodic (normally five-yearly) surveys of the diet and behaviours of members of the public residing in the locality of major nuclear licensed sites in the UK. These surveys collate information on the food consumption rates and occupancy habits of adult, child and infant age groups[1], as well as other relevant occupational and recreational activities that take place close to nuclear licensed sites that could result in the exposure of members of the public to radioactivity in the environment. The output from these surveys provides information on the habits of members of the public which may influence their radiation exposure.

4.2.8 Cefas has performed three habits surveys for the Existing Power Station ([RD14]; [RD15]; [RD16]) which cover the areas that are most likely to be impacted by discharges to the marine environment, discharges to air and from direct radiation emanating from the Existing Power Station. The Power Station is situated immediately adjacent to the Existing Power Station site and so the habits data presented in the Cefas habits survey reports for the Existing Power Station are therefore considered to directly apply to the Power Station without the need to make any modifications.

4.2.9 Ingestion rates used in the assessment are based on the top two approach[2]. For accident scenarios, the food groups varied depending on the accident scenario. For the LOCA, FHA and SA, green vegetables and milk were consumed at 97.5th percentile rates. For the OGF, root vegetables and milk were consumed at 97.5th percentile rates. Other foods were consumed at mean rates, using the median value of the 97.5th percentile and mean values from the three Cefas reports. This approach is expected to result in robust dose assessment outcomes.

4.2.10 The habit data for the local reference group are shown in table 4-7.

[1] For the purposes of the assessment children are assumed to be 10 years old and infants one year old

[2] A screening dose assessment is carried out using food intake rates set at 'critical levels' (97.5th percentile) for all food categories. The two food categories contributing the highest dose are retained at critical levels whilst the remaining categories are set to mean levels (50th percentile rates). This approach avoids undue pessimism in overall food consumption rates and ensures that calorific intakes are within reasonable limits. It can be implemented using either generic or site-specific data

Table 4-7 Consumption rates for the local reference group assessment

Food type	Consumption rate (kg/y)					
	Adults		Children		Infants	
	Mean	97.5th %-ile	Mean	97.5th %-ile	Mean	97.5th %-ile
Cow's milk	140.3	193.1	140.3	193.1	187.0	257.4
Root vegetables	141.3	172.4	91.5	110.5	44.7	54.9
Green vegetables	47.4	69.7	22.2	32.4	10.1	14.9
Fruit	34.2	36.9	21.7	24.0	13.8	16.1
Beef	31.5	31.5	21.0	21.0	7.0	7.0
Sheep meat	12.2	17.0	4.9	6.8	1.5	2.0

Inhalation rates

4.2.11 The adult inhalation rate for the local reference group is based upon the NRPB-W41 [RD17]. The '24 hour total' value for a heavy worker is used, which includes eight hours of sleep, eight hours of heavy work and eight hours of non-occupational activity.

Adult inhalation rate = 27m^3/24 hours = 1.123m^3/hr.

4.2.12 Inhalation rates for the infant and child members of the local reference group are based upon NRPB-W41 [RD17].

Child inhalation rate = 0.64m^3/hr.

Infant inhalation rate = 0.22m^3/hr.

Assessment for the nearest country (Ireland)

Dispersion and deposition

4.2.13 For the nearest country (Ireland), the time-integrated activity concentration, the dry deposition and the wet deposition are calculated as described in NRPB-R124 [RD18], whilst the plume depletion due to deposition is calculated as described in NRPB-R122 [RD11]. The results obtained are for the 90th percentile as recommended in NRPB-R124 [RD18]. The dry deposition velocities and the washout coefficients are the same as those used for the local assessment as presented in table 4-5.

Meteorological conditions

4.2.14 The meteorological conditions are based on the NRPB-R124 methodology [RD18] and are presented in table 4-8.

Table 4-8 Meteorological parameters for the assessment for the nearest country (Ireland)

Mixing layer depth (m)	Wind speed (m/s)	Rainfall rate in wet conditions (mm/hr)
1000	8	0.1

Habit data

4.2.15 The Radiological Protection Institute of Ireland (now part of the Irish Environmental Protection Agency) published an assessment of the potential radiological implications for Ireland from proposed new build of nuclear power plants in the UK [RD19]. This assessment included habit and occupancy data for reference groups impacted by routine discharges to air and sea and for accident scenarios.

4.2.16 The habit data presented in the assessment for releases to atmosphere were used when assessing the doses to the nearest country (Ireland). Mean and 95th percentile consumption rates were presented and the 95th percentile rates have been used to represent individuals with higher than average consumption rates. This approach is expected to result in robust dose assessment outcomes.

4.2.17 The greater Dublin area contains a number of dairy farms and milk processing centres, as well as farms growing vegetables for sale. The reference group is a hypothetical dairy and market gardening farming family living and working in the greater Dublin area that will be expected to eat higher than average rates of locally-grown foods. The family is assumed to live in a rural location and spend an above-average length of time outdoors, for example adults working the land.

4.2.18 The top two approach has been used regarding the use of food ingestion habits data. A local fraction of 1.0 (consumption of 100% locally produced food) has been assumed for the food categories consumed at critical levels and 0.5 (50% locally produced food) for all other groups. Given the scale and reach of modern food distribution systems, these were considered conservative values. For accident scenarios, the food groups varied depending on the accident scenario or age group. For adults the top two foodstuffs were milk products and milk (FHA, OGF and SA), and milk products and beef (LOCA). For children the top two foodstuffs were milk products and milk for all scenarios.

4.2.19 The habit data for the nearest country (Ireland) reference group are presented in table 4-9.

Table 4-9 Consumption rates for the assessment for the nearest country (Ireland)

Food type	Consumption rate (kg/y)					
	Adults		Children		Infants	
	Mean	97.5th %-ile	Mean	97.5th %-ile	Mean	97.5th %-ile
Cow's milk	77.4	336.9	100.7	311.7	105.9	449.2
Cow's milk products	24.5	113.2	27.4	104.8	18.3	84.9
Root vegetables	58.0	196.0	42.7	124.8	14.5	67.8
Green vegetables	26.3	109.9	9.9	45.6	3.8	20.6
Fruit	17.9	71.9	15.0	48.5	8.0	33.6
Beef	25.4	117.2	15.5	60.5	5.1	26.0
Sheep meat	4.9	31.9	3.8	18.9	0.5	3.8

Inhalation rates

4.2.20 Inhalation rates for the nearest country (Ireland) reference group have been aligned with those previously used by the Radiological Protection Institute of Ireland and are based upon NRPB-W41 [RD17] values for all age groups.

Adult inhalation rate = 0.92 m^3/hr.

Child inhalation rate = 0.64 m^3/hr.

Infant inhalation rate = 0.22 m^3/hr.

4.3 Calculation of doses

4.3.1 The following exposure pathways are considered in the calculation of doses:

- cloud gamma from the plume;
- ground gamma due to deposited radionuclides;
- inhalation from the plume;
- inhalation as a result of resuspension of deposited radionuclides; and
- ingestion of contaminated food.

4.3.2 The activity concentration in soil and terrestrial foods per unit deposit values were obtained using the FARMLAND model within PC CREAM 08 [RD20]. Although FARMLAND was originally formulated to estimate annual individual doses from normal operational discharges of radionuclides to atmosphere, the model can be used satisfactorily to produce an integrated dose to an individual following a single deposit on the ground by a straightforward dimensional conversion of the units in which the results are produced.

4.3.3 The values obtained using the FARMLAND model are effectively used as transfer factors to determine the time integrated activity concentrations in various foods using the NRPB-R91 [RD10] and NRPB-R124 [RD18] results for deposition (and activity concentration in the case of H-3 and C-14).

4.3.4 To obtain the activity concentrations for cow's milk products, the same method as implemented in PC CREAM is followed. A scaling factor is used to generate the activity concentration in cow's milk products from the activity concentration in cow's milk for each radionuclide. These scaling factors can be found in appendix E of the 'PC CREAM Help' available in the PC CREAM program itself.

4.3.5 The results for the local reference group are calculated for the distance at which maximum exposure levels are experienced, for distances greater than 200m. For building releases (OGF) this is 200m, whilst for stack releases (LOCA, FHA and SA) this is 1,060m. For LOCA, wet weather conditions were found to reduce the distance of the maximum concentrations and to result in significantly higher concentrations than dry weather conditions. The results for the Ireland reference group are calculated at a distance of 118km.

4.3.6 The effective dose coefficients for inhalation and ingestion are taken from International Commission on Radiological Protection (ICRP) data [RD21]. For most radionuclides, it is necessary to select the appropriate absorption type which corresponds to how readily material is absorbed into the blood from the respiratory tract. Where possible, the absorption type was selected using the guidance given in ICRP Publication 71 [RD22]. In other cases, the absorption type was chosen so that the highest value was selected in the case of two available absorption types or the middle value was selected in the case of three available absorption types.

4.4 Results

Maximum time integrated concentrations and surface contamination levels

4.4.2 Table 4-10 presents the maximum time integrated activity concentrations for the two reference groups. For FHA, OGF and SA, the difference between the time integrated activity concentrations for dry weather conditions and wet weather conditions is insignificant and so a single value is presented. For LOCA, the difference between the time integrated activity concentrations for the dry weather conditions and wet weather conditions is significant so two values (wet and dry) are presented.

Table 4-10 Maximum time integrated activity concentration

Reference accident scenario	Time integrated activity concentration (Bqs/m^3)	
	Local reference group	Ireland reference group
LOCA	7.57E+04 (dry) 2.13E+05 (wet)	1.41E+02 (dry) 1.39E+02 (wet)
FHA	7.37E+08	1.67E+06
OGF	2.88E+08	1.37E+03
SA	1.11E+11	1.51E+08

4.4.3 The greatest difference between the time integrated activity concentrations is observed for the OGF, with the value for the local reference group being over 100,000 times greater than the value for the Ireland reference group. This difference is much greater than for the other accident scenarios and is most likely due to the OGF release being from a building, with the local results presented at a distance of only 200m. For all reference accident scenarios, the value for the local reference group is over 400 times greater than the value for the Ireland reference group.

4.4.4 The maximum surface contamination levels for the two reference groups are presented in table 4-11. Results for dry weather conditions and wet weather conditions are provided.

Table 4-11 Maximum surface contamination levels

Reference accident scenario	Surface contamination (Bq/m^2)			
	Local reference group		Ireland reference group	
	Dry weather	Wet weather	Dry weather	Wet weather
LOCA	8.82E+00	1.01E+02	1.63E-02	1.55E-01
FHA	2.46E-01	7.32E-01	5.52E-04	5.24E-03
OGF	1.04E+04	1.41E+04	4.35E-01	4.13E+00
SA	1.26E+04	1.29E+04	1.49E+01	1.66E+01

4.4.5 As expected, wet weather conditions result in greater surface contamination levels than dry weather conditions as a result of washout. Wet weather conditions were conservatively used to assess the doses for the three design basis faults. However, more realistic dry weather conditions were more appropriate for the representative SA assessed given the low frequency of such events.

Expected levels of radioactive contamination of foodstuffs

4.4.6 The integrated activity concentrations in foods are presented in table 4-12 and table 4-22 for the local reference group and the Ireland reference group

respectively. Cow's milk products are predicted to have the greatest activity concentrations for both reference groups. However, cow's milk products do not contribute to the ingestion dose for the local reference group since it is assumed that there is no consumption of cow's milk products produced from local cow's milk.

Table 4-12 Expected levels of radioactive contamination of foodstuffs for the local reference group

Reference accident scenario	Activity concentrations in foods, integrated to 50 years (Bqy/kg)					
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit
LOCA	9.04E-02	6.93E-02	7.00E-02	8.49E-02	7.72E-02	7.88E-02
FHA	4.14E-03	2.11E-02	4.41E-02	3.47E-03	3.07E-03	8.41E-03
OGF	3.39E+01	2.62E+01	2.62E+01	3.00E+01	2.97E+01	2.98E+01
SA	1.26E+01	5.30E+00	6.72E+00	9.52E+00	1.79E+00	6.13E+00

Local reference group doses

4.4.7 Table 4-13, table 4-14 and table 4-15 present the effective dose to an adult, a 10 year old child and a one year old infant for the local reference group for each pathway.

Table 4-13 Maximum effective dose to adults for the local reference group

Reference accident scenario	Effective dose to adults (Sv)				
	Inhalation	Cloud gamma	Ground gamma	Ingestion	Total
LOCA	5.79E-10	1.74E-10	5.72E-08	5.30E-09	6.33E-08
FHA	3.50E-10	4.74E-07	5.13E-08	4.05E-08	5.66E-07
OGF	5.67E-07	7.88E-06	1.37E-07	2.81E-06	1.14E-05
SA	1.58E-05	1.97E-04	1.07E-06	8.02E-05	2.94E-04

Table 4-14 Maximum effective dose to children for the local reference group

Reference accident scenario	Effective dose to children (Sv)				
	Inhalation	Cloud gamma	Ground gamma	Ingestion	Total
LOCA	4.90E-10	1.04E-10	2.91E-08	7.41E-09	3.71E-08
FHA	1.63E-10	2.84E-07	2.61E-08	2.01E-08	3.31E-07
OGF	7.61E-07	4.73E-06	6.96E-08	5.26E-06	1.08E-05
SA	2.17E-05	1.18E-04	5.47E-07	1.59E-04	2.99E-04

Table 4-15 Maximum effective dose to infants for the local reference group

Reference accident scenario	Effective dose to infants (Sv)				
	Inhalation	Cloud gamma	Ground gamma	Ingestion	Total
LOCA	3.96E-10	8.12E-11	1.98E-08	2.02E-08	4.05E-08
FHA	8.42E-11	2.21E-07	1.77E-08	1.95E-08	2.58E-07
OGF	1.00E-06	3.68E-06	4.72E-08	2.01E-05	2.48E-05
SA	2.58E-05	9.21E-05	3.71E-07	6.23E-04	7.41E-04

4.4.8 Since ingestion is the dominant pathway in the majority of cases, a breakdown by food type is presented in table 4-16, table 4-17 and table 4-18 for adults, children and infants respectively.

Table 4-16 Maximum effective dose due to ingestion for adults (local) – breakdown by food type

Reference accident scenario	Effective dose (Sv)					
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit
LOCA	3.20E-09	2.47E-10	1.23E-10	1.05E-09	4.38E-10	2.39E-10
FHA	1.04E-08	8.69E-09	9.78E-09	2.15E-09	5.67E-09	3.76E-09
OGF	1.74E-06	1.30E-07	6.30E-08	4.68E-07	2.55E-07	1.62E-07
SA	5.14E-05	3.57E-06	1.77E-06	1.33E-05	5.53E-06	4.55E-06

Table 4-17 Maximum effective dose due to ingestion for children (local) – breakdown by food type

Reference accident scenario	Effective dose (Sv)					
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit
LOCA	5.27E-09	2.34E-10	6.42E-11	1.13E-09	4.38E-10	2.76E-10
FHA	8.06E-09	4.45E-09	2.17E-09	7.76E-10	2.82E-09	1.83E-09
OGF	3.96E-06	1.90E-07	5.59E-08	4.93E-07	3.32E-07	2.29E-07
SA	1.22E-04	5.60E-06	1.67E-06	1.46E-05	8.45E-06	6.81E-06

Table 4-18 Maximum effective dose due to ingestion for infants (local) – breakdown by food type

Reference accident scenario	Effective dose (Sv)					
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit
LOCA	1.78E-08	1.82E-10	4.35E-11	1.28E-09	5.01E-10	4.26E-10
FHA	1.30E-08	1.78E-09	7.96E-10	4.28E-10	2.04E-09	1.40E-09
OGF	1.81E-05	2.13E-07	5.75E-08	7.74E-07	5.14E-07	4.90E-07
SA	5.62E-04	6.47E-06	1.77E-06	2.34E-05	1.43E-05	1.50E-05

Nearest country (Ireland) reference group doses

4.4.9 Table 4-19, table 4-20 and table 4-21 present the effective dose to an adult, a 10 year old child and a one year old infant for the Ireland reference group respectively. As for the local reference group, in the majority of cases ingestion is the dominant pathway.

Table 4-19 Maximum effective dose to adults for the nearest country (Ireland) reference group

Reference accident scenario	Effective dose to adults (Sv)				
	Inhalation	Cloud gamma	Ground gamma	Ingestion	Total
LOCA	2.72E-13	1.09E-13	8.84E-11	3.70E-11	1.26E-10
FHA	5.63E-13	1.08E-09	3.71E-10	7.57E-10	2.21E-09
OGF	1.67E-11	1.64E-11	3.61E-11	3.85E-09	3.92E-09
SA	1.67E-08	2.23E-07	1.39E-09	5.16E-07	7.56E-07

Table 4-20 Maximum effective dose to children for the nearest country (Ireland) reference group

Reference accident scenario	Effective dose to children (Sv)				
	Inhalation	Cloud gamma	Ground gamma	Ingestion	Total
LOCA	2.81E-13	6.53E-14	4.50E-11	5.71E-11	1.02E-10
FHA	3.19E-13	6.50E-10	1.89E-10	4.65E-10	1.30E-09
OGF	2.73E-11	9.82E-12	1.84E-11	8.34E-09	8.39E-09
SA	2.79E-08	1.34E-07	7.07E-10	1.12E-06	1.28E-06

Table 4-21 Maximum effective dose to infants for the nearest country (Ireland) reference group

Reference accident scenario	Effective dose to infants (Sv)				
	Inhalation	Cloud gamma	Ground gamma	Ingestion	Total
LOCA	2.27E-13	5.08E-14	3.06E-11	1.38E-10	1.68E-10
FHA	1.65E-13	5.06E-10	1.28E-10	5.11E-10	1.15E-09
OGF	3.58E-11	7.64E-12	1.25E-11	2.74E-08	2.75E-08
SA	3.31E-08	1.04E-07	4.80E-10	3.68E-06	3.28E-06

4.4.10 Since ingestion is the dominant pathway in the majority of cases, a breakdown by food type is presented in table 4-23, table 4-24 and table 4-25 for adults, children and infants respectively. It is noted that the inclusion of cow's milk products has a significant effect on the dose, with this being the greatest contributor to the total despite the consumption rates being higher for other food types.

Table 4-22 Expected levels of radioactive contamination of foodstuffs for the nearest country (Ireland) reference group

Reference accident scenario	Activity concentrations in foods, integrated to 50 years (Bqy/kg)						
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit	Cow's milk products
LOCA	5.48E-05	4.13E-05	4.23E-05	5.59E-05	4.41E-05	4.66E-05	8.35E-05
FHA	2.96E-05	1.51E-04	3.15E-04	2.48E-05	2.20E-05	6.01E-05	3.25E-04
OGF	1.41E-03	1.05E-03	1.06E-03	1.25E-05	1.15E-03	1.20E-03	1.79E-03
SA	1.62E-02	6.84E-03	8.68E-03	1.21E-02	2.31E-03	7.91E-03	1.60E-01

Table 4-23 Maximum effective dose due to ingestion for adults nearest country (Ireland) – breakdown by food type

Reference accident scenario	Effective dose (Sv)						
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit	Cow's milk products
LOCA	8.01E-12	1.37E-13	3.48E-14	2.84E-13	9.87E-14	8.34E-14	2.83E-11
FHA	1.50E-11	2.31E-10	1.01E-11	4.26E-12	8.32E-12	7.03E-12	4.81E-10
OGF	8.72E-10	1.43E-11	3.53E-12	2.50E-11	1.16E-11	1.17E-11	2.91E-09
SA	1.16E-07	1.86E-09	4.61E-10	3.24E-09	1.47E-09	1.54E-09	3.91E-07

Table 4-24 Maximum effective dose due to ingestion for children nearest country (Ireland) – breakdown by food type

Reference accident scenario	Effective dose (Sv)						
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit	Cow's milk products
LOCA	1.24E-11	1.20E-13	3.52E-14	2.55E-13	1.20E-13	1.33E-13	4.40E-11
FHA	9.30E-11	1.18E-11	6.01E-12	1.24E-12	4.71E-12	4.53E-12	3.44E-10
OGF	1.89E-09	2.01E-11	6.30E-12	2.21E-11	1.95E-11	2.28E-11	6.35E-09
SA	2.53E-07	2.67E-09	8.39E-10	2.88E-09	2.55E-09	3.04E-09	8.56E-07

Table 4-25 Maximum effective dose due to ingestion for infants nearest country (Ireland) – breakdown by food type

Reference accident scenario	Effective dose (Sv)						
	Cow's milk	Beef	Sheep meat	Green veg	Root veg	Fruit	Cow's milk products
LOCA	4.56E-11	9.30E-14	1.03E-14	2.43E-13	9.83E-14	1.74E-13	9.14E-11
FHA	1.163E-10	4.64E-12	9.48E-13	5.75E-13	1.92E-12	2.91E-12	3.38E-10
OGF	9.46E-09	2.28E-11	2.85E-12	2.94E-11	2.26E-11	4.19E-11	1.78E-08
SA	1.27E-06	3.04E-09	3.82E-10	3.85E-09	3.00E-09	5.62E-09	2.40E-06

5 Emergency planning and countermeasures

5.1.1 Mitigation of the environmental impacts of accidental releases is achieved through the implementation of emergency arrangements, and the utilisation of appropriate countermeasures.

5.2 UK emergency planning arrangements

5.2.1 UK emergency arrangements have been formulated over many years taking into consideration learning and recommendations from both nuclear and non-nuclear events. National doctrine has been established to provide a framework for all civil defence arrangements under the Civil Contingencies Act 2004. In Wales, a dedicated government team supports multi-agency co-operation and engagement with the UK government on issues relating to civil protection and emergency preparedness.

5.2.2 The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) is the main set of UK regulations regulating the emergency arrangements at UK nuclear power plants.

5.2.3 REPPIR establishes a framework of emergency preparedness measures to ensure that members of the public are:

- properly informed and prepared, in advance, about what to do in the unlikely event of a radiation emergency occurring; and
- provided with information if a radiation emergency actually occurs.

5.2.4 REPPIR does not prescribe the actions that a nuclear power plant operator must take in an emergency but it does require adequate on-site and off-site emergency plans to be written to deal with reasonably foreseeable radiation emergencies. Response plans for radiation emergencies are expected to fit within the broader resilience plans at national and local levels to give a robust command and control structure for all potential emergencies.

5.2.5 Under REPPIR the ONR is responsible for the determination of an off-site emergency planning area (being the area within which, in ONR's opinion, any member of the public is likely to be affected in the event of a radiation emergency). REPPIR also provides for prior information to be distributed to the public within such off-site emergency planning areas.

5.2.6 The local authority is required to prepare an off-site emergency plan according to ONR's determination for the defined emergency planning areas with the purpose of protecting the public and minimising any potential radiation exposures. This plan will identify the appropriate protection measures which can be taken, such as sheltering, the taking of stable iodine tablets and evacuation, in order to reduce radiation exposures to members of the public within all or parts of this area.

5.2.7 The local resilience plans would be developed via close coordination between the operator of the Power Station, local authority, local emergency services and other agencies, as required.

5.3 Intervention levels established for different types of countermeasures

5.3.1 In the event of a radiation emergency, mitigation is provided by considering the potential radiological protection benefits, the practical implications and the potential harm of any countermeasures that might be advised.

5.3.2 Public Health England has recommended emergency reference levels of doses for the justification of countermeasures to protect the public [RD23]. These are used to identify which actions will be most suitable in specific circumstances. For each countermeasure, there is a lower and upper reference level of dose averted by the countermeasure. Below the lower level, the countermeasure is unlikely to be worthwhile; above the upper level, it is likely to be worthwhile.

5.3.3 During a radiation emergency, health countermeasures need to be implemented promptly in order to maximise the level of protection provided to members of the public. When considering early countermeasures for an off-site radiation emergency, the primary ways to protect the public are to take one or more of the following actions:

- to shelter;
- to evacuate; and/or
- to administer stable iodine (for operating reactor sites).

5.3.4 The emergency reference levels for these countermeasures are shown in table 5-1.

Sheltering

5.3.5 Sheltering refers to staying inside, with doors and windows closed and ventilation systems turned off. Sheltering provides a degree of shielding against external radiation exposure (depending on the material of the building) and reduces the exposure to inhaled particles.

5.3.6 There are four main situations for which sheltering will be the optimum countermeasure:

- a release consisting mainly of radioisotopes of noble gases (to reduce the external dose);
- a release which will result in relatively low doses;
- a release which will result in very large short-term doses, for which evacuation could not be carried out in advance of the release; and
- circumstances in which evacuation either is not possible or will entail considerable risk to evacuees [RD23].

Evacuation

5.3.7 Where the risk to public health posed by an off-site release of radioactive contamination has been identified or is predicted through radiation monitoring/modelling it may be decided to evacuate the affected areas. The

primary purpose of evacuation is to protect the population against the internal and external exposure to radionuclides in the air or deposited on the ground.

5.3.8 Evacuation is the only countermeasure which has the potential to prevent virtually all exposure to a release. However, this is only achieved if the evacuation is carried out before the release occurs. While people are in transit their protection against external irradiation and inhalation is likely to be much less than the protection they will receive from remaining inside typical UK residential dwellings [RD23].

Administration of stable iodine tablets

5.3.9 The administration of stable iodine reduces the exposure from radioactive iodine. Stable iodine can significantly reduce the exposure to radioactive iodine because once the thyroid is 'flooded' with non-radioactive iodine, thyroid-uptake of radioactive iodine will be blocked and radioactive iodine will be expelled more quickly. This countermeasure is only relevant to facilities where radioactive iodine is a potential hazard.

5.3.10 The administration of stable iodine is likely to be in conjunction with sheltering or evacuation to ensure the most effective countermeasure strategy.

Table 5-1 Recommended emergency reference levels for early countermeasures

Countermeasure	Organ	Dose averted (mSv)	
		Lower	Upper
Sheltering	Whole body	3	30
Evacuation	Whole body	30	300
Stable iodine	Thyroid (organ dose)	30	300

Food safety countermeasures

5.3.11 In the event of a radiation emergency, precautionary food safety advice and, if necessary, implementation of food restriction orders will be provided by the Food Standards Agency (FSA). Advice from the FSA may cover different geographical areas and different time periods from other countermeasures. The criteria for intervention for food safety issues (at least initially) will be the Council Food Intervention Levels laid down by the European Union. These set maximum permitted levels of radioactivity in foodstuffs and animal feeding stuffs. The FSA can impose statutory restriction orders, made under the Food and Environment Protection Act 1985.

5.3.12 Council Food Intervention Levels for milk, baby foods and other foodstuffs are listed in table 5-2. Note that these are radioactivity concentration-based rather than dose-based.

Table 5-2 Council Food Intervention Levels for food countermeasures

Radionuclide	Dairy produce and liquid foods (Bq/l)	Other foods (Bq/kg)	Minor foods (Bq/kg)	Baby foods (Bq/kg)
Alpha emitting isotopes	20	80	800	1
Strontium Isotope	125	750	7,500	75
Iodine Isotopes	500	2,000	20,000	150
All other Nuclides of Half-life > 10 days e.g. Cs-137	1,000	1,250	1,250	400

Recovery countermeasures

5.3.13 Recovery countermeasures refer to the countermeasures that would be implemented to protect both individuals and the wider public from longer-term, chronic risks. There are two main approaches to dose reduction (other than countermeasures relating to food) that can be employed in the recovery phase; decontamination and restriction of access [RD24].

5.3.14 Decontamination techniques reduce exposure by treating contaminated areas directly and include such techniques as removing contaminated materials from the area and redistributing or fixing radionuclides so that they are less available to contribute to exposure [RD24].

5.3.15 Restricted access measures reduce exposure by removing people from areas of contamination, or by controlling the time spent in such areas [RD24].

5.4 UK emergency response arrangements

5.4.1 During a radiation emergency there are broadly four discrete but interconnected tiers, which work together to ensure an effective response. These tiers are as follows:

- site level – on which the radiological release has occurred or is expected;
- local strategic level – from which the local level multi-agency strategic response will be coordinated;
- national level – which includes central government engagement through Cabinet Office Briefing Room as well as, where appropriate, support from national agencies and individual departments; and
- international level – which includes organisations such as the IAEA as well as foreign governments with whom the UK Government will liaise to notify of the emergency and potentially request assistance from.

5.4.2 In the event of a radiation emergency in Wales, the UK Government is responsible for overall policy and strategy, and command and control mechanisms will remain through the Strategic Coordination Centre and local

mechanisms, including set-up and establishment of the Emergency Control Centre Wales. Responsibilities of the Welsh Government will include:

- keeping the Minister and other members of the Welsh Cabinet fully informed of all aspects of the management of the emergency;
- helping keep local and other authorities, and the public informed;
- advising central government on any adjustments to priorities or redeployment of resources necessary to meet Welsh needs; and
- acting as a central reporting point for local agencies where this can assist central government.

Exchange of information with other countries

5.4.3 In the event of a radiation emergency in the UK, the Department for Business, Energy and Industrial Strategy (BEIS) as the designated Competent Authority, will lead on engagement with multi-national organisations such as the IAEA or EU.

5.4.4 The UK is party to the IAEA Convention on Early Notification of a Nuclear Accident (18 November 1986 INFCIRC/335); this obliges the UK to target a two-hour deadline for informing the IAEA of a 'general emergency' at a UK plant with a potential for transboundary consequences. The UK is a signatory to Council Decision 87/600/EURATOM on Community arrangements for the early exchange of information in the event of a radiation emergency; this ensures that the Commission and Member States are promptly informed in the event of a radiation emergency, and sets out the information which is to be provided. The EC Urgent Radiological Information Exchange system provides an exchange platform for managing the graded response between Member States.

5.4.5 BEIS will also undertake initial notification of the emergency to countries with which the UK has relevant bi-lateral agreements, such as Belgium, Denmark, Netherlands, France, Ireland, Norway and Russia.

5.4.6 In the event of a radiation emergency the Radioactive Incident Monitoring Network will be used to collect, collate and communicate data about off-site radiation and contamination levels.

5.4.7 As part of the IAEA Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, BEIS will coordinate UK international assistance arrangements both in the case of a domestic or overseas event, such as through the Response and Assistance Network managed by the IAEA.

5.5 Environmental monitoring in the event of a radiation emergency

5.5.1 Specialist resources and equipment are available to undertake environmental and personal radiation monitoring following a radiation emergency in the UK, or in response to an overseas radiation incident. Within the UK, responsibilities for radiation monitoring in the event of a radiation emergency lie with a number

of organisations. Public Health England Centre for Radiation, Chemical and Environmental Hazards is responsible for the overall co-ordination of the activities of organisations undertaking radiation monitoring.

5.5.2 As part of nuclear site licensing requirements and REPPIR, the operator of the Power Station would have arrangements in place that would detail the environmental monitoring that would be carried out in the event of an emergency situation. These arrangements would document what off-site surveillance would be undertaken, including dose rate monitoring and sampling of water, soil and identified items within the food chain. The off-site survey would detail the extent of initial environmental monitoring, with the ability to extend the monitoring out to a further distance depending on the extent of the emergency situation.

5.5.3 The principal responsibilities of other organisations are identified under these key monitoring functions.

- People monitoring – the health services locally are responsible for activating local facilities for monitoring in relation to people, specifically to provide reassurance to members of the public.
- Environmental monitoring – the Environment Agency and Natural Resources Wales in England and Wales have contractors who carry out environmental monitoring programmes in support of their regulatory responsibilities.
- Food monitoring – the FSA is responsible for arrangements for monitoring and food sampling and assessing the results to define any area to be subject to food advice and controls.
- Water monitoring – utility companies and authorities are responsible for ensuring the potability of drinking water supplied to their customers, including its radioactivity content, and identifying potentially contaminated water supplies.

6 Impact assessment of accidental releases

6.1.1 The impact assessment methodology for authorised discharges of radioactivity described in chapter B14 (Radiological effects) (Application Reference Number: 6.2.14) is not appropriate for accidental releases because the latter have a very low probability of occurrence (<10^{-5}/yr). The environmental impact of accidental releases can be described by the potential doses incurred and the potential for the release to require the implementation of countermeasures.

6.2 Impact assessment methodology

Value of receptors

6.2.2 One type of receptor has been identified for this assessment, namely members of the public exposed to radiation, who are judged to be of high value/sensitivity.

Assessment of magnitude and significance

6.2.3 For the purpose of environmental impact assessment, the doses for levels of countermeasures that may be required to mitigate off-site impacts have been selected as the basis of the impact and significance criteria (see table 6-1). The most severe of these refers to the requirement to implement evacuation, the most disruptive countermeasure response. Lower dose level bands can also be set to correspond to levels at which sheltering should be implemented and sheltering should be considered. The UK public dose limit is set as the dose equivalent to a negligible impact.

6.2.4 This assessment scale is considered appropriate when considering the magnitude of the UK public dose limit for all sources (1mSv/yr) and the typical background radiation exposure of the UK population (2.8mSv/yr – see chapter D14, Application Reference Number: 6.4.14).

6.2.5 For the impact assessment, the magnitude of change is a measure of the scale or extent of the change, irrespective of the value of the receptor(s) affected. The criteria used to determine the magnitude of change are set out in table 6-1 and are derived from the countermeasure levels described in table 5-1.

6.2.6 The degree of significance is influenced by the value of a receptor and the magnitude of the predicted impact. As all receptors for which impacts are assessed are judged to be of high sensitivity, then the significance can also be assessed using the ranges shown in table 6-1.

Table 6-1 Criteria for impact and significance of effect assessment

Magnitude of impact and significance effect	Dose resulting from accident (mSv)	Basis of level
Large magnitude Major significance	300	Dose at which evacuation should be implemented
Medium magnitude Moderate significance	30	Dose at which evacuation should be considered and sheltering should be implemented
Small magnitude Minor significance	3	Dose at which sheltering should be considered
Negligible magnitude Negligible significance	1	UK public dose limit

6.3 Assessment

6.3.1 From the doses assessed for the reference accidents presented in section 4.4, the following impact assessment is developed for the most exposed members of the local population. This is summarised in table 6-2.

6.3.2 The three DBAs all result in low off-site releases and resulting doses are below 1mSv and are judged as being of negligible impact and negligible significance.

6.3.3 The SA also has an assessed impact of below 1mSv. Based on this, the SA is also judged as being of negligible impact and negligible significance.

6.3.4 Doses in the nearest country (Ireland) are two to three orders of magnitude lower than this (see section 4.4). The resulting impact and significance is also assessed as negligible. Assuming an inverse power relationship between air concentration, ground deposition and dose with distance from the Power Station, impacts at greater distances will also be much lower than this.

6.3.5 The countermeasure levels used as the basis for the impact assessment also correspond to the doses that would be averted if that countermeasure was implemented. Because of this, the results described in table 6-2 also describe the residual impact.

Table 6-2 Impact and significance assessment of accidental releases

Accident	Local reference group maximum total dose (mSv)	Impact	Significance
Loss of Coolant Accident	6.3E-5	Negligible	Negligible
Fuel Handling Accident	5.7E-4	Negligible	Negligible
Off-gas system Failure	2.5E-2	Negligible	Negligible
Severe Accident (containment leakage from Drywell (failed RPV))	7.4E-1	Negligible	Negligible

6.3.6 The DBAs and SA identified for the UK ABWR are all judged to result in negligible impact and be of negligible significance to the most exposed members of the local population (should they occur). As the resulting radioactivity concentrations, and hence doses, will be much lower at the relevant distances, the impacts to members of the public in other countries will also be judged be of negligible impact and significance.

7 References

Table 7-1 Schedule of references

ID	Reference
RD1	United Nations Economic Commission for Europe. 1991. *The Convention on Environmental Impact Assessment in a Transboundary Context*. [Online]. [Accessed: 3 July 2017] Available from: https://www.unece.org/fileadmin/DAM/env/eia/documents/legaltexts/Espoo_Convention_authentic_ENG.pdf.
RD2	Office for Nuclear Regulation. Generic design assessment of the UK ABWR. [Online]. [Accessed: 15 January 2018] Available from: http://www.onr.org.uk/new-reactors/uk-abwr/index.htm
RD3	Office for Nuclear Regulation. Nuclear site licensing. [Online]. [Accessed: 3 July 2017] Available from: http://www.onr.org.uk/civil-nuclear-reactors/licensing.htm .
RD4	Hitachi-GE Nuclear Energy, Ltd. UK Advanced Boiling Water Reactor. [Online]. [Accessed: 3 January 2018] Available from: http://www.hitachi-hgne-uk-abwr.co.uk/gda_library.html.
RD5	International Atomic Energy Agency (IAEA). 2010. *Deterministic Safety Analysis for Nuclear Power Plants. Specific Safety Guide*. IAEA Safety Standards Series No. SSG-2. IAEA: Vienna.
RD6	International Atomic Energy Agency (IAEA). 2010. *Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants*. Specific Safety Guide. IAEA Safety Standards Series No. SSG-3. IAEA: Vienna.
RD7	International Atomic Energy Agency (IAEA). 2010. *Development and Application of Level 2 Probabilistic Safety Assessment for Nuclear Power Plants*. Specific Safety Guide. IAEA Safety Standards Series No. SSG-4. IAEA: Vienna.
RD8	US Nuclear Regulatory Commission. Issued Design Certification - Advanced Boiling-Water Reactor (ABWR). [Online]. [Accessed: 3 July 2017]. Available from: https://www.nrc.gov/reactors/new-reactors/design-cert/abwr.html.
RD9	Office for Nuclear Regulation (ONR). 2014. *Safety Assessment Principles for Nuclear Facilities*. London: The Stationery Office.
RD10	Clarke, R.H. 1979. *The first report of a working group on atmospheric dispersion. A model for short and medium range dispersion of radionuclides released to the atmosphere*. NRPB-R91. National Radiological Protection Board: Chilton.
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RD12	Jones, J.A. 1983. *The fifth report of a Working Group on Atmospheric Dispersion: Models to Allow for the Effects of Coastal Sites, Plume Rise and Buildings on Dispersion of Radionuclides and Guidance on the Value of Deposition Velocity and Washout Coefficients*. NRPB-R157. National Radiological Protection Board: Chilton.
RD13	Smith, J.G., Bedwell, P., Walsh, C. and Haywood, S.M. 2004. *A Methodology for Assessing Doses from Short-Term Planned Discharges to Atmosphere.* NRPB-W54. National Radiological Protection Board: Chilton.
RD14	The Centre for Environment, Fisheries and Aquaculture Science. 2005. *Radiological Habits Survey: Wylfa 2004*. Environment Report RL 02/05.
RD15	The Centre for Environment, Fisheries and Aquaculture Science. 2010. *Radiological Habits Survey: Wylfa 2009*. Environment Report RL 03/10.
RD16	The Centre for Environment, Fisheries and Aquaculture Science. 2014. *Radiological Habits Survey: Wylfa 2013*. Environment Report RL 03/14.
RD17	Smith, K.R and Jones, A.L. 2003. *Generalised habit data for radiological assessments*. NRPB-W41. National Radiological Protection Board; Chilton.
RD18	Jones, J.A. 1981. *Model for Long Range Atmospheric Dispersion of Radionuclides Released Over a Short Period, The Fourth Report of a Working Group on Atmospheric Dispersion*. NRPB-R124. National Radiological Protection Board: Chilton.
RD19	Radiological Protection Institute of Ireland. 2013. *Proposed nuclear power station in the UK – Potential radiological implications for Ireland*. RPII 13/01.
RD20	Smith, J.G. and Simmonds, J.R. 2009. *The Methodology for Assessing the Radiological Consequences of Routine Releases of Radionuclides to the Environment Used in PC-CREAM 08*. HPA-RPD-058.
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RD22	International Commission on Radiological Protection (ICRP). 1995. *Age-dependent Doses to Members of the Public from Intake of Radionuclides - Part 4 Inhalation Dose Coefficients*. ICRP Publication 71. Ann. ICRP 25 (3-4).
RD23	Documents of the NRPB. 1990. *Statement on Emergency Reference Levels*. Volume 1, No 4. National Radiological Protection Board: Chilton.
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Wylfa Newydd Project

6.5.1 ES Volume E - Off-Site Power Station Facilities: AECC, ESL and MEEG E1 - Proposed development

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Contents

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1 Proposed development

1.1 Introduction

1.1.1 This chapter provides a description of the proposed Wylfa Newydd Off-Site Power Station Facilities; the Mobile Emergency Equipment Garage (MEEG), Alternative Emergency Control Centre (AECC) and the Environmental Survey Laboratory (ESL). The chapter provides a description of the proposed site for the Off-Site Power Station Facilities, the surrounding area and environmental context. The chapter also describes the three facilities and associated infrastructure, outlining the construction, operation and decommissioning phases, details of embedded mitigation and the approach to management of waste and materials.

1.2 Site location and environmental context

1.2.1 The positioning of the Off-Site Power Station Facilities must meet certain locational criteria, as outlined below:

- located at a point immediately adjacent to, and which provided straightforward access to, the main road network (A5025, A55, A5);
- located in an area upwind of the Power Station Site;
- located in a zone of low seismic activity; and
- located in a radius between 1.5km and 7.5km from the Power Station Site.

1.2.2 Further detail on the locational criteria and the site selection process is described in chapter E2 (alternatives and design evolution) (Application Reference Number: 6.5.2) of the Environmental Statement and the Site Selection Report – volume 4 - Off-Site Power Station Facilities (Application Reference Number: 8.24.3).

1.2.3 The proposed site for the facilities is at Llanfaethlu, on a former bus depot that is currently being used as a garage and for vehicle parking. This site is located to the east of the existing A5025, approximately 7.5km from the Wylfa Newydd Development Area. Figure E1-1 (Application Reference Number: 6.5.27) shows the site location and boundary.

1.2.4 The site is predominantly hardstanding and houses two existing commercial garages and a motor vehicle repair building. There is an existing single-storey house in the south-west area of the site. Vegetation and scattered planting is present on the northern boundary including an evergreen shelterbelt, while earth bunds and hedgerows are present along the eastern and southern boundaries.

1.2.5 The site is bound by the A5025 to the west, residential and storage buildings to the north, and farmland to the south and east. There are residential properties located to the north and south of the existing entrance, as well as some scattered properties outside of the site boundary, to the south and east of the site.

1.2.6 A new school, Llanfaethlu Primary School, has just been constructed approximately 120m to the south-west of the site on the opposite side of the A5025. This school opened in autumn 2017.

1.2.7 Figure E1-2 (Application Reference Number: 6.5.27) shows the environmental context of the area. The site sits within an area of undulating landform gently rising to the north-west, and is at a lower elevation than the surrounding area. The site lies approximately 15m to the east of the boundary of the Ynys Môn/Anglesey Area of Outstanding Natural Beauty on the opposite side of the A5025, and is located within the Anglesey Special Landscape Area.

1.2.8 The vegetation pattern within the site includes hedgerows with dense linear belts of planting on the southern and eastern boundaries. Surrounding the site there are areas of vegetation around local farmsteads and areas of marsh, scrub and rocky outcrops.

1.2.9 A small unnamed watercourse, which is a tributary of the Afon Llanrhyddlad, is located to the south-east of the site, running in a westerly direction towards Llanfaethlu village.

1.2.10 The site has a very low to negligible hazard rating for natural geological hazards, such as shrink-swelling, landslides, soluble rocks, compressible ground and collapsible rocks.

1.3 Proposals for the Off-Site Power Station Facilities

1.3.1 The following facilities have been included in the layout and design of the Off-Site Power Station Facilities (see figure E1-4, Application Reference Number: 6.5.27):

- MEEG/AECC building;
- ESL building;
- car parking and pedestrian walkways;
- access and delivery areas;
- generator;
- pump house;
- fuel pump and fill point;
- substation;
- two underground fuel tanks;
- refuse compound;
- portable office pods;
- container storage;
- security fencing; and
- drainage swale.

1.3.2 Further information on the main elements of the design is provided in the following sub-sections.

AECC

1.3.3 The AECC would provide back-up command and communications facilities that would be used to remotely manage an incident at the Power Station in the extremely unlikely event the primary facilities on the Power Station Site were untenable or if there was no access to the Power Station Site.

1.3.4 During normal operation of the Power Station, it is expected that the AECC would be in use only once per year for an annual incident exercise. This would normally be carried out during working hours, however in some instances a full out-of-hours exercise may be required.

1.3.5 In the event of an incident the AECC would be operational 24 hours a day.

1.3.6 Should there be an incident, there could be more than 58 staff working at the MEEG/AECC building.

1.3.7 Training at the AECC would be required in addition to the annual incident exercise and would take place at regular intervals, involving a small number of staff using the main AECC area for a limited period of time.

1.3.8 Approximately once a month, maintenance would need to be carried out at the facility, which may include running a back-up generator for a short time.

MEEG

1.3.9 The MEEG would enable Horizon to store a number of specialist vehicles at a location close to, but separate from, the Power Station Site, allowing them to be rapidly deployed if needed to support an incident. The MEEG could also be used as a marshalling point for support arriving on Anglesey before onward dispatch to the Power Station Site in an emergency situation.

1.3.10 The MEEG would have an operational workforce of up to four staff and 12 drivers during training (which would happen during normal working hours approximately once a year). During an incident, the staff would be working 24 hours per day, seven days per week. During periodic vehicle checks, typically once every six months, a similar number of staff would also be required on-site. The facility would not be staffed at other times.

1.3.11 The MEEG and the AECC would be co-located within one building at the centre of the site, with the AECC located at the northern end of the building.

ESL

1.3.12 The ESL will be used for environmental monitoring and would contain radiation monitoring equipment to conduct radiological surveys in the local area.

1.3.13 The ESL would be used for routine sampling. There would be an operational workforce of three staff at the ESL on a regular basis working normal day time hours only. In an incident, the ESL would be operational 24 hours per day.

1.3.14 The ESL would be located in a separate building at the north-west of the site.

Architectural design

1.3.15 A restricted natural palette would be adopted for the buildings, helping to link them visually with, and be unimposing on, their surroundings.

1.3.16 The MEEG/AECC building would be two storeys high with profile sheet cladding and large vehicle access doors.

1.3.17 The ESL building would be single storey with profile sheet cladding.

1.3.18 The buildings would be screened as far as possible and they have been orientated on the site to reduce their effect on the surrounding areas as far as practicable within operational requirements.

1.3.19 Further information relating to design principles for the Off-Site Power Station Facilities is described in volume 3 of the Design and Access Statement (Application Reference Number: 8.2.3).

Landscaping

1.3.20 The landscape design (refer to figure E1-4, Application Reference Number: 6.5.27) is made up of landscape elements which help enhance the site within the local landscape character. Landscaping includes species-rich grassland, linear belts of shrubs and trees, native hedgerow and trees.

1.3.21 Existing stone walling would be retained at the site boundary lines.

1.3.22 Landscape objectives relevant to the Off-Site Power Station Facilities buildings include:

- native linear belt of shrubs and tree planting along the north, south and east site boundaries to provide screening and integrate the Off-Site Power Station Facilities into the surrounding landscape, using a combination of existing hedgerows and additional planting;
- native hedgerow planting on the north-east and southern boundaries;
- extension of the existing southern boundary hedgerow; and
- a mixed-planting composition to complement and integrate with the adjacent A5025 Off-line and On-line Highway Improvements and surrounding landscape character of the area, including species-rich grassland, linear belts of shrubs and trees, and native hedgerows.

Access and parking

1.3.23 There would be 13 staff car spaces provided on the hardstanding portion of the site (including two disabled spaces) and two motorcycle spaces.

1.3.24 Additionally, there would be an overspill car park for 54 spaces provided in the southern portion of the site. This would be used during an incident or training exercise, and would be paved in ‘grasscrete’, a permeable paving material.

1.3.25 Access for 4x4 vehicles would be provided up to the ESL building entrance with turning space.

1.3.26 The site has been designed to allow for two-way heavy goods vehicle (HGV) access into and out of the site, with space for manoeuvring about the site via turning circles on both sides of the MEEG/AECC building.

1.3.27 Vehicle access would be via the existing site access point. The proposed entrance gate to the site would be located a sufficient distance from the road to allow an HGV to wait for the gate to open without the road being obstructed.

1.3.28 Pedestrian access routing has also been provided on-site, with a pedestrian/cycle gated site access separate from the vehicle access.

Security and fencing

1.3.29 The Off-Site Power Station Facilities would be served by closed circuit television and lighting. The perimeter of the site would be secured with a 2.4m high mesh panel security fence.

1.3.30 The AECC and MEEG require critical infrastructure protection status and are integral to the operation of the Power Station. The necessary security would be achieved through a strengthened exterior construction of stone walling, fencing and retaining walls, combined with vegetation barriers.

Lighting

1.3.31 Lighting would be provided at the buildings on-site, car park and pedestrian footpath, and entrance to the site. The lighting requirements for the MEEG/AECC building are likely to vary between day-to-day operation and emergency events and the lighting would be designed to be responsive. Lights would be switched down to a minimum at the end of the working day and through the night. When the MEEG/AECC building is unmanned, lighting at the site would be minimal.

The ESL building would generally only be in operation from 8.00 to 18.00 on weekdays during non-emergency periods. During non-emergency periods, low lighting levels (typically a 50% reduction) would be applied during evenings and on weekends. An override would be programmed into the system so that if an emergency event occurs, the lighting could be switched to a maximum for that period to facilitate safe movement of emergency vehicles, equipment and people. Lighting at the car park, which may not be required during weekends, could be deactivated or switched off during the night.

Utilities

1.3.32 Utilities (including water and telecommunications) would be connected to the site via existing service routes.

1.3.33 The buildings would be serviced with a low energy ventilation system, low energy heating and low energy lighting.

Drainage

1.3.34 A drainage scheme incorporating Sustainable Urban Drainage System techniques has been proposed for the site to manage surface water runoff.

1.3.35 A drainage swale would be located to the south of the hardstanding section of the site to accommodate surface water flows. The swale would be approximately 2.2m wide, and would channel surface water flows to the unnamed watercourse to the south-east of the site.

1.3.36 The vehicle hardstanding would be constructed using permeable paving and, when necessary, surface runoff would be contained in a below-ground storage system until it could be drained after a flood event.

1.3.37 The foul drainage systems at the site would connect into the public sewer.

1.3.38 An attenuation pond associated with the A5025 Off-line Highway Improvements is located in the south-east portion of the site. Please refer to volume G (Application Reference Numbers: 6.7.1 to 6.7.48) for a description of the attenuation pond and the environmental assessment.

Waste and materials

1.3.39 An initial forecast of waste and materials associated with construction, operation and decommissioning activities for the Off-Site Power Station Facilities is included in chapter C6 (project-wide effects – waste and materials management) (Application Reference Number: 6.3.6).

1.3.40 Waste and materials would arise from the construction of the Off-Site Power Station Facilities. Typical waste and materials generated through construction could include, but are not limited to:

- topsoil clearance;
- vegetation removal;
- bulk earthworks;
- concrete;
- aggregates; and
- packaging.

1.3.41 All waste and materials arising from construction works at the Off-Site Power Station Facilities would be managed in a responsible manner with the clear intention of applying the principles of the waste hierarchy, as described in the waste and materials management strategy in the Wylfa Newydd Code of Construction Practice (CoCP) (Application Reference Number: 8.6).

1.3.42 Waste would be generated during the operation of the Off-Site Power Station Facilities, including waste arising from maintenance activities, site administration and welfare facilities. These activities would lead to generation of the following types of waste:

- packaging materials for goods entering the site, e.g. paper, card, glass, plastic and metal;
- office and administrative materials;
- canteen waste from the kitchen and restaurant/café facilities;
- waste electronic and electrical equipment, e.g. computers, cookers and fridges;

- switchgear, pumps;
- metal waste from maintenance works, garages;
- building maintenance waste, e.g. timber, plasterboard, insulation, paint tins and metals; and
- hazardous wastes, e.g. some chemicals, paints, fuel and oils.

1.3.43 The decommissioning process would involve the removal of all buildings and infrastructure, the replacement of subsoil and topsoil and, as far as reasonable to do so, landscaping of the site to restore it back to its previous condition of primarily hardstanding.

1.3.44 Anticipated waste arisings from the decommissioning phase are likely to include volumes of recovered structural steel and reinforcing bar, tarmac and crushed concrete rubble. It is also likely that a wide range of materials, products, equipment and furniture would be generated. At this stage, the quantities of waste and materials generated through the decommissioning phase are not known.

1.3.45 All waste and materials generated during decommissioning would be managed in accordance with the waste hierarchy and legislative requirements. It is unlikely that the waste arisings from the decommissioning would be suitable for re-use and therefore they would need to be taken off-site for re-use, recycling or, as a last resort, to landfill for disposal.

1.4 Rochdale Envelope and parameters

1.4.1 A description of the Rochdale Envelope and parameter approach is provided in chapter B1 (introduction to the assessment process) (Application Reference Number: 6.2.1) of the Environmental Statement.

1.4.2 In order to cope with potential change through the design development processes, Horizon has proposed a parameter based approach for the construction and operation of the Off-Site Power Station Facilities. As such, the application for development consent is based on bounded parameters rather than a defined design.

1.4.3 The parameters are contained within the following:

- **Order Limits:** these define the area within which the Off-Site Power Station Facilities may be constructed, operated and maintained under article 3 of the draft DCO (Application Reference Number: 3.1). The Order Limits are illustrated on figure E1-3 (Application Reference Number: 6.5.27).
- **Works Plans** (Application Reference Number: 2.3)**:** these identify the limits of deviation for, and location of, each work package (or 'work area') under Schedule 1 (authorised development) as referred to in article 4 of the draft Development Consent Order (DCO) (Application Reference Number: 3.1). The whole of the Off-Site Power Station Facilities is one work area (Work No. 5) and Schedule 1 lists the works that can take place within the defined area.

- **Parameter Plan:** this identifies the zones within which buildings, structures and works identified in the parameter table (see below) must be located. There are two parameter zones for the Off-Site Power Station Facilities as illustrated on figure E1.3 (Application Reference Number 6.5.27):
  - MEEG/AECC building
  - ESL building
- **Parameter table:** this identifies maximum building dimensions and the zones within which specific buildings, structures and works must be located (as shown on the Parameter Plan). The parameter table for the Off-Site Power Station Facilities is included as table E1-1.

Table E1-1 Parameters for the Off-Site Power Station Facility

Building	Parameter Zone	Maximum Parameter		
		Length (m)	Width (m)	Height (m)
MEEG/AECC	5-1	55	25	14
ESL	5-2	30	19	8

1.4.4 The flexibility associated with buildings, structures and works is restricted through the application of the parameters. These parameters have been informed by the potential to create adverse environmental effects. For those buildings where the location is sensitive in terms of Environmental Impact Assessment, location has been limited to relatively modest limits of deviation.

Indicative design

Figure E1-4 in the volume E Figures booklet (Application Reference Number: 6.5.27), illustrates the indicative site layout which has been used, in combination with the above parameter envelope, as the basis of the Environmental Impact Assessment.

1.5 Development phases and activities

Construction

1.5.1 Construction activities would be undertaken within the site footprint, except for works to adapt the entrance to the west of the site, which would require minor amendments to the existing A5025 such as new road markings and signage.

1.5.2 The two existing commercial garages, motor vehicle repair building and existing single-storey house in the south-west of the site would be demolished.

1.5.3 The construction of the Off-Site Power Station Facilities would commence in the third year following grant of development consent, and last for approximately two years. The Off-Site Power Station Facilities would be operated until the decommissioning of the Power Station.

1.5.4 The construction of the Off-Site Power Station Facilities would commence following the completion of the A5025 Highway Improvements. The

construction workforce for the Off-Site Power Station Facilities would be a maximum of 85 workers on the construction site at any one time, working in shift patterns of a minimum of six hours per day.

1.5.5 The construction contractor would typically undertake construction works between 08.00 to 18.00 Monday to Friday and 08.00 to 13.00 on Saturdays as necessary.

1.5.6 During construction, it is anticipated that the peak vehicle trip generation would be 204 two-way vehicle trips per day (i.e. 102 in and 102 out), including 48 HGV trips, 102 car trips and 54 minibus and light goods vehicle trips.

1.5.7 The proposed construction activities include the following:

- establish the site compound in the portable cabin office area;
- demolish three existing buildings on-site and a single-storey house in the south-west corner of the site;
- stripping of topsoil and subsoil (as required);
- form foundations for the MEEG/AECC building and the ESL building;
- undertake drainage and utility works;
- form the new road surface moving east to west including installation of the surface water storage tank and drainage;
- erect the MEEG/AECC building, followed by the ESL building;
- form pedestrian routes within the site and parking areas; and
- undertake soft landscaping.

1.5.8 It is anticipated that construction plant would include excavators, tipper trucks, dozers, fork lifts, rotary bored piling rig, mobile cranes and dump trucks.

Operation

1.5.9 The MEEG/AECC building would not be staffed day-to-day but would be accessed for training events, periodic vehicle checks, maintenance and during an emergency response event.

1.5.10 General activities and functions of the MEEG during the management of an incident would include:

- securing weatherproof storage of vehicles and equipment;
- simple vehicle checks, cleaning and routine maintenance;
- controlled deployment to the Power Station Site when required;
- straightforward access to the road network;
- briefing of drivers for the deployment of the vehicles and equipment;
- recovery of vehicles and equipment; and
- provision of accommodation and communications for the facility leadership team.

1.5.11 Operational vehicles required to be stationed at the MEEG are likely to include:

- 12 large emergency response multi-terrain vehicles;
- 18 vans;
- two excavators;
- staff cars; and
- forklifts.

1.5.12 General activities and functions at the AECC during the management of an incident would include:

- determining the site-strategic response to the incident;
- managing protection of the public, personnel, plant and the environment while also ensuring security of the site;
- communicating and liaising directly with the local control centre, main control room, security and all emergency facilities;
- gathering information about the incident;
- developing the strategy and tactics to respond to the incident and displaying information regarding the incident;
- collating muster and roll-call information;
- recording incident information; and
- briefing stakeholders.

1.5.13 The ESL building would be staffed day-to-day during normal business hours. General operational activities and functions at the ESL would include:

- receipt of environmental samples.
- undertaking simple radiochemical analysis
- control of environmental survey vehicles;
- administrative recording of the samples; and
- storage of instrumentation used for radiological surveys in the environment.

1.5.14 Operational traffic for the Off-Site Power Station Facilities would primarily be associated with the day-to-day operation of the ESL, and would include 10 two-way vehicle trips per day, including four HGV trips, two car trips and four light goods vehicle or minibus trips.

Decommissioning

1.5.15 At present, it is assumed that the MEEG, AECC and ESL buildings would be decommissioned and removed from the site around the same time as decommissioning of the Power Station commences at the end of its operational life. Any alternative proposals for use of the buildings or the site beyond this period would need to be considered and determined as part of a future planning application at that time.

1.6 Embedded and good practice mitigation

1.6.1 Environmental mitigation embedded into the design includes:

- use of appropriate massing and external surfacing on the buildings, sympathetic to the agricultural built heritage of the Isle of Anglesey;
- buildings on-site of a similar scale, height and character to existing buildings;
- landscaping of the site, including planting along the perimeter of the site to soften the boundary;
- locating the security fence 3m from existing vegetation and proposed planting and retaining the stone wall and existing trees along the boundaries, to limit the visual impact of the Off-Site Power Station Facilities;
- retention of existing features such as hedgerows, stone walls and boundary features and the unnamed watercourse to the south-east of the site;
- incorporation of Sustainable Urban Drainage Systems to reduce runoff and to reduce the risk of watercourse pollution; and
- lighting design to avoid light spill onto surrounding buildings, watercourses and boundary features such as hedgerows.

1.6.2 Chapter J1 (environmental commitments) (Application Reference Number: 6.10.1) of the Environmental Statement gives further information on how these embedded mitigation measures are being secured.

1.6.3 Good practice mitigation would be employed during construction. This mitigation would be secured through the Wylfa Newydd CoCP (Application Reference Number: 8.6) and the Off-Site Power Station Facilities sub-CoCP (Application Reference Number: 8.9), within which full information is given.

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6.5.9 ES Volume E - Off-Site Power Station Facilities: AECC, ESL and MEEG E9 - Terrestrial and freshwater ecology

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9 Terrestrial and freshwater ecology

9.1 Introduction

9.1.1 This chapter describes the assessment of potential terrestrial and freshwater ecology effects resulting from the construction, operation and decommissioning of the Off-Site Power Station Facilities.

9.1.2 Please refer to chapter B9 (terrestrial and freshwater ecology) (Application Reference Number: 6.2.9) for the technical basis for the assessment including a summary of legislation, policy and guidance; key points arising in consultation that have guided the terrestrial and freshwater ecology assessment; and assessment methodologies and criteria.

9.1.3 This chapter should be read in conjunction with the Off-Site Power Station Facilities Ecology Factual Report (see appendix E9-1, Terrestrial ecology survey at proposed MEEG site, Llanfaethlu, Application Reference Number: 6.5.17) and appendix E9-2 Off-Site Power Station Facilities Protected and Legally Controlled Species Compliance Report (Application Reference Number: 6.5.18). The latter discusses species protected or controlled by UK legislation (including breeding birds, great crested newts (GCN) (*Triturus cristatus*), reptiles, bats, otter (*Lutra lutra*), water vole (*Arvicola amphibius*) and Invasive Non-Native Species of plant) and the legal implications of the proposed development on these species.

9.2 Study area

9.2.1 This section describes the study area relevant to the terrestrial and freshwater ecology assessment for the Off-Site Power Station Facilities.

9.2.2 The area for the desk study was a 2km radius from the Off-Site Power Station Facilities for legally protected species and designated sites (statutory and non-statutory) of nature conservation importance. This search area was based on professional judgement and good practice guidelines (e.g. [RD1]) and was considered to be sufficient to account for the majority of ecological receptors that would be potentially vulnerable to effects arising from construction, operation and decommissioning activities within the Off-Site Power Station Facilities. This took into account the Zones of Influence relevant to other disciplines such as air quality (chapter E5) (Application Reference Number: 6.5.5) and surface and ground water (chapter E8) (Application Reference Number: 6.5.8).

9.2.3 Within the desk study area, the areas subject to specific surveys were defined by appropriate best practice guidelines and professional judgement based on the habitat preferences of the target species (see section 9.3 and baseline report appended to this chapter (appendix E9-1, Application Reference Number: 6.5.17). This area is referred to as the field survey area for terrestrial and freshwater ecology, and includes all areas within the boundary of the Off-Site Power Station Facilities and a buffer zone extending approximately 500m. The 500m buffer was influenced by the results of the desk study, good practice guidelines (e.g. [RD1]), and professional

judgement, and is considered to be an appropriate distance beyond which most development related impacts would not extend.

9.3 Baseline environment

9.3.1 This section provides a summary of the baseline conditions for terrestrial and freshwater ecology within the study area described in section 9.2. Receptors have been valued according to the methodology and criteria described in chapter B9 (Application Reference Number: 6.2.9).

Statutory and non-statutory designated sites

9.3.2 Figure E9-1 (Application Reference Number: 6.5.27) illustrates the statutory and non-statutory designated sites within the study area. The Off-Site Power Station Facilities do not lie within or adjacent to any statutory or non-statutory designated sites.

9.3.3 The following statutory designated site was recorded within the desk study area.

- Llyn Garreg-lwyd Site of Special Scientific Interest: located approximately 700m to the north-west of the Off-Site Power Station Facilities site. It is a large reedbed (17.7ha) in a former ornamental lake, and is an example of tall fen dominated by common reed and supports a range of breeding birds [RD2].

9.3.4 The following non-statutory designated sites were recorded within the desk study area.

- Coed Carreglwyd Isle of Anglesey County Council Wildlife Site. 12.28ha site, approximately 700m north-west of the Off-Site Power Station Facilities site. This site consists of broadleaved woodland dominated by sycamore (*Acer pseudoplatanus*) with abundant wych elm (*Ulmus glabra*), and scattered sessile oak (*Quercus petraea*) and ash (*Fraxinus excelsior*). This is the largest area of broadleaved woodland in the north-west corner of Anglesey.
- Ancient semi-natural woodland site (4.56ha) and restored ancient woodland site (5.94ha), approximately 700m north-west of the Off-Site Power Station Facilities site. The boundary coincides with much of the Coed Carreglwyd Isle of Anglesey County Council Wildlife Site.

9.3.5 In accordance with the criteria presented in table B9-12, the Site of Special Scientific Interest is of high value as this site is a nationally important statutory designated site.

9.3.6 The Isle of Anglesey County Council Wildlife Site is considered to be of medium value, as it is a non-statutory designation, important in a county/regional context.

9.3.7 Ancient semi-natural woodland is a non-statutory designation but is considered to be important at a national level due to its restricted range and highly limited potential for substitution, and is therefore considered to be of high value.

Terrestrial habitats and species

Habitats

9.3.8 The terrestrial habitats within the study area are shown in appendix E9-1 (Application Reference Number: 6.5.17) as recorded during a Phase 1 habitat survey in June 2016.

9.3.9 The terrestrial habitats within the boundary of the Off-Site Power Station Facilities comprised hardstanding and buildings associated with a vehicle repair garage covering an area of approximately 1ha, together with a similar sized area of semi-improved grassland to the south of the hardstanding. Habitats outside of the development footprint and within the 500m buffer comprised improved grassland, semi-improved neutral grassland, semi-improved grassland and species-poor native hedges. There were small areas of habitat that could be classified as contributing to the targets of the *Working for the wealth of wildlife: Anglesey Local Biodiversity Action Plan* [RD3] for field edges and scrub, but not to a significant degree. These features are common and widespread within Anglesey.

9.3.10 The Phase 1 habitat survey recorded a species-poor native hedgerow within the southern half of the Off-Site Power Station Facilities site (see appendix E9-1, Application Reference Number: 6.5.17). This hedge does not fulfil the ecological criteria for being considered important under the Hedgerow Regulations 1997 [RD4].

9.3.11 Terrestrial habitats likely to be affected by development of the Off-Site Power Station Facilities are considered to be of negligible value, but do have the potential to support notable and protected species.

9.3.12 Due to the absence or limited extent of habitats necessary to support notable assemblages of fungi, lichens, bryophytes, higher plants, terrestrial invertebrates, or overwintering birds recorded during the Phase 1 habitat survey (see appendix E9-1, Application Reference Number: 6.5.17), these groups are not considered further in this assessment. Similarly, due to the limited extent of suitable habitat that would be affected by the Off-Site Power Station Facilities, reptiles and notable mammals (with the exception of bats, otter and water vole) have been excluded from this assessment.

Species

Invasive Non-Native Species of plant

9.3.13 During the Phase 1 habitat survey, Himalayan balsam (*Impatiens glandulifera*) was recorded within the boundary of the Off-Site Power Station Facilities, as shown in appendix E9-1 (Application Reference Number: 6.5.17). This species is listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), meaning that it is illegal to plant, or otherwise cause this species to grow in the wild.

9.3.14 This species does not form a receptor, and so is not assigned a value, but does have the potential to cause a significant environmental effect which would require appropriate mitigation.

Amphibians

9.3.15 Cofnod provided no records of GCN within the study area during the last 10 years.

9.3.16 Habitat Suitability Index assessments were undertaken of water bodies within the study area, where land access was permitted. Subsequent field surveys recorded the presence of GCN in Pond 21.

9.3.17 Surveys of these water bodies were undertaken as part of the baseline data collection for the A5025 Off-line Highways Improvements as the Off-Site Power Station Facilities lie within the highways survey area. The locations of these water bodies and survey results are shown in appendix G9-2 (A5025 Terrestrial Ecology Factual Report 2014-2016, Application Reference Number: 6.7.23) and appendix G9-5 (A5025 Route Improvement Contract EIA: Great Crested Newt Field Survey Results, Application Reference Number: 6.7.26).

9.3.18 The GCN recorded in Pond 21 are unlikely to use the habitat within the boundary of the Off-Site Power Station Facilities as it lies on the opposite side of the A5025, and this main road is considered to be a barrier to GCN movement from that pond.

9.3.19 Taken together, the absence of records on the eastern side of the A5025, the limited habitat suitability within the Off-Site Power Station Facilities boundary (see appendix E9-1, Application Reference Number: 6.5.17), and due to the A5025 acting as a barrier to dispersal for GCN, it is considered that GCN are absent from the Off-Site Power Station Facilities site. Effects on GCN have therefore not been assessed in this chapter.

Breeding birds

9.3.20 Cofnod data provided 41 records of birds between 2007 and 2017, as shown in figure E9-1 (Application Reference Number: 6.5.27), including song thrush (*Turdus philomelos)*, swallow (*Hirundo rustica)*, cuckoo (*Cuculus canorus)* and dunnock (*Prunella modularis)*.

9.3.21 Habitats with the potential to support breeding birds within the study area include the species-poor native hedgerows and interior and exterior features of the buildings. There is no evidence to suggest that these features support species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), although there is the potential for species listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016 to be present, e.g. house sparrow (*Passer domesticus*). There are records of *Local Biodiversity Action Plan* [RD3] listed species, skylark (*Alauda arvensis*) and song thrush (*Turdus philomelos*) from surveys of adjacent habitats, albeit very occasionally and in limited numbers (see appendix G9-4, A5025 Route Improvement Contract EIA: Breeding Bird Survey Report, Application Reference Number: 6.7.25).

9.3.22 In summary, the potential nesting features present in the study area are common and widespread in the local area. As such, the breeding bird assemblage likely to use the Off-Site Power Station Facilities is assigned a low value.

Bats

9.3.23 Cofnod data showed records of noctule bat (*Nyctalus noctula*) within the study area, see figure E9-1 (Application Reference Number: 6.5.27).

9.3.24 The habitats present within the Off-Site Power Station Facilities site have negligible potential to provide foraging resources for bats and are also unlikely to form a significant part of a commuting network in the wider environment due to the small size of the site and habitats therein. This assessment is supported by incidental data recorded during the 2016 surveys, during which only low numbers of pipistrelles (*Pipistrellus* species) and high-flying commuting noctules were recorded (see appendix E9-1, Application Reference Number: 6.5.17). Any value of the proposed Off-Site Power Station Facilities to bats is therefore limited to the potential for buildings to support roosting bats.

9.3.25 Bat surveys were completed in 2016 and comprised:

- external and internal inspections of all buildings; and
- dusk emergence surveys and dawn re-entry surveys of buildings that would be demolished, i.e. buildings M1, M2, M4, M5 and M6 as shown in appendix E9-1 (Application Reference Number: 6.5.17), with the exception of Building M3 which was not included within the scope of works at the time of survey.

9.3.26 The results from the surveys are set out in detail in appendix E9-1 (Application Reference Number: 6.5.17) and summarised in table E9-1.

Table E9-1 Summary of bat survey results

Building No.	Building potential to support roosting bats using criteria from [RD1]	Dusk emergence and dawn re-entry survey results
M1	Low	No bats recorded.
M2	Low	No bats recorded.
M3	Moderate	No surveys completed as outside the proposed development area at time of survey.
M4	Negligible	None required based on building potential.
M5	Low	No bats recorded.
M6	Negligible	None required based on building potential.

9.3.27 There were no bat roosts recorded within any of the buildings, although the residential properties around the Off-Site Power Station Facilities were noted as having potential to support roosting bats. The species recorded in the locality were common and widespread, and the site offered negligible foraging or commuting habitat; therefore, bats are valued as low in relation to the proposed development.

Otter and water vole

9.3.28 Cofnod provided no records of otter or water vole within the study area. The 2010 Otter Survey of Wales highlighted Anglesey as having an expanding otter population [RD5]. The report shows otter distribution increasing from being present at 18% of the sites surveyed in 2002 to being present at 67.5% of the sites surveyed in 2009, with new sites recorded to the west and north of the island.

9.3.29 The East Drain (described below in the Freshwater habitats and species section) has the potential to support both otter and water vole. Evidence of water vole has been recorded through an incidental sighting during a survey of the A5025 Off-line Highways Improvements. This sighting was from the East Drain, approximately 380m to the east of the Off-Site Power Station Facilities site. Otter has not been recorded, although records for otter exist in connected watercourses north and south of the proposed development (see appendix E9-1, Application Reference Number: 6.5.17).

9.3.30 Given the limited evidence for these species on the site, the legal protection afforded to them and their listing on Section 7 of the Environment (Wales) Act 2016, they are considered to be of low value.

Freshwater habitats and species

Habitats

9.3.31 The freshwater habitats recorded within the study area are described in appendix G9-1 (A5025 Freshwater Baseline Surveys 2014-2015, Application Reference Number: 6.7.22), chapter E8 (Application Reference Number: 6.5.8) and are shown in figure E8-1 (Application Reference Number: 6.5.27), and comprised two water bodies:

- East Drain: a drainage ditch close to the south-eastern corner flowing eastwards; a tributary of the Afon Llanrhyddlad; and
- Hen-shop Drain: a culverted tributary of the East Drain flowing from the north.

9.3.32 The East Drain was typical for drainage ditches in the area with some potential to support aquatic and riparian species, but this was limited by ephemerality and poor connectivity. The Hen-shop Drain was culverted with no potential to support freshwater receptors. The freshwater habitat in the study area is therefore considered to be of negligible value.

Species

Invertebrates and macrophytes

9.3.33 No species of conservation interest were recorded during freshwater surveys in 2015 and 2016 (see appendix G9-1, Application Reference Number: 6.7.22). The East Drain supported a freshwater invertebrate and macrophyte community of low quality, dominated by ubiquitous species typical of slow flowing ditch watercourses.

9.3.34 Based upon the low habitat quality and presence of species common to similar watercourses of this nature across the wider landscape, freshwater invertebrates and macrophytes are considered to be of negligible value.

Fish

9.3.35 No species of conservation interest were recorded during surveys in 2016 (see appendix G9-1, Application Reference Number: 6.7.22). Three-spined stickleback (*Gasterosteus aculeatus*) were recorded in the East Drain, a species typical of this common habitat type. The low habitat quality, seasonally variable water levels and distance from sea for migratory species mean that the fish assemblage is considered to be of negligible value.

Summary of receptors

9.3.36 In accordance with chapter B9 (Application Reference Number: 6.2.9), only those receptors considered to be of low, medium and high value and with the potential to be affected by the proposed development, are taken forward to assessment. These are listed in table E9-2. Terrestrial habitats, GCN, and freshwater habitats and species, have been assigned a negligible value and have therefore not been taken forward within this assessment.

Table E9-2 Value of receptors taken forward to assessment

Receptor	Value of Receptor
Llyn Garreg-lwyd Site of Special Scientific Interest	High
Ancient woodland	High
Coed Carreglwyd Isle of Anglesey County Council Wildlife Site	Medium
Breeding birds	Low
Bats	Low
Otter	Low
Water vole	Low

Evolution of the baseline

9.3.37 The Off-Site Power Station Facilities site predominantly supported hardstanding habitat and buildings of negligible ecological value. It is likely that, over time, the site would continue to be utilised as a garage and motor vehicle repair site. Long-term changes could relate to the use of the site, which might include the demolition of the buildings for site redevelopment.

9.4 Design basis and activities

9.4.1 This section sets out the design basis for the 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 would be adopted

to reduce adverse effects as inherent design features or by implementation of standard industry good working practice.

9.4.2 As described in chapter E1 (proposed development) (Application Reference Number: 6.5.1), the application for development consent is based on a parameter approach. The assessment described within this chapter has taken into consideration the flexibility afforded by the parameters. A worst case scenario has therefore been assessed from a terrestrial and freshwater ecology perspective within the parameters described in chapter E1 (Application Reference Number: 6.5.1).

Construction

9.4.3 The design and construction of the Off-Site Power Station Facilities has been described in chapter E1 (Application Reference Number: 6.5.1).

Basis of assessment and assumptions

9.4.4 The key activities and elements of the design that are most relevant to terrestrial and freshwater ecology are as outlined below:

- demolition of buildings present on-site;
- clearance and landscaping of semi-improved grassland habitat;
- lighting of construction area;
- construction up to existing watercourses – no buffer zone applied;
- soft landscaping of approximately 1.0ha; and
- installation of an attenuation tank and oil interceptor to collect hardstanding runoff before discharge into the East Drain.

Embedded mitigation

9.4.5 Mitigation embedded in the design presented in chapter E1 (Application Reference Number: 6.5.1), the Wylfa Newydd Code of Construction Practice (CoCP) (Application Reference Number: 8.6), volume 3 of the Design and Access Statement (Associated Developments and Off-Site Power Station Facilities) (Application Reference Number: 8.2.3), and the Off-Site Power Station Facilities sub-CoCP (Application Reference Number: 8.9) includes the following measures relevant to ecological receptors.

- The design of the development of the Off-Site Power Station Facilities has avoided habitats of low or greater value and existing features have been retained where practicable, e.g. hedgerows, boundary features and watercourses.
- Existing boundary hedges and trees would be retained where possible.
- Retention of stone walls to the north and east of the site.
- The lighting used during construction of the Off-Site Power Station Facilities would seek to limit the effects on habitats of most value to sensitive ecological receptors.

Good practice mitigation

9.4.6 Good practice during the construction phase includes the following measures which would be implemented in accordance with the Wylfa Newydd CoCP (Application Reference Number: 8.6) and the Off-Site Power Station Facilities sub-CoCP (Application Reference Number: 8.9).

- Where possible, habitat with the potential to support bird nests, would be removed outside the breeding bird season (typically March to August inclusive). This would ensure that no birds are nesting on-site at the start of construction within or/near to the identified habitat. If it is not possible to avoid the breeding bird season, then clearance works would be supervised by the implementation of the measures outlined below.
  - An Ecological Clerk of Works (ECoW) would complete a pre-construction survey prior to removing any habitat with the potential to support nesting birds, including ground nesting species. The pre-construction survey would identify the presence of any active nests, and in the event they are identified, establish appropriate methodologies to reduce any potential impacts on these nests during clearance works.
  - The ECoW would supervise the clearance of habitats once it has been established that there are no nests present.
  - Should active nests be found, either during the pre-construction survey or during supervision, then the ECoW would set up a work exclusion zone of an appropriate distance to prevent disturbance. The exclusion zone distance would be set based on the judgement of the ECoW and the species concerned, but would typically range between 5m and 10m.
  - Work exclusion zones would be maintained until chicks have fledged or the nest has become inactive, as determined through monitoring visits by the ECoW.
- In order to manage the risk of introducing and/or spreading INNS, Horizon will prepare one (or more) Biosecurity Risk Assessment (s) and Method Statement (s) to cover all activities. Each Biosecurity Risk Assessment will consider in general:
  - measures that will be undertaken to control and eradicate INNS within the area of works; and
  - measures or actions that aim to prevent INNS being introduced to the site for the duration of the construction phase of the scheme.
- In the management of existing known presence of INNS, Biosecurity Risk Assessments and Method Statements will detail:
  - how areas with the presence of INNS will be demarcated;
  - how any contaminated materials will be appropriately managed throughout the works, including where appropriate eradication from the site;

  - appropriate disposal; and
  - how any transfer or spread will be prevented.
- In terms of prevention of new introduction to the site through terrestrial and marine pathways, Biosecurity Risk Assessments and Method Statements will detail:
  - Risk pathways and risk activities for the transfer and spread of non-native species;
  - risk assessment for the transfer and spread of individual non-native species of known concern;
  - methods to manage risk of transfer including any actions to be undertaken prior to reaching site; and,
  - contingency planning and corrective actions.
- Horizon will implement a monitoring programme for non-native species. This will include observational surveys on structures that may provide suitable substrate for non-native species. Surveys will record presence/abundance of non-native species with reporting in agreement with Natural Resources Wales (NRW). Monitoring survey requirements for specific sites are set out in the sub-CoCPs where relevant. Where new presence of INNS is discovered, Biosecurity Risk Assessments and Method Statements will be reviewed and amended where necessary. Wherever appropriate, workers will be given an activity specific tool-box talk from an ECoW. This will include photographs of any INNS species known to be present on a site.
- A pre-construction survey would be completed prior to connecting any drainage infrastructure to existing watercourses to survey for the presence of otter holts and water vole burrows which might be affected by the Off-Site Power Station Facilities.
- Dependent on the results of the pre-construction survey, provision of a replacement bat roost (in the form of bat boxes), and measures to avoid killing or injuring bats (such as roost exclusion) would be implemented when Building M3 is demolished. If required, the demolition work would take place under the provisions of a European Protected Species licence.

Operation

Basis of assessment and assumptions

9.4.7 The activities involved in the operation of the Off-Site Power Station Facilities site would be as described in chapter E1 (Application Reference Number: 6.5.1).

Embedded mitigation

9.4.8 Mitigation embedded in the design presented in chapter E1 (Application Reference Number: 6.5.1) includes the following measures relevant to ecological receptors.

- Soft landscaping, including e.g. hedgerow, shrub and tree planting, on the eastern and southern boundaries of the Off-Site Power Station Facilities site would help reduce light spill onto sensitive ecological receptors, where this does not conflict with operational and security requirements.
- The drainage design would provide attenuation capacity to address the potential for increased surface water runoff rates and pollution risks. This would avoid degradation of habitats suitable for otter and water vole.

Good practice mitigation

9.4.9 No specific good practice mitigation in relation to the operation phase of the Off-Site Power Station Facilities has been identified for terrestrial and freshwater ecology. However, measures of relevance to ecology during operation include those measures designed to further reduce hydrological effects that are set out in chapter E8 (Application Reference Number: 6.5.8) of this volume.

Decommissioning

Basis of assessment and assumptions

9.4.10 Upon closure of the Power Station, the proposed Off-Site Power Station Facilities site would either be cleared of all buildings and returned to its pre-development state (minus buildings) or the buildings would be retained for re-use. Should demolition take place, all activities would be undertaken in accordance with the relevant legislation and guidance in place at the time.

9.4.11 It is assumed that the drainage system would not be removed as part of decommissioning and therefore this system would continue to provide mitigation against surface water flooding and pollution within the runoff.

Embedded mitigation

9.4.12 Should buildings require demolition, embedded mitigation for the decommissioning of the Off-Site Power Station Facilities is likely to use similar measures to those employed during the construction phase.

Good practice mitigation

9.4.13 Good practice mitigation for the decommissioning of the Off-Site Power Station Facilities is likely to use similar measures to those employed during the construction phase should buildings require demolition.

9.5 Assessment of effects

9.5.1 This section presents the findings of the assessment of potential impact pathways associated with the construction, operation and decommissioning of the Off-Site Power Station Facilities. Table E9-3 provides a summary of the potential impact pathways.

Table E9-3 Summary of potential impact pathways for ecological receptors

Potential impact pathway	Area in which the impact may influence ecological receptors	Receptors that could be affected
Changes in air quality during construction and operation.	Dust emissions – areas within 50m of the Off-Site Power Station Facilities, and within 50m of the access roads situated up to 500m from each section's site entrance, (as set out in chapter E5 (Application Reference Number: 6.5.5). Emissions from plant and machinery (i.e. non-road mobile machinery) (as set out in chapter E5 (Application Reference Number: 6.5.5)). Potential for habitat loss or degradation in areas affected. Emissions may affect ecological receptors up to 200m from roads affected by increased traffic using the Off-Site Power Station Facilities across the whole of Anglesey. This is addressed in chapter C4 (air quality effects of traffic) (Application Reference Number: 6.3.4).	Statutory and non-statutory designated sites for nature conservation. Ancient woodland.
Habitat loss during construction.	Habitat loss would be restricted to areas cleared to make way for the construction of the Off-Site Power Station Facilities. There would be no additional habitat loss during operation of the Off-Site Power Station Facilities.	Breeding birds. Bats. Otter and water vole.
Mortality and injury during construction	Demolition of Building M3 could result in mortality or injury of bats.	Bats.

Potential impact pathway	Area in which the impact may influence ecological receptors	Receptors that could be affected
Disturbance via increases in noise and light pollution during construction, operation and decommissioning.	Disturbance via increases in lighting and noise during all stages could affect habitats within the Off-Site Power Station Facilities, and its immediate boundary.	Breeding birds. Bats. Otter and water vole.
Hydrological changes during construction, operation and decommissioning.	Hydrological changes through changes in volume and quality as a result of surface water runoff.	Otter and water vole.

Construction

Air quality changes

9.5.2 There were no statutory or non-statutory sites designated for nature conservation (see section 9.3.2) within the areas potentially affected by dust emissions, as detailed in chapter E5 (Application Reference Number: 6.5.5).

9.5.3 Changes in air quality as a result of emissions from plant and machinery have the potential to affect statutory or non-statutory sites and ancient woodland via nitrogen and acid deposition or exceedance of critical levels. As set out in chapter E5 (Application Reference Number: 6.5.5), the phased construction programme, relatively low number and size of plant and machinery items required, and low existing air quality concentrations, mean the potential effect on local air quality would be negligible. This aspect was therefore screened out from requiring further assessment.

Habitat loss

9.5.4 The habitat lost as a result of the construction of the Off-Site Power Station Facilities comprises hardstanding, species poor hedgerow and six buildings. The embedded mitigation would retain the majority of the boundary habitats of value to breeding birds and bats and includes soft landscaping planting of a hedgerow, native trees and shrubs. This net gain in habitat is considered to be a small change with a minor positive effect for bats (foraging and commuting) and breeding birds.

9.5.5 Building M3 (see appendix E9-1, Application Reference Number: 6.5.17)) would be demolished and was identified as offering moderate potential to support roosting bats. It is considered unlikely that this building would support a high status roost given limited bat activity recorded during the roost surveys on adjacent buildings. It is therefore considered this building is only likely to be used by small numbers of common species. Pre-construction surveys would be undertaken to determine whether the building was a roost. If required, good practice mitigation to provide a replacement roost (in the form of bat boxes) under a European Protected Species Licence

would result in a negligible magnitude of change, with a negligible effect predicted if this building does support roosting bats.

9.5.6 Installation of drainage into East Drain could affect otter and water vole through the loss of places of shelter and refuge. Good practice mitigation to undertake pre-construction surveys of any areas affected by drainage installation for the presence of water vole burrows and/or otter resting sites would allow such features to be avoided, leading to a negligible magnitude of change. This is detailed in the Off-Site Power Station Facilities sub-CoCP (Application Reference Number: 8.9), and the significance of the effects would therefore be negligible.

Mortality and injury

9.5.7 The demolition of Building M3 could result in the mortality or injury of bats (if a roost was confirmed in the building). The good practice mitigation measures that would form part of a European Protected Species licence (if required) would result in a negligible magnitude of change and a negligible effect on bats.

Disturbance

9.5.8 The predicted changes in noise and vibration are assessed in chapter E6 (noise and vibration) (Application Reference Number: 6.5.6). The predicted worst-case noise levels would occur in month three of the Off-Site Power Station Facilities construction programme when demolition, site clearance and groundworks would be undertaken. Disturbance due to noise and lighting could affect breeding birds, bats (if roosting in adjacent properties), otter and water vole. However, with the application of embedded mitigation (e.g. sensitive lighting positions) and good practice mitigation as detailed in the Off-Site Power Station Facilities sub-CoCP (Application Reference Number: 8.9) (e.g. avoidance of removal of vegetation during the breeding bird season), and because of the small scale of works, the magnitude of change is predicted to be negligible. Given the potentially very minor detrimental alteration to these receptors and their habitats, the effect of disturbance on these receptors would be negligible.

Hydrological changes

9.5.9 Embedded and good practice mitigation, as detailed in the Wylfa Newydd CoCP (Application Reference Number: 8.6) and the Off-Site Power Station Facilities sub-CoCP (Application Reference Number: 8.9), would avoid the potential for negative effects on otter and water vole through changes in water quality and flow. Primarily this comprises designing the Off-Site Power Station Facilities to avoid the watercourse as much as possible. Based on the design it is assessed that the ecological functioning of the watercourse for otter and water vole would not be altered. Good practice mitigation in the form of the works to remove Himalayan balsam would improve the watercourse habitat for both species. Taken together the magnitude of change due to hydrological changes is therefore considered to be negligible, with the overall significance of the effect also being negligible.

Operation

Air quality changes

9.5.10 The potential for changes in air quality during operation are limited to emissions from a back-up diesel generator, as set out in chapter E5 (Application Reference Number: 6.5.5). Given its relatively small size, infrequent and short-term use, distance from the nearest sensitive locations, and the frequency of wind blowing towards each of the nearby receptors, there is unlikely to be a perceptible change in air quality. The magnitude of change is therefore considered to be negligible and any potential effects on statutory or non-statutory sites or ancient woodland are predicted to be negligible.

9.5.11 The assessment of air quality as result of vehicle emissions is addressed in chapter C4 (Application Reference Number: 6.3.4).

Disturbance

9.5.12 During operation of the Off-Site Power Station Facilities, lighting and human activity have the potential to affect breeding birds, bats, otter and water vole. These effects would be mitigated by protecting hedges, and by the lighting design reducing light-spill towards features that could be used for foraging and commuting. The potential magnitude of change from this would be a very minor detrimental alteration to the use of these habitats by each receptor. The effects are therefore predicted to be of negligible significance.

Hydrological and habitat changes

9.5.13 The Off-Site Power Station Facilities site is considered to have a minor beneficial effect on terrestrial and freshwater receptors for the following reasons.

- Provision of a surface water drainage system that is attenuated prior to discharge is an improvement to the existing situation, where sediment-laden and potentially polluted runoff can pass in to Hen-shop and East Drains.
- The native planting proposed would create a greater area of habitat available for breeding birds and foraging bats compared to the existing situation. Both of these groups have species listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016, so this change could be considered to contribute towards the duty to conserve and enhance species on that list.

Decommissioning

9.5.14 The potential impact pathways during decommissioning would be similar to those experienced by ecological receptors during construction. The list of embedded and good practice mitigation measures and the predicted significance of effects are therefore not repeated here. None of the effects of decommissioning are predicted to be significant.

9.6 Additional mitigation

9.6.1 The assessment of effects with the application of embedded and good practice mitigation in this chapter concluded no likely significant effects would remain. There is therefore no requirement for additional mitigation for effects on terrestrial and freshwater ecological receptors.

9.7 Residual effects

9.7.1 It is assessed that, with embedded and good practice mitigation applied, there would be no significant residual effects.

9.8 References

Table E9-4 Schedule of references

ID	Reference
RD1	Collins, J. 2016. *Bat Surveys for Professional Ecologists: Good Practice Guidelines*. Third Edition. London: Bat Conservation Trust.
RD2	Countryside Council for Wales. 1990. *Llyn Garreg-lwyd Site of Special Scientific Interest: Citation*. [Online]. [Accessed: November 2016]. Available from: http://angleseynature.co.uk/webmaps/llyngarreglwyddesc.htm.
RD3	Isle of Anglesey County Council. 2003. *Working for the wealth of wildlife: Anglesey's local biodiversity action plan – B2 Habitat Action Plans and Species Action Plans.*
RD4	UK Government. 2016. *Countryside hedgerows: protection and management*. [Online]. [Accessed: June 2017]. Available from: https://www.gov.uk/guidance/countryside-hedgerows-regulation-and-management.
RD5	Strachan, R. 2010. *Wales Otter Report 2009-10*. Natural Resources Wales.

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ENERGY WORKING FOR BRITAIN

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6.5.18 ES Volume E - Off-Site Power Station Facilities: AECC, ESL and MEEG App E9-2 - Off-Site Power Station Facilities Protected and Legally Controlled Species Compliance Report

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Contents

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1 Introduction

1.1 Document purpose

1.1.1 The purpose of this document is to assess the likelihood that the construction of the Off-Site Power Station Facilities, described in section 1.5 of this report, would contravene the following legislation:

- Conservation of Habitats and Species Regulations 2017
- Wildlife and Countryside Act 1981 (as amended); and
- Environmental Protection Act 1990 (in relation to the disposal of controlled plant species only).

1.1.2 This document considers species that are protected or controlled according to the above legislation, but it does not constitute legal advice. It forms one of several reports prepared as part of the planning application for the Proposed Development.

1.2 Background

1.2.1 Further detail of the Off-Site Power Station Facilities can be found in chapter E1 (proposed development) (Application Reference Number: 6.5.1).

2 Scope

2.1 Scope of the report

2.1.1 The offences considered in this report are only those that could occur as a result of the construction and operation of the Off-Site Power Station Facilities. Offences relating to cruelty, possession, transport, sale and certain methods for capturing/taking and killing have not been considered as they do not form a defined part of the implementation of the construction and operation of the Off-Site Power Station Facilities.

2.1.2 *The Hedgerows Regulations 1997* provide a definition as to what constitutes important hedgerows. Planning authorities must consider the impacts of the removal of hedgerows that fall under these Regulations where applications are made to do so. However, these Regulations do not apply here as the Proposed Development would only be taken forward if a Development Consent Order was granted under the *Planning Act 2008*, meaning any important hedgerow removal would be considered to be permitted work under regulation 6(1)(e) of *The Hedgerows Regulations 1997*.

2.1.3 In relation to the offence of introducing non-native species to the wild, the disposal of waste following control of species such as Himalayan balsam is covered by section 33 ((1a) and (1b)) of the Environmental Protection Act 1990. No other aspects of the Environmental Protection Act 1990 are considered within this report as they are not considered relevant to the receptors present and potentially affected by the Off-Site Power Station Facilities.

2.1.4 The relevant legislation and potential offences that could occur as a result of the construction and operation of the Off-Site Power Station Facilities are set out in table 2-1.

2.2 Licences

2.2.1 Within this report, licences have been referred to and, depending on the protected species in question, are defined as set out in the following paragraphs.

2.2.2 If an offence is considered likely under the *Conservation of Habitats and Species Regulations 2017* [RD1] (as listed in table 2-1) then it can be derogated via a European Protected Species (EPS) licence. Natural Resources Wales (NRW) issues licences under Regulation 55 to allow the Proposed Development to be implemented within the law.

Offences under the Wildlife and Countryside Act 1981 (as amended) (as listed in table 2-1) (also referred to as schedule 5 offences) are not licensable in the same way and the legal defences are as set out in s10(3)(c), s4(2A)(a) and s14(3). This means that a developer who has development consent must make a reasonable effort to avoid committing an offence. Unusually, where offences relating to water vole require animals to be moved, NRW can issue a conservation licence to permit the translocation of the animals. However,

steps should be made to avoid offences before resorting to animal translocation.

Table 2-1 Potential offences under UK legislation

General descriptor	Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)
Capturing, killing, and injuring	To deliberately capture, injure or kill any wild animal of an EPS (Reg. 43(1)(a)).	To intentionally kill, injure or take any wild bird (s1(1)). To intentionally kill, injure or take any wild animal included in Schedule 5. (s9(1)).
Disturbing (affecting ability to survive, breed or rear young)	To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)) Reg. 43(2)(a)(i) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young.	-
Disturbing (impairing ability to migrate or hibernate)	To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)) Reg. 43(2)(a)(ii) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability, in the case of animals of a hibernating or migratory species, to hibernate or migrate.	-
Disturbing (affecting local distribution or abundance)	To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b) and Reg. 43(2)(b)) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to affect significantly the local distribution or abundance of the species to which they belong.	-
Disturbing (whilst occupying a structure or place used for shelter or protection)	-	To intentionally or recklessly disturb any wild bird included in Schedule 1 while it is building a nest or is in, on or near a nest containing eggs or young; or to disturb dependent young of such a bird (s1(5)(a)). To intentionally or recklessly disturb any wild animals specified in Schedule 5 while it is occupying a structure or place which it uses for shelter or protection (s9(4)(b)).

General descriptor	Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)
Taking eggs	To deliberately take or destroy the eggs of such an EPS animal (Reg. 43(1)(c)).	To intentionally take or destroy an egg of any wild bird. (s1 (1)(c)).
Obstructing access	-	To intentionally or recklessly obstruct access to any structure or place which any animal specified in Schedule 5 uses for shelter or protection. (s9 (4)(c)).
Damage or destruction of a breeding site or resting place.	To damage or destroy a breeding site or resting place of a wild animal of a EPS (Reg. 43(1)(d)).	To intentionally take, damage or destroy the nest of a wild bird included in Schedule ZA1 (s1 (1)(aa)). To intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built (s1 (1)(b)). To intentionally or recklessly damage or destroy any structure or place which any wild animal specified in Schedule 5 uses for shelter or protection. (s9 (4)(a)).
Introducing non-native species.	-	To plant or otherwise cause to grow in the wild any plant which is included in Part II of Schedule 9. (s14 (2)). Waste produced from management of some species would be “controlled waste” and managed accordingly under the Environmental Protection Act 1990 (s33 (1a) and (1b)).

3 European Protected Species licence tests

3.1.1 An EPS licence can only be granted by NRW if the following three tests can be met:

- test 1: the purpose of the work meets one of those listed (see below) in the Conservation of Habitats and Species Regulations 2017;
- test 2: there is no satisfactory alternative; and
- test 3: the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

3.1.2 Under test 1 the specific set of purposes referred to includes:

- "preserving public health or public safety or other imperative reasons of overriding public interest, including those of a social or economic nature, and beneficial consequences of primary importance for the environment;
- scientific and educational purposes;
- ringing or marking or examining any ring or mark on, wild animals;
- conserving wild animals or wild plants or introducing them to particular areas;
- protecting any zoological or botanical collection;
- preventing the spread of disease; and
- preventing serious damage to livestock, foodstuffs for livestock, crops, vegetables, fruit, growing timber or any other form of property or to fisheries".

3.1.3 A review of the Proposed Development against the three tests concluded the following.

- test 1: the purpose of the Proposed Development is considered to be "preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment".
- test 2: there is no satisfactory alternative to the Proposed Development. The Proposed Development has been subjected to a staged optioneering process which has informed the identification and selection of a final, optimised design solution. Chapter E2 (alternatives and design evolution) (Application Reference Number: 6.5.2), provides further information on the need for the Off-Site Power Station Facilities, the alternatives considered and the design evolution.
- test 3: this would be met via implementation of the proposed strategy relating to the EPS described in this report.

4 Methodology

4.1.1 The legislation under which species are protected or controlled, as set out in table 2-1, has been reviewed to identify the potential for the construction and operation of the Off-Site Power Station Facilities to result in an offence.

4.1.2 The review took the form of identifying whether or not a protected or controlled species was present within the area affected by the construction of the Off-Site Power Station Facilities.

4.1.3 The baseline information is based on a desk-based study which included consultation with North Wales Environmental Information Service (Cofnod), and field survey work.

4.1.4 Data from Cofnod were requested in June 2017 and are unpublished [RD1]. These comprised all protected and notable species records from within 2.5km of the centre of the Off-Site Power Station Facilities site. Data from fieldwork are presented in the baseline terrestrial ecology survey report in appendix E9-1 Terrestrial ecology survey at proposed MEEG site, Llanfaethlu (Application Reference Number: 6.5.17).

4.1.5 The baseline data collected have recorded evidence of the following species or groups for which the legislation listed above, applies:

- Protected species:
  - bats;
  - reptiles;
  - breeding birds (all species);
  - otter (*Lutra lutra*); and
  - water vole (Arvicola amphibius).
- Controlled species:
  - Himalayan balsam (Impatiens glandulifera).

4.1.6 The proposed strategies presented in this report to avoid offences are in addition to those outlined in the chapter E9 terrestrial and freshwater ecology (Application Reference Number: 6.5.9), which seek to minimise likely effects on terrestrial and freshwater ecology, and which would be included within the contractual documentation associated with construction of the Off-Site Power Station Facilities.

4.1.7 The following sections provide an assessment of the potential to cause an offence in relation to each species or group, as well as the approach to mitigation to avoid offences being committed, or that are required to secure an EPS licence.

4.1.8 Conclusions are presented for each protected and controlled species in relation to legislative compliance.

5 Bats

5.1 Relevant legislation

5.1.1 The legislation relevant to the protection of bats comprises:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 5 species; and
- The Conservation of Habitats and Species Regulations 2017 – Schedule 2 species.

5.2 Baseline information

5.2.1 Six buildings were identified as having the potential to support roosting bats within or adjacent to the Off-Site Power Station Facilities (see appendix E9-1, Application Reference Number: 6.5.17). No bats were recorded emerging from or re-entering any of the buildings surveyed within the proposed site boundary. Noctule (*Nyctalus noctula*), common pipistrelle (*Pipistrellus pipistrellus*) and brown long-eared bat (*Plecotus auritus*) were recorded foraging and commuting in the area.

5.3 Potential to commit an offence

5.3.1 Building M3 would require demolition as part of the Off-Site Power Station Facilities. Building M3 was not specifically surveyed for emerging or re-entering bats as it was outside of the survey boundary at the time of survey. However, Building M3 had a moderate potential to support roosting bats, and could become a roost in the intervening period between the 2016 surveys and demolition. In the event that bats were found in Building M3 prior to its demolition, the possible breaches of wildlife legislation are provided in table 5-1.

Table 5-1 Bats – potential to commit an offence in absence of proposed strategy

Legislation	Relevant section of legislation	Offence likely in the absence of proposed strategy
The Conservation of Habitats and Species Regulations 2017	To deliberately capture, injure or kill any wild animal of an EPS. (Reg. 43(1)(a)).	Yes – if bats are present in Building M3 prior to its demolition.
	To deliberately disturb wild animals of an EPS [wherever they are occurring]. (Reg. 43(1)(b)) Reg. 43(2)(a)(i). For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young.	Yes – if bats are present in Building M3 prior to its demolition.
	To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg43(1)(b)) Reg. 43(2)(a)(ii). For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability, in the case of animals of a hibernating or migratory species, to hibernate or migrate.	No offence likely – Building M3 is not considered suitable to support hibernating bats.
	To deliberately disturb wild animals of an EPS [wherever they are occurring]. (Reg. 43(1)(b)) Reg. 43(2)(b). For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to affect significantly the local distribution or abundance of the species to which they belong.	No offence likely – the habitat on site is considered to be of negligible potential for bats and as such any loss is unlikely to affect the conservation status of bats in the area.
	To damage or destroy a breeding site or resting place of a wild animal of an EPS. (Reg. 43(1)(d)).	Yes – if bats are present in Building M3 prior to its demolition.
Wildlife and Countryside Act 1981 (as amended)	To intentionally or recklessly disturb any wild animal specified in Schedule 5 while it is occupying a structure or place which it uses for shelter or protection. (s9(4)(b)).	Yes – if bats are present in Building M3 prior to its demolition.
	To intentionally or recklessly obstruct access to any structure or place which any animal specified in Schedule 5 uses for shelter or protection. (s9(4)(c)).	No offence likely – works would not involve any obstruction of access points for bats to Building M3.

5.4 Proposed strategy

5.4.1 The following steps would be taken during construction to ensure legislation protecting bats, outlined in paragraph 5.1.1, would not be contravened:

- pre-construction surveys;
- European Protected Species Mitigation Licencing, if needed; and
- supervision of works by an ECoW.

Pre-demolition survey

5.4.2 It is considered that Building M3 offers moderate potential to support roosting bats (see appendix E9-1, Application Reference Number: 6.5.17). A pre-demolition survey would take place at Building M3. In accordance with best practice guidance [RD2] this would consist of a dusk emergence survey and a separate dawn re-entry survey. If no bats were recorded leaving or entering the building then it would be demolished. If bats were recorded using the building then demolition would be postponed until a European Protected Species Mitigation Licence was obtained to derogate from the offences described in table 5-1.

European Protected Species Mitigation Licensing

5.4.3 Should an EPSML be required, the application would include methods to avoid killing or injuring bat, and provide compensation for the loss of a roost. Methods to avoid killing and injury could include exclusion from the roost structure, and would follow best practice measures such as those set out in the Bat Conservation Trust guidelines [RD2]. To offset the loss of a roost, bat boxes would be provided on the nearest retained trees or purposely installed poles. Bat boxes to compensate for roost loss would be specific in design to the species and status of that roost e.g. maternity, transitory.

Supervision of works by an ECoW

5.4.4 If no bats were recorded emerging or re-entering the building but there was significant bat activity in the area following the pre-demolition survey then the ecologists may recommend that demolition takes place under the supervision of an ECoW. The ECoW would be licensed to handle bats and would intervene in the extremely unlikely event that a bat is found.

5.4.5 Should a bat be found within Building M3 during its demolition, all works would cease and the roosting feature would be reinstated if it had been damaged. The bat would then be returned to it and the building made safe. If a bat is injured then the Bat Conservation Trust would be contacted to determine where the nearest vet or bat carer is in relation to the site, which the bat would then be taken to. Demolition works would then not resume until an EPSML had been obtained from NRW.

Avoiding Schedule 5 offences

5.4.6 The measures set out in the preceding paragraphs would result in the Schedule 5 offences, disturbance and obstruction, being avoided.

5.5 Conclusion

5.5.1 Bats have not been recorded in Building M3 but at present there is the potential for breaches in the legislation protecting them, as described in paragraph 5.1.1. With the measures proposed in this report, the risk of bats being found would be negligible, but in the event that they are found, works would be delayed until an EPSML had been obtained from NRW to derogate from the relevant offence.

6 Reptiles

6.1 Relevant legislation

6.1.1 The legislation relevant to the protection of the species of reptile which could be affected during construction of the Off-Site Power Station Facilities comprises:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 5 species (protection from killing/injury only s9 (1)).

6.2 Baseline information

6.2.1 Cofnod provided two records of common lizard (*Lacerta vivipara*), 2.5km west of the Off-Site Power Station Facilities site, both from coastal habitats, in 2014 and 2017 [RD1].

6.2.2 The baseline terrestrial ecology survey report (see appendix E9-1, Application Reference Number: 6.5.17) identified small areas of habitats within the boundary of the Off-Site Power Station Facilities site with the potential to support reptiles. These areas include field boundaries, rock outcrops and stands of tall ruderal vegetation.

6.2.3 There have not been surveys completed to establish presence or likely absence of reptiles in these habitats, but their potential presence is assumed given the presence of suitable habitat.

6.3 Potential to commit an offence

6.3.1 The risk of committing an offence occurs if reptiles are present in the areas of habitats to be cleared i.e. areas of tall vegetation and boundary features (walls and hedgerows). The activity under the Wildlife and Countryside Act 1981 (as amended) which could result in potential offences is shown in table 6-1.

Table 6-1 Reptiles – potential to commit an offence in absence of proposed strategy

Wildlife and Countryside Act 1981 (as amended)	Offence likely in absence of proposed strategy
To intentionally kill, injure or take any wild animal included in Schedule 5 (s9(1)).	Yes – during removal of suitable habitat.

6.4 Proposed strategy

6.4.1 Steps would be taken prior to construction to ensure legislation protecting reptiles would not be contravened. A summary of the measures that would be undertaken is provided below and expanded upon in the subsequent sections:

- habitat manipulation would be used to encourage dispersal of reptiles away from habitats that would be removed during construction of the Off-Site Power Station Facilities, into areas of adjacent suitable habitat that would not be affected; and

- supervision of destructive works by an Ecological Clerk of Works (ECoW) to capture and move any reptiles encountered, and releasing them into areas of adjacent suitable habitat that would not be affected.

Habitat manipulation

6.4.2 The primary approach to reptile mitigation would be displacement. Habitat manipulation would be utilised to displace reptiles from areas subject to clearance into adjacent undisturbed areas of suitable habitat in order to protect animals from injury and mortality. This would be achieved by cutting and clearance of vegetation in stages, in the direction of existing retained habitats such as hedgerows, woodland edge, tussocky grassland and scrub. This will only be completed during the active period for reptiles (March to October) when they are not in hibernation, and during suitable weather conditions i.e. over 10^0C and no precipitation.

6.4.3 Vegetation to be cleared would first be cut with hand tools (e.g. strimmers/brush cutters and chain saws) down to a height of approximately 150mm, with cut material removed from the site. After a rest period of between two and seven days (to allow any reptiles present to relocate naturally) the remaining habitat would be cleared with machinery to ground level, under the supervision of an ECoW, as described below.

Supervision of destructive search by an ECoW

6.4.4 The second stage in removing reptiles would be a destructive search under the supervision of an ECoW. This would comprise the removal of all remaining habitat features e.g. tree stumps, concrete waste and other debris, which reptiles could use for shelter. The ECoW would undertake a finger-tip search of these features before the contractors remove them. All reptiles found would be relocated to adjacent suitable habitat.

6.4.5 These works would also only be undertaken during the active period for reptiles when they are not in hibernation.

6.5 Conclusion

6.5.1 The construction of the Off-Site Power Station Facilities could result in killing or injuring reptiles and would therefore result in a breach of the Wildlife and Countryside Act 1981 (as amended), as set out in paragraph 6.1.1. The strategy described above would result in this offence being avoided.

7 Birds

7.1 Relevant legislation

7.1.1 The legislation relevant to the protection of species of bird with the potential to be affected during construction of the Off-Site Power Station Facilities comprises:

- Wildlife and Countryside Act 1981 (as amended).

7.2 Baseline information

7.2.1 The baseline terrestrial ecology survey report (see appendix E9-1, Application Reference Number: 6.5.17) identified habitats with the potential to support breeding birds within the boundary of the Off-Site Power Station Facilities site. These included species-poor native hedgerows and interior and exterior features of the buildings. There is no evidence to suggest that these features support species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).

7.3 Potential to commit an offence

7.3.1 The vegetation clearance phase of the construction of the Off-Site Power Station Facilities could result in an offence in relation to breeding birds under the Wildlife and Countryside Act 1981 (as amended). Details are provided in table 7-1.

Table 7-1 Birds – potential to commit an offence in absence of proposed strategy

Wildlife and Countryside Act 1981 (as amended)	Offence likely in absence of proposed strategy
To intentionally kill, injure or take any wild bird. (s1(1)).	Yes – to unfledged chicks during vegetation clearance.
To intentionally or recklessly disturb any wild bird included in Schedule 1 while it is building a nest or is in, on or near a nest containing eggs or young; or to disturb dependent young of such a bird. (s1(5)(a)(b)).	No – birds listed on Schedule 1 have not been recorded breeding within the areas where vegetation clearance is required.
To take or destroy an egg of any wild bird. (s1(1)(c)).	Yes – during removal of suitable nesting habitat.
To intentionally take, damage or destroy the nest of a wild bird included in Schedule ZA1. (s1(1)(aa)).	No offence likely – birds listed in Schedule 1 have not been recorded breeding within the areas where vegetation clearance is required.
To intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built. (s1(1)(b)).	Yes – during vegetation clearance.

7.4 Proposed strategy

7.4.1 The following steps would be taken during construction to ensure legislation protecting birds would not be contravened:

- timing of vegetation clearance;
- supervision of vegetation clearance; and
- protection of existing retained vegetation.

Timing of vegetation clearance

7.4.2 To avoid destroying an egg/eggs of a wild bird, or damaging or destroying the nest of a wild bird, vegetation suitable to support breeding birds would not be cleared during the bird breeding season (March-August inclusive). Where this was not possible, vegetation would only be cleared following pre-clearance checks and under the supervision of an ECoW, should it be determined that birds and/or active nests are not present.

Supervision of vegetation clearance

7.4.3 Pre-clearance checks would be carried out within all areas of vegetation clearance to assess for the presence of active bird nests. This would involve an ECoW checking vegetation prior to the arrival on site of clearance contractors to avoid the risk of disturbance to birds from excessive movement of vehicles/people or through the noise of the hand tools used during the clearance works. This would also include times outside the main breeding season (March–August inclusive) in habitats that support species that can breed before and/or after this period, such as barn owls (*Tyto alba*), corvids and pigeons.

7.4.4 Pre-clearance checks would firstly involve watching habitats to be cleared for birds frequently visiting the same area, which may indicate the presence of a nest. This stage would last for as long as the ECoW determines it is necessary. The second stage would be more intrusive and involve actively searching areas of thicker vegetation for nests.

7.4.5 If the pre-clearance check does not identify any active nests, then the clearance would be allowed to proceed but only with the continued supervision of the ECoW.

7.4.6 Should an active nest be identified, then works within its vicinity would stop and the ECoW would determine a suitable buffer zone around the nest within which no further clearance or other works would occur. This would be dependent on the type and density of vegetation surrounding the nest and the species present. A minimum buffer zone would be 5m from a nest but may be extended following advice from the ECoW. The buffer zone would be clearly marked using demarcation tape or fencing to ensure no works take place within that area. These would also be marked on an environmental constraints map and displayed in the site office as well as being issued to all contractors on site.

7.4.7 The ECoW would monitor activity at each nest to determine when it is no longer active so that works could continue. Once the ECoW determines that the nest is no longer active, the contractor would be allowed to proceed with vegetation clearance. The ECoW would be available on site should any further input/assistance be required.

Protection of retained vegetation

7.4.8 Areas of retained vegetation within construction working areas would be clearly demarcated to ensure no accidental incursion of construction work.

7.5 Conclusion

7.5.1 The construction of the Off-Site Power Station Facilities could result in the contravention of the legislation with respect to birds set out in paragraph 7.1.1. This would be from killing or injuring wild birds, destroying eggs and damaging or destroying nests. The strategy set out above would result in these offences being avoided.

8 Otter

8.1 Relevant legislation

8.1.1 The legislation relevant to the protection of otter with the potential to be affected during construction of the Off-Site Power Station Facilities comprises:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 5 species; and
- Conservation of Habitats and Species Regulations 2017 – Schedule 2 species.

8.2 Baseline information

8.2.1 There was one record of otter provided by Cofnod [RD1]. This comprised a spraint found in a watercourse 2.5km southwest of the Off-Site Power Station Facilities site in 2012. Surveys of the study area did not find any evidence of otter (see appendix E9-1, Application Reference Number: 6.5.17), although the ditch within the boundary of the Off-Site Power Station Facilities site did have the potential to be used as foraging habitat by otter. This is supported by the 2010 Otter Survey of Wales [RD3] showing records nearby and suggesting that Anglesey has an expanding otter population.

8.3 Potential to commit an offence

8.3.1 Otter use a number of watercourses in proximity to the Off-Site Power Station Facilities site. There is therefore a risk that a breeding site or resting place could be created in an affected area prior to the start of construction, constituting an offence if it is damaged or destroyed. Details are provided in table 8-1.

Table 8-1 Otter – potential to commit an offence in absence of proposed strategy

Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981	Offence likely in absence of proposed strategy
To deliberately capture, injure or kill any wild animal of an EPS (Reg. 43(1)(a)).	-	No offence likely – mobile species would avoid construction works.
To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)). Reg. 43(2)(a)(i) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young.	-	No offence likely – no holts recorded and the limited nature of the works would not be considered to disturb at this scale.
To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)).	-	No offence likely – no holts recorded and the limited nature of the works would not

Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981	Offence likely in absence of proposed strategy
Reg. 43(2)(a)(ii) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability, in the case of animals of a hibernating or migratory species, to hibernate or migrate.		be considered to disturb at this scale.
To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)). Reg. 43(2)(b) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to affect significantly the local distribution or abundance of the species to which they belong.	-	No offence likely – no holts recorded and the limited nature of the works would not be considered to disturb at this scale.
To damage or destroy a breeding site or resting place of a wild animal of an EPS (Reg. 43(1)(d)).	-	No offence likely - no holts or resting places have been recorded within the Off-Site Power Station Facilities footprint.
-	To intentionally or recklessly disturb any wild animal listed on Schedule 5 while it is occupying a structure or place which it uses for shelter or protection. (s9(4)(b))	No offence likely - no holts or resting places have been recorded within the Off-Site Power Station Facilities footprint.
-	To intentionally or recklessly obstruct access to any structure or place which any animal specified in Schedule 5 uses for shelter or protection. (s9(4)(c))	No offence likely - no holts or resting places have been recorded within the Off-Site Power Station Facilities footprint.

8.4 Proposed Strategy

8.4.1 No offences are considered likely to occur as no otter holts or resting places have been recorded within the Off-Site Power Station Facilities. However, widespread records of this species were recorded during the field survey and there is a minor risk that otters could create a holt in the intervening period before construction commences. The following steps would be taken during construction to ensure legislation protecting otter would not be contravened:

- pre-construction surveys; and
- supervision of works by an ECoW.

Pre-construction survey

8.4.2 A pre-construction survey would be completed before any works to ditches commence. This would cover areas up to 50m from the boundary of the Off-Site Power Station Facilities site, as these could be affected by indirect effects e.g. noise and vibration.

8.4.3 This pre-construction survey may extend in duration, delaying construction works starting, should features be found where their usage is unclear. This would include burrows or holes, and could involve the use of camera traps, for a period of time determined by the ECoW.

8.4.4 In the unlikely event that a holt or lay-up site is identified, any work which could affect it and lead to contravention of the legislation described in paragraph 8.1.1. would be put on hold. Natural Resources Wales would be consulted with regards to the need to obtain an EPSML to allow works to continue. Details on licensing requirements are given in section 3.

Supervision of works

8.4.5 Supervision of works would only be required in the event that a feature that could be a holt or lay-up site is found where reasonable effort has shown that risk of otter presence is negligible, but a residual risk remains. Supervision would be undertaken by an ECoW who would establish whether features were being used by otter and whether they were present.

8.4.6 In the unlikely event that a holt or lay-up site is identified, further work that could lead to contravention of the legislation described in paragraph 8.1.1. would be put on hold. Natural Resources Wales would then need to be consulted with regards to the need to obtain an EPSML to allow works to continue.

8.5 Conclusion

8.5.1 Although otters are present within the wider catchment, it is considered that there is currently a low risk that the legislation set out in paragraph 8.1.1 would be contravened. The proposed strategy provides measures to ensure that the risks are managed throughout construction.

9 Water vole

9.1 Relevant legislation

9.1.1 The legislation relevant to the protection of the species of water vole with the potential to be affected during construction of the Off-Site Power Station Facilities comprises:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 5 species.

9.2 Baseline information

9.2.1 There were two records of water vole provided by Cofnod [RD1]. These comprised live sightings of three individuals 875m north of the Off-Site Power Station Facilities site in 2008 and live sighting of three individuals 1,615m northwest of the Off-Site Power Station Facilities site in 2000.

9.2.2 The baseline terrestrial ecology survey report (see appendix E9-1, Application Reference Number: 6.5.17) identified ditches with the potential to support water vole within the boundary of the Off-Site Power Station Facilities site. An incidental record of a water vole sighting was made during surveys associated with the A5025 Off-Line Highway Improvements in the East Drain to the east of the Off-Site Power Station Facilities in 2014, approximately 375m from the Off-Site Power Station Facilities site.

9.3 Potential to commit an offence

9.3.1 Water vole are common on Anglesey and there potential for the ditch within the Off-Site Power Station Facilities to become populated by the species. There is therefore a risk that, should water vole move into the ditch, they could be disturbed, injured or killed, or that use of their protection or sheltering structures could be obstructed, damaged or destroyed, as detailed in table 9-1.

Table 9-1 Water vole – potential to commit an offence in absence of proposed strategy

Wildlife and Countryside Act 1981	Offence likely in absence of proposed strategy
To intentionally kill, injure or take any wild animal included in Schedule 5 (s9(1)).	Yes – if water vole are present within the Off-Site Power Station Facilities site.
To intentionally or recklessly disturb any wild animal specified in Schedule 5 while it is occupying a structure or place which it uses for shelter or protection (s9(4)(b)).	Yes – if water vole are present within the Off-Site Power Station Facilities site.
To intentionally or recklessly obstruct access to any structure or place which any animal specified in Schedule 5 uses for shelter or protection (s9(4)(c)).	Yes – if water vole are present within the Off-Site Power Station Facilities site.
To intentionally or recklessly damage or destroy any structure or place which any wild animal	Yes – if water vole are present within the Off-Site Power Station Facilities site.

Wildlife and Countryside Act 1981	Offence likely in absence of proposed strategy
specified in Schedule 5 uses for shelter or protection (s9(4)(a)).	

9.4 Proposed Strategy

9.4.1 The following paragraphs set out the steps that would be taken prior to the construction of the Off-Site Power Station Facilities to ensure the legislation protecting water vole, detailed in paragraph 9.1.1, was not contravened. In summary it would take the form of:

- pre-construction survey to update water vole activity in ditches affected by construction of the Off-Site Power Station Facilities; and
- supervision of works by an ECoW.

Pre-construction surveys

9.4.2 A pre-construction survey would be completed before any works to ditches took place to search for evidence of water vole, including burrows, latrines and feeding remains, and would include areas up to 50m from the boundary of the Off-Site Power Station Facilities site, as these could be affected by indirect effects e.g. noise and vibration.

9.4.3 The pre-construction survey may extend in duration should features be found where their origins are unclear. This would include burrows or holes, and could involve the use of camera traps to establish usage.

9.4.4 In the unlikely event that evidence of water vole presence is identified, any work which could lead to contravention of the legislation described in paragraph 9.1.1 would be put on hold. Natural Resources Wales would then need to be consulted with regards to the need to obtain a conservation licence to allow works to continue. Details on licensing requirements are given in section 2.2.

Supervision of works

9.4.5 Supervision of works would only be required in the event that a feature that could be a water vole burrow is found with unknown usage that would be directly affected by works. This would be completed by an ECoW who would supervise works and hand-search as necessary, to establish that features are not being used by water vole and that they are not present.

9.4.6 In the unlikely event that an active burrow is identified or a water vole is found, then work which could affect it would not be possible. Natural Resources Wales would then need to be consulted with regards to the need to obtain a conservation licence to allow works to continue. Details on licensing requirements are given in section 2.2.

Displacement and destructive searching

9.4.7 Should the pre-construction survey identify water vole burrows in the areas of the attenuation pond affected by works, then a conservation licence from NRW would need to be obtained. This would not only define the exact details of how water vole would be protected but also identify how enhancements for water vole would be provided. The methods available to undertake displacement and destructive searching are outlined below.

9.4.8 Displacement involves the removal of vegetation around water vole burrow systems (by strimming) with the aim of making the habitat unsuitable and therefore causing the water vole to relocate to adjacent unaffected habitat [RD4].

9.4.9 Displacement should occur in accordance with the Water Vole Mitigation Handbook [RD4] which recommends this technique between 15 February and 15 April, inclusive and would need to be completed prior to works to install drainage infrastructure. It is not appropriate to attempt to displace water voles over distances longer than 50m, but this would be unlikely to be an issue for the scale of the proposed works.

9.4.10 Following displacement through habitat manipulation, the area would be monitored for signs of water vole activity and, once it has been reasonably established that there is a low risk of occupancy of any burrows present by water vole, destructive searching would take place.

9.4.11 Any burrows found within the construction area would be excavated by hand and followed back to ensure that they are empty before being filled in. It is not considered likely that there would be a high density of burrows in the works area given the baseline information, and so it not anticipated that trapping or translocation of animals would be required.

9.5 Conclusion

9.5.1 Although water vole are present within the catchment, it is considered that the risk of water vole being recorded within the area required for construction is low, and the actions and commitments described above would ensure no offence is committed under the legislation set out in paragraph 9.1.1.

10 Schedule 9 Invasive Species

10.1 Relevant legislation

10.1.1 The legislation relevant to the control of invasive species of plant are:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 9 species; and
- Environmental Protection Act 1990 (see section 2.1.3).

10.2 Baseline information

10.2.1 Himalayan balsam has been identified within the construction boundary of the Off-Site Power Station Facilities, as shown in the baseline terrestrial ecology survey report (see appendix E9-1, Application Reference Number: 6.5.17).

10.3 Potential to commit an offence

10.3.1 Himalayan balsam is a species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended). Table 10-1 describes the offence relating to Schedule 9 species and the risk of committing an offence as part of construction of the Off-Site Power Station Facilities.

Table 10-1 Invasive non-native species – potential to commit an offence in absence of proposed strategy

Wildlife and Countryside Act 1981 (as amended)	Environmental Protection Act 1990	Offence likely in absence of proposed strategy
To plant or otherwise cause to grow in the wild any plant which is included in Part II of Schedule 9. (s14 (2)).	-	Yes – by spread of existing plants within construction area or importation of plants from outside the Off-Site Power Station Facilities.
-	Section 33 (1a) and (1b) set out offences dealing with the deposit, treating, keeping or disposing of controlled waste without a permit. Section 33 (1)(c) makes it an offence to keep, treat or dispose of controlled waste in a manner likely to cause pollution of the environment.	Yes – by management and disposal of existing plants cleared from site.

10.4 Proposed strategy

10.4.1 In summary, the following steps would be taken prior to construction to ensure legislation relating to Schedule 9 species would not be contravened:

- pre-construction surveys;
- provision and implementation of a construction method statement; and
- monitoring and reporting.

Pre-construction surveys

10.4.2 Pre-construction surveys would be undertaken to record the location and extent of Schedule 9 species within the Off-Site Power Station Facilities site. An updated assessment of control measures required, including waste disposal, would then be made and incorporated into the Code of Construction Practice.

Code of Construction Practice

10.4.3 The Code of Construction Practice would include information detailing the control and, if necessary, eradication of the invasive species, using good practice guidance publications e.g. *'Guidance: Prevent harmful weeds and invasive non-native plants spreading'* [RD5]. Other measures to avoid accidental incursion into invasive species areas would include the following:

- fencing and/or clear demarcation with hazard warning tape.
- clear demarcation of haulage routes in areas with invasive species present. If haulage routes are required to pass through exclusion zones, appropriate methods to prevent contact with the soil would be implemented, such as the installation of temporary tracking.
- implementation of biosecurity measures to include prevention of introduction or transfer of invasive non-native species across construction working areas by machinery or personnel, and the suitable procurement and screening of planting stock to prevent accidental introduction of invasive species.

Monitoring and reporting

10.4.4 An ECoW would be employed to ensure that the implementation of the appropriate control measures would be undertaken during construction. Post-construction monitoring would be undertaken to confirm that non-native invasive species had not spread or re-established as a result of the Off-Site Power Station Facilities.

10.4.5 A report would be produced annually during construction, and for a specified period post-construction, in order to provide a review of the monitoring results and recommendations for remedial action if required.

10.5 Conclusion

10.5.1 The approach outlined above provides actions and commitments which would minimise the risk that an offence was committed under the legislation set out in paragraph 10.1.1.

11 References

ID	Reference
RD1	Cofnod. 2017. *Data search of protected species within 2km of Off-Site Power Station Facilities (National Grid Reference SH 3171 487187)*. Unpublished data provided by Cofnod to Horizon.
RD2	Collins, J. 2016. *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition)*. Bat Conservation Trust.
RD3	Strachan, R. 2010. *Wales Otter Report 2009-10*. Natural Resources Wales.
RD4	Dean, M., Strachan, R., Gow, D. and Andrews, R. 2016. *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)*. The Mammal Society: London.
RD5	Natural England, Department for Environment, Food & Rural Affairs, and Environment Agency. 2016. Guidance: *Prevent harmful weeds and invasive non-native plants spreading*. [Online] [Accessed: June 2017] Available from https://www.gov.uk/guidance/prevent-the-spread-of-harmful-invasive-and-non-native-plants.

HORIZON
NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.6.1 ES Volume F - Park and Ride F1 - Proposed development

PINS Reference Number: EN010007

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1 Proposed development

1.1 Introduction

1.1.1 The Park and Ride at Dalar Hir forms part of the Wylfa Newydd Project. The Park and Ride would be used during the construction phase of the Power Station to transport and manage the flow of some of the construction workforce to and from the Power Station Site.

1.1.2 The Park and Ride is located immediately to the north-east of Junction 4 on the A55, approximately 18.5km from the Wylfa Newydd Development Area. Figure F1-1 (Application Reference Number: 6.6.38) shows the Park and Ride location and boundary.

1.1.3 The Park and Ride consists of:

- secure parking for up to 1,900 cars, which includes 10 disabled car spaces, as well as spaces for up to 55 minibuses, and 35 motorbikes;
- a bus waiting, pick-up and drop-off zone for up to 15 buses with additional parking for up to eight buses;
- a bus transport facility (transfer facility) building to provide transport information, a waiting area, welfare facilities, a bus driver canteen and management office facilities;
- access via a new roundabout located near the existing A55-A5 junction (Junction 4);
- landscaping and screen planting for visual mitigation; and
- other ancillary development, including a cycle store for up to 25 bicycles, signage, fencing, lighting, closed-circuit television (CCTV) and utilities.

1.1.4 It is predicted that there would be a maximum total of 78 daily return bus movements from the Park and Ride to the Power Station Site. This is based on three staggered morning shifts (33 return trips at the start and end of the shift) and three staggered night shifts (six return trips at the start and end of the shift), with a capacity of 50 workers per bus. These maximum predicted bus movements, and associated environmental effects, represent a 'worst case' for the conservative assessment purposes of this Environmental Statement.

1.1.5 There would be a maximum of 22 peak hour one-way movements from the Park and Ride to the Power Station Site between 07:00 and 08:00, and 22 peak hour one-way movements back to the Park and Ride from the Power Station Site between 18:00 and 19:00. There would be a further four northbound trips associated with the night shift, travelling to the Power Station Site from the Park and Ride between 16:30 and 17:30, and four inbound trips back to the Park and Ride, between 03:30 and 04:30. This assumes a travel time of approximately 30 minutes between the end of the shift and arriving at the Park and Ride.

1.1.6 In addition to these daily movements, it is predicted that there would be up to five additional buses (each making four trips over a day) travelling between

the Wylfa Newydd Development Area and the Park and Ride on a Thursday and Sunday. This would provide transport for construction workers living at the Site Campus travelling to and from their permanent place of residence for their weekend break.

1.1.7 Following construction of the Power Station, the Park and Ride would be removed and the land restored to its existing use (agricultural land). This would involve the removal of temporary structures and services, breaking up concrete and surfacing, and the importation and deposition of topsoil of a similar grade (see paragraph 1.2.5 below) to that which was in place before the Park and Ride was constructed. The existing hedge line along the central spine road would be enhanced as part of the development and a new hedge line introduced to the west of the site. This, along with enhanced tree and shrub planting using native species on the southern boundary, would be retained as a legacy benefit.

1.2 Site location and environmental context

1.2.1 The Park and Ride covers approximately 19.5ha of land. This includes the main car park area, a small strip of land to the south of the site (for screening planting), and an area of land that would be required for footway/cycleway improvements and site exit road works.

1.2.2 The Park and Ride's location immediately to the north-east of Junction 4 of the A55 allows easy access to the road network. It is bounded to the south by Holyhead Road (the A5), and to the west by the local London Road that links the A55 to the village of Bodedern. To the immediate east is the Cartio Môn go-karting centre, whilst to the west is a DVSA (Driver and Vehicle Standards Agency – formally known as VOSA) weighbridge and lorry checkpoint. Hedgerows mark the northern and eastern extent of the Park and Ride.

1.2.3 The Park and Ride and surrounding area is rural in nature with a number of isolated farm properties nearby, including two farmsteads (the Dalar Hir farmhouse on the site and the Bryngoleu farmhouse approximately 200m east, at the site of the Cartio Môn go-karting centre). The Dalar Hir farmhouse is vacant and the development proposals include its demolition. The Bryngoleu farmhouse is the closest residential receptor.

1.2.4 The nearest settlements to the Park and Ride are Llanfihangel-yn-Nhywyn, located 400m to the south, and Caergeiliog approximately 900m to the south-west. The Gwyddfor Residential Home is located approximately 250m north-east of the site.

1.2.5 The landscape largely comprises pastoral farmland, characterised by open fields with hedgerows marking the field boundaries. The Agricultural Land Classification soil quality at the site has been determined as Subgrade 3b (moderate quality). No geologically important sites with the potential to be affected have been identified. Only localised and limited sources of potential soil contamination have been identified from the desk study undertaken. A ground investigation (and subsequent remediation, if required) would be undertaken prior to the construction works commencing.

1.2.6 The topography of the area is relatively flat, ranging between 20m and 25m above ordnance datum. There are a number of small watercourses both within the site itself and in the immediate surrounds. The Park and Ride is classified on Natural Resources Wales surface water mapping [RD1] as being within flood zone A, which according to Technical Advice Note 15 [RD2], means that there is considered to be little to no risk of fluvial or tidal flooding to the site. Natural Resources Wales surface water mapping [RD1] does indicate that some parts of the site are at risk from surface water flooding; however, it must be noted that, due to their scale, these maps do not mean a great deal for catchments as small as the Park and Ride.

1.2.7 The Ynys Môn/Anglesey Area of Outstanding Natural Beauty lies to the west of the Park and Ride, approximately 2.5km away at its closest point.

1.2.8 The Park and Ride lies within the non-designated wider landscape, which covers the majority of Anglesey inland of the Area of Outstanding Natural Beauty.

1.2.9 The main habitats present on the Park and Ride are improved and semi-improved grassland, and cultivated fields with hedgerows. A number of protected species have been recorded within the Park and Ride and its immediate environs. Further information on these is provided in chapter F9 (terrestrial and freshwater ecology) (Application Reference Number: 6.6.9).

1.2.10 Nant Dalar Hir runs north-east to south-west across the site and is hydrologically connected to a moderately base-rich lake designated as part of the Llyn Traffwll Site of Special Scientific Interest (SSSI), which is located approximately 830m south of the Park and Ride. This lake is designated as a SSSI due to the range of aquatic flora and wintering wildfowl it supports.

1.2.11 There are also a series of smaller lakes (including Llyn Dinam and Llyn Penrhyn), designated as the Llynnau y Fali SSSI, located over 1.2km south-west of the Park and Ride.

1.2.12 In terms of cultural heritage, the Park and Ride can very broadly be divided into improved fields and associated drainage channels around the late 19th century Bryngoleu farmhouse, and semi-improved fields and relict field boundaries around the early 19th century Dalar Hir farmhouse. Heritage assets within the Park and Ride include post-medieval field boundaries, post-medieval farmsteads and a boundary wall built for the A5 Telford Road.

1.2.13 There are no Public Rights of Way or footpaths within, or near to, the Park and Ride. The nearest footpath is over 300m to the north.

1.2.14 Key environmental features in the vicinity of the Park and Ride are shown on figure F1-2 (Application Reference Number: 6.6.38).

1.3 Proposals for the Park and Ride

Site layout and access

1.3.1 The layout and land uses of the site are shown in figure F1-3 (Application Reference Number: 6.6.38).

1.3.2 Landscaping, water and ecological factors have been of prime importance in influencing the Park and Ride layout, in particular screening planting on boundaries and buffer zones around the Nant Dalar Hir and tributary.

1.3.3 There would be ecological and hydrological protection buffer zones of 15m around the Nant Dalar Hir, and of 10m around its main tributary (the wet ditch located near the centre of the site). Further ecological buffer zones would also be created around hedgerows and around an existing badger sett in the north of the site.

1.3.4 Vehicular and pedestrian access to the Park and Ride would be via a new access, in the form of a new roundabout at A55-A5 Junction 4. This has been designed to minimise congestion on the public roads immediately adjacent to the site. Figure F1-4 (Application Reference Number: 6.6.38) shows the proposed road arrangement for the Park and Ride.

1.3.5 The bus transport facility building would be located centrally on the site in order to minimise the pedestrian route from the furthermost car parking bay areas, as well as to effectively maximise the distance from this building to sensitive receptors off-site. The bus waiting, pick-up and drop-off zone would be located next to the bus transport facility in order to reduce boarding time.

1.3.6 Vehicle parking areas would be organised into five main areas, arranged around the building and accessed separately from the internal spine road.

1.3.7 The public bus stop on the adjacent A5 would be accessible via a short footway/cycleway.

Building scale and design

1.3.8 The proposed dimensions for each of the proposed buildings/structures (which have formed the basis for the environmental assessment) are detailed in table F1-1.

1.3.9 The bus transport facility building would be a simple, single-storey structure faced with stone effect and timber effect cladding.

1.3.10 It is proposed that the cycle store would be constructed using timber effect cladding and bus shelters would be constructed using steel frames and Perspex shelters.

Security

1.3.11 The Park and Ride would have a 24-hour manned security presence. The security guards would monitor the access point, CCTV and carry out patrols of the facility.

1.3.12 The Park and Ride would include 1.8m-high security fencing around the parking and bus terminus area.

Architectural design

1.3.13 The overall architectural design approach for the Park and Ride has been driven by the desire to create an unimposing appearance, where the buildings are screened as far as possible, and where visible, they are of an appearance that allows them to harmonise with, and complement, the surroundings. Natural colours would be adopted for the buildings on-site, helping to link them visually, and enabling them to be unimposing within their surroundings.

1.3.14 The buildings on-site would be temporary and would be dismantled following construction of the Power Station. They would therefore be pre-fabricated modular units with an external cladding, and designed with simplicity and efficiency of construction and removal as a priority. The final proposed design would be developed to ensure that it responds to the local context, recognising that, although temporary in nature, the developments would be *in situ* until the construction of the Power Station has ceased.

Landscaping

1.3.15 The northern, western and eastern boundaries of the site are to be planted with species-rich grass, and a short length of hedgerow would be reinstated adjacent to parking zones along the north edge of the site. The existing tree and shrub planting on the southern boundary would be retained and enhanced to screen views from the A5. There would be additional planting along the A5, as shown on figure F1-3 (Application Reference Number: 6.6.38), to provide improved screening from the A55.

Lighting

1.3.16 The lighting design for the Park and Ride would ensure that light spill onto water bodies and hedgerow/boundary habitats is avoided, wherever possible. However, keeping pedestrians safe would be a priority, and the use of a central lighting management system with movement sensors would allow lighting throughout the site to be controlled, allowing intelligent dimming of each light independently of the others. Lighting would be dimmed automatically and settings would be adjustable and reviewed as necessary. Seasonal variations to lighting would be applied and, in the event of an emergency, lighting could be triggered to revert back to 100% capacity.

1.3.17 Car parking zones which are not required at certain stages in the life of the Park and Ride would be blocked off and the lighting deactivated.

1.3.18 The Nant Dalar Hir flows through the site. An open-span bridge would link the car parks on either side. The bridge and approach road to the stream would not be lit in order to mitigate light pollution in this area.

1.3.19 The main hours of Park and Ride operation would be from 06:00 to 20:00, up to a maximum of 24 hours a day, seven days a week, during the peak construction period of the Power Station.

1.3.20 External lighting would be to the minimum lux level required in accordance with 'Park Mark' standards and *BS 5489-1:2013 – Code of practice for the design of road lighting* [RD3]. Lighting columns that are 6m high would be used for the parking areas and roundabouts would use 8m high lighting columns.

Drainage

1.3.21 To minimise the amount of hardstanding on-site, the car parking areas would use a permeable paving type product. This would improve drainage compared to traditional hardstanding, and would be easy to remove and facilitate the site's eventual return to agricultural land. Roads and the bus drop-off area would require a traditional macadam surface to withstand the traffic volumes and types of vehicle that would be using them.

1.3.22 A drainage design incorporating sustainable drainage techniques has been developed to manage surface water runoff associated with the Park and Ride.

1.3.23 All surface water flows from the site would pass through an interceptor and be collected in attenuation tanks before being discharged into the local water courses at green-field runoff rates.

1.3.24 The foul drainage systems consist of a site treatment plant which would be located near to the bus transport facility building.

Utilities

1.3.25 Utilities (including electricity, water and telecommunications) are proposed to be connected to the site via a utilities trench along the internal circulation road.

1.3.26 The proposed buildings would be serviced with a low energy ventilation system, low energy heating and low energy lighting.

Waste and materials

1.3.27 An initial forecast of waste and materials associated with construction, operation and decommissioning activities for the Park and Ride is included in chapter C6 (waste and materials management) (Application Reference Number: 6.3.6).

1.3.28 Typical waste and materials generated through the construction of the Park and Ride could include, but are not limited to:

- topsoil clearance;
- vegetation removal;
- bulk earthworks;
- concrete;
- aggregates; and
- packaging.

1.3.29 All waste and materials arising from construction works at the Park and Ride would be managed in a responsible manner with the clear intention of applying the principles of the waste hierarchy, as described in the Wylfa Newydd Code

of Construction Practice (CoCP) (Application Reference Number: 8.6), aiming to increase reuse of materials on the Wylfa Newydd Development Area where possible. This would reduce the volume of material required to be removed from the site and increase the reuse, recycling and recovery of waste off-site.

1.3.30 Waste would be generated during the operation of the Park and Ride, including waste arising from maintenance activities, site administration and welfare facilities. These activities could lead to generation of the following types of waste:

- packaging materials for goods entering the site, e.g. paper, card, glass, plastic and metal;
- biodegradable food waste from the welfare facilities;
- hazardous wastes, e.g. some paints, fuel and gas bottles;
- building maintenance waste, e.g. timber, plasterboard, insulation, paint tins and metals;
- green waste from landscape maintenance operations;
- hygiene wastes; and
- municipal waste and litter from the facility users.

1.3.31 The decommissioning process would involve the removal of the building structures, roads and paths, lighting, and all hardstanding. The quantities of waste and materials generated through the decommissioning phase are not yet known. However, all waste and materials generated during this phase would be managed in accordance with the waste hierarchy and legislative requirements.

1.4 Rochdale Envelope and parameters

1.4.1 A description of the Rochdale Envelope and parameter approach is provided in chapter B1 (introduction to the assessment process) (Application Reference Number: 6.2.1).

1.4.2 In order to cope with inevitable change through the design development processes, Horizon has proposed a parameter based approach for the construction and operation of the Park and Ride. As such, the application for development consent is based on bounded parameters rather than a defined design.

1.4.3 The parameters are contained within the following.

- **Order Limits** – these define the area within which the Park and Ride may be constructed, operated and maintained under article 3 of the draft Development Consent Order (Application Reference Number: 3.1). The Order Limits are illustrated on figure F1-6 (Application Reference Number: 6.6.38).
- **Works Plans** (Application Reference Number: 2.3)– these identify the limits of deviation for, and location of, each work package (or ‘work area’) under Schedule 1 (authorised development) as referred to in article 4 of

the draft DCO (Application Reference Number: 3.1). The whole of the Park and Ride is one work area (Work No. 6) and Schedule 1 lists the works that can take place within the defined area.

- **Parameter Plan** – this identifies the zones within which buildings, structures and works identified in the parameter table (see below) must be located. There are 12 parameter zones for the Park and Ride as illustrated on figure F1.6 (Application Reference Number 6.6.38).
- **Parameter table** – this identifies maximum building dimensions and zones within which specific buildings, structures and works must be located (as shown on the Parameter Plan, figure F1-6). The parameter table for the Park and Ride is included as table F1-1.

Table F1-1 Parameters for the Park and Ride

Building	Parameter Zone	Maximum Parameter		
		Length (m)	Width (m)	Height (m)
Car park area 2	6-1	Extent of zone 6-1		
Car park area 3	6-2	Extent of zone 6-2		
Car park area 4	6-3	Extent of zone 6-3		
Bus shelter - long	6-4	70	5	5
Bus shelter - short	6-4	54	5	5
Bus waiting/pickup/drop off zone	6-4	Extent of zone 6-4		
Bus terminal building	6-5	30	13	5
Cycle shelter/bin store	6-6	11	7	5
Staff and accessible parking area	6-7	Extent of zone 6-7		
Car park area 1	6-8	Extent of zone 6-8		
Car park area 5	6-9	Extent of zone 6-9		
Roundabout	6-10	Extent of zone 6-10		

1.4.4 In essence, the Order Limits define the whole area which is the subject of the draft Development Consent Order (Application Reference Number: 3.1). In the case of the Park and Ride, that area is also the work area within which all works could take place. The actual work that takes place in those areas is then further constrained by the Parameter Plan and the information contained in the parameter table.

1.4.5 The flexibility associated with buildings, structures and works is restricted through the application of the parameters. These parameters have been informed by the potential to create adverse environmental effects. For those

buildings where the location is sensitive in terms of Environmental Impact Assessment, locations have been limited to relatively modest limits of deviation.

Indicative design

1.4.6 Figure F1-3 (Application Reference Number: 6.6.38) illustrates the indicative site layout which has been used, in combination with the above parameter envelope, as the basis of the Environmental Impact Assessment.

1.5 Development phases and activities

Construction

1.5.1 It is anticipated that construction of the Park and Ride would commence in the first year following grant of development consent and that construction activity on the site would last for approximately 18 months. It is anticipated that construction plant would include excavators, tipper trucks, dozers, fork lifts, rotary bored piling rig, mobile cranes and dump trucks. Construction would be phased in order to most effectively cater for construction workforce ramp up during the period in which the Power Station is being constructed.

1.5.2 The construction workforce for the Park and Ride would be a maximum of 70 workers on the construction site at any one time. Construction work on the Park and Ride would be limited to 08:00 to 18:00 hours weekdays and 08:00 to 13:00 hours Saturdays. No work would take place during evening and/or night-time periods or during Saturday afternoon, Sundays or Bank Holidays.

1.5.3 The anticipated programme for construction would be as shown below.

- Site establishment including:
  - building demolition;
  - mobilisation of construction plant;
  - establishment of pedestrian and haul routes;
  - fencing-off of sensitive areas not to be encroached upon;
  - site clearance;
  - establishment of site compound and welfare facilities; and
  - construction of site boundary and security fences.
- Topsoil removal and preparation of site haul road.
- Phase 1 works: working east to west across the site, construct car parks in the vicinity of the bus transport facility as well as the foundations for the buildings. The advantage of this is that it provides a relatively large initial facility, whilst minimising development at the eastern side of the site (nearest to receptors such as the Cartio Môn go-karting centre and Gwyddfor Residential Home).
- Phase 2 works: construct the buildings, and develop car park zones two, three, and four.

- Final road construction.
- Finalise and create pedestrian routes and landscaping, environmental mitigation, and install signage and lighting.
- Car park five construction.

1.5.4 Earthworks in all areas outside the environmental buffer zones would take place in accordance with the *Code of Practice for Earthworks* [RD4]. These earthworks are required to enable the site to be constructed with a suitable sub-base. This would involve the following.

- Stripping topsoil from all areas outside buffer zones, to an assumed depth of 300mm. It is currently anticipated that all topsoil would be removed from site.
- Excavating to allow for placement of sub-base for all roads, bus drop-off areas and pedestrian footways: 250mm to 750mm assumed. Car park areas are assumed to have permeable paving on top of a drainage layer which would be built up from topsoil strip depth. All assumptions are subject to detailed ground investigation.
- Excavating to allow for placement of foundations for new building. Foundations would need to be a minimum 900mm below ground level.

1.5.5 Concrete batching is expected to be undertaken off-site.

1.5.6 No utility diversions are expected. The existing buildings on-site would have their services isolated and disconnected prior to demolition.

1.5.7 Possible construction storage areas (e.g. for temporary topsoil storage) include the north-east corner of the site and the triangular area to the west of the bus drop-off area.

Operation

1.5.8 It is anticipated that the Park and Ride would be in operation for approximately 10 years.

1.5.9 The normal sequence of activities during this operational period is expected to be as follows:

- the workers would arrive at the site via the entrance off a new roundabout at the A55-A5 Junction 4;
- they may need to queue on the access road within the site, before the barriers;
- cars would be recognised by an automatic number plate recognition system, the barriers would open and cars admitted one at a time;
- workers would park at one of the parking zones in accordance with the nature of their trip (long term or short term);
- they would walk to the bus transport facility building via a pedestrian walkway;
- workers may wait at the facility building or use the amenities;

- workers would proceed to walk through to the bus waiting, pick-up and drop-off zone; and
- workers would board the bus after satisfying necessary security requirements.

1.5.10 The Park and Ride would be expected to have an operational workforce of 15 bus drivers and 10 members of staff, with staff split between security, control room and management.

1.5.11 When the Park and Ride is operational, there would be vehicle movements associated with staff and deliveries. Based on a typical working day and an operational workforce of 25 staff, this would result in a worst case scenario of 34 additional vehicle trips along the A55 per day (two-way) (i.e. 17 vehicles in and 17 vehicles out of the Park and Ride). Deliveries by Light Goods Vehicles are estimated to be two vehicle movements per day (two-way) (i.e. two vehicles in and two vehicles out of the facility).

Decommissioning

1.5.12 Once no longer required, and on the basis that no subsequent planning permission is granted for a future use, the Park and Ride would be returned to its current agricultural land use, preserving the enhanced hedgerows and areas of habitat created along the Nant Dalar Hir and its tributaries. Reinstatement would seek to restore the original field pattern, and would be in accordance with the proposals illustrated in figure F1-5 (Application Reference Number: 6.6.38).

1.5.13 Phased decommissioning may be possible as worker numbers decrease, but this is still to be confirmed. If decommissioning takes place in one phase, it is expected that this would take 12 months. It is anticipated that dismantling and site reinstatement would follow a programme broadly the reverse of construction. Key activities would include but are not limited to:

- formation of demolition site compound;
- demolition plant mobilisation and traffic movements;
- demolition and removal of temporary structures and services;
- breaking up of concrete and surfacing if required;
- management of waste and other materials; and
- environmental mitigation works.

1.5.14 Buried utilities would not be removed.

1.6 Embedded and good practice mitigation

1.6.1 The following environmental mitigation has been embedded into the design:

- drainage design and 15m buffer either side of the Nant Dalar Hir in order to avoid any impact on Llyn Trafwll SSSI;
- the preservation of heritage assets on-site (including field boundaries and boundary wall);

- the incorporation of landscaping measures to preserve the landscape character of the area;
- measures aimed at maximising future efficient conversion to legacy land use (i.e. return to greenfield site) and minimising waste and materials use;
- design measures minimising the generation of waste that needs to be disposed of off-site;
- buffer zones of 10m either side of drainage ditches within which no development would occur (aside from necessary works such as outfalls);
- the minimisation of areas of site to be covered by hardstanding in order to reduce the impact on soil resources;
- the retention of waterbodies identified on-site;
- the retention and protection of hedgerows, trees and walls around, and within, the site boundary;
- a layout that maximises distances between potential noise sources and receptors;
- the use of buildings as noise barriers, and the enclosure of features generating noise;
- lighting design that avoids light spill onto waterbodies, retained hedgerow and boundary habitats;
- the reuse of site soil as far as practicable, for example through the landscape areas, or identification of locations for reuse to minimise requirements for off-site disposal;
- the incorporation of hedgerow creation/tree planting with native species of local provenance in order to enhance retained hedgerows to create species-rich hedgerows; and
- seeding and appropriate management of any grassland creation with appropriate grassland species.

1.6.2 Chapter J1 (environmental commitments) (Application Reference Number: 6.10.1) gives further information on how these embedded mitigation measures are being secured.

- Good practice mitigation would be employed during construction. This mitigation would be secured by the Wylfa Newydd CoCP (Application Reference Number: 8.6) and the Park and Ride sub-CoCP (Application Reference Number: 8.10), within which full information is given.

1.7 References

Table F1-2 Schedule of references

ID	Reference
RD1	Welsh Assembly Government. 2015. *Development Advice Maps.* Hosted on Natural Resources Wales' website. [Online]. [Accessed: 09 June 2017]. Available from: https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en.
RD2	Welsh Assembly Government. 2004. *Technical Advice Note 15*: *Development and Flood Risk.* [Online]. [Accessed: 16 May 2017]. Available from: http://gov.wales/docs/desh/publications/040701tan15en.pdf.
RD3	British Standards Institution. 2013. *BS 5489-1:2013 – Code of practice for the design of road lighting*. London: British Standards Institution.
RD4	British Standards Institution. 2009. *BS 6031:2009 – Code of Practice for Earthworks*. London: British Standards Institution.

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HORIZON
NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.6.8 ES Volume F - Park and Ride F8 - Surface water and groundwater

PINS Reference Number: EN010007

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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 Llynnau y Fali SSSI, located over 1.2km south-west 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;
- Llynnau 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
	Caer Elen Farm downstream: off-site flood risk.	High
Fluvial geomorphology	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
	Other watercourses (including drains): typically man-made extensions to the drainage network with a limited range of morphological features.	Low
Groundwater	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
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.	Management of flood waters from both fluvial and pluvial sources within the Park and Ride.	Acceptable management of flood risk to Park and Ride.

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. *Site of Special Scientific Interest: Citation – Anglesey Llyn Traffwll*. [Online]. [Accessed: 08 June 2017]. Available from: http://angleseynature.co.uk/webmaps/llyntraffwlldesc.htm
RD2	Welsh Government. *Development Advice Maps*. 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. *Technical Advice Note 15: Development and Flood Risk*. (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. *Water Watch Wales Map Gallery*. [Online]. [Accessed: 06 June 2017]. Available from: http://waterwatchwales.naturalresourceswales.gov.uk/en/
RD6	Cranfield Soil and Water Institute. 2015. *Soilscapes*. [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. *Western Wales River Basin Management Plan 2015-2021.* [Online]. [Accessed: January 2016]. Available from: https://naturalresources.wales/media/676165/wwrbdsummary.pdf
RD9	NIEA, SEPA, NRW. 2017. *Works and maintenance in or near water: GPP 5*. [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. *Control of water pollution from construction sites: Guidance for consultants and contractors* (C532). London: CIRIA.

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

HORIZON
NUCLEAR POWER

WYLFA NEWYDD

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Wylfa Newydd Project

6.6.9 ES Volume F - Park and Ride F9 - Terrestrial and freshwater ecology

PINS Reference Number: EN010007

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Contents

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9 Terrestrial and freshwater ecology

9.1 Introduction

9.1.1 This chapter describes the assessment of potential terrestrial and freshwater ecology effects resulting from the construction, operation and decommissioning of the Park and Ride Facility at Dalar Hir (hereafter referred to as 'Park and Ride').

9.1.2 Please refer to chapter B9 (terrestrial and freshwater ecology) (Application Reference Number: 6.2.9) for the technical basis for the assessment including a summary of legislation, policy and guidance; key points arising in consultation that have guided the terrestrial and freshwater ecology assessment; and assessment methodologies and criteria.

9.1.3 This chapter should be read in conjunction with the Dalar Hir baseline survey reports in:

- appendix F9-1 Extended Phase 1 Habitat Survey and HSI Survey (Application Reference Number: 6.6.17);
- appendix F9-2 Dalar Hir Buffer Extended Phase 1 Report (Application Reference Number: 6.6.18);
- appendix F9-3 Wylfa Dalar Hir bats and barn owl report (Application Reference Number: 6.6.19);
- appendix F9-4 Wylfa Dalar Hir badgers report (Application Reference Number: 6.6.20);
- appendix F9-5 Wylfa Dalar Hir water vole report (Application Reference Number: 6.6.21);
- appendix F9-6 Wylfa Dalar Hir great crested newt report (Application Reference Number: 6.6.22);
- appendix F9-7 Wylfa Dalar Hir reptiles report (Application Reference Number: 6.6.23);
- appendix F9-8 Wylfa Dalar Hir: Building 12 Bat Survey 2016 (Application Reference Number: 6.6.24); and
- appendix F9-10 - Dalar Hir freshwater ecology report (Application Reference Number: 6.6.26).

9.1.4 This chapter should also be read in conjunction with the Dalar Hir Protected and Legally Controlled Species Compliance Report (see appendix F9-9, Application Reference Number: 6.6.25) which discusses species protected and legally controlled by UK legislation including:

- fish;
- breeding birds;
- badgers (*Meles meles*);
- bats;

- otter (*Lutra lutra*);
- water vole (*Arvicola amphibius*);
- Invasive Non-Native Species (INNS) of plant; and
- the legal implications of the proposed development on these species.

9.1.5 Effects from proposed developments can arise from direct and indirect impacts upon habitats or species, and be of a temporary or permanent nature. As indirect effects can occur through changes in hydrology, pollution of air and water, and via noise, this chapter is supported by information from the relevant chapters of the Environmental Statement. Where necessary, cross-reference to information in other chapters is provided.

9.2 Study area

9.2.1 This section describes the study area relevant to the terrestrial and freshwater ecology assessment for the Park and Ride.

9.2.2 The area for the desk study was a 2km radius from the Park and Ride site for legally protected species and designated sites (statutory and non-statutory) of nature conservation importance. This search area was based on professional judgement and good practice guidelines (e.g. [RD1]) and was considered to be sufficient to account for the majority of ecological receptors that would be potentially vulnerable to effects arising from construction, operation and decommissioning activities within the Park and Ride site. This took into account the zones of influence relevant to other disciplines such as air quality (chapter F5, Application Reference Number: 6.6.5) and surface water and groundwater (chapter F8, Application Reference Number: 6.6.8).

9.2.3 Within the desk study area, the areas subject to specific surveys were defined by appropriate best practice guidelines and professional judgement based on the habitat preferences of the target species (see section 9.3 and baseline reports listed in 9.1.3). This area is referred to as the field survey area for terrestrial and freshwater ecology, and included all areas within the boundary of the Park and Ride site and a buffer zone extending approximately 500m. The 500m buffer was influenced by the results of the desk study, good practice guidelines (e.g. [RD1]), and professional judgement, and is considered to be an appropriate distance beyond which most development related impacts would not extend.

9.3 Baseline environment

9.3.1 This section provides a summary of the baseline conditions for terrestrial and freshwater ecology within the study area described in section 9.2. Receptors have been valued according to the methodology and criteria described in chapter B9 (Application Reference Number: 6.2.9).

Statutory and non-statutory designated sites

9.3.2 The proposed Park and Ride does not lie within or adjacent to any statutory or non-statutory designated sites. The following statutory sites were recorded

within the desk study area and are shown on figure F9-1 (Application Reference Number: 6.6.38).

- Llyn Dinam Special Area of Conservation (SAC): 36.69ha site, approximately 1.2km south-west of the Park and Ride site with Annex I habitats: 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition – type vegetation (see the Shadow Habitats Regulations Assessment Report) (Application Reference Number: 5.2).
- Llynnau y Fali – Valley Lakes Site of Special Scientific Interest (SSSI): 98ha site, approximately 1.2km south-west of the Park and Ride site. A mosaic of open water areas with associated mesotrophic marshland and damp grassland habitats supporting rare plant species such as marsh fern (*Thelypteris thelypteroides*) and cyperus sedge (*Carex pseudocyperus*).
- Llyn Traffwll SSSI: 44.8ha site, approximately 900m to the south of the Park and Ride site. It comprises a small shallow lake supporting aquatic flora and over-wintering wildfowl. It forms part of the Royal Society for the Protection of Birds (RSPB) Valley Wetlands Reserve.

9.3.3 The following non-statutory designated sites have been recorded within the study area.

- Cors Plas (E14) Isle of Anglesey County Council (IACC) Wildlife Site: 54.6ha site, approximately 1.2km south-east of the Park and Ride site. An extensive area of marshy grassland with several excavated pools and some willow scrub. The site is important mainly for its wildfowl and a large part of the site is managed by the RSPB and forms part of the Valley Wetlands Reserve.
- Rhostir a Phwll Caergeiliog (E13) IACC Wildlife Site: 4.5ha, approximately 1.4km west of the Park and Ride site. An area of wet heath and a basin mire which has grown over the site of a former pool. There is also some scrub bordering the mire on the eastern side, dominated by common gorse *Ulex europaeus* and hawthorn *Crataegus monogyna*.
- Gwely Cyrs Caergeiliog (E01) IACC Wildlife Site: 2.7ha site, approximately 1.9km west of the Park and Ride site. The site is a reedbed surrounded by a band of marshy grassland. The reedbed has great reedmace *Typha latifolia* and common reed *Phragmites australis* with soft rush *Juncus effusus* near its edge.
- Valley Wetlands RSPB Reserve: 35.88ha site, approximately 1km south of the Park and Ride site. A wetland habitat mosaic supporting wading and over-wintering bird species.

9.3.4 In accordance with the criteria presented in table B9-12, the SAC site is of high value as it is a designation important in an international context.

9.3.5 In accordance with the criteria presented in table B9-12, the SSSIs are of high value as they are statutory designated sites of national importance.

9.3.6 The IACC Wildlife Sites are considered to be of medium value, as they are a non-statutory designation, important in a county/regional context.

9.3.7 The Valley Wetlands RSPB Reserve supports bird species and habitat types of low value. Although some of the bird species recorded are listed on Schedule 1 of the Wildlife and Countryside Act 1981, the Local Biodiversity Action Plan [RD2] and/or are listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016 as species of principal importance, they are not present in sufficient numbers to form a critical part of a wider population at this scale. The Valley Wetlands RSPB Reserve is therefore considered to be of low value.

Terrestrial and freshwater habitats and species

Habitats

9.3.8 The majority of terrestrial habitats recorded in the study area during a Phase 1 habitat survey in 2013 were improved grassland, semi-improved neutral grassland, semi-improved grassland and marshy grassland. Also present were the following habitats (appendix F9-1, Application Reference Number: 6.6.17; and F9-2, Application Reference Number: 6.6.18):

- hedgerows;
- young plantation woodland;
- broadleaved semi-natural woodland;
- scattered scrub;
- tall ruderal vegetation;
- bare ground; and
- buildings.

9.3.9 The grassland habitat types present are common and widespread, and were considered to be of negligible value. However, some small areas of habitats were present that are listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016, for example field edges (this is represented by rank grassland within the study area), scrub and broadleaved woodland. These habitats were limited in extent and are considered to be of low value.

9.3.10 Taken together, it is considered that terrestrial habitats within the study area are of low value.

9.3.11 Due to the absence or limited extent of habitats necessary to support notable assemblages of fungi, lichens, bryophytes, higher plants, terrestrial invertebrates or overwintering birds, these groups are not considered further in this assessment. Similarly, due to the limited extent of suitable habitat that would be affected by the Park and Ride, notable mammals (with the exception of badger, bats and water vole) have been excluded from this assessment.

9.3.12 The physical habitat of the watercourses within the field survey area was characteristic of a semi-rural ditch system, where water features have been re-sectioned and realigned to serve as field and road drainage. The still-water waterbodies had different levels of physical habitat modification, with some

pond features recognised as part of the sustainable drainage network of ponds serving local infrastructure (see appendix F9-10, Application Reference Number: 6.6.26). Sample locations and nomenclature given to waterbody locations are provided in appendix F9-10 (Application Reference Number: 6.6.26).

9.3.13 Dissolved oxygen percent saturation varied across sample sites from 31.1% to 107% (super-saturated) and suspended solids ranged from <3mg/l to 733mg/l. Nutrient levels were generally low with the exception of reactive phosphorus with readings of between 0.167mg/l and 0.234mg/l. Metal concentrations were elevated at two sample locations. In summary, water quality across the site is typical of that found within a rural setting close to a main transport route.

9.3.14 Taken together the value of the freshwater habitats is considered to be low.

Species

Invasive non-native species of plant

9.3.15 Japanese knotweed (*Fallopia japonica*), montbretia (*Crocosmia x crocosmiiflora*) and Canadian pondweed (*Elodea canadensis*) have been recorded from within the boundary of the Park and Ride site (see appendices F9-1, Application Reference Number: 6.6.17; and F9-2, Application Reference Number: 6.6.18 of this Environmental Statement). This group does not form a receptor, and so is not assigned a value, but does have the potential to cause a significant environmental effect which would require appropriate mitigation.

Amphibians

9.3.16 Cofnod (the North Wales Environmental Information Service) returned four records of great crested newt (GCN) between 2007 and 2017 within 2km of the Park and Ride site.

9.3.17 No GCN have been recorded in any waterbodies within the boundary of the Park and Ride site. However, GCN were recorded in the attenuation pond complex located approximately 25m to the south of the Park and Ride site boundary between the A5 and A55 in Pond 13 and Pond 16b (see appendix F9-6, Application Reference Number: 6.6.22). The peak count of GCN from these ponds was two and one adults respectively.

9.3.18 Surveys of the complex of attenuation ponds have also been completed as part of monitoring of success of the mitigation by the North and Mid-Wales Trunk Road Agent. The data available from appendix F9-6 (Application Reference Number: 6.6.22) and monitoring surveys combined are provided in table F9-1.

Table F9-1 GCN survey data from monitoring of mitigation pond complex

Year	No. of surveys	Maximum count
2010	3	0
2011	3	0
2012	3	0
2013	3	0
2014	7	Pond 13 – 2 and Pond 16b – 1
2015	3	Pond 13 – 2
2016	3	Pond 13 – 2
2017	1	Pond 13 – 1

9.3.19 The terrestrial habitats within the boundary of the Park and Ride site are separated from the ponds supporting GCN by a road (the A5) and two mortared stone walls, although the Nant Dalar Hir links the two areas through a culvert. The physical barriers between the Park and Ride site and the small populations present in the two ponds, combined within the lack of evidence of GCN from ponds to the north of the A5, suggest that GCN are likely to be absent from terrestrial habitats within the boundary of the Park and Ride site. There is therefore no potential for the species to be affected.

9.3.20 Common toad (*Bufo bufo*) were recorded in one pond to the north of the Park and Ride site, and in two ponds in the same complex as those supporting GCN between the A5 and A55. Common toads were also recorded under refuges placed for the reptile surveys throughout the boundary of the Park and Ride site.

9.3.21 Common frog (*Rana temporaria*) and palmate newt (*Lissitriton helveticus*) were also recorded in ponds throughout the study area.

9.3.22 In summary, GCN is considered to be absent from habitats within the Park and Ride site. Common toad is listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016, and would therefore be a low value receptor due to its conservation status. Common frog and palmate newt are assigned a negligible value as they are common, widespread and receive no legal protection.

Reptiles

9.3.23 Cofnod returned two records of reptiles between 2007 and 2017 within 2km of the Park and Ride site: adder (*Vipera berus*) and common lizard (*Zootoca vivipara*).

No reptiles were recorded during the surveys. The group is therefore considered to be absent from the Park and Ride site and they are not discussed further in this assessment (see appendix F9-7, Application Reference Number: 6.6.23).

Breeding birds

9.3.24 Cofnod returned numerous bird records between 2007 and 2017 within 2km of the Park and Ride site. The majority were recorded along the A55 and within the Valley Wetlands RSPB Reserve.

9.3.25 During the Extended Phase 1 habitat survey (see appendix F9-1, Application Reference Number: 6.6.17), the Park and Ride site was found to have habitats with the potential to support breeding birds. These included hedgerows, plantation woodland and a building (Building 12). Several notable species were also recorded incidentally e.g. dunnock (*Prunella modularis*) and kestrel (*Falco tinnunculus*). While no breeding bird surveys were completed, evidence of nesting by swallow (*Hirundo rustica*) and house sparrow (*Passer domesticus*) was recorded from Building 12 (see appendix F9-3, Application Reference Number: 6.6.19). No evidence of barn owl using the buildings within the study area was recorded during surveys, and so the species is not discussed further in this assessment (see appendix F9-3, Application Reference Number: 6.6.19).

9.3.26 The extent of the habitats likely to be used by breeding birds, including notable species, would limit the assemblage that the Park and Ride site could support. The value of the breeding bird population that could be affected by the development of the Park and Ride site is considered to be low.

Badgers

9.3.27 Cofnod returned no records of badgers between 2007 and 2017 within 2km of the Park and Ride site.

9.3.28 Evidence of badger was recorded within the boundary of the Park and Ride site, as shown in appendix F9-4 (Application Reference Number: 6.6.20). This evidence consisted of one active single-hole outlier sett. A further two possible single-hole outlier setts were also found, although their recent use was not confirmed. No evidence of foraging or latrines was recorded.

9.3.29 Badgers are rare on Anglesey and, combined with their legal protection status are an important receptor. However, usage of the study area by badgers appears to be occasional and so badgers are assigned a low value.

Bats

9.3.30 Cofnod returned nine records of bats between 2007 and 2017 within 2km of the Park and Ride site and included noctule bat (*Nyctalus noctula*), Natterer's bat (*Myotis nattereri*) and brown long-eared bat (*Plecotus auritus)*.

9.3.31 No bat roosts were recorded within the boundary of the Park and Ride site. However, Building 12 would be demolished and was found to have low potential to support roosting bats (see appendix F9-3, Application Reference Number: 6.6.19). The study area was considered to have habitats that bats are likely to use for commuting and foraging.

9.3.32 An inspection and dusk emergence survey of Building 12 was completed in 2016 (see appendix F9-8, Application Reference Number: 6.6.24). This survey did not record any evidence of bats. During the survey, there was one

pass by a noctule, indicating that bat usage of the area in general is likely to be low.

9.3.33 The bats that the study area supports are therefore assigned a low value.

Otter and water vole

9.3.34 Cofnod returned nine records of otter and four records of water vole between 2007 and 2017 within the study area.

9.3.35 No evidence of otter has been recorded within the boundary of the Park and Ride site (see appendix F9-1, Application Reference Number: 6.6.17; and appendix F9-5, Application Reference Number: 6.6.21). However, the habitats within the Nant Dalar Hir were considered to be suitable to support the species. Impacts on otter are therefore not assessed in this chapter, but they are included in the Dalar Hir Protected and Controlled Species Report (see appendix F9-9, Application Reference Number: 6.6.25) to address potential outcomes of the species moving into the Park and Ride site.

9.3.36 Evidence of water vole was recorded on the Nant Dalar Hir (Ditch 9) within the boundary of the Park and Ride site. Evidence of water vole was also recorded outside the boundary of the Park and Ride site on Ditch 11, Ditch 24, Pond 14, and Pond 16d within the wider study area. The locations of all waterbodies are shown in appendix F9-5 (Application Reference Number: 6.6.21).

9.3.37 The water vole population in the study area is likely to be small given the limited amount of suitable habitat. In the context of the wider area, the study area is therefore likely to form only a small part of the network of waterbodies supporting the species in Anglesey. Water vole are therefore considered to be of low value.

Diatoms

9.3.38 There is a large variability in diatom populations recorded across the study area, which would be expected given the range of habitat types assessed (see appendix F9-10, Application Reference Number: 6.6.26). No species of conservation interest were recorded and community structure was typical of lowland drainage channels set in a semi-rural landscape. The value of the diatom assemblage is therefore considered to be negligible.

Macrophytes

9.3.39 Cofnod returned numerous records of macrophytes between 2007 and 2017. These were generally associated with the A55 and Valley Wetlands RSPB Reserve.

9.3.40 The macrophyte communities at all sites surveyed were relatively poor in terms of diversity of scoring taxa and number of truly aquatic groups. However, two plants listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016 were recorded: pillwort (*Pilularia globulifera*) and tubular water-dropwort (*Oenanthe fistulosa*), both of which were found in Pond 14a (see appendix F9-10, Application Reference Number: 6.6.26).

9.3.41 The presence of these species means that the value of the macrophytes is therefore considered to be low.

Macroinvertebrates

9.3.42 Four species of conservation importance were recorded during surveys of the study area (see appendix F9-10, Application Reference Number: 6.6.26). These were:

- a horse leech (*Haemopis sanguisuga*) in Ditch 24a and Ditch 29;
- a leech (*Erpobdella testacea*) in Ditch 9, Ditch 24a and Ditch 34;
- the moss bladder snail (*Aplexa hypnorum*) in Ditch 17; and
- the white-lipped ramshorn snail (*Anisus leucostoma*) in Ditch 17 and Ditch 33.

9.3.43 All four species have a conservation score of five from the river flow indexing framework using benthic macroinvertebrates [RD3] and are of Local conservation importance. The presence of these species has resulted in Moderate Community Conservation Index scores [RD4] across all sites. The remaining species are ubiquitous in the observed habitat types. This supports the habitat characterisation of the study area, which largely consists of field boundary ditch systems with limited numbers of plant species and flow types, and little substrate diversity.

9.3.44 Taken together the value of the macroinvertebrate communities in the waterbodies present in the study area is considered to be low.

Fish

9.3.45 Three species of fish were recorded in the study area (see appendix F9-10, Application Reference Number: 6.6.26) as listed below:

- European eel (*Anguilla anguilla*);
- nine-spined stickleback (*Pungitius pungitius*); and
- three-spined stickleback (*Gasterosteus aculeatus*).

9.3.46 The European eel, which receives protection via the Eels (England and Wales) Regulations 2009, is listed as critically endangered on the Red List [RD5], and is a species listed in accordance with the requirements of Section 7 of the Environment (Wales) Act 2016. Nine-spined stickleback and three-spined stickleback have been found in Ditch 9, Ditch 24a, Ditch 29, Ditch 33, Ditch 34 and Pond 16d during field surveys.

9.3.47 Fish are assigned a medium value. This is based on the presence of European eel as the species of the highest value, and qualified by the legal protection they are afforded.

Summary of receptors

9.3.48 In accordance with chapter B9 (Application Reference Number: 6.2.9), only those receptors considered to be of low, medium and high value and that have potential to be affected by the proposed development are taken forward to assessment. These are summarised in table F9-2.

Table F9-2 Value of receptors taken forward to assessment

Receptor	Value of receptor
Llyn Dinam SAC	High
Llynnan y Fali SSSI	High
Llyn Traffwll SSSI	High
Cors Plas IACC Wildlife Site	Medium
Rhostir a Phwll Caergeiliog IACC Wildlife Site	Medium
Gwely Cyrs Caergeiliog IACC Wildlife Site	Medium
Fish	Medium
Valley Wetlands RSPB Reserve	Low
Terrestrial habitats	Low
Freshwater habitats	Low
Macrophytes	Low
Macroinvertebrates	Low
Common toad	Low
Breeding birds	Low
Badger	Low
Bats	Low
Water vole	Low

Evolution of the baseline

9.3.49 The environmental baseline presented above is unlikely to change significantly as a result of external influences for the period covering construction, operation and decommissioning of the Park and Ride. Whilst it is acknowledged in chapter F8 (surface water and groundwater, Application Reference Number: 6.6.8) that over the medium to long term, climate change could potentially alter the hydrological regime of the watercourses in the study area, it is likely that effects would remain localised and of relatively low magnitude given the channel types. Therefore, the assessments in this chapter do not include the evolution of baseline conditions as a factor for consideration.

9.4 Design basis and activities

9.4.1 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 would be adopted to reduce adverse effects as inherent design features or by implementation of standard industry good working practice.

9.4.2 As described in chapter F1 (proposed development) (Application Reference Number: 6.6.1), the application for development consent is based on a parameter approach. The assessment described within this chapter has taken into consideration the flexibility afforded by the parameters. A worst case scenario has therefore been assessed from a terrestrial and freshwater ecology perspective within the parameters described in chapter F1 (Application Reference Number: 6.6.1).

Construction

9.4.3 Construction would follow the approach described in chapter F1 (Application Reference Number: 6.6.1). Those activities which could affect ecological receptors include:

- site clearance (including demolition) and vegetation clearance;
- operation of construction vehicles and machinery;
- earthworks (outside environmental buffer zones) including topsoil stripping, excavation for sub-base to all roads, and excavation for foundations to the new building;
- creating pedestrian routes, landscaping, and installing signage and lighting;
- the construction of site drainage channels, outfalls, culverts and a storm water attenuation tank; and
- measures to protect the environment or to reinstate environmental features damaged during construction.

Basis of assessment and assumptions

9.4.4 Upon completion of the construction of the Power Station, the Park and Ride site would be returned to its pre-development state (i.e. agricultural land use).

9.4.5 It is assumed that the drainage system would not be removed as part of decommissioning and therefore this system would continue to provide mitigation against surface water flooding and pollution within the runoff.

Embedded mitigation

9.4.6 Mitigation embedded in the designs presented in chapter F1 (Application Reference Number: 6.6.1) includes the following measures relevant to ecological receptors that would be delivered through the Park and Ride sub-Code of Construction Practice (CoCP) (Application Reference Number: 8.10) and volume 3 of the Design and Access Statement (Associated Developments and Off-Site Power Station Facilities) (Application Reference Number: 8.2.3).

- To avoid disturbance to water vole, the crossing installed over the Nant Dalar Hir would consist of a clear span (single span) bridge rather than a culvert.
- To avoid loss of habitat of most value to breeding birds, bats and common toad, and to avoid disturbance to active badger setts, hedgerows, trees (including root protection zones) and walls would be reinstated and protected wherever practicable.

Good practice mitigation

9.4.7 Good practice during the construction phase includes the following measures which would be implemented via the overarching Wylfa Newydd CoCP (Application Reference Number: 8.6) and the Park and Ride sub-CoCP (Application Reference Number: 8.10).

- With the exception of Ditch 7, all remaining ditches and streams within the boundary of the Park and Ride site will be retained and protected by a 15m machinery/plant exclusion zone surrounding watercourses to mitigate impacts on water quality. Where works within this zone are required, e.g. for drainage infrastructure installation, appropriate risk assessments and method statements will be prepared to limit impacts, prior to works commencing within this zone, which will be completed in the presence of an Environmental Clerk of Works (ECoW).
- A buffer zone of 30m would be in place around an existing badger sett in the north of the site. Within these buffer zones, use of heavy plant machinery would not take place. Where work cannot be avoided, hand tools only would be used in accordance with appropriate risk assessments and method statements, and in the presence of an ECoW.
- Works compounds, storage sites, access roads and construction work would be located/carried out at an agreed minimum distance from water features as advised by an ECoW.
- Horizon will manage emergency pollution control measures in keeping with Pollution Prevention Guidelines (PPGs) previously issued by the Environment Agency (until replaced by corresponding Guidance for Pollution Prevention (GPPs)), in particular PPG01, GPP05, PPG06 and GPP13 [RD6, RD7, RD8 and RD9] and ensuring the necessary consents for working in proximity to watercourses are obtained. This would include using measures such as management of runoff and use of spill kits.
- Implementing measures to control air quality changes such as dust suppression on haul roads and implementation of appropriate controls on emissions from construction plant.
- Where possible, habitat with the potential to support bird nests would be removed outside the breeding bird season (typically March to August inclusive). This would ensure that no birds are nesting on-site at the start of construction within or/near to the identified habitat. If it is not possible

to avoid the breeding bird season, then clearance works would be supervised by the implementation of the measures outlined below.

- An ECoW would complete a pre-construction survey prior to removing any habitat with the potential to support nesting birds, including ground nesting species. The pre-construction survey would identify the presence of any active nests, and in the event they are identified, establish appropriate methodologies to reduce any potential impacts on these nests during clearance works.
- The ECoW would supervise the clearance of habitats once it has been established that there are no nests present.
- Should active nests be found, either during the pre-construction survey or during supervision, then the ECoW would set up a work exclusion zone of an appropriate distance to prevent disturbance. The exclusion zone distance would be set based on the judgement of the ECoW and the species concerned, but would typically range between 5-10m.
- Work exclusion zones would be maintained until chicks have fledged or the nest has become inactive, as determined through monitoring visits by the ECoW.

- In order to manage the risk of introducing and/or spreading INNS, Horizon will prepare one (or more) Biosecurity Risk Assessment (s) and Method Statement (s) to cover all activities. Each Biosecurity Risk Assessment will consider in general:
  - measures that will be undertaken to control and eradicate INNS within the area of works; and
  - measures or actions that aim to prevent INNS being introduced to the site for the duration of the construction phase of the scheme.
- In the management of existing known presence of INNS, Biosecurity Risk Assessments and Method Statements will detail:
  - how areas with the presence of INNS will be demarcated;
  - how any contaminated materials will be appropriately managed throughout the works, including where appropriate eradication from the site;
  - appropriate disposal; and
  - how any transfer or spread will be prevented.
- In terms of prevention of new introduction to the site through terrestrial and marine pathways, Biosecurity Risk Assessments and Method Statements will detail:
  - Risk pathways and risk activities for the transfer and spread of non-native species;
  - risk assessment for the transfer and spread of individual non-native species of known concern;

  - methods to manage risk of transfer including any actions to be undertaken prior to reaching site; and,
  - contingency planning and corrective actions.
- Horizon will implement a monitoring programme for non-native species. This will include observational surveys on structures that may provide suitable substrate for non-native species. Surveys will record presence/abundance of non-native species with reporting in agreement with Natural Resources Wales (NRW). Monitoring survey requirements for specific sites are set out in the sub-CoCPs where relevant. Where new presence of INNS is discovered, Biosecurity Risk Assessments and Method Statements will be reviewed and amended where necessary. Wherever appropriate, workers will be given an activity specific tool-box talk from an ECoW. This will include photographs of any INNS species known to be present on a site.
- Badger would be protected from accidental entrapment during the construction phase. This would include covering excavations overnight where possible. Where this is not possible, trenches would have shallow sloped ends until they are filled in, or rough planks would be left to act as ramps to allow badger to climb out.
- A pre-demolition bat survey would be carried out for any building to be demolished. In accordance with best practice guidance [RD1] this would consist of a dusk emergence survey followed by a dawn re-entry survey, before demolition is due to take place. If no bats were recorded leaving or entering the building, then it would be demolished as soon as possible after the survey. If bats are recorded using the building, then demolition would be postponed until a European Protected Species (EPS) mitigation Licence has been obtained.
- Pre-construction surveys would be completed to determine the exact locations of any water vole burrows in areas of habitat likely to be affected during drainage infrastructure installation. This would inform micro-siting of works to avoid impacts to burrows and the animals themselves. This would be secured as a DCO requirement, Draft Development Consent Order (Application Reference Number: 3.1).
- During works to install drainage infrastructure where effects on burrows are likely (as informed by pre-construction surveys), vegetation clearance would take place ahead of works. This is an effective way of dissuading water vole from using an area, if used over a short period, and in small areas. This would be followed by supervision of all works to banks of watercourses by an ECoW. Any water voles found would be released into areas of retained habitat.

9.4.8 Those good practice mitigation measures relating to the avoidance of breaches of the legislation protecting species e.g. the timing of works, are also described in appendix F9-9 (Application Reference Number: 6.6.25).

Operation

9.4.9 Operation would follow the approach described in chapter F1 (Application Reference Number: 6.6.1).

Basis of assessment and assumptions

9.4.10 The basis for the assessment is that the most valuable habitats for ecological receptors are being retained, as a result of measures set out in paragraph 9.4.6 and 9.4.7, including the majority of those listed in accordance with Section 7 of the Environment (Wales) Act 2016. This minimises effects on all aquatic receptors, common toad, breeding birds, badger, bats and water vole. However, during operation, air quality changes, disturbance and hydrological changes were identified.

Embedded mitigation

9.4.11 Mitigation embedded in the project description in chapter F1 (Application Reference Number: 6.6.1) includes the following measures relevant to ecological receptors.

- Lighting during the operational stage would ensure that light-spill onto hedges and watercourses are avoided wherever practicable. This would reduce disturbance to fish, breeding birds and badger.
- The surface water drainage design would include measures to control the peak runoff rate from the site. Attenuation capacity provided would be sufficient to control flooding of the Park and Ride. This would prevent degradation of habitats suitable for fish, macrophytes, macroinvertebrates and water vole, and avoid degradation of Llyn Traffwll SSSI. This would be secured through volume 3 of the Design and Access Statement (Application Reference Number: 8.2.3).

Good practice mitigation

9.4.12 There are not considered to be any effects likely to be mitigated by good practice mitigation measures.

Decommissioning

9.4.13 Decommissioning would follow the approach described in chapter F1 (Application Reference Number: 6.6.1).

Basis of assessment and assumptions

9.4.14 The main assumption relating to ecological receptors is that the Park and Ride site would be returned to its current state (i.e. agricultural land use). A further assumption is that the effect pathways during decommissioning works i.e. construction type activities, would be similar in scale to those during construction.

Embedded mitigation

9.4.15 The embedded mitigation during decommissioning would be the same as for construction, with measures in place primarily to protect retained habitat features of value to ecological receptors.

9.4.16 The embedded mitigation measures would also involve reinstatement of habitats removed during construction to facilitate operation, as described in chapter F1 (Application Reference Number: 6.6.1). This would include grassland habitats, but most significantly would also include the reinstatement of hedges and walls in gaps created to allow access to the Park and Ride.

Good practice mitigation

The good practice mitigation measures would be the same as those proposed during the construction phase, with measures in place primarily to protect retained habitats features of value to ecological receptors, and minimise the significance of other effect pathways, for example changes in air quality or hydrological effects.

9.5 Assessment of effects

9.5.1 This section presents the findings of the assessment of potential impact pathways associated with the construction, operation and decommissioning of the Park and Ride. Table F9-3 provides a summary of the potential impact pathways.

Table F9-3 Summary of potential impact pathways for ecological receptors

Potential impact	Area in which the impact may influence ecological receptors	Receptors that could be affected
Changes in air quality during construction and decommissioning.	Release of fugitive dust could affect receptors within 50m of the Park and Ride site boundary, and within 50m of access roads which lie within 500m from the Park and Ride entrance. Emissions from plant and machinery (i.e. non-road mobile machinery) (as set out in chapter F5 (Application Reference Number: 6.6.5). Potential for habitat loss or degradation in areas affected.	Statutory and non-statutory designated sites for nature conservation. Terrestrial habitats.
Changes in air quality during operation.	Emissions may affect ecological receptors up to 200m from roads affected by increased traffic using the Park and Ride across the whole of Anglesey (see chapter C4 (air quality effects	Statutory and non-statutory designated sites for nature conservation.

Potential impact	Area in which the impact may influence ecological receptors	Receptors that could be affected
	of traffic, Application Reference Number: 6.3.4) of this Environmental Statement).	
Habitat loss during construction.	Habitat loss would be restricted to areas cleared to make way for the construction of the Park and Ride. There would be no additional habitat loss during operation of the Park and Ride.	Badger Bats Breeding birds Common toad Freshwater habitats Macroinvertebrates Macrophytes Terrestrial habitats Water vole
Habitat reinstatement during decommissioning.	During decommissioning habitat reinstatement would only occur within the boundary of the Park and Ride.	Badger Breeding birds Common toad Water vole
Disturbance via increases in noise and light pollution during construction, operation and decommissioning.	Disturbance via increases in lighting and noise during all stages could affect habitats within the Park and Ride, and its immediate boundary.	Badger Bats Breeding birds Fish Water vole
Hydrological changes during construction, operation and decommissioning.	Hydrological changes could affect areas crossed by infrastructure installed within the Park and Ride, and habitats downstream of the most northerly outfall.	Fish Freshwater habitats Macrophytes Macroinvertebrates Statutory and non-statutory designated sites for nature conservation. Water vole
Mortality and injury during construction and decommissioning	Mortality and injury if species are present when their habitats are affected during construction and decommissioning.	Badger Breeding birds Common toad Macroinvertebrates
Introduction and spread of INNS of plant during	INNS of plant could be spread within or be introduced to habitats within the Park and	Freshwater habitats

Potential impact	Area in which the impact may influence ecological receptors	Receptors that could be affected
construction and decommissioning.	Ride site. Habitats outside of the Park and Ride site could be affected should materials from within the Park and Ride site containing viable propagules of INNS of plant not be disposed of properly, or if propagules are accidentally transported by people or vehicles.	Statutory and non-statutory designated sites for nature conservation. Terrestrial habitats

Construction

Air quality changes

9.5.2 There were no statutory or non-statutory sites within the areas potentially affected by dust emissions. The embedded and good practice measures set out in chapter F5 (Application Reference Number: 6.6.5) would result in there being a negligible change in air quality as a result of dust during construction. A negligible effect on statutory designated sites and terrestrial habitat is therefore predicted.

9.5.3 Changes in air quality as a result of emissions from plant and machinery have the potential to affect statutory or non-statutory sites and terrestrial habitat via nitrogen and acid deposition or exceedance of critical levels of acid or oxides of nitrogen. As set out in chapter F5 (Application Reference Number: 6.6.5), the phased construction programme, and the relatively low number and size of plant and machinery required means the potential effect on local air quality would be negligible, and therefore a negligible effect on the ecology receptors is predicted.

Habitat loss

9.5.4 The Park and Ride would result in the loss of areas of improved and semi-improved grassland, ephemeral ditches 7 and 8, and the demolition of Building 12. The design has been developed to retain the most valuable terrestrial habitats: field edges, hedgerows and riparian habitat.

9.5.5 The limited loss of terrestrial and freshwater habitat in itself is considered to be a negligible magnitude of change and would therefore be of negligible significance.

9.5.6 The loss of terrestrial habitats could also affect the use of the site by foraging and commuting bats, badger, breeding birds, and common toad. Good practice and embedded mitigation includes the provision of buffer zones along existing hedgerows, field edges, ditches and the badger setts, and the planting of trees, shrubs and hedgerows. The parts of the site of most value to these species/groups would be largely retained, with areas of new planting proposed. This is considered to be a minor benefit and a small magnitude of

change. A minor positive effect on these species groups is predicted as a result.

9.5.7 The demolition of Building 12 could affect bats and breeding birds. The baseline survey data indicated that this building was not used by roosting bats but was used by swallow and house sparrow. The loss of this building is considered to be a small magnitude of change as there would be a loss of nest building habitat for swallow and house sparrow and, given the new buildings at the Park and Ride would provide similar nesting opportunities as those being lost for these species, a negligible effect is predicted.

9.5.8 The loss of freshwater habitats would occur in the Nant Dalar Hir where the clear span bridge and the drainage infrastructure are constructed. The loss would be localised with the majority of the watercourse protected by a buffer and construction activities controlled by good practice mitigation. From the perspective of compliance with the Water Framework Directive, this is assessed in a project-wide context within the Water Framework Directive Compliance Assessment (Application Reference Number: 8.26).

9.5.9 The loss of bank-side vegetation due to shading from the new bridge and provision of drainage outfalls is considered to be a small magnitude of change and of negligible significance as the ecological functionality of the watercourse would not be affected. This loss could also affect macro invertebrates and water vole. The good practice mitigation includes micro siting of the drainage infrastructure which would avoid the loss of any water vole burrows. This would be a small magnitude of change and is assessed as being of a negligible effect on the macroinvertebrate and water vole population.

Disturbance

9.5.10 Disturbance from noise and vibration could affect fish, breeding birds, badger and water vole. The changes in noise during construction have been assessed in chapter F6 (noise and vibration) (Application Reference Number: 6.6.6) and any changes in noise above 65dB LAeqT would be within and immediately adjacent to the Park and Ride site boundary. However, with embedded mitigation in the form of the buffer zones around ecological features, and good practice mitigation set out in chapter F6 (Application Reference Number: 6.6.6), the magnitude of change is predicted to be small; a measurable change could occur, but the effect would be negligible.

9.5.11 Good practice mitigation would reduce the risk of water vole being in burrows close to drainage infrastructure installation. This would protect water vole from mortality and injury but would also reduce potential disturbance effects on water vole to negligible levels.

9.5.12 Disturbance during the night to fish in watercourses, and commuting and foraging badger and bats is not predicted, as there is no night working planned. Furthermore, lighting would be minimised and directed away from watercourses, hedges and the boundary of the Park and Ride in general.

9.5.13 In summary, the magnitude of change due to disturbance affecting fish, breeding birds, badger and water vole would be small. The significance of this effect would be negligible.

Hydrological changes

9.5.14 Embedded mitigation would ensure that watercourses are protected in the first instance from runoff and accidental pollution through the provision of buffer zones. They are further protected by good practice mitigation in the form of adherence to PPGs where works to install structures such as headwalls are required (see chapter F8, Application Reference Number: 6.6.8). From the perspective of compliance with the Water Framework Directive, this is assessed in a project-wide context in the Water Framework Directive Compliance Assessment (Application Reference Number: 8.26).

9.5.15 A further embedded mitigation measure includes minimising the number and size of drainage infrastructure connections as much as practically possible, thereby further reducing the potential for deleterious effects. While some effects are inevitable in terms of alteration of small sections of riparian and instream habitats, these effects would be localised to the study area and would not be measurable 900m downstream at the Llyn Traffwll SSSI. These small magnitude effects would therefore only affect freshwater habitats in the study area which are of low value, and would represent an effect of negligible significance.

9.5.16 Surface water draining into the Nant Dalar Hir would be attenuated and would not have any deleterious effects on its water quality, and therefore would not affect the Llyn Traffwll SSSI.

9.5.17 In summary, the magnitude of change due to hydrological changes affecting Llyn Traffwll SSSI would be negligible. The magnitude of change due to hydrological changes affecting fish, macrophytes, macroinvertebrates and water vole would be small. The significance of this effect would be negligible and it would not be significant.

Mortality and injury

9.5.18 There is the potential for mortality and injury to affect breeding birds if their nests are present in areas affected by habitat removal. These effects would be avoided by the timing of works as good practice mitigation, and would be reduced to negligible levels.

9.5.19 The retention of the majority of hedges and watercourses as embedded mitigation makes it likely that the risk of mortality and injury to common toad and badger would be negligible. The provision of measures to protect badgers from being trapped in excavations, such as covering excavations or providing escape routes, would also reduce this risk to negligible levels.

9.5.20 Potential mortality and injury effects on water vole are possible during works to install drainage infrastructure, but would be reduced to negligible levels by good practice mitigation via pre-construction surveys, micro-siting of works, vegetation clearance and supervision of work by an ECoW.

9.5.21 Mortality and injury effects on macroinvertebrates are also possible during construction works to install drainage infrastructure. However, the small scale of these works would limit the significance of effects to negligible levels. It is also considered that recolonisation would occur naturally from upstream and downstream areas of unaffected habitat, contiguous with construction areas.

9.5.22 In summary, the magnitude of change due to mortality and injury affecting macroinvertebrates, common toad, breeding birds and badger would be negligible. The significance of this effect would be negligible.

Introduction or spread of invasive non-native species of plant

9.5.23 Adherence to the Biosecurity Risk Assessment and Method Statement would ensure that INNS are safely removed from the Park and Ride site, and that their introduction and spread is prevented. This would be of benefit to terrestrial habitats, but due to the small scale of the areas covered by INNS this would be a small magnitude of change and a positive effect of minor significance. The enhancement to terrestrial habitats due to the removal of INNS would therefore not be significant.

Operation

Air quality changes

9.5.24 The assessment of air quality as a result of vehicle emissions is addressed in chapter C4 (Application Reference Number: 6.3.4).

Disturbance

9.5.25 During operation of the Park and Ride, light and human activity does have the potential to affect fish, badger, bats and water vole. These effects would be mitigated by embedded mitigation in the form of buffer zones protecting the hedges and watercourses and by the lighting design avoiding light-spill towards features that could be used for foraging and commuting. These effects are therefore predicted to cause a negligible magnitude of change and would be of negligible significance.

Hydrological changes

9.5.26 The drainage strategy for the operation of the Park and Ride is such that there would be a negligible change in hydrology within the receiving watercourses (see chapter F8, Application Reference Number: 6.6.8), including the Nant Dalar Hir which is hydrologically connected to the Llyn Traffwll SSSI. It is therefore considered that there would be a negligible magnitude of change on the receiving watercourses and any effects on the SSSI, freshwater habitats, macrophytes, macroinvertebrates, fish and water vole are considered to be negligible. From the perspective of compliance with the Water Framework Directive, this is assessed in a project-wide context in the Water Framework Directive Compliance Assessment (Application Reference Number: 8.26).

Decommissioning

9.5.27 The pathways for effect during decommissioning would be similar to those experienced by ecological receptors during construction. The list of embedded and good practice mitigation measures and the predicted significance of effects are therefore not repeated here. None of the effects of decommissioning are predicted to be significant.

9.6 Additional mitigation

9.6.1 There are no minor, moderate or major adverse effects predicted during the construction, operation or decommissioning of the Park and Ride. There is therefore no additional mitigation proposed.

9.7 Residual effects

9.7.1 No adverse effects of minor significance or greater were identified for terrestrial and freshwater ecology.

9.7.2 The embedded and good practice mitigation for the Park and Ride is predicted to avoid and reduce potential effects on all receptors following construction, operation and decommissioning of the Park and Ride to the extent that no minor, moderate or major adverse effects on ecological receptors are likely. There would therefore be no significant effects on any ecological receptor.

9.8 References

Table F9-4 Schedule of references

ID	Reference
RD1	Collins, J. 2016. *Bat Surveys for Professional Ecologists: Good Practice Guidelines*. 3rd Edition. London: Bat Conservation Trust.
RD2	Isle of Anglesey County Council. 2003. *Working for the wealth of wildlife: Anglesey's local biodiversity action plan (LBAP)* – B2 Habitat Action Plans (HAPs) and Species Action Plans (SAPs).
RD3	Extence, C., Balbi, D. and Chadd, R. 1999. *River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives.* River Research and Applications. 15(6), pp. 545-574.
RD4	Chadd, R and Extence, C. 2004. *The conservation of freshwater macroinvertebrate populations: a community based classification scheme*. Aquatic Conservation: Marine and Freshwater Ecosystems. 14: 597 – 624.
RD5	International Union for Conservation of Nature. 2015. *The IUCN Red List of Threatened Species*. Version 2015.1. [Online]. [Accessed: June 2015]. Available from: http://www.iucnredlist.org
RD6	Environment Alliance. 2007. *Pollution Prevention Guidelines – Understanding Your Environmental Responsibilities – Good Environmental Practices: PPG1*. [Online]. [Accessed: February 2016]. Available from: http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/lit_1404_8bdf51.pdf.
RD7	Northern Ireland Environment Agency, Scottish Environment Protection Agency and Natural Resources Wales. 2017. *Guidance for Pollution Prevention: Works and maintenance in or near water: GPP 5*. Cardiff. Natural Resources Wales.
RD8	Environment Alliance. 2007. *Pollution Prevention Guidelines – Working at construction and demolition sites: PPG6*. [Online]. [Accessed: May 2017]. Available from: http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/pmho0412bwfe-e-e.pdf.
RD9	Northern Ireland Environment Agency, Scottish Environment Protection Agency and Natural Resources Wales. 2017. *GPP 13: Vehicle washing and cleaning.* Cardiff: Natural Resources Wales.

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HORIZON
NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.6.25 ES Volume F - Park and Ride App F9-9 - Dalar Hir Protected and Legally Controlled Species Compliance Report

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Contents

List of Tables

1 Introduction

1.1 Document purpose

1.1.1 The purpose of this document is to assess the likely risks of the construction of the Park and Ride facility at Dalar Hir (hereafter known as 'the Park and Ride'), described in section 1.5 of this report, contravening the following legislation:

- Conservation of Habitats and Species Regulations 2017;
- Wildlife and Countryside Act 1981 (as amended);
- Protection of Badgers Act 1992;
- The Eels (England and Wales) Regulations 2009 (as amended); and,
- Environmental Protection Act 1990 (in relation to the disposal of controlled plant species only).

1.1.2 This document considers species that are protected or controlled according to the above legislation, but it does not constitute legal advice. It forms one of several reports prepared as part of the planning application for the Proposed Development.

1.2 Background

1.2.1 Further detail of the Park and Ride can be found in chapter F1 Proposed development (Application Reference Number: 6.6.1).

2 Scope

2.1 Scope of the report

2.1.1 The offences considered in this report are only those that could occur as a result of the construction of the Park and Ride. Offences relating to cruelty, possession, transport, sale and certain methods for capturing/taking and killing have not been considered as they do not form a defined part of the implementation of the construction and operation of the Park and Ride.

2.1.2 *The Hedgerows Regulations 1997* provide a definition as to what constitutes important hedges. Planning authorities must consider the impacts of the removal of hedges that fall under these Regulations where applications are made to do so. However, these regulations do not apply here as the Park and Ride would only be taken forward if a Development Consent Order was granted under the *Planning Act 2008*, meaning any hedgerow removal would be considered to be permitted work under regulation 6(1)(e) of *The Hedgerows Regulations 1997*.

2.1.3 In relation to the offence of introducing non-native species to the wild, the disposal of waste from control of species such as Japanese knotweed is covered by the Environmental Protection Act 1990. No other aspects of the Environmental Protection Act 1990 are considered within this report as they are not considered relevant to the receptors present.

2.1.4 The relevant legislation and potential offences that could occur as a result of the construction and operation of the Park and Ride are set out in table 2-1.

2.2 Licences

2.2.1 Within this report, licences have been referred to and, depending on the protected species in question, are defined as set out in the following paragraphs.

2.2.2 If an offence is considered likely under the Conservation of Habitats and Species Regulations 2017 (as listed in table 2-1) then it can be derogated via a European Protected Species (EPS) licence. Natural Resources Wales (NRW) issues licences under Regulation 55 to allow the Park and Ride to be implemented within the law.

2.2.3 Offences under the Wildlife and Countryside Act 1981 (as amended) (as listed in table 2-1) (also referred to as Schedule 5 offences) are not licensable in the same way and the legal defences are as set out in s10(3)(c), s4(2A)(a) and s14(3). This means that a developer who has planning permission must make a reasonable effort to avoid committing an offence. Unusually, where offences relating to water vole require animals to be moved, NRW can issue a conservation licence to permit the translocation of the animals. However, steps should be made to avoid offences before resorting to animal translocation.

2.2.4 Offences under the *Protection of Badgers Act 1992* (as listed in table 2-1) are also licensable if it is necessary to interfere with a badger sett as a result of

construction works. NRW issues licences to interfere with setts, should it be required for the purposes of development.

Table 2-1 Potential offences under UK legislation

General descriptor	Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)	Protection of Badgers Act 1992	The Eels (England and Wales) Regulations 2009 (as amended)	Salmon and Freshwater Fisheries Act 1975 (as amended).
Capturing, killing and injuring	To deliberately capture, injure or kill any wild animal of an EPS (Reg. 43(1)(a)).	To intentionally kill, injure or take any wild bird (s1(1)). To intentionally kill, injure or take any wild animal included in Schedule 5 (s9(1)).	To wilfully kill, injure or take, or attempt to kill, injure or take a badger (s1(1)).	-	-
Disturbing (affecting ability to survive, breed or rear young)	To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b) and Reg. 43(2)(a)(i)). For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young.	-	-	-	-
Disturbing (impairing ability to migrate or hibernate)	To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)) Reg. 43(2)(a)(ii). For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability, in the case of animals of a hibernating or migratory species, to hibernate or migrate.	-	-	To construct, alter or maintain a dam or structure and fail to notify the Agency, i.e. NRW (Part 4, 12 (1), (2)(4)).	-

General descriptor	Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)	Protection of Badgers Act 1992	The Eels (England and Wales) Regulations 2009 (as amended)	Salmon and Freshwater Fisheries Act 1975 (as amended).
Disturbing (affecting local distribution or abundance)	To deliberately disturb wild animals of a European Protected Species (EPS) [wherever they are occurring] (Reg. 43(1)(b) and Reg. 43(2)(b)). For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to affect significantly the local distribution or abundance of the species to which they belong.	-	-	-	-
Disturbing (whilst occupying a structure or place used for shelter or protection)	-	To intentionally or recklessly disturb any wild bird included in Schedule 1 while it is building a nest or is in, on or near a nest containing eggs or young; or disturb dependent young of such a bird. To intentionally or recklessly disturb any wild Schedule 5 animal while it is occupying a structure or place which it uses for shelter or protection (s9(4)(b)).	To intentionally or recklessly disturb a badger when it is occupying a badger sett (s3(e)).	-	-
Taking eggs	To deliberately take or destroy the eggs of such an EPS animal (Reg. 43(1)(c)).	To take or destroy an egg of any wild bird (p1(1)(c)).	-	-	-

General descriptor	Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)	Protection of Badgers Act 1992	The Eels (England and Wales) Regulations 2009 (as amended)	Salmon and Freshwater Fisheries Act 1975 (as amended).
Damage or destruction of a breeding site or resting place	To damage or destroy a breeding site or resting place of a wild animal of an EPS (Reg. 43(1)(d)).	To intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built. To intentionally or recklessly damage or destroy any structure or place which any wild animal specified in Schedule 5 uses for shelter or protection (S9(4)(a)).	To intentionally or recklessly damage a badger sett or any part of it or to destroy a badger sett (s3(a)(b)).	-	Knowingly permits to flow, or puts or knowingly permits to be put, into any waters containing fish or into any tributaries of waters containing fish, any liquid or solid matter to such an extent as to cause the waters to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish, shall be guilty of an offence (Part I, 4 (1)).
Introducing new species	-	To plant or otherwise cause to grow in the wild any plant which is included in Part II of Schedule 9 (s14 (2)). Waste produced from management of some species would be “controlled waste” and managed accordingly under the Environmental Protection Act 1990 (s33 (1a) and (1b)).	-	-	-

3 European Protected Species licence tests

3.1.1 An EPS licence can only be granted by NRW if the following three tests can be met:

- test 1: the purpose of the work meets one of those listed (see below) in the Conservation of Habitats and Species Regulations 2017;
- test 2: there is no satisfactory alternative; and
- test 3: the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

3.1.2 Under test 1 the specific set of purposes referred to includes:

- “preserving public health or public safety or other imperative reasons of overriding public interest, including those of a social or economic nature, and beneficial consequences of primary importance for the environment;
- scientific and educational purposes;
- ringing or marking;
- conserving wild animals or wild plants;
- protecting any zoological or botanical collection;
- preventing the spread of disease; and
- preventing serious damage”.

3.1.3 A review of the Park and Ride against the three tests concluded the following:

- test 1: the purpose of the Park and Ride is considered to be “preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment”.
- test 2: there is no satisfactory alternative to the proposed development. The Park and Ride has been subjected to a staged optioneering process which has informed the identification and selection of a final, optimised design solution. Chapter F2 Alternatives and design evolution (Application Reference Number: 6.6.2), provides further information on the need for the Park and Ride, the alternatives considered and the design evolution.
- test 3: this would be met via implementation of the proposed strategy relating to the EPS described in this report.

4 Methodology

4.1.1 The legislation under which species are protected or controlled, as set out in table 2-1, has been reviewed to identify the potential for the construction and operation of the Park and Ride to cause offences.

4.1.2 The review took the form of identifying whether or not a protected or controlled species was present within the area affected by the construction of the Park and Ride.

4.1.3 The baseline information is based on a desk-based study which included consultation with North Wales Environmental Information Service (Cofnod) where considered necessary, and field survey work.

4.1.4 Data from Cofnod were requested in June 2017 and are unpublished [RD1]. These comprised a request of all protected and notable species records from within 2.5km of the centre of the Park and Ride. Data from fieldwork are presented in baseline terrestrial ecology survey reports which are referenced throughout and form appendices to the Environmental Statement for the Park and Ride.

4.1.5 The baseline data collected have recorded evidence of the following species or groups for which the legislation listed above, applies:

- Protected species:
  - breeding birds (all species);
  - badger (*Meles meles*);
  - otter (*Lutra lutra*); and
  - water vole (*Arvicola amphibius*).
- Controlled species:
  - Canadian pondweed (*Elodea canadensis*);
  - Japanese knotweed (*Fallopia japonica*); and
  - montbretia (*Crocosmia x crocosmiiflora*).
  - freshwater fish, including European eel (*Anguilla anguilla*);

4.1.6 The proposed strategies presented in this report to avoid offences are in addition to those outlined in the chapter F9 terrestrial and freshwater ecology (Application Reference Number: 6.6.9) which seek to minimise likely effects on terrestrial and freshwater ecology, and which would be included within the contractual documentation associated with construction of the Park and Ride.

4.1.7 The following sections provide an assessment of the potential to cause an offence in relation to each species or group, as well as the approach to mitigation to avoid offences being committed, or that are required to secure an EPS licence.

4.1.8 Conclusions are presented for each protected and controlled species in relation to legislative compliance.

5 Breeding birds

5.1 Relevant legislation

5.1.1 The legislation relevant to the protection of bird species with the potential to be affected during construction of the Park and Ride comprises:

- Wildlife and Countryside Act 1981 (as amended).

5.2 Baseline information

5.2.1 The baseline terrestrial ecology survey report (Appendix F9-1 Dalar Hir Extended Phase 1 Habitat Survey and HSI Survey. Application Reference Number: 6.6.17) identified habitats with the potential to support breeding birds within the boundary of the Park and Ride. These included species-poor native hedgerows and interior features of the building to be demolished (Building 12). There is no evidence to suggest that these features support species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended).

5.3 Potential to commit an offence

5.3.1 The vegetation clearance phase of the construction of the Park and Ride could result in an offence in relation to breeding birds under the Wildlife and Countryside Act 1981 (as amended). Details are provided in table 5-1.

Table 5-1 Breeding birds – potential to commit an offence

Wildlife and Countryside Act 1981 (as amended)	Offence likely in absence of the proposed strategy
To intentionally kill, injure or take any wild bird. (s1(1)).	Yes – to unfledged chicks during vegetation clearance or demolition of Building 12.
To intentionally or recklessly disturb any wild bird included in Schedule 1 while it is building a nest or is in, on or near a nest containing eggs or young; or to disturb dependent young of such a bird. (s1(5)(a)(b)).	No – birds listed on Schedule 1 have not been recorded breeding within the areas where vegetation clearance or building demolition is required.
To take or destroy an egg of any wild bird. (s1(1)(c)).	Yes – during removal of suitable nesting habitat (in vegetation or buildings).
To intentionally take, damage or destroy the nest of a wild bird included in Schedule ZA1.	No offence likely - birds listed in Schedule 1 have not been recorded breeding within the areas where vegetation clearance or building demolition is required.
To intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built.	Yes – during vegetation clearance and building demolition.

5.4 Proposed strategy

5.4.1 The following steps would be taken during construction to ensure legislation protecting birds would not be contravened:

- timing of vegetation clearance;

- supervision of vegetation clearance; and
- protection of retained vegetation.

Timing of vegetation clearance

5.4.2 To avoid destroying an egg or eggs of a wild bird, or damaging or destroying the nest of a wild bird, vegetation suitable for supporting breeding birds would not be cleared during the bird breeding season (March-August, inclusive). Where this was not possible, vegetation would be cleared following pre-clearance checks and under the supervision of an Ecological Clerk of Works (ECoW) should it be determined birds and/or active nests are not present.

Supervision of vegetation clearance

5.4.3 Pre-clearance checks would be carried out within all areas of vegetation clearance to determine the presence of active bird nests. This would involve an ECoW checking vegetation prior to the arrival on site of clearance contractors to avoid the risk of disturbance to birds from excessive movement of vehicles/people or through the noise of the hand tools used during the clearance works. This would also include times outside the main breeding season (March–August, inclusive) in habitats that support species that can breed before and/or after this period, such as barn owls, corvids and pigeons.

5.4.4 The pre-clearance check would firstly involve watching habitats to be cleared for birds frequently visiting the same area. This would indicate the presence of a nest. This stage would last for as long as the ECoW determines it is necessary. The second stage would be more intrusive and involve actively searching areas of thicker vegetation for nests.

5.4.5 If the pre-clearance check does not identify any active nests, then the clearance would be allowed to proceed but only with the continued supervision of the ECoW.

5.4.6 Should an active nest be identified, then works within its vicinity would stop and the ECoW would determine a suitable buffer zone around the nest within which no further clearance or other works would occur. This would be dependent on the type and density of vegetation surrounding the nest and the species present. A minimum buffer zone would be 5m from a nest but may be extended following advice from the ECoW. The buffer zone would be clearly marked using demarcation tape or fencing to ensure no works take place within that area. These would also be marked on an environmental constraints map and displayed in the site office as well as being issued to all contractors on site.

5.4.7 The ECoW would monitor activity at each nest to determine when it is no longer active so that works could continue. Once the ECoW determined that the nest is no longer active, the contractor would be allowed to proceed with vegetation clearance. The ECoW would be available on site should any further input/assistance be required.

Protection of retained vegetation

5.4.8 Areas of retained vegetation within the Park and Ride would be clearly demarcated to ensure no accidental incursion of construction work.

5.5 Conclusion

5.5.1 The Park and Ride could result in the contravention of the legislation with respect to birds as set out in paragraph 5.1.1. This would be from killing or injuring wild birds, destroying eggs and damaging or destroying nests. The strategy set out above would result in these offences being avoided.

6 Badger

6.1 Relevant legislation

6.1.1 The legislation relevant to the protection of badger with the potential to be affected during construction of the Park and Ride comprises:

- The Protection of Badgers Act 1992.

6.2 Baseline information

6.2.1 The badger baseline surveys undertaken in 2014 (appendix F9-4 Dalar Hir Badger Report. Application Reference Number: 6.6.20) identified one active outlier sett in a hedge bank on the northern boundary of the Park and Ride. Two possible outlier setts were also found in hedge banks both comprising single holes. However, these were outside of the boundary of the Park and Ride and were a sufficient distance away to not be affected during works.

6.3 Potential to commit an offence

6.3.1 A review of the potential for the development to result in an offence is detailed in table 6-1. This is based on the Park and Ride design avoiding all areas within 30m of the sett on the northern boundary of the Park and Ride.

Table 6-1 Badger – potential to commit an offence

Protection of Badgers Act 1992	Offence likely in absence of the proposed strategy
To wilfully kill, injure or take, or attempt to kill, injure or take a badger (s1(1)).	Yes – if badger are injured or killed by falling into and becoming trapped in excavations within the construction site.
To intentionally or recklessly disturb a badger when it is occupying a badger sett (s3(e)).	No – setts will be protected by a 30m works exclusion buffer zone.
To intentionally or recklessly obstruct access to, or any entrance of, a badger sett (s3(c)).	No – setts will be protected by a 30m works exclusion buffer zone.
To intentionally or recklessly damage a badger sett or any part of it or to destroy a badger sett (s3(a)(b)).	No – setts will be protected by a 30m works exclusion buffer zone.

6.4 Proposed strategy

6.4.1 The design of the Park and Ride includes work exclusion buffer zones around the badger sett. This would protect it from being affected by construction works and eliminate any potential for breaches in the legislation protecting it.

6.4.2 In summary, the following steps would be taken prior to construction to ensure legislation set out in paragraph 6.1.1 would not be contravened:

- pre-construction surveys;

- avoiding disturbance / damage (should badgers be confirmed present and affected by the works); and
- sett closure, under licence (should the sett be confirmed as active and affected by the works).

Pre-construction surveys

6.4.3 A pre-construction survey of the Park and Ride would be carried out prior to the start of construction, in order to identify whether any active badger setts were present and could be affected by the works. The survey timing would allow sufficient time to be available to allow for a licence application and sett closure before any activities which could contravene the legislation described in paragraph 6.1.1 were scheduled to commence.

Avoiding killing or injury

6.4.4 Badgers may enter construction areas and would therefore be at risk of injury or mortality from being trapped in excavations. This would be prevented by the following means:

- construction fencing would be installed and would deter badgers from entering the construction site;
- excavations with the potential to trap badgers would be covered at night if possible;
- the sides of excavations would either be gently sloped or a ramp would be installed to allow badgers to escape;
- excavations and materials stored on site would be checked daily for the presence of trapped animals by the ECoW; and
- if any badgers were found trapped during works then works would cease in that area, and an appropriate wildlife rescue organisation contacted for advice, whose details would be kept on site in contractors' compounds.

Avoiding disturbance and damage

6.4.5 If an active sett was recorded in close proximity to the construction works and did not need to be destroyed, it may be possible to alter working methods in that location. By reducing machinery sizes or working with hand tools, disturbance and damage could be adequately mitigated.

Licensing

6.4.6 If an active badger sett was discovered in close proximity to an area that is required for construction during the pre-construction survey or the construction period, work would cease in that area until a licence to interfere with a sett was obtained from NRW.

6.4.7 The most common form of mitigation associated with such a licence, if required, is sett exclusion. Badger licences are normally only granted for sett exclusions between July and November, which would be incorporated into the work schedule. However, depending on the nature of the work, its proximity to a sett and the type of sett, it may be possible to alter working methods to minimise disturbance to badgers or avoid damage to a sett.

6.4.8 An example methodology for both avoiding damage/disturbance and sett exclusion is set out in the following paragraphs.

Sett exclusion

6.4.9 The following methods could be used if a badger sett required exclusion under licence to interfere with a sett.

- All active sett entrances would be fitted with badger gates.
- After a bedding-in period, the gates would be set to one-way to effect exclusion, and would be monitored for 21 days. Once it had been confirmed that badgers were no longer using the sett, it would be excavated under the supervision of a licensed ecologist.

6.4.10 The excavation would be conducted to avoid collapsing any chambers within the sett because of the possibility of badgers remaining undetected. If any badgers were disturbed, all work would cease and they would be allowed to leave the area without interference.

6.4.11 Given that the risk of a main sett needing to be closed is extremely low, a replacement sett is unlikely to be required. If a replacement sett is required, sufficient land is considered to be available to allow an appropriate location to be found.

6.5 Conclusion

6.5.1 There would be no direct effect on badger setts during the construction of the Park and Ride through the provision of work exclusion buffer zones embedded within the design. The potential for contravening the legislation afforded to badger would therefore be limited to injuring or killing, as a result of badger entering the construction site. By employment of the measures described above, it is considered unlikely that any breaches of the legislation protecting badgers described in paragraph 6.1.1 would occur.

7 Otter

7.1 Relevant legislation

7.1.1 The legislation relevant to the protection of otter with the potential to be affected during construction of the Park and Ride comprises:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 5 species; and
- Conservation of Habitats and Species Regulations 2017 – Schedule 2 species.

7.2 Baseline information

7.2.1 There are 23 records of otter from with 2.5km of the boundary of the Park and Ride [RD1]. The nearest record is from 120m south of the Park and Ride in the Nant Dalar Hir, from 2007.

7.2.2 Surveys of the study area did not find any evidence of otter, although the Nant Dalar Hir and other ditches did have the potential for otter to use them, albeit probably only for foraging (Appendix F9-1. Application Reference Number: 6.6.17 and Appendix F9-5 Dalar Hir Water Vole Report. Application Reference Number 6.6.21). This is supported by the Wales Otter Report 2009-10 [RD3] showing records nearby and suggesting that Anglesey has an expanding otter population.

7.3 Potential to commit an offence

7.3.1 Otters use a number of watercourses in proximity to the Park and Ride, so there is a risk that a breeding site or resting place could be created in an affected area prior to construction of the Park and Ride, which could lead to an offence if it was damaged or destroyed. Details of potential offences under the legislation described in paragraph 7.1.1 are provided in table 7-1.

Table 7-1 Otter – potential to commit an offence

Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)	Offence likely in absence of the proposed strategy
To deliberately capture, injure or kill any wild animal of an EPS (Reg. 43(1)(a)).	-	No offence likely – mobile species would avoid construction works.
To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)). Reg. 43(2)(a)(i) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young.	-	No offence likely – no holts recorded and the limited nature of the works would not be considered to disturb at this scale.

Conservation of Habitats and Species Regulations 2017	Wildlife and Countryside Act 1981 (as amended)	Offence likely in absence of the proposed strategy
To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)). Reg. 43(2)(a)(ii) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to impair their ability, in the case of animals of a hibernating or migratory species, to hibernate or migrate.	-	No offence likely – no holts recorded and the limited nature of the works would not be considered to disturb at this scale.
To deliberately disturb wild animals of an EPS [wherever they are occurring] (Reg. 43(1)(b)). Reg. 43(2)(b) For the purposes of Reg. 43(1)(b), disturbance of animals includes in particular any disturbance which is likely to affect significantly the local distribution or abundance of the species to which they belong.	-	No offence likely – no holts recorded and the limited nature of the works would not be considered to disturb at this scale.
To damage or destroy a breeding site or resting place of a wild animal of an EPS (Reg. 43(1)(d)).		No offence likely – no holts recorded and the limited nature of the works would not be considered to disturb at this scale.
-	To intentionally or recklessly disturb any wild animal listed on schedule 5 while it is occupying a structure or place which it uses for shelter or protection (s9(4)(b)).	No offence likely – no holts or resting places have been recorded in the proposed scheme footprint.
-	To intentionally or recklessly obstruct access to any structure or place which any Schedule 5 animal uses for shelter or protection (s9(4)(c)).	No offence likely – no holts or resting places have been recorded in the proposed scheme footprint.

7.4 Proposed strategy

7.4.1 No offences are considered likely to occur as no otter holts or resting places have been recorded within the Park and Ride site. However, there is a minor risk that otters could create a holt in the intervening period before construction commences. The following steps would be taken during construction to ensure legislation protecting otter would not be contravened:

- pre-construction surveys; and
- supervision of works by an ECoW.

Pre-construction survey

7.4.2 A pre-construction survey would be completed before any works to ditches or works in close proximity to the Nant Dalar Hir commence. This would survey for evidence of holts and laying-up sites that could be affected, and would include areas up to 50m from the boundary of the Park and Ride, as these could be affected by indirect effects e.g. noise and vibration.

7.4.3 This pre-construction survey may extend in duration should features be found where their usage is unclear. This would include burrows or holes, and could involve the use of camera traps, for a period of time determined by the ECoW.

7.4.4 In the unlikely event that a holt or lay-up site is identified, any work which could affect it and lead to contravention of the legislation described in paragraph 7.1.1 would be put on hold. NRW would be consulted with regard to the need to obtain an EPSML to allow works to continue. Details on licensing requirements are given in section 3.

Supervision of works

7.4.5 Supervision of works would only be required in the event that a feature that could be a holt or lay-up site is found where reasonable effort has shown that risk of otter presence is negligible, but a residual risk remains. Supervision would be undertaken by an ECoW who would establish whether features were being used by otter and whether they were present.

7.4.6 In the unlikely event that a holt or lay-up site is identified, further work that could lead to contravention of the legislation described in paragraph 7.1.1 would be put on hold. NRW would then need to be consulted with regard to the need to obtain an EPSML to allow works to continue.

7.5 Conclusion

7.5.1 Although otters are present within the wider catchment, it is considered that there is currently a low risk that the legislation set out in paragraph 7.1.1 would be contravened. The proposed strategy provides measures to ensure that the risks are managed throughout construction.

8 Water vole

8.1 Relevant legislation

8.1.1 The legislation relevant to the protection of water vole with the potential to be affected during construction of the Park and Ride comprises:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 5 species.

8.2 Baseline information

8.2.1 There are more than 40 records of water vole within 2.5km of the boundary of the Park and Ride site [RD1]. The nearest record is 230m west of the Park and Ride, recorded in 2007.

8.2.2 The baseline terrestrial ecology survey report (appendix F9-5 Application Reference Number: 6.6.21) found evidence of water vole on the Nant Dalar Hir within the boundary of the Park and Ride site. No evidence of water vole was found within Ditch 7, which is likely to be affected by the construction of the Park and Ride.

8.3 Potential to commit an offence

8.3.1 As a result of the Park and Ride, there is a risk that water vole could be disturbed, injured or killed, that use of their protection or sheltering structures could be obstructed, or that their protection or sheltering structures could be damaged or destroyed, as detailed in table 8-1.

Table 8-1 Water vole – potential to commit an offence

Wildlife and Countryside Act 1981 (as amended)	Offence likely in absence of the proposed strategy
To intentionally kill, injure or take any wild animal included in Schedule 5 (s9(1)).	Yes – if water vole were present within the construction extent of the Park and Ride.
To intentionally or recklessly disturb any wild Schedule 5 animal while it is occupying a structure or place which it uses for shelter or protection (s9(4)(b)).	Yes – water vole have been recorded within the boundary of the Park and Ride.
To intentionally or recklessly obstruct access to any structure or place which any Schedule 5 animal uses for shelter or protection (s9(4)(c)).	Yes – if water vole burrows were present within the construction extent of the Park and Ride.
To intentionally or recklessly damage or destroy any structure or place which any wild animal specified in Schedule 5 uses for shelter or protection (s9(4)(a)).	Yes – if water vole burrows were present within the construction extent of the Park and Ride.

8.4 Proposed strategy

8.4.1 The following paragraphs set out the steps that would be taken prior to the construction of the Park and Ride to ensure the legislation protecting water vole, detailed in paragraph 8.1.1, was not contravened. In summary it will take the following form:

- avoidance of impacts to habitats with the potential to support water vole;
- pre-construction survey to update water vole activity in watercourses affected by the Park and Ride; and
- displacement and destructive searching under a conservation licence issued by NRW.

Avoidance of habitats

8.4.2 Mitigation through avoidance is the primary method by which effects on water vole would be addressed.

8.4.3 As described in volume F, chapter 1 to the Environmental Statement, the design for the Park and Ride avoids impacts to the Nant Dalar Hir, with the exception of small scale drainage infrastructure installation, and the provision of a clear-span bridge as the means of providing the necessary watercourse crossing.

8.4.4 This will minimise the impacts to bankside vegetation and associated water vole burrows which may be present.

8.4.5 Whilst the use of a clear-span bridge reduces effects, works could still result in breaches of legislation affecting water vole. Pre-construction surveys, supervision and licensing may therefore still be required in line with the methods outlined below.

Pre-construction surveys

8.4.6 A pre-construction survey would be completed before any works in close proximity to the Nant Dalar Hir would take place. This would look for evidence of water vole, including burrows, latrines and feeding remains, and would include areas up to 50m from the locations of working near the Nant Dalar Hir, as these could be affected by indirect effects e.g. noise and vibration.

8.4.7 The pre-construction survey may extend in duration and delay construction works starting should features be found where their origins are unclear. This would include burrows or holes, and could involve the use of camera traps to establish usage.

8.4.8 In the unlikely event that evidence of water vole presence is identified, any work which could lead to contravention of the legislation described in paragraph 8.1.1 would be put on hold. NRW would then need to be consulted with regard to the need to obtain a conservation licence to allow works to continue. Details on licensing requirements are given in section 2.2.

Displacement and destructive searching

8.4.9 As described above, should the pre-construction survey identify water vole burrows in the areas of habitat directly affected by works to watercourses, then a conservation licence from NRW would need to be obtained. This would not only define the exact details of how water vole would be protected but also identify how enhancements for water vole would be provided.

8.4.10 Displacement of water vole through habitat manipulation may be appropriate if the area affected was less than 50m in length, which is likely to be the case for the installation of drainage and the construction of a clear-span bridge. Displacement involves the deliberate removal of vegetation around water vole burrows by strimming, making the habitat unsuitable and therefore encouraging the water vole to relocate to adjacent unaffected habitat. This technique can be used in a specific timeframe only: 15 February to 14 April, inclusive [RD4].

8.4.11 A destructive search would follow displacement of water vole. Should a small number of burrows be affected, they would be excavated by hand and animals caught would be released into adjacent areas of habitat either up or downstream of the affected area.

8.4.12 If large numbers of burrows were found, fencing followed by trapping and translocation would be undertaken (permitted 1 March to 15 April and 15 September to 30 November, inclusive). Trapping details and duration would be detailed in the conservation licence and would be dependent on the number of burrows, and the predicted number of water vole present. Fencing would remain in place for the duration of the construction period in each trapped area, and would be removed as soon as possible.

8.4.13 The installation of a 15m buffer zone either side of the Nant Dalar Hir within the Park and Ride would remove grazing pressure and allow dense and species-rich riparian vegetation to develop. This would lead to an increase in habitat quality for water vole.

8.5 Conclusion

8.5.1 Water vole are known to be present within the Nant Dalar Hir and there is a risk that the legislation protecting the species, detailed in paragraph 8.1.1, could be contravened as a result of construction of the Park and Ride. This would be avoided by a pre-construction survey and, if required, displacement through habitat clearance, trapping and translocation. These measures would be completed under a conservation licence issued by NRW.

9 Schedule 9 Invasive Species

9.1 Relevant legislation

9.1.1 The legislation relevant to the control of invasive species of plant are:

- Wildlife and Countryside Act 1981 (as amended) – Schedule 9 species; and
- Environmental Protection Act 1990 (see section 2.1.3).

9.2 Baseline information

9.2.1 Japanese knotweed, montbretia and Canadian pondweed were recorded at various locations within the proposed site during the extended Phase 1 survey (appendix F9-1 Application Reference Number: 6.6.17).

9.3 Potential to commit an offence

9.3.1 The greatest risk of contravening the legislation relating to Schedule 9 species is during the vegetation clearance phase of the works.

9.3.2 In relation to the offence of introducing non-native species to the wild, the disposal of waste from controlled species such as Japanese knotweed comes under the Environmental Protection Act 1990. No other aspects of this legislation are considered. These are summarised in table 9-1 below.

Table 9-1 Invasive non-native species – potential to commit an offence

Wildlife and Countryside Act 1981 (as amended)	Environmental Protection Act 1990	Offence likely in absence of the proposed strategy
To plant or otherwise cause to grow in the wild any plant which is included in Part II of Schedule 9 (s14 (2)).	-	Yes – through the spread of Schedule 9 plants from existing plants within the Park and Ride site boundary as a result of construction works or importation of plants from outside the Park and Ride site.
-	Section 33 (1a) and (1b) set out offences dealing with the deposit, treating, keeping or disposing of controlled waste without a permit. Section 33 (1)(c) makes it an offence to keep, treat or dispose of controlled waste in a manner likely to cause pollution of the environment.	Yes – by management and disposal of existing plants cleared from site.

9.4 Proposed strategy

9.4.1 The following steps would be taken prior to construction to ensure legislation relating to Schedule 9 species would not be contravened:

- pre-construction surveys;
- provision and implementation of a sub-Code of Construction Practice (sub-CoCP); and
- environmental permitting from NRW, if required.

Pre-construction surveys

9.4.2 Pre-construction surveys would be undertaken to record the location and extent of Schedule 9 species within the Park and Ride. An updated assessment of control measures required, including waste disposal, would then be made and incorporated into a sub-CoCP.

Sub-Code of Construction Practice

9.4.3 The Park and Ride sub-CoCP details control and, if necessary, eradication methods for the invasive species present, using best practice guidance publications e.g. [RD5]. Other measures to avoid accidental incursion into invasive species areas could include the following.

- Fencing and/or clear demarcation with hazard warning tape.
- Clear demarcation of haulage routes in areas of invasive species. If haulage routes are required to pass through exclusion zones, appropriate methods to prevent contact with the soil would be implemented, such as the installation of tracking.
- Implementation of biosecurity measures to include prevention of introduction or transfer of invasive non-native species across construction working areas by machinery or personnel and the suitable procurement and screening of planting stock to prevent accidental introduction of invasive species.
- Obtaining an environmental permit from NRW to remove any soil contaminated with Japanese knotweed. This would mean that disposal of the soil would only be permitted at landfill sites that are licensed to receive hazardous waste of this type or buried on site under a method statement agreed with NRW.

Environmental permit

- An environmental permit from NRW would need to be secured to remove any soil contaminated with Japanese knotweed. Disposal of the soil would only be permitted at landfill sites that are licensed to receive hazardous waste of this type, or it could be buried on site under a method statement agreed with NRW.

9.5 Conclusion

9.5.1 The approach outlined provides actions and commitments which would minimise the risk that an offence was committed under the legislation set out in paragraph 9.1.1.

10 Fish

10.1 Relevant legislation

10.1.1 The legislation relevant to the protection of fish with the potential to be affected during construction of the Park and Ride comprises:

- The Eels (England and Wales) Regulations 2009 (as amended).

10.2 Baseline information

10.2.1 Electric-fishing surveys were conducted within the Park and Ride and a 500m buffer to identify the presence of fish and identify species. These included surveys of three sites, with incidental sightings recorded for a further five sites ([RD2] and appendix F9-10 Dalar Hir Freshwater Ecology Report. Application Reference Number: 6.6.26).

10.2.2 European eel, three-spined stickleback (*Gasterosteus aculeatus*) and nine-spined stickleback (*Pungitius pungitius*) were all identified in the Nant Dalar Hir. Ditch 7 ([RD2] and appendix F9-10 Application Reference Number: 6.6.26), which would be culverted, was not found to be suitable to support fish.

10.3 Potential to commit an offence

10.3.1 Works to install culverting and drainage infrastructure could result in an offence in relation to the legislation as detailed in table 10-1.

Table 10-1 Fish – potential to commit an offence

The Eels (England and Wales) Regulations 2009 (as amended).	*Salmon and Freshwater Fisheries Act 1975* (as amended)	Offence likely in absence of mitigation
To construct, alter or maintain a dam or structure and failing to notify the Agency (NRW) first will be guilty of an offence (Part 4, 12 (1), (2).(4).)	-	No offence likely - there are no new culverts/structures proposed that would cause obstruction.
	To cause or knowingly permit to flow, or put or knowingly permit to be put, into any waters containing fish or into any tributaries of waters containing fish, any liquid or solid matter to such an extent as to cause the waters to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish, shall be guilty of an offence. (Part I, 4 (1)).	No offence likely - the Park and Ride would be constructed using good practice mitigation measures, as set out in the chapter F8, Volume F of the Environmental Statement, in relation to pollution prevention.

10.4 Proposed strategy

10.4.1 The proposed strategy to avoid contravening legislation includes the following.

- appropriate environmental management of construction working areas and the construction compounds; and,
- the use of good practice industry standards during construction such as those set out within chapter F8 to prevent pollution of watercourses.

10.5 Conclusion

10.5.1 The implementation of mitigation measures set out above means that no offences would be likely with regard to the legislation set out in paragraph 10.1.1.

11 References

ID	Reference
RD1	Cofnod. 2017. *Data search of protected species within 2km of the Park and Ride (National Grid Reference SH 32809 78383)*. Unpublished data provided by Cofnod to Horizon.
RD2	Jacobs. 2017. *Consultancy Report: Dalar Hir Freshwater Surveys*. Unpublished report on behalf Horizon Nuclear Power Wylfa Ltd. Ref. No. WN03.01.01-S5-PAC-REP-00019.
RD3	Strachan, R. 2010. *Wales Otter Report 2009-10*. Natural Resources Wales: Cardiff.
RD4	Dean, M., Strachan, R., Gow, D. and Andrews, R. 2016. *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)*. The Mammal Society: London.
RD5	Natural England, Department for Environment, Food & Rural Affairs, and Environment Agency. 2016. *Guidance: Prevent harmful weeds and invasive non-native plants spreading*. [Online] [Accessed: June 2017] Available from https://www.gov.uk/guidance/prevent-the-spread-of-harmful-invasive-and-non-native-plants.