HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.7.2 ES Volume G - A5025 Off-line Highway Improvements G2 - Alternatives and design evolution

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2.1 Introduction

2.1.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 require the main alternatives studied by Horizon to be outlined in the Environmental Statement, together with an indication of the main reasons for Horizon's choice, taking into account the environmental effects. Although the 2009 Regulations apply to the Wylfa Newydd Development Consent Order Project (see chapter A5 (overarching environmental legislation, policy and guidance) (Application Reference Number: 6.1.5)), Horizon has also had regard to the requirements on alternatives in the 2017 Regulations, i.e. *"A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the applicant or appellant which are relevant to the proposed development and its specific characteristics and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*."

2.1.2 This chapter outlines the staged process of design development for the A5025 Off-line Highway Improvements, which comprise part of the Associated Development proposed for the Wylfa Newydd Project.

2.1.3 It describes how the outcomes of the Environmental Impact Assessment (EIA), consultation and optioneering processes have combined to influence the form of the A5025 Off-line Highway Improvements (including the proposed Power Station Access Road Junction) described in chapter G1 (proposed development) (Application Reference Number: 6.7.1) and reduce, where practicable, their likely environmental effects.

2.2 Alternatives considered

2.2.1 Constructing a new nuclear power station involves the transport of significant amounts of materials, large components and people travelling to work on the construction site.

2.2.2 Independent transport studies commissioned in 2010 and 2011 by the Isle of Anglesey County Council (IACC) and Horizon [RD1]; [RD2]; [RD3]; [RD4]; [RD5]; [RD6]; [RD7] have informed the development of a transport strategy for the Wylfa Newydd Project, designed to reduce the burden placed by these requirements on the highway network, and in particular the A5025 which would form the principal route for road-based transport to and from the Wylfa Newydd Development Area. These studies also considered the identification of potential transportation options that may have a role in fulfilling the transport strategic objectives, comprising both 'hard' (e.g. new infrastructure) and 'soft' (e.g. driver information) solutions.

2.2.3 These studies identified a number of physical constraints and capacity issues associated with the Isle of Anglesey's existing transportation network, and evaluated the potential effects that construction of the new nuclear power station could have on the network. A range of potential road, sea, air and rail transportation solutions were identified in the studies (including the

development of a Marine Off-Loading Facility (MOLF) and use of rail), which were subsequently evaluated by Horizon as part of the early stages of the Wylfa Newydd Project. As discussed in chapter A4 (strategic alternatives) (Application Reference Number: 6.1.4), the conclusion of the strategic transport studies was for sea and road transport to be used for the transport of materials and workers for the Wylfa Newydd Project. As part of this, the following transport solutions were identified:

- use of the MOLF for abnormal loads, and bulk materials;
- use of the Logistics Centre to manage the movement of vehicles leaving and entering the Wylfa Newydd Development Area;
- highway improvements to the A5025; and
- use of the Park and Ride to manage the movement of workers to and from the Wylfa Newydd Development Area.

2.2.4 The consideration of the MOLF and Logistics Centre, in terms of their design and proposed layout, and how these have been influenced by environmental considerations, is discussed further in chapter D2 (alternatives and design evolution) (Application Reference Number: 6.4.2) and chapter H2 (alternatives and design evolution) (Application Reference Number: 6.8.2) respectively.

2.2.5 For the use of road transport, the studies indicated that if a package of highway improvements were not implemented as part of the Wylfa Newydd Project, there would be a number of potentially substantial environmental effects on drivers and Non-Motorised Users (NMUs) travelling along the A5025 relating to:

- increased severance;
- delay;
- reduced amenity, which is the pleasantness of a journey (normally influenced by noise, air quality and visual effects);
- fear, intimidation and frustration; and
- accidents and safety.

2.2.6 The effects identified above are attributed to the potential reduction in free flow conditions along the A5025, its current standard and condition, and the likelihood of increased conflict between construction vehicles and other road users, particularly within communities such as Valley, Llanfachraeth and Llanfaethlu, further detail of this assessment can be found in chapter C2 (traffic and transport) (Application Reference Number: 6.3.2)

2.2.7 Furthermore, there would also be potential noise and air quality effects on residential properties along the route, as the result of traffic congestion on the A5025, if a package of highway improvements were not implemented. Further detail of this assessment can be found in chapter C4 (air quality) (Application Reference Number: 6.3.4) and C5 (noise and vibration) (Application Reference Number: 6.3.5).

2.2.8 A series of preliminary highway improvements to the A5025 were proposed as part of these studies, based on the following types of solution.

- **On-line improvements** – which would involve implementing localised road widening, new pavement surfacing and carriageway markings within and immediately adjacent to the existing highway boundary to increase verge widths, allow heavy goods vehicles (HGVs) to pass safely and provide drivers with safer overtaking opportunities.
- **Off-line improvements** – which would involve the construction of new bypasses to take construction traffic away from residential properties and community facilities, and new junctions and bend improvements to increase the accessibility and manoeuvrability of HGVs.

2.2.9 This chapter focuses on summarising the alternatives considered as part of the design development of the A5025 Off-line Highway Improvements only.

2.2.10 The following sections outline the design and location alternatives considered by Horizon during three stages of design development of the A5025 Off-line Highway Improvements, as prescribed in volume 5 of the *Design Manual for Roads and Bridges* (DMRB) guidance (TD37/93) [RD8] and summarised below.

- **DMRB Stage 1**: Involving the identification of environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with broadly defined improvement strategies.
- **DMRB Stage 2**: Involving the identification of the factors to be taken into account in choosing alternative routes or improvement schemes and to identify the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with those routes or schemes.
- **DMRB Stage 3**: Involving the clear identification of the advantages and disadvantages, in environmental, engineering, economic and traffic terms, of the preferred solution(s). As part of the EIA, any design changes in order to reduce the environmental effects of the scheme, have been considered. This stage also requires an assessment of the significant environmental effects of the preferred solution to be undertaken, in accordance with the statutory obligations under the prevailing EIA Regulations. These environmental effects have been considered in chapters G3 to G12 (Application Reference Numbers: 6.7.3 to 6.7.12).

2.2.11 The main reasons behind the identification and selection of alternatives during each of the three stages are also recorded, including how the consideration of their potential environmental effects has informed the development of the design solution assessed in this EIA as part of Stage 3.

DMRB Stage 1

Development of preliminary highway designs

2.2.12 Meetings were held between Horizon, the IACC and Mott MacDonald (Horizon's appointed highway design and environmental assessment

consultant) in 2011 to develop the preliminary highway improvements identified within the commissioned transport studies [RD1]; [RD2]; [RD3]; [RD4]; [RD5]; [RD6]; [RD7] into a suite of conceptual design options.

2.2.13 The following types of solution were initially identified for consideration during DMRB Stage 1.

- Implementation of localised highway treatments, such as the application of new carriageway markings and signage (termed the 'do minimum' solution).
- Localised widening to achieve the desired carriageway width(s).
- Realignment of the carriageway to achieve a more suitable alignment.

2.2.14 The development of the above solutions into design options took account of various considerations, including: existing traffic conditions, physical constraints (such as carriageway width), overtaking opportunities, capacity, public transport provision, Public Rights of Way (PRoWs) and committed developments (such as unrelated improvements planned on the highway network).

2.2.15 Consideration was also given to existing environmental and social interests and sensitivities along, and in proximity to, the A5025 which could present a constraint to, or influence, option development (for example designated landscapes, recorded heritage features and ecologically sensitive areas).

2.2.16 Based on an evaluation of the above, the DMRB Stage 1 studies [RD9] identified a number of potential options for the following four locations along the A5025 as shown in figures within appendix G2-1 (DMRB Stage 1 Options) (Application Reference Number: 6.7.13).

- **Valley** – It was concluded that a new section of off-line carriageway would be required to enable traffic to bypass the existing signalised junction within the settlement of Valley. This was due to issues with the existing junction being able to accommodate the future traffic flows, which would cause queuing. Furthermore, there were issues with the existing constrained junction (in terms of space) being able to deal with the number of HGVs turning onto/off the A5025. As a consequence, a do minimum option of carrying out localised widening of the junction and associated highway was not possible. Therefore, two off-line options were accordingly developed.
  - Option 1 (red) comprised a new direct link between the A55 Junction 3 and the A5025 which was proposed to directly bypass the Valley area and the existing junction, the concept being to create another arm from the existing A55 roundabout and provide a new link road to tie into the A5025 at a point north of Valley.
  - Option 2 (blue) comprised a new three-arm roundabout connecting the A5025 with the A5, located approximately 250m south-east of the existing crossroads

- **Llanfachraeth** – A range of options comprising localised widening of the existing highway and provision of off-line bypasses to the east of Llanfachraeth were developed.
  - A do minimum option, which comprised localised widening of the existing highway through the village to achieve a minimum carriageway width.
  - Option 1 (red) comprised a new bypass to the east of the village, the alignment of which kept as close as possible to the edge of the village to reduce land take.
  - Option 2 (blue) comprised an alignment that would provide limited overtaking opportunities, but would still provide clearance between the highway and adjacent properties.
  - Option 3 (green) comprised a straight alignment, the purpose of which was to provide additional overtaking opportunities.
- **Llanfaethlu** – A review of the existing highway conditions identified a requirement to address two bends that do not meet current design standards, and various dwellings in close proximity to the highway. It was not possible to resolve the alignment of the two bends through widening within the existing highway boundary, which would have been the do minimum option. As a result, the following options based on bend relaxation and off-line solutions were developed.
  - Option 1 (red) comprised a design which sought to relax the existing highway alignment through the two bends, and incorporated an off-line extension north of the two bends, which would interface with the A5025 via a new three-arm roundabout.
  - Option 2 (blue) comprised a shorter version of option 1 (red) which did not include the off-line extension.
  - Option 3 (green), option 4 (aqua) and option 5 (yellow) comprised off-line bypasses that would take traffic away from the community, the alignments of which varied in distance from the eastern edge of the settlement.
- **Llanrhwydrus (Caerdegog Bend)** – A review of the existing highway at this location identified that the carriageway comprises one large curve which does not meet current design standards. The following localised widening and bypass options were accordingly developed.
  - A do minimum option, which comprised localised widening of the existing highway to achieve improved carriageway width.
  - Option 1 (red) comprised a new off-line section of carriageway which would bypass the existing bend and take traffic on a straighter alignment.

2.2.17 The DMRB Stage 1 options for Valley, Llanfachraeth, Llanfaethlu and Llanrhwydrus (Caerdegog Bend) are depicted on drawing numbers

291019/006/009 to 219019/006/012 within appendix G2-1 (Application Reference Number: 6.7.13).

Stakeholder workshop

2.2.18 Following the identification of the DMRB Stage 1 options, a stakeholder workshop was held between Horizon, Mott MacDonald and the IACC in October 2011 to review the preliminary options and agree those to be taken forward for appraisal and evaluation as part of DMRB Stage 2. The details from this workshop and the associated decisions and changes are included in the Stage 1 Scheme Assessment Report [RD9].

2.2.19 The following decisions were made at the workshop.

- **Valley** – attendees agreed that option 1 (red) should not be taken forward for further appraisal due to the potential constraints and difficulties associated with connecting a fourth-arm to the existing A55 Junction 3 roundabout. There is limited space at the roundabout junction for a fourth arm, and the off-line section of road from this junction, would cause greater environmental effects due to greater land take, and habitat loss. It was accordingly concluded to take option 2 (blue) forward for more detailed appraisal.
- **Llanfachraeth** – attendees agreed that bypassing Llanfachraeth via an eastern alignment was the most appropriate design solution, concluding that the Anglesey Area of Outstanding Natural Beauty (AONB) and adjacent Beddmanarch-Cymyran Site of Special Scientific Interest (SSSI) would constrain any westerly alignment. It was accordingly concluded to take option 1 (red), option 2 (blue) and option 3 (green) forward for further appraisal. Notwithstanding this, attendees also noted that the do minimum option involving localised widening within Llanfachraeth should also be developed and taken forward for appraisal as a potential option, although this would have adverse effects to air quality to the residents of Llanfachraeth.
- **Llanfaethlu** – attendees agreed that bypassing Llanfaethlu via an eastern alignment was preferable over bypassing the village to the west due to the presence of the AONB. It was concluded not to take option 1 (red), option 3 (green), option 4 (aqua) and option 5 (yellow) forward, and to progress option 2 (blue) forward to detailed appraisal.
- **Llanrhwydrus (Caerdegog Bend)** – attendees noted that option 1 (red) should be taken forward for more detailed appraisal only if the do minimum option was unable to adequately address the identified constraints on this bend.

2.2.20 Additionally, the workshop attendees:

- noted a potential benefit in developing a further option for Llanfaethlu, based on amended version of option 2 (blue), which would re-route the carriageway to pass further to the west of properties adjacent to the

A5025, and incorporating a roundabout or suitable junction arrangement to reduce severance; and

- highlighted a potential need for footway and cycleway provision to be considered within the options, and for the incorporation of measures to enable continued farm access in the areas associated with off-line bypass options.

2.2.21 Following the stakeholder workshop, a further option emerged at Llanrhwydrus (Caerdegog Bend) – termed option 2 (blue) – which involved extending the option 1 (red) bypass alignment further south of the Caerdegog bend to address a number of other highway alignment issues near Cefn Coch. This was accordingly taken forward and option 1 (red) was discounted from further consideration.

2.2.22 The DMRB Stage 1 options that were developed and/or retained for progression following the stakeholder workshop are depicted on figures within appendix G2-1 (Application Reference Number: 6.7.13). These were then subjected to a high-level appraisal as part of DMRB Stage 1 [RD9] by Mott MacDonald to establish their relative environmental, social and transport planning advantages and disadvantages.

2.2.23 Although the appraisal did not identify any major differentiators between the DMRB Stage 1 options on environmental grounds, the outcomes of the process were used to inform consultation and the design development process going forwards.

Stage One Pre-Application Consultation

2.2.24 A series of preliminary off-line alignments based on the four locations associated with DMRB Stage 1 options were published as part of Stage One Pre-Application Consultation in September 2014, the details of which were presented in the associated Consultation Overview Document [RD10].

2.2.25 In order to provide a suitable highway junction off the A5025 to connect with the Power Station Access Road, an outline design comprising a three-arm roundabout south of Tregele was developed for the Power Station Access Road Junction. This component was consulted upon but did not form part of the A5025 Off-line Highway Improvements at that time; rather, it formed an integral part of the Wylfa Newydd Power Station designs.

2.2.26 Feedback recorded from statutory and non-statutory consultees and the general public highlighted a general acceptance that improvements to the A5025 were necessary as part of the Wylfa Newydd Project, but noted that these could affect villages along the route in terms of traffic relocation, dust, recreation, visual impact and general disruption (e.g. loss of passing trade to businesses during construction).

2.2.27 Respondents passed specific comments on aspects including the proposed locations of the off-line options and where they would re-join the existing A5025, whether parts should be built to dual carriageway standard, road speeds, accessibility onto the new sections of highway, and public transport and cycling provision. Feedback was also provided by statutory consultees such as the IACC and Natural Resources Wales (NRW) with regard to the

technical dimension of the EIAs being undertaken as part of the Wylfa Newydd Project.

2.2.28 Following this consultation, modifications were made to the preliminary designs which resulted in the selection of options to be taken forward to DMRB Stage 2 for further design development. These modifications centred upon changes to the Valley design to incorporate lighting at the roundabout on safety grounds, and changes to the tie-in location of the Llanfachraeth bypass options.

DMRB Stage 2

A5025 sections

2.2.29 Following completion of DMRB Stage 1 and during Stage One Pre-Application Consultation, Horizon appointed URS (now AECOM) and Jacobs in late 2014 to commence engineering design work and undertake environmental studies respectively for DMRB Stage 2.

2.2.30 To assist the development of options, the 17.3km stretch of the A5025 identified for improvement was split into the following eight sections.

- Section 1 – Junction 3 of the A55 to Valley Junction A5/A5025 (chainage 0m to 500m).
- Section 2 – Valley Junction A5/A5025 to North of Llanynghenedl (chainage 500m to 3400m).
- Section 3 – North of Llanynghenedl to North of Llanfachraeth (chainage 3400m to 5600m).
- Section 4 – North of Llanfachraeth to South of Llanfaethlu (chainage 5600m to 8300m).
- Section 5 – South of Llanfaethlu to North of Llanfaethlu (chainage 8300m to 9800m).
- Section 6 – North of Llanfaethlu to North of Llanrhuddlad (chainage 9800m to 13100m).
- Section 7 – North of Llanrhuddlad to North of Cefn Coch (chainage 13100m to 14400m).
- Section 8 – North of Cefn Coch to Wylfa Site Access (chainage 14400m to 17300m).

2.2.31 Sections 1, 3, 5 and 7 related to the four locations identified during DMRB Stage 1 as potentially requiring off-line improvement, and sections 2, 4, 6 and 8 comprised sections of the A5025 potentially requiring on-line improvement.

Information sources and environmental constraints

2.2.32 The following information was obtained and used to inform the development of the DMRB Stage 2 options within sections 1, 3, 5 and 7.

- Consultation with statutory and non-statutory organisations, landowners and the general public to obtain baseline information, views and opinions at various stages of the design development process.
- Data acquired through desk-based and site-based surveys covering aspects such as topography, drainage, ground conditions, pavement condition, highway accessibility, existing traffic flows and environmental conditions.
- Published information on utilities, mining and accident records relating to the A5025, and significant committed developments on the Isle of Anglesey.

2.2.33 The following key environmental constraints were identified as relevant to option development within the four sections identified for off-line improvement.

- Section 1 – Agricultural land bounds either side of the A5025 corridor, with settlements and buildings primarily located around the existing junction within Valley. The Anglesey AONB is located to the west of the village, and National Cycle Network Routes 5 and 8 are located to the north and west of the existing junction. The area immediately south-east of the village is known to be at risk of flooding and has a network of watercourses. The village also has a number of community facilities including schools and places of worship.
- Section 3 – Farmland is located east of Llanfachraeth, with the Anglesey AONB and Beddmanarch-Cymyran SSSI located to the west of the village. Several listed buildings and community facilities are also located within the village, in proximity to the existing A5025.
- Section 5 – The boundary of the Anglesey AONB is formed by the A5025 and the northern fringes of Llanfaethlu village. The southern boundary of the Llyn Garreg-lwyd SSSI lies within 500m of the A5025, and Capel Soar standing stone (a Scheduled Monument) lies adjacent to the A5025 south of the village.
- Section 7 – The A5025 is bound by farmland interspersed by isolated dwellings, and is in close proximity to the Llyn Llygeirian SSSI, part of which is also designated as a Special Protection Area (SPA). The eastern boundary of the Anglesey AONB is located west of the A5025.

Re-evaluation of DMRB Stage 1 options

2.2.34 A decision was made by Horizon and AECOM to re-evaluate the feasibility of implementing localised widening solutions within the four locations that Mott MacDonald had previously identified as being suitable for off-line improvement. The outcomes of this review were as follows.

- Section 1 – It was concluded that the existing junction within Valley was unsuitable to accommodate any increased vehicle numbers due to its geometry and its inability to accommodate HGVs approaching from Junction 3 and turning right onto the A5025. It was also concluded that

the close proximity of commercial and residential properties to the junction effectively restricted widening opportunities (which would have been the do minimum option).

- Section 3 – It was concluded that increased traffic during construction would have a marked impact on the existing highway network through the village. The following observations were made:
  - that residential properties located on the back of the footway and/or carriageway would restrict widening opportunities;
  - that there could be air quality and noise effects due to the predicted traffic flow increase;
  - that parked cars outside properties currently restrict traffic flows in both directions; and
  - that existing accesses onto the A5025 within the village currently have poor visibility.
- Section 5 – It was concluded that the two existing sharp bends do not conform to current DMRB highways design standards for safety considerations, with which any new road improvement would have to comply. Therefore, it was not possible to resolve the alignment of the two bends through widening within the existing highway boundary, which would have been the do minimum option.
- Section 7 – It was concluded that whilst on-line improvements could be used to smooth out the existing bends within this section of carriageway, they would still not achieve the required highway standards for safety considerations.

2.2.35 A decision was also made to review the DMRB Stage 1 options, prior to carrying these through to DMRB Stage 2. The review confirmed that it would be environmentally unacceptable to develop alternative off-line alignment options:

- to the west of Llanfachraeth (section 3), as this would require permanent land take within the Anglesey AONB, and the Beddmanarch-Cymyran SSSI;
- to the west of Llanfaethlu (section 5), as this would also require permanent land take within the Anglesey AONB and would potentially bring traffic in closer proximity to the more developed areas of the village; and
- to the east of the A5025 near the settlement of Cefn Coch (section 7), as the local topography of the area would require considerable earthworks to achieve the required levels and road profile, which could appear incongruous in the local landscape.

Design development of options

2.2.36 As part of the early phases of DMRB Stage 2 design development undertaken from late 2014 to early 2015 it was identified that all options within sections 1, 3, 5 and 7:

- should seek to avoid environmentally sensitive features, interests, designations, habitats and assets wherever possible, and should mitigate for their loss where impacts are unavoidable;
- should consider and where possible avoid receptors that would be sensitive to noise and air quality impacts;
- would need to be developed in a manner that identifies adequate space (land take) early in the design development process to ensure any later requirements for drainage and environmental mitigation could be adequately accommodated within the overall design(s);
- would need to identify how to tie into the existing A5025, side roads and private accesses by considering whether roads should be retained open to traffic, fully closed, or partially closed to vehicles;
- should consider whether rivers, streams and ditches should be diverted, crossed with bridges, or contained within culverts;
- would need to consider how road drainage could be managed by understanding how and where road runoff could be directed, and where attenuation ponds could be used to hold water prior to its release into local watercourses;
- would need to include provisions for potential site compounds to support their construction and reduce the need to transport materials along the A5025 between working areas;
- would need to take account of the potential effect of flooding, particularly those that would be located in areas known to be at risk of localised flooding such as Valley;
- should be designed in a manner that avoids any requirement to include interceptor-based pollution control measures, due to long-term maintenance requirements;
- should be designed to achieve, where possible an earthworks balance of cut and fill material to reduce the environmental effects associated with the movement, importation and disposal of material on the local highway network;
- should consider how and where measures such as underpasses beneath the road, access tracks around the road and gates should be provided, to enable continued access for landowners, users of community facilities and local residents;
- should reduce the need for stopping-up of existing routes and junctions, due to the potential disruption such changes can cause to people and

the movements they make on the local highway network, and where unavoidable turning heads should be included in the design(s); and

- should seek to include, where possible, appropriate segregated cycleway and/or footway provisions along one side of the A5025 to improve route connectivity in the area.

2.2.37 Key decisions made during this period that directly influenced the form of the options within each of the four sections are described below. The full details of these options are described in the Stage 2 Scheme Assessment Report [RD11].

Section 1

2.2.38 Design development work on potential solutions for Valley focused on refining the DMRB Stage 1 A5/A5025 bypass and roundabout junction proposed and developing different options based on this general configuration. The following off-line bypass and junction options were accordingly developed and evaluated for section 1.

- Option 1 – comprised a three-arm roundabout connecting the A5 with the A5025 to the east of the existing junction. It was proposed to locate the roundabout close to the existing signalised junction and at the rear of residential and commercial properties. The off-line design would enable vehicular use of the existing highway to be maintained throughout the majority of the works. On completion, a 100m section of the A5025 south of the tie-in to the highway would be permanently stopped-up. This option is depicted on figures within appendix G2-2 (DMRB Stage 2 Options) (Application Reference Number: 6.7.14).
- Option 2 – comprised a four-arm roundabout connecting the A5 with the A5025 to the east of the existing junction. The roundabout would be located further east of the existing junction than in option 1, and further from properties on the A5025. It would be constructed on the line of the A5 to reduce land take and the visual impact. The fourth arm of the roundabout would provide a direct access to the freight yard owned by Network Rail, as an alternative arrangement to providing a ghost island junction. On completion, a 140m section of the A5025 south of the tie-in to the highway would be permanently stopped-up. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 3 – comprised a four-arm roundabout connecting the A5 with the A5025 to the east of the existing junction. The roundabout would be situated north of the location proposed for option 2 and off-line of the existing A5. On completion, a 140m section of the A5025 south of the tie-in to the highway would be stopped-up. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).

2.2.39 The form and location of the above options were informed by the following environmental considerations:

- possible retention and incorporation of an existing footway along the A5 into the options, to provide continued connectivity along this route for NMUs;
- inclusion of dedicated cycling provisions to allow movements along part of the alignment and across the roundabout, and consideration of whether a cycleway link between the roundabout and Junction 3 of the A55 should be included in the design;
- consideration of whether the roundabout could be moved further south, to increase the separation distance from properties on the edge of the village;
- a need to incorporate flood protection, specifically the raising of the alignment on low embankments within the floodplain and inclusion of flood compensation measures where necessary; and
- the stopping up of the A5025 north of the village to ensure future traffic transfers onto the bypass, to reduce the potential for conflicts between vehicles and NMUs within the village.

Section 3

2.2.40 Design development work on potential solutions for Llanfachraeth focused on refining the preliminary bypass alignments proposed during DMRB Stage 1. The following options were accordingly developed and evaluated for section 3.

- Option 1 – would move traffic off the existing A5025 within the village and away from properties west of the existing highway. The design would also remove an existing bend and provide overtaking opportunities for approximately 50% of the overall bypass length. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 2 (2a and 2b) – would provide a straighter horizontal alignment than option 1, and would be located around 10m further east than option 1 for approximately 1km of the bypass length. The alignment would provide overtaking opportunities for approximately 45% of the overall bypass length. The difference between option 2a and 2b related to their vertical alignment and the inclusion/exclusion of an underpass. These options are depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 3 (3a and 3b) – would be of a comparable horizontal alignment to option 2, but with two side road crossing options comprising an on-line overbridge (3a) and off-line (3b) overbridge, rather than the T-junction presented as part of option 1, option 2a and option 2b. These options are depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).

2.2.41 The form and location of the above options were informed by the following environmental considerations.

- A requirement to include accommodation works to provide continued access for farm vehicles, such as agricultural underpasses, within affected landholdings.
- Consideration of whether free span bridges rather than culverts could be used as part of the crossing of the Afon Alaw and associated tributary, to reduce any potential ecological effects associated with modifications to the watercourse(s) and loss of bankside habitat. This also enabled the diversion of the PRoW under the bridge.
- Consideration of an overbridge structure for a side road, which would enable NMUs to cross the bypass without coming into direct conflict with traffic flows. The overbridge structure would also be constructed 'offline' to the alignment of the existing side road, in order to reduce adverse severance effects during construction.

Section 5

2.2.42 Design development work on potential solutions for Llanfaethlu focused on refining the preliminary bend improvements proposed during DMRB Stage 1. The following options were accordingly developed and evaluated for section 5.

- Option 1 – would comprise the realignment of the existing A5025 to bypass the two bends, with the alignment tying back into the existing highway between the bends to maintain access to farms. Access to properties adjacent to the Black Lion Inn would be re-provided from a new side road, and another side road would be provided to offer direct access to residential properties in the village. Option 1 also included two cattle underpasses to allow continued agricultural access to adjacent fields. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 2 – would also realign the existing A5025 to bypass the two bends, and would have a comparable horizontal and vertical alignment to option 1. The key differences would be the movement of a junction into Llanfaethlu approximately 20m north, and the inclusion of an accommodation overbridge (for cattle crossing) and an underpass to allow agricultural access to fields either side of the highway. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 3 – would have a comparable alignment to option 1 for part of its length, but which would change significantly where the bypass would cross the existing highway. From this point, the new alignment would be relatively straight, running along the west side of the A5025 until tying into a farm access track via a simple priority controlled junction. The alignment would then continue and would involve the construction of a

new four-arm roundabout junction, to replace an existing simple T-junction, which would connect the new alignment into the existing highway network. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).

2.2.43 The form and location of the above options were informed by the following environmental considerations:

- a requirement to include accommodation works to provide continued access for farm vehicles and the movement of livestock within affected landholdings;
- a need to achieve the desired sight lines through the widening of verges near junctions and consideration of the use of diverge lanes, whilst aiming to reduce land take requirements wherever possible;
- the careful positioning of junctions within the options to reduce agricultural land take;
- avoidance of a potential bat roost associated with an existing lime kiln, achieved through minor alignment and steepening of earthworks;
- the designing of culvert structures in a way that permits future maintenance to be carried out; and
- consideration of footway and cycleway provisions to provide connectivity to the existing PRoW network.

Section 7

2.2.44 Design development work on potential solutions for the Cefn Coch locality focused on refining the preliminary bypass alignments proposed during DMRB Stage 1. The following options were accordingly developed and evaluated for section 7.

- Option 1 – comprised a bypass which would stop up the existing highway at bypass intersection points, without the provision of access onto the existing highway at either end. The bypass also included a staggered junction close to an existing crossroad junction as a means of access onto the existing A5025 and a side road. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 2 – comprised a bypass which included provision to access the bypass from the existing A5025 at either end and from a side road to the north of the bypass. An existing side road to the south would be stopped-up, and an accommodation bridge proposed to cross the bypass to provide landowner access either side of the highway. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).
- Option 3 – comprised a bypass which included a staggered junction at a side road, and would involve the stopping up of the existing A5025 at this junction. Access to the existing A5025 would be provided at either end

of the bypass, with field access either side of the bypass is maintained by way of a vehicular underpass.

- Option 4 – comprised a combination of features within options 1, 2 and 3 and provided staggered and simple T-junctions with the existing A5025 and a side road to provide shorter routes for all journeys. The existing section of the A5025 towards the north of the bypass would be stopped-up and access is provided from the new junctions. This option is depicted on figures within appendix G2-2 (Application Reference Number: 6.7.14).

2.2.45 The form and location of the above options were informed by the following environmental considerations:

- consideration of access arrangements for affected landowners, due to the potential need to stop up parts of the A5025 and side roads;
- consideration of alignment option boundaries to take account of the operational requirements of affected landowners; and
- a requirement for alignment and junction options to avoid an exposed and protected bedrock cascade water feature located in close proximity to the junction of the A5025 and a side road.

2.2.46 Development of the DMRB Stage 2 options also involved the identification and evaluation of on-line improvements within and immediately beyond the existing highway boundary within sections 2, 4, 6 and 8 of the A5025.

Option evaluation workshop

2.2.47 Horizon undertook an option evaluation workshop in March 2015 to identify the relative advantages and disadvantages of each of the DMRB Stage 2 options, in order to refine the number of alternatives under consideration ahead of planned information events to be held by Horizon to present the proposed A5025 Off-line Highway Improvements in July 2015.

2.2.48 The workshop was attended by Horizon, AECOM, Jacobs and IACC Highways Officers and involved evaluation of each off-line option against a series of environmental, cost, deliverability, safety and construction criteria. The following conclusions were drawn from the workshop, which concluded there to be minor differences across all options.

- Section 1 – Option 3 emerged as the best performing option in relation to potential construction disruption and safety on the highway network, distance from the village and flood risk.
- Section 3 – Option 3b emerged as performing better due to a reduced potential for operational noise, vibration and dust effects, the increased distance from residential dwellings, reduced disruption and increased visibility (safety) for road users, and the avoidance of severance of existing routes used by NMUs.
- Section 5 – Option 2 was determined to perform marginally better than Option 1 in terms of it involving a more simplified construction process,

and having reduced environmental impact and accident risk. Option 3 was discounted due to its increased alignment length, encroachment into the Anglesey AONB, increased severance of landholdings and visual impact.

- Section 7 – Option 2 emerged as performing better in construction terms on the basis of it having a significantly improved materials balance in comparison to the other options, due to its differing vertical alignment. As option 2 would be positioned in cutting, it performed better on visual impact and noise grounds, and would reduce the risk of slow manoeuvring vehicles between junctions.

2.2.49 Following the workshop, ongoing landowner discussions resulted in further design changes being made to the options. It was determined that the proposed accommodation overbridge within section 5 would not be required to enable the continued operation of agricultural land on both sides of the highway; accordingly, a new field access to the east of the Llanfaethlu bend improvements and a cattle handling facility were incorporated into the design of the preferred option. Additionally, a minor amendment was made to the design of the Cefn Coch bypass in section 7 to allow for the safe movement of cattle between severed agricultural land, achieved via a new cattle underpass beneath the highway embankments.

July 2015 information events

2.2.50 Horizon held a series of public information events in July 2015 which presented the options for the A5025 Off-line Highway Improvements.

2.2.51 Scope was offered for attendees to comment on the designs and influence them prior to their progression to the next stage of design development. The events invited responses on aspects including:

- progressing either an overbridge or T-junction option to an existing side road within Llanfachraeth (section 3);
- potential options for cycle route improvements around Valley and near to the Power Station Site; and
- preferences on traffic management during construction.

2.2.52 Feedback from the events concluded that:

- the vast majority of respondents preferred an overbridge crossing to link the existing side road in Llanfachraeth to the village;
- a strong preference by cyclists to continue travelling on the existing A5 between Valley and Caergeiliog, rather than having to navigate the new A5/A5025 Junction proposed as part of the bypass design;
- a preference by cyclists to be routed onto Nanner Road across to Llanfechell, with other alternatives (such as a dedicated cycle path) being offered by respondents; and

- a majority preference by respondents to have construction works managed by single lane traffic lights to reduce daily disruption, but which would lead to a longer construction duration overall.

2.2.53 The majority of general comments focused on the distance of the new off-line sections from properties, particularly at Llanfachraeth, with concerns raised about potential noise, vibration and pollution effects caused by increased traffic at this location.

2.2.54 Requests were made to mitigate the potential environmental effects of the A5025 Off-line Highway Improvements through measures such as triple glazing to reduce noise levels, landscaping to screen new sections of highway, and through the installation of calming measures within the bypassed villages to reduce potential rat-running. Suggestions were also made to use land that would be left between the villages and new sections of highway for landscaping and community use.

2.2.55 Based on the event outcomes, further modifications to the design of the A5025 Off-line Highway Improvements were made. These included progressing with the side road overbridge option within Llanfachraeth (section 3) and further development of the emerging cycling provisions prior to carrying the option designs through to DMRB Stage 3.

DMRB Stage 3

Design development of the preferred options

2.2.56 The designs for the DMRB Stage 2 options were subject to continued development and refinement as part of DMRB Stage 3.

2.2.57 The following aspects were accordingly examined as part of the early design development work within DMRB Stage 3 from mid-2015 to early 2016, which were informed by the outcomes of discussions with the Design Commission for Wales (DCfW) in November 2015, consultation responses to a Project Update held between January and March 2016 and ongoing regular engagement with the IACC and NRW throughout.

2.2.58 The emerging outcomes of the EIA process were used as the basis for the identification of environmental mitigation measures to be embedded into the design of the A5025 Off-line Highway, as described in the following sub-sections.

Engineering and environmental land take

2.2.59 Potential land areas required to construct and permanently accommodate the A5025 Off-line Highway Improvements, including any associated environmental mitigation, were identified in order to inform ongoing landowner discussions and the EIA process.

2.2.60 Discussions with affected landowners resulted in the adjustment of the horizontal and vertical alignments within the designs to adequately accommodate the operational requirements of affected landowners and reduce field severance.

2.2.61 Potential land requirements to accommodate Construction Compounds were also considered based on an assumption of one compound being required to construct each individual section.

2.2.62 Additionally, an indicative landscape and ecological mitigation strategy was developed to integrate the A5025 Off-line Highway Improvements into the local landscape pattern, visually screen and filter the improvements in available views, and to provide ecological mitigation for flora and fauna.

PRoW connectivity and cycling provision

2.2.63 The requirement for PRoW diversions within the designs was considered, which extended to the examination of the form of cycling provisions required within section 1 to enable continued movements along the A5 and the safe crossing of the proposed roundabout, and within section 5 around the proposed bypass junctions.

2.2.64 In response, a number of PRoWs and cycle measures were incorporated into the designs which focused on avoiding or minimising route severance and maintaining or improving connectivity with the existing network.

2.2.65 The inclusion of a full-length cycleway along the A5025 between Valley and the Wylfa Newydd Development Area, previously suggested by the IACC, was discounted on the grounds of cost and the requirement for additional land take which was not considered essential to deliver the objectives of the A5025 Off-line Highway Improvements.

Drainage and hydrology

2.2.66 The need for drainage infrastructure to capture, hold and treat road runoff was considered, based on a drainage design strategy developed by AECOM (which developed the initial principles identified by Mott MacDonald during DMRB Stage 1).

2.2.67 This resulted in a combination of measures including linear drains, ditches, attenuation ponds and swales being incorporated into the designs. The opportunity for some of the features to be used to provide ecological mitigation was also considered as part of the design development process.

2.2.68 The review resulted in the designs being developed in a manner to avoid encroaching on an exposed bedrock cascade feature and associated watercourse within section 7.

Afon Alaw crossing

2.2.69 The suitability of culvert structures to take the alignment over the Afon Alaw and its associated tributary within section 3 were evaluated, the conclusion being that a free span viaduct crossing would provide significant ecological, hydrological and geomorphological benefits and offered scope to incorporate a PRoW diversion and remove a proposed livestock underpass.

2.2.70 Accordingly, this feature was accommodated into the design at Llanfachraeth.

Design Commission for Wales (November 2015)

2.2.71 The DMRB Stage 3 designs for the A5025 Off-line Highway Improvements were presented to the DCfW in November 2015.

2.2.72 Emphasis was placed in the meeting on discussing the design challenges and available options for the A5025 Off-line Highway Improvements, with section 3 used as an example to demonstrate how design development was progressing towards achieving an integrated engineering, environmental and social solution.

2.2.73 Feedback from DCfW focused on a number of themes, particularly demonstrating the overall design approach adopted for the highway and its associated structures, and ensuring any landscaping proposals responded to the existing landscape framework and pattern. Positive statements were made in relation to the proposed viaduct crossing and how this would offer scope to rationalise a number of design-related issues in section 3, with recommendations made to consider its appearance and finish.

2.2.74 Further recommendations were made on the basis that the A5025 Off-line Highway Improvements represented an opportunity for positive local intervention. These related to interpretation of heritage in the local area, developing the emerging drainage proposals to provide wider community value, and improving the network of footpaths in the area to create meaningful connections.

2.2.75 The outcomes from DCfW engagement were accordingly reviewed and considered as part of the design development process.

Project Update 2016

2.2.76 Horizon provided a Project Update in January 2016, the purpose of which was to continue to gather feedback on the Wylfa Newydd Project and take account of the views of statutory consultees and local people.

2.2.77 In relation to the A5025 Off-line Highway Improvements, the Project Update provided indicative information on the alignments of the proposed improvements within Valley, Llanfachraeth, Llanfaethlu and Cefn Coch, and presented a summary of the ongoing EIA process.

2.2.78 The design for the Power Station Access Road Junction was also presented as part of this consultation. This component remained part of the Wylfa Newydd Power Station design at that time, and did not form part of the A5025 Off-line Highway Improvements.

2.2.79 Statutory consultees considered the proposed designs to be well thought out and were sympathetic to the surrounding environment, with the promotion of cycling within the designs welcomed. Some concerns were raised by NRW in relation to potential areas of flood risk at Valley and Cefn Coch, and requested information on the alternatives considered to avoid such areas.

2.2.80 The majority of other consultees expressed concerns in relation to the environmental impacts associated with increased traffic, particularly at unsociable times and during busy periods at residential properties located close to the A5025.

2.2.81 The above were accordingly considered as part of the ongoing design development of the DMRB Stage 3 options, described below, between March and August 2016.

Design development between March and August 2016

2.2.82 Following the Project Update, further work was undertaken from March 2016 on developing the designs of the A5025 Off-line Highway Improvements and taking account of issues raised by consultees.

2.2.83 A Road Safety Audit was undertaken on the designs in early 2016, the outcomes of which were used to refine the emerging designs from a safety perspective.

2.2.84 An audit of existing PRoW and cycling provisions along the A5025 was also undertaken, which involved a review of how the designs could affect routes and facilities currently used by NMUs and the adequacy of the proposed solutions incorporated into the A5025 Off-line Highway Improvements. The recommendations arising from this audit were factored into the design process.

2.2.85 The location and sizing of attenuation ponds at this stage was principally informed by the operational requirements of the design and the outcomes of landowner discussions. A number of locations and designs were developed, modelled and evaluated, several of which were discounted due to difficulties in achieving an appropriate profile within the local topography and/or their likely visual prominence in existing views and future views from the new sections of highway.

2.2.86 Modifications were made to some of the proposed earthwork embankments to improve their integration and appearance in the landscape, for example the reduction of backslopes associated with the proposed viaduct in section 3 to reduce their gradient whilst maintaining an overall earthworks balance.

2.2.87 Consideration was given to the proposed finish of the viaduct. Options considered included weathered or painted steel, exposed concrete or a cladding. No selection was made at this time, but it was considered that aesthetically the structure would need to be simple in form for it to be in keeping with local landscape character.

2.2.88 Preliminary modelling undertaken as part of the EIA identified a requirement for mitigation to protect properties to the east of Llanfachraeth from noise associated with future traffic travelling along the bypass within section 3. The design considered comprised the application of a low noise surfacing to the pavement to attenuate noise at source, the erection of noise barriers (fencing) along parts of the highway (or potentially off-site) mitigate potential noise impacts. It was concluded that a combination of surface treatment and sections of attenuation barrier along the highway would likely be necessary in proximity to and on the viaduct crossing to mitigate noise and reduce this to an acceptable level, as these would be the most effective solution in mitigating noise and would not require additional land take.

2.2.89 Regular meetings were held with NRW and IACC around this time to establish their views and requirements on landscaping, ecological mitigation, drainage,

flooding and environmental enhancement opportunities. The outcomes of these discussions were factored into the designs, and included considerations such as the minimum land take required to replace protected species habitats and its location in relation to habitat that would be lost to the A5025 Off-line Highway Improvements.

Stage Two Pre-Application Consultation

2.2.90 Horizon undertook its second stage of Pre-Application Consultation on the Wylfa Newydd Project between August and October 2016.

2.2.91 Details of the A5025 Off-line Highway Improvements were presented within the Preliminary Environmental Information Report [RD12] and the Main Consultation Document [RD13] which provided information on the current design position of the improvements, details of the proposed approach to construction and the emerging EIA outcomes. Information was also presented on the designs for the Power Station Access Road Junction, which formed a component of the Wylfa Newydd Power Station at that time.

2.2.92 Feedback recorded from statutory and non-statutory consultees and the general public highlighted a number of key concerns, as noted below.

2.2.93 Respondents passed specific comment on aspects including layout issues such as:

- awkward bends;
- road speeds;
- whether the new sections would be constructed to minimum standards;
- increase in accidents rates on parts of the highway not included in the A5025 Off-line Highway Improvements;
- increases in traffic volumes on adjacent local roads; and
- whether increases in traffic flows could affect accident response times.

2.2.94 Additionally, feedback was provided by statutory consultees with regard to including controls during construction for the release of silt into the watercourses adjacent to the works. Particular reference was made to the potential effects to Beddmanarch - Cymyran SSSI, where silt released down the Afon Alaw, could potentially indirectly affect birds by modifying siltation patterns in the estuary and modifying their roost/loafing areas.

Design review workshop

2.2.95 In parallel with Stage Two Pre-Application Consultation, Horizon continued to refine its design proposals for the A5025 Off-line Highway Improvements.

2.2.96 A design review workshop was held in August 2016, at which the design solutions were subject to review and challenge by Horizon's design team from an environmental, engineering, buildability and cost perspective. The following issues and recommendations were put forward for consideration in the design development process.

- Future maintenance – the designs would need to include sufficient access provisions and provide clearance around features such as boundary planting, fences, habitats and ditches to enable access with machinery for future maintenance and inspection.
- Land take – the designs would need to be modified to reduce, where possible, the overall depth of larger planting blocks such as woodland in locations such as Valley, the purpose being to reduce the area of agricultural land lost whilst still ensuring they achieve their intended functions and objectives.
- Field severance – the designs would need to incorporate redundant parcels of land and field corners that would be unviable to farm by the current owners.
- Existing highway – the designs would need to include appropriate provisions for the return of redundant sections of carriageway to be returned to the appropriate landowners.
- Replacement habitats – the designs would need to include sufficient land to compensate for the loss of protected species and their habitats, as required by NRW.
- Heritage – where in proximity to built heritage and above ground archaeology, the designs would need to be modified to reduce the extent of visual intrusion into their setting.
- Designated landscapes and features – the designs would need be modified to avoid encroachment into (and the loss of) any designated landscapes and features, where possible.
- Wylfa Newydd Project components – the designs would need to be cognisant of the potential future presence of other Wylfa Newydd Project components, and should be designed in a way that they are compatible with those elements.
- Environmental mitigation – the preliminary environmental designs would need to be adjusted to achieve full landscaping and ecological benefits, and provide enhancement opportunities where possible.

Design optimisation between October 2016 –May 2017

2.2.97 Modifications were made to the DMRB Stage 3 designs between October 2016 and May 2017 in response to the design review workshop, Stage Two Pre-Application Consultation, the ongoing EIA process and landowner discussions. The full details of this process and the description of the final design is included in the Stage 3 Scheme Assessment Report [RD14].

2.2.98 These changes are summarised below, and resulted in the design described in chapter G1 (Application Reference Number: 6.7.1).

Section 1

2.2.99 The most significant design changes to section 1 related to the movement of the horizontal alignment of the bypass further to the east, and amendments to the roundabout junction design to bring this closer to the existing A5. These amendments were made in response to flood modelling undertaken as part of the EIA process, which identified a need to take the bypass alignment and roundabout junction further outside areas at potential risk of flooding.

2.2.100 As short sections of the bypass would still need to be sited within the edge of the floodplain (due to local topographical variation), the EIA and design development process identified a requirement to provide flood storage. Accordingly, a flood compensation area was incorporated into the design between the existing A5025 and the bypass, the design of which was influenced by the flood modelling outcomes, landowner requests and opportunities to provide local ecological enhancement for water vole. Options considered for this area initially focused on the inclusion of an attenuation pond; however, this was later replaced with a solution based on the use of swales, ditches, ponds, culverts and marshy grassland due to flooding concerns. Potential discharge points from the area were also identified and incorporated into the drainage design in section 1.

2.2.101 In relation to NMU provision, the design of the roundabout was developed further to include dedicated sections of cycleway to enable cyclists to safely navigate and cross the junction, and to upgrade the existing footway along the southern edge of the A5 to provide a combined footway and cycleway between the roundabout and the existing A55 (Junction 3). Further modifications were made in relation to closing the existing (bypassed) A5025 to vehicles but retaining access for NMUs.

2.2.102 In identifying a suitable location for a Construction Compound, a parcel of land was initially identified between the proposed southern roundabout arm and the cemetery on the A5. Evaluation of this location through the EIA process confirmed that although the location would facilitate construction, there would be potential visual and noise concerns due to its proximity to the cemetery. Following the repositioning of the bypass horizontal alignment, an alternative compound location became available in proximity to the bypass tie-in point with the existing A5025, which was subsequently incorporated into the design, as this would have a reduced environmental impact.

2.2.103 The approach to environmental mitigation within section 1 developed as a result of the EIA process and landowner discussions, a key consideration being to successfully integrate the bypass and roundabout junction in the open landscape and provide visual screening from the southern and eastern fringes of Valley. The EIA process identified that a combination of tree and shrub planting, hedgerows, stone walls and grassland measures should be used. The use of ornamental planting at the roundabout was initially considered but was discounted on the grounds that this would not be compatible with the local landscape and planting associated with the existing road network.

Section 3

2.2.104 The most significant design changes to section 3 related to modifications to the viaduct design across the Afon Alaw. The positions of the viaduct embankments were reviewed and repositioned further back from the watercourse and its associated tributary to provide a minimum 8m clearance to the banks, as advised by NRW through ongoing consultation with them during design development. This buffer area was incorporated into the design to reduce the potential for effects on ecology, water quality and geomorphology associated with the construction and future maintenance of the viaduct crossing, and was based on the distance presented in NRW guidance on undertaking flood risk activities in proximity to main rivers [RD15].

2.2.105 As a result of the embankment modifications and flood modelling outputs, the length of the viaduct span also increased and the design of the columns were amended so that they could be skewed to cater for flood flows. The modelling also identified a need for an area of flood compensation to be provided within the design. Accordingly, an area of land to the east of the viaduct was identified and included in the design and refined to accommodate the flood compensation requirements, which also offered opportunities to provide environmental enhancements through the inclusion of new ponds for water voles.

2.2.106 The size and location of attenuation ponds required to hold and discharge highway runoff were developed and refined during this period. The siting and sizing of these features was informed by landowner discussions and land availability, the outcomes of related environmental assessments, and highway operational, maintenance and access requirements. It was recorded as part of the design development process that these ponds offered scope to provide ecological enhancement through appropriate landscaping. Accordingly, consideration was given to the type of vegetation and grassland species that could be planted both within and surrounding these features to enhance local biodiversity.

2.2.107 The EIA process identified a requirement to provide noise mitigation along parts of section 3 to protect properties on the eastern fringes of Llanfachraeth, and more isolated properties beyond the settlement, from traffic-related noise. Following a review of potential mitigation options, it was concluded through preliminary noise modelling that a combination of low noise road surfacing (applied to the pavement surface) and attenuation barriers up to 2m in height should be incorporated into the design. It was identified that the use of false cuttings (earthworks) to provide a barrier between the bypass and affected properties would not be feasible due to the amount of land take they would require. In identifying the form, height and location of attenuation barriers, consideration was given to both their potential acoustic performance and potential visual effects to adjacent properties and users of PRoWs, from the views of the proposed bypass and viaduct.

2.2.108 Associated with the bypass, there would be some unavoidable permanent loss of habitat used by protected species which has been minimised as much as possible by using the chosen route alignment. The EIA recorded that replacement land would be required to mitigate effects on great crested newt

(GCN). Following calculation of the potential loss of land, a number of land parcels adjacent to the bypass were identified and reviewed for their suitability. It was concluded that two areas would be required for mitigation, one either side of the bypass, to ensure these would be contiguous with existing (affected) habitats. The selection of land parcels also considered the presence of existing hydrological features such as ponds and ditches that could be used by GCN, the connectivity of parcels separated by the bypass, and the need to provide access routes into these areas to facilitate their long-term maintenance and management.

2.2.109 No alternative locations were considered for the proposed Construction Compound located on land at the southern tie-in of the bypass to the existing A5025, as it was considered this location would offer direct accessibility onto the highway and would have limited environmental effects due to its distance from environmental receptors.

2.2.110 The design development process identified a requirement to provide a PRoW at the northern tie-in to the A5025 to enable continued connectivity from existing side roads across the bypass.

2.2.111 In order to link the diverted PRoW to Llanfachraeth village, a new section of footway was incorporated into the design.

2.2.112 Options for landscaping of the bypass centred on the need to screen the more visually prominent earthworks, viaduct and attenuation barriers associated with the design. Design options for the viaduct considered the three different types of finish available, and it was concluded that a simple design made from concrete would be in keeping with other structures on the highway network and would not appear visually prominent in the outlook from visual receptors. This design solution would also reduce the need for future maintenance of the structure.

2.2.113 Options for landscaping of the bypass were influenced by the need to reinstate severed field boundaries, integrate earthworks and structures into the landscape and provide visual screening of new features in available views. Various types of planting such as trees, shrubs, scrub and hedgerows were initially considered, taking account of future maintenance requirements, which were developed and refined based on the outcomes of the EIA.

Section 5

2.2.114 The design development of section 5 focused on making changes and refinements to the design during this period, principally driven by landowner discussions and the EIA outcomes.

2.2.115 A review of the relationship between the bend improvements and the boundary of the Anglesey AONB identified potential for encroachment into this designated landscape. In order to avoid permanent land take, the design was modified to avoid this sensitivity. Modifications were also made to avoid land take of habitat associated with a pond known to contain GCN, with additional land taken to the west of the alignment to provide replacement habitat for this species.

2.2.116 The earthworks design associated with section 5 identified potential for visual effects on the existing setting of the Capel Soar Standing Stone. In order to help retain the open aspect of views associated with this designated asset, the backslopes of earthworks adjacent to this feature were slackened to reduce the visual intrusion. This modification also meant that screening (planting) initially proposed at this location would no longer be required.

2.2.117 A review of the relationship between the proposed bend improvements and other proposed Wylfa Newydd Project components, specifically the Mobile Emergency Equipment Garage (MEEG) and Alternative Emergency Control Centre (AECC) facilities, concluded a need to alter the proposed drainage and planting designs. Alternative options involved siting an attenuation pond and associated drains in different locations, and the potential combining of drainage across the components into a single solution.

2.2.118 A number of locations for ponds and ditches required to attenuate highway runoff were initially identified as part of the bend improvements. The location and sizing of these features were subsequently modified following landowner discussions and a review of highways drainage operational requirements. As part of the landscaping strategy, it was determined that each of the proposed attenuation ponds should be environmentally enhanced to include marginal planting with wetland plant species and marshy grassland.

2.2.119 Replacement habitat for GCN was identified, based on the EIA predicting a loss of existing habitat used by this species. Land parcels adjacent to the southern tie-in with the A5025 were identified as providing suitable mitigation due to their relationship to areas and ponds used by GCN. An ecological underpass was also introduced into the design to provide connectivity between land parcels severed by the bend improvements, and to facilitate access for future maintenance and management of the replacement GCN habitat.

2.2.120 Modifications to the designs of sections 5 and 7 were considered to take account of potential future components of the Wylfa Newydd Project, which could result in changes to the proposed drainage and planting designs.

2.2.121 In order to provide linkages to Llanfaethlu village and other PRoW, a footway and cycleway has been included on the western side of the road, and a pedestrian crossing and a footway link with timber gate has been included (following a request by IACC).

2.2.122 The location of the Construction Compound at the southern tie-in with the A5025 was proposed based on similar environmental and operational reasons to those noted for the proposed compound in section 3.

2.2.123 Options for landscaping of the bend improvements were focused on further reducing the effect on the setting of the Capel Soar Standing Stone, providing ecological connectivity and addressing field severance through the reinstatement of boundary features, and the planting of embankment slopes to visually integrate earthworks into the local landscape.

Section 7

2.2.124 Amendments were made to the design of section 7 during this period. The most significant modifications related to PRoW diversions and provisions where the bypass would cross existing routes used by NMUs, modifications to the proposed drainage design, and horizontal alignment changes.

2.2.125 The need for the closure and diversion of a PRoW that would be severed by the bypass was reviewed, and this concluded that a new section of PRoW would be needed across the bypass to reinstate connectivity between a side road near Ty Capel and the existing A5025. The design of the diversion was informed by the need to take users safely along the bypass and cross at an appropriate location with good visibility. Accordingly, a route was selected with the provision of gates and steps; however, it was noted during design development that NMU access could be difficult due to local topography and having to climb slopes associated with the bypass. Accordingly, this was modified to provide open access and a ramp which would facilitate access by all NMUs, including wheelchair users.

2.2.126 Based on the outcomes of landowner discussions, various alternatives were considered to ensure continued operational viability of affected landholdings and businesses. These included the consideration of farm access tracks, underpasses and overbridges, and cattle handling facilities at various points in the design development process, all of which were discussed with affected landowners in pursuit of an agreeable solution.

2.2.127 Opportunities were taken as part of design development to combine a proposed agricultural underpass at the southern tie-in with the A5025 with an ecological underpass, and to introduce an ecological underpass as part of a watercourse crossing further north.

2.2.128 Modifications were made to the proposed T-junction with the A5025 at the southern end of the bypass. This junction was moved further south as part of design development to reduce land take.

2.2.129 The designs initially identified compensatory planting to replace the loss of ancient woodland that would result from the northern tie-in with the A5025; however, upon review, it was considered that avoidance of this historic feature would be a more preferable solution. Accordingly, the extent of the highway design was modified at this location by reducing the carriageway width to avoid encroachment into the woodland and any loss of this historic landscape feature. The carriageway width was also reduced at the southern end of section 7 to reduce the extent of earthworks in this area.

2.2.130 The drainage design was modified to include access tracks to the proposed attenuation ponds for future maintenance. The locations of the attenuation ponds were informed by their potential land take and landowner discussions. Planting of marshy grassland, marginal and wetland species within and surrounding these features is proposed as enhancement measures.

2.2.131 A Construction Compound was proposed at the southern end of the bypass, near to the tie-in with the existing A5025. This location was considered the optimal location based on the distance from environmental receptors and to reduce potential visual impact.

2.2.132 The landscaping strategy for the bypass centred upon integrating the route into the landscape whilst providing visual containment of its more prominent earthworks in available views. Options included the use of linear belts of trees and shrubs, hedgerows and hedgerow trees and different grassland mixtures.

Power Station Access Road Junction

2.2.133 As part of the latter stages of DMRB Stage 3, a decision was made by Horizon to revisit the inclusion of the Power Station Access Road Junction into the A5025 Off-line Highway Improvements.

2.2.134 It was concluded that the design of the three-arm roundabout junction proposed as part of the Wylfa Newydd Power Station south of Tregele should be incorporated into the overall scope of the improvements and developed to a standard comparable to the improvements proposed within sections 1, 3, 5 and 7.

2.2.135 At the time of inclusion, the location of the Power Station Access Road Junction south of Tregele had been identified through the design development of the Wylfa Newydd Power Station. The location of this component was moved approximately 500m further south to preserve a Cwt Dyrnwr (threshing shed), a feature of agricultural history.

2.2.136 The design considered and responded to the differing topographical levels of land immediately west of the A5025 near Groes Fechan, and the need for the Power Station Access Road, which it would connect to, to be positioned on a slight embankment.

2.2.137 The potential requirement for a Construction Compound for the Power Station Access Road Junction was initially considered, and a parcel of land adjacent to the northern arm of the roundabout was included in the overall design. However, following its review as part of the EIA process it was concluded that there would be potential noise, visual and land take effects if this were to be progressed as part of the design. An alternative solution was therefore identified, based on the construction of the Power Station Access Road Junction being handled by way of the compound proposed as part of the improvements to section 7.

2.2.138 Options for landscaping of this component focused on visually integrating the form of the roundabout into the local landscape through the use of planting. It was concluded that smaller shrub species and individual trees would be preferable to larger planting due to the open nature of the landscape at this location.

2.3 References

Table G2-1 Schedule of references

ID	Reference
RD1	Halcrow. 2010. Nuclear Power Project - Site Development: Heavy Route and MOLF Strategy Study (May 2010).
RD2	RPS. 2010. *Wylfa B - Initial Transport Study (July 2010).*
RD3	RPS. 2011. *Wylfa - Transport Strategy Overview (August 2011).*
RD4	Grontmij. 2011. *Strategic Transport Study for Major Developments - Wylfa B Highways Review and Recommendations (August 2011).*
RD5	Grontmij. 2011. *Transport Position Statement for Major Developments - Revision C (September 2011).*
RD6	Grontmij. 2011. *Transport Position Statement for Wylfa New Nuclear Power Station - Revision A (September 2011).*
RD7	Grontmij. 2011. *Strategic Transport Study for Major Developments - Final Report - Revision C (September 2011).*
RD8	Highways Agency. 1993. *Design Manual for Roads and Bridges, Volume 5, Section 1, Part 2 - Scheme Assessment Reporting (TD37/93).* [Online]. [Accessed: August 2017]. Available from: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol5/section1/td3793.pdf
RD9	Mott MacDonald. 2011. *Stage 1 Scheme Assessment Report (October 2011).*
RD10	Horizon Nuclear Power. 2014. *Wylfa Newydd Project - Pre-Application Consultation - Stage 1: Consultation Overview Document.* [Online]. [Accessed: August 2017]. Available from: https://consultation.horizonnuclearpower.com/download/documents/74
RD11	RPS. 2014. *Stage 2 Scheme Assessment Report (December 2014).*
RD12	Horizon Nuclear Power. 2016. *Stage Two Pre-Application Consultation Preliminary Environmental Information Report.* [Online]. [Accessed: December 2016]. Available from: https://consultation.horizonnuclearpower.com/download/documents/152
RD13	Horizon Nuclear Power. 2016. *Stage Two Pre-Application Consultation Main Consultation Document.* [Online]. [Accessed: August 2017]. Available from: https://consultation.horizonnuclearpower.com/download/documents/149
RD14	AECOM. 2017. *Stage 3 Scheme Assessment Report (September 2017).*
RD15	Natural Resources Wales. 2017. *Guidance.* [Online]. [Accessed: August 2017]. Available from:

ID	Reference
	https://naturalresources.wales/permits-and-permissions/flood-risk-activities/guidance/?lang=en

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