Llywodraeth Cymru / Welsh Government

A487 New Dyfi Bridge

Environmental Statement – Volume 1: Chapter 2 The Project

900237-ARP-ZZ-ZZ-RP-YE-00025

Final Issue | September 2017

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2 The Project

2.1 Introduction

2.1.1 This chapter of the Environmental Statement (ES) outlines the description of the Scheme including the environmental design, construction methodology, the construction programme and the post construction activities.

2.2 Description of the Scheme

General

2.2.1 The proposed A487 New Dyfi Bridge Scheme consists of a new viaduct structure across the floodplain and a river bridge to cross the Afon Dyfi approximately 480m upstream of the existing Pont-ar-Ddyfi. The length of the Scheme is approximately 1200m with approximately 725m being on structures.

2.2.2 The Scheme lies partly within SNP and partly within its landscape setting. The receiving environment is highly sensitive. The potential effects on the environment have been considered through the iterative process of design, environmental assessment and redesign to reduce and where possible avoid adverse effects on the environment which are described below under Environmental Design.

2.2.3 The Scheme consists of a new section of single carriageway road, with a typical overall width of 14.3m. The typical paved carriageway width would be 9.3 m (excluding verges), which would consist of two 3.65 m wide lanes, with a 1 m hard strip on either side of the carriageway. In addition, the typical cross section would include 2.5 m grass verges along both sides of the Scheme, increasing in width to accommodate forward visibility requirements as required.

2.2.4 The typical 9.3m paved carriageway width would be the same on the proposed viaduct structure across the floodplain and Afon Dyfi. A 2.5m paved verge would be provided on the western side of carriageway which would accommodate a shared footway/cycleway and associated 1.4m high parapet. The Eastern verge would vary in width from 0.6m along the straight section of viaduct to a maximum of 4.9m in order to provide adequate visibility around the curved section of viaduct to the south.

2.2.5 For most of its route, the Scheme would be elevated across a generally flat floodplain and at its highest point (on the river

bridge) it would be some 9m above ground level (see Volume 2 Figure 2.2).

2.2.6 The majority of the Scheme would have a National speed limit. A 30mph speed limit would be provided at the southern end of the Scheme, south of the proposed viaduct southern abutment, reflecting the extent of the existing urban speed limit. Approaching from the north, a 200m long 40mph 'buffer' speed limit would be provided at the southern end of the viaduct in advance of the 30mph urban area.

2.2.7 The Scheme would not have road lighting, except at the southern end of the scheme within the 30mph speed limit reflecting the extent of the existing street lighting. The requirement for the provision of highway lighting on the remainder of the Scheme has been assessed and concluded that there is no specific requirement for highway lighting.

2.2.8 The highway drainage would be a kerb and gulley highway drainage system, with combined kerb drainage units provided on the viaduct and the bridge. Pollution prevention measures are required to protect the downstream ecological resource from a spillage should it occur, as such this is an improvement and enhancement to the current situation. Containment measures provided (e.g. stop-logs) would provide a limited storage capacity in the event of a tanker spill. There has not been an allowance for spills above this capacity as, due to the improved highway design, the risk of collisions and subsequent spills has been assessed as being below the threshold required for additional containment measures. The highway drainage systems would discharge at the following three.

- Highway Drainage Catchment 1 – The existing northern drainage catchment (see Volume 2 Figure 15.1), located north of Afon Dyfi at Fridd Gate, drains into the existing A487 road via gulley and piped drainage network, and outfalls directly to Afon Dyfi just downstream of Millennium Cycle Bridge. There is no existing treatment/ attenuation or isolation device. The drainage catchment (see Volume 2 Figure 15.2) will increase in area and incorporate a new junction. In order to mitigate the slight increased chance of a spillage event, it is proposed to incorporate a petrol interceptor and isolation device (pen stock gate valve or similar) prior to the outfall. This will help remove contaminants and provides a means by which spillages can be isolated. Alternative Sustainable Urban Drainage System (SUDS) treatment methods such as ditches/ ponds are unsuitable due to the steep topography north of the river. The Scheme therefore offers a slight improvement over the existing case.

- Highway Drainage Catchment 2 – The existing A487 catchment (see Volume 2 Figure 15.1) drains to the south along the existing ditch on eastern side of A487. This crosses the A487 via culvert/ pipe to a ditch on western side before outfalling via culvert to ditch south of railway. Some treatment and attenuation may be provided by the existing ditch. There is no spillage isolation currently provided. The proposed catchment (see Volume 2 Figure 15.2) will decrease in area from existing because of the provision of a new drainage catchment 3 which will drain the new A487 viaduct and existing A487 between the Dyfi Eco Park and Pont-ar-Ddyfi. The proposed drainage will outfall to proposed ditches located between A487 and Dyfi Eco Park before crossing A487 as per existing to the ditch on western side and outfalling via culvert to ditch south of railway. Treatment and attenuation will be provided by the ditches, and proposed spillage isolation device (stop logs or similar). The Scheme with a decreased catchment area and new spillage isolation thereby offers a slight improvement over the existing case.
- Highway Drainage Catchment 3 – The proposed viaduct catchment (see Volume 2 Figure 15.2) drains via a combined kerb drainage system to the southern abutment. It then enters a short pipe network prior to outfalling to the ditch to the western side of the new A487 viaduct approach embankment. The ditch will re-use the line of the existing ditch along the eastern side of the existing A487, but will be re-profiled to flow from south to north (rather than north to south). The ditch will then cross under the existing A487 via a culvert before continuing further north along the west side of the existing A487 to outfall to the Afon Dyfi downstream of Pont-ar-Ddyfi. In order to provide water treatment, a petrol interceptor and isolation device (pen stock gate valve or similar) will be included within the short pipe network prior to outfalling to the ditch. This will provide treatment and a means of short term isolation even during a flooding event. Further treatment would be provided by ditch vegetation, and a further means of isolation by an isolation device (stop logs or similar) located upstream of a culvert under the existing A487. The proposed petrol interceptor, drainage ditches and isolation devices ensure no negative effect from the proposed new viaduct drainage.

2.2.9 The Scheme aims to be earthworks neutral, although there may potentially be a deficit of general earthworks materials. For detailed earthwork quantities refer to Table 11.5 of Chapter 11. The imported material would not include any inappropriate material or invasive species e.g. Japanese knotweed. The disposal of spoil contaminated with invasive species will be achieved by wrapping and burying it within the proposed works

in accordance with Environment Agency Guidance. In the unlikely event that burial is not possible the spoil will be disposed of at a licenced tip. For detailed information on how invasive species will be managed refer to the Invasive Species Management Plan in Volume 3 Appendix 17.1 Pre-CEMP Annex C.

2.2.10 A satellite working area for location of welfare facilities, material, fuel and equipment storage will be situated to the north east of the Scheme, see construction area highlighted on Figure 2.4, Volume 2. The topsoil storage will be limited to the soil stripped from the area of the new A493/A487 junction and will not include soil removed from the north abutment where there is Japanese Knotweed. Topsoil will be stored in accordance with best practice, see attached Volume 3 Appendix 17.1 Pre-CEMP Annex G Outline Materials Management Plan. It should be noted that there will be no stockpiling of topsoil within the floodplain.

2.2.11 The Scheme crosses the Afon Dyfi and its floodplain on a structure, from a short embankment north of the Cambrian Line Railway Bridge over the A487 on the edge of Machynlleth. A simple priority T-junction is provided towards the southern end of the Scheme connecting the proposed works with the realigned existing A487 to the west, and a further simple priority T-junction connecting the proposed works with the Dyfi Eco Park to the east.

2.2.12 At the northern end of the Scheme the new A487 alignment ties into the existing A487 in the area of the completed Ffridd Gate Improvement.

2.2.13 The existing A487 north of Afon Dyfi, between Pont-ar-Ddyfi and the new A487, would be de-trunked and renumbered as the A493 and will join the new A487 alignment via a ghost island T- junction (i.e. a painted traffic island to indicate that vehicles should not enter).

2.2.14 A section of traffic calming would be introduced to reduce speed and increase safety, by constructing build-outs on the A493 immediately north of Pont-ar-Ddyfi near Pen-y-Bont Cottages. Give Way lines would create a priority single lane requiring westbound traffic to give priority to opposing eastbound traffic.

2.2.15 The existing A487 south of Pont-ar-Ddyfi would be de-trunked and a no-through route formed by installing a line of bollards on both the north and south side of Pont-ar-Ddyfi. Access to the section of de-trunked A487 south of the river would be provided from the new southern T-junction located opposite to the Dyfi Eco Park.

2.2.16 The Scheme would introduce restrictions to the use of Pont-ar-Ddyfi, by means of a Traffic Regulation Order, restricting use to

Non-Motorised Users (NMUs) and emergency access for authorised vehicles (subject to weight restriction) during times of flood only.

2.2.17 For the General Arrangement plans refer to Volume 2 Figure 2.1. Long sections are shown in Volume 2, Figure 2.2. A de-trunking plan is shown in Volume 2 Figure 2.3.

Ch. 0 – 0+220 Southern Tie In and Embankment

2.2.18 The Scheme will commence immediately north of the existing Cambrian Line Railway Bridge over the existing A487. To the north of the bridge the alignment will begin to rise and move off-line to the west of the existing road, to a height of 4.4 m above ground level at Ch. 0+220.

2.2.19 The existing simple priority T-junction to the Dyfi Eco Park would be reconfigured and relocated approximately 20m to the west, on a 1.7m high embankment in order to tie into the new A487 alignment. A short connection will be provided between the existing Dyfi Eco Park access road and the new A487 alignment.

2.2.20 A simple priority T-junction is proposed at Ch. 0+100 to connect the new A487 alignment with the realigned existing A487, which would be de-trunked.

2.2.21 The existing 30mph speed limit would be retained with speed limit signs and a gateway provided at the southern abutment of the new structure, Ch. 2+220. Road lighting would be provided within the 30mph speed limit to replicate the existing provision.

2.2.22 An approximately 1.5m high flood bund (crest level 9.5m AOD) would be provided along the western side of the Scheme, starting from the existing railway embankment at Ch. 0+020 and tying into the earthworks associated with the proposed access to the realigned existing A487 at Ch. 0+100.

2.2.23 A further approximately 2.0 to 2.5m high flood bund (crest level 10.00m AOD at west to 10.30m AOD at the east) would be provided along the northern boundary of the Dyfi Eco Park, connecting to the new A487 viaduct southern abutment and wingwalls at the western end, and the existing railway embankment at the eastern end of the Dyfi Eco Park. An agricultural access track to replicate existing access provision would be provided up and over the bund at approximately the mid-point along the bund, to the east of Dyfi Eco Park.

2.2.24 A new pumped drainage systems would be installed at the Cambrian Line Railway Bridge, which combined with upgraded drainage systems, will address existing flooding issues. The new western flood bund would prevent overland flow into this area from river flooding, and the pumped drainage system would

discharge to highway drainage catchment 3 outfall ditch to Afon Dyfi.

Ch. 0+220 – 0+815 Viaduct

2.2.25 The proposed viaduct across the floodplain would consist of 18 spans: 16 No. 34m spans and 2 No. 27m spans at the southern end. The viaduct superstructure would be supported by pairs of concrete columns on piled foundations with the bridge deck structure being a multi span steel/concrete composite construction. The viaduct would accommodate a shared footway/cycleway along its length.

2.2.26 The initial section of the viaduct (Ch. 0+220 to Ch. 0+380) is on a right hand bend, with deck widening of the eastern verge to maintain visibility.

2.2.27 The viaduct beyond Ch. 0+380 has a constant horizontal and vertical alignment.

Ch. 0+815 – 0+940 River Bridge

2.2.28 The proposed river bridge would have two larger spans than the viaduct section, a 74m span over the river and 50m span immediately south of the river before the viaduct section. The northern abutment would be located on the land to the north of the existing river. The deck construction would be of multi-girder construction, similar to the ladder deck construction of the viaduct, but with 4 beams rather than 2. Due to the weight of the bridge beams, the beams would be lifted in from the north and south of the river.

Ch. 0+940 – 1+200 Junction and Northern Tie In

2.2.29 The Scheme would include a ghost island priority T-junction with the existing A487 (which would be de-trunked to become the A493). The existing A487 would be realigned slightly to approach the new A487 at near perpendicular, and alterations would be made to the existing residential/agricultural vehicular access track to the north. A ghost island (i.e. a painted traffic island to indicate that vehicles should not enter) would be provided as part of the junction layout to accommodate the right turning traffic from the southbound A487 onto the A493, refer to Figure 2.3 De-trunking Plan in Volume 2.

2.2.30 Advance directional reflective traffic signage would be provided in the verge of the existing carriageway north of the junction.

Existing A487, Pont-ar-Ddyfi and other works

2.2.31 The Pont-ar-Ddyfi would be restricted to Non-Motorised Users (NMUs) and authorised vehicles only (subject to weight restriction) during times of flood only. A line of fixed and de-mountable bollards would be installed along both northern and southern ends of Pont-ar-Ddyfi in order to control vehicular access onto the bridge. These would be carefully selected in agreement between the landscape architect (Arup) and the heritage consultant (Arup) in consultation with Cadw to ensure their design (scale, colour and materials) complements the fabric and historic setting of Pont-ar-Ddyfi and nearby dwellings

2.2.32 The existing A487 south of the river would be de-trunked between its connection with the Scheme to the south and the new line of bollards at the southern end of Pont-ar-Ddyfi, refer to Figure 2.3 De-trunking Plan in Volume 2.

2.2.33 The existing A487 south of the river would be retained as a public means of access. A short section of the existing two lane carriageway would be converted to single lane, with the second lane converted to several parking spaces for anglers or walkers.

2.2.34 The existing NMU route along the west side of the existing A487 will be retained.

2.2.35 The existing drainage channel, partially along the eastern side of the A487, would be profiled and extended to provide the outfall channel for the highway drainage of the existing A487 and new A487 viaduct structure.

2.2.36 The existing A487/A493 junction immediately north of Pont-ar-Ddyfi would be reconfigured to provide an A493 through route.

2.2.37 The section of existing A487 north of the Afon Dyfi, between Pont-ar-Ddyfi and the new northern junction, would become an extension of the A493, refer to Figure 2.3 De-trunking Plan in Volume 2.

2.2.38 A section of traffic calming would be introduced to reduce speed and increase safety, by constructing build-outs on the A493 immediately north of Pont-ar-Ddyfi near Pen-y-Bont Cottages. Give Way lines would create a priority single lane working requiring westbound traffic to give priority to opposing eastbound traffic. The build-outs would provide a raised footway along the front of existing Pen-y-Bont Cottages, with a safe Non-Motorised User crossing point.

2.2.39 In order to protect the A493 and Pen-y-Bont Cottages from fluvial flooding, a single longitudinal carrier drain would be installed along the A493 in order to intercept and consolidate the numerous existing drainage networks into a single network with a single gravity outfall to the river. A non-return flap valve would

be installed on the single gravity outfall. Existing drainage outfalls would be removed or grouted up, and the existing stone parapet wall sealed to provide an effective flood barrier. These measures would act to prevent any flow path for river flood water, and thereby protect the A493 and Pen-y-Bont Cottages from fluvial flooding.

2.2.40 A pump station would be provided within a chamber adjacent to the A493 which would operate when the river is in flood and the flap valve on the drainage gravity outfall is closed, preventing outflow. The pump station would be sized to ensure no flooding of the cottages up to the 100yr pluvial storm event.

Environmental Design

2.2.41 The high sensitivity of the receiving environment has been a major factor in shaping the design of the Scheme. Where significant environmental effects have been identified throughout the iterative design and assessment process, changes have been adopted and built into the Scheme. For this assessment, these aspects of the design are considered to be mitigation and are considered as integral to the Scheme design and are described below under each relevant topic.

2.2.42 It should be noted that descriptions of further mitigation measures can be found in the following chapters of the ES:

- **Chapter 6** - Construction mitigation for air quality and dust;
- **Chapter 7** – Pre-construction avoidance of Pont-ar-Ddyfi milestone and construction mitigation for cultural heritage assets;
- **Chapter 8** – Landscape mitigation measures are outlined within this chapter and Environmental Masterplan (EMPs) drawings at Figure 8.9;
- **Chapter 9** – Ecological mitigation measures to be included within the Scheme during the construction and operation phase;
- **Chapter 11** – Construction mitigation measures for material resources and waste arisings are outlined within this chapter. Disposal of waste will be limited and the Site Waste Management Plan will measure and monitor the quantities and area for disposal;
- **Chapter 12** – Construction mitigation measures for noise and vibration are outlined within Chapter 12. Further information on construction noise control and monitoring is provided in the Pre-Construction Environmental Plan (pre-CEMP) in Appendix 17.1, Volume 3;

- **Chapter 13** – Construction and operation mitigation measures for Effects on Travellers are outlined within Chapter 13;
- **Chapter 14** – Construction and operation mitigation measures on private property and associated land take, agricultural land and land used by community are outlined within Chapter 14;
- **Chapter 15** – Construction and operation mitigation measures on road drainage and water environment are outlined within Chapter 15 and the pre-CEMP; and
- **Chapter 17** – Register of Commitments outlines all mitigation measures for the Scheme

Landscape and Visual Design

2.2.43 The Scheme has been designed largely as an elevated structure to avoid impacting on flooding and to reduce severance and physical impact on the landscape beneath it.

2.2.44 The distinctive large-scale topography of a broad, 'U'-shaped valley is able to accommodate change of the type proposed. The presence of existing road infrastructure and other humanising elements means the landscape is more likely to be able to accommodate change. On the other hand, the elevated and linear nature of the Scheme, mean it would be visually prominent and would contrast with the, soft, textured pattern and rural character of the local landscape. See **Chapter 8** of this ES for further discussion on these landscape effects.

2.2.45 New infrastructure of this type and scale cannot readily be screened by planting, but through careful design and appropriate landscape mitigation it will be integrated into the receiving landscape.

2.2.46 It has been agreed within the design team and, as detailed in Table 8.1 in Chapter 8 of this report, with external consultees such as Design Commission for Wales (DCfW) and Natural Resources Wales (NRW), that rather than attempt to screen or hide the negative aspects of the Scheme, efforts should be focussed on designing a Scheme that should not simply be screened to reduce adverse effects, but where possible designed to complement and even enhance its landscape and visual setting as much as possible.

2.2.47 These measures described below have been integrated into the design to avoid or reduce adverse effects at source and to create a simple and elegant Scheme that fits into its setting.

Design Ethos- light-touch, simple and elegant

2.2.48 Many aspects of the design of the Scheme and in particular the elevated viaduct and bridge sections have been carefully designed to be uncluttered, coherent, visually appealing and to minimise contrast with the receiving landscape.

Overall form

2.2.49 The viaduct section of the Scheme is predominately straight in plan and uniform in design with a gentle and elegant vertical arched curve along its length.

2.2.50 The composite steel bridge deck was chosen for its efficient use of materials and its simple, minimal elevational mass when compared with other bridge types such as arch and truss structures. The viaduct and bridge have been designed to optimise the span arrangements for economy and with the view to finding a balance between both the number of spans and the elevational depth of the beams. The elevational mass has further been minimised by selecting open parapets and simple, slim, paired and evenly spaced supporting columns.

2.2.51 The roadside embankments and cuttings within the Scheme have been designed to have a smoothed 'S' shaped profile so as to appear to tie as naturally as possible back into the surrounding landscape. These slopes will be formed using unameliorated, site-won subsoil to reduce fertility and encourage grass sward and wildflowers to establish at the same time as supressing ruderal species and succession to scrub.

2.2.52 All disturbed ground including these embankments will be cultivated and seeded with an appropriate lowland meadow grass seed mix.

2.2.53 These aspects of the design are described below under the following subheadings.

Materials

2.2.54 The new structure has been designed with a simple, limited palette of hard materials of neutral tones comprising natural brown steel for the supporting girders, fair-faced concrete elevations and soffit, black asphalt road and path surfaces and galvanised steel for the safety railings and local natural stone.

2.2.55 The precise colour of the concrete used for the main structure is to be agreed by the project team following discussion with the statutory environmental bodies such as Snowdonia National Park Authority.

2.2.56 Limiting the number of different materials and carefully designed junctions between the different materials and elements of the structures results in a visually uniform and uncluttered design. This is in line with the simple and elegant design ethos. Reducing

visual clutter and complexity will make the Scheme less visually intrusive, contrasting less with the receiving landscape.

2.2.57 The elevational view of the structure will comprise a simple galvanised steel post and rail parapet of 1.4m high, with mesh infill, above a fair-faced precast concrete parapet edge beam. The visible surface of the concrete columns will be finished with a fine vertical ribbing to direct water vertically down their elevations, this will help create a vertically uniform and gently textured finish to the columns. The final colour and texture of the concrete surfaces will be agreed using sample panels on site during detailed design.

2.2.58 The visually prominent northern abutment wall and its wing walls will be faced with an appropriate natural stone to match the local vernacular.

2.2.59 The superstructure of the bridge will have brown steel girders. Along the viaduct these girders have a uniform elevational depth. They would be approximately 1.5m deep. Where longer spans are required for the bridge section over the Afon Dyfi, the girders would need to be deeper for structural reasons, but for aesthetic and cost reasons have been designed with an elegant curved longitudinal profile.

2.2.60 The bridge and viaduct would be supported on pairs of circular concrete columns as described below.

Supporting structures

2.2.61 The team have designed several iterations of the viaduct columns with different cross sections. An early decision was made to avoid an elongated form as although these may look more slight when viewed end on, they would equally look heavier when viewed side on. In order to reduce the visual elevational mass of the structure and in line with advice received from Design Commission for Wales to adhere to a design ethos of simple, elegant and light touch, the supporting structures have been designed as simple circular columns with as thin a cross section as possible for the proposed mono-pile arrangement. .

2.2.62 The viaduct and bridge have been designed to optimise the span arrangements with the view to minimising both the number of spans and the elevational depth of the beams.

2.2.63 The steel girders rest directly on bearing plates on top of each column. These will be designed to minimise their visibility from ground level. The column footings will be piled concrete foundations finished below ground level so as not to be visible on the surface.

Lighting

2.2.64 SNP is designated as a Dark Skies Reserve as described in Chapter 8 of this report. The Scheme lies partly within this designation (that covers the entire SNP area) and entirely within an area classified as Intrinsically Dark (Environmental Zone E1, Institute of Lighting Professionals).

2.2.65 In order to avoid adverse effect on the night-time environment, the operational scheme will not be lit with the exception of the area at the southern end of the Scheme within the 30mph zone which is currently lit on the existing A487.

Northern bridge abutment

2.2.66 The design of the northern abutment, incorporating a cattle underpass and maintenance access is particularly important because it would be so close and clearly visible to sensitive visual receptors using the PRoW along the river.

2.2.67 The cattle underpass and maintenance access has been incorporated into the abutment design in order to minimise the need for retaining structures and wing walls. This brings the cattle route around in front of the abutment. The abutment wall is therefore set back into the riverbank by at least the 3.5m width of the underpass. The abutment wall will be faced with a natural stone finish to match the local stone walls. The wing walls will then turn and run north, parallel to the road, and taper into the grassed embankments.

2.2.68 The cattle underpass and maintenance access track would be surfaced with in-situ concrete to give it the feel of a farm track rather than the appearance of a minor road. As this passes under the new bridge it would be separated from the riverbank by timber post and wire stock proof fencing. On the river side of this fence a gravel strip French drain would capture water runoff from the track and allow it to soak into the top of the bank. Any nutrient rich infiltrated water from the drain will be intercepted and utilised, prior to reaching the river, by low growing shade tolerant native plants on the river bank below.

2.2.69 The steep northern river bank under the bridge would be retained up to the height of the underpass (13m AOD, approximately 6m above normal river level). This retained part of the river bank would be cleared of existing vegetation which currently comprises scrub and trees mixed with Japanese Knotweed. This would involve the excavation of soil contaminated with Japanese Knotweed roots. The riverbank would then be reinstated around the bridge abutment and underpass. It would be protected and replanted as described in the landscape mitigation measures at Chapter 8 of this report and illustrated at Volume 2 Figure 8.9 Environmental Masterplans. For detailed information on how

invasive species will be managed refer to the Invasive Species Management Plan in Volume 3 Appendix 17.1 Pre-CEMP Annex C.

Existing A487 and Pont-ar-Ddyfi

2.2.70 As described above at paragraphs 2.2.31 to 2.2.40, access along the existing route would be changed and in places restricted. This 'old' route would need to remain open to traffic and Non-Motorised Users (NMUs) during the construction of the main Scheme and southern tie in junction. Once the Scheme is complete and vehicular traffic is using the new viaduct, the old route will be de-trunked and the section south of Afon Dyfi will be reduced in width to give it a character more in keeping with that of a rural lane than of a trunk road.

2.2.71 This would comprise partly removing the eastern most (southbound) lane of the road. Where the old route is along its original alignment, the existing ditch along its eastern side would be widened to the west, to avoid damage to the roots of the existing hedgerow. The ditch side slope would encroach into the existing southbound carriageway of the A487.

2.2.72 The ditch channel would be re-profiled, culverted under the existing A487 road and extended to outfall into the Afon Dyfi just downstream of the Pont-ar-Ddyfi.

2.2.73 At the southern end of the Scheme the junction between the old A487 route and the new A487 would need to be on a new re-aligned section of road extending up to approximately 60m further west of the existing road. The southern end of this realigned section would need to be on embankment rising up to meet the new A487 opposite the Dyfi Eco Park. The junction with the new A487 would include kerb level changes and materials to give this junction the character of a minor lane or agricultural access, and appropriate no through route signage.

2.2.74 The existing A487/A493 junction immediately north of Pont-ar-Ddyfi would be reconfigured to provide an A493 through route. A line of fixed and lockable de-mountable bollards would be installed at both northern and southern ends of Pont-ar-Ddyfi to control unauthorised vehicular access to the bridge whilst allowing free movement of pedestrian and NMUs.

Re-connecting the Landscape

2.2.75 The roadside embankments and cuttings within the Scheme have been designed to have smoothed 'S' shaped profiles with a maximum gradient of 1:2 so as to tie as naturally as possible into the surrounding landscape. The footprint of embankments need to be minimised to reduce impact on flooding, so shallower slopes would not be possible. The slopes will be formed of low-

fertility site-won subsoil in order to establish a low maintenance species rich grass sward.

2.2.76 Hedgerows and field boundaries severed by the Scheme, and that run beneath the viaduct, would be reconnected with stock proof fence lines to maintain field boundaries and bat flight routes. New hedges would be planted as described at Chapter 8 of this report and shown on the environmental Masterplans in Volume 2 Figure 8.9.

2.2.77 The proposed drainage channel running along the existing A487 across the floodplain will be constructed to encroach into the eastern carriageway of the adjacent A487. This means that the existing hedgerow to the east of the ditch would not be affected and can be protected and retained. If for any unforeseen reason any lengths of this drain do necessitate removal of the adjacent hedgerow, hedgerow translocation would be carried out. In this case, the hedgerows would only be moved the minimum distance east required to allow for construction of the drainage channel.

2.2.78 There will be a temporary construction access track/haul road on both sides of the viaduct that will be made from stone and will be reinstated to grass. The alignment is shown at Figure 8.9. The Temporary haul road of compacted gravel would be constructed to finish 200mm below prevailing ground levels. Following the construction phase, the haul road would be left in situ, regraded as necessary and covered with a 200mm layer of topsoil, cultivated and seeded with a meadow grass mix to reinstate the grassland at grade with the existing. This route would then be used as a permanent pasture with a 5m easement retained either side of the viaduct kept clear of obstacles for maintenance access

Road Drainage and the Water Environment

2.2.79 It is proposed that the following measures will be implemented as part of the design to mitigate potential geomorphology impacts on the Afon Dyfi:

- To reduce risk to the integrity of the northern (right) bank at the location of the new abutment, tree clearance will be minimised. Where tree removal is required, where possible, stumps will be left in place to continue to provide cohesion to the bank material and buffering from flows. Compensatory planting of appropriate woody species should be carried out to further reduce the risk of bank erosion. Hard slope surfacing would be avoided;
- The pile cap of the pier closest to the southern riverbank will extend into the active, unvegetated area of the gravel bar. This area is not inundated during average flows and is therefore considered to be outside of the river channel but

within the wider floodplain. The size of the pile cap would be minimised to the greatest extent possible and the top of the cap buried to beneath the minimum average flow level (6.576mAOD). This would allow the reinstated gravel bar to continue functioning naturally with natural exchange of bed material. It is also aimed at eliminating the need for hard revetment and helping preserve the aesthetics of the site over the long term;

- Scouring around the piers on the floodplain is likely to be less severe. Bioengineering methods would be incorporated into the detailed design stage to prevent the formation and growth of scour holes on the floodplain. Similar measures would be used around the southern abutment. Pre-established coir matting would be considered as an alternative to seeding in order to provide immediate protection and aid in rapid vegetation establishment;
- These areas would be monitored to ensure establishment and continued performance of the bioengineering in erosion and scour protection;
- The new ditch outfall to the Afon Dyfi downstream of the Pont-ar-Dyfi would be designed in such a way as to manage the risk of bank erosion using softer engineering solutions or bioengineering rather than hard revetment.

2.2.80 In addition the drainage scheme would incorporate mitigation measures to prevent contaminated spills from accidentally entering the watercourses, outside of flood flows in the Afon Dyfi. These will include shut off containment valves at the outfall to the north of the Dyfi, at the Southern Drainage Ditch and at the new ditch outfall to the Afon Dyfi. The northern and new ditch outfalls will also be fitted with petrol interceptors which will be incorporated in to the Scheme.

2.3 Construction Strategy

Methodology and overview

2.3.1 This section details the main construction activities that are expected to take place during advance/preparatory works and construction of the proposed single carriageway, junctions, bridge and viaduct, and proposed flood bunds (collectively the Scheme).

2.3.2 For the purpose of this ES, basic assumptions have been made on construction activities based upon the team's experience; however, the detailed strategy would be developed in line with detailed design.

Viaduct Construction Method

2.3.3 The initial section of the viaduct (Ch. 0+220 to Ch. 0+380) would be crane erected due to the complexity of the structural layout of this widened and curved section

2.3.4 The viaduct beyond Ch. 0+380 has a constant horizontal and vertical alignment. Therefore to minimise the works in the floodplain the intention is to construct the majority of the viaduct in sections, on a 20m wide temporary platform/embankment between Ch. 0+300 and Ch. 0+380, and 'push launch' it across the floodplain.

2.3.5 Push launching will involve construction using the 'incremental launching method' (ILM). This ILM is considered the most economical and safe procedure for constructing bridges and has been proposed for the viaduct as it offers significant advantages in this location. Appendix 2.1 in Volume 3 provides an illustration of the push launch construction sequence.

2.3.6 By working from the south and pushing the structure from one location access arrangements for delivery of materials and equipment becomes easier and steel fabrication and welding operations are more efficient providing increased quality control. It is also proposed to use precast concrete units to construct the bridge deck. It is proposed to construct one 34 metre span of ladder beam bridge deck and place and fix precast concrete deck slab units on the steelwork prior to jacking the structure forward.

2.3.7 Hydraulic jacks will be used to "push" the bridge deck to the first pier creating the first span and making way for the erection of the next bridge deck span. The process is then repeated until the whole push launched structure is completed.

Programme

2.3.8 The start date for the construction phase would depend upon a number of factors including the successful completion of the Statutory Processes into making the Orders to construct the Scheme, the availability of Welsh Government funding and the formal signing of the contract to construct the works. It is currently anticipated that the construction activities for the Scheme would commence in 2017/2018 and this has informed this Environmental Statement.

2.3.9 For the purpose of this ES the Scheme Opening and Design Years have been taken as 2019 and 2034 respectively.

2.3.10 The construction programme would be finalised by the main contractor in advance of the works. The duration of the works is currently estimated to require a construction period of 25 months, including advance works/vegetation clearance/utility diversions,

archaeological testing and de-trunking of the existing road. Following construction there will be a 36 month environmental aftercare maintenance and monitoring period.

Sequence of Construction Activities

2.3.11 The construction activities for the Scheme would be typical of a major road scheme and consist of the following:

- Advance/preparatory works likely to be undertaken prior to construction;
- Site establishment and vegetation clearance;
- Main construction works involved in the scheme drainage, earthworks, including the flood alleviation infrastructure;
- Main viaduct and bridge structure construction;
- Road works and other associated structures; and
- Final tie-ins and soft landscape works.

2.3.12 Advance/preparatory would be undertaken at the start of the project. The initial phase of earthworks would be the excavation associated with the northern junction, allowing a realignment of the A487, and generating material for the southern approach embankment and the flood bunds, refer to Figure 2.1 Scheme General Arrangement.

2.3.13 The southern approach embankment would then be constructed and the viaduct piles installed to form the structural piers. The temporary platform/embankment to allow the erection and push launch of the main viaduct would also be formed. Appendix 2.1 in Volume 3 provides an illustration of the push launch construction sequence.

2.3.14 The floodplain viaduct would then be constructed and launched from the southern end of the Scheme. The main river bridge spans would then be constructed from both the north and south of the river.

Key Construction Activities

2.3.15 ***Advance/Preparatory Works*** - There are a number of services that are impacted by the Scheme, including electricity, telecoms, gas pipeline and water supplies. During the early phases of the construction works, and potentially before any major construction works the diversion/protection of the various utilities would be undertaken where possible. Other diversions works would follow aligned with construction phasing. Pre-construction ecological checks would be undertaken prior to site clearance including the treatment of the invasive plant species such as Japanese Knotweed in agreement with NRW and the implementation of the

Invasive Species Management Plan. The disposal of Spoil contaminated with invasive species will be achieved by wrapping and burying it within the proposed works in accordance with Environment Agency Guidance. In the unlikely event that burial is not possible the spoil will be disposed of at a licenced tip. There is no orchestrated spaying programme proposed. For detailed information on how invasive species will be managed refer to the Invasive Species Management Plan in Volume 3 Appendix 17.1 Pre-CEMP Annex C;

2.3.16 ***Archaeological Investigations*** - Advanced archaeological surveys and watching briefs would be undertaken in the early stages of the project, through a supervised topsoil strip and/or trial trenching;

2.3.17 ***Site Clearance*** - The initial activities following site establishment would be fencing (including ecological fencing as required), site clearance, the installation of pre-earthworks drainage and topsoil strip under archaeological supervision where identified as required;

2.3.18 ***Earthworks*** - Following the topsoil strip the major earthworks can begin. Where possible earthworks material would be derived from on-site (i.e. re-use of onsite cut for fill sections), although some higher quality material may be imported to form the base for the carriageway (capping/sub-base) and backfill to the proposed structures;

2.3.19 ***Drainage*** - Pollution prevention measures would be implemented to ensure that land and rivers are not contaminated. A Surface Water Management Plan would be developed and temporary settlement ponds and cut-off ditches would be designed into the works and installed before the bulk earthworks and piling were undertaken;

2.3.20 ***Floodplain Viaduct*** - The structural works for the viaduct would commence with the installation of a temporary piling platform/ haul road to allow the installation of the piles, followed by the pier construction. The piling and pier construction would be undertaken south to north. Once the initial piles and piers are complete the focus of the bridge works would be on the erection and push launch of the viaduct deck from the southern end. The pre-cast bridge deck units would be installed prior to the push launch with stitching of the constructions joints completed after the push launch. The southern spans on the right hand bend would then be lifted in from ground level, with the final two sections constructed following the completion of the push launch. Appendix 2.1 in Volume 3 provides an illustration of the push launch construction sequence. The push launch method has the following advantages:

- Minimise disturbance to the surroundings including the environmentally sensitive areas;
- A smaller, but more concentrated area required for the superstructure assembly;
- Increased worker safety since all erection work is performed at a lower elevation (reducing working at height);
- Reduce risk to construction programme by avoiding working in a floodplain;
- Reduce the risk of potential environmental incident – silt pollution/fuel spills etc.; and
- Improved quality control.

2.3.21 ***Main River Bridge*** - The main river bridge works would be undertaken in parallel with the viaduct works, starting with the installation of the piles associated with the northern abutment. The piers at the southern end of the main span and back spans would be constructed in parallel with the viaduct piles/piers. Once complete the main span beams would be lifted into place from the north of the river, with back span beams lifted in from a temporary platform on the south of the river. The lifting of the bridge beams would be followed by completion of the bridge deck and installation of the parapets; and

2.3.22 ***Highways and Surfacing Works*** - On completion of the viaduct and bridge the final highways works, surfacing, barrier, etc. would be installed and the road opened. At which point other works associated with the de-trunking would be completed.

Site Working Areas, Working Hours and Construction Equipment

2.3.23 The location of construction and lay-down areas, shown in Volume 2 Figure 2.4, is currently envisaged at the south-eastern end and at the north-eastern end.

2.3.24 Stockpile areas for topsoil would be located outside of the floodplain.

2.3.25 The working day would vary between the seasons. However, it would typically be Monday – Friday 7am to 7pm in the summer months and 7am to 5pm in the winter. Weekend or night work would be required in some instances, typically for works on or adjacent to existing highways. These instances would be kept to a minimum and require agreement with Welsh Government beforehand.

2.3.26 In terms of construction plant and equipment, the site clearance phase of the works is likely to involve use of chainsaws and excavators. The bulk earthworks would be constructed using

articulated dump trucks, excavators up to 35T capacity, dozers and rollers. The new structures would be constructed using cranes, telescopic boom lifts, piling rigs and telescopic forklifts. Task lighting at structure locations during the winter months only, and other locations where required, would also be provided.

Construction Flood Risk Management

2.3.27 A robust procedure would be established for managing the flood risk during the construction phase. During any proposed works the Site Manager will regularly check river levels, via the NRW Flood Monitoring Station, and the three day weather forecast. Any operations within the floodplain will be planned and detailed and take into account the weather conditions and any likely flooding.

2.3.28 All personnel will be made aware of the flooding risk and there will be a comprehensive evacuation procedure for the workforce to secure the works and evacuate the works areas to a place of safety behind the flood bund.

2.3.29 Where there is a risk of flooding all plant and equipment will be moved out of the floodplain to a position of safety behind the flood bund, or a level on the embankment above the flood level. Following a flood event any equipment or temporary works would be checked for integrity prior to commencing works.

Construction Water Management

2.3.30 For the whole of its length, the new section of viaduct crosses the Dyfi Valley floodplain, which contain a number of small watercourses and field ditches which feed into the Afon Dyfi. Where the access/haul roads cross existing ditches, temporary pipes would be installed within the existing ditches early in the construction programme so as to maintain connectivity of the watercourses and to provide temporary plant crossings. The number of pipes installed would vary according to the ditch channel dimensions and the discharge rate.

2.3.31 During construction, surface water runoff would be managed by capture and settlement before being released to the existing ditch system. The runoff would be captured in a bunded area, located along the corridor of construction between the main line embankment and the permanent parallel field ditch/replacement ditch. The bund would be approximately 0.6metre above ground level. The adjacent channel would remain vegetated (i.e. the topsoil would not be stripped).

2.3.32 Due to the minimal longitudinal falls across the Levels, the bunded areas would act as lateral settlement lagoons. Silt fences and settlement weirs would be installed at ditches.

Traffic Management and Construction Routes

2.3.33 The existing A487 road carries vehicles throughout the day and night, however because the majority of the Scheme is being constructed offline, conflict with this traffic would be limited. When work is required online, a series of traffic management measures would be implemented including:

- Early construction of realigned A487 at southern and northern ends to move traffic away from construction works and facilitate construction of bridge;
- Single way working of traffic in each direction maintained at all times; and
- Speed restriction in work areas for the safety of road users and the construction workforce. These restrictions would only be introduced when the works commence and would remain until a specific section was complete.

2.3.34 The existing A487 would serve as the main access to the construction site for construction and workforce movements. All haul routes would be internal and access points to the site would be via the existing A487. It is envisaged that the Scheme could generate up to an average of 15 total construction vehicle trips (to and from site) per day over a duration of 400 days, therefore a total of 6,000 construction movements. The majority of these construction vehicle movements are likely to pass through Machynlleth from the south (either A489 or A487).

Construction Environmental Phasing

2.3.35 Similar to the design features integrated into the operational Scheme described above, the environment team have influenced the design and management of the construction phase to ensure disruption to the sensitive environment as a result of the construction phase is minimised. These measures are not considered as mitigation, but as an integral part of the construction phase. They are described below.

- the location, number and layout of construction working areas, laydown areas, haul roads,
- the approach to push launching of the viaduct section of the scheme (paragraph 2.2.25) ; and
- the overall phasing of the works,

2.3.36 Any disruption is to be controlled and managed using good construction practice as set out in the Construction Environmental Management Plan (CEMP), as described below and detailed in Chapter 17 of this ES. A pre-CEMP is included in Volume 3 Appendix 17.1.

Site set-up, clearance and reinstatement

2.3.37 Fencing around working areas would be standard 2m high Heras-type security fencing, but fitted with an olive green netting to minimise its visual prominence and to heavily filter views into the low level construction activities and stockpiles within the working areas.

2.3.38 Topsoil displaced by the Scheme or temporarily removed to accommodate the construction works would be handled and stored on site in accordance with *BS 3882:2015 Specification for topsoil, Annex A Recommendations for stripping, handling and preparing topsoil.*

2.3.39 Once construction is complete, hard standings and elements associated with working areas, haul roads crane pads or other temporary installations would be completely removed from site and the ground made good, topsoil replaced, cultivated and re-seeded with an appropriate lowland meadow grass mix to reinstate its existing use and condition.

Vegetation clearance

2.3.40 Vegetation clearance would be undertaken with great care to remove the minimum necessary and to protect and retain adjacent vegetation. Trees to be retained would be protected with fencing in accordance with British Standard BS 5837:2012 Trees in relation to design, demolition and construction and as shown on the Tree Protection Plan (TPP) in the arboricultural report at Volume 3 Appendix 2.2 of this report. These works would be undertaken outside of the bird nesting season (March to October inclusive) and would be supervised by a qualified Environmental Clerk of Works.

Lighting

2.3.41 Site lighting would be required during working hours when dark and for general security during the construction phase. SNP is designated as a Dark Skies Reserve as described in Chapter 8 of this report. The Scheme lies within this designation and entirely within an area classified as Intrinsically Dark (Environmental Zone E1, Institute of Lighting Professionals). There would be two types of lighting required on site during the construction phase, construction task lighting and security lighting.

2.3.42 Security lighting would be limited to construction working areas and lay down areas where plant and materials are left overnight. This would be minimised.

2.3.43 Construction task lighting would be limited to the winter months when it is dark for a limited period at the beginning or end of the working day. This would be intermittent and would be dynamic

and change location and intensity as the construction activities demand. There would be restrictions on working hours in the vicinity of the Afon Dyfi and northern extent of the Scheme to avoid night working thus avoid the need for any task lighting along the dark river corridor.

2.3.44 Where it is necessary to use security and construction task lighting, this would be low level and fully cut-off or "fully shielded" in order to minimise adverse light pollution effects on the protected night time environment.

Construction Environmental Management Plan

2.3.45 Environmental management during the construction of the Scheme is detailed in Chapter 17 of this ES and a pre-CEMP is included in Volume 3 Appendix 17.1.

2.4 Post Construction Activities

2.4.1 The Contractor would carry out environmental monitoring, aftercare and maintenance for the three year Aftercare Period following completion of the works. This would be undertaken in accordance with the agreed Environmental, Landscape and Ecology, Monitoring, Aftercare and Management Plan (refer to Chapter 17 - Environmental Management for details).

2.4.2 During the Environmental Aftercare Period, the Contractor would review the effectiveness of the environmental mitigation against their intended function as identified within the ES and would provide any remedial actions if required.

2.4.3 At the completion of this three year Environmental Aftercare Period, the management of the soft estate and environmental mitigation measures would be transferred to the North and Mid Wales Trunk Road Agent (NMWTRA). The Contractor would prepare a ten year Handover Environmental Management Plan (HEMP), which would set out on-going management and monitoring actions (refer to Chapter 17 - Environmental Management for details).