Rivers Parrett and Tone Dredge – Bank Profile Restoration

Environmental Statement Addendum

July 2014

We are the Environment Agency. We protect and improve the environment and make it a better place for people and wildlife.

We operate at the place where environmental change has its greatest impact on people's lives. We reduce the risks to people and properties from flooding; make sure there is enough water for people and wildlife; protect and improve air, land and water quality and apply the environmental standards within which industry can operate.

Acting to reduce climate change and helping people and wildlife adapt to its consequences are at the heart of all that we do.

We cannot do this alone. We work closely with a wide range of partners including government, business, local authorities, other agencies, civil society groups and the communities we serve.

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Quality Assurance

Project name	*Rivers Parrett and Tone Dredge – Bank Profile Restoration*
Project 1B1S reference	
Date	*July 2014*
Version number	*1*
Author	Galliford Black & Veatch

Approvals

Name	*Signature*	*Title*	*Date*	*Version*

EIA Quality Mark

This Environmental Statement, and the Environmental Impact Assessment (EIA) carried out to identify the significant environmental effects of the proposed development, was undertaken in line with the EIA Quality Mark Commitments.

The EIA Quality Mark is a voluntary scheme, operated by the Institute of Environmental Management and Assessment (IEMA), through which EIA activity is independently reviewed, on an annual basis, to ensure it delivers excellence in the following areas:

EIA Management

EIA Team Capabilities

EIA Regulatory Compliance

EIA Context & Influence

EIA Content

EIA Presentation

Improving EIA practice

To find out more about the EIA Quality Mark please visit:

www.iema.net/qmark This Environmental Statement, and the Environmental Impact

Rivers Parrett and Tone Dredge – Bank Profile Restoration

Environmental Statement Addendum

Non-Technical Summary

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Non-Technical Summary

Introduction

This Non-Technical Summary (NTS) describes the findings of an Environmental Impact Assessment (EIA) into the likely significant effects of the dredging of a section of the Rivers Parrett and Tone, including the construction of three stockpiles to store dredged material for up to a year and bank profile restoration. It provides a description of the existing environment, the likely environmental impacts and the measures which we (the Environment Agency) will implement to avoid or reduce further impact. This NTS is available to view both as a standalone document, and as part of the Environmental Statement (ES) and two subsequent addendums which together provide a comprehensive record of the EIA.

In February 2014 it was initially proposed that dredged material would be temporarily stockpiled for up to a month before being ploughed into land for agricultural benefit and this was assessed for the original EIA. In April 2014 however, it became apparent that dredged materials could potentially be used for future flood risk management works. This would require the construction of three larger stockpiles to store material for up to one year whilst such proposals were developed. Since this change was considered significantly different to the original proposals, an Addendum to the original ES was carried out to assess subsequent changes to the environmental impacts, and submitted as part of planning applications submitted to Taunton Deane Borough Council.

In July 2014, another addendum was produced to document the potential for any further environmental impacts associated with plans to restore bank profiles using dredged material along sections of the River Parrett. This NTS summarises the findings of the EIA and both subsequent addendums.

The locations for the proposed dredging works are shown in Figure 1 and the three proposed stockpile locations are shown on Figure 2. Figure 3 shows the proposed locations of bank profile restoration works.

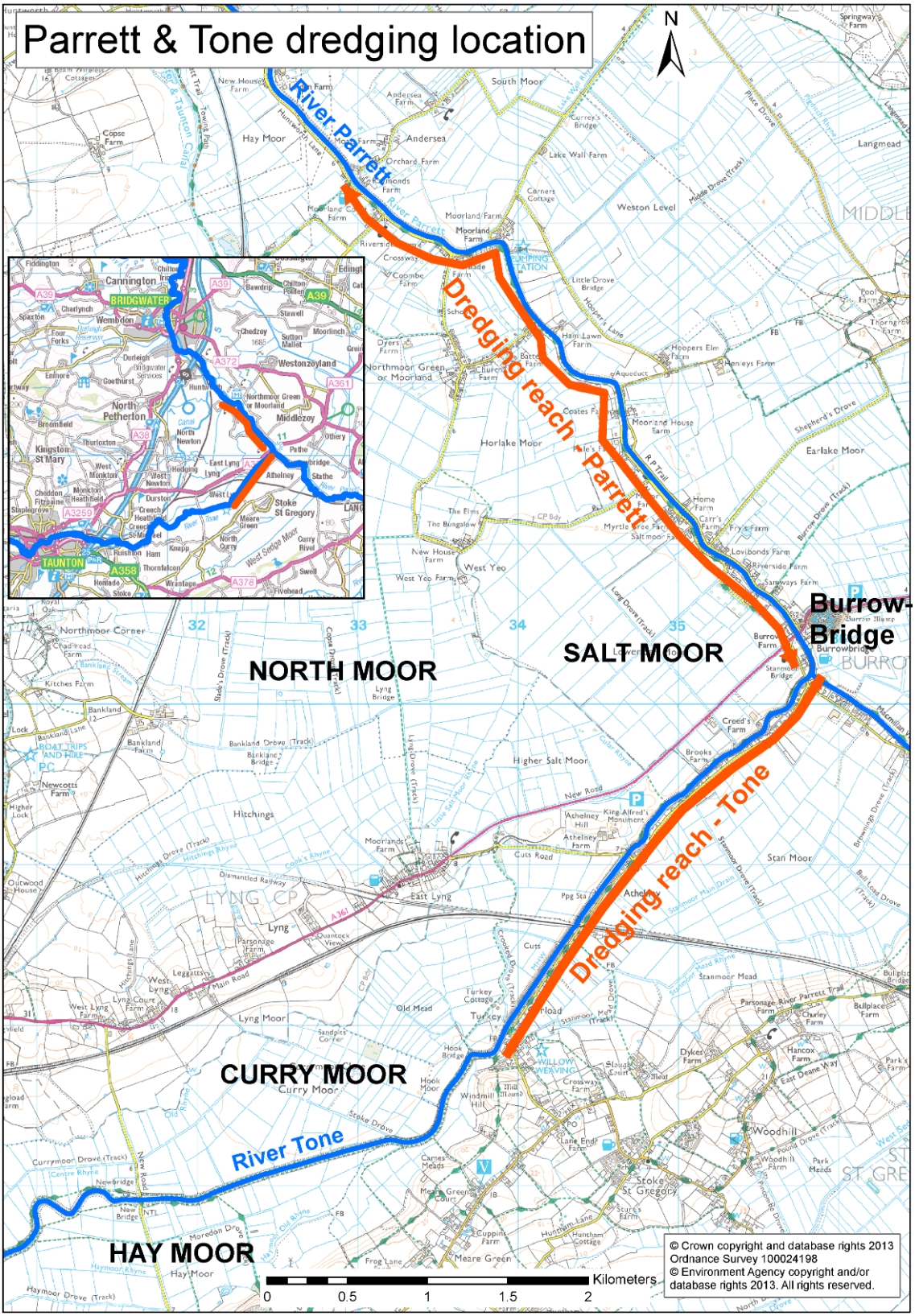

Figure 1: Dredging Location Plan

Background

Extended wet periods, rather than intense but short storms, are most likely to lead to problem flooding on the Levels and Moors (see Plate 1 below).

The prolonged wet weather and subsequent flooding began in mid-December 2013. Within the Levels and Moors over 100 properties were flooded internally and 11,000 hectares of agricultural land were under water. Over 200 homes in several communities, such as Muchelney, Oath and Thorney, were cut off, some for more than 2 months. There was major disruption to transport; with several A-roads blocked as well as strategic road and rail routes into the South West peninsula.

This project will improve river capacity in the Parrett and Tone rivers, which in combination with a network of ditches, rhynes and pumping stations drain a large part of the Somerset Levels and Moors. The rivers are tidally influenced and have a very shallow gradient which makes them particularly prone to siltation, primarily from the sea but also from the surrounding land. Through dredging, we will increase the flow capacity along approximately 8km of the Lower River Tone below Hook Bridge and the River Parrett from the confluence of the Tone to North Moor Pumping Station.

By increasing the channel capacity of the River Tone and River Parrett through a one-off dredge we will reduce the risk of flooding to over 100 properties, the road and rail network, and relieve existing flood frequency, extent and duration to land on Curry Moor, Hay Moor, North Moor and Salt Moor (which include both internationally and nationally designated nature conservation sites) (see Figure 4).

The bank restoration element will be delivered using dredged material in tandem with a series of isolated defence improvements within the same reach to help reduce the frequency, duration and extent of flooding for Curry Moor, Hay Moor and North Moor. The environmental impact of these isolated defence improvements are not covered in this report.

Plate 1: Flooding During the Winter of 2013/14

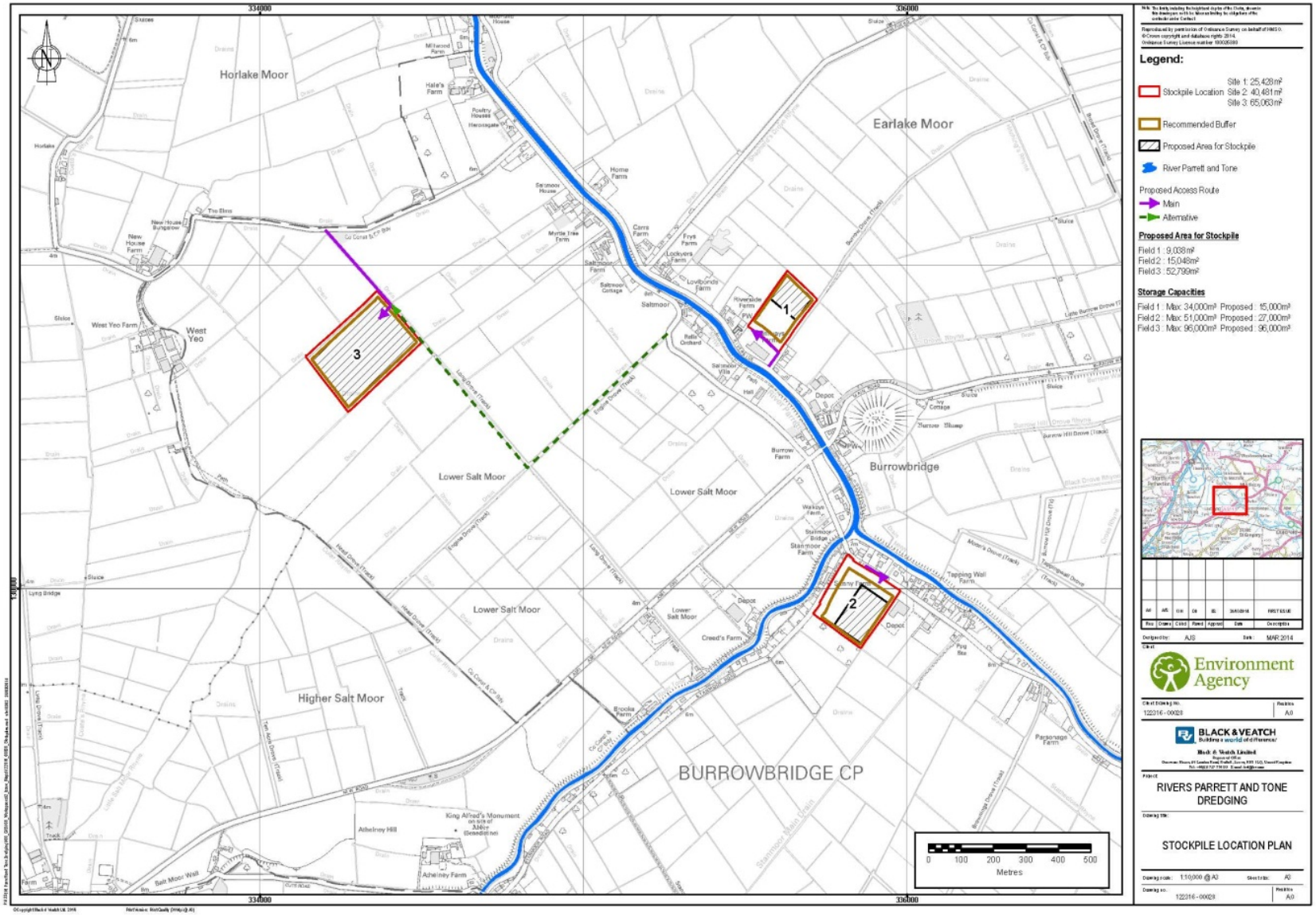

Figure 2: Proposed Stockpile Locations

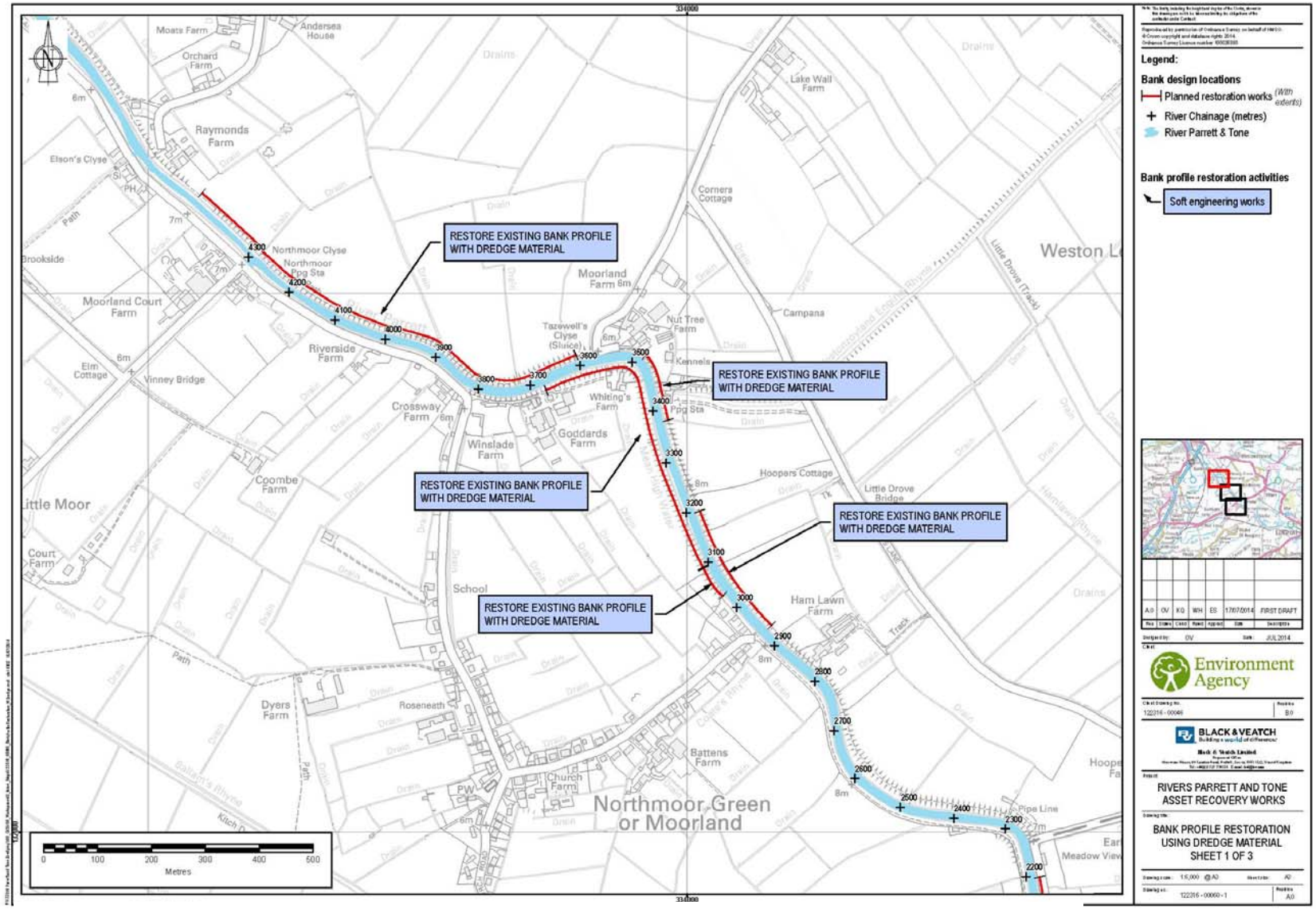

Figure 3: Proposed Locations of Bank Profile Restoration

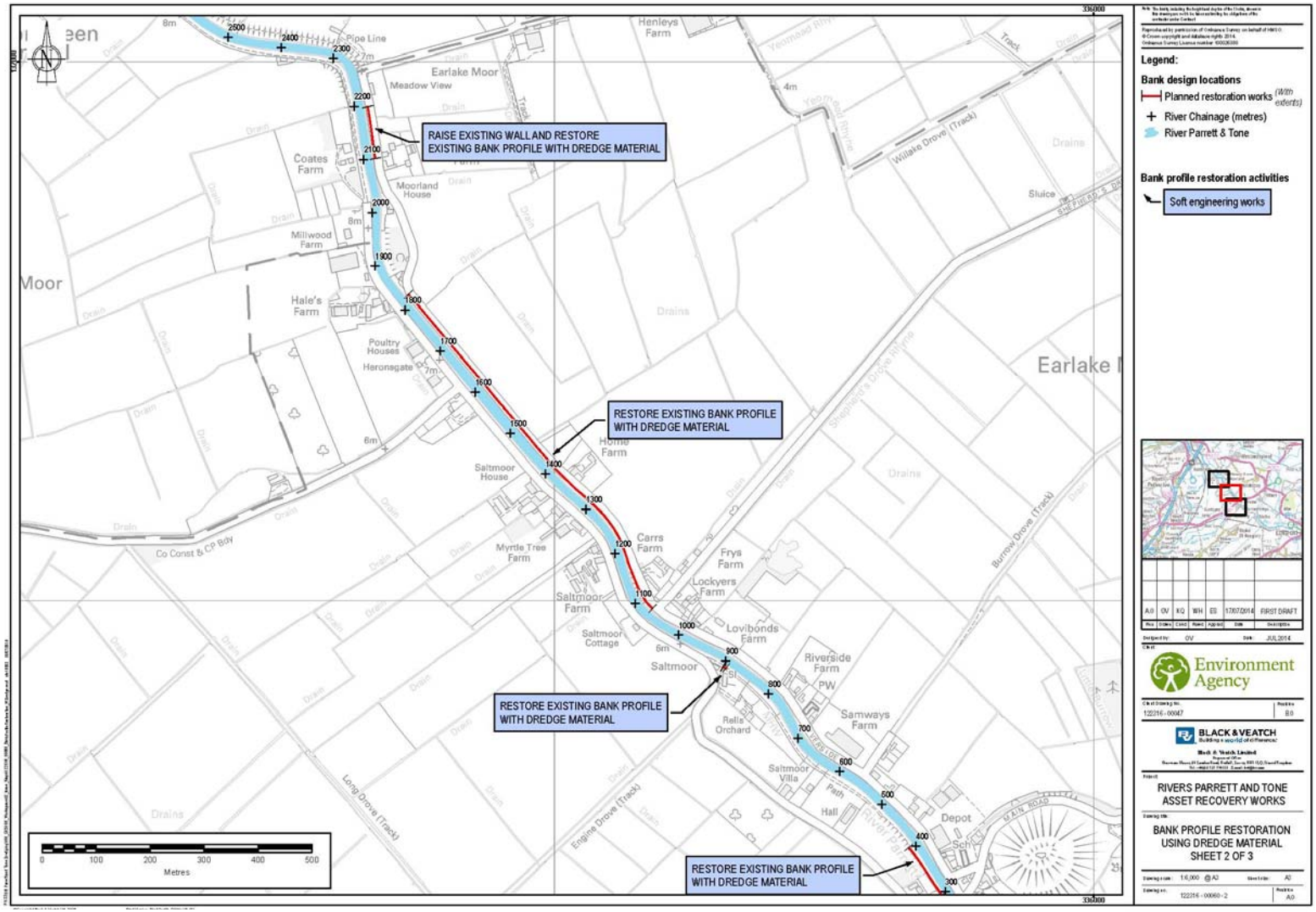

Figure 3b: Proposed Locations of Bank Profile Restoration

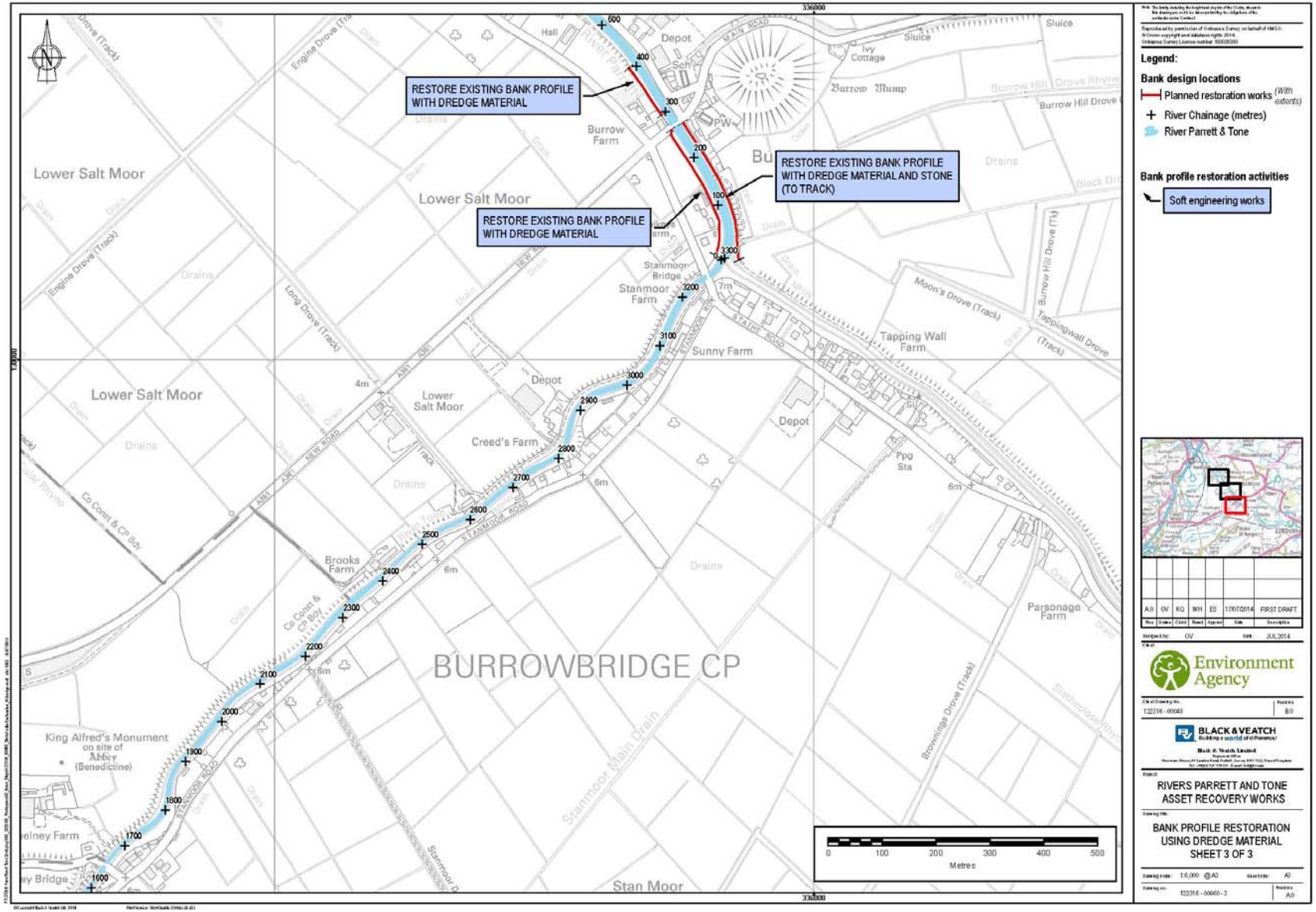

Figure 3c: Proposed Locations of Bank Profile Restoration

The Proposed Scheme

The aim of the project is to improve the channel capacity of the River Tone and the River Parrett, from downstream of Hook Bridge to North Moor Pumping Station, in order to reduce the frequency and duration of flood events, their impact and associated disruption.

We anticipate that the dredging, stockpiling and bank profile restoration works will occur between April and October 2014. Main decommissioning of the stockpiles is anticipated to be from April to October 2015. The benefits of the dredge scheme without maintenance are likely to last approximately 5 years before the river naturally re-silts. The benefits of the bank restoration will last for longer than 10 years without maintenance.

Method of Works

In total, approximately 235,000m^3 of sediment will be removed from the river channel using a combination of mechanical plant; situated on the banks of the rivers or from pontoons where necessary.

Plate 2: Dredged material spread on farmland.

Some of the dredged material will be used to restore sections of the adjacent banks of the River Parrett to approximately their 1960s profile. This will involve raising the embankments typically by 200-600mm. Additional dredged material that is tested and found to be suitable for future flood risk management works or as a soil improver will be stockpiled for up to a year in three agricultural fields (see Figure 2) (the main stockpiles).

The remainder of the dredged material will be stockpiled temporarily on the adjacent bank and, after testing for potential contamination, will either be moved by pipe or vehicles to where it can be spread or ploughed into farmland (see Plates 2 and 3). If the material is not suitable for spreading on land, it will be appropriately disposed of at a controlled waste disposal site.

Plate 3: Dredged material waiting to be spread.

Sites considered environmentally sensitive (such as for nature conservation, drainage, or archaeology) will be avoided. The majority of the land area required for spreading will be found within 1.5km of the dredging areas however a small proportion of the material may need to be spread on land up to 8km away.

Up to 8 separate dredging teams (using mechanical plant such as that shown in Plates 4 and 5) will be employed simultaneously during this period, each team will have an assigned 'Environmental Clerk of Works' to monitor the implementation of required environmental actions. Four additional construction teams will be required for bank profile restoration. The bank profile restoration teams will follow on from the dredge teams so there will be no overlap in construction activity in any one location. The target date for completion of the bank profile restoration works is by the end of October 2014. Natural England will be consulted prior to any works beyond this date to review this risk to over-wintering birds.

Plate 4: Large long-reach excavator.

Plate 5: Amphibious excavator.

Two distinct construction methods will be used to restore the profile of the banks with the dredged material:

- Minor bank profile restoration will involve transporting dredge material to the flood bank in agricultural trailers, tipping (if space available) or unloading dredge material using an excavator onto the bank and then carrying out informal compaction of the bank by tracking over with the excavator.
- Engineered rebuilding of the embankment will require stripping/ cutting back the embankment, cutting a bench into the embankment, placing dredge material and compacting/re-forming with formal compaction plant.

Alternative Options Considered

This dredging project is an essential component of the 'Somerset Levels and Moors Flood Action Plan 2014 - A 20 year plan for a sustainable future' currently under development and led by Somerset County Council (commonly referred to as the '6 week plan'). This dredging project is one of several investments required to reduce the future frequency and duration of floods across the Levels and Moors.

The proposed Parrett and Tone dredge is a standalone component of the Plan and in tandem with other interventions will reduce the frequency, duration and extent of flooding for Curry Moor, Hay Moor and North Moor.

Within this context, the alternatives considered as part of this project related to:

a. The location of the dredging.
b. The methods employed to undertake the dredge.
c. Management, reuse and disposal of dredged silt.

The preferred dredging location was chosen for the following reasons:

- The 8km length has accumulated the greatest build-up of silt since the 1960s Tone Valley Scheme.
- The length chosen will provide the greatest reduction in risk to the railway line, A361 and the 100 properties in Moorland/North Moor.
- Further upstream on the Tone the river cross section remains as it was from the 1960s scheme, so this section does not require dredging.
- Dredging further upstream on the Parrett could increase flows at the confluence, restricting the Tone discharge and thereby causing greater flood risk to Curry Moor and North Moor.
- Further downstream from the section to be dredged on the Parrett, the fluvial capacity is sufficient and does not cause the flooding in North Moor.

The bank profile restoration forms an integral part of the flood recovery works identified in response to the 2014 flooding of the Somerset Moors and Levels. Alternatives considered related to:

a. The location of the bank profile restoration.
b. The extent of the bank profile restoration.
c. Management, reuse and disposal of dredged silt.

The preferred bank profile restoration locations were prioritised under the following criteria:

- Lengths where overtopping directly flooded property or major roads during the 2014 flooding.
- Lengths where overtopping flooded agricultural land or minor roads during the 2014 flooding.
- Lengths where topographic surveys revealed the bank was below design target level and could be restored to this level through the re-use of dredged material.

The three stockpile locations were chosen based on their proximity to dredging sites, land availability, landowner agreement and low environmental sensitivity. Land avoided included:

- Complex or sensitive drainage networks; areas with buried or overhead services.
- Areas designated for nature conservation interest.
- Designated heritage sites (Scheduled Monuments, Listed Buildings and visible features listed on the Somerset Historic Environment record).

Legislative Regime

The proposal to dredge the rivers and restore the profile of sections of the adjacent embankments, as described in the original ES and addendum for bank profile restoration, will be undertaken using our Permitted Development Powers and does not require planning approval. The original EIA was therefore carried out under the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (as amended).

The proposals to temporarily store dredged material on agricultural land, prior to use as a soil improver and construction material, required planning permission. The ES Stockpiles Addendum was therefore carried out under The Town and Country Planning (Environmental Impact Assessment) Regulations 2011 (as amended), and supported the planning applications made to Taunton Deane Borough Council. By June 2014, the three proposed stockpile locations had all been granted planning permission.

The original ES and the ES Addendums include assessments of the likely significant environmental effects of the scheme following a review of existing data and consultation with key statutory bodies.

Various other legislative requirements and policy advice have informed the proposed design and a range of consents are required to deliver the Rivers Parrett and Tone Dredge scheme, including a Water Framework Directive (WFD) compliance assessment, Habitats Regulations Assessment (HRA) and assent for works with the potential to affect a Site of Special Scientific Interest. Following detailed assessments and identification of measures required to prevent or reduce certain impacts, we have concluded that the dredging works will comply with the WFD and will not significantly affect any sites that are designated for nature conservation.

Consultation

We have worked closely with our statutory stakeholders in developing the project plan and have held discussions on the potential effects and issues with the Department for Environment, Food & Rural Affairs (Defra), Natural England, English Heritage, the Marine Management Organisation, Somerset County Council, Taunton Deane Borough Council, Sedgemoor District Council and the Somerset Drainage Boards Consortium. In addition we have:

- Created a Communications Plan and have identified all those we need to engage, consult and inform.
- Published statutory notices in local papers; and released a press statement regarding the dredging project (on the 20th February 2014). These have contained information on how people can view and comment on the ES.
- Circulated briefing notes for local and Parish Councillors, stakeholders and the community to update them on the project and describe the locations where we intend to undertake dredging as well as rough timescales.
- Briefed the Wessex Regional Flood and Coastal Committee and the Somerset Drainage Boards Consortium.

During the 28 day consultation period for the original Environmental Statement we also:

- Met with the National Farmers Union (NFU), Countryside Land and Business Association (CLA) and Farming and Wildlife Advisory Group (FWAG) to brief them on the project.
- Met with local Non-Government Organisations (NGOs); the Somerset Wildlife trust and RSPB as well as holding a drop in session for Councillors.
- Held community engagement events as the project progresses.

Throughout the production of the ES Addendums for the stockpiles and the bank profile restoration works we have continued to consult with local landowners, internal Environment Agency Specialists, Taunton Deane Borough Council, and the local community. We have also met with Natural England to seek their views on the bank profile restoration works. Natural England was satisfied on the clarification that the bank profile restoration works:

1. would not affect the level of Curry Moor spillway;
2. would not affect the ability to flood Southlake Moor to be seasonally flooded for nature conservation; and
3. there would be no impact on the hydrology of West Sedgemoor or King Sedgemoor.

We will meet the Somerset Wildlife Trust and the RSPB to discuss the bank profile restoration proposals prior to commencing on site.

Our Approach

We undertook a scoping activity for the main works, to identify which environmental receptors could potentially be affected by the proposal and therefore needed to be included in the EIA.

The receptors scoped-in are:

- Population
- Land Use
- Flora and Fauna
- Water
- Landscape Character and Visual Amenity
- Historic Environment
- Traffic and Transport

We scoped out of the assessment any environmental receptors that were considered, by expert opinion, not to be significantly affected by the development. The receptors scoped-out are:

- Soils and Geology
- Air Quality
- Waste (effects of waste disposal will be assessed under other receptors)
- Noise and Vibration

The assessment also considered whether the scheme would give rise to cumulative impacts either through physical environmental change or through disruption to other known plans, developments or projects within the vicinity.

The scoping process was subsequently reviewed for production of the ES Addendums to take account of the proposed stockpiling and bank profile restoration works. This resulted in the following receptors being scoped in to the ES Addendums.

The receptors scoped-in to the ES Stockpile Addendum are:

- Population: effects on human beings from disturbance of noise, vibration and odour.
- Flora & Fauna: potential for effects on certain protected and notable species and designated conservation sites.
- Landscape and Visual Amenity: visual changes and effect on local landscape character from siting of stockpiles, and effects on local landscape character resulting from vehicle movements.
- Cultural Heritage: potential for damage to Listed Buildings.
- Traffic & Transport: effects of traffic movements on local roads.

The receptors scoped-in to the ES Bank Profile Restoration Addendum are:

- Population: effects on human beings from changed flood risk.

- Flora & Fauna: potential for effects on certain protected and notable species and designated conservation sites.
- Landscape and Visual Amenity: potential effects on visual amenity as a result of the increased height of the defences.
- Cultural Heritage: potential to cause degradation to historic flood banks and affect the setting of Listed Buildings.

Traffic & Transport was scoped out of the addendum for the bank profile restoration works as the impacts were not considered to be significantly different to those already assessed.

Significant Environmental Impacts and Mitigation

The EIA and ES Addendums were carried out to assess the likely significant effects of the proposed scheme. They have been prepared in accordance with all relevant legislation and follow consultation between our technical specialists and statutory bodies. The information used to compile the ES relies upon desktop studies, records of environmental surveys previously undertaken in the area and local knowledge. Project-specific field surveys could not be undertaken due to the flooding affecting the study area at the time for original EIA; however an ecological survey of the proposed stockpile sites was carried out for production of the ES Stockpile Addendum. Ecological monitoring on site of the ongoing dredging informed the assessment for the ES Bank Profile Restoration Addendum.

The assessment considered how changes to the existing environment caused by the proposed dredge, stockpiling, silt disposal and bank profile restoration would affect each of the environmental parameters scoped into the EIA (see 'Our Approach'). The significance of impact was assessed according to the predicted magnitude of the effects and the sensitivity of the receptors affected.

The EIA also contains a range of mitigation measures that will be implemented to prevent or reduce environmental impacts. These measures have been incorporated in to an Environmental Action Plan and will be delivered during the construction and operation phases. A summary of the main potential impacts and proposed mitigation is given in the following sections.

Human Population

One of the main benefits of the proposed dredging and bank profile restoration is to reduce the net flood risk to residential, commercial and agricultural areas. There is, however, the potential for increased overtopping of South Lake Moor and Aller Moor during extreme tidal events but there would still be an overall benefit to any properties affected. Modelling will be undertaken and the risk of increased overtopping will be reviewed once complete.

There is also the potential to adversely affect commercial glass eel fisheries due to a change in water quality and reduced access to the river during the last month of the licence period (April). The preparation of an Ecological Monitoring Plan to work alongside planned dredging methods will help ensure that this is not significant.

Appropriate measures will be undertaken to ensure that long distance footpaths, such as the Parrett Trail, East Deane Way and Macmillan Way remain open during the works. If it is considered unsafe to keep access along these paths open, temporary diversion routes will be made available and signposted in consultation with Somerset County Council.

A number of HGVs, tractors and trailers will be required to transport the dredged material to the stockpile locations, resulting in potentially significant noise and vibration disturbance to local residents. There is also the potential for an increase in odour levels during construction and decommissioning of the stockpiles. We will, however, work to minimise these impacts through a variety of good construction practices including covering stockpiles with a membrane, screening if required and consultation with the Local Authority Environmental Health Officers. Affected residents will be kept informed of any potential disturbance throughout the works.

Land Use

The reduction in flood risk will bring benefits to agricultural lands, the local road network and railway lines running through the area.

There are Environmental Stewardship schemes in place offering funding to encourage farmers to adopt agricultural practices to safeguard and enhance parts of the country with high landscape, wildlife or historic value. Spreading of the dredged silt in such areas will only be undertaken where this action does not threaten or contravene the individual management and payment options that the landowners are committed to within their stewardship agreements.

Agricultural land will be improved by the application of fertile, nutrient-rich sediment from the river bed, however if the dredged silts are saline in nature this has the potential to reduce its productivity. Checks will be undertaken before it is spread to ensure that its use would be of benefit to the agricultural community and their land. If assessed to contain unacceptable levels of contamination or salinity, the dredged material will be disposed of to a licenced waste disposal site or used for alternative beneficial purposes in accordance with the materials management plan. Any agricultural areas that are used for spreading will require the temporary cessation of farming activities however compensatory agreements will be put in place where required.

Flora and Fauna

There are a number of sites that have been designated for their international, national and local importance to nature conservation close to the proposed dredging works. These include Special Protection Areas, Special Areas of Conservation, Ramsar Sites (all international designations), Sites of Special Scientific Interest and National Nature Reserves (national designations) and Local Wildlife Sites (local designation). These habitats are known to support numerous protected and notable species.

The proposed dredging activities are an integral component of the ‘Somerset Levels and Moors Flood Action Plan 2014’ which is seeking to outline a sustainable future for the area in respect to its community and the natural environment. Acute impacts arising from the direct dredging and bank profile restoration activities to designated sites will be low, but measures will still be implemented to minimise any unavoidable risks, notable mitigation measures will comprise;

- Dredging, stockpiling and bank profile restoration works will be primarily undertaken in summer which avoids impacts to over-wintering birds, but where this isn’t possible no works will take place within 250m of the designated sites in winter.
- No dredged sediment will be spread over designated sites.
- Waterside plants will be ‘stripped and recovered’ to encourage re-growth and re-planted where possible.

- A low flow channel will be left to minimise impact to fish.
- Access to the spreading areas will not be permitted through designated sites.
- Monitoring of habitats and wintering bird populations on Curry Moor for several years after dredging is completed and subsequent review of management practices if required.

The dredging, stockpiling and bank profile restoration works also have the potential to affect protected and notable species, primarily through destruction or disturbance to habitats, or impacts to their main food sources. Mitigation measures will be implemented (in addition to those noted above) to prevent or reduce impacts to water voles, otters, reptiles, badgers, great crested newts, nesting birds, fish and rare invertebrates. These measures are summarised below. This list is not exhaustive and not all measures apply to all protected/notable species, rather it is intended to give a broad overview of the range of specific actions that will be considered at sensitive sites:

- Pre-construction checks and/or surveys to confirm presence of species.
- Detailed mitigation strategies as appropriate, in consultation with Natural England, and other appropriate organisations such as the local wildlife trust.
- Licensed translocation, removal, or exclusion of a species from affected area if necessary.
- Creation of construction buffer zones around protected populations in situ.
- Sensitive removal of any vegetation potentially used as habitat.
- Protection of nesting birds.
- Use sensitive construction techniques to dredge the river and protect any food sources which protected species rely on (e.g. fish).
- Construction of new otter holts will be undertaken as part of the works.
- Dredging and stockpiling activities to be supervised by an ecologist. If species are found works may cease until appropriate action agreed and undertaken.
- Biosecurity measures to prevent the spread of non-native or invasive species.

Post project it is anticipated that many species will experience beneficial effects due to the likelihood that their habitat will flood less frequently or for shorter durations.

A Habitats Regulations Assessment (HRA) has been carried out as a separate, but associated, process to the Environmental Impact Assessment, and updated following proposals to restore the banks. The HRA focuses on effects to the features of the internationally designated sites. The HRA (which required the inclusion of a stage known as 'Appropriate Assessment') concluded that, subject to implementing a monitoring and management programme during and after dredging, the scheme would not have an adverse effect on the 'integrity' of the network of internationally designated sites.

Water

The Parrett and Tone rivers flow from their sources in the southwest and east of the catchment into a large lowland floodplain, before reaching the Bristol Channel through the Parrett Estuary. The lower reaches of the River Parrett and Tone are tidally influenced. This section is called the 'Parrett Transitional' water body in the South West River Basin Management Plan (a document required by the Water Framework Directive).

During dredging there will be some adverse effects to this section of the water body. This includes increased turbidity and subsequent reductions in light and dissolved oxygen levels which can adversely affect fish. In addition, the mobilisation of silt can also cause bacteria such as E Coli to flourish, which when combined with warm temperatures can affect the quality of bathing waters and cause indirect risks to human health. There are no bathing waters within the immediate vicinity of the dredging works but water quality at Burnham-on-Sea approximately 20km downstream has the potential to be affected.

To ensure these impacts are minimised, we will ensure that the water temperature will be closely monitored, and water quality regularly tested for elevated levels. Good construction practice and carefully designed and planned mitigation will be implemented such as favouring dry excavations where possible and stopping works during particularly high river temperatures.

On completion, the rivers will be wider which will draw in more tidal flows (and sediment) into the river, especially along the River Tone which is currently dominated by freshwater flows. This can affect water quality, which in turn can affect temperature and salinity and harm the ecology of the river. These impacts can also be reduced through good working practice including not dredging the full channel width and bed to leave a central low-flow channel.

The scheme, with the mitigation that has been developed, is considered to be compliant with the Water Framework Directive.

Landscape Character and Visual Amenity

Effects on the landscape character or visual amenity of the area will result from the need to temporarily stockpile dredged materials and the presence of additional vehicles in the local landscape. Stockpiles will be 2m in height on average and will be located at least 25m away from private households and 10m away from public access routes (such as the Parrett Trail) in order to minimise visual impacts. Main stockpiles will also be covered and sealed in black sheeting.

The reduction in views as a result of bank profile restoration was considered within the ES Addendum, however, the relatively small scale of the proposed re-profiling coupled with limited existing pre-construction views of the embankments, means that views will not be obstructed to a noticeable extent.

Historic Environment

The Somerset Levels are known to have been used by humans since the Neolithic period. The landscape includes large areas of former marshland and reed bed, reclaimed by people since at least the Roman period. The local historic landscape is comprised of remains of various field systems, trackways, medieval embankments and settlements and its significance reflected through the designation of numerous Scheduled Monuments such as Burrow Mump and an Anglo-Saxon site on Athelney Hill. There are also numerous Listed Buildings and non-designated features listed on the Somerset Historic Environmental Record (HER) and there will inevitably be many other sites that are as yet undiscovered. Consultation has been undertaken with archaeological experts to assess the impact of the works, which will arise primarily during construction.

Good construction practice and the avoidance of topsoil stripping and spreading or stockpiling on known archaeological sites such as Scheduled Monuments and earthworks listed on the Somerset Historic Environment Record will ensure that any potential for impacts is kept to a minimum. Some historic sites exist as crop marks only and, in consultation with

the County Archaeologist, have been considered acceptable for the spreading or stockpiling of dredged material. At the main stockpile sites we will spread a layer of dredged material after the stockpiles have been removed to create a buffer between buried archaeology and future ploughing activities. Engineered rebuilding of the embankments (see 'Method of Works') has the potential to degrade the value of potentially historic river banks. Bank profile restoration works over known historic embankments will be avoided where possible, however, where it cannot be avoided works will be undertaken in consultation with the County Archaeologist and appropriate mitigation will be agreed if necessary.

There will be major benefits to features of historic interest (such as Listed Buildings) due to the improved standard of flood protection provided by the scheme.

Traffic and Transport

There will be a temporary increase in traffic during the works. The intention is to re-use dredged materials as close to their site of extraction as possible, mostly on agricultural land within 1.5km or to restore the existing bank profiles. This will provide localised agricultural benefit and minimise the distance travelled by vehicles. Some spreading sites may be up to 8km from the river and if dredged material is found to be contaminated it will be moved to a suitably licensed waste disposal site. Tractors and trailers will be used to transport the material to main stockpile sites, to other agricultural fields for spreading or to the banks for use in their restoration.

It is possible that some dredged material will be unsuitable for reuse as it may contain contaminants. When contaminants are found to be present, the material will be disposed of as waste, and transferred to an appropriate site by Heavy Goods Vehicles (HGV). This is likely to require transportation of materials over a larger distance.

A Traffic Management Plan will be introduced to consider and minimise these effects on local residents. The plan will include measures such as: agreed delivery/haulage routes; pre-construction condition surveys; delivery schedules to avoid peak traffic times; and, vehicle control measures (such as the use of 'banksmen' and road signage). Through use of the Traffic Management Plan and communication with the local community, the project will seek to reduce adverse effects on the local road network.

Cumulative Impacts

A desk-based review of planning applications and other Environment Agency improvement works within the Study Area has been undertaken. Other known planned developments in the area are small, localised and are not anticipated to give rise to significant effects when considered in combination with the proposed dredging scheme.

Environment Agency asset recovery works along the Rivers Parrett and Tone consist of a combination of 'hard' and 'soft' engineering techniques. The soft engineering constitutes the bank profile restoration works assessed within the ES addendum. The hard engineering works, however, are considered as separate civil engineering works, but will be undertaken over a broadly similar timescale to the dredging and bank profile restoration works. Hard engineering works will typically involve a combination of raising walls, installing and raising piles with reinforced concrete caps and construction of new hard defences. Exact details of these works are currently unknown, but their construction will take into account the potential impacts associated with interaction with the dredging and associated works.

Our assessment of changes to flood risk takes into account bank profile restoration for both hard and soft defences along the River Parrett. Additional minor capital works on the Tone,

between Hook Bridge and the confluence with the Parrett, would not have any further impact on the hydrology of Curry Moor.

The full extent of repair works required to surrounding infrastructure and services is still currently unknown. It is anticipated however that repairs by various parties such as the Local Authorities, Canal and Rivers Trust, Highways Agency and Network Rail will be required within the locality. As details of such work become clearer they will be considered for cumulative impact and appropriate mitigation measures developed where necessary.

Summary

Overall, the Environmental Statement has concluded that with appropriate mitigation and with good site management in place, it will be possible to avoid significant permanent negative environmental impacts resulting from the works. There will however, be some short and medium term adverse impacts. There will also be a significant temporary beneficial effect on flood risk to residential housing, commercial structures, agricultural land, listed buildings and transport links in the area. The main impacts have been highlighted in this NTS and are described in detail within the ES and subsequent addendums.

Scheme Progress and Next Steps

The consultation period for the original ES is now over and no objections were received. The comments received were considered during the detailed development of the main dredging works and correspondence was maintained with the respondents. In March 2014 we advertised a notice of our intention to proceed with the works and dredging commenced on site in April 2014.

The ES Addendum for the stockpiles was submitted to Taunton Deane Borough Council to support the three planning applications. Planning consent for all three sites was granted by June 2014 at the end of a public consultation period.

Bank profile restoration works are considered to fall under the Environment Agency's Permitted Development rights and therefore additional planning consent is not required. The ES Bank Profile Restoration Addendum will be advertised. We will review any comments received and, taking into account of due process for dealing with objections, bank profile restoration works will then commence imminently following this consultation period.

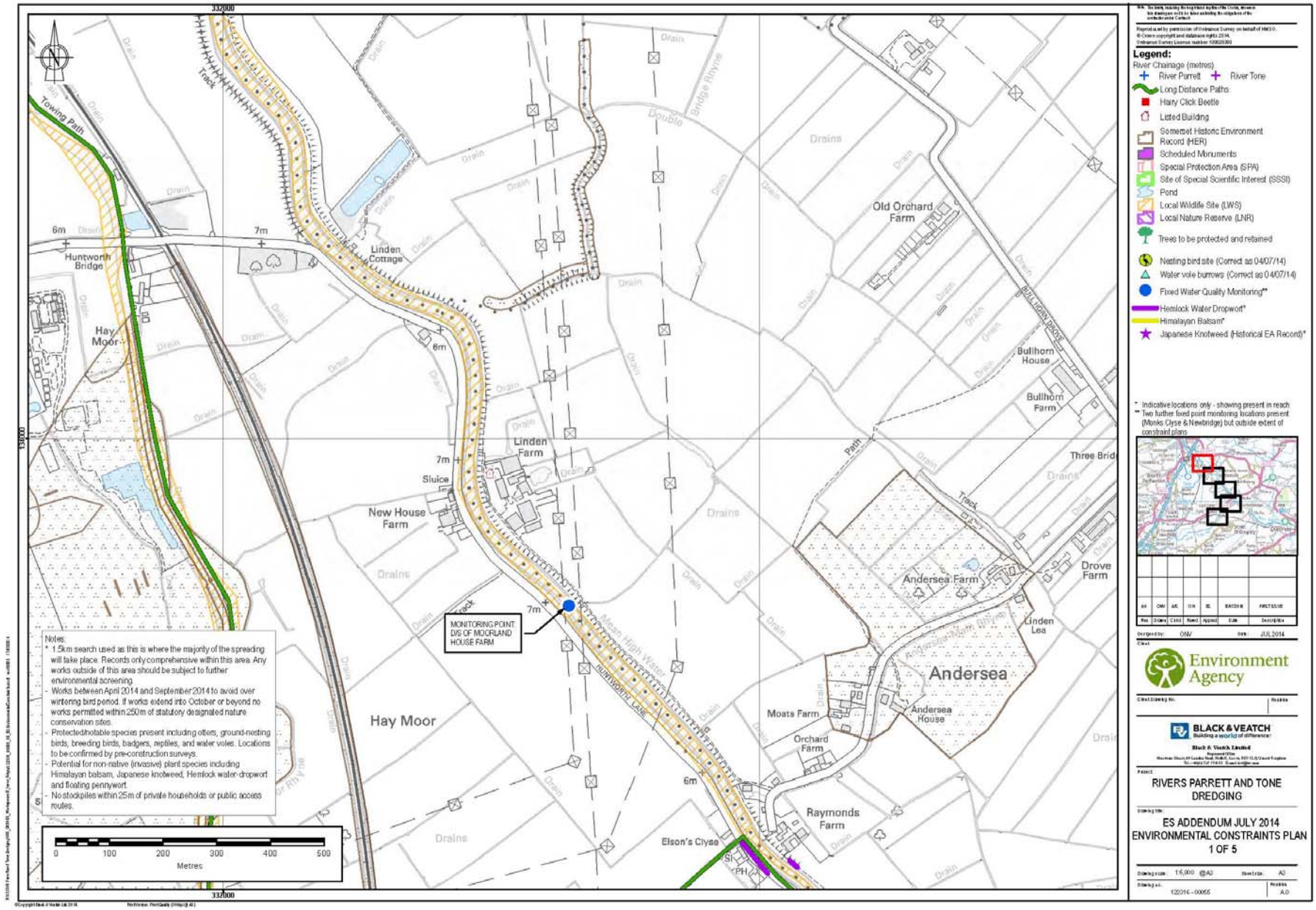

Figure 4: Environmental Constraints Plan

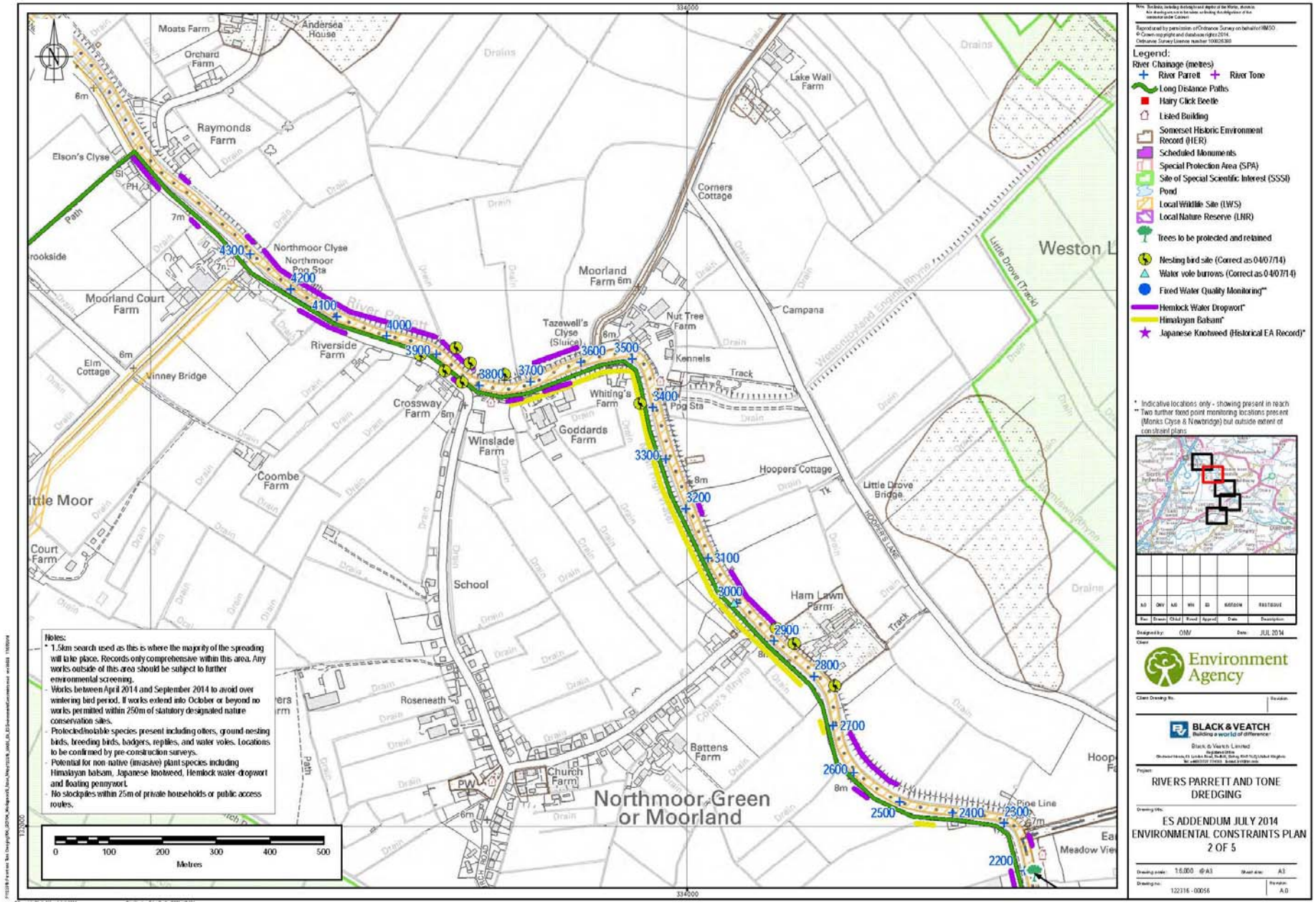

Figure 4a: Environmental Constraints Plan

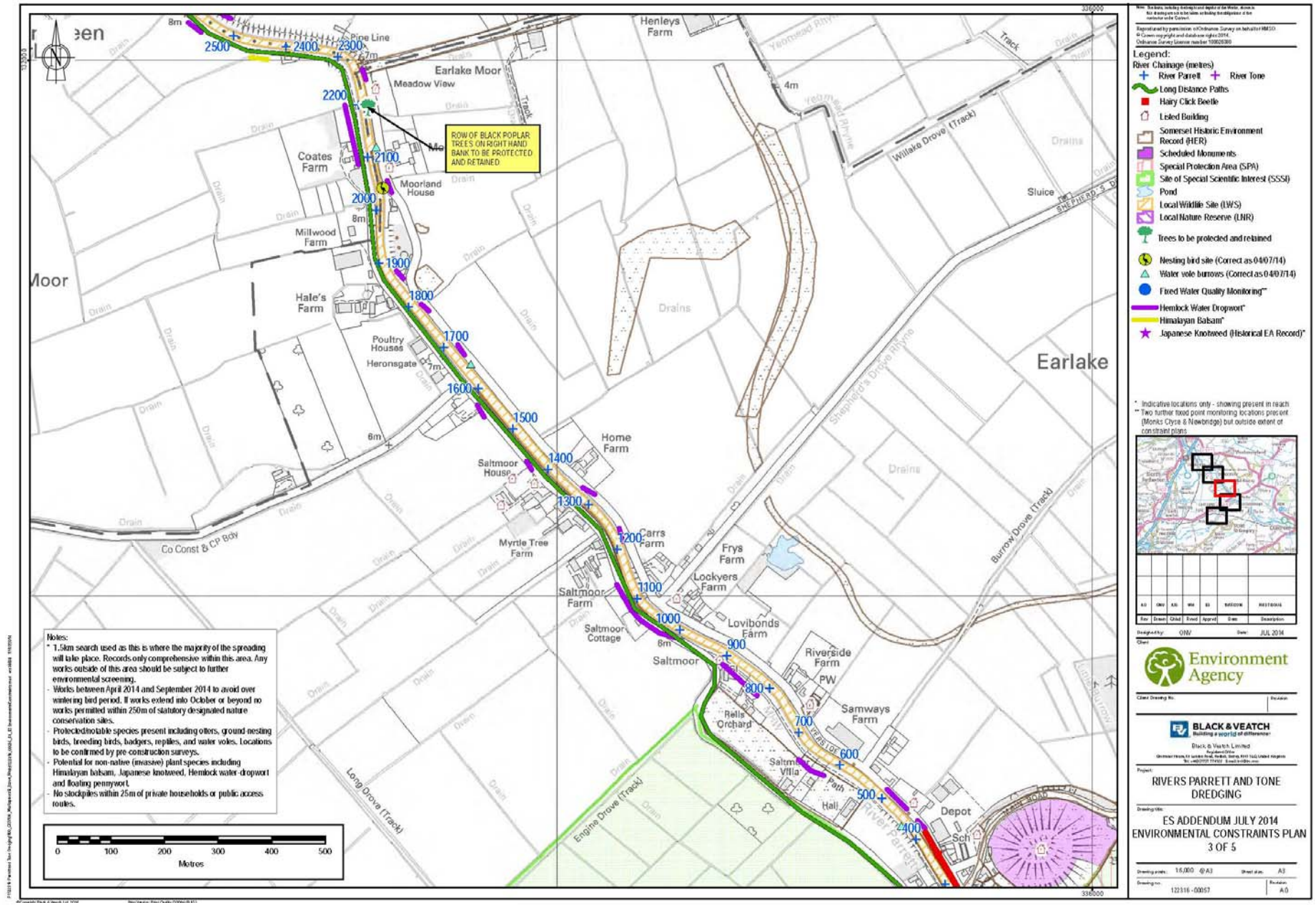

Figure 4b: Environmental Constraints Plan

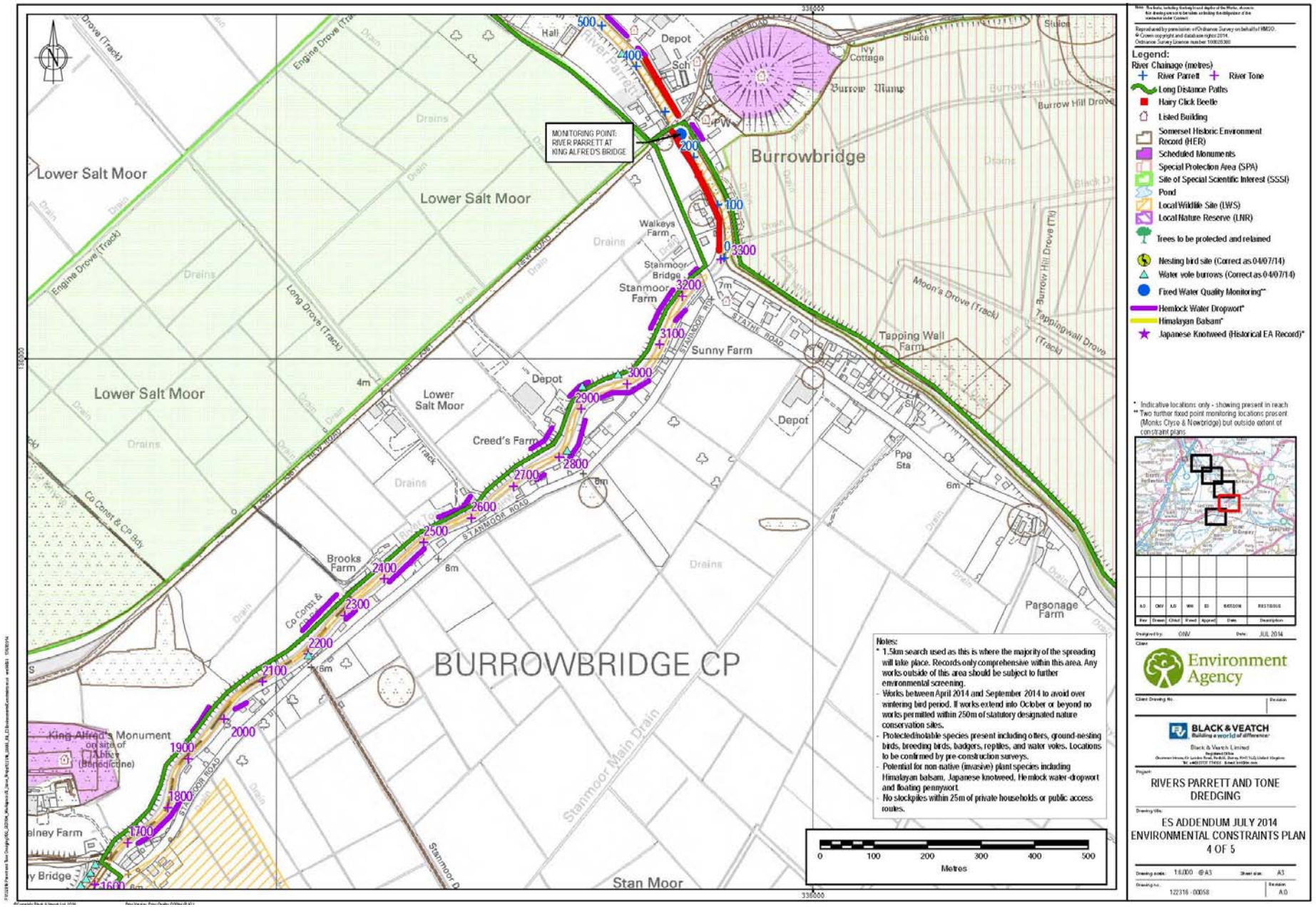

Figure 4c: Environmental Constraints Plan

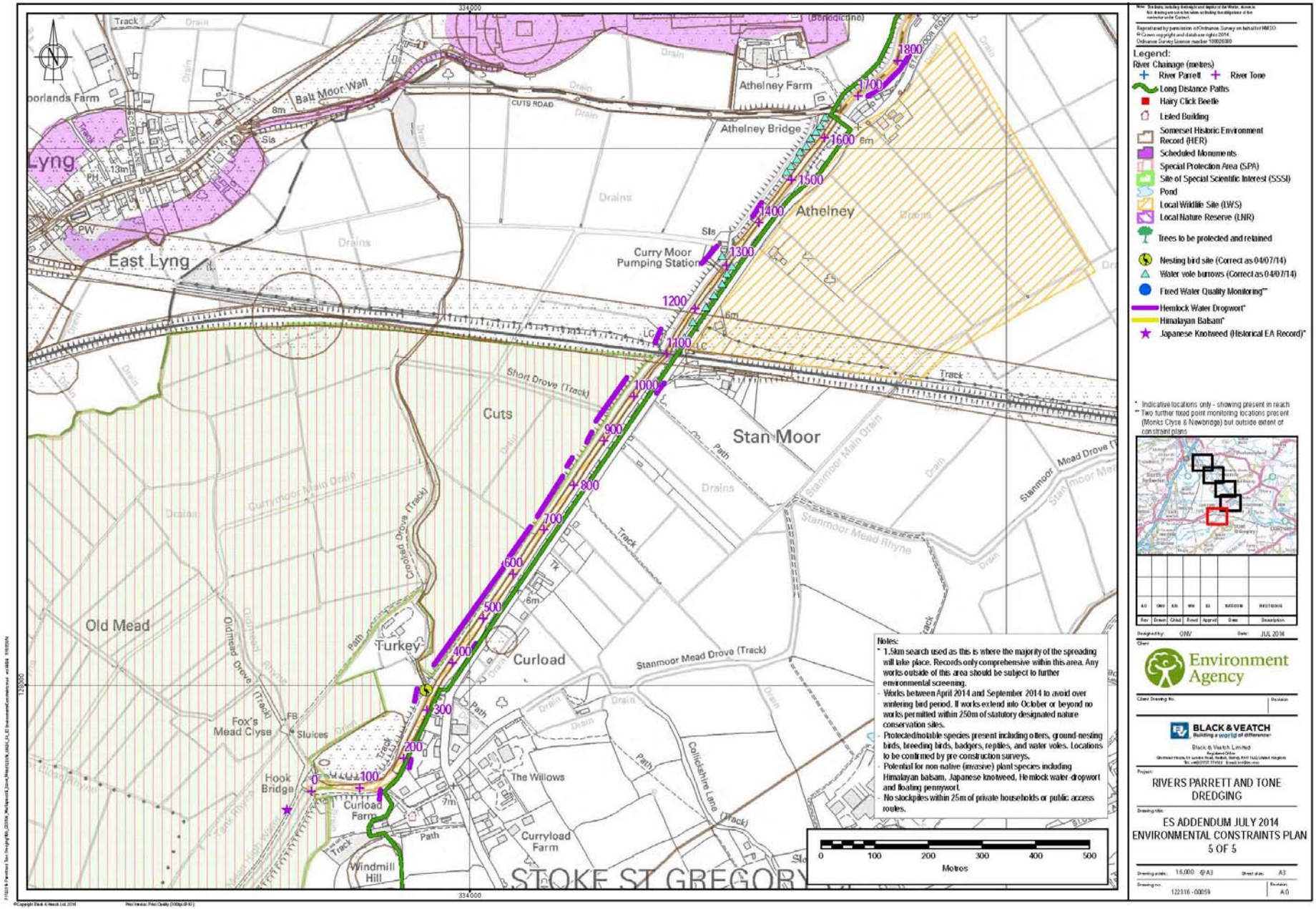

Figure 4d: Environmental Constraints Plan

Contact Us

This NTS and the full ES and Addendums are available to view at the Environment Agency's office in Bridgwater. To ensure that queries are dealt with appropriately, it is advisable to make an appointment by contacting the telephone number below.

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1 Background

1.1 Introduction

An Environmental Statement (ES) was published by the Environment Agency in March 2014 (Environment Agency, 2014c), to document the findings of the Environmental Impact Assessment (EIA) carried out to assess the likely significant effects (positive and negative) of the proposed Rivers Parrett and Tone Dredge scheme. It was prepared following desk-top studies, consultation with key Environment Agency technical specialists and statutory bodies, and other relevant consultees. Field surveys could not be undertaken at the time due to flooding. The EIA influenced the development of the proposed scheme including the working method, as well as developing mitigation that will be undertaken to ensure that any environmental effects are minimised as far as possible, whilst still achieving the scheme objectives. The original ES assessed a scheme whereby dredged material would be temporarily stockpiled for up to a month before being ploughed in to the land for agricultural benefit, pumped direct to land, or removed from site if found to contain contaminants.

Following publication of the original ES, it was identified that suitable dredged material could be used for future flood risk management works associated with the commitments of The Somerset Levels and Moors Flood Action Plan, or for beneficial reuse during autumn 2014 or spring 2015 as a soil improver for spreading on agricultural land. This requires some dredged material to be stockpiled for up to 1 year whilst future flood risk management proposals and suitable locations for reuse are developed. This altered methodology constituted a significant change to the original assessment and, as such, an Addendum to the ES was produced in April 2014 (Environment Agency, 2014d).

In view of the fact that planning permission was required for the stockpiles; the ES Addendum (Environment Agency, 2014d) was carried out under The Town and Country Planning (Environmental Impact Assessment) Regulations 2011 (as amended), and supported the planning applications made to Taunton Deane Borough Council.

Since publication of the ES Addendum, further flood risk management actions have been identified, and the Environment Agency is considering restoring the bank levels of the Rivers Parrett and Tone through a combination of hard and soft engineering techniques. The sections of bank to be restored include the River Tone between Hook Bridge and its confluence with the River Parrett, and the River Parrett between its confluence with the River Tone and Moorland Court Farm. The proposals include restoring the profile of the existing defences along the aforementioned stretches of the rivers Parrett and Tone by between 200-600mm, in order to return the rivers back to approximately their 1960s profile (i.e. when they were last dredged). This constitutes the same stretch of the rivers that are currently being dredged following the winter flood of 2013/14. This methodology constitutes a significant change to the original assessment and, as such, a further Addendum to the ES is required. Locations of the stretches of embankment that are to be restored are shown on drawing 122316-00060 (Appendix A).

The bank restoration proposals are permitted by virtue of Part 15 Class A(b) of Schedule 2 of the Town & Country Planning (General Permitted Development) Order 1995 (as amended), and therefore planning permission is not required. This ES Addendum has therefore been carried out under the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (as amended).

Other environmental regulations which are particularly relevant to the proposal include The Conservation of Habitats and Species Regulations 2010 (as amended), the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 and the Wildlife and Countryside Act 1981 (as amended); as described in Section 1.2.

A background to the proposed Rivers Parrett and Tone Dredge is given in the original ES (Environment Agency, 2014c).

1.2 Regulatory Regime

1.2.1 Environmental Impact Assessment, planning and permitting

Dredging

On 20 February 2014 the Environment Agency published formal notification of its intention to carry out improvement works related to flood defence on the Rivers Parrett and Tone in Somerset. The notice confirmed the Environment Agency had determined the works were likely to have significant effects on the environment and intended to prepare an ES in respect of them.

A further notice was published on 1 March 2014, which highlighted that an ES had been prepared. The EIA was carried out under the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (as amended) (hereafter referred to as 'the Land Drainage EIA Regulations').

The development assessed by the original EIA was considered to be permitted by virtue of Part 15 Class A(b) of Schedule 2 of the Town & Country Planning (General Permitted Development) Order 1995 (as amended) (GPDO):

> *"Development in, on or under any watercourse or land drainage works and required in connection with the improvement, maintenance or repair of that watercourse or those works."*

Stockpiling

Spreading and ploughing-in the dredged material onto agricultural land as a soil improver is not development. However, the proposals, to temporarily store the dredged material on agricultural land prior to its use as a soil improver and construction material, is development that is not permitted by the GPDO, and therefore planning permission was required.

Whilst the stockpile sites did not themselves comprise development described in either Schedule 1 or 2 of The Town and Country Planning (Environmental Impact Assessment) Regulations 2011 (as amended), the proposals were directly related to, and a consequence of, the dredging works that were the subject of EIA. The dredging works were already authorised and were in the process of being executed. Therefore, the proposal to use stockpiles was a change to that development which is identified as Schedule 2 development in the Land Drainage EIA Regulations and in the Town & Country Planning EIA Regulations.

Separate planning applications for each of the three stockpiles along with the ES Stockpile Addendum were submitted to Taunton Deane Borough Council, and the relevant planning permissions received on the 23rd May and 4th June 2014.

The stockpiling works will also be undertaken in accordance with the Environmental Permitting Regulations (England and Wales) 2010 (as amended).

Bank profile restoration

Under the latest proposals, use of dredged material to restore the profile of the existing flood banks constitutes 'improvement works' i.e. works to 'raise, widen or otherwise improve or alter any existing drainage works'[1]. As mentioned above, improvement of land drainage works are permitted under Part 15 of Schedule 2 of the GPDO, and therefore planning permission is not required.

The Environment Agency has revisited and reviewed the original EIA to determine whether its scope and conclusions were changed by the proposals to use dredged material to restore the profile of the existing flood banks. This EIA Addendum reports the findings of that review and updates the conclusions of the EIA of the project as it is proposed to be changed.

1.2.2 Water Framework Directive

A preliminary WFD assessment has been undertaken and this is reported in the original ES. This concludes that there is not a risk of deterioration in waterbody status, and that the proposed scheme will not prevent achievement of the WFD objectives in any of the relevant waterbodies. The proposal to restore the profile of the existing flood banks has been screened for impacts that would prevent achievement of the WFD objectives, and determined that there is no risk of deterioration. No additional impacts were highlighted or changes to the significance of the effects assessed in the original WFD assessment.

1.2.3 Habitats Regulations Assessment

A Habitats Regulations screening assessment has been updated for the bank profile restoration (Appendix D). This identified that the project could have likely significant effects on the Somerset Levels and Moors Special Protection Area (SPA) and Ramsar site and the Severn Estuary Special Area of Conservation (SAC), SPA and Ramsar site but these were unchanged from those identified in the original ES. The Appropriate Assessment that was reported in the original ES remains unchanged. The Appropriate Assessment concluded that, subject to implementing a monitoring and management programme during and after dredging, the project would not have an adverse effect on the integrity of any Natura 2000 site. The stockpiles will not directly affect any Natura 2000 site and the use of the stockpile locations will not change the outcomes of the Appropriate Assessment.

1.3 Structure of the report

This ES Addendum considers whether the introduction of bank profile restoration to the scheme results in a change to the significance of impacts documented in the original ES. It also considers whether there are any new impacts that arise, and whether any impacts previously identified are no longer applicable.

[1] 'Drainage' as defined by the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (as amended) includes defence against water, including sea water.

This Addendum only includes chapters for the receptors where scoping has identified where there could be a significant change in impact (see Chapter 4). The chapters have been included as they were presented in the original ES; text written in **red** within the technical chapters of this report (Chapters 5 to 10) constitute the changes made to the ES Stockpile Addendum (Environment Agency, 2014d) in order to assess the impact of the bank restoration. Text coloured black (in Chapters 5 to 10) remains valid and unchanged from the ES Stockpile Addendum. Where the previous content is no longer valid it is still shown for information but with a ~~strikethrough~~. This report is structured as follows.

Chapter	Content
2	Project development process, including need for bank profile restoration, alternative options considered and consultation to date.
3	Describes the proposal.
4	Explains the key issues relevant to the scheme including the background to the EIA process, the methodology undertaken, and the uncertainties and assumptions of the assessment.
5 to 8	Considers each of the key receptors that have been scoped into the EIA Addendum.
9	Considers any cumulative effects that may arise as a result of the scheme as well as in-combination effects with other known plans and projects.
10	Provides a summary of the EIA findings.
11	Environmental Action Plan (EAP) provides a record of the actions identified within this ES Addendum that will be included within the contract for the works and that are required to manage the environmental effects prior to, during, and after construction.
12	Lists the references used to compile this ES Addendum.
13	Provides a list of abbreviations which are used throughout the ES Addendum.
14	Provides definitions of any key words and terms which are used in this document.
Appendices	
Appendix A	Drawings
Appendix B	ES Addendum EIA Screening and Scoping Study
Appendix C	Visual Amenity Assessment: Assessment Table
Appendix D	Habitat Regulations Assessment

Please refer to the original ES for descriptions of the dredging works including:

- The problem
- Project aims and objectives
- Links to other strategies and schemes
- Need for the scheme
- Alternative options considered
- Description of the proposal
- Construction methods
- EIA methodology
- Planning context.

2 Project development – bank profile restoration

2.1 Need for the bank profile restoration

The combined effect of the flat relief, heavy rainfall and high tides is to cause flooding and drainage problems in the Somerset Moors and Levels. Approximately 2,000 upland square kilometres drain into 600 lowland square kilometres through rivers which have scarcely any fall, and whose outfalls may be closed at high tides. Since the introduction of mechanised pumping in the nineteenth century it has been possible to drain the land, for the benefit of agriculture and residents, but this is ultimately limited by the capacity of the main river system to carry floodwater to the sea.

The southern moors are drained to the sea by the River Parrett and its tributaries, principally the River Tone, River Yeo and River Isle, supported by an extensive network of pumping stations. The areas of Curry Moor, Hay Moor, Salt Moor and North Moor drain to the tidally influenced reaches of the River Tone and River Parrett. Downstream flood risk is reduced by allowing excess floodwater in the River Tone to flow into Curry Moor via the Hook Bridge Spillway where it is stored before being pumped back into river when conditions allow. This arrangement means that Curry Moor acts as a washland 'safety valve' during the winter and benefits agriculture during the summer. Under more extreme conditions, Curry Moor can become full and excess water flows into North Moor and Salt Moor via the Athelney spillway and the former railway cutting at Lyng. This flow route is set at a high level to ensure this is not a regular event. If prolonged flows over the spillway occur then infrastructure and properties in North and Salt Moors are at risk of flooding.

Following floods in October 1960, to reduce the frequency and extent of flooding, the Tone Valley Scheme was undertaken. This was designed to reduce flooding to Curry Moor and Hay Moor by increasing channel capacity of the Tone and Parrett, as far down as North Moor pumping station, although to a much lower standard than for the urban area. If more floodwater can safely bypass Curry Moor, down an enlarged river channel, the likelihood of it filling and then overtopping into North Moor is reduced. It also reduces the extent of overtopping experienced during high tides on the tidal Parrett and Tone, particularly at Burrowbridge and North Moor. Below North Moor, the river channel capacity is naturally greater, although its ability to convey fluvially derived flow is limited by high tide levels.

Over the past 50 years, the flood embankments have settled up to 600mm in places. This has resulted in an increased frequency and extent of flooding during both fluvial and tidal events. The recent flooding in 2014 highlighted the direct impact of this settlement on the flood mechanisms in and around North Moor:

- Extensive overtopping was experienced during high spring tides, resulting in flooding of properties at Burrowbridge and Huntworth Lane
- Uncontrolled overtopping of embankments caused early impoundment of Curry Moor and in turn North Moor; and increased cumulative inflow into Curry Moor and North Moor
- Uncontrolled overtopping of non-engineered banks carries the risk of breach and an associated potential threat to life
- Short-term flooding of local roads causing inconvenience.

The increased frequency and extent of overtopping also contributes to wider problems in the area, which might historically have been expected around 1 year in 5 on a long term average (i.e. 20% annual probability of flooding). Local problems can include:

- Prolonged flooding of agricultural land leading to grass and crop kill, especially if it occurs in the growing season
- Short-term flooding of local roads causing inconvenience
- Extended pumping operations to drain the moors.

Flooding becomes more serious, and has regional implications, when the following occurs:

- Flooding of local communities include Moorland and Fordgate
- Disruption to main roads including the A361 from Taunton to Glastonbury, causing congestion as far afield as Taunton and Bridgwater
- Flooding affecting the main railway lines connecting the South West to Bristol and London
- Isolation of small communities as minor roads are impassable
- Severe disruption to farming activity and other local businesses
- Significant costs for operating authorities and emergency services, including the need for temporary high capacity emergency pumping equipment.

The threshold for serious flooding has been based on a long term average, around 1 year in 10 (i.e. 10% annual probability of flooding) but such events have recently been seen to be more frequent.

2.1.1 Alternative Options Considered

The bank restoration forms an integral part of the flood recovery works identified in response to the 2014 flooding of the Somerset Moors and Levels. The project is to be delivered under the Wessex Asset Recovery Programme, an essential component of the 'Somerset Levels and Moors Flood Action Plan 2014 - A 20 year plan for a sustainable future', currently under development and led by Somerset County Council.

The bank restoration element will be delivered in tandem with a series of isolated defence improvements within the same reach to help reduce the frequency, duration and extent of flooding for Curry Moor, Hay Moor and North Moor. The environmental impact of these isolated defence improvements are not covered in this report.

Within this context, the alternatives considered as part of this project related to:

d. The location of the bank restoration
e. The extent of the bank restoration
f. Management, reuse and disposal of dredged silt.

The preferred bank profile restoration locations were prioritised under the following criteria:

- Address those lengths where overtopping flooded property or major roads was observed during the 2014 flooding
- Address those lengths where overtopping flooded agricultural land or minor roads was observed during the 2014 flooding

- Address those lengths where topographic surveys revealed the bank was below design target level and could be restored to this level through the re-use of dredged material.

Design target level on the River Tone was based on those design levels interpreted from the Technical Report of the 1960s Tone Valley Scheme.

Design target levels on the River Parrett were derived from more recent studies namely:

- Comprehensive Scheme for Bridgwater to Burrowbridge (1970s and 1980s)
- Lower Parrett and Tone Flood Risk Management Strategy and associated design work.

2.1.2 Consultation

Prior to the submission of the original ES, we worked closely with our statutory stakeholders in developing the project plan and have held discussions on the potential effects and issues with the Department for Environment, Food & Rural Affairs (Defra), Natural England (NE), English Heritage (EH), the Marine Management Organisation (MMO), Somerset County Council, Taunton Deane Borough Council, Sedgemoor District Council and the Somerset Drainage Board Consortium. In addition we have:

- created a Communications Plan and have identified all those we need to engage, consult and inform;
- released a press statement regarding the dredging project (on the 20th February 2014) as well as an EIA advert;
- posted planning notices and notice of intention to proceed for the stockpiles in the local press;
- circulated briefing notes for local Councillors, stakeholders and the community to update them on the project and describe the locations where we intend to undertake dredging and locate stockpiles as well as rough timescales;
- met with NE, Somerset Wildlife Trust and the RSPB to seek their views on the bank profile restoration works; and
- briefed the Wessex Regional Flood and Coastal Committee and the Somerset Drainage Boards Consortium.

During the 28 day consultation period on the original ES in March 2014 we also:

- met with the National Farmers Union (NFU), Countryside Land and Business Association (CLA) and Farming and Wildlife Advisory Group (FWAG) to brief them on the project. Met with local NGOs; the Somerset Wildlife Trust and RSPB as well as holding a drop-in session for Councillors; and
- held community engagement events and prepared weekly briefing notes.

Throughout the production of the ES Addendums for the stockpiles and the bank profile restoration works, we have continued to consult with local landowners, internal Environment Agency Specialists (Archaeologist, Landscape Architect and Environmental Permitting Officers), Taunton Deane Borough Council, and the local community.

We have also met with NE to seek their views on the bank profile restoration works. Natural England was satisfied on the clarification that the bank profile restoration works:

4. would not affect the level of Curry Moor spillway;
5. would not affect the ability for flood Southlake Moor to be seasonally flooded for nature conservation; and
6. there would be no impact on the hydrology of West Sedgemoor or King Sedgemoor.

We will meet the Somerset Wildlife Trust and the RSPB to discuss the bank profile restoration proposals prior to commencing on site.

3 The Proposal

3.1 Description of the bank profile restoration

The Environment Agency is considering restoring the bank levels of the Rivers Parrett and Tone through a combination of hard and soft engineering techniques. The sections of bank to be restored include the River Tone between Hook Bridge and its confluence with the River Parrett, and the River Parrett between its confluence with the River Tone and Moorland Court Farm. This constitutes the same stretch of the rivers that are currently being dredged following the winter flood of 2013/14 (Drawing 122316-00001, Appendix A).

It is proposed to restore the existing defences by raising them by between 200-600mm along the majority of the scheme length.

Works to restore the profile of the banks (both hard and soft engineering) are programmed to commence in mid-August and to be complete by the end of October 2014, and will overlap with the ongoing dredging activities. This ES Addendum assesses only the impact of restoring the banks where soft engineering solutions apply and the material is derived from the dredging.

3.2 Method of construction

Dredged material will be used as the construction material. The dredged material will be temporarily stockpiled behind the existing banks and then used to re-form the banks to their restored design profile and target level. Where there is insufficient space to stockpile material behind the existing flood banks, adjacent fields will be temporarily used for storage (subject to landowner agreement).

Two distinct construction methods will be used to restore the profile of the banks with the dredged material:

- Minor bank raising will involve transporting dredged material to the flood bank in agricultural trailers, tipping (if space is available) or unloading dredge material using an excavator onto the bank and then carrying out informal compaction of the bank by tracking over with an excavator.
- Engineered rebuilding of the bank will require stripping/cutting back the bank, cutting a bench into the bank, placing dredge material and compacting/re-forming with formal compaction plant.

If there is found to be excess dredged material then this may be spread over local fields into November (subject to landowner agreement). If there are any delays in re-use or spreading then the stockpiles may remain for up to one year.

Stockpiling activities will be undertaken in accordance with the specifications detailed in the ES Stockpile Addendum (Environment Agency, 2014d), however quantities of stockpiled material are likely to be reduced following the bank profile restoration works.

3.2.1 Compounds and access

The site compound and welfare facility locations will be located on existing hardstanding at Creed's Farm, just upstream of Burrowbridge on the River Tone (subject to landowner agreement). A second satellite compound will also be located at the Environment Agency owned North Moor Pumping Station.

Construction working areas will be the same as those required for the previous proposed dredge to bank. Access routes will be the same as previously highlighted for the main dredging work with material being transported from stockpiles to the banks along the back of banks.

3.2.2 Vehicle movements

Assumptions made for the purposes of the EIA on the type and numbers of vehicle movements, are detailed in Section 4.3.

Plant required is similar to that required for the dredging works, and will be limited to excavators, tractors and trailers for most areas of raising. However, some additional 'compaction' plant will be required to compact the sections of bank that are raised using the 'engineered rebuilding' method.

4 Key issues and methodology

4.1 The Environmental Impact Assessment

4.1.1 Screening and Scoping

As part of the original EIA process, the Environment Agency carried out an 'EIA Screening and Scoping Study' to identify the key issues that needed to be addressed in the EIA; this is included within Appendix D of the original ES.

The 'EIA Screening and Scoping Study' was reviewed for the production of this ES Addendum, and a scoping exercise undertaken for the bank profile restoration works (Appendix B). This considered the advice gained from original consultations and knowledge gained through the production of the original ES. The following receptors were scoped in for assessment within this Addendum:

- Population (potential change in flood risk to people, land and property)
- Flora & Fauna (potential for effects on Natura 2000 and nationally protected sites, certain protected and notable species)
- Visual Amenity (effects on visual amenity from reduction/loss of views due to increased height of defences)
- Cultural Heritage (potential for damage to Listed Buildings and HER sites, as well as degradation of historic landscape).

Effects on all other receptors remain unchanged from the original assessment.

Actions to ensure good environmental management practices are employed during construction works for receptors scoped out of further assessment, have been included in the Environmental Action Plan for the scheme (Chapter 11).

4.2 Impact Assessment Methodology

The impact assessment methodology used for this ES Addendum is unchanged from that followed for the production of the original ES; refer to Chapter 4 of the original ES for more detail.

4.3 Uncertainties, Assumptions and Limitations

The certainty with which effects on the environment can be predicted and evaluated is dependent on the data that is available and the knowledge about how different receptors respond to changes in the environment. Limitations to the EIA are as reported in the original ES.

A number of uncertainties remain with regard to the proposed bank profile restoration works, in addition to those identified in the original ES and the ES Addendum for the stockpiles:

- Exact access routes to and from: the working area; compounds and welfare facilities; and existing material stockpiles (if the latter are used as a source of material) are uncertain.
- The exact profile that the banks will be restored to.
- The detailed programme of bank restoration works has not been confirmed.

For the purposes of this ES Addendum, the following assumptions have been made in addition to those identified in the original ES and the ES Addendum for the stockpiles:

Vehicle movements

- Bank profile restoration works will result in a doubling of light traffic (car and van movements), and 10-12 additional HGV deliveries per day, from those assessed in the original ES, between mid-August and the end of October. However, dredging and bank restoration will not occur simultaneously at any stretch of bank, and so these journeys will be partially dissipated across the 8km dredge reach.
- Agricultural tractor/trailer movements will remain similar to the original assessment.
- Most construction plant will remain on site for the duration of the works.

Design

- The existing banks will be restored to a design target level, and therefore will be raised by typically 200mm to 600mm.
- Following bank profile restoration the proposed reinstatement of the embankment (in terms of soil structure and re-seeding) is successful.
- Bank profile restoration is a one-off exercise; bank maintenance is not included and will be justified and assessed separately.
- Without maintenance the restored banks will settle and degrade over time. Typically banks may be expected to lower by approximately 10mm a year, although this could be significantly more in areas that are grazed. The restored banks are therefore expected to provide a benefit (protection from overtopping during flood events) for approximately 10 years.

Programme

- Bank profile restoration works have the potential to extend through weekends and bank holidays.
- There will be four bank restoration teams working on site simultaneously.
- As an average bank profile restoration will be undertaken at a rate of at least 100m/day. Therefore, the restoration is a relatively quick activity, so even though it will overlap with dredging works, it is not considered that the bank restoration work will significantly prolong construction activity or create significant additional disturbance over and above that which has already been assessed in the original ES.

Potential for effects

- No additional vegetation clearance, tree or hedgerow removal is anticipated, above and beyond that which has already been undertaken for dredging.
- Bank profile restoration will not require any in-channel works, and will therefore not affect the project's compliance with WFD (as previously assessed).
- Any stockpiling will be in the form of 'windrows', using the same form, scale and principles of stockpiling as were assessed within the original ES.

- The proposals will require no more permanent land take than is required for the ongoing dredging activities (and has already been assessed within the original ES).
- Where there is limited space to stockpile dredged material temporarily on the landward side of the existing embankments, adjacent fields may be used (with landowner permission). Instead of stockpiles being used prior to spreading, they will now be used to store material prior to re-use to raise the river banks. Therefore, there will be no net change in land take for stockpiles as a result of the proposals.
- There will be a reduction in HGV movements as less material is likely to be transported to stockpile sites, and will instead be used to restore the bank profiles insitu wherever possible.
- Wherever possible long distance paths will not be closed or diverted; rather, banksmen will be used to protect users of the paths. Any agreement for temporary closure/diversion, should the need arise, will be agreed with Somerset County Council Rights of Way team.

5 Population

This Chapter addresses the impact of the project upon the local human population. A desk-based assessment has been undertaken to investigate the potential impacts. Impacts upon visual amenity, traffic and transport and water (WFD) are assessed separately in subsequent chapters. For the purposes of this Chapter, impacts have been assessed in relation to the Study Area shown in Appendix A ~~of the original ES~~ (Drawing 122316-00001); following the general EIA methodology described in Chapter 4 of the original ES. Sensitivity of receptors, magnitude of impacts and significance of impacts are defined according to the criteria set out in Tables 4-1 to 4-4 (Environment Agency, 2014c).

Scoped-in receptors and potential impacts

The receptors and potential impacts related to this 'Population' chapter that have been scoped-in to the impact assessment are listed in Table 5-1.

Table 5-1 Receptors and potential impacts scoped-in to the Population chapter

Scoped-in receptor	Scoped-in potential impact
Human Beings	Changed flood risk to people (residential areas) as a result of dredging and bank profile restoration works. Impact arising during the *operation stage*.
	Disturbance to adjacent residents in Burrowbridge as a result of vehicle movements associated with the construction and decommissioning of stockpiles (effects of noise, vibration and odour). Impact arising during the *construction and decommissioning phases*.
Economy	Indirect effects on glass eel fishery activities - arising from dredging activity and the exclusion of glass eel fishing during construction. Impact arising during the *construction phase*.
	Changed flood risk to businesses (commercial and agricultural areas) as a result of dredging and bank profile restoration works. Impact arising during the *operation phase*.
Recreation	Potential for impacts (closure/diversion) upon the River Parrett Trail, East Deane Way and Macmillan Way West Long Distance Paths. Impact arising during the *construction phase*.
Tourism	Potential for indirect impacts on tourism at Burnham-on-Sea as a result of changes to bathing water quality arising from dredging activity (potential for release of contaminants over and above those in the water under baseline conditions). Impact arising during the *construction phase*.

5.1 Existing environment

Human Beings

Central to the dredging area and at the confluence of the two rivers is the village of Burrowbridge. This rural village contains 212 dwellings, Burrowbridge Primary School building (the school is now closed), petrol station and public house. Dwellings are primarily located along main roads however; many are set back and/or screened from the roads by vegetation. The 2011 census recorded 508 residents within Burrowbridge, 59% of which were of working age (18-64 years old) and 24% were of school age (up to 17 years old). Only 17% of residents were of retirement age (65+ years). The majority of residents (94%) registered the Burrowbridge property as their only address; properties in the village are therefore expected to be occupied throughout the year. The Study Area (Drawing 122316-00001) encompasses a number of other small villages and hamlets as well as numerous farms. The area is sparsely populated with the majority of properties being concentrated in two key villages, Moorland and Fordgate. There are a number of properties (50-100) that are located adjacent to the river.

The town of Bridgwater is not itself included within the Study Area, although the channel of the River Parrett is included for consideration of effects in other chapters of the original Environmental Statement (notably Chapter 8).

Economy

The Study Area is spatially dominated by aspects of the rural economy, such as fields of grazing livestock and arable land. However, it should be noted that the most recent Census (2011) data for the area shows a spread of economic activity in which the local population are engaged. The most dominant industry in terms of numbers employed in the area, and in Somerset as a whole, is the wholesale and retail trade. Human health and social work and education are also notably high employment areas. Agriculture, forestry and fishing account for a relatively small proportion of employment (Somerset County Council, 2011).

The main fisheries use of the Parrett and Tone is the glass eel fishery. This operates from the 14th February to the 30th April annually. Licences are issued by the Environment Agency on an unlimited basis (i.e. there is no limit to the number issued). In 2013, 169 licences were issued, which resulted in the capture of 4,000kg of glass eels. This comprises 90% of the Environment Agency south-west region, and 40% of the total UK, glass eel catch. The economic value of the fishery fluctuates annually, depending on the prevailing market price of glass eels, which is in turn a reflection of supply (i.e. natural abundance and catches). Thus, in 2013 the value was £100/kg, which, given the capture of 4,000kg would have given the fishery a value of £400,000. However, in other years the market value has risen as high as £250-£300/kg.

Chapter 6 discusses ecological impacts, including potential impacts on the health and survival of eels, elvers and other fish within the Study Area.

Recreation

Long Distance Paths are recreational trails which can, to varying degrees, be used for a range of non-motorised travelling options (including walking, cycling and horse riding). What marks Long Distance Paths apart from normal Public Rights of Way (PRoWs) is the distances they cover; typically, they will be at least 31 miles (50km) long and will take the user more than a day to walk, but many are much longer than this.

There are three Long Distance Paths within the Study Area – these are the River Parrett Trail, which also constitutes a National Cycle Network (NCN) in part, East Deane Way and Macmillan Way West (as shown in Appendix A ~~of the original ES~~, Drawing 122316-00015). These paths are all in close proximity to the proposed dredging and bank profile restoration locations along the River Parrett and Tone.

Tourism

Burnham-on-Sea is a designated beach for bathing and is tested by the Environment Agency regularly under the EU Bathing Water Directive (2006/7/EC). As shown in Appendix A (Drawing 122316-00001), Burnham-on-Sea is approximately 3km downstream of the confluence of the River Parrett with the Severn Estuary. The confluence is approximately 15km from the northern part of the dredging and bank profile restoration area.

The Environment Agency and its partners have invested significant effort and money over recent years to improve the bathing water quality at Burnham-on-Sea and to meet the strict minimum standard of the revised Bathing Water Directive by its 2015 inception. Many tourism-related businesses in Burnham-on Sea are reliant on the quality of the beach and bathing water and could suffer if the bathing water quality does not satisfy the requirements of the new Directive in 2015.

For the last five years the sampling location at Burnham Jetty North has met the minimum or higher Annual Compliance Result (ACR) target. The most recent ACR was in 2013 and showed the water quality was meeting the minimum mandatory requirements of the Directive (Environment Agency, 2014a). Further information and assessment of potential changes to water quality as well as the implications of the proposed works on the objectives of the Water Framework Directive (WFD) are provided in Chapter 8.

5.2 Likely significant effects

5.2.1 Construction Impacts

Impacts on fish are assessed in Chapter 6.

Impacts of increased vehicle movements on the local road network are assessed in Chapter 9 of the ES Stockpile Addendum (Environment Agency, 2014d).

Human beings

Disturbance to adjacent residents in Burrowbridge as a result of vehicle movements associated with the construction and decommissioning of main stockpiles (effects of noise, vibration and odour).

The three main stockpiles are to be located within the fields adjacent to properties within the village of Burrowbridge; vehicle movements associated with the transportation of waste arisings will therefore be concentrated here and disturbance impacts upon the local residents associated with noise and vibration from traffic and potentially odour from the dredged materials will result during the construction and decommissioning phases of the stockpiling works. It is not anticipated that such impacts will arise during the operational phase as embedded mitigation within the project proposals includes the sealing of stockpiles, which is likely to contain any odours.

As a receptor, the population of Burrowbridge is classed as being of **moderate sensitivity** to the movement of tractors and trailers due to its rural nature, the majority of properties being set back or screened from the road and the small number of residents in the village.

The construction phase of the stockpiles is anticipated to take place during June to October 2014 inclusive; the main decommissioning phase is currently estimated to occur from April to October 2015 inclusive. Disturbance is therefore a **temporary effect**, lasting for the **short-term**.

The properties within Burrowbridge are primarily located adjacent to the main roads that will be used by vehicles transporting materials. It is estimated that 40% of these properties will be subject to disturbance effects as they are not screened and are located directly adjacent to the roads. Their proximity to the roads potentially exposes the properties to vibration effects as a result of increased vehicle movements. Stockpiling works are anticipated to take place through the week, and potentially during weekends and bank holidays. As the majority of residents are not expected to be at home through the week and 40% of properties are likely to experience direct disturbance effects of noise, vibration and odour from the movement of construction vehicles, the magnitude of the adverse impact is considered to be **moderate**.

In accordance with the recognised methodology for classifying significance levels (see Table 4-3 in the original ES), the effect is assessed to be of **moderate s ignificance** prior to mitigation.

In summary: this effect is **moderate, temporary, short-term** and **adverse**; it is considered to be a **significant adverse effect**.

Economy

Indirect effects on glass eel fishery activities - arising from mechanical dredging activity and the exclusion of glass eel fishing during construction.

As a receptor, the glass eel fishery operating within the Study Area is classified as being of **high** sensitivity.

As described in Chapter 3 of the original ES, dredging is to be conducted by mechanical plant, either from the bank or from pontoons. There is, therefore, a risk of direct removal of glass eels migrating in the margins and a resultant reduction in numbers available to the commercial fishery. Prior to mitigation, this is considered likely to have a temporary, **short-term, moderate magnitude adverse impact**.

There will be up to eight dredging teams working at any one time. Commercial fishing activity will be excluded in work areas during dredging operations. Prior to mitigation, this is considered likely to have a temporary, **short-term, low magnitude adverse impact**.

The overall indirect effect of these impacts is the loss of revenue to the glass eel fishery operating on the rivers. This indirect impact is likely to last for the construction phase and up to one year afterwards; and is therefore a **temporary, short-term** impact.

The timing of the works will coincide with the last month of licenced glass eel fishery season (which runs from 14th February to 30th April). However, given the extent and duration of the floods, the baseline high sediment loads during the eel fishery season for 2014 and the impracticality of actually operating during this period, it is considered that the overall

magnitude of the impact (prior to mitigation) is **low**. Most of the licensable activity is considered likely to occur downstream of Bridgwater in 2014.

In accordance with the recognised methodology for classifying significance levels (see Table 4-3 in the original ES) the effect is assessed as being of **moderate significance**.

In summary: the anticipated impact (prior to mitigation) is **moderate, temporary, short-term** and **adverse**; it is considered to be a **significant adverse effect**.

Recreation

Potential for impacts (closure/diversion) upon the River Parrett Trail, East Deane Way and Macmillan Way West Long Distance Paths.

As a receptor, the Long Distance Paths are classified as being of **moderate** sensitivity as they are considered to be of local and up to regional importance.

The dredging and bank profile restoration works are anticipated to result in restricted access to the River Parrett Trail, East Deane Way and Macmillan Way West Long Distance Paths whilst dredging is undertaken. Up to eight dredging gangs and four bank restoration gangs will operate at any one time; though, programme-depending, this may reduce at weekends and bank holidays when the footpaths will be most used. This impact is likely to last during the construction period; and is therefore a **temporary, short-term** impact.

The magnitude of impact arising from any single restriction to a Long Distance Path would be low, as only small sections of the Long Distance Path would be affected by the works. However, as there are up to eight dredging gangs and four bank restoration gangs working within the Study Area, there is the potential for multiple restrictions to access along the Long Distance Paths at any one time. Given this potential for cumulative effects, the **magnitude** of impact is considered to be **moderate**.

In accordance with the recognised methodology for classifying significance levels, the impact is assessed as being of **moderate significance**.

In summary: the anticipated impact (prior to mitigation) is **moderate, temporary, short-term** and **adverse**; it is considered to be a **significant adverse effect**.

Tourism

Potential for indirect impacts on tourism at Burnham-on-Sea as a result of changes to bathing water quality arising from dredging activity (potential for release of contaminants over and above those in the water under baseline conditions).

As a receptor, tourism at Burnham-on-Sea is classified as being of **moderate** sensitivity as it is considered to be of between local and regional importance.

As described in Chapter 3 of the original ES, the dredging works will be carried out between the months of April and October with potential to continue into the winter period. It is only during this construction period that the potential for indirect effects upon tourism, arising as a result of changes to bathing water quality, are considered relevant. Impacts arising are therefore classified as **temporary** and **short term.**

As detailed in Chapter 8 of the original ES, there are a number of sewage treatment works located along the Parrett transitional WFD water body. There is the potential for mobilisation

of silt during the proposed mechanical dredging which could allow bacteria numbers to flourish and therefore impact on downstream beach water quality. E Coli and Intestinal Entercocci (IE) are identified as the main risks to bathing water quality; however the risk is considered to be low, temporary and can be mitigated for.

The construction period encompasses the key tourism period for Burnham-on-Sea, which covers the period of May to September. Despite the coincidence of the works with the tourist season, the **magnitude** of indirect effects on tourism as a result of changes to bathing water quality (prior to mitigation) is considered to be **low**.

In accordance with the recognised methodology for classifying significance levels, the impact is assessed as being of **minor significance**.

In summary: the anticipated impact (prior to mitigation) is **minor, temporary, short-term** and **adverse**; this effect is not considered to be significant.

5.2.2 Operational Impacts

Human beings

As a receptor, 'human beings' are classified as being of **high sensitivity**.

Changed flood risk to people (residential areas).

It should be noted that dredging and the bank restoration works, will result in a significant overall beneficial change to flood risk. There are some areas where under certain conditions there is potential for a minor adverse impact. However, even in these areas the overall impact may be beneficial

This is explained in more detail below and is due to the fact that, along the 8km reach, both tidal and fluvial flooding can occur either in isolation or in combination depending on the timing of fluvial flooding and the timing of tidal flood peaks.

The dredging works will reduce the risk of fluvial flooding within the area of benefit (as shown in Appendix A of the original ES, Drawing 122316-00002) for up to five years. This reduction in flood risk is therefore a **temporary effect**, lasting for the **medium-term**. There will be a reduced fluvial flood risk to up to 500 properties and the people therein. However, the majority of these already have a very high standard of protection. The main reduction in flood risk will be to around 100 properties, the majority of which are in Moorland and Fordgate. This is considered to be a beneficial impact of **moderate magnitude.**

In accordance with the recognised methodology for classifying significance levels (see Table 4-3 in the original ES) the effect is assessed as being of **major significance**.

In summary: this effect is **major, temporary, medium-term** and **beneficial**; it is considered to be a **significant beneficial effect**.

Bank profile restoration works will also reduce the risk of tidal flooding to communities in the moor areas that adjoin the River Parrett along the length being dredged due to the frequency of tidal overtopping of the flood embankments being reduced (see Drawing 122316-00064). The flood risk benefit from bank profile restoration is anticipated to last for more than 10 years. This reduction in flood risk is therefore a **permanent effect**. The reduced flood risk will mainly benefit the properties that are close to the river bank, but will also include

properties at Burrowbridge, Moorland, Fordgate, Andersea and Westonzoyland. This is considered to be a beneficial impact of **low magnitude**.

In accordance with the recognised methodology for classifying significance levels the effect is assessed as being of **moderate significance** prior to mitigation.

In summary: this effect is **moderate**, **permanent** and **beneficial**.

Greater overtopping of the banks during the peak of the tidal flooding events.

Dredging will also result in a small increase in tidal flood risk as the increased channel capacity allows the tide to pass further upstream. This could result in some increased localised overtopping of the banks for a short period during the peak of the tide. This **adverse** impact is assessed as being **temporary**, **medium-term adverse** and of **very low magnitude**. It is assessed as being of **minor significance** prior to mitigation.

One of the main benefits of the proposed dredging and bank profile restoration is to reduce the net flood risk to residential, commercial and agricultural areas. There is, however, the potential for increased overtopping of South Lake Moor and Aller Moor during extreme tidal events due to the bank profile restoration but there would still be an overall benefit to any properties affected (see Drawing 122316-00064). Any tidal overtopping into Southlake or into Aller Moor will only occur during very infrequent surge tides. The increased overtopping will be for short durations at the peak of the tide. Generally where there is limited existing overtopping the additional overtopping will be contained within the receiving drainage network. Where there is currently large volumes of overtopping the increased overtopping will only result in a small percentage change to the volumes.

Since the impacts of bank restoration will last for more than 10 years this **adverse effect** will be **permanent**.

This impact will primarily affect agricultural land; however there is the potential for some properties in Burrowbridge, Athelney and Curload to be affected, although for all these properties there is an overall beneficial impact. The **adverse** impact is assessed as being **permanent adverse,** and of **very low magnitu de**. However, modelling will be undertaken and the risk of increased overtopping will be reviewed once complete.

In accordance with the recognised methodology for classifying significance levels the effect is assessed as being of **minor significance**.

Economy

Changed flood risk to businesses (including commercial and agricultural premises).

As a receptor, the local economy is classified as being of **high sensitivity**.

The dredging works will reduce the risk of flooding to businesses (including agricultural and commercial premises) within the area of benefit (as shown in Appendix A ~~of the original ES~~, Drawing 122316-00002) for up to five years. This reduction in flood risk is therefore a **temporary effect**, lasting for the **medium-term**.

Dredging the 8km of river will ensure that during flood events more water will remain in the channel, with less entering the adjacent moor areas (Curry, Hay, Salt and North Moors specifically). This will result in these moors being inundated less frequently and for a shorter duration in the more extreme flood events. Due to the way water builds up first in Curry Moor before spilling into Salt and North Moors, the impact will be more significant in Salt and

North Moors. There will be a reduced flood risk (in terms of depth, duration and frequency of flooding) to roads including the locally important A361 and two major railway lines. There will be a reduced flooding impact to 3,000Ha of land. In addition through the reduced flooding, and in particular during the growing season, there will be reduced flood damages to crops and subsequent impacts on farming. There will also be a reduced operational cost and response during flood events from all partner organisations.

The **magnitude** of this beneficial impact to local businesses (including commercial and agricultural premises) is considered to be **moderate**.

In accordance with the recognised methodology for classifying significance levels the effect is assessed as being of **major significance**.

In summary: this effect is **major, temporary, medium-term** and **beneficial**; it is considered to be a **significant beneficial effect**.

The bank profile restoration works will alter the risk of tidal flooding to businesses (including agricultural and commercial premises) for more than 10 years as described in *Changed flood risk for people* (above). This reduction in flood risk is therefore a **permanent effect**. Bank profile restoration will ensure that during more extreme flood events less water will enter Earlake Moor, Weston Level and South Moor on the right bank and Salt and North Moors on the left bank. This is in addition to the reduction in fluvial flooding that the dredging provides. This is considered to be a beneficial impact of **very low magnitude**.

In accordance with the recognised methodology for classifying significance levels the effect is assessed as being of **minor significance** prior to mitigation.

In summary: this effect is **minor**, **permanent** and **beneficial**.

Greater overtopping of the banks during the peak of the tidal flooding events.

Change in flood risk to businesses from overtopping of the banks during the peak of tidal flooding events will be the same as for *Human Beings*, as outlined above.

5.3 Residual effects

The in-combination effects of doing both the dredge and bank restoration have been considered. As the dredge primarily has an impact on reduction in fluvial flooding and the bank restoration on tidal flooding, then there is little potential for in-combination effects. Overall, the benefit in reduction in flood risk is assessed as major for the short-term, reducing to moderate. Both the dredge and the bank restoration therefore have the potential to increase tidal overtopping on high spring tides or surges, but additional increase is very minor, hence the in-combination effect of greater overtopping during the peak of tidal flooding events on both human beings and the economy is assessed as minor adverse (not significant).

Taking into account the mitigation measures outlined in Table 5-2, there are no significant adverse residual effects arising to the receptors considered within this Population chapter. However, reduced fluvial flood risk does provide significant (**major**) permanent ~~medium-term~~ benefits.

Table 5-2 Potential Impacts of the Proposed Scheme on Population

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Construction Impacts						
Disturbance to adjacent residents in Burrowbridge as a result of vehicle movements associated with the construction and decommissioning of three additional stockpiles (effects of noise, vibration and odour).	Moderate	Moderate	**Moderate, temporary, short-term and adverse**	Implement a Traffic Management Plan (TMP); refer to Chapter 9. Plant to be well maintained and suitably sized for the works. Engines to be switched off when not in use. Inform residents of proposed timings, likely impacts and duration of works. If deemed to be necessary, use of screening to block odours in the direction of the prevailing wind during the stockpile construction and decommissioning phases. Consultation with local authority Environmental Health Officers to determine maximum noise levels. Noise monitoring to ensure adherence. Condition surveys to be undertaken on adjacent properties, where considered to be at a risk of damage from	Moderate	**Moderate, temporary, short-term and adverse**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				vibration impacts.		
Indirect effects on glass eel fishery activities; potentially arising as a result of restricted access and loss of revenue.	High	Low	**Moderate, temporary, short-term and adverse**	Mitigation will include: A low-flow channel will be left within the channel (i.e. not all of the channel width and bed depth will be dredged). This will help with mitigating the impacts of loss of flow depth for migratory species including eels and salmonids; and the fisheries which they support. On the lower reaches, dredging of exposed material only – following the ebb tide. Liaison will be carried out with the commercial fishing sector before and during operations to ensure the scheduled work plan is available. Appropriate signage will be put in work (and planned work) areas. An Ecological Monitoring Plan will be prepared and agreed with the Environment Agency Fisheries Team and Natural England prior to construction.	Very Low	**Minor, temporary, short-term and adverse**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Potential for impacts (closure/diversion) upon the River Parrett Trail, East Deane Way and Macmillan Way West Long Distance Paths.	Moderate	Moderate	**Moderate, temporary, short-term and adverse**	Wherever possible Long Distance Paths will not be closed or diverted, rather a 'banksman' will be used to protect users of the paths from the works. If a temporary closure is required, this to be agreed with the Rights of Way team at Somerset County Council and an alternative diversion route will be agreed where available and signposted for users of the paths.	Low	**Minor, temporary, short-term and adverse**
Potential for indirect impacts on tourism at Burnham-on-Sea as a result of changes to bathing water quality arising from dredging activity (potential for release of contaminants over and above those in the water under baseline conditions).	Moderate	Low	**Minor, temporary, short-term and adverse**	Dredging works will adhere to EA Pollution Prevention Guidelines (for example, where practicable and if required, silt traps will be deployed upstream and downstream (upstream due to the tidal nature of the watercourse) if necessary. During high water temperatures (>20ºC) the dredging works will be phased to promote dry excavation where possible, to reduce suspended sediment loadings, and reduce the risk of bacterial release (triggered by organics in the water). This will help to mitigate adverse effects to water body physico-chemical	Very Low	**Negligible**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				conditions including those found in the downstream bathing waters.		
Operation Impacts						
Reduced flood risk to people (residential areas) from dredging.	High	Moderate	**Major, temporary, medium-term and beneficial**	No mitigation required as it is a beneficial effect.	Moderate	**Major, temporary, medium-term and beneficial**
Reduced flood risk to people (residential areas) from bank profile restoration.	High	Low	**Moderate, permanent, and beneficial**	No mitigation required as it is a beneficial effect.	Low	**Moderate, permanent, and beneficial**
Greater overtopping of the banks for a short period during the peak of very extreme tidal flooding events (residential, commercial and agricultural areas) from dredging.	High	Very Low	**Minor, temporary, medium-term and adverse**	Environment Agency flood warning systems will be updated to account for the changes to local hydrological flows and will be able to warn affected householders which sign-up to the service of impending tidal flooding events.	Very Low	**Minor, temporary, medium-term and adverse**
Greater overtopping of the banks for a short period during the peak of very extreme tidal flooding events (residential, commercial and agricultural areas) from bank profile restoration.	High	Very Low	**Minor, permanent, and adverse**	Modelling will be undertaken and the risk of increased overtopping will be reviewed once complete. Environment Agency flood warning systems will be updated to account for the changes to local hydrological flows and will be able to warn affected householders which sign-up to the service of impending tidal	Very Low	**Minor, permanent, and adverse**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				flooding events.		
Reduced flood risk to businesses (commercial and agricultural areas) from dredging.	High	Moderate	**Major, temporary, medium-term and beneficial**	No mitigation required as it is a beneficial effect.	Moderate	**Major, temporary, medium-term and beneficial**
Reduced flood risk to businesses (commercial and agricultural areas) from bank profile restoration.	High	Very Low	**Minor, permanent, and beneficial**	No mitigation required as it is a beneficial effect.	Very Low	**Minor, permanent, and beneficial**

6 Flora and Fauna

This Chapter addresses the impact of the project upon statutory and non-statutory nature conservation sites and legally protected or otherwise notable flora and fauna. A desk-based assessment has been undertaken to investigate the potential impacts, and an ecology survey carried out of the proposed stockpiling locations and bank profile restoration. Any necessary mitigation measures with regard to relevant nature conservation legislation have been identified.

Scoped-in receptors and potential impacts

The receptors and potential impacts related to this 'Flora and Fauna' chapter that have been scoped-in to the impact assessment are listed in Table 6-1.

Table 6-1 Receptors and potential impacts scoped-in to the Flora and Fauna chapter

Scoped-in receptor	Scoped-in potential impact
Natura 2000 Sites (Special Area of Conservation, Special Protection Area and Ramsar Sites)	Potential for indirect impacts from: disturbance; temporary short-term changes in water quality affecting mobile species; temporary medium-term changes to river habitat used by mobile species; and, changes to water levels on moors. Scoped out for the three main stockpiles. Scoped in for bank restoration including potential for direct habitat loss.
Nationally protected sites (Site of Special Scientific Interest & National Nature Reserves)	Potential for direct impacts such as habitat loss or degradation; or, indirect impacts such as changes to habitats as a result of altered water or sediment regimes. Scoped out for the three main stockpiles. Scoped in for bank restoration.
Non-statutory sites and other conservation areas	Potential for direct impacts such as habitat loss or degradation; or, indirect impacts such as changes to habitats as a result of altered water or sediment regimes. Scoped out for the three main stockpiles and bank restoration.
Natural Environment Research Council (NERC) Habitats of Principal Importance	Potential for direct impacts such as habitat loss or degradation; or, indirect impacts such as changes to habitats as a result of altered water or sediment regimes. Scoped out for bank restoration.
Water vole	Potential for damage to water vole habitat and any re-established burrows within the dredging areas and the three main stockpile locations and bank restoration.
Otter	Potential for damage to resting places or any re-established holts within the dredging areas and the three main stockpile locations. Scoped out for bank restoration.
Reptiles	Potential for killing or injury of reptiles (especially grass snakes) through destruction of hibernation and/or foraging and basking areas. Scoped out for bank restoration.
Badgers	Potential for destruction of setts or disturbance to badgers as a result of plant and vehicle movements and location of spreading / stockpiling and bank restoration areas and site compounds.

Scoped-in receptor	Scoped-in potential impact
Great Crested Newt (GCN)	Potential for killing or injury of GCN or impairment to their ability to breed; either through destruction of hibernation and/or foraging and commuting areas (including through rough grassland connecting breeding ponds). Scoped out for bank restoration.
Ground-nesting birds	Potential for killing or injury of ground-nesting birds (such as mallard and coot) and/or destruction of nests or eggs through clearance of ground vegetation and location of spreading and compound areas. Scoped out for bank restoration.
Breeding birds (other than ground-nesting species)	Loss of nesting habitat (such as habitats used by sedge warblers, reed warblers and blackbirds) and/ or damage to nests caused by land clearance for site access, storage areas or other clearance of vegetation associated with the works. Scoped out for the three main stockpiles and bank restoration.
Fish (including eels)	Potential for killing of fish as a direct result of the dredging activity (i.e. fish being caught up in the dredging activity). Also potential for dredging to result in increased sediment load and release of contaminants (over and above those experienced in the baseline conditions). The indirect result of this could be changes to turbidity, dissolved oxygen levels and damage to fish gills, impacts on fish habitats, spawning grounds, feeding grounds and effects on migration. Scoped out for the three main stockpiles and bank restoration.
Notable/ nationally rare or scarce invertebrates	Direct loss of invertebrates (including the locally resident and nationally notable Hairy Click Beetle) as a result of removal with the dredged sediment. Scoped out for the three main stockpiles and bank restoration.
Non-native invasive species and pathogens	Spreading of invasive species (including Himalayan balsam) and pathogens (e.g. ash die-back) within the working area (and potentially beyond). Scoped out for the three main stockpiles and bank restoration.

6.1 Assessment Methodology

6.1.1 Scope of the Assessment

The scope of the assessment has been based on the critical project assumptions stated in Section 4.4 of the original ES.

The assessment of impacts on receptors was made within the parameters outlined below:

Designated sites were assessed within the Study Area shown on Drawings 121316-00014 and 122316–00016 (Appendix A) as they form part of an assemblage of sites, related to those on the Somerset Levels.

- A search radius of 1.5km around the proposed dredging locations was used for consideration of likely protected and notable species presence (with the exception of invertebrates) as the majority of dredged sediment will be stockpiled and / or

spread within this distance and much of the surrounding land is similar in character. Effects are not expected to spread beyond this distance for protected species. Therefore this search radius was also used for a biological records and Local Wildlife Sites data request. Invertebrate data searches were made within the river channels in close proximity to the dredge areas.

- A Phase 1 survey was undertaken at each of the three proposed stockpiling locations to classify the habitats present and therefore determine the potential for protected species. The habitats at the stockpiling locations are mapped on Drawings 122316-00029 to 122316-00031 in Appendix A of the ES Stockpile Addendum.
- When considering location of nearby ponds for GCN potential, a 1.5km search buffer was adopted. However, because GCN typically only travel within a few hundred metres of their breeding ponds, and because for this scheme any habitat impacts will be temporary, only works within a 250m buffer were considered to cause a potential impact.
- Further information on protected and invasive species has been collected during monitoring surveys undertaken for the dredge scheme between April and July (and are ongoing). Updated species information is provided on Drawing 122316-00021, Appendix A.

6.1.2 Baseline Methodology

A baseline data gathering exercise was conducted, including reference to existing information gathered from previous investigations on the Somerset Levels and internet sources such as the National Biodiversity Network (NBN). Consultation with the following relevant organisations was carried out:

- Somerset Environmental Records Centre (SERC);
- Natural England (in relation to Habitat Regulations Assessment); and
- Environment Agency technical specialists.

Data provided by the SERC included badger sett records from Somerset County Council Highways Department. All records provided from within the past ten years have been considered as part of this assessment.

Technical specialists from the local Environment Agency team were consulted to gain an understanding of the protected and notable species that have been found near to or within the site in previous years, as well as fisheries data. The fisheries data is based on the catches of anglers fishing the reach, observations made during fish strandings / rescues and known information on migratory fish species using the Severn Estuary.

Previous investigations on the Somerset Levels of relevance to this assessment include:

- *The Somerset Levels and Moors – Asset Management Strategy: Lower Tone and Parrett Dredging Appraisal – Environmental Desk Study (2013).*
- *River Parrett and River Tone Banks Badger Survey (2010).*

6.1.3 Survey of Stockpile Locations

An extended Phase 1 Survey (P1HS) was undertaken for each of the three proposed stockpiling sites on 19th March 2014 by a Black & Veatch ecologist (a full member of CIEEM). The locations of the three sites are shown on Drawing 122316-00028, Appendix A of the ES Stockpile Addendum. The survey methods were based on the P1HS methodology (JNCC, 2010) and the Guidelines for Preliminary Ecological Appraisal (Institute of Ecology and Environmental Management, 2012).

All land parcels were mapped according to JNCC P1HS habitat types with target notes taken, as appropriate, to provide supplementary information on habitat conditions, features too small to map, species composition, structure and management. Potential for protected and invasive species was identified or confirmed where possible.

6.1.4 Limitations

No site surveys for habitats or protected species have been undertaken to date as part of this project except for the proposed stockpiling locations as part of ongoing ecological monitoring during the construction stage of the dredge of the river and its banks. More details are provided in Section 4.4 of the original ES.

Although local technical specialist knowledge has been able to provide a good indication of the protected or notable species likely to be present on site, precise data records from past surveys within the Study Area were limited. This is likely due to the lack of previous development in the area and hence survey effort. See also Section 4.4 of the original ES. In particular, invasive species such as Himalayan balsam are known to be present along the banks of both the River Parrett and the River Tone but the extent of their spread is uncertain. This information is now more up to date from the surveys that have been undertaken during the dredge works.

6.1.5 Assessment of Impact Significance

The assessment of ecological effects has been undertaken with reference to the Chartered Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the UK (IEEM, 2006).

The IEEM guidelines note that the sensitivity of the receptor takes into account the following factors:

- The sensitivity and biodiversity value of the receiving habitat, for example in terms of its relative extent, fragility (including its ability to recover) and rarity;
- The nature and significance of any nature conservation designations that apply to the receiving site/habitat; and
- The presence and sensitivity of any scarce, rare, protected or otherwise notable species of flora or fauna.

The levels of sensitivity adopted in this assessment are provided in Table 6-2. Where a species or habitat may be protected or designated, but be relatively common in the local area the sensitivity may be reduced. Where necessary this is discussed in the relevant section(s) of the assessment.

Table 6-2 Sensitivity of ecological receptors

Receptor	High	Moderate	Low
Designated sites/habitats	International or national designation	Regional or local designation S41 NERC	No designation
Floral and faunal species	Legally protected	Red list or rare species S41 NERC	No listing

6.1.6 Characterisation of effects and assessment of magnitude

The magnitude of change considers factors such as the extent and integrity of the affected area, and the duration of potentially damaging effects (IEEM, 2006). The levels of change adopted in this assessment are provided in Table 6-3 below.

Table 6-3 Magnitude of change

Characteristic	High	Moderate	Low	Very Low
Extent	75-100% of area or receptor affected	25-75% of area or receptor affected	5-25% of area or receptor affected	0- <5% of area or receptor affected
Integrity	Adverse effect on site integrity, in terms of coherence of ecological structure or function	Adverse effect on a site's ecological objectives	Neither integrity nor ecological objectives of site compromised, negligible adverse effects	No observable change

6.2 Existing Environment

6.2.1 Statutorily Designated Sites

The Glossary (Chapter 18) references the associated legislation relating to statutory sites.

The location of the internationally protected sites and national Sites of Special Scientific Interest (SSSI) sites are mapped on Drawing 122316-00014 (Appendix A). National Nature Reserves and Local Nature Reserves are mapped on Drawing 122316–00016 (Appendix A of the original ES).

Somerset Levels and Moors SPA and Ramsar Site

The Somerset Levels and Moors Special Protection Areas (SPA) and Ramsar sites comprise a number of discrete areas of moorland. The SPA and Ramsar sites have the same boundaries. The moors are wet during the winter, with water entering the moors from rivers either via overtopping flood banks or via water control structures. The interest features for each site are summarised in Table 6-4.

Table 6-4 Somerset levels and Moors SPA and Ramsar features

Interest Feature	SPA	Ramsar
Bewick's swan *Cygnus columbianis bewickii* (over winter)	X	X
European golden plover *Pluvialis apricaria* (over winter)	X	
Eurasian teal *Anas crecca* (over winter)	X	X
Northern lapwing *Vanellus vanellus* (over winter)	X	X
Eurasian wigeon *Anas penelope* (over winter) *	X	
Northern shoveler *Anas clypeata* (over winter) *	X	
Internationally important assemblage of waterfowl (over winter)	X	X
17 species of British Red Data Book invertebrates		X

* Identified by 2001 SPA review

Severn Estuary SAC

The River Parrett flows into the Severn Estuary Special Area of Conservation (SAC) at Bridgwater Bay, towards the western extent of the estuary. The SAC is designated for the following habitat and species interest features:

- Estuaries
- Mudflats and sandflats not covered by seawater at low tide
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Sandbanks which are slightly covered by sea water all the time
- Reefs
- Sea lamprey *Petromyzon marinus*
- River lamprey *Lampetra fluviatilis*
- Twaite shad *Alosa fallax*.

Severn Estuary SPA and Ramsar Site

The Severn Estuary SPA and Ramsar sites cover approximately the same extent as the Severn Estuary SAC. The interest features for each site are summarised in Table 6-5.

Table 6-5 Severn Estuary SPA and Ramsar features

Interest Feature	SPA	Ramsar
Bewick's swan *Cygnus columbianis bewickii* (over winter)	X	X
Eurasian teal *Anas crecca* (over winter)		X
Gadwall *Anas strepera* (over winter)	X	X
White fronted goose *Anser albifrons* (over winter)	X	X
Dunlin *Calidris alpina* (over winter)	X	X
Shelduck *Tadorna tadorna* (over winter)	X	X
Redshank *Tringa totanus* (over winter)	X	X
Internationally important assemblage of waterfowl (over winter)	X	X
Immense tidal range		X
Unusual estuarine communities		X
Run of migratory fish between sea and river via estuary		X
Migratory birds in spring and autumn		X
Fish of the whole estuarine and river system		X

The Somerset Levels and Moors SPA and Ramsar sites are ecologically linked to the Severn Estuary SPA and Ramsar sites. This is because the Severn Estuary populations of wintering waterfowl use the Somerset Levels and Moors as an alternative wintering site.

Species of migratory fish designated under the Severn Estuary Ramsar site include salmon *Salmo salar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *A. fallax*, and eel *Anguilla anguilla.*

Some migratory fish from the Severn Estuary will make use of the Parrett and Tone catchments for their freshwater life stages. However, other than for glass eels, there is no formal survey data on the species which utilise the Tone and Parrett and little other information. Therefore, the actual extent to which these species use the rivers is unknown. However, whilst the proportion of the populations of the Severn Estuary that rely on the other major rivers entering the Severn is significant (the Wye and Usk are known to host freshwater life stages of the species concerned in significant numbers), the support that the river habitat of the Parrett and Tone provides is likely to be significantly less, because:

a) the lowland reaches of the Parrett and Tone are heavily modified, and arguably less inherently suitable to lamprey and shad; and

b) the Parrett and the Tone are much smaller (thus offering less habitat of any type).

Neither the Parrett nor Tone are designated by Defra as “principal salmon rivers”.

Somerset Levels National Nature Reserve (NNR)

The Somerset Levels NNR is located at Burrowbridge, where the River Tone joins the River Parrett. The reserve is adjacent to the River Parrett between Burrowbridge and Stathe. The main habitats present are open water and lowland grassland and the site supports a variety of bird interest. The site boundary is entirely within the Southlake Moor SSSI boundary (see below).

Southlake Moors Site of Special Scientific Interest (SSSI)

Southlake Moor SSSI is located at Burrowbridge, where the River Tone joins the River Parrett. The land is below sea level in the basin of the River Parrett. The water table is high throughout the greater part of the year with the system of ditches and rhynes being penned at high levels during summer. When conditions in the River Parrett are suitable, it may be flooded deliberately in winter by means of a sluice in the river bank.

The majority of the site is permanent grassland with a wide range of grassland types resulting from varying topographic and management conditions. There is a considerable variation in species composition. A range of ditch clearing methods are used resulting in diverse aquatic communities and a good submergent flora. Refer to Table 6-8 for notable invertebrate fauna.

When the moor is flooded large numbers of waterfowl may be present; with up to 22,000 wigeon, 250 Bewick’s swan and good numbers of pochard *Aythya farina,* teal and tufted duck *Aythya fuligula.* When floods recede, large flocks of lapwing *Vanellus vanellus* and snipe *Gallinago gallinago* return to feed; with dunlin and black-tailed godwit *Limosa limosa* often present. Much of the moor remains moist into the spring and early summer, providing suitable conditions for breeding snipe, redshank and lapwing.

Regular signs of otter are seen on the banks of the River Parrett. The ditches on the east side of the site contain a population of the palmate newt.

North Moor SSSI

North Moor SSSI is approximately 50m west of the proposed dredging works at Burrowbridge. The site is designated for its nationally important grazing marsh and ditch system. A range of neutral grassland types supporting common and scarce plants has developed mainly due to variations in soil and management practices. Although some fields are managed as short-term grass leys and a few are under arable cropping, most of the site is in permanent pasture.

Aquatic plant communities present are exceptionally diverse with good populations of nationally sparse species. The main community type is characterised by a combination of emergent species, floating species and submerged species. The ditches have a rare aquatic invertebrate community which includes two nationally rare species (refer to Table 6-8). The meadows and ditches contain at least twenty-five nationally notable invertebrate species.

The site has special interest in its breeding and wintering bird populations. There are good populations of breeding lapwing and whinchat *Saxicola rubetra* on the central part of the moor. In winter the wet grasslands support large flocks of lapwing, snipe, dunlin and golden plover *Pluvialis apricaria* with small numbers of additional species when flooding occurs.

The ditches and rhynes are known to be used by otter.

Langmead and Weston Levels SSSI

The Langmead and Weston Levels SSSI is nationally important for its species-rich neutral grassland and the invertebrate community found in the ditches and rhynes. The land lies in the floodplain of the River Parrett and many of the fields are poorly drained and seasonally water logged. A range of grassland types have developed including a nationally rare community type. Field ditches and rhynes contain a rich variety of wetland plants both in the water and on the banks. The terrestrial and aquatic invertebrates at the site include four nationally rare species. Twenty-one nationally scarce species have been found.

The site is approximately 500m from the works, is outside of the River Parrett floodplain and has no overwintering bird interest, therefore it is unlikely that the works would give rise to any significant impacts given the nature of the site interest features. This site has therefore been scoped out of further assessment.

Curry and Hay Moors SSSI

The Curry and Hay Moors SSSI is located adjacent to the River Tone, at a location to be dredged. The river overtops annually, flooding the fields in winter. Vegetation in the grazing meadows consists almost entirely of agriculturally improved swards. A small number of hay meadows are herb-rich. The flora and fauna of the ditches is of national importance. Over 70 bankside vascular plants have been recorded. Over 100 species of aquatic invertebrates inhabit the ditches including one nationally rare soldier fly (see Table 6-8) and 13 nationally scarce species.

In winter the flooded fields provide food for large numbers of waterfowl with several thousand lapwing, hundreds of snipe and smaller numbers of golden plover and dunlin

regularly present. Over 200 Bewick's swans have been recorded, making this site an internationally important wintering ground for this species. Large numbers of wigeon, teal and pochard regularly winter on the flooded fields.

Raptor species including short-eared owl *Asio flammeus,* merlin *Falco columbarius* and peregrine *Falco peregrinus* regularly hunt over the site in winter. The moist fields in spring and early summer support a breeding bird population.

Vertebrate species present include grass snake *Natrix natrix* and common frog *Rana temporaria.* Otter are regularly recorded on the site.

Bridgwater Bay SSSI

The River Parrett flows into the Bridgwater Bay SSSI towards the mouth of the river where it meets the Severn Estuary.

Bridgwater Bay comprises a succession of habitats ranging through extensive intertidal mudflats, saltmarsh, shingle beach and grazing marsh intersected by a complex network of freshwater and brackish ditches. The site is an integral part of the Severn Estuary system and is ecologically linked to the Somerset Levels which provide alternative winter feeding grounds for waders and wildfowl.

Bridgwater Bay is a critical feeding ground for passage and over-wintering waders and wildfowl. In its own right it supports internationally important numbers of whimbrel and black-tailed godwit. Of the overwintering species it attracts nationally important numbers of dunlin and wigeon. The assemblage of wildfowl and waders contains individual populations present in internationally important numbers including dunlin, shelduck, wigeon, curlew, redshank and teal. Populations of national importance are those of ringed plover *Charadrius hiaticula* and grey plover *Pluvialis squatarola*. Significant numbers of knot *Calidris canutus*, turnstone *Arenaria interpres*, snipe and mallard also occur.

Screech Owl Local Nature Reserve (LNR)

The Screech Owl LNR is situated adjacent to the River Parrett at Dunwear. It is a wetland area where redshank, curlew and wigeon have been recorded as well as water voles and otters. Grass snakes are likely to be present.

There will be no direct impact to the LNR from the works and no disturbance. There will be a small reduction to flood risk in the area from the dredging; however the site currently only floods from North Moor in an extreme flood event. Therefore, there will not be any significant impacts to this site and it has been scoped out of further assessment.

6.2.2 Non-statutorily Designated Sites

Important Bird Areas (IBA) and Local Wildlife Sites are mapped on Drawing 122316-00016.

Somerset Levels and Moors Important Bird Area (IBA)

Within the Study Area, the Somerset Levels and Moors IBA is incorporated within the areas of Southlake Moor SSSI and Curry and Hay Moor SSSI. Therefore, the notable bird interest of these areas is described within the corresponding SSSI descriptions in Section 6.3.1.

Local Wildlife Sites

Local Wildlife Sites (LWSs) have been assessed if they fall within the Study Area.

The River Parrett between Middlemoor and Screech Owl is designated as a LWS as it is a catchment seen to be in regular use by otter, and supports Red Data Book species and other notable species.

The River Tone and tributaries are designated as a LWS as it is considered:

- The best example in the county of a whole river from source to saline limit of each river type.
- A section of river with a minimum of modification to bed and water level and a high proportion of semi-natural habitats on both banks.
- To have high biological quality.
- The river catchment is in regular recent use by otter, including all bankside wetland, scrub and woodland.

North Moor Drain and the Bridgwater and Taunton Canal are both designated as LWSs for having a higher than average number of submerged floating and emergent plant species for a community type. They are also known to have two or more Somerset notable species.

Fordgate Wetlands LWS is a complex of ponds, swamps and willow carr.

Athelney Fields LWS is a series of fields with rhynes supporting some protected species.

6.2.3 Habitats of Principal Importance (NERC Act Section 41)

There are several habitats of principal importance (mapped on Drawing 122316-00005, Appendix A of original ES) within the Study Area. However, only 'Rivers', 'Coastal and floodplain grazing marsh' (the dominant habitat type surrounding both the River Parrett and the River Tone) and 'Lowland Meadows' have the potential to be significantly affected by the proposals and have been scoped into further assessment.

A collection of lowland meadows are present over 300m from the River Parrett, to the south-east of Burrowbridge.

Additional stockpile sites

The proposed stockpile locations 1 and 2 (as mapped on Drawings 122316-00029 and 122316-00030 in Appendix A of the ES Stockpile Addendum) are arable fields. This habitat is considered as having low ecological value in this area, except as providing supporting habitat for species (see Section 6.2.4). Location 3 is classified under P1HS as poor semi-improved grassland although it is not permanent pasture and is actually arable land on rotation. It has therefore not been classified as a NERC habitat. All habitats present within the proposed stockpiling sites have been mapped in Appendix A. Where potential for protected or notable species exists, this is described in Section 6.2.4.

6.2.4 Protected and Notable Species

Records of protected and notable species that have been considered in this assessment are mapped on Drawing 122316-00021 (Appendix A of the original ES). However, badger sett records have not been mapped due to the sensitivity to persecution.

Water vole

For the original ES Technical specialists from the Environment Agency advised that there are records of water vole within the study area. Their presence after the 2012/13 floods was confirmed (specific locations undisclosed) in at least two locations adjacent to the proposed dredge areas and a further site approximately one mile upstream on the River Parrett. 15 records of water vole field signs were provided by SERC within the 1.5km study area. The closest records to the dredge sites were on the banks of the River Parrett and the River Tone.

However, local populations were still recovering after effects of the flooding event in 2012/2013 and would have been further impacted by the 2013/14 floods. Although population numbers are currently unknown, water voles are likely to be present in the catchment and assumed likely to recolonise the site at some point during the works.

Monitoring of the dredging site has now shown that since June 2014 water voles have started recolonising at both the Parrett and Tone. There were eight known locations at the beginning of July, often just one or two burrows but more extensive activity has been recorded on the River Tone around Curry Moor Pumping Station and Athelney Bridge. A survey of Southlake Moor by Natural England in July 2014 has found a good population (NE pers comm).

All stockpile locations are bordered by ditches however, the ditches bordering stockpile location 1 and the majority of ditches bordering location 2 are vegetated with low bramble hedges and are therefore not considered suitable water vole habitat. No burrows were recorded at the proposed stockpiling locations but one water vole latrine was noted at location 2 (see Drawing 122316-00030, Appendix A of the ES Stockpile Addendum), within the only ditch that provides suitable habitat at this location. Location 3 is considered to offer potential water vole habitat once flooding subsides as the surrounding ditches are vegetated with reeds and other suitable vegetation.

Otter

Over 350 records of otter field signs within 1.5km were provided by SERC from within the last ten years, the most recent of which was in 2012. Otters have been recorded on the Parrett and Tone banks and are considered frequent users of the wider area. They are also noted for North Moor SSSI, Curry and Hay Moor SSSI and Southlake Moor SSSI (see Section 7.2.1.).

While holts or resting places along the Parrett and Tone are likely to have been flooded out over winter 2012/13, otters are likely to still use the rivers. No otter holts have been identified during ongoing monitoring of the dredge site. Only stockpile location 3 provides potential habitat for holts and resting places; the bordering ditch has flowing water and is likely to contain fish. However, no holts or resting places were identified during the survey. Otters may forage along the ditches of other stockpile locations.

Reptiles

The Curry and Hay Moor SSSI citation states that grass snake is present within the designated site. In addition, technical specialists from the Environment Agency have confirmed grass snakes have been recorded within the proposed working areas. Due to the area's suitability for grass snake, it is also considered highly likely that other species of reptile are supported in the surrounding habitats. Therefore it has been assumed that common lizards, slow worms and adders may also be present within the working areas; although populations in some areas will have been affected by recent flooding. The habitat present is not suitable for sand lizards or smooth snakes so these species have not been considered further in the assessment.

Three records of grass snake, one record of common lizard and one record of slow worm were provided by SERC. The nearest record to the proposed dredge sites was a grass snake record at Stoke St. Gregory, approximately 1km south of the River Tone.

None of the stockpile locations were considered of particular suitability as reptile habitat as they are located on arable fields that are likely to be regularly disturbed and lacking in vegetative cover.

Badgers

A survey was undertaken in 2010 to record badger sett locations on sections of the River Parrett and the River Tone (Black & Veatch 2010). The survey included the proposed dredge areas and found a total of six badger setts (precise locations remain undisclosed due to the sensitivity of the information) within the banks of the river to be dredged. Although it is not known what the present status of these setts is following recent flooding, it can be confirmed that badgers are likely to be within the working area. Six records of badger were provided by SERC within the Study Area, the nearest of which was at Stathe Bridge on the River Parrett. This is approximately 1.5km upstream of the proposed dredge site.

Surveys undertaken during the dredge works have to date identified two additional badgers setts along the banks of the River Tone and ten on the River Parrett.

The walkover ecology survey identified badger footprints at proposed stockpile locations 2 and 3 but no badger setts.

Great Crested Newt (GCN)

Environment Agency technical specialists have advised that GCN are present within the wider Somerset area and some local ponds are suitable for GCN. Therefore there is potential for GCN to be within the Study Area. Pond locations have been plotted on Drawing 122316-00005 (Appendix A of original ES) from OS mapping, which shows there are over 20 ponds within 1.5km of the dredge locations. There is also an extensive network of drainage rhynes surrounding the site, some of which may be suitable breeding sites for GCN. However, any local populations of GCN will have been affected by the recent flooding. There were no records of GCN in the data provided by SERC or on the NBN Gateway within the Study Area but this is likely due to lack of survey effort rather than an indication of absence.

There is one pond approximately 250m from stockpile location 1. While the range of GCN can extend over 500m, English Nature Research Report 576 '*An assessment of the efficiency of capture techniques and the value of different habitats for the great crested*

newt Triturus cristatus' found that most GCN were captured within 50m of ponds and few animals captured at distances over 100m. In addition, the works will be confined to existing arable land, which is subject to regular disturbance, and there will be no impact to boundary habitats which are more likely to provide habitat for GCN if present. Therefore, no impact on the population status of GCN is envisaged as part of the works and any direct harm to GCN is considered unlikely. The stockpiles will be covered by a membrane which will prevent GCN or other amphibians using them as refugia.

Ground-nesting birds

Waterfowl will use the river channels for nesting and surrounding farmland, including the stockpile locations, is likely to provide suitable for ground nesting species such as skylark or lapwing once recent flooding subsides.

Breeding birds (other than ground-nesting species)

Tall rank vegetation, sedges and reeds along the riverbanks are likely to support a variety of breeding birds over the nesting season. In particular, reed and sedge warblers have been recorded nesting in the vicinity in the past, as well as species such as blackbirds nesting in areas of bramble close to the rivers. Away from the river, boundary vegetation will also support nesting birds.

At the stockpile sites breeding birds are likely to be found in the boundary vegetation such as hedgerows and trees but this is to be unaffected.

Fish (including eels)

The proposed dredge reach is subject to tidal influence, but is characterised by low salinity. Thus, the dredged reach is characterised by a freshwater fish community, with a number of estuarine specialists also featuring, particularly in the lower reaches. The reach is within the 'Parrett (Transitional)' water body (GB540805210900) with respect to the Water Framework Directive (WFD). No fish classification exists for this water body, although the River Tone (Freshwater) water body has been classified as High status for fish. The lower reaches of the River Parrett (Freshwater) water body have not been classified with regard to fish populations.

No systematic fish survey data, or indeed ad-hoc data, is available for the reaches concerned of the Rivers Parrett or Tone, and information has been gained based on the knowledge of local Environment Agency fisheries and biodiversity staff (see Section 7.2.3). This information is summarised in Table 6-6. In addition, Environment Agency data from fish surveys conducted at the tidal limit of the River Tone (approximately 1.5 km beyond the upstream extent of the proposed dredging works) from 2007 to 2010 confirmed the presence of bleak, ruff, gudgeon, rudd and silver bream. It is assumed that these surveys were conducted upstream of the sluice at Newbridge in the freshwater reach of the River Tone; however, this is unconfirmed.

It is considered that the fish species discussed are not likely to have been impacted significantly by the recent flooding events.

Table 6-6 Seasonality of fish species identified as present or likely to be present

Common name	SEASONAL TIMING OF RIVER ENTRY											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Salmon (Adult)												
Salmon (Smolt)												
Sea trout (Adult)												
Sea trout (Smolt)												
Allis shad												
Twaite shad												
Glass eel												
Elver												
Yellow eel												
Silver eel												
River Lamprey												
Sea Lamprey												
Bass	Estuarine residents / nursery area											
Flounder												
Mullet												
Chub	Freshwater residents											
Common Bream												
Common carp												
Dace												
Pike												
Perch												
Roach												
Tench												

Salmon

The Rivers Parrett and Tone are not designated as principal salmon rivers, and thus do not benefit from a salmon action plan and an associated numerical conservation limit. However, the River Tone is regarded as an improving river in terms of its salmon run, with the annual number of returning adults likely to be in the order of several tens of adults, with incidental observations of ascending adults (e.g. attempting to surmount barriers in the catchment) made in 2013 suggesting good numbers of returning adults relative to preceding years (Andy Baines, EA Technical Specialist Pers. Comm.). Although salmon may return to river systems throughout the year, the peak period of river entry and estuarine passage would be expected to be during the summer and early autumn (July - Sept). Salmon smolts generally migrate downstream to the sea from March to June, although no data specific to the Parrett and Tone is available. On many rivers there is also an autumn descent of salmonid smolts.

Sea trout

Sea trout have a similar life history to salmon, returning to rivers mainly during the summer (June to July), although potentially throughout the year. As for salmon, the current population size is unknown. Sea trout smolts generally migrate downstream to the sea from March to June.

Shad

Allis and twaite shad are designated as features of the Severn Estuary SAC and Ramsar site, with spawning populations of twaite shad being identified in the rivers Severn, Wye,

Usk, and Tywi. Although neither twaite nor allis shad have never been recorded in the River Parrett (Environment Agency fisheries, Pers. Comm), this does not necessarily preclude their presence in the lower sections (they have been recorded at Hinkley Point B Power Station approximately 0.5km along the coast from the River Parrett estuary). However, shads tend to favour medium energy systems with erosive channels and require access to suitable upstream spawning habitats, which may be lacking in the Parrett system.

Eel

The Parrett is an Index river for eels and is therefore monitored. The Parrett is included in the South West Eel Management Plan under the EC Eel Recovery Plan.

Monitoring data is recorded for glass eel/elvers at the bristle eel pass situated at Oath Lock. This samples a proportion (unknown) of the glass eel run, and thus provides a) an absolute minimum estimate of numbers and b) a reliable picture of the seasonal pattern of glass eel migration into the system. Numbers recorded for 2013 are detailed in Table 6-7.

Table 6-7 Glass eel and elver numbers 2013

Month	Numbers of glass eel and elver
April	9,910
May	50,652
June	45,731
July	29,196
August	6,353
September	3,317
October	1,146
November	0

Glass eel recruitment throughout Europe during 2013 was widely reported to be the highest recorded in recent years (SEG, 2013). Official Drawings show the glass eel catch in the UK increased from 3.8t in 2012 to 8.6t in 2013, with little variation in fishing effort (ICES, 2013). The catch recorded in the South West River Basin District in 2013 was approximately 4,000kg, mainly from the River Parrett. Assuming 3,000 individuals per kilogram, this equates to approximately 12 million glass eels captured by the commercial fishery. The total yearly number of glass eels migrating up the River Parrett, therefore, would likely be in the range of several tens of millions.

Lamprey

Both river and sea lamprey are also designated as features of the Severn Estuary SAC and Ramsar site, although data on populations within the Rivers Parrett and Tone are limited. Both species migrate through estuaries and river systems during the autumn to spawning areas upstream. Lamprey ammocoetes are potentially present in the silt deposits targeted for removal.

Estuarine resident / nursery area species

Various species utilise estuaries and the lower tidal reaches of river systems as nursery areas or summer habitat. Such species identified as being present with the estuary of the River Parrett include bass, flounder and mullet. Although population estimates are not available for these species, juveniles can be locally abundant during the summer months.

Freshwater 'resident' species

Although a variety of freshwater fish species have been recorded in the tidal reaches of the Rivers Tone and Parrett, these fish are regarded as being vagrants that have likely been washed downstream from freshwater habitats during high flow events. The River Parrett upstream of Oath Lock is regarded as a relatively healthy coarse fishery, with a variety of freshwater fish species present, and is likely the main source for freshwater fish in the lower tidal sections of the river. The tidal section is thus unlikely to feature habitat characteristics to enable freshwater resident species to complete their full life-cycle.

Glass eel fishery

Impact on the fishery operations is considered in Chapter 5.

Notable / nationally rare or scarce invertebrates

The river reaches are tidal, and water level rises and falls by up to 50cm during spring tides. Saline influence is however low, typically salinity being 0.25–0.35 psu, and a saline wedge is not expected to penetrate as far inland as the dredging locations (Partrac Ltd, 2009). There are three SSSIs within the vicinity of the dredging reaches (Curry and Hay Moors, Southlake Moor and North Moor), all of which include aquatic invertebrate species within their notifications (see Table 6-8). While most of these species are associated with pools and drainage ditches rather than the main river channels, one (*Stratiomys singularior*, the flecked general soldierfly) occurs where there is a slight saline influence.

There is currently little information available on invertebrates in the dredging reaches of the Rivers Parrett and Tone. However, there are several NERC S41 invertebrate species in the area. River Parrett at and immediately upstream of the dredging reach is one of only three recent localities in the UK for the hairy click beetle *Synaptus filiformis*, whose larvae live in waterlogged soil and whose adults live in emergent vegetation, particularly reed canary-grass *Phalaris arundinacea* (see Drawing 122316-00021, Appendix A of original ES). The depressed river mussel *Pseudanodonta complanata* is a bivalve mussel inhabiting the beds of lowland rivers; it is known from other sites in the catchment and is likely to be present at the dredging locations. Other notable freshwater species are associated with the smaller ditches and pools rather than the main river channels: the snails *Omphiscola glabra*, *Segmentina nitida* and *Valvata macrostoma*. Species of crayfish are also unlikely in either of the rivers to be dredged but may be within some of the muddier side drains. Species richness in drainage ditches of the surrounding wet meadows is high, particularly with respect to water beetles (Armitage, 1981). The invertebrate species discussed are not likely to have been impacted significantly by the recent flooding events.

The key habitat for many invertebrate species along main rivers in the Somerset Levels and Moors is emergent and fringing vegetation, with its associated detritus and waterlogged soil. This often supports a good biodiversity, including typically several species of freshwater snails and beetles within a single locality; dragonfly and damselfly larvae will also be present, while emergent vegetation will be important for adults of these species. The area supports ten species of dragonfly and nine species of damselfly (Table 6-9), all of which may potentially breed in the main river margins and, as adults, may use the marginal habitats. The river bed will support a lower diversity of species than the margins but is likely to contain several species of freshwater mussels, along with large numbers of oligochaete worms that are important food for various bottom-feeding fish species.

Table 6-8 Freshwater invertebrates of conservation interest in the area around the proposed dredging sites (mentioned in SSSI notifications or NERC S41 listed). CHM=Curry & Hay Moors SSSI; NM=North Moor SSSI; SLM=Southlake Moor SSSI.

Species	SSSI	Habitat preferences
Agabus uliginosus (beetle)	CHM	Temporary still waters on low ground, sometimes on marshes subject to tidal influence, and in puddles around springs in otherwise dry terrain. Source: Foster G.N. & Friday L.E. (2011) *Keys to Adults of the British Water Beetles of Britain and Ireland* (Part 1). Handbooks for the Identification of British Insects Vo. 4 (Part 5) 2nd Edition. Shrewsbury, Field Studies Council.
Brachytron pratense (hairy dragonfly)	NM; SLM	Ponds, lakes, fens, ditches, and canals rich in vegetation, favouring lowland levels; susceptible to poor ditch management. Adapted to still waters. Sources: Hammond C.O. (1983) *The Dragonflies of Great Britain and Ireland.* 2nd Edition. Colchester, Harley Books. Hof, C., Brändle, M., Dehling, D.M., Munguía, M., Brandl, R., Araújo, M.B., & Rahbek, C. (2012). *Habitat stability affects dispersal and the ability to track climate change.* Biology Letters. doi: 10.1098/rsbl.2012.0023 available online at http://www.alphagalileo.org/ViewItem.aspx?ItemId=118061&CultureCode=en [last accessed 26th February 2014].
Coenagrion pulchellum (damselfly)	NM; SLM	Well-vegetated ditches, canals and ponds. Rarely in flowing water. Source: British Dragonfly Society (2014) *Variable Damselfly* available online at: http://www.british-dragonflies.org.uk/species/variable-damselfly [last accessed 26th February 2014].
Gyraulus laevis (snail)	SLM	Shallow, slow flowing waters, rivers, lakes and ponds, usually found on weeds, but sometimes on muddy bottoms and on stones. Occasionally in canals and ditches. Source: IUCN (2013) Gyraulus laevisavailable online at: http://www.iucnredlist.org/details/155828/0 [last accessed 26th February 2014].
Helophorus nanus (beetle)	CHM	Acid fens. Source: Friday L.E. (1988) *A Key to the Adults of British Water Beetles.* Field Studies, 7, 1-151.
Hydaticus transversalis (beetle)	CHM	Ditches in grazing levels that are rich in emergent and submerged macrophyte vegetation. Sources: Friday L.E. (1988) A Key to the Adults of British Water Beetles. Field Studies, 7, 1-151. Cornish Red Data Book (unknown) *Hydaticus transversalis* available online at: http://www.cisfbr.org.uk/CRDB/CRDB%20Hydaticus%20transversalis.htm [last accessed 26th February 2014].
Hydrophilus piceus (great silver diving beetle)	NM	Weedy ponds, especially those covered in duckweed. Good quality ditches. Rare and localised. Sources: Friday L.E. (1988) A Key to the Adults of British Water Beetles. Field Studies, 7, 1-151. Bumblebee.org (2014) *Water Beetles* available online at: http://www.bumblebee.org/invertebrates/ColeopteraA.htm [last accessed 26th February 2014].
Odontomyia ornata (true fly; large soldier fly)	CHM; NM; SLM	Wide, open ditches on grazing marshes. Somerset Levels is one of two British strongholds Source: Stubbs A. & Drake M. (2001) British Soldierflies and their Allies. Reading, British Entomological and Natural History Society.
Sigara semistriata (bug)	NM; SLM	Lowland, normally slightly acid water. Source: Savage A.A. (1989) *Adults of the British Aquatic Hemiptera Heteroptera. A Key with Ecological Notes*. Ambleside, Freshwater Biological Association.
Stratiomys singularior (=furcata) (true fly)	SLM	Ponds and ditches, particularly those with a slight brackish influence. Source: Stubbs A. & Drake M. (2001) British Soldierflies and their Allies. Reading, British Entomological and Natural History Society.
Other NERC S41 species found in the area		
Omphiscola glabra (snail)		Generally restricted to small pools, ponds, ditches and marshy

Species	SSSI	Habitat preferences
		areas on uncultivated heaths and commons. Source: JNCC (2010) *UK priority species – Version 2* available online at: http://jncc.defra.gov.uk/_speciespages/2464.pdf [last accessed 26th February 2014].
Pseudanodonta complanata (mussel)		Slow rivers; occasionally canals. Source: Ellis A.E. (1978) *British Freshwater Bivalve Mollusca.* Linnean Society Synopses of the British Fauna No. 11. London, Academic Press.
Segmentina nitida (snail)		Ditches. Found at a single Somerset Levels site (and elsewhere but not well distributed). Source: JNCC (2010) *UK priority species – Version 2* available online at: http://jncc.defra.gov.uk/_speciespages/570.pdf [last accessed 26th February 2014].
Valvata macrostoma (snail)		Weedy ditches draining grazing marshes; never in rivers. Known from West Sedgemoor. Sources: Chadd R. (2007) The Identification of Freshwater Invertebrates to Species Level; a Distance-learning Course. Module 2. Environment Agency, unpublished. JNCC (2010) *UK priority species – Version 2* available online at: http://jncc.defra.gov.uk/_speciespages/2686.pdf [last accessed 26th February 2014].

Table 6-9 Dragonflies and damselflies recorded from the vicinity of the pro posed dredging works (source: NBN Gateway, accessed 18/02/14)

Dragonflies	
Aeshna cyanea	Southern hawker
Aeshna mixta	Migrant hawker
Aeshna juncea	Common hawker
Anax imperator	Emperor dragonfly
Orthertrum cancellatum	Black-tailed skimmer
Libellula depressa	Broad-bodied chaser
Libellula fulva	Scarce chaser
Libellula quadrimaculata	Four-spotted chaser
Brachytron pratense	Hairy dragonfly
Sympetrum sanguineum	Ruddy darter
Sympetrum striolatum	Common darter
Damselflies	
Calopteryx splendens	Banded demoiselle
Lestes sponsa	Emerald damselfly
Ischnura elegans	Blue-tailed damselfly
Pyrrhosoma nymphula	Large red damselfly
Coenagrion pulchellum	Variable damselfy
Coenagrion puella	Azure damselfly
Erythromma najas	Red-eyed damselfly
Platycnemis pennipes	White-legged damselfly
Enallagma cyathigerum	Common blue damselfly

Non-native invasive species or pathogens

Environment Agency technical specialists have reported a frequent occurrence of Himalayan balsam *Impatiens glandulifera* within the River Parrett and the River Tone catchments. Japanese knotweed *Fallopia japonica* has also been recorded recently on the River Parrett. It is therefore considered that there is a reasonable likelihood that invasive non-native species such as these will be encountered within the working areas.

In addition, floating pennywort *Hydrocotyle ranunculoides* has been recorded historically on the River Tone, although not since the local flooding events of 2012 / 2013. It is also thought to be prevalent on other local watercourses.

Data from SERC and the NBN Gateway did not contain any records of Himalayan balsam, Japanese knotweed or giant hogweed within the Study Area.

No invasive species were identified during the ecology survey at the three proposed stockpiling locations.

6.3 Likely Significant Effects

6.3.1 Construction Impacts

Statutorily Designated Sites

Internationally Designated Sites

A Habitats Regulations Assessment of possible significant effects is reported in Appendix D and summarised below.

As receptors, all internationally designated sites are classified as being of **high** sensitivity. An assessment to identify likely significant effects on internationally designated sites identified the following potential effects during construction:

- Somerset Levels and Moors SPA and Ramsar sites: Disturbance of **wintering birds**.
- Somerset Levels and Moors SPA and Ramsar sites: Direct land take.
- Severn Estuary SAC: Obstruction to passage and mortality of **migratory fish** that form part of the Severn Estuary populations (including salmon, eels and lamprey) due to temporary disturbance and deterioration in water quality of the River Tone and River Parrett during dredging.
- Severn Estuary SPA and Ramsar sites: Disturbance of **wintering birds** at Somerset Levels and Moors could affect individuals that form part of the Severn Estuary populations.

The removal of intertidal sediment during the works will result in temporary short-term change in hydromorphology which may affect downstream habitats within the Severn Estuary SAC/SPA/Ramsar. As this is a one-off dredging activity, this will be a negligible change within the wider context of the Severn Estuary and is unlikely to impact on intertidal habitats outside of normal natural variability. Further details are provided in the WFD Assessment (Appendix B of the original ES).

The majority of dredging will take place over summer, thereby avoiding disturbance to wintering birds. However, some dredging may be needed in March 2014, and there is a programme risk that dredging may need to extend into winter 2014/15 due to weather conditions. The location of the works means that the areas of wintering habitat potentially disturbed are limited to an area in the north-east of Curry Moor and an area in the west of Southlake Moor. The total area potentially affected is very small in relation to the Somerset Level and Moors SPA and Ramsar site, and of the Severn Estuary system as whole, resulting in a very low magnitude of effect.

Bank restoration will occur for approximately 150m at Southlake Moor. Land take within the designated site will be up to 2m from existing toe of bank. This is land at the edge of large extent of the designated area and would not have a likely significant impact on supporting habitat to the features of interest.

The significance of construction effects before mitigation on the Somerset Levels and Moors SPA and Ramsar and the Severn Estuary SPA and Ramsar sites is assessed as **minor, short-term and adverse** and temporary except for the land take which will be permanent.

Dredging has potential to cause reductions in water quality, particularly during periods of elevated temperature and reduced flow typically encountered in the summer. Particular risks include increased ammonia levels, increased turbidity and reduced dissolved oxygen levels. Dredging can also generate noise and vibration disturbance. Reduced water quality poses risk of harm and mortality to fish and together with disturbance can impede the movement of fish along rivers. The rivers Parrett and Tone are known to be used by migratory fish including salmon and eels that move between sea and freshwater habitats at different stages of their lifecycle. These form part of the designated Severn Estuary fish populations. Shad and lamprey species may also use the Parrett and Tone.

There is uncertainty about how many fish use the rivers Parrett and Tone, and what proportion of the Severn Estuary populations use the rivers. However, whilst the proportion of the populations of the Severn Estuary SAC that rely on the other major rivers entering the Severn (the Wye and Usk are known to host freshwater life stages of the species concerned in significant numbers) is substantial, the support that the river habitat of the Parrett and Tone provides is likely to be substantially less, because:

a) the lowland reaches of the Parrett and Tone are heavily modified, and arguably less inherently suitable to lamprey and shad; and

b) the Parrett and the Tone are much smaller (thus offering less habitat of any type).

In addition, neither the Parrett nor the Tone is designated as a principal salmon river.

Overall, although individual fish may be affected, the magnitude of effect on the Severn Estuary migratory fish population is anticipated to be very low.

The significance of construction effects before mitigation on the Severn Estuary SAC/Ramsar is assessed as **minor, temporary, medium-term and adverse**.

Southlake Moor SSSI/Somerset Levels NNR

As a receptor, Southlake Moor SSSI (which incorporates the Somerset Levels NNR) is classified as being of **high** sensitivity.

There is potential for the disturbance of overwintering bird species using the site. However, as described under Internationally Designated Sites, the majority of dredging will take place over summer, thereby avoiding disturbance to wintering birds. However, some dredging may be needed in March 2014, and dredging may need to extend into winter 2014/15. Working in summer has the potential to disturb breeding birds and it may also be necessary for plant to track along the river bank within the SSSI boundary.

The magnitude of change from these impacts is considered to be low as only a proportion of the site would be subject to these impacts, therefore the significance of the effect before mitigation is assessed as **moderate, temporary, short-term and adverse.**

As described in Internationally Designated Sites above there will be some permanent land take in Southlake Moors SSSI. The banks will be reseeded with National Vegetation Classification (NVC) MG5c mix to provide some localised improvement to biodiversity. The magnitude of change is considered to be very low as only a small proportion of the periphery of the site would be lost, therefore the significance of the effect before mitigation is assessed as **minor, permanent and adverse.**

North Moor SSSI

As a receptor, North Moor SSSI is classified as being of **high** sensitivity.

As for Southlake Moor there is the potential for the disturbance of bird species using the site.

The magnitude of change from these impacts is considered to be very low as less than 5% of the site would be subject to disturbance, therefore the significance of the effect before mitigation is assessed as **minor, temporary, short-term and adverse.**

Curry and Hay Moors SSSI

As a receptor, Curry and Hay Moors SSSI is classified as being of **high** sensitivity.

The site is located in close proximity to approximately 1km reach of the proposed dredging. As for Southlake Moor, there is potential for the disturbance of overwintering and breeding bird species using the site. It may also be necessary for plant to track along the river bank within the SSSI boundary.

The magnitude of change from these impacts is considered to be low as only a small proportion of the site will be affected, therefore the significance of the effect before mitigation is assessed as **moderate, temporary, short- term and adverse.**

Bridgwater Bay SSSI

As a receptor, Bridgwater Bay SSSI is classified as being of **high** sensitivity.

The removal of intertidal sediment during the works will result in temporary short-term change in hydromorphology which may affect downstream habitats within the Bridgewater Bay SSSI. As this is a one-off dredging activity, this will be a negligible change within the wider context of the Severn Estuary and is unlikely to impact on intertidal habitats outside of normal natural variability. Further details are provided in the WFD Assessment (Appendix B).

The site is of such a distance that overwintering birds will not be directly disturbed by the dredging works. However, the Somerset Levels are ecologically linked to Bridgwater Bay SSSI as the levels are known to provide alternative winter feeding grounds for waders and wildfowl that form part of the site's designation. Impacts will be as for the Somerset Levels and Moors and the Severn Estuary SPA described previously. Impacts are expected to be of a very low magnitude and the significance would be **minor, temporary, short-term and adverse.**

6.3.2 Non-statutorily Designated Sites and Other Habitats

Somerset Levels and Moors Important Bird Area (IBA)

As a receptor, the Somerset Levels and Moors IBA is classified as being of **moderate** sensitivity.

Potential impacts will be as described under Southlake Moor SSSI and Curry and Hay Moor SSSI. The magnitude of change from these impacts is considered to be low, therefore the significance of the effect before mitigation is assessed as **minor, temporary, short-term and adverse.**

Local Wildlife Sites (LWS)

LWSs are considered to be of a **moderate** sensitivity.

The River Parrett and the River Tone LWSs will be directly impacted by the dredging activities. Bankside habitats will be completely removed and local species that use the rivers will be disturbed. Impacts on legally protected and notable species are assessed separately under Section 6.2.3. The magnitude of change from the dredging activity is considered to be high; therefore the significance of the effect before mitigation is assessed as **major, temporary, medium-term and adverse.**

Athelney Fields LWS is located adjacent to the River Tone and there is potential for the dredged arisings to be spread across this site, thereby affecting habitat quality. However, the designation features are related to the species using the rhynes, which will not be directly affected but there is a risk of run-off. The magnitude of change from the spreading is considered to be moderate, therefore the significance of the effect before mitigation is assessed as **moderate, temporary, short-term and adverse.**

Habitats of Principal Importance

As a receptor, all the following habitats of principal importance have been classified as being of **moderate** sensitivity.

Lowland meadows are unlikely to be affected by the construction of the dredging scheme due to their location at least 300m from the nearest dredge location. They are within a SSSI boundary and therefore would not be used for spreading.

The scheme will involve dredging 8km of river which will have adverse impacts on the habitat and fauna it supports. However, only 8km of the total length of the Parrett and Tone would be affected which would result in a low magnitude of change in the context of overall availability of river habitat. Therefore, the significance of the effect before mitigation is assessed as **minor, temporary, medium-term and adverse.**

Areas of coastal and floodplain grazing marsh are likely to be used for the spreading of dredged material. Due to the abundance of the habitat in the local area it would be hard to avoid using such sites. The magnitude of change from this impact is considered to be low, therefore the significance of the effect before mitigation is assessed as **minor, temporary, short-term and adverse.**

6.3.3 Protected and Notable Species

Water vole

As a receptor, water voles are classified as being of **high** sensitivity.

Potential impacts to water vole during the construction phase include:

- Damage to water vole habitat including destruction of burrows and foraging habitat (both current habitat and habitat that recovering populations would otherwise have potentially moved into).
- Direct harm to water voles if within a burrow at the time of excavation.

The magnitude of change from these impacts is considered to be moderate, therefore the significance of the effect before mitigation is assessed as **major, temporary, medium-term and adverse.**

Water voles are now known to have started to colonise both the Parrett and Tone rivers. Where dredging still needs to occur voles are being either displaced or relocated by trapping (under licence) to local sites. It is therefore likely that voles will be mainly absent from most areas where bank raising is to occur as it is unlikely that banks will have recolonised enough with cover to provide suitable habitat for voles. However, where bank raising is proposed where dredging was completed earlier in the year then it is possible that voles may have recolonised. Bank raising works are unlikely to impact water vole burrows directly as raising is being carried out from landward side but it is possible that animals could be disturbed if present. While this would provide a set back to the recovering population it is clear from current recolonisation that a wider population has survived the floods and is expanding so there should be no impact on the overall viability of the population. Overall there is not thought to be any significant change in the impact assessed for the original ES for the dredge scheme (as described above).

There would be no direct or indirect impact to water voles at the stockpile locations as stockpiling will not occur within 10m of any boundary rhyne/ditch. Therefore there is no change to the assessment of impact on water voles above from the revised scheme.

Otter

As a receptor, otter are classified as being of **high** sensitivity.

Potential impacts to otter during the construction phase include:

- Damage or destruction of any resting places (holts or lay-up sites).
- Disturbance to hunting territory.
- Impacts on fish, a main food resource.
- Impacts on water quality.

An otter territory could be 20-40km and therefore only up to half is likely to be directly affected by the proposed works. Indirect effects, e.g. on water quality or fish, would be wider. Otters are mainly active from dusk to dawn so disturbance to hunting activity would be limited.

The magnitude of change from the destruction of a resting place is considered to be moderate. The significance of the effect before mitigation is therefore assessed as **major, temporary, short-term and adverse.**

The magnitude of change from general disturbance within hunting territory is considered to be low. The significance of the effect before mitigation is therefore assessed as **low to moderate, temporary, short-term and adverse.**

The magnitude of change from the impact on fish and water quality is considered to be moderate. The significance of the effect before mitigation is assessed as **moderate to major, temporary, short to medium-term and adverse.**

There would be no direct or indirect impact to otters at the stockpile locations as no holts or resting places were identified and stockpiling will not occur within 10m of any boundary rhyne/ditch. Therefore there is no change to the assessment of impact on otters above from the revised scheme.

Reptiles

As a receptor, the reptile species considered to present in the Study Area are classified as being of **moderate** sensitivity.

During the construction works, general plant movement has the potential to kill or injure reptile species through the destruction of foraging and basking areas. In addition, if dredging commences prior to the end of March, or April is unusually cold, there is potential for reptiles to be hibernating in small mammal burrows within the river banks. There is potential to kill or injure reptiles if any such sites are tracked over. However, only a small proportion of available habitat will be affected on the riverbanks themselves. Spreading and stockpiling operations will avoid field boundaries and reptiles are unlikely to be found within arable fields or rotational pasture.

The magnitude of change is considered to be low. The significance of the effect before mitigation is assessed as **minor, temporary, short-term and adverse.**

Badgers

As a receptor, badgers are classified as being of **moderate** sensitivity as, though legally protected, their protection is to prevent persecution rather than for conservation and the species is generally considered widespread in the area.

As badgers are known to be reasonably active along the River Parrett and Tone banks, and setts have been recorded in the vicinity in the past, there is the potential for the destruction of badger setts and disturbance to badgers as a result of plant and vehicle movements, access routes, site compounds, bank restoration and spreading activity.

The magnitude of change is considered to be moderate. The significance of the effect before mitigation is assessed as **moderate, temporary, short-term a nd adverse.** This assessment has not changed with the inclusion of the bank restoration works.

No badger setts have been identified in the stockpile sites and while badger activity has been noted there would be no significant change in impact than assessed above.

Great crested newt (GCN)

As a receptor, GCN are classified as being of **high** sensitivity.

There is potential during the construction works for killing or injury of GCN or impairment to their ability to breed due to the sediment or spreading. This could be either through the destruction of hibernation and/or foraging and commuting areas or the destruction of rough grassland that links breeding ponds. No ponds would be directly affected.

The magnitude of change from these impacts is considered to be low, therefore the significance of the effect before mitigation is assessed as **moderate, temporary, short-term and adverse.**

Ground-nesting birds

As a receptor, ground-nesting birds are classified as being of **moderate** sensitivity (whilst nesting) as no Schedule 1 ground nesting birds are considered likely to be impacted by the works.

There is potential to disturb, kill or injure ground-nesting birds and to destroy their nests within agricultural fields during spreading operations. These impacts also apply whilst siting access, temporary stockpiles and compound areas. In addition, there is potential to disturb species such as waterfowl nesting on the riverside banks during dredging. The construction programme runs from March to the end of October and potentially into winter. Therefore not all habitats will be impacted during the breeding season.

The magnitude of change from these impacts is considered to be moderate, therefore the significance of the effect before mitigation is assessed as **moderate, temporary, short-term and adverse.**

The fields proposed for stockpiling also offer some potential for ground nesting birds but there would be no change in the significance of effect from that described above.

Breeding birds (other than ground-nesting species)

As a receptor, breeding birds are classified as being of **moderate** sensitivity as no Schedule 1 breeding birds are considered likely to be impacted by the works.

There is potential for the dredging plant to directly destroy bird's nests within bankside sedges and reeds whilst the channel sides are being excavated.

Indirect disturbance to nests is not considered significant as the operations proposed are similar to agricultural or maintenance operations and are not considered further.

The magnitude of change from these impacts is considered to be moderate, therefore the significance of the effect before mitigation is assessed as **moderate, temporary, short-term and adverse.**

Fish (including eels)

As a receptor, fish and eels are classified as being of **moderate** sensitivity.

The potential impacts on fish from the construction period are outlined below:

Water quality

Dredging has an inherently high risk of causing deterioration in water quality, particularly during periods of elevated temperature and reduced flow typically encountered in the summer, to the extent that fish mortality is possible. As a result, water quality impacts are the primary mechanism of impact on fish species. Dredging will encompass the entire channel width for some length of the channel and this, plus the timing of the dredge activities during migratory periods, means that potentially all diadromous species entering the river and/or resident populations within the affected reaches will be exposed to changes in water quality.

Mobilisation of sediment may affect dissolved oxygen levels, augmented by increased biological oxygen demand of organic material. Prolonged periods of reduced dissolved oxygen would likely result in mortalities of both resident and migratory fish species utilising the affected reaches. The magnitude of change from these impacts is considered to be moderate, therefore this is considered a **moderate, temporary, short-term and adverse** impact**.**

Increased turbidity through elevated levels of Total Suspended Solids (TSS) may affect resident fish populations through gill damage and impacts on respiration. Feeding and prey capture by predatory fish species may also be affected. The magnitude of change from these impacts is considered to be moderate, therefore this is considered a **moderate, temporary, short-medium term and adverse** impact**.**

In addition, behavioural cues of migratory fish species could potentially be affected by high turbidity levels, with salmonids known to avoid excessively turbid environments. The magnitude of change from these impacts is considered to be moderate, therefore this is considered a **moderate, temporary, short-term and adverse** impact. Given the naturally highly turbid estuarine environment associated with glass eel migration (particularly within the Severn Estuary), magnitude of the impact is considered very low and potential impacts of increased turbidity on this species/life stage are considered **negligible, temporary , short-term and adverse**.

Previous sediment contaminant analysis within the proposed dredge sites (Environment Agency, 2009b) indicated elevated levels of Polycyclic Aromatic Hydrocarbons (PAH). Although chronic exposure to PAH may lead to reproduction and growth impacts on fish, short term exposure during re-suspension as a result of dredging activities is unlikely to have any significant impact due to the generally high PAH biotransformation capability of fish (Eisler, 1987). The magnitude of the impact is considered very low and impacts are considered **negligible, temporary, short-term and adverse**.

Removal of marginal or in-stream macrophyte cover may potentially increase water temperatures as a result of reduced shading. This could further exacerbate any problems associated with reduced dissolved oxygen levels, particularly during periods of naturally low flow. However, the magnitude of the impact is considered very low and is considered a **negligible, temporary, short-term and adverse.**

Mechanical operation of dredging gear

Dredging is to be conducted by mechanical plant, either from the bank or from pontoons. There is, therefore, a risk of direct destruction of fish eggs or juveniles (particularly lamprey ammocoetes, if present) and adult eels associated with marginal and submerged macrophytes that are removed during dredging operations. In addition, glass eels migrating in the margins may be susceptible to removal by the dredging operations. The

magnitude of the impact is considered moderate. Therefore, this is considered a **moderate, temporary, short-term and adverse** impact.

Noise, vibration and visual disturbance

Given the relatively narrow channels within the dredging reaches and the absence of alternative migratory routes, migratory species such as salmon, sea trout, shad and eels may have their passage delayed or halted as a result of avoidance behaviour associated with the noise, vibration and visual disturbance caused by the dredging activities. The magnitude of the impact is considered to be moderate and therefore is considered a **moderate, temporary, short-term and adverse impact.**

Impoverished benthic fauna

Removal of channel and marginal substrate will likely result in a reduction in benthic invertebrate fauna, with a resultant impact on food availability for resident fish populations. The magnitude of the impact is considered to be high and therefore is considered a **major, temporary, medium-term and a dverse** impact. However, given the existing highly modified channel form at the proposed dredge sites, with minimal habitat heterogeneity or ecosystem functioning, potential fish population impacts at the catchment scale are considered **minor to negligible**.

Reduced habitat diversity

Depending on the type of dredging activities and proposed channel design, there could be a reduction in shallow marginal areas and vegetation (e.g. *Phragmites*) to act as high flow refuges or juvenile nursery habitat. The magnitude of this impact is high and is considered a **major, temporary , medium-term and adverse** impact**.** However, given the existing highly modified channel form at the proposed dredge sites, with minimal habitat heterogeneity or ecosystem functioning, potential fish population impacts at the catchment scale are considered **minor to negligible**.

Reduction in spawning habitat

Many coarse fish species spawn on dense submerged vegetation or other complex habitat structures. The proposed dredging activities will remove all vegetation and other complex substrate material within the affected reaches, with a resultant loss in spawning habitat for a variety of different fish species. This is an impact of moderate magnitude and therefore is considered a **moderate, temporary, medium- term and adverse** impact.

Reduction in resting or 'hold up' areas for migratory salmonids

Migratory salmonids require resting or 'hold up' areas during their upstream migration. These areas generally comprise deeper pools or in-stream features providing low flow areas. The proposed dredging may result in the loss of any such areas within the impacted reaches, depending on the channel design. This is of low magnitude and is considered a **minor, temporary , long-term and adverse** impact. However, given the existing highly modified channel form at the proposed dredge sites, with minimal existing hold up opportunities, potential fish population impacts at the catchment scale are considered **minor to negligible**.

Notable / nationally rare or scarce invertebrates

As a receptor, notable / nationally rare or scarce invertebrates are classified as being of **moderate** sensitivity.

There is potential for impacts to invertebrates during the construction period for the following reasons:

Loss of bankside habitat. Digging out banks will remove the key habitat for many invertebrate species: emergent and fringing vegetation and associated detritus. It will also remove populations of invertebrates living within this habitat, impeding the ability for rapid local recolonisation. The magnitude of the impact is considered to be moderate (three out of seven confirmed colonies of hairy click beetle will be affected) and therefore is considered to be a **major, temporary, medium-term and adverse** impact.

Mobilisation of sediment. Dredging work will disturb sediment, clouding the water and smothering benthic (bed-inhabiting) organisms. This will impede respiration, by clogging gills, and filter-feeding by mussels. The magnitude of the impact is considered to be moderate and therefore is considered to be a **moderate, temporary, sho rt-term and adverse** impact; although may become **major** if dredging activities continue over an extended period into the time of year when mussels become more active.

Physical removal of invertebrates in dredgings. Bottom dwelling animals will be removed along with sediment that is extracted from the channel. The magnitude of the impact is considered to be moderate and therefore is considered to be a **moderate, temporary , short-term and adverse** impact for most species, but a **medium term** impact for larger long-lived species, such as mussels.

Loss of instream habitat heterogeneity. Unsympathetic dredging will destroy areas of variable flow. The magnitude of the impact is considered to be low and therefore this is considered to be a **minor, temporary, long-term and adverse** impact.

Disturbance to reproductive cycle of freshwater mussels. Freshwater mussels have a reproductive cycle that involves release of larval stages (glochidia) which then parasitise freshwater fish. Physical disturbance during the reproductive period may cause premature release of glochidia and may result in fish vacating the area, thus affecting an annual reproductive cycle. The magnitude of the impact is considered to be moderate and therefore this is considered to be a **moderate, temporary, medium-term and a dverse** impact.

Toxic effects of herbicide application. Control of invasive plant species using herbicides may input toxins into the water, with impacts on the invertebrate fauna. The magnitude of the impact is considered to be high and therefore is considered to be a **major, temporary, short-term and adverse** impact.

Nutrient mobilisation. May lead to enhanced phytoplankton and epiphytic growth, increasing food availability for grazers and filter feeders but impeding growth of macrophytes and shoots of emergent plant species. The magnitude of the impact is considered to be low and therefore this is considered to be a **minor, temporary , short-term and adverse** impact.

Disposal of dredgings. Unsympathetic disposal of dredgings adjacent to or upstream of grazing marshes of conservation interest will be deleterious to vulnerable and protected species living within the ditch habitats. Where dredgings are placed directly, this will have

an obvious destructive effect on the habitat. Where water and other residue leach out of the dredgings this will contaminate drainage ditches. The magnitude of the impact is considered to be high and therefore this is considered to be a **major, permanent and adverse** impact.

Greater proportion of hard or large particle substrate. Will encourage colonisation by species that prefer hard substrate and reduction of those preferring soft substrate. Possible impacts include establishment by invasive zebra mussel *Dreissena polymorpha* and, where saline influence is greatest, *Mytilopsis leucophaeta*. The magnitude of this impact is considered to be moderate, therefore considered a **moderate, potentiall y permanent and adverse** impact.

Non-native invasive species or pathogens

The sensitivity of the surrounding environment (designated or not) to the effects of non-native invasive species is considered to be **high**.

As Himalayan balsam has been recorded on site and is known to be frequent on riverbanks throughout the River Parrett and River Tone catchments, it is likely that a seed bank has become established within the sediments of the river channel, having already been spread by natural causes. Himalayan balsam seeds remain viable for one year. The dredging works have the potential to cause the spread of these seeds further by both spreading dredged sediments onto adjacent agricultural land, and by tracking over riverbank soil, which could also contain dormant seeds. This material has the potential to be spread to any suitable location, including to stockpiling locations tracked by the plant.

Dredging will also leave banks exposed in the short- term, which will be therefore be more vulnerable to the establishment of a variety of non-native invasive species known to spread along watercourses in the catchment e.g. Himalayan balsam.

The potential for spreading non-native invasive species is considered to be of moderate magnitude. The significance of the effect before mitigation is assessed as **major, permanent and adverse.**

If any spreading works are required outside of Study Area, this will be assessed and mitigated if necessary as part of the permitting process and in accordance with site selection and mitigation described in Chapter 3 of the original ES and the EAP. However, impacts would be expected to be as those considered for the Study Area above as habitats and species in the local area will be similar.

6.3.4 Operational Impacts

Statutorily Designated Sites

Internationally Designated Sites

An assessment to identify likely significant effects on internationally designated sites identified the following potential effects during operation:

- Somerset Levels and Moors SPA and Ramsar sites: Reduction in habitat quality at Curry Moor due to reduced overtopping of the River Tone. Potential for adverse effects on wintering birds and invertebrate assemblage

- Severn Estuary SPA and Ramsar sites: Effects on wintering birds at Somerset Levels and Moors could affect individuals that form part of the Severn Estuary populations.

The potential for deterioration in habitat quality at Curry Moor, and effects on the species that it supports, is uncertain. The key source of overtopping is at Hook Bridge spillway and this may still overtop sufficiently to maintain the necessary quality of habitats that support wintering birds and invertebrates. Water can also be allowed to enter through various hatches. The dredging works will not affect water levels at other moors within the Somerset Levels and Moors SPA and Ramsar site, including Southlake Moor and West Sedgemoor. Overall, the magnitude of effect is predicted to be very low, but could be medium-term without mitigation.

Bank restoration will not have any significant effects on the hydrology of the designated sites, above that already assessed for the dredge specifically:

1. Southlake Moor is deliberately flooded when required from a structure on the River Sowy. Bank restoration will not affect this operation. The only impacts on Southlake will be from increased tidal overtopping from the Parrett but this will just be for a short duration during high tides (high spring tides and surges) and will be small increases to existing flows (see Section 5.2.2 Population). Although this overtopping comes as a result of high tides, the tide effectively prevents the fluvial flow from continuing downstream. Therefore the overtopping at Southlake mainly consists of non-saline water. In addition salinity levels would be much diluted from other fluvial flows entering Southlake during such an event. Therefore there would be no significant impact from salinity.
2. There would be no impact to West Sedgemoor or King Sedgemoor component parts of the SPA/Ramsar. For West Sedgemoor this is because the banks are designed so that the right bank (into Aller Moor) is lower than the left bank (into West Sedgemoor). Therefore the impact of higher tide levels is that there is increased overtopping over the right bank, but minimal or no overtopping on the left bank into West Sedgemoor. Tidal overtopping over the right bank will generally be focused around Beasleys spillway. This overtopping will generally be then carried in bank in the River Sowy, and will be combined with the fluvial flow. If there is significant overtopping into the neighbouring moors (Aller Moor, Kings Sedgemoor and Southlake) then this will be due to the fluvial component of the flow which will be the same as before the bank restoration works.
3. Through the bank raising on the Parrett there will be an increased tidal peak on the River Tone. This will result in slightly higher overtopping over the banks and Hookbridge spillway in extreme events. However the volume of this overtopping will be

minimal due to the duration of it (and will be a small fraction of the overtopping volumes in a fluvial event), and will be contained within the drainage network of the moor. Therefore the further increase in flooding to Curry Moor and Hay Moors from bank restoration would be negligible.

The effects of the dredge will last up to five years; the effects of the restoration will last at least 10 years (see Section 5.2.2 Population), which is considered permanent.

The significance of operational effects before mitigation on the Somerset Levels and Moors and the Severn Estuary SPA and Ramsar sites is assessed as **minor, temporary, permanent, and adverse.**

North Moor SSSI

Summer feeds to North Moor are partly from the Parrett, but flooding is from overtopping from Curry Moor. This overtopping currently only happens during large flood events currently. Therefore there will no likely measureable operational impact.

Curry and Hay Moors SSSI

Impacts on Curry and Hay Moor SSSI will be as described under Internationally Designated Sites above plus:

- Reduction in the regular uncontrolled flooding of the moors and reduced risk of summer flooding of the moors.

Reduction in the regular uncontrolled flooding of the moors will reduce short term impacts to invertebrates and ground nesting birds etc. It will also reduce risk of summer flooding of the moors leading to grass and crop kill and dissolved oxygen issues/fish kill.

These impacts are considered to be **minor, temporary , medium-term,** both **adverse** (impacts on wintering birds) and **beneficial** (for reduction of summer flooding).

Non-statutorily Designated Sites

Local Wildlife Sites

Following construction, the aquatic habitats of Athelney Fields, North Moor Drain, Fordgate Wetlands and the Bridgwater and Taunton Canal LWSs may potentially change due to reduced flood events but only in extreme events. This is considered a **negligible impact.**

Following construction during low flows in the River Parrett Tone LWS there will be a smaller depth of flow in the channel, which will impact fish migration (assessed under Fish). However the channel will quickly revert to having a smaller low flow channel. During high flows the water levels will also be lower than existing, reducing the impact on bankside ecology. This is considered an impact of very low magnitude and therefore **negligible** significance.

Habitats of Principal Importance

The coastal and floodplain grazing marsh habitat surrounding the site will flood less frequently following the dredging in the benefit area shown on Drawing 121316-00002 (Appendix A of the original ES). Duration of flooding will be shorter however, there is unlikely to be a significant change in habitat quality. Overall the magnitude of the impact is considered to be low and therefore a **minor, temporary, medium-term and a dverse impact**.

Impacts to rivers will be as to the River Tone and Tributaries LWS above.

Protected and Notable Species

The scheme will result in 3000ha of land being inundated less frequently and for a shorter duration in the extreme flood events. This will include habitat used by water vole, reptiles, badgers, great crested newts and ground-nesting birds. The magnitude of this impact is considered to be low, therefore having a **minor to moderate, temporary , medium-term and beneficial** impact on the species' population statuses.

Fish (including eels)

Reduced variability in flow velocity

The dredged channel may experience reduced spatial variability in flow velocity, depending on channel design, resulting in reduced survival or washout of fish (particularly juveniles) during high flow periods. The magnitude of this impact is considered to be moderate, therefore considered a **moderate, temporary, medium-term, and ad verse impact**. However, given the existing highly modified channel form at the proposed dredge sites, with minimal spatial variability in flow velocity, and few high flow refuge areas present, potential fish population impacts at the catchment scale are considered **minor to negligible**.

Notable / nationally rare or scarce invertebrates

There is potential for impacts to invertebrates during the operational period for the following reasons:

Saline intrusion. Increasing the capacity of the channel may induce greater influx of saline water. Removing bed heterogeneity may increase the volume of water at depth occupied by a saline wedge. The magnitude of this impact is considered to be low, therefore considered a **minor, temporary, medium-term adverse impact.**

Altered hydraulics. Increasing channel volume and smoothness will raise mean flow rates and remove flow heterogeneity, impeding recolonisation of fringing vegetation and impairing filtering activity by bivalve mussels. The magnitude of this impact is considered to be moderate, therefore is considered a **moderate, te mporary, medium-term and adverse impact**.

6.4 Residual Effects

Dredging could cause significant adverse impacts to the Rivers Tone and Parrett, but effects would only last up to 5 years until the river system re-naturalises' (medium-term).

There could also be significant short to medium-term impacts on associated fish and invertebrate fauna plus short-term impacts to riverside mammals such as otters and water voles within working areas during construction. These impacts will be reduced by the implementation of an Ecological Monitoring Plan and the use of Ecological Clerks of Works to undertake species checks and supervise mitigation. The spreading of invasive species such as Himalayan balsam in the dredged arisings could also be significant but will be monitored and managed.

However, although some very low magnitude residual effects may remain, with the application of the mitigation and monitoring programme there will be no significant effects on the Somerset Levels and Moors SPA and Ramsar site, or on the Severn Estuary SAC, SPA and Ramsar sites.

Table 6-10 Potential impacts of the proposed scheme on the Flora and Fauna

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Construction Impacts						
Statutorily Designated Sites						
All designated sites				Gaining access to rivers by tracking across designated sites will not be permitted, except where access can be achieved by tracking along the crest of the river bank.		
Somerset Levels and Moors SPA and Ramsar site: Disturbance of wintering waterfowl affecting overwinter survival and populations.	High	Very Low	**Minor, temporary, short-term and adverse.**	Majority of dredging will take place outside of wintering bird period. Any overwinter dredging needed (e.g. March 2014, after October 2014), will not be undertaken within 250m of the SPA/Ramsar site boundaries.	No Change	**None.**
Somerset Levels and Moors SPA and Ramsar site and Southlake Moor SSSI/Somerset Levels NNR: Landtake with South Moor for bank restoration	High	Very Low	**Minor, permanent, short-term and adverse.**	Banks will be reseeded with MG5c NVC seed mix to locally improve/restore biodiversity.	Very Low	**Minor, permanent and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Severn Estuary SAC: Temporary deterioration in water quality causing mortality of migratory fish (incl. salmon eels & lamprey) using the River Parrett and River Tone; delayed/halted migration due to water quality, noise, vibration and turbidity; potential to affect Severn Estuary breeding populations.	High	Very Low	**Minor, temporary, medium-term and adverse.**	The works will 'Strip and Recover' approximately 25% of the *Phragmites* / marginal plants, which will be re-planted as a fringe as operations proceed. Where possible, material will be removed in a way to leave channel irregularities. Dredging will maintain / create a low-flow channel. The monitoring and management strategy will also be followed (see Appendix E of the original ES) which will include:	Very Low	**Minor, temporary, short-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				Monitoring water temperature, dissolved oxygen, ammonia and during works, stopping dredging to review working practices if necessary. Dissolved oxygen must remain between 30% and 120%. If water temperatures exceed 15^{o}C, then material will only be removed from above the water line. If water temperatures exceed 20^{o}C, then all dredging will be suspended and operations reviewed. Restricted working practices will be used, if necessary, including closed buckets, single bank dredging and removing material only from above the water line.		

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				Hydrogen peroxide (H_2O_2) will be administered or aeration deployed to working areas if needed.		
Disturbance to birds and tracking of dredging plant adjacent to river banks on the Somerset Levels that form part of the North Moor SSSI (bird disturbance only), Southlake Moors SSSI, Somerset Levels WNR Curry and Hay Moors SSSI.	High.	Low.	**Moderate, temporary, short-term and adverse.**	No works within 250m of a SSSI boundary during over-wintering period. Pre-construction checks for nesting birds (see Breeding Birds below). Dredging plant will be no further than 5m from river bank. Works within SSSIs to be supervised by ECW.	No change.	**Minor, temporary, short-term and adverse.**
Disturbance to birds on the Somerset Levels that form part of the Bridgwater Bay SSSI.	High.	Very Low.	**Minor, temporary, short-term and adverse.**	No works within 250m of a SSSI boundary during over-wintering period.	No change.	**None.**
Non-statutorily Designated Sites						
Somerset Levels and Moors IBA	Moderate.	Low.	**Minor, temporary, short-term and adverse.**	No works within 250m of a SSSI boundary during over-wintering period.	No change.	**None.**
8km of S41 Habitat 'Rivers' will be directly impacted through dredging works.	Moderate	Low.	**Minor, temporary, medium-term and adverse.**	As for Local Wildlife Sites below.	Low.	**Minor, temporary, medium-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
The River Parrett and Tone Local Wildlife Sites will be directly impacted by the dredging activities. Bankside habitats will be completely removed and local species that use the rivers will be disturbed.	Moderate.	High.	**Major, temporary, medium-term and adverse.**	No dredged sediment will be spread over land within a LWS. Access to rivers will not be permitted through LWS. Works adjacent to the river will be supervised by the ECW. See mitigation under Severn Estuary SAC and Protected and Notable Species below.	Moderate.	**Moderate, temporary, medium-term and adverse.**
There is potential for the dredged arisings to be spread across Athelney Fields LWS, affecting habitat quality.	Moderate.	Moderate.	**Moderate, temporary, short-term and adverse.**	No dredged arisings will be spread within the LWS. Plant will only access through the LWS along river bank, under supervision of ECW.	Very Low.	**Negligible.**
Areas of coastal and floodplain grazing marsh (S41 Habitats) are likely to be used for the spreading of dredged material.	Moderate.	Low.	**Minor, temporary, short-term and adverse.**	The dredged sediment will only be spread on site once it has been tested and confirmed free of contaminants.	Very Low.	**Negligible, temporary, short- term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Protected and Notable Species						
Potential for damage to water vole habitat. Potential for direct impact to water voles if within burrows at the time of clearance. Potential indirect impacts from loss of feeding resource.	High.	Moderate.	**Major, temporary, medium-term and adverse.**	The ECW will undertake pre-construction checks before dredging commences in each reach. Where required, vegetation will be strimmed to discourage water voles from recolonising the working areas. Where voles are present displacement will be carried out in line with a Method Statement agreed with NE. If displacement fails then water voles will be trapped and translocated under a Conservation Licence. The works will 'Strip and Recover' approximately 25% of the *Phragmites* / marginal plants. No spreading will occur closer to any rhynes or other watercourses than existing agricultural operations e.g. no semi-	Low.	**Moderate, temporary, medium-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				natural buffer zones affected. No stockpiles within 6m of a rhynes or other watercourses to prevent damage to burrows unless water voles confirmed absent by the ECW. Demarcate working areas within stockpile sites.		
Potential for the destruction of an otter's resting place and impacting on its' fish supplies.	High.	Moderate.	**Major, temporary, short-term and adverse.**	The ECW will undertake pre-construction checks for holts and resting sites. If found holts and resting places will be left in-situ with a buffer zone. If this is not possible, a licence for temporary holt closure or disturbance would be applied for from NE and an appropriate mitigation strategy devised.	Low.	**Moderate, temporary, short-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Indirect impact to otters through impacts to water quality/fish.	High.	Low to Moderate.	**Moderate to major, temporary, short to medium-term and adverse.**	As for fish.	Low.	**Moderate, temporary, short to medium-term and adverse.**
Potential for disturbance to otters.	High.	Low.	**Moderate, temporary, short-term and adverse.**	Works will not be carried out on both banks concurrently.	Very Low.	**Minor, temporary, short-term and adverse.**
Potential to kill or injure reptile species through the destruction of foraging, basking and hibernation areas.	Moderate.	Low.	**Minor, temporary, short-term and adverse.**	Undertake pre-construction assessment of habitat suitability for reptiles. Where required potential refugia will be removed as soon as possibly in all area of proposed works before reptiles move back in after the flooding. Field boundaries, which are the most suitable areas for reptiles, will not be directly impacted by the spreading or stockpiling. Grass and any other tall vegetation considered suitable reptile habitat will be strimmed in a two-staged approach.	Low.	**Minor, temporary, short-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Potential for destruction of setts or disturbance to badgers as a result of plant and vehicle movements and siting of storage areas and site compounds.	Moderate.	Moderate.	**Moderate, temporary, short-term and adverse.**	The ECW will undertake pre-construction checks of all working areas. If an active badger sett is located within an agricultural field identified for sediment spreading, the scope of the spreading will be reduced in that particular field so as not to cause disturbance to the badgers. If an active badger sett is located along a river bank, then wherever possible it will be left in-situ with an appropriate buffer to avoid disturbance. If this is not possible, a licence for a temporary sett closure would be obtained and an appropriate mitigation strategy devised.	Very Low.	**Minor, temporary, short- term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Potential for killing or injury of GCN or impairment to their ability to breed; either through destruction of hibernation and/or foraging and commuting areas.	High.	Low.	**Moderate, temporary, short-term and adverse.**	The ECW will undertake a Habitat Suitability Assessment of all ponds within 250m of dredging or spreading works in advance. Where there is considered a reasonable risk of GCN being present then a mitigation strategy will be devised considering the nature of works in that area and the habitat effected. This may include Reasonable Avoidance Measures such as: • Strimming of grass and any other tall vegetation in a two-staged approach to allow GCN to vacate the area on first disturbance, so long as there is suitable adjacent habitat.	Very Low.	**Minor, temporary, short-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				• If works are carried out during the hibernation period then a check would be made for any suitable hibernation sites that could be affected while GCN are still active and hibernation sites made unsuitable. If a GCN is found at any point during construction, works will cease in the area and the ECW contacted. If it considered an offence could be caused under the Habitats Regulations then a licence will be obtained in advance from NE and a mitigation strategy agreed.		

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Potential for disturbance, killing or injury of nesting birds and/or destruction of nests or eggs through dredging, spreading dredged sediment, clearance of vegetation and siting of access stockpiles and compound areas. Includes ground-nesting birds.	Moderate.	Moderate.	**Moderate, temporary, short-term and adverse.**	All vegetation to be cleared between March to September as part of the scheme will be strimmed as soon as it is practical. Checks will be carried out in advance by the ECW. An ecologist will undertake a nesting bird survey in agricultural fields prior to the stockpiling or spreading or establishment of access roads/compounds. Should a nesting bird be discovered, an exclusion zone will be erected and works shall not continue until young have fledged. Site compounds shall be located at least 5m from hedgerows or trees.	Low	**Minor, temporary, short-term and adverse.**
Mobilisation of sediment may affect dissolved oxygen levels, likely result in	Moderate.	Low to High.	**Minor to major, temporary, short-medium term and adverse.**	In addition to mitigation measures described above in Internationally	Low to moderate.	**Minor to moderate, temporary, short to medium-term**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
mortalities of both resident and migratory fish species. Overall impacts on fish including: • Reduced water quality • Mechanical operation of dredging gear • Noise, vibration and visual disturbance. • Impoverished benthic fauna. • Reduced habitat diversity • Reduction in spawing habitat • Reduction in resting or 'hold up' areas for migratory birds				Designated Sites: Risk of harm from suspended solids will be reduced by seeking to maintain a portion of the channel width relatively unimpacted e.g. by dredging on one bank only at any one time. Monitoring fish mortality and if observed dredging will be suspended, causes investigated, and operations reviewed. One bucket sample will be taken per day across all the works which will include a search for all obvious fauna. Monitoring and thresholds for water quality will follow standards set out in the Environment Agency's 'Dissolved Oxygen During Aquatic Weedcutting' guidance		**and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				(Environment Agency, 2011b).		
Overall impacts to notable/ nationally rare or scarce invertebrates (excluding hairy click beetle) including: • Loss of bankside habitat. • Mobilisation of sediment. • Physical removal of invertebrates in dredgings. • Loss of instream habitat heterongeneity. • Disturbance to reproductive cycle of freshwater mussels. • Toxic effects of herbicides. • Nutrient mobilisation. • Disposal of dredgings.	Moderate.	Low to High.	**Minor to major, temporary, short to medium-term and adverse.**	In addition to mitigation described for Severn Estuary SAC: • Single bank work at anytime. • Vegetation stands on worked banks will be left wherever possible and rhizomes left in place to encourage rapid regrowth. • Sensitive disposal of dredging in line with Environment Agency PPGs. • Monitor drainage and take remedial action if inappropriate discharge of water occurs.	Low to Moderate	**Minor to moderate, temporary, short to medium-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Direct impacts to hairy click beetle habitat through dredging.	High	Moderate.	**Major, potentially permanent and adverse.**	Dredging will be minimalised in the vicinity of known hairy click beetle locations. Translocation will be considered as required, ensuring that appropriate expertise is sought for identifying suitable sites and carrying out the movement	Low	**Moderate, temporary, short-term and adverse impact.**
Direct impact of dredging on mussels				Mussels: Test samples will be carried out to determine the presence of freshwater mussel and depressed river mussel. If found mitigation will be agreed with Environment Agency specialists. During these test samples, should crayfish be discovered they will be identified and appropriate mitigation will be agreed with the Environment Agency depending on the species.		

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Potential to spread invasive species (esp. Himalayan balsam) by spreading / stockpiling dredged arisings over agricultural land, tracking over riverbank soil and leaving dredged banks exposed short- term. Also importation of invasive species.	High.	Moderate.	**Major, permanent and adverse.**	• The ECW shall undertake pre-construction checks of all working areas and land adjacent to working areas. • Biosecurity measures such as hosing shall be provided on site. • An invasive species management plan will be devised. This will detail an appropriate strategy to manage invasive species growth on all spreading areas. For Himalayan balsam a post-construction 18 month management strategy of uprooting or cutting fresh growth annually before the seeding period is likely to be adopted.	Low.	**Moderate, temporary, medium-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				• A proportion of *Phragmites l* marginal plants stripped from the dredge areas will be replanted in a fringe as operations proceed. • Invasion by *Dreissena* will be managed by ensuring boats, dredging equipment etc. are not contaminated. • Vigilance will be maintained for signs of ash die-back disease. • If white-clawed crayfish are found then mitigation will be agreed with EA specialists.		

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Operation Impacts						
Statutorily Designated Sites						
Somerset Levels and Moors and Severn Estuary SPA and Ramsar sites: Reduction in quality of habitat on Curry Moor due to decreased overtopping of the River Tone: effects on overwinter survival and populations of **wintering birds** and for assemblage of invertebrates (Somerset Levels Ramsar only).	High	Very Low	**Minor, temporary, medium-term and adverse.**	Condition of winter habitats, wintering bird numbers and species will be monitored for several years after dredging has been completed; if deterioration is observed, then alternative methods to maintain the required water levels will be investigated through future reviews of the WLMP.	Very Low	**Minor, temporary, medium-term and adverse**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Somerset Levels and Moors and Severn Estuary SPA and Ramsar sites: Increased tidal overtopping of Southlake Moor: effects of salinity and increased flooding	High	Very Low	**Minor, permanent, and adverse.**	Condition of winter habitats, wintering bird numbers and species will be monitored for several years after dredging has been completed; if deterioration is observed, then alternative methods to maintain the required water levels will be investigated through future planned reviews of the WLMP.	Very Low	**Minor, permanent, medium-term and adverse.**
Curry and Hay Moor SSSI. Impacts as described for SPA/Ramsar sites plus: Reduction in regular uncontrolled flooding on the moors and reduced risk of summer flooding.	High	Very Low	**Minor, temporary, medium-term and adverse (wintering birds) and beneficial reduced (summer flooding).**	As for SPA/Ramsar sites.	Very Low	**Minor, temporary, medium-term and adverse (wintering birds) and beneficial reduced (summer flooding).**
Southlake Moor SSSI: Impacts as described for SPA/Ramsar Sites above.	High	Very Low	**Minor, permanent and adverse.**	As for SPA/Ramsar sites.	Very Low	**Minor, permanent, and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Locally Designated Sites and Habitats						
Some areas of coastal and floodplain grazing marsh habitat surrounding the site will flood less frequently and for shorter durations following the dredging. This could to alter the species composition of the habitat slightly, though precise species differences are unknown.	Moderate.	Low.	**Minor, temporary, medium-term and adverse.**	N/A.	**Low Minor,**	**temporary, medium-term and adverse.**
Potential to affect aquatic habitats of Athelney Fields, North Moor Drain, Fordgate Wetlands and the Bridgwater and Taunton Canal LWSs due to reduced flood events.	Moderate.	Very Low.	**Negligible, temporary, medium-term, and adverse.**	N/A	Very Low	**Negligible, medium-term, moderate and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Protected and Notable Species						
Impact on water vole, reptiles, badgers, great crested newts and ground-nesting birds due to their habitats flooding less frequently and for shorter durations in extreme events.	High	Low	**Minor to moderate, temporary, medium-term and beneficial.**	N/A.	Low	**Minor to moderate, temporary, medium-term beneficial.**
The dredged channel may experience reduced spatial variability in flow velocity, resulting in reduced survival or washout of fish (particularly juveniles) during high flow periods.	Moderate.	Moderate.	**Moderate, temporary, medium-term and adverse.** **(negligible to minor adverse at catchment scale).**	As for fish under construction impacts.	Low	**Minor, temporary, medium-term and adverse.**
Increasing the capacity of the channel may induce greater influx of saline water. Removing bed heterogeneity may increase the volume of water at depth occupied by a saline wedge.	Moderate.	Low.	**Minor, temporary, medium-term and adverse.**	Designing in river bed heterogeneity where possible.	Low	**Minor, temporary, medium-term and adverse.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Altered hydraulics: Increasing channel volume and smoothness will raise mean flow rates and remove flow heterogeneity, impeding recolonisation of fringing vegetation and impairing filtering activity by bivalve mussels.	Moderate.	Moderate.	**Moderate, temporary, medium-term and adverse.**	As for fish under construction impacts.	Low.	**Minor, temporary, medium-term and adverse.**

7 Landscape and Visual Amenity

This Chapter addresses the impact of the project upon landscape as a resource in its own right, and also upon visual amenity as experienced by specific groups of people from defined key viewpoints.

The purpose of this addendum is to update the assessment provided in the ~~original~~ Environmental Statement (ES) Stockpiles Addendum (Rivers Parrett and Tone Dredge, Environmental Statement Addendum, Environment Agency, 2014d) to address the effects from ~~'strategic stockpiles' of dredging arisings~~ bank profile restoration. The additional visual assessment associated with the ~~strategic stockpiles~~ bank profile restoration is presented in red text. The landscape and visual assessment in the ~~original~~ ES Stockpiles Addendum covered shorter term (4 week duration) stockpiling and 'strategic stockpiling'. As this ~~shorter term stockpiling~~ remains part of the proposals, ~~in addition to the 'strategic stockpiling',~~ the content of the previous landscape and visual assessment which relates to it and remains valid is included below in black text. Where the previous content is no longer valid it is still shown below for information but with a ~~strikethrough.~~ No new information is available about the shorter term stockpiles. The assumptions made about them in the original landscape assessment, the lack of specific proposals for their location, the maximum 4 week duration, and the likely volumes, remain as stated in the original ES (Environment Agency, 2014a).

Several issues relevant to landscape are discussed in other chapters. These include planning policy (Section 4.5 of original ES), agricultural classifications (Chapter 6 of original ES), nature conservation (Chapter 6), cultural heritage designations and potential impacts on the historic landscape and heritage assets (Chapter 8). In terms of cultural heritage, this chapter considers the effects of development on landscape character, and in so doing it recognises the influence of cultural heritage in defining that character.

Scoped-in receptors and potential impacts

The receptors and potential impacts related to this LVIA chapter that have been scoped-in to the impact assessment are:

Scoped in:

- Temporary loss of visual amenity and temporary effects on local landscape character resulting from stockpiling of dredging arisings
- Loss of visual amenity and effects on local landscape character resulting from vehicle movements (at the strategic stockpiles only)
- Loss of visual amenity due to reduction in views as a result of bank profile restoration.

Scoped out:

- Loss of visual amenity and effects on local landscape character resulting from spreading of dredging arisings
- Loss of visual amenity and effects on local landscape character resulting from channel widening / changes in channel morphology
- Loss of visual amenity and effects on local landscape character resulting from the appearance of the restored embankment themselves (this assumes grass reinstatement - an integral part of the proposal - is successful, and excludes the potential reduction of views from any increase in embankment height)
- Loss of visual amenity and effects on local landscape character resulting from vegetation clearance / tree removal

- Loss of visual amenity and effects on local landscape character resulting from presence of construction machinery / vehicle movements (except for the strategic stockpiles)
- Loss of visual amenity and effects on local landscape character resulting from siting of site compound
- Changes in water levels as a result of dredging; the area will still flood on higher events and monitoring and subsequent changes to the Water Level Management Plans will ensure that correct levels of water are maintained to protect habitats in areas of conservation interest.

Refer to Appendix B for scoping rationale.

7.1 Methodology

~~As summarised above, the scope of this assessment is limited to short term temporary effects.~~ The approach taken in this assessment follows the general principles set out in the third edition of the 'Guidelines for Landscape and Visual Impact Assessment' (GLVIA3) published by the Landscape Institute and the Institute of Environmental Management and Assessment (IEMA) in 2013 and is proportionate to this very limited scope. The full methodology setting out how these guidelines have been applied in ~~this assessment~~ the assessment of the 'strategic stockpiles' and the criteria for classifying the significance of landscape and visual effects is provided in Appendix F of the ES Stockpiles Addendum. Cumulative effects are included within Chapter 9.

Baseline conditions have been assessed through a desk top study of landscape character assessments combined with reviews of other reports and environmental appraisals focussed on dredging in the Somerset Levels, study of photographs including aerial views and OS data. No site walkover survey for the original assessment has been undertaken due to the flooded conditions present during the period of the assessment. For ~~this~~ the ES Stockpiles Addendum, the desk top study was supplemented by a site assessment undertaken by landscape architects on 19th - 20th March 2014. Weather conditions were clear and dry with very good visibility; there were no restrictions to access for assessment of the Zone of Theoretical Visibility (ZTV).

The Study Area for the original LVIA has been limited to 1.5km around the areas to be dredged, expanded slightly south of the River Tone to include the elevated sandstone ridge which offers long range views over the Tone. 1.5km either side of the channel is the area within which the majority of spreading of the dredging is likely to occur on agricultural land and hence the shorter term stockpiling. This area is not strictly an estimated visual envelope: given the flat and open nature of the landscape it is likely that a visual envelope might indicate potential visibility beyond this area, but it represents a distance beyond which no significant landscape or visual effects could reasonably be expected, given the relatively small scale of the works in terms of visible form and 2m maximum vertical elevation.

The Study Area for ~~this~~ the ES Stockpiles Addendum, focussing on the strategic stockpiles is as above but expanded slightly, to allow 1.5km around the known locations of the strategic stockpiles.

The study area for this addendum remains the same as for the original ES, which is limited to 1.5km around the banks to be restored (the same extents as the area to be dredged as assessed in the original ES). There was no further site survey by a landscape architect to inform this addendum, as extensive information was already available in the form of desk study, site assessment undertaken by landscape architects for the ES Stockpiles Addendum, topographic survey and cross sections of the proposed river profile.

No ZTV was mapped for this addendum, however due to the limited scale of the works, which in the worst case scenario will typically include increasing the height of existing defences by 600mm as part of the bank profile restoration, it is considered that potential receptors will be limited to:

- In the case of users of PRoWs, long distance paths, cycleways and roads to those adjacent to the restored defences;
- In the case of properties to those within 100m and with a direct view of the restored defences.

7.2 Existing Environment

This section focuses on the study area's baseline conditions in terms of existing landscape character assessments. The information presented from these character assessments identifies the distinctive and important aspects of local landscape character that must be considered in assessing likely impacts. The descriptions include the existing visual amenity of the area and the typical nature of existing views.

There are several ~~Public Rights of Ways (~~PRoWs~~)~~ in the study area (see Chapter 5), of which the Parrett Trail is a key receptor of potential visual effects. PRoWs, and other key visual receptors, are shown on drawings 122316-00062 and 122316-00063 in Appendix A and on Drawings 122316-00023 to 00025 in Appendix A of the ES Stockpiles Addendum.

The landscape character descriptions below are based on assessments both at the national and local level. They include reference to, and recognise the influence of, the historic development of the landscape. Local landscape character areas are considered most relevant due to the nature and scale of the works, and these are shown on Drawing 122316-00012 in Appendix A of the ES Stockpiles Addendum.

7.2.1 Landscape Character Classifications

(a) National Character Areas

The Study Area is within NCA number 142: Somerset Levels and Moors. This NCA extends from the Bristol Channel coastline between Stolford and (but not including) Clevedon and inland in stretches loosely encompassing the Rivers Parrett, Brue, Axe and Kenn. This area includes Bridgwater, Weston-Super-Mare, Burnham-on-Sea and the majority of Street.

Key characteristics of this NCA as defined by Natural England include the following.

- Flat, open landscape of wet pasture, arable and wetland divided up by wet ditches or 'rhynes'.
- Absence of dispersed farmsteads or any buildings on levels and moors. Nucleated settlements on ridges/islands.
- Surrounded, and divided up, by low hills, ridges and islands which form distinctive skylines.
- Peat working and nature reserves contrasting with the rectilinear planned landscape of the Moors.
- Dramatic and prominent hills such as Burrow Mump, rising above the Levels and Moors.
- Sparse tree cover on Levels and Moors contrasting with woodland, hedges and orchards of surrounding hills.

- Sparsely populated Moors but settlements common on hills, ridges and islands.
- Historic landscape strongly evident in features ranging from prehistoric track-ways and lake villages to post-medieval enclosures and peat working.
- International nature-conservation significance for wetland, waders and waterfowl.
- Raised rivers and levées, with main roads and causeways flanked by houses.
- Flooding in winter over large areas.

This NCA covers an extensive area, however it is considered that the likely effects of the proposals within the scope of this assessment will be experienced at a much more localised level and will not have any significant impact upon the distinctive features of NCA number 142 Somerset Levels and Moors.

(b) Local Landscape Character

The northern half of the proposed dredging reach along the River Parrett lies within Sedgemoor District Council. The *Sedgemoor Landscape Assessment and Countryside Design Summary* (Revised Edition, 2003) provides definitions and detailed descriptions of the local landscape character.

As shown on Drawing 122316-00012 in Appendix A of the ES Stockpiles Addendum, the **'Levels and Moors'** is the main character area within the Sedgemoor District potentially affected by the project. There are further sub areas within this for which more detailed descriptions are provided; two sub areas are potentially affected by the proposed works.

General description of the Levels and Moors landscape character area:

The Somerset Levels and Moors is a vast area of drained wetland which lies at or below the level of high tide in the adjacent Bristol Channel. Covering a total of about 230 square miles, this landscape extends beyond the District boundary into the heart of Somerset and is drained by the Rivers Parrett, Brue, Axe and their tributaries. Formed mainly by the accumulation of marine and estuarine alluvium as sea levels rose in the postglacial era, broad valleys have been filled to a depth of up to 30 metres. This is topped by peat which began forming from wetland vegetation about 6000 years ago. Continued deposition of marine/estuarine clays created the broad belt of coastal "Levels" which are slightly higher than the inland "Moors". This height difference allowed the Levels and a number of low islands to be drained and occupied much earlier than the Moors. The Moors were generally not drained and enclosed until the eighteenth century, prior to which they had a more untamed wetland waste character and hence were called "Moors".

This distinction between "Levels" and "Moors" persists in local place names and is relevant to this landscape assessment but in common usage the phrase "Levels and Moors" is often used as a generic term. The Levels and Moors landscape is commonly characterised as an area of summer pastures criss-crossed with a geometric pattern of rhynes (drainage ditches), long straight access droves and distinctive pollarded willows. But whilst these elements are characteristic of some Moors, others have hawthorn hedgerows and the Levels landscape shows further differences with a pattern of drainage ditches and lanes which is often much less regular and includes more mixed hedgerows.

The Sedgemoor Landscape Character Assessment states:

Recent severe flood events have been a reminder of the vulnerability of the Moors. With the prospect that climatic change may increase the frequency of such floods, attention must also turn to floodplain management.

The two sub areas of the Levels and Moors landscape character area which may be affected by the proposed dredging works to the River Parrett are the 'Clay Moors' and the 'Peat Moors'. The following description of these Moors areas is taken from the Sedgemoor Landscape Character Assessment.

The Moors comprise the very low-lying areas which, other than limited attempts at draining land at the edges, were mainly marsh or fenlands until large-scale drainage and enclosure was affected between 1770 and the mid-nineteenth century. Elevation here is generally between 3 and 5 metres AOD, well below the high tide levels in the Bristol Channel, although in the Axe valley a height of 6 metres is more common. The Moors are characterised by a strong rectilinear pattern of drainage channels and accompanying straight drove roads. The complex system of control of water levels is apparent through the hierarchy of ditches, rhynes and canalised rivers or cuts, with sluices and pumping stations.

Views are mostly wide and panoramic. It is a particularly distinctive and atmospheric landscape, with a very remote feeling strengthened by its lack of buildings and settlement. Hedgerows or woodland can be a localised obstruction to long views but the Brue valley in particular has views which feature Glastonbury Tor. Rhynes give a constant awareness of the presence of water and the landscape is of course dramatically transformed in times of flood. Timber field gates with associated wing fences mark the points where bridges or culverts give access over the 'wet fences' of the rhyne network. These 'winged gates' are a distinctive element of the Levels and Moors landscape and can be particularly prominent in areas of open moor, where they may be the only vertical element in the landscape.

The proposed dredging reach along the River Tone, and the southern half of the dredging reach along the River Parrett, fall within the Taunton Deane District. *The Taunton Deane Landscape Character Assessment* (Taunton Deane Borough Council, 1992) describes two local Landscape Character Areas which might potentially be affected by the proposed works. The proposed works fall mainly within the '**Curry Moor Character Area'** (the description of this character area is combined with the West Sedge Moor area). The key characteristics of this area are given in the Taunton Deane Landscape Character Assessment as:

- *Low-lying landscape of drained inland marshland (Moors) predominantly defined by an agricultural land use of dairying and stock rearing.**
- *Strong sense of human intervention in the landscape due to hierarchy of water channels – draining the land and controlling flooding.*
- *Strikingly flat landform with a regular, geometric pattern of enclosure (boundaries often defined by drainage channels or 'rhynes').*
- *Large areas of standing water in the winter, providing important habitat for wild fowl and wading birds.*
- *Internationally important landscape – a designated Ramsar site, Special Protection Area and Environmentally Sensitive Area. There are a number of SSSI sites and an area designated as a National Nature Reserve.*
- *Fields of withies, associated with a long tradition of willow weaving.*
- *Lines of pollarded willows - aligning rhymes, droves and roads – create strong landscape pattern and sense of place.*
- *Burrow Mump – a natural (although modified) landform feature with its ruined chapel is a prominent landmark, offering extensive views across the Moors.*

- *Limited, linear settlement at Burrowbridge, Stathe and Curload - Athelney – following the course of main water channels.*

* Note: from the March 2014 site assessment visit it is apparent that the land use is predominantly arable fields which appear to be regularly ploughed. This is important in the context of this assessment because it creates a scene which is regularly changing over the short term due to seasonal patterns of crop rotation and ploughing. Although it is acknowledged that arable fields may periodically be used as grass leys for cattle grazing or for silage to reserve the nutrient status, the arable landscape is still more prone to regular changes in appearance when compared to the much more static landscape of permanently grazed fields, within which changes of the nature of the proposed stockpiles might appear a more noticeable departure from the norm.

The detailed description of the Curry Moor Landscape Character Area states:

…the present day landscape is one that has been manufactured and tamed by humans through an extensive engineering programme of water management and drainage. The 'Levels' were drained earlier than the 'Moors' and this is reflected in their landscape pattern – typically having a more irregular and organic pattern of drainage compared with the noticeably more organised, geometric drainage system occurring on the Moors and clearly illustrated within Moors landscape of Taunton Deane. Here, the water-management system includes the embanked rivers of the Tone and Parrett (high water carriers - elevated above the surrounding ground levels), a wide drain (West Sedgemoor Main Drain), a number of rhynes (including North Drove Rhyne and Centre Rhyne) and a large number of small drainage ditches. The majority of the rhynes and ditches date to the period of enclosure in the 18th and 19th centuries.

The 'strength of character' of the Curry Moor Landscape Character Area is judged to be strong. *The dramatically flat landform, the engineered drainage system of ditches, rhynes and embanked rivers, the fields of withies, the pollarded willows and areas of standing water combine to make a very recognisable, distinct landscape. Landscape condition is judged to be moderate overall (poor in places).*

The landscape strategy for the Curry Moor Landscape Character Area focusses on: *…conserving the distinctive wetland landscape but enhancing (and restoring) individual elements that contribute to landscape character e.g. encouraging traditional pollarding of willows and planting new stock along roads, droves and drainage channels would strengthen the landscape pattern.*

To the south of the River Tone is the adjacent '**North Curry Character Area'**. This is an area of sandstone ridge, a *…clearly defined, and easily distinguishable, landscape, contrasting to the surrounding lowland wetland areas. The North Curry Landscape Type covers the land surrounding Meare Green and Stoke St Gregory and offers views across the surrounding low-lying landscapes.*

7.2.2 Site Observations

The March 2014 site assessment for the strategic stockpiles revealed that the strong character as described in 'Curry and West Sedge Moors' was present in the Study Area. The land use was predominantly arable agricultural fields bounded by drainage ditches and hedgerows. Hedgerows and trees along the boundaries in many cases restrict views, although their intermittent nature means that long reaching views are possible in some locations. Due to the flat topography any features with significant vertical elevation are clearly visible, notably Burrow Mump and the sandstone ridge of North Curry.

7.2.3 Designations

There are no designations affecting the study area specifically to protect landscape as a resource in its own right, and no Conservation Areas (there are however three Conservation Areas in the Bridgwater area, just north of the LVIA Study Area).

The following national designations are present within the Study Area and provide protection to specific components of landscape due to their cultural heritage value:

- Scheduled Monuments. There are four within the study area, however none are directly affected by the works, and only Burrow Mump Scheduled Monument is considered to have a view of the strategic stockpiles according to the ZTV;
- Listed Buildings.

There are a number of trees within the Study Area which are covered by Tree Preservation Orders (TPOs). There is unlikely to be a requirement for any tree removal or cutting to enable the proposed works, but if required the Local Authority will be consulted to ensure no tree protected by a TPO will be affected.

The value of the landscape is considered be of local importance due to its strong sense of character, the 'intactness' of the landscape and presence of historical features which are nationally designated. Furthermore, as a rural landscape with a number of PRoWs and other recreational routes, it is evident that the landscape is valuable for the purpose of outdoor recreation due its perceptual qualities, including visual amenity and tranquillity.

7.3 Likely Significant Effects

7.3.1 Likely Significant Effects on Landscape

Construction Effects:

As the area is strikingly flat and open with some long ranging panoramic views and few elements with noticeable vertical elevation, there is a potential for short term temporary effects on local landscape character to be caused by the temporary stockpiling of the dredging arisings.

The nature of the two proposed forms of stockpiling proposals is described below, under the headings 'Strategic Stockpiling' and 'Shorter Term Stockpiling'. Common to both forms, if found to be contaminated, the dredged arisings will be removed for further treatment or disposal to a suitably licensed waste facility, in accordance with the Hazardous Waste

Regulations and the Duty of Care Regulations. If waste is uncontaminated but an immediate location cannot be found to spread it, it may be taken to an existing Environment Agency waste transfer station (see Section 3.3.2 of the original ES).

Strategic Stockpiling

The strategic stockpile locations are shown on Drawing 122316-00028 in Appendix A of the ES Stockpiles Addendum.

Dredging material will be stored in stockpiles in three proposed locations for up to 1 year. Each stockpile will be up to 2m in height with 1:3 side slopes and will be covered with black sheeting.

All three stockpiling locations will be located within an area of similar character, therefore one landscape receptor has been identified as being affected by the proposed stockpiling: the Curry and West Sedge Moors character area - as defined by Taunton Deane District Council, and described in Section 7.2.1.

Shorter Term Stockpiling

As described in Section 3.2.2 of the original ES, it is assumed that the majority of the 235,000m^3 of dredged material will be spread within 1.5km of the scheme. Only where it is not spread directly to bank or pumped will stockpiling be required until land is dry enough to plough. Material will be stockpiled on land where it is intended to be spread or close to embankments where it is intended to be re-used. An indicative photo of stockpiles is provided in Plate 7.1.

Plate 7.1: Example of shorter term stockpiling of dredged material prior to spreading (*note this photograph is not based on the Somerset Levels area and is intended to represent*

typical stockpiling not typical landscape features. It is also not representative of the likely appearance or scale of the strategic stockpiling)

The size of each stockpile is, under The Environmental Permitting (England and Wales) Regulations 2010, limited to 3,000 tonnes per unit (e.g. per field) but will be stored below 2m in height. Material will be stockpiled for as short a period of time as possible to allow full use of the agricultural land; approximate duration would be 4 weeks

Sensitivity

Although not nationally or locally designated, the landscape has a strong sense of place due to distinctive features which are common throughout the area, as described in Section 7.2.2. The sensitivity of the receptor, i.e. the local landscape character areas described above, potentially affected by the proposed stockpiling, is considered to be **moderate**.

Magnitude and Significance of Effect on Landscape

The likely magnitude of change resulting from the presence of the stockpiles is considered to be **low**, i.e. only a localised and temporary change to the characteristically flat moor land. It is not expected that landscape elements and features other than topography will be affected by the works. The resulting level of significance of the effect is expected to be **minor**, i.e. not significant, **adverse, but short-term** and **temporary**. Section 4.2 of the original ES provides an explanation of the methodology of determining significance.

7.3.2 Likely Significant Effects on Visual Amenity

Construction Effects

As the area is strikingly flat and open with some long ranging panoramic views and few elements with noticeable vertical elevation, there is a potential for short term temporary effects on visual amenity to be caused by the temporary stockpiling of the dredging arisings. The strategic stockpile locations are shown on Drawing 122316-00028 in Appendix A of the ES Stockpiles Addendum.

The likely scale and nature of both the strategic stockpiling and the shorter term stockpiling are described in Section 7.3.1 above.

Strategic Stockpiling

A number of receptors of visual amenity have been identified which include:

- Private households
- Users of the Parrett Trail PRoW and other public footpaths
- Users of the local road and rail network
- Local businesses.

The Zone of Theoretical Visibility for the strategic stockpiles is shown on Drawing 122316-00022 (Appendix A of the ES Stockpiles Addendum) and has been used to identify likely visual receptors as explained in the methodology (Appendix C of the ES Stockpiles Addendum).

The significance of effect of the strategic stockpiles on each of the receptors has been considered and details are provided in Table 1.1, Appendix D of the ES Stockpiles Addendum. Refer to Drawings 122316-00023 to 00025, Appendix A of the ES Stockpiles

Addendum for the location of the visual receptors which are numbered V1-V15. Those receptors which are considered to have a significant effect (i.e. major or moderate significance) on visual amenity are described below.

In the assessment of the significance of the proposed works on all receptors, the effect of land use on views has been considered. In a regularly ploughed arable agricultural landscape, such as this, the views are constantly changing through the year. Users of the land (the receptors) will be accustomed to this change. Therefore the change in land use itself from agricultural land to land used for stockpiling is not in itself considered to be a significant change to views. The potential effects of the vertical elevation of the stockpiles to block or restrict views into the distance may however be significant as the flat land in this area affords long reaching views.

Similarly, agricultural vehicles and heavy machinery are common in this type of landscape and therefore heavy goods vehicles used for transporting dredging material may not, depending on the intensity and duration of movements, necessarily be considered a significant additional element within views.

Receptor Reference: V2

Plate 2 (P2, Appendix E of the ES Stockpiles Addendum) represents the view from the rear of residential properties on Riverside towards stockpiling location 1 (Drawing 122316-00023, Appendix A of the ES Stockpiles Addendum). As residential properties, these are **high sensitivity** receptors.

There is little or no screening at the rear of the properties, resulting in direct open views of the proposed stockpiling area from ground floor windows (in some cases) as well as upper floor windows. The stockpiles will be situated at the furthest extent from the residential properties on Riverside with a minimum distance of 25m between the properties and the stockpiles, so will be visible in the middle distance. Although altering the view of the field itself by the addition of a new element, i.e. the 2m high stockpiles (which will be covered in black sheeting), the view into the distance will not be blocked, with the horizon remaining visible above the stockpiles. The magnitude is therefore considered to be **low** and the significance **moderate adverse,** i.e. significant, but **short term** and **temporary.**

Receptor Reference: V5

Plate 12 (P12, Appendix E of the ES Stockpiles Addendum) shows the panoramic view from Stathe Road towards stockpiling location 2 to represent the view from residential properties on Stathe Road and Stanmoor Road (Drawing 122316-00024, Appendix A of the ES Stockpiles Addendum). As residential properties, these are **high sensitivity** receptors.

There is some screening from ground floor windows provided by property boundaries and the hedge along the field boundary. The boundary hedge varies in height however and in the worst case scenario (mostly along Stathe Road) there are direct views into the field from ground floor as well as upper floor windows. The stockpiles will be situated at the furthest extent from residential properties with a minimum distance of 25m between the properties and the stockpiles so will be visible in the middle distance. Although altering the view of the field itself by the addition of a new element, the view into the distance will not be blocked. The magnitude is therefore considered to be **low** and the significance **moderate,** i.e. significant, **adverse,** but **short term** and **temporary**.

Receptor Reference: V15

Plates 8, 9 and 10 (Appendix E of the ES Stockpiles Addendum) show the view from Burrow Mump towards stockpile locations 1, 2 and 3 respectively (Drawings 122316-00023 -00025, Appendix A of the ES Stockpiles Addendum). As a public place, and a Listed Building and Scheduled Monument which is used by the public with the intent of admiring the view, this is a **high sensitivity** receptor.

From this position of high ground there are long reaching, panoramic views. The stockpiling locations are therefore visible over boundary hedgerows, trees and properties and there are direct views of all three stockpile locations. Due to the wide views encompassing large areas of land, the stockpiles themselves will only be a small element of a view in which the remainder of the view is not affected by the works.

Stockpile locations 1 and 2 can be seen in the middle distance. The magnitude is therefore considered to be **low** and the significance **moderate i.e. significant, adverse,** but **short term** and **temporary**.

Stockpile location 3 can be seen in the distance and is considered too far away to be readily noticeable. The magnitude is therefore considered to be **very low** and the significance **minor adverse,** but **short term** and **temporary.**

Shorter Term Stockpiling

Temporary effects on visual amenity resulting from the shorter term stockpiling might be experienced by a range of receptors, with varying levels of sensitivity and magnitude of effect depending on proximity. Potential receptors include:

- Private households;
- Users of the Parrett Trail PRoW and other public footpaths;
- Users of the local road and rail network;
- Local businesses.

The assessment below is based only on the 'worst case' scenario, i.e. private households (considered to be high sensitivity receptors) in close proximity to (i.e. within 250m) and with direct views of the proposed stockpiling areas.

The sensitivity of the receptors is considered to be **high**. The likely magnitude of loss of visual amenity resulting from the presence of the stockpiles is considered to be **very low**, i.e. only a small scale and temporary change to a limited proportion of typical views. The resulting level of significance of the effect is expected to be **minor**, i.e. not significant, **short-term adverse** and **temporary**. Section 4.2.4 of the original ES provides an explanation of the methodology of determining significance.

Similar effects would be likely to be experienced by users of the Parrett Trail and other public footpaths if they provide direct short range views of stockpile areas. The other receptors noted above would be expected to experience even less significant levels of effects due to their lower sensitivity.

Operational Effects

There is potential for permanent effects on visual amenity from the reduction or loss of views from key receptors, due to increased height of defences as part of bank profile restoration.

The locations of bank profile restoration are shown on Drawing 122316-00060 in Appendix A.

Banks will typically be raised by a maximum of 600mm as part of profile restoration and in many cases to a lesser extent. This is expected to be completed by October 2014, after which the banks will be re-seeded.

Bank Profile Restoration

A number of receptors of visual amenity have been identified which include:

- Private households
- Users of the River Parrett Trail, Macmillan Way West, other PRoWs and the National Cycle Network
- Users of the local road network
- Local businesses.

The significance of effect of the bank profile restoration on each of the receptors has been considered and details are provided in Table 1.1, Appendix C. Refer to Drawings 122316-00062 and 122316-00063, Appendix A for the location of the visual receptors which are numbered R1-R9.

In this assessment only the effect on visual amenity due to reduction in views as a result of bank profile restoration has been considered. The assessment found that many of the potential receptors identified either do not have views of the embankment to be restored as these views are blocked by property boundary hedgerows and fences; or the existing embankment height is such that there are no existing views over it. Of the receptors identified to have views over the embankment, the limited scale of the re-profiling means that views are not likely to be obstructed to a noticeable extent and therefore it is considered that there will be no significant effects (i.e. of major or moderate significance) on visual amenity from bank profile restoration.

Figure 7.1 illustrates the views of receptors R2 and R7 towards the bank profile restoration, demonstrating that boundary hedging restricts views from adjacent properties. Similar working sections have been generated and analysed within our desk study in relation to all of the receptors, in order to form our assessment.

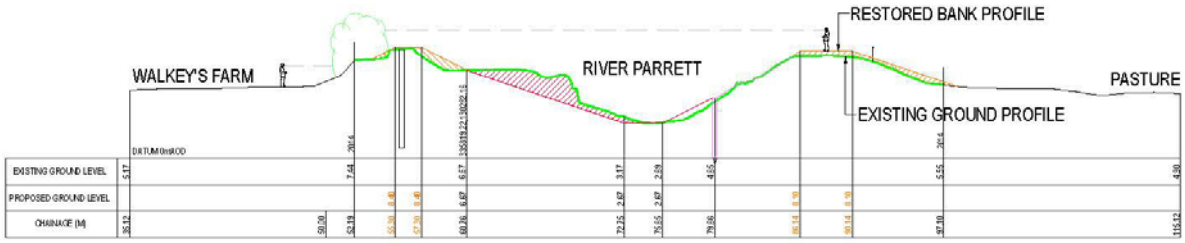

Figure 7.1 (not to scale): cross section through River Parrett showing the existing and restored bank profiles. A property on West Yeo Road (receptor R7) can be seen on the left. The Macmillan Way West (receptor R2) runs along the right embankment crest.

7.4 Residual Effects

The residual effect on landscape character resulting from both the **shorter term** stockpiles and the **strategic** stockpiles of arisings would be **not sig nificant**. The residual effect on visual amenity resulting from the **shorter term** stockpiles and bank profile restoration would also be **not significant**.

The residual effect on visual amenity resulting from the **strategic stockpiles** in most cases would not be significant. Three visual receptors have however been identified where moderate significant effects are considered likely to result from the strategic stockpiling. However due to the short-term, temporary nature of the proposed works, no mitigation is considered necessary.

The trees potentially affected by proposed stockpiling are all located within field hedge lines; no trees are within the fields designated for stockpiling. An offset of 10m from field perimeters is being provided for the location of all stockpiles.

Table 7.1 provides a summary of the landscape and visual effects, proposed mitigation measures, and the residual effects. In addition, the Environmental Action Plan (EAP) identifies the Contractor's responsibility to ensure that the local road network and associated verges and vegetation is fully reinstated.

Impact on trees is not identified as a significant effect, and it is noted that there are no trees actually within the fields identified for strategic stockpiling but some are present within the perimeter hedgerows, around which a 10m buffer has been designated. Within and beyond this 10m buffer however any potential damage to trees, including their root areas and canopies, should also be avoided by the Contractor by employing tree protection measures as set out in BS5837:2012.

Table 7.1 Summary of the proposed scheme on Landscape and Visual Amenity

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
LANDSCAPE						
Temporary change to local landscape character from **shorter term and strategic** stockpiling of dredging arisings.	Moderate	Low	**Minor, short-term, adverse**	None required as only minor effect.	Low	**Minor, short-term, adverse**
VISUAL AMENITY						
Temporary loss of visual amenity due to **shorter term** stockpiling of dredging arisings (note – worst case scenario of private households with close range direct views of stockpile areas).	High	Very Low	**Minor, short-term, adverse**	Avoid locations within 25m of private households and 10m of public access routes.	Very Low	**Minor, short-term, adverse**
V1 (P1) View to **strategic stockpiling** location 1 from Restricted Byway BW20/29 (adjacent to stockpile location 1).	High	Very Low	**Minor, short-term, adverse**	No mitigation is proposed as mitigation measures have already been incorporated into the design (ensuring a 10m buffer between field boundaries and stockpiles and a 25m buffer between residential properties and stockpiles; using black sheeting to cover the stockpiles) or are not considered appropriate due to the temporary nature of the works.	Very Low	**Minor, short-term, adverse**
V2 (P2) View to **strategic stockpiling** location 1 from rear of residential properties on Riverside	High	Low	**Moderate, short-term, adverse**	As above.	Low	**Moderate, short-term, adverse**
V3 (P3) View to **strategic stockpiling** location 1 from rear of	Moderate	Low	**Minor, short-term,**	As above.	Low	**Minor, short-term,**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Gillards Transport on Riverside			**adverse adverse**			
V4 (P11) View to **strategic stockpiling** location 1 from residential properties on Burrow Drove.	High	Very Low	**Minor, short-term, adverse**	As above.	Very Low	**Minor, short-term, adverse**
V5 (P12) View to **strategic stockpiling** location 2 from residential properties on Stathe Road and Stanmoor Road	High	Low	**Moderate, short-term, adverse**	As above.	Low	**Moderate, short-term, adverse**
V6 (P12) View to **strategic stockpiling** location 2 from Stathe Road and Stanmoor Road	Moderate	Very Low	**Negligible, short-term, adverse**	As above.	Very Low	**Negligible, short-term, adverse**
V7 (P12) View to **strategic stockpiling** location 2 from NCN 339 on Stathe Road towards stockpile	High	Very Low	**Minor, short-term, adverse**	As above.	Very Low	**Minor, short-term, adverse**
V8 (P13) View from **strategic stockpile** location 2 towards rear of farm on Stathe Road to represent views of farm workers.	Moderate	Low	**Minor, short-term, adverse**	As above.	Low	**Minor, short-term, adverse**
V9 (P4) View from Public Footpath T25/1 towards **strategic stockpile** location 2.	High	No Change	**None**	As above.	No Change	**None**
V10 (P5) View from NCN 339/ River Parrett Trail towards **strategic stockpile** location 3.	High	Very Low / No change	**Negligible, short-term, adverse**	As above.	Very Low / No change	**Negligible, short-term, adverse**
V11 (P5) View from road towards **strategic stockpile** location 3.	Moderate	Very Low	**Negligible, short-term, adverse**	As above.	Very Low	**Negligible, short-term, adverse**
V12 (P6) View from road toward **strategic stockpile** location 3.	Moderate	Very Low	**Negligible, short-term,**	As above.	Very Low	**Negligible, short-term,**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
			adverse adverse			
V13 (P14) View from **strategic stockpile** location 3 towards New Road A361 to represent views of road users.	Low	No Change	**None**	As above.	No Change	**None**
V14 (P7) View from Public Footpath BW23/80 towards **strategic stockpile** location 3.	High	No Change	**None**	As above.	No Change	**None**
V15 (P8-10) View from Burrow Mump towards all **strategic stockpiling** locations.	High	Low	**Moderate, short-term, adverse**	As above.	Low	**Moderate, short-term, adverse**
R1 View from River Parrett Trail toward **Parrett**	High	Very Low	**Minor, permanent, adverse**	No mitigation is proposed as the effects on visual amenity are not significant.	Very Low	**Minor, permanent, adverse**
R2 View from Macmillan Way West (MWW) toward **Parrett**	High	Very Low	**Minor, permanent, adverse**	As above.	Very Low	**Minor, permanent, adverse**
R3 View from BW 23/91 toward **Parrett left bank**	High	No Change	**None**	As above.	No Change	**None**
R4 View from National Cycle Network 339 toward **Parrett left bank**	High	Very Low	**Minor, permanent, adverse**	As above.	Very Low	**Minor, permanent, adverse**
R5 View from West Yeo Road toward **Parrett left bank**	Moderate	Very Low	**Negligible, permanent, adverse**	As above.	Very Low	**Negligible, permanent, adverse**
R6 View from Riverside toward **Parrett right bank**	Moderate	Low	**Minor, permanent, adverse**	As above.	Low	**Minor, permanent, adverse**

Impact	Sensitivity of receptor	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
R7 View from rear of residential properties on West Yeo Road and Stathe Road toward **Parrett left bank**	High	No Change	**None**	As above.	No Change	**None**
R8 View from Carrs Farm toward **Parrett right bank**	High	No Change	**None**	As above.	No Change	**None**
R9 View from Home Farm toward **Parrett right bank**	High	No Change	**None**	As above.	No Change	**None**

8 Historic Environment

This Chapter addresses the impact of the project upon the archaeology and cultural heritage of the Somerset Levels. A heritage assessment has been undertaken, in consultation with County Archaeologists and English Heritage, to investigate the potential impacts. It assesses the impact of the works upon sites of cultural heritage, and known and unknown archaeology as well as its potential to affect the historic landscape. It also identifies a number of mitigation measures that will be implemented.

The historic environment is important because it provides evidence of the past development of our civilisation and the remains are irreplaceable.

Scoped-in receptors and potential impacts

The receptors and potential impacts related to this 'Historic Environment' chapter that have been scoped-in to the impact assessment are listed in Table 8-1.

Table 8-1 Receptors and potential impacts scoped-in to the Historic Environment chapter

Scoped-in Receptor	Scoped-in potential impact
Sites of cultural heritage value	Reduced flood risk to cultural heritage sites.
	Potential for degradation of historic landscape through inappropriate material spreading of dredging arisings and tracking of machinery.
Known archaeological sites	Potential for degradation of archaeological sites through inappropriate spreading of dredging arisings and tracking of machinery; in-channel impacts of dredging activity and visual impact of reprofiled banks.
Previously undiscovered archaeology or heritage sites	Potential for damage to previously unknown archaeology or heritage sites by tracking of machinery and siting of compounds and material spreading areas.

8.1 Existing environment

8.1.1 Historic Landscape and Sites of Cultural Heritage Value

The Somerset Levels have a distinct landscape which is known to have been exploited by humans since at least the Neolithic period. The Somerset Historic Environment Record (HER) describes the area around the River Parrett and River Tone as an historic landscape of former wetlands that were then enclosed.

The historic landscape of the Study Area is composed of fragmentary remains of a planned landscape comprising of field systems, trackways and settlements – defined by banks, ditches, platforms and vegetation marks.

In prehistory, the Somerset Levels comprised a large area of wetland; a landscape of reed and marshland, with small, easily defended settlements. These sites often occupied the boundary between the wetland and higher ground, and were in places linked by wooden track ways. The ecological diversity of the reed beds made the area an attractive location for early hunter gatherers.

Gradually, with the development of agriculture, parcels of land were reclaimed from the marsh, through the digging of ditches and the throwing up of low banks to hold back coastal and fluvial flooding. This process continued through the Roman, Saxon and Medieval periods.

The intertidal nature of the levels has left large areas of buried peat, sealing and in places sealed by silts laid down during episodes of coastal inundation. These peat deposits are of particular archaeological importance, preserving both organic plant remains as evidence for the human influence on the landscape of the levels and also wooden and leather objects that do not survive in other parts of the country.

The following Scheduled Monuments (SM) are present within the Study Area:

- Burrow Mump SM located approximately 80m from the River Parrett at Burrowbridge.
- An Anglo-Saxon occupation site and site of Athelney Abbey on Athelney Hill is present approximately 70m from the River Tone.
- An Anglo-Saxon burh at East Lyng, located approximately 800m from the River Tone.
- Duck decoy pond over 500m south of the River Tone at Hay Moor.

There are numerous listed buildings/structures within the Study Area including a number of built structures (farmhouses, gates, chapels, public houses) facing onto the section of the River Parrett which is to be dredged and some close to the proposed sections of bank to be restored; these include Burrow Bridge, where the A361 crosses the River Parrett.

Saltmoor Pumping Station, a Grade II listed building, is one of the proposed locations for a welfare unit.

Locations of all SMs and listed buildings are shown on Drawing 122316-00013 in Appendix A of the original ES.

Due to the national significance of the historic landscape, such as the presence of SMs, this receptor is considered to be of **high sensitivity** to the scheme.

8.1.2 Known and unknown archaeology

Known archaeology

Aside from the features highlighted above, the desk study identified a number of non-designated features of archaeological and historic interest potentially affected by the scheme. There is evidence that the River Parrett and Tone have been significantly modified by human action since the medieval period. To the east of the River Parrett (between 200 and 800m from the river) there is evidence of its former channel, visible from aerial photography and LiDAR imagery. This is thought to have been redundant by 1235 as meadows in the area were created at this time.

In the area surrounding Burrowbridge there is further evidence of the modifications to both rivers; the River Parrett at the confluence with the River Tone is thought to have been straightened in the medieval period in connection with a medieval settlement further south. Along the section of the River Tone to be dredged there is evidence of the river being canalised, diverted and at Curload (along the Crocked Drove track) there is evidence of its abandoned course. Therefore many sections of the river embankments are considered to have historic significance. Documentary evidence suggests that parts of the surviving flood banks may pre-date the 13th century. The Somerset HER notes a section of the river bank that was subject to a watching brief in 2001 to monitor engineering test pits undertaken prior to previous bank stabilisation works. The watching brief identified silts which are thought to represent evidence for early river courses.

Other archaeological remains, including brickworks, withy boilers, wicker works oak timbers, roman coins, a Bronze Age bronze palstave and 4th Century Romano-British pottery, have also been found in the Study Area.

Locations of all the known archaeological features are shown on Drawing 122316-00013 in Appendix A of the original ES.

Known archaeology is considered to be highly regarded at the regional or local level and therefore this receptor is considered to be of **moderate sensitivity** to the scheme.

Unknown archaeology

Given the wealth of archaeological remains in the area, is it anticipated that there are currently unidentified archaeological sites beyond the river channel and beneath the widths and depths originally dredged in the 1960s.

Unknown archaeology may be of national or international importance and therefore this receptor is considered to be of **high sensitivity** to the scheme.

8.2 Likely significant effects

8.2.1 Construction Impacts

The following construction activities are identified to have a potential effect on the historic environment:

- There is a potential for accidental damage to the listed buildings and SMs due to the proximity of construction works and access routes. Those features that are particularly close to the works and are located between potential access routes and the rivers include King Alfred public house in Burrowbridge, Saltmoor Pumping Station, Westonzoyland Old Pumping Station (Grade II* Listed), Dyke House, Burrowbridge Baptist Chapel, the Church of St. Michael and Burrow Bridge (all Grade II Listed, except where otherwise stated). Furthermore, Burrow Bridge and New Bridge are likely to be used by construction vehicles, including the transportation of dredged arisings, which may potentially lead to accidental damage. Prior to mitigation, accidental damage to these features could have a **moderate adverse, permanent** effect on the historic landscape and setting as any damage is likely to be irreversible.
- There is a potential for the tracking of plant and machinery and positioning of site compounds over sensitive landscape features and archaeology, such as the

historic earthworks, to damage or degrade them. Prior to mitigation, accidental damage to these features could have a **moderate adverse, permanent** effect on the historical landscape as any damage is likely to be irreversible.

- There will be the requirement for river-side banks to be tracked down, or even re-profiled, to allow access by excavators to floating pontoons, which has the potential to damage the historic earthworks. Prior to mitigation, damage to these features could have a **moderate adverse, permanent** effect.
- Saltmoor Pumping Station is proposed as a site for a welfare unit. This is an existing operational site. However, as it is anticipated that the welfare unit will be placed on existing hardstanding within the site there is considered to be **no impact** as a result of the works.
- Although the scheme does not intend to widen or deepen the channel beyond the widths and depths originally dredged in the 1960s, there is still a risk that this may occur in some localised sections. Consequently, there is a potential risk of exposing and subsequently damaging unknown archaeology. Prior to mitigation, damage to unknown archaeology in the river channel is considered to be a **moderate adverse, permanent** effect as any damage to archaeology is likely to be irreversible.
- There is a potential for damage to SMs due to spreading of dredged material on the designated sites. Spreading on these features could have a **moderate adverse, permanent** effect prior to mitigation as it will alter the historical landscape.
- Some of the dredged material will be spread on existing river banks and there is a potential for the historic earthworks to be degraded and for the historic landscape to be altered. Prior to mitigation, degradation from depositing dredged material is considered to be a **minor adverse, permanent** effect.
- Some of the dredged material will also be used to restore the profile of the river banks thus there is a potential for the banks to be degraded and for the historic landscape to be altered. As described in Chapter 3 of this Addendum, bank profile restoration works will be undertaken using a combination of construction techniques. Engineered rebuilding of the bank, which involves cutting a bench into the existing structures, has the largest potential for effects on the historic environment by disturbing the historic bank core. Prior to mitigation, using dredge material to restore the banks is considered to be a **moderate adverse, permanent** effect.
- Agricultural land, mainly within 1.5km of the dredged river sections, will also be used to deposit dredged material. Deposits will be ploughed into the land by usual agricultural methods. Permanent pasture will not be used. The agricultural land will have previously been worked to this plough depth. In some of these ploughed fields however, earthworks are still visible and these have the potential to be obscured or lost by spreading over them. Stockpile locations have been designed to avoid Scheduled Monuments and any visible earthworks listed on the Somerset HER. Stockpile location 1 (see Figure 122316-00028, Appendix A of the original ES) is partly intersected by the former channel of the River Parrett, but this exists as crop marks only. Prior to mitigation the impact to known and unknown archaeology is considered to be **moderate adverse, perma nent.** Sites that only exist as cropmarks would receive some additional protection if material is spread over them as it would create a buffer to protect them from future ploughing. During decommissioning of the stockpiles a small quantity of material will be spread over the receptor fields to create a buffer to protect them from future ploughing; this is a **minor beneficial, short-term effect.**

8.2.2 Operational Impacts

- The historic buildings and structures in the benefit area (see Drawing 122316-00002 in Appendix A or original ES) will be afforded with a higher level of flood protection than existing. The proposed scheme will therefore assist in the retention of the historical assets. This is predicted to have a **major beneficial, medium-term** effect on listed buildings and structures. There would be no benefit on buried archaeology or earthworks.
- Potential effects on the setting of listed buildings as a result of the proposed bank profile restoration works have been considered. There are sixteen listed buildings that are close enough to the proposed works to be potentially affected, and these are shown on drawing 122316-00013 (Archaeology and Cultural Heritage) (sheets 1 and 2), in Appendix A. Fifteen of these are Grade II listed, and one (Westonzoyland Pumping Station) is Grade II*. A significant (moderate or major) effect on their setting might result if one or more of the following situations could be caused by the proposed bank restoration:

  1. A noticeable change in the appearance and character of the landscape surrounding the listed building, to the extent that the perceived historic and/or architectural value or properties of the listed building are affected.
  2. The formation of a new physical disconnection or barrier to accessing the listed building.
  3. A significant loss or reduction in the visibility of the listed building within its surroundings due to new visual obstructions.

  The proposed bank profile restoration works amount to no more than minor modifications to existing structures. No new barriers or obstructions will be created. Once the banks have been reinstated with grass, even in locations with the maximum 600mm of raising, the subtle change is not considered likely to have any effect on the general character of the local landscape. The only possible area of impact is likely to be a very slight reduction in the visibility of some buildings from some viewing locations due to the increased bank height. This will not affect all listed buildings, and where there is an effect, it is likely to be barely perceptible, minor, and therefore not significant.

8.3 Residual effects

Table 8-2 summarises the potential impacts of the proposed scheme on archaeology and cultural heritage.

Potential adverse effects as a result of the proposed scheme are directly associated with the construction phase of works through the potential for the tracking of plant and machinery to damage features of archaeological and historic interest. Bank profile restoration works may also affect the core of any remaining medieval banks. However, none are assessed as being significant subject to mitigation.

During operation the reduced flood risk will have a significant benefit for listed buildings and structures in the **medium-term**.

Table 8-2 Potential impacts of the proposed scheme on the historic environment

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Construction Impacts						
Potential for accidental damage to the historic landscape, listed buildings and SMs due to the proximity of construction works and access routes.	High	Low	**Moderate adverse, permanent**	• A Traffic Management Plan (TMP) will be produced and will include measures to avoid impacting upon features of archaeological and historic interest. • The TMP will also include measures to prevent damage to the designated bridges in the Study Area. • Archaeological and historic features will be clearly identified on construction drawings. • Toolbox talks will inform the contractor of particular precautions to take whilst working within close proximity to features of interest.	No change	**None**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
Potential damage from the tracking of plant and machinery and siting of compounds over sensitive archaeology.	Moderate	Moderate	**Moderate adverse, permanent**	• Tracking over known archaeology will be avoided where possible. • Advice from the NEAS archaeology expert and County Archaeologist / English Heritage will be taken as to the mitigation measures required to limit damaging known archaeology where it cannot be avoided.	Low	**Minor adverse, permanent**
Potential damage of river-side historic earthworks to allow access by excavators to floating pontoons.	Moderate	Moderate	**Moderate adverse, permanent**	• Avoid tracking and re-profiling sections of the river-side embankment where there are known historic earthworks. • Advice from the County Archaeologist / English Heritage will be taken as to the mitigation measures required to limit damaging the earthworks, where it cannot be avoided. • Where advised, it may	Low	**Minor adverse, short-term.**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				be possible to reinstate and replicate the earthworks after construction.		
Saltmoor Pumping Station listed building to be used as a site for a welfare unit.	High	No change	**None**	N/A	N/A	**None**
Potential damage to unknown archaeology in the river channel.	High	Low	**Moderate adverse, permanent**	• Where the river channel is likely to be altered beyond the 1960s width and depth, advice from the County Archaeologist / English Heritage will be sought. • Where advised, a watching brief for specific locations may be required. • Any finds will be reported to the Environment Agency and County Archaeologist immediately. • Any in-channel finds will be kept immersed	Very low	**Minor adverse, permanent**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
				in water following discovery in order to protect them. • Toolbox talks will also train site staff to be aware of the potential for unrecorded archaeology and, if found, works will cease until an archaeologist has been consulted.		
Potential for SMs to be damaged due to spreading of dredged material.	High	Low	**Moderate adverse, permanent**	• Dredged material will not be spread on SMs.	No change	**None**
Potential for the historical earthworks on the river embankment to be degraded as a result of deposited material.	Moderate	Low	**Minor adverse, permanent**	• Spreading over known historic earthworks will be avoided where possible. • Advice from the County Archaeologist / English Heritage will be taken as to the mitigation measures required to limit damaging known archaeology where it cannot be avoided.	Low	**Minor adverse, medium-term**
Potential for the	Moderate	Moderate	**Moderate adverse,**	• Bank profile restoration	Low	**Minor**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
historic banks to be degraded as a result of bank profile restoration works.			**permanent**	works over known historic embankments will be avoided where possible. • Advice from the County Archaeologist will be taken as to the mitigation measures required to limit damaging known archaeology where it cannot be avoided.		**adverse, permanent**
Potential for impact to known and unknown archaeology from deposition of dredged deposits and creation of stockpiles on agricultural land.	Moderate	Moderate	**Moderate adverse, permanent**	All designated heritage sites and undesignated earthwork sites, particularly that are visible, will be avoided by spreading (see Drawing 122316-00013 for locations). Spreading and stockpiling over crop marks will be permitted.	No change	**None**
Additional protection provided to earthwork sites that exist as cropmarks from deposition of	High	Very Low	**Minor be neficial, permanent**	During decommissioning of the main stockpiles a small quantity of material will be spread over the	N/A	**Minor beneficial, permanent**

Impact	Sensitivity of receptors	Magnitude of impact before mitigation	Significance and duration before mitigation	Mitigation	Magnitude of impact after mitigation	Residual effect
dredged deposits.				receptor fields to create a buffer to protect them from future ploughing.		
Operation Impacts						
Listed buildings and structures will be afforded with a higher level of flood protection than existing.	High	Moderate	**Major be neficial, medium-term**	N/A	N/A	**Major beneficial, medium-term**
Potential effects on the setting of listed buildings from the formation of the proposed raised banks.	High	No change to Very low	**None to minor adverse, permanent**	N/A	No change to Very low	**None to minor adverse, permanent**

9 Cumulative effects and inter-relationships

9.1 Introduction

Projects are not planned, built, operated and decommissioned in isolation, but within regional, national and international processes of change which include other projects, plans and policies. IEMA guidelines (2011) recommend an EIA should assess the effects of a development cumulatively with other planned developments, where there are likely to be significant environmental effects. The EIA regulations require that an assessment should describe the likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects. In summary, an EIA should assess the following:

- Secondary or indirect effects that are not a direct result of the project, but occur away from the original effect or as a result of a complex pathway. Examples of secondary effects are a development that changes the water table and thus effects the ecology of a nearby wetland; and construction of one project that facilitates or attracts other developments.
- Cumulative effects arise as a result of incremental changes caused by other past, present or reasonably foreseeable actions together with the project. These may occur, for instance, where several developments each have insignificant effects, but together have a significant effect or several significant effects together; or where several individual effects of the project (e.g. noise, dust and visual) have a combined effect.
- Synergistic effects interact to produce a total effect greater than the sum of the individual effects. Synergistic effects often happen as habitats, resources or human communities get close to capacity. For instance, a wildlife habitat can become progressively fragmented with limited effects on a particular species until the last fragmentation makes the area too small to support the species. Synergistic effects are considered within the individual topic chapters (Chapter 5 to 11 of the original ES, Chapters 5 to 9 of the ES Stockpiles Addendum and Chapters 5 to 8 of this Addendum).

Secondary, indirect and synergistic effects are integral to the assessment made in each of the individual topic chapters (Chapters 5 to 11 of the original ES). This Chapter considers the potential cumulative effects that arise from a combination of other known projects within the Rivers Parrett and Tone Dredge Study Area.

Cumulative effects (or 'in-combination effects') are also considered as part of the HRA and WFD compliance assessments and have been used to inform the ES and subsequent addendums.

Cumulative effects of the main stockpiles and the scope of works documented in the original ES have been assessed within the topic chapters 5-9 of the ES Stockpiles Addendum.

9.2 Impact Assessment Methodology

For the purposes of this chapter, the Study Area is taken to be within 1.5km of the proposed dredging works on the Rivers Parrett and Tone, as this is likely to be the distance that the majority of dredged material will be spread.

The greatest potential for cumulative impacts is from an overlap of construction stage effects. Projects that are due to be completed before the dredging scheme commences are not assessed for cumulative effects as the construction period associated with these projects will have ended. Similarly, projects that are not due to commence until after the dredging works are complete have also been screened out of the assessment.

Only projects within the public domain and for which sufficient information is available (i.e. with a submitted planning application as of July ~~February~~ 2014) have been taken into consideration.

Searches of the Taunton Deane Borough Council and Sedgemoor District Council's planning websites have been undertaken in order to identify projects with the potential for cumulative impacts with the scheme.

The potentially relevant projects were initially screened in or out of the assessment on the basis of their nature, scale and spatial or temporal proximity to relevant sections of the proposed dredging works and associated spreading. The only operational impact of this scheme is the overall reduction in flood impacts and is therefore unlikely to have cumulative impacts with other projects once complete. There are no other projects that would be likely to have impacts on water levels.

The greatest potential for cumulative impacts is therefore from an overlap of construction stage effects, thus where this is the case, these projects have been screened in for further assessment of cumulative effects.

Projects screened in for assessment were then assessed for their potential to have likely significant effects in combination with the Rivers Parrett and Tone Dredge and associated bank profile restoration works. This assessment was undertaken by reviewing the effects identified in the preceding specific topic chapters of this ES against any environmental effects which were addressed within the supporting planning documents of the other projects. Ultimately, expert judgement was used to determine whether identified impacts between the schemes will act in-combination to produce significant cumulative effects.

9.3 Other Identified Projects

Numerous planning applications have been submitted to both Sedgemoor District Council and Taunton Deane Borough Council that fall within the 1.5km Study Area. The majority of these however are small-scale developments that relate to single dwellings or minor changes of land use (i.e. property extensions or conversions). It is not considered necessary to consider such developments in-combination with the proposed scheme as their environmental impacts are generally considered negligible. The main potential for cumulative effects to arise as a result of small-scale developments relate primarily to site access and construction traffic arrangements however these will be addressed as part of the Traffic Management Plan. The following projects were however considered further in order to determine whether they should be screened in or out of the assessment of cumulative effects.

9.3.1 Sedgemoor District Council

Formation of a golf centre (ref: 37/12/00084) – full planning permission granted 19/2/13

Development includes a change of land use of 15ha from agricultural. It will include the formation of a golf centre, including green keeper's building, building to form teaching rooms, golf shop, coffee shop, driving range bays, formation of a 9-hole golf course, car parking, access and service roads. The planning application is considered a 'major application' on Sedgemoor District Councils planning website.

A second phase of development will be subject to a separate planning application submitted in due course to create a main 18-hole course.

9.3.2 Taunton Deane Borough Council

Mixed use residential development (ref: 5 1/11/0013) – outline p lanning permission granted conditionally 04/01/2013

Outline application has been granted conditionally for the erection of 25 dwellings, 3 starter units, 1 mixed use starter unit, school pickup point, public open space, allotments, access and highway works, and demolition of existing buildings at Gillards Transport, Lyng Farm, Burrowbridge. The planning application has not been subject to an EIA, however the conditions of approval do give consideration to recommendations made within a protected species survey report and the conditions of the approval state that a written scheme of archaeological investigation must be prepared.

9.4 Screening Projects for Further Assessment

An initial assessment of the environmental impacts of the projects identified above was undertaken to help determine which projects could subsequently be screened in or out of this cumulative effects assessment.

With regards to the planning applications listed above, the following conclusions were reached:

Formation of golf cen tre: It is envisaged that this development, which lies approximately 1.5km from the northern extent of the proposed dredging scheme, will begin imminently. The location of the golf centre provides good transport links just 0.5km from junction 24 of the M5. Construction traffic will not share use of the minor road (Notaro Way) which leads from the motorway to the proposed golf centre. Dredged material will only be spread on this site subject to landowner agreement. Due to the distance between the two schemes, no other potential cumulative effects are anticipated and development of the golf centre has therefore been **screened out** of further assessment.

Mixed-use residential development, Burrowbridge: An outline planning application for the proposed development was conditionally approved in January 2013. Under the conditions of the approval it is stated that an application for the reserved matters must be obtained from the Local Authority in writing before any development is commenced. Although an application for the approval of reserved matters has not been submitted yet (as of July 2014), there is some potential for overlap in construction periods if the application for

reserved matters is submitted prior to the end of dredging works. The mixed-use development has therefore been **screened in** of further assessment of cumulative effects

9.5 Identifying Likely Significant Cumulative Effects

Of the known planned developments in the vicinity of the works only the mixed-use residential development at Burrowbridge has been screened in for further assessment of cumulative effects.

An application for the approval of reserved matters has yet to be submitted to Taunton Deane Borough Council in relation to the residential development. This process can take up to 8 weeks and it is therefore reasonable to assume that approval could be received before the dredging and bank restoration works are complete. If this does happen, consultation will be undertaken between the Environment Agency and the third party developer to minimise impacts on each other's projects and limit cumulative effects.

There may be some impacts associated with increased traffic movements during construction. Most traffic resulting from the dredging will be associated with the creation and decommissioning of the stockpiles, and spreading of dredged material over agricultural land or to the banks for restoration. This will result in increased traffic in and around Burrowbridge (see Chapter 11: Traffic and Transport of the ES Stockpiles Addendum) and will occur close to the proposed residential mixed-use development described in Section 9.3.2 (Gillards Transport site). This site, however, is in the same location as the ~~proposed~~ construction compound for the dredging works. Therefore it is highly unlikely that the construction periods of the two schemes will coincide; however, if they do, it is considered likely that contingency measures to be included within the Traffic Management Plan (TMP) will result in any cumulative effects on the transport network being **not significant**.

The new residential development has the potential to reduce flood storage capacity in the floodplain. The proposed dredging and bank restoration works will have no net impact on flood storage capacity and therefore there is **no potential for cumulative effects.**

9.6 Cumulative Impacts of Other Environment Agency Schemes

The Environment Agency and Local Authorities are working together to develop a long-term plan to manage flood risk and water levels on the Somerset Levels and Moors. Details of the Somerset Levels and Moors Flood Action Plan were released in March 2014, setting out a number of objectives including to reduce flooding, increase resilience, maintain and enhance connectivity with Somerset and to the rest of the country and to protect the special characteristics of the local environment over the course of the next 20 years. The plan includes a number of different approaches to flood risk management including dredging and river management, land management, urban water management and building of local resilience. The measures listed within the plan include a combination of short and long term and relatively cheap and expensive plans. Most works are not likely to commence until after the majority of the dredging and associated bank restoration works are complete, other than routine maintenance works. If any works associated with the 20 year plan require an EIA, an assessment of cumulative effects, giving regard to the dredging of the Rivers Parrett and Tone and reinstatement of bank profiles, will be undertaken and documented within the Environmental Statement, if deemed necessary.

~~are still being developed, and therefore this has not been taken into account during the consideration of cumulative effects. The plan is however, likely to require an EIA. If it does, an assessment of cumulative effects giving regard to the proposed dredging of the Rivers Parrett and Tone will be undertaken and documented within the Environmental Statement~~

Asset recovery works along the sections of the Parrett and Tone being dredged will involve a combination of hard and soft engineering techniques (see drawing 122316-00061 in Appendix A). Only the restoration of the river bank using dredged material is considered as EIA development and is assessed within this ES Addendum. The exception to this is that our assessment of flood risk takes into account bank profile restoration for both hard and soft defences within the reaches subject to dredge on the River Parrett.

Additional minor capital works on the Tone, between Hook Bridge and the confluence of the River Parrett would not have any further impact on the hydrology of Curry Moor.

Minor civil works on the hard defences will be undertaken over a broadly similar construction programme to the dredging and bank restoration works. The works will typically involve a combination of raising walls, installing and raising piles with reinforced concrete caps and construction of new hard defences. Exact details of these works are currently being developed and the potential to affect flood risk is subject to further modelling. However, the mitigation actions that form part of the EAP for the dredge and bank restoration works (see Chapter 11 of this Addendum) will form the basis of the subsequent EAPs that will be prepared for the minor civil works. Consequently environmental impacts will be subject to the same degree of mitigation, control and monitoring and no significant cumulative impacts are expected. Any minor civil works that require further consents such as planning or listed building consent will consider the cumulative impacts of the dredging and bank restoration.

There are also a number of other Environment Agency flood risk management projects under consideration. Most of these are still in the early stages of development and therefore cannot be assessed for cumulative effects.

Repair works are, however, planned at the Curry Moor flood storage reservoir (FSR). These works aim to restore the reservoir to a good condition to maintain the existing standard of protection and comply with the Reservoirs Act 1975 by undertaking works recommended by the inspecting engineer. These works will be undertaken during the summer of 2014, possibly extending into the summer of 2015 to avoid the wintering bird period within the Curry and Hay Moors SSSI and Somerset Levels and Moors SPA/Ramsar sites. This coincides with the proposed programme of works to dredge the Parrett and Tone rivers. Exact details of the scheme are currently still being developed but the works are likely to be undertaken using the Environment Agency's permitted development rights and have been initially screened against the EIA (Land Drainage Improvement Works) Regulations to determine that an EIA is not required. As such, any environmental risks are planned to be addressed using general mitigation measures. Indicative environmental risks identified relate primarily to:

- **The Historic Environment**: Two Scheduled Monuments (SMs), Balt Moor Wall and Athelney Slipway, will both be affected by the works. Consultation will be undertaken with the County Archaeologist. The dredging or bank restoration of the Parrett and Tone will have no impact on these sites and thus there is no potential for cumulative impacts.
- **Flora and Fauna:** The works will take place within the Somerset Levels and Moors SPA and Ramsar site and Curry and Hay Moors SSSI. They comprise maintaining existing structures and will be outside of the wintering bird period. However, there is potential for cumulative effects on breeding birds as works will be mainly carried out

in summer. The Rivers Parrett and Tone Dredge will only effect approximately 1km of the SSSI immediately adjacent to the river. Given the overall size of the SSSI, significant cumulative effects are not anticipated.

- **Water Framework Directive:** The scheme lies adjacent to the River Parrett (HMWB) water body, which has an ecological potential of moderate and target objective for good potential by 2027. It is unlikely that the FSR works would have any significant impact on WFD (or require a detailed assessment) so would not impose a cumulative effect.
- **Traffic and Transport:** There will be some increased traffic flows as a result of vehicle and machinery movements. This risk will be mitigated through the implementation of a Traffic Management Plan (TMP). The works comprise maintenance activities and are not anticipated to generate significant quantities of incoming traffic. However, the damage caused by recent flooding may result in the requirement for earthworks, which may generate additional traffic. The effect of increased traffic on local roads during the dredging works has been assessed of moderate adverse, short-term significance following mitigation, with the effect on the A361 assumed to be less (see Chapter 9 in the ES Stockpiles Addendum). Although details are unknown, other than on the A361, the construction traffic between the 2 schemes are unlikely to use the same roads and, if they do, it will be for relatively short distances and time periods. In addition, both schemes are being undertaken by the Environment Agency, and therefore plans will be made for peak traffic movements to avoid each other when possible, if required. For these reasons, it is not anticipated that the significance rating for the Rivers Parrett and Tone dredge and bank restoration (i.e. moderate, adverse, short-term) will increase when considered cumulatively with the FSR works.

For the reasons outlined above, the Curry Moor FSR repair works will not create significant cumulative effects in combination with the proposed dredging and bank restoration works. If the scope of the Curry Moor repair works changes significantly as a result of the recent flood event, an assessment of cumulative effects will be made against the proposed dredging and bank restoration works of the Parrett and Tone.

There are no other known permissions, plans or projects that have the potential to interact with the proposed dredging and bank restoration works to create cumulative effects.

9.7 Uncertainties

~~The full extent of damage caused by the flooding of 2013/2014 will remain unknown until after the waters have retreated. It is anticipated however that repairs by~~ Various parties such as the local authorities, Canal and Rivers Trust, Highways Agency and Network Rail are required to undertake repairs to their assets as a result of the flooding of 2013/14. ~~Will be required~~. As details of such work are currently unknown, it has not been possible to undertake an assessment of cumulative effects against these developments.

If other planning applications for work within the vicinity of the proposed dredging works are submitted, it will be the responsibility of the third party developers to take Rivers Parrett and Tone Dredge works into account in their consideration of cumulative impacts, if the development requires a statutory EIA. Taunton Deane Borough Council and Sedgemoor District Council, as the Local Planning Authorities, will advise developers of this requirement during the pre-application stage and/or the EIA Screening and Scoping consultation process. If it is determined that additional mitigation measures are required in response to any newly submitted planning applications, these will be included within the EAP and implemented as required.

9.8 Summary

A desk-based review of planning applications and other Environment Agency repair works within the study area has been undertaken. It has been concluded that, although there are a number of uncertainties, at this stage no foreseeable cumulative impacts will arise in combination with the dredging and bank restoration of the Rivers Parrett and Tone.

10 Summary

10.1 Introduction

The aim of the project is to improve the channel capacity of the River Tone and the River Parrett, from downstream of Hook Bridge to North Moor Pumping Station, in order to reduce the frequency and duration of flood events, their impact and associated disruption.

The primary objectives of the project are to:

- Dredge over 8km of the Rivers Tone and Parrett near their confluence to give a cross sectional area as close as possible to that proposed in the 1960s Tone Valley Scheme allowing for physical constraints. This will involve removing approximately 235,000 cubic metres of silt. The Environment Agency proposes to use a proportion of this material to restore the bank profile along sections of the River Parrett
- Start dredging as soon as it is safe to do so and once the relevant environmental consents are received.
- Secure approval and support for a sustainable approach from key partners including: Local Authorities, Somerset Drainage Board Consortium, landowners, the local community, Natural England and the Marine Management Organisation.

Dredging works commenced in April 2014 and are anticipated to finish in October 2014. Bank profile restoration works are programmed to commence in mid-August and will be complete in October 2014. ~~The works are anticipated to occur between April and October 2014.~~ If works are not completed they will recommence and finish in spring/summer 2015.

The original ES, the ES Stockpile Addendum and this addendum for bank profile restoration have ~~and this Addendum have~~ documented the findings of the EIA carried out to assess the likely significant effects of undertaking dredging operations to help alleviate flooding in the moor areas adjacent to the lower reaches of the Rivers Parrett and Tone. It has been prepared in accordance with all relevant legislation and follows consultation with Environment Agency technical specialists and statutory bodies. The information used to compile the ES relies upon desktop studies, records of environmental surveys previously undertaken in the study area the local knowledge of technical specialists. Since dredging commenced, monitoring surveys have also provided further information about the ecological baseline. ~~Project-specific field surveys could not be undertaken due to the current flooding.~~

Chapters 5-9 of this addendum have identified the likely environmental effects arising to receptors as a result of the proposals to restore the profile of sections of the bank along the River Parrett. ~~Chapters 5-9 of this Addendum have identified the likely environmental effects arising to receptors as a result of the proposal to construct temporary stockpiles for up to one year.~~ The individual topic chapters provide full details on the assessment of all scoped-in impacts; their initial significance; mitigation measures; and, a full account of the significance of the residual effects still likely to occur following mitigation.

This chapter provides an updated overall summary of all of the potential significant environmental effects identified within the topic assessments as a result of the original ES and both subsequent addendums. It also provides a brief summary of the conclusions of the WFD Assessment and HRA; which are both directly linked to the EIA for this scheme and appended to the original ES.

10.2 Summary of significant environmental effects

Significant effects are classified as those identified as moderate or major, whether adverse or beneficial (refer to section 4.2 of the original ES). The predicted effects are initially assessed without the implementation of any mitigation.

Table 10.1 summarises the likely significant environmental effects *prior to mitigation* identified within this ES, or subsequent addendums for the proposed stockpiles and bank restoration works. Not all chapters within the original ES identified likely significant effects, therefore not all topics are included in the table. Measures required to prevent or reduce the significant effects identified are also shown in the table, along with the assessment of residual significance following application of the mitigation.

There are not anticipated to be any significant environmental effects arising as a result of combined (intra-project) impacts or cumulative effects of the scheme with other known developments within the area. It is acknowledged that there is the potential for small impacts to arise, including as a result of proposed minor capital works on the hard defences along both the Rivers Parrett and Tone, but these will be mitigated for.

Mitigation measures to, as far as possible, prevent and reduce all the adverse environmental effects identified throughout the ES are presented in an Environmental Action Plan (EAP) within Chapter 11~~12~~. This summarises the actions required to implement the project in accordance with the ES during subsequent stages of the project. The EAP also details the roles and responsibilities of those involved.

Table 10-1: Significant environmental effects identified by the EIA, mitigation measures identified and residual significance

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
Population			
Construction and decommissioning stages: Disturbance to adjacent residents in Burrowbridge as a result of vehicle movements (effects of noise, vibration and odour).	**Moderate, temporary, short-term and adverse**	Implement a Traffic Management Plan (TMP). Plant to be well maintained and suitably sized for the works. Engines to be switched off when not in use. Inform residents of proposed timings, likely impacts and duration of works. If deemed to be necessary, use of screening to block odours in the direction of the prevailing wind during the stockpile construction and decommissioning phases. Consultation with local authority Environmental Health Officers to determine maximum noise levels. Noise monitoring to ensure adherence. Condition surveys to be undertaken on adjacent properties, where considered to be at a risk of damage from vibration impacts.	**Moderate, temporary, short-term and adverse**
Construction-stage: Indirect effects on glass eel fishery activities; potentially arising as a result of restricted access and loss of revenue.	**Moderate, temporary, short-term and adverse.**	A low-flow channel will be left within the channel (i.e. not all of the channel width and bed depth will be dredged). This will help with mitigating the impacts of loss of flow depth for migratory species including eels and salmonids; and the fisheries which they support. On the lower reaches, dredging of exposed material only – following the ebb tide. Liaison will be carried out with the commercial fishing sector before and during operations to ensure the scheduled work plan is available. Appropriate signage will be put in work (and planned work) areas. An Ecological Monitoring Plan will be prepared and agreed with the Environment Agency Fisheries Team and Natural England prior to construction.	**Minor, temporary, short-term and adverse.**
Construction-stage: Potential for impacts (closure/diversion) upon the River Parrett Trail, East Deane Way and Macmillan Way West Long Distance Paths.	**Moderate, temporary, short-term and adverse.**	Wherever possible Long Distance Paths will not be closed or diverted, rather a 'banksman' will be used to protect users of the paths from the works. If a temporary closure is required, this will be agreed with the Rights of Way team at Somerset County Council and an alternative diversion route will be agreed where available and signposted for users of the paths.	**Minor, temporary, short-term and adverse.**
Operation-stage: Reduced	**Major, tem porary,**	No mitigation required as it is a beneficial effect.	**Major,**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
flood risk to people (residential areas).	**medium-term and beneficial.**		**temporary, medium-term and beneficial.**
Operation-stage: Reduced flood risk to businesses (commercial and agricultural areas).	**Major, tem porary, medium-term and beneficial.**	No mitigation required as it is a beneficial effect.	**Major, temporary, medium-term and beneficial.**
Operation-stage: Reduced flood risk to people (residential areas) from bank profile restoration	**Moderate permanent, beneficial**	No mitigation required as it is a beneficial effect.	**Moderate permanent, beneficial**
Land Use			
Construction-stage: Non-compliance with Environmental Stewardship and ESA agreements.	**Minor to Major adverse, short-term.**	The dredged arisings will only be spread on Environmental Stewardship land where this action does not contravene the individual management options that the landowners are committed to within their stewardship agreements.	**Negligible to Moderate adverse, short-term.**
Construction-stage: Soil enrichment/conditioning of agricultural land through the spreading of dredged material.	**Negligible to Moderate beneficial, short-term.**	Chemical analysis will be undertaken of receptor fields and sediment to demonstrate tangible soil conditioning benefit.	**Negligible to Moderate beneficial, short-term.**
Construction-stage: Spreading of dredged arisings with high salinity levels may result in agricultural land becoming less productive.	**Minor to Major adverse, short-term.**	When identifying recovery sites for saline dredged sediment the following characteristics should be considered, which will determine whether there will be a detrimental impact on the receiving land: content of sodium and chloride ions in the dredged sediment; the type of soil (e.g. peat or clay/silt) on the receiving agricultural field; the possibility of diluting the sodium and chloride content prior to spreading; the possibility of speeding up drainage following spreading; the proximity of	**Negligible to Minor adverse, short-term.**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
		surface water and groundwater resources and their functions (CIRIA, 1996). If it is concluded that following mitigation the salinity levels are unacceptably high for the receiving soil the dredged arisings will be disposed of to landfill.	
Construction-stage: Short term cessation of all farming activities on areas of agricultural land where the dredged arisings are being spread. Magnitude will depend on proportion of each farm affected. Damage to agricultural fields used as access or during spreading operations.	**Minor to Major adverse, short-term.**	Consultation will be undertaken with the affected farmers to minimise disruption to agricultural activities and compensatory agreements will be assessed in line with the provisions of the Water Resources Act 1991.	**Minor adverse, short-term.**
Construction-stage: Damage to agricultural fields used as access or during spreading operations.	**Negligible to Moderate adverse, short-term.**	Suitable access will be identified on farms and roads to minimise impact to ground conditions. Pre and post construction site inspections will be undertaken to ensure that the reinstatements of access routes and working areas have been carried out to an acceptable level.	**Negligible to minor adverse, short-term.**
Operation-stage: Reduction in flood risk to agricultural land.	**Minor to Major beneficial, medium-term.**	No mitigation required for this beneficial effect.	**Minor to Major beneficial, medium-term.**
Operation-stage: Reduction in flood risk to local road network, the A361.	**Moderate beneficial, medium-term.**	No mitigation required for this beneficial effect.	**Moderate beneficial, medium-term.**
Operation-stage: Reduction in flood risk to railway lines.	**Major beneficial, medium-term.**	No mitigation required for this beneficial effect.	**Major beneficial, medium-term.**
Flora and Fauna			

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
Construction-stage: Disturbance to birds and tracking of dredging plant adjacent to river banks on the Somerset Levels that form part of the North Moor SSSI (bird disturbance only), Southlake Moor SSSI, Somerset Levels NNR and Curry and Hay Moors SSSI.	**Moderate, temporary, short-term and adverse.**	No works within 250m of a SSSI boundary during over-wintering period. Pre-construction checks for nesting birds. Dredging plant will be no further than 5m from river bank. Works within SSSIs to be supervised by the Ecological Clerk of Works (ECW).	**Minor, temporary, short-term and adverse.**
Construction-stage: The River Parrett and the River Tone LWSs will be directly impacted by the dredging activities. Bankside habitats will be completely removed and local species that use the rivers will be disturbed.	**Major, temporary, medium-term and adverse.**	The works will 'Strip and Recover' a proportion of the *Phragmites* / marginal plants, which will be re-planted as a fringe as operations proceed. Where possible, material will be removed in a way to leave channel irregularities. Dredging will maintain / create a low-flow channel. An Ecological Monitoring Plan will also be followed which will include: monitoring water temperature, dissolved oxygen, ammonia and during works, stopping dredging to review working practices if necessary; dissolved oxygen must remain between 30% and 120%; A minimum level of 30% will be satisfactory so long as works continue with care (Environment Agency, 2011b); if water temperatures exceed 15^{o}C, then material will only be removed from above the water line; If water temperatures exceed 20^{o}C, then all dredging will be suspended and operations reviewed. Restricted working could include only removing sediment from above the water line; using closed buckets; and single bank working. Hydrogen peroxide (H_2O_2) will be administered or aeration deployed to working areas if needed.	**Moderate, temporary, medium-term and adverse.**
Construction-stage: There is potential for the dredged	**Moderate, temporary, short-**	No dredged arisings will be spread within the LWS. Plant will only access through the LWS along river bank, under supervision of ECW.	**Negligible.**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
arisings to be spread across Athelney Fields LWS, affecting habitat quality.	**term and adverse.**		
Construction-stage: Potential for damage to water vole habitat. Potential for direct impact to water voles if within burrows at the time of clearance. Potential indirect impacts from loss of feeding resource.	**Major, temporary, medium-term and adverse.**	ECW will undertake pre-construction checks before dredging or bank profile restoration commences. Where required, vegetation will be strimmed to discourage water voles from recolonising the working areas. Where voles are present displacement will be carried out in line with a Method Statement agreed with NE. If displacement fails then water voles will be trapped and translocated under a Conservation Licence. ~~If water voles are discovered within the working area at any time, works will stop in that area and a mitigation strategy will be agreed with Natural England under a Conservation Licence if appropriate.~~ The works will 'Strip and Recover' a proportion of the *Phragmites* / marginal plants. No spreading will occur closer to any rhynes or other watercourses than existing agricultural operations e.g. no semi-natural buffer zones affected. No stockpiles within 10m of a rhynes or other watercourses to prevent damage to burrows unless water voles confirmed absent by the ECW.	**Moderate, temporary, medium-term and adverse.**
Construction-stage: Potential for the destruction of an otter's resting place and impacting on its' fish supplies.	**Major, temporary, short-term and adverse.**	The ECW will undertake pre-construction checks for holts and resting sites. If found it will be left in-situ with a buffer zone. If this is not possible, a licence for temporary holt closure or disturbance would be applied for from NE and an appropriate mitigation strategy devised.	**Moderate, temporary, short-term and adverse.**
Construction-stage: Indirect impact to otters through impacts to water quality/fish.	**Moderate to Major, temporary, short to medium-term and adverse.**	In addition to mitigation measures described for LWS, the following mitigation measures will be incorporated in order to prevent or reduce impacts on fish (including eels): Risk of harm from suspended solids will be reduced by seeking to maintain a portion of the channel width relatively unimpacted, e.g. by dredging on one bank only at any one time.	**Moderate, temporary, short to medium-term and adverse.**
Construction-stage: Potential for disturbance to otters.	**Moderate, temporary, short-**	Works will not be carried out on both banks concurrently where there is otter activity.	**Minor, temporary,**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
	term and adverse.		**short-term and adverse.**
Construction-stage: Potential for destruction of setts or disturbance to badgers as a result of plant and vehicle movements and siting of storage areas and site compounds.	**Moderate, temporary, short-term and adverse.**	The ECW will undertake pre-construction checks of all working areas. If an active badger sett is located within an agricultural field identified for sediment spreading, the scope of the spreading will be reduced in that particular field so as not to cause disturbance to the badgers. If an active badger sett is located along a river bank, then wherever possible it will be left in-situ with an appropriate buffer so as to avoid disturbance. If this is not possible, a licence for a temporary sett closure would be obtained and an appropriate mitigation strategy devised.	**Minor, temporary, short- term and adverse.**
Construction-stage: Potential for killing or injury of Great Crested Newts (GCN) or impairment to their ability to breed during spreading operations; either through destruction of hibernation and/or foraging and commuting areas.	**Moderate, temporary, short-term and adverse.**	An ECW is to undertake a pre-construction Habitat Suitability Assessment. Further mitigation may include Reasonable Avoidance Measures or mitigation under a Natural England Licence. If a GCN is found all works in that area will stop and ECW contacted.	**Minor, temporary, short-term and adverse.**
Construction-stage: Potential for disturbance, killing or injury of nesting birds and/or destruction of nests or eggs through dredging, spreading dredged sediment, clearance of vegetation and siting of access stockpiles and compound areas. Includes ground-nesting birds.	**Moderate, temporary, short-term and adverse.**	All vegetation to be cleared between March and September as part of the scheme will be flailed as soon as it is practical. Checks will be carried out in advance by the ECW. An ecologist will undertake a nesting bird survey in agricultural fields prior to the stockpiling or spreading or establishment of access roads/compounds. Should a nesting bird be discovered, an exclusion zone will be erected and works shall not continue until young have fledged. Site compounds shall be located at least 5m from hedgerows or trees.	**Minor, temporary, short-term and adverse.**
Construction-stage:	**Minor to Major,**	Mitigation measures described above in LWS.	**Minor to**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
Mobilisation of sediment may affect dissolved oxygen levels, likely result in mortalities of both resident and migratory fish species. Overall impacts on fish including: Reduced water quality; Mechanical operation of dredging gear; Noise, vibration and visual disturbance; Impoverished benthic fauna; Reduced habitat diversity; Reduction in spawning habitat; Reduction in resting or 'hold up' areas for migratory birds.	**temporary, short-term and adverse.**		**Moderate, temporary, short to medium-term and adverse.**
Construction-stage: Impacts to notable/ nationally rare or scarce invertebrates (excluding hairy click beetle) including: Loss of bankside habitat; Mobilisation of sediment; Physical removal of invertebrates in dredgings; Loss of instream habitat heterogeneity; Disturbance to reproductive cycle of freshwater mussels; Toxic effects of herbicides; Nutrient mobilisation; Disposal of dredgings.	**Minor to Major, temporary, short to medium-term and adverse.**	Mitigation will as for described for LWS. Monitoring of the presence of mussels; Sensitive disposal of dredging in line with Environment Agency PPGs.	**Minor to Moderate, temporary, short to medium-term and adverse.**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
Construction-stage: Direct impacts to hairy click beetle habitat through dredging.	**Major, potentially permanent and adverse.**	Dredging will be minimalised in the vicinity of known hairy click beetle locations. Translocation will be considered as required, ensuring that appropriate expertise is sought for identifying suitable sites and carrying out the movement. Advice will be sought from Environment Agency technical specialists prior to bank profile restoration for the potential for further impacts and required mitigation.	**Moderate, temporary, short-term and adverse impact.**
Construction-stage: Potential to spread invasive species (esp. Himalayan balsam) by spreading/ stockpiling dredged arisings over agricultural land, tracking over riverbank soil and leaving dredged banks exposed short- term.	**Major, permanent and adverse.**	The ECW shall undertake pre-construction checks of all working areas and land adjacent to working areas. Biosecurity measures such as hosing shall be provided on site. An invasive species management plan will be devised. This will detail an appropriate strategy to manage invasive species growth on all spreading areas. Invasion by *Dreissena* will be managed by ensuring boats, dredging equipment etc. are not contaminated.	**Moderate, temporary, medium-term and adverse.**
Operation-stage: Impact on water vole, reptiles, badgers, great crested newts and ground-nesting birds due to their habitats flooding less frequently and for shorter durations in extreme events.	**Minor to Moderate, temporary, medium-term and beneficial.**	No mitigation required for this beneficial effect.	**Minor to Moderate, temporary, medium-term and beneficial.**
Operation-stage: The dredged channel may experience reduced spatial variability in flow velocity, resulting in reduced survival or washout of fish (particularly juveniles) during high flow periods.	**Moderate, temporary, medium-term and adverse.** **(Negligible to minor at catchment scale).**	As for fish under construction impacts.	**Minor, temporary, medium-term and adverse.**
Operation-stage: Altered	**Moderate,**		**Minor,**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
hydraulics: Increasing channel volume and smoothness will raise mean flow rates and remove flow heterogeneity, impeding recolonisation of fringing vegetation and impairing filtering activity by bivalve mussels.	**temporary, medium-term and adverse.**		**temporary, medium-term and adverse.**
Water			
Construction-stage: Dredging increases bacteria numbers and causes impact on downstream bathing water quality at Burnham on Sea. Effect less likely due to distance of works from receptor. E coli and Intertestinal enterococci (IE) are the main risks to Bathing Water Quality.	**Major adverse, short term**.	Set up a monitoring regime upstream of Bathing Waters to test for elevated bacteria levels. Follow good working practice to mitigate risk of bacteria dispersal during works. During high water temperatures phase the dredging to promote dry excavation where possible, to reduce suspended sediment loadings, and the risk of bacterial release.	**Negligible adverse, short-term.**
Operation-stage: Channel modification (enlargement of width) affecting hydromorphology, physico-chemical and biological WFD quality elements.	**Moderate adverse, medium term.**	Follow good working practice to mitigate risk, including not dredging the full channel width and bed, to leave a central low-flow channel.	**Minor adverse, medium term**.
Landscape and Visual Amenity			
Operation-stage: View from rear of residential properties on Riverside towards Stockpile	**Moderate, short-term, adverse**	No mitigation is proposed as mitigation measures have already been incorporated into the design (ensuring a 10m buffer between field boundaries and stockpiles and a 25m buffer between residential	**Moderate, short-term, adverse**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
Location 1.		properties and stockpiles; using black sheeting to cover the stockpiles) or are not considered appropriate due to the temporary nature of the works.	
Operation-stage: View from residential properties on Stathe Road and Stanmoor Road towards Stockpile Location 2.	**Moderate, short-term, adverse**	As above.	**Moderate, short-term, adverse**
Operation-stage: View from Burrow Mump towards all stockpiles.	**Moderate, short-term, adverse**	As above.	**Moderate, short-term, adverse**
Historic Environment			
Construction-stage: Potential for accidental damage to the listed buildings and SMs due to the proximity of construction works and access routes.	**Moderate adverse, permanent.**	A Traffic Management Plan (TMP) will be produced and will include measures to avoid impacting upon features of archaeological and historic interest. The TMP will also include measures to prevent damage to the designated bridges in the Study Area. Archaeological and historic features will be clearly identified on construction drawings. Toolbox talks will inform the contractor of particular precautions to take whilst working within close proximity. Tracking over known archaeology will be avoided where possible. Advice from the County Archaeologist / English Heritage will be taken as to the mitigation measures required to limit damaging known archaeology where it cannot be avoided.	**None.**
Construction-stage: Potential damage from the tracking of plant and machinery and siting of compounds over sensitive archaeology.	**Moderate adverse, permanent.**	Tracking over known archaeology will be avoided where possible. Advice from the County Archaeologist / English Heritage will be taken as to the mitigation measures required to limit damaging known archaeology where it cannot be avoided.	**Minor adverse, permanent.**
Construction-stage: Potential damage of river-side historic earthworks to allow access by	**Moderate adverse, permanent.**	Avoid tracking and re-profiling sections of the river-side embankment where there are known historic earthworks. Advice from the County Archaeologist / English Heritage will be taken as to the mitigation	**Minor adverse, short-term.**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
excavators to floating pontoons.		measures required to limit damaging the earthworks, where it cannot be avoided. Where advised, it may be possible to reinstate and replicate the earthworks after construction.	
Construction-stage: Potential damage to unknown archaeology in the river channel.	**Moderate adverse, permanent.**	Where the river channel is likely to be altered beyond the 1960s width and depth, advice from the County Archaeologist / English Heritage will be sought. Where advised, a watching brief for specific locations may be required. Any finds will be reported to the Environment Agency and County Archaeologist immediately. Any in-channel finds will be kept immersed in water following discovery in order to protect them. Toolbox talks will also train site staff to be aware of the potential for unrecorded archaeology and, if found, works will cease until an archaeologist has been consulted.	**Minor adverse, permanent.**
Construction-stage: Potential for Scheduled Monuments to be damaged due to spreading of dredged material.	**Moderate adverse, permanent.**	Dredged material will not be spread on Scheduled Monuments.	**None.**
Construction stage: Potential for the historic banks to be degraded as a result of bank profile restoration works.	**Moderate adverse, permanent.**	Bank profile restoration works over known historic embankments will be avoided where possible. Advice from the County Archaeologist will be taken as to the mitigation measures required to limit damaging known archaeology where it cannot be avoided	**Minor adverse, permanent**
Operation-stage: Potential for impact to known & unknown archaeology from deposition of dredged deposits on agricultural land.	**Moderate adverse, permanent.**	All designated heritage sites and undesignated earthwork sites, particularly that are visible, will be avoided by spreading.	**None.**
Operation-stage: Listed buildings and structures will be afforded with a higher level of flood protection than existing.	**Major beneficial, medium-term.**	No mitigation required for this beneficial effect.	**Major beneficial, medium-term.**

Significant effect	Likely impact before mitigation	Mitigation	Residual significance
Traffic and Transport			
Construction-stage: Disruption to local traffic flows as a result of increased vehicle/ machinery movements.	**Major, temporary, short-term and adverse.**	Mitigation measures will be incorporated into a construction-stage Traffic Management Plan; these will include: agreed delivery/ haulage routes; locations for warning signs on local roads; delivery schedules to avoid peak traffic times; contingency plans for emergency access/ egress; and, measures to minimise vehicle movements. In addition, 'banksmen' will be used to reduce the likelihood of needing temporary road closures. Pre-construction condition surveys of access routes.	**Moderate, temporary, short-term and adverse.**
Operation-stage: Reduced flooding to the local road network (including the locally important A361).	**Moderate, temporary, medium-term and beneficial.**	No mitigation required for this beneficial effect.	**Moderate, temporary, medium-term and beneficial.**
Operation-stage: Reduction in flooding of railway lines.	**Major, temporary, medium-term and beneficial.**	No mitigation required for this beneficial effect.	**Major, temporary, medium-term and beneficial**

10.3 Summary of Water Framework Directive Assessment conclusions

The WFD assessment concluded that the works will not cause deterioration from Moderate Ecological Potential for the Parrett Transitional Waterbody so long as the mitigation described is implemented. The WFD assessment also concluded that the works will not prevent achievement of water body objectives reaching Good Ecological Potential by 2027 (the full WFD Assessment is included in Appendix B of the original ES).

10.4 Summary of Habitats Regulations Assessment conclusions

A Habitats Regulations Screening Assessment identified that the project could have likely significant effects on the Somerset Levels and Moors SPA and Ramsar site and the Severn Estuary SAC, SPA and Ramsar site. An Appropriate Assessment was undertaken which concluded that, subject to implementing a monitoring and management programme during and after dredging, the project would not have an adverse effect on the integrity of any Natura 2000 site. The assessment has been summarised in Chapter 6 of this addendum (Flora and Fauna), and the full HRA Screening Assessment and Appropriate Assessment documents are provided in Appendix D.

10.5 Conclusion and next steps

Overall, the ES, ES Stockpile Addendum and Bank Restoration Addendum found that with mitigation and good site management in place, it will be possible to avoid significant negative environmental impacts resulting from the works. Significant adverse residual effects are largely temporary and associated with the ecological risks of the dredging works, visual effects and disturbance to residents and the local road network. There will be major significant temporary beneficial effect on flood risk to residential housing, commercial structures, agricultural land, listed buildings and transport links in the area.

The consultation period for the original ES is now over and no objections have been received. We advertised our intention to commence with the works and began dredging in April 2014.All works are programmed to be complete by October 2014. ~~We have advertised a notice of our intention to proceed with the works and will commence dredging in April 2014.~~

~~The ES Addendum will be submitted to support the planning applications for the creation of the main stockpiles.~~

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11 Environmental Action Plan

11.1 Purpose

This Environmental Action Plan (EAP) summarises the actions required to implement the environmental mitigation and outcomes contained within the Environmental Statement that has been prepared following Environment Agency Operational Instructions for the dredging of the specified sections of the Rivers Parrett and Tone. It sets out specific objectives and targets defining the way in which we wish the findings to be addressed during the implementation phase of the project (pre-construction, during the works and post-work phases). It is a live document and has been updated since the production of the original ES to take account of any changes to the baseline environment and progress of the works. It sets out specific objectives and targets defining the way in which the works are to be carried out. It also details roles and responsibilities of those involved in the project, and refers to all temporary and permanent works.

This EAP follows Environment Agency guidance as an example of best practice for addressing environmental risks. It forms the basis of the contract documentation for the Contractor and will be adhered to at all times.

11.2 Roles

Each action in the table below has **one** named person who is responsible for ensuring that the action is implemented. It is ultimately the contractor's responsibility for ensuring the EAP commitments are delivered.

The Environment Agency's National Environmental Assessment Service (NEAS) are responsible for agreeing any changes to the EAP and for signing off, or agreeing to the signing off of, the actions.

The contractor and Project Manager are responsible for advising NEAS of any changes to Method Statements or the planned construction work as these may result in changes to the EAP or require additional consultation with statutory consultees. NEAS will assess the significance of these changes and determine the appropriate course of action.

The contractor is also responsible for implementing good environmental practice on site, in line with their own Environmental Management System (EMS). The Environmental Clerk of Works (ECW) will monitor adherence to the EMS. Typical issues include:

- Any working hour restrictions
- Dust suppression measures
- Traffic management
- Pre-construction and post-construction recording of highway and footpath conditions; carry out remedial repairs if necessary
- Site waste management
- Materials management
- Maintenance of the carbon calculator
- Vehicle maintenance and management

- Pollution prevention and control (including Environment Agency Pollution Prevention Guidelines (PPGs) for storage, refuelling and incident response); silt traps to be deployed upstream and downstream if necessary
- Adherence to 'Code of Considerate Practice' under the Considerate Contractors Scheme
- Response procedures, e.g. services strike, contaminated land
- Hazardous materials handling and storage
- Noise management
- Securing and delineation of working areas including signage and fencing
- Keeping construction sites clean and tidy during the works, including no storage of material outside pre-defined working areas
- All waste to be removed and sites to be left clean and tidy at the end of the works. All temporary works removed and areas reinstated to as good a condition as previously, including reinstatement of vegetation.

11.3 Consents and Licenses

The following consents and licences are required:

- Temporary Flood Defence (Land Drainage) Consent
- Environmental permitting for dredging/disposal
- SSSI Assent
- Protected species licensing
- Habitats Regulations Assessment.

The above list is not exhaustive, and the need for consents and licenses will need to be re-evaluated during the works phases.

11.4 Environmental Audits

Site audits have been, and will continue to be carried out on a regular basis during the works. Audits will typically be carried out weekly, but the frequency will vary between sites and work stages depending on the level of environmental risk, in agreement with NEAS.

The appended template should be used when undertaking any site audits during construction. Such audits can be undertaken by NEAS Environmental Project Managers (EPM) or delegated by NEAS to the ECW or other suitably qualified individuals. Technical assistance can be obtained from specialist staff as appropriate. Site audits can potentially highlight good practice and can be separate to the review of EAP actions that is undertaken at progress meetings. They do not replace the regular checks undertaken by the ECW during the works; no set template has been provided for this.

11.5 Environmental Incident Reporting system

All environmental incidents must be reported to the Environment Agency Incident Hotline 0800 80 70 60 at the earliest opportunity and then to the External Cost Consultant (ECC), Project Manager, Site Supervisor, Environment Agency Project Manager (EA PM) and Environment Agency NEAS EPM. In addition, near misses must be reported via the hotline where there was/is the potential for a significant impact and where lessons can be learned.

Initial reports for such incidents and near misses must be followed by a written report using the contractor's in-house forms. This must include the following information:

- Project/location
- Date
- Contractor
- National Incident Recording System (NIRS) reference number
- Details of what happened
- Cause of incident
- Lessons learned.

This final and comprehensive investigation report is to be provided by the Contractor to the ECC Project Manager, EA PM and Safety, Health and Environment Manager within 14 days.

11.6 Summary of scope of works

This EAP includes actions required to undertake the proposed dredging of the Rivers Parrett and Tone as well as bank profile restoration, as described in Chapter 3 of the original Environmental Statement and Chapter 3 of this ES Addendum. In summary, the works are as follows:

- An approximately 3.5km section of the River Tone upstream of its confluence with the River Parrett, and an approximately 4.5km section of the River Parrett downstream of where it is joined by the River Tone, will be widened to increase flow capacity and reduce flood risk. The River Parrett flows into the Severn Estuary.
- The channels and banks will be returned to the same width and profile as they were immediately after the dredging in the 1960's, except where restrictions such as bank stabilisation schemes prevent this. In addition the full channel width and bed will not be dredged, to leave a central low-flow channel.
- Material will be removed by mechanical plant which will be standing either on the river banks or pontoons.
- Dredged material will be placed on the landward faces of flood defences, spread across farmland, used to restore the bank profile along sections of the River Parrett or disposed of in a licenced landfill site depending on the characteristics of the dredged material. The material will be tested before deciding on final placement method or disposal.
- All licences to stockpile and dispose of material will be obtained by the contractor.
- There will be up to 8 dredging teams working at any one time and 4 teams working on the bank profile restoration.
- The works are underway having commenced in April and are programme for completion in October 2014.
- There is potential for dredging to extend into winter 2014 depending on progress and weather conditions.

This EAP should be read in conjunction with the EAP produced for the three main stockpile sites that required planning permission (Table 12.1 in ES Stockpiles Addendum, Environment Agency, April 2014).

Rows that have been shaded out indicate where actions have been completed for the dredge works.

Table 11.1 Environmental Action Plan (to be read in conjunction with EAP for stockpiles)

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
Pre-construction						
P1	Ensure all supervision/liaison is in place	Ensure the following positions are appointed: ECW – initially on every gang. Geomorphologist – to ensure that WFD mitigation measures are implemented. Environmental scientist – required to undertake monitoring role, water quality/temperature, sampling (inverts etc). Ecologists – to undertake pre construction checks. Archaeological watching brief – possibly required further liaison required with County Archaeologist and English Heritage to determine need. Community/Agricultural Liaison officer.	EA PM		Vicky Durston (EA) to be Communications/Community Liaison Officer Amy Roberts to be main ECW and co-ordinate ecologists and environmental scientists Jane Moon/Jo Barlow to be site geomorphologists GBV providing other Ecologists/Environmental Scientists (Ahern Ecology). In-house EA specialists to assist with static water quality monitoring and pre-construction ecological surveys.	All supervisory roles appointed. Signed off 31/3/14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
1. Human Population						
A1.1	Reduce impact of dredging activities on commercial fisheries.	Communicate location and programme of works to commercial fishing sector/ licence holders.	EA PM		Andy Hohl advised in pre-start meeting he's sure had been completed by EA Communications but was getting confirmation.	Signed off 25.05.14.
		Ecological Monitoring Plan to be produced and agreed with Natural England.	Consultant	Draft Ecological Monitoring Plan included in Appendix E of Environmental Statement (ES). Updated Version Rev. C issued 24/3/14.		Actions from the Ecological Monitoring Plan have been incorporated within the EAP. Signed off by NE as part of Habitats Regulations Assessment included in ES.
		Consideration of fisheries will be included within contractor's Method Statements and will include adherence to the Ecological Monitoring Plan. EA Fisheries and Biodiversity (F&B) will approve Method Statements.	Contractor	Works will be undertaken in the license period for glass eels during 2014 (14 February-April inclusive). If works extend into 2015, this period will be avoided.	Ongoing as Method Statements are completed.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Design to incorporate a low-flow channel to be left within the channel (i.e. not all of the channel width and bed depth to be dredged).	Consultant	ES	GBV geomorphologist has attended site and completed a Toolbox Talk on creation of the low-flow channel to the site team for the Moorland House Farm phase.	Design drawings beyond the Moorland House Farm phase incorporate the low flow channel. Signed off 30/05/14.
A1.2	Keep local community informed.	Inform local community about objectives and programme of works and provide contact name and number.	EA PM	Communications Plan	Press statement regarding dredging project released 20th February and EIA advert. Weekly briefing notes being circulated to local community. Advert of intention to proceed with works was placed on 29/3/14. Letter drop to residents local to Moorland House Farm dredge was undertaken w/c 24/3/14. A twice weekly public drop-in session has been advertised and run locally to the dredging works (EA attendance).	Local community have been kept well informed of dredging works. Signed off 31.3.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Liaise with adjacent and local landowners/tenants over nature and duration of works and provide contact name and number.	EA PM		Ongoing as works progress. Key landowners have all been directly contacted.	Signed off for Moorland House Farm 31.3.14.
A1.3	To minimise disruption to Public Rights of Way (PRoWs) and footpaths.	Consult with Somerset County Council (SCC) footpath officers about the works, required PRoW closure times and notice periods, diversions and reinstatement. If required, get agreement with footpath officer that access can be maintained through use of banksmen to maintain all safety requirements.	Contractor		Parrett Trail, East Deane Way and Macmillan Way West long distance paths likely to be affected by works. Rachel Pether of GBV has liaised with SCC initially, Contractor to continue to update SCC. Will require further conversations for bank profile restoration.	SCC has been contacted and PRoW closures have been obtained for both the River Parrett and Tone. Signed off for dredge 30.5.14.
		If required, apply for and obtain permission for footpath closures.	Contractor			Not required for Moorland House Farm, signed off 31.3.14. PRoW closures for Tone and Parrett have been approved by SCC. Signed off for dredge 30/05/14.
		Advertise footpath disruptions and erect signage before the works commence.	Contractor		Ongoing.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
2. Land Use						
A2.1	Maintain the suitability of agricultural land.	Undertake chemical analysis of dredged arisings and land prior to spreading and gain all necessary environmental permits prior to spreading.	Contractor		Ongoing.	Signed off for Moorland House Farm 31.3.14.
		Agree spreading locations with landowners. Compensation agreements to be assessed in line with the provisions of the Water Resources Act 1991.	EA PM		Consultation ongoing.	Signed off for Moorland House Farm 31.3.14.
A2.2	To avoid breach of management options within Environmentally Sensitive Areas or Environmental Stewardship agreements.	Confirm areas where spreading of dredged material would contravene stewardship agreements which landowners are committed to.	EA PM	ES	Ongoing.	Signed off for Moorland House Farm 31.3.14.
		Obtain sign off of all spreading locations from EA PM and Kevin House (NEAS) (who will get sign off from NE).	Contractor	ES	Ongoing.	Signed off for Moorland House Farm 31.3.14.
A2.3	Identify suitable access routes on roads and farms.	Suitable access routes to minimise impact to ground conditions to be agreed within Traffic Management Plan (TMP) (see clause A8.1). Where possible ground will be stripped; geo-textile and stone will be placed above stripped ground to form works access routes.	Contractor		Ongoing.	Signed off for Moorland House Farm 31.3.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Make arrangements to use local agricultural plant/ machinery to transport dredgings if possible.	Contractor		Ongoing. Not practical within timescales of Moorland House Farm. Gillard's Transport is one company being considered for haulage for the main scheme.	Gillard's Transport and other local farmers and landowners have been selected to haul silt to fields. Signed off for dredge 30.05.14.
		Pre-construction site inspection to assess condition of access routes and compound areas, in liaison with EA Estates team if required.	Contractor		Ongoing.	Completed for Moorland House Farm. Signed off for dredge 31.3.14.
3. Flora and Fauna						
A3.1	Minimise impacts to fisheries.	Consider whether there are opportunities to carry out improvement through "green engineering" (e.g. replace hard rock armour with softer solutions) or irregularisation of the channel (e.g. with berms, pools) to provide habitat improvements and protect from future scour in wider WFD waterbody.	EA PM		Design drawings to include measures for habitat improvements where possible. Ongoing.	Signed off 30.05.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Set up a monitoring regime (up and downstream) for water quality, habitats and species.	EA PM	Draft Ecological Monitoring Plan (ES Appendix E) Updated Ecological Monitoring Plan issued 24/3/14 (Rev C) Environmental Constraints Plans	Fixed monitoring points will be established at: • River Parrett, d/s of Moorland House Farm ST3264433688 • River Parrett, King Alfred's Bridge Burrowbridge ST3574330437 • River Parrett, Monks clyse ST40947 27598 • River Tone: Newbridge ST3163526907	Fixed monitoring point sondes were all deployed prior to dredge commencing. Sign-off 1.3.14. Update signed off 30.05.14.
A3.2	Monitor dissolved oxygen (DO) to establish baseline, and assess impact.	Set up fixed point monitoring and monitor DO continuously at half hourly intervals, starting before dredge and continuing through dredge period.	EA Analysis and Research (A&R)	Trigger thresholds: Should not fall below **30%.** If above **120%** proceed with caution and monitor closely. At **180%** stop work. (based on the Wessex Area Somerset Rivers weed cutting protocol).	Monitoring locations are both at fixed sites and mobile locations (upstream and downstream of excavator). The 120% threshold has been exceeded at Moorland House Farm (122% w/c 14/4/14); EA Environmental Monitoring Team have been advised and works are proceeding under supervision.	Monitoring regime established. Sign-off 30.05.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A3.3	Monitor temperature to establish baseline, and assess impact.	Set up fixed point monitoring and monitor at half hour intervals before dredging starts then during dredging period.	EA A&R	**Trigger levels:** **Exceeds 15° C:** dredging above the water line only unless monitoring shows it is safe to continue. **Exceeds 20° C**: suspend all dredging; then review whether dredging can continue under operational restrictions, e.g. time of day, location, dredge with the tide, closed buckets, single bank working.	Minimum threshold has not yet been exceeded (last report 25/4/14).	Monitoring regime established. Sign-off 30.05.14.
A3.4	Monitor ammonia to establish baseline, and assess impact.	Set up fixed point monitoring and monitor at half hour intervals before dredging starts then during dredging period.	EA A&R. Spot tests to be undertaken if required by ECW or as delegated.	**Trigger level: 3mg/l**	Minimum threshold has not yet been exceeded (last report 25/4/14).	Monitoring regime established. Sign-off 30.05.14.
A3.5	Monitor riparian vegetation community to establish baseline, and assess impact.	Carry out walkover survey. Once before and after dredge.	EA Environmental Monitoring (EM)		Pre-construction surveys are ongoing. Macrophytes will be re-done in un-dredged sections in summer as levels were high and vegetation not grown.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A3.6	Monitor fish to establish baseline, assess impact and monitor recovery.	Carry out fixed point fyke nets at locations as benthic invertebrates below.	EA Sampling & Collection Team	Once before and after dredge. One sample in Moorland House Farm.	Completed samples before dredge.	Pre-construction sample signed off 30.05.14.
A3.7	Monitor aquatic macrophytes (within tidal zone) to establish baseline, assess impact and monitor recovery.	Carry out detailed survey of macrophyte communities at 3 fixed points (same locations as invertebrates A3.8 below). Both banks, 100m.	EA A&R	Before dredge then repeated in summer. Re-survey in Year 1.	Completed prior to dredge.	Pre-construction sample signed off 30.05.14.
		Walkover survey of wider dredge area to map/access nature and extent of in 'river' macrophyte community.	EA A&R	Pre-dredge and immediately post dredge of first dredge sections to assess 'remove and replace' methodology.	Pre-dredge survey completed.	Pre-construction sample signed off 30.05.14.
A3.8	Monitor benthic invertebrates to establish baseline, assess impact and monitor recovery.	Sample at 3 fixed points (in tidal reach of Parrett & Tone upstream u/s dredge and Parrett downstream d/s dredge).	EA A&R	Before the dredge starts and repeat in summer and autumn, concluding when dredge has completed.	Completed pre-dredge.	Pre-construction sample signed off 30.05.14.
		If European Protected Species (EPS) are found review operations, mitigation and apply for any EPS licences.	EA NEAS		EPS not found at Moorland House Farm or main scheme.	Signed off for Moorland House Farm 31.3.14. Signed off main scheme 30.05.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A3.9	Prevent any measureable effects to statutory designated sites (including Natura 2000 Sites, SSSIs and NNR).	Method Statements to be produced to document construction activities and restrictions to include: No dredging activity to be carried out within designated sites, and no further than 5m from the river bank. Undertake works outside of wintering bird period. If works do over-run in to wintering bird period then no works will be undertaken within 250m of sites designated for over-wintering birds. No machinery to be tracked through designated sites (except immediately along river bank). No compound areas to be established within designated sites. Dredged arisings will not be spread within designated sites. Water control structures that connect the main river channels to the moors will be closed during the works.	Contractor	Environmental Constraints Plan	Ongoing. A plan has been drafted by the ECW to agree with NEAS where would be the best locations for the 'strip and recover' and to ensure at least 25% of stretches are included. This is currently under review as to the effectiveness of the process 30.05.14. Meeting with Natural England held at Curry Moor SSSI 21.05.14 to start discussions of dredging to bank within the SSSI. Agreed at meeting on 2/7/14.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		No stockpiling or spreading of material within 10m of ditches. 'Strip and recover' approx. 25% of *Phragmites* and marginal plants. Leave irregularities in the channel if possible. Leave a low flow channel. Supervision of all works in SSSI by ECW.			Locations of stockpiles within spreading fields under ongoing discussion.	
		Obtain SSSI Assent from Natural England for works within SSSIs.	EA NEAS		NE has confirmed 'dredge to bank' would be a possibility in Curry Moor SSSI. Agreed in principle 2/7/14. Formal Assent still required.	
A3.10	Minimise impacts upon non-statutory designated sites and NERC habitats of principle importance, including habitats loss or degradation.	Method Statements to be produced to document construction activities to include: No spreading within LWS or equivalent. Works adjacent to the river in LWS will be supervised by an ECW. See also A3.1 Fisheries. Machinery to only pass through the Athelney Fields LWS along the river bank under supervision from an ECW.	Contractor		Ongoing.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A3.11	Prevent killing or injuring ground nesting or breeding birds (including destruction of nests or eggs).	Pre-construction checks to be carried out (including areas used for access and spreading areas). Findings to be recorded.	ECW	Ground nesting may include waterfowl and birds may be nesting in marginal vegetation.	Pre-construction check for Moorland House Farm to be carried out by ECW 25/3/14. Pre-construction checks for main scheme ongoing. Nesting sites are being continually updated on Environmental Constraints Plans.	Moorland House Farm signed off 25/3/14.
		If nests found exclusion zone to be set up until young have fledged (size as directed by ECW). If clear, flail vegetation immediately.	Contractor		Nine nests found by 30/5/14 and exclusion zones have been set-up/marked out as appropriate. Ongoing.	
		Site walkover to be held with contractor, ECW and EA F&B Officer to confirm what vegetation to be cleared along river corridor and to what height. This may include grassed banks/fields. No trees other than those clearly within channel to be cleared without prior authorisation from NEAS. Black poplars to be retained and protected (for both dredge and bank profile restoration).	Contractor	Environmental Constraints Plan.	Walkover completed. Vegetation clearance priority plan completed. Ongoing amendments to vegetation plan required as access routes etc. are planned and agreed.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		All vegetation suitable for nesting to be cleared as soon as possible. If this period is within the bird breeding season, checks must be carried out in advance by an ECW (see above).	Contractor	Arisings to be removed for first cut of marginal vegetation and where grassland cutting would leave a thick thatch.		Moorland House Farm signed off 31.3.14. First cut for main scheme has been completed and will be maintained during construction. Sign-off 30.05.14.
A3.12	To prevent harm to bats or nesting birds.	Any lopping of tree branches for access to be agreed with ECW in advance.	Contractor		Several trees on the left bank of Moorland House Farm were removed prior to checks being made due to a communication error between Contractor Teams. This has been documented in ECW Report 3 (16/04/14) and an agreed communication method of spraying checked trees has been adopted going forward. Ongoing.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A3.13	Prevent injuring or killing Great Crested Newts (GCN).	Identify ponds within 250m of the scheme (including spreading areas) with the potential to support GCN.	ECW		EA Technical Specialists have advised of potential for ponds to support GCN. No desk study records. Ongoing.	No ponds within 250m of Moorland House Farm, signed off 25/04/14.
		Where there is a reasonable risk of GCN presence, a mitigation strategy should be compiled and adhered to. Update EAP accordingly.	ECW		Ongoing.	
		As directed by ECW, grass and any other tall vegetation to be strimmed in a two-staged approach to allow GCN to vacate the area.	Contractor		Ongoing.	
		If works are required during the hibernation period, ECW to undertake pre-construction check for suitable hibernation sites. Sites to be made unsuitable by an ECW.	ECW		No potential hibernation sites identified in working areas to date (30/05/14).	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A3.14	To prevent the import or spread of (non-native) invasive or harmful species	ECW to inspect site for signs of Japanese knotweed, Himalayan balsam and hemlock water-dropwort. Findings to be recorded. Update EAP/Constraints Plan as required.	ECW	Both species known to occur on the Parrett and Tone.	Findings of survey have been recorded on updated Environmental Constraints Plans. Plans will be updated as growth season continues.	Constraints plans have been updated to show invasive and harmful species. These will continue to be updated during construction. Sign-off 30.05.14.
		Assume presence of Himalayan balsam and possible presence of Japanese knotweed in environmental risk assessments and Method Statements as may not be able to be identified after floods. Prepare and implement Invasive Species Management Plan and Bio-security Risk Assessment.	Contractor	For Himalayan Balsam an 18 month management strategy is likely to be adopted.	Invasive Species Management Plan has been drafted by Contractor. Review and development of Method Statements ongoing.	
		Method of control of hemlock water dropwort through spreading to be agreed with NEAS.	Contractor	Can cause death of stock if grazed.	Material dredged to bank must be stock-proof fenced if hemlock water dropwort is present to stop livestock eating it and therefore risking serious harm.	NEAS has circulated advice note, details of which are being incorporated into Invasive and Harmful Species Management Plan. Sign off 30.05.14.
A3.15	Prevent killing or injuring water voles (including destruction of habitats).	Undertake pre-construction checks before dredging or bank profile restoration commences.	ECW		Pre-construction check for Moorland House Farm Dredge programmed for 25/3/14. Ongoing for main scheme.	Moorland House Farm signed off 31.3.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		If found, a mitigation strategy will be compiled and agreed with NE. Update the EAP as required.	ECW		No water vole found in Moorland House Farm reach. Water voles confirmed on both Parrett and Tone in June. Meeting held with NE to agree strategy 2/7/14. EAP updated.	Signed off 2/7/14.
		Where required, vegetation will be strimmed to a short height to discourage colonisation of the working area.	Contractor		Vegetation is being strimmed throughout to reduce nesting bird risk. Application of herbicide is also being considered.	Two cuts of entire site have been undertaken to date. Maintenance will continue into construction. Sign off 30.05.14.
		Where water voles are present displacement will be carried out in line with a Method Statement agreed with NE. If displacement fails then water voles will be trapped and translocated under a Conservation Licence.	ECW		Outline Mitigation Method Statement (July 2014) issued to NE. Licence application being prepared.	
A3.16	Avoid impacts to otters.	Undertake pre-construction checks for holts and resting sites. Findings to be recorded.	ECW		Pre-construction check for Moorland House Farm Dredge programmed for 25/3/14. Ongoing for main scheme.	Moorland House Farm signed off 31.4.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		If a holt or resting place is found it will be left in-situ with a buffer zone. If this is not possible, a licence for temporary holt closure will be applied for from NE and an appropriate mitigation strategy devised.	EA PM		No holts were discovered during pre-construction checks at Moorland House Farm. Ongoing for main scheme, though no holts found to date (30/05/14).	
A3.17	Avoid impacts to badgers.	Pre-construction checks for badgers. Findings to be recorded. If found, appropriate buffers to be employed. If this is not possible appropriate licences to be obtained from Natural England and update EAP if required.	ECW		20m buffer to be left at badger sett at Moorland House Farm for placing dredgings. Pre-construction checks have been undertaken along the dredging sites and mitigation measures agreed with local badger specialist. Mitigation measures have been added to Environmental Constraints Plans. Will need to be reviewed for bank profile restoration. Ongoing for spreading locations.	
A3.18	Avoid impacts to reptiles.	ECW to assess all habitats in working areas for suitability to support reptiles. Where required, potential refugia to be removed as soon as possible from areas of proposed works before reptiles move back in after the flooding. Findings to be recorded.	ECW		No suitable refugia sites disturbed at Moorland House Farm. Ongoing.	Moorland House Farm signed off 31.3.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		As directed by ECW, where necessary grass and other tall vegetation to be strimmed in a two-stage approach to allow reptiles to vacate the area.	Contractor		Ongoing for spreading locations.	
A3.19	Avoid impacts to notable/ nationally rare or scarce invertebrates.	Dredging to be minimised in areas where the hairy click beetle has been recorded.	Contractor	Environmental Constraints Plans	Dredging will be undertaken in these areas however, strip and recover of beetle habitat is planned.	Signed off 30/05/14.
		Translocation of hairy click beetle colonies will be considered as required	EA PM		Vegetation in hairy click beetle habitat to be returned to location it was taken from.	Signed off 25/4/14.
		Minimise impact of hairy click beetle from bank profile restoration. Consult with EA F&B prior to works.	Contractor	Environmental Constraints Plans		
A3.20	Avoid impacts to ecologically valuable trees.	Provide suitable protection to valuable trees before dredging works commence in the applicable locations.	Contractor, with advice from ECW	Environmental Constraints Plans	Row of black poplars on right bank, between Meadow View and Moorland House Farm (approx. 70m u/s of Moorland House Farm dredge location). Ongoing.	
4. Water						
A4.1	Ensure compliance with the Water Framework Directive (WFD).	Undertake tests of the dredged sediment prior to removal to assess the risk of deterioration of existing high chemical status of Parrett Transitional water body.	Contractor		Ongoing. Mechanical dredging method proposed should remove the majority of contaminated sediments from the water body, preventing future mobilisation if eroded by river flows.	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
A4.2	To avoid degradation of water quality.	Prepare and implement an Ecological Monitoring Plan. See also Flora and Fauna above.	EA PM		Ecological Monitoring Plan (Rev C) actions incorporated into Construction Issue EAP (Issue 1).	Signed off 30.05.14.
5. Soil, Geology and Hydrogeology						
No mitigation measures identified for pre-construction other than good practice stated.						
6. Landscape Character and Visual Amenity						
No mitigation measures identified for pre-construction other than good practice stated.						
7. Cultural Heritage						
A7.1	Avoid degradation of historic sites.	Provide advice on the identification and avoidance of cultural heritage sites. For sites that cannot be avoided, provide advice on statutory consents and the procurement of archaeological contractors.	EA Archaeologist		Nearby Scheduled Monuments, Listed Buildings and undesignated sites listed on the Somerset Historic Environment Record (HER) will be clearly noted on construction drawings and Environmental Constraints Plans.	Signed off 30.05.14.
		To consult with the Local Authority and English Heritage to establish further potential and known archaeology 'hot-spots' and add to Constraints Plan.	EA Archaeologist		EA Archaeologist has been in contact with Richard Brunning of SCC and is happy all archaeological data has been obtained. All designated sites records obtained.	Signed off for dredging works 30/4/13.
		Seek advice of County Archaeologist to determine requirement for any additional mitigation associated with bank profile restoration works.	Contractor			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		TMP to be prepared (see clause A8.1) to include measures to avoid impacting upon features of archaeological and historic interest.	Contractor		Ongoing.	Moorland House Farm signed off 31.3.14.
A7.2	To protect known and unknown archaeological assets.	To advise the ECW on the provision of a toolbox talk.	EA Archaeologist		Toolbox talks will inform the contractor of particular precautions to take whilst working in close proximity to archaeological assets. Toolbox talks will also train staff to be aware of the potential for unrecorded archaeology and, if found, works will cease until an archaeologist has been consulted. Ongoing as new dredge teams start works.	Included in ECW Toolbox Talk on 28/3/14.
		Toolbox talk to be provided to contractor to undertake works with due regard for known and unknown archaeology.	ECW			
		Avoid altering the river channel beyond 1960s width and depth. Produce pre-construction survey of bank profiles.	Contractor	Design drawings to be provided to contractor.	Bathymetric survey complete.	Signed off 30/05/14.
		Clearly identify features of archaeological and historic interest on construction drawings and Environmental Constraints Plans.	Consultant	Environmental Constraints Plans	Included on all design drawings issued to date. Ongoing.	All dredge drawings issued. Signed off 30.05.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
8. Traffic and Transport						
A8.1	To minimise disruption to public highways	Develop a TMP for the works. Likely to include: Selection of most suitable delivery/ haulage routes; clear signage. Delivery schedule to minimise disruption to the local road network. Emergency contingency plans for access and egress (e.g. during flood events). Details of parking for construction staff to minimise disruption. Measures to avoid mud on public highways. Car sharing initiatives.	Contractor	ES Chapter 11: Traffic and Transport.	Ongoing.	Signed off for Moorland House Farm 25.4.14.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
9. Planning Requirements						
A9.1	Advertise that the scheme falls under the Environment Agency's Permitted Development rights.	Advertise and make the ES and Addendum for Bank Profile Raising available for public viewing for works to be undertaken using the Environment Agency's Permitted Development rights at least 28 days in advance of construction works. Advertise intention to proceed with works once consultation period is completed if no objections received.	EA PM	ES	Proposed dredging works are to be undertaken under Environment Agency's Permitted Development rights. Sedgemoor District Council and Taunton Deane Borough Council have confirmed the dredge works do not require planning permission.	Signed off 25/04/14 for dredge.
During construction						
1. Human Population						
B1.1	Maintain public health and safety.	Risks to be managed through good site practice, including the use of banksmen, appropriate signage and warning notices on site to restrict public access during the works.	Contractor		Banksmen constantly in use during dredging activity. PRoW on left bank of Moorland House Farm has been closed to public whilst working in that area.	
B1.2	Reduce impact of dredging activities on commercial fisheries.	Adhere to Ecological Monitoring Plan. See also section B4 (Water).	Contractor	Actions from Ecological Monitoring Plan (Rev C) now included in EAP.		Actions recorded elsewhere in EAP.

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Leave a low-flow channel within the river.	Contractor			
		Liaison with the commercial fishing sector/ license holders to continue during operations.	EA PM			
B1.3	Avoid degradation to bathing water quality.	See B4 (Water).	Contractor			
		During high water temperatures, phase dredging works to maximise extent of dry excavation.	Contractor	Draft Ecological Monitoring Plan (ES Appendix E)	Water temperatures are being monitored closely.	
B1.4	To minimise disruption to PRoWs/footpaths.	See clause A1.3. If needed, adhere to conditions of closure and advertise with signage.				
B1.5	Keep local community informed.	Keep local community informed on progress and programme through construction.	EA PM		Twice weekly drop-in sessions are underway, updates take place on social media websites and formal briefing updates are released into the public domain.	
2. Land Use						
B2.1	To avoid breach of management options within Environmentally Sensitive Areas or Environmental Stewardship agreements.	Do not spread dredged material on land that contravenes individual management options that relate to stewardship agreements (see clause A2.2).	Contractor			
		Measures employed to reduce salinity of dredged material if required.	Contractor			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
B2.2	Reduce the impact on grazing land.	Spreading to be on arable fields where possible. All spreading locations to be signed off by EA PM and NEAS.	Contractor			
		If after testing (see clause A2.1) it is concluded that soil is contaminated or has high salinity levels, dredged arisings will be disposed of to a licenced waste transfer site or landfill.	Contractor			
		Where possible make use of local agricultural plant/machinery to transport dredgings (see clause A2.3)	Contractor			
3. Flora and Fauna						
B3.1	Minimise impacts to eels and other fish.	Monitor water temperature, dissolved oxygen levels, ammonia, bacteria levels and sediment plumes. Monitor against specified trigger levels (see below) that will flag the need to stop works or change working methods.	ECW			
		Establish continuous mobile monitoring dissolved oxygen (DO) via probes and telemetry. Mobile monitoring locations	ECW		Alarms to be reported to EA	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		established at the upstream and downstream extents of each reach to be dredged each day. Proposed use of automatic monitoring equipment using a probe on a float system. Levels should not fall below 30% If they do proceed with caution and monitor closely At 180% stop work. If triggers reached review operations and implement appropriate tiered mitigation (e.g. time of day, location, operational restrictions) and as last resort administer H_2O_2 (see below).			Somerset Environmental Duty Officer on 0800 917 3409.	
		EA to administer H_2O_2 if low oxygen levels occur and significant fish kill is underway or anticipated.	EA PM			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Set up continuous water temperature monitoring as for DO above. **If exceeds 15°C**: dredging above the water line only unless monitoring shows it is safe to continue. **If exceeds 20°C**: suspend all dredging; then review whether dredging can continue under operational restrictions, e.g. time of day, location, dredge with the tide, closed buckets, single bank working.	ECW			
		Set up continuous ammonia monitoring as for DO above. Trigger level 3mg/l. If alarm level reached undertake more detailed spot monitoring and review operations.	ECW			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		If any above trigger levels are hit then adjust working methods as advised by ECW.	Contractor	Restricted working methods may include only removing sediment from above the water line; using closed lidded buckets; single bank working. Only dredge one side of the river during the day; do not dredge the opposite bank until the next day.		
		Sample benthic invertebrates at approx. 6 locations to be specified by A&R (including 1 within the 'Moorland House Farm' 200m). Samples either collected as sub-samples from dredge buckets &/or using EA sampling equipment. Sample during or immediately prior to dredging.	EA A&R		Sampling is currently being undertaken by GBV for Moorland House Farm (one per day) for fish and bivalves.	
		If EPS are found review operations, implement mitigation and apply for any EPS licences.	NEAS			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Monitor fish using fyke nets at Moorland House Farm.	EA Sampling & Collection (S&C) Team		Bucket sampling is currently being undertaken by GBV for Moorland House Farm (one per day) for fish and bivalves. Pre-dredge fyke net survey was undertaken just d/s of Moorland House Farm by S&C. May repeat.	
		Carry out dredging to create/maintain a low flow channel, e.g. by not dredging the entire channel width, and/or dredging to different depths.	Contractor	Draft Ecological Monitoring Plan (ES Appendix E)		
		Review areas where it may be possible to provide irregularisation of the channel (i.e. berms, pools) See A3.1.	EA to advise	Draft Ecological Monitoring Plan (ES Appendix E)		
		Monitor fish mortality. Report any dead or moribund fish. If found, suspend dredging, investigate causes and review operations.	Contractor	Draft Ecological Monitoring Plan (ES Appendix E)		

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		If trigger levels are hit or fish mortality observed then undertake herding, exclusion or removal of fish if required.	EA F&B	Method will need to be developed on case-by-case basis, if needed, and is likely to only be practicable under low flow conditions. Seine netting the entire width of the channel with exclusion nets placed at each end of the dredge area is theoretically possible, and has been employed previously by LAWS e.g. in the case of the Tame Canal dredge in 2012. Bubble nets could also be considered. No overnight netting to exclude fish.		
		"Strip and recover" approximately 25% of existing Phragmites/ marginal plants, replanting as a fringe as works proceed.	Contractor	No trees or shrubs to be replanted.	Effectiveness of this process is currently under review (30.05.14).	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
B3.2	Prevent any measureable effects to statutory designated sites (including Natura 2000 Sites, SSSIs and NNR).	Adhere to Method Statements (see clause A3.9) and Ecological Monitoring Plan.	Contractor	Habitats Regulations Assessment Actions from Ecological Monitoring Plan (Rev C) now included in Construction EAP (Issue 1).		
		Undertake works outside of the wintering bird period.	Contractor	Habitats Regulations Assessment	Wintering bird period taken as September-March. Should works over-run into the winter period then no works will be undertaken within 250m of sites designated for over-wintering birds.	
B3.3	Minimise impacts upon non-statutory designated sites and NERC habitats of principle importance, including habitat loss or degradation.	Adhere to Method Statements (see clause A3.10).	Contractor			
		If it is determined that temporary impacts on non-statutory sites are likely and unavoidable, additional good practice measures (such as using track mats) will be agreed with affected parties. All works in LWS to be supervised by ECW.	Contractor			
		Approximately 25% of Phragmites/marginal plants to be stripped and replanted.	Contractor		Effectiveness of this process is currently under review (30.05.14).	

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
B3.4	To prevent the import or spread of (non-native) invasive species.	Adhere to invasive species management plan and bio-security risk assessment (see clause A3.14).	Contractor			
		Manage invasion by zebra mussel by ensuring boats, dredging equipment etc. are not contaminated.	Contractor			
B3.5	Prevent killing or injuring ground nesting or breeding birds (including destruction of nests or eggs).	If found nests will be protected with construction buffer zones until young have fledged (see clause A3.11).	Contractor		Nine nesting sites have currently been excluded from the working area and are marked-out (30.05.14).	
		Site compounds to be located at least 5m from hedgerows and trees.	Contractor			
		If construction programme significantly affected by active nest then consult with NEAS over potential to obtain a licence to destroy. Do not destroy/disturb without licence in place.	Contractor	.		
		Maintain short vegetation height to discourage nesting birds.	Contractor	F&B have confirmed arisings can be left in situ for maintenance cuts.		
B3.6	Prevent killing or injuring Great Crested Newts (GCN).	If GCN are found at any time works must cease and ecologist contacted.	Contractor			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
B3.7	Prevent killing or injuring water voles (including destruction of habitats).	If water voles are discovered within the working area at any time, works will stop in that area and a mitigation strategy will be agreed with NE under a Conservation Licence if appropriate.	Contractor		Outline mitigation strategy for displacement has been agreed with NE. Conservation licence to be applied for in the event that trapping is needed.	
		'Strip and recover' approximately 25% of the existing Phragmites/ marginal plants and replant as fringe works proceed.	Contractor		Effectiveness of this process is currently under review (30.05.14).	
		No spreading to occur closer to any rhynes or other watercourses than existing agricultural operations extend.	Contractor			
		No stockpiles within 6m of rhynes or other watercourses unless the ECW confirms the absence of water voles.	Contractor			
B3.8	Avoid impacts to otters.	Works should not be carried out concurrently and on opposite banks where advised by ECW.	Contractor			
		Install artificial otter holts along river corridor.	EA PM			
B3.9	Avoid impacts to ecologically valuable trees.	Adhere to protection measures established for ecologically valuable trees (see Clause A.3.20).	Contractor	Environmental Constraints Plans		

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
B3.10	Prevent spread of fungal pathogens.	Site team to remain vigilant for signs of fungal pathogens such as ash dieback. If signs are found, a management plan should be devised and EAP updated accordingly.	Contractor			
4. Water						
B4.1	Avoid degradation of water quality.	See Flora and Fauna.	Contractor			
		Monitor bacteria upstream and downstream of extreme dredge locations.	EA A&R	From mid-April one per week for one month and then review further need. Frequency initially weekly but may increase if any concern.		
B4.2	To mitigate for impacts to the inter-tidal zone.	'Strip and recover' approximately 25% of the marginal plants and re-plant fringe vegetation.	Contractor		Strip and recover commenced at Moorland House Farm. Under review.	
B4.3	To avoid affecting the physico-chemical conditions of water bodies.	See Flora and Fauna.	Contractor		Action dependent on location and tide conditions. Dredging on flood tide may be possible on upper reaches and during neap tides; not on high springs.	
B4.4	Minimise the loss of flow depth for migratory/protected species, including eels and salmonids.	Do not dredge the full channel width and bed to leave a low flow channel. See also clauses A1.1, B1.2 and B3.1.	Contractor			
		Initial works to be supervised by ECW.	ECW			
5. Soils, Geology and Hydrogeology						

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
No mitigation measures identified after construction other than good practice stated.						
6. Landscape Character and Visual Amenity						
B6.1	To prevent the loss of visual amenity.	Stockpiles to be located a minimum of 25m away from private households and 10m from public footpaths including the Parrett Trail.	Contractor			
		Keep size of stockpiles to a maximum of 2m in height and for approximately 4 weeks maximum.	Contractor			
7. Cultural Heritage						
B7.1	Avoid degradation of known and unknown historic environment sites.	Seek advice from NEAS Archaeologist, County Archaeologist and English Heritage if damage is unavoidable or if channel is likely to be altered beyond 1960s profile. If considered necessary (see clause A7.1) an archaeological watching brief will be undertaken.	Contractor			
		Adhere to TMP (see clauses A7.1 and A8.1).	Contractor			
		Take appropriate precautions whilst working in close proximity to features of historic and archaeological interest (see clause A7.2).	Contractor			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		No deposition of dredged material on designated heritage sites. Tracking over and deposition and spreading of dredged material over sensitive sites will be avoided.	Contractor	ES Chapter 12: Historic Environment		
		Avoid tracking and re-profiling of the river-side embankment where there are known historic earthworks.	Contractor	Environmental Constraints Plans.		
		If previously unknown archaeology is discovered, works will cease until the County Archaeologist and EA have been consulted. Any finds to be reported immediately to the County Archaeologist and EA. Any finds applicable to the Treasures Act 1996 to be reported to the Coroner in accordance with the Act (finds of gold, silver, groups of coins and base metal prehistoric objects). Also any fossils, antiquities, structures, remains or other objects of geological or archaeological interest or value to be reported to the County Museum Service.	Contractor		Any discoveries are likely to be waterlogged. It is essential that they are kept immersed in water following discovery to avoid drying/breaking up. Discoveries may add to the existing Somerset Historic Environment Record (HER).	
8. Traffic and Transport						
B8.1	To minimise disruption to public highways.	Adhere to TMP as agreed in clause A8.1.	Contractor			

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Use banksmen to safely navigate plant and machinery around the working area.	Contractor			
		If the use of banksmen is considered unsuitable (see above) and the need for formal road closures arise, agree requirements with Somerset County Council and ensure it is for the minimum duration possible.	Contractor			
Post construction						
1. Human Population						
C1.1	To update flood warning systems.	EA flood warning systems will be updated to account for the changes to local hydrological flows.	EA PM			
2. Land Use						
C2.1	To reinstate compound areas and access routes.	Access routes and compound areas to be subject to post-construction inspection to ensure that reinstatement of access routes has been carried out to an acceptable level (see clause A2.3).	Contractor			
3. Flora and Fauna						
C3.1	To maintain the quality of the Somerset Levels designated sites.	Condition of wintering habitats, wintering bird numbers and species to be monitored as stated in ecological monitoring plan.	ECW	Ecological Monitoring Plan (Rev C)		

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
		Findings of monitoring will be used to inform future reviews and implementation of a revised Water Level Management Plan if required.	EA PM			
		Banks to be reseeded with native MG5c seed mix within designated sites.	Contractor			
		Comply with all post-construction conditions of ecological monitoring plan.	EA PM	Ecological Monitoring Plan (Rev C)		
C3.2	To prevent the spread of (non-native) invasive and harmful species.	Post spoil-spreading monitoring and control to be carried out by the Contractor. If outbreaks occur appropriate measures are likely to include cutting, spraying, pulling or grazing of Himalayan balsam.	Contractor		Will include hemlock water-dropwort.	
C3.3	To improve ecological knowledge of the area.	Ecological field data collected from pre-construction protected/ notable species checks and surveys to be provided to the EA and Biodiversity Records Centre (SERC).	ECW			
4. Water						
C4.1	Avoid degradation of water quality.	Comply with all post-construction conditions of Ecological Monitoring Plan.	EA PM	Ecological Monitoring Plan (Rev C)		
5. Soils, Geology and Hydrogeology						
No mitigation measures identified after construction other than good practice stated.						
6. Landscape Character and Visual Amenity						
No mitigation measures identified after construction other than good practice stated.						

Ref. No.	Objective	Action	Responsibility	Reference to further information	Progress and Further Action	Sign off and date
7. Cultural Heritage						
C7.1	Reinstate any affected earthworks.	Where degradation to historic earthworks is unavoidable (see clause B7.1) consult archaeologist to consider potential to reinstate or replicate.	Contractor			
C7.2	Any reporting as appropriate.	Ensure a report is produced to the standards required by the Somerset HER for any archaeological work carried out.	Contractor			
		Produce post-construction survey of bank profiles and check against pre-construction profiles (see clause A7.2).	Contractor			
8. Traffic and Transport						
No mitigation measures identified after construction other than good practice stated.						

Environmental audit record

Project		**Project ref.:**	
Project Manager:		**NEAS EPM:**	
Location		**Grid reference**	

Site Visit Audit Details

Visit During/Post Construction:		**Date of Visit:**		**Time of Visit:**	
Audit Officer:		**Photos ta ken (y/n):**		**Referenced to Pre-Photos(y/n):**	

Does the Site Supervisor have an up to date copy of the EAP? Yes / No

General comments

12 References

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13 List of abbreviations

AADF	Annual Average Daily Flows
A&R	Analysis and Research
ACR	Annual Compliance Result
AoD	Above Ordnance Datum
AWB	Artificial Water Body
BAP	Biodiversity Action Plan
BQE	Biological Quality Elements
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CLA	Countryside, Land and Business Association
CFPM	Catchment Flood Management Plan
Defra	Department of Environment Food and Rural Affairs
D/S	Downstream
EA	Environment Agency
EAL	Environmental Action Level
EAP	Environmental Action Plan
ECC	External Cost Consultant
ECW	Environmental Clerk of Works
EIA	Environmental Impact Assessment
EM	Environmental Monitoring
EMS	Environmental Management System
EPM	Environmental Project Manager
ES	Environmental Statement
ESA	Environmentally Sensitive Area

FSR	Flood Storage Reservoir
FWAG	Farming and Wildlife Advisory Group
GBV	Galliford Black and Veatch
GCN	Great Crested Newt
GEP	Good Ecological Potential
GES	Good Ecological Status
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HER	Historic Environment Record
HGV	Heavy Goods Vehicles
HMWB	Heavily Modified Water Body
HRA	Habitats Regulations Assessment
IBA	Important Bird Area
IE	Intertestinal Entercocci
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Assessment
LERN	Local Environmental Records Centre
LGV	Light Goods Vehicle
LiDAR	Light Detection and Ranging
LNP	Local Nature Partnership
LNR	Local Nature Reserve
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Sites
MMO	Marine Management Organisation
NBN	National Biodiversity Network
NCA	National Character Area

NCN	National Cycle Network
NE	Natural England
NEAS	National Environmental Assessment Service
NERC	National Environmental Research Council
NFU	National Farmers Union
NGO	Non-Government Organisation
NIRS	National Incident Recording System
NNR	National Nature Reserves
NPPF	National Planning Policy Framework
OS	Ordnance Survey
PAH	Polycyclic Aromatic Hydrocarbons
PIRP	Pollution Incident Response Plan
PPGs	Environment Agency Pollution Prevention Guidelines
PRoW	Public Right of Way
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
S&C	Sampling and Collection
SERC	Somerset Environmental Records Centre
SM	Scheduled Monument
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
TMP	Traffic Management Plan
TPO	Tree Preservation Order
TSS	Total Suspended Solids
U/S	Upstream
WFD	Water Framework Directive

WLMP Water Level Management Plan

14 Glossary

Amber List Species	The UK's birds can be split into three categories of conservation importance - red, amber and green. Red is the highest conservation priority, with species needing urgent action. Amber is the next most critical group, followed by green.
Appropriate Assessment	See Habitats Regulations Assessment.
Archaeology	The systematic study of past human life and culture by the recovery and examination of remaining material evidence, such as graves, buildings, tools and pottery.
Archaeological Priority Areas	An area specified by Local Planning Authorities to help protect archaeological remains that might be affected by development.
Baseline	A description of the present state of the environment with the consideration of how the environment would change in the future in the absence of the plan/programme/project as a result of natural events and other human activities.
Baseline studies/ survey	Collection of information about the environment which is likely to be affected by the project.
Bathing Water Directive	The EC Bathing Water Directive (2006/07/EC) is implemented in England and Wales by the Bathing Water Regulations (SI1365/2013) and sets standards for classified bathing waters.
Biodiversity	Biodiversity is the living component of the natural world and embraces all plant and animal species and communities associated with terrestrial, aquatic and marine habitats. It also includes genetic variation within species.
Biodiversity Action Plan (BAP)	An agreed plan for a habitat or species, which forms part of the UK's commitment to biodiversity in response to the Convention on Biological Diversity, Rio de Janeiro 1992.
Catchment	A surface water catchment is the total area that drains into a river. A groundwater catchment is the total area that supplies the groundwater part of the river flow.
Catchment Flood Management Plan (CFMP)	A high level plan carried out by the Environment Agency in order to manage the risk of flooding to people, property and the environment in an integrated way. These plans form the basis of future flood risk management proposals.
Character area	An area of land with distinctive landscape features resulting from an interaction of wildlife, landforms, geology, land use and human activity as defined by the Countryside Agency.
Climate Change	Refers to long term trends in weather patterns at large geographic and temporal scales.
Conservation Area	An area designated under the Town and Country Planning Act, 1990 to protect its architectural or historic character.

Conservation of Habitats and Species Regulations 2010 (as amended)	Consolidates all amendments made to the Conservation (Natural Habitats, &c.) Regulations 1994 in respect of England and Wales. The Regulations transpose Council Directive 92/43/EEC relating to the conservation of habitats, flora and fauna in national law.
Cumulative Impacts	The combined impacts of several projects within an area, which individually are not significant, but together amount to a significant impact. Cumulative impacts may also arise where several individual effects of a project have a combined effect.
Department for Environment, Food and Rural Affairs (DEFRA)	The government department responsible for flood management policy in England.
Dredging	Dredging is the process of removing silt from the bottom and sides of a river channel, normally done when there is a need to increase the depth of the river and straighten channels. It can also be used to improve land drainage by creating artificial channels.
Ecology	The relationships between the air, land, water, animals, plants, etc., usually of a particular area.
English Heritage (EH)	Government statutory advisor on the historic environment, funded jointly by the government and by revenue from properties and members.
Environment Agency	A public body established by the Environment Act 1995. Generally speaking, the Environment Agency is empowered under the Water Resources Act 1991 to manage flood risk arising from designated main rivers and the sea. The Environment Agency is also responsible for flood forecasting and flood warning dissemination, and for exercising a general supervision over matters relating to flood defence.
Environmental Action Plan (EAP)	A standalone report or section within another environmental impact assessment document which ensures that constraints, objectives and targets set in the main Environmental Report/Statement are actually carried out on the ground. Actions are separated into those to be carried out before, during and after construction.
Environmental Clerk of Works	An individual responsible for undertaking legislation and compliance monitoring during construction by auditing the EAP on a regular basis. Also responsible for the provision of environmental advice.

Environmental Impact Assessment (EIA)	"EIA is an assessment process applied to both new development proposals and changes or extensions to existing developments that are likely to have significant effects on the environment. The EIA process ensures that potential effects on the environment are considered, including natural resources such as water, air and soil; conservation of species and habitats; and community issues such as visual effects and impacts on the population. EIA provides a mechanism by which the interaction of environmental effects resulting from development can be predicted, allowing them to be avoided or reduced through the development of mitigation measures. As such, it is a critical part of the decision-making process." www.iema.net/eiareport.
Environmentally Sensitive Area (ESA)	An area of particularly high landscape, wildlife or historical importance within which DEFRA offered inducements to encourage farmers to adopt agricultural practices to safeguard or enhance those features. Payments have now been superseded by the Environmental Stewardship Scheme.
Environmental Statement (ES)	The document produced to describe the environmental impact assessment process where statutory environmental impact assessment is required.
European Commission Directive on the Conservation of Wild Birds/Birds Directive	Directive 2009/147/EC adopted in 2009 by all EU Member states provides a detailed scheme of protection for all native wild bird species with the European Union. This includes protection from deliberate killing, capture and destruction of nests/eggs as well as the protection of habitats essential for supporting bird species.
Fauna	Animals, considered as a group
Flood defence	A structure (or system of structures) that reduce flooding from rivers or the sea.
Flood Plain	An area of land over which river or sea water flows or is stored in times of flood
Flood Risk Management	The National Flood and Coastal Erosion Risk Management Strategy for England (as laid before the UK Parliament by Defra and the Environment Agency in 2011) states that flood risk management involves: knowing when and where flooding are likely to happen; taking reasonable steps to reduce the likelihood of them happening; forecasting and providing warnings of floods so that people, businesses, infrastructure providers and public services can take effective action to minimise the consequences of floods, and acting to reduce the risk to life, damage and disruption caused by flooding."
Flora	Plants considered as a group, especially the plants of a particular country, region, or time.
General Permitted Development Order (GPDO)	The Town and Country Planning (General Permitted Development) Order 1995 sets out what may be built without needing planning permission. Part 15 applies specifically to the Environment Agency.
Habitat	A place where an organism lives; a type of environment inhabited by a particular species and/or communities; often characterised by dominant plant forms, physical characters, or a combination of these.

Habitats Directive	EC Directive (92/43/EEC) on the Conservation of natural habitats and of wild flora and fauna. Implemented (with the Birds Directive (79/409/EEC)) in the UK as the Conservation (Natural habitats and wild flora and fauna) Regulations (1994). This establishes a system of protection of certain flora, fauna and habitats considered to be of International or European conservation importance. Sites are designated as Special areas of conservation (SACs), special protection areas (SPAs) and/or Ramsar sites. Any developments in or close to these designated areas are subject to the Habitat Regulations for approval of English Nature. Together these sites are referred to as the Natura 2000 network.
Habitats Regulations Assessment (HRA)	The Conservations of Habitats and Species Regulations 2010 impose a duty on operating authorities to maintain the integrity of Natura 2000 complexes. Under these regulations, if there are assessed to be likely significant effects, there is a requirement to undertake an Appropriate Assessment to assess the effects of implementing the project upon the conservation objectives of the designated sites, in order to determine whether it is likely to result in an adverse effect upon the integrity of the sites.
Hydrogeology	Hydrogeology (hydro- meaning water, and -geology meaning the study of the Earth) is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust (commonly in aquifers).
Invasive species	See non-native (invasive) species.
Land Drainage Regulations	The Environmental Impact Assessment (Land Drainage Improvement Works) Regulations (SI 1999 No. 1783) (as amended) apply to improvement works to land drainage infrastructure undertaken by land drainage bodies, including the Environment Agency. Such works are permitted development and therefore not subject to the Town and Country Planning EIA requirements.
Landscape	The physical features of an area of land including those formed naturally such as mountains, rivers and woodland as well as man-made land use such as buildings and transport infrastructure.
LiDAR	Light Detecting and Ranging (LiDAR) is a remote sensing technology that uses laser scanning to collect height or elevation data. Captured data can be classified into different layers (e.g. ground, buildings or vegetation) and may be used to create a digital terrain model or a digital surface model.
Listed Building	A building or structure that is designated for its special architectural or historic interest, the character or appearance of which is desirable to preserve or enhance. Designated under the Planning (Listed Buildings and Conservation Areas) Act 1990.
Local Development Plan	The statutory development plan for each Local Planning Authority area required under Part 6 of the Planning and Compulsory Purchase Act, 2004.

Local Nature Reserve (LNR)	Nature reserves designated under the National Parks and Countryside Act (1949) for locally important wildlife or geological features. They are controlled by local authorities in liaison with English Nature.
Local Wildlife Site (LWS)	Places considered being of importance for their wildlife in a county and local council context and including a variety of habitats. LWS are not the subject of statutory conservation designations but some level of protection is afforded to these sites by Local Planning Authorities in Local Plans.
Main river	A watercourse designated by DEFRA. The Environment Agency has permissive powers to carry out flood defence works, maintenance and operational activities on main rivers. Responsibility for maintenance rests on the riparian owner.
Marine Licence	Marine licenses and the conditions set out within them seek to promote economically and socially beneficial activity whilst minimising any adverse impacts on the environment, human health and users of the sea. The Marine and Coastal Access Act 2009 has put in place a more streamlined approach to marine licensing by reducing the number of licenses required for a marine project, and all licensing decisions will be made in accordance with the Marine Policy Statement and relevant Marine Plan.
Marine Management Organisation	An executive non-departmental public body established under the Marine and Coastal Access Act 2009 with responsibilities including marine licensing and working with Natural England and others to manage a network of marine protected areas (marine conservation zones and European marine sites).
Mitigation measures	Actions that are taken to minimise, prevent or compensate for adverse effects of the development.
National Character Areas	Natural England has divided England into areas with similar landscape character, which are called National Character Areas (NCAs). The NCAs are a widely recognised national spatial framework and form part of the background data for local Landscape Character Assessment (LCA) applicable to a Local Authority area.
National Nature Reserve (NNR)	Nature reserves designated under the National Parks and Countryside Act (1949) for nationally important wildlife or geological features (these may be the best examples in the country). They are controlled by English Nature.
Natural England	Natural England is an executive non-departmental public body responsible to the Secretary of State for Environment, Food and Rural Affairs. Their purpose is to protect and improve England's natural environment and encourage people to enjoy and get involved in their surroundings. Their aim is to create a better natural environment that covers all of our urban, country and coastal landscapes, along with all of the animals, plants and other organisms that live with us.

Natural Environment and Rural Communities Act 2006 (NERC Act 2006) esp. Section 41 (S41).	Makes amendments to the Wildlife and Countryside Act 1981, including relating to invasive species. Section 41 details the list of species of principal importance for conservation of biological diversity in England.
Nature Conservation	The preservation, management and enhancement of natural plant and animal communities, and occasionally modified vegetation, as representative samples of their kind.
Non-native (invasive) species	Non-native plants and animals that have been introduced to this country by accident or as a consequence of trade or deliberate collection. Their growth is often to the detriment of native species.
Planning Permission	The permission required within the UK from a Local Planning Authority in order to allow a development to go ahead.
Pollution Prevention Guidelines	The Environment Agency has written a range of Pollution Prevention Guidance Notes (PPGs). Each PPG gives advice on the law and good environmental practice, to help reduce environmental risks from business activities.
Ramsar site	Wetland site of international importance listed under the Convention on Wetlands of International Importance under the Conservation of Waterfowl Habitat (Ramsar) Convention 1973.
Receptor	The physical resource or group that will experience an effect as a result of the proposed development e.g. people, birds.
Red List Species	The UK's birds can be split into three categories of conservation importance - red, amber and green. Red is the highest conservation priority, with species needing urgent action. Amber is the next most critical group, followed by green.
Residual	The quantity remaining at the end of a process. In the context of the EIA, this usually refers to the level of risk remaining once mitigation measures have been implemented.
Scheduled monument	Nationally important historic sites, buildings or monuments identified by English Heritage and designated by the Secretary of State for Culture, Media and Sport. Any work affecting a scheduled monument must gain consent from English Heritage under the Ancient Monuments and Archaeological Areas Act (1979).
Scoping	The process of deciding the scope or level of detail of an EIA/ SEA. During this stage the key environmental issues (likely significant effects) of a project/strategy are identified so that the rest of the process can focus on these issues. Issues may result from the proposal itself or from sensitivities of the site.
Screening	The process of determining which developments require a statutory environmental impact assessment to be carried out.
Sensitivity	Gives regard to the quality, relative abundances and level of statutory protection of the receptor.

Site of Special Scientific Interest (SSSI)	Nationally important sites designated for their flora, fauna, geological or physiographical features under the Wildlife and Countryside Act (1981) (as amended) and the Countryside Rights of Way (CRoW) Act (2000).
Special Area for Conservation (SAC)	Sites of European importance for habitats and non bird species. Above mean low water mark they are also SSSIs.
Special Protection Area (SPA)	An area designated for rare or vulnerable birds, or migratory birds and their habitats, classified under Article 4 of the EC Directive on the Conservation of Wild Birds (79/409/EEC). They are also SSSIs.
Standard of protection (SoP)	The level of protection from flooding, for example a SoP of 1 in 100 means that the flood defences in an area provide protection from floods up to a size of flood with a probability of occurring of 1 in 100 in any year.
Tool Box Talk	A toolbox talk is focused on one specific topic and addresses it in simple terms. It provides an opportunity for a supervisor/environmental advisor to emphasise the importance of a particular issue or procedure, and for the site team to understand the local issues.
Traffic Management Plan (TMP)	A document which details the procedures to follow for vehicular and pedestrian movements around a development site. This includes the timing of vehicular movements, one way systems and road closures.
UK Post-2010 Biodiversity Framework	Published in July 2012, this has now succeeded the UK BAP. In particular, due to devolution and the creation of country-level biodiversity strategies, much of the work previously carried out under the UK BAP is now focussed at a country level. Additionally, international priorities have changed: the framework particularly sets out the priorities for UK-level work to support the Convention on Biological Diversity's (CBD's) *Strategic Plan for Biodiversity 2011-2020* and its five strategic goals and 20 'Aichi Targets', agreed at the CBD meeting in Nagoya, Japan, in October 2010; and the new EU Biodiversity Strategy (EUBS) in May 2011.
Water Framework Directive (WFD)	EC Directive (2000/60/EC) on integrated river basin management. The WFD sets out environmental objectives for water status based on ecological and chemical parameters, common monitoring and assessment strategies, arrangements for river basin administration and planning and a programme of measures in order to meet the objectives.
Wildlife and Countryside Act 1981 (W&C Act 1981) (as amended)	The principle legislation for the protection of wildlife in Great Britain

Appendices

See separate documents

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